# Computer Algebra
# Independent Integration Tests

Summer 2023 edition with Rubi V 4.17.3

## 6-Hyperbolic-functions/6.6-Hyperbolic-cosecant/183-6.6.3-Hyperbolic-cosecant-functions

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# Contents


**1 Introduction** **2**

**2 detailed summary tables of results** **20**

**3 Listing of integrals** **75**

**4 Appendix** **1141**

CHAPTER 1

# Introduction


1.1 Listing of CAS systems tested . . . . . 3
1.2 Results . . . . . 4
1.3 Time and leaf size Performance . . . . . 7
1.4 Performance based on number of rules Rubi used . . . . . 9
1.5 Performance based on number of steps Rubi used . . . . . 10
1.6 Solved integrals histogram based on leaf size of result . . . . . 11
1.7 Solved integrals histogram based on CPU time used . . . . . 12
1.8 Leaf size vs. CPU time used . . . . . 13
1.9 list of integrals with no known antiderivative . . . . . 14
1.10 List of integrals solved by CAS but has no known antiderivative . . . . . 14
1.11 list of integrals solved by CAS but failed verification . . . . . 14
1.12 Timing . . . . . 15
1.13 Verification . . . . . 15
1.14 Important notes about some of the results . . . . . 16
1.15 Design of the test system . . . . . 19

This report gives the result of running the computer algebra independent integration test.The download section in on the main webpage contains links to download the problems in plain text format used for all CAS systems. The number of integrals in this report is [ 175 ]. This is test number [ 183 ].

## 1.1 Listing of CAS systems tested

The following are the CAS systems tested:

1. Mathematica 13.3.1 (August 16, 2023) on windows 10.
2. Rubi 4.17.3 (Sept 25, 2023) on Mathematica 13.3.1 on windows 10
3. Maple 2023.1 (July, 12, 2023) on windows 10.
4. Maxima 5.47 (June 1, 2023) using Lisp SBCL 2.3.0 on Linux via sagemath 10.1 (Aug 20, 2023).
5. FriCAS 1.3.9 (July 8, 2023) based on sbcl 2.3.0 on Linux via sagemath 10.1 (Aug 20, 2023).
6. Giac/Xcas 1.9.0-57 (June 26, 2023) on Linux via sagemath 10.1 (Aug 20, 2023).
7. Sympy 1.12 (May 10, 2023) Using Python 3.11.3 on Linux.
8. Mupad using Matlab 2021a with Symbolic Math Toolbox Version 8.7 on windows 10.

Maxima and Fricas and Giac are called using Sagemath. This was done using Sagemath `integrate` command by changing the name of the algorithm to use the different CAS systems.

Sympy was run directly in Python not via sagemath.

## 1.2 Results

Important note: A number of problems in this test suite have no antiderivative in closed form. This means the antiderivative of these integrals can not be expressed in terms of elementary, special functions or `Hypergeometric2F1` functions. `RootSum` and `RootOf` are not allowed. If a CAS returns the above integral unevaluated within the time limit, then the result is counted as passed and assigned an A grade.

However, if CAS times out, then it is assigned an F grade even if the integral is not integrable, as this implies CAS could not determine that the integral is not integrable in the time limit.

If a CAS returns an antiderivative to such an integral, it is assigned an A grade automatically and this special result is listed in the introduction section of each individual test report to make it easy to identify as this can be important result to investigate.

The results given in in the table below reflects the above.

| System | % solved | % Failed |
|---|---|---|
| Mathematica | 100.00 ( 175 ) | 0.00 ( 0 ) |
| Rubi | 99.43 ( 174 ) | 0.57 ( 1 ) |
| Fricas | 96.57 ( 169 ) | 3.43 ( 6 ) |
| Maple | 77.71 ( 136 ) | 22.29 ( 39 ) |
| Maxima | 62.29 ( 109 ) | 37.71 ( 66 ) |
| Giac | 61.14 ( 107 ) | 38.86 ( 68 ) |
| Mupad | 52.00 ( 91 ) | 48.00 ( 84 ) |
| Sympy | 1.71 ( 3 ) | 98.29 ( 172 ) |

Table 1.1: Percentage solved for each CAS

The table below gives additional break down of the grading of quality of the antiderivatives generated by each CAS. The grading is given using the letters A,B,C and F with A being the best quality. The grading is accomplished by comparing the antiderivative generated with the optimal antiderivatives included in the test suite. The following table describes the meaning of these grades.

| grade | description |
|---|---|
| A | Integral was solved and antiderivative is optimal in quality and leaf size. |
| B | Integral was solved and antiderivative is optimal in quality but leaf size is larger than twice the optimal antiderivatives leaf size. |
| C | Integral was solved and antiderivative is non-optimal in quality. This can be due to one or more of the following reasons<br>1. antiderivative contains a hypergeometric function and the optimal antiderivative does not.<br>2. antiderivative contains a special function and the optimal antiderivative does not.<br>3. antiderivative contains the imaginary unit and the optimal antiderivative does not. |
| F | Integral was not solved. Either the integral was returned unevaluated within the time limit, or it timed out, or CAS hanged or crashed or an exception was raised. |

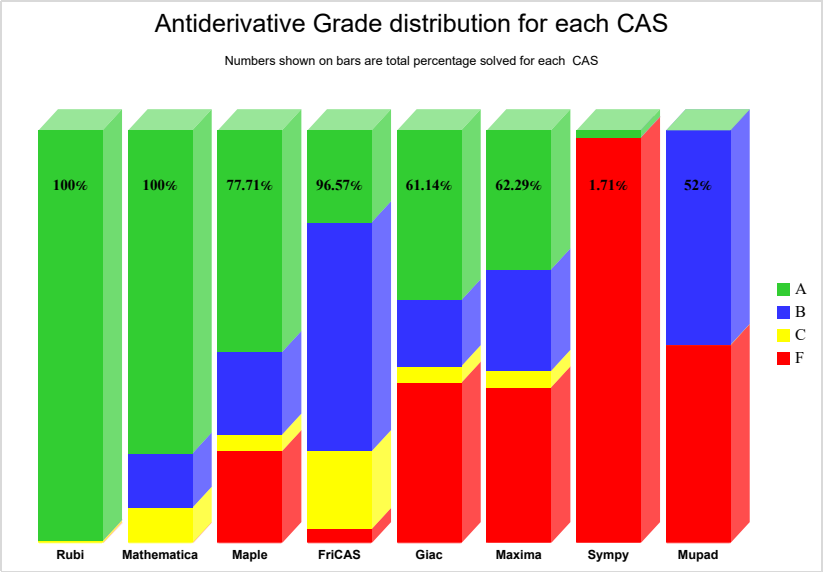
Table 1.2: Description of grading applied to integration result

Grading is implemented for all CAS systems. Based on the above, the following table summarizes the grading for this test suite.

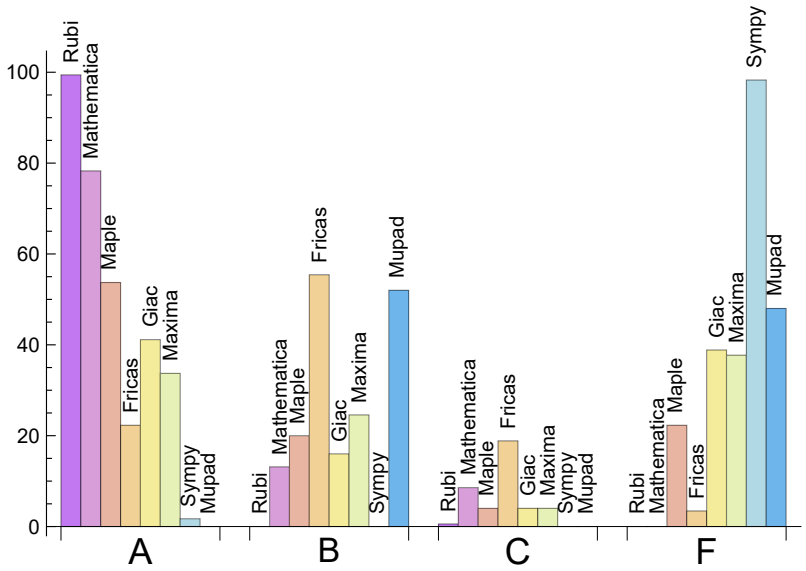
| System | % A grade | % B grade | % C grade | % F grade |
|---|---|---|---|---|
| Rubi | 86.286 | 0.000 | 13.143 | 0.571 |
| Mathematica | 78.286 | 13.143 | 8.571 | 0.000 |
| Maple | 53.714 | 20.000 | 4.000 | 22.286 |
| Giac | 41.143 | 16.000 | 4.000 | 38.857 |
| Maxima | 33.714 | 24.571 | 4.000 | 37.714 |
| Fricas | 22.286 | 55.429 | 18.857 | 3.429 |
| Sympy | 1.714 | 0.000 | 0.000 | 98.286 |
| Mupad | 0.000 | 52.000 | 0.000 | 48.000 |

Table 1.3: Antiderivative Grade distribution of each CAS

The following is a Bar chart illustration of the data in the above table.




The figure below compares the grades of the CAS systems.




The following table shows the distribution of the different types of failures for each CAS. There are 3 types failures. The first is when CAS returns the input within the time limit, which means it could not solve it. This is the typical failure and given as **F**.

The second failure is due to time out. CAS could not solve the integral within the 3 minutes time limit which is assigned. This is assigned **F(-1)**.

The third is due to an exception generated, indicated as **F(-2)**. This most likely indicates an interface problem between sagemath and the CAS (applicable only to FriCAS, Maxima

and Giac) or it could be an indication of an internal error in the CAS itself. This type of error requires more investigation to determine the cause.

| System | Number failed | Percentage normal failure | Percentage timeout failure | Percentage exception failure |
|---|---|---|---|---|
| Mathematica | 0 | 0.00 | 0.00 | 0.00 |
| Rubi | 1 | 100.00 | 0.00 | 0.00 |
| Fricas | 6 | 100.00 | 0.00 | 0.00 |
| Maple | 39 | 100.00 | 0.00 | 0.00 |
| Maxima | 66 | 96.97 | 0.00 | 3.03 |
| Giac | 68 | 58.82 | 36.76 | 4.41 |
| Mupad | 84 | 0.00 | 100.00 | 0.00 |
| Sympy | 172 | 100.00 | 0.00 | 0.00 |

Table 1.4: Failure statistics for each CAS

## 1.3 Time and leaf size Performance

The table below summarizes the performance of each CAS system in terms of time used and leaf size of results.

Mean size is the average leaf size produced by the CAS (before any normalization). The Normalized mean is relative to the mean size of the optimal anti-derivative given in the input files.

For example, if CAS has **Normalized mean** of 3, then the mean size of its leaf size is 3 times as large as the mean size of the optimal leaf size.

Median size is value of leaf size where half the values are larger than this and half are smaller (before any normalization). i.e. The Middle value.

Similarly the **Normalized median** is relative to the median leaf size of the optimal.

For example, if a CAS has Normalized median of 1.2, then its median is 1.2 as large as the median leaf size of the optimal.

| System | Mean time (sec) |
|---|---|
| Fricas | 0.23 |
| Maxima | 0.23 |
| Giac | 0.29 |
| Sympy | 0.30 |
| Rubi | 0.35 |
| Mathematica | 0.40 |
| Mupad | 2.11 |
| Maple | 3.75 |

Table 1.5: Time performance for each CAS

| System | Mean size | Normalized mean | Median size | Normalized median |
|---|---|---|---|---|
| Sympy | 27.00 | 1.60 | 22.00 | 1.42 |
| Rubi | 70.99 | 1.10 | 68.00 | 1.05 |
| Mathematica | 75.07 | 1.31 | 62.00 | 1.00 |
| Giac | 91.97 | 1.64 | 62.00 | 1.46 |
| Maple | 102.65 | 1.78 | 87.00 | 1.46 |
| Maxima | 105.02 | 1.76 | 75.00 | 1.55 |
| Mupad | 151.23 | 2.36 | 81.00 | 2.16 |
| Fricas | 415.40 | 5.06 | 154.00 | 3.19 |

Table 1.6: Leaf size performance for each CAS

## 1.4 Performance based on number of rules Rubi used

This section shows how each CAS performed based on the number of rules Rubi needed to solve the same integral. One diagram is given for each CAS.

On the $y$ axis is the percentage solved which Rubi itself needed the number of rules given the $x$ axis. These plots show that as more rules are needed then most CAS system percentage of solving decreases which indicates the integral is becoming more complicated to solve.

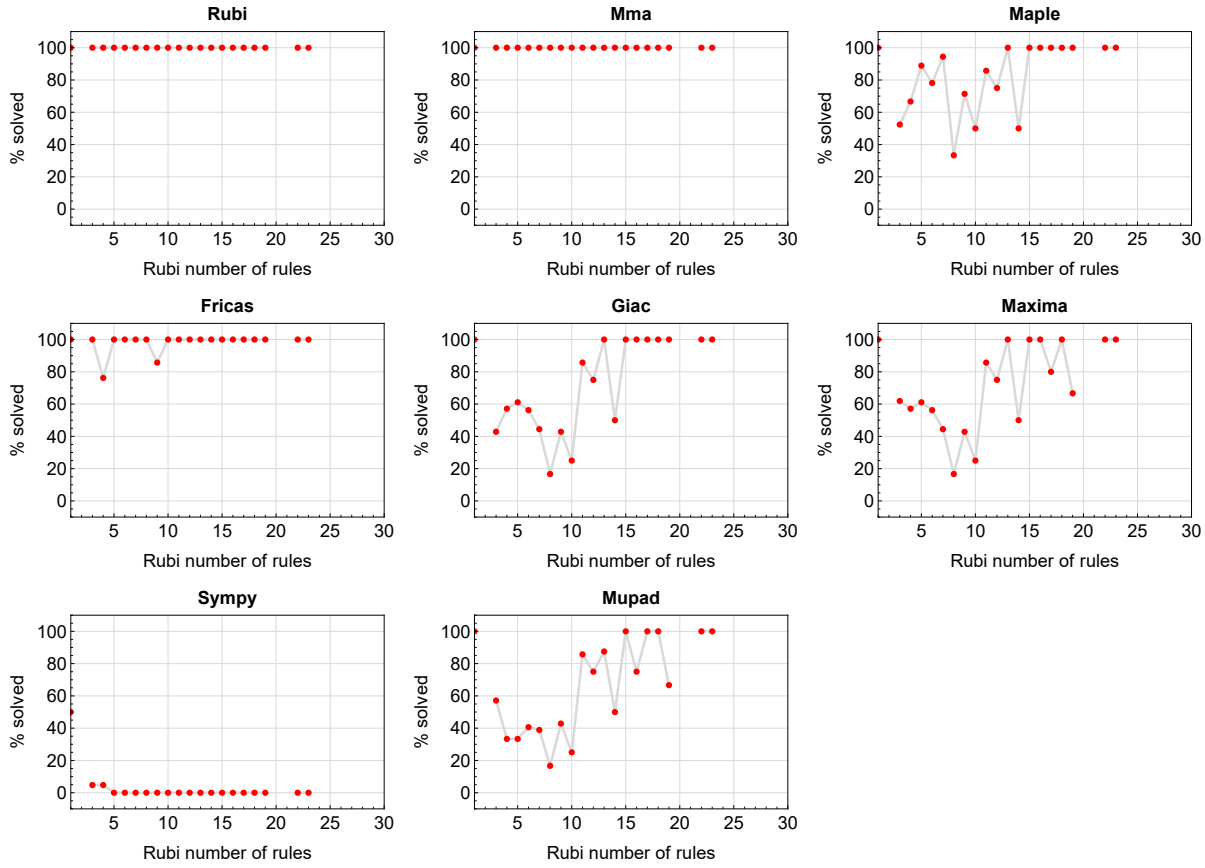



Figure 1.1: Solving statistics per number of Rubi rules used

## 1.5 Performance based on number of steps Rubi used

This section shows how each CAS performed based on the number of steps Rubi needed to solve the same integral. Note that the number of steps Rubi needed can be much higher than the number of rules, as the same rule could be used more than once.

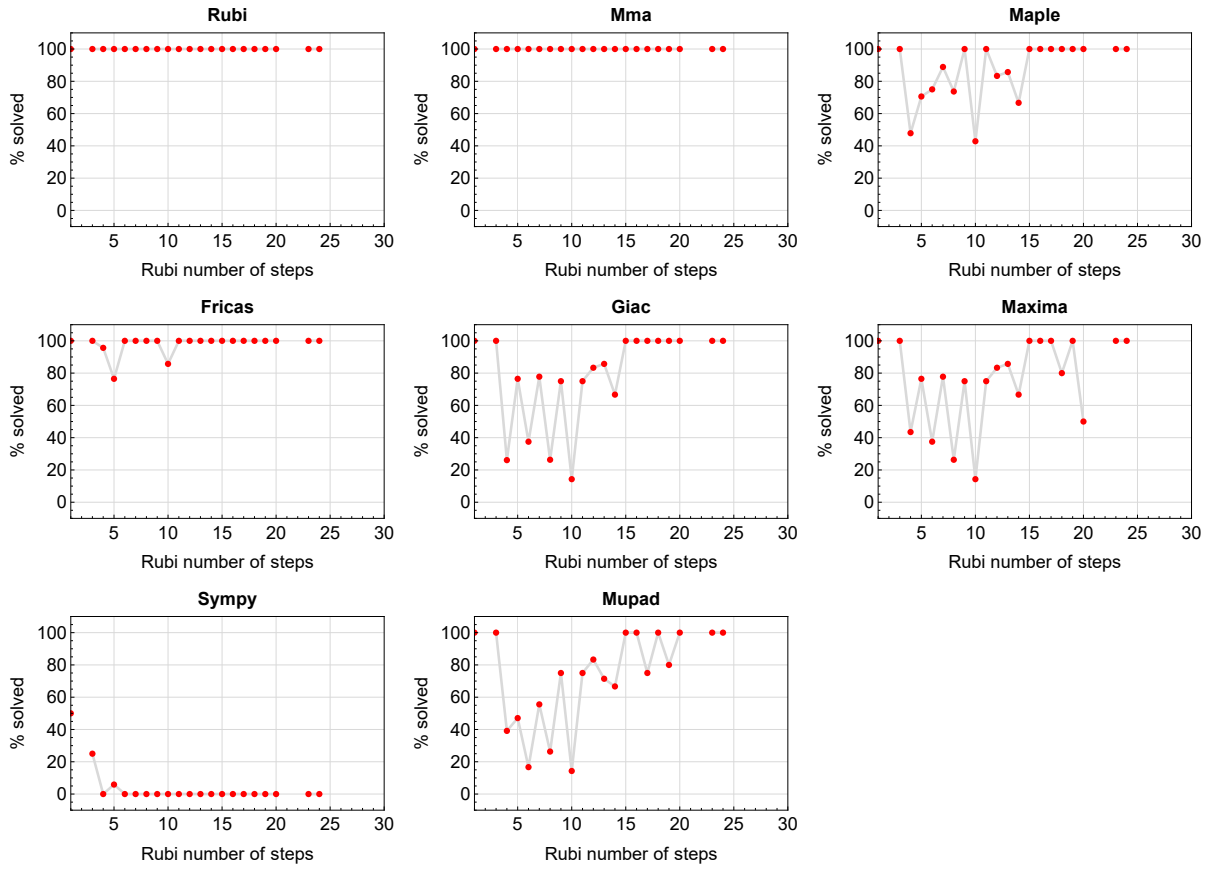



Figure 1.2: Solving statistics per number of Rubi steps used

The above diagram show that the precentage of solved intergals decreases for most CAS systems as the number of steps increases. As expected, for integrals that required less steps by Rubi, CAS systems had more success which indicates the integral was not as hard to solve. As Rubi needed more steps to solve the integral, the solved percentage decreased for most CAS systems which indicates the integral is becoming harder to solve.

## 1.6 Solved integrals histogram based on leaf size of result

The following shows the distribution of solved integrals for each CAS system based on leaf size of the antiderivatives produced by each CAS. It shows that most integrals solved produced leaf size less than about 100 to 150. The bin size used is 40.

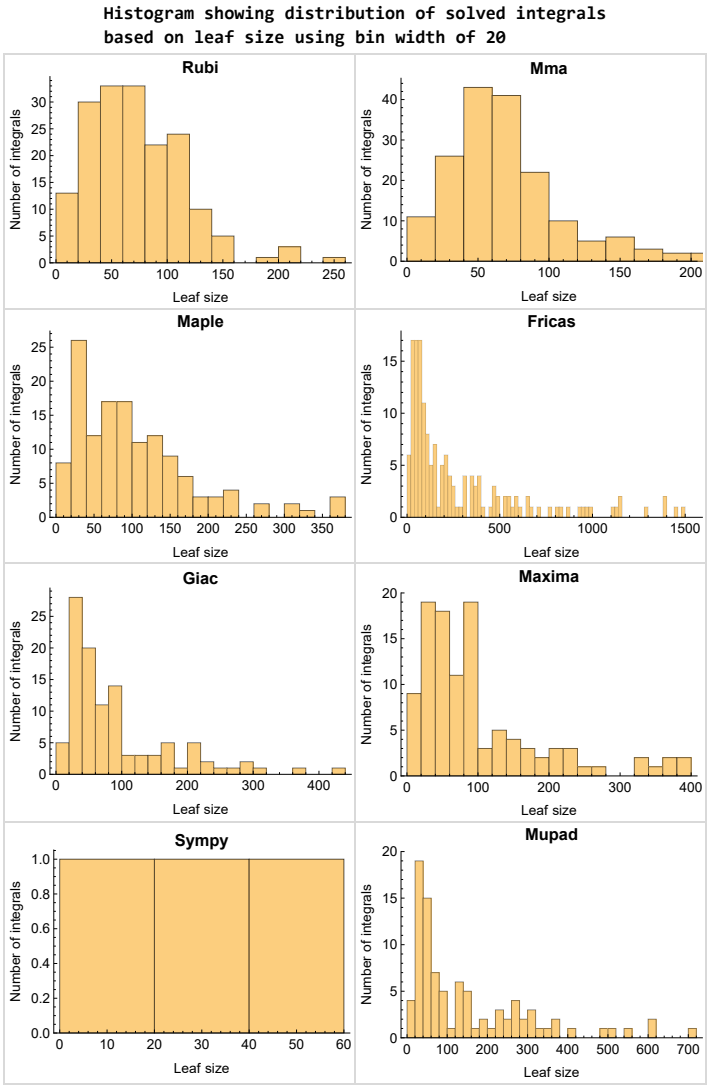



Figure 1.3: Solved integrals based on leaf size distribution

## 1.7 Solved integrals histogram based on CPU time used

The following shows the distribution of solved integrals for each CAS system based on CPU time used in seconds. The bin size used is 0.1 second.

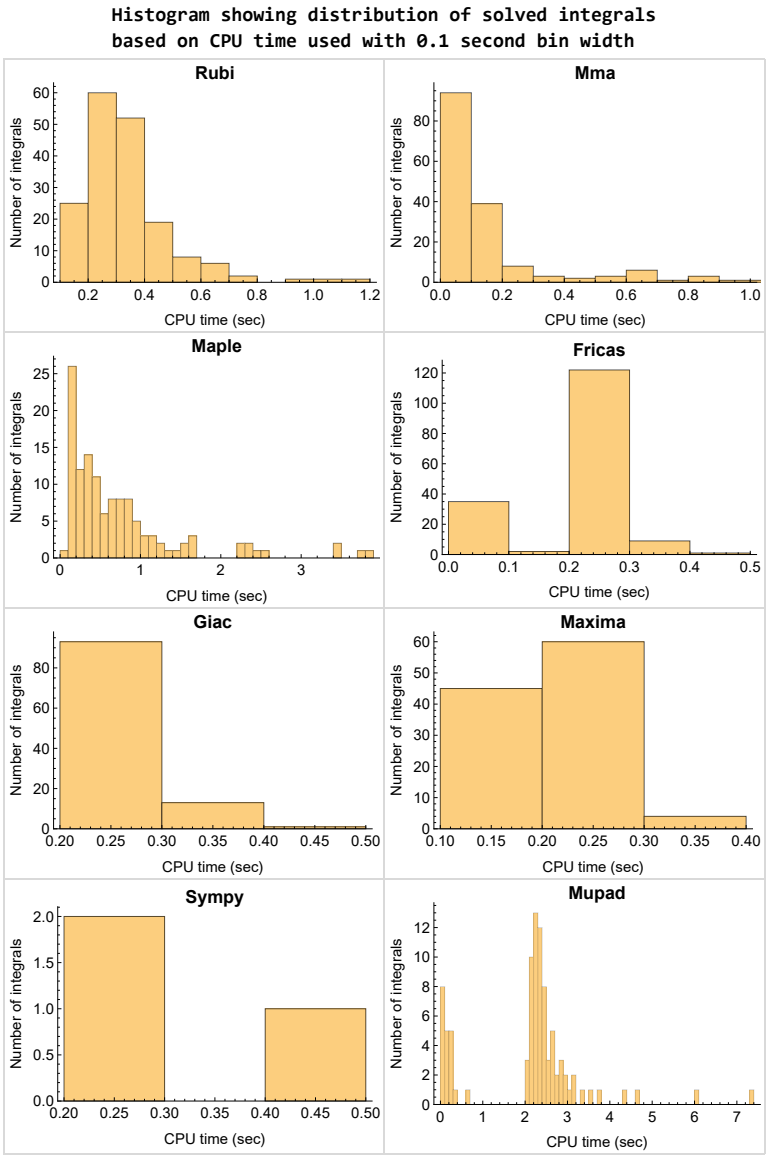



Figure 1.4: Solved integrals histogram based on CPU time used

## 1.8 Leaf size vs. CPU time used

The following gives the relation between the CPU time used to solve an integral and the leaf size of the antiderivative.

The result for Fricas, Maxima and Giac is shifted more to the right than the other CAS system due to the use of sagemath to call them, which causes an initial slight delay in the timing to start the integration due to overhead of starting a new process each time.

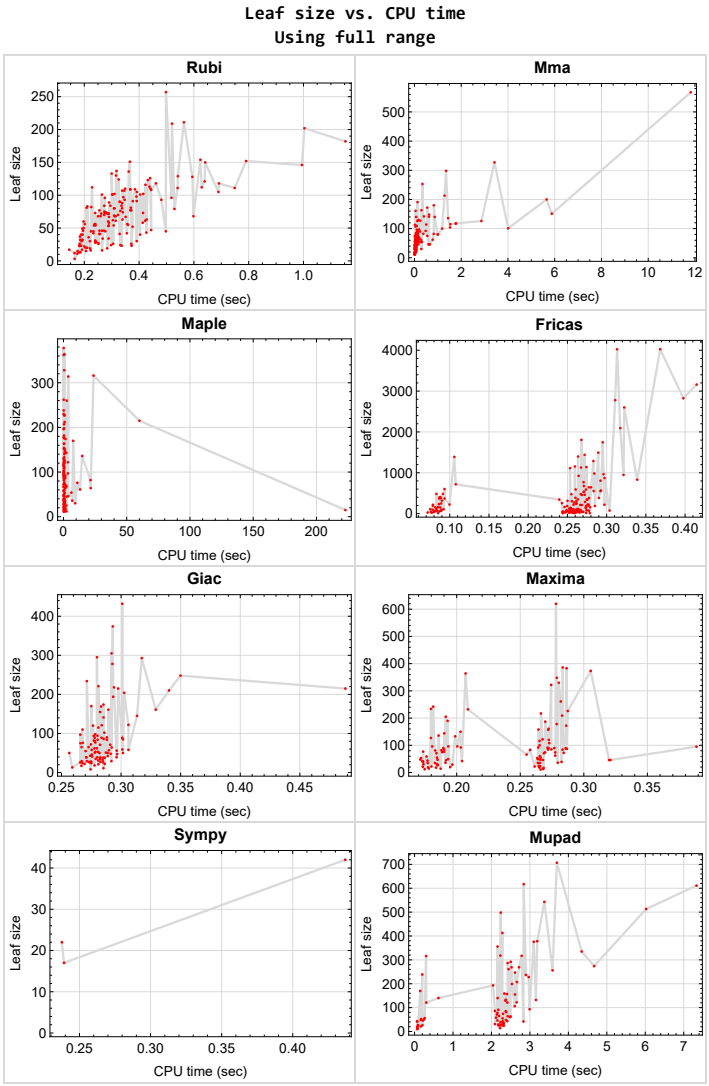



Figure 1.5: Leaf size vs. CPU time. Full range

## 1.9 list of integrals with no known antiderivative

{}

## 1.10 List of integrals solved by CAS but has no known antiderivative

**Rubi** {}

**Mathematica** {}

**Maple** {}

**Maxima** {}

**Fricas** {}

**Sympy** {}

**Giac** {}

**Mupad** {}

## 1.11 list of integrals solved by CAS but failed verification

The following are integrals solved by CAS but the verification phase failed to verify the anti-derivative produced is correct. This does not necessarily mean that the anti-derivative is wrong as additional methods of verification might be needed, or more time is needed (3 minutes time limit was used). These integrals are listed here to make it possible to do further investigation to determine why the result could not be verified.

**Rubi** {74, 75, 76, 130, 131, 132, 134, 135, 136, 137, 139, 142, 143, 144, 146, 147, 148, 149, 150, 151, 154, 155}

**Mathematica** {164}

**Maple** {125, 126, 127, 128, 129, 130, 131}

**Maxima** Verification phase not currently implemented.

**Fricas** Verification phase not currently implemented.

**Sympy** Verification phase not currently implemented.

**Giac** Verification phase not currently implemented.

**Mupad** Verification phase not currently implemented.

## 1.12 Timing

The command `AbsoluteTiming[]` was used in Mathematica to obtain the elapsed time for each integrate call. In Maple, the command `Usage` was used as in the following example

```
cpu_time := Usage(assign ('result_of_int',int(expr,x)),output='realtime'
```

For all other CAS systems, the elapsed time to complete each integral was found by taking the difference between the time after the call completed from the time before the call was made. This was done using Python's `time.time()` call.

All elapsed times shown are in seconds. A time limit of 3 CPU minutes was used for each integral. If the integrate command did not complete within this time limit, the integral was aborted and considered to have failed and assigned an F grade. The time used by failed integrals due to time out was not counted in the final statistics.

## 1.13 Verification

A verification phase was applied on the result of integration for `Rubi` and `Mathematica`.

Future version of this report will implement verification for the other CAS systems. For the integrals whose result was not run through a verification phase, it is assumed that the antiderivative was correct.

Verification phase also had 3 minutes time out. An integral whose result was not verified could still be correct, but further investigation is needed on those integrals. These integrals were marked in the summary table below and also in each integral separate section so they are easy to identify and locate.

## 1.14 Important notes about some of the results

### 1.14.1 Important note about Maxima results

Since tests were run in a batch mode, and using an automated script, then any integral where Maxima needed an interactive response from the user to answer a question during the evaluation of the integral will fail.

The exception raised is `ValueError`. Therefore Maxima results is lower than what would result if Maxima was run directly and each question was answered correctly.

The percentage of such failures were not counted for each test file, but for an example, for the `Timofeev` test file, there were about 14 such integrals out of total 705, or about 2 percent. This percentage can be higher or lower depending on the specific input test file.

Such integrals can be identified by looking at the output of the integration in each section for Maxima. The exception message will indicate the cause of error.

Maxima integrate was run using SageMath with the following settings set by default

```
'besselexpand : true'
'display2d : false'
'domain : complex'
'keepfloat : true'
'load(to_poly_solve)'
'load(simplify_sum)'
'load(abs_integrate)' 'load(diag)'
```

SageMath automatic loading of Maxima `abs_integrate` was found to cause some problems. So the following code was added to disable this effect.

```
from sage.interfaces.maxima_lib import maxima_lib
maxima_lib.set('extra_definite_integration_methods', '[]')
maxima_lib.set('extra_integration_methods', '[]')
```

See `https://ask.sagemath.org/question/43088/integrate-results-that-are-different-from-using-maxima/` for reference.

### 1.14.2 Important note about FriCAS result

There were few integrals which failed due to SageMath interface and not because FriCAS system could not do the integration.

These will fail With error `Exception raised: NotImplementedError`.

The number of such cases seems to be very small. About 1 or 2 percent of all integrals. These can be identified by looking at the exception message given in the result.

### 1.14.3 Important note about finding leaf size of antiderivative

For Mathematica, Rubi, and Maple, the builtin system function `LeafSize` was used to find the leaf size of each antiderivative.

The other CAS systems (SageMath and Sympy) do not have special builtin function for this purpose at this time. Therefore the leaf size for Fricas and Sympy antiderivative was determined using the following function, thanks to user `slelievre` at `https://ask.sagemath.org/question/57123/could-we-have-a-leaf_count-function-in-base-sagemath/`

```
def tree_size(expr):
    r"""
    Return the tree size of this expression.
    """
    if expr not in SR:
        # deal with lists, tuples, vectors
        return 1 + sum(tree_size(a) for a in expr)
    expr = SR(expr)
    x, aa = expr.operator(), expr.operands()
    if x is None:
        return 1
    else:
        return 1 + sum(tree_size(a) for a in aa)
```

For Sympy, which was called directly from Python, the following code was used to obtain the leafsize of its result

```
try:
  # 1.7 is a fudge factor since it is low side from actual leaf count
  leafCount = round(1.7*count_ops(anti))

  except Exception as ee:
        leafCount =1
```

### 1.14.4 Important note about Mupad results

Matlab's symbolic toolbox does not have a leaf count function to measure the size of the antiderivative. Maple was used to determine the leaf size of Mupad output by post processing Mupad result.

Currently no grading of the antiderivative for Mupad is implemented. If it can integrate the problem, it was assigned a B grade automatically as a placeholder. In the future, when grading function is implemented for Mupad, the tests will be rerun again.

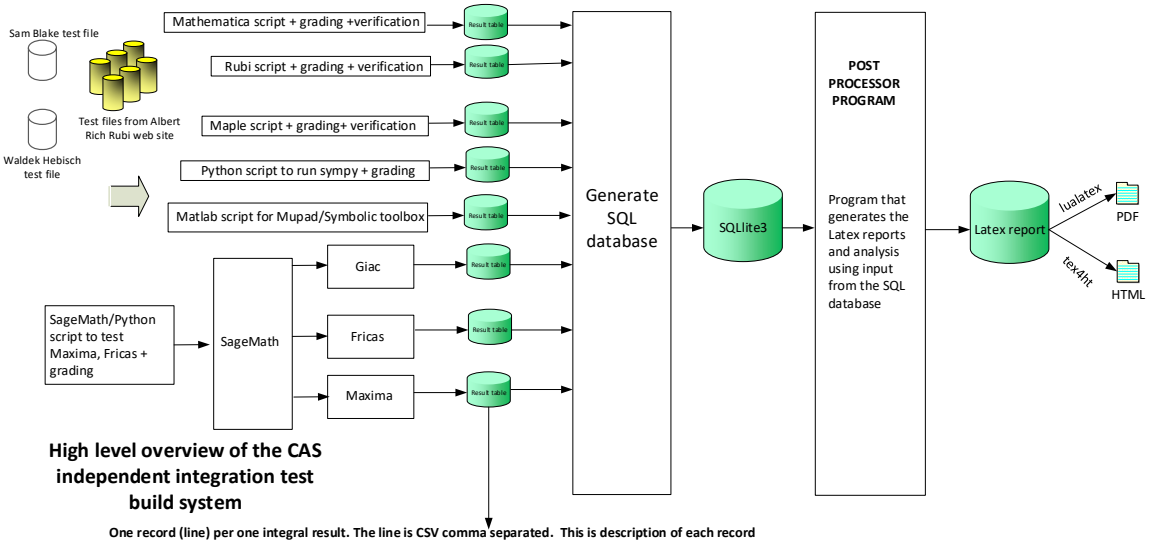
The following is an example of using Matlab's symbolic toolbox (Mupad) to solve an integral

```
integrand = evalin(symengine,'cos(x)*sin(x)')
the_variable = evalin(symengine,'x')
anti = int(integrand,the_variable)
```

Which gives `sin(x)^2/2`

# 1.15 Design of the test system

The following diagram gives a high level view of the current test build system.




**High level overview of the CAS independent integration test build system**

**One record (line) per one integral result. The line is CSV comma separated. This is description of each record**

1. integer, the problem number.
2. integer. 0 for failed, 1 for passed, -1 for timeout, -2 for CAS specific exception. (this is not the grade field)
3. integer. Leaf size of result.
4. integer. Leaf size of the optimal antiderivative.
5. number. CPU time used to solve this integral. 0 if failed.
6. string. The integral in Latex format
7. string. The input used in CAS own syntax.
8. string. The result (antiderivative) produced by CAS in Latex format
9. string. The optimal antiderivative in Latex format.
10. integer. 0 or 1. Indicates if problem has known antiderivative or not
11. String. The result (antiderivative) in CAS own syntax.
12. String. The grade of the antiderivative. Can be "A", "B", "C", or "F"
13. String. Small string description of why the grade was given.
14. integer. 1 if result was verified or 0 if not verified. (For mma, rubi and maple only)

*The following fields are present only in **Rubi** Table file*

15. integer. Number of steps used.
16. integer. Number of rules used.
17. integer. Integrand leaf size.
18. real number. Ratio. Field 16 over field 17
19. String of form "{n,n,..}" which is list of the rules used by Rubi
20. String. The optimal antiderivative in Mathematica syntx

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June 27, 2023
Design.vsdx

# CHAPTER 2

## DETAILED SUMMARY TABLES OF RESULTS


2.1 List of integrals sorted by grade for each CAS . . . . . 21
2.2 Detailed conclusion table per each integral for all CAS systems . . . . . 25
2.3 Detailed conclusion table specific for Rubi results . . . . . 69

# 2.1 List of integrals sorted by grade for each CAS

2.1.1 Rubi . . . . . 21
2.1.2 Mma . . . . . 21
2.1.3 Maple . . . . . 22
2.1.4 Fricas . . . . . 22
2.1.5 Maxima . . . . . 23
2.1.6 Giac . . . . . 23
2.1.7 Mupad . . . . . 24
2.1.8 Sympy . . . . . 24

## 2.1.1 Rubi

**A grade** { 1, 2, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 80, 81, 84, 85, 86, 87, 88, 89, 90, 91, 92, 94, 96, 97, 99, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 115, 117, 118, 119, 120, 122, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 161, 162, 163, 164, 165, 166, 170, 171, 172, 173, 174, 175 }

**B grade** { }

**C grade** { 3, 4, 5, 6, 42, 43, 44, 77, 78, 79, 82, 83, 93, 95, 98, 100, 116, 121, 123, 160, 167, 168, 169 }

**F normal fail** { 114 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

## 2.1.2 Mma

**A grade** { 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 90, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 104, 105, 106, 107, 108, 109, 111, 114, 116, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 133, 135, 137, 138, 139, 141, 143, 145, 147, 149, 152, 153, 156, 157, 158, 160, 163, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175 }

**B grade** { 1, 3, 5, 23, 24, 55, 67, 68, 69, 70, 71, 72, 73, 89, 91, 103, 110, 112, 159, 161, 162, 164, 165 }

**C grade** { 113, 115, 117, 132, 134, 136, 140, 142, 144, 146, 148, 150, 151, 154, 155 }

**F normal fail** { }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.3 Maple

**A grade** { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 42, 43, 44, 45, 49, 50, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 79, 80, 81, 82, 83, 85, 87, 88, 93, 95, 96, 97, 98, 99, 100, 102, 103, 104, 105, 106, 107, 108, 109, 113, 114, 115, 116, 117, 118, 119, 121, 123, 132, 133, 134, 135, 136, 138, 140, 141, 142, 143, 144, 145, 146, 147, 148, 150, 151, 152, 160, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175 }

**B grade** { 17, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 46, 47, 48, 76, 77, 78, 84, 86, 89, 90, 91, 92, 94, 101, 110, 111, 112, 120, 122, 124 }

**C grade** { 125, 126, 127, 128, 129, 130, 131 }

**F normal fail** { 13, 14, 15, 16, 18, 19, 20, 21, 36, 37, 38, 39, 40, 41, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 137, 139, 149, 153, 154, 155, 156, 157, 158, 159, 161, 162, 163, 164 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.4 Fricas

**A grade** { 49, 50, 62, 63, 66, 84, 97, 107, 108, 117, 118, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 146, 147, 148, 149, 151, 152, 153, 154, 155, 161, 162 }

**B grade** { 1, 2, 3, 4, 5, 6, 29, 30, 31, 32, 33, 34, 35, 42, 43, 44, 45, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 64, 65, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 98, 99, 100, 101, 102, 103, 104, 105, 106, 109, 110, 111, 112, 113, 114, 115, 116, 119, 120, 121, 122, 123, 124, 125, 126, 127, 145, 160, 163, 164, 165, 166, 167, 168, 169 }

**C grade** { 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 36, 37, 38, 39, 40, 41, 170, 171, 172, 173, 174, 175 }

**F normal fail** { 21, 150, 156, 157, 158, 159 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.5 Maxima

**A grade** { 1, 2, 29, 30, 31, 32, 33, 34, 35, 45, 46, 47, 48, 49, 50, 62, 63, 64, 65, 66, 67, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 84, 87, 93, 95, 97, 98, 105, 106, 107, 114, 115, 116, 117, 118, 119, 123, 126, 127, 128, 129, 130, 131, 133, 145, 162, 165, 166 }

**B grade** { 3, 4, 5, 6, 42, 43, 44, 68, 69, 70, 76, 83, 85, 86, 88, 89, 92, 94, 96, 99, 100, 101, 102, 103, 104, 108, 109, 110, 111, 112, 113, 120, 121, 122, 124, 125, 141, 153, 160, 161, 167, 168, 169 }

**C grade** { 22, 23, 24, 25, 26, 27, 28 }

**F normal fail** { 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 36, 37, 38, 39, 40, 41, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 132, 134, 135, 136, 137, 138, 139, 140, 142, 143, 144, 146, 147, 148, 149, 150, 151, 152, 154, 155, 156, 157, 158, 159, 163, 164, 170, 171, 172, 173, 174, 175 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { 90, 91 }

### 2.1.6 Giac

**A grade** { 2, 4, 6, 29, 30, 31, 33, 34, 35, 42, 43, 44, 45, 46, 47, 48, 49, 50, 62, 63, 64, 65, 66, 67, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 87, 93, 94, 95, 96, 97, 98, 100, 102, 103, 104, 105, 106, 107, 108, 114, 116, 117, 118, 119, 123, 125, 126, 127, 128, 129, 130, 131, 161, 162, 166, 168 }

**B grade** { 1, 3, 5, 32, 68, 85, 86, 88, 89, 90, 91, 92, 99, 101, 109, 110, 111, 112, 113, 115, 120, 121, 122, 124, 160, 165, 167, 169 }

**C grade** { 22, 23, 24, 25, 26, 27, 28 }

**F normal fail** { 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 36, 37, 38, 39, 40, 41, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 132, 133, 135, 156, 157, 158, 159, 164 }

**F(-1) timedout fail** { 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 149, 150, 151, 152, 153, 154, 155, 163, 170, 171, 172, 173, 174, 175 }

**F(-2) exception fail** { 134, 136, 148 }

### 2.1.7 Mupad

**A grade** { }

**B grade** { 1, 2, 3, 4, 5, 6, 25, 32, 42, 43, 44, 45, 49, 50, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 133, 141, 145, 153, 160, 161, 162, 165, 166, 167, 168, 169 }

**C grade** { }

**F normal fail** { }

**F(-1) timedout fail** { 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 46, 47, 48, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 76, 128, 129, 130, 131, 132, 134, 135, 136, 137, 138, 139, 140, 142, 143, 144, 146, 147, 148, 149, 150, 151, 152, 154, 155, 156, 157, 158, 159, 163, 164, 170, 171, 172, 173, 174, 175 }

**F(-2) exception fail** { }

### 2.1.8 Sympy

**A grade** { 1, 73, 165 }

**B grade** { }

**C grade** { }

**F normal fail** { 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

## 2.2 Detailed conclusion table per each integral for all CAS systems

Detailed conclusion table per each integral is given by the table below. The elapsed time is in seconds. For failed result it is given as **F(-1)** if the failure was due to timeout. It is given as **F(-2)** if the failure was due to an exception being raised, which could indicate a bug in the system. If the failure was due to integral not being evaluated within the time limit, then it is given as **F**.

In this table, the column `N.S.` means **normalized size** and is defined as $\frac{\text{antiderivative leaf size}}{\text{optimal antiderivative leaf size}}$. To make the table fit the page, the name `Mathematica` was abbreviated to `MMA`.

| Problem 1 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | A | B | A | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 12 | 12 | 38 | 15 | 14 | 38 | 17 | 27 | 27 |
| N.S. | 1 | 1.00 | 3.17 | 1.25 | 1.17 | 3.17 | 1.42 | 2.25 | 2.25 |
| time (sec) | N/A | 0.171 | 0.021 | 0.092 | 0.187 | 0.265 | 0.239 | 0.273 | 0.090 |

| Problem 2 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 11 | 11 | 11 | 12 | 18 | 43 | 0 | 18 | 18 |
| N.S. | 1 | 1.00 | 1.00 | 1.09 | 1.64 | 3.91 | 0.00 | 1.64 | 1.64 |
| time (sec) | N/A | 0.179 | 0.017 | 0.763 | 0.184 | 0.244 | 0.000 | 0.278 | 0.074 |

| Problem 3 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | B | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 34 | 42 | 75 | 27 | 84 | 387 | 0 | 84 | 86 |
| N.S. | 1 | 1.24 | 2.21 | 0.79 | 2.47 | 11.38 | 0.00 | 2.47 | 2.53 |
| time (sec) | N/A | 0.243 | 0.019 | 0.763 | 0.190 | 0.260 | 0.000 | 0.280 | 2.091 |

| Problem 4 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 26 | 32 | 35 | 23 | 90 | 164 | 0 | 31 | 31 |
| N.S. | 1 | 1.23 | 1.35 | 0.88 | 3.46 | 6.31 | 0.00 | 1.19 | 1.19 |
| time (sec) | N/A | 0.193 | 0.013 | 0.804 | 0.189 | 0.246 | 0.000 | 0.281 | 2.092 |

| Problem 5 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | B | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 55 | 70 | 113 | 41 | 133 | 1114 | 0 | 110 | 193 |
| N.S. | 1 | 1.27 | 2.05 | 0.75 | 2.42 | 20.25 | 0.00 | 2.00 | 3.51 |
| time (sec) | N/A | 0.336 | 0.024 | 0.788 | 0.199 | 0.253 | 0.000 | 0.268 | 2.042 |

| Problem 6 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 42 | 46 | 56 | 33 | 205 | 344 | 0 | 42 | 42 |
| N.S. | 1 | 1.10 | 1.33 | 0.79 | 4.88 | 8.19 | 0.00 | 1.00 | 1.00 |
| time (sec) | N/A | 0.197 | 0.021 | 0.755 | 0.191 | 0.240 | 0.000 | 0.289 | 0.075 |

| Problem 7 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 80 | 80 | 61 | 101 | 0 | 194 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.76 | 1.26 | 0.00 | 2.42 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.339 | 0.101 | 0.362 | 0.000 | 0.078 | 0.000 | 0.000 | 0.000 |

| Problem 8 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 76 | 76 | 57 | 154 | 0 | 96 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.75 | 2.03 | 0.00 | 1.26 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.348 | 0.173 | 0.368 | 0.000 | 0.078 | 0.000 | 0.000 | 0.000 |

| Problem 9 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 54 | 54 | 48 | 87 | 0 | 24 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 1.61 | 0.00 | 0.44 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.246 | 0.158 | 0.308 | 0.000 | 0.077 | 0.000 | 0.000 | 0.000 |

| Problem 10 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 54 | 54 | 50 | 108 | 0 | 150 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.93 | 2.00 | 0.00 | 2.78 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.244 | 0.031 | 0.474 | 0.000 | 0.088 | 0.000 | 0.000 | 0.000 |

| Problem 11 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 80 | 80 | 63 | 100 | 0 | 223 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.79 | 1.25 | 0.00 | 2.79 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.327 | 0.053 | 0.393 | 0.000 | 0.100 | 0.000 | 0.000 | 0.000 |

| Problem 12 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 80 | 80 | 67 | 164 | 0 | 370 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.84 | 2.05 | 0.00 | 4.62 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.327 | 0.094 | 0.398 | 0.000 | 0.086 | 0.000 | 0.000 | 0.000 |

| Problem 13 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 116 | 118 | 79 | 0 | 0 | 484 | 0 | 0 | 0 |
| N.S. | 1 | 1.02 | 0.68 | 0.00 | 0.00 | 4.17 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.481 | 0.149 | 0.000 | 0.000 | 0.083 | 0.000 | 0.000 | 0.000 |

| Problem 14 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 88 | 88 | 66 | 0 | 0 | 217 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.75 | 0.00 | 0.00 | 2.47 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.356 | 0.087 | 0.000 | 0.000 | 0.079 | 0.000 | 0.000 | 0.000 |

| Problem 15 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 84 | 84 | 60 | 0 | 0 | 107 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.71 | 0.00 | 0.00 | 1.27 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.341 | 0.053 | 0.000 | 0.000 | 0.075 | 0.000 | 0.000 | 0.000 |

| Problem 16 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 56 | 56 | 54 | 0 | 0 | 27 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.96 | 0.00 | 0.00 | 0.48 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.247 | 0.037 | 0.000 | 0.000 | 0.072 | 0.000 | 0.000 | 0.000 |

| Problem 17 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 56 | 56 | 52 | 227 | 0 | 154 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.93 | 4.05 | 0.00 | 2.75 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.249 | 0.047 | 0.504 | 0.000 | 0.082 | 0.000 | 0.000 | 0.000 |

| Problem 18 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 90 | 90 | 73 | 0 | 0 | 232 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.81 | 0.00 | 0.00 | 2.58 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.350 | 0.076 | 0.000 | 0.000 | 0.086 | 0.000 | 0.000 | 0.000 |

| Problem 19 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 90 | 90 | 68 | 0 | 0 | 378 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.76 | 0.00 | 0.00 | 4.20 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.344 | 0.110 | 0.000 | 0.000 | 0.089 | 0.000 | 0.000 | 0.000 |

| Problem 20 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 118 | 126 | 80 | 0 | 0 | 483 | 0 | 0 | 0 |
| N.S. | 1 | 1.07 | 0.68 | 0.00 | 0.00 | 4.09 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.463 | 0.136 | 0.000 | 0.000 | 0.091 | 0.000 | 0.000 | 0.000 |

| Problem 21 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | F | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 74 | 74 | 90 | 0 | 0 | 0 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.293 | 0.126 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Problem 22 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | C | C | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 40 | 49 | 51 | 114 | 74 | 117 | 0 | 72 | 0 |
| N.S. | 1 | 1.22 | 1.28 | 2.85 | 1.85 | 2.92 | 0.00 | 1.80 | 0.00 |
| time (sec) | N/A | 0.204 | 0.154 | 0.274 | 0.270 | 0.263 | 0.000 | 0.275 | 0.000 |

| Problem 23 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | B | C | C | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 24 | 26 | 51 | 99 | 49 | 67 | 0 | 57 | 0 |
| N.S. | 1 | 1.08 | 2.12 | 4.12 | 2.04 | 2.79 | 0.00 | 2.38 | 0.00 |
| time (sec) | N/A | 0.196 | 0.040 | 0.156 | 0.264 | 0.256 | 0.000 | 0.290 | 0.000 |

| Problem 24 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | B | C | C | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 3 | 3 | 30 | 67 | 19 | 15 | 0 | 27 | 0 |
| N.S. | 1 | 1.00 | 10.00 | 22.33 | 6.33 | 5.00 | 0.00 | 9.00 | 0.00 |
| time (sec) | N/A | 0.178 | 0.009 | 0.173 | 0.265 | 0.258 | 0.000 | 0.274 | 0.000 |

| Problem 25 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | C | C | F | C | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 13 | 15 | 13 | 58 | 11 | 14 | 0 | 25 | 31 |
| N.S. | 1 | 1.15 | 1.00 | 4.46 | 0.85 | 1.08 | 0.00 | 1.92 | 2.38 |
| time (sec) | N/A | 0.188 | 0.004 | 0.146 | 0.266 | 0.259 | 0.000 | 0.274 | 2.285 |

| Problem 26 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | C | C | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 33 | 37 | 27 | 118 | 23 | 26 | 0 | 38 | 0 |
| N.S. | 1 | 1.12 | 0.82 | 3.58 | 0.70 | 0.79 | 0.00 | 1.15 | 0.00 |
| time (sec) | N/A | 0.197 | 0.038 | 0.149 | 0.266 | 0.257 | 0.000 | 0.282 | 0.000 |

| Problem 27 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | C | C | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 49 | 60 | 33 | 178 | 35 | 38 | 0 | 50 | 0 |
| N.S. | 1 | 1.22 | 0.67 | 3.63 | 0.71 | 0.78 | 0.00 | 1.02 | 0.00 |
| time (sec) | N/A | 0.206 | 0.044 | 0.154 | 0.264 | 0.260 | 0.000 | 0.289 | 0.000 |

| Problem 28 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | C | C | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 65 | 83 | 39 | 238 | 47 | 50 | 0 | 62 | 0 |
| N.S. | 1 | 1.28 | 0.60 | 3.66 | 0.72 | 0.77 | 0.00 | 0.95 | 0.00 |
| time (sec) | N/A | 0.215 | 0.051 | 0.175 | 0.266 | 0.252 | 0.000 | 0.280 | 0.000 |

| Problem 29 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 65 | 82 | 51 | 123 | 92 | 1128 | 0 | 75 | 0 |
| N.S. | 1 | 1.26 | 0.78 | 1.89 | 1.42 | 17.35 | 0.00 | 1.15 | 0.00 |
| time (sec) | N/A | 0.229 | 0.120 | 0.328 | 0.264 | 0.267 | 0.000 | 0.266 | 0.000 |

| Problem 30 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 46 | 56 | 39 | 103 | 60 | 340 | 0 | 58 | 0 |
| N.S. | 1 | 1.22 | 0.85 | 2.24 | 1.30 | 7.39 | 0.00 | 1.26 | 0.00 |
| time (sec) | N/A | 0.209 | 0.082 | 0.155 | 0.265 | 0.276 | 0.000 | 0.275 | 0.000 |

| Problem 31 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 26 | 30 | 30 | 67 | 24 | 97 | 0 | 29 | 0 |
| N.S. | 1 | 1.15 | 1.15 | 2.58 | 0.92 | 3.73 | 0.00 | 1.12 | 0.00 |
| time (sec) | N/A | 0.200 | 0.033 | 0.169 | 0.264 | 0.264 | 0.000 | 0.271 | 0.000 |

| Problem 32 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 13 | 17 | 13 | 58 | 17 | 83 | 0 | 24 | 33 |
| N.S. | 1 | 1.31 | 1.00 | 4.46 | 1.31 | 6.38 | 0.00 | 1.85 | 2.54 |
| time (sec) | N/A | 0.194 | 0.027 | 0.161 | 0.268 | 0.274 | 0.000 | 0.275 | 2.314 |

| Problem 33 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 36 | 50 | 27 | 130 | 35 | 285 | 0 | 41 | 0 |
| N.S. | 1 | 1.39 | 0.75 | 3.61 | 0.97 | 7.92 | 0.00 | 1.14 | 0.00 |
| time (sec) | N/A | 0.208 | 0.042 | 0.165 | 0.266 | 0.273 | 0.000 | 0.276 | 0.000 |

| Problem 34 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 55 | 81 | 36 | 196 | 53 | 590 | 0 | 53 | 0 |
| N.S. | 1 | 1.47 | 0.65 | 3.56 | 0.96 | 10.73 | 0.00 | 0.96 | 0.00 |
| time (sec) | N/A | 0.219 | 0.053 | 0.158 | 0.263 | 0.274 | 0.000 | 0.279 | 0.000 |

| Problem 35 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 74 | 112 | 42 | 262 | 71 | 984 | 0 | 65 | 0 |
| N.S. | 1 | 1.51 | 0.57 | 3.54 | 0.96 | 13.30 | 0.00 | 0.88 | 0.00 |
| time (sec) | N/A | 0.251 | 0.069 | 0.148 | 0.269 | 0.284 | 0.000 | 0.267 | 0.000 |

| Problem 36 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 135 | 150 | 68 | 0 | 0 | 1389 | 0 | 0 | 0 |
| N.S. | 1 | 1.11 | 0.50 | 0.00 | 0.00 | 10.29 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.688 | 0.139 | 0.000 | 0.000 | 0.106 | 0.000 | 0.000 | 0.000 |

| Problem 37 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 81 | 108 | 56 | 0 | 0 | 395 | 0 | 0 | 0 |
| N.S. | 1 | 1.33 | 0.69 | 0.00 | 0.00 | 4.88 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.461 | 0.106 | 0.000 | 0.000 | 0.087 | 0.000 | 0.000 | 0.000 |

| Problem 38 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 56 | 77 | 42 | 0 | 0 | 60 | 0 | 0 | 0 |
| N.S. | 1 | 1.38 | 0.75 | 0.00 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.386 | 0.036 | 0.000 | 0.000 | 0.081 | 0.000 | 0.000 | 0.000 |

| Problem 39 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 62 | 81 | 43 | 0 | 0 | 127 | 0 | 0 | 0 |
| N.S. | 1 | 1.31 | 0.69 | 0.00 | 0.00 | 2.05 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.390 | 0.070 | 0.000 | 0.000 | 0.083 | 0.000 | 0.000 | 0.000 |

| Problem 40 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 89 | 110 | 57 | 0 | 0 | 407 | 0 | 0 | 0 |
| N.S. | 1 | 1.24 | 0.64 | 0.00 | 0.00 | 4.57 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.470 | 0.074 | 0.000 | 0.000 | 0.088 | 0.000 | 0.000 | 0.000 |

| Problem 41 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 135 | 154 | 71 | 0 | 0 | 718 | 0 | 0 | 0 |
| N.S. | 1 | 1.14 | 0.53 | 0.00 | 0.00 | 5.32 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.665 | 0.107 | 0.000 | 0.000 | 0.108 | 0.000 | 0.000 | 0.000 |

| Problem 42 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 164 | 84 | 59 | 72 | 620 | 2825 | 0 | 51 | 498 |
| N.S. | 1 | 0.51 | 0.36 | 0.44 | 3.78 | 17.23 | 0.00 | 0.31 | 3.04 |
| time (sec) | N/A | 0.282 | 0.058 | 0.832 | 0.278 | 0.398 | 0.000 | 0.278 | 2.241 |

| Problem 43 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 118 | 68 | 47 | 60 | 322 | 1493 | 0 | 39 | 356 |
| N.S. | 1 | 0.58 | 0.40 | 0.51 | 2.73 | 12.65 | 0.00 | 0.33 | 3.02 |
| time (sec) | N/A | 0.271 | 0.044 | 0.758 | 0.274 | 0.289 | 0.000 | 0.271 | 2.158 |

| Problem 44 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 62 | 46 | 33 | 46 | 120 | 529 | 0 | 27 | 46 |
| N.S. | 1 | 0.74 | 0.53 | 0.74 | 1.94 | 8.53 | 0.00 | 0.44 | 0.74 |
| time (sec) | N/A | 0.264 | 0.037 | 0.159 | 0.272 | 0.271 | 0.000 | 0.275 | 2.155 |

| Problem 45 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 16 | 16 | 16 | 29 | 13 | 81 | 0 | 13 | 71 |
| N.S. | 1 | 1.00 | 1.00 | 1.81 | 0.81 | 5.06 | 0.00 | 0.81 | 4.44 |
| time (sec) | N/A | 0.234 | 0.027 | 0.194 | 0.268 | 0.263 | 0.000 | 0.259 | 2.142 |

| Problem 46 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 36 | 30 | 24 | 89 | 22 | 253 | 0 | 26 | 0 |
| N.S. | 1 | 0.83 | 0.67 | 2.47 | 0.61 | 7.03 | 0.00 | 0.72 | 0.00 |
| time (sec) | N/A | 0.228 | 0.043 | 0.181 | 0.261 | 0.262 | 0.000 | 0.266 | 0.000 |

| Problem 47 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 86 | 63 | 38 | 230 | 46 | 1141 | 0 | 50 | 0 |
| N.S. | 1 | 0.73 | 0.44 | 2.67 | 0.53 | 13.27 | 0.00 | 0.58 | 0.00 |
| time (sec) | N/A | 0.350 | 0.058 | 0.162 | 0.268 | 0.274 | 0.000 | 0.282 | 0.000 |

| Problem 48 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | B | F | A | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 132 | 93 | 55 | 362 | 72 | 2600 | 0 | 76 | 0 |
| N.S. | 1 | 0.70 | 0.42 | 2.74 | 0.55 | 19.70 | 0.00 | 0.58 | 0.00 |
| time (sec) | N/A | 0.488 | 0.103 | 0.168 | 0.284 | 0.322 | 0.000 | 0.268 | 0.000 |

| Problem 49 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 32 | 32 | 54 | 27 | 35 | 32 | 0 | 29 | 26 |
| N.S. | 1 | 1.00 | 1.69 | 0.84 | 1.09 | 1.00 | 0.00 | 0.91 | 0.81 |
| time (sec) | N/A | 0.193 | 0.320 | 0.406 | 0.183 | 0.261 | 0.000 | 0.292 | 2.250 |

| Problem 50 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 32 | 32 | 54 | 27 | 35 | 32 | 0 | 29 | 26 |
| N.S. | 1 | 1.00 | 1.69 | 0.84 | 1.09 | 1.00 | 0.00 | 0.91 | 0.81 |
| time (sec) | N/A | 0.196 | 0.255 | 0.395 | 0.177 | 0.261 | 0.000 | 0.267 | 2.286 |

| Problem 51 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 107 | 111 | 136 | 0 | 0 | 566 | 0 | 0 | 0 |
| N.S. | 1 | 1.04 | 1.27 | 0.00 | 0.00 | 5.29 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.567 | 1.438 | 0.000 | 0.000 | 0.293 | 0.000 | 0.000 | 0.000 |

| Problem 52 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 72 | 72 | 100 | 0 | 0 | 461 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.39 | 0.00 | 0.00 | 6.40 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.303 | 1.186 | 0.000 | 0.000 | 0.272 | 0.000 | 0.000 | 0.000 |

| Problem 53 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 40 | 40 | 80 | 0 | 0 | 383 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.00 | 0.00 | 0.00 | 9.58 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.198 | 0.989 | 0.000 | 0.000 | 0.278 | 0.000 | 0.000 | 0.000 |

| Problem 54 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 91 | 91 | 118 | 0 | 0 | 551 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.30 | 0.00 | 0.00 | 6.05 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.404 | 1.777 | 0.000 | 0.000 | 0.292 | 0.000 | 0.000 | 0.000 |

| Problem 55 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 123 | 129 | 327 | 0 | 0 | 873 | 0 | 0 | 0 |
| N.S. | 1 | 1.05 | 2.66 | 0.00 | 0.00 | 7.10 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.580 | 3.422 | 0.000 | 0.000 | 0.297 | 0.000 | 0.000 | 0.000 |

| Problem 56 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 40 | 40 | 80 | 0 | 0 | 383 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.00 | 0.00 | 0.00 | 9.58 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.193 | 1.007 | 0.000 | 0.000 | 0.290 | 0.000 | 0.000 | 0.000 |

| Problem 57 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 91 | 91 | 117 | 0 | 0 | 551 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.29 | 0.00 | 0.00 | 6.05 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.409 | 1.761 | 0.000 | 0.000 | 0.283 | 0.000 | 0.000 | 0.000 |

| Problem 58 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 23 | 23 | 46 | 0 | 0 | 212 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.00 | 0.00 | 0.00 | 9.22 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.188 | 0.655 | 0.000 | 0.000 | 0.266 | 0.000 | 0.000 | 0.000 |

| Problem 59 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 23 | 23 | 46 | 0 | 0 | 212 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.00 | 0.00 | 0.00 | 9.22 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.197 | 0.630 | 0.000 | 0.000 | 0.269 | 0.000 | 0.000 | 0.000 |

| Problem 60 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 23 | 23 | 46 | 0 | 0 | 218 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.00 | 0.00 | 0.00 | 9.48 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.197 | 0.630 | 0.000 | 0.000 | 0.277 | 0.000 | 0.000 | 0.000 |

| Problem 61 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 23 | 23 | 46 | 0 | 0 | 218 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.00 | 0.00 | 0.00 | 9.48 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.191 | 0.602 | 0.000 | 0.000 | 0.297 | 0.000 | 0.000 | 0.000 |

| Problem 62 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 58 | 63 | 63 | 65 | 71 | 79 | 0 | 62 | 64 |
| N.S. | 1 | 1.09 | 1.09 | 1.12 | 1.22 | 1.36 | 0.00 | 1.07 | 1.10 |
| time (sec) | N/A | 0.447 | 0.154 | 1.660 | 0.184 | 0.259 | 0.000 | 0.278 | 2.420 |

| Problem 63 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 46 | 52 | 56 | 53 | 59 | 67 | 0 | 50 | 52 |
| N.S. | 1 | 1.13 | 1.22 | 1.15 | 1.28 | 1.46 | 0.00 | 1.09 | 1.13 |
| time (sec) | N/A | 0.391 | 0.153 | 1.068 | 0.176 | 0.266 | 0.000 | 0.256 | 0.168 |

| Problem 64 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 36 | 42 | 46 | 39 | 47 | 55 | 0 | 38 | 38 |
| N.S. | 1 | 1.17 | 1.28 | 1.08 | 1.31 | 1.53 | 0.00 | 1.06 | 1.06 |
| time (sec) | N/A | 0.364 | 0.160 | 0.905 | 0.185 | 0.258 | 0.000 | 0.282 | 2.306 |

| Problem 65 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 20 | 24 | 35 | 25 | 31 | 39 | 0 | 24 | 24 |
| N.S. | 1 | 1.20 | 1.75 | 1.25 | 1.55 | 1.95 | 0.00 | 1.20 | 1.20 |
| time (sec) | N/A | 0.308 | 0.089 | 0.643 | 0.184 | 0.255 | 0.000 | 0.268 | 2.322 |

| Problem 66 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 14 | 13 | 27 | 11 | 12 | 8 | 0 | 8 | 10 |
| N.S. | 1 | 0.93 | 1.93 | 0.79 | 0.86 | 0.57 | 0.00 | 0.57 | 0.71 |
| time (sec) | N/A | 0.187 | 0.094 | 0.282 | 0.175 | 0.244 | 0.000 | 0.274 | 0.068 |

| Problem 67 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 17 | 26 | 46 | 19 | 27 | 31 | 0 | 22 | 26 |
| N.S. | 1 | 1.53 | 2.71 | 1.12 | 1.59 | 1.82 | 0.00 | 1.29 | 1.53 |
| time (sec) | N/A | 0.320 | 0.130 | 0.450 | 0.185 | 0.247 | 0.000 | 0.286 | 0.204 |

| Problem 68 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 26 | 26 | 70 | 35 | 53 | 77 | 0 | 46 | 60 |
| N.S. | 1 | 1.00 | 2.69 | 1.35 | 2.04 | 2.96 | 0.00 | 1.77 | 2.31 |
| time (sec) | N/A | 0.385 | 0.196 | 0.768 | 0.172 | 0.267 | 0.000 | 0.276 | 2.482 |

| Problem 69 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 37 | 47 | 90 | 53 | 77 | 120 | 0 | 50 | 63 |
| N.S. | 1 | 1.27 | 2.43 | 1.43 | 2.08 | 3.24 | 0.00 | 1.35 | 1.70 |
| time (sec) | N/A | 0.452 | 0.241 | 0.948 | 0.174 | 0.255 | 0.000 | 0.302 | 2.496 |

| Problem 70 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 109 | 116 | 567 | 92 | 234 | 1440 | 0 | 169 | 239 |
| N.S. | 1 | 1.06 | 5.20 | 0.84 | 2.15 | 13.21 | 0.00 | 1.55 | 2.19 |
| time (sec) | N/A | 0.441 | 11.817 | 1.480 | 0.180 | 0.272 | 0.000 | 0.283 | 0.200 |

| Problem 71 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 75 | 77 | 151 | 66 | 136 | 769 | 0 | 122 | 170 |
| N.S. | 1 | 1.03 | 2.01 | 0.88 | 1.81 | 10.25 | 0.00 | 1.63 | 2.27 |
| time (sec) | N/A | 0.267 | 5.874 | 1.114 | 0.186 | 0.271 | 0.000 | 0.306 | 0.147 |

| Problem 72 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 34 | 34 | 75 | 37 | 44 | 222 | 0 | 59 | 74 |
| N.S. | 1 | 1.00 | 2.21 | 1.09 | 1.29 | 6.53 | 0.00 | 1.74 | 2.18 |
| time (sec) | N/A | 0.303 | 0.549 | 0.860 | 0.177 | 0.276 | 0.000 | 0.301 | 2.301 |

| Problem 73 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | A | B | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 17 | 17 | 43 | 20 | 19 | 44 | 22 | 32 | 42 |
| N.S. | 1 | 1.00 | 2.53 | 1.18 | 1.12 | 2.59 | 1.29 | 1.88 | 2.47 |
| time (sec) | N/A | 0.146 | 0.005 | 0.133 | 0.177 | 0.270 | 0.238 | 0.285 | 0.064 |

| Problem 74 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 54 | 53 | 64 | 82 | 85 | 186 | 0 | 84 | 121 |
| N.S. | 1 | 0.98 | 1.19 | 1.52 | 1.57 | 3.44 | 0.00 | 1.56 | 2.24 |
| time (sec) | N/A | 0.302 | 0.200 | 0.322 | 0.275 | 0.274 | 0.000 | 0.288 | 0.304 |

| Problem 75 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 101 | 121 | 142 | 176 | 187 | 645 | 0 | 161 | 269 |
| N.S. | 1 | 1.20 | 1.41 | 1.74 | 1.85 | 6.39 | 0.00 | 1.59 | 2.66 |
| time (sec) | N/A | 0.665 | 0.403 | 0.344 | 0.270 | 0.277 | 0.000 | 0.329 | 2.717 |

| Problem 76 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | A | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 163 | 202 | 213 | 328 | 373 | 2094 | 0 | 293 | 0 |
| N.S. | 1 | 1.24 | 1.31 | 2.01 | 2.29 | 12.85 | 0.00 | 1.80 | 0.00 |
| time (sec) | N/A | 1.063 | 1.286 | 0.513 | 0.305 | 0.317 | 0.000 | 0.317 | 0.000 |

| Problem 77 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | B | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 107 | 146 | 104 | 198 | 157 | 807 | 0 | 155 | 199 |
| N.S. | 1 | 1.36 | 0.97 | 1.85 | 1.47 | 7.54 | 0.00 | 1.45 | 1.86 |
| time (sec) | N/A | 1.050 | 1.521 | 0.422 | 0.272 | 0.292 | 0.000 | 0.282 | 2.532 |

| Problem 78 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | B | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 80 | 105 | 82 | 152 | 116 | 456 | 0 | 115 | 157 |
| N.S. | 1 | 1.31 | 1.02 | 1.90 | 1.45 | 5.70 | 0.00 | 1.44 | 1.96 |
| time (sec) | N/A | 0.726 | 0.825 | 0.318 | 0.265 | 0.269 | 0.000 | 0.281 | 2.404 |

| Problem 79 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 57 | 77 | 61 | 92 | 84 | 238 | 0 | 86 | 129 |
| N.S. | 1 | 1.35 | 1.07 | 1.61 | 1.47 | 4.18 | 0.00 | 1.51 | 2.26 |
| time (sec) | N/A | 0.384 | 0.287 | 0.277 | 0.272 | 0.261 | 0.000 | 0.285 | 2.364 |

| Problem 80 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 37 | 45 | 45 | 35 | 54 | 111 | 0 | 56 | 49 |
| N.S. | 1 | 1.22 | 1.22 | 0.95 | 1.46 | 3.00 | 0.00 | 1.51 | 1.32 |
| time (sec) | N/A | 0.285 | 0.023 | 0.103 | 0.266 | 0.258 | 0.000 | 0.296 | 0.166 |

| Problem 81 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 50 | 58 | 67 | 49 | 83 | 156 | 0 | 82 | 287 |
| N.S. | 1 | 1.16 | 1.34 | 0.98 | 1.66 | 3.12 | 0.00 | 1.64 | 5.74 |
| time (sec) | N/A | 0.428 | 0.214 | 0.169 | 0.258 | 0.279 | 0.000 | 0.277 | 2.421 |

| Problem 82 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 59 | 79 | 92 | 73 | 100 | 345 | 0 | 98 | 292 |
| N.S. | 1 | 1.34 | 1.56 | 1.24 | 1.69 | 5.85 | 0.00 | 1.66 | 4.95 |
| time (sec) | N/A | 0.553 | 0.480 | 0.234 | 0.265 | 0.275 | 0.000 | 0.278 | 2.501 |

| Problem 83 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 83 | 111 | 148 | 108 | 158 | 947 | 0 | 141 | 617 |
| N.S. | 1 | 1.34 | 1.78 | 1.30 | 1.90 | 11.41 | 0.00 | 1.70 | 7.43 |
| time (sec) | N/A | 0.792 | 0.627 | 0.302 | 0.264 | 0.322 | 0.000 | 0.285 | 2.838 |

| Problem 84 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 38 | 43 | 32 | 116 | 42 | 43 | 0 | 38 | 41 |
| N.S. | 1 | 1.13 | 0.84 | 3.05 | 1.11 | 1.13 | 0.00 | 1.00 | 1.08 |
| time (sec) | N/A | 0.455 | 0.054 | 0.152 | 0.173 | 0.252 | 0.000 | 0.285 | 2.292 |

| Problem 85 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 19 | 23 | 19 | 15 | 39 | 36 | 0 | 35 | 39 |
| N.S. | 1 | 1.21 | 1.00 | 0.79 | 2.05 | 1.89 | 0.00 | 1.84 | 2.05 |
| time (sec) | N/A | 0.363 | 0.008 | 222.886 | 0.174 | 0.248 | 0.000 | 0.279 | 2.235 |

| Problem 86 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 20 | 24 | 20 | 30 | 30 | 31 | 0 | 26 | 29 |
| N.S. | 1 | 1.20 | 1.00 | 1.50 | 1.50 | 1.55 | 0.00 | 1.30 | 1.45 |
| time (sec) | N/A | 0.343 | 0.042 | 9.222 | 0.174 | 0.252 | 0.000 | 0.285 | 2.213 |

| Problem 87 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 16 | 16 | 16 | 25 | 21 | 28 | 0 | 21 | 12 |
| N.S. | 1 | 1.00 | 1.00 | 1.56 | 1.31 | 1.75 | 0.00 | 1.31 | 0.75 |
| time (sec) | N/A | 0.278 | 0.011 | 2.259 | 0.173 | 0.252 | 0.000 | 0.281 | 0.084 |

| Problem 88 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 28 | 30 | 20 | 30 | 41 | 52 | 0 | 51 | 46 |
| N.S. | 1 | 1.07 | 0.71 | 1.07 | 1.46 | 1.86 | 0.00 | 1.82 | 1.64 |
| time (sec) | N/A | 0.414 | 0.027 | 1.185 | 0.173 | 0.256 | 0.000 | 0.287 | 0.218 |

| Problem 89 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 19 | 23 | 64 | 31 | 81 | 32 | 0 | 27 | 31 |
| N.S. | 1 | 1.21 | 3.37 | 1.63 | 4.26 | 1.68 | 0.00 | 1.42 | 1.63 |
| time (sec) | N/A | 0.399 | 0.062 | 0.606 | 0.183 | 0.252 | 0.000 | 0.283 | 2.307 |

| Problem 90 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | F(-2) | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 40 | 45 | 32 | 61 | 0 | 142 | 0 | 94 | 122 |
| N.S. | 1 | 1.12 | 0.80 | 1.52 | 0.00 | 3.55 | 0.00 | 2.35 | 3.05 |
| time (sec) | N/A | 0.526 | 0.043 | 13.089 | 0.000 | 0.254 | 0.000 | 0.280 | 2.655 |

| Problem 91 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | B | F(-2) | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 29 | 40 | 96 | 93 | 0 | 68 | 0 | 55 | 207 |
| N.S. | 1 | 1.38 | 3.31 | 3.21 | 0.00 | 2.34 | 0.00 | 1.90 | 7.14 |
| time (sec) | N/A | 0.423 | 0.100 | 0.229 | 0.000 | 0.254 | 0.000 | 0.270 | 2.663 |

| Problem 92 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 102 | 101 | 97 | 378 | 242 | 1398 | 0 | 194 | 228 |
| N.S. | 1 | 0.99 | 0.95 | 3.71 | 2.37 | 13.71 | 0.00 | 1.90 | 2.24 |
| time (sec) | N/A | 0.419 | 0.198 | 0.129 | 0.181 | 0.264 | 0.000 | 0.293 | 2.968 |

| Problem 93 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 125 | 152 | 180 | 215 | 217 | 924 | 0 | 221 | 247 |
| N.S. | 1 | 1.22 | 1.44 | 1.72 | 1.74 | 7.39 | 0.00 | 1.77 | 1.98 |
| time (sec) | N/A | 0.824 | 0.827 | 60.041 | 0.266 | 0.264 | 0.000 | 0.281 | 2.613 |

| Problem 94 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 57 | 56 | 56 | 136 | 127 | 476 | 0 | 97 | 121 |
| N.S. | 1 | 0.98 | 0.98 | 2.39 | 2.23 | 8.35 | 0.00 | 1.70 | 2.12 |
| time (sec) | N/A | 0.371 | 0.028 | 14.752 | 0.180 | 0.255 | 0.000 | 0.266 | 2.415 |

| Problem 95 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 77 | 96 | 80 | 122 | 122 | 304 | 0 | 121 | 159 |
| N.S. | 1 | 1.25 | 1.04 | 1.58 | 1.58 | 3.95 | 0.00 | 1.57 | 2.06 |
| time (sec) | N/A | 0.542 | 0.127 | 3.476 | 0.268 | 0.261 | 0.000 | 0.284 | 2.335 |

| Problem 96 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 20 | 19 | 19 | 31 | 48 | 80 | 0 | 39 | 20 |
| N.S. | 1 | 0.95 | 0.95 | 1.55 | 2.40 | 4.00 | 0.00 | 1.95 | 1.00 |
| time (sec) | N/A | 0.294 | 0.008 | 0.656 | 0.171 | 0.260 | 0.000 | 0.271 | 0.075 |

| Problem 97 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 64 | 54 | 56 | 72 | 66 | 57 | 0 | 89 | 93 |
| N.S. | 1 | 0.84 | 0.88 | 1.12 | 1.03 | 0.89 | 0.00 | 1.39 | 1.45 |
| time (sec) | N/A | 0.328 | 0.048 | 0.266 | 0.255 | 0.259 | 0.000 | 0.284 | 2.991 |

| Problem 98 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 60 | 73 | 67 | 81 | 91 | 256 | 0 | 85 | 133 |
| N.S. | 1 | 1.22 | 1.12 | 1.35 | 1.52 | 4.27 | 0.00 | 1.42 | 2.22 |
| time (sec) | N/A | 0.423 | 0.176 | 0.490 | 0.271 | 0.243 | 0.000 | 0.302 | 2.371 |

| Problem 99 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 95 | 123 | 127 | 143 | 161 | 675 | 0 | 218 | 256 |
| N.S. | 1 | 1.29 | 1.34 | 1.51 | 1.69 | 7.11 | 0.00 | 2.29 | 2.69 |
| time (sec) | N/A | 0.445 | 0.250 | 2.237 | 0.272 | 0.271 | 0.000 | 0.294 | 3.589 |

| Problem 100 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 104 | 128 | 114 | 170 | 226 | 1155 | 0 | 174 | 269 |
| N.S. | 1 | 1.23 | 1.10 | 1.63 | 2.17 | 11.11 | 0.00 | 1.67 | 2.59 |
| time (sec) | N/A | 0.634 | 0.507 | 7.646 | 0.287 | 0.260 | 0.000 | 0.285 | 2.522 |

| Problem 101 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 149 | 209 | 163 | 316 | 348 | 2778 | 0 | 374 | 513 |
| N.S. | 1 | 1.40 | 1.09 | 2.12 | 2.34 | 18.64 | 0.00 | 2.51 | 3.44 |
| time (sec) | N/A | 0.548 | 0.299 | 23.740 | 0.279 | 0.311 | 0.000 | 0.293 | 6.022 |

| Problem 102 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 109 | 101 | 75 | 97 | 144 | 304 | 0 | 120 | 274 |
| N.S. | 1 | 0.93 | 0.69 | 0.89 | 1.32 | 2.79 | 0.00 | 1.10 | 2.51 |
| time (sec) | N/A | 0.275 | 0.139 | 3.434 | 0.190 | 0.256 | 0.000 | 0.276 | 4.669 |

| Problem 103 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 52 | 61 | 126 | 68 | 96 | 124 | 0 | 58 | 237 |
| N.S. | 1 | 1.17 | 2.42 | 1.31 | 1.85 | 2.38 | 0.00 | 1.12 | 4.56 |
| time (sec) | N/A | 0.443 | 0.123 | 2.424 | 0.181 | 0.252 | 0.000 | 0.306 | 2.894 |

| Problem 104 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 77 | 73 | 61 | 71 | 96 | 186 | 0 | 94 | 140 |
| N.S. | 1 | 0.95 | 0.79 | 0.92 | 1.25 | 2.42 | 0.00 | 1.22 | 1.82 |
| time (sec) | N/A | 0.257 | 0.084 | 1.672 | 0.200 | 0.285 | 0.000 | 0.277 | 0.622 |

| Problem 105 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 36 | 41 | 71 | 35 | 42 | 50 | 0 | 34 | 85 |
| N.S. | 1 | 1.14 | 1.97 | 0.97 | 1.17 | 1.39 | 0.00 | 0.94 | 2.36 |
| time (sec) | N/A | 0.350 | 0.103 | 1.218 | 0.204 | 0.260 | 0.000 | 0.282 | 2.370 |

| Problem 106 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 45 | 45 | 39 | 35 | 45 | 71 | 0 | 53 | 50 |
| N.S. | 1 | 1.00 | 0.87 | 0.78 | 1.00 | 1.58 | 0.00 | 1.18 | 1.11 |
| time (sec) | N/A | 0.234 | 0.030 | 0.804 | 0.192 | 0.278 | 0.000 | 0.281 | 0.244 |

| Problem 107 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 13 | 13 | 13 | 15 | 15 | 11 | 0 | 11 | 14 |
| N.S. | 1 | 1.00 | 1.00 | 1.15 | 1.15 | 0.85 | 0.00 | 0.85 | 1.08 |
| time (sec) | N/A | 0.188 | 0.007 | 1.027 | 0.178 | 0.279 | 0.000 | 0.285 | 2.222 |

| Problem 108 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 11 | 15 | 22 | 18 | 20 | 16 | 0 | 17 | 21 |
| N.S. | 1 | 1.36 | 2.00 | 1.64 | 1.82 | 1.45 | 0.00 | 1.55 | 1.91 |
| time (sec) | N/A | 0.214 | 0.071 | 1.625 | 0.195 | 0.274 | 0.000 | 0.267 | 0.164 |

| Problem 109 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 12 | 20 | 12 | 12 | 36 | 40 | 0 | 39 | 27 |
| N.S. | 1 | 1.67 | 1.00 | 1.00 | 3.00 | 3.33 | 0.00 | 3.25 | 2.25 |
| time (sec) | N/A | 0.222 | 0.013 | 2.366 | 0.191 | 0.269 | 0.000 | 0.280 | 2.219 |

| Problem 110 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 27 | 34 | 76 | 46 | 55 | 86 | 0 | 43 | 56 |
| N.S. | 1 | 1.26 | 2.81 | 1.70 | 2.04 | 3.19 | 0.00 | 1.59 | 2.07 |
| time (sec) | N/A | 0.285 | 0.050 | 3.824 | 0.184 | 0.275 | 0.000 | 0.274 | 0.263 |

| Problem 111 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 30 | 36 | 30 | 54 | 75 | 100 | 0 | 65 | 81 |
| N.S. | 1 | 1.20 | 1.00 | 1.80 | 2.50 | 3.33 | 0.00 | 2.17 | 2.70 |
| time (sec) | N/A | 0.227 | 0.012 | 6.257 | 0.189 | 0.264 | 0.000 | 0.273 | 2.383 |

| Problem 112 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 43 | 55 | 140 | 76 | 96 | 157 | 0 | 71 | 106 |
| N.S. | 1 | 1.28 | 3.26 | 1.77 | 2.23 | 3.65 | 0.00 | 1.65 | 2.47 |
| time (sec) | N/A | 0.376 | 0.069 | 10.997 | 0.193 | 0.274 | 0.000 | 0.291 | 2.606 |

| Problem 113 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 194 | 257 | 253 | 364 | 383 | 4025 | 0 | 432 | 611 |
| N.S. | 1 | 1.32 | 1.30 | 1.88 | 1.97 | 20.75 | 0.00 | 2.23 | 3.15 |
| time (sec) | N/A | 0.490 | 0.340 | 0.812 | 0.286 | 0.368 | 0.000 | 0.301 | 7.331 |

| Problem 114 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | F | A | A | A | B | F | A | B |
| verified | N/A | N/A | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 183 | 0 | 141 | 207 | 261 | 1746 | 0 | 215 | 707 |
| N.S. | 1 | 0.00 | 0.77 | 1.13 | 1.43 | 9.54 | 0.00 | 1.17 | 3.86 |
| time (sec) | N/A | 0.000 | 0.618 | 0.468 | 0.282 | 0.295 | 0.000 | 0.297 | 3.700 |

| Problem 115 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | A | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 113 | 151 | 191 | 182 | 172 | 965 | 0 | 234 | 335 |
| N.S. | 1 | 1.34 | 1.69 | 1.61 | 1.52 | 8.54 | 0.00 | 2.07 | 2.96 |
| time (sec) | N/A | 0.374 | 0.133 | 0.447 | 0.286 | 0.296 | 0.000 | 0.271 | 4.346 |

| Problem 116 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 100 | 112 | 82 | 95 | 108 | 349 | 0 | 102 | 376 |
| N.S. | 1 | 1.12 | 0.82 | 0.95 | 1.08 | 3.49 | 0.00 | 1.02 | 3.76 |
| time (sec) | N/A | 0.683 | 0.382 | 0.277 | 0.273 | 0.263 | 0.000 | 0.286 | 3.099 |

| Problem 117 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 61 | 84 | 63 | 97 | 74 | 75 | 0 | 89 | 132 |
| N.S. | 1 | 1.38 | 1.03 | 1.59 | 1.21 | 1.23 | 0.00 | 1.46 | 2.16 |
| time (sec) | N/A | 0.303 | 0.040 | 0.298 | 0.278 | 0.304 | 0.000 | 0.278 | 3.156 |

| Problem 118 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 19 | 22 | 11 | 21 | 28 | 27 | 0 | 22 | 25 |
| N.S. | 1 | 1.16 | 0.58 | 1.11 | 1.47 | 1.42 | 0.00 | 1.16 | 1.32 |
| time (sec) | N/A | 0.209 | 0.007 | 0.316 | 0.185 | 0.265 | 0.000 | 0.269 | 0.088 |

| Problem 119 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 57 | 68 | 75 | 84 | 90 | 141 | 0 | 89 | 316 |
| N.S. | 1 | 1.19 | 1.32 | 1.47 | 1.58 | 2.47 | 0.00 | 1.56 | 5.54 |
| time (sec) | N/A | 0.634 | 0.101 | 0.462 | 0.272 | 0.273 | 0.000 | 0.301 | 0.299 |

| Problem 120 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 32 | 41 | 37 | 75 | 82 | 199 | 0 | 80 | 261 |
| N.S. | 1 | 1.28 | 1.16 | 2.34 | 2.56 | 6.22 | 0.00 | 2.50 | 8.16 |
| time (sec) | N/A | 0.265 | 0.034 | 0.670 | 0.188 | 0.277 | 0.000 | 0.278 | 2.443 |

| Problem 121 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 88 | 118 | 172 | 150 | 178 | 831 | 0 | 161 | 378 |
| N.S. | 1 | 1.34 | 1.95 | 1.70 | 2.02 | 9.44 | 0.00 | 1.83 | 4.30 |
| time (sec) | N/A | 0.742 | 0.549 | 1.128 | 0.279 | 0.339 | 0.000 | 0.289 | 3.191 |

| Problem 122 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 70 | 75 | 83 | 174 | 190 | 1288 | 0 | 170 | 155 |
| N.S. | 1 | 1.07 | 1.19 | 2.49 | 2.71 | 18.40 | 0.00 | 2.43 | 2.21 |
| time (sec) | N/A | 0.287 | 0.085 | 1.597 | 0.193 | 0.283 | 0.000 | 0.275 | 2.613 |

| Problem 123 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 183 | 211 | 298 | 260 | 330 | 3160 | 0 | 305 | 543 |
| N.S. | 1 | 1.15 | 1.63 | 1.42 | 1.80 | 17.27 | 0.00 | 1.67 | 2.97 |
| time (sec) | N/A | 0.600 | 1.352 | 2.576 | 0.280 | 0.415 | 0.000 | 0.292 | 3.374 |

| Problem 124 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 119 | 124 | 130 | 314 | 364 | 4024 | 0 | 295 | 317 |
| N.S. | 1 | 1.04 | 1.09 | 2.64 | 3.06 | 33.82 | 0.00 | 2.48 | 2.66 |
| time (sec) | N/A | 0.345 | 0.171 | 3.737 | 0.207 | 0.313 | 0.000 | 0.280 | 2.784 |

| Problem 125 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | B | B | F | A | B |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 199 | 113 | 84 | 87 | 386 | 592 | 0 | 90 | 413 |
| N.S. | 1 | 0.57 | 0.42 | 0.44 | 1.94 | 2.97 | 0.00 | 0.45 | 2.08 |
| time (sec) | N/A | 0.462 | 0.062 | 1.368 | 0.283 | 0.260 | 0.000 | 0.288 | 2.283 |

| Problem 126 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | A | B | F | A | B |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 147 | 93 | 72 | 65 | 209 | 315 | 0 | 77 | 91 |
| N.S. | 1 | 0.63 | 0.49 | 0.44 | 1.42 | 2.14 | 0.00 | 0.52 | 0.62 |
| time (sec) | N/A | 0.367 | 0.048 | 1.275 | 0.283 | 0.250 | 0.000 | 0.278 | 2.179 |

| Problem 127 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | A | B | F | A | B |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 58 | 58 | 56 | 40 | 84 | 121 | 0 | 64 | 78 |
| N.S. | 1 | 1.00 | 0.97 | 0.69 | 1.45 | 2.09 | 0.00 | 1.10 | 1.34 |
| time (sec) | N/A | 0.310 | 0.034 | 0.358 | 0.283 | 0.253 | 0.000 | 0.292 | 2.156 |

| Problem 128 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | A | A | F | A | F(-1) |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 46 | 46 | 44 | 29 | 39 | 42 | 0 | 48 | 0 |
| N.S. | 1 | 1.00 | 0.96 | 0.63 | 0.85 | 0.91 | 0.00 | 1.04 | 0.00 |
| time (sec) | N/A | 0.291 | 0.031 | 0.316 | 0.282 | 0.245 | 0.000 | 0.291 | 0.000 |

| Problem 129 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | A | A | F | A | F(-1) |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 74 | 61 | 48 | 60 | 36 | 66 | 0 | 71 | 0 |
| N.S. | 1 | 0.82 | 0.65 | 0.81 | 0.49 | 0.89 | 0.00 | 0.96 | 0.00 |
| time (sec) | N/A | 0.329 | 0.036 | 0.416 | 0.279 | 0.250 | 0.000 | 0.282 | 0.000 |

| Problem 130 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | A | A | F | A | F(-1) |
| verified | N/A | No | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 162 | 74 | 76 | 75 | 62 | 126 | 0 | 204 | 0 |
| N.S. | 1 | 0.46 | 0.47 | 0.46 | 0.38 | 0.78 | 0.00 | 1.26 | 0.00 |
| time (sec) | N/A | 0.364 | 0.049 | 0.719 | 0.278 | 0.255 | 0.000 | 0.303 | 0.000 |

| Problem 131 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | A | A | F | A | F(-1) |
| verified | N/A | No | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 250 | 102 | 109 | 88 | 90 | 218 | 0 | 278 | 0 |
| N.S. | 1 | 0.41 | 0.44 | 0.35 | 0.36 | 0.87 | 0.00 | 1.11 | 0.00 |
| time (sec) | N/A | 0.447 | 0.102 | 0.726 | 0.277 | 0.258 | 0.000 | 0.293 | 0.000 |

| Problem 132 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 81 | 101 | 80 | 125 | 0 | 72 | 0 | 0 | 0 |
| N.S. | 1 | 1.25 | 0.99 | 1.54 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.316 | 0.133 | 0.822 | 0.000 | 0.089 | 0.000 | 0.000 | 0.000 |

| Problem 133 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | F | F | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 30 | 28 | 44 | 39 | 46 | 48 | 0 | 0 | 42 |
| N.S. | 1 | 0.93 | 1.47 | 1.30 | 1.53 | 1.60 | 0.00 | 0.00 | 1.40 |
| time (sec) | N/A | 0.255 | 0.035 | 0.157 | 0.320 | 0.244 | 0.000 | 0.000 | 2.830 |

| Problem 134 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-2) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 119 | 107 | 60 | 127 | 0 | 97 | 0 | 0 | 0 |
| N.S. | 1 | 0.90 | 0.50 | 1.07 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.364 | 0.086 | 0.653 | 0.000 | 0.090 | 0.000 | 0.000 | 0.000 |

| Problem 135 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | F | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 69 | 73 | 74 | 97 | 0 | 92 | 0 | 0 | 0 |
| N.S. | 1 | 1.06 | 1.07 | 1.41 | 0.00 | 1.33 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.293 | 0.098 | 0.205 | 0.000 | 0.266 | 0.000 | 0.000 | 0.000 |

| Problem 136 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-2) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 60 | 72 | 57 | 109 | 0 | 63 | 0 | 0 | 0 |
| N.S. | 1 | 1.20 | 0.95 | 1.82 | 0.00 | 1.05 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.274 | 0.120 | 0.560 | 0.000 | 0.084 | 0.000 | 0.000 | 0.000 |

| Problem 137 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 60 | 68 | 75 | 0 | 0 | 86 | 0 | 0 | 0 |
| N.S. | 1 | 1.13 | 1.25 | 0.00 | 0.00 | 1.43 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.264 | 0.080 | 0.000 | 0.000 | 0.260 | 0.000 | 0.000 | 0.000 |

| Problem 138 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 46 | 46 | 43 | 90 | 0 | 11 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.93 | 1.96 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.277 | 0.082 | 0.420 | 0.000 | 0.085 | 0.000 | 0.000 | 0.000 |

| Problem 139 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 41 | 41 | 54 | 0 | 0 | 43 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.32 | 0.00 | 0.00 | 1.05 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.269 | 0.084 | 0.000 | 0.000 | 0.263 | 0.000 | 0.000 | 0.000 |

| Problem 140 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 74 | 54 | 58 | 126 | 0 | 72 | 0 | 0 | 0 |
| N.S. | 1 | 0.73 | 0.78 | 1.70 | 0.00 | 0.97 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.307 | 0.072 | 0.679 | 0.000 | 0.088 | 0.000 | 0.000 | 0.000 |

| Problem 141 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | F | F(-1) | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 25 | 29 | 33 | 38 | 89 | 37 | 0 | 0 | 58 |
| N.S. | 1 | 1.16 | 1.32 | 1.52 | 3.56 | 1.48 | 0.00 | 0.00 | 2.32 |
| time (sec) | N/A | 0.253 | 0.029 | 0.150 | 0.286 | 0.260 | 0.000 | 0.000 | 2.118 |

| Problem 142 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 64 | 70 | 60 | 112 | 0 | 56 | 0 | 0 | 0 |
| N.S. | 1 | 1.09 | 0.94 | 1.75 | 0.00 | 0.88 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.287 | 0.070 | 0.569 | 0.000 | 0.087 | 0.000 | 0.000 | 0.000 |

| Problem 143 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 128 | 133 | 95 | 121 | 0 | 110 | 0 | 0 | 0 |
| N.S. | 1 | 1.04 | 0.74 | 0.95 | 0.00 | 0.86 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.315 | 0.149 | 0.201 | 0.000 | 0.263 | 0.000 | 0.000 | 0.000 |

| Problem 144 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 118 | 130 | 80 | 133 | 0 | 80 | 0 | 0 | 0 |
| N.S. | 1 | 1.10 | 0.68 | 1.13 | 0.00 | 0.68 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.333 | 0.123 | 0.571 | 0.000 | 0.084 | 0.000 | 0.000 | 0.000 |

| Problem 145 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | F(-1) | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 30 | 28 | 44 | 47 | 46 | 56 | 0 | 0 | 42 |
| N.S. | 1 | 0.93 | 1.47 | 1.57 | 1.53 | 1.87 | 0.00 | 0.00 | 1.40 |
| time (sec) | N/A | 0.256 | 0.036 | 0.148 | 0.321 | 0.257 | 0.000 | 0.000 | 2.296 |

| Problem 146 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 162 | 136 | 63 | 140 | 0 | 106 | 0 | 0 | 0 |
| N.S. | 1 | 0.84 | 0.39 | 0.86 | 0.00 | 0.65 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.386 | 0.094 | 0.660 | 0.000 | 0.092 | 0.000 | 0.000 | 0.000 |

| Problem 147 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 96 | 102 | 87 | 113 | 0 | 102 | 0 | 0 | 0 |
| N.S. | 1 | 1.06 | 0.91 | 1.18 | 0.00 | 1.06 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.292 | 0.129 | 0.200 | 0.000 | 0.263 | 0.000 | 0.000 | 0.000 |

| Problem 148 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-2) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 86 | 101 | 65 | 124 | 0 | 71 | 0 | 0 | 0 |
| N.S. | 1 | 1.17 | 0.76 | 1.44 | 0.00 | 0.83 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.310 | 0.089 | 0.550 | 0.000 | 0.082 | 0.000 | 0.000 | 0.000 |

| Problem 149 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 91 | 89 | 88 | 0 | 0 | 94 | 0 | 0 | 0 |
| N.S. | 1 | 0.98 | 0.97 | 0.00 | 0.00 | 1.03 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.303 | 0.117 | 0.000 | 0.000 | 0.261 | 0.000 | 0.000 | 0.000 |

| Problem 150 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | F | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 130 | 110 | 60 | 152 | 0 | 0 | 0 | 0 | 0 |
| N.S. | 1 | 0.85 | 0.46 | 1.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.354 | 0.115 | 0.646 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Problem 151 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 96 | 96 | 63 | 130 | 0 | 106 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.66 | 1.35 | 0.00 | 1.10 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.275 | 0.084 | 0.192 | 0.000 | 0.264 | 0.000 | 0.000 | 0.000 |

| Problem 152 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 67 | 67 | 54 | 163 | 0 | 60 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.81 | 2.43 | 0.00 | 0.90 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.354 | 0.098 | 0.450 | 0.000 | 0.080 | 0.000 | 0.000 | 0.000 |

| Problem 153 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | B | A | F | F(-1) | B |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 27 | 31 | 33 | 0 | 87 | 29 | 0 | 0 | 29 |
| N.S. | 1 | 1.15 | 1.22 | 0.00 | 3.22 | 1.07 | 0.00 | 0.00 | 1.07 |
| time (sec) | N/A | 0.247 | 0.026 | 0.000 | 0.287 | 0.255 | 0.000 | 0.000 | 2.174 |

| Problem 154 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | F | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 69 | 72 | 66 | 0 | 0 | 43 | 0 | 0 | 0 |
| N.S. | 1 | 1.04 | 0.96 | 0.00 | 0.00 | 0.62 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.283 | 0.089 | 0.000 | 0.000 | 0.080 | 0.000 | 0.000 | 0.000 |

| Problem 155 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | F | F | A | F | F(-1) | F(-1) |
| verified | N/A | No | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 69 | 67 | 53 | 0 | 0 | 78 | 0 | 0 | 0 |
| N.S. | 1 | 0.97 | 0.77 | 0.00 | 0.00 | 1.13 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.292 | 0.079 | 0.000 | 0.000 | 0.249 | 0.000 | 0.000 | 0.000 |

| Problem 156 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | F | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 62 | 62 | 62 | 0 | 0 | 0 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.318 | 0.779 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Problem 157 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | F | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 68 | 68 | 126 | 0 | 0 | 0 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.319 | 2.863 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Problem 158 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | F | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 69 | 69 | 101 | 0 | 0 | 0 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.326 | 4.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Problem 159 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | F | F | F | F | F | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 68 | 68 | 200 | 0 | 0 | 0 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 2.94 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.323 | 5.653 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Problem 160 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 42 | 137 | 30 | 82 | 95 | 187 | 0 | 215 | 65 |
| N.S. | 1 | 3.26 | 0.71 | 1.95 | 2.26 | 4.45 | 0.00 | 5.12 | 1.55 |
| time (sec) | N/A | 0.341 | 0.295 | 21.335 | 0.389 | 0.250 | 0.000 | 0.488 | 2.199 |

| Problem 161 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | F | B | A | F | A | B |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 26 | 27 | 62 | 0 | 76 | 48 | 0 | 38 | 48 |
| N.S. | 1 | 1.04 | 2.38 | 0.00 | 2.92 | 1.85 | 0.00 | 1.46 | 1.85 |
| time (sec) | N/A | 0.248 | 0.144 | 0.000 | 0.190 | 0.256 | 0.000 | 0.286 | 2.376 |

| Problem 162 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | F | A | A | F | A | B |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 26 | 26 | 65 | 0 | 49 | 49 | 0 | 39 | 36 |
| N.S. | 1 | 1.00 | 2.50 | 0.00 | 1.88 | 1.88 | 0.00 | 1.50 | 1.38 |
| time (sec) | N/A | 0.258 | 0.070 | 0.000 | 0.193 | 0.248 | 0.000 | 0.296 | 2.313 |

| Problem 163 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | F | F | B | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 90 | 97 | 115 | 0 | 0 | 475 | 0 | 0 | 0 |
| N.S. | 1 | 1.08 | 1.28 | 0.00 | 0.00 | 5.28 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.356 | 1.537 | 0.000 | 0.000 | 0.267 | 0.000 | 0.000 | 0.000 |

| Problem 164 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | F | F | B | F | F | F(-1) |
| verified | N/A | Yes | No | N/A | TBD | TBD | TBD | TBD | TBD |
| size | 66 | 107 | 140 | 0 | 0 | 539 | 0 | 0 | 0 |
| N.S. | 1 | 1.62 | 2.12 | 0.00 | 0.00 | 8.17 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.364 | 0.869 | 0.000 | 0.000 | 0.271 | 0.000 | 0.000 | 0.000 |

| Problem 165 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | B | A | A | B | A | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 20 | 20 | 54 | 23 | 22 | 65 | 42 | 145 | 43 |
| N.S. | 1 | 1.00 | 2.70 | 1.15 | 1.10 | 3.25 | 2.10 | 7.25 | 2.15 |
| time (sec) | N/A | 0.221 | 0.044 | 0.261 | 0.180 | 0.256 | 0.437 | 0.313 | 2.411 |

| Problem 166 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 19 | 19 | 19 | 20 | 29 | 71 | 0 | 28 | 25 |
| N.S. | 1 | 1.00 | 1.00 | 1.05 | 1.53 | 3.74 | 0.00 | 1.47 | 1.32 |
| time (sec) | N/A | 0.228 | 0.062 | 1.096 | 0.197 | 0.250 | 0.000 | 0.275 | 2.180 |

| Problem 167 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 55 | 60 | 107 | 45 | 150 | 643 | 0 | 210 | 140 |
| N.S. | 1 | 1.09 | 1.95 | 0.82 | 2.73 | 11.69 | 0.00 | 3.82 | 2.55 |
| time (sec) | N/A | 0.301 | 0.045 | 2.374 | 0.203 | 0.280 | 0.000 | 0.340 | 2.160 |

| Problem 168 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 42 | 45 | 56 | 36 | 92 | 272 | 0 | 47 | 55 |
| N.S. | 1 | 1.07 | 1.33 | 0.86 | 2.19 | 6.48 | 0.00 | 1.12 | 1.31 |
| time (sec) | N/A | 0.247 | 0.039 | 6.915 | 0.203 | 0.258 | 0.000 | 0.297 | 2.290 |

| Problem 169 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | C | A | A | B | B | F | B | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 89 | 98 | 161 | 64 | 232 | 1806 | 0 | 248 | 318 |
| N.S. | 1 | 1.10 | 1.81 | 0.72 | 2.61 | 20.29 | 0.00 | 2.79 | 3.57 |
| time (sec) | N/A | 0.402 | 0.047 | 21.529 | 0.209 | 0.268 | 0.000 | 0.350 | 2.231 |

| Problem 170 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 111 | 109 | 84 | 144 | 0 | 318 | 0 | 0 | 0 |
| N.S. | 1 | 0.98 | 0.76 | 1.30 | 0.00 | 2.86 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.407 | 0.139 | 1.589 | 0.000 | 0.090 | 0.000 | 0.000 | 0.000 |

| Problem 171 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 107 | 105 | 80 | 212 | 0 | 159 | 0 | 0 | 0 |
| N.S. | 1 | 0.98 | 0.75 | 1.98 | 0.00 | 1.49 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.418 | 0.077 | 0.895 | 0.000 | 0.085 | 0.000 | 0.000 | 0.000 |

| Problem 172 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 72 | 72 | 66 | 120 | 0 | 39 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.92 | 1.67 | 0.00 | 0.54 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.298 | 0.059 | 0.819 | 0.000 | 0.076 | 0.000 | 0.000 | 0.000 |

| Problem 173 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 72 | 72 | 68 | 146 | 0 | 248 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.94 | 2.03 | 0.00 | 3.44 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.308 | 0.048 | 0.958 | 0.000 | 0.089 | 0.000 | 0.000 | 0.000 |

| Problem 174 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 111 | 109 | 86 | 143 | 0 | 370 | 0 | 0 | 0 |
| N.S. | 1 | 0.98 | 0.77 | 1.29 | 0.00 | 3.33 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.394 | 0.087 | 0.940 | 0.000 | 0.093 | 0.000 | 0.000 | 0.000 |

| Problem 175 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | C | F | F(-1) | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 111 | 109 | 95 | 227 | 0 | 602 | 0 | 0 | 0 |
| N.S. | 1 | 0.98 | 0.86 | 2.05 | 0.00 | 5.42 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.408 | 0.129 | 0.930 | 0.000 | 0.093 | 0.000 | 0.000 | 0.000 |

## 2.3 Detailed conclusion table specific for Rubi results

The following table is specific to Rubi only. It gives additional statistics for each integral. the column **steps** is the number of steps used by Rubi to obtain the antiderivative. The **rules** column is the number of unique rules used. The **integrand size** column is the leaf size of the integrand. Finally the ratio $\frac{\text{number of rules}}{\text{integrand size}}$ is also given. The larger this ratio is, the harder the integral is to solve. In this test file, problem number [48] had the largest ratio of [1.8999999999999991]

Table 2.1: Rubi specific breakdown of results for each integral

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 1 | A | 3 | 3 | 1.00 | 6 | 0.500 |
| 2 | A | 5 | 4 | 1.00 | 8 | 0.500 |
| 3 | C | 7 | 7 | 1.24 | 8 | 0.875 |
| 4 | C | 4 | 3 | 1.23 | 8 | 0.375 |
| 5 | C | 11 | 11 | 1.27 | 8 | 1.375 |
| 6 | C | 5 | 4 | 1.10 | 8 | 0.500 |
| 7 | A | 6 | 6 | 1.00 | 10 | 0.600 |
| 8 | A | 6 | 6 | 1.00 | 10 | 0.600 |
| 9 | A | 4 | 4 | 1.00 | 10 | 0.400 |
| 10 | A | 4 | 4 | 1.00 | 10 | 0.400 |
| 11 | A | 6 | 6 | 1.00 | 10 | 0.600 |
| 12 | A | 6 | 6 | 1.00 | 10 | 0.600 |
| 13 | A | 8 | 8 | 1.02 | 12 | 0.667 |
| 14 | A | 6 | 6 | 1.00 | 12 | 0.500 |
| 15 | A | 6 | 6 | 1.00 | 12 | 0.500 |
| 16 | A | 4 | 4 | 1.00 | 12 | 0.333 |
| 17 | A | 4 | 4 | 1.00 | 12 | 0.333 |
| 18 | A | 6 | 6 | 1.00 | 12 | 0.500 |
| 19 | A | 6 | 6 | 1.00 | 12 | 0.500 |
| 20 | A | 8 | 8 | 1.07 | 12 | 0.667 |
| 21 | A | 4 | 4 | 1.00 | 10 | 0.400 |
| 22 | A | 6 | 5 | 1.22 | 10 | 0.500 |

Continued on next page

Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 23 | A | 5 | 4 | 1.08 | 10 | 0.400 |
| 24 | A | 4 | 3 | 1.00 | 10 | 0.300 |
| 25 | A | 4 | 3 | 1.15 | 10 | 0.300 |
| 26 | A | 5 | 4 | 1.12 | 10 | 0.400 |
| 27 | A | 6 | 5 | 1.22 | 10 | 0.500 |
| 28 | A | 7 | 6 | 1.28 | 10 | 0.600 |
| 29 | A | 7 | 6 | 1.26 | 10 | 0.600 |
| 30 | A | 6 | 5 | 1.22 | 10 | 0.500 |
| 31 | A | 5 | 4 | 1.15 | 10 | 0.400 |
| 32 | A | 4 | 3 | 1.31 | 10 | 0.300 |
| 33 | A | 5 | 4 | 1.39 | 10 | 0.400 |
| 34 | A | 6 | 5 | 1.47 | 10 | 0.500 |
| 35 | A | 7 | 6 | 1.51 | 10 | 0.600 |
| 36 | A | 14 | 14 | 1.11 | 10 | 1.400 |
| 37 | A | 10 | 10 | 1.33 | 10 | 1.000 |
| 38 | A | 8 | 8 | 1.38 | 10 | 0.800 |
| 39 | A | 8 | 8 | 1.31 | 10 | 0.800 |
| 40 | A | 10 | 10 | 1.24 | 10 | 1.000 |
| 41 | A | 14 | 14 | 1.14 | 10 | 1.400 |
| 42 | C | 8 | 7 | 0.51 | 10 | 0.700 |
| 43 | C | 8 | 7 | 0.58 | 10 | 0.700 |
| 44 | C | 8 | 7 | 0.74 | 10 | 0.700 |
| 45 | A | 8 | 7 | 1.00 | 10 | 0.700 |
| 46 | A | 7 | 7 | 0.83 | 10 | 0.700 |
| 47 | A | 13 | 13 | 0.73 | 10 | 1.300 |
| 48 | A | 19 | 19 | 0.70 | 10 | 1.900 |
| 49 | A | 3 | 3 | 1.00 | 15 | 0.200 |
| 50 | A | 3 | 3 | 1.00 | 15 | 0.200 |
| 51 | A | 12 | 11 | 1.04 | 17 | 0.647 |
| 52 | A | 7 | 6 | 1.00 | 17 | 0.353 |
| 53 | A | 4 | 3 | 1.00 | 17 | 0.176 |
| 54 | A | 10 | 9 | 1.00 | 17 | 0.529 |
| 55 | A | 13 | 12 | 1.05 | 17 | 0.706 |
| 56 | A | 4 | 3 | 1.00 | 17 | 0.176 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 57 | A | 10 | 9 | 1.00 | 17 | 0.529 |
| 58 | A | 4 | 3 | 1.00 | 12 | 0.250 |
| 59 | A | 4 | 3 | 1.00 | 12 | 0.250 |
| 60 | A | 4 | 3 | 1.00 | 12 | 0.250 |
| 61 | A | 4 | 3 | 1.00 | 12 | 0.250 |
| 62 | A | 17 | 16 | 1.09 | 13 | 1.231 |
| 63 | A | 18 | 17 | 1.13 | 13 | 1.308 |
| 64 | A | 15 | 15 | 1.17 | 13 | 1.154 |
| 65 | A | 13 | 13 | 1.20 | 11 | 1.182 |
| 66 | A | 4 | 4 | 0.93 | 11 | 0.364 |
| 67 | A | 9 | 9 | 1.53 | 13 | 0.692 |
| 68 | A | 13 | 13 | 1.00 | 13 | 1.000 |
| 69 | A | 20 | 19 | 1.27 | 13 | 1.462 |
| 70 | A | 5 | 5 | 1.06 | 12 | 0.417 |
| 71 | A | 3 | 3 | 1.03 | 12 | 0.250 |
| 72 | A | 11 | 10 | 1.00 | 12 | 0.833 |
| 73 | A | 1 | 1 | 1.00 | 10 | 0.100 |
| 74 | A | 7 | 6 | 0.98 | 12 | 0.500 |
| 75 | A | 14 | 13 | 1.20 | 12 | 1.083 |
| 76 | A | 17 | 16 | 1.24 | 12 | 1.333 |
| 77 | C | 24 | 23 | 1.36 | 13 | 1.769 |
| 78 | C | 18 | 17 | 1.31 | 13 | 1.308 |
| 79 | C | 12 | 11 | 1.35 | 11 | 1.000 |
| 80 | A | 8 | 7 | 1.22 | 11 | 0.636 |
| 81 | A | 13 | 12 | 1.16 | 13 | 0.923 |
| 82 | C | 17 | 16 | 1.34 | 13 | 1.231 |
| 83 | C | 19 | 18 | 1.34 | 13 | 1.385 |
| 84 | A | 19 | 18 | 1.13 | 13 | 1.385 |
| 85 | A | 15 | 14 | 1.21 | 13 | 1.077 |
| 86 | A | 15 | 15 | 1.20 | 13 | 1.154 |
| 87 | A | 10 | 9 | 1.00 | 11 | 0.818 |
| 88 | A | 18 | 17 | 1.07 | 11 | 1.545 |
| 89 | A | 17 | 16 | 1.21 | 13 | 1.231 |
| 90 | A | 20 | 19 | 1.12 | 13 | 1.462 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 91 | A | 18 | 17 | 1.38 | 13 | 1.308 |
| 92 | A | 12 | 11 | 0.99 | 13 | 0.846 |
| 93 | C | 18 | 17 | 1.22 | 13 | 1.308 |
| 94 | A | 12 | 11 | 0.98 | 13 | 0.846 |
| 95 | C | 15 | 14 | 1.25 | 13 | 1.077 |
| 96 | A | 12 | 11 | 0.95 | 11 | 1.000 |
| 97 | A | 14 | 13 | 0.84 | 11 | 1.182 |
| 98 | C | 14 | 13 | 1.22 | 13 | 1.000 |
| 99 | A | 14 | 13 | 1.29 | 13 | 1.000 |
| 100 | C | 16 | 15 | 1.23 | 13 | 1.154 |
| 101 | A | 16 | 15 | 1.40 | 13 | 1.154 |
| 102 | A | 7 | 6 | 0.93 | 13 | 0.462 |
| 103 | A | 13 | 13 | 1.17 | 13 | 1.000 |
| 104 | A | 7 | 6 | 0.95 | 13 | 0.462 |
| 105 | A | 11 | 11 | 1.14 | 13 | 0.846 |
| 106 | A | 7 | 6 | 1.00 | 11 | 0.545 |
| 107 | A | 6 | 5 | 1.00 | 11 | 0.455 |
| 108 | A | 5 | 5 | 1.36 | 13 | 0.385 |
| 109 | A | 7 | 6 | 1.67 | 13 | 0.462 |
| 110 | A | 7 | 7 | 1.26 | 13 | 0.538 |
| 111 | A | 7 | 6 | 1.20 | 13 | 0.462 |
| 112 | A | 12 | 12 | 1.28 | 13 | 0.923 |
| 113 | A | 7 | 6 | 1.32 | 13 | 0.462 |
| 114 | F | 0 | 0 | N/A | 0.000 | N/A |
| 115 | A | 6 | 5 | 1.34 | 13 | 0.385 |
| 116 | C | 23 | 22 | 1.12 | 13 | 1.692 |
| 117 | A | 7 | 6 | 1.38 | 11 | 0.545 |
| 118 | A | 7 | 6 | 1.16 | 11 | 0.545 |
| 119 | A | 19 | 18 | 1.19 | 13 | 1.385 |
| 120 | A | 7 | 6 | 1.28 | 13 | 0.462 |
| 121 | C | 19 | 18 | 1.34 | 13 | 1.385 |
| 122 | A | 6 | 5 | 1.07 | 13 | 0.385 |
| 123 | C | 9 | 9 | 1.15 | 13 | 0.692 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 124 | A | 7 | 6 | 1.04 | 13 | 0.462 |
| 125 | A | 7 | 6 | 0.57 | 25 | 0.240 |
| 126 | A | 7 | 6 | 0.63 | 25 | 0.240 |
| 127 | A | 5 | 4 | 1.00 | 25 | 0.160 |
| 128 | A | 5 | 4 | 1.00 | 25 | 0.160 |
| 129 | A | 6 | 5 | 0.82 | 25 | 0.200 |
| 130 | A | 7 | 6 | 0.46 | 25 | 0.240 |
| 131 | A | 7 | 6 | 0.41 | 25 | 0.240 |
| 132 | A | 7 | 6 | 1.25 | 15 | 0.400 |
| 133 | A | 4 | 3 | 0.93 | 15 | 0.200 |
| 134 | A | 10 | 9 | 0.90 | 15 | 0.600 |
| 135 | A | 7 | 6 | 1.06 | 15 | 0.400 |
| 136 | A | 6 | 5 | 1.20 | 13 | 0.385 |
| 137 | A | 7 | 6 | 1.13 | 11 | 0.545 |
| 138 | A | 6 | 5 | 1.00 | 15 | 0.333 |
| 139 | A | 6 | 5 | 1.00 | 15 | 0.333 |
| 140 | A | 8 | 7 | 0.73 | 15 | 0.467 |
| 141 | A | 4 | 3 | 1.16 | 15 | 0.200 |
| 142 | A | 6 | 5 | 1.09 | 15 | 0.333 |
| 143 | A | 9 | 8 | 1.04 | 15 | 0.533 |
| 144 | A | 8 | 7 | 1.10 | 15 | 0.467 |
| 145 | A | 4 | 3 | 0.93 | 15 | 0.200 |
| 146 | A | 11 | 10 | 0.84 | 15 | 0.667 |
| 147 | A | 8 | 7 | 1.06 | 15 | 0.467 |
| 148 | A | 7 | 6 | 1.17 | 15 | 0.400 |
| 149 | A | 8 | 7 | 0.98 | 15 | 0.467 |
| 150 | A | 10 | 9 | 0.85 | 13 | 0.692 |
| 151 | A | 8 | 7 | 1.00 | 11 | 0.636 |
| 152 | A | 8 | 7 | 1.00 | 15 | 0.467 |
| 153 | A | 4 | 3 | 1.15 | 15 | 0.200 |
| 154 | A | 6 | 5 | 1.04 | 15 | 0.333 |
| 155 | A | 7 | 6 | 0.97 | 15 | 0.400 |
| 156 | A | 5 | 4 | 1.00 | 11 | 0.364 |
| 157 | A | 5 | 4 | 1.00 | 13 | 0.308 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 158 | A | 5 | 4 | 1.00 | 13 | 0.308 |
| 159 | A | 5 | 4 | 1.00 | 13 | 0.308 |
| 160 | C | 1 | 1 | 3.26 | 45 | 0.022 |
| 161 | A | 4 | 3 | 1.04 | 15 | 0.200 |
| 162 | A | 5 | 4 | 1.00 | 15 | 0.267 |
| 163 | A | 4 | 3 | 1.08 | 20 | 0.150 |
| 164 | A | 4 | 3 | 1.62 | 21 | 0.143 |
| 165 | A | 5 | 4 | 1.00 | 15 | 0.267 |
| 166 | A | 6 | 5 | 1.00 | 17 | 0.294 |
| 167 | C | 9 | 8 | 1.09 | 17 | 0.471 |
| 168 | C | 5 | 4 | 1.07 | 17 | 0.235 |
| 169 | C | 13 | 12 | 1.10 | 17 | 0.706 |
| 170 | A | 8 | 7 | 0.98 | 19 | 0.368 |
| 171 | A | 8 | 7 | 0.98 | 19 | 0.368 |
| 172 | A | 6 | 5 | 1.00 | 19 | 0.263 |
| 173 | A | 6 | 5 | 1.00 | 19 | 0.263 |
| 174 | A | 8 | 7 | 0.98 | 19 | 0.368 |
| 175 | A | 8 | 7 | 0.98 | 19 | 0.368 |

# CHAPTER 3

## Listing of integrals


3.1 $\int \operatorname{csch}(a+bx)\,dx$ . . . 82
3.2 $\int \operatorname{csch}^2(a+bx)\,dx$ . . . 87
3.3 $\int \operatorname{csch}^3(a+bx)\,dx$ . . . 92
3.4 $\int \operatorname{csch}^4(a+bx)\,dx$ . . . 98
3.5 $\int \operatorname{csch}^5(a+bx)\,dx$ . . . 103
3.6 $\int \operatorname{csch}^6(a+bx)\,dx$ . . . 110
3.7 $\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx$ . . . 116
3.8 $\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx$ . . . 121
3.9 $\int \sqrt{\operatorname{csch}(a+bx)}\,dx$ . . . 126
3.10 $\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx$ . . . 131
3.11 $\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx$ . . . 136
3.12 $\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx$ . . . 141
3.13 $\int (b\operatorname{csch}(c+dx))^{7/2}\,dx$ . . . 146
3.14 $\int (b\operatorname{csch}(c+dx))^{5/2}\,dx$ . . . 152
3.15 $\int (b\operatorname{csch}(c+dx))^{3/2}\,dx$ . . . 157
3.16 $\int \sqrt{b\operatorname{csch}(c+dx)}\,dx$ . . . 162
3.17 $\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx$ . . . 166
3.18 $\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx$ . . . 171
3.19 $\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx$ . . . 176
3.20 $\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx$ . . . 181
3.21 $\int (b\operatorname{csch}(c+dx))^n\,dx$ . . . 187
3.22 $\int \left(-\operatorname{csch}^2(x)\right)^{5/2}\,dx$ . . . 192
3.23 $\int \left(-\operatorname{csch}^2(x)\right)^{3/2}\,dx$ . . . 197
3.24 $\int \sqrt{-\operatorname{csch}^2(x)}\,dx$ . . . 202
3.25 $\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx$ . . . 206

3.26 $\int \frac{1}{\left(-\text{csch}^2(x)\right)^{3/2}}\,dx$ . . . 211
3.27 $\int \frac{1}{\left(-\text{csch}^2(x)\right)^{5/2}}\,dx$ . . . 216
3.28 $\int \frac{1}{\left(-\text{csch}^2(x)\right)^{7/2}}\,dx$ . . . 221
3.29 $\int \left(a\text{csch}^2(x)\right)^{5/2}\,dx$ . . . 227
3.30 $\int \left(a\text{csch}^2(x)\right)^{3/2}\,dx$ . . . 233
3.31 $\int \sqrt{a\text{csch}^2(x)}\,dx$ . . . 238
3.32 $\int \frac{1}{\sqrt{a\text{csch}^2(x)}}\,dx$ . . . 243
3.33 $\int \frac{1}{\left(a\text{csch}^2(x)\right)^{3/2}}\,dx$ . . . 248
3.34 $\int \frac{1}{\left(a\text{csch}^2(x)\right)^{5/2}}\,dx$ . . . 253
3.35 $\int \frac{1}{\left(a\text{csch}^2(x)\right)^{7/2}}\,dx$ . . . 259
3.36 $\int \left(a\text{csch}^3(x)\right)^{5/2}\,dx$ . . . 266
3.37 $\int \left(a\text{csch}^3(x)\right)^{3/2}\,dx$ . . . 273
3.38 $\int \sqrt{a\text{csch}^3(x)}\,dx$ . . . 279
3.39 $\int \frac{1}{\sqrt{a\text{csch}^3(x)}}\,dx$ . . . 284
3.40 $\int \frac{1}{\left(a\text{csch}^3(x)\right)^{3/2}}\,dx$ . . . 290
3.41 $\int \frac{1}{\left(a\text{csch}^3(x)\right)^{5/2}}\,dx$ . . . 296
3.42 $\int \left(a\text{csch}^4(x)\right)^{7/2}\,dx$ . . . 303
3.43 $\int \left(a\text{csch}^4(x)\right)^{5/2}\,dx$ . . . 311
3.44 $\int \left(a\text{csch}^4(x)\right)^{3/2}\,dx$ . . . 318
3.45 $\int \sqrt{a\text{csch}^4(x)}\,dx$ . . . 324
3.46 $\int \frac{1}{\sqrt{a\text{csch}^4(x)}}\,dx$ . . . 329
3.47 $\int \frac{1}{\left(a\text{csch}^4(x)\right)^{3/2}}\,dx$ . . . 334
3.48 $\int \frac{1}{\left(a\text{csch}^4(x)\right)^{5/2}}\,dx$ . . . 341
3.49 $\int \frac{1}{a+ia\text{csch}(a+bx)}\,dx$ . . . 349
3.50 $\int \frac{1}{a-ia\text{csch}(a+bx)}\,dx$ . . . 354
3.51 $\int (a+ia\text{csch}(c+dx))^{5/2}\,dx$ . . . 359
3.52 $\int (a+ia\text{csch}(c+dx))^{3/2}\,dx$ . . . 366
3.53 $\int \sqrt{a+ia\text{csch}(c+dx)}\,dx$ . . . 371
3.54 $\int \frac{1}{\sqrt{a+ia\text{csch}(c+dx)}}\,dx$ . . . 376
3.55 $\int \frac{1}{(a+ia\text{csch}(c+dx))^{3/2}}\,dx$ . . . 383

3.56 $\int \sqrt{a-ia\operatorname{csch}(c+dx)}\,dx$ . . . 390
3.57 $\int \frac{1}{\sqrt{a-ia\operatorname{csch}(c+dx)}}\,dx$ . . . 395
3.58 $\int \sqrt{3+3i\operatorname{csch}(x)}\,dx$ . . . 402
3.59 $\int \sqrt{3-3i\operatorname{csch}(x)}\,dx$ . . . 407
3.60 $\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx$ . . . 412
3.61 $\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx$ . . . 417
3.62 $\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 422
3.63 $\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 429
3.64 $\int \frac{\sinh^2(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 435
3.65 $\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 441
3.66 $\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 447
3.67 $\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 452
3.68 $\int \frac{\operatorname{csch}^3(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 457
3.69 $\int \frac{\operatorname{csch}^4(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 463
3.70 $\int (a+b\operatorname{csch}(c+dx))^4\,dx$ . . . 470
3.71 $\int (a+b\operatorname{csch}(c+dx))^3\,dx$ . . . 478
3.72 $\int (a+b\operatorname{csch}(c+dx))^2\,dx$ . . . 484
3.73 $\int (a+b\operatorname{csch}(c+dx))\,dx$ . . . 490
3.74 $\int \frac{1}{a+b\operatorname{csch}(c+dx)}\,dx$ . . . 494
3.75 $\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx$ . . . 499
3.76 $\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx$ . . . 507
3.77 $\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 516
3.78 $\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 532
3.79 $\int \frac{\sinh(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 541
3.80 $\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 548
3.81 $\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 554
3.82 $\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 561
3.83 $\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 569
3.84 $\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 578
3.85 $\int \frac{\cosh^3(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 585
3.86 $\int \frac{\cosh^2(x)}{i+\operatorname{csch}(x)}\,dx$ . . . 591

3.87 $\int \frac{\cosh(x)}{i+\text{csch}(x)}\,dx$ . . . 597
3.88 $\int \frac{\text{sech}(x)}{i+\text{csch}(x)}\,dx$ . . . 602
3.89 $\int \frac{\text{sech}^2(x)}{i+\text{csch}(x)}\,dx$ . . . 608
3.90 $\int \frac{\text{sech}^3(x)}{i+\text{csch}(x)}\,dx$ . . . 615
3.91 $\int \frac{\text{sech}^4(x)}{i+\text{csch}(x)}\,dx$ . . . 623
3.92 $\int \frac{\cosh^5(x)}{a+b\text{csch}(x)}\,dx$ . . . 630
3.93 $\int \frac{\cosh^4(x)}{a+b\text{csch}(x)}\,dx$ . . . 638
3.94 $\int \frac{\cosh^3(x)}{a+b\text{csch}(x)}\,dx$ . . . 648
3.95 $\int \frac{\cosh^2(x)}{a+b\text{csch}(x)}\,dx$ . . . 654
3.96 $\int \frac{\cosh(x)}{a+b\text{csch}(x)}\,dx$ . . . 662
3.97 $\int \frac{\text{sech}(x)}{a+b\text{csch}(x)}\,dx$ . . . 668
3.98 $\int \frac{\text{sech}^2(x)}{a+b\text{csch}(x)}\,dx$ . . . 675
3.99 $\int \frac{\text{sech}^3(x)}{a+b\text{csch}(x)}\,dx$ . . . 682
3.100 $\int \frac{\text{sech}^4(x)}{a+b\text{csch}(x)}\,dx$ . . . 690
3.101 $\int \frac{\text{sech}^5(x)}{a+b\text{csch}(x)}\,dx$ . . . 698
3.102 $\int \frac{\tanh^5(x)}{i+\text{csch}(x)}\,dx$ . . . 707
3.103 $\int \frac{\tanh^4(x)}{i+\text{csch}(x)}\,dx$ . . . 714
3.104 $\int \frac{\tanh^3(x)}{i+\text{csch}(x)}\,dx$ . . . 721
3.105 $\int \frac{\tanh^2(x)}{i+\text{csch}(x)}\,dx$ . . . 727
3.106 $\int \frac{\tanh(x)}{i+\text{csch}(x)}\,dx$ . . . 733
3.107 $\int \frac{\coth(x)}{i+\text{csch}(x)}\,dx$ . . . 738
3.108 $\int \frac{\coth^2(x)}{i+\text{csch}(x)}\,dx$ . . . 743
3.109 $\int \frac{\coth^3(x)}{i+\text{csch}(x)}\,dx$ . . . 748
3.110 $\int \frac{\coth^4(x)}{i+\text{csch}(x)}\,dx$ . . . 753
3.111 $\int \frac{\coth^5(x)}{i+\text{csch}(x)}\,dx$ . . . 759
3.112 $\int \frac{\coth^6(x)}{i+\text{csch}(x)}\,dx$ . . . 765
3.113 $\int \frac{\tanh^5(x)}{a+b\text{csch}(x)}\,dx$ . . . 772
3.114 $\int \frac{\tanh^4(x)}{a+b\text{csch}(x)}\,dx$ . . . 780
3.115 $\int \frac{\tanh^3(x)}{a+b\text{csch}(x)}\,dx$ . . . 794

3.116 $\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 801
3.117 $\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 810
3.118 $\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 816
3.119 $\int \frac{\coth^2(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 821
3.120 $\int \frac{\coth^3(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 829
3.121 $\int \frac{\coth^4(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 835
3.122 $\int \frac{\coth^5(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 844
3.123 $\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 850
3.124 $\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx$ . . . 858
3.125 $\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx$ . . . 865
3.126 $\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx$ . . . 872
3.127 $\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx$ . . . 878
3.128 $\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx$ . . . 883
3.129 $\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx$ . . . 888
3.130 $\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx$ . . . 893
3.131 $\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx$ . . . 899
3.132 $\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$ . . . 905
3.133 $\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$ . . . 910
3.134 $\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$ . . . 915
3.135 $\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$ . . . 922
3.136 $\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$ . . . 927
3.137 $\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$ . . . 932
3.138 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx$ . . . 937
3.139 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx$ . . . 942
3.140 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx$ . . . 947
3.141 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx$ . . . 952
3.142 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx$ . . . 957
3.143 $\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 962
3.144 $\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 968

3.145 $\int \frac{x^6}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 974
3.146 $\int \frac{x^5}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 979
3.147 $\int \frac{x^4}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 986
3.148 $\int \frac{x^3}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 992
3.149 $\int \frac{x^2}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 997
3.150 $\int \frac{x}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 1002
3.151 $\int \frac{1}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$ . . . 1008
3.152 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx$ . . . 1014
3.153 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx$ . . . 1019
3.154 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx$ . . . 1023
3.155 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx$ . . . 1028
3.156 $\int \text{csch}(a+b\log(cx^n))\,dx$ . . . 1033
3.157 $\int \text{csch}^2(a+b\log(cx^n))\,dx$ . . . 1038
3.158 $\int \text{csch}^3(a+b\log(cx^n))\,dx$ . . . 1043
3.159 $\int \text{csch}^4(a+b\log(cx^n))\,dx$ . . . 1048
3.160 $\int \left(-((1-b^2n^2)\,\text{csch}(a+b\log(cx^n))) + 2b^2n^2\text{csch}^3(a+b\log(cx^n))\right)\,dx$ . . . 1053
3.161 $\int \text{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx$ . . . 1058
3.162 $\int \text{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx$ . . . 1062
3.163 $\int \text{csch}^p\left(a+\frac{\log(cx^n)}{n(-2+p)}\right)\,dx$ . . . 1067
3.164 $\int \text{csch}^p\left(a-\frac{\log(cx^n)}{n(-2+p)}\right)\,dx$ . . . 1072
3.165 $\int \frac{\text{csch}(a+b\log(cx^n))}{x}\,dx$ . . . 1077
3.166 $\int \frac{\text{csch}^2(a+b\log(cx^n))}{x}\,dx$ . . . 1082
3.167 $\int \frac{\text{csch}^3(a+b\log(cx^n))}{x}\,dx$ . . . 1087
3.168 $\int \frac{\text{csch}^4(a+b\log(cx^n))}{x}\,dx$ . . . 1094
3.169 $\int \frac{\text{csch}^5(a+b\log(cx^n))}{x}\,dx$ . . . 1099
3.170 $\int \frac{\text{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx$ . . . 1107
3.171 $\int \frac{\text{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx$ . . . 1113
3.172 $\int \frac{\sqrt{\text{csch}(a+b\log(cx^n))}}{x}\,dx$ . . . 1119
3.173 $\int \frac{1}{x\sqrt{\text{csch}(a+b\log(cx^n))}}\,dx$ . . . 1124
3.174 $\int \frac{1}{x\text{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx$ . . . 1129

3.175 $\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx$ . . . . . 1135

# 3.1 $\int \operatorname{csch}(a+bx)\,dx$

3.1.1 Optimal result . . . . . 82
3.1.2 Mathematica [B] (verified) . . . . . 82
3.1.3 Rubi [A] (verified) . . . . . 83
3.1.4 Maple [A] (verified) . . . . . 84
3.1.5 Fricas [B] (verification not implemented) . . . . . 84
3.1.6 Sympy [A] (verification not implemented) . . . . . 85
3.1.7 Maxima [A] (verification not implemented) . . . . . 85
3.1.8 Giac [B] (verification not implemented) . . . . . 85
3.1.9 Mupad [B] (verification not implemented) . . . . . 86

## 3.1.1 Optimal result

Integrand size = 6, antiderivative size = 12

$$\int \operatorname{csch}(a+bx)\,dx = -\frac{\operatorname{arctanh}(\cosh(a+bx))}{b}$$

output
```
-arctanh(cosh(b*x+a))/b
```

## 3.1.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 38 vs. $2(12) = 24$.

Time = 0.02 (sec) , antiderivative size = 38, normalized size of antiderivative = 3.17

$$\int \operatorname{csch}(a+bx)\,dx = -\frac{\log\left(\cosh\left(\frac{a}{2}+\frac{bx}{2}\right)\right)}{b} + \frac{\log\left(\sinh\left(\frac{a}{2}+\frac{bx}{2}\right)\right)}{b}$$

input
```
Integrate[Csch[a + b*x],x]
```

output
```
-(Log[Cosh[a/2 + (b*x)/2]]/b) + Log[Sinh[a/2 + (b*x)/2]]/b
```

### 3.1.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 12, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}(a+bx)\,dx$$
$$\downarrow 3042$$
$$\int i\csc(ia+ibx)dx$$
$$\downarrow 26$$
$$i\int \csc(ia+ibx)dx$$
$$\downarrow 4257$$
$$-\frac{\operatorname{arctanh}(\cosh(a+bx))}{b}$$

input
```
Int[Csch[a + b*x],x]
```

output
```
-(ArcTanh[Cosh[a + b*x]]/b)
```

#### 3.1.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

### 3.1.4 Maple [A] (verified)

Time = 0.09 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.25

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)}{b}$ | 15 |
| default | $\frac{\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)}{b}$ | 15 |
| parallelrisch | $\frac{\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)}{b}$ | 15 |
| risch | $\frac{\ln\left(e^{bx+a}-1\right)}{b}-\frac{\ln\left(e^{bx+a}+1\right)}{b}$ | 29 |

input
```
int(csch(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
1/b*ln(tanh(1/2*b*x+1/2*a))
```

### 3.1.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 38 vs. $2(12) = 24$.

Time = 0.27 (sec) , antiderivative size = 38, normalized size of antiderivative = 3.17

$$\int \operatorname{csch}(a+bx)\,dx = -\frac{\log\left(\cosh\left(bx+a\right)+\sinh\left(bx+a\right)+1\right)-\log\left(\cosh\left(bx+a\right)+\sinh\left(bx+a\right)-1\right)}{b}$$

input
```
integrate(csch(b*x+a),x, algorithm="fricas")
```

output
```
-(log(cosh(b*x + a) + sinh(b*x + a) + 1) - log(cosh(b*x + a) + sinh(b*x +
a) - 1))/b
```

### 3.1.6 Sympy [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.42

$$\int \operatorname{csch}(a+bx)\,dx = \begin{cases} \frac{\log\left(\tanh\left(\frac{a}{2}+\frac{bx}{2}\right)\right)}{b} & \text{for } b \neq 0 \\ x \operatorname{csch}(a) & \text{otherwise} \end{cases}$$

input
```
integrate(csch(b*x+a),x)
```

output
```
Piecewise((log(tanh(a/2 + b*x/2))/b, Ne(b, 0)), (x*csch(a), True))
```

### 3.1.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 14, normalized size of antiderivative = 1.17

$$\int \operatorname{csch}(a+bx)\,dx = \frac{\log\left(\tanh\left(\frac{1}{2}\,bx+\frac{1}{2}\,a\right)\right)}{b}$$

input
```
integrate(csch(b*x+a),x, algorithm="maxima")
```

output
```
log(tanh(1/2*b*x + 1/2*a))/b
```

### 3.1.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 27 vs. $2(12) = 24$.

Time = 0.27 (sec) , antiderivative size = 27, normalized size of antiderivative = 2.25

$$\int \operatorname{csch}(a+bx)\,dx = -\frac{\log\left(e^{(bx+a)}+1\right) - \log\left(\left|e^{(bx+a)}-1\right|\right)}{b}$$

input
```
integrate(csch(b*x+a),x, algorithm="giac")
```

output
```
-(log(e^(b*x + a) + 1) - log(abs(e^(b*x + a) - 1)))/b
```

### 3.1.9 Mupad [B] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 27, normalized size of antiderivative = 2.25

$$\int \operatorname{csch}(a+bx)\,dx = -\frac{2\operatorname{atan}\left(\frac{e^{b\,x}\,e^{a}\sqrt{-b^2}}{b}\right)}{\sqrt{-b^2}}$$

input
```
int(1/sinh(a + b*x),x)
```

output
```
-(2*atan((exp(b*x)*exp(a)*(-b^2)^(1/2))/b))/(-b^2)^(1/2)
```

# 3.2 $\int \operatorname{csch}^2(a+bx)\,dx$

3.2.1 Optimal result . . . 87
3.2.2 Mathematica [A] (verified) . . . 87
3.2.3 Rubi [A] (verified) . . . 88
3.2.4 Maple [A] (verified) . . . 89
3.2.5 Fricas [B] (verification not implemented) . . . 89
3.2.6 Sympy [F] . . . 90
3.2.7 Maxima [A] (verification not implemented) . . . 90
3.2.8 Giac [A] (verification not implemented) . . . 90
3.2.9 Mupad [B] (verification not implemented) . . . 91

## 3.2.1 Optimal result

Integrand size = 8, antiderivative size = 11

$$\int \operatorname{csch}^2(a+bx)\,dx = -\frac{\coth(a+bx)}{b}$$

output
```
-coth(b*x+a)/b
```

## 3.2.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 11, normalized size of antiderivative = 1.00

$$\int \operatorname{csch}^2(a+bx)\,dx = -\frac{\coth(a+bx)}{b}$$

input
```
Integrate[Csch[a + b*x]^2,x]
```

output
```
-(Coth[a + b*x]/b)
```

### 3.2.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 11, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 25, 4254, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^2(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int -\csc(ia+ibx)^2 dx$$

$$\downarrow 25$$

$$-\int \csc(ia+ibx)^2 dx$$

$$\downarrow 4254$$

$$-\frac{i\int 1 d(-i\coth(a+bx))}{b}$$

$$\downarrow 24$$

$$-\frac{\coth(a+bx)}{b}$$

input
```
Int[Csch[a + b*x]^2,x]
```

output
```
-(Coth[a + b*x]/b)
```

#### 3.2.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

### 3.2.4 Maple [A] (verified)

Time = 0.76 (sec) , antiderivative size = 12, normalized size of antiderivative = 1.09

| method | result | size |
|---|---|---|
| derivativedivides | $-\frac{\coth(bx+a)}{b}$ | 12 |
| default | $-\frac{\coth(bx+a)}{b}$ | 12 |
| risch | $-\frac{2}{b\left(e^{2bx+2a}-1\right)}$ | 19 |
| parallelrisch | $\frac{-\coth\left(\frac{bx}{2}+\frac{a}{2}\right)-\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)}{2b}$ | 29 |

input
```
int(csch(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-coth(b*x+a)/b
```

### 3.2.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 43 vs. 2(11) = 22.

Time = 0.24 (sec) , antiderivative size = 43, normalized size of antiderivative = 3.91

$$\int \operatorname{csch}^2(a+bx)\,dx = -\frac{2}{b\cosh(bx+a)^2 + 2\,b\cosh(bx+a)\sinh(bx+a) + b\sinh(bx+a)^2 - b}$$

input
```
integrate(csch(b*x+a)^2,x, algorithm="fricas")
```

output
```
-2/(b*cosh(b*x + a)^2 + 2*b*cosh(b*x + a)*sinh(b*x + a) + b*sinh(b*x + a)^
2 - b)
```

### 3.2.6 Sympy [F]

$$\int \operatorname{csch}^2(a+bx)\,dx = \int \operatorname{csch}^2(a+bx)\,dx$$

input
```
integrate(csch(b*x+a)**2,x)
```

output
```
Integral(csch(a + b*x)**2, x)
```

### 3.2.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 18, normalized size of antiderivative = 1.64

$$\int \operatorname{csch}^2(a+bx)\,dx = \frac{2}{b(e^{(-2\,bx-2\,a)}-1)}$$

input
```
integrate(csch(b*x+a)^2,x, algorithm="maxima")
```

output
```
2/(b*(e^(-2*b*x - 2*a) - 1))
```

### 3.2.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 18, normalized size of antiderivative = 1.64

$$\int \operatorname{csch}^2(a+bx)\,dx = -\frac{2}{b(e^{(2\,bx+2\,a)}-1)}$$

input
```
integrate(csch(b*x+a)^2,x, algorithm="giac")
```

output
```
-2/(b*(e^(2*b*x + 2*a) - 1))
```

### 3.2.9 Mupad [B] (verification not implemented)

Time = 0.07 (sec) , antiderivative size = 18, normalized size of antiderivative = 1.64

$$\int \operatorname{csch}^2(a+bx)\,dx = -\frac{2}{b\,(\mathrm{e}^{2\,a+2\,b\,x}-1)}$$

input
```
int(1/sinh(a + b*x)^2,x)
```

output
```
-2/(b*(exp(2*a + 2*b*x) - 1))
```

# 3.3 $\int \operatorname{csch}^3(a+bx)\,dx$


3.3.1 Optimal result . . . . . 92
3.3.2 Mathematica [B] (verified) . . . . . 92
3.3.3 Rubi [C] (verified) . . . . . 93
3.3.4 Maple [A] (verified) . . . . . 94
3.3.5 Fricas [B] (verification not implemented) . . . . . 95
3.3.6 Sympy [F] . . . . . 95
3.3.7 Maxima [B] (verification not implemented) . . . . . 96
3.3.8 Giac [B] (verification not implemented) . . . . . 96
3.3.9 Mupad [B] (verification not implemented) . . . . . 96


## 3.3.1 Optimal result

Integrand size = 8, antiderivative size = 34

$$\int \operatorname{csch}^3(a+bx)\,dx = \frac{\operatorname{arctanh}(\cosh(a+bx))}{2b} - \frac{\coth(a+bx)\operatorname{csch}(a+bx)}{2b}$$

output
```
1/2*arctanh(cosh(b*x+a))/b-1/2*coth(b*x+a)*csch(b*x+a)/b
```

## 3.3.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 75 vs. $2(34) = 68$.

Time = 0.02 (sec) , antiderivative size = 75, normalized size of antiderivative = 2.21

$$\int \operatorname{csch}^3(a+bx)\,dx = -\frac{\operatorname{csch}^2\left(\frac{1}{2}(a+bx)\right)}{8b} + \frac{\log\left(\cosh\left(\frac{1}{2}(a+bx)\right)\right)}{2b} - \frac{\log\left(\sinh\left(\frac{1}{2}(a+bx)\right)\right)}{2b} - \frac{\operatorname{sech}^2\left(\frac{1}{2}(a+bx)\right)}{8b}$$

input
```
Integrate[Csch[a + b*x]^3,x]
```

output
```
-1/8*Csch[(a + b*x)/2]^2/b + Log[Cosh[(a + b*x)/2]]/(2*b) - Log[Sinh[(a +
b*x)/2]]/(2*b) - Sech[(a + b*x)/2]^2/(8*b)
```

### 3.3.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.24 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.24, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.875$, Rules used = {3042, 26, 4255, 26, 3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^3(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int -i\csc(ia+ibx)^3 dx$$

$$\downarrow 26$$

$$-i\int \csc(ia+ibx)^3 dx$$

$$\downarrow 4255$$

$$-i\left(\frac{1}{2}\int -i\operatorname{csch}(a+bx)dx - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{1}{2}i\int \operatorname{csch}(a+bx)dx - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{1}{2}i\int i\csc(ia+ibx)dx - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{1}{2}\int \csc(ia+ibx)dx - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right)$$

$$\downarrow 4257$$

$$-i\left(\frac{i\operatorname{arctanh}(\cosh(a+bx))}{2b} - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right)$$

input
```
Int[Csch[a + b*x]^3,x]
```

output
```
(-I)*(((I/2)*ArcTanh[Cosh[a + b*x]])/b - ((I/2)*Coth[a + b*x]*Csch[a + b*x
])/b)
```

#### 3.3.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

### 3.3.4 Maple [A] (verified)

Time = 0.76 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.79

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{-\frac{\operatorname{csch}(bx+a)\coth(bx+a)}{2}+\operatorname{arctanh}\left(e^{bx+a}\right)}{b}$ | 27 |
| default | $\frac{-\frac{\operatorname{csch}(bx+a)\coth(bx+a)}{2}+\operatorname{arctanh}\left(e^{bx+a}\right)}{b}$ | 27 |
| parallelrisch | $\frac{\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)^2-\coth\left(\frac{bx}{2}+\frac{a}{2}\right)^2-4\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)}{8b}$ | 43 |
| risch | $-\frac{e^{bx+a}\left(1+e^{2bx+2a}\right)}{b\left(e^{2bx+2a}-1\right)^2}-\frac{\ln\left(e^{bx+a}-1\right)}{2b}+\frac{\ln\left(e^{bx+a}+1\right)}{2b}$ | 65 |

input
```
int(csch(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/b*(-1/2*csch(b*x+a)*coth(b*x+a)+arctanh(exp(b*x+a)))
```

### 3.3.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 387 vs. $2(30) = 60$.

Time $= 0.26$ (sec) , antiderivative size $= 387$, normalized size of antiderivative $= 11.38$

$$\int \operatorname{csch}^3(a+bx)\,dx =$$

$$-\frac{2\cosh(bx+a)^3 + 6\cosh(bx+a)\sinh(bx+a)^2 + 2\sinh(bx+a)^3 - (\cosh(bx+a)^4 + 4\cosh(bx+a$$

input
```
integrate(csch(b*x+a)^3,x, algorithm="fricas")
```

output
```
-1/2*(2*cosh(b*x + a)^3 + 6*cosh(b*x + a)*sinh(b*x + a)^2 + 2*sinh(b*x + a
)^3 - (cosh(b*x + a)^4 + 4*cosh(b*x + a)*sinh(b*x + a)^3 + sinh(b*x + a)^4
 + 2*(3*cosh(b*x + a)^2 - 1)*sinh(b*x + a)^2 - 2*cosh(b*x + a)^2 + 4*(cosh
(b*x + a)^3 - cosh(b*x + a))*sinh(b*x + a) + 1)*log(cosh(b*x + a) + sinh(b
*x + a) + 1) + (cosh(b*x + a)^4 + 4*cosh(b*x + a)*sinh(b*x + a)^3 + sinh(b
*x + a)^4 + 2*(3*cosh(b*x + a)^2 - 1)*sinh(b*x + a)^2 - 2*cosh(b*x + a)^2
+ 4*(cosh(b*x + a)^3 - cosh(b*x + a))*sinh(b*x + a) + 1)*log(cosh(b*x + a)
 + sinh(b*x + a) - 1) + 2*(3*cosh(b*x + a)^2 + 1)*sinh(b*x + a) + 2*cosh(b
*x + a))/(b*cosh(b*x + a)^4 + 4*b*cosh(b*x + a)*sinh(b*x + a)^3 + b*sinh(b
*x + a)^4 - 2*b*cosh(b*x + a)^2 + 2*(3*b*cosh(b*x + a)^2 - b)*sinh(b*x + a
)^2 + 4*(b*cosh(b*x + a)^3 - b*cosh(b*x + a))*sinh(b*x + a) + b)
```

### 3.3.6 Sympy [F]

$$\int \operatorname{csch}^3(a+bx)\,dx = \int \operatorname{csch}^3(a+bx)\,dx$$

input
```
integrate(csch(b*x+a)**3,x)
```

output
```
Integral(csch(a + b*x)**3, x)
```

### 3.3.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 84 vs. $2(30) = 60$.

Time = 0.19 (sec) , antiderivative size = 84, normalized size of antiderivative = 2.47

$$\int \operatorname{csch}^3(a+bx)\,dx = \frac{\log\left(e^{(-bx-a)}+1\right)}{2\,b} - \frac{\log\left(e^{(-bx-a)}-1\right)}{2\,b} + \frac{e^{(-bx-a)}+e^{(-3\,bx-3\,a)}}{b(2\,e^{(-2\,bx-2\,a)}-e^{(-4\,bx-4\,a)}-1)}$$

input
```
integrate(csch(b*x+a)^3,x, algorithm="maxima")
```

output
```
1/2*log(e^(-b*x - a) + 1)/b - 1/2*log(e^(-b*x - a) - 1)/b + (e^(-b*x - a)
+ e^(-3*b*x - 3*a))/(b*(2*e^(-2*b*x - 2*a) - e^(-4*b*x - 4*a) - 1))
```

### 3.3.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 84 vs. $2(30) = 60$.

Time = 0.28 (sec) , antiderivative size = 84, normalized size of antiderivative = 2.47

$$\int \operatorname{csch}^3(a+bx)\,dx = -\frac{\frac{4\left(e^{(bx+a)}+e^{(-bx-a)}\right)}{\left(e^{(bx+a)}+e^{(-bx-a)}\right)^2-4} - \log\left(e^{(bx+a)}+e^{(-bx-a)}+2\right) + \log\left(e^{(bx+a)}+e^{(-bx-a)}-2\right)}{4\,b}$$

input
```
integrate(csch(b*x+a)^3,x, algorithm="giac")
```

output
```
-1/4*(4*(e^(b*x + a) + e^(-b*x - a))/((e^(b*x + a) + e^(-b*x - a))^2 - 4)
- log(e^(b*x + a) + e^(-b*x - a) + 2) + log(e^(b*x + a) + e^(-b*x - a) - 2
))/b
```

### 3.3.9 Mupad [B] (verification not implemented)

Time = 2.09 (sec) , antiderivative size = 86, normalized size of antiderivative = 2.53

$$\int \operatorname{csch}^3(a+bx)\,dx = \frac{\operatorname{atan}\left(\frac{\mathrm{e}^{b\,x}\,\mathrm{e}^{a}\,\sqrt{-b^2}}{b}\right)}{\sqrt{-b^2}} - \frac{2\,\mathrm{e}^{a+b\,x}}{b\,\left(\mathrm{e}^{4\,a+4\,b\,x}-2\,\mathrm{e}^{2\,a+2\,b\,x}+1\right)} - \frac{\mathrm{e}^{a+b\,x}}{b\,\left(\mathrm{e}^{2\,a+2\,b\,x}-1\right)}$$

input
```
int(1/sinh(a + b*x)^3,x)
```

output
```
atan((exp(b*x)*exp(a)*(-b^2)^(1/2))/b)/(-b^2)^(1/2) - (2*exp(a + b*x))/(b*
(exp(4*a + 4*b*x) - 2*exp(2*a + 2*b*x) + 1)) - exp(a + b*x)/(b*(exp(2*a +
2*b*x) - 1))
```

# 3.4 $\int \operatorname{csch}^4(a+bx)\,dx$

3.4.1 Optimal result . . . 98
3.4.2 Mathematica [A] (verified) . . . 98
3.4.3 Rubi [C] (verified) . . . 99
3.4.4 Maple [A] (verified) . . . 100
3.4.5 Fricas [B] (verification not implemented) . . . 100
3.4.6 Sympy [F] . . . 101
3.4.7 Maxima [B] (verification not implemented) . . . 101
3.4.8 Giac [A] (verification not implemented) . . . 101
3.4.9 Mupad [B] (verification not implemented) . . . 102

## 3.4.1 Optimal result

Integrand size = 8, antiderivative size = 26

$$\int \operatorname{csch}^4(a+bx)\,dx = \frac{\coth(a+bx)}{b} - \frac{\coth^3(a+bx)}{3b}$$

output
```
coth(b*x+a)/b-1/3*coth(b*x+a)^3/b
```

## 3.4.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.35

$$\int \operatorname{csch}^4(a+bx)\,dx = \frac{2\coth(a+bx)}{3b} - \frac{\coth(a+bx)\operatorname{csch}^2(a+bx)}{3b}$$

input
```
Integrate[Csch[a + b*x]^4,x]
```

output
```
(2*Coth[a + b*x])/(3*b) - (Coth[a + b*x]*Csch[a + b*x]^2)/(3*b)
```

### 3.4.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.19 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.23, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.375$, Rules used = {3042, 4254, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^4(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int \csc(ia+ibx)^4 dx$$

$$\downarrow 4254$$

$$\frac{i\int \left(1-\coth^2(a+bx)\right) d(-i\coth(a+bx))}{b}$$

$$\downarrow 2009$$

$$\frac{i\left(\frac{1}{3}i\coth^3(a+bx)-i\coth(a+bx)\right)}{b}$$

input
```
Int[Csch[a + b*x]^4,x]
```

output
```
(I*((-I)*Coth[a + b*x] + (I/3)*Coth[a + b*x]^3))/b
```

#### 3.4.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

### 3.4.4 Maple [A] (verified)

Time = 0.80 (sec) , antiderivative size = 23, normalized size of antiderivative = 0.88

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{\left(\frac{2}{3}-\frac{\operatorname{csch}(bx+a)^2}{3}\right)\coth(bx+a)}{b}$ | 23 |
| default | $\frac{\left(\frac{2}{3}-\frac{\operatorname{csch}(bx+a)^2}{3}\right)\coth(bx+a)}{b}$ | 23 |
| risch | $-\frac{4\left(3\,e^{2bx+2a}-1\right)}{3b\left(e^{2bx+2a}-1\right)^3}$ | 32 |
| parallelrisch | $\frac{-\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)^3-\coth\left(\frac{bx}{2}+\frac{a}{2}\right)^3+9\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)+9\coth\left(\frac{bx}{2}+\frac{a}{2}\right)}{24b}$ | 55 |

input
```
int(csch(b*x+a)^4,x,method=_RETURNVERBOSE)
```

output
```
1/b*(2/3-1/3*csch(b*x+a)^2)*coth(b*x+a)
```

### 3.4.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 164 vs. 2(24) = 48.

Time = 0.25 (sec) , antiderivative size = 164, normalized size of antiderivative = 6.31

$$\int \operatorname{csch}^4(a+bx)\,dx =$$

$$-\frac{}{3\left(b\cosh(bx+a)^5+5\,b\cosh(bx+a)\sinh(bx+a)^4+b\sinh(bx+a)^5-3\,b\cosh(bx+a)^3+\left(10\,b\cosh\right.\right.}$$

input
```
integrate(csch(b*x+a)^4,x, algorithm="fricas")
```

output
```
-8/3*(cosh(b*x + a) + 2*sinh(b*x + a))/(b*cosh(b*x + a)^5 + 5*b*cosh(b*x +
 a)*sinh(b*x + a)^4 + b*sinh(b*x + a)^5 - 3*b*cosh(b*x + a)^3 + (10*b*cosh
(b*x + a)^2 - 3*b)*sinh(b*x + a)^3 + (10*b*cosh(b*x + a)^3 - 9*b*cosh(b*x
+ a))*sinh(b*x + a)^2 + 2*b*cosh(b*x + a) + (5*b*cosh(b*x + a)^4 - 9*b*cos
h(b*x + a)^2 + 4*b)*sinh(b*x + a))
```

### 3.4.6 Sympy [F]

$$\int \operatorname{csch}^4(a+bx)\,dx = \int \operatorname{csch}^4(a+bx)\,dx$$

input
```
integrate(csch(b*x+a)**4,x)
```

output
```
Integral(csch(a + b*x)**4, x)
```

### 3.4.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 90 vs. $2(24) = 48$.

Time $= 0.19$ (sec) , antiderivative size $= 90$, normalized size of antiderivative $= 3.46$

$$\int \operatorname{csch}^4(a+bx)\,dx = \frac{4\,e^{(-2\,bx-2\,a)}}{b(3\,e^{(-2\,bx-2\,a)} - 3\,e^{(-4\,bx-4\,a)} + e^{(-6\,bx-6\,a)} - 1)} - \frac{4}{3\,b(3\,e^{(-2\,bx-2\,a)} - 3\,e^{(-4\,bx-4\,a)} + e^{(-6\,bx-6\,a)} - 1)}$$

input
```
integrate(csch(b*x+a)^4,x, algorithm="maxima")
```

output
```
4*e^(-2*b*x - 2*a)/(b*(3*e^(-2*b*x - 2*a) - 3*e^(-4*b*x - 4*a) + e^(-6*b*x
 - 6*a) - 1)) - 4/3/(b*(3*e^(-2*b*x - 2*a) - 3*e^(-4*b*x - 4*a) + e^(-6*b*
x - 6*a) - 1))
```

### 3.4.8 Giac [A] (verification not implemented)

Time $= 0.28$ (sec) , antiderivative size $= 31$, normalized size of antiderivative $= 1.19$

$$\int \operatorname{csch}^4(a+bx)\,dx = -\frac{4\left(3\,e^{(2\,bx+2\,a)} - 1\right)}{3\,b(e^{(2\,bx+2\,a)} - 1)^3}$$

input
```
integrate(csch(b*x+a)^4,x, algorithm="giac")
```

output
```
-4/3*(3*e^(2*b*x + 2*a) - 1)/(b*(e^(2*b*x + 2*a) - 1)^3)
```

### 3.4.9 Mupad [B] (verification not implemented)

Time = 2.09 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.19

$$\int \operatorname{csch}^4(a+bx)\,dx = -\frac{4\left(3\,\mathrm{e}^{2a+2bx}-1\right)}{3b\left(\mathrm{e}^{2a+2bx}-1\right)^3}$$

input
```
int(1/sinh(a + b*x)^4,x)
```

output
```
-(4*(3*exp(2*a + 2*b*x) - 1))/(3*b*(exp(2*a + 2*b*x) - 1)^3)
```

# 3.5 $\int \operatorname{csch}^5(a+bx)\,dx$


3.5.1 Optimal result . . . 103
3.5.2 Mathematica [B] (verified) . . . 103
3.5.3 Rubi [C] (verified) . . . 104
3.5.4 Maple [A] (verified) . . . 106
3.5.5 Fricas [B] (verification not implemented) . . . 106
3.5.6 Sympy [F] . . . 107
3.5.7 Maxima [B] (verification not implemented) . . . 108
3.5.8 Giac [B] (verification not implemented) . . . 108
3.5.9 Mupad [B] (verification not implemented) . . . 109


## 3.5.1 Optimal result

Integrand size = 8, antiderivative size = 55

$$\int \operatorname{csch}^5(a+bx)\,dx = -\frac{3\operatorname{arctanh}(\cosh(a+bx))}{8b} + \frac{3\coth(a+bx)\operatorname{csch}(a+bx)}{8b} - \frac{\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}$$

output
```
-3/8*arctanh(cosh(b*x+a))/b+3/8*coth(b*x+a)*csch(b*x+a)/b-1/4*coth(b*x+a)*
csch(b*x+a)^3/b
```

## 3.5.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 113 vs. 2(55) = 110.

Time = 0.02 (sec) , antiderivative size = 113, normalized size of antiderivative = 2.05

$$\int \operatorname{csch}^5(a+bx)\,dx = \frac{3\operatorname{csch}^2\left(\frac{1}{2}(a+bx)\right)}{32b} - \frac{\operatorname{csch}^4\left(\frac{1}{2}(a+bx)\right)}{64b} - \frac{3\log\left(\cosh\left(\frac{1}{2}(a+bx)\right)\right)}{8b} + \frac{3\log\left(\sinh\left(\frac{1}{2}(a+bx)\right)\right)}{8b} + \frac{3\operatorname{sech}^2\left(\frac{1}{2}(a+bx)\right)}{32b} + \frac{\operatorname{sech}^4\left(\frac{1}{2}(a+bx)\right)}{64b}$$

input
```
Integrate[Csch[a + b*x]^5,x]
```

output
```
(3*Csch[(a + b*x)/2]^2)/(32*b) - Csch[(a + b*x)/2]^4/(64*b) - (3*Log[Cosh[
(a + b*x)/2]])/(8*b) + (3*Log[Sinh[(a + b*x)/2]])/(8*b) + (3*Sech[(a + b*x
)/2]^2)/(32*b) + Sech[(a + b*x)/2]^4/(64*b)
```

### 3.5.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.34 (sec) , antiderivative size = 70, normalized size of antiderivative = 1.27, number of steps used = 11, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 1.375$, Rules used = {3042, 26, 4255, 26, 3042, 26, 4255, 26, 3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^5(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int i\csc(ia+ibx)^5 dx$$

$$\downarrow 26$$

$$i\int \csc(ia+ibx)^5 dx$$

$$\downarrow 4255$$

$$i\left(\frac{3}{4}\int i\operatorname{csch}^3(a+bx)dx + \frac{i\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 26$$

$$i\left(\frac{3}{4}i\int \operatorname{csch}^3(a+bx)dx + \frac{i\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 3042$$

$$i\left(\frac{3}{4}i\int -i\csc(ia+ibx)^3 dx + \frac{i\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 26$$

$$i\left(\frac{3}{4}\int \csc(ia+ibx)^3 dx + \frac{i\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 4255$$

$$i\left(\frac{3}{4}\left(\frac{1}{2}\int -i\operatorname{csch}(a+bx)dx - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right) + \frac{i\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 26$$

$$i\left(\frac{3}{4}\left(-\frac{1}{2}i\int \operatorname{csch}(a+bx)dx - \frac{i\coth(a+bx)\operatorname{csch}(a+bx)}{2b}\right) + \frac{i\coth(a+bx)\operatorname{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 3042$$

$$i\left(\frac{3}{4}\left(-\frac{1}{2}i\int i\csc(ia+ibx)dx-\frac{i\coth(a+bx)\text{csch}(a+bx)}{2b}\right)+\frac{i\coth(a+bx)\text{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 26$$

$$i\left(\frac{3}{4}\left(\frac{1}{2}\int \csc(ia+ibx)dx-\frac{i\coth(a+bx)\text{csch}(a+bx)}{2b}\right)+\frac{i\coth(a+bx)\text{csch}^3(a+bx)}{4b}\right)$$

$$\downarrow 4257$$

$$i\left(\frac{3}{4}\left(\frac{i\text{arctanh}(\cosh(a+bx))}{2b}-\frac{i\coth(a+bx)\text{csch}(a+bx)}{2b}\right)+\frac{i\coth(a+bx)\text{csch}^3(a+bx)}{4b}\right)$$

input
```
Int[Csch[a + b*x]^5,x]
```

output
```
I*(((I/4)*Coth[a + b*x]*Csch[a + b*x]^3)/b + (3*(((I/2)*ArcTanh[Cosh[a + b
*x]])/b - ((I/2)*Coth[a + b*x]*Csch[a + b*x])/b))/4)
```

### 3.5.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

### 3.5.4 Maple [A] (verified)

Time = 0.79 (sec) , antiderivative size = 41, normalized size of antiderivative = 0.75

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{\left(-\frac{\operatorname{csch}(bx+a)^3}{4}+\frac{3\operatorname{csch}(bx+a)}{8}\right)\coth(bx+a)-\frac{3\operatorname{arctanh}\left(e^{bx+a}\right)}{4}}{b}$ | 41 |
| default | $\frac{\left(-\frac{\operatorname{csch}(bx+a)^3}{4}+\frac{3\operatorname{csch}(bx+a)}{8}\right)\coth(bx+a)-\frac{3\operatorname{arctanh}\left(e^{bx+a}\right)}{4}}{b}$ | 41 |
| parallelrisch | $\frac{\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)^4-\coth\left(\frac{bx}{2}+\frac{a}{2}\right)^4-8\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)^2+8\coth\left(\frac{bx}{2}+\frac{a}{2}\right)^2+24\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)}{64b}$ | 69 |
| risch | $\frac{e^{bx+a}\left(3e^{6bx+6a}-11e^{4bx+4a}-11e^{2bx+2a}+3\right)}{4b\left(e^{2bx+2a}-1\right)^4}-\frac{3\ln\left(e^{bx+a}+1\right)}{8b}+\frac{3\ln\left(e^{bx+a}-1\right)}{8b}$ | 89 |

input
```
int(csch(b*x+a)^5,x,method=_RETURNVERBOSE)
```

output
```
1/b*((-1/4*csch(b*x+a)^3+3/8*csch(b*x+a))*coth(b*x+a)-3/4*arctanh(exp(b*x+
a)))
```

### 3.5.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1114 vs. $2(49) = 98$.

Time = 0.25 (sec) , antiderivative size = 1114, normalized size of antiderivative = 20.25

$$\int \operatorname{csch}^5(a+bx)\,dx = \text{Too large to display}$$

input
```
integrate(csch(b*x+a)^5,x, algorithm="fricas")
```

output

```
1/8*(6*cosh(b*x + a)^7 + 42*cosh(b*x + a)*sinh(b*x + a)^6 + 6*sinh(b*x + a
)^7 + 2*(63*cosh(b*x + a)^2 - 11)*sinh(b*x + a)^5 - 22*cosh(b*x + a)^5 + 1
0*(21*cosh(b*x + a)^3 - 11*cosh(b*x + a))*sinh(b*x + a)^4 + 2*(105*cosh(b*
x + a)^4 - 110*cosh(b*x + a)^2 - 11)*sinh(b*x + a)^3 - 22*cosh(b*x + a)^3
+ 2*(63*cosh(b*x + a)^5 - 110*cosh(b*x + a)^3 - 33*cosh(b*x + a))*sinh(b*x
 + a)^2 - 3*(cosh(b*x + a)^8 + 8*cosh(b*x + a)*sinh(b*x + a)^7 + sinh(b*x
+ a)^8 + 4*(7*cosh(b*x + a)^2 - 1)*sinh(b*x + a)^6 - 4*cosh(b*x + a)^6 + 8
*(7*cosh(b*x + a)^3 - 3*cosh(b*x + a))*sinh(b*x + a)^5 + 2*(35*cosh(b*x +
a)^4 - 30*cosh(b*x + a)^2 + 3)*sinh(b*x + a)^4 + 6*cosh(b*x + a)^4 + 8*(7*
cosh(b*x + a)^5 - 10*cosh(b*x + a)^3 + 3*cosh(b*x + a))*sinh(b*x + a)^3 +
4*(7*cosh(b*x + a)^6 - 15*cosh(b*x + a)^4 + 9*cosh(b*x + a)^2 - 1)*sinh(b*
x + a)^2 - 4*cosh(b*x + a)^2 + 8*(cosh(b*x + a)^7 - 3*cosh(b*x + a)^5 + 3*
cosh(b*x + a)^3 - cosh(b*x + a))*sinh(b*x + a) + 1)*log(cosh(b*x + a) + si
nh(b*x + a) + 1) + 3*(cosh(b*x + a)^8 + 8*cosh(b*x + a)*sinh(b*x + a)^7 +
sinh(b*x + a)^8 + 4*(7*cosh(b*x + a)^2 - 1)*sinh(b*x + a)^6 - 4*cosh(b*x +
 a)^6 + 8*(7*cosh(b*x + a)^3 - 3*cosh(b*x + a))*sinh(b*x + a)^5 + 2*(35*co
sh(b*x + a)^4 - 30*cosh(b*x + a)^2 + 3)*sinh(b*x + a)^4 + 6*cosh(b*x + a)^
4 + 8*(7*cosh(b*x + a)^5 - 10*cosh(b*x + a)^3 + 3*cosh(b*x + a))*sinh(b*x
+ a)^3 + 4*(7*cosh(b*x + a)^6 - 15*cosh(b*x + a)^4 + 9*cosh(b*x + a)^2 - 1
)*sinh(b*x + a)^2 - 4*cosh(b*x + a)^2 + 8*(cosh(b*x + a)^7 - 3*cosh(b*x...
```

### 3.5.6 Sympy [F]

$$\int \operatorname{csch}^5(a+bx)\,dx = \int \operatorname{csch}^5(a+bx)\,dx$$

input

```
integrate(csch(b*x+a)**5,x)
```

output

```
Integral(csch(a + b*x)**5, x)
```

### 3.5.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 133 vs. $2(49) = 98$.

Time = 0.20 (sec) , antiderivative size = 133, normalized size of antiderivative = 2.42

$$\int \operatorname{csch}^5(a+bx)\,dx = -\frac{3\log\left(e^{(-bx-a)}+1\right)}{8b} + \frac{3\log\left(e^{(-bx-a)}-1\right)}{8b} - \frac{3e^{(-bx-a)} - 11e^{(-3bx-3a)} - 11e^{(-5bx-5a)} + 3e^{(-7bx-7a)}}{4b(4e^{(-2bx-2a)} - 6e^{(-4bx-4a)} + 4e^{(-6bx-6a)} - e^{(-8bx-8a)} - 1)}$$

input
```
integrate(csch(b*x+a)^5,x, algorithm="maxima")
```

output
```
-3/8*log(e^(-b*x - a) + 1)/b + 3/8*log(e^(-b*x - a) - 1)/b - 1/4*(3*e^(-b*
x - a) - 11*e^(-3*b*x - 3*a) - 11*e^(-5*b*x - 5*a) + 3*e^(-7*b*x - 7*a))/(
b*(4*e^(-2*b*x - 2*a) - 6*e^(-4*b*x - 4*a) + 4*e^(-6*b*x - 6*a) - e^(-8*b*
x - 8*a) - 1))
```

### 3.5.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 110 vs. $2(49) = 98$.

Time = 0.27 (sec) , antiderivative size = 110, normalized size of antiderivative = 2.00

$$\int \operatorname{csch}^5(a+bx)\,dx = \frac{\frac{4\left(3\left(e^{(bx+a)}+e^{(-bx-a)}\right)^3 - 20e^{(bx+a)} - 20e^{(-bx-a)}\right)}{\left(\left(e^{(bx+a)}+e^{(-bx-a)}\right)^2-4\right)^2} - 3\log\left(e^{(bx+a)}+e^{(-bx-a)}+2\right) + 3\log\left(e^{(bx+a)}+e^{(-bx-a)}-2\right)}{16b}$$

input
```
integrate(csch(b*x+a)^5,x, algorithm="giac")
```

output
```
1/16*(4*(3*(e^(b*x + a) + e^(-b*x - a))^3 - 20*e^(b*x + a) - 20*e^(-b*x -
a))/((e^(b*x + a) + e^(-b*x - a))^2 - 4)^2 - 3*log(e^(b*x + a) + e^(-b*x -
 a) + 2) + 3*log(e^(b*x + a) + e^(-b*x - a) - 2))/b
```

### 3.5.9 Mupad [B] (verification not implemented)

Time = 2.04 (sec) , antiderivative size = 193, normalized size of antiderivative = 3.51

$$\int \operatorname{csch}^5(a+bx)\,dx = \frac{3\,e^{a+bx}}{4b\left(e^{2a+2bx}-1\right)} - \frac{e^{a+bx}}{2b\left(e^{4a+4bx}-2\,e^{2a+2bx}+1\right)} - \frac{2\,e^{a+bx}}{b\left(3\,e^{2a+2bx}-3\,e^{4a+4bx}+e^{6a+6bx}-1\right)} - \frac{4\,e^{3a+3bx}}{b\left(6\,e^{4a+4bx}-4\,e^{2a+2bx}-4\,e^{6a+6bx}+e^{8a+8bx}+1\right)} - \frac{3\operatorname{atan}\left(\frac{e^{bx}\,e^{a}\sqrt{-b^2}}{b}\right)}{4\sqrt{-b^2}}$$

input
```
int(1/sinh(a + b*x)^5,x)
```

output
```
(3*exp(a + b*x))/(4*b*(exp(2*a + 2*b*x) - 1)) - exp(a + b*x)/(2*b*(exp(4*a
 + 4*b*x) - 2*exp(2*a + 2*b*x) + 1)) - (2*exp(a + b*x))/(b*(3*exp(2*a + 2*
b*x) - 3*exp(4*a + 4*b*x) + exp(6*a + 6*b*x) - 1)) - (4*exp(3*a + 3*b*x))/
(b*(6*exp(4*a + 4*b*x) - 4*exp(2*a + 2*b*x) - 4*exp(6*a + 6*b*x) + exp(8*a
 + 8*b*x) + 1)) - (3*atan((exp(b*x)*exp(a)*(-b^2)^(1/2))/b))/(4*(-b^2)^(1/
2))
```

# 3.6 $\int \operatorname{csch}^6(a+bx)\,dx$

3.6.1 Optimal result . . . 110
3.6.2 Mathematica [A] (verified) . . . 110
3.6.3 Rubi [C] (verified) . . . 111
3.6.4 Maple [A] (verified) . . . 112
3.6.5 Fricas [B] (verification not implemented) . . . 113
3.6.6 Sympy [F] . . . 113
3.6.7 Maxima [B] (verification not implemented) . . . 114
3.6.8 Giac [A] (verification not implemented) . . . 114
3.6.9 Mupad [B] (verification not implemented) . . . 115

## 3.6.1 Optimal result

Integrand size = 8, antiderivative size = 42

$$\int \operatorname{csch}^6(a+bx)\,dx = -\frac{\coth(a+bx)}{b} + \frac{2\coth^3(a+bx)}{3b} - \frac{\coth^5(a+bx)}{5b}$$

output
```
-coth(b*x+a)/b+2/3*coth(b*x+a)^3/b-1/5*coth(b*x+a)^5/b
```

## 3.6.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.33

$$\int \operatorname{csch}^6(a+bx)\,dx = -\frac{8\coth(a+bx)}{15b} + \frac{4\coth(a+bx)\operatorname{csch}^2(a+bx)}{15b} - \frac{\coth(a+bx)\operatorname{csch}^4(a+bx)}{5b}$$

input
```
Integrate[Csch[a + b*x]^6,x]
```

output
```
(-8*Coth[a + b*x])/(15*b) + (4*Coth[a + b*x]*Csch[a + b*x]^2)/(15*b) - (Co
th[a + b*x]*Csch[a + b*x]^4)/(5*b)
```

### 3.6.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.20 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.10, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 25, 4254, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^6(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int -\csc(ia+ibx)^6 dx$$

$$\downarrow 25$$

$$-\int \csc(ia+ibx)^6 dx$$

$$\downarrow 4254$$

$$-\frac{i\int \left(\coth^4(a+bx)-2\coth^2(a+bx)+1\right) d(-i\coth(a+bx))}{b}$$

$$\downarrow 2009$$

$$-\frac{i\left(-\frac{1}{5}i\coth^5(a+bx)+\frac{2}{3}i\coth^3(a+bx)-i\coth(a+bx)\right)}{b}$$

input
```
Int[Csch[a + b*x]^6,x]
```

output
```
((-I)*((-I)*Coth[a + b*x] + ((2*I)/3)*Coth[a + b*x]^3 - (I/5)*Coth[a + b*x
]^5))/b
```

#### 3.6.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

### 3.6.4 Maple [A] (verified)

Time = 0.76 (sec) , antiderivative size = 33, normalized size of antiderivative = 0.79

| method | result | s |
|---|---|---|
| derivativedivides | $\frac{\left(-\frac{8}{15}-\frac{\operatorname{csch}(bx+a)^4}{5}+\frac{4\operatorname{csch}(bx+a)^2}{15}\right)\coth(bx+a)}{b}$ | 3 |
| default | $\frac{\left(-\frac{8}{15}-\frac{\operatorname{csch}(bx+a)^4}{5}+\frac{4\operatorname{csch}(bx+a)^2}{15}\right)\coth(bx+a)}{b}$ | 3 |
| risch | $-\frac{16\left(10\,e^{4bx+4a}-5\,e^{2bx+2a}+1\right)}{15b\left(e^{2bx+2a}-1\right)^5}$ | 4 |
| parallelrisch | $\frac{-3\coth\left(\frac{bx}{2}+\frac{a}{2}\right)^5-3\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)^5+25\coth\left(\frac{bx}{2}+\frac{a}{2}\right)^3+25\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)^3-150\coth\left(\frac{bx}{2}+\frac{a}{2}\right)-150\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)}{480b}$ | 8 |

input
```
int(csch(b*x+a)^6,x,method=_RETURNVERBOSE)
```

output
```
1/b*(-8/15-1/5*csch(b*x+a)^4+4/15*csch(b*x+a)^2)*coth(b*x+a)
```

### 3.6.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 344 vs. $2(38) = 76$.

Time $= 0.24$ (sec) , antiderivative size $= 344$, normalized size of antiderivative $= 8.19$

$$\int \operatorname{csch}^6(a+bx)\,dx =$$

$$-\frac{}{15\left(b\cosh\left(bx+a\right)^8+8\,b\cosh\left(bx+a\right)\sinh\left(bx+a\right)^7+b\sinh\left(bx+a\right)^8-5\,b\cosh\left(bx+a\right)^6+\left(28\,b\cos\right.\right.}$$

input
```
integrate(csch(b*x+a)^6,x, algorithm="fricas")
```

output
```
-16/15*(11*cosh(b*x + a)^2 + 18*cosh(b*x + a)*sinh(b*x + a) + 11*sinh(b*x
+ a)^2 - 5)/(b*cosh(b*x + a)^8 + 8*b*cosh(b*x + a)*sinh(b*x + a)^7 + b*sin
h(b*x + a)^8 - 5*b*cosh(b*x + a)^6 + (28*b*cosh(b*x + a)^2 - 5*b)*sinh(b*x
 + a)^6 + 2*(28*b*cosh(b*x + a)^3 - 15*b*cosh(b*x + a))*sinh(b*x + a)^5 +
10*b*cosh(b*x + a)^4 + 5*(14*b*cosh(b*x + a)^4 - 15*b*cosh(b*x + a)^2 + 2*
b)*sinh(b*x + a)^4 + 4*(14*b*cosh(b*x + a)^5 - 25*b*cosh(b*x + a)^3 + 10*b
*cosh(b*x + a))*sinh(b*x + a)^3 - 11*b*cosh(b*x + a)^2 + (28*b*cosh(b*x +
a)^6 - 75*b*cosh(b*x + a)^4 + 60*b*cosh(b*x + a)^2 - 11*b)*sinh(b*x + a)^2
 + 2*(4*b*cosh(b*x + a)^7 - 15*b*cosh(b*x + a)^5 + 20*b*cosh(b*x + a)^3 -
9*b*cosh(b*x + a))*sinh(b*x + a) + 5*b)
```

### 3.6.6 Sympy [F]

$$\int \operatorname{csch}^6(a+bx)\,dx = \int \operatorname{csch}^6\left(a+bx\right)dx$$

input
```
integrate(csch(b*x+a)**6,x)
```

output
```
Integral(csch(a + b*x)**6, x)
```

### 3.6.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 205 vs. $2(38) = 76$.

Time $= 0.19$ (sec) , antiderivative size $= 205$, normalized size of antiderivative $= 4.88$

$$\begin{aligned}
&\int \operatorname{csch}^6(a+bx)\,dx \\
&= -\frac{16\,e^{(-2\,bx-2\,a)}}{3\,b(5\,e^{(-2\,bx-2\,a)} - 10\,e^{(-4\,bx-4\,a)} + 10\,e^{(-6\,bx-6\,a)} - 5\,e^{(-8\,bx-8\,a)} + e^{(-10\,bx-10\,a)} - 1)} \\
&\quad + \frac{32\,e^{(-4\,bx-4\,a)}}{3\,b(5\,e^{(-2\,bx-2\,a)} - 10\,e^{(-4\,bx-4\,a)} + 10\,e^{(-6\,bx-6\,a)} - 5\,e^{(-8\,bx-8\,a)} + e^{(-10\,bx-10\,a)} - 1)} \\
&\quad + \frac{16}{15\,b(5\,e^{(-2\,bx-2\,a)} - 10\,e^{(-4\,bx-4\,a)} + 10\,e^{(-6\,bx-6\,a)} - 5\,e^{(-8\,bx-8\,a)} + e^{(-10\,bx-10\,a)} - 1)}
\end{aligned}$$

input
```
integrate(csch(b*x+a)^6,x, algorithm="maxima")
```

output
```
-16/3*e^(-2*b*x - 2*a)/(b*(5*e^(-2*b*x - 2*a) - 10*e^(-4*b*x - 4*a) + 10*e
^(-6*b*x - 6*a) - 5*e^(-8*b*x - 8*a) + e^(-10*b*x - 10*a) - 1)) + 32/3*e^(
-4*b*x - 4*a)/(b*(5*e^(-2*b*x - 2*a) - 10*e^(-4*b*x - 4*a) + 10*e^(-6*b*x
- 6*a) - 5*e^(-8*b*x - 8*a) + e^(-10*b*x - 10*a) - 1)) + 16/15/(b*(5*e^(-2
*b*x - 2*a) - 10*e^(-4*b*x - 4*a) + 10*e^(-6*b*x - 6*a) - 5*e^(-8*b*x - 8*
a) + e^(-10*b*x - 10*a) - 1))
```

### 3.6.8 Giac [A] (verification not implemented)

Time $= 0.29$ (sec) , antiderivative size $= 42$, normalized size of antiderivative $= 1.00$

$$\int \operatorname{csch}^6(a+bx)\,dx = -\frac{16\left(10\,e^{(4\,bx+4\,a)} - 5\,e^{(2\,bx+2\,a)} + 1\right)}{15\,b(e^{(2\,bx+2\,a)} - 1)^5}$$

input
```
integrate(csch(b*x+a)^6,x, algorithm="giac")
```

output
```
-16/15*(10*e^(4*b*x + 4*a) - 5*e^(2*b*x + 2*a) + 1)/(b*(e^(2*b*x + 2*a) -
1)^5)
```

### 3.6.9 Mupad [B] (verification not implemented)

Time = 0.07 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.00

$$\int \operatorname{csch}^6(a+bx)\,dx = -\frac{16\left(10\,\mathrm{e}^{4a+4bx} - 5\,\mathrm{e}^{2a+2bx} + 1\right)}{15\,b\left(\mathrm{e}^{2a+2bx} - 1\right)^5}$$

input
```
int(1/sinh(a + b*x)^6,x)
```

output
```
-(16*(10*exp(4*a + 4*b*x) - 5*exp(2*a + 2*b*x) + 1))/(15*b*(exp(2*a + 2*b*
x) - 1)^5)
```

# 3.7 $\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx$


3.7.1 Optimal result . . . 116
3.7.2 Mathematica [A] (verified) . . . 116
3.7.3 Rubi [A] (verified) . . . 117
3.7.4 Maple [A] (verified) . . . 118
3.7.5 Fricas [C] (verification not implemented) . . . 119
3.7.6 Sympy [F] . . . 119
3.7.7 Maxima [F] . . . 119
3.7.8 Giac [F] . . . 120
3.7.9 Mupad [F(-1)] . . . 120


## 3.7.1 Optimal result

Integrand size = 10, antiderivative size = 80

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx = -\frac{2\cosh(a+bx)\operatorname{csch}^{\frac{3}{2}}(a+bx)}{3b} + \frac{2i\sqrt{\operatorname{csch}(a+bx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ibx\right),2\right)\sqrt{i\sinh(a+bx)}}{3b}$$

output
```
-2/3*cosh(b*x+a)*csch(b*x+a)^(3/2)/b-2/3*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*x)^
2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*x)*EllipticF(cos(1/2*I*a+1/4*Pi+1/2*I*
b*x),2^(1/2))*csch(b*x+a)^(1/2)*(I*sinh(b*x+a))^(1/2)/b
```

## 3.7.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 61, normalized size of antiderivative = 0.76

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx = -\frac{2\sqrt{\operatorname{csch}(a+bx)}\left(\coth(a+bx)+i\,\text{EllipticF}\left(\frac{1}{4}(-2ia+\pi-2ibx),2\right)\sqrt{i\sinh(a+bx)}\right)}{3b}$$

input
```
Integrate[Csch[a + b*x]^(5/2),x]
```

output
```
(-2*Sqrt[Csch[a + b*x]]*(Coth[a + b*x] + I*EllipticF[((-2*I)*a + Pi - (2*I
)*b*x)/4, 2]*Sqrt[I*Sinh[a + b*x]]))/(3*b)
```

### 3.7.3 Rubi [A] (verified)

Time = 0.34 (sec) , antiderivative size = 80, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4255, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int (i\csc(ia+ibx))^{5/2}dx$$

$$\downarrow 4255$$

$$-\frac{1}{3}\int \sqrt{\operatorname{csch}(a+bx)}dx - \frac{2\cosh(a+bx)\operatorname{csch}^{\frac{3}{2}}(a+bx)}{3b}$$

$$\downarrow 3042$$

$$-\frac{2\cosh(a+bx)\operatorname{csch}^{\frac{3}{2}}(a+bx)}{3b} - \frac{1}{3}\int \sqrt{i\csc(ia+ibx)}dx$$

$$\downarrow 4258$$

$$-\frac{2\cosh(a+bx)\operatorname{csch}^{\frac{3}{2}}(a+bx)}{3b} - \frac{1}{3}\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\int \frac{1}{\sqrt{i\sinh(a+bx)}}dx$$

$$\downarrow 3042$$

$$-\frac{2\cosh(a+bx)\operatorname{csch}^{\frac{3}{2}}(a+bx)}{3b} - \frac{1}{3}\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\int \frac{1}{\sqrt{\sin(ia+ibx)}}dx$$

$$\downarrow 3120$$

$$-\frac{2\cosh(a+bx)\operatorname{csch}^{\frac{3}{2}}(a+bx)}{3b} + \frac{2i\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\operatorname{EllipticF}\left(\frac{1}{2}\left(ia+ibx-\frac{\pi}{2}\right),2\right)}{3b}$$

input
```
Int[Csch[a + b*x]^(5/2),x]
```

output
```
(-2*Cosh[a + b*x]*Csch[a + b*x]^(3/2))/(3*b) + (((2*I)/3)*Sqrt[Csch[a + b*
x]]*EllipticF[(I*a - Pi/2 + I*b*x)/2, 2]*Sqrt[I*Sinh[a + b*x]])/b
```

#### 3.7.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.7.4 Maple [A] (verified)

Time = 0.36 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.26

| method | result | size |
|---|---|---|
| default | $-\frac{i\sqrt{1-i\sinh(bx+a)}\,\sqrt{2}\,\sqrt{1+i\sinh(bx+a)}\,\sqrt{i\sinh(bx+a)}\,\text{EllipticF}\left(\sqrt{1-i\sinh(bx+a)},\frac{\sqrt{2}}{2}\right)\sinh(bx+a)+2\cosh(bx+a)^2}{3\sinh(bx+a)^{\frac{3}{2}}\cosh(bx+a)b}$ | 101 |

input
```
int(csch(b*x+a)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
-1/3/sinh(b*x+a)^(3/2)*(I*(1-I*sinh(b*x+a))^(1/2)*2^(1/2)*(1+I*sinh(b*x+a)
)^(1/2)*(I*sinh(b*x+a))^(1/2)*EllipticF((1-I*sinh(b*x+a))^(1/2),1/2*2^(1/2
))*sinh(b*x+a)+2*cosh(b*x+a)^2)/cosh(b*x+a)/b
```

### 3.7.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 194, normalized size of antiderivative = 2.42

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx =$$

$$-\frac{2\left(\sqrt{2}\left(\cosh(bx+a)^2+2\cosh(bx+a)\sinh(bx+a)+\sinh(bx+a)^2+1\right)\sqrt{\frac{\cosh(bx+a)+\sinh(}{\cosh(bx+a)^2+2\cosh(bx+a)\sinh(}}\right.}{3\left(b\cosh(\right.}$$

input
```
integrate(csch(b*x+a)^(5/2),x, algorithm="fricas")
```

output
```
-2/3*(sqrt(2)*(cosh(b*x + a)^2 + 2*cosh(b*x + a)*sinh(b*x + a) + sinh(b*x
+ a)^2 + 1)*sqrt((cosh(b*x + a) + sinh(b*x + a))/(cosh(b*x + a)^2 + 2*cosh
(b*x + a)*sinh(b*x + a) + sinh(b*x + a)^2 - 1)) + (sqrt(2)*cosh(b*x + a)^2
 + 2*sqrt(2)*cosh(b*x + a)*sinh(b*x + a) + sqrt(2)*sinh(b*x + a)^2 - sqrt(
2))*weierstrassPInverse(4, 0, cosh(b*x + a) + sinh(b*x + a)))/(b*cosh(b*x
+ a)^2 + 2*b*cosh(b*x + a)*sinh(b*x + a) + b*sinh(b*x + a)^2 - b)
```

### 3.7.6 Sympy [F]

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx = \int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx$$

input
```
integrate(csch(b*x+a)**(5/2),x)
```

output
```
Integral(csch(a + b*x)**(5/2), x)
```

### 3.7.7 Maxima [F]

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx = \int \operatorname{csch}(bx+a)^{\frac{5}{2}}\,dx$$

input
```
integrate(csch(b*x+a)^(5/2),x, algorithm="maxima")
```

output
```
integrate(csch(b*x + a)^(5/2), x)
```

### 3.7.8 Giac [F]

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx = \int \operatorname{csch}\left(bx+a\right)^{\frac{5}{2}}\,dx$$

input
```
integrate(csch(b*x+a)^(5/2),x, algorithm="giac")
```

output
```
integrate(csch(b*x + a)^(5/2), x)
```

### 3.7.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^{\frac{5}{2}}(a+bx)\,dx = \int \left(\frac{1}{\sinh\left(a+b\,x\right)}\right)^{5/2} dx$$

input
```
int((1/sinh(a + b*x))^(5/2),x)
```

output
```
int((1/sinh(a + b*x))^(5/2), x)
```

# 3.8 $\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx$


3.8.1 Optimal result . . . 121
3.8.2 Mathematica [A] (verified) . . . 121
3.8.3 Rubi [A] (verified) . . . 122
3.8.4 Maple [A] (verified) . . . 123
3.8.5 Fricas [C] (verification not implemented) . . . 124
3.8.6 Sympy [F] . . . 124
3.8.7 Maxima [F] . . . 124
3.8.8 Giac [F] . . . 125
3.8.9 Mupad [F(-1)] . . . 125


## 3.8.1 Optimal result

Integrand size = 10, antiderivative size = 76

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = -\frac{2\cosh(a+bx)\sqrt{\operatorname{csch}(a+bx)}}{b} - \frac{2iE\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ibx\right)\middle|\,2\right)}{b\sqrt{\operatorname{csch}(a+bx)}\sqrt{i\sinh(a+bx)}}$$

output
```
-2*cosh(b*x+a)*csch(b*x+a)^(1/2)/b+2*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*x)^2)^(
1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*x)*EllipticE(cos(1/2*I*a+1/4*Pi+1/2*I*b*x)
,2^(1/2))/b/csch(b*x+a)^(1/2)/(I*sinh(b*x+a))^(1/2)
```

## 3.8.2 Mathematica [A] (verified)

Time = 0.17 (sec) , antiderivative size = 57, normalized size of antiderivative = 0.75

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = -\frac{2\sqrt{\operatorname{csch}(a+bx)}\left(\cosh(a+bx) - E\left(\frac{1}{4}(-2ia+\pi-2ibx)\middle|\,2\right)\sqrt{i\sinh(a+bx)}\right)}{b}$$

input
```
Integrate[Csch[a + b*x]^(3/2),x]
```

output
```
(-2*Sqrt[Csch[a + b*x]]*(Cosh[a + b*x] - EllipticE[((-2*I)*a + Pi - (2*I)*
b*x)/4, 2]*Sqrt[I*Sinh[a + b*x]]))/b
```

### 3.8.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 76, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx$$

$$\downarrow 3042$$

$$\int (i\csc(ia+ibx))^{3/2}dx$$

$$\downarrow 4255$$

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}dx - \frac{2\cosh(a+bx)\sqrt{\operatorname{csch}(a+bx)}}{b}$$

$$\downarrow 3042$$

$$-\frac{2\cosh(a+bx)\sqrt{\operatorname{csch}(a+bx)}}{b} + \int \frac{1}{\sqrt{i\csc(ia+ibx)}}dx$$

$$\downarrow 4258$$

$$-\frac{2\cosh(a+bx)\sqrt{\operatorname{csch}(a+bx)}}{b} + \frac{\int \sqrt{i\sinh(a+bx)}dx}{\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

$$\downarrow 3042$$

$$-\frac{2\cosh(a+bx)\sqrt{\operatorname{csch}(a+bx)}}{b} + \frac{\int \sqrt{\sin(ia+ibx)}dx}{\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

$$\downarrow 3119$$

$$-\frac{2\cosh(a+bx)\sqrt{\operatorname{csch}(a+bx)}}{b} - \frac{2iE\left(\frac{1}{2}\left(ia+ibx-\frac{\pi}{2}\right)\middle|\,2\right)}{b\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

input
```
Int[Csch[a + b*x]^(3/2),x]
```

output
```
(-2*Cosh[a + b*x]*Sqrt[Csch[a + b*x]])/b - ((2*I)*EllipticE[(I*a - Pi/2 +
I*b*x)/2, 2])/(b*Sqrt[Csch[a + b*x]]*Sqrt[I*Sinh[a + b*x]])
```

#### 3.8.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.8.4 Maple [A] (verified)

Time = 0.37 (sec) , antiderivative size = 154, normalized size of antiderivative = 2.03

| method | result |
|---|---|
| default | $\frac{2\sqrt{1-i\sinh(bx+a)}\,\sqrt{2}\,\sqrt{1+i\sinh(bx+a)}\,\sqrt{i\sinh(bx+a)}\,\text{EllipticE}\left(\sqrt{1-i\sinh(bx+a)},\frac{\sqrt{2}}{2}\right)-\sqrt{1-i\sinh(bx+a)}\,\sqrt{2}\,\sqrt{1+i\sinh(bx+a}}{\cosh(bx+a)\sqrt{\sinh(bx+a)}\,b}$ |

input
```
int(csch(b*x+a)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
(2*(1-I*sinh(b*x+a))^(1/2)*2^(1/2)*(1+I*sinh(b*x+a))^(1/2)*(I*sinh(b*x+a))
^(1/2)*EllipticE((1-I*sinh(b*x+a))^(1/2),1/2*2^(1/2))-(1-I*sinh(b*x+a))^(1
/2)*2^(1/2)*(1+I*sinh(b*x+a))^(1/2)*(I*sinh(b*x+a))^(1/2)*EllipticF((1-I*s
inh(b*x+a))^(1/2),1/2*2^(1/2))-2*cosh(b*x+a)^2)/cosh(b*x+a)/sinh(b*x+a)^(1
/2)/b
```

### 3.8.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.26

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = -\frac{2\left(\sqrt{2}\sqrt{\frac{\cosh(bx+a)+\sinh(bx+a)}{\cosh(bx+a)^2+2\cosh(bx+a)\sinh(bx+a)+\sinh(bx+a)^2-1}}(\cosh(bx+a)+\sinh(bx+a))+\sqrt{2}\text{weierstrassZet}\right.}{b}$$

input
```
integrate(csch(b*x+a)^(3/2),x, algorithm="fricas")
```

output
```
-2*(sqrt(2)*sqrt((cosh(b*x + a) + sinh(b*x + a))/(cosh(b*x + a)^2 + 2*cosh
(b*x + a)*sinh(b*x + a) + sinh(b*x + a)^2 - 1))*(cosh(b*x + a) + sinh(b*x
+ a)) + sqrt(2)*weierstrassZeta(4, 0, weierstrassPInverse(4, 0, cosh(b*x +
 a) + sinh(b*x + a))))/b
```

### 3.8.6 Sympy [F]

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = \int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx$$

input
```
integrate(csch(b*x+a)**(3/2),x)
```

output
```
Integral(csch(a + b*x)**(3/2), x)
```

### 3.8.7 Maxima [F]

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = \int \operatorname{csch}(bx+a)^{\frac{3}{2}}\,dx$$

input
```
integrate(csch(b*x+a)^(3/2),x, algorithm="maxima")
```

output
```
integrate(csch(b*x + a)^(3/2), x)
```

### 3.8.8 Giac [F]

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = \int \operatorname{csch}\left(bx+a\right)^{\frac{3}{2}}\,dx$$

input
```
integrate(csch(b*x+a)^(3/2),x, algorithm="giac")
```

output
```
integrate(csch(b*x + a)^(3/2), x)
```

### 3.8.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^{\frac{3}{2}}(a+bx)\,dx = \int \left(\frac{1}{\sinh\left(a+b\,x\right)}\right)^{3/2} dx$$

input
```
int((1/sinh(a + b*x))^(3/2),x)
```

output
```
int((1/sinh(a + b*x))^(3/2), x)
```

# 3.9 $\int \sqrt{\operatorname{csch}(a+bx)}\,dx$


3.9.1 Optimal result . . . 126
3.9.2 Mathematica [A] (verified) . . . 126
3.9.3 Rubi [A] (verified) . . . 127
3.9.4 Maple [A] (verified) . . . 128
3.9.5 Fricas [C] (verification not implemented) . . . 128
3.9.6 Sympy [F] . . . 129
3.9.7 Maxima [F] . . . 129
3.9.8 Giac [F] . . . 129
3.9.9 Mupad [F(-1)] . . . 130


## 3.9.1 Optimal result

Integrand size = 10, antiderivative size = 54

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = -\frac{2i\sqrt{\operatorname{csch}(a+bx)}\,\operatorname{EllipticF}\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ibx\right),2\right)\sqrt{i\sinh(a+bx)}}{b}$$

output
```
2*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*x)^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*x)*
EllipticF(cos(1/2*I*a+1/4*Pi+1/2*I*b*x),2^(1/2))*csch(b*x+a)^(1/2)*(I*sinh
(b*x+a))^(1/2)/b
```

## 3.9.2 Mathematica [A] (verified)

Time = 0.16 (sec) , antiderivative size = 48, normalized size of antiderivative = 0.89

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = \frac{2\operatorname{csch}^{\frac{3}{2}}(a+bx)\,\operatorname{EllipticF}\left(\frac{1}{4}(-2ia+\pi-2ibx),2\right)(i\sinh(a+bx))^{3/2}}{b}$$

input
```
Integrate[Sqrt[Csch[a + b*x]],x]
```

output
```
(2*Csch[a + b*x]^(3/2)*EllipticF[((-2*I)*a + Pi - (2*I)*b*x)/4, 2]*(I*Sinh
[a + b*x])^(3/2))/b
```

### 3.9.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{i\csc(ia+ibx)}dx$$

$$\downarrow 4258$$

$$\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\int \frac{1}{\sqrt{i\sinh(a+bx)}}dx$$

$$\downarrow 3042$$

$$\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\int \frac{1}{\sqrt{\sin(ia+ibx)}}dx$$

$$\downarrow 3120$$

$$-\frac{2i\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ia+ibx-\frac{\pi}{2}\right),2\right)}{b}$$

input
```
Int[Sqrt[Csch[a + b*x]],x]
```

output
```
((-2*I)*Sqrt[Csch[a + b*x]]*EllipticF[(I*a - Pi/2 + I*b*x)/2, 2]*Sqrt[I*Si
nh[a + b*x]])/b
```

#### 3.9.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.9.4 Maple [A] (verified)

Time = 0.31 (sec) , antiderivative size = 87, normalized size of antiderivative = 1.61

| method | result | size |
|---|---|---|
| default | $\frac{i\sqrt{-i(\sinh(bx+a)+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(bx+a)+i)}\,\sqrt{i\sinh(bx+a)}\,\text{EllipticF}\left(\sqrt{-i(\sinh(bx+a)+i)},\frac{\sqrt{2}}{2}\right)}{\cosh(bx+a)\sqrt{\sinh(bx+a)}\,b}$ | 87 |

input
```
int(csch(b*x+a)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
I*(-I*(sinh(b*x+a)+I))^(1/2)*2^(1/2)*(-I*(-sinh(b*x+a)+I))^(1/2)*(I*sinh(b
*x+a))^(1/2)*EllipticF((-I*(sinh(b*x+a)+I))^(1/2),1/2*2^(1/2))/cosh(b*x+a)
/sinh(b*x+a)^(1/2)/b
```

### 3.9.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 24, normalized size of antiderivative = 0.44

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = \frac{2\sqrt{2}\text{weierstrassPInverse}(4,0,\cosh(bx+a)+\sinh(bx+a))}{b}$$

input
```
integrate(csch(b*x+a)^(1/2),x, algorithm="fricas")
```

output
```
2*sqrt(2)*weierstrassPInverse(4, 0, cosh(b*x + a) + sinh(b*x + a))/b
```

### 3.9.6 Sympy [F]

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = \int \sqrt{\operatorname{csch}(a+bx)}\,dx$$

input
```
integrate(csch(b*x+a)**(1/2),x)
```

output
```
Integral(sqrt(csch(a + b*x)), x)
```

### 3.9.7 Maxima [F]

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = \int \sqrt{\operatorname{csch}(bx+a)}\,dx$$

input
```
integrate(csch(b*x+a)^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(csch(b*x + a)), x)
```

### 3.9.8 Giac [F]

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = \int \sqrt{\operatorname{csch}(bx+a)}\,dx$$

input
```
integrate(csch(b*x+a)^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(csch(b*x + a)), x)
```

### 3.9.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{\operatorname{csch}(a+bx)}\,dx = \int \sqrt{\frac{1}{\sinh(a+b\,x)}}\,dx$$

input
```
int((1/sinh(a + b*x))^(1/2),x)
```

output
```
int((1/sinh(a + b*x))^(1/2), x)
```

# 3.10 $\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx$

3.10.1 Optimal result . . . 131
3.10.2 Mathematica [A] (verified) . . . 131
3.10.3 Rubi [A] (verified) . . . 132
3.10.4 Maple [A] (verified) . . . 133
3.10.5 Fricas [C] (verification not implemented) . . . 134
3.10.6 Sympy [F] . . . 134
3.10.7 Maxima [F] . . . 134
3.10.8 Giac [F] . . . 135
3.10.9 Mupad [F(-1)] . . . 135

## 3.10.1 Optimal result

Integrand size = 10, antiderivative size = 54

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = -\frac{2iE\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ibx\right)\middle|\,2\right)}{b\sqrt{\operatorname{csch}(a+bx)}\sqrt{i\sinh(a+bx)}}$$

output
```
2*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*x)^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*x)*
EllipticE(cos(1/2*I*a+1/4*Pi+1/2*I*b*x),2^(1/2))/b/csch(b*x+a)^(1/2)/(I*si
nh(b*x+a))^(1/2)
```

## 3.10.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 50, normalized size of antiderivative = 0.93

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = \frac{2\sqrt{\operatorname{csch}(a+bx)}E\left(\frac{1}{2}\left(\frac{\pi}{2}-i(a+bx)\right)\middle|\,2\right)\sqrt{i\sinh(a+bx)}}{b}$$

input
```
Integrate[1/Sqrt[Csch[a + b*x]],x]
```

output
```
(2*Sqrt[Csch[a + b*x]]*EllipticE[(Pi/2 - I*(a + b*x))/2, 2]*Sqrt[I*Sinh[a
+ b*x]])/b
```

### 3.10.3 Rubi [A] (verified)

Time = 0.24 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{\sqrt{i\csc(ia+ibx)}}dx$$
$$\downarrow 4258$$
$$\frac{\int \sqrt{i\sinh(a+bx)}dx}{\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$
$$\downarrow 3042$$
$$\frac{\int \sqrt{\sin(ia+ibx)}dx}{\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$
$$\downarrow 3119$$
$$-\frac{2iE\left(\frac{1}{2}\left(ia+ibx-\frac{\pi}{2}\right)\middle|\,2\right)}{b\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

input
```
Int[1/Sqrt[Csch[a + b*x]],x]
```

output
```
((-2*I)*EllipticE[(I*a - Pi/2 + I*b*x)/2, 2])/(b*Sqrt[Csch[a + b*x]]*Sqrt[
I*Sinh[a + b*x]])
```

#### 3.10.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.10.4 Maple [A] (verified)

Time = 0.47 (sec) , antiderivative size = 108, normalized size of antiderivative = 2.00

| method | result |
|---|---|
| default | $\frac{\sqrt{-i(\sinh(bx+a)+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(bx+a)+i)}\,\sqrt{i\sinh(bx+a)}\left(2\,\text{EllipticE}\left(\sqrt{1-i\sinh(bx+a)},\frac{\sqrt{2}}{2}\right)-\text{EllipticF}\left(\sqrt{1-i\sinh(bx+a)},\right.\right.}{\cosh(bx+a)\sqrt{\sinh(bx+a)}\,b}$ |
| risch | $\frac{\sqrt{2}}{b\sqrt{\frac{e^{bx+a}}{e^{2bx+2a}-1}}}-\frac{\left(\frac{2e^{2bx+2a}-2}{\sqrt{e^{bx+a}\left(e^{2bx+2a}-1\right)}}-\frac{\sqrt{e^{bx+a}+1}\,\sqrt{-2e^{bx+a}+2}\,\sqrt{-e^{bx+a}}\left(-2\,\text{EllipticE}\left(\sqrt{e^{bx+a}+1},\frac{\sqrt{2}}{2}\right)+\text{EllipticF}\left(\sqrt{e^{bx+a}+1},\frac{\sqrt{2}}{2}\right.\right.\right.}{\sqrt{e^{3bx+3a}-e^{bx+a}}}\right)}{b\sqrt{\frac{e^{bx+a}}{e^{2bx+2a}-1}}\,(e^{2bx+2a}-1)}$ |

input
```
int(1/csch(b*x+a)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
(-I*(sinh(b*x+a)+I))^(1/2)*2^(1/2)*(-I*(-sinh(b*x+a)+I))^(1/2)*(I*sinh(b*x
+a))^(1/2)*(2*EllipticE((1-I*sinh(b*x+a))^(1/2),1/2*2^(1/2))-EllipticF((1-
I*sinh(b*x+a))^(1/2),1/2*2^(1/2)))/cosh(b*x+a)/sinh(b*x+a)^(1/2)/b
```

### 3.10.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 150, normalized size of antiderivative = 2.78

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = -\frac{\sqrt{2}\left(\cosh(bx+a)^2+2\cosh(bx+a)\sinh(bx+a)+\sinh(bx+a)^2-1\right)\sqrt{\frac{\cosh(bx+a)+\sinh(bx+}{\cosh(bx+a)^2+2\cosh(bx+a)\sinh(bx+}}$$

input
```
integrate(1/csch(b*x+a)^(1/2),x, algorithm="fricas")
```

output
```
-(sqrt(2)*(cosh(b*x + a)^2 + 2*cosh(b*x + a)*sinh(b*x + a) + sinh(b*x + a)
^2 - 1)*sqrt((cosh(b*x + a) + sinh(b*x + a))/(cosh(b*x + a)^2 + 2*cosh(b*x
 + a)*sinh(b*x + a) + sinh(b*x + a)^2 - 1)) + 2*(sqrt(2)*cosh(b*x + a) + s
qrt(2)*sinh(b*x + a))*weierstrassZeta(4, 0, weierstrassPInverse(4, 0, cosh
(b*x + a) + sinh(b*x + a))))/(b*cosh(b*x + a) + b*sinh(b*x + a))
```

### 3.10.6 Sympy [F]

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = \int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx$$

input
```
integrate(1/csch(b*x+a)**(1/2),x)
```

output
```
Integral(1/sqrt(csch(a + b*x)), x)
```

### 3.10.7 Maxima [F]

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = \int \frac{1}{\sqrt{\operatorname{csch}(bx+a)}}\,dx$$

input
```
integrate(1/csch(b*x+a)^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/sqrt(csch(b*x + a)), x)
```

### 3.10.8 Giac [F]

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = \int \frac{1}{\sqrt{\operatorname{csch}\left(bx+a\right)}}\,dx$$

input
```
integrate(1/csch(b*x+a)^(1/2),x, algorithm="giac")
```

output
```
integrate(1/sqrt(csch(b*x + a)), x)
```

### 3.10.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}\,dx = \int \frac{1}{\sqrt{\frac{1}{\sinh(a+b\,x)}}}\,dx$$

input
```
int(1/(1/sinh(a + b*x))^(1/2),x)
```

output
```
int(1/(1/sinh(a + b*x))^(1/2), x)
```

# 3.11 $\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx$

3.11.1 Optimal result . . . 136
3.11.2 Mathematica [A] (verified) . . . 136
3.11.3 Rubi [A] (verified) . . . 137
3.11.4 Maple [A] (verified) . . . 138
3.11.5 Fricas [C] (verification not implemented) . . . 139
3.11.6 Sympy [F] . . . 139
3.11.7 Maxima [F] . . . 140
3.11.8 Giac [F] . . . 140
3.11.9 Mupad [F(-1)] . . . 140

## 3.11.1 Optimal result

Integrand size = 10, antiderivative size = 80

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx = \frac{2\cosh(a+bx)}{3b\sqrt{\operatorname{csch}(a+bx)}} + \frac{2i\sqrt{\operatorname{csch}(a+bx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ibx\right),2\right)\sqrt{i\sinh(a+bx)}}{3b}$$

output
```
2/3*cosh(b*x+a)/b/csch(b*x+a)^(1/2)-2/3*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*x)^2
)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*x)*EllipticF(cos(1/2*I*a+1/4*Pi+1/2*I*b
*x),2^(1/2))*csch(b*x+a)^(1/2)*(I*sinh(b*x+a))^(1/2)/b
```

## 3.11.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 63, normalized size of antiderivative = 0.79

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx = \frac{\sqrt{\operatorname{csch}(a+bx)}\left(-2i\,\text{EllipticF}\left(\frac{1}{4}(-2ia+\pi-2ibx),2\right)\sqrt{i\sinh(a+bx)}+\sinh(2(a+bx))\right)}{3b}$$

input
```
Integrate[Csch[a + b*x]^(-3/2),x]
```

output
```
(Sqrt[Csch[a + b*x]]*((-2*I)*EllipticF[((-2*I)*a + Pi - (2*I)*b*x)/4, 2]*S
qrt[I*Sinh[a + b*x]] + Sinh[2*(a + b*x)]))/(3*b)
```

### 3.11.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 80, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4256, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(i\csc(ia+ibx))^{3/2}}dx$$

$$\downarrow 4256$$

$$\frac{2\cosh(a+bx)}{3b\sqrt{\operatorname{csch}(a+bx)}} - \frac{1}{3}\int \sqrt{\operatorname{csch}(a+bx)}dx$$

$$\downarrow 3042$$

$$\frac{2\cosh(a+bx)}{3b\sqrt{\operatorname{csch}(a+bx)}} - \frac{1}{3}\int \sqrt{i\csc(ia+ibx)}dx$$

$$\downarrow 4258$$

$$\frac{2\cosh(a+bx)}{3b\sqrt{\operatorname{csch}(a+bx)}} - \frac{1}{3}\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\int \frac{1}{\sqrt{i\sinh(a+bx)}}dx$$

$$\downarrow 3042$$

$$\frac{2\cosh(a+bx)}{3b\sqrt{\operatorname{csch}(a+bx)}} - \frac{1}{3}\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\int \frac{1}{\sqrt{\sin(ia+ibx)}}dx$$

$$\downarrow 3120$$

$$\frac{2\cosh(a+bx)}{3b\sqrt{\operatorname{csch}(a+bx)}} + \frac{2i\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ia+ibx-\frac{\pi}{2}\right),2\right)}{3b}$$

input
```
Int[Csch[a + b*x]^(-3/2),x]
```

output
```
(2*Cosh[a + b*x])/(3*b*Sqrt[Csch[a + b*x]]) + (((2*I)/3)*Sqrt[Csch[a + b*x
]]*EllipticF[(I*a - Pi/2 + I*b*x)/2, 2]*Sqrt[I*Sinh[a + b*x]])/b
```

#### 3.11.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.11.4 Maple [A] (verified)

Time = 0.39 (sec) , antiderivative size = 100, normalized size of antiderivative = 1.25

| method | result | size |
|---|---|---|
| default | $\frac{-\frac{i\sqrt{1-i\sinh(bx+a)}\,\sqrt{2}\,\sqrt{1+i\sinh(bx+a)}\,\sqrt{i\sinh(bx+a)}\,\operatorname{EllipticF}\left(\sqrt{1-i\sinh(bx+a)},\frac{\sqrt{2}}{2}\right)}{3}+\frac{2\cosh(bx+a)^2\sinh(bx+a)}{3}}{\cosh(bx+a)\sqrt{\sinh(bx+a)}\,b}$ | 100 |

input
```
int(1/csch(b*x+a)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
(-1/3*I*(1-I*sinh(b*x+a))^(1/2)*2^(1/2)*(1+I*sinh(b*x+a))^(1/2)*(I*sinh(b*
x+a))^(1/2)*EllipticF((1-I*sinh(b*x+a))^(1/2),1/2*2^(1/2))+2/3*cosh(b*x+a)
^2*sinh(b*x+a))/cosh(b*x+a)/sinh(b*x+a)^(1/2)/b
```

### 3.11.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.10 (sec) , antiderivative size = 223, normalized size of antiderivative = 2.79

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx$$
$$= \frac{\sqrt{2}\big(\cosh(bx+a)^4 + 4\cosh(bx+a)^3\sinh(bx+a) + 6\cosh(bx+a)^2\sinh(bx+a)^2 + 4\cosh(bx+a)\sin$$

input
```
integrate(1/csch(b*x+a)^(3/2),x, algorithm="fricas")
```

output
```
1/6*(sqrt(2)*(cosh(b*x + a)^4 + 4*cosh(b*x + a)^3*sinh(b*x + a) + 6*cosh(b
*x + a)^2*sinh(b*x + a)^2 + 4*cosh(b*x + a)*sinh(b*x + a)^3 + sinh(b*x + a
)^4 - 1)*sqrt((cosh(b*x + a) + sinh(b*x + a))/(cosh(b*x + a)^2 + 2*cosh(b*
x + a)*sinh(b*x + a) + sinh(b*x + a)^2 - 1)) - 4*(sqrt(2)*cosh(b*x + a)^2
+ 2*sqrt(2)*cosh(b*x + a)*sinh(b*x + a) + sqrt(2)*sinh(b*x + a)^2)*weierst
rassPInverse(4, 0, cosh(b*x + a) + sinh(b*x + a)))/(b*cosh(b*x + a)^2 + 2*
b*cosh(b*x + a)*sinh(b*x + a) + b*sinh(b*x + a)^2)
```

### 3.11.6 Sympy [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx = \int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx$$

input
```
integrate(1/csch(b*x+a)**(3/2),x)
```

output
```
Integral(csch(a + b*x)**(-3/2), x)
```

### 3.11.7 Maxima [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx = \int \frac{1}{\operatorname{csch}\left(bx+a\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/csch(b*x+a)^(3/2),x, algorithm="maxima")
```

output
```
integrate(csch(b*x + a)^(-3/2), x)
```

### 3.11.8 Giac [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx = \int \frac{1}{\operatorname{csch}\left(bx+a\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/csch(b*x+a)^(3/2),x, algorithm="giac")
```

output
```
integrate(csch(b*x + a)^(-3/2), x)
```

### 3.11.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+bx)}\,dx = \int \frac{1}{\left(\frac{1}{\sinh(a+b\,x)}\right)^{3/2}}\,dx$$

input
```
int(1/(1/sinh(a + b*x))^(3/2),x)
```

output
```
int(1/(1/sinh(a + b*x))^(3/2), x)
```

# 3.12 $\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx$

3.12.1 Optimal result . . . 141
3.12.2 Mathematica [A] (verified) . . . 141
3.12.3 Rubi [A] (verified) . . . 142
3.12.4 Maple [A] (verified) . . . 143
3.12.5 Fricas [C] (verification not implemented) . . . 144
3.12.6 Sympy [F] . . . 144
3.12.7 Maxima [F] . . . 145
3.12.8 Giac [F] . . . 145
3.12.9 Mupad [F(-1)] . . . 145

## 3.12.1 Optimal result

Integrand size = 10, antiderivative size = 80

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx = \frac{2\cosh(a+bx)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)} + \frac{6iE\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ibx\right)\middle|\,2\right)}{5b\sqrt{\operatorname{csch}(a+bx)}\sqrt{i\sinh(a+bx)}}$$

output
```
2/5*cosh(b*x+a)/b/csch(b*x+a)^(3/2)-6/5*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*x)^2
)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*x)*EllipticE(cos(1/2*I*a+1/4*Pi+1/2*I*b
*x),2^(1/2))/b/csch(b*x+a)^(1/2)/(I*sinh(b*x+a))^(1/2)
```

## 3.12.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 67, normalized size of antiderivative = 0.84

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx = \frac{2\left(\cosh(a+bx) - 3\operatorname{csch}^2(a+bx)E\left(\frac{1}{4}(-2ia+\pi-2ibx)\middle|\,2\right)\sqrt{i\sinh(a+bx)}\right)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)}$$

input
```
Integrate[Csch[a + b*x]^(-5/2),x]
```

output
```
(2*(Cosh[a + b*x] - 3*Csch[a + b*x]^2*EllipticE[((-2*I)*a + Pi - (2*I)*b*x
)/4, 2]*Sqrt[I*Sinh[a + b*x]]))/(5*b*Csch[a + b*x]^(3/2))
```

### 3.12.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 80, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4256, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(i\csc(ia+ibx))^{5/2}}dx$$

$$\downarrow 4256$$

$$\frac{2\cosh(a+bx)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)} - \frac{3}{5}\int \frac{1}{\sqrt{\operatorname{csch}(a+bx)}}dx$$

$$\downarrow 3042$$

$$\frac{2\cosh(a+bx)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)} - \frac{3}{5}\int \frac{1}{\sqrt{i\csc(ia+ibx)}}dx$$

$$\downarrow 4258$$

$$\frac{2\cosh(a+bx)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)} - \frac{3\int \sqrt{i\sinh(a+bx)}dx}{5\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

$$\downarrow 3042$$

$$\frac{2\cosh(a+bx)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)} - \frac{3\int \sqrt{\sin(ia+ibx)}dx}{5\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

$$\downarrow 3119$$

$$\frac{2\cosh(a+bx)}{5b\operatorname{csch}^{\frac{3}{2}}(a+bx)} + \frac{6iE\left(\frac{1}{2}\left(ia+ibx-\frac{\pi}{2}\right)\middle|\,2\right)}{5b\sqrt{i\sinh(a+bx)}\sqrt{\operatorname{csch}(a+bx)}}$$

input
```
Int[Csch[a + b*x]^(-5/2),x]
```

output
```
(2*Cosh[a + b*x])/(5*b*Csch[a + b*x]^(3/2)) + (((6*I)/5)*EllipticE[(I*a -
Pi/2 + I*b*x)/2, 2])/(b*Sqrt[Csch[a + b*x]]*Sqrt[I*Sinh[a + b*x]])
```

#### 3.12.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.12.4 Maple [A] (verified)

Time = 0.40 (sec) , antiderivative size = 164, normalized size of antiderivative = 2.05

| method | result |
|---|---|
| default | $-\frac{6\sqrt{1-i\sinh(bx+a)}\,\sqrt{2}\,\sqrt{1+i\sinh(bx+a)}\,\sqrt{i\sinh(bx+a)}\,\text{EllipticE}\left(\sqrt{1-i\sinh(bx+a)},\frac{\sqrt{2}}{2}\right)}{5}+\frac{3\sqrt{1-i\sinh(bx+a)}\,\sqrt{2}\,\sqrt{1+i\sinh(bx+a)}\,\sqrt{i\sinh(bx+a)}}{5}$ $\cosh(bx+a)\sqrt{\sinh(bx+a)}\,b$ |

input
```
int(1/csch(b*x+a)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
(-6/5*(1-I*sinh(b*x+a))^(1/2)*2^(1/2)*(1+I*sinh(b*x+a))^(1/2)*(I*sinh(b*x+
a))^(1/2)*EllipticE((1-I*sinh(b*x+a))^(1/2),1/2*2^(1/2))+3/5*(1-I*sinh(b*x
+a))^(1/2)*2^(1/2)*(1+I*sinh(b*x+a))^(1/2)*(I*sinh(b*x+a))^(1/2)*EllipticF
((1-I*sinh(b*x+a))^(1/2),1/2*2^(1/2))+2/5*cosh(b*x+a)^4-2/5*cosh(b*x+a)^2)
/cosh(b*x+a)/sinh(b*x+a)^(1/2)/b
```

### 3.12.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 370, normalized size of antiderivative = 4.62

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx$$
$$= \frac{\sqrt{2}\big(\cosh(bx+a)^6 + 6\cosh(bx+a)\sinh(bx+a)^5 + \sinh(bx+a)^6 + \big(15\cosh(bx+a)^2 + 11\big)\sinh(bx+$$

input
```
integrate(1/csch(b*x+a)^(5/2),x, algorithm="fricas")
```

output
```
1/20*(sqrt(2)*(cosh(b*x + a)^6 + 6*cosh(b*x + a)*sinh(b*x + a)^5 + sinh(b*
x + a)^6 + (15*cosh(b*x + a)^2 + 11)*sinh(b*x + a)^4 + 11*cosh(b*x + a)^4
+ 4*(5*cosh(b*x + a)^3 + 11*cosh(b*x + a))*sinh(b*x + a)^3 + (15*cosh(b*x
+ a)^4 + 66*cosh(b*x + a)^2 - 13)*sinh(b*x + a)^2 - 13*cosh(b*x + a)^2 + 2
*(3*cosh(b*x + a)^5 + 22*cosh(b*x + a)^3 - 13*cosh(b*x + a))*sinh(b*x + a)
 + 1)*sqrt((cosh(b*x + a) + sinh(b*x + a))/(cosh(b*x + a)^2 + 2*cosh(b*x +
 a)*sinh(b*x + a) + sinh(b*x + a)^2 - 1)) + 24*(sqrt(2)*cosh(b*x + a)^3 +
3*sqrt(2)*cosh(b*x + a)^2*sinh(b*x + a) + 3*sqrt(2)*cosh(b*x + a)*sinh(b*x
 + a)^2 + sqrt(2)*sinh(b*x + a)^3)*weierstrassZeta(4, 0, weierstrassPInver
se(4, 0, cosh(b*x + a) + sinh(b*x + a))))/(b*cosh(b*x + a)^3 + 3*b*cosh(b*
x + a)^2*sinh(b*x + a) + 3*b*cosh(b*x + a)*sinh(b*x + a)^2 + b*sinh(b*x +
a)^3)
```

### 3.12.6 Sympy [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx = \int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx$$

input
```
integrate(1/csch(b*x+a)**(5/2),x)
```

output
```
Integral(csch(a + b*x)**(-5/2), x)
```

### 3.12.7 Maxima [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx = \int \frac{1}{\operatorname{csch}\left(bx+a\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/csch(b*x+a)^(5/2),x, algorithm="maxima")
```

output
```
integrate(csch(b*x + a)^(-5/2), x)
```

### 3.12.8 Giac [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx = \int \frac{1}{\operatorname{csch}\left(bx+a\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/csch(b*x+a)^(5/2),x, algorithm="giac")
```

output
```
integrate(csch(b*x + a)^(-5/2), x)
```

### 3.12.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+bx)}\,dx = \int \frac{1}{\left(\frac{1}{\sinh(a+b\,x)}\right)^{5/2}}\,dx$$

input
```
int(1/(1/sinh(a + b*x))^(5/2),x)
```

output
```
int(1/(1/sinh(a + b*x))^(5/2), x)
```

# 3.13 $\int (b\operatorname{csch}(c+dx))^{7/2}\,dx$

3.13.1 Optimal result . . . 146
3.13.2 Mathematica [A] (verified) . . . 146
3.13.3 Rubi [A] (verified) . . . 147
3.13.4 Maple [F] . . . 149
3.13.5 Fricas [C] (verification not implemented) . . . 149
3.13.6 Sympy [F] . . . 150
3.13.7 Maxima [F] . . . 150
3.13.8 Giac [F] . . . 151
3.13.9 Mupad [F(-1)] . . . 151

## 3.13.1 Optimal result

Integrand size = 12, antiderivative size = 116

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx = \frac{6b^3\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{5d} - \frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d} + \frac{6ib^4E\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right)\middle|2\right)}{5d\sqrt{b\operatorname{csch}(c+dx)}\sqrt{i\sinh(c+dx)}}$$

output
```
-2/5*b*cosh(d*x+c)*(b*csch(d*x+c))^(5/2)/d+6/5*b^3*cosh(d*x+c)*(b*csch(d*x
+c))^(1/2)/d-6/5*I*b^4*(sin(1/2*I*c+1/4*Pi+1/2*I*d*x)^2)^(1/2)/sin(1/2*I*c
+1/4*Pi+1/2*I*d*x)*EllipticE(cos(1/2*I*c+1/4*Pi+1/2*I*d*x),2^(1/2))/d/(b*c
sch(d*x+c))^(1/2)/(I*sinh(d*x+c))^(1/2)
```

## 3.13.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 79, normalized size of antiderivative = 0.68

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx = -\frac{2b^3\sqrt{b\operatorname{csch}(c+dx)}\left(-3\cosh(c+dx)+\coth(c+dx)\operatorname{csch}(c+dx)+3E\left(\frac{1}{4}(-2ic+\pi-2idx)\middle|2\right)\sqrt{i\sinh(c+dx)}\right.}{5d}$$

input
```
Integrate[(b*Csch[c + d*x])^(7/2),x]
```

output
```
(-2*b^3*Sqrt[b*Csch[c + d*x]]*(-3*Cosh[c + d*x] + Coth[c + d*x]*Csch[c + d
*x] + 3*EllipticE[((-2*I)*c + Pi - (2*I)*d*x)/4, 2]*Sqrt[I*Sinh[c + d*x]])
)/(5*d)
```

### 3.13.3 Rubi [A] (verified)

Time = 0.48 (sec) , antiderivative size = 118, normalized size of antiderivative = 1.02, number of steps used = 8, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}} = 0.667$, Rules used = {3042, 4255, 3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx$$

$$\downarrow 3042$$

$$\int (ib\csc(ic+idx))^{7/2}dx$$

$$\downarrow 4255$$

$$-\frac{3}{5}b^2\int (b\operatorname{csch}(c+dx))^{3/2}dx-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}-\frac{3}{5}b^2\int (ib\csc(ic+idx))^{3/2}dx$$

$$\downarrow 4255$$

$$-\frac{3}{5}b^2\left(b^2\int\frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}dx-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d}\right)-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}-\frac{3}{5}b^2\left(-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d}+b^2\int\frac{1}{\sqrt{ib\csc(ic+idx)}}dx\right)$$

$$\downarrow 4258$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}-\frac{3}{5}b^2\left(-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d}+\frac{b^2\int\sqrt{i\sinh(c+dx)}dx}{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}\right)$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}-\frac{3}{5}b^2\left(-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d}+\frac{b^2\int\sqrt{\sin(ic+idx)}dx}{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}\right)$$

$$\downarrow 3119$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{5/2}}{5d}-\frac{3}{5}b^2\left(-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d}-\frac{2ib^2E\left(\frac{1}{2}\left(ic+idx-\frac{\pi}{2}\right)\middle|2\right)}{d\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}\right)$$

input
```
Int[(b*Csch[c + d*x])^(7/2),x]
```

output
```
(-2*b*Cosh[c + d*x]*(b*Csch[c + d*x])^(5/2))/(5*d) - (3*b^2*((-2*b*Cosh[c
+ d*x]*Sqrt[b*Csch[c + d*x]])/d - ((2*I)*b^2*EllipticE[(I*c - Pi/2 + I*d*x
)/2, 2])/(d*Sqrt[b*Csch[c + d*x]]*Sqrt[I*Sinh[c + d*x]])))/5
```

### 3.13.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.13.4 Maple [F]

$$\int (b \operatorname{csch}(dx+c))^{\frac{7}{2}}\, dx$$

input
```
int((b*csch(d*x+c))^(7/2),x)
```

output
```
int((b*csch(d*x+c))^(7/2),x)
```

### 3.13.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 484, normalized size of antiderivative = 4.17

$$\int (b\operatorname{csch}(c + dx))^{7/2}\, dx = \frac{2\left(3\sqrt{2}\left(b^3\cosh(dx+c)^4 + 4\,b^3\cosh(dx+c)\sinh(dx+c)^3 + b^3\sinh(dx+c)^4 - 2\,b^3\cosh(d$$

input
```
integrate((b*csch(d*x+c))^(7/2),x, algorithm="fricas")
```

output
```
2/5*(3*sqrt(2)*(b^3*cosh(d*x + c)^4 + 4*b^3*cosh(d*x + c)*sinh(d*x + c)^3
+ b^3*sinh(d*x + c)^4 - 2*b^3*cosh(d*x + c)^2 + b^3 + 2*(3*b^3*cosh(d*x +
c)^2 - b^3)*sinh(d*x + c)^2 + 4*(b^3*cosh(d*x + c)^3 - b^3*cosh(d*x + c))*
sinh(d*x + c))*sqrt(b)*weierstrassZeta(4, 0, weierstrassPInverse(4, 0, cos
h(d*x + c) + sinh(d*x + c))) + sqrt(2)*(3*b^3*cosh(d*x + c)^5 + 15*b^3*cos
h(d*x + c)*sinh(d*x + c)^4 + 3*b^3*sinh(d*x + c)^5 - 8*b^3*cosh(d*x + c)^3
 + b^3*cosh(d*x + c) + 2*(15*b^3*cosh(d*x + c)^2 - 4*b^3)*sinh(d*x + c)^3
+ 6*(5*b^3*cosh(d*x + c)^3 - 4*b^3*cosh(d*x + c))*sinh(d*x + c)^2 + (15*b^
3*cosh(d*x + c)^4 - 24*b^3*cosh(d*x + c)^2 + b^3)*sinh(d*x + c))*sqrt((b*c
osh(d*x + c) + b*sinh(d*x + c))/(cosh(d*x + c)^2 + 2*cosh(d*x + c)*sinh(d*
x + c) + sinh(d*x + c)^2 - 1)))/(d*cosh(d*x + c)^4 + 4*d*cosh(d*x + c)*sin
h(d*x + c)^3 + d*sinh(d*x + c)^4 - 2*d*cosh(d*x + c)^2 + 2*(3*d*cosh(d*x +
 c)^2 - d)*sinh(d*x + c)^2 + 4*(d*cosh(d*x + c)^3 - d*cosh(d*x + c))*sinh(
d*x + c) + d)
```

### 3.13.6 Sympy [F]

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx = \int (b\operatorname{csch}(c+dx))^{\frac{7}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))**(7/2),x)
```

output
```
Integral((b*csch(c + d*x))**(7/2), x)
```

### 3.13.7 Maxima [F]

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx = \int (b\operatorname{csch}(dx+c))^{\frac{7}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))^(7/2),x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^(7/2), x)
```

### 3.13.8 Giac [F]

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx = \int (b\operatorname{csch}(dx+c))^{\frac{7}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))^(7/2),x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^(7/2), x)
```

### 3.13.9 Mupad [F(-1)]

Timed out.

$$\int (b\operatorname{csch}(c+dx))^{7/2}\,dx = \int \left(\frac{b}{\sinh(c+dx)}\right)^{7/2} dx$$

input
```
int((b/sinh(c + d*x))^(7/2),x)
```

output
```
int((b/sinh(c + d*x))^(7/2), x)
```

# 3.14 $\int (b\operatorname{csch}(c+dx))^{5/2}\,dx$

3.14.1 Optimal result . . . 152
3.14.2 Mathematica [A] (verified) . . . 152
3.14.3 Rubi [A] (verified) . . . 153
3.14.4 Maple [F] . . . 154
3.14.5 Fricas [C] (verification not implemented) . . . 154
3.14.6 Sympy [F] . . . 155
3.14.7 Maxima [F] . . . 155
3.14.8 Giac [F] . . . 156
3.14.9 Mupad [F(-1)] . . . 156

## 3.14.1 Optimal result

Integrand size = 12, antiderivative size = 88

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx = -\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{3/2}}{3d} + \frac{2ib^2\sqrt{b\operatorname{csch}(c+dx)}\,\operatorname{EllipticF}\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right),2\right)\sqrt{i\sinh(c+dx)}}{3d}$$

output
```
-2/3*b*cosh(d*x+c)*(b*csch(d*x+c))^(3/2)/d-2/3*I*b^2*(sin(1/2*I*c+1/4*Pi+1
/2*I*d*x)^2)^(1/2)/sin(1/2*I*c+1/4*Pi+1/2*I*d*x)*EllipticF(cos(1/2*I*c+1/4
*Pi+1/2*I*d*x),2^(1/2))*(b*csch(d*x+c))^(1/2)*(I*sinh(d*x+c))^(1/2)/d
```

## 3.14.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.75

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx = -\frac{2b^2\sqrt{b\operatorname{csch}(c+dx)}\left(\coth(c+dx)+i\,\operatorname{EllipticF}\left(\frac{1}{4}(-2ic+\pi-2idx),2\right)\sqrt{i\sinh(c+dx)}\right)}{3d}$$

input
```
Integrate[(b*Csch[c + d*x])^(5/2),x]
```

output
```
(-2*b^2*Sqrt[b*Csch[c + d*x]]*(Coth[c + d*x] + I*EllipticF[((-2*I)*c + Pi
- (2*I)*d*x)/4, 2]*Sqrt[I*Sinh[c + d*x]]))/(3*d)
```

### 3.14.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 88, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4255, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx$$

$$\downarrow 3042$$

$$\int (ib\csc(ic+idx))^{5/2}dx$$

$$\downarrow 4255$$

$$-\frac{1}{3}b^2\int \sqrt{b\operatorname{csch}(c+dx)}dx - \frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{3/2}}{3d}$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{3/2}}{3d} - \frac{1}{3}b^2\int \sqrt{ib\csc(ic+idx)}dx$$

$$\downarrow 4258$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{3/2}}{3d} - \frac{1}{3}b^2\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{i\sinh(c+dx)}}dx$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{3/2}}{3d} - \frac{1}{3}b^2\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{\sin(ic+idx)}}dx$$

$$\downarrow 3120$$

$$-\frac{2b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{3/2}}{3d} + \frac{2ib^2\sqrt{i\sinh(c+dx)}\operatorname{EllipticF}\left(\frac{1}{2}(ic+idx-\frac{\pi}{2}),2\right)\sqrt{b\operatorname{csch}(c+dx)}}{3d}$$

input
```
Int[(b*Csch[c + d*x])^(5/2),x]
```

output
```
(-2*b*Cosh[c + d*x]*(b*Csch[c + d*x])^(3/2))/(3*d) + (((2*I)/3)*b^2*Sqrt[b
*Csch[c + d*x]]*EllipticF[(I*c - Pi/2 + I*d*x)/2, 2]*Sqrt[I*Sinh[c + d*x]]
)/d
```

#### 3.14.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.14.4 Maple [F]

$$\int (b \operatorname{csch}(dx+c))^{\frac{5}{2}}\, dx$$

input
```
int((b*csch(d*x+c))^(5/2),x)
```

output
```
int((b*csch(d*x+c))^(5/2),x)
```

### 3.14.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 217, normalized size of antiderivative = 2.47

$$\int (b\operatorname{csch}(c+dx))^{5/2}\, dx =$$

$$-\frac{2\left(\sqrt{2}\left(b^2\cosh(dx+c)^2+2\,b^2\cosh(dx+c)\sinh(dx+c)+b^2\sinh(dx+c)^2-b^2\right)\sqrt{b}\text{weierstrassPInverse}\right.}{3\left(d\cosh\right.}$$

input
```
integrate((b*csch(d*x+c))^(5/2),x, algorithm="fricas")
```

output
```
-2/3*(sqrt(2)*(b^2*cosh(d*x + c)^2 + 2*b^2*cosh(d*x + c)*sinh(d*x + c) + b
^2*sinh(d*x + c)^2 - b^2)*sqrt(b)*weierstrassPInverse(4, 0, cosh(d*x + c)
+ sinh(d*x + c)) + sqrt(2)*(b^2*cosh(d*x + c)^2 + 2*b^2*cosh(d*x + c)*sinh
(d*x + c) + b^2*sinh(d*x + c)^2 + b^2)*sqrt((b*cosh(d*x + c) + b*sinh(d*x
+ c))/(cosh(d*x + c)^2 + 2*cosh(d*x + c)*sinh(d*x + c) + sinh(d*x + c)^2 -
 1)))/(d*cosh(d*x + c)^2 + 2*d*cosh(d*x + c)*sinh(d*x + c) + d*sinh(d*x +
c)^2 - d)
```

### 3.14.6 Sympy [F]

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx = \int (b\operatorname{csch}(c+dx))^{\frac{5}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))**(5/2),x)
```

output
```
Integral((b*csch(c + d*x))**(5/2), x)
```

### 3.14.7 Maxima [F]

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx = \int (b\operatorname{csch}(dx+c))^{\frac{5}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))^(5/2),x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^(5/2), x)
```

### 3.14.8 Giac [F]

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx = \int (b\operatorname{csch}(dx+c))^{\frac{5}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))^(5/2),x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^(5/2), x)
```

### 3.14.9 Mupad [F(-1)]

Timed out.

$$\int (b\operatorname{csch}(c+dx))^{5/2}\,dx = \int \left(\frac{b}{\sinh(c+dx)}\right)^{5/2} dx$$

input
```
int((b/sinh(c + d*x))^(5/2),x)
```

output
```
int((b/sinh(c + d*x))^(5/2), x)
```

# 3.15 $\int (b\operatorname{csch}(c+dx))^{3/2}\,dx$

3.15.1 Optimal result . . . 157
3.15.2 Mathematica [A] (verified) . . . 157
3.15.3 Rubi [A] (verified) . . . 158
3.15.4 Maple [F] . . . 159
3.15.5 Fricas [C] (verification not implemented) . . . 159
3.15.6 Sympy [F] . . . 160
3.15.7 Maxima [F] . . . 160
3.15.8 Giac [F] . . . 160
3.15.9 Mupad [F(-1)] . . . 161

## 3.15.1 Optimal result

Integrand size = 12, antiderivative size = 84

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx = -\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d} - \frac{2ib^2 E\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right)\middle|\,2\right)}{d\sqrt{b\operatorname{csch}(c+dx)}\sqrt{i\sinh(c+dx)}}$$

output
```
-2*b*cosh(d*x+c)*(b*csch(d*x+c))^(1/2)/d+2*I*b^2*(sin(1/2*I*c+1/4*Pi+1/2*I
*d*x)^2)^(1/2)/sin(1/2*I*c+1/4*Pi+1/2*I*d*x)*EllipticE(cos(1/2*I*c+1/4*Pi+
1/2*I*d*x),2^(1/2))/d/(b*csch(d*x+c))^(1/2)/(I*sinh(d*x+c))^(1/2)
```

## 3.15.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.71

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx = -\frac{2b\sqrt{b\operatorname{csch}(c+dx)}\left(\cosh(c+dx) - E\left(\frac{1}{4}(-2ic+\pi-2idx)\middle|\,2\right)\sqrt{i\sinh(c+dx)}\right)}{d}$$

input
```
Integrate[(b*Csch[c + d*x])^(3/2),x]
```

output
```
(-2*b*Sqrt[b*Csch[c + d*x]]*(Cosh[c + d*x] - EllipticE[((-2*I)*c + Pi - (2
*I)*d*x)/4, 2]*Sqrt[I*Sinh[c + d*x]]))/d
```

### 3.15.3 Rubi [A] (verified)

Time = 0.34 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx$$

$$\downarrow 3042$$

$$\int (ib\csc(ic+idx))^{3/2}dx$$

$$\downarrow 4255$$

$$b^2\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}dx - \frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d}$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d} + b^2\int \frac{1}{\sqrt{ib\csc(ic+idx)}}dx$$

$$\downarrow 4258$$

$$-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d} + \frac{b^2\int \sqrt{i\sinh(c+dx)}dx}{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

$$\downarrow 3042$$

$$-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d} + \frac{b^2\int \sqrt{\sin(ic+idx)}dx}{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

$$\downarrow 3119$$

$$-\frac{2b\cosh(c+dx)\sqrt{b\operatorname{csch}(c+dx)}}{d} - \frac{2ib^2E\left(\frac{1}{2}\left(ic+idx-\frac{\pi}{2}\right)\middle|\,2\right)}{d\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

input
```
Int[(b*Csch[c + d*x])^(3/2),x]
```

output
```
(-2*b*Cosh[c + d*x]*Sqrt[b*Csch[c + d*x]])/d - ((2*I)*b^2*EllipticE[(I*c -
 Pi/2 + I*d*x)/2, 2])/(d*Sqrt[b*Csch[c + d*x]]*Sqrt[I*Sinh[c + d*x]])
```

#### 3.15.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.15.4 Maple [F]

$$\int (b \operatorname{csch}(dx+c))^{\frac{3}{2}}\,dx$$

input
```
int((b*csch(d*x+c))^(3/2),x)
```

output
```
int((b*csch(d*x+c))^(3/2),x)
```

### 3.15.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 107, normalized size of antiderivative = 1.27

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx =$$

$$-\frac{2\left(\sqrt{2}b^{\frac{3}{2}}\operatorname{weierstrassZeta}(4,0,\operatorname{weierstrassPInverse}(4,0,\cosh(dx+c)+\sinh(dx+c)))+\sqrt{2}(b\cosh(dx+\right.}{d}$$

input
```
integrate((b*csch(d*x+c))^(3/2),x, algorithm="fricas")
```

output
```
-2*(sqrt(2)*b^(3/2)*weierstrassZeta(4, 0, weierstrassPInverse(4, 0, cosh(d
*x + c) + sinh(d*x + c))) + sqrt(2)*(b*cosh(d*x + c) + b*sinh(d*x + c))*sq
rt((b*cosh(d*x + c) + b*sinh(d*x + c))/(cosh(d*x + c)^2 + 2*cosh(d*x + c)*
sinh(d*x + c) + sinh(d*x + c)^2 - 1)))/d
```

### 3.15.6 Sympy [F]

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx = \int (b\operatorname{csch}(c+dx))^{\frac{3}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))**(3/2),x)
```

output
```
Integral((b*csch(c + d*x))**(3/2), x)
```

### 3.15.7 Maxima [F]

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx = \int (b\operatorname{csch}(dx+c))^{\frac{3}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))^(3/2),x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^(3/2), x)
```

### 3.15.8 Giac [F]

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx = \int (b\operatorname{csch}(dx+c))^{\frac{3}{2}}\,dx$$

input
```
integrate((b*csch(d*x+c))^(3/2),x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^(3/2), x)
```

### 3.15.9 Mupad [F(-1)]

Timed out.

$$\int (b\operatorname{csch}(c+dx))^{3/2}\,dx = \int \left(\frac{b}{\sinh(c+d\,x)}\right)^{3/2} dx$$

input
```
int((b/sinh(c + d*x))^(3/2),x)
```

output
```
int((b/sinh(c + d*x))^(3/2), x)
```

# 3.16 $\int \sqrt{b\operatorname{csch}(c+dx)}\,dx$

3.16.1 Optimal result . . . 162
3.16.2 Mathematica [A] (verified) . . . 162
3.16.3 Rubi [A] (verified) . . . 163
3.16.4 Maple [F] . . . 164
3.16.5 Fricas [C] (verification not implemented) . . . 164
3.16.6 Sympy [F] . . . 164
3.16.7 Maxima [F] . . . 165
3.16.8 Giac [F] . . . 165
3.16.9 Mupad [F(-1)] . . . 165

## 3.16.1 Optimal result

Integrand size = 12, antiderivative size = 56

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = -\frac{2i\sqrt{b\operatorname{csch}(c+dx)}\,\operatorname{EllipticF}\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right),2\right)\sqrt{i\sinh(c+dx)}}{d}$$

output
```
2*I*(sin(1/2*I*c+1/4*Pi+1/2*I*d*x)^2)^(1/2)/sin(1/2*I*c+1/4*Pi+1/2*I*d*x)*
EllipticF(cos(1/2*I*c+1/4*Pi+1/2*I*d*x),2^(1/2))*(b*csch(d*x+c))^(1/2)*(I*
sinh(d*x+c))^(1/2)/d
```

## 3.16.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 54, normalized size of antiderivative = 0.96

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = \frac{2i\sqrt{b\operatorname{csch}(c+dx)}\,\operatorname{EllipticF}\left(\frac{1}{2}\left(\frac{\pi}{2}-i(c+dx)\right),2\right)\sqrt{i\sinh(c+dx)}}{d}$$

input
```
Integrate[Sqrt[b*Csch[c + d*x]],x]
```

output
```
((2*I)*Sqrt[b*Csch[c + d*x]]*EllipticF[(Pi/2 - I*(c + d*x))/2, 2]*Sqrt[I*S
inh[c + d*x]])/d
```

### 3.16.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$, Rules used = {3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{ib\csc(ic+idx)}dx$$

$$\downarrow 4258$$

$$\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{i\sinh(c+dx)}}dx$$

$$\downarrow 3042$$

$$\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{\sin(ic+idx)}}dx$$

$$\downarrow 3120$$

$$-\frac{2i\sqrt{i\sinh(c+dx)}\operatorname{EllipticF}\left(\frac{1}{2}(ic+idx-\frac{\pi}{2}),2\right)\sqrt{b\operatorname{csch}(c+dx)}}{d}$$

input
```
Int[Sqrt[b*Csch[c + d*x]],x]
```

output
```
((-2*I)*Sqrt[b*Csch[c + d*x]]*EllipticF[(I*c - Pi/2 + I*d*x)/2, 2]*Sqrt[I*
Sinh[c + d*x]])/d
```

#### 3.16.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.16.4 Maple [F]

$$\int \sqrt{b \operatorname{csch}(dx+c)}dx$$

input
```
int((b*csch(d*x+c))^(1/2),x)
```

output
```
int((b*csch(d*x+c))^(1/2),x)
```

### 3.16.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.07 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.48

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = \frac{2\sqrt{2}\sqrt{b}\text{weierstrassPInverse}(4,0,\cosh(dx+c)+\sinh(dx+c))}{d}$$

input
```
integrate((b*csch(d*x+c))^(1/2),x, algorithm="fricas")
```

output
```
2*sqrt(2)*sqrt(b)*weierstrassPInverse(4, 0, cosh(d*x + c) + sinh(d*x + c))
/d
```

### 3.16.6 Sympy [F]

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = \int \sqrt{b\operatorname{csch}(c+dx)}\,dx$$

input
```
integrate((b*csch(d*x+c))**(1/2),x)
```

output
```
Integral(sqrt(b*csch(c + d*x)), x)
```

### 3.16.7 Maxima [F]

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = \int \sqrt{b\,\operatorname{csch}(dx+c)}\,dx$$

input
```
integrate((b*csch(d*x+c))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(b*csch(d*x + c)), x)
```

### 3.16.8 Giac [F]

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = \int \sqrt{b\,\operatorname{csch}(dx+c)}\,dx$$

input
```
integrate((b*csch(d*x+c))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(b*csch(d*x + c)), x)
```

### 3.16.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{b\operatorname{csch}(c+dx)}\,dx = \int \sqrt{\frac{b}{\sinh(c+d\,x)}}\,dx$$

input
```
int((b/sinh(c + d*x))^(1/2),x)
```

output
```
int((b/sinh(c + d*x))^(1/2), x)
```

# 3.17 $\int \frac{1}{\sqrt{b\,\mathbf{csch}(c+dx)}}\,dx$

3.17.1 Optimal result . . . 166
3.17.2 Mathematica [A] (verified) . . . 166
3.17.3 Rubi [A] (verified) . . . 167
3.17.4 Maple [B] (verified) . . . 168
3.17.5 Fricas [C] (verification not implemented) . . . 169
3.17.6 Sympy [F] . . . 169
3.17.7 Maxima [F] . . . 169
3.17.8 Giac [F] . . . 170
3.17.9 Mupad [F(-1)] . . . 170

## 3.17.1 Optimal result

Integrand size = 12, antiderivative size = 56

$$\int \frac{1}{\sqrt{b\,\mathrm{csch}(c+dx)}}\,dx = -\frac{2iE\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right)\middle|\,2\right)}{d\sqrt{b\,\mathrm{csch}(c+dx)}\sqrt{i\sinh(c+dx)}}$$

output
```
2*I*(sin(1/2*I*c+1/4*Pi+1/2*I*d*x)^2)^(1/2)/sin(1/2*I*c+1/4*Pi+1/2*I*d*x)*
EllipticE(cos(1/2*I*c+1/4*Pi+1/2*I*d*x),2^(1/2))/d/(b*csch(d*x+c))^(1/2)/(
I*sinh(d*x+c))^(1/2)
```

## 3.17.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 52, normalized size of antiderivative = 0.93

$$\int \frac{1}{\sqrt{b\,\mathrm{csch}(c+dx)}}\,dx = \frac{2iE\left(\frac{1}{4}(-2ic+\pi-2idx)\middle|\,2\right)}{d\sqrt{b\,\mathrm{csch}(c+dx)}\sqrt{i\sinh(c+dx)}}$$

input
```
Integrate[1/Sqrt[b*Csch[c + d*x]],x]
```

output
```
((2*I)*EllipticE[((-2*I)*c + Pi - (2*I)*d*x)/4, 2])/(d*Sqrt[b*Csch[c + d*x
]]*Sqrt[I*Sinh[c + d*x]])
```

### 3.17.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$, Rules used = {3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{ib\csc(ic+idx)}}dx$$

$$\downarrow 4258$$

$$\frac{\int \sqrt{i\sinh(c+dx)}dx}{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

$$\downarrow 3042$$

$$\frac{\int \sqrt{\sin(ic+idx)}dx}{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

$$\downarrow 3119$$

$$-\frac{2iE\left(\frac{1}{2}\left(ic+idx-\frac{\pi}{2}\right)\middle|\,2\right)}{d\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

input
```
Int[1/Sqrt[b*Csch[c + d*x]],x]
```

output
```
((-2*I)*EllipticE[(I*c - Pi/2 + I*d*x)/2, 2])/(d*Sqrt[b*Csch[c + d*x]]*Sqr
t[I*Sinh[c + d*x]])
```

#### 3.17.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.17.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 226 vs. $2(79) = 158$.

Time = 0.50 (sec) , antiderivative size = 227, normalized size of antiderivative = 4.05

| method | result |
|---|---|
| risch | $\frac{\sqrt{2}}{d\sqrt{\frac{b\,e^{dx+c}}{e^{2dx+2c}-1}}} - \frac{\left(\frac{2b\,e^{2dx+2c}-2b}{b\sqrt{e^{dx+c}\left(b\,e^{2dx+2c}-b\right)}} - \frac{\sqrt{e^{dx+c}+1}\sqrt{-2\,e^{dx+c}+2}\sqrt{-e^{dx+c}}\left(-2\,\mathrm{EllipticE}\left(\sqrt{e^{dx+c}+1},\frac{\sqrt{2}}{2}\right)+\mathrm{EllipticF}\left(\sqrt{e^{dx+c}+1},\right.\right.\right.}{\sqrt{e^{3dx+3c}b-e^{dx+c}b}}$ |

input
```
int(1/(b*csch(d*x+c))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/d*2^(1/2)/(b*exp(d*x+c)/(exp(d*x+c)^2-1))^(1/2)-1/d*(2*(b*exp(d*x+c)^2-b
)/b/(exp(d*x+c)*(b*exp(d*x+c)^2-b))^(1/2)-(exp(d*x+c)+1)^(1/2)*(-2*exp(d*x
+c)+2)^(1/2)*(-exp(d*x+c))^(1/2)/(exp(d*x+c)^3*b-exp(d*x+c)*b)^(1/2)*(-2*E
llipticE((exp(d*x+c)+1)^(1/2),1/2*2^(1/2))+EllipticF((exp(d*x+c)+1)^(1/2),
1/2*2^(1/2))))*2^(1/2)/(b*exp(d*x+c)/(exp(d*x+c)^2-1))^(1/2)*(b*exp(d*x+c)
*(exp(d*x+c)^2-1))^(1/2)/(exp(d*x+c)^2-1)
```

### 3.17.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 154, normalized size of antiderivative = 2.75

$$\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx =$$

$$-\frac{2\sqrt{2}\sqrt{b}(\cosh(dx+c)+\sinh(dx+c))\text{weierstrassZeta}(4,0,\text{weierstrassPInverse}(4,0,\cosh(dx+c)+si}{bd}$$

input
```
integrate(1/(b*csch(d*x+c))^(1/2),x, algorithm="fricas")
```

output
```
-(2*sqrt(2)*sqrt(b)*(cosh(d*x + c) + sinh(d*x + c))*weierstrassZeta(4, 0,
weierstrassPInverse(4, 0, cosh(d*x + c) + sinh(d*x + c))) + sqrt(2)*(cosh(
d*x + c)^2 + 2*cosh(d*x + c)*sinh(d*x + c) + sinh(d*x + c)^2 - 1)*sqrt((b*
cosh(d*x + c) + b*sinh(d*x + c))/(cosh(d*x + c)^2 + 2*cosh(d*x + c)*sinh(d
*x + c) + sinh(d*x + c)^2 - 1)))/(b*d*cosh(d*x + c) + b*d*sinh(d*x + c))
```

### 3.17.6 Sympy [F]

$$\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))**(1/2),x)
```

output
```
Integral(1/sqrt(b*csch(c + d*x)), x)
```

### 3.17.7 Maxima [F]

$$\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{b\operatorname{csch}(dx+c)}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/sqrt(b*csch(d*x + c)), x)
```

### 3.17.8 Giac [F]

$$\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{b\,\operatorname{csch}\left(dx+c\right)}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(1/2),x, algorithm="giac")
```

output
```
integrate(1/sqrt(b*csch(d*x + c)), x)
```

### 3.17.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{\frac{b}{\sinh(c+d\,x)}}}\,dx$$

input
```
int(1/(b/sinh(c + d*x))^(1/2),x)
```

output
```
int(1/(b/sinh(c + d*x))^(1/2), x)
```

# 3.18 $\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx$

3.18.1 Optimal result . . . 171
3.18.2 Mathematica [A] (verified) . . . 171
3.18.3 Rubi [A] (verified) . . . 172
3.18.4 Maple [F] . . . 173
3.18.5 Fricas [C] (verification not implemented) . . . 173
3.18.6 Sympy [F] . . . 174
3.18.7 Maxima [F] . . . 174
3.18.8 Giac [F] . . . 175
3.18.9 Mupad [F(-1)] . . . 175

## 3.18.1 Optimal result

Integrand size = 12, antiderivative size = 90

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx = \frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} + \frac{2i\sqrt{b\operatorname{csch}(c+dx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right),2\right)\sqrt{i\sinh(c+dx)}}{3b^2d}$$

output
```
2/3*cosh(d*x+c)/b/d/(b*csch(d*x+c))^(1/2)-2/3*I*(sin(1/2*I*c+1/4*Pi+1/2*I*
d*x)^2)^(1/2)/sin(1/2*I*c+1/4*Pi+1/2*I*d*x)*EllipticF(cos(1/2*I*c+1/4*Pi+1
/2*I*d*x),2^(1/2))*(b*csch(d*x+c))^(1/2)*(I*sinh(d*x+c))^(1/2)/b^2/d
```

## 3.18.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 73, normalized size of antiderivative = 0.81

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx = \frac{\operatorname{csch}^2(c+dx)\left(-2i\,\text{EllipticF}\left(\frac{1}{4}(-2ic+\pi-2idx),2\right)\sqrt{i\sinh(c+dx)}+\sinh(2($$
$$3d(b\operatorname{csch}(c+dx))^{3/2}$$

input
```
Integrate[(b*Csch[c + d*x])^(-3/2),x]
```

output
```
(Csch[c + d*x]^2*((-2*I)*EllipticF[((-2*I)*c + Pi - (2*I)*d*x)/4, 2]*Sqrt[
I*Sinh[c + d*x]] + Sinh[2*(c + d*x)]))/(3*d*(b*Csch[c + d*x])^(3/2))
```

### 3.18.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 90, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4256, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(ib\csc(ic+idx))^{3/2}}dx$$

$$\downarrow 4256$$

$$\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\int \sqrt{b\operatorname{csch}(c+dx)}dx}{3b^2}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\int \sqrt{ib\csc(ic+idx)}dx}{3b^2}$$

$$\downarrow 4258$$

$$\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{i\sinh(c+dx)}}dx}{3b^2}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{\sin(ic+idx)}}dx}{3b^2}$$

$$\downarrow 3120$$

$$\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} + \frac{2i\sqrt{i\sinh(c+dx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ic+idx-\frac{\pi}{2}\right),2\right)\sqrt{b\operatorname{csch}(c+dx)}}{3b^2d}$$

input
```
Int[(b*Csch[c + d*x])^(-3/2),x]
```

output
```
(2*Cosh[c + d*x])/(3*b*d*Sqrt[b*Csch[c + d*x]]) + (((2*I)/3)*Sqrt[b*Csch[c
 + d*x]]*EllipticF[(I*c - Pi/2 + I*d*x)/2, 2]*Sqrt[I*Sinh[c + d*x]])/(b^2*
d)
```

#### 3.18.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.18.4 Maple [F]

$$\int \frac{1}{(b \operatorname{csch}(dx+c))^{\frac{3}{2}}} dx$$

input
```
int(1/(b*csch(d*x+c))^(3/2),x)
```

output
```
int(1/(b*csch(d*x+c))^(3/2),x)
```

### 3.18.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 232, normalized size of antiderivative = 2.58

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}} dx =$$

$$-\frac{4\sqrt{2}\left(\cosh(dx+c)^2 + 2\cosh(dx+c)\sinh(dx+c) + \sinh(dx+c)^2\right)\sqrt{b}\,\text{weierstrassPInverse}(4, 0, \cosh(dx$$

input
```
integrate(1/(b*csch(d*x+c))^(3/2),x, algorithm="fricas")
```

output
```
-1/6*(4*sqrt(2)*(cosh(d*x + c)^2 + 2*cosh(d*x + c)*sinh(d*x + c) + sinh(d*
x + c)^2)*sqrt(b)*weierstrassPInverse(4, 0, cosh(d*x + c) + sinh(d*x + c))
 - sqrt(2)*(cosh(d*x + c)^4 + 4*cosh(d*x + c)^3*sinh(d*x + c) + 6*cosh(d*x
 + c)^2*sinh(d*x + c)^2 + 4*cosh(d*x + c)*sinh(d*x + c)^3 + sinh(d*x + c)^
4 - 1)*sqrt((b*cosh(d*x + c) + b*sinh(d*x + c))/(cosh(d*x + c)^2 + 2*cosh(
d*x + c)*sinh(d*x + c) + sinh(d*x + c)^2 - 1)))/(b^2*d*cosh(d*x + c)^2 + 2
*b^2*d*cosh(d*x + c)*sinh(d*x + c) + b^2*d*sinh(d*x + c)^2)
```

### 3.18.6 Sympy [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(c+dx))^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))**(3/2),x)
```

output
```
Integral((b*csch(c + d*x))**(-3/2), x)
```

### 3.18.7 Maxima [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(dx+c))^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(3/2),x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^(-3/2), x)
```

### 3.18.8 Giac [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(dx+c))^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(3/2),x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^(-3/2), x)
```

### 3.18.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{\left(\frac{b}{\sinh(c+dx)}\right)^{3/2}}\,dx$$

input
```
int(1/(b/sinh(c + d*x))^(3/2),x)
```

output
```
int(1/(b/sinh(c + d*x))^(3/2), x)
```

# 3.19 $\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx$


3.19.1 Optimal result . . . 176
3.19.2 Mathematica [A] (verified) . . . 176
3.19.3 Rubi [A] (verified) . . . 177
3.19.4 Maple [F] . . . 178
3.19.5 Fricas [C] (verification not implemented) . . . 178
3.19.6 Sympy [F] . . . 179
3.19.7 Maxima [F] . . . 179
3.19.8 Giac [F] . . . 180
3.19.9 Mupad [F(-1)] . . . 180


## 3.19.1 Optimal result

Integrand size = 12, antiderivative size = 90

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx = \frac{2\cosh(c+dx)}{5bd(b\operatorname{csch}(c+dx))^{3/2}} + \frac{6iE\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right)\middle|2\right)}{5b^2d\sqrt{b\operatorname{csch}(c+dx)}\sqrt{i\sinh(c+dx)}}$$

output
```
2/5*cosh(d*x+c)/b/d/(b*csch(d*x+c))^(3/2)-6/5*I*(sin(1/2*I*c+1/4*Pi+1/2*I*
d*x)^2)^(1/2)/sin(1/2*I*c+1/4*Pi+1/2*I*d*x)*EllipticE(cos(1/2*I*c+1/4*Pi+1
/2*I*d*x),2^(1/2))/b^2/d/(b*csch(d*x+c))^(1/2)/(I*sinh(d*x+c))^(1/2)
```

## 3.19.2 Mathematica [A] (verified)

Time = 0.11 (sec) , antiderivative size = 68, normalized size of antiderivative = 0.76

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx = \frac{-\frac{6iE\left(\frac{1}{4}(-2ic+\pi-2idx)|2\right)}{\sqrt{i\sinh(c+dx)}} + \sinh(2(c+dx))}{5b^2d\sqrt{b\operatorname{csch}(c+dx)}}$$

input
```
Integrate[(b*Csch[c + d*x])^(-5/2),x]
```

output
```
(((-6*I)*EllipticE[((-2*I)*c + Pi - (2*I)*d*x)/4, 2])/Sqrt[I*Sinh[c + d*x]
] + Sinh[2*(c + d*x)])/(5*b^2*d*Sqrt[b*Csch[c + d*x]])
```

### 3.19.3 Rubi [A] (verified)

Time = 0.34 (sec) , antiderivative size = 90, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4256, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(ib\csc(ic+idx))^{5/2}}\,dx$$

$$\downarrow 4256$$

$$\frac{2\cosh(c+dx)}{5bd(b\operatorname{csch}(c+dx))^{3/2}} - \frac{3\int \frac{1}{\sqrt{b\operatorname{csch}(c+dx)}}dx}{5b^2}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{5bd(b\operatorname{csch}(c+dx))^{3/2}} - \frac{3\int \frac{1}{\sqrt{ib\csc(ic+idx)}}dx}{5b^2}$$

$$\downarrow 4258$$

$$\frac{2\cosh(c+dx)}{5bd(b\operatorname{csch}(c+dx))^{3/2}} - \frac{3\int \sqrt{i\sinh(c+dx)}dx}{5b^2\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{5bd(b\operatorname{csch}(c+dx))^{3/2}} - \frac{3\int \sqrt{\sin(ic+idx)}dx}{5b^2\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

$$\downarrow 3119$$

$$\frac{2\cosh(c+dx)}{5bd(b\operatorname{csch}(c+dx))^{3/2}} + \frac{6iE\left(\frac{1}{2}\left(ic+idx-\frac{\pi}{2}\right)\middle|\,2\right)}{5b^2d\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}}$$

input
```
Int[(b*Csch[c + d*x])^(-5/2),x]
```

output
```
(2*Cosh[c + d*x])/(5*b*d*(b*Csch[c + d*x])^(3/2)) + (((6*I)/5)*EllipticE[(
I*c - Pi/2 + I*d*x)/2, 2])/(b^2*d*Sqrt[b*Csch[c + d*x]]*Sqrt[I*Sinh[c + d*
x]])
```

#### 3.19.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.19.4 Maple [F]

$$\int \frac{1}{(b \operatorname{csch}(dx+c))^{\frac{5}{2}}} dx$$

input
```
int(1/(b*csch(d*x+c))^(5/2),x)
```

output
```
int(1/(b*csch(d*x+c))^(5/2),x)
```

### 3.19.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 378, normalized size of antiderivative = 4.20

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}} dx = \frac{24\sqrt{2}(\cosh(dx+c)^3 + 3\cosh(dx+c)^2\sinh(dx+c) + 3\cosh(dx+c)\sinh(dx$$

input
```
integrate(1/(b*csch(d*x+c))^(5/2),x, algorithm="fricas")
```

output
```
1/20*(24*sqrt(2)*(cosh(d*x + c)^3 + 3*cosh(d*x + c)^2*sinh(d*x + c) + 3*co
sh(d*x + c)*sinh(d*x + c)^2 + sinh(d*x + c)^3)*sqrt(b)*weierstrassZeta(4,
0, weierstrassPInverse(4, 0, cosh(d*x + c) + sinh(d*x + c))) + sqrt(2)*(co
sh(d*x + c)^6 + 6*cosh(d*x + c)*sinh(d*x + c)^5 + sinh(d*x + c)^6 + (15*co
sh(d*x + c)^2 + 11)*sinh(d*x + c)^4 + 11*cosh(d*x + c)^4 + 4*(5*cosh(d*x +
 c)^3 + 11*cosh(d*x + c))*sinh(d*x + c)^3 + (15*cosh(d*x + c)^4 + 66*cosh(
d*x + c)^2 - 13)*sinh(d*x + c)^2 - 13*cosh(d*x + c)^2 + 2*(3*cosh(d*x + c)
^5 + 22*cosh(d*x + c)^3 - 13*cosh(d*x + c))*sinh(d*x + c) + 1)*sqrt((b*cos
h(d*x + c) + b*sinh(d*x + c))/(cosh(d*x + c)^2 + 2*cosh(d*x + c)*sinh(d*x
+ c) + sinh(d*x + c)^2 - 1)))/(b^3*d*cosh(d*x + c)^3 + 3*b^3*d*cosh(d*x +
c)^2*sinh(d*x + c) + 3*b^3*d*cosh(d*x + c)*sinh(d*x + c)^2 + b^3*d*sinh(d*
x + c)^3)
```

### 3.19.6 Sympy [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(c+dx))^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))**(5/2),x)
```

output
```
Integral((b*csch(c + d*x))**(-5/2), x)
```

### 3.19.7 Maxima [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(dx+c))^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(5/2),x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^(-5/2), x)
```

### 3.19.8 Giac [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(dx+c))^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(5/2),x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^(-5/2), x)
```

### 3.19.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{5/2}}\,dx = \int \frac{1}{\left(\frac{b}{\sinh(c+dx)}\right)^{5/2}}\,dx$$

input
```
int(1/(b/sinh(c + d*x))^(5/2),x)
```

output
```
int(1/(b/sinh(c + d*x))^(5/2), x)
```

# 3.20 $\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx$

3.20.1 Optimal result . . . 181
3.20.2 Mathematica [A] (verified) . . . 181
3.20.3 Rubi [A] (verified) . . . 182
3.20.4 Maple [F] . . . 184
3.20.5 Fricas [C] (verification not implemented) . . . 184
3.20.6 Sympy [F] . . . 185
3.20.7 Maxima [F] . . . 185
3.20.8 Giac [F] . . . 185
3.20.9 Mupad [F(-1)] . . . 186

## 3.20.1 Optimal result

Integrand size = 12, antiderivative size = 118

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx = \frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{10\cosh(c+dx)}{21b^3d\sqrt{b\operatorname{csch}(c+dx)}} - \frac{10i\sqrt{b\operatorname{csch}(c+dx)}\,\text{EllipticF}\left(\frac{1}{2}\left(ic-\frac{\pi}{2}+idx\right),2\right)\sqrt{i\sinh(c+dx)}}{21b^4d}$$

output
```
2/7*cosh(d*x+c)/b/d/(b*csch(d*x+c))^(5/2)-10/21*cosh(d*x+c)/b^3/d/(b*csch(
d*x+c))^(1/2)+10/21*I*(sin(1/2*I*c+1/4*Pi+1/2*I*d*x)^2)^(1/2)/sin(1/2*I*c+
1/4*Pi+1/2*I*d*x)*EllipticF(cos(1/2*I*c+1/4*Pi+1/2*I*d*x),2^(1/2))*(b*csch
(d*x+c))^(1/2)*(I*sinh(d*x+c))^(1/2)/b^4/d
```

## 3.20.2 Mathematica [A] (verified)

Time = 0.14 (sec) , antiderivative size = 80, normalized size of antiderivative = 0.68

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx = \frac{\sqrt{b\operatorname{csch}(c+dx)}\left(40i\,\text{EllipticF}\left(\frac{1}{4}(-2ic+\pi-2idx),2\right)\sqrt{i\sinh(c+dx)} - 26\sinh\right.}{84b^4d}$$

input
```
Integrate[(b*Csch[c + d*x])^(-7/2),x]
```

output
```
(Sqrt[b*Csch[c + d*x]]*((40*I)*EllipticF[((-2*I)*c + Pi - (2*I)*d*x)/4, 2]
*Sqrt[I*Sinh[c + d*x]] - 26*Sinh[2*(c + d*x)] + 3*Sinh[4*(c + d*x)]))/(84*
b^4*d)
```

### 3.20.3 Rubi [A] (verified)

Time = 0.46 (sec) , antiderivative size = 126, normalized size of antiderivative = 1.07, number of steps used = 8, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}} = 0.667$, Rules used = {3042, 4256, 3042, 4256, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(ib\csc(ic+idx))^{7/2}}\,dx$$

$$\downarrow 4256$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\int \frac{1}{(b\operatorname{csch}(c+dx))^{3/2}}\,dx}{7b^2}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\int \frac{1}{(ib\csc(ic+idx))^{3/2}}\,dx}{7b^2}$$

$$\downarrow 4256$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\left(\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\int \sqrt{b\operatorname{csch}(c+dx)}\,dx}{3b^2}\right)}{7b^2}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\left(\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\int \sqrt{ib\csc(ic+idx)}\,dx}{3b^2}\right)}{7b^2}$$

$$\downarrow 4258$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\left(\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int \frac{1}{\sqrt{i\sinh(c+dx)}}\,dx}{3b^2}\right)}{7b^2}$$

$$\downarrow 3042$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\left(\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} - \frac{\sqrt{i\sinh(c+dx)}\sqrt{b\operatorname{csch}(c+dx)}\int\frac{1}{\sqrt{\sin(ic+idx)}}dx}{3b^2}\right)}{7b^2}$$

$$\downarrow 3120$$

$$\frac{2\cosh(c+dx)}{7bd(b\operatorname{csch}(c+dx))^{5/2}} - \frac{5\left(\frac{2\cosh(c+dx)}{3bd\sqrt{b\operatorname{csch}(c+dx)}} + \frac{2i\sqrt{i\sinh(c+dx)}\,\text{EllipticF}\left(\frac{1}{2}(ic+idx-\frac{\pi}{2}),2\right)\sqrt{b\operatorname{csch}(c+dx)}}{3b^2d}\right)}{7b^2}$$

input
```
Int[(b*Csch[c + d*x])^(-7/2),x]
```

output
```
(2*Cosh[c + d*x])/(7*b*d*(b*Csch[c + d*x])^(5/2)) - (5*((2*Cosh[c + d*x])/
(3*b*d*Sqrt[b*Csch[c + d*x]]) + (((2*I)/3)*Sqrt[b*Csch[c + d*x]]*EllipticF
[(I*c - Pi/2 + I*d*x)/2, 2]*Sqrt[I*Sinh[c + d*x]])/(b^2*d)))/(7*b^2)
```

### 3.20.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.20.4 Maple [F]

$$\int \frac{1}{(b\ \mathrm{csch}\,(dx+c))^{\frac{7}{2}}}dx$$

input
```
int(1/(b*csch(d*x+c))^(7/2),x)
```

output
```
int(1/(b*csch(d*x+c))^(7/2),x)
```

### 3.20.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 483, normalized size of antiderivative = 4.09

$$\int \frac{1}{(b\mathrm{csch}(c+dx))^{7/2}}\,dx = \frac{80\sqrt{2}\left(\cosh\left(dx+c\right)^4 + 4\cosh\left(dx+c\right)^3\sinh\left(dx+c\right) + 6\cosh\left(dx+c\right)^2\sinh\left(d\right.\right.}{}$$

input
```
integrate(1/(b*csch(d*x+c))^(7/2),x, algorithm="fricas")
```

output
```
1/168*(80*sqrt(2)*(cosh(d*x + c)^4 + 4*cosh(d*x + c)^3*sinh(d*x + c) + 6*c
osh(d*x + c)^2*sinh(d*x + c)^2 + 4*cosh(d*x + c)*sinh(d*x + c)^3 + sinh(d*
x + c)^4)*sqrt(b)*weierstrassPInverse(4, 0, cosh(d*x + c) + sinh(d*x + c))
 + sqrt(2)*(3*cosh(d*x + c)^8 + 24*cosh(d*x + c)*sinh(d*x + c)^7 + 3*sinh(
d*x + c)^8 + 2*(42*cosh(d*x + c)^2 - 13)*sinh(d*x + c)^6 - 26*cosh(d*x + c
)^6 + 12*(14*cosh(d*x + c)^3 - 13*cosh(d*x + c))*sinh(d*x + c)^5 + 30*(7*c
osh(d*x + c)^4 - 13*cosh(d*x + c)^2)*sinh(d*x + c)^4 + 8*(21*cosh(d*x + c)
^5 - 65*cosh(d*x + c)^3)*sinh(d*x + c)^3 + 2*(42*cosh(d*x + c)^6 - 195*cos
h(d*x + c)^4 + 13)*sinh(d*x + c)^2 + 26*cosh(d*x + c)^2 + 4*(6*cosh(d*x +
c)^7 - 39*cosh(d*x + c)^5 + 13*cosh(d*x + c))*sinh(d*x + c) - 3)*sqrt((b*c
osh(d*x + c) + b*sinh(d*x + c))/(cosh(d*x + c)^2 + 2*cosh(d*x + c)*sinh(d*
x + c) + sinh(d*x + c)^2 - 1)))/(b^4*d*cosh(d*x + c)^4 + 4*b^4*d*cosh(d*x
+ c)^3*sinh(d*x + c) + 6*b^4*d*cosh(d*x + c)^2*sinh(d*x + c)^2 + 4*b^4*d*c
osh(d*x + c)*sinh(d*x + c)^3 + b^4*d*sinh(d*x + c)^4)
```

### 3.20.6 Sympy [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(c+dx))^{\frac{7}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))**(7/2),x)
```

output
```
Integral((b*csch(c + d*x))**(-7/2), x)
```

### 3.20.7 Maxima [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(dx+c))^{\frac{7}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(7/2),x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^(-7/2), x)
```

### 3.20.8 Giac [F]

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx = \int \frac{1}{(b\operatorname{csch}(dx+c))^{\frac{7}{2}}}\,dx$$

input
```
integrate(1/(b*csch(d*x+c))^(7/2),x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^(-7/2), x)
```

### 3.20.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{(b\operatorname{csch}(c+dx))^{7/2}}\,dx = \int \frac{1}{\left(\frac{b}{\sinh(c+dx)}\right)^{7/2}}\,dx$$

input
```
int(1/(b/sinh(c + d*x))^(7/2),x)
```

output
```
int(1/(b/sinh(c + d*x))^(7/2), x)
```

# 3.21 $\int (b\operatorname{csch}(c+dx))^n\,dx$

3.21.1 Optimal result . . . 187
3.21.2 Mathematica [A] (verified) . . . 187
3.21.3 Rubi [A] (verified) . . . 188
3.21.4 Maple [F] . . . 189
3.21.5 Fricas [F] . . . 189
3.21.6 Sympy [F] . . . 190
3.21.7 Maxima [F] . . . 190
3.21.8 Giac [F] . . . 190
3.21.9 Mupad [F(-1)] . . . 191

## 3.21.1 Optimal result

Integrand size = 10, antiderivative size = 74

$$\int (b\operatorname{csch}(c+dx))^n\,dx = \frac{b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{-1+n}\operatorname{Hypergeometric2F1}\left(\frac{1}{2},\frac{1-n}{2},\frac{3-n}{2},-\sinh^2(c+dx)\right)}{d(1-n)\sqrt{\cosh^2(c+dx)}}$$

output
```
b*cosh(d*x+c)*(b*csch(d*x+c))^(-1+n)*hypergeom([1/2, 1/2-1/2*n],[3/2-1/2*n
],-sinh(d*x+c)^2)/d/(1-n)/(cosh(d*x+c)^2)^(1/2)
```

## 3.21.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 90, normalized size of antiderivative = 1.22

$$\int (b\operatorname{csch}(c+dx))^n\,dx = -\frac{2^n\left(\frac{e^{c+dx}}{-1+e^{2(c+dx)}}\right)^n\left(-1+e^{2(c+dx)}\right)\operatorname{csch}^{-n}(c+dx)(b\operatorname{csch}(c+dx))^n\operatorname{Hypergeometric2F1}\left(1,1-\frac{n}{2},1+\frac{n}{2},\right.}{dn}$$

input
```
Integrate[(b*Csch[c + d*x])^n,x]
```

output
```
-((2^n*(E^(c + d*x)/(-1 + E^(2*(c + d*x))))^n*(-1 + E^(2*(c + d*x)))*(b*Cs
ch[c + d*x])^n*Hypergeometric2F1[1, 1 - n/2, 1 + n/2, E^(2*(c + d*x))])/(d
*n*Csch[c + d*x]^n))
```

### 3.21.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4259, 3042, 3122}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (b\operatorname{csch}(c+dx))^n\,dx$$

$$\downarrow 3042$$

$$\int (ib\csc(ic+idx))^n dx$$

$$\downarrow 4259$$

$$\left(\frac{\sinh(c+dx)}{b}\right)^n (b\operatorname{csch}(c+dx))^n \int \left(\frac{\sinh(c+dx)}{b}\right)^{-n} dx$$

$$\downarrow 3042$$

$$\left(\frac{\sinh(c+dx)}{b}\right)^n (b\operatorname{csch}(c+dx))^n \int \left(-\frac{i\sin(ic+idx)}{b}\right)^{-n} dx$$

$$\downarrow 3122$$

$$\frac{b\cosh(c+dx)(b\operatorname{csch}(c+dx))^{n-1}\operatorname{Hypergeometric2F1}\left(\frac{1}{2},\frac{1-n}{2},\frac{3-n}{2},-\sinh^2(c+dx)\right)}{d(1-n)\sqrt{\cosh^2(c+dx)}}$$

input
```
Int[(b*Csch[c + d*x])^n,x]
```

output
```
(b*Cosh[c + d*x]*(b*Csch[c + d*x])^(-1 + n)*Hypergeometric2F1[1/2, (1 - n)
/2, (3 - n)/2, -Sinh[c + d*x]^2])/(d*(1 - n)*Sqrt[Cosh[c + d*x]^2])
```

#### 3.21.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3122
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Sin[c + d*x])^(n + 1)/(b*d*(n + 1)*Sqrt[Cos[c + d*x]^2]))*Hypergeometric2
F1[1/2, (n + 1)/2, (n + 3)/2, Sin[c + d*x]^2], x] /; FreeQ[{b, c, d, n}, x]
 &&  !IntegerQ[2*n]
```

rule 4259
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^(n - 1)*((Sin[c + d*x]/b)^(n - 1)   Int[1/(Sin[c + d*x]/b)^n, x]), x] /;
FreeQ[{b, c, d, n}, x] &&  !IntegerQ[n]
```

### 3.21.4 Maple [F]

$$\int (b \operatorname{csch}(dx+c))^n \, dx$$

input
```
int((b*csch(d*x+c))^n,x)
```

output
```
int((b*csch(d*x+c))^n,x)
```

### 3.21.5 Fricas [F]

$$\int (b\operatorname{csch}(c+dx))^n \, dx = \int (b \operatorname{csch}(dx+c))^n \, dx$$

input
```
integrate((b*csch(d*x+c))^n,x, algorithm="fricas")
```

output
```
integral((b*csch(d*x + c))^n, x)
```

### 3.21.6 Sympy [F]

$$\int (b\operatorname{csch}(c+dx))^n\,dx = \int (b\,\operatorname{csch}(c+dx))^n\,dx$$

input
```
integrate((b*csch(d*x+c))**n,x)
```

output
```
Integral((b*csch(c + d*x))**n, x)
```

### 3.21.7 Maxima [F]

$$\int (b\operatorname{csch}(c+dx))^n\,dx = \int (b\,\operatorname{csch}(dx+c))^n\,dx$$

input
```
integrate((b*csch(d*x+c))^n,x, algorithm="maxima")
```

output
```
integrate((b*csch(d*x + c))^n, x)
```

### 3.21.8 Giac [F]

$$\int (b\operatorname{csch}(c+dx))^n\,dx = \int (b\,\operatorname{csch}(dx+c))^n\,dx$$

input
```
integrate((b*csch(d*x+c))^n,x, algorithm="giac")
```

output
```
integrate((b*csch(d*x + c))^n, x)
```

### 3.21.9 Mupad [F(-1)]

Timed out.

$$\int (b\operatorname{csch}(c+dx))^n\,dx = \int \left(\frac{b}{\sinh(c+d\,x)}\right)^n dx$$

input
```
int((b/sinh(c + d*x))^n,x)
```

output
```
int((b/sinh(c + d*x))^n, x)
```

# 3.22 $\int \left(-\text{csch}^2(x)\right)^{5/2}\,dx$

3.22.1 Optimal result . . . . . 192
3.22.2 Mathematica [A] (verified) . . . . . 192
3.22.3 Rubi [A] (verified) . . . . . 193
3.22.4 Maple [B] (verified) . . . . . 194
3.22.5 Fricas [C] (verification not implemented) . . . . . 195
3.22.6 Sympy [F] . . . . . 195
3.22.7 Maxima [C] (verification not implemented) . . . . . 195
3.22.8 Giac [C] (verification not implemented) . . . . . 196
3.22.9 Mupad [F(-1)] . . . . . 196

## 3.22.1 Optimal result

Integrand size = 10, antiderivative size = 40

$$\int \left(-\text{csch}^2(x)\right)^{5/2}\,dx = \frac{3}{8}\arcsin(\coth(x)) + \frac{3}{8}\coth(x)\sqrt{-\text{csch}^2(x)} + \frac{1}{4}\coth(x)\left(-\text{csch}^2(x)\right)^{3/2}$$

output
```
3/8*arcsin(coth(x))+1/4*coth(x)*(-csch(x)^2)^(3/2)+3/8*coth(x)*(-csch(x)^2
)^(1/2)
```

## 3.22.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 51, normalized size of antiderivative = 1.28

$$\int \left(-\text{csch}^2(x)\right)^{5/2}\,dx = \frac{1}{64}\left(-\text{csch}^2(x)\right)^{5/2}\sinh(x)\left(-22\cosh(x)+6\left(\cosh(3x)+4\left(-\log\left(\cosh\left(\frac{x}{2}\right)\right)+\log\left(\text{s}\right.\right.\right.\right.$$

input
```
Integrate[(-Csch[x]^2)^(5/2),x]
```

output
```
((-Csch[x]^2)^(5/2)*Sinh[x]*(-22*Cosh[x] + 6*(Cosh[3*x] + 4*(-Log[Cosh[x/2
]] + Log[Sinh[x/2]])*Sinh[x]^4)))/64
```

### 3.22.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 49, normalized size of antiderivative = 1.22, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4610, 211, 211, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(-\text{csch}^2(x)\right)^{5/2} dx$$

$$\downarrow 3042$$

$$\int \left(\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{5/2} dx$$

$$\downarrow 4610$$

$$\int \left(1-\coth^2(x)\right)^{3/2} d\coth(x)$$

$$\downarrow 211$$

$$\frac{3}{4}\int \sqrt{1-\coth^2(x)}d\coth(x) + \frac{1}{4}\coth(x)\left(1-\coth^2(x)\right)^{3/2}$$

$$\downarrow 211$$

$$\frac{3}{4}\left(\frac{1}{2}\int \frac{1}{\sqrt{1-\coth^2(x)}}d\coth(x) + \frac{1}{2}\sqrt{1-\coth^2(x)}\coth(x)\right) + \frac{1}{4}\coth(x)\left(1-\coth^2(x)\right)^{3/2}$$

$$\downarrow 223$$

$$\frac{3}{4}\left(\frac{1}{2}\arcsin(\coth(x)) + \frac{1}{2}\coth(x)\sqrt{1-\coth^2(x)}\right) + \frac{1}{4}\coth(x)\left(1-\coth^2(x)\right)^{3/2}$$

input
```
Int[(-Csch[x]^2)^(5/2),x]
```

output
```
(Coth[x]*(1 - Coth[x]^2)^(3/2))/4 + (3*(ArcSin[Coth[x]]/2 + (Coth[x]*Sqrt[
1 - Coth[x]^2])/2))/4
```

#### 3.22.3.1 Defintions of rubi rules used

rule 211
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[x*((a + b*x^2)^p/(2*p + 1
)), x] + Simp[2*a*(p/(2*p + 1))   Int[(a + b*x^2)^(p - 1), x], x] /; FreeQ[
{a, b}, x] && GtQ[p, 0] && (IntegerQ[4*p] || IntegerQ[6*p])
```

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.22.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 113 vs. $2(30) = 60$.

Time $= 0.27$ (sec) , antiderivative size $= 114$, normalized size of antiderivative $= 2.85$

| method | result | siz |
|---|---|---|
| risch | $\frac{\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}\left(3e^{6x}-11e^{4x}-11e^{2x}+3\right)}{4\left(e^{2x}-1\right)^3}-\frac{3\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}e^{-x}\left(e^{2x}-1\right)\ln\left(e^x+1\right)}{8}+\frac{3\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}e^{-x}\left(e^{2x}-1\right)\ln\left(e^x-1\right)}{8}$ | 11 |

input
```
int((-csch(x)^2)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
1/4/(exp(2*x)-1)^3*(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)*(3*exp(6*x)-11*exp(4
*x)-11*exp(2*x)+3)-3/8*(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)*exp(-x)*(exp(2*x
)-1)*ln(exp(x)+1)+3/8*(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)*exp(-x)*(exp(2*x)
-1)*ln(exp(x)-1)
```

### 3.22.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 117, normalized size of antiderivative = 2.92

$$\int \left(-\operatorname{csch}^2(x)\right)^{5/2}\,dx =$$
$$-\frac{3\left(i\,e^{(8\,x)}-4i\,e^{(6\,x)}+6i\,e^{(4\,x)}-4i\,e^{(2\,x)}+i\right)\log\left(e^x+1\right)+3\left(-i\,e^{(8\,x)}+4i\,e^{(6\,x)}-6i\,e^{(4\,x)}+4i\,e^{(2\,x)}-i\right)\text{lo}}{8\left(e^{(8\,x)}-4\,e^{(6\,x)}+6\,e^{(4\,x)}-4\,e^{(2\,x)}+1\right)}$$

input
```
integrate((-csch(x)^2)^(5/2),x, algorithm="fricas")
```

output
```
-1/8*(3*(I*e^(8*x) - 4*I*e^(6*x) + 6*I*e^(4*x) - 4*I*e^(2*x) + I)*log(e^x
+ 1) + 3*(-I*e^(8*x) + 4*I*e^(6*x) - 6*I*e^(4*x) + 4*I*e^(2*x) - I)*log(e^
x - 1) - 6*I*e^(7*x) + 22*I*e^(5*x) + 22*I*e^(3*x) - 6*I*e^x)/(e^(8*x) - 4
*e^(6*x) + 6*e^(4*x) - 4*e^(2*x) + 1)
```

### 3.22.6 Sympy [F]

$$\int \left(-\operatorname{csch}^2(x)\right)^{5/2}\,dx = \int \left(-\operatorname{csch}^2(x)\right)^{\frac{5}{2}}\,dx$$

input
```
integrate((-csch(x)**2)**(5/2),x)
```

output
```
Integral((-csch(x)**2)**(5/2), x)
```

### 3.22.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.85

$$\int \left(-\operatorname{csch}^2(x)\right)^{5/2}\,dx = \frac{3i\,e^{(-x)}-11i\,e^{(-3\,x)}-11i\,e^{(-5\,x)}+3i\,e^{(-7\,x)}}{4\left(4\,e^{(-2\,x)}-6\,e^{(-4\,x)}+4\,e^{(-6\,x)}-e^{(-8\,x)}-1\right)}$$
$$+\frac{3}{8}i\,\log\left(e^{(-x)}+1\right)-\frac{3}{8}i\,\log\left(e^{(-x)}-1\right)$$

input
```
integrate((-csch(x)^2)^(5/2),x, algorithm="maxima")
```

output
```
1/4*(3*I*e^(-x) - 11*I*e^(-3*x) - 11*I*e^(-5*x) + 3*I*e^(-7*x))/(4*e^(-2*x
) - 6*e^(-4*x) + 4*e^(-6*x) - e^(-8*x) - 1) + 3/8*I*log(e^(-x) + 1) - 3/8*
I*log(e^(-x) - 1)
```

### 3.22.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.80

$$\int \left(-\operatorname{csch}^2(x)\right)^{5/2} dx =$$
$$-\frac{1}{16}\left(\frac{4i\left(3\left(e^{(-x)}+e^{x}\right)^3-20\,e^{(-x)}-20\,e^{x}\right)}{\left(\left(e^{(-x)}+e^{x}\right)^2-4\right)^2}-3i\log\left(e^{(-x)}+e^{x}+2\right)+3i\log\left(e^{(-x)}+e^{x}-2\right)\right)\operatorname{sgn}\left(-e^{(3}\right.$$
$$\left.+e^{x}\right)$$

input
```
integrate((-csch(x)^2)^(5/2),x, algorithm="giac")
```

output
```
-1/16*(4*I*(3*(e^(-x) + e^x)^3 - 20*e^(-x) - 20*e^x)/((e^(-x) + e^x)^2 - 4
)^2 - 3*I*log(e^(-x) + e^x + 2) + 3*I*log(e^(-x) + e^x - 2))*sgn(-e^(3*x)
+ e^x)
```

### 3.22.9 Mupad [F(-1)]

Timed out.

$$\int \left(-\operatorname{csch}^2(x)\right)^{5/2} dx = \int \left(-\frac{1}{\sinh(x)^2}\right)^{5/2} dx$$

input
```
int((-1/sinh(x)^2)^(5/2),x)
```

output
```
int((-1/sinh(x)^2)^(5/2), x)
```

# 3.23 $\int \left(-\text{csch}^2(x)\right)^{3/2}\,dx$

3.23.1 Optimal result . . . 197
3.23.2 Mathematica [B] (verified) . . . 197
3.23.3 Rubi [A] (verified) . . . 198
3.23.4 Maple [B] (verified) . . . 199
3.23.5 Fricas [C] (verification not implemented) . . . 199
3.23.6 Sympy [F] . . . 200
3.23.7 Maxima [C] (verification not implemented) . . . 200
3.23.8 Giac [C] (verification not implemented) . . . 200
3.23.9 Mupad [F(-1)] . . . 201

## 3.23.1 Optimal result

Integrand size = 10, antiderivative size = 24

$$\int \left(-\text{csch}^2(x)\right)^{3/2}\,dx = \frac{1}{2}\arcsin(\coth(x)) + \frac{1}{2}\coth(x)\sqrt{-\text{csch}^2(x)}$$

output
```
1/2*arcsin(coth(x))+1/2*coth(x)*(-csch(x)^2)^(1/2)
```

## 3.23.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 51 vs. 2(24) = 48.

Time = 0.04 (sec) , antiderivative size = 51, normalized size of antiderivative = 2.12

$$\int \left(-\text{csch}^2(x)\right)^{3/2}\,dx = \frac{1}{8}\sqrt{-\text{csch}^2(x)}\left(\text{csch}^2\left(\frac{x}{2}\right) - 4\log\left(\cosh\left(\frac{x}{2}\right)\right) + 4\log\left(\sinh\left(\frac{x}{2}\right)\right) + \text{sech}^2\left(\frac{x}{2}\right)\right)\sinh(x)$$

input
```
Integrate[(-Csch[x]^2)^(3/2),x]
```

output
```
(Sqrt[-Csch[x]^2]*(Csch[x/2]^2 - 4*Log[Cosh[x/2]] + 4*Log[Sinh[x/2]] + Sec
h[x/2]^2)*Sinh[x])/8
```

### 3.23.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.08, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4610, 211, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(-\text{csch}^2(x)\right)^{3/2}\, dx$$

$$\downarrow 3042$$

$$\int \left(\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{3/2} dx$$

$$\downarrow 4610$$

$$\int \sqrt{1-\coth^2(x)}\, d\coth(x)$$

$$\downarrow 211$$

$$\frac{1}{2}\int \frac{1}{\sqrt{1-\coth^2(x)}}\, d\coth(x) + \frac{1}{2}\sqrt{1-\coth^2(x)}\coth(x)$$

$$\downarrow 223$$

$$\frac{1}{2}\arcsin(\coth(x)) + \frac{1}{2}\coth(x)\sqrt{1-\coth^2(x)}$$

input
```
Int[(-Csch[x]^2)^(3/2),x]
```

output
```
ArcSin[Coth[x]]/2 + (Coth[x]*Sqrt[1 - Coth[x]^2])/2
```

#### 3.23.3.1 Defintions of rubi rules used

rule 211
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[x*((a + b*x^2)^p/(2*p + 1
)), x] + Simp[2*a*(p/(2*p + 1))   Int[(a + b*x^2)^(p - 1), x], x] /; FreeQ[
{a, b}, x] && GtQ[p, 0] && (IntegerQ[4*p] || IntegerQ[6*p])
```

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.23.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 98 vs. $2(18) = 36$.

Time $= 0.16$ (sec) , antiderivative size $= 99$, normalized size of antiderivative $= 4.12$

| method | result | size |
|---|---|---|
| risch | $\frac{\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}\left(1+e^{2x}\right)}{e^{2x}-1} - \frac{\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}\, e^{-x}\left(e^{2x}-1\right)\ln(e^x+1)}{2} + \frac{\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}\, e^{-x}\left(e^{2x}-1\right)\ln(e^x-1)}{2}$ | 99 |

input
```
int((-csch(x)^2)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/(exp(2*x)-1)*(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)*(1+exp(2*x))-1/2*(-1/(ex
p(2*x)-1)^2*exp(2*x))^(1/2)*exp(-x)*(exp(2*x)-1)*ln(exp(x)+1)+1/2*(-1/(exp
(2*x)-1)^2*exp(2*x))^(1/2)*exp(-x)*(exp(2*x)-1)*ln(exp(x)-1)
```

### 3.23.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time $= 0.26$ (sec) , antiderivative size $= 67$, normalized size of antiderivative $= 2.79$

$$\int \left(-\operatorname{csch}^2(x)\right)^{3/2}\, dx = \frac{\left(-i\, e^{(4x)} + 2i\, e^{(2x)} - i\right)\log\left(e^x+1\right) + \left(i\, e^{(4x)} - 2i\, e^{(2x)} + i\right)\log\left(e^x-1\right) + 2i\, e^{(3x)} -}{2\left(e^{(4x)} - 2\, e^{(2x)} + 1\right)}$$

input
```
integrate((-csch(x)^2)^(3/2),x, algorithm="fricas")
```

output
```
1/2*((-I*e^(4*x) + 2*I*e^(2*x) - I)*log(e^x + 1) + (I*e^(4*x) - 2*I*e^(2*x
) + I)*log(e^x - 1) + 2*I*e^(3*x) + 2*I*e^x)/(e^(4*x) - 2*e^(2*x) + 1)
```

### 3.23.6 Sympy [F]

$$\int \left(-\operatorname{csch}^2(x)\right)^{3/2}\,dx = \int \left(-\operatorname{csch}^2(x)\right)^{\frac{3}{2}}\,dx$$

input
```
integrate((-csch(x)**2)**(3/2),x)
```

output
```
Integral((-csch(x)**2)**(3/2), x)
```

### 3.23.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 49, normalized size of antiderivative = 2.04

$$\int \left(-\operatorname{csch}^2(x)\right)^{3/2}\,dx = \frac{i\,e^{(-x)} + i\,e^{(-3\,x)}}{2\,e^{(-2\,x)} - e^{(-4\,x)} - 1} + \frac{1}{2}i\,\log\left(e^{(-x)} + 1\right) - \frac{1}{2}i\,\log\left(e^{(-x)} - 1\right)$$

input
```
integrate((-csch(x)^2)^(3/2),x, algorithm="maxima")
```

output
```
(I*e^(-x) + I*e^(-3*x))/(2*e^(-2*x) - e^(-4*x) - 1) + 1/2*I*log(e^(-x) + 1
) - 1/2*I*log(e^(-x) - 1)
```

### 3.23.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.29 (sec) , antiderivative size = 57, normalized size of antiderivative = 2.38

$$\int \left(-\operatorname{csch}^2(x)\right)^{3/2}\,dx = -\frac{1}{4}\left(\frac{4i\left(e^{(-x)} + e^{x}\right)}{\left(e^{(-x)} + e^{x}\right)^2 - 4} - i\,\log\left(e^{(-x)} + e^{x} + 2\right) + i\,\log\left(e^{(-x)} + e^{x} - 2\right)\right)\operatorname{sgn}\left(-e^{(3\,x)} + e^{x}\right)$$

input
```
integrate((-csch(x)^2)^(3/2),x, algorithm="giac")
```

output
```
-1/4*(4*I*(e^(-x) + e^x)/((e^(-x) + e^x)^2 - 4) - I*log(e^(-x) + e^x + 2)
+ I*log(e^(-x) + e^x - 2))*sgn(-e^(3*x) + e^x)
```

### 3.23.9 Mupad [F(-1)]

Timed out.

$$\int \left(-\operatorname{csch}^2(x)\right)^{3/2}\,dx = \int \left(-\frac{1}{\sinh(x)^2}\right)^{3/2}\,dx$$

input
```
int((-1/sinh(x)^2)^(3/2),x)
```

output
```
int((-1/sinh(x)^2)^(3/2), x)
```

# 3.24 $\int \sqrt{-\text{csch}^2(x)}\,dx$

3.24.1 Optimal result . . . . . 202
3.24.2 Mathematica [B] (verified) . . . . . 202
3.24.3 Rubi [A] (verified) . . . . . 203
3.24.4 Maple [B] (verified) . . . . . 204
3.24.5 Fricas [C] (verification not implemented) . . . . . 204
3.24.6 Sympy [F] . . . . . 204
3.24.7 Maxima [C] (verification not implemented) . . . . . 205
3.24.8 Giac [C] (verification not implemented) . . . . . 205
3.24.9 Mupad [F(-1)] . . . . . 205

## 3.24.1 Optimal result

Integrand size = 10, antiderivative size = 3

$$\int \sqrt{-\text{csch}^2(x)}\,dx = \arcsin(\coth(x))$$

output
```
arcsin(coth(x))
```

## 3.24.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 30 vs. 2(3) = 6.

Time = 0.01 (sec) , antiderivative size = 30, normalized size of antiderivative = 10.00

$$\int \sqrt{-\text{csch}^2(x)}\,dx = \sqrt{-\text{csch}^2(x)}\left(-\log\left(\cosh\left(\frac{x}{2}\right)\right)+\log\left(\sinh\left(\frac{x}{2}\right)\right)\right)\sinh(x)$$

input
```
Integrate[Sqrt[-Csch[x]^2],x]
```

output
```
Sqrt[-Csch[x]^2]*(-Log[Cosh[x/2]] + Log[Sinh[x/2]])*Sinh[x]
```

### 3.24.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 3, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.300$, Rules used = {3042, 4610, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{-\operatorname{csch}^2(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{\sec\left(\frac{\pi}{2}+ix\right)^2}\,dx$$

$$\downarrow 4610$$

$$\int \frac{1}{\sqrt{1-\coth^2(x)}}\,d\coth(x)$$

$$\downarrow 223$$

$$\arcsin(\coth(x))$$

input
```
Int[Sqrt[-Csch[x]^2],x]
```

output
```
ArcSin[Coth[x]]
```

#### 3.24.3.1 Defintions of rubi rules used

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.24.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 66 vs. $2(3) = 6$.

Time $= 0.17$ (sec) , antiderivative size $= 67$, normalized size of antiderivative $= 22.33$

| method | result | size |
|---|---|---|
| risch | $\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}\, e^{-x}(e^{2x}-1)\ln(e^x-1) - \sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}\, e^{-x}(e^{2x}-1)\ln(e^x+1)$ | 67 |

input
```
int((-csch(x)^2)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)*exp(-x)*(exp(2*x)-1)*ln(exp(x)-1)-(-1/(
exp(2*x)-1)^2*exp(2*x))^(1/2)*exp(-x)*(exp(2*x)-1)*ln(exp(x)+1)
```

### 3.24.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time $= 0.26$ (sec) , antiderivative size $= 15$, normalized size of antiderivative $= 5.00$

$$\int \sqrt{-\operatorname{csch}^2(x)}\, dx = -i \log(e^x + 1) + i \log(e^x - 1)$$

input
```
integrate((-csch(x)^2)^(1/2),x, algorithm="fricas")
```

output
```
-I*log(e^x + 1) + I*log(e^x - 1)
```

### 3.24.6 Sympy [F]

$$\int \sqrt{-\operatorname{csch}^2(x)}\, dx = \int \sqrt{-\operatorname{csch}^2(x)}\, dx$$

input
```
integrate((-csch(x)**2)**(1/2),x)
```

output
```
Integral(sqrt(-csch(x)**2), x)
```

### 3.24.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 19, normalized size of antiderivative = 6.33

$$\int \sqrt{-\operatorname{csch}^2(x)}\,dx = i\,\log\left(e^{(-x)}+1\right) - i\,\log\left(e^{(-x)}-1\right)$$

input
```
integrate((-csch(x)^2)^(1/2),x, algorithm="maxima")
```

output
```
I*log(e^(-x) + 1) - I*log(e^(-x) - 1)
```

### 3.24.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 27, normalized size of antiderivative = 9.00

$$\int \sqrt{-\operatorname{csch}^2(x)}\,dx = \left(i\,\log\left(e^x+1\right) - i\,\log\left(\left|e^x-1\right|\right)\right)\operatorname{sgn}\left(-e^{(3\,x)}+e^x\right)$$

input
```
integrate((-csch(x)^2)^(1/2),x, algorithm="giac")
```

output
```
(I*log(e^x + 1) - I*log(abs(e^x - 1)))*sgn(-e^(3*x) + e^x)
```

### 3.24.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{-\operatorname{csch}^2(x)}\,dx = \int \sqrt{-\frac{1}{\sinh(x)^2}}\,dx$$

input
```
int((-1/sinh(x)^2)^(1/2),x)
```

output
```
int((-1/sinh(x)^2)^(1/2), x)
```

# 3.25 $\int \frac{1}{\sqrt{-\text{csch}^2(x)}}\,dx$

3.25.1 Optimal result . . . . . 206
3.25.2 Mathematica [A] (verified) . . . . . 206
3.25.3 Rubi [A] (verified) . . . . . 207
3.25.4 Maple [B] (verified) . . . . . 208
3.25.5 Fricas [C] (verification not implemented) . . . . . 208
3.25.6 Sympy [F] . . . . . 209
3.25.7 Maxima [C] (verification not implemented) . . . . . 209
3.25.8 Giac [C] (verification not implemented) . . . . . 209
3.25.9 Mupad [B] (verification not implemented) . . . . . 210

## 3.25.1 Optimal result

Integrand size = 10, antiderivative size = 13

$$\int \frac{1}{\sqrt{-\text{csch}^2(x)}}\,dx = \frac{\coth(x)}{\sqrt{-\text{csch}^2(x)}}$$

output
```
coth(x)/(-csch(x)^2)^(1/2)
```

## 3.25.2 Mathematica [A] (verified)

Time = 0.00 (sec) , antiderivative size = 13, normalized size of antiderivative = 1.00

$$\int \frac{1}{\sqrt{-\text{csch}^2(x)}}\,dx = \frac{\coth(x)}{\sqrt{-\text{csch}^2(x)}}$$

input
```
Integrate[1/Sqrt[-Csch[x]^2],x]
```

output
```
Coth[x]/Sqrt[-Csch[x]^2]
```

### 3.25.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.15, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.300$, Rules used = {3042, 4610, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{\sec\left(\frac{\pi}{2}+ix\right)^2}}dx$$

$$\downarrow 4610$$

$$\int \frac{1}{\left(1-\coth^2(x)\right)^{3/2}}d\coth(x)$$

$$\downarrow 208$$

$$\frac{\coth(x)}{\sqrt{1-\coth^2(x)}}$$

input
```
Int[1/Sqrt[-Csch[x]^2],x]
```

output
```
Coth[x]/Sqrt[1 - Coth[x]^2]
```

#### 3.25.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.25.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 57 vs. $2(11) = 22$.

Time = 0.15 (sec) , antiderivative size = 58, normalized size of antiderivative = 4.46

| method | result | size |
|---|---|---|
| risch | $\frac{e^{2x}}{2\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}\left(e^{2x}-1\right)}+\frac{1}{2\left(e^{2x}-1\right)\sqrt{-\frac{e^{2x}}{\left(e^{2x}-1\right)^2}}}$ | 58 |

input
```
int(1/(-csch(x)^2)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/2/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)/(exp(2*x)-1)*exp(2*x)+1/2/(exp(2*x)
-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)
```

### 3.25.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 14, normalized size of antiderivative = 1.08

$$\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx = \frac{1}{2}\left(-i\,e^{(2\,x)}-i\right)e^{(-x)}$$

input
```
integrate(1/(-csch(x)^2)^(1/2),x, algorithm="fricas")
```

output
```
1/2*(-I*e^(2*x) - I)*e^(-x)
```

### 3.25.6 Sympy [F]

$$\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx = \int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx$$

input
```
integrate(1/(-csch(x)**2)**(1/2),x)
```

output
```
Integral(1/sqrt(-csch(x)**2), x)
```

### 3.25.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 11, normalized size of antiderivative = 0.85

$$\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx = \frac{1}{2} i\, e^{(-x)} + \frac{1}{2} i\, e^{x}$$

input
```
integrate(1/(-csch(x)^2)^(1/2),x, algorithm="maxima")
```

output
```
1/2*I*e^(-x) + 1/2*I*e^x
```

### 3.25.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 25, normalized size of antiderivative = 1.92

$$\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx = -\frac{-i\, e^{(-x)} - i\, e^{x}}{2 \operatorname{sgn}\left(-e^{(3\,x)} + e^{x}\right)}$$

input
```
integrate(1/(-csch(x)^2)^(1/2),x, algorithm="giac")
```

output
```
-1/2*(-I*e^(-x) - I*e^x)/sgn(-e^(3*x) + e^x)
```

### 3.25.9 Mupad [B] (verification not implemented)

Time = 2.28 (sec) , antiderivative size = 31, normalized size of antiderivative = 2.38

$$\int \frac{1}{\sqrt{-\operatorname{csch}^2(x)}}\,dx = -\mathrm{e}^{-2x}\sqrt{-\frac{1}{\left(\frac{\mathrm{e}^{-x}}{2}-\frac{\mathrm{e}^{x}}{2}\right)^2}}\left(\frac{\mathrm{e}^{4x}}{4}-\frac{1}{4}\right)$$

input
```
int(1/(-1/sinh(x)^2)^(1/2),x)
```

output
```
-exp(-2*x)*(-1/(exp(-x)/2 - exp(x)/2)^2)^(1/2)*(exp(4*x)/4 - 1/4)
```

# 3.26 $\int \frac{1}{\left(-\text{csch}^2(x)\right)^{3/2}}\,dx$

3.26.1 Optimal result . . . 211
3.26.2 Mathematica [A] (verified) . . . 211
3.26.3 Rubi [A] (verified) . . . 212
3.26.4 Maple [B] (verified) . . . 213
3.26.5 Fricas [C] (verification not implemented) . . . 214
3.26.6 Sympy [F] . . . 214
3.26.7 Maxima [C] (verification not implemented) . . . 214
3.26.8 Giac [C] (verification not implemented) . . . 215
3.26.9 Mupad [F(-1)] . . . 215

## 3.26.1 Optimal result

Integrand size = 10, antiderivative size = 33

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{3/2}}\,dx = \frac{\coth(x)}{3\left(-\text{csch}^2(x)\right)^{3/2}} + \frac{2\coth(x)}{3\sqrt{-\text{csch}^2(x)}}$$

output
```
1/3*coth(x)/(-csch(x)^2)^(3/2)+2/3*coth(x)/(-csch(x)^2)^(1/2)
```

## 3.26.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.82

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{3/2}}\,dx = \frac{9\coth(x) - \cosh(3x)\text{csch}(x)}{12\sqrt{-\text{csch}^2(x)}}$$

input
```
Integrate[(-Csch[x]^2)^(-3/2),x]
```

output
```
(9*Coth[x] - Cosh[3*x]*Csch[x])/(12*Sqrt[-Csch[x]^2])
```

### 3.26.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 37, normalized size of antiderivative = 1.12, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4610, 209, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{3/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{3/2}}dx$$

$$\downarrow 4610$$

$$\int \frac{1}{\left(1-\coth^2(x)\right)^{5/2}}d\coth(x)$$

$$\downarrow 209$$

$$\frac{2}{3}\int \frac{1}{\left(1-\coth^2(x)\right)^{3/2}}d\coth(x)+\frac{\coth(x)}{3\left(1-\coth^2(x)\right)^{3/2}}$$

$$\downarrow 208$$

$$\frac{2\coth(x)}{3\sqrt{1-\coth^2(x)}}+\frac{\coth(x)}{3\left(1-\coth^2(x)\right)^{3/2}}$$

input
```
Int[(-Csch[x]^2)^(-3/2),x]
```

output
```
Coth[x]/(3*(1 - Coth[x]^2)^(3/2)) + (2*Coth[x])/(3*Sqrt[1 - Coth[x]^2])
```

#### 3.26.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 209
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(-x)*((a + b*x^2)^(p + 1)
/(2*a*(p + 1))), x] + Simp[(2*p + 3)/(2*a*(p + 1))   Int[(a + b*x^2)^(p + 1
), x], x] /; FreeQ[{a, b}, x] && ILtQ[p + 3/2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.26.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 117 vs. $2(25) = 50$.

Time $= 0.15$ (sec) , antiderivative size $= 118$, normalized size of antiderivative $= 3.58$

| method | result | size |
|---|---|---|
| risch | $-\frac{e^{4x}}{24(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}}+\frac{3e^{2x}}{8\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}(e^{2x}-1)}+\frac{3}{8(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}}-\frac{e^{-2x}}{24(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}}$ | 118 |

input
```
int(1/(-csch(x)^2)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
-1/24*exp(4*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)+3/8/(-1/(ex
p(2*x)-1)^2*exp(2*x))^(1/2)/(exp(2*x)-1)*exp(2*x)+3/8/(exp(2*x)-1)/(-1/(ex
p(2*x)-1)^2*exp(2*x))^(1/2)-1/24*exp(-2*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2
*exp(2*x))^(1/2)
```

### 3.26.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 26, normalized size of antiderivative = 0.79

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \frac{1}{24}\left(i\,e^{(6\,x)} - 9i\,e^{(4\,x)} - 9i\,e^{(2\,x)} + i\right)e^{(-3\,x)}$$

input
```
integrate(1/(-csch(x)^2)^(3/2),x, algorithm="fricas")
```

output
```
1/24*(I*e^(6*x) - 9*I*e^(4*x) - 9*I*e^(2*x) + I)*e^(-3*x)
```

### 3.26.6 Sympy [F]

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(-csch(x)**2)**(3/2),x)
```

output
```
Integral((-csch(x)**2)**(-3/2), x)
```

### 3.26.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 23, normalized size of antiderivative = 0.70

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{3/2}}\,dx = -\frac{1}{24}i\,e^{(3\,x)} + \frac{3}{8}i\,e^{(-x)} - \frac{1}{24}i\,e^{(-3\,x)} + \frac{3}{8}i\,e^{x}$$

input
```
integrate(1/(-csch(x)^2)^(3/2),x, algorithm="maxima")
```

output
```
-1/24*I*e^(3*x) + 3/8*I*e^(-x) - 1/24*I*e^(-3*x) + 3/8*I*e^x
```

### 3.26.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 38, normalized size of antiderivative = 1.15

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \frac{\left(9i\,e^{(2\,x)} - i\right)e^{(-3\,x)} - i\,e^{(3\,x)} + 9i\,e^{x}}{24\,\operatorname{sgn}\left(-e^{(3\,x)} + e^{x}\right)}$$

input
```
integrate(1/(-csch(x)^2)^(3/2),x, algorithm="giac")
```

output
```
1/24*((9*I*e^(2*x) - I)*e^(-3*x) - I*e^(3*x) + 9*I*e^x)/sgn(-e^(3*x) + e^x
)
```

### 3.26.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(-\frac{1}{\sinh(x)^2}\right)^{3/2}}\,dx$$

input
```
int(1/(-1/sinh(x)^2)^(3/2),x)
```

output
```
int(1/(-1/sinh(x)^2)^(3/2), x)
```

# 3.27 $\int \frac{1}{\left(-\text{csch}^2(x)\right)^{5/2}}\,dx$

3.27.1 Optimal result . . . 216
3.27.2 Mathematica [A] (verified) . . . 216
3.27.3 Rubi [A] (verified) . . . 217
3.27.4 Maple [B] (verified) . . . 218
3.27.5 Fricas [C] (verification not implemented) . . . 219
3.27.6 Sympy [F] . . . 219
3.27.7 Maxima [C] (verification not implemented) . . . 219
3.27.8 Giac [C] (verification not implemented) . . . 220
3.27.9 Mupad [F(-1)] . . . 220

## 3.27.1 Optimal result

Integrand size = 10, antiderivative size = 49

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{5/2}}\,dx = \frac{\coth(x)}{5\left(-\text{csch}^2(x)\right)^{5/2}} + \frac{4\coth(x)}{15\left(-\text{csch}^2(x)\right)^{3/2}} + \frac{8\coth(x)}{15\sqrt{-\text{csch}^2(x)}}$$

output
```
1/5*coth(x)/(-csch(x)^2)^(5/2)+4/15*coth(x)/(-csch(x)^2)^(3/2)+8/15*coth(x
)/(-csch(x)^2)^(1/2)
```

## 3.27.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 33, normalized size of antiderivative = 0.67

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{5/2}}\,dx = \frac{(150\cosh(x) - 25\cosh(3x) + 3\cosh(5x))\text{csch}(x)}{240\sqrt{-\text{csch}^2(x)}}$$

input
```
Integrate[(-Csch[x]^2)^(-5/2),x]
```

output
```
((150*Cosh[x] - 25*Cosh[3*x] + 3*Cosh[5*x])*Csch[x])/(240*Sqrt[-Csch[x]^2]
)
```

### 3.27.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.22, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4610, 209, 209, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{5/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{5/2}}dx$$

$$\downarrow 4610$$

$$\int \frac{1}{\left(1-\coth^2(x)\right)^{7/2}}d\coth(x)$$

$$\downarrow 209$$

$$\frac{4}{5}\int \frac{1}{\left(1-\coth^2(x)\right)^{5/2}}d\coth(x)+\frac{\coth(x)}{5\left(1-\coth^2(x)\right)^{5/2}}$$

$$\downarrow 209$$

$$\frac{4}{5}\left(\frac{2}{3}\int \frac{1}{\left(1-\coth^2(x)\right)^{3/2}}d\coth(x)+\frac{\coth(x)}{3\left(1-\coth^2(x)\right)^{3/2}}\right)+\frac{\coth(x)}{5\left(1-\coth^2(x)\right)^{5/2}}$$

$$\downarrow 208$$

$$\frac{\coth(x)}{5\left(1-\coth^2(x)\right)^{5/2}}+\frac{4}{5}\left(\frac{2\coth(x)}{3\sqrt{1-\coth^2(x)}}+\frac{\coth(x)}{3\left(1-\coth^2(x)\right)^{3/2}}\right)$$

input
```
Int[(-Csch[x]^2)^(-5/2),x]
```

output
```
Coth[x]/(5*(1 - Coth[x]^2)^(5/2)) + (4*(Coth[x]/(3*(1 - Coth[x]^2)^(3/2))
+ (2*Coth[x])/(3*Sqrt[1 - Coth[x]^2])))/5
```

#### 3.27.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 209
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(-x)*((a + b*x^2)^(p + 1)
/(2*a*(p + 1))), x] + Simp[(2*p + 3)/(2*a*(p + 1))   Int[(a + b*x^2)^(p + 1
), x], x] /; FreeQ[{a, b}, x] && ILtQ[p + 3/2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.27.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 177 vs. $2(37) = 74$.

Time = 0.15 (sec) , antiderivative size = 178, normalized size of antiderivative = 3.63

| method | result |
|---|---|
| risch | $\frac{e^{6x}}{160(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}} - \frac{5e^{4x}}{96(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}} + \frac{5e^{2x}}{16\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}(e^{2x}-1)} + \frac{5}{16(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}} - \frac{5e^{-}}{96(e^{2x}-1)\sqrt{}}$ |

input
```
int(1/(-csch(x)^2)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
1/160*exp(6*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)-5/96*exp(4*
x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)+5/16/(-1/(exp(2*x)-1)^2
*exp(2*x))^(1/2)/(exp(2*x)-1)*exp(2*x)+5/16/(exp(2*x)-1)/(-1/(exp(2*x)-1)^
2*exp(2*x))^(1/2)-5/96*exp(-2*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))
^(1/2)+1/160*exp(-4*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)
```

### 3.27.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 38, normalized size of antiderivative = 0.78

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \frac{1}{480}\left(-3i\,e^{(10\,x)} + 25i\,e^{(8\,x)} - 150i\,e^{(6\,x)} - 150i\,e^{(4\,x)} + 25i\,e^{(2\,x)} - 3i\right)e^{(-5\,x)}$$

input
```
integrate(1/(-csch(x)^2)^(5/2),x, algorithm="fricas")
```

output
```
1/480*(-3*I*e^(10*x) + 25*I*e^(8*x) - 150*I*e^(6*x) - 150*I*e^(4*x) + 25*I
*e^(2*x) - 3*I)*e^(-5*x)
```

### 3.27.6 Sympy [F]

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(-csch(x)**2)**(5/2),x)
```

output
```
Integral((-csch(x)**2)**(-5/2), x)
```

### 3.27.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.71

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \frac{1}{160}i\,e^{(5\,x)} - \frac{5}{96}i\,e^{(3\,x)} + \frac{5}{16}i\,e^{(-x)} - \frac{5}{96}i\,e^{(-3\,x)} + \frac{1}{160}i\,e^{(-5\,x)} + \frac{5}{16}i\,e^{x}$$

input
```
integrate(1/(-csch(x)^2)^(5/2),x, algorithm="maxima")
```

output
```
1/160*I*e^(5*x) - 5/96*I*e^(3*x) + 5/16*I*e^(-x) - 5/96*I*e^(-3*x) + 1/160
*I*e^(-5*x) + 5/16*I*e^x
```

### 3.27.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.29 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.02

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{5/2}}\,dx = -\frac{\left(-150i\,e^{(4\,x)} + 25i\,e^{(2\,x)} - 3i\right)e^{(-5\,x)} - 3i\,e^{(5\,x)} + 25i\,e^{(3\,x)} - 150i\,e^{x}}{480\,\operatorname{sgn}\left(-e^{(3\,x)} + e^{x}\right)}$$

input
```
integrate(1/(-csch(x)^2)^(5/2),x, algorithm="giac")
```

output
```
-1/480*((-150*I*e^(4*x) + 25*I*e^(2*x) - 3*I)*e^(-5*x) - 3*I*e^(5*x) + 25*
I*e^(3*x) - 150*I*e^x)/sgn(-e^(3*x) + e^x)
```

### 3.27.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(-\frac{1}{\sinh(x)^2}\right)^{5/2}}\,dx$$

input
```
int(1/(-1/sinh(x)^2)^(5/2),x)
```

output
```
int(1/(-1/sinh(x)^2)^(5/2), x)
```

# 3.28 $\int \frac{1}{\left(-\text{csch}^2(x)\right)^{7/2}}\,dx$

3.28.1 Optimal result . . . 221
3.28.2 Mathematica [A] (verified) . . . 221
3.28.3 Rubi [A] (verified) . . . 222
3.28.4 Maple [B] (verified) . . . 223
3.28.5 Fricas [C] (verification not implemented) . . . 224
3.28.6 Sympy [F] . . . 224
3.28.7 Maxima [C] (verification not implemented) . . . 225
3.28.8 Giac [C] (verification not implemented) . . . 225
3.28.9 Mupad [F(-1)] . . . 226

## 3.28.1 Optimal result

Integrand size = 10, antiderivative size = 65

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{7/2}}\,dx = \frac{\coth(x)}{7\left(-\text{csch}^2(x)\right)^{7/2}} + \frac{6\coth(x)}{35\left(-\text{csch}^2(x)\right)^{5/2}} + \frac{8\coth(x)}{35\left(-\text{csch}^2(x)\right)^{3/2}} + \frac{16\coth(x)}{35\sqrt{-\text{csch}^2(x)}}$$

output
```
1/7*coth(x)/(-csch(x)^2)^(7/2)+6/35*coth(x)/(-csch(x)^2)^(5/2)+8/35*coth(x
)/(-csch(x)^2)^(3/2)+16/35*coth(x)/(-csch(x)^2)^(1/2)
```

## 3.28.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.60

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{7/2}}\,dx = \frac{(1225\cosh(x) - 245\cosh(3x) + 49\cosh(5x) - 5\cosh(7x))\text{csch}(x)}{2240\sqrt{-\text{csch}^2(x)}}$$

input
```
Integrate[(-Csch[x]^2)^(-7/2),x]
```

output
```
((1225*Cosh[x] - 245*Cosh[3*x] + 49*Cosh[5*x] - 5*Cosh[7*x])*Csch[x])/(224
0*Sqrt[-Csch[x]^2])
```

### 3.28.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 83, normalized size of antiderivative = 1.28, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4610, 209, 209, 209, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(-\text{csch}^2(x)\right)^{7/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{7/2}}dx$$

$$\downarrow 4610$$

$$\int \frac{1}{\left(1-\coth^2(x)\right)^{9/2}}d\coth(x)$$

$$\downarrow 209$$

$$\frac{6}{7}\int \frac{1}{\left(1-\coth^2(x)\right)^{7/2}}d\coth(x)+\frac{\coth(x)}{7\left(1-\coth^2(x)\right)^{7/2}}$$

$$\downarrow 209$$

$$\frac{6}{7}\left(\frac{4}{5}\int \frac{1}{\left(1-\coth^2(x)\right)^{5/2}}d\coth(x)+\frac{\coth(x)}{5\left(1-\coth^2(x)\right)^{5/2}}\right)+\frac{\coth(x)}{7\left(1-\coth^2(x)\right)^{7/2}}$$

$$\downarrow 209$$

$$\frac{6}{7}\left(\frac{4}{5}\left(\frac{2}{3}\int \frac{1}{\left(1-\coth^2(x)\right)^{3/2}}d\coth(x)+\frac{\coth(x)}{3\left(1-\coth^2(x)\right)^{3/2}}\right)+\frac{\coth(x)}{5\left(1-\coth^2(x)\right)^{5/2}}\right)+\frac{\coth(x)}{7\left(1-\coth^2(x)\right)^{7/2}}$$

$$\downarrow 208$$

$$\frac{\coth(x)}{7\left(1-\coth^2(x)\right)^{7/2}}+\frac{6}{7}\left(\frac{\coth(x)}{5\left(1-\coth^2(x)\right)^{5/2}}+\frac{4}{5}\left(\frac{2\coth(x)}{3\sqrt{1-\coth^2(x)}}+\frac{\coth(x)}{3\left(1-\coth^2(x)\right)^{3/2}}\right)\right)$$

input
```
Int[(-Csch[x]^2)^(-7/2),x]
```

output
```
Coth[x]/(7*(1 - Coth[x]^2)^(7/2)) + (6*(Coth[x]/(5*(1 - Coth[x]^2)^(5/2))
+ (4*(Coth[x]/(3*(1 - Coth[x]^2)^(3/2)) + (2*Coth[x])/(3*Sqrt[1 - Coth[x]^
2])))/5))/7
```

#### 3.28.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 209
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(-x)*((a + b*x^2)^(p + 1)
/(2*a*(p + 1))), x] + Simp[(2*p + 3)/(2*a*(p + 1))   Int[(a + b*x^2)^(p + 1
), x], x] /; FreeQ[{a, b}, x] && ILtQ[p + 3/2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.28.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 237 vs. $2(49) = 98$.

Time $= 0.18$ (sec) , antiderivative size $= 238$, normalized size of antiderivative $= 3.66$

| method | result |
|---|---|
| risch | $-\frac{e^{8x}}{896(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}}+\frac{7e^{6x}}{640(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}}-\frac{7e^{4x}}{128(e^{2x}-1)\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}}+\frac{35e^{2x}}{128\sqrt{-\frac{e^{2x}}{(e^{2x}-1)^2}}(e^{2x}-1)}+\frac{}{128(e^{2}}$ |

input
```
int(1/(-csch(x)^2)^(7/2),x,method=_RETURNVERBOSE)
```

output
```
-1/896*exp(8*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)+7/640*exp(
6*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)-7/128*exp(4*x)/(exp(2
*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)+35/128/(-1/(exp(2*x)-1)^2*exp(2*
x))^(1/2)/(exp(2*x)-1)*exp(2*x)+35/128/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp
(2*x))^(1/2)-7/128*exp(-2*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/
2)+7/640*exp(-4*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)-1/896*e
xp(-6*x)/(exp(2*x)-1)/(-1/(exp(2*x)-1)^2*exp(2*x))^(1/2)
```

### 3.28.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.25 (sec) , antiderivative size = 50, normalized size of antiderivative = 0.77

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \frac{1}{4480}\left(5i\,e^{(14\,x)} - 49i\,e^{(12\,x)} + 245i\,e^{(10\,x)} - 1225i\,e^{(8\,x)} - 1225i\,e^{(6\,x)} + 245i\,e^{(4\,x)} - 49\right.$$

input
```
integrate(1/(-csch(x)^2)^(7/2),x, algorithm="fricas")
```

output
```
1/4480*(5*I*e^(14*x) - 49*I*e^(12*x) + 245*I*e^(10*x) - 1225*I*e^(8*x) - 1
225*I*e^(6*x) + 245*I*e^(4*x) - 49*I*e^(2*x) + 5*I)*e^(-7*x)
```

### 3.28.6 Sympy [F]

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{\frac{7}{2}}}\,dx$$

input
```
integrate(1/(-csch(x)**2)**(7/2),x)
```

output
```
Integral((-csch(x)**2)**(-7/2), x)
```

### 3.28.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 47, normalized size of antiderivative = 0.72

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{7/2}}\,dx = -\frac{1}{896}i\,e^{(7\,x)} + \frac{7}{640}i\,e^{(5\,x)} - \frac{7}{128}i\,e^{(3\,x)} + \frac{35}{128}i\,e^{(-x)} - \frac{7}{128}i\,e^{(-3\,x)} + \frac{7}{640}i\,e^{(-5\,x)} - \frac{1}{896}i\,e^{(-7\,x)} + \frac{35}{128}i\,e^{x}$$

input
```
integrate(1/(-csch(x)^2)^(7/2),x, algorithm="maxima")
```

output
```
-1/896*I*e^(7*x) + 7/640*I*e^(5*x) - 7/128*I*e^(3*x) + 35/128*I*e^(-x) - 7
/128*I*e^(-3*x) + 7/640*I*e^(-5*x) - 1/896*I*e^(-7*x) + 35/128*I*e^x
```

### 3.28.8 Giac [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 62, normalized size of antiderivative = 0.95

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{7/2}}\,dx = -\frac{\left(-1225i\,e^{(6\,x)} + 245i\,e^{(4\,x)} - 49i\,e^{(2\,x)} + 5i\right)e^{(-7\,x)} + 5i\,e^{(7\,x)} - 49i\,e^{(5\,x)} + 245i\,e^{(3\,x)} - 1225i\,e^{x}}{4480\,\operatorname{sgn}\left(-e^{(3\,x)} + e^{x}\right)}$$

input
```
integrate(1/(-csch(x)^2)^(7/2),x, algorithm="giac")
```

output
```
-1/4480*((-1225*I*e^(6*x) + 245*I*e^(4*x) - 49*I*e^(2*x) + 5*I)*e^(-7*x) +
 5*I*e^(7*x) - 49*I*e^(5*x) + 245*I*e^(3*x) - 1225*I*e^x)/sgn(-e^(3*x) + e
^x)
```

### 3.28.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(-\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \int \frac{1}{\left(-\frac{1}{\sinh(x)^2}\right)^{7/2}}\,dx$$

input
```
int(1/(-1/sinh(x)^2)^(7/2),x)
```

output
```
int(1/(-1/sinh(x)^2)^(7/2), x)
```

# 3.29 $\int \left(a\operatorname{csch}^2(x)\right)^{5/2} dx$

3.29.1 Optimal result . . . 227
3.29.2 Mathematica [A] (verified) . . . 227
3.29.3 Rubi [A] (verified) . . . 228
3.29.4 Maple [B] (verified) . . . 229
3.29.5 Fricas [B] (verification not implemented) . . . 230
3.29.6 Sympy [F] . . . 231
3.29.7 Maxima [A] (verification not implemented) . . . 231
3.29.8 Giac [A] (verification not implemented) . . . 231
3.29.9 Mupad [F(-1)] . . . 232

## 3.29.1 Optimal result

Integrand size = 10, antiderivative size = 65

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2} dx = -\frac{3}{8}a^{5/2}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(x)}{\sqrt{a\operatorname{csch}^2(x)}}\right) + \frac{3}{8}a^2\coth(x)\sqrt{a\operatorname{csch}^2(x)} - \frac{1}{4}a\coth(x)\left(a\operatorname{csch}^2(x)\right)^{3/2}$$

output
```
-3/8*a^(5/2)*arctanh(coth(x)*a^(1/2)/(a*csch(x)^2)^(1/2))-1/4*a*coth(x)*(a
*csch(x)^2)^(3/2)+3/8*a^2*coth(x)*(a*csch(x)^2)^(1/2)
```

## 3.29.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 51, normalized size of antiderivative = 0.78

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2} dx = \frac{1}{64}\left(a\operatorname{csch}^2(x)\right)^{5/2}\sinh(x)\left(-22\cosh(x)+6\left(\cosh(3x)+4\left(-\log\left(\cosh\left(\frac{x}{2}\right)\right)+\log\left(\text{si}\right.\right.\right.\right.$$

input
```
Integrate[(a*Csch[x]^2)^(5/2),x]
```

output
```
((a*Csch[x]^2)^(5/2)*Sinh[x]*(-22*Cosh[x] + 6*(Cosh[3*x] + 4*(-Log[Cosh[x/
2]] + Log[Sinh[x/2]])*Sinh[x]^4)))/64
```

### 3.29.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.26, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4610, 211, 211, 224, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2} dx$$

$$\downarrow 3042$$

$$\int \left(-a\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{5/2} dx$$

$$\downarrow 4610$$

$$-a\int \left(a\coth^2(x)-a\right)^{3/2} d\coth(x)$$

$$\downarrow 211$$

$$-a\left(\frac{1}{4}\coth(x)\left(a\coth^2(x)-a\right)^{3/2}-\frac{3}{4}a\int \sqrt{a\coth^2(x)-a}d\coth(x)\right)$$

$$\downarrow 211$$

$$-a\left(\frac{1}{4}\coth(x)\left(a\coth^2(x)-a\right)^{3/2}-\frac{3}{4}a\left(\frac{1}{2}\coth(x)\sqrt{a\coth^2(x)-a}-\frac{1}{2}a\int \frac{1}{\sqrt{a\coth^2(x)-a}}d\coth(x)\right)\right)$$

$$\downarrow 224$$

$$-a\left(\frac{1}{4}\coth(x)\left(a\coth^2(x)-a\right)^{3/2}-\frac{3}{4}a\left(\frac{1}{2}\coth(x)\sqrt{a\coth^2(x)-a}-\frac{1}{2}a\int \frac{1}{1-\frac{a\coth^2(x)}{a\coth^2(x)-a}}d\frac{\coth(x)}{\sqrt{a\coth^2(x)-a}}\right)\right)$$

$$\downarrow 219$$

$$-a\left(\frac{1}{4}\coth(x)\left(a\coth^2(x)-a\right)^{3/2}-\frac{3}{4}a\left(\frac{1}{2}\coth(x)\sqrt{a\coth^2(x)-a}-\frac{1}{2}\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(x)}{\sqrt{a\coth^2(x)-a}}\right)\right)\right)$$

input
```
Int[(a*Csch[x]^2)^(5/2),x]
```

output
```
-(a*((Coth[x]*(-a + a*Coth[x]^2)^(3/2))/4 - (3*a*(-1/2*(Sqrt[a]*ArcTanh[(S
qrt[a]*Coth[x])/Sqrt[-a + a*Coth[x]^2]]) + (Coth[x]*Sqrt[-a + a*Coth[x]^2]
)/2))/4))
```

#### 3.29.3.1 Defintions of rubi rules used

rule 211
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[x*((a + b*x^2)^p/(2*p + 1
)), x] + Simp[2*a*(p/(2*p + 1))   Int[(a + b*x^2)^(p - 1), x], x] /; FreeQ[
{a, b}, x] && GtQ[p, 0] && (IntegerQ[4*p] || IntegerQ[6*p])
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 224
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Subst[Int[1/(1 - b*x^2), x],
x, x/Sqrt[a + b*x^2]] /; FreeQ[{a, b}, x] &&  !GtQ[a, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.29.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 122 vs. $2(49) = 98$.

Time $= 0.33$ (sec) , antiderivative size $= 123$, normalized size of antiderivative $= 1.89$

| method | result | s |
|---|---|---|
| risch | $\frac{a^2\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\left(3e^{6x}-11e^{4x}-11e^{2x}+3\right)}{4\left(e^{2x}-1\right)^3}+\frac{3a^2e^{-x}\left(e^{2x}-1\right)\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\ln\left(e^x-1\right)}{8}-\frac{3a^2e^{-x}\left(e^{2x}-1\right)\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\ln\left(e^x+1\right)}{8}$ | 1 |

input
```
int((a*csch(x)^2)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
1/4*a^2/(exp(2*x)-1)^3*(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)*(3*exp(6*x)-11*ex
p(4*x)-11*exp(2*x)+3)+3/8*a^2*exp(-x)*(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)-1
)^2)^(1/2)*ln(exp(x)-1)-3/8*a^2*exp(-x)*(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)
-1)^2)^(1/2)*ln(exp(x)+1)
```

### 3.29.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1128 vs. $2(49) = 98$.

Time $= 0.27$ (sec) , antiderivative size $= 1128$, normalized size of antiderivative $= 17.35$

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2}\,dx = \text{Too large to display}$$

input
```
integrate((a*csch(x)^2)^(5/2),x, algorithm="fricas")
```

output
```
-1/8*(6*a^2*cosh(x)^7 - 6*(a^2*e^(2*x) - a^2)*sinh(x)^7 - 22*a^2*cosh(x)^5
 - 42*(a^2*cosh(x)*e^(2*x) - a^2*cosh(x))*sinh(x)^6 + 2*(63*a^2*cosh(x)^2
- 11*a^2 - (63*a^2*cosh(x)^2 - 11*a^2)*e^(2*x))*sinh(x)^5 - 22*a^2*cosh(x)
^3 + 10*(21*a^2*cosh(x)^3 - 11*a^2*cosh(x) - (21*a^2*cosh(x)^3 - 11*a^2*co
sh(x))*e^(2*x))*sinh(x)^4 + 2*(105*a^2*cosh(x)^4 - 110*a^2*cosh(x)^2 - 11*
a^2 - (105*a^2*cosh(x)^4 - 110*a^2*cosh(x)^2 - 11*a^2)*e^(2*x))*sinh(x)^3
+ 6*a^2*cosh(x) + 2*(63*a^2*cosh(x)^5 - 110*a^2*cosh(x)^3 - 33*a^2*cosh(x)
 - (63*a^2*cosh(x)^5 - 110*a^2*cosh(x)^3 - 33*a^2*cosh(x))*e^(2*x))*sinh(x
)^2 - 2*(3*a^2*cosh(x)^7 - 11*a^2*cosh(x)^5 - 11*a^2*cosh(x)^3 + 3*a^2*cos
h(x))*e^(2*x) + 3*(a^2*cosh(x)^8 - (a^2*e^(2*x) - a^2)*sinh(x)^8 - 4*a^2*c
osh(x)^6 - 8*(a^2*cosh(x)*e^(2*x) - a^2*cosh(x))*sinh(x)^7 + 4*(7*a^2*cosh
(x)^2 - a^2 - (7*a^2*cosh(x)^2 - a^2)*e^(2*x))*sinh(x)^6 + 6*a^2*cosh(x)^4
 + 8*(7*a^2*cosh(x)^3 - 3*a^2*cosh(x) - (7*a^2*cosh(x)^3 - 3*a^2*cosh(x))*
e^(2*x))*sinh(x)^5 + 2*(35*a^2*cosh(x)^4 - 30*a^2*cosh(x)^2 + 3*a^2 - (35*
a^2*cosh(x)^4 - 30*a^2*cosh(x)^2 + 3*a^2)*e^(2*x))*sinh(x)^4 - 4*a^2*cosh(
x)^2 + 8*(7*a^2*cosh(x)^5 - 10*a^2*cosh(x)^3 + 3*a^2*cosh(x) - (7*a^2*cosh
(x)^5 - 10*a^2*cosh(x)^3 + 3*a^2*cosh(x))*e^(2*x))*sinh(x)^3 + 4*(7*a^2*co
sh(x)^6 - 15*a^2*cosh(x)^4 + 9*a^2*cosh(x)^2 - a^2 - (7*a^2*cosh(x)^6 - 15
*a^2*cosh(x)^4 + 9*a^2*cosh(x)^2 - a^2)*e^(2*x))*sinh(x)^2 + a^2 - (a^2*co
sh(x)^8 - 4*a^2*cosh(x)^6 + 6*a^2*cosh(x)^4 - 4*a^2*cosh(x)^2 + a^2)*e^...
```

### 3.29.6 Sympy [F]

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2}\,dx = \int \left(a\,\operatorname{csch}^2(x)\right)^{\frac{5}{2}}\,dx$$

input
```
integrate((a*csch(x)**2)**(5/2),x)
```

output
```
Integral((a*csch(x)**2)**(5/2), x)
```

### 3.29.7 Maxima [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 92, normalized size of antiderivative = 1.42

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2}\,dx = \frac{3}{8}\,a^{\frac{5}{2}}\log\left(e^{(-x)}+1\right) - \frac{3}{8}\,a^{\frac{5}{2}}\log\left(e^{(-x)}-1\right) + \frac{3\,a^{\frac{5}{2}}e^{(-x)} - 11\,a^{\frac{5}{2}}e^{(-3\,x)} - 11\,a^{\frac{5}{2}}e^{(-5\,x)} + 3\,a^{\frac{5}{2}}e^{(-7\,x)}}{4\left(4\,e^{(-2\,x)} - 6\,e^{(-4\,x)} + 4\,e^{(-6\,x)} - e^{(-8\,x)} - 1\right)}$$

input
```
integrate((a*csch(x)^2)^(5/2),x, algorithm="maxima")
```

output
```
3/8*a^(5/2)*log(e^(-x) + 1) - 3/8*a^(5/2)*log(e^(-x) - 1) + 1/4*(3*a^(5/2)
*e^(-x) - 11*a^(5/2)*e^(-3*x) - 11*a^(5/2)*e^(-5*x) + 3*a^(5/2)*e^(-7*x))/
(4*e^(-2*x) - 6*e^(-4*x) + 4*e^(-6*x) - e^(-8*x) - 1)
```

### 3.29.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 75, normalized size of antiderivative = 1.15

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2}\,dx = \frac{1}{16}\,a^{\frac{5}{2}}\left(\frac{4\left(3\left(e^{(-x)}+e^{x}\right)^3 - 20\,e^{(-x)} - 20\,e^{x}\right)}{\left(\left(e^{(-x)}+e^{x}\right)^2-4\right)^2} - 3\log\left(e^{(-x)}+e^{x}+2\right) + 3\log\left(e^{(-x)}-e^{x}\right)\right)$$

input
```
integrate((a*csch(x)^2)^(5/2),x, algorithm="giac")
```

output
```
1/16*a^(5/2)*(4*(3*(e^(-x) + e^x)^3 - 20*e^(-x) - 20*e^x)/((e^(-x) + e^x)^
2 - 4)^2 - 3*log(e^(-x) + e^x + 2) + 3*log(e^(-x) + e^x - 2))*sgn(e^(3*x)
- e^x)
```

### 3.29.9 Mupad [F(-1)]

Timed out.

$$\int \left(a\operatorname{csch}^2(x)\right)^{5/2}\,dx = \int \left(\frac{a}{\sinh\left(x\right)^2}\right)^{5/2}\,dx$$

input
```
int((a/sinh(x)^2)^(5/2),x)
```

output
```
int((a/sinh(x)^2)^(5/2), x)
```

# 3.30 $\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx$

3.30.1 Optimal result . . . 233
3.30.2 Mathematica [A] (verified) . . . 233
3.30.3 Rubi [A] (verified) . . . 234
3.30.4 Maple [B] (verified) . . . 235
3.30.5 Fricas [B] (verification not implemented) . . . 236
3.30.6 Sympy [F] . . . 236
3.30.7 Maxima [A] (verification not implemented) . . . 237
3.30.8 Giac [A] (verification not implemented) . . . 237
3.30.9 Mupad [F(-1)] . . . 237

## 3.30.1 Optimal result

Integrand size = 10, antiderivative size = 46

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx = \frac{1}{2}a^{3/2}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(x)}{\sqrt{a\operatorname{csch}^2(x)}}\right) - \frac{1}{2}a\coth(x)\sqrt{a\operatorname{csch}^2(x)}$$

output
```
1/2*a^(3/2)*arctanh(coth(x)*a^(1/2)/(a*csch(x)^2)^(1/2))-1/2*a*coth(x)*(a*
csch(x)^2)^(1/2)
```

## 3.30.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.85

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx = -\frac{1}{2}a\sqrt{a\operatorname{csch}^2(x)}\left(\coth(x)\operatorname{csch}(x) - \log\left(\cosh\left(\frac{x}{2}\right)\right) + \log\left(\sinh\left(\frac{x}{2}\right)\right)\right)\sinh(x)$$

input
```
Integrate[(a*Csch[x]^2)^(3/2),x]
```

output
```
-1/2*(a*Sqrt[a*Csch[x]^2]*(Coth[x]*Csch[x] - Log[Cosh[x/2]] + Log[Sinh[x/2
]])*Sinh[x])
```

### 3.30.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.22, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4610, 211, 224, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx$$

$$\downarrow 3042$$

$$\int \left(-a\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{3/2}\,dx$$

$$\downarrow 4610$$

$$-a\int \sqrt{a\coth^2(x)-a}d\coth(x)$$

$$\downarrow 211$$

$$-a\left(\frac{1}{2}\coth(x)\sqrt{a\coth^2(x)-a}-\frac{1}{2}a\int \frac{1}{\sqrt{a\coth^2(x)-a}}d\coth(x)\right)$$

$$\downarrow 224$$

$$-a\left(\frac{1}{2}\coth(x)\sqrt{a\coth^2(x)-a}-\frac{1}{2}a\int \frac{1}{1-\frac{a\coth^2(x)}{a\coth^2(x)-a}}d\frac{\coth(x)}{\sqrt{a\coth^2(x)-a}}\right)$$

$$\downarrow 219$$

$$-a\left(\frac{1}{2}\coth(x)\sqrt{a\coth^2(x)-a}-\frac{1}{2}\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(x)}{\sqrt{a\coth^2(x)-a}}\right)\right)$$

input
```
Int[(a*Csch[x]^2)^(3/2),x]
```

output
```
-(a*(-1/2*(Sqrt[a]*ArcTanh[(Sqrt[a]*Coth[x])/Sqrt[-a + a*Coth[x]^2]]) + (C
oth[x]*Sqrt[-a + a*Coth[x]^2])/2))
```

#### 3.30.3.1 Defintions of rubi rules used

rule 211
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[x*((a + b*x^2)^p/(2*p + 1
)), x] + Simp[2*a*(p/(2*p + 1))   Int[(a + b*x^2)^(p - 1), x], x] /; FreeQ[
{a, b}, x] && GtQ[p, 0] && (IntegerQ[4*p] || IntegerQ[6*p])
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 224
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Subst[Int[1/(1 - b*x^2), x],
x, x/Sqrt[a + b*x^2]] /; FreeQ[{a, b}, x] &&  !GtQ[a, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.30.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 102 vs. $2(34) = 68$.

Time = 0.16 (sec) , antiderivative size = 103, normalized size of antiderivative = 2.24

| method | result | size |
|---|---|---|
| risch | $-\frac{a\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\left(1+e^{2x}\right)}{e^{2x}-1}+\frac{a\,e^{-x}\left(e^{2x}-1\right)\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\ln\left(e^{x}+1\right)}{2}-\frac{a\,e^{-x}\left(e^{2x}-1\right)\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\ln\left(e^{x}-1\right)}{2}$ | 103 |

input
```
int((a*csch(x)^2)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
-a/(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)*(1+exp(2*x))+1/2*a*exp(-
x)*(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)*ln(exp(x)+1)-1/2*a*exp(-
x)*(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)*ln(exp(x)-1)
```

### 3.30.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 340 vs. $2(34) = 68$.

Time $= 0.28$ (sec) , antiderivative size $= 340$, normalized size of antiderivative $= 7.39$

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx = \frac{\left(2\,a\cosh(x)^3 - 2\left(ae^{(2\,x)} - a\right)\sinh(x)^3 - 6\left(a\cosh(x)\,e^{(2\,x)} - a\cosh(x)\right)\sinh(x)^2 -}{}$$

input
```
integrate((a*csch(x)^2)^(3/2),x, algorithm="fricas")
```

output
```
1/2*(2*a*cosh(x)^3 - 2*(a*e^(2*x) - a)*sinh(x)^3 - 6*(a*cosh(x)*e^(2*x) -
a*cosh(x))*sinh(x)^2 + 2*a*cosh(x) - 2*(a*cosh(x)^3 + a*cosh(x))*e^(2*x) -
 (a*cosh(x)^4 - (a*e^(2*x) - a)*sinh(x)^4 - 4*(a*cosh(x)*e^(2*x) - a*cosh(
x))*sinh(x)^3 - 2*a*cosh(x)^2 + 2*(3*a*cosh(x)^2 - (3*a*cosh(x)^2 - a)*e^(
2*x) - a)*sinh(x)^2 - (a*cosh(x)^4 - 2*a*cosh(x)^2 + a)*e^(2*x) + 4*(a*cos
h(x)^3 - a*cosh(x) - (a*cosh(x)^3 - a*cosh(x))*e^(2*x))*sinh(x) + a)*log((
cosh(x) + sinh(x) + 1)/(cosh(x) + sinh(x) - 1)) + 2*(3*a*cosh(x)^2 - (3*a*
cosh(x)^2 + a)*e^(2*x) + a)*sinh(x))*sqrt(a/(e^(4*x) - 2*e^(2*x) + 1))*e^x
/(4*cosh(x)*e^x*sinh(x)^3 + e^x*sinh(x)^4 + 2*(3*cosh(x)^2 - 1)*e^x*sinh(x
)^2 + 4*(cosh(x)^3 - cosh(x))*e^x*sinh(x) + (cosh(x)^4 - 2*cosh(x)^2 + 1)*
e^x)
```

### 3.30.6 Sympy [F]

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx = \int \left(a\,\operatorname{csch}^2(x)\right)^{\frac{3}{2}}\,dx$$

input
```
integrate((a*csch(x)**2)**(3/2),x)
```

output
```
Integral((a*csch(x)**2)**(3/2), x)
```

### 3.30.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.30

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx = -\frac{1}{2}\,a^{\frac{3}{2}}\log\left(e^{(-x)}+1\right)+\frac{1}{2}\,a^{\frac{3}{2}}\log\left(e^{(-x)}-1\right)-\frac{a^{\frac{3}{2}}e^{(-x)}+a^{\frac{3}{2}}e^{(-3\,x)}}{2\,e^{(-2\,x)}-e^{(-4\,x)}-1}$$

input
```
integrate((a*csch(x)^2)^(3/2),x, algorithm="maxima")
```

output
```
-1/2*a^(3/2)*log(e^(-x) + 1) + 1/2*a^(3/2)*log(e^(-x) - 1) - (a^(3/2)*e^(-
x) + a^(3/2)*e^(-3*x))/(2*e^(-2*x) - e^(-4*x) - 1)
```

### 3.30.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.26

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx =$$
$$-\frac{1}{4}\,a^{\frac{3}{2}}\left(\frac{4\left(e^{(-x)}+e^{x}\right)}{\left(e^{(-x)}+e^{x}\right)^2-4}-\log\left(e^{(-x)}+e^{x}+2\right)+\log\left(e^{(-x)}+e^{x}-2\right)\right)\operatorname{sgn}\left(e^{(3\,x)}-e^{x}\right)$$

input
```
integrate((a*csch(x)^2)^(3/2),x, algorithm="giac")
```

output
```
-1/4*a^(3/2)*(4*(e^(-x) + e^x)/((e^(-x) + e^x)^2 - 4) - log(e^(-x) + e^x +
 2) + log(e^(-x) + e^x - 2))*sgn(e^(3*x) - e^x)
```

### 3.30.9 Mupad [F(-1)]

Timed out.

$$\int \left(a\operatorname{csch}^2(x)\right)^{3/2}\,dx = \int \left(\frac{a}{\sinh\left(x\right)^2}\right)^{3/2}\,dx$$

input
```
int((a/sinh(x)^2)^(3/2),x)
```

output
```
int((a/sinh(x)^2)^(3/2), x)
```

# 3.31 $\int \sqrt{a\operatorname{csch}^2(x)}\,dx$

3.31.1 Optimal result . . . 238
3.31.2 Mathematica [A] (verified) . . . 238
3.31.3 Rubi [A] (verified) . . . 239
3.31.4 Maple [B] (verified) . . . 240
3.31.5 Fricas [B] (verification not implemented) . . . 241
3.31.6 Sympy [F] . . . 241
3.31.7 Maxima [A] (verification not implemented) . . . 241
3.31.8 Giac [A] (verification not implemented) . . . 242
3.31.9 Mupad [F(-1)] . . . 242

## 3.31.1 Optimal result

Integrand size = 10, antiderivative size = 26

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx = -\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(x)}{\sqrt{a\operatorname{csch}^2(x)}}\right)$$

output
```
-arctanh(coth(x)*a^(1/2)/(a*csch(x)^2)^(1/2))*a^(1/2)
```

## 3.31.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.15

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx = \sqrt{a\operatorname{csch}^2(x)}\left(-\log\left(\cosh\left(\frac{x}{2}\right)\right)+\log\left(\sinh\left(\frac{x}{2}\right)\right)\right)\sinh(x)$$

input
```
Integrate[Sqrt[a*Csch[x]^2],x]
```

output
```
Sqrt[a*Csch[x]^2]*(-Log[Cosh[x/2]] + Log[Sinh[x/2]])*Sinh[x]
```

### 3.31.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.15, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4610, 224, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{-a\sec\left(\frac{\pi}{2}+ix\right)^2}\,dx$$

$$\downarrow 4610$$

$$-a\int \frac{1}{\sqrt{a\coth^2(x)-a}}d\coth(x)$$

$$\downarrow 224$$

$$-a\int \frac{1}{1-\frac{a\coth^2(x)}{a\coth^2(x)-a}}d\frac{\coth(x)}{\sqrt{a\coth^2(x)-a}}$$

$$\downarrow 219$$

$$-\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(x)}{\sqrt{a\coth^2(x)-a}}\right)$$

input
```
Int[Sqrt[a*Csch[x]^2],x]
```

output
```
-(Sqrt[a]*ArcTanh[(Sqrt[a]*Coth[x])/Sqrt[-a + a*Coth[x]^2]])
```

#### 3.31.3.1 Defintions of rubi rules used

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 224
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Subst[Int[1/(1 - b*x^2), x],
x, x/Sqrt[a + b*x^2]] /; FreeQ[{a, b}, x] &&  !GtQ[a, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.31.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 66 vs. $2(20) = 40$.

Time $= 0.17$ (sec) , antiderivative size $= 67$, normalized size of antiderivative $= 2.58$

| method | result | size |
|---|---|---|
| risch | $-\mathrm{e}^{-x}(\mathrm{e}^{2x}-1)\sqrt{\frac{a\,\mathrm{e}^{2x}}{(\mathrm{e}^{2x}-1)^2}}\,\ln(\mathrm{e}^{x}+1)+\mathrm{e}^{-x}(\mathrm{e}^{2x}-1)\sqrt{\frac{a\,\mathrm{e}^{2x}}{(\mathrm{e}^{2x}-1)^2}}\,\ln(\mathrm{e}^{x}-1)$ | 67 |

input
```
int((a*csch(x)^2)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-exp(-x)*(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)*ln(exp(x)+1)+exp(-
x)*(exp(2*x)-1)*(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)*ln(exp(x)-1)
```

### 3.31.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 55 vs. $2(20) = 40$.

Time $= 0.26$ (sec) , antiderivative size $= 97$, normalized size of antiderivative $= 3.73$

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx$$

$$= \left[\sqrt{\frac{a}{e^{(4x)} - 2\,e^{(2x)} + 1}}\left(e^{(2x)} - 1\right)\log\left(\frac{\cosh(x) + \sinh(x) - 1}{\cosh(x) + \sinh(x) + 1}\right), 2\sqrt{-a}\arctan\left(\frac{\sqrt{-a}\sqrt{\frac{a}{e^{(4x)} - 2\,e^{(2x)} + 1}}\left(e^{(}\right.\right.\right.$$
$$\left.\left.\left.a\cosh(x)\,e^{x} + a e^{x}\,\mathrm{s}\right.\right.\right.$$

input
```
integrate((a*csch(x)^2)^(1/2),x, algorithm="fricas")
```

output
```
[sqrt(a/(e^(4*x) - 2*e^(2*x) + 1))*(e^(2*x) - 1)*log((cosh(x) + sinh(x) -
1)/(cosh(x) + sinh(x) + 1)), 2*sqrt(-a)*arctan(sqrt(-a)*sqrt(a/(e^(4*x) -
2*e^(2*x) + 1))*(e^(2*x) - 1)*e^x/(a*cosh(x)*e^x + a*e^x*sinh(x)))]
```

### 3.31.6 Sympy [F]

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx = \int \sqrt{a\,\operatorname{csch}^2(x)}\,dx$$

input
```
integrate((a*csch(x)**2)**(1/2),x)
```

output
```
Integral(sqrt(a*csch(x)**2), x)
```

### 3.31.7 Maxima [A] (verification not implemented)

Time $= 0.26$ (sec) , antiderivative size $= 24$, normalized size of antiderivative $= 0.92$

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx = \sqrt{a}\log\left(e^{(-x)} + 1\right) - \sqrt{a}\log\left(e^{(-x)} - 1\right)$$

input
```
integrate((a*csch(x)^2)^(1/2),x, algorithm="maxima")
```

output
```
sqrt(a)*log(e^(-x) + 1) - sqrt(a)*log(e^(-x) - 1)
```

### 3.31.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.12

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx = -\sqrt{a}(\log(e^x+1)-\log(|e^x-1|))\operatorname{sgn}\left(e^{(3x)}-e^x\right)$$

input
```
integrate((a*csch(x)^2)^(1/2),x, algorithm="giac")
```

output
```
-sqrt(a)*(log(e^x + 1) - log(abs(e^x - 1)))*sgn(e^(3*x) - e^x)
```

### 3.31.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{a\operatorname{csch}^2(x)}\,dx = \int \sqrt{\frac{a}{\sinh(x)^2}}\,dx$$

input
```
int((a/sinh(x)^2)^(1/2),x)
```

output
```
int((a/sinh(x)^2)^(1/2), x)
```

# 3.32 $\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx$

3.32.1 Optimal result . . . . . 243
3.32.2 Mathematica [A] (verified) . . . . . 243
3.32.3 Rubi [A] (verified) . . . . . 244
3.32.4 Maple [B] (verified) . . . . . 245
3.32.5 Fricas [B] (verification not implemented) . . . . . 245
3.32.6 Sympy [F] . . . . . 246
3.32.7 Maxima [A] (verification not implemented) . . . . . 246
3.32.8 Giac [B] (verification not implemented) . . . . . 246
3.32.9 Mupad [B] (verification not implemented) . . . . . 247

## 3.32.1 Optimal result

Integrand size = 10, antiderivative size = 13

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx = \frac{\coth(x)}{\sqrt{a\operatorname{csch}^2(x)}}$$

output
```
coth(x)/(a*csch(x)^2)^(1/2)
```

## 3.32.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 13, normalized size of antiderivative = 1.00

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx = \frac{\coth(x)}{\sqrt{a\operatorname{csch}^2(x)}}$$

input
```
Integrate[1/Sqrt[a*Csch[x]^2],x]
```

output
```
Coth[x]/Sqrt[a*Csch[x]^2]
```

### 3.32.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.31, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.300$, Rules used = {3042, 4610, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{-a\sec\left(\frac{\pi}{2}+ix\right)^2}}dx$$

$$\downarrow 4610$$

$$-a\int \frac{1}{\left(a\coth^2(x)-a\right)^{3/2}}d\coth(x)$$

$$\downarrow 208$$

$$\frac{\coth(x)}{\sqrt{a\coth^2(x)-a}}$$

input
```
Int[1/Sqrt[a*Csch[x]^2],x]
```

output
```
Coth[x]/Sqrt[-a + a*Coth[x]^2]
```

#### 3.32.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.32.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 57 vs. $2(11) = 22$.

Time = 0.16 (sec) , antiderivative size = 58, normalized size of antiderivative = 4.46

| method | result | size |
|---|---|---|
| risch | $\frac{e^{2x}}{2\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}\left(e^{2x}-1\right)}+\frac{1}{2\left(e^{2x}-1\right)\sqrt{\frac{a\,e^{2x}}{\left(e^{2x}-1\right)^2}}}$ | 58 |

input
```
int(1/(a*csch(x)^2)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/2/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)/(exp(2*x)-1)*exp(2*x)+1/2/(exp(2*x)-
1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)
```

### 3.32.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 83 vs. $2(11) = 22$.

Time = 0.27 (sec) , antiderivative size = 83, normalized size of antiderivative = 6.38

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx$$
$$= \frac{\left(\left(e^{(2\,x)}-1\right)\sinh(x)^2-\cosh(x)^2+\left(\cosh(x)^2+1\right)e^{(2\,x)}+2\left(\cosh(x)\,e^{(2\,x)}-\cosh(x)\right)\sinh(x)-1\right)\sqrt{\frac{a}{e^{(4}}}}{2\left(a\cosh(x)\,e^x+a e^x\sinh(x)\right)}$$

input
```
integrate(1/(a*csch(x)^2)^(1/2),x, algorithm="fricas")
```

output
```
1/2*((e^(2*x) - 1)*sinh(x)^2 - cosh(x)^2 + (cosh(x)^2 + 1)*e^(2*x) + 2*(co
sh(x)*e^(2*x) - cosh(x))*sinh(x) - 1)*sqrt(a/(e^(4*x) - 2*e^(2*x) + 1))*e^
x/(a*cosh(x)*e^x + a*e^x*sinh(x))
```

### 3.32.6 Sympy [F]

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx = \int \frac{1}{\sqrt{a\,\operatorname{csch}^2(x)}}\,dx$$

input
```
integrate(1/(a*csch(x)**2)**(1/2),x)
```

output
```
Integral(1/sqrt(a*csch(x)**2), x)
```

### 3.32.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.31

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx = -\frac{e^{(-x)}}{2\sqrt{a}} - \frac{e^{x}}{2\sqrt{a}}$$

input
```
integrate(1/(a*csch(x)^2)^(1/2),x, algorithm="maxima")
```

output
```
-1/2*e^(-x)/sqrt(a) - 1/2*e^x/sqrt(a)
```

### 3.32.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 24 vs. 2(11) = 22.

Time = 0.28 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.85

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx = \frac{e^{(-x)} + e^{x}}{2\sqrt{a}\operatorname{sgn}\left(e^{(3\,x)} - e^{x}\right)}$$

input
```
integrate(1/(a*csch(x)^2)^(1/2),x, algorithm="giac")
```

output
```
1/2*(e^(-x) + e^x)/(sqrt(a)*sgn(e^(3*x) - e^x))
```

### 3.32.9 Mupad [B] (verification not implemented)

Time = 2.31 (sec) , antiderivative size = 33, normalized size of antiderivative = 2.54

$$\int \frac{1}{\sqrt{a\operatorname{csch}^2(x)}}\,dx = -\frac{\left(\frac{e^{-2x}}{2}-\frac{e^{2x}}{2}\right)\sqrt{\frac{1}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^2}}}{2\sqrt{a}}$$

input
```
int(1/(a/sinh(x)^2)^(1/2),x)
```

output
```
-((exp(-2*x)/2 - exp(2*x)/2)*(1/(exp(-x)/2 - exp(x)/2)^2)^(1/2))/(2*a^(1/2
))
```

# 3.33 $\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx$


3.33.1 Optimal result . . . . . 248
3.33.2 Mathematica [A] (verified) . . . . . 248
3.33.3 Rubi [A] (verified) . . . . . 249
3.33.4 Maple [B] (verified) . . . . . 250
3.33.5 Fricas [B] (verification not implemented) . . . . . 251
3.33.6 Sympy [F] . . . . . 251
3.33.7 Maxima [A] (verification not implemented) . . . . . 252
3.33.8 Giac [A] (verification not implemented) . . . . . 252
3.33.9 Mupad [F(-1)] . . . . . 252


## 3.33.1 Optimal result

Integrand size = 10, antiderivative size = 36

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \frac{\coth(x)}{3\left(a\operatorname{csch}^2(x)\right)^{3/2}} - \frac{2\coth(x)}{3a\sqrt{a\operatorname{csch}^2(x)}}$$

output
```
1/3*coth(x)/(a*csch(x)^2)^(3/2)-2/3*coth(x)/a/(a*csch(x)^2)^(1/2)
```

## 3.33.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.75

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \frac{(-9\cosh(x)+\cosh(3x))\operatorname{csch}^3(x)}{12\left(a\operatorname{csch}^2(x)\right)^{3/2}}$$

input
```
Integrate[(a*Csch[x]^2)^(-3/2),x]
```

output
```
((-9*Cosh[x] + Cosh[3*x])*Csch[x]^3)/(12*(a*Csch[x]^2)^(3/2))
```

### 3.33.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.39, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {3042, 4610, 209, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(-a\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{3/2}}dx$$

$$\downarrow 4610$$

$$-a\int \frac{1}{\left(a\coth^2(x)-a\right)^{5/2}}d\coth(x)$$

$$\downarrow 209$$

$$-a\left(-\frac{2\int \frac{1}{\left(a\coth^2(x)-a\right)^{3/2}}d\coth(x)}{3a}-\frac{\coth(x)}{3a\left(a\coth^2(x)-a\right)^{3/2}}\right)$$

$$\downarrow 208$$

$$-a\left(\frac{2\coth(x)}{3a^2\sqrt{a\coth^2(x)-a}}-\frac{\coth(x)}{3a\left(a\coth^2(x)-a\right)^{3/2}}\right)$$

input
```
Int[(a*Csch[x]^2)^(-3/2),x]
```

output
```
-(a*(-1/3*Coth[x]/(a*(-a + a*Coth[x]^2)^(3/2)) + (2*Coth[x])/(3*a^2*Sqrt[-
a + a*Coth[x]^2])))
```

#### 3.33.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 209
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(-x)*((a + b*x^2)^(p + 1)
/(2*a*(p + 1))), x] + Simp[(2*p + 3)/(2*a*(p + 1))   Int[(a + b*x^2)^(p + 1
), x], x] /; FreeQ[{a, b}, x] && ILtQ[p + 3/2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.33.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 129 vs. $2(28) = 56$.

Time $= 0.16$ (sec) , antiderivative size $= 130$, normalized size of antiderivative $= 3.61$

| method | result | size |
|---|---|---|
| risch | $\frac{e^{4x}}{24a(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} - \frac{3\,e^{2x}}{8a(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} - \frac{3}{8\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}\,(e^{2x}-1)a} + \frac{e^{-2x}}{24a(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}}$ | 130 |

input
```
int(1/(a*csch(x)^2)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/24/a*exp(4*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)-3/8/a*exp(2
*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)-3/8/(a*exp(2*x)/(exp(2*
x)-1)^2)^(1/2)/(exp(2*x)-1)/a+1/24/a*exp(-2*x)/(exp(2*x)-1)/(a*exp(2*x)/(e
xp(2*x)-1)^2)^(1/2)
```

### 3.33.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 285 vs. $2(28) = 56$.

Time $= 0.27$ (sec) , antiderivative size $= 285$, normalized size of antiderivative $= 7.92$

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \frac{\left(\left(e^{(2\,x)}-1\right)\sinh(x)^6-\cosh(x)^6+6\left(\cosh(x)\,e^{(2\,x)}-\cosh(x)\right)\sinh(x)^5-3\left(5\,\cos\right.\right.}{}$$

input
```
integrate(1/(a*csch(x)^2)^(3/2),x, algorithm="fricas")
```

output
```
1/24*((e^(2*x) - 1)*sinh(x)^6 - cosh(x)^6 + 6*(cosh(x)*e^(2*x) - cosh(x))*
sinh(x)^5 - 3*(5*cosh(x)^2 - (5*cosh(x)^2 - 3)*e^(2*x) - 3)*sinh(x)^4 + 9*
cosh(x)^4 - 4*(5*cosh(x)^3 - (5*cosh(x)^3 - 9*cosh(x))*e^(2*x) - 9*cosh(x)
)*sinh(x)^3 - 3*(5*cosh(x)^4 - 18*cosh(x)^2 - (5*cosh(x)^4 - 18*cosh(x)^2
- 3)*e^(2*x) - 3)*sinh(x)^2 + 9*cosh(x)^2 + (cosh(x)^6 - 9*cosh(x)^4 - 9*c
osh(x)^2 + 1)*e^(2*x) - 6*(cosh(x)^5 - 6*cosh(x)^3 - (cosh(x)^5 - 6*cosh(x
)^3 - 3*cosh(x))*e^(2*x) - 3*cosh(x))*sinh(x) - 1)*sqrt(a/(e^(4*x) - 2*e^(
2*x) + 1))*e^x/(a^2*cosh(x)^3*e^x + 3*a^2*cosh(x)^2*e^x*sinh(x) + 3*a^2*co
sh(x)*e^x*sinh(x)^2 + a^2*e^x*sinh(x)^3)
```

### 3.33.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}^2(x)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**2)**(3/2),x)
```

output
```
Integral((a*csch(x)**2)**(-3/2), x)
```

### 3.33.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.97

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = -\frac{e^{(3x)}}{24\,a^{\frac{3}{2}}} + \frac{3\,e^{(-x)}}{8\,a^{\frac{3}{2}}} - \frac{e^{(-3x)}}{24\,a^{\frac{3}{2}}} + \frac{3\,e^{x}}{8\,a^{\frac{3}{2}}}$$

input
```
integrate(1/(a*csch(x)^2)^(3/2),x, algorithm="maxima")
```

output
```
-1/24*e^(3*x)/a^(3/2) + 3/8*e^(-x)/a^(3/2) - 1/24*e^(-3*x)/a^(3/2) + 3/8*e
^x/a^(3/2)
```

### 3.33.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.14

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = -\frac{\left(9\,e^{(2x)}-1\right)e^{(-3x)} - e^{(3x)} + 9\,e^{x}}{24\,a^{\frac{3}{2}}\operatorname{sgn}\left(e^{(3x)}-e^{x}\right)}$$

input
```
integrate(1/(a*csch(x)^2)^(3/2),x, algorithm="giac")
```

output
```
-1/24*((9*e^(2*x) - 1)*e^(-3*x) - e^(3*x) + 9*e^x)/(a^(3/2)*sgn(e^(3*x) -
e^x))
```

### 3.33.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^2}\right)^{3/2}}\,dx$$

input
```
int(1/(a/sinh(x)^2)^(3/2),x)
```

output
```
int(1/(a/sinh(x)^2)^(3/2), x)
```

# 3.34 $\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx$

3.34.1 Optimal result . . . 253
3.34.2 Mathematica [A] (verified) . . . 253
3.34.3 Rubi [A] (verified) . . . 254
3.34.4 Maple [B] (verified) . . . 255
3.34.5 Fricas [B] (verification not implemented) . . . 256
3.34.6 Sympy [F] . . . 257
3.34.7 Maxima [A] (verification not implemented) . . . 257
3.34.8 Giac [A] (verification not implemented) . . . 257
3.34.9 Mupad [F(-1)] . . . 258

## 3.34.1 Optimal result

Integrand size = 10, antiderivative size = 55

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \frac{\coth(x)}{5\left(a\operatorname{csch}^2(x)\right)^{5/2}} - \frac{4\coth(x)}{15a\left(a\operatorname{csch}^2(x)\right)^{3/2}} + \frac{8\coth(x)}{15a^2\sqrt{a\operatorname{csch}^2(x)}}$$

output
```
1/5*coth(x)/(a*csch(x)^2)^(5/2)-4/15*coth(x)/a/(a*csch(x)^2)^(3/2)+8/15*co
th(x)/a^2/(a*csch(x)^2)^(1/2)
```

## 3.34.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 36, normalized size of antiderivative = 0.65

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \frac{(150\cosh(x) - 25\cosh(3x) + 3\cosh(5x))\sqrt{a\operatorname{csch}^2(x)}\sinh(x)}{240a^3}$$

input
```
Integrate[(a*Csch[x]^2)^(-5/2),x]
```

output
```
((150*Cosh[x] - 25*Cosh[3*x] + 3*Cosh[5*x])*Sqrt[a*Csch[x]^2]*Sinh[x])/(24
0*a^3)
```

### 3.34.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 81, normalized size of antiderivative = 1.47, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4610, 209, 209, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(-a\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{5/2}}dx$$

$$\downarrow 4610$$

$$-a\int \frac{1}{\left(a\coth^2(x)-a\right)^{7/2}}d\coth(x)$$

$$\downarrow 209$$

$$-a\left(-\frac{4\int \frac{1}{\left(a\coth^2(x)-a\right)^{5/2}}d\coth(x)}{5a}-\frac{\coth(x)}{5a\left(a\coth^2(x)-a\right)^{5/2}}\right)$$

$$\downarrow 209$$

$$-a\left(-\frac{4\left(-\frac{2\int \frac{1}{\left(a\coth^2(x)-a\right)^{3/2}}d\coth(x)}{3a}-\frac{\coth(x)}{3a\left(a\coth^2(x)-a\right)^{3/2}}\right)}{5a}-\frac{\coth(x)}{5a\left(a\coth^2(x)-a\right)^{5/2}}\right)$$

$$\downarrow 208$$

$$-a\left(-\frac{4\left(\frac{2\coth(x)}{3a^2\sqrt{a\coth^2(x)-a}}-\frac{\coth(x)}{3a\left(a\coth^2(x)-a\right)^{3/2}}\right)}{5a}-\frac{\coth(x)}{5a\left(a\coth^2(x)-a\right)^{5/2}}\right)$$

input
```
Int[(a*Csch[x]^2)^(-5/2),x]
```

output
```
-(a*(-1/5*Coth[x]/(a*(-a + a*Coth[x]^2)^(5/2)) - (4*(-1/3*Coth[x]/(a*(-a +
 a*Coth[x]^2)^(3/2)) + (2*Coth[x])/(3*a^2*Sqrt[-a + a*Coth[x]^2])))/(5*a))
)
```

#### 3.34.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 209
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(-x)*((a + b*x^2)^(p + 1)
/(2*a*(p + 1))), x] + Simp[(2*p + 3)/(2*a*(p + 1))   Int[(a + b*x^2)^(p + 1
), x], x] /; FreeQ[{a, b}, x] && ILtQ[p + 3/2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.34.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 195 vs. $2(43) = 86$.

Time $= 0.16$ (sec) , antiderivative size $= 196$, normalized size of antiderivative $= 3.56$

| method | result |
|---|---|
| risch | $\frac{e^{6x}}{160a^2(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} - \frac{5\,e^{4x}}{96a^2(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} + \frac{5\,e^{2x}}{16a^2(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} + \frac{5}{16\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}\,(e^{2x}-1)a^2} - \frac{5}{96a^2(e^{2x}-$ |

input
```
int(1/(a*csch(x)^2)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
1/160/a^2*exp(6*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)-5/96/a^2
*exp(4*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)+5/16/a^2*exp(2*x)
/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)+5/16/(a*exp(2*x)/(exp(2*x)
-1)^2)^(1/2)/(exp(2*x)-1)/a^2-5/96/a^2*exp(-2*x)/(exp(2*x)-1)/(a*exp(2*x)/
(exp(2*x)-1)^2)^(1/2)+1/160/a^2*exp(-4*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*
x)-1)^2)^(1/2)
```

### 3.34.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 590 vs. $2(43) = 86$.

Time = 0.27 (sec) , antiderivative size = 590, normalized size of antiderivative = 10.73

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \text{Too large to display}$$

input
```
integrate(1/(a*csch(x)^2)^(5/2),x, algorithm="fricas")
```

output
```
1/480*(3*(e^(2*x) - 1)*sinh(x)^10 - 3*cosh(x)^10 + 30*(cosh(x)*e^(2*x) - c
osh(x))*sinh(x)^9 - 5*(27*cosh(x)^2 - (27*cosh(x)^2 - 5)*e^(2*x) - 5)*sinh
(x)^8 + 25*cosh(x)^8 - 40*(9*cosh(x)^3 - (9*cosh(x)^3 - 5*cosh(x))*e^(2*x)
 - 5*cosh(x))*sinh(x)^7 - 10*(63*cosh(x)^4 - 70*cosh(x)^2 - (63*cosh(x)^4
- 70*cosh(x)^2 + 15)*e^(2*x) + 15)*sinh(x)^6 - 150*cosh(x)^6 - 4*(189*cosh
(x)^5 - 350*cosh(x)^3 - (189*cosh(x)^5 - 350*cosh(x)^3 + 225*cosh(x))*e^(2
*x) + 225*cosh(x))*sinh(x)^5 - 10*(63*cosh(x)^6 - 175*cosh(x)^4 + 225*cosh
(x)^2 - (63*cosh(x)^6 - 175*cosh(x)^4 + 225*cosh(x)^2 + 15)*e^(2*x) + 15)*
sinh(x)^4 - 150*cosh(x)^4 - 40*(9*cosh(x)^7 - 35*cosh(x)^5 + 75*cosh(x)^3
- (9*cosh(x)^7 - 35*cosh(x)^5 + 75*cosh(x)^3 + 15*cosh(x))*e^(2*x) + 15*co
sh(x))*sinh(x)^3 - 5*(27*cosh(x)^8 - 140*cosh(x)^6 + 450*cosh(x)^4 + 180*c
osh(x)^2 - (27*cosh(x)^8 - 140*cosh(x)^6 + 450*cosh(x)^4 + 180*cosh(x)^2 -
 5)*e^(2*x) - 5)*sinh(x)^2 + 25*cosh(x)^2 + (3*cosh(x)^10 - 25*cosh(x)^8 +
 150*cosh(x)^6 + 150*cosh(x)^4 - 25*cosh(x)^2 + 3)*e^(2*x) - 10*(3*cosh(x)
^9 - 20*cosh(x)^7 + 90*cosh(x)^5 + 60*cosh(x)^3 - (3*cosh(x)^9 - 20*cosh(x
)^7 + 90*cosh(x)^5 + 60*cosh(x)^3 - 5*cosh(x))*e^(2*x) - 5*cosh(x))*sinh(x
) - 3)*sqrt(a/(e^(4*x) - 2*e^(2*x) + 1))*e^x/(a^3*cosh(x)^5*e^x + 5*a^3*co
sh(x)^4*e^x*sinh(x) + 10*a^3*cosh(x)^3*e^x*sinh(x)^2 + 10*a^3*cosh(x)^2*e^
x*sinh(x)^3 + 5*a^3*cosh(x)*e^x*sinh(x)^4 + a^3*e^x*sinh(x)^5)
```

### 3.34.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}^2(x)\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**2)**(5/2),x)
```

output
```
Integral((a*csch(x)**2)**(-5/2), x)
```

### 3.34.7 Maxima [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 53, normalized size of antiderivative = 0.96

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = -\frac{e^{(5x)}}{160\,a^{\frac{5}{2}}} + \frac{5\,e^{(3x)}}{96\,a^{\frac{5}{2}}} - \frac{5\,e^{(-x)}}{16\,a^{\frac{5}{2}}} + \frac{5\,e^{(-3x)}}{96\,a^{\frac{5}{2}}} - \frac{e^{(-5x)}}{160\,a^{\frac{5}{2}}} - \frac{5\,e^{x}}{16\,a^{\frac{5}{2}}}$$

input
```
integrate(1/(a*csch(x)^2)^(5/2),x, algorithm="maxima")
```

output
```
-1/160*e^(5*x)/a^(5/2) + 5/96*e^(3*x)/a^(5/2) - 5/16*e^(-x)/a^(5/2) + 5/96
*e^(-3*x)/a^(5/2) - 1/160*e^(-5*x)/a^(5/2) - 5/16*e^x/a^(5/2)
```

### 3.34.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 53, normalized size of antiderivative = 0.96

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \frac{\left(150\,e^{(4x)} - 25\,e^{(2x)} + 3\right)e^{(-5x)} + 3\,e^{(5x)} - 25\,e^{(3x)} + 150\,e^{x}}{480\,a^{\frac{5}{2}}\operatorname{sgn}\left(e^{(3x)} - e^{x}\right)}$$

input
```
integrate(1/(a*csch(x)^2)^(5/2),x, algorithm="giac")
```

output
```
1/480*((150*e^(4*x) - 25*e^(2*x) + 3)*e^(-5*x) + 3*e^(5*x) - 25*e^(3*x) +
150*e^x)/(a^(5/2)*sgn(e^(3*x) - e^x))
```

### 3.34.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^2}\right)^{5/2}}\,dx$$

input
```
int(1/(a/sinh(x)^2)^(5/2),x)
```

output
```
int(1/(a/sinh(x)^2)^(5/2), x)
```

# 3.35 $\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx$


3.35.1 Optimal result . . . 259
3.35.2 Mathematica [A] (verified) . . . 259
3.35.3 Rubi [A] (verified) . . . 260
3.35.4 Maple [B] (verified) . . . 262
3.35.5 Fricas [B] (verification not implemented) . . . 262
3.35.6 Sympy [F] . . . 263
3.35.7 Maxima [A] (verification not implemented) . . . 264
3.35.8 Giac [A] (verification not implemented) . . . 264
3.35.9 Mupad [F(-1)] . . . 264


## 3.35.1 Optimal result

Integrand size = 10, antiderivative size = 74

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \frac{\coth(x)}{7\left(a\operatorname{csch}^2(x)\right)^{7/2}} - \frac{6\coth(x)}{35a\left(a\operatorname{csch}^2(x)\right)^{5/2}} + \frac{8\coth(x)}{35a^2\left(a\operatorname{csch}^2(x)\right)^{3/2}} - \frac{16\coth(x)}{35a^3\sqrt{a\operatorname{csch}^2(x)}}$$

output

```
1/7*coth(x)/(a*csch(x)^2)^(7/2)-6/35*coth(x)/a/(a*csch(x)^2)^(5/2)+8/35*co
th(x)/a^2/(a*csch(x)^2)^(3/2)-16/35*coth(x)/a^3/(a*csch(x)^2)^(1/2)
```

## 3.35.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 42, normalized size of antiderivative = 0.57

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \frac{(-1225\cosh(x) + 245\cosh(3x) - 49\cosh(5x) + 5\cosh(7x))\sqrt{a\operatorname{csch}^2(x)}\sinh(x)}{2240a^4}$$

input

```
Integrate[(a*Csch[x]^2)^(-7/2),x]
```

output

```
((-1225*Cosh[x] + 245*Cosh[3*x] - 49*Cosh[5*x] + 5*Cosh[7*x])*Sqrt[a*Csch[
x]^2]*Sinh[x])/(2240*a^4)
```

### 3.35.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 112, normalized size of antiderivative = 1.51, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {3042, 4610, 209, 209, 209, 208}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(-a\sec\left(\frac{\pi}{2}+ix\right)^2\right)^{7/2}}dx$$

$$\downarrow 4610$$

$$-a\int \frac{1}{\left(a\coth^2(x)-a\right)^{9/2}}d\coth(x)$$

$$\downarrow 209$$

$$-a\left(-\frac{6\int \frac{1}{\left(a\coth^2(x)-a\right)^{7/2}}d\coth(x)}{7a}-\frac{\coth(x)}{7a\left(a\coth^2(x)-a\right)^{7/2}}\right)$$

$$\downarrow 209$$

$$-a\left(-\frac{6\left(-\frac{4\int \frac{1}{\left(a\coth^2(x)-a\right)^{5/2}}d\coth(x)}{5a}-\frac{\coth(x)}{5a\left(a\coth^2(x)-a\right)^{5/2}}\right)}{7a}-\frac{\coth(x)}{7a\left(a\coth^2(x)-a\right)^{7/2}}\right)$$

$$\downarrow 209$$

$$-a\left(-\frac{6\left(-\frac{4\left(-\frac{2\int\frac{1}{\left(a\coth^2(x)-a\right)^{3/2}}d\coth(x)}{3a}-\frac{\coth(x)}{3a\left(a\coth^2(x)-a\right)^{3/2}}\right)}{5a}-\frac{\coth(x)}{5a\left(a\coth^2(x)-a\right)^{5/2}}\right)}{7a}-\frac{\coth(x)}{7a\left(a\coth^2(x)-a\right)^{7/2}}\right)$$

$$\downarrow 208$$

$$-a\left(-\frac{6\left(-\frac{4\left(\frac{2\coth(x)}{3a^2\sqrt{a\coth^2(x)-a}}-\frac{\coth(x)}{3a\left(a\coth^2(x)-a\right)^{3/2}}\right)}{5a}-\frac{\coth(x)}{5a\left(a\coth^2(x)-a\right)^{5/2}}\right)}{7a}-\frac{\coth(x)}{7a\left(a\coth^2(x)-a\right)^{7/2}}\right)$$

input
```
Int[(a*Csch[x]^2)^(-7/2),x]
```

output
```
-(a*(-1/7*Coth[x]/(a*(-a + a*Coth[x]^2)^(7/2)) - (6*(-1/5*Coth[x]/(a*(-a +
 a*Coth[x]^2)^(5/2)) - (4*(-1/3*Coth[x]/(a*(-a + a*Coth[x]^2)^(3/2)) + (2*
Coth[x])/(3*a^2*Sqrt[-a + a*Coth[x]^2])))/(5*a)))/(7*a)))
```

### 3.35.3.1 Defintions of rubi rules used

rule 208
```
Int[((a_) + (b_.)*(x_)^2)^(-3/2), x_Symbol] :> Simp[x/(a*Sqrt[a + b*x^2]),
x] /; FreeQ[{a, b}, x]
```

rule 209
```
Int[((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(-x)*((a + b*x^2)^(p + 1)
/(2*a*(p + 1))), x] + Simp[(2*p + 3)/(2*a*(p + 1))   Int[(a + b*x^2)^(p + 1
), x], x] /; FreeQ[{a, b}, x] && ILtQ[p + 3/2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4610
```
Int[((b_.)*sec[(e_.) + (f_.)*(x_)]^2)^(p_), x_Symbol] :> With[{ff = FreeFac
tors[Tan[e + f*x], x]}, Simp[b*(ff/f)   Subst[Int[(b + b*ff^2*x^2)^(p - 1),
 x], x, Tan[e + f*x]/ff], x]] /; FreeQ[{b, e, f, p}, x] &&  !IntegerQ[p]
```

### 3.35.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 261 vs. $2(58) = 116$.

Time = 0.15 (sec) , antiderivative size = 262, normalized size of antiderivative = 3.54

| method | result |
|---|---|
| risch | $\frac{e^{8x}}{896a^3(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} - \frac{7e^{6x}}{640a^3(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} + \frac{7e^{4x}}{128a^3(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} - \frac{35e^{2x}}{128a^3(e^{2x}-1)\sqrt{\frac{a\,e^{2x}}{(e^{2x}-1)^2}}} - \frac{}{128\sqrt{}}$ |

input
```
int(1/(a*csch(x)^2)^(7/2),x,method=_RETURNVERBOSE)
```

output
```
1/896/a^3*exp(8*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)-7/640/a^
3*exp(6*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)+7/128/a^3*exp(4*
x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)-35/128/a^3*exp(2*x)/(exp
(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^(1/2)-35/128/(a*exp(2*x)/(exp(2*x)-1)
^2)^(1/2)/(exp(2*x)-1)/a^3+7/128/a^3*exp(-2*x)/(exp(2*x)-1)/(a*exp(2*x)/(e
xp(2*x)-1)^2)^(1/2)-7/640/a^3*exp(-4*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)
-1)^2)^(1/2)+1/896/a^3*exp(-6*x)/(exp(2*x)-1)/(a*exp(2*x)/(exp(2*x)-1)^2)^
(1/2)
```

### 3.35.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 984 vs. $2(58) = 116$.

Time = 0.28 (sec) , antiderivative size = 984, normalized size of antiderivative = 13.30

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \text{Too large to display}$$

input
```
integrate(1/(a*csch(x)^2)^(7/2),x, algorithm="fricas")
```

output
```
1/4480*(5*(e^(2*x) - 1)*sinh(x)^14 - 5*cosh(x)^14 + 70*(cosh(x)*e^(2*x) -
cosh(x))*sinh(x)^13 - 7*(65*cosh(x)^2 - (65*cosh(x)^2 - 7)*e^(2*x) - 7)*si
nh(x)^12 + 49*cosh(x)^12 - 28*(65*cosh(x)^3 - (65*cosh(x)^3 - 21*cosh(x))*
e^(2*x) - 21*cosh(x))*sinh(x)^11 - 7*(715*cosh(x)^4 - 462*cosh(x)^2 - (715
*cosh(x)^4 - 462*cosh(x)^2 + 35)*e^(2*x) + 35)*sinh(x)^10 - 245*cosh(x)^10
 - 70*(143*cosh(x)^5 - 154*cosh(x)^3 - (143*cosh(x)^5 - 154*cosh(x)^3 + 35
*cosh(x))*e^(2*x) + 35*cosh(x))*sinh(x)^9 - 35*(429*cosh(x)^6 - 693*cosh(x
)^4 + 315*cosh(x)^2 - (429*cosh(x)^6 - 693*cosh(x)^4 + 315*cosh(x)^2 - 35)
*e^(2*x) - 35)*sinh(x)^8 + 1225*cosh(x)^8 - 8*(2145*cosh(x)^7 - 4851*cosh(
x)^5 + 3675*cosh(x)^3 - (2145*cosh(x)^7 - 4851*cosh(x)^5 + 3675*cosh(x)^3
- 1225*cosh(x))*e^(2*x) - 1225*cosh(x))*sinh(x)^7 - 7*(2145*cosh(x)^8 - 64
68*cosh(x)^6 + 7350*cosh(x)^4 - 4900*cosh(x)^2 - (2145*cosh(x)^8 - 6468*co
sh(x)^6 + 7350*cosh(x)^4 - 4900*cosh(x)^2 - 175)*e^(2*x) - 175)*sinh(x)^6
+ 1225*cosh(x)^6 - 14*(715*cosh(x)^9 - 2772*cosh(x)^7 + 4410*cosh(x)^5 - 4
900*cosh(x)^3 - (715*cosh(x)^9 - 2772*cosh(x)^7 + 4410*cosh(x)^5 - 4900*co
sh(x)^3 - 525*cosh(x))*e^(2*x) - 525*cosh(x))*sinh(x)^5 - 35*(143*cosh(x)^
10 - 693*cosh(x)^8 + 1470*cosh(x)^6 - 2450*cosh(x)^4 - 525*cosh(x)^2 - (14
3*cosh(x)^10 - 693*cosh(x)^8 + 1470*cosh(x)^6 - 2450*cosh(x)^4 - 525*cosh(
x)^2 + 7)*e^(2*x) + 7)*sinh(x)^4 - 245*cosh(x)^4 - 140*(13*cosh(x)^11 - 77
*cosh(x)^9 + 210*cosh(x)^7 - 490*cosh(x)^5 - 175*cosh(x)^3 - (13*cosh(x...
```

### 3.35.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}^2(x)\right)^{\frac{7}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**2)**(7/2),x)
```

output
```
Integral((a*csch(x)**2)**(-7/2), x)
```

### 3.35.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 71, normalized size of antiderivative = 0.96

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = -\frac{e^{(7x)}}{896\,a^{\frac{7}{2}}} + \frac{7\,e^{(5x)}}{640\,a^{\frac{7}{2}}} - \frac{7\,e^{(3x)}}{128\,a^{\frac{7}{2}}} + \frac{35\,e^{(-x)}}{128\,a^{\frac{7}{2}}} - \frac{7\,e^{(-3x)}}{128\,a^{\frac{7}{2}}} + \frac{7\,e^{(-5x)}}{640\,a^{\frac{7}{2}}} - \frac{e^{(-7x)}}{896\,a^{\frac{7}{2}}} + \frac{35\,e^{x}}{128\,a^{\frac{7}{2}}}$$

input
```
integrate(1/(a*csch(x)^2)^(7/2),x, algorithm="maxima")
```

output
```
-1/896*e^(7*x)/a^(7/2) + 7/640*e^(5*x)/a^(7/2) - 7/128*e^(3*x)/a^(7/2) + 3
5/128*e^(-x)/a^(7/2) - 7/128*e^(-3*x)/a^(7/2) + 7/640*e^(-5*x)/a^(7/2) - 1
/896*e^(-7*x)/a^(7/2) + 35/128*e^x/a^(7/2)
```

### 3.35.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 65, normalized size of antiderivative = 0.88

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = -\frac{\left(1225\,e^{(6x)} - 245\,e^{(4x)} + 49\,e^{(2x)} - 5\right)e^{(-7x)} - 5\,e^{(7x)} + 49\,e^{(5x)} - 245\,e^{(3x)} + 1225\,e^{x}}{4480\,a^{\frac{7}{2}}\operatorname{sgn}\left(e^{(3x)} - e^{x}\right)}$$

input
```
integrate(1/(a*csch(x)^2)^(7/2),x, algorithm="giac")
```

output
```
-1/4480*((1225*e^(6*x) - 245*e^(4*x) + 49*e^(2*x) - 5)*e^(-7*x) - 5*e^(7*x
) + 49*e^(5*x) - 245*e^(3*x) + 1225*e^x)/(a^(7/2)*sgn(e^(3*x) - e^x))
```

### 3.35.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^2(x)\right)^{7/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^2}\right)^{7/2}}\,dx$$

input
```
int(1/(a/sinh(x)^2)^(7/2),x)
```

output
```
int(1/(a/sinh(x)^2)^(7/2), x)
```

# 3.36 $\int \left(a\text{csch}^3(x)\right)^{5/2}\,dx$

3.36.1 Optimal result . . . 266
3.36.2 Mathematica [A] (verified) . . . 266
3.36.3 Rubi [A] (verified) . . . 267
3.36.4 Maple [F] . . . 270
3.36.5 Fricas [C] (verification not implemented) . . . 270
3.36.6 Sympy [F] . . . 271
3.36.7 Maxima [F] . . . 271
3.36.8 Giac [F] . . . 271
3.36.9 Mupad [F(-1)] . . . 272

## 3.36.1 Optimal result

Integrand size = 10, antiderivative size = 135

$$\int \left(a\text{csch}^3(x)\right)^{5/2}\,dx = -\frac{154}{585}a^2\coth(x)\sqrt{a\text{csch}^3(x)} + \frac{22}{117}a^2\coth(x)\text{csch}^2(x)\sqrt{a\text{csch}^3(x)} - \frac{2}{13}a^2\coth(x)\text{csch}^4(x)\sqrt{a\text{csch}^3(x)} + \frac{154}{195}a^2\cosh(x)\sqrt{a\text{csch}^3(x)}\sinh(x) - \frac{154ia^2\sqrt{a\text{csch}^3(x)}E\left(\frac{\pi}{4}-\frac{ix}{2}\middle|2\right)\sinh^2(x)}{195\sqrt{i\sinh(x)}}$$

output

```
-154/585*a^2*coth(x)*(a*csch(x)^3)^(1/2)+22/117*a^2*coth(x)*csch(x)^2*(a*c
sch(x)^3)^(1/2)-2/13*a^2*coth(x)*csch(x)^4*(a*csch(x)^3)^(1/2)+154/195*a^2
*cosh(x)*sinh(x)*(a*csch(x)^3)^(1/2)-154/195*I*a^2*(sin(1/4*Pi+1/2*I*x)^2)
^(1/2)/sin(1/4*Pi+1/2*I*x)*EllipticE(cos(1/4*Pi+1/2*I*x),2^(1/2))*sinh(x)^
2*(a*csch(x)^3)^(1/2)/(I*sinh(x))^(1/2)
```

## 3.36.2 Mathematica [A] (verified)

Time = 0.14 (sec) , antiderivative size = 68, normalized size of antiderivative = 0.50

$$\int \left(a\text{csch}^3(x)\right)^{5/2}\,dx = -\frac{2}{585}a^2\sqrt{a\text{csch}^3(x)}\left(-231\cosh(x) + \coth(x)\text{csch}(x)\left(77 - 55\text{csch}^2(x) + 45\text{csch}^4(x)\right) + 231E\left(\frac{1}{4}(\pi-2ix)\middle|2\right)\sqrt{i\sinh(x)}\right)\sinh(x)$$

input
```
Integrate[(a*Csch[x]^3)^(5/2),x]
```

output
```
(-2*a^2*Sqrt[a*Csch[x]^3]*(-231*Cosh[x] + Coth[x]*Csch[x]*(77 - 55*Csch[x]
^2 + 45*Csch[x]^4) + 231*EllipticE[(Pi - (2*I)*x)/4, 2]*Sqrt[I*Sinh[x]])*S
inh[x])/585
```

### 3.36.3 Rubi [A] (verified)

Time = 0.69 (sec) , antiderivative size = 150, normalized size of antiderivative = 1.11, number of steps used = 14, number of rules used = 14, $\frac{\text{number of rules}}{\text{integrand size}} = 1.400$, Rules used = {3042, 4611, 3042, 4255, 3042, 4255, 3042, 4255, 3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\operatorname{csch}^3(x)\right)^{5/2}\,dx$$

$$\downarrow 3042$$

$$\int \left(ia\sec\left(\frac{\pi}{2}+ix\right)^3\right)^{5/2}dx$$

$$\downarrow 4611$$

$$-\frac{a^2\sqrt{a\operatorname{csch}^3(x)}\int(i\operatorname{csch}(x))^{15/2}dx}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$-\frac{a^2\sqrt{a\operatorname{csch}^3(x)}\int(-\csc(ix))^{15/2}dx}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$-\frac{a^2\sqrt{a\operatorname{csch}^3(x)}\left(\frac{11}{13}\int(i\operatorname{csch}(x))^{11/2}dx-\frac{2}{13}i\cosh(x)(i\operatorname{csch}(x))^{13/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$-\frac{a^2\sqrt{a\operatorname{csch}^3(x)}\left(\frac{11}{13}\int(-\csc(ix))^{11/2}dx-\frac{2}{13}i\cosh(x)(i\operatorname{csch}(x))^{13/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\int(i\operatorname{csch}(x))^{7/2}dx-\frac{2}{9}i\cosh(x)(i\operatorname{csch}(x))^{9/2}\right)-\frac{2}{13}i\cosh(x)(i\operatorname{csch}(x))^{13/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\int(-\csc(ix))^{7/2}dx-\frac{2}{9}i\cosh(x)(i\operatorname{csch}(x))^{9/2}\right)-\frac{2}{13}i\cosh(x)(i\operatorname{csch}(x))^{13/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\int(i\operatorname{csch}(x))^{3/2}dx-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(x)(i\operatorname{csch}(x))^{9/2}\right)-\frac{2}{13}i\cosh(x)(ics\right.}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\int(-\csc(ix))^{3/2}dx-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(x)(i\operatorname{csch}(x))^{9/2}\right)-\frac{2}{13}i\cosh(x)(i\right.}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\left(-\int\frac{1}{\sqrt{i\operatorname{csch}(x)}}dx-2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(x)(i\right.\right.}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\left(-\int\frac{1}{\sqrt{-\csc(ix)}}dx-2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(x)(icsc\right.\right.}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4258$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\left(-\frac{\int\sqrt{i\sinh(x)}dx}{\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}}-2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(\right.\right.}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$-\frac{a^2\sqrt{\operatorname{acsch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\left(-\frac{\int\sqrt{\sin(ix)}dx}{\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}}-2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(\right.\right.}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3119$$

$$-\frac{a^2\sqrt{a\operatorname{csch}^3(x)}\left(\frac{11}{13}\left(\frac{7}{9}\left(\frac{3}{5}\left(-2i\cosh(x)\sqrt{i\operatorname{csch}(x)}-\frac{2iE\left(\frac{\pi}{4}-\frac{ix}{2}\middle|2\right)}{\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}}\right)-\frac{2}{5}i\cosh(x)(i\operatorname{csch}(x))^{5/2}\right)-\frac{2}{9}i\cosh(x\right.}{(i\operatorname{csch}(x))^{3/2}}$$

input
```
Int[(a*Csch[x]^3)^(5/2),x]
```

output
```
-((a^2*Sqrt[a*Csch[x]^3]*(((-2*I)/13)*Cosh[x]*(I*Csch[x])^(13/2) + (11*(((
-2*I)/9)*Cosh[x]*(I*Csch[x])^(9/2) + (7*(((-2*I)/5)*Cosh[x]*(I*Csch[x])^(5
/2) + (3*((-2*I)*Cosh[x]*Sqrt[I*Csch[x]] - ((2*I)*EllipticE[Pi/4 - (I/2)*x
, 2])/(Sqrt[I*Csch[x]]*Sqrt[I*Sinh[x]])))/5))/9))/13))/(I*Csch[x])^(3/2))
```

### 3.36.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.36.4 Maple [F]

$$\int \left(a \operatorname{csch}(x)^3\right)^{\frac{5}{2}} dx$$

input
```
int((a*csch(x)^3)^(5/2),x)
```

output
```
int((a*csch(x)^3)^(5/2),x)
```

### 3.36.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.11 (sec) , antiderivative size = 1389, normalized size of antiderivative = 10.29

$$\int \left(a\operatorname{csch}^3(x)\right)^{5/2} dx = \text{Too large to display}$$

input
```
integrate((a*csch(x)^3)^(5/2),x, algorithm="fricas")
```

output
```
2/585*(231*sqrt(2)*(a^2*cosh(x)^12 + 12*a^2*cosh(x)*sinh(x)^11 + a^2*sinh(
x)^12 - 6*a^2*cosh(x)^10 + 6*(11*a^2*cosh(x)^2 - a^2)*sinh(x)^10 + 15*a^2*
cosh(x)^8 + 20*(11*a^2*cosh(x)^3 - 3*a^2*cosh(x))*sinh(x)^9 + 15*(33*a^2*c
osh(x)^4 - 18*a^2*cosh(x)^2 + a^2)*sinh(x)^8 - 20*a^2*cosh(x)^6 + 24*(33*a
^2*cosh(x)^5 - 30*a^2*cosh(x)^3 + 5*a^2*cosh(x))*sinh(x)^7 + 4*(231*a^2*co
sh(x)^6 - 315*a^2*cosh(x)^4 + 105*a^2*cosh(x)^2 - 5*a^2)*sinh(x)^6 + 15*a^
2*cosh(x)^4 + 24*(33*a^2*cosh(x)^7 - 63*a^2*cosh(x)^5 + 35*a^2*cosh(x)^3 -
 5*a^2*cosh(x))*sinh(x)^5 + 15*(33*a^2*cosh(x)^8 - 84*a^2*cosh(x)^6 + 70*a
^2*cosh(x)^4 - 20*a^2*cosh(x)^2 + a^2)*sinh(x)^4 - 6*a^2*cosh(x)^2 + 20*(1
1*a^2*cosh(x)^9 - 36*a^2*cosh(x)^7 + 42*a^2*cosh(x)^5 - 20*a^2*cosh(x)^3 +
 3*a^2*cosh(x))*sinh(x)^3 + 6*(11*a^2*cosh(x)^10 - 45*a^2*cosh(x)^8 + 70*a
^2*cosh(x)^6 - 50*a^2*cosh(x)^4 + 15*a^2*cosh(x)^2 - a^2)*sinh(x)^2 + a^2
+ 12*(a^2*cosh(x)^11 - 5*a^2*cosh(x)^9 + 10*a^2*cosh(x)^7 - 10*a^2*cosh(x)
^5 + 5*a^2*cosh(x)^3 - a^2*cosh(x))*sinh(x))*sqrt(a)*weierstrassZeta(4, 0,
 weierstrassPInverse(4, 0, cosh(x) + sinh(x))) + sqrt(2)*(231*a^2*cosh(x)^
13 + 3003*a^2*cosh(x)*sinh(x)^12 + 231*a^2*sinh(x)^13 - 1540*a^2*cosh(x)^1
1 + 154*(117*a^2*cosh(x)^2 - 10*a^2)*sinh(x)^11 + 4367*a^2*cosh(x)^9 + 169
4*(39*a^2*cosh(x)^3 - 10*a^2*cosh(x))*sinh(x)^10 + 11*(15015*a^2*cosh(x)^4
 - 7700*a^2*cosh(x)^2 + 397*a^2)*sinh(x)^9 - 6808*a^2*cosh(x)^7 + 33*(9009
*a^2*cosh(x)^5 - 7700*a^2*cosh(x)^3 + 1191*a^2*cosh(x))*sinh(x)^8 + 4*(...
```

### 3.36.6 Sympy [F]

$$\int \left(a\operatorname{csch}^3(x)\right)^{5/2}\,dx = \int \left(a\,\operatorname{csch}^3\left(x\right)\right)^{\frac{5}{2}}\,dx$$

input
```
integrate((a*csch(x)**3)**(5/2),x)
```

output
```
Integral((a*csch(x)**3)**(5/2), x)
```

### 3.36.7 Maxima [F]

$$\int \left(a\operatorname{csch}^3(x)\right)^{5/2}\,dx = \int \left(a\,\operatorname{csch}\left(x\right)^3\right)^{\frac{5}{2}}\,dx$$

input
```
integrate((a*csch(x)^3)^(5/2),x, algorithm="maxima")
```

output
```
integrate((a*csch(x)^3)^(5/2), x)
```

### 3.36.8 Giac [F]

$$\int \left(a\operatorname{csch}^3(x)\right)^{5/2}\,dx = \int \left(a\,\operatorname{csch}\left(x\right)^3\right)^{\frac{5}{2}}\,dx$$

input
```
integrate((a*csch(x)^3)^(5/2),x, algorithm="giac")
```

output
```
integrate((a*csch(x)^3)^(5/2), x)
```

### 3.36.9 Mupad [F(-1)]

Timed out.

$$\int \left(a\operatorname{csch}^3(x)\right)^{5/2}\,dx = \int \left(\frac{a}{\sinh\left(x\right)^3}\right)^{5/2}\,dx$$

input
```
int((a/sinh(x)^3)^(5/2),x)
```

output
```
int((a/sinh(x)^3)^(5/2), x)
```

# 3.37 $\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx$


3.37.1 Optimal result . . . . . 273
3.37.2 Mathematica [A] (verified) . . . . . 273
3.37.3 Rubi [A] (verified) . . . . . 274
3.37.4 Maple [F] . . . . . 276
3.37.5 Fricas [C] (verification not implemented) . . . . . 276
3.37.6 Sympy [F] . . . . . 277
3.37.7 Maxima [F] . . . . . 277
3.37.8 Giac [F] . . . . . 277
3.37.9 Mupad [F(-1)] . . . . . 278


## 3.37.1 Optimal result

Integrand size = 10, antiderivative size = 81

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx = \frac{10}{21}a\cosh(x)\sqrt{a\operatorname{csch}^3(x)} - \frac{2}{7}a\coth(x)\operatorname{csch}(x)\sqrt{a\operatorname{csch}^3(x)} + \frac{10}{21}ia\sqrt{a\operatorname{csch}^3(x)}\,\text{EllipticF}\left(\frac{\pi}{4}-\frac{ix}{2},2\right)\sqrt{i\sinh(x)}\sinh(x)$$

output
```
10/21*a*cosh(x)*(a*csch(x)^3)^(1/2)-2/7*a*coth(x)*csch(x)*(a*csch(x)^3)^(1
/2)+10/21*I*a*(sin(1/4*Pi+1/2*I*x)^2)^(1/2)/sin(1/4*Pi+1/2*I*x)*EllipticF(
cos(1/4*Pi+1/2*I*x),2^(1/2))*sinh(x)*(a*csch(x)^3)^(1/2)*(I*sinh(x))^(1/2)
```

## 3.37.2 Mathematica [A] (verified)

Time = 0.11 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.69

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx = -\frac{2}{21}a\sqrt{a\operatorname{csch}^3(x)}\left(\coth(x)\left(-5+3\operatorname{csch}^2(x)\right) - 5i\,\text{EllipticF}\left(\frac{1}{4}(\pi-2ix),2\right)\sqrt{i\sinh(x)}\right)\sinh(x)$$

input
```
Integrate[(a*Csch[x]^3)^(3/2),x]
```

output
```
(-2*a*Sqrt[a*Csch[x]^3]*(Coth[x]*(-5 + 3*Csch[x]^2) - (5*I)*EllipticF[(Pi
- (2*I)*x)/4, 2]*Sqrt[I*Sinh[x]])*Sinh[x])/21
```

### 3.37.3 Rubi [A] (verified)

Time = 0.46 (sec) , antiderivative size = 108, normalized size of antiderivative = 1.33, number of steps used = 10, number of rules used = 10, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 4611, 3042, 4255, 3042, 4255, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\operatorname{acsch}^3(x)\right)^{3/2}\,dx$$

$$\downarrow 3042$$

$$\int \left(ia\sec\left(\frac{\pi}{2}+ix\right)^3\right)^{3/2}dx$$

$$\downarrow 4611$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\int(i\operatorname{csch}(x))^{9/2}dx}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\int(-\csc(ix))^{9/2}dx}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\int(i\operatorname{csch}(x))^{5/2}dx-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))^{7/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\int(-\csc(ix))^{5/2}dx-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))^{7/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\left(\frac{1}{3}\int\sqrt{i\operatorname{csch}(x)}dx-\frac{2}{3}i\cosh(x)(i\operatorname{csch}(x))^{3/2}\right)-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))^{7/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\left(\frac{1}{3}\int\sqrt{-\csc(ix)}dx-\frac{2}{3}i\cosh(x)(i\operatorname{csch}(x))^{3/2}\right)-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))^{7/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4258$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\left(\frac{1}{3}\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\int\frac{1}{\sqrt{i\sinh(x)}}dx-\frac{2}{3}i\cosh(x)(i\operatorname{csch}(x))^{3/2}\right)-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))^{7/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\left(\frac{1}{3}\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\int\frac{1}{\sqrt{\sin(ix)}}dx-\frac{2}{3}i\cosh(x)(i\operatorname{csch}(x))^{3/2}\right)-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))^{7/2}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3120$$

$$\frac{ia\sqrt{\operatorname{acsch}^3(x)}\left(\frac{5}{7}\left(\frac{2}{3}i\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\operatorname{EllipticF}\left(\frac{\pi}{4}-\frac{ix}{2},2\right)-\frac{2}{3}i\cosh(x)(i\operatorname{csch}(x))^{3/2}\right)-\frac{2}{7}i\cosh(x)(i\operatorname{csch}(x))\right.}{(i\operatorname{csch}(x))^{3/2}}$$

input
```
Int[(a*Csch[x]^3)^(3/2),x]
```

output
```
(I*a*Sqrt[a*Csch[x]^3]*(((-2*I)/7)*Cosh[x]*(I*Csch[x])^(7/2) + (5*(((-2*I)
/3)*Cosh[x]*(I*Csch[x])^(3/2) + ((2*I)/3)*Sqrt[I*Csch[x]]*EllipticF[Pi/4 -
 (I/2)*x, 2]*Sqrt[I*Sinh[x]]))/7))/(I*Csch[x])^(3/2)
```

### 3.37.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.37.4 Maple [F]

$$\int \left(a \operatorname{csch}(x)^3\right)^{\frac{3}{2}} dx$$

input
```
int((a*csch(x)^3)^(3/2),x)
```

output
```
int((a*csch(x)^3)^(3/2),x)
```

### 3.37.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 395, normalized size of antiderivative = 4.88

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2} dx = \frac{2\left(5\sqrt{2}\left(a\cosh(x)^6 + 6\,a\cosh(x)\sinh(x)^5 + a\sinh(x)^6 - 3\,a\cosh(x)^4 + 3\left(5\,a\cosh\right.\right.\right.}$$

input
```
integrate((a*csch(x)^3)^(3/2),x, algorithm="fricas")
```

output
```
2/21*(5*sqrt(2)*(a*cosh(x)^6 + 6*a*cosh(x)*sinh(x)^5 + a*sinh(x)^6 - 3*a*c
osh(x)^4 + 3*(5*a*cosh(x)^2 - a)*sinh(x)^4 + 4*(5*a*cosh(x)^3 - 3*a*cosh(x
))*sinh(x)^3 + 3*a*cosh(x)^2 + 3*(5*a*cosh(x)^4 - 6*a*cosh(x)^2 + a)*sinh(
x)^2 + 6*(a*cosh(x)^5 - 2*a*cosh(x)^3 + a*cosh(x))*sinh(x) - a)*sqrt(a)*we
ierstrassPInverse(4, 0, cosh(x) + sinh(x)) + sqrt(2)*(5*a*cosh(x)^6 + 30*a
*cosh(x)*sinh(x)^5 + 5*a*sinh(x)^6 - 17*a*cosh(x)^4 + (75*a*cosh(x)^2 - 17
*a)*sinh(x)^4 + 4*(25*a*cosh(x)^3 - 17*a*cosh(x))*sinh(x)^3 - 17*a*cosh(x)
^2 + (75*a*cosh(x)^4 - 102*a*cosh(x)^2 - 17*a)*sinh(x)^2 + 2*(15*a*cosh(x)
^5 - 34*a*cosh(x)^3 - 17*a*cosh(x))*sinh(x) + 5*a)*sqrt((a*cosh(x) + a*sin
h(x))/(cosh(x)^2 + 2*cosh(x)*sinh(x) + sinh(x)^2 - 1)))/(cosh(x)^6 + 6*cos
h(x)*sinh(x)^5 + sinh(x)^6 + 3*(5*cosh(x)^2 - 1)*sinh(x)^4 - 3*cosh(x)^4 +
 4*(5*cosh(x)^3 - 3*cosh(x))*sinh(x)^3 + 3*(5*cosh(x)^4 - 6*cosh(x)^2 + 1)
*sinh(x)^2 + 3*cosh(x)^2 + 6*(cosh(x)^5 - 2*cosh(x)^3 + cosh(x))*sinh(x) -
 1)
```

### 3.37.6 Sympy [F]

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx = \int \left(a\,\operatorname{csch}^3(x)\right)^{\frac{3}{2}}\,dx$$

input
```
integrate((a*csch(x)**3)**(3/2),x)
```

output
```
Integral((a*csch(x)**3)**(3/2), x)
```

### 3.37.7 Maxima [F]

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx = \int \left(a\,\operatorname{csch}(x)^3\right)^{\frac{3}{2}}\,dx$$

input
```
integrate((a*csch(x)^3)^(3/2),x, algorithm="maxima")
```

output
```
integrate((a*csch(x)^3)^(3/2), x)
```

### 3.37.8 Giac [F]

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx = \int \left(a\,\operatorname{csch}(x)^3\right)^{\frac{3}{2}}\,dx$$

input
```
integrate((a*csch(x)^3)^(3/2),x, algorithm="giac")
```

output
```
integrate((a*csch(x)^3)^(3/2), x)
```

### 3.37.9 Mupad [F(-1)]

Timed out.

$$\int \left(a\operatorname{csch}^3(x)\right)^{3/2}\,dx = \int \left(\frac{a}{\sinh\left(x\right)^3}\right)^{3/2}\,dx$$

input
```
int((a/sinh(x)^3)^(3/2),x)
```

output
```
int((a/sinh(x)^3)^(3/2), x)
```

# 3.38 $\int \sqrt{a\operatorname{csch}^3(x)}\,dx$

3.38.1 Optimal result . . . 279
3.38.2 Mathematica [A] (verified) . . . 279
3.38.3 Rubi [A] (verified) . . . 280
3.38.4 Maple [F] . . . 282
3.38.5 Fricas [C] (verification not implemented) . . . 282
3.38.6 Sympy [F] . . . 282
3.38.7 Maxima [F] . . . 283
3.38.8 Giac [F] . . . 283
3.38.9 Mupad [F(-1)] . . . 283

## 3.38.1 Optimal result

Integrand size = 10, antiderivative size = 56

$$\int \sqrt{a\operatorname{csch}^3(x)}\,dx = -2i\sqrt{a\operatorname{csch}^3(x)}E\left(\frac{\pi}{4}-\frac{ix}{2}\middle|2\right)(i\sinh(x))^{3/2} - 2\cosh(x)\sqrt{a\operatorname{csch}^3(x)}\sinh(x)$$

output
```
-2*I*(sin(1/4*Pi+1/2*I*x)^2)^(1/2)/sin(1/4*Pi+1/2*I*x)*EllipticE(cos(1/4*P
i+1/2*I*x),2^(1/2))*(I*sinh(x))^(3/2)*(a*csch(x)^3)^(1/2)-2*cosh(x)*sinh(x
)*(a*csch(x)^3)^(1/2)
```

## 3.38.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 42, normalized size of antiderivative = 0.75

$$\int \sqrt{a\operatorname{csch}^3(x)}\,dx = -2\sqrt{a\operatorname{csch}^3(x)}\left(\cosh(x) - E\left(\frac{1}{4}(\pi-2ix)\middle|2\right)\sqrt{i\sinh(x)}\right)\sinh(x)$$

input
```
Integrate[Sqrt[a*Csch[x]^3],x]
```

output
```
-2*Sqrt[a*Csch[x]^3]*(Cosh[x] - EllipticE[(Pi - (2*I)*x)/4, 2]*Sqrt[I*Sinh
[x]])*Sinh[x]
```

### 3.38.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 77, normalized size of antiderivative = 1.38, number of steps used = 8, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}} = 0.800$, Rules used = {3042, 4611, 3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{a\operatorname{csch}^3(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{ia\sec\left(\frac{\pi}{2}+ix\right)^3}\,dx$$

$$\downarrow 4611$$

$$\frac{\sqrt{a\operatorname{csch}^3(x)}\int (i\operatorname{csch}(x))^{3/2}dx}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{\sqrt{a\operatorname{csch}^3(x)}\int (-\csc(ix))^{3/2}dx}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4255$$

$$\frac{\sqrt{a\operatorname{csch}^3(x)}\left(-\int \frac{1}{\sqrt{i\operatorname{csch}(x)}}dx - 2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{\sqrt{a\operatorname{csch}^3(x)}\left(-\int \frac{1}{\sqrt{-\csc(ix)}}dx - 2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 4258$$

$$\frac{\sqrt{a\operatorname{csch}^3(x)}\left(-\frac{\int \sqrt{i\sinh(x)}dx}{\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}} - 2i\cosh(x)\sqrt{i\operatorname{csch}(x)}\right)}{(i\operatorname{csch}(x))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{\sqrt{acsch^3(x)}\left(-\frac{\int\sqrt{\sin(ix)}dx}{\sqrt{i\sinh(x)}\sqrt{icsch(x)}}-2i\cosh(x)\sqrt{icsch(x)}\right)}{(icsch(x))^{3/2}}$$

$$\downarrow 3119$$

$$\frac{\sqrt{acsch^3(x)}\left(-2i\cosh(x)\sqrt{icsch(x)}-\frac{2iE\left(\frac{\pi}{4}-\frac{ix}{2}|2\right)}{\sqrt{i\sinh(x)}\sqrt{icsch(x)}}\right)}{(icsch(x))^{3/2}}$$

input
```
Int[Sqrt[a*Csch[x]^3],x]
```

output
```
(Sqrt[a*Csch[x]^3]*((-2*I)*Cosh[x]*Sqrt[I*Csch[x]] - ((2*I)*EllipticE[Pi/4
 - (I/2)*x, 2])/(Sqrt[I*Csch[x]]*Sqrt[I*Sinh[x]])))/(I*Csch[x])^(3/2)
```

### 3.38.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.38.4 Maple [F]

$$\int \sqrt{a \operatorname{csch}(x)^3}\, dx$$

input
```
int((a*csch(x)^3)^(1/2),x)
```

output
```
int((a*csch(x)^3)^(1/2),x)
```

### 3.38.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.07

$$\begin{aligned}
&\int \sqrt{a\operatorname{csch}^3(x)}\, dx \\
&= -2\sqrt{2}\sqrt{\frac{a\cosh(x) + a\sinh(x)}{\cosh(x)^2 + 2\cosh(x)\sinh(x) + \sinh(x)^2 - 1}}(\cosh(x) + \sinh(x)) \\
&\quad - 2\sqrt{2}\sqrt{a}\,\text{weierstrassZeta}(4, 0, \text{weierstrassPInverse}(4, 0, \cosh(x) + \sinh(x)))
\end{aligned}$$

input
```
integrate((a*csch(x)^3)^(1/2),x, algorithm="fricas")
```

output
```
-2*sqrt(2)*sqrt((a*cosh(x) + a*sinh(x))/(cosh(x)^2 + 2*cosh(x)*sinh(x) + s
inh(x)^2 - 1))*(cosh(x) + sinh(x)) - 2*sqrt(2)*sqrt(a)*weierstrassZeta(4,
0, weierstrassPInverse(4, 0, cosh(x) + sinh(x)))
```

### 3.38.6 Sympy [F]

$$\int \sqrt{a\operatorname{csch}^3(x)}\, dx = \int \sqrt{a \operatorname{csch}^3(x)}\, dx$$

input
```
integrate((a*csch(x)**3)**(1/2),x)
```

output
```
Integral(sqrt(a*csch(x)**3), x)
```

### 3.38.7 Maxima [F]

$$\int \sqrt{a\operatorname{csch}^3(x)}\,dx = \int \sqrt{a\,\operatorname{csch}(x)^3}\,dx$$

input
```
integrate((a*csch(x)^3)^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(a*csch(x)^3), x)
```

### 3.38.8 Giac [F]

$$\int \sqrt{a\operatorname{csch}^3(x)}\,dx = \int \sqrt{a\,\operatorname{csch}(x)^3}\,dx$$

input
```
integrate((a*csch(x)^3)^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(a*csch(x)^3), x)
```

### 3.38.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{a\operatorname{csch}^3(x)}\,dx = \int \sqrt{\frac{a}{\sinh(x)^3}}\,dx$$

input
```
int((a/sinh(x)^3)^(1/2),x)
```

output
```
int((a/sinh(x)^3)^(1/2), x)
```

# 3.39 $\int \frac{1}{\sqrt{a\,\mathbf{csch}^3(x)}}\,dx$


3.39.1 Optimal result . . . . . 284
3.39.2 Mathematica [A] (verified) . . . . . 284
3.39.3 Rubi [A] (verified) . . . . . 285
3.39.4 Maple [F] . . . . . 287
3.39.5 Fricas [C] (verification not implemented) . . . . . 287
3.39.6 Sympy [F] . . . . . 288
3.39.7 Maxima [F] . . . . . 288
3.39.8 Giac [F] . . . . . 288
3.39.9 Mupad [F(-1)] . . . . . 289


## 3.39.1 Optimal result

Integrand size = 10, antiderivative size = 62

$$\int \frac{1}{\sqrt{a\,\text{csch}^3(x)}}\,dx = \frac{2\coth(x)}{3\sqrt{a\,\text{csch}^3(x)}} - \frac{2i\,\text{csch}^2(x)\,\text{EllipticF}\left(\frac{\pi}{4} - \frac{ix}{2}, 2\right)\sqrt{i\sinh(x)}}{3\sqrt{a\,\text{csch}^3(x)}}$$

output
```
2/3*coth(x)/(a*csch(x)^3)^(1/2)-2/3*I*csch(x)^2*(sin(1/4*Pi+1/2*I*x)^2)^(1
/2)/sin(1/4*Pi+1/2*I*x)*EllipticF(cos(1/4*Pi+1/2*I*x),2^(1/2))*(I*sinh(x))
^(1/2)/(a*csch(x)^3)^(1/2)
```

## 3.39.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 43, normalized size of antiderivative = 0.69

$$\int \frac{1}{\sqrt{a\,\text{csch}^3(x)}}\,dx = \frac{2\left(\coth(x) + \frac{\text{csch}(x)\,\text{EllipticF}\left(\frac{1}{4}(\pi - 2ix), 2\right)}{\sqrt{i\sinh(x)}}\right)}{3\sqrt{a\,\text{csch}^3(x)}}$$

input
```
Integrate[1/Sqrt[a*Csch[x]^3],x]
```

output
```
(2*(Coth[x] + (Csch[x]*EllipticF[(Pi - (2*I)*x)/4, 2])/Sqrt[I*Sinh[x]]))/(
3*Sqrt[a*Csch[x]^3])
```

### 3.39.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 81, normalized size of antiderivative = 1.31, number of steps used = 8, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}} = 0.800$, Rules used = {3042, 4611, 3042, 4256, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{a\operatorname{csch}^3(x)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{ia\sec\left(\frac{\pi}{2}+ix\right)^3}}dx$$

$$\downarrow 4611$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\int \frac{1}{(i\operatorname{csch}(x))^{3/2}}dx}{\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\int \frac{1}{(-\csc(ix))^{3/2}}dx}{\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{1}{3}\int \sqrt{i\operatorname{csch}(x)}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)}{\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{1}{3}\int \sqrt{-\csc(ix)}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)}{\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4258$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{1}{3}\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\int \frac{1}{\sqrt{i\sinh(x)}}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)}{\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{1}{3}\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\int\frac{1}{\sqrt{\sin(ix)}}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)}{\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3120$$

$$\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{2}{3}i\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\,\text{EllipticF}\left(\frac{\pi}{4}-\frac{ix}{2},2\right)-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)}{\sqrt{a\operatorname{csch}^3(x)}}$$

input
```
Int[1/Sqrt[a*Csch[x]^3],x]
```

output
```
((I*Csch[x])^(3/2)*((((-2*I)/3)*Cosh[x])/Sqrt[I*Csch[x]] + ((2*I)/3)*Sqrt[
I*Csch[x]]*EllipticF[Pi/4 - (I/2)*x, 2]*Sqrt[I*Sinh[x]]))/Sqrt[a*Csch[x]^3
]
```

### 3.39.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.39.4 Maple [F]

$$\int \frac{1}{\sqrt{a \operatorname{csch}(x)^3}} dx$$

input
```
int(1/(a*csch(x)^3)^(1/2),x)
```

output
```
int(1/(a*csch(x)^3)^(1/2),x)
```

### 3.39.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 127, normalized size of antiderivative = 2.05

$$\int \frac{1}{\sqrt{a\operatorname{csch}^3(x)}} dx =$$
$$-\frac{4\sqrt{2}\left(\cosh(x)^2 + 2\cosh(x)\sinh(x) + \sinh(x)^2\right)\sqrt{a}\,\text{weierstrassPInverse}(4, 0, \cosh(x) + \sinh(x)) - \sqrt{2}}{6\left(a\cosh(x)\right.}$$

input
```
integrate(1/(a*csch(x)^3)^(1/2),x, algorithm="fricas")
```

output
```
-1/6*(4*sqrt(2)*(cosh(x)^2 + 2*cosh(x)*sinh(x) + sinh(x)^2)*sqrt(a)*weiers
trassPInverse(4, 0, cosh(x) + sinh(x)) - sqrt(2)*(cosh(x)^4 + 4*cosh(x)^3*
sinh(x) + 6*cosh(x)^2*sinh(x)^2 + 4*cosh(x)*sinh(x)^3 + sinh(x)^4 - 1)*sqr
t((a*cosh(x) + a*sinh(x))/(cosh(x)^2 + 2*cosh(x)*sinh(x) + sinh(x)^2 - 1))
)/(a*cosh(x)^2 + 2*a*cosh(x)*sinh(x) + a*sinh(x)^2)
```

### 3.39.6 Sympy [F]

$$\int \frac{1}{\sqrt{a\operatorname{csch}^3(x)}}\,dx = \int \frac{1}{\sqrt{a\,\operatorname{csch}^3(x)}}\,dx$$

input
```
integrate(1/(a*csch(x)**3)**(1/2),x)
```

output
```
Integral(1/sqrt(a*csch(x)**3), x)
```

### 3.39.7 Maxima [F]

$$\int \frac{1}{\sqrt{a\operatorname{csch}^3(x)}}\,dx = \int \frac{1}{\sqrt{a\,\operatorname{csch}(x)^3}}\,dx$$

input
```
integrate(1/(a*csch(x)^3)^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/sqrt(a*csch(x)^3), x)
```

### 3.39.8 Giac [F]

$$\int \frac{1}{\sqrt{a\operatorname{csch}^3(x)}}\,dx = \int \frac{1}{\sqrt{a\,\operatorname{csch}(x)^3}}\,dx$$

input
```
integrate(1/(a*csch(x)^3)^(1/2),x, algorithm="giac")
```

output
```
integrate(1/sqrt(a*csch(x)^3), x)
```

### 3.39.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{a\operatorname{csch}^3(x)}}\,dx = \int \frac{1}{\sqrt{\frac{a}{\sinh(x)^3}}}\,dx$$

input
```
int(1/(a/sinh(x)^3)^(1/2),x)
```

output
```
int(1/(a/sinh(x)^3)^(1/2), x)
```

# 3.40 $\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx$


3.40.1 Optimal result . . . . . 290
3.40.2 Mathematica [A] (verified) . . . . . 290
3.40.3 Rubi [A] (verified) . . . . . 291
3.40.4 Maple [F] . . . . . 293
3.40.5 Fricas [C] (verification not implemented) . . . . . 293
3.40.6 Sympy [F] . . . . . 294
3.40.7 Maxima [F] . . . . . 294
3.40.8 Giac [F] . . . . . 295
3.40.9 Mupad [F(-1)] . . . . . 295


## 3.40.1 Optimal result

Integrand size = 10, antiderivative size = 89

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx = -\frac{14\cosh(x)}{45a\sqrt{a\operatorname{csch}^3(x)}} + \frac{14i\operatorname{csch}(x)E\left(\frac{\pi}{4}-\frac{ix}{2}\middle|2\right)}{15a\sqrt{a\operatorname{csch}^3(x)}\sqrt{i\sinh(x)}} + \frac{2\cosh(x)\sinh^2(x)}{9a\sqrt{a\operatorname{csch}^3(x)}}$$

output
```
-14/45*cosh(x)/a/(a*csch(x)^3)^(1/2)+2/9*cosh(x)*sinh(x)^2/a/(a*csch(x)^3)
^(1/2)+14/15*I*csch(x)*(sin(1/4*Pi+1/2*I*x)^2)^(1/2)/sin(1/4*Pi+1/2*I*x)*E
llipticE(cos(1/4*Pi+1/2*I*x),2^(1/2))/a/(a*csch(x)^3)^(1/2)/(I*sinh(x))^(1
/2)
```

## 3.40.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 57, normalized size of antiderivative = 0.64

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx = \frac{-33\cosh(x)+5\cosh(3x)+84\operatorname{csch}^2(x)E\left(\frac{1}{4}(\pi-2ix)\middle|2\right)\sqrt{i\sinh(x)}}{90a\sqrt{a\operatorname{csch}^3(x)}}$$

input
```
Integrate[(a*Csch[x]^3)^(-3/2),x]
```

output
```
(-33*Cosh[x] + 5*Cosh[3*x] + 84*Csch[x]^2*EllipticE[(Pi - (2*I)*x)/4, 2]*S
qrt[I*Sinh[x]])/(90*a*Sqrt[a*Csch[x]^3])
```

### 3.40.3 Rubi [A] (verified)

Time = 0.47 (sec) , antiderivative size = 110, normalized size of antiderivative = 1.24, number of steps used = 10, number of rules used = 10, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 4611, 3042, 4256, 3042, 4256, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(ia\sec\left(\frac{\pi}{2}+ix\right)^3\right)^{3/2}}dx$$

$$\downarrow 4611$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\int \frac{1}{(i\operatorname{csch}(x))^{9/2}}dx}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\int \frac{1}{(-\csc(ix))^{9/2}}dx}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\int \frac{1}{(i\operatorname{csch}(x))^{5/2}}dx-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\int \frac{1}{(-\csc(ix))^{5/2}}dx-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\left(\frac{3}{5}\int \frac{1}{\sqrt{i\operatorname{csch}(x)}}dx-\frac{2i\cosh(x)}{5(i\operatorname{csch}(x))^{3/2}}\right)-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\left(\frac{3}{5}\int\frac{1}{\sqrt{-\operatorname{csc}(ix)}}dx-\frac{2i\cosh(x)}{5(i\operatorname{csch}(x))^{3/2}}\right)-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4258$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\left(\frac{3\int\sqrt{i\sinh(x)}dx}{5\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}}-\frac{2i\cosh(x)}{5(i\operatorname{csch}(x))^{3/2}}\right)-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\left(\frac{3\int\sqrt{\sin(ix)}dx}{5\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}}-\frac{2i\cosh(x)}{5(i\operatorname{csch}(x))^{3/2}}\right)-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3119$$

$$-\frac{i(i\operatorname{csch}(x))^{3/2}\left(\frac{7}{9}\left(\frac{6iE\left(\frac{\pi}{4}-\frac{ix}{2}\middle|2\right)}{5\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}}-\frac{2i\cosh(x)}{5(i\operatorname{csch}(x))^{3/2}}\right)-\frac{2i\cosh(x)}{9(i\operatorname{csch}(x))^{7/2}}\right)}{a\sqrt{a\operatorname{csch}^3(x)}}$$

input
```
Int[(a*Csch[x]^3)^(-3/2),x]
```

output
```
((-I)*(I*Csch[x])^(3/2)*((((-2*I)/9)*Cosh[x])/(I*Csch[x])^(7/2) + (7*((((-
2*I)/5)*Cosh[x])/(I*Csch[x])^(3/2) + (((6*I)/5)*EllipticE[Pi/4 - (I/2)*x,
2])/(Sqrt[I*Csch[x]]*Sqrt[I*Sinh[x]])))/9))/(a*Sqrt[a*Csch[x]^3])
```

### 3.40.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.40.4 Maple [F]

$$\int \frac{1}{\left(a \operatorname{csch}(x)^3\right)^{\frac{3}{2}}} dx$$

input
```
int(1/(a*csch(x)^3)^(3/2),x)
```

output
```
int(1/(a*csch(x)^3)^(3/2),x)
```

### 3.40.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 407, normalized size of antiderivative = 4.57

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}} dx =$$

$$-\frac{672\sqrt{2}\left(\cosh(x)^5 + 5\cosh(x)^4\sinh(x) + 10\cosh(x)^3\sinh(x)^2 + 10\cosh(x)^2\sinh(x)^3 + 5\cosh(x)\sinh\right.}{}$$

input
```
integrate(1/(a*csch(x)^3)^(3/2),x, algorithm="fricas")
```

output
```
-1/720*(672*sqrt(2)*(cosh(x)^5 + 5*cosh(x)^4*sinh(x) + 10*cosh(x)^3*sinh(x
)^2 + 10*cosh(x)^2*sinh(x)^3 + 5*cosh(x)*sinh(x)^4 + sinh(x)^5)*sqrt(a)*we
ierstrassZeta(4, 0, weierstrassPInverse(4, 0, cosh(x) + sinh(x))) - sqrt(2
)*(5*cosh(x)^10 + 50*cosh(x)*sinh(x)^9 + 5*sinh(x)^10 + (225*cosh(x)^2 - 4
3)*sinh(x)^8 - 43*cosh(x)^8 + 8*(75*cosh(x)^3 - 43*cosh(x))*sinh(x)^7 + 2*
(525*cosh(x)^4 - 602*cosh(x)^2 - 149)*sinh(x)^6 - 298*cosh(x)^6 + 4*(315*c
osh(x)^5 - 602*cosh(x)^3 - 447*cosh(x))*sinh(x)^5 + 2*(525*cosh(x)^6 - 150
5*cosh(x)^4 - 2235*cosh(x)^2 + 187)*sinh(x)^4 + 374*cosh(x)^4 + 8*(75*cosh
(x)^7 - 301*cosh(x)^5 - 745*cosh(x)^3 + 187*cosh(x))*sinh(x)^3 + (225*cosh
(x)^8 - 1204*cosh(x)^6 - 4470*cosh(x)^4 + 2244*cosh(x)^2 - 43)*sinh(x)^2 -
 43*cosh(x)^2 + 2*(25*cosh(x)^9 - 172*cosh(x)^7 - 894*cosh(x)^5 + 748*cosh
(x)^3 - 43*cosh(x))*sinh(x) + 5)*sqrt((a*cosh(x) + a*sinh(x))/(cosh(x)^2 +
 2*cosh(x)*sinh(x) + sinh(x)^2 - 1)))/(a^2*cosh(x)^5 + 5*a^2*cosh(x)^4*sin
h(x) + 10*a^2*cosh(x)^3*sinh(x)^2 + 10*a^2*cosh(x)^2*sinh(x)^3 + 5*a^2*cos
h(x)*sinh(x)^4 + a^2*sinh(x)^5)
```

### 3.40.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**3)**(3/2),x)
```

output
```
Integral((a*csch(x)**3)**(-3/2), x)
```

### 3.40.7 Maxima [F]

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(a\operatorname{csch}(x)^3\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)^3)^(3/2),x, algorithm="maxima")
```

output
```
integrate((a*csch(x)^3)^(-3/2), x)
```

### 3.40.8 Giac [F]

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}(x)^3\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)^3)^(3/2),x, algorithm="giac")
```

output
```
integrate((a*csch(x)^3)^(-3/2), x)
```

### 3.40.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^3}\right)^{3/2}}\,dx$$

input
```
int(1/(a/sinh(x)^3)^(3/2),x)
```

output
```
int(1/(a/sinh(x)^3)^(3/2), x)
```

# 3.41 $\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx$


3.41.1 Optimal result . . . . . 296
3.41.2 Mathematica [A] (verified) . . . . . 297
3.41.3 Rubi [A] (verified) . . . . . 297
3.41.4 Maple [F] . . . . . 300
3.41.5 Fricas [C] (verification not implemented) . . . . . 300
3.41.6 Sympy [F] . . . . . 301
3.41.7 Maxima [F] . . . . . 302
3.41.8 Giac [F] . . . . . 302
3.41.9 Mupad [F(-1)] . . . . . 302


## 3.41.1 Optimal result

Integrand size = 10, antiderivative size = 135

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx = -\frac{26\coth(x)}{77a^2\sqrt{a\operatorname{csch}^3(x)}} + \frac{26i\operatorname{csch}^2(x)\,\text{EllipticF}\left(\frac{\pi}{4}-\frac{ix}{2},2\right)\sqrt{i\sinh(x)}}{77a^2\sqrt{a\operatorname{csch}^3(x)}} + \frac{78\cosh(x)\sinh(x)}{385a^2\sqrt{a\operatorname{csch}^3(x)}} - \frac{26\cosh(x)\sinh^3(x)}{165a^2\sqrt{a\operatorname{csch}^3(x)}} + \frac{2\cosh(x)\sinh^5(x)}{15a^2\sqrt{a\operatorname{csch}^3(x)}}$$

output

```
-26/77*coth(x)/a^2/(a*csch(x)^3)^(1/2)+78/385*cosh(x)*sinh(x)/a^2/(a*csch(
x)^3)^(1/2)-26/165*cosh(x)*sinh(x)^3/a^2/(a*csch(x)^3)^(1/2)+2/15*cosh(x)*
sinh(x)^5/a^2/(a*csch(x)^3)^(1/2)+26/77*I*csch(x)^2*(sin(1/4*Pi+1/2*I*x)^2
)^(1/2)/sin(1/4*Pi+1/2*I*x)*EllipticF(cos(1/4*Pi+1/2*I*x),2^(1/2))*(I*sinh
(x))^(1/2)/a^2/(a*csch(x)^3)^(1/2)
```

### 3.41.2 Mathematica [A] (verified)

Time = 0.11 (sec) , antiderivative size = 71, normalized size of antiderivative = 0.53

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx = \frac{\sqrt{a\operatorname{csch}^3(x)}\sinh(x)\left(24960i\,\text{EllipticF}\left(\frac{1}{4}(\pi-2ix),2\right)\sqrt{i\sinh(x)}-19122\sinh(2x)+\right.}{73920a^3}$$

input
```
Integrate[(a*Csch[x]^3)^(-5/2),x]
```

output
```
(Sqrt[a*Csch[x]^3]*Sinh[x]*((24960*I)*EllipticF[(Pi - (2*I)*x)/4, 2]*Sqrt[
I*Sinh[x]] - 19122*Sinh[2*x] + 4406*Sinh[4*x] - 826*Sinh[6*x] + 77*Sinh[8*
x]))/(73920*a^3)
```

### 3.41.3 Rubi [A] (verified)

Time = 0.67 (sec) , antiderivative size = 154, normalized size of antiderivative = 1.14, number of steps used = 14, number of rules used = 14, $\frac{\text{number of rules}}{\text{integrand size}} = 1.400$, Rules used = {3042, 4611, 3042, 4256, 3042, 4256, 3042, 4256, 3042, 4256, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(ia\sec\left(\frac{\pi}{2}+ix\right)^3\right)^{5/2}}dx$$

$$\downarrow 4611$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\int \frac{1}{(i\operatorname{csch}(x))^{15/2}}dx}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\int \frac{1}{(-\csc(ix))^{15/2}}dx}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\int\frac{1}{(i\operatorname{csch}(x))^{11/2}}dx-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\int\frac{1}{(-\csc(ix))^{11/2}}dx-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\int\frac{1}{(i\operatorname{csch}(x))^{7/2}}dx-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right)-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\int\frac{1}{(-\csc(ix))^{7/2}}dx-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right)-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\int\frac{1}{(i\operatorname{csch}(x))^{3/2}}dx-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right)-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\int\frac{1}{(-\csc(ix))^{3/2}}dx-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right)-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4256$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\left(\frac{1}{3}\int\sqrt{i\operatorname{csch}(x)}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right)-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/2}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\left(\frac{1}{3}\int\sqrt{-\csc(ix)}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right)-\frac{2i\cosh(x)}{15(i\operatorname{csch}(x))^{13/}}\right)}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 4258$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\left(\frac{1}{3}\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\int\frac{1}{\sqrt{i\sinh(x)}}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/}}\right.\right.}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3042$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\left(\frac{1}{3}\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\int\frac{1}{\sqrt{\sin(ix)}}dx-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i\cosh(x)}{11(i\operatorname{csch}(x))^{9/2}}\right.\right.}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

$$\downarrow 3120$$

$$-\frac{(i\operatorname{csch}(x))^{3/2}\left(\frac{13}{15}\left(\frac{9}{11}\left(\frac{5}{7}\left(\frac{2}{3}i\sqrt{i\sinh(x)}\sqrt{i\operatorname{csch}(x)}\,\text{EllipticF}\left(\frac{\pi}{4}-\frac{ix}{2},2\right)-\frac{2i\cosh(x)}{3\sqrt{i\operatorname{csch}(x)}}\right)-\frac{2i\cosh(x)}{7(i\operatorname{csch}(x))^{5/2}}\right)-\frac{2i}{11(ic}\right.\right.}{a^2\sqrt{a\operatorname{csch}^3(x)}}$$

input
```
Int[(a*Csch[x]^3)^(-5/2),x]
```

output
```
-(((I*Csch[x])^(3/2)*((((-2*I)/15)*Cosh[x])/(I*Csch[x])^(13/2) + (13*((((-
2*I)/11)*Cosh[x])/(I*Csch[x])^(9/2) + (9*((((-2*I)/7)*Cosh[x])/(I*Csch[x])
^(5/2) + (5*((((-2*I)/3)*Cosh[x])/Sqrt[I*Csch[x]] + ((2*I)/3)*Sqrt[I*Csch[
x]]*EllipticF[Pi/4 - (I/2)*x, 2]*Sqrt[I*Sinh[x]]))/7))/11))/15))/(a^2*Sqrt
[a*Csch[x]^3]))
```

### 3.41.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.41.4 Maple [F]

$$\int \frac{1}{\left(a \operatorname{csch}(x)^3\right)^{\frac{5}{2}}} dx$$

input
```
int(1/(a*csch(x)^3)^(5/2),x)
```

output
```
int(1/(a*csch(x)^3)^(5/2),x)
```

### 3.41.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.11 (sec) , antiderivative size = 718, normalized size of antiderivative = 5.32

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}} dx = \text{Too large to display}$$

input
```
integrate(1/(a*csch(x)^3)^(5/2),x, algorithm="fricas")
```

output
```
1/147840*(49920*sqrt(2)*(cosh(x)^8 + 8*cosh(x)^7*sinh(x) + 28*cosh(x)^6*si
nh(x)^2 + 56*cosh(x)^5*sinh(x)^3 + 70*cosh(x)^4*sinh(x)^4 + 56*cosh(x)^3*s
inh(x)^5 + 28*cosh(x)^2*sinh(x)^6 + 8*cosh(x)*sinh(x)^7 + sinh(x)^8)*sqrt(
a)*weierstrassPInverse(4, 0, cosh(x) + sinh(x)) + sqrt(2)*(77*cosh(x)^16 +
 1232*cosh(x)*sinh(x)^15 + 77*sinh(x)^16 + 14*(660*cosh(x)^2 - 59)*sinh(x)
^14 - 826*cosh(x)^14 + 196*(220*cosh(x)^3 - 59*cosh(x))*sinh(x)^13 + 2*(70
070*cosh(x)^4 - 37583*cosh(x)^2 + 2203)*sinh(x)^12 + 4406*cosh(x)^12 + 8*(
42042*cosh(x)^5 - 37583*cosh(x)^3 + 6609*cosh(x))*sinh(x)^11 + 2*(308308*c
osh(x)^6 - 413413*cosh(x)^4 + 145398*cosh(x)^2 - 9561)*sinh(x)^10 - 19122*
cosh(x)^10 + 4*(220220*cosh(x)^7 - 413413*cosh(x)^5 + 242330*cosh(x)^3 - 4
7805*cosh(x))*sinh(x)^9 + 6*(165165*cosh(x)^8 - 413413*cosh(x)^6 + 363495*
cosh(x)^4 - 143415*cosh(x)^2)*sinh(x)^8 + 16*(55055*cosh(x)^9 - 177177*cos
h(x)^7 + 218097*cosh(x)^5 - 143415*cosh(x)^3)*sinh(x)^7 + 2*(308308*cosh(x
)^10 - 1240239*cosh(x)^8 + 2035572*cosh(x)^6 - 2007810*cosh(x)^4 + 9561)*s
inh(x)^6 + 19122*cosh(x)^6 + 4*(84084*cosh(x)^11 - 413413*cosh(x)^9 + 8723
88*cosh(x)^7 - 1204686*cosh(x)^5 + 28683*cosh(x))*sinh(x)^5 + 2*(70070*cos
h(x)^12 - 413413*cosh(x)^10 + 1090485*cosh(x)^8 - 2007810*cosh(x)^6 + 1434
15*cosh(x)^2 - 2203)*sinh(x)^4 - 4406*cosh(x)^4 + 8*(5390*cosh(x)^13 - 375
83*cosh(x)^11 + 121165*cosh(x)^9 - 286830*cosh(x)^7 + 47805*cosh(x)^3 - 22
03*cosh(x))*sinh(x)^3 + 2*(4620*cosh(x)^14 - 37583*cosh(x)^12 + 145398*...
```

### 3.41.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}^3(x)\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**3)**(5/2),x)
```

output
```
Integral((a*csch(x)**3)**(-5/2), x)
```

### 3.41.7 Maxima [F]

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}(x)^3\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)^3)^(5/2),x, algorithm="maxima")
```

output
```
integrate((a*csch(x)^3)^(-5/2), x)
```

### 3.41.8 Giac [F]

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}(x)^3\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)^3)^(5/2),x, algorithm="giac")
```

output
```
integrate((a*csch(x)^3)^(-5/2), x)
```

### 3.41.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^3(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^3}\right)^{5/2}}\,dx$$

input
```
int(1/(a/sinh(x)^3)^(5/2),x)
```

output
```
int(1/(a/sinh(x)^3)^(5/2), x)
```

# 3.42 $\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx$

3.42.1 Optimal result . . . . . 303
3.42.2 Mathematica [A] (verified) . . . . . 304
3.42.3 Rubi [C] (verified) . . . . . 304
3.42.4 Maple [A] (verified) . . . . . 306
3.42.5 Fricas [B] (verification not implemented) . . . . . 306
3.42.6 Sympy [F] . . . . . 307
3.42.7 Maxima [B] (verification not implemented) . . . . . 308
3.42.8 Giac [A] (verification not implemented) . . . . . 308
3.42.9 Mupad [B] (verification not implemented) . . . . . 309

## 3.42.1 Optimal result

Integrand size = 10, antiderivative size = 164

$$\begin{aligned}\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx &= 2a^3\cosh^2(x)\coth(x)\sqrt{a\operatorname{csch}^4(x)}\\ &- 3a^3\cosh^2(x)\coth^3(x)\sqrt{a\operatorname{csch}^4(x)} + \frac{20}{7}a^3\cosh^2(x)\coth^5(x)\sqrt{a\operatorname{csch}^4(x)}\\ &- \frac{5}{3}a^3\cosh^2(x)\coth^7(x)\sqrt{a\operatorname{csch}^4(x)} + \frac{6}{11}a^3\cosh^2(x)\coth^9(x)\sqrt{a\operatorname{csch}^4(x)}\\ &- \frac{1}{13}a^3\cosh^2(x)\coth^{11}(x)\sqrt{a\operatorname{csch}^4(x)} - a^3\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\sinh(x)\end{aligned}$$

output

```
2*a^3*cosh(x)^2*coth(x)*(a*csch(x)^4)^(1/2)-3*a^3*cosh(x)^2*coth(x)^3*(a*c
sch(x)^4)^(1/2)+20/7*a^3*cosh(x)^2*coth(x)^5*(a*csch(x)^4)^(1/2)-5/3*a^3*c
osh(x)^2*coth(x)^7*(a*csch(x)^4)^(1/2)+6/11*a^3*cosh(x)^2*coth(x)^9*(a*csc
h(x)^4)^(1/2)-1/13*a^3*cosh(x)^2*coth(x)^11*(a*csch(x)^4)^(1/2)-a^3*cosh(x
)*sinh(x)*(a*csch(x)^4)^(1/2)
```

### 3.42.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 59, normalized size of antiderivative = 0.36

$$\int \left(a\text{csch}^4(x)\right)^{7/2}\,dx =$$

$$-\frac{a^3\cosh(x)\sqrt{a\text{csch}^4(x)}\left(1024-512\text{csch}^2(x)+384\text{csch}^4(x)-320\text{csch}^6(x)+280\text{csch}^8(x)-252\text{csch}^{10}(x)+\right.}{3003}$$

input
```
Integrate[(a*Csch[x]^4)^(7/2),x]
```

output
```
-1/3003*(a^3*Cosh[x]*Sqrt[a*Csch[x]^4]*(1024 - 512*Csch[x]^2 + 384*Csch[x]
^4 - 320*Csch[x]^6 + 280*Csch[x]^8 - 252*Csch[x]^10 + 231*Csch[x]^12)*Sinh
[x])
```

### 3.42.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 84, normalized size of antiderivative = 0.51, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.700$, Rules used = {3042, 4611, 25, 3042, 25, 4254, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\text{csch}^4(x)\right)^{7/2}\,dx$$

$$\downarrow 3042$$

$$\int \left(a\sec\left(\frac{\pi}{2}+ix\right)^4\right)^{7/2}\,dx$$

$$\downarrow 4611$$

$$-a^3\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int -\text{csch}^{14}(x)dx$$

$$\downarrow 25$$

$$a^3\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int \text{csch}^{14}(x)dx$$

$$\downarrow 3042$$

$$a^3 \sinh^2(x) \sqrt{a\text{csch}^4(x)} \int -\csc(ix)^{14} dx$$

$$\downarrow 25$$

$$-a^3 \sinh^2(x) \sqrt{a\text{csch}^4(x)} \int \csc(ix)^{14} dx$$

$$\downarrow 4254$$

$$-ia^3 \sinh^2(x) \sqrt{a\text{csch}^4(x)} \int \left(\coth^{12}(x) - 6\coth^{10}(x) + 15\coth^8(x) - 20\coth^6(x) + 15\coth^4(x) - 6\coth^2(x) + 1\right.$$

$$\downarrow 2009$$

$$-ia^3 \sinh^2(x) \left(-\frac{1}{13} i \coth^{13}(x) + \frac{6}{11} i \coth^{11}(x) - \frac{5}{3} i \coth^9(x) + \frac{20}{7} i \coth^7(x) - 3i \coth^5(x) + 2i \coth^3(x) - i \coth\right.$$

input
```
Int[(a*Csch[x]^4)^(7/2),x]
```

output
```
(-I)*a^3*((-I)*Coth[x] + (2*I)*Coth[x]^3 - (3*I)*Coth[x]^5 + ((20*I)/7)*Co
th[x]^7 - ((5*I)/3)*Coth[x]^9 + ((6*I)/11)*Coth[x]^11 - (I/13)*Coth[x]^13)
*Sqrt[a*Csch[x]^4]*Sinh[x]^2
```

### 3.42.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.42.4 Maple [A] (verified)

Time = 0.83 (sec) , antiderivative size = 72, normalized size of antiderivative = 0.44

| method | result | size |
|---|---|---|
| risch | $-\frac{2048a^3 e^{-2x}\sqrt{\frac{a\,e^{4x}}{\left(e^{2x}-1\right)^4}}\left(1716\,e^{12x}-1287\,e^{10x}+715\,e^{8x}-286\,e^{6x}+78\,e^{4x}-13\,e^{2x}+1\right)}{3003\left(e^{2x}-1\right)^{11}}$ | 72 |

input
```
int((a*csch(x)^4)^(7/2),x,method=_RETURNVERBOSE)
```

output
```
-2048/3003*a^3*exp(-2*x)/(exp(2*x)-1)^11*(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)
*(1716*exp(12*x)-1287*exp(10*x)+715*exp(8*x)-286*exp(6*x)+78*exp(4*x)-13*e
xp(2*x)+1)
```

### 3.42.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2825 vs. $2(142) = 284$.

Time = 0.40 (sec) , antiderivative size = 2825, normalized size of antiderivative = 17.23

$$\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx = \text{Too large to display}$$

input
```
integrate((a*csch(x)^4)^(7/2),x, algorithm="fricas")
```

output
```
-2048/3003*(1716*a^3*cosh(x)^12 - 1287*a^3*cosh(x)^10 + 1716*(a^3*e^(4*x)
- 2*a^3*e^(2*x) + a^3)*sinh(x)^12 + 20592*(a^3*cosh(x)*e^(4*x) - 2*a^3*cos
h(x)*e^(2*x) + a^3*cosh(x))*sinh(x)^11 + 715*a^3*cosh(x)^8 + 1287*(88*a^3*
cosh(x)^2 - a^3 + (88*a^3*cosh(x)^2 - a^3)*e^(4*x) - 2*(88*a^3*cosh(x)^2 -
 a^3)*e^(2*x))*sinh(x)^10 + 4290*(88*a^3*cosh(x)^3 - 3*a^3*cosh(x) + (88*a
^3*cosh(x)^3 - 3*a^3*cosh(x))*e^(4*x) - 2*(88*a^3*cosh(x)^3 - 3*a^3*cosh(x
))*e^(2*x))*sinh(x)^9 - 286*a^3*cosh(x)^6 + 715*(1188*a^3*cosh(x)^4 - 81*a
^3*cosh(x)^2 + a^3 + (1188*a^3*cosh(x)^4 - 81*a^3*cosh(x)^2 + a^3)*e^(4*x)
 - 2*(1188*a^3*cosh(x)^4 - 81*a^3*cosh(x)^2 + a^3)*e^(2*x))*sinh(x)^8 + 11
44*(1188*a^3*cosh(x)^5 - 135*a^3*cosh(x)^3 + 5*a^3*cosh(x) + (1188*a^3*cos
h(x)^5 - 135*a^3*cosh(x)^3 + 5*a^3*cosh(x))*e^(4*x) - 2*(1188*a^3*cosh(x)^
5 - 135*a^3*cosh(x)^3 + 5*a^3*cosh(x))*e^(2*x))*sinh(x)^7 + 78*a^3*cosh(x)
^4 + 286*(5544*a^3*cosh(x)^6 - 945*a^3*cosh(x)^4 + 70*a^3*cosh(x)^2 - a^3
+ (5544*a^3*cosh(x)^6 - 945*a^3*cosh(x)^4 + 70*a^3*cosh(x)^2 - a^3)*e^(4*x
) - 2*(5544*a^3*cosh(x)^6 - 945*a^3*cosh(x)^4 + 70*a^3*cosh(x)^2 - a^3)*e^
(2*x))*sinh(x)^6 + 572*(2376*a^3*cosh(x)^7 - 567*a^3*cosh(x)^5 + 70*a^3*co
sh(x)^3 - 3*a^3*cosh(x) + (2376*a^3*cosh(x)^7 - 567*a^3*cosh(x)^5 + 70*a^3
*cosh(x)^3 - 3*a^3*cosh(x))*e^(4*x) - 2*(2376*a^3*cosh(x)^7 - 567*a^3*cosh
(x)^5 + 70*a^3*cosh(x)^3 - 3*a^3*cosh(x))*e^(2*x))*sinh(x)^5 - 13*a^3*cosh
(x)^2 + 26*(32670*a^3*cosh(x)^8 - 10395*a^3*cosh(x)^6 + 1925*a^3*cosh(x...
```

### 3.42.6 Sympy [F]

$$\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx = \int \left(a\,\operatorname{csch}^4\left(x\right)\right)^{\frac{7}{2}}\,dx$$

input
```
integrate((a*csch(x)**4)**(7/2),x)
```

output
```
Integral((a*csch(x)**4)**(7/2), x)
```

### 3.42.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 620 vs. $2(142) = 284$.

Time = 0.28 (sec) , antiderivative size = 620, normalized size of antiderivative = 3.78

$$\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx = \text{Too large to display}$$

input
```
integrate((a*csch(x)^4)^(7/2),x, algorithm="maxima")
```

output
```
-2048/231*a^(7/2)*e^(-2*x)/(13*e^(-2*x) - 78*e^(-4*x) + 286*e^(-6*x) - 715
*e^(-8*x) + 1287*e^(-10*x) - 1716*e^(-12*x) + 1716*e^(-14*x) - 1287*e^(-16
*x) + 715*e^(-18*x) - 286*e^(-20*x) + 78*e^(-22*x) - 13*e^(-24*x) + e^(-26
*x) - 1) + 4096/77*a^(7/2)*e^(-4*x)/(13*e^(-2*x) - 78*e^(-4*x) + 286*e^(-6
*x) - 715*e^(-8*x) + 1287*e^(-10*x) - 1716*e^(-12*x) + 1716*e^(-14*x) - 12
87*e^(-16*x) + 715*e^(-18*x) - 286*e^(-20*x) + 78*e^(-22*x) - 13*e^(-24*x)
 + e^(-26*x) - 1) - 4096/21*a^(7/2)*e^(-6*x)/(13*e^(-2*x) - 78*e^(-4*x) +
286*e^(-6*x) - 715*e^(-8*x) + 1287*e^(-10*x) - 1716*e^(-12*x) + 1716*e^(-1
4*x) - 1287*e^(-16*x) + 715*e^(-18*x) - 286*e^(-20*x) + 78*e^(-22*x) - 13*
e^(-24*x) + e^(-26*x) - 1) + 10240/21*a^(7/2)*e^(-8*x)/(13*e^(-2*x) - 78*e
^(-4*x) + 286*e^(-6*x) - 715*e^(-8*x) + 1287*e^(-10*x) - 1716*e^(-12*x) +
1716*e^(-14*x) - 1287*e^(-16*x) + 715*e^(-18*x) - 286*e^(-20*x) + 78*e^(-2
2*x) - 13*e^(-24*x) + e^(-26*x) - 1) - 6144/7*a^(7/2)*e^(-10*x)/(13*e^(-2*
x) - 78*e^(-4*x) + 286*e^(-6*x) - 715*e^(-8*x) + 1287*e^(-10*x) - 1716*e^(
-12*x) + 1716*e^(-14*x) - 1287*e^(-16*x) + 715*e^(-18*x) - 286*e^(-20*x) +
 78*e^(-22*x) - 13*e^(-24*x) + e^(-26*x) - 1) + 8192/7*a^(7/2)*e^(-12*x)/(
13*e^(-2*x) - 78*e^(-4*x) + 286*e^(-6*x) - 715*e^(-8*x) + 1287*e^(-10*x) -
 1716*e^(-12*x) + 1716*e^(-14*x) - 1287*e^(-16*x) + 715*e^(-18*x) - 286*e^
(-20*x) + 78*e^(-22*x) - 13*e^(-24*x) + e^(-26*x) - 1) + 2048/3003*a^(7/2)
/(13*e^(-2*x) - 78*e^(-4*x) + 286*e^(-6*x) - 715*e^(-8*x) + 1287*e^(-10...
```

### 3.42.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 51, normalized size of antiderivative = 0.31

$$\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx = -\frac{2048\,a^{\frac{7}{2}}\left(1716\,e^{(12\,x)} - 1287\,e^{(10\,x)} + 715\,e^{(8\,x)} - 286\,e^{(6\,x)} + 78\,e^{(4\,x)} - 13\,e^{(2\,x)} + 1\right)}{3003\left(e^{(2\,x)} - 1\right)^{13}}$$

input
```
integrate((a*csch(x)^4)^(7/2),x, algorithm="giac")
```

output
```
-2048/3003*a^(7/2)*(1716*e^(12*x) - 1287*e^(10*x) + 715*e^(8*x) - 286*e^(6
*x) + 78*e^(4*x) - 13*e^(2*x) + 1)/(e^(2*x) - 1)^13
```

### 3.42.9 Mupad [B] (verification not implemented)

Time = 2.24 (sec) , antiderivative size = 498, normalized size of antiderivative = 3.04

$$\int \left(a\operatorname{csch}^4(x)\right)^{7/2}\,dx = -\frac{2048\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{7\,(e^{2x}-1)^7\,(e^{2x}-2\,e^{4x}+e^{6x})}$$
$$-\frac{1536\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{(e^{2x}-1)^8\,(e^{2x}-2\,e^{4x}+e^{6x})}$$
$$-\frac{10240\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{3\,(e^{2x}-1)^9\,(e^{2x}-2\,e^{4x}+e^{6x})}$$
$$-\frac{4096\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{(e^{2x}-1)^{10}\,(e^{2x}-2\,e^{4x}+e^{6x})}$$
$$-\frac{30720\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{11\,(e^{2x}-1)^{11}\,(e^{2x}-2\,e^{4x}+e^{6x})}$$
$$-\frac{1024\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{(e^{2x}-1)^{12}\,(e^{2x}-2\,e^{4x}+e^{6x})}$$
$$-\frac{2048\,a^3\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1)}{13\,(e^{2x}-1)^{13}\,(e^{2x}-2\,e^{4x}+e^{6x})}$$

input
```
int((a/sinh(x)^4)^(7/2),x)
```

output

```
- (2048*a^3*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x) - 4*exp(2*x) -
4*exp(6*x) + exp(8*x) + 1))/(7*(exp(2*x) - 1)^7*(exp(2*x) - 2*exp(4*x) + e
xp(6*x))) - (1536*a^3*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x) - 4*e
xp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/((exp(2*x) - 1)^8*(exp(2*x) - 2*exp(
4*x) + exp(6*x))) - (10240*a^3*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4
*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/(3*(exp(2*x) - 1)^9*(exp(2*
x) - 2*exp(4*x) + exp(6*x))) - (4096*a^3*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2
)*(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/((exp(2*x) - 1)^1
0*(exp(2*x) - 2*exp(4*x) + exp(6*x))) - (30720*a^3*(a/(exp(-x)/2 - exp(x)/
2)^4)^(1/2)*(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/(11*(ex
p(2*x) - 1)^11*(exp(2*x) - 2*exp(4*x) + exp(6*x))) - (1024*a^3*(a/(exp(-x)
/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) +
 1))/((exp(2*x) - 1)^12*(exp(2*x) - 2*exp(4*x) + exp(6*x))) - (2048*a^3*(a
/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + e
xp(8*x) + 1))/(13*(exp(2*x) - 1)^13*(exp(2*x) - 2*exp(4*x) + exp(6*x)))
```

# 3.43 $\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx$

3.43.1 Optimal result . . . 311
3.43.2 Mathematica [A] (verified) . . . 311
3.43.3 Rubi [C] (verified) . . . 312
3.43.4 Maple [A] (verified) . . . 313
3.43.5 Fricas [B] (verification not implemented) . . . 314
3.43.6 Sympy [F] . . . 315
3.43.7 Maxima [B] (verification not implemented) . . . 315
3.43.8 Giac [A] (verification not implemented) . . . 316
3.43.9 Mupad [B] (verification not implemented) . . . 317

## 3.43.1 Optimal result

Integrand size = 10, antiderivative size = 118

$$\begin{aligned}\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx &= \frac{4}{3}a^2\cosh^2(x)\coth(x)\sqrt{a\operatorname{csch}^4(x)}\\ &-\frac{6}{5}a^2\cosh^2(x)\coth^3(x)\sqrt{a\operatorname{csch}^4(x)}+\frac{4}{7}a^2\cosh^2(x)\coth^5(x)\sqrt{a\operatorname{csch}^4(x)}\\ &-\frac{1}{9}a^2\cosh^2(x)\coth^7(x)\sqrt{a\operatorname{csch}^4(x)}-a^2\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\sinh(x)\end{aligned}$$

output
```
4/3*a^2*cosh(x)^2*coth(x)*(a*csch(x)^4)^(1/2)-6/5*a^2*cosh(x)^2*coth(x)^3*
(a*csch(x)^4)^(1/2)+4/7*a^2*cosh(x)^2*coth(x)^5*(a*csch(x)^4)^(1/2)-1/9*a^
2*cosh(x)^2*coth(x)^7*(a*csch(x)^4)^(1/2)-a^2*cosh(x)*sinh(x)*(a*csch(x)^4
)^(1/2)
```

## 3.43.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 47, normalized size of antiderivative = 0.40

$$\begin{aligned}\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx &= -\frac{1}{315}a^2\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\big(128\\ &-64\operatorname{csch}^2(x)+48\operatorname{csch}^4(x)-40\operatorname{csch}^6(x)+35\operatorname{csch}^8(x)\big)\sinh(x)\end{aligned}$$

input
```
Integrate[(a*Csch[x]^4)^(5/2),x]
```

output
```
-1/315*(a^2*Cosh[x]*Sqrt[a*Csch[x]^4]*(128 - 64*Csch[x]^2 + 48*Csch[x]^4 -
 40*Csch[x]^6 + 35*Csch[x]^8)*Sinh[x])
```

### 3.43.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 68, normalized size of antiderivative = 0.58, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.700$, Rules used = {3042, 4611, 25, 3042, 25, 4254, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\text{csch}^4(x)\right)^{5/2}\,dx$$

$$\downarrow 3042$$

$$\int \left(a\sec\left(\frac{\pi}{2}+ix\right)^4\right)^{5/2}dx$$

$$\downarrow 4611$$

$$-a^2\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int -\text{csch}^{10}(x)dx$$

$$\downarrow 25$$

$$a^2\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int \text{csch}^{10}(x)dx$$

$$\downarrow 3042$$

$$a^2\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int -\csc(ix)^{10}dx$$

$$\downarrow 25$$

$$-a^2\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int \csc(ix)^{10}dx$$

$$\downarrow 4254$$

$$-ia^2\sinh^2(x)\sqrt{a\text{csch}^4(x)}\int \left(\coth^8(x)-4\coth^6(x)+6\coth^4(x)-4\coth^2(x)+1\right)d(-i\coth(x))$$

$$\downarrow 2009$$

$$-ia^2\sinh^2(x)\left(-\frac{1}{9}i\coth^9(x)+\frac{4}{7}i\coth^7(x)-\frac{6}{5}i\coth^5(x)+\frac{4}{3}i\coth^3(x)-i\coth(x)\right)\sqrt{a\text{csch}^4(x)}$$

input
```
Int[(a*Csch[x]^4)^(5/2),x]
```

output
```
(-I)*a^2*((-I)*Coth[x] + ((4*I)/3)*Coth[x]^3 - ((6*I)/5)*Coth[x]^5 + ((4*I
)/7)*Coth[x]^7 - (I/9)*Coth[x]^9)*Sqrt[a*Csch[x]^4]*Sinh[x]^2
```

#### 3.43.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.43.4 Maple [A] (verified)

Time = 0.76 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.51

| method | result | size |
|---|---|---|
| risch | $-\frac{256a^2\mathrm{e}^{-2x}\sqrt{\frac{a\,\mathrm{e}^{4x}}{\left(\mathrm{e}^{2x}-1\right)^4}}\left(126\,\mathrm{e}^{8x}-84\,\mathrm{e}^{6x}+36\,\mathrm{e}^{4x}-9\,\mathrm{e}^{2x}+1\right)}{315(\mathrm{e}^{2x}-1)^7}$ | 60 |

input
```
int((a*csch(x)^4)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
-256/315*a^2*exp(-2*x)/(exp(2*x)-1)^7*(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)*(1
26*exp(8*x)-84*exp(6*x)+36*exp(4*x)-9*exp(2*x)+1)
```

### 3.43.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1493 vs. $2(100) = 200$.

Time = 0.29 (sec) , antiderivative size = 1493, normalized size of antiderivative = 12.65

$$\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx = \text{Too large to display}$$

input
```
integrate((a*csch(x)^4)^(5/2),x, algorithm="fricas")
```

output
```
-256/315*(126*a^2*cosh(x)^8 + 126*(a^2*e^(4*x) - 2*a^2*e^(2*x) + a^2)*sinh
(x)^8 - 84*a^2*cosh(x)^6 + 1008*(a^2*cosh(x)*e^(4*x) - 2*a^2*cosh(x)*e^(2*
x) + a^2*cosh(x))*sinh(x)^7 + 84*(42*a^2*cosh(x)^2 - a^2 + (42*a^2*cosh(x)
^2 - a^2)*e^(4*x) - 2*(42*a^2*cosh(x)^2 - a^2)*e^(2*x))*sinh(x)^6 + 36*a^2
*cosh(x)^4 + 504*(14*a^2*cosh(x)^3 - a^2*cosh(x) + (14*a^2*cosh(x)^3 - a^2
*cosh(x))*e^(4*x) - 2*(14*a^2*cosh(x)^3 - a^2*cosh(x))*e^(2*x))*sinh(x)^5
+ 36*(245*a^2*cosh(x)^4 - 35*a^2*cosh(x)^2 + a^2 + (245*a^2*cosh(x)^4 - 35
*a^2*cosh(x)^2 + a^2)*e^(4*x) - 2*(245*a^2*cosh(x)^4 - 35*a^2*cosh(x)^2 +
a^2)*e^(2*x))*sinh(x)^4 - 9*a^2*cosh(x)^2 + 48*(147*a^2*cosh(x)^5 - 35*a^2
*cosh(x)^3 + 3*a^2*cosh(x) + (147*a^2*cosh(x)^5 - 35*a^2*cosh(x)^3 + 3*a^2
*cosh(x))*e^(4*x) - 2*(147*a^2*cosh(x)^5 - 35*a^2*cosh(x)^3 + 3*a^2*cosh(x
))*e^(2*x))*sinh(x)^3 + 9*(392*a^2*cosh(x)^6 - 140*a^2*cosh(x)^4 + 24*a^2*
cosh(x)^2 - a^2 + (392*a^2*cosh(x)^6 - 140*a^2*cosh(x)^4 + 24*a^2*cosh(x)^
2 - a^2)*e^(4*x) - 2*(392*a^2*cosh(x)^6 - 140*a^2*cosh(x)^4 + 24*a^2*cosh(
x)^2 - a^2)*e^(2*x))*sinh(x)^2 + a^2 + (126*a^2*cosh(x)^8 - 84*a^2*cosh(x)
^6 + 36*a^2*cosh(x)^4 - 9*a^2*cosh(x)^2 + a^2)*e^(4*x) - 2*(126*a^2*cosh(x
)^8 - 84*a^2*cosh(x)^6 + 36*a^2*cosh(x)^4 - 9*a^2*cosh(x)^2 + a^2)*e^(2*x)
 + 18*(56*a^2*cosh(x)^7 - 28*a^2*cosh(x)^5 + 8*a^2*cosh(x)^3 - a^2*cosh(x)
 + (56*a^2*cosh(x)^7 - 28*a^2*cosh(x)^5 + 8*a^2*cosh(x)^3 - a^2*cosh(x))*e
^(4*x) - 2*(56*a^2*cosh(x)^7 - 28*a^2*cosh(x)^5 + 8*a^2*cosh(x)^3 - a^2...
```

### 3.43.6 Sympy [F]

$$\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx = \int \left(a\,\operatorname{csch}^4\left(x\right)\right)^{\frac{5}{2}}\,dx$$

input
```
integrate((a*csch(x)**4)**(5/2),x)
```

output
```
Integral((a*csch(x)**4)**(5/2), x)
```

### 3.43.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 322 vs. 2(100) = 200.

Time = 0.27 (sec) , antiderivative size = 322, normalized size of antiderivative = 2.73

$$\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx =$$

$$-\frac{256\,a^{\frac{5}{2}}e^{(-2x)}}{35\left(9\,e^{(-2x)}-36\,e^{(-4x)}+84\,e^{(-6x)}-126\,e^{(-8x)}+126\,e^{(-10x)}-84\,e^{(-12x)}+36\,e^{(-14x)}-9\,e^{(-16x)}+e^{(-18}}$$

$$+\frac{1024\,a^{\frac{5}{2}}e^{(-4x)}}{35\left(9\,e^{(-2x)}-36\,e^{(-4x)}+84\,e^{(-6x)}-126\,e^{(-8x)}+126\,e^{(-10x)}-84\,e^{(-12x)}+36\,e^{(-14x)}-9\,e^{(-16x)}+e^{(-18x}}$$

$$-\frac{1024\,a^{\frac{5}{2}}e^{(-6x)}}{15\left(9\,e^{(-2x)}-36\,e^{(-4x)}+84\,e^{(-6x)}-126\,e^{(-8x)}+126\,e^{(-10x)}-84\,e^{(-12x)}+36\,e^{(-14x)}-9\,e^{(-16x)}+e^{(-18}}$$

$$+\frac{512\,a^{\frac{5}{2}}e^{(-8x)}}{5\left(9\,e^{(-2x)}-36\,e^{(-4x)}+84\,e^{(-6x)}-126\,e^{(-8x)}+126\,e^{(-10x)}-84\,e^{(-12x)}+36\,e^{(-14x)}-9\,e^{(-16x)}+e^{(-18x)}}$$

$$+\frac{256\,a^{\frac{5}{2}}}{315\left(9\,e^{(-2x)}-36\,e^{(-4x)}+84\,e^{(-6x)}-126\,e^{(-8x)}+126\,e^{(-10x)}-84\,e^{(-12x)}+36\,e^{(-14x)}-9\,e^{(-16x)}+e^{(-18}}$$

input
```
integrate((a*csch(x)^4)^(5/2),x, algorithm="maxima")
```

output
```
-256/35*a^(5/2)*e^(-2*x)/(9*e^(-2*x) - 36*e^(-4*x) + 84*e^(-6*x) - 126*e^(
-8*x) + 126*e^(-10*x) - 84*e^(-12*x) + 36*e^(-14*x) - 9*e^(-16*x) + e^(-18
*x) - 1) + 1024/35*a^(5/2)*e^(-4*x)/(9*e^(-2*x) - 36*e^(-4*x) + 84*e^(-6*x
) - 126*e^(-8*x) + 126*e^(-10*x) - 84*e^(-12*x) + 36*e^(-14*x) - 9*e^(-16*
x) + e^(-18*x) - 1) - 1024/15*a^(5/2)*e^(-6*x)/(9*e^(-2*x) - 36*e^(-4*x) +
 84*e^(-6*x) - 126*e^(-8*x) + 126*e^(-10*x) - 84*e^(-12*x) + 36*e^(-14*x)
- 9*e^(-16*x) + e^(-18*x) - 1) + 512/5*a^(5/2)*e^(-8*x)/(9*e^(-2*x) - 36*e
^(-4*x) + 84*e^(-6*x) - 126*e^(-8*x) + 126*e^(-10*x) - 84*e^(-12*x) + 36*e
^(-14*x) - 9*e^(-16*x) + e^(-18*x) - 1) + 256/315*a^(5/2)/(9*e^(-2*x) - 36
*e^(-4*x) + 84*e^(-6*x) - 126*e^(-8*x) + 126*e^(-10*x) - 84*e^(-12*x) + 36
*e^(-14*x) - 9*e^(-16*x) + e^(-18*x) - 1)
```

### 3.43.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.33

$$\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx = -\frac{256\,a^{\frac{5}{2}}\left(126\,e^{(8\,x)} - 84\,e^{(6\,x)} + 36\,e^{(4\,x)} - 9\,e^{(2\,x)} + 1\right)}{315\left(e^{(2\,x)} - 1\right)^9}$$

input
```
integrate((a*csch(x)^4)^(5/2),x, algorithm="giac")
```

output
```
-256/315*a^(5/2)*(126*e^(8*x) - 84*e^(6*x) + 36*e^(4*x) - 9*e^(2*x) + 1)/(
e^(2*x) - 1)^9
```

### 3.43.9 Mupad [B] (verification not implemented)

Time = 2.16 (sec) , antiderivative size = 356, normalized size of antiderivative = 3.02

$$\int \left(a\operatorname{csch}^4(x)\right)^{5/2}\,dx = -\frac{128\,a^2\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,\left(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1\right)}{5\,\left(e^{2x}-1\right)^5\,\left(e^{2x}-2\,e^{4x}+e^{6x}\right)}$$
$$-\frac{256\,a^2\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,\left(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1\right)}{3\,\left(e^{2x}-1\right)^6\,\left(e^{2x}-2\,e^{4x}+e^{6x}\right)}$$
$$-\frac{768\,a^2\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,\left(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1\right)}{7\,\left(e^{2x}-1\right)^7\,\left(e^{2x}-2\,e^{4x}+e^{6x}\right)}$$
$$-\frac{64\,a^2\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,\left(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1\right)}{\left(e^{2x}-1\right)^8\,\left(e^{2x}-2\,e^{4x}+e^{6x}\right)}$$
$$-\frac{128\,a^2\,\sqrt{\frac{a}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\,\left(6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1\right)}{9\,\left(e^{2x}-1\right)^9\,\left(e^{2x}-2\,e^{4x}+e^{6x}\right)}$$

input
```
int((a/sinh(x)^4)^(5/2),x)
```

output
```
- (128*a^2*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x) - 4*exp(2*x) - 4
*exp(6*x) + exp(8*x) + 1))/(5*(exp(2*x) - 1)^5*(exp(2*x) - 2*exp(4*x) + ex
p(6*x))) - (256*a^2*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x) - 4*exp
(2*x) - 4*exp(6*x) + exp(8*x) + 1))/(3*(exp(2*x) - 1)^6*(exp(2*x) - 2*exp(
4*x) + exp(6*x))) - (768*a^2*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6*exp(4*x
) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/(7*(exp(2*x) - 1)^7*(exp(2*x)
 - 2*exp(4*x) + exp(6*x))) - (64*a^2*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(6
*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/((exp(2*x) - 1)^8*(ex
p(2*x) - 2*exp(4*x) + exp(6*x))) - (128*a^2*(a/(exp(-x)/2 - exp(x)/2)^4)^(
1/2)*(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1))/(9*(exp(2*x) -
 1)^9*(exp(2*x) - 2*exp(4*x) + exp(6*x)))
```

# 3.44 $\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx$

3.44.1 Optimal result . . . . . 318
3.44.2 Mathematica [A] (verified) . . . . . 318
3.44.3 Rubi [C] (verified) . . . . . 319
3.44.4 Maple [A] (verified) . . . . . 320
3.44.5 Fricas [B] (verification not implemented) . . . . . 321
3.44.6 Sympy [F] . . . . . 321
3.44.7 Maxima [B] (verification not implemented) . . . . . 322
3.44.8 Giac [A] (verification not implemented) . . . . . 322
3.44.9 Mupad [B] (verification not implemented) . . . . . 323

## 3.44.1 Optimal result

Integrand size = 10, antiderivative size = 62

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx = \frac{2}{3}a\cosh^2(x)\coth(x)\sqrt{a\operatorname{csch}^4(x)} - \frac{1}{5}a\cosh^2(x)\coth^3(x)\sqrt{a\operatorname{csch}^4(x)} - a\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\sinh(x)$$

output
```
2/3*a*cosh(x)^2*coth(x)*(a*csch(x)^4)^(1/2)-1/5*a*cosh(x)^2*coth(x)^3*(a*c
sch(x)^4)^(1/2)-a*cosh(x)*sinh(x)*(a*csch(x)^4)^(1/2)
```

## 3.44.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 33, normalized size of antiderivative = 0.53

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx = -\frac{1}{15}a\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\left(8 - 4\operatorname{csch}^2(x) + 3\operatorname{csch}^4(x)\right)\sinh(x)$$

input
```
Integrate[(a*Csch[x]^4)^(3/2),x]
```

output
```
-1/15*(a*Cosh[x]*Sqrt[a*Csch[x]^4]*(8 - 4*Csch[x]^2 + 3*Csch[x]^4)*Sinh[x]
)
```

### 3.44.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 46, normalized size of antiderivative = 0.74, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.700$, Rules used = {3042, 4611, 25, 3042, 25, 4254, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx$$

$$\downarrow 3042$$

$$\int \left(a\sec\left(\frac{\pi}{2}+ix\right)^4\right)^{3/2}dx$$

$$\downarrow 4611$$

$$-a\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int -\operatorname{csch}^6(x)dx$$

$$\downarrow 25$$

$$a\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int \operatorname{csch}^6(x)dx$$

$$\downarrow 3042$$

$$a\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int -\csc(ix)^6dx$$

$$\downarrow 25$$

$$-a\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int \csc(ix)^6dx$$

$$\downarrow 4254$$

$$-ia\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int \left(\coth^4(x)-2\coth^2(x)+1\right)d(-i\coth(x))$$

$$\downarrow 2009$$

$$-ia\sinh^2(x)\left(-\frac{1}{5}i\coth^5(x)+\frac{2}{3}i\coth^3(x)-i\coth(x)\right)\sqrt{a\operatorname{csch}^4(x)}$$

input
```
Int[(a*Csch[x]^4)^(3/2),x]
```

output
```
(-I)*a*((-I)*Coth[x] + ((2*I)/3)*Coth[x]^3 - (I/5)*Coth[x]^5)*Sqrt[a*Csch[
x]^4]*Sinh[x]^2
```

#### 3.44.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.44.4 Maple [A] (verified)

Time = 0.16 (sec) , antiderivative size = 46, normalized size of antiderivative = 0.74

| method | result | size |
|---|---|---|
| risch | $-\frac{16a\,\mathrm{e}^{-2x}\sqrt{\frac{a\,\mathrm{e}^{4x}}{\left(\mathrm{e}^{2x}-1\right)^4}}\left(10\,\mathrm{e}^{4x}-5\,\mathrm{e}^{2x}+1\right)}{15(\mathrm{e}^{2x}-1)^3}$ | 46 |

input
```
int((a*csch(x)^4)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
-16/15*a*exp(-2*x)/(exp(2*x)-1)^3*(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)*(10*ex
p(4*x)-5*exp(2*x)+1)
```

### 3.44.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 529 vs. $2(52) = 104$.

Time $= 0.27$ (sec) , antiderivative size $= 529$, normalized size of antiderivative $= 8.53$

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx =$$

$$-\frac{16\left(10\,a\cosh(x)^4+1\right.}{15\left(10\cosh(x)\,e^{(2x)}\sinh(x)^9+e^{(2x)}\sinh(x)^{10}+5\left(9\cosh(x)^2-1\right)e^{(2x)}\sinh(x)^8+40\left(3\cosh(x)^3-\mathrm{co}\right.\right.}$$

input
```
integrate((a*csch(x)^4)^(3/2),x, algorithm="fricas")
```

output
```
-16/15*(10*a*cosh(x)^4 + 10*(a*e^(4*x) - 2*a*e^(2*x) + a)*sinh(x)^4 + 40*(
a*cosh(x)*e^(4*x) - 2*a*cosh(x)*e^(2*x) + a*cosh(x))*sinh(x)^3 - 5*a*cosh(
x)^2 + 5*(12*a*cosh(x)^2 + (12*a*cosh(x)^2 - a)*e^(4*x) - 2*(12*a*cosh(x)^
2 - a)*e^(2*x) - a)*sinh(x)^2 + (10*a*cosh(x)^4 - 5*a*cosh(x)^2 + a)*e^(4*
x) - 2*(10*a*cosh(x)^4 - 5*a*cosh(x)^2 + a)*e^(2*x) + 10*(4*a*cosh(x)^3 -
a*cosh(x) + (4*a*cosh(x)^3 - a*cosh(x))*e^(4*x) - 2*(4*a*cosh(x)^3 - a*cos
h(x))*e^(2*x))*sinh(x) + a)*sqrt(a/(e^(8*x) - 4*e^(6*x) + 6*e^(4*x) - 4*e^
(2*x) + 1))*e^(2*x)/(10*cosh(x)*e^(2*x)*sinh(x)^9 + e^(2*x)*sinh(x)^10 + 5
*(9*cosh(x)^2 - 1)*e^(2*x)*sinh(x)^8 + 40*(3*cosh(x)^3 - cosh(x))*e^(2*x)*
sinh(x)^7 + 10*(21*cosh(x)^4 - 14*cosh(x)^2 + 1)*e^(2*x)*sinh(x)^6 + 4*(63
*cosh(x)^5 - 70*cosh(x)^3 + 15*cosh(x))*e^(2*x)*sinh(x)^5 + 10*(21*cosh(x)
^6 - 35*cosh(x)^4 + 15*cosh(x)^2 - 1)*e^(2*x)*sinh(x)^4 + 40*(3*cosh(x)^7
- 7*cosh(x)^5 + 5*cosh(x)^3 - cosh(x))*e^(2*x)*sinh(x)^3 + 5*(9*cosh(x)^8
- 28*cosh(x)^6 + 30*cosh(x)^4 - 12*cosh(x)^2 + 1)*e^(2*x)*sinh(x)^2 + 10*(
cosh(x)^9 - 4*cosh(x)^7 + 6*cosh(x)^5 - 4*cosh(x)^3 + cosh(x))*e^(2*x)*sin
h(x) + (cosh(x)^10 - 5*cosh(x)^8 + 10*cosh(x)^6 - 10*cosh(x)^4 + 5*cosh(x)
^2 - 1)*e^(2*x))
```

### 3.44.6 Sympy [F]

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx = \int \left(a\,\operatorname{csch}^4(x)\right)^{\frac{3}{2}}\,dx$$

input
```
integrate((a*csch(x)**4)**(3/2),x)
```

output
```
Integral((a*csch(x)**4)**(3/2), x)
```

### 3.44.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 120 vs. $2(52) = 104$.

Time = 0.27 (sec) , antiderivative size = 120, normalized size of antiderivative = 1.94

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx = -\frac{16\,a^{\frac{3}{2}}e^{(-2x)}}{3\left(5\,e^{(-2x)}-10\,e^{(-4x)}+10\,e^{(-6x)}-5\,e^{(-8x)}+e^{(-10x)}-1\right)} + \frac{32\,a^{\frac{3}{2}}e^{(-4x)}}{3\left(5\,e^{(-2x)}-10\,e^{(-4x)}+10\,e^{(-6x)}-5\,e^{(-8x)}+e^{(-10x)}-1\right)} + \frac{16\,a^{\frac{3}{2}}}{15\left(5\,e^{(-2x)}-10\,e^{(-4x)}+10\,e^{(-6x)}-5\,e^{(-8x)}+e^{(-10x)}-1\right)}$$

input
```
integrate((a*csch(x)^4)^(3/2),x, algorithm="maxima")
```

output
```
-16/3*a^(3/2)*e^(-2*x)/(5*e^(-2*x) - 10*e^(-4*x) + 10*e^(-6*x) - 5*e^(-8*x
) + e^(-10*x) - 1) + 32/3*a^(3/2)*e^(-4*x)/(5*e^(-2*x) - 10*e^(-4*x) + 10*
e^(-6*x) - 5*e^(-8*x) + e^(-10*x) - 1) + 16/15*a^(3/2)/(5*e^(-2*x) - 10*e^
(-4*x) + 10*e^(-6*x) - 5*e^(-8*x) + e^(-10*x) - 1)
```

### 3.44.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.44

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx = -\frac{16\,a^{\frac{3}{2}}\left(10\,e^{(4x)}-5\,e^{(2x)}+1\right)}{15\left(e^{(2x)}-1\right)^5}$$

input
```
integrate((a*csch(x)^4)^(3/2),x, algorithm="giac")
```

output
```
-16/15*a^(3/2)*(10*e^(4*x) - 5*e^(2*x) + 1)/(e^(2*x) - 1)^5
```

### 3.44.9 Mupad [B] (verification not implemented)

Time = 2.15 (sec) , antiderivative size = 46, normalized size of antiderivative = 0.74

$$\int \left(a\operatorname{csch}^4(x)\right)^{3/2}\,dx = -\frac{4\,a\,\mathrm{e}^{-2\,x}\,\sqrt{\frac{a}{\left(\frac{\mathrm{e}^{-x}}{2}-\frac{\mathrm{e}^{x}}{2}\right)^4}}\,\left(10\,\mathrm{e}^{4\,x}-5\,\mathrm{e}^{2\,x}+1\right)}{15\,\left(\mathrm{e}^{2\,x}-1\right)^3}$$

input
```
int((a/sinh(x)^4)^(3/2),x)
```

output
```
-(4*a*exp(-2*x)*(a/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(10*exp(4*x) - 5*exp(2*
x) + 1))/(15*(exp(2*x) - 1)^3)
```

# 3.45 $\int \sqrt{a\operatorname{csch}^4(x)}\,dx$

3.45.1 Optimal result . . . 324
3.45.2 Mathematica [A] (verified) . . . 324
3.45.3 Rubi [A] (verified) . . . 325
3.45.4 Maple [A] (verified) . . . 326
3.45.5 Fricas [B] (verification not implemented) . . . 327
3.45.6 Sympy [F] . . . 327
3.45.7 Maxima [A] (verification not implemented) . . . 327
3.45.8 Giac [A] (verification not implemented) . . . 328
3.45.9 Mupad [B] (verification not implemented) . . . 328

## 3.45.1 Optimal result

Integrand size = 10, antiderivative size = 16

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = -\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\sinh(x)$$

output
```
-cosh(x)*sinh(x)*(a*csch(x)^4)^(1/2)
```

## 3.45.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 16, normalized size of antiderivative = 1.00

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = -\cosh(x)\sqrt{a\operatorname{csch}^4(x)}\sinh(x)$$

input
```
Integrate[Sqrt[a*Csch[x]^4],x]
```

output
```
-(Cosh[x]*Sqrt[a*Csch[x]^4]*Sinh[x])
```

### 3.45.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 16, normalized size of antiderivative = 1.00, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.700$, Rules used = {3042, 4611, 25, 3042, 25, 4254, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{a\sec\left(\frac{\pi}{2}+ix\right)^4}\,dx$$

$$\downarrow 4611$$

$$\sinh^2(x)\left(-\sqrt{a\operatorname{csch}^4(x)}\right)\int -\operatorname{csch}^2(x)dx$$

$$\downarrow 25$$

$$\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int \operatorname{csch}^2(x)dx$$

$$\downarrow 3042$$

$$\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int -\csc(ix)^2dx$$

$$\downarrow 25$$

$$\sinh^2(x)\left(-\sqrt{a\operatorname{csch}^4(x)}\right)\int \csc(ix)^2dx$$

$$\downarrow 4254$$

$$-i\sinh^2(x)\sqrt{a\operatorname{csch}^4(x)}\int 1d(-i\coth(x))$$

$$\downarrow 24$$

$$\sinh(x)(-\cosh(x))\sqrt{a\operatorname{csch}^4(x)}$$

input
```
Int[Sqrt[a*Csch[x]^4],x]
```

output
```
-(Cosh[x]*Sqrt[a*Csch[x]^4]*Sinh[x])
```

#### 3.45.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.45.4 Maple [A] (verified)

Time = 0.19 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.81

| method | result | size |
|---|---|---|
| risch | $-2\sqrt{\frac{a\,\mathrm{e}^{4x}}{(\mathrm{e}^{2x}-1)^4}}\,\mathrm{e}^{-2x}(\mathrm{e}^{2x}-1)$ | 29 |

input
```
int((a*csch(x)^4)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-2*(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)*exp(-2*x)*(exp(2*x)-1)
```

### 3.45.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 81 vs. $2(14) = 28$.

Time $= 0.26$ (sec) , antiderivative size $= 81$, normalized size of antiderivative $= 5.06$

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = -\frac{2\sqrt{\frac{a}{e^{(8x)}-4e^{(6x)}+6e^{(4x)}-4e^{(2x)}+1}}\left(e^{(4x)}-2e^{(2x)}+1\right)e^{(2x)}}{2\cosh(x)e^{(2x)}\sinh(x)+e^{(2x)}\sinh(x)^2+\left(\cosh(x)^2-1\right)e^{(2x)}}$$

input
```
integrate((a*csch(x)^4)^(1/2),x, algorithm="fricas")
```

output
```
-2*sqrt(a/(e^(8*x) - 4*e^(6*x) + 6*e^(4*x) - 4*e^(2*x) + 1))*(e^(4*x) - 2*
e^(2*x) + 1)*e^(2*x)/(2*cosh(x)*e^(2*x)*sinh(x) + e^(2*x)*sinh(x)^2 + (cos
h(x)^2 - 1)*e^(2*x))
```

### 3.45.6 Sympy [F]

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = \int \sqrt{a\operatorname{csch}^4(x)}\,dx$$

input
```
integrate((a*csch(x)**4)**(1/2),x)
```

output
```
Integral(sqrt(a*csch(x)**4), x)
```

### 3.45.7 Maxima [A] (verification not implemented)

Time $= 0.27$ (sec) , antiderivative size $= 13$, normalized size of antiderivative $= 0.81$

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = \frac{2\sqrt{a}}{e^{(-2x)}-1}$$

input
```
integrate((a*csch(x)^4)^(1/2),x, algorithm="maxima")
```

output
```
2*sqrt(a)/(e^(-2*x) - 1)
```

### 3.45.8 Giac [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 13, normalized size of antiderivative = 0.81

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = -\frac{2\sqrt{a}}{e^{(2x)}-1}$$

input
```
integrate((a*csch(x)^4)^(1/2),x, algorithm="giac")
```

output
```
-2*sqrt(a)/(e^(2*x) - 1)
```

### 3.45.9 Mupad [B] (verification not implemented)

Time = 2.14 (sec) , antiderivative size = 71, normalized size of antiderivative = 4.44

$$\int \sqrt{a\operatorname{csch}^4(x)}\,dx = -\frac{\sqrt{a}\,\sqrt{\frac{1}{\left(\frac{e^{-x}}{2}-\frac{e^{x}}{2}\right)^4}}\left(3\,e^{4x}-2\,e^{2x}-2\,e^{6x}+\frac{e^{8x}}{2}+\frac{1}{2}\right)}{\left(e^{2x}-1\right)\left(e^{2x}-2\,e^{4x}+e^{6x}\right)}$$

input
```
int((a/sinh(x)^4)^(1/2),x)
```

output
```
-(a^(1/2)*(1/(exp(-x)/2 - exp(x)/2)^4)^(1/2)*(3*exp(4*x) - 2*exp(2*x) - 2*
exp(6*x) + exp(8*x)/2 + 1/2))/((exp(2*x) - 1)*(exp(2*x) - 2*exp(4*x) + exp
(6*x)))
```

# 3.46 $\int \frac{1}{\sqrt{a\,\mathbf{csch}^4(x)}}\,dx$

3.46.1 Optimal result . . . 329
3.46.2 Mathematica [A] (verified) . . . 329
3.46.3 Rubi [A] (verified) . . . 330
3.46.4 Maple [B] (verified) . . . 331
3.46.5 Fricas [B] (verification not implemented) . . . 332
3.46.6 Sympy [F] . . . 332
3.46.7 Maxima [A] (verification not implemented) . . . 333
3.46.8 Giac [A] (verification not implemented) . . . 333
3.46.9 Mupad [F(-1)] . . . 333

## 3.46.1 Optimal result

Integrand size = 10, antiderivative size = 36

$$\int \frac{1}{\sqrt{a\,\mathrm{csch}^4(x)}}\,dx = \frac{\coth(x)}{2\sqrt{a\,\mathrm{csch}^4(x)}} - \frac{x\,\mathrm{csch}^2(x)}{2\sqrt{a\,\mathrm{csch}^4(x)}}$$

output
```
1/2*coth(x)/(a*csch(x)^4)^(1/2)-1/2*x*csch(x)^2/(a*csch(x)^4)^(1/2)
```

## 3.46.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 24, normalized size of antiderivative = 0.67

$$\int \frac{1}{\sqrt{a\,\mathrm{csch}^4(x)}}\,dx = \frac{\coth(x) - x\,\mathrm{csch}^2(x)}{2\sqrt{a\,\mathrm{csch}^4(x)}}$$

input
```
Integrate[1/Sqrt[a*Csch[x]^4],x]
```

output
```
(Coth[x] - x*Csch[x]^2)/(2*Sqrt[a*Csch[x]^4])
```

### 3.46.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 30, normalized size of antiderivative = 0.83, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.700$, Rules used = {3042, 4611, 25, 3042, 25, 3115, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{a\operatorname{csch}^4(x)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{a\sec\left(\frac{\pi}{2}+ix\right)^4}}dx$$

$$\downarrow 4611$$

$$-\frac{\operatorname{csch}^2(x)\int -\sinh^2(x)dx}{\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$\frac{\operatorname{csch}^2(x)\int \sinh^2(x)dx}{\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$\frac{\operatorname{csch}^2(x)\int -\sin(ix)^2dx}{\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\int \sin(ix)^2dx}{\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{\int 1dx}{2}-\frac{1}{2}\sinh(x)\cosh(x)\right)}{\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 24$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{x}{2}-\frac{1}{2}\sinh(x)\cosh(x)\right)}{\sqrt{a\operatorname{csch}^4(x)}}$$

input
```
Int[1/Sqrt[a*Csch[x]^4],x]
```

output
```
-((Csch[x]^2*(x/2 - (Cosh[x]*Sinh[x])/2))/Sqrt[a*Csch[x]^4])
```

#### 3.46.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.46.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 88 vs. $2(28) = 56$.

Time $= 0.18$ (sec) , antiderivative size $= 89$, normalized size of antiderivative $= 2.47$

| method | result | size |
|---|---|---|
| risch | $-\frac{e^{2x}x}{2\sqrt{\frac{a\,e^{4x}}{\left(e^{2x}-1\right)^4}}\left(e^{2x}-1\right)^2}+\frac{e^{4x}}{8\sqrt{\frac{a\,e^{4x}}{\left(e^{2x}-1\right)^4}}\left(e^{2x}-1\right)^2}-\frac{1}{8\left(e^{2x}-1\right)^2\sqrt{\frac{a\,e^{4x}}{\left(e^{2x}-1\right)^4}}}$ | 89 |

input
```
int(1/(a*csch(x)^4)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-1/2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)/(exp(2*x)-1)^2*exp(2*x)*x+1/8/(a*ex
p(4*x)/(exp(2*x)-1)^4)^(1/2)/(exp(2*x)-1)^2*exp(4*x)-1/8/(exp(2*x)-1)^2/(a
*exp(4*x)/(exp(2*x)-1)^4)^(1/2)
```

### 3.46.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 253 vs. $2(28) = 56$.

Time = 0.26 (sec) , antiderivative size = 253, normalized size of antiderivative = 7.03

$$\int \frac{1}{\sqrt{a\operatorname{csch}^4(x)}}\,dx$$
$$= \frac{\left(\left(e^{(4\,x)} - 2\,e^{(2\,x)} + 1\right)\sinh(x)^4 + \cosh(x)^4 + 4\left(\cosh(x)\,e^{(4\,x)} - 2\,\cosh(x)\,e^{(2\,x)} + \cosh(x)\right)\sinh(x)^3 - 4\,x\right.}{}$$

input
```
integrate(1/(a*csch(x)^4)^(1/2),x, algorithm="fricas")
```

output
```
1/8*((e^(4*x) - 2*e^(2*x) + 1)*sinh(x)^4 + cosh(x)^4 + 4*(cosh(x)*e^(4*x)
- 2*cosh(x)*e^(2*x) + cosh(x))*sinh(x)^3 - 4*x*cosh(x)^2 + 2*(3*cosh(x)^2
+ (3*cosh(x)^2 - 2*x)*e^(4*x) - 2*(3*cosh(x)^2 - 2*x)*e^(2*x) - 2*x)*sinh(
x)^2 + (cosh(x)^4 - 4*x*cosh(x)^2 - 1)*e^(4*x) - 2*(cosh(x)^4 - 4*x*cosh(x
)^2 - 1)*e^(2*x) + 4*(cosh(x)^3 - 2*x*cosh(x) + (cosh(x)^3 - 2*x*cosh(x))*
e^(4*x) - 2*(cosh(x)^3 - 2*x*cosh(x))*e^(2*x))*sinh(x) - 1)*sqrt(a/(e^(8*x
) - 4*e^(6*x) + 6*e^(4*x) - 4*e^(2*x) + 1))*e^(2*x)/(a*cosh(x)^2*e^(2*x) +
 2*a*cosh(x)*e^(2*x)*sinh(x) + a*e^(2*x)*sinh(x)^2)
```

### 3.46.6 Sympy [F]

$$\int \frac{1}{\sqrt{a\operatorname{csch}^4(x)}}\,dx = \int \frac{1}{\sqrt{a\,\operatorname{csch}^4(x)}}\,dx$$

input
```
integrate(1/(a*csch(x)**4)**(1/2),x)
```

output
```
Integral(1/sqrt(a*csch(x)**4), x)
```

### 3.46.7 Maxima [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.61

$$\int \frac{1}{\sqrt{a\operatorname{csch}^4(x)}}\,dx = -\frac{\left(e^{(-4x)}-1\right)e^{(2x)}}{8\sqrt{a}} - \frac{x}{2\sqrt{a}}$$

input
```
integrate(1/(a*csch(x)^4)^(1/2),x, algorithm="maxima")
```

output
```
-1/8*(e^(-4*x) - 1)*e^(2*x)/sqrt(a) - 1/2*x/sqrt(a)
```

### 3.46.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 26, normalized size of antiderivative = 0.72

$$\int \frac{1}{\sqrt{a\operatorname{csch}^4(x)}}\,dx = \frac{\left(2\,e^{(2x)}-1\right)e^{(-2x)} - 4\,x + e^{(2x)}}{8\sqrt{a}}$$

input
```
integrate(1/(a*csch(x)^4)^(1/2),x, algorithm="giac")
```

output
```
1/8*((2*e^(2*x) - 1)*e^(-2*x) - 4*x + e^(2*x))/sqrt(a)
```

### 3.46.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{a\operatorname{csch}^4(x)}}\,dx = \int \frac{1}{\sqrt{\frac{a}{\sinh(x)^4}}}\,dx$$

input
```
int(1/(a/sinh(x)^4)^(1/2),x)
```

output
```
int(1/(a/sinh(x)^4)^(1/2), x)
```

# 3.47 $\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx$


3.47.1 Optimal result . . . 334
3.47.2 Mathematica [A] (verified) . . . 334
3.47.3 Rubi [A] (verified) . . . 335
3.47.4 Maple [B] (verified) . . . 337
3.47.5 Fricas [B] (verification not implemented) . . . 338
3.47.6 Sympy [F] . . . 339
3.47.7 Maxima [A] (verification not implemented) . . . 339
3.47.8 Giac [A] (verification not implemented) . . . 339
3.47.9 Mupad [F(-1)] . . . 340


## 3.47.1 Optimal result

Integrand size = 10, antiderivative size = 86

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = \frac{5\coth(x)}{16a\sqrt{a\operatorname{csch}^4(x)}} - \frac{5x\operatorname{csch}^2(x)}{16a\sqrt{a\operatorname{csch}^4(x)}} - \frac{5\cosh(x)\sinh(x)}{24a\sqrt{a\operatorname{csch}^4(x)}} + \frac{\cosh(x)\sinh^3(x)}{6a\sqrt{a\operatorname{csch}^4(x)}}$$

output

```
5/16*coth(x)/a/(a*csch(x)^4)^(1/2)-5/16*x*csch(x)^2/a/(a*csch(x)^4)^(1/2)-
5/24*cosh(x)*sinh(x)/a/(a*csch(x)^4)^(1/2)+1/6*cosh(x)*sinh(x)^3/a/(a*csch
(x)^4)^(1/2)
```

## 3.47.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 38, normalized size of antiderivative = 0.44

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = \frac{\operatorname{csch}^6(x)(-60x + 45\sinh(2x) - 9\sinh(4x) + \sinh(6x))}{192\left(a\operatorname{csch}^4(x)\right)^{3/2}}$$

input

```
Integrate[(a*Csch[x]^4)^(-3/2),x]
```

output

```
(Csch[x]^6*(-60*x + 45*Sinh[2*x] - 9*Sinh[4*x] + Sinh[6*x]))/(192*(a*Csch[
x]^4)^(3/2))
```

### 3.47.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 63, normalized size of antiderivative = 0.73, number of steps used = 13, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.300$, Rules used = {3042, 4611, 25, 3042, 25, 3115, 3042, 3115, 25, 3042, 25, 3115, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(a\sec\left(\frac{\pi}{2}+ix\right)^4\right)^{3/2}}dx$$

$$\downarrow 4611$$

$$-\frac{\operatorname{csch}^2(x)\int -\sinh^6(x)dx}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$\frac{\operatorname{csch}^2(x)\int \sinh^6(x)dx}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$\frac{\operatorname{csch}^2(x)\int -\sin(ix)^6dx}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\int \sin(ix)^6dx}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{5}{6}\int \sinh^4(x)dx-\frac{1}{6}\sinh^5(x)\cosh(x)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{6}\sinh^5(x)\cosh(x)+\frac{5}{6}\int \sin(ix)^4dx\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{5}{6}\left(\frac{3}{4}\int -\sinh^2(x)dx+\frac{1}{4}\sinh^3(x)\cosh(x)\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)-\frac{3}{4}\int \sinh^2(x)dx\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{6}\sinh^5(x)\cosh(x)+\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)-\frac{3}{4}\int -\sin(ix)^2dx\right)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{6}\sinh^5(x)\cosh(x)+\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)+\frac{3}{4}\int \sin(ix)^2dx\right)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{5}{6}\left(\frac{3}{4}\left(\frac{\int 1dx}{2}-\frac{1}{2}\sinh(x)\cosh(x)\right)+\frac{1}{4}\sinh^3(x)\cosh(x)\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 24$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)+\frac{3}{4}\left(\frac{x}{2}-\frac{1}{2}\sinh(x)\cosh(x)\right)\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)}{a\sqrt{a\operatorname{csch}^4(x)}}$$

input
```
Int[(a*Csch[x]^4)^(-3/2),x]
```

output
```
-((Csch[x]^2*(-1/6*(Cosh[x]*Sinh[x]^5) + (5*((Cosh[x]*Sinh[x]^3)/4 + (3*(x
/2 - (Cosh[x]*Sinh[x])/2))/4))/6))/(a*Sqrt[a*Csch[x]^4]))
```

#### 3.47.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

### 3.47.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 229 vs. $2(70) = 140$.

Time $= 0.16$ (sec) , antiderivative size $= 230$, normalized size of antiderivative $= 2.67$

| method | result |
|---|---|
| risch | $-\frac{5\,e^{2x}x}{16a(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}+\frac{e^{8x}}{384a(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}-\frac{3\,e^{6x}}{128a(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}+\frac{15\,e^{4x}}{128a(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}-\frac{}{128}\sqrt{}$ |

input
```
int(1/(a*csch(x)^4)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
-5/16/a*exp(2*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)*x+1/384/
a*exp(8*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)-3/128/a*exp(6*
x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)+15/128/a*exp(4*x)/(exp
(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)-15/128/(a*exp(4*x)/(exp(2*x)-
1)^4)^(1/2)/(exp(2*x)-1)^2/a+3/128/a*exp(-2*x)/(exp(2*x)-1)^2/(a*exp(4*x)/
(exp(2*x)-1)^4)^(1/2)-1/384/a*exp(-4*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*
x)-1)^4)^(1/2)
```

### 3.47.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1141 vs. $2(70) = 140$.

Time = 0.27 (sec) , antiderivative size = 1141, normalized size of antiderivative = 13.27

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = \text{Too large to display}$$

input
```
integrate(1/(a*csch(x)^4)^(3/2),x, algorithm="fricas")
```

output
```
1/384*((e^(4*x) - 2*e^(2*x) + 1)*sinh(x)^12 + cosh(x)^12 + 12*(cosh(x)*e^(
4*x) - 2*cosh(x)*e^(2*x) + cosh(x))*sinh(x)^11 + 3*(22*cosh(x)^2 + (22*cos
h(x)^2 - 3)*e^(4*x) - 2*(22*cosh(x)^2 - 3)*e^(2*x) - 3)*sinh(x)^10 - 9*cos
h(x)^10 + 10*(22*cosh(x)^3 + (22*cosh(x)^3 - 9*cosh(x))*e^(4*x) - 2*(22*co
sh(x)^3 - 9*cosh(x))*e^(2*x) - 9*cosh(x))*sinh(x)^9 + 45*(11*cosh(x)^4 - 9
*cosh(x)^2 + (11*cosh(x)^4 - 9*cosh(x)^2 + 1)*e^(4*x) - 2*(11*cosh(x)^4 -
9*cosh(x)^2 + 1)*e^(2*x) + 1)*sinh(x)^8 + 45*cosh(x)^8 + 72*(11*cosh(x)^5
- 15*cosh(x)^3 + (11*cosh(x)^5 - 15*cosh(x)^3 + 5*cosh(x))*e^(4*x) - 2*(11
*cosh(x)^5 - 15*cosh(x)^3 + 5*cosh(x))*e^(2*x) + 5*cosh(x))*sinh(x)^7 - 12
0*x*cosh(x)^6 + 6*(154*cosh(x)^6 - 315*cosh(x)^4 + 210*cosh(x)^2 + (154*co
sh(x)^6 - 315*cosh(x)^4 + 210*cosh(x)^2 - 20*x)*e^(4*x) - 2*(154*cosh(x)^6
 - 315*cosh(x)^4 + 210*cosh(x)^2 - 20*x)*e^(2*x) - 20*x)*sinh(x)^6 + 36*(2
2*cosh(x)^7 - 63*cosh(x)^5 + 70*cosh(x)^3 - 20*x*cosh(x) + (22*cosh(x)^7 -
 63*cosh(x)^5 + 70*cosh(x)^3 - 20*x*cosh(x))*e^(4*x) - 2*(22*cosh(x)^7 - 6
3*cosh(x)^5 + 70*cosh(x)^3 - 20*x*cosh(x))*e^(2*x))*sinh(x)^5 + 45*(11*cos
h(x)^8 - 42*cosh(x)^6 + 70*cosh(x)^4 - 40*x*cosh(x)^2 + (11*cosh(x)^8 - 42
*cosh(x)^6 + 70*cosh(x)^4 - 40*x*cosh(x)^2 - 1)*e^(4*x) - 2*(11*cosh(x)^8
- 42*cosh(x)^6 + 70*cosh(x)^4 - 40*x*cosh(x)^2 - 1)*e^(2*x) - 1)*sinh(x)^4
 - 45*cosh(x)^4 + 20*(11*cosh(x)^9 - 54*cosh(x)^7 + 126*cosh(x)^5 - 120*x*
cosh(x)^3 + (11*cosh(x)^9 - 54*cosh(x)^7 + 126*cosh(x)^5 - 120*x*cosh(x...
```

### 3.47.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}^4(x)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**4)**(3/2),x)
```

output
```
Integral((a*csch(x)**4)**(-3/2), x)
```

### 3.47.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 46, normalized size of antiderivative = 0.53

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = -\frac{\left(9\,e^{(-2\,x)} - 45\,e^{(-4\,x)} + 45\,e^{(-8\,x)} - 9\,e^{(-10\,x)} + e^{(-12\,x)} - 1\right)e^{(6\,x)}}{384\,a^{\frac{3}{2}}} - \frac{5\,x}{16\,a^{\frac{3}{2}}}$$

input
```
integrate(1/(a*csch(x)^4)^(3/2),x, algorithm="maxima")
```

output
```
-1/384*(9*e^(-2*x) - 45*e^(-4*x) + 45*e^(-8*x) - 9*e^(-10*x) + e^(-12*x) -
 1)*e^(6*x)/a^(3/2) - 5/16*x/a^(3/2)
```

### 3.47.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 50, normalized size of antiderivative = 0.58

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = \frac{\left(110\,e^{(6\,x)} - 45\,e^{(4\,x)} + 9\,e^{(2\,x)} - 1\right)e^{(-6\,x)} - 120\,x + e^{(6\,x)} - 9\,e^{(4\,x)} + 45\,e^{(2\,x)}}{384\,a^{\frac{3}{2}}}$$

input
```
integrate(1/(a*csch(x)^4)^(3/2),x, algorithm="giac")
```

output
```
1/384*((110*e^(6*x) - 45*e^(4*x) + 9*e^(2*x) - 1)*e^(-6*x) - 120*x + e^(6*
x) - 9*e^(4*x) + 45*e^(2*x))/a^(3/2)
```

### 3.47.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{3/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^4}\right)^{3/2}}\,dx$$

input
```
int(1/(a/sinh(x)^4)^(3/2),x)
```

output
```
int(1/(a/sinh(x)^4)^(3/2), x)
```

# 3.48 $\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx$


3.48.1 Optimal result . . . 341
3.48.2 Mathematica [A] (verified) . . . 341
3.48.3 Rubi [A] (verified) . . . 342
3.48.4 Maple [B] (verified) . . . 345
3.48.5 Fricas [B] (verification not implemented) . . . 346
3.48.6 Sympy [F] . . . 346
3.48.7 Maxima [A] (verification not implemented) . . . 347
3.48.8 Giac [A] (verification not implemented) . . . 347
3.48.9 Mupad [F(-1)] . . . 348


## 3.48.1 Optimal result

Integrand size = 10, antiderivative size = 132

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx = \frac{63\coth(x)}{256a^2\sqrt{a\operatorname{csch}^4(x)}} - \frac{63x\operatorname{csch}^2(x)}{256a^2\sqrt{a\operatorname{csch}^4(x)}} - \frac{21\cosh(x)\sinh(x)}{128a^2\sqrt{a\operatorname{csch}^4(x)}} + \frac{21\cosh(x)\sinh^3(x)}{160a^2\sqrt{a\operatorname{csch}^4(x)}} - \frac{9\cosh(x)\sinh^5(x)}{80a^2\sqrt{a\operatorname{csch}^4(x)}} + \frac{\cosh(x)\sinh^7(x)}{10a^2\sqrt{a\operatorname{csch}^4(x)}}$$

output
```
63/256*coth(x)/a^2/(a*csch(x)^4)^(1/2)-63/256*x*csch(x)^2/a^2/(a*csch(x)^4
)^(1/2)-21/128*cosh(x)*sinh(x)/a^2/(a*csch(x)^4)^(1/2)+21/160*cosh(x)*sinh
(x)^3/a^2/(a*csch(x)^4)^(1/2)-9/80*cosh(x)*sinh(x)^5/a^2/(a*csch(x)^4)^(1/
2)+1/10*cosh(x)*sinh(x)^7/a^2/(a*csch(x)^4)^(1/2)
```

## 3.48.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 55, normalized size of antiderivative = 0.42

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx = \frac{\sqrt{a\operatorname{csch}^4(x)}\sinh^2(x)(-2520x + 2100\sinh(2x) - 600\sinh(4x) + 150\sinh(6x) - 25\sinh(8x) + 2\sinh(10x))}{10240a^3}$$

input
```
Integrate[(a*Csch[x]^4)^(-5/2),x]
```

output
```
(Sqrt[a*Csch[x]^4]*Sinh[x]^2*(-2520*x + 2100*Sinh[2*x] - 600*Sinh[4*x] + 1
50*Sinh[6*x] - 25*Sinh[8*x] + 2*Sinh[10*x]))/(10240*a^3)
```

### 3.48.3 Rubi [A] (verified)

Time = 0.49 (sec) , antiderivative size = 93, normalized size of antiderivative = 0.70, number of steps used = 19, number of rules used = 19, $\frac{\text{number of rules}}{\text{integrand size}} = 1.900$, Rules used = {3042, 4611, 25, 3042, 25, 3115, 3042, 3115, 25, 3042, 25, 3115, 3042, 3115, 25, 3042, 25, 3115, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\left(a\sec\left(\frac{\pi}{2}+ix\right)^4\right)^{5/2}}dx$$

$$\downarrow 4611$$

$$-\frac{\operatorname{csch}^2(x)\int -\sinh^{10}(x)dx}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$\frac{\operatorname{csch}^2(x)\int \sinh^{10}(x)dx}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$\frac{\operatorname{csch}^2(x)\int -\sin(ix)^{10}dx}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\int \sin(ix)^{10}dx}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\int \sinh^8(x)dx-\frac{1}{10}\sinh^9(x)\cosh(x)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{10}\sinh^9(x)\cosh(x)+\frac{9}{10}\int\sin(ix)^8dx\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{7}{8}\int-\sinh^6(x)dx+\frac{1}{8}\sinh^7(x)\cosh(x)\right)-\frac{1}{10}\sinh^9(x)\cosh(x)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)-\frac{7}{8}\int\sinh^6(x)dx\right)-\frac{1}{10}\sinh^9(x)\cosh(x)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{10}\sinh^9(x)\cosh(x)+\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)-\frac{7}{8}\int-\sin(ix)^6dx\right)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{10}\sinh^9(x)\cosh(x)+\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)+\frac{7}{8}\int\sin(ix)^6dx\right)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{7}{8}\left(\frac{5}{6}\int\sinh^4(x)dx-\frac{1}{6}\sinh^5(x)\cosh(x)\right)+\frac{1}{8}\sinh^7(x)\cosh(x)\right)-\frac{1}{10}\sinh^9(x)\cosh(x)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{10}\sinh^9(x)\cosh(x)+\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)+\frac{7}{8}\left(-\frac{1}{6}\sinh^5(x)\cosh(x)+\frac{5}{6}\int\sin(ix)^4dx\right)\right)\right)}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{7}{8}\left(\frac{5}{6}\left(\frac{3}{4}\int-\sinh^2(x)dx+\frac{1}{4}\sinh^3(x)\cosh(x)\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)+\frac{1}{8}\sinh^7(x)\cosh(x)\right)-\frac{1}{10}\sinh\right.}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{7}{8}\left(\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)-\frac{3}{4}\int\sinh^2(x)dx\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)+\frac{1}{8}\sinh^7(x)\cosh(x)\right)-\frac{1}{10}\sinh^9(\right.}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{10}\sinh^9(x)\cosh(x)+\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)+\frac{7}{8}\left(-\frac{1}{6}\sinh^5(x)\cosh(x)+\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)-\frac{3}{4}\int\right.\right.\right.\right.}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 25$$

$$-\frac{\operatorname{csch}^2(x)\left(-\frac{1}{10}\sinh^9(x)\cosh(x)+\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)+\frac{7}{8}\left(-\frac{1}{6}\sinh^5(x)\cosh(x)+\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)+\frac{3}{4}\int\right.\right.\right.\right.}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 3115$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{7}{8}\left(\frac{5}{6}\left(\frac{3}{4}\left(\frac{\int 1dx}{2}-\frac{1}{2}\sinh(x)\cosh(x)\right)+\frac{1}{4}\sinh^3(x)\cosh(x)\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)+\frac{1}{8}\sinh^7(x)\cosh\right.\right.\right.}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

$$\downarrow 24$$

$$-\frac{\operatorname{csch}^2(x)\left(\frac{9}{10}\left(\frac{1}{8}\sinh^7(x)\cosh(x)+\frac{7}{8}\left(\frac{5}{6}\left(\frac{1}{4}\sinh^3(x)\cosh(x)+\frac{3}{4}\left(\frac{x}{2}-\frac{1}{2}\sinh(x)\cosh(x)\right)\right)-\frac{1}{6}\sinh^5(x)\cosh(x)\right)\right)-\right.}{a^2\sqrt{a\operatorname{csch}^4(x)}}$$

input
```
Int[(a*Csch[x]^4)^(-5/2),x]
```

output
```
-((Csch[x]^2*(-1/10*(Cosh[x]*Sinh[x]^9) + (9*((Cosh[x]*Sinh[x]^7)/8 + (7*(
-1/6*(Cosh[x]*Sinh[x]^5) + (5*((Cosh[x]*Sinh[x]^3)/4 + (3*(x/2 - (Cosh[x]*
Sinh[x])/2))/4))/6))/8))/10))/(a^2*Sqrt[a*Csch[x]^4]))
```

### 3.48.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 4611
```
Int[((b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_), x_Symbol] :> Simp[b^
IntPart[p]*((b*(c*Sec[e + f*x])^n)^FracPart[p]/(c*Sec[e + f*x])^(n*FracPart
[p]))   Int[(c*Sec[e + f*x])^(n*p), x], x] /; FreeQ[{b, c, e, f, n, p}, x]
&&  !IntegerQ[p]
```

## 3.48.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 361 vs. $2(108) = 216$.

Time = 0.17 (sec) , antiderivative size = 362, normalized size of antiderivative = 2.74

| method | result |
|---|---|
| risch | $-\frac{63\,e^{2x}x}{256a^2(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}+\frac{e^{12x}}{10240a^2(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}-\frac{5\,e^{10x}}{4096a^2(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}+\frac{15\,e^{8x}}{2048a^2(e^{2x}-1)^2\sqrt{\frac{a\,e^{4x}}{(e^{2x}-1)^4}}}$ |

input
```
int(1/(a*csch(x)^4)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
-63/256/a^2*exp(2*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)*x+1/
10240/a^2*exp(12*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)-5/409
6/a^2*exp(10*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)+15/2048/a
^2*exp(8*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)-15/512/a^2*ex
p(6*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)+105/1024/a^2*exp(4
*x)/(exp(2*x)-1)^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)-105/1024/(a*exp(4*x)/
(exp(2*x)-1)^4)^(1/2)/(exp(2*x)-1)^2/a^2+15/512/a^2*exp(-2*x)/(exp(2*x)-1)
^2/(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)-15/2048/a^2*exp(-4*x)/(exp(2*x)-1)^2/
(a*exp(4*x)/(exp(2*x)-1)^4)^(1/2)+5/4096/a^2*exp(-6*x)/(exp(2*x)-1)^2/(a*e
xp(4*x)/(exp(2*x)-1)^4)^(1/2)-1/10240/a^2*exp(-8*x)/(exp(2*x)-1)^2/(a*exp(
4*x)/(exp(2*x)-1)^4)^(1/2)
```

### 3.48.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2600 vs. 2(108) = 216.

Time = 0.32 (sec) , antiderivative size = 2600, normalized size of antiderivative = 19.70

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx = \text{Too large to display}$$

input
```
integrate(1/(a*csch(x)^4)^(5/2),x, algorithm="fricas")
```

output
```
1/20480*(2*(e^(4*x) - 2*e^(2*x) + 1)*sinh(x)^20 + 2*cosh(x)^20 + 40*(cosh(
x)*e^(4*x) - 2*cosh(x)*e^(2*x) + cosh(x))*sinh(x)^19 + 5*(76*cosh(x)^2 + (
76*cosh(x)^2 - 5)*e^(4*x) - 2*(76*cosh(x)^2 - 5)*e^(2*x) - 5)*sinh(x)^18 -
 25*cosh(x)^18 + 30*(76*cosh(x)^3 + (76*cosh(x)^3 - 15*cosh(x))*e^(4*x) -
2*(76*cosh(x)^3 - 15*cosh(x))*e^(2*x) - 15*cosh(x))*sinh(x)^17 + 15*(646*c
osh(x)^4 - 255*cosh(x)^2 + (646*cosh(x)^4 - 255*cosh(x)^2 + 10)*e^(4*x) -
2*(646*cosh(x)^4 - 255*cosh(x)^2 + 10)*e^(2*x) + 10)*sinh(x)^16 + 150*cosh
(x)^16 + 48*(646*cosh(x)^5 - 425*cosh(x)^3 + (646*cosh(x)^5 - 425*cosh(x)^
3 + 50*cosh(x))*e^(4*x) - 2*(646*cosh(x)^5 - 425*cosh(x)^3 + 50*cosh(x))*e
^(2*x) + 50*cosh(x))*sinh(x)^15 + 60*(1292*cosh(x)^6 - 1275*cosh(x)^4 + 30
0*cosh(x)^2 + (1292*cosh(x)^6 - 1275*cosh(x)^4 + 300*cosh(x)^2 - 10)*e^(4*
x) - 2*(1292*cosh(x)^6 - 1275*cosh(x)^4 + 300*cosh(x)^2 - 10)*e^(2*x) - 10
)*sinh(x)^14 - 600*cosh(x)^14 + 120*(1292*cosh(x)^7 - 1785*cosh(x)^5 + 700
*cosh(x)^3 + (1292*cosh(x)^7 - 1785*cosh(x)^5 + 700*cosh(x)^3 - 70*cosh(x)
)*e^(4*x) - 2*(1292*cosh(x)^7 - 1785*cosh(x)^5 + 700*cosh(x)^3 - 70*cosh(x
))*e^(2*x) - 70*cosh(x))*sinh(x)^13 + 60*(4199*cosh(x)^8 - 7735*cosh(x)^6
+ 4550*cosh(x)^4 - 910*cosh(x)^2 + (4199*cosh(x)^8 - 7735*cosh(x)^6 + 4550
*cosh(x)^4 - 910*cosh(x)^2 + 35)*e^(4*x) - 2*(4199*cosh(x)^8 - 7735*cosh(x
)^6 + 4550*cosh(x)^4 - 910*cosh(x)^2 + 35)*e^(2*x) + 35)*sinh(x)^12 + 2100
*cosh(x)^12 + 80*(4199*cosh(x)^9 - 9945*cosh(x)^7 + 8190*cosh(x)^5 - 27...
```

### 3.48.6 Sympy [F]

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(a\,\operatorname{csch}^4(x)\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/(a*csch(x)**4)**(5/2),x)
```

output
```
Integral((a*csch(x)**4)**(-5/2), x)
```

### 3.48.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 72, normalized size of antiderivative = 0.55

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx =$$
$$-\frac{\left(25\,e^{(-2\,x)}-150\,e^{(-4\,x)}+600\,e^{(-6\,x)}-2100\,e^{(-8\,x)}+2100\,e^{(-12\,x)}-600\,e^{(-14\,x)}+150\,e^{(-16\,x)}-25\,e^{(-18\,x)}-\right.}{20480\,a^{\frac{5}{2}}}$$
$$-\frac{63\,x}{256\,a^{\frac{5}{2}}}$$

input
```
integrate(1/(a*csch(x)^4)^(5/2),x, algorithm="maxima")
```

output
```
-1/20480*(25*e^(-2*x) - 150*e^(-4*x) + 600*e^(-6*x) - 2100*e^(-8*x) + 2100
*e^(-12*x) - 600*e^(-14*x) + 150*e^(-16*x) - 25*e^(-18*x) + 2*e^(-20*x) -
2)*e^(10*x)/a^(5/2) - 63/256*x/a^(5/2)
```

### 3.48.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 76, normalized size of antiderivative = 0.58

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx = \frac{\left(5754\,e^{(10\,x)}-2100\,e^{(8\,x)}+600\,e^{(6\,x)}-150\,e^{(4\,x)}+25\,e^{(2\,x)}-2\right)e^{(-10\,x)}-5040\,x+2\,e}{20480\,a^{\frac{5}{2}}}$$

input
```
integrate(1/(a*csch(x)^4)^(5/2),x, algorithm="giac")
```

output
```
1/20480*((5754*e^(10*x) - 2100*e^(8*x) + 600*e^(6*x) - 150*e^(4*x) + 25*e^
(2*x) - 2)*e^(-10*x) - 5040*x + 2*e^(10*x) - 25*e^(8*x) + 150*e^(6*x) - 60
0*e^(4*x) + 2100*e^(2*x))/a^(5/2)
```

### 3.48.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\left(a\operatorname{csch}^4(x)\right)^{5/2}}\,dx = \int \frac{1}{\left(\frac{a}{\sinh(x)^4}\right)^{5/2}}\,dx$$

input
```
int(1/(a/sinh(x)^4)^(5/2),x)
```

output
```
int(1/(a/sinh(x)^4)^(5/2), x)
```

# 3.49 $\int \frac{1}{a+ia\,\mathbf{csch}(a+bx)}\,dx$

3.49.1 Optimal result . . . . . 349
3.49.2 Mathematica [A] (verified) . . . . . 349
3.49.3 Rubi [A] (verified) . . . . . 350
3.49.4 Maple [A] (verified) . . . . . 351
3.49.5 Fricas [A] (verification not implemented) . . . . . 351
3.49.6 Sympy [F] . . . . . 352
3.49.7 Maxima [A] (verification not implemented) . . . . . 352
3.49.8 Giac [A] (verification not implemented) . . . . . 352
3.49.9 Mupad [B] (verification not implemented) . . . . . 353

## 3.49.1 Optimal result

Integrand size = 15, antiderivative size = 32

$$\int \frac{1}{a+ia\,\mathrm{csch}(a+bx)}\,dx = \frac{x}{a} - \frac{\coth(a+bx)}{b(a+ia\,\mathrm{csch}(a+bx))}$$

output
```
x/a-coth(b*x+a)/b/(a+I*a*csch(b*x+a))
```

## 3.49.2 Mathematica [A] (verified)

Time = 0.32 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.69

$$\int \frac{1}{a+ia\,\mathrm{csch}(a+bx)}\,dx = \frac{1}{b} + \frac{x}{a} - \frac{2\sinh\left(\frac{1}{2}(a+bx)\right)}{ab\left(\cosh\left(\frac{1}{2}(a+bx)\right) - i\sinh\left(\frac{1}{2}(a+bx)\right)\right)}$$

input
```
Integrate[(a + I*a*Csch[a + b*x])^(-1),x]
```

output
```
b^(-1) + x/a - (2*Sinh[(a + b*x)/2])/(a*b*(Cosh[(a + b*x)/2] - I*Sinh[(a +
 b*x)/2]))
```

### 3.49.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {3042, 4264, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{a + ia\text{csch}(a + bx)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{a - a\csc(ia + ibx)}dx$$
$$\downarrow 4264$$
$$-\frac{\int -adx}{a^2} - \frac{\coth(a + bx)}{b(a + ia\text{csch}(a + bx))}$$
$$\downarrow 24$$
$$\frac{x}{a} - \frac{\coth(a + bx)}{b(a + ia\text{csch}(a + bx))}$$

input
```
Int[(a + I*a*Csch[a + b*x])^(-1),x]
```

output
```
x/a - Coth[a + b*x]/(b*(a + I*a*Csch[a + b*x]))
```

#### 3.49.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4264
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-Cot[c
+ d*x])*((a + b*Csc[c + d*x])^n/(d*(2*n + 1))), x] + Simp[1/(a^2*(2*n + 1))
   Int[(a + b*Csc[c + d*x])^(n + 1)*(a*(2*n + 1) - b*(n + 1)*Csc[c + d*x]),
 x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0] && LeQ[n, -1] && Int
egerQ[2*n]
```

## 3.49.4 Maple [A] (verified)

Time = 0.41 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.84

| method | result | size |
|---|---|---|
| risch | $\frac{x}{a}+\frac{2i}{ba\left(\mathrm{e}^{bx+a}+i\right)}$ | 27 |
| parallelrisch | $\frac{ixb+\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)(bx-2i)}{ba\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)+i\right)}$ | 44 |
| derivativedivides | $\frac{\ln\left(1+\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)-\frac{2}{\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)+i}-\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)-1\right)}{ab}$ | 54 |
| default | $\frac{\ln\left(1+\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)-\frac{2}{\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)+i}-\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)-1\right)}{ab}$ | 54 |

input
```
int(1/(a+I*a*csch(b*x+a)),x,method=_RETURNVERBOSE)
```

output
```
x/a+2*I/b/a/(exp(b*x+a)+I)
```

## 3.49.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.00

$$\int \frac{1}{a+ia\operatorname{csch}(a+bx)}\,dx = \frac{bxe^{(bx+a)}+i\,bx+2i}{abe^{(bx+a)}+i\,ab}$$

input
```
integrate(1/(a+I*a*csch(b*x+a)),x, algorithm="fricas")
```

output
```
(b*x*e^(b*x + a) + I*b*x + 2*I)/(a*b*e^(b*x + a) + I*a*b)
```

### 3.49.6 Sympy [F]

$$\int \frac{1}{a+ia\operatorname{csch}(a+bx)}\,dx = -\frac{i\int \frac{1}{\operatorname{csch}(a+bx)-i}\,dx}{a}$$

input
```
integrate(1/(a+I*a*csch(b*x+a)),x)
```

output
```
-I*Integral(1/(csch(a + b*x) - I), x)/a
```

### 3.49.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.09

$$\int \frac{1}{a+ia\operatorname{csch}(a+bx)}\,dx = \frac{bx+a}{ab} + \frac{2i}{(ae^{(-bx-a)} - i\,a)b}$$

input
```
integrate(1/(a+I*a*csch(b*x+a)),x, algorithm="maxima")
```

output
```
(b*x + a)/(a*b) + 2*I/((a*e^(-b*x - a) - I*a)*b)
```

### 3.49.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.91

$$\int \frac{1}{a+ia\operatorname{csch}(a+bx)}\,dx = \frac{\frac{bx+a}{a} + \frac{2i}{a\left(e^{(bx+a)}+i\right)}}{b}$$

input
```
integrate(1/(a+I*a*csch(b*x+a)),x, algorithm="giac")
```

output
```
((b*x + a)/a + 2*I/(a*(e^(b*x + a) + I)))/b
```

### 3.49.9 Mupad [B] (verification not implemented)

Time = 2.25 (sec) , antiderivative size = 26, normalized size of antiderivative = 0.81

$$\int \frac{1}{a + ia\operatorname{csch}(a + bx)}\,dx = \frac{x}{a} + \frac{2\mathrm{i}}{a\,b\,(\mathrm{e}^{a+b\,x} + 1\mathrm{i})}$$

input
```
int(1/(a + (a*1i)/sinh(a + b*x)),x)
```

output
```
x/a + 2i/(a*b*(exp(a + b*x) + 1i))
```

# 3.50 $\int \frac{1}{a-ia\mathbf{csch}(a+bx)}\,dx$

3.50.1 Optimal result . . . 354
3.50.2 Mathematica [A] (verified) . . . 354
3.50.3 Rubi [A] (verified) . . . 355
3.50.4 Maple [A] (verified) . . . 356
3.50.5 Fricas [A] (verification not implemented) . . . 356
3.50.6 Sympy [F] . . . 357
3.50.7 Maxima [A] (verification not implemented) . . . 357
3.50.8 Giac [A] (verification not implemented) . . . 357
3.50.9 Mupad [B] (verification not implemented) . . . 358

## 3.50.1 Optimal result

Integrand size = 15, antiderivative size = 32

$$\int \frac{1}{a-ia\operatorname{csch}(a+bx)}\,dx = \frac{x}{a} - \frac{\coth(a+bx)}{b(a-ia\operatorname{csch}(a+bx))}$$

output
```
x/a-coth(b*x+a)/b/(a-I*a*csch(b*x+a))
```

## 3.50.2 Mathematica [A] (verified)

Time = 0.26 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.69

$$\int \frac{1}{a-ia\operatorname{csch}(a+bx)}\,dx = \frac{1}{b} + \frac{x}{a} - \frac{2\sinh\left(\frac{1}{2}(a+bx)\right)}{ab\left(\cosh\left(\frac{1}{2}(a+bx)\right) + i\sinh\left(\frac{1}{2}(a+bx)\right)\right)}$$

input
```
Integrate[(a - I*a*Csch[a + b*x])^(-1),x]
```

output
```
b^(-1) + x/a - (2*Sinh[(a + b*x)/2])/(a*b*(Cosh[(a + b*x)/2] + I*Sinh[(a +
 b*x)/2]))
```

### 3.50.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {3042, 4264, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{a - ia\operatorname{csch}(a+bx)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{a + a\csc(ia+ibx)}\,dx$$
$$\downarrow 4264$$
$$-\frac{\int -a\,dx}{a^2} - \frac{\coth(a+bx)}{b(a - ia\operatorname{csch}(a+bx))}$$
$$\downarrow 24$$
$$\frac{x}{a} - \frac{\coth(a+bx)}{b(a - ia\operatorname{csch}(a+bx))}$$

input
```
Int[(a - I*a*Csch[a + b*x])^(-1),x]
```

output
```
x/a - Coth[a + b*x]/(b*(a - I*a*Csch[a + b*x]))
```

#### 3.50.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4264
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-Cot[c
+ d*x])*((a + b*Csc[c + d*x])^n/(d*(2*n + 1))), x] + Simp[1/(a^2*(2*n + 1))
   Int[(a + b*Csc[c + d*x])^(n + 1)*(a*(2*n + 1) - b*(n + 1)*Csc[c + d*x]),
 x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0] && LeQ[n, -1] && Int
egerQ[2*n]
```

### 3.50.4 Maple [A] (verified)

Time = 0.40 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.84

| method | result | size |
|---|---|---|
| risch | $\frac{x}{a}-\frac{2i}{ba\left(e^{bx+a}-i\right)}$ | 27 |
| parallelrisch | $\frac{(-bx-2i)\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)+ixb}{ba\left(-\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)+i\right)}$ | 47 |
| derivativedivides | $\frac{-\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)-1\right)+\ln\left(1+\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)-\frac{2}{\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)-i}}{ab}$ | 54 |
| default | $\frac{-\ln\left(\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)-1\right)+\ln\left(1+\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)\right)-\frac{2}{\tanh\left(\frac{bx}{2}+\frac{a}{2}\right)-i}}{ab}$ | 54 |

input
```
int(1/(a-I*a*csch(b*x+a)),x,method=_RETURNVERBOSE)
```

output
```
x/a-2*I/b/a/(exp(b*x+a)-I)
```

### 3.50.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.00

$$\int \frac{1}{a-ia\operatorname{csch}(a+bx)}\,dx=\frac{bxe^{(bx+a)}-i\,bx-2i}{abe^{(bx+a)}-i\,ab}$$

input
```
integrate(1/(a-I*a*csch(b*x+a)),x, algorithm="fricas")
```

output
```
(b*x*e^(b*x + a) - I*b*x - 2*I)/(a*b*e^(b*x + a) - I*a*b)
```

### 3.50.6 Sympy [F]

$$\int \frac{1}{a - ia\operatorname{csch}(a+bx)}\,dx = \frac{i\int \frac{1}{\operatorname{csch}(a+bx)+i}\,dx}{a}$$

input
```
integrate(1/(a-I*a*csch(b*x+a)),x)
```

output
```
I*Integral(1/(csch(a + b*x) + I), x)/a
```

### 3.50.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.09

$$\int \frac{1}{a - ia\operatorname{csch}(a+bx)}\,dx = \frac{bx+a}{ab} - \frac{2i}{(ae^{(-bx-a)} + i\,a)b}$$

input
```
integrate(1/(a-I*a*csch(b*x+a)),x, algorithm="maxima")
```

output
```
(b*x + a)/(a*b) - 2*I/((a*e^(-b*x - a) + I*a)*b)
```

### 3.50.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.91

$$\int \frac{1}{a - ia\operatorname{csch}(a+bx)}\,dx = \frac{\frac{bx+a}{a} - \frac{2i}{a\left(e^{(bx+a)}-i\right)}}{b}$$

input
```
integrate(1/(a-I*a*csch(b*x+a)),x, algorithm="giac")
```

output
```
((b*x + a)/a - 2*I/(a*(e^(b*x + a) - I)))/b
```

### 3.50.9 Mupad [B] (verification not implemented)

Time = 2.29 (sec) , antiderivative size = 26, normalized size of antiderivative = 0.81

$$\int \frac{1}{a - ia\operatorname{csch}(a + bx)}\,dx = \frac{x}{a} - \frac{2\mathrm{i}}{a\,b\,(\mathrm{e}^{a+b\,x} - \mathrm{i})}$$

input
```
int(1/(a - (a*1i)/sinh(a + b*x)),x)
```

output
```
x/a - 2i/(a*b*(exp(a + b*x) - 1i))
```

# 3.51 $\int (a + ia\,\mathrm{csch}(c + dx))^{5/2}\,dx$


3.51.1 Optimal result . . . . . 359
3.51.2 Mathematica [A] (verified) . . . . . 359
3.51.3 Rubi [A] (verified) . . . . . 360
3.51.4 Maple [F] . . . . . 363
3.51.5 Fricas [B] (verification not implemented) . . . . . 363
3.51.6 Sympy [F] . . . . . 364
3.51.7 Maxima [F] . . . . . 364
3.51.8 Giac [F] . . . . . 365
3.51.9 Mupad [F(-1)] . . . . . 365


## 3.51.1 Optimal result

Integrand size = 17, antiderivative size = 107

$$\int (a + ia\,\mathrm{csch}(c + dx))^{5/2}\,dx = \frac{2a^{5/2}\mathrm{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\,\mathrm{csch}(c+dx)}}\right)}{d} + \frac{14a^3\coth(c+dx)}{3d\sqrt{a+ia\,\mathrm{csch}(c+dx)}} + \frac{2a^2\coth(c+dx)\sqrt{a+ia\,\mathrm{csch}(c+dx)}}{3d}$$

output
```
2*a^(5/2)*arctanh(coth(d*x+c)*a^(1/2)/(a+I*a*csch(d*x+c))^(1/2))/d+14/3*a^
3*coth(d*x+c)/d/(a+I*a*csch(d*x+c))^(1/2)+2/3*a^2*coth(d*x+c)*(a+I*a*csch(
d*x+c))^(1/2)/d
```

## 3.51.2 Mathematica [A] (verified)

Time = 1.44 (sec) , antiderivative size = 136, normalized size of antiderivative = 1.27

$$\int (a + ia\,\mathrm{csch}(c + dx))^{5/2}\,dx = \frac{2a^2\sqrt{a+ia\,\mathrm{csch}(c+dx)}\left(-7i + \coth(c+dx) + \frac{3(-1)^{3/4}\mathrm{arctanh}\left((-1)^{3/4}\sqrt{i+\mathrm{csch}(c+dx)}\right)\coth(c+dx)}{(-i+\mathrm{csch}(c+dx))\sqrt{i+\mathrm{csch}(c+dx)}}\right.}{3d}$$

input
```
Integrate[(a + I*a*Csch[c + d*x])^(5/2),x]
```

output
```
(2*a^2*Sqrt[a + I*a*Csch[c + d*x]]*(-7*I + Coth[c + d*x] + (3*(-1)^(3/4)*A
rcTanh[(-1)^(3/4)*Sqrt[I + Csch[c + d*x]]]*Coth[c + d*x])/((-I + Csch[c +
d*x])*Sqrt[I + Csch[c + d*x]]) + (14*Sinh[(c + d*x)/2])/(Cosh[(c + d*x)/2]
 - I*Sinh[(c + d*x)/2])))/(3*d)
```

### 3.51.3 Rubi [A] (verified)

Time = 0.57 (sec) , antiderivative size = 111, normalized size of antiderivative = 1.04, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 0.647$, Rules used = {3042, 4262, 27, 3042, 4403, 26, 3042, 26, 4261, 216, 4279}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a + i a \operatorname{csch}(c + dx))^{5/2}\, dx$$

$$\downarrow 3042$$

$$\int (a - a \csc(ic + idx))^{5/2} dx$$

$$\downarrow 4262$$

$$\frac{2}{3}a \int \frac{1}{2}\sqrt{i\operatorname{csch}(c+dx)a + a}(7i\operatorname{csch}(c+dx)a + 3a)dx + \frac{2a^2 \coth(c+dx)\sqrt{a + ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 27$$

$$\frac{1}{3}a \int \sqrt{i\operatorname{csch}(c+dx)a + a}(7i\operatorname{csch}(c+dx)a + 3a)dx + \frac{2a^2 \coth(c+dx)\sqrt{a + ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 3042$$

$$\frac{1}{3}a \int (3a - 7a \csc(ic + idx))\sqrt{a - a\csc(ic+idx)}dx + \frac{2a^2 \coth(c+dx)\sqrt{a + ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 4403$$

$$\frac{1}{3}a\left(3a \int \sqrt{i\operatorname{csch}(c+dx)a + a}dx - 7a \int -i\operatorname{csch}(c+dx)\sqrt{i\operatorname{csch}(c+dx)a + a}dx\right) + \frac{2a^2 \coth(c+dx)\sqrt{a + ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 26$$

$$\frac{1}{3}a\left(3a\int\sqrt{i\operatorname{csch}(c+dx)a+a}dx+7ia\int\operatorname{csch}(c+dx)\sqrt{i\operatorname{csch}(c+dx)a+a}dx\right)+\frac{2a^2\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 3042$$

$$\frac{1}{3}a\left(3a\int\sqrt{a-a\csc(ic+idx)}dx+7ia\int i\csc(ic+idx)\sqrt{a-a\csc(ic+idx)}dx\right)+\frac{2a^2\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 26$$

$$\frac{1}{3}a\left(3a\int\sqrt{a-a\csc(ic+idx)}dx-7a\int\csc(ic+idx)\sqrt{a-a\csc(ic+idx)}dx\right)+\frac{2a^2\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 4261$$

$$\frac{1}{3}a\left(-\frac{6ia^2\int\frac{1}{a-\frac{a^2\coth^2(c+dx)}{i\operatorname{csch}(c+dx)a+a}}d\frac{ia\coth(c+dx)}{\sqrt{i\operatorname{csch}(c+dx)a+a}}}{d}-7a\int\csc(ic+idx)\sqrt{a-a\csc(ic+idx)}dx\right)+\frac{2a^2\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 216$$

$$\frac{1}{3}a\left(\frac{6a^{3/2}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}-7a\int\csc(ic+idx)\sqrt{a-a\csc(ic+idx)}dx\right)+\frac{2a^2\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{3d}$$

$$\downarrow 4279$$

$$\frac{2a^2\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{3d}+\frac{1}{3}a\left(\frac{6a^{3/2}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}+\frac{14a^2\coth(c+dx)}{d\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)$$

input
```
Int[(a + I*a*Csch[c + d*x])^(5/2),x]
```

## 3.51. $\int(a+ia\operatorname{csch}(c+dx))^{5/2}\,dx$

output
```
(2*a^2*Coth[c + d*x]*Sqrt[a + I*a*Csch[c + d*x]])/(3*d) + (a*((6*a^(3/2)*A
rcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a + I*a*Csch[c + d*x]]])/d + (14*a^2*C
oth[c + d*x])/(d*Sqrt[a + I*a*Csch[c + d*x]])))/3
```

#### 3.51.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4262
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-b^2)*C
ot[c + d*x]*((a + b*Csc[c + d*x])^(n - 2)/(d*(n - 1))), x] + Simp[a/(n - 1)
   Int[(a + b*Csc[c + d*x])^(n - 2)*(a*(n - 1) + b*(3*n - 4)*Csc[c + d*x]),
 x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0] && GtQ[n, 1] && Inte
gerQ[2*n]
```

rule 4279
```
Int[csc[(e_.) + (f_.)*(x_)]*Sqrt[csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)], x_S
ymbol] :> Simp[-2*b*(Cot[e + f*x]/(f*Sqrt[a + b*Csc[e + f*x]])), x] /; Free
Q[{a, b, e, f}, x] && EqQ[a^2 - b^2, 0]
```

rule 4403
```
Int[Sqrt[csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)]*(csc[(e_.) + (f_.)*(x_)]*(d_
.) + (c_)), x_Symbol] :> Simp[c   Int[Sqrt[a + b*Csc[e + f*x]], x], x] + Si
mp[d   Int[Sqrt[a + b*Csc[e + f*x]]*Csc[e + f*x], x], x] /; FreeQ[{a, b, c,
 d, e, f}, x] && NeQ[b*c - a*d, 0] && EqQ[a^2 - b^2, 0]
```

### 3.51.4 Maple [F]

$$\int (a + ia \operatorname{csch}(dx + c))^{\frac{5}{2}}\, dx$$

input
```
int((a+I*a*csch(d*x+c))^(5/2),x)
```

output
```
int((a+I*a*csch(d*x+c))^(5/2),x)
```

### 3.51.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 566 vs. $2(87) = 174$.

Time $= 0.29$ (sec) , antiderivative size $= 566$, normalized size of antiderivative $= 5.29$

$$\int (a + ia\operatorname{csch}(c + dx))^{5/2}\, dx = \frac{3\sqrt{\frac{a^5}{d^2}}\left(de^{(2\,dx+2\,c)} - d\right)\log\left(\frac{2\left(a^3e^{(dx+c)} + i\,a^3 + \sqrt{\frac{a^5}{d^2}}\left(de^{(2\,dx+2\,c)} - d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\right)e^{(-dx-c)}}{d}\right) - 3\sqrt{\frac{a^5}{d^2}}(de$$

input
```
integrate((a+I*a*csch(d*x+c))^(5/2),x, algorithm="fricas")
```

output
```
1/6*(3*sqrt(a^5/d^2)*(d*e^(2*d*x + 2*c) - d)*log(2*(a^3*e^(d*x + c) + I*a^
3 + sqrt(a^5/d^2)*(d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x + 2*c) - 1)))*e
^(-d*x - c)/d) - 3*sqrt(a^5/d^2)*(d*e^(2*d*x + 2*c) - d)*log(2*(a^3*e^(d*x
 + c) + I*a^3 - sqrt(a^5/d^2)*(d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x + 2
*c) - 1)))*e^(-d*x - c)/d) + 3*sqrt(a^5/d^2)*(d*e^(2*d*x + 2*c) - d)*log(2
*(sqrt(a^5/d^2)*(a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d) + (a^3*e
^(3*d*x + 3*c) - 2*I*a^3*e^(2*d*x + 2*c) - a^3*e^(d*x + c) + 2*I*a^3)*sqrt
(a/(e^(2*d*x + 2*c) - 1)))*e^(-2*d*x - 2*c)/d) - 3*sqrt(a^5/d^2)*(d*e^(2*d
*x + 2*c) - d)*log(-2*(sqrt(a^5/d^2)*(a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x +
 c) - 2*a*d) - (a^3*e^(3*d*x + 3*c) - 2*I*a^3*e^(2*d*x + 2*c) - a^3*e^(d*x
 + c) + 2*I*a^3)*sqrt(a/(e^(2*d*x + 2*c) - 1)))*e^(-2*d*x - 2*c)/d) + 8*(4
*a^2*e^(3*d*x + 3*c) - 3*I*a^2*e^(2*d*x + 2*c) - 3*a^2*e^(d*x + c) + 4*I*a
^2)*sqrt(a/(e^(2*d*x + 2*c) - 1)))/(d*e^(2*d*x + 2*c) - d)
```

### 3.51.6 Sympy [F]

$$\int (a + ia\operatorname{csch}(c + dx))^{5/2}\,dx = \int (ia\operatorname{csch}(c + dx) + a)^{\frac{5}{2}}\,dx$$

input
```
integrate((a+I*a*csch(d*x+c))**(5/2),x)
```

output
```
Integral((I*a*csch(c + d*x) + a)**(5/2), x)
```

### 3.51.7 Maxima [F]

$$\int (a + ia\operatorname{csch}(c + dx))^{5/2}\,dx = \int (i\,a\operatorname{csch}(dx + c) + a)^{\frac{5}{2}}\,dx$$

input
```
integrate((a+I*a*csch(d*x+c))^(5/2),x, algorithm="maxima")
```

output
```
integrate((I*a*csch(d*x + c) + a)^(5/2), x)
```

### 3.51.8 Giac [F]

$$\int (a + ia\text{csch}(c + dx))^{5/2}\, dx = \int (i\, a\, \text{csch}\,(dx + c) + a)^{\frac{5}{2}}\, dx$$

input
```
integrate((a+I*a*csch(d*x+c))^(5/2),x, algorithm="giac")
```

output
```
integrate((I*a*csch(d*x + c) + a)^(5/2), x)
```

### 3.51.9 Mupad [F(-1)]

Timed out.

$$\int (a + ia\text{csch}(c + dx))^{5/2}\, dx = \int \left(a + \frac{a\, 1\text{i}}{\sinh\,(c + d\, x)}\right)^{5/2} dx$$

input
```
int((a + (a*1i)/sinh(c + d*x))^(5/2),x)
```

output
```
int((a + (a*1i)/sinh(c + d*x))^(5/2), x)
```

# 3.52 $\int (a + ia\,\mathbf{csch}(c + dx))^{3/2}\,dx$


3.52.1 Optimal result . . . . . 366
3.52.2 Mathematica [A] (verified) . . . . . 366
3.52.3 Rubi [A] (verified) . . . . . 367
3.52.4 Maple [F] . . . . . 368
3.52.5 Fricas [B] (verification not implemented) . . . . . 369
3.52.6 Sympy [F] . . . . . 369
3.52.7 Maxima [F] . . . . . 370
3.52.8 Giac [F] . . . . . 370
3.52.9 Mupad [F(-1)] . . . . . 370


## 3.52.1 Optimal result

Integrand size = 17, antiderivative size = 72

$$\int (a + ia\,\mathrm{csch}(c + dx))^{3/2}\,dx = \frac{2a^{3/2}\mathrm{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\,\mathrm{csch}(c+dx)}}\right)}{d} + \frac{2a^2\coth(c+dx)}{d\sqrt{a + ia\,\mathrm{csch}(c+dx)}}$$

output
```
2*a^(3/2)*arctanh(coth(d*x+c)*a^(1/2)/(a+I*a*csch(d*x+c))^(1/2))/d+2*a^2*c
oth(d*x+c)/d/(a+I*a*csch(d*x+c))^(1/2)
```

## 3.52.2 Mathematica [A] (verified)

Time = 1.19 (sec) , antiderivative size = 100, normalized size of antiderivative = 1.39

$$\int (a + ia\,\mathrm{csch}(c + dx))^{3/2}\,dx = -\frac{2ia\coth(c+dx)\sqrt{a + ia\,\mathrm{csch}(c+dx)}\left(-\sqrt[4]{-1}\,\mathrm{arctanh}\left((-1)^{3/4}\sqrt{i + \mathrm{csch}(c+dx)}\right) + \sqrt{i + \mathrm{csch}(c+dx)}\right)}{d(-i + \mathrm{csch}(c+dx))\sqrt{i + \mathrm{csch}(c+dx)}}$$

input
```
Integrate[(a + I*a*Csch[c + d*x])^(3/2),x]
```

output
```
((-2*I)*a*Coth[c + d*x]*Sqrt[a + I*a*Csch[c + d*x]]*(-((-1)^(1/4)*ArcTanh[
(-1)^(3/4)*Sqrt[I + Csch[c + d*x]]]) + Sqrt[I + Csch[c + d*x]]))/(d*(-I +
Csch[c + d*x])*Sqrt[I + Csch[c + d*x]])
```

### 3.52.3 Rubi [A] (verified)

Time = 0.30 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.00, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.353$, Rules used = {3042, 4262, 27, 3042, 4261, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a + ia\text{csch}(c + dx))^{3/2}\, dx$$

$$\downarrow 3042$$

$$\int (a - a\csc(ic + idx))^{3/2} dx$$

$$\downarrow 4262$$

$$2a \int \frac{1}{2}\sqrt{i\text{csch}(c + dx)a + a} dx + \frac{2a^2 \coth(c + dx)}{d\sqrt{a + ia\text{csch}(c + dx)}}$$

$$\downarrow 27$$

$$a \int \sqrt{i\text{csch}(c + dx)a + a} dx + \frac{2a^2 \coth(c + dx)}{d\sqrt{a + ia\text{csch}(c + dx)}}$$

$$\downarrow 3042$$

$$a \int \sqrt{a - a\csc(ic + idx)} dx + \frac{2a^2 \coth(c + dx)}{d\sqrt{a + ia\text{csch}(c + dx)}}$$

$$\downarrow 4261$$

$$\frac{2a^2 \coth(c + dx)}{d\sqrt{a + ia\text{csch}(c + dx)}} - \frac{2ia^2 \int \frac{1}{a - \frac{a^2 \coth^2(c+dx)}{i\text{csch}(c+dx)a+a}} d\frac{ia\coth(c+dx)}{\sqrt{i\text{csch}(c+dx)a+a}}}{d}$$

$$\downarrow 216$$

$$\frac{2a^{3/2}\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\text{csch}(c+dx)}}\right)}{d} + \frac{2a^2 \coth(c + dx)}{d\sqrt{a + ia\text{csch}(c + dx)}}$$

input
```
Int[(a + I*a*Csch[c + d*x])^(3/2),x]
```

output
```
(2*a^(3/2)*ArcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a + I*a*Csch[c + d*x]]])/d
 + (2*a^2*Coth[c + d*x])/(d*Sqrt[a + I*a*Csch[c + d*x]])
```

#### 3.52.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4262
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-b^2)*C
ot[c + d*x]*((a + b*Csc[c + d*x])^(n - 2)/(d*(n - 1))), x] + Simp[a/(n - 1)
   Int[(a + b*Csc[c + d*x])^(n - 2)*(a*(n - 1) + b*(3*n - 4)*Csc[c + d*x]),
 x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0] && GtQ[n, 1] && Inte
gerQ[2*n]
```

### 3.52.4 Maple [F]

$$\int (a + ia \operatorname{csch}(dx + c))^{\frac{3}{2}}\, dx$$

input
```
int((a+I*a*csch(d*x+c))^(3/2),x)
```

output
```
int((a+I*a*csch(d*x+c))^(3/2),x)
```

### 3.52.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 461 vs. $2(60) = 120$.

Time = 0.27 (sec) , antiderivative size = 461, normalized size of antiderivative = 6.40

$$\int (a + ia\operatorname{csch}(c + dx))^{3/2}\,dx = \frac{\sqrt{\frac{a^3}{d^2}}d\log\left(\frac{2\left(a^2e^{(dx+c)}+i\,a^2+(de^{(2\,dx+2\,c)}-d)\sqrt{\frac{a^3}{d^2}}\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\right)e^{(-dx-c)}}{d}\right) - \sqrt{\frac{a^3}{d^2}}d\log\left(\frac{2\left(a^2e^{(dx+c)}+i\,a^2-\right.\right.}{}$$

input
```
integrate((a+I*a*csch(d*x+c))^(3/2),x, algorithm="fricas")
```

output
```
1/2*(sqrt(a^3/d^2)*d*log(2*(a^2*e^(d*x + c) + I*a^2 + (d*e^(2*d*x + 2*c) -
 d)*sqrt(a^3/d^2)*sqrt(a/(e^(2*d*x + 2*c) - 1)))*e^(-d*x - c)/d) - sqrt(a^
3/d^2)*d*log(2*(a^2*e^(d*x + c) + I*a^2 - (d*e^(2*d*x + 2*c) - d)*sqrt(a^3
/d^2)*sqrt(a/(e^(2*d*x + 2*c) - 1)))*e^(-d*x - c)/d) + sqrt(a^3/d^2)*d*log
(2*((a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d)*sqrt(a^3/d^2) + (a^2
*e^(3*d*x + 3*c) - 2*I*a^2*e^(2*d*x + 2*c) - a^2*e^(d*x + c) + 2*I*a^2)*sq
rt(a/(e^(2*d*x + 2*c) - 1)))*e^(-2*d*x - 2*c)/d) - sqrt(a^3/d^2)*d*log(-2*
((a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d)*sqrt(a^3/d^2) - (a^2*e^
(3*d*x + 3*c) - 2*I*a^2*e^(2*d*x + 2*c) - a^2*e^(d*x + c) + 2*I*a^2)*sqrt(
a/(e^(2*d*x + 2*c) - 1)))*e^(-2*d*x - 2*c)/d) + 4*(a*e^(d*x + c) - I*a)*sq
rt(a/(e^(2*d*x + 2*c) - 1)))/d
```

### 3.52.6 Sympy [F]

$$\int (a + ia\operatorname{csch}(c + dx))^{3/2}\,dx = \int (ia\operatorname{csch}(c + dx) + a)^{\frac{3}{2}}\,dx$$

input
```
integrate((a+I*a*csch(d*x+c))**(3/2),x)
```

output
```
Integral((I*a*csch(c + d*x) + a)**(3/2), x)
```

### 3.52.7 Maxima [F]

$$\int (a + ia\operatorname{csch}(c + dx))^{3/2}\, dx = \int (i\, a\, \operatorname{csch}(dx + c) + a)^{\frac{3}{2}}\, dx$$

input
```
integrate((a+I*a*csch(d*x+c))^(3/2),x, algorithm="maxima")
```

output
```
integrate((I*a*csch(d*x + c) + a)^(3/2), x)
```

### 3.52.8 Giac [F]

$$\int (a + ia\operatorname{csch}(c + dx))^{3/2}\, dx = \int (i\, a\, \operatorname{csch}(dx + c) + a)^{\frac{3}{2}}\, dx$$

input
```
integrate((a+I*a*csch(d*x+c))^(3/2),x, algorithm="giac")
```

output
```
integrate((I*a*csch(d*x + c) + a)^(3/2), x)
```

### 3.52.9 Mupad [F(-1)]

Timed out.

$$\int (a + ia\operatorname{csch}(c + dx))^{3/2}\, dx = \int \left(a + \frac{a\,1\mathrm{i}}{\sinh(c + d\,x)}\right)^{3/2} dx$$

input
```
int((a + (a*1i)/sinh(c + d*x))^(3/2),x)
```

output
```
int((a + (a*1i)/sinh(c + d*x))^(3/2), x)
```

# 3.53 $\int \sqrt{a+ia\operatorname{csch}(c+dx)}\,dx$

3.53.1 Optimal result . . . 371
3.53.2 Mathematica [A] (verified) . . . 371
3.53.3 Rubi [A] (verified) . . . 372
3.53.4 Maple [F] . . . 373
3.53.5 Fricas [B] (verification not implemented) . . . 373
3.53.6 Sympy [F] . . . 374
3.53.7 Maxima [F] . . . 374
3.53.8 Giac [F] . . . 375
3.53.9 Mupad [F(-1)] . . . 375

## 3.53.1 Optimal result

Integrand size = 17, antiderivative size = 40

$$\int \sqrt{a+ia\operatorname{csch}(c+dx)}\,dx = \frac{2\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}$$

output
```
2*arctanh(coth(d*x+c)*a^(1/2)/(a+I*a*csch(d*x+c))^(1/2))*a^(1/2)/d
```

## 3.53.2 Mathematica [A] (verified)

Time = 0.99 (sec) , antiderivative size = 80, normalized size of antiderivative = 2.00

$$\int \sqrt{a+ia\operatorname{csch}(c+dx)}\,dx = \frac{2(-1)^{3/4}\operatorname{arctanh}\left((-1)^{3/4}\sqrt{i+\operatorname{csch}(c+dx)}\right)\coth(c+dx)\sqrt{a+ia\operatorname{csch}(c+dx)}}{d(-i+\operatorname{csch}(c+dx))\sqrt{i+\operatorname{csch}(c+dx)}}$$

input
```
Integrate[Sqrt[a + I*a*Csch[c + d*x]],x]
```

output
```
(2*(-1)^(3/4)*ArcTanh[(-1)^(3/4)*Sqrt[I + Csch[c + d*x]]]*Coth[c + d*x]*Sq
rt[a + I*a*Csch[c + d*x]])/(d*(-I + Csch[c + d*x])*Sqrt[I + Csch[c + d*x]]
)
```

### 3.53.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.176$, Rules used = {3042, 4261, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{a + ia\operatorname{csch}(c+dx)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{a - a\csc(ic+idx)}dx$$

$$\downarrow 4261$$

$$-\frac{2ia\int \frac{1}{a-\frac{a^2\coth^2(c+dx)}{ia\operatorname{csch}(c+dx)+a}}d\frac{ia\coth(c+dx)}{\sqrt{ia\operatorname{csch}(c+dx)+a}}}{d}$$

$$\downarrow 216$$

$$\frac{2\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}$$

input
```
Int[Sqrt[a + I*a*Csch[c + d*x]],x]
```

output
```
(2*Sqrt[a]*ArcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a + I*a*Csch[c + d*x]]])/d
```

#### 3.53.3.1 Defintions of rubi rules used

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

### 3.53.4 Maple [F]

$$\int \sqrt{a + ia \operatorname{csch}(dx + c)}\, dx$$

input
```
int((a+I*a*csch(d*x+c))^(1/2),x)
```

output
```
int((a+I*a*csch(d*x+c))^(1/2),x)
```

### 3.53.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 383 vs. $2(32) = 64$.

Time = 0.28 (sec) , antiderivative size = 383, normalized size of antiderivative = 9.58

$$\int \sqrt{a + ia\operatorname{csch}(c + dx)}\, dx$$

$$= \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(\frac{2\left(\left(de^{(2\,dx+2\,c)} - d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{a}{d^2}} + ae^{(dx+c)} + i\,a\right)e^{(-dx-c)}}{d}\right)$$

$$- \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(-\frac{2\left(\left(de^{(2\,dx+2\,c)} - d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{a}{d^2}} - ae^{(dx+c)} - i\,a\right)e^{(-dx-c)}}{d}\right)$$

$$+ \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(\frac{2\left(\left(ae^{(3\,dx+3\,c)} - 2i\,ae^{(2\,dx+2\,c)} - ae^{(dx+c)} + 2i\,a\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}} + \left(ade^{(2\,dx+2\,c)} - i\,ade^{(dx+c)}\right.\right.\right.$$

$$- \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(\frac{2\left(\left(ae^{(3\,dx+3\,c)} - 2i\,ae^{(2\,dx+2\,c)} - ae^{(dx+c)} + 2i\,a\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}} - \left(ade^{(2\,dx+2\,c)} - i\,ade^{(dx+c)}\right.\right.\right.$$

input
```
integrate((a+I*a*csch(d*x+c))^(1/2),x, algorithm="fricas")
```

output
```
1/2*sqrt(a/d^2)*log(2*((d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x + 2*c) - 1
))*sqrt(a/d^2) + a*e^(d*x + c) + I*a)*e^(-d*x - c)/d) - 1/2*sqrt(a/d^2)*lo
g(-2*((d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x + 2*c) - 1))*sqrt(a/d^2) -
a*e^(d*x + c) - I*a)*e^(-d*x - c)/d) + 1/2*sqrt(a/d^2)*log(2*((a*e^(3*d*x
+ 3*c) - 2*I*a*e^(2*d*x + 2*c) - a*e^(d*x + c) + 2*I*a)*sqrt(a/(e^(2*d*x +
 2*c) - 1)) + (a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d)*sqrt(a/d^2
))*e^(-2*d*x - 2*c)/d) - 1/2*sqrt(a/d^2)*log(2*((a*e^(3*d*x + 3*c) - 2*I*a
*e^(2*d*x + 2*c) - a*e^(d*x + c) + 2*I*a)*sqrt(a/(e^(2*d*x + 2*c) - 1)) -
(a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d)*sqrt(a/d^2))*e^(-2*d*x -
 2*c)/d)
```

### 3.53.6 Sympy [F]

$$\int \sqrt{a + ia\operatorname{csch}(c + dx)}\, dx = \int \sqrt{ia\,\operatorname{csch}(c + dx) + a}\, dx$$

input
```
integrate((a+I*a*csch(d*x+c))**(1/2),x)
```

output
```
Integral(sqrt(I*a*csch(c + d*x) + a), x)
```

### 3.53.7 Maxima [F]

$$\int \sqrt{a + ia\operatorname{csch}(c + dx)}\, dx = \int \sqrt{i\,a\,\operatorname{csch}(dx + c) + a}\, dx$$

input
```
integrate((a+I*a*csch(d*x+c))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(I*a*csch(d*x + c) + a), x)
```

### 3.53.8 Giac [F]

$$\int \sqrt{a + i a \operatorname{csch}(c + dx)}\, dx = \int \sqrt{i\, a \operatorname{csch}(dx + c) + a}\, dx$$

input
```
integrate((a+I*a*csch(d*x+c))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(I*a*csch(d*x + c) + a), x)
```

### 3.53.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{a + i a \operatorname{csch}(c + dx)}\, dx = \int \sqrt{a + \frac{a\, 1\mathrm{i}}{\sinh(c + d\, x)}}\, dx$$

input
```
int((a + (a*1i)/sinh(c + d*x))^(1/2),x)
```

output
```
int((a + (a*1i)/sinh(c + d*x))^(1/2), x)
```

# 3.54 $\int \frac{1}{\sqrt{a+ia\,\mathbf{csch}(c+dx)}}\,dx$


3.54.1 Optimal result . . . . . 376
3.54.2 Mathematica [A] (verified) . . . . . 376
3.54.3 Rubi [A] (verified) . . . . . 377
3.54.4 Maple [F] . . . . . 379
3.54.5 Fricas [B] (verification not implemented) . . . . . 379
3.54.6 Sympy [F] . . . . . 381
3.54.7 Maxima [F] . . . . . 381
3.54.8 Giac [F] . . . . . 381
3.54.9 Mupad [F(-1)] . . . . . 382


## 3.54.1 Optimal result

Integrand size = 17, antiderivative size = 91

$$\int \frac{1}{\sqrt{a+ia\,\mathrm{csch}(c+dx)}}\,dx = \frac{2\,\mathrm{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\,\mathrm{csch}(c+dx)}}\right)}{\sqrt{a}d} - \frac{\sqrt{2}\,\mathrm{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{2}\sqrt{a+ia\,\mathrm{csch}(c+dx)}}\right)}{\sqrt{a}d}$$

output
```
2*arctanh(coth(d*x+c)*a^(1/2)/(a+I*a*csch(d*x+c))^(1/2))/d/a^(1/2)-arctanh
(1/2*coth(d*x+c)*a^(1/2)*2^(1/2)/(a+I*a*csch(d*x+c))^(1/2))*2^(1/2)/d/a^(1
/2)
```

## 3.54.2 Mathematica [A] (verified)

Time = 1.78 (sec) , antiderivative size = 118, normalized size of antiderivative = 1.30

$$\int \frac{1}{\sqrt{a+ia\,\mathrm{csch}(c+dx)}}\,dx = \frac{\sqrt{a}\left(2\arctan\left(\frac{\sqrt{ia(i+\mathrm{csch}(c+dx))}}{\sqrt{a}}\right) - \sqrt{2}\arctan\left(\frac{\sqrt{ia(i+\mathrm{csch}(c+dx))}}{\sqrt{2}\sqrt{a}}\right)\right)\coth(c+dx)}{d\sqrt{ia(i+\mathrm{csch}(c+dx))}\sqrt{a+ia\,\mathrm{csch}(c+dx)}}$$

input
```
Integrate[1/Sqrt[a + I*a*Csch[c + d*x]],x]
```

output
```
(Sqrt[a]*(2*ArcTan[Sqrt[I*a*(I + Csch[c + d*x])]/Sqrt[a]] - Sqrt[2]*ArcTan
[Sqrt[I*a*(I + Csch[c + d*x])]/(Sqrt[2]*Sqrt[a])])*Coth[c + d*x])/(d*Sqrt[
I*a*(I + Csch[c + d*x])]*Sqrt[a + I*a*Csch[c + d*x]])
```

### 3.54.3 Rubi [A] (verified)

Time = 0.40 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.00, number of steps used = 10, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.529$, Rules used = {3042, 4263, 26, 3042, 26, 4261, 216, 4282, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{a+ia\text{csch}(c+dx)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{a-a\csc(ic+idx)}}dx$$

$$\downarrow 4263$$

$$\int -\frac{i\text{csch}(c+dx)}{\sqrt{i\text{csch}(c+dx)a+a}}dx+\frac{\int \sqrt{i\text{csch}(c+dx)a+a}dx}{a}$$

$$\downarrow 26$$

$$\frac{\int \sqrt{i\text{csch}(c+dx)a+a}dx}{a}-i\int \frac{\text{csch}(c+dx)}{\sqrt{i\text{csch}(c+dx)a+a}}dx$$

$$\downarrow 3042$$

$$\frac{\int \sqrt{a-a\csc(ic+idx)}dx}{a}-i\int \frac{i\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx$$

$$\downarrow 26$$

$$\int \frac{\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx+\frac{\int \sqrt{a-a\csc(ic+idx)}dx}{a}$$

$$\downarrow 4261$$

$$\int \frac{\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx-\frac{2i\int \frac{1}{a-\frac{a^2\coth^2(c+dx)}{i\text{csch}(c+dx)a+a}}d\frac{ia\coth(c+dx)}{\sqrt{i\text{csch}(c+dx)a+a}}}{d}$$

$$\downarrow 216$$

$$\int \frac{\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx + \frac{2\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d}$$

$$\downarrow 4282$$

$$\frac{2i\int \frac{1}{2a-\frac{a^2\coth^2(c+dx)}{ia\text{csch}(c+dx)+a}}d\frac{ia\coth(c+dx)}{\sqrt{ia\text{csch}(c+dx)+a}}}{d} + \frac{2\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d}$$

$$\downarrow 216$$

$$\frac{2\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d} - \frac{\sqrt{2}\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{2}\sqrt{a+ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d}$$

input
```
Int[1/Sqrt[a + I*a*Csch[c + d*x]],x]
```

output
```
(2*ArcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a + I*a*Csch[c + d*x]]])/(Sqrt[a]*
d) - (Sqrt[2]*ArcTanh[(Sqrt[a]*Coth[c + d*x])/(Sqrt[2]*Sqrt[a + I*a*Csch[c
 + d*x]])])/(Sqrt[a]*d)
```

### 3.54.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4263
```
Int[1/Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[1/a   I
nt[Sqrt[a + b*Csc[c + d*x]], x], x] - Simp[b/a   Int[Csc[c + d*x]/Sqrt[a +
b*Csc[c + d*x]], x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4282
```
Int[csc[(e_.) + (f_.)*(x_)]/Sqrt[csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)], x_S
ymbol] :> Simp[-2/f   Subst[Int[1/(2*a + x^2), x], x, b*(Cot[e + f*x]/Sqrt[
a + b*Csc[e + f*x]])], x] /; FreeQ[{a, b, e, f}, x] && EqQ[a^2 - b^2, 0]
```

### 3.54.4 Maple [F]

$$\int \frac{1}{\sqrt{a + ia \operatorname{csch}(dx + c)}} dx$$

input
```
int(1/(a+I*a*csch(d*x+c))^(1/2),x)
```

output
```
int(1/(a+I*a*csch(d*x+c))^(1/2),x)
```

### 3.54.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 551 vs. $2(72) = 144$.

Time = 0.29 (sec) , antiderivative size = 551, normalized size of antiderivative = 6.05

$$\int \frac{1}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\,dx =$$

$$-\frac{1}{2}\sqrt{2}\sqrt{\frac{1}{ad^2}}\log\left(2\left(\sqrt{2}\left(ade^{(2\,dx+2\,c)}-ad\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}+ae^{(dx+c)}-i\,a\right)e^{(-dx-c)}\right)$$

$$+\frac{1}{2}\sqrt{2}\sqrt{\frac{1}{ad^2}}\log\left(-2\left(\sqrt{2}\left(ade^{(2\,dx+2\,c)}-ad\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}-ae^{(dx+c)}+i\,a\right)e^{(-dx-c)}\right)$$

$$+\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(\frac{2\left(\left(de^{(2\,dx+2\,c)}-d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}+e^{(dx+c)}+i\right)e^{(-dx-c)}}{d}\right)$$

$$-\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(-\frac{2\left(\left(de^{(2\,dx+2\,c)}-d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}-e^{(dx+c)}-i\right)e^{(-dx-c)}}{d}\right)$$

$$+\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(\frac{2\left(\left(ade^{(2\,dx+2\,c)}-i\,ade^{(dx+c)}-2\,ad\right)\sqrt{\frac{1}{ad^2}}+\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\left(e^{(3\,dx+3\,c)}-2i\,e^{(2\,dx+2\,c)}-e^{(dx}\right.\right.\right.}{d}$$

$$-\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(-\frac{2\left(\left(ade^{(2\,dx+2\,c)}-i\,ade^{(dx+c)}-2\,ad\right)\sqrt{\frac{1}{ad^2}}-\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\left(e^{(3\,dx+3\,c)}-2i\,e^{(2\,dx+2\,c)}-e^{(}\right.\right.\right.}{d}$$

input
```
integrate(1/(a+I*a*csch(d*x+c))^(1/2),x, algorithm="fricas")
```

output
```
-1/2*sqrt(2)*sqrt(1/(a*d^2))*log(2*(sqrt(2)*(a*d*e^(2*d*x + 2*c) - a*d)*sq
rt(a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a*d^2)) + a*e^(d*x + c) - I*a)*e^(-d*x
 - c)) + 1/2*sqrt(2)*sqrt(1/(a*d^2))*log(-2*(sqrt(2)*(a*d*e^(2*d*x + 2*c)
- a*d)*sqrt(a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a*d^2)) - a*e^(d*x + c) + I*a
)*e^(-d*x - c)) + 1/2*sqrt(1/(a*d^2))*log(2*((d*e^(2*d*x + 2*c) - d)*sqrt(
a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a*d^2)) + e^(d*x + c) + I)*e^(-d*x - c)/d
) - 1/2*sqrt(1/(a*d^2))*log(-2*((d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x +
 2*c) - 1))*sqrt(1/(a*d^2)) - e^(d*x + c) - I)*e^(-d*x - c)/d) + 1/2*sqrt(
1/(a*d^2))*log(2*((a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d)*sqrt(1
/(a*d^2)) + sqrt(a/(e^(2*d*x + 2*c) - 1))*(e^(3*d*x + 3*c) - 2*I*e^(2*d*x
 + 2*c) - e^(d*x + c) + 2*I))*e^(-2*d*x - 2*c)/d) - 1/2*sqrt(1/(a*d^2))*log
(-2*((a*d*e^(2*d*x + 2*c) - I*a*d*e^(d*x + c) - 2*a*d)*sqrt(1/(a*d^2)) - s
qrt(a/(e^(2*d*x + 2*c) - 1))*(e^(3*d*x + 3*c) - 2*I*e^(2*d*x + 2*c) - e^(d
*x + c) + 2*I))*e^(-2*d*x - 2*c)/d)
```

### 3.54.6 Sympy [F]

$$\int \frac{1}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{ia\,\operatorname{csch}(c+dx)+a}}\,dx$$

input
```
integrate(1/(a+I*a*csch(d*x+c))**(1/2),x)
```

output
```
Integral(1/sqrt(I*a*csch(c + d*x) + a), x)
```

### 3.54.7 Maxima [F]

$$\int \frac{1}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{i\,a\,\operatorname{csch}(dx+c)+a}}\,dx$$

input
```
integrate(1/(a+I*a*csch(d*x+c))^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/sqrt(I*a*csch(d*x + c) + a), x)
```

### 3.54.8 Giac [F]

$$\int \frac{1}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{i\,a\,\operatorname{csch}(dx+c)+a}}\,dx$$

input
```
integrate(1/(a+I*a*csch(d*x+c))^(1/2),x, algorithm="giac")
```

output
```
integrate(1/sqrt(I*a*csch(d*x + c) + a), x)
```

### 3.54.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{a+\frac{a\,1\mathrm{i}}{\sinh(c+d\,x)}}}\,dx$$

input
```
int(1/(a + (a*1i)/sinh(c + d*x))^(1/2),x)
```

output
```
int(1/(a + (a*1i)/sinh(c + d*x))^(1/2), x)
```

# 3.55 $\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx$

3.55.1 Optimal result . . . 383
3.55.2 Mathematica [B] (verified) . . . 383
3.55.3 Rubi [A] (verified) . . . 384
3.55.4 Maple [F] . . . 387
3.55.5 Fricas [B] (verification not implemented) . . . 387
3.55.6 Sympy [F] . . . 388
3.55.7 Maxima [F] . . . 389
3.55.8 Giac [F] . . . 389
3.55.9 Mupad [F(-1)] . . . 389

## 3.55.1 Optimal result

Integrand size = 17, antiderivative size = 123

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx = \frac{2\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{a^{3/2}d} - \frac{5\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{2}\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{2\sqrt{2}a^{3/2}d} - \frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

output

```
2*arctanh(coth(d*x+c)*a^(1/2)/(a+I*a*csch(d*x+c))^(1/2))/a^(3/2)/d-1/2*cot
h(d*x+c)/d/(a+I*a*csch(d*x+c))^(3/2)-5/4*arctanh(1/2*coth(d*x+c)*a^(1/2)*2
^(1/2)/(a+I*a*csch(d*x+c))^(1/2))/a^(3/2)/d*2^(1/2)
```

## 3.55.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 327 vs. 2(123) = 246.

Time = 3.42 (sec) , antiderivative size = 327, normalized size of antiderivative = 2.66

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx = \frac{\left(-2\sqrt{a} - 8\arctan\left(\frac{\sqrt{ia(i+\operatorname{csch}(c+dx))}}{\sqrt{a}}\right)\right)\sqrt{ia(i+\operatorname{csch}(c+dx))} + 5\sqrt{2}\,\text{arcta}$$

input
```
Integrate[(a + I*a*Csch[c + d*x])^(-3/2),x]
```

output
```
((-2*Sqrt[a] - 8*ArcTan[Sqrt[I*a*(I + Csch[c + d*x])]/Sqrt[a]]*Sqrt[I*a*(I
 + Csch[c + d*x])] + 5*Sqrt[2]*ArcTan[Sqrt[I*a*(I + Csch[c + d*x])]/(Sqrt[
2]*Sqrt[a])]*Sqrt[I*a*(I + Csch[c + d*x])] + I*Csch[c + d*x]*(2*Sqrt[a] -
8*ArcTan[Sqrt[I*a*(I + Csch[c + d*x])]/Sqrt[a]]*Sqrt[I*a*(I + Csch[c + d*x
])] + 5*Sqrt[2]*ArcTan[Sqrt[I*a*(I + Csch[c + d*x])]/(Sqrt[2]*Sqrt[a])]*Sq
rt[I*a*(I + Csch[c + d*x])]))*(Cosh[(c + d*x)/2] + I*Sinh[(c + d*x)/2]))/(
4*a^(3/2)*d*(I + Csch[c + d*x])*Sqrt[a + I*a*Csch[c + d*x]]*(Cosh[(c + d*x
)/2] - I*Sinh[(c + d*x)/2]))
```

### 3.55.3 Rubi [A] (verified)

Time = 0.58 (sec) , antiderivative size = 129, normalized size of antiderivative = 1.05, number of steps used = 13, number of rules used = 12, $\frac{\text{number of rules}}{\text{integrand size}} = 0.706$, Rules used = {3042, 4264, 27, 3042, 4408, 26, 3042, 26, 4261, 216, 4282, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(a-a\csc(ic+idx))^{3/2}}dx$$

$$\downarrow 4264$$

$$-\frac{\int -\frac{4a-ia\operatorname{csch}(c+dx)}{2\sqrt{i\operatorname{csch}(c+dx)a+a}}dx}{2a^2} - \frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 27$$

$$\frac{\int \frac{4a-ia\operatorname{csch}(c+dx)}{\sqrt{i\operatorname{csch}(c+dx)a+a}}dx}{4a^2} - \frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{\int \frac{\csc(ic+idx)a+4a}{\sqrt{a-a\csc(ic+idx)}}dx}{4a^2} - \frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 4408$$

$$\frac{5a\int -\frac{i\operatorname{csch}(c+dx)}{\sqrt{i\operatorname{csch}(c+dx)a+a}}dx+4\int \sqrt{i\operatorname{csch}(c+dx)a+a}dx}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 26$$

$$\frac{4\int \sqrt{i\operatorname{csch}(c+dx)a+a}dx-5ia\int \frac{\operatorname{csch}(c+dx)}{\sqrt{i\operatorname{csch}(c+dx)a+a}}dx}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 3042$$

$$\frac{4\int \sqrt{a-a\csc(ic+idx)}dx-5ia\int \frac{i\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 26$$

$$\frac{5a\int \frac{\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx+4\int \sqrt{a-a\csc(ic+idx)}dx}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 4261$$

$$\frac{5a\int \frac{\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx-\frac{8ia\int \frac{1}{a-\frac{a^2\coth^2(c+dx)}{i\operatorname{csch}(c+dx)a+a}}d\frac{ia\coth(c+dx)}{\sqrt{i\operatorname{csch}(c+dx)a+a}}}{d}}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 216$$

$$\frac{5a\int \frac{\csc(ic+idx)}{\sqrt{a-a\csc(ic+idx)}}dx+\frac{8\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 4282$$

$$\frac{\frac{10ia\int \frac{1}{2a-\frac{a^2\coth^2(c+dx)}{i\operatorname{csch}(c+dx)a+a}}d\frac{ia\coth(c+dx)}{\sqrt{i\operatorname{csch}(c+dx)a+a}}}{d}+\frac{8\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

$$\downarrow 216$$

$$\frac{\frac{8\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}-\frac{5\sqrt{2}\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{2}\sqrt{a+ia\operatorname{csch}(c+dx)}}\right)}{d}}{4a^2}-\frac{\coth(c+dx)}{2d(a+ia\operatorname{csch}(c+dx))^{3/2}}$$

input
```
Int[(a + I*a*Csch[c + d*x])^(-3/2),x]
```

## 3.55. $\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}dx$

output
```
((8*Sqrt[a]*ArcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a + I*a*Csch[c + d*x]]])/
d - (5*Sqrt[2]*Sqrt[a]*ArcTanh[(Sqrt[a]*Coth[c + d*x])/(Sqrt[2]*Sqrt[a + I
*a*Csch[c + d*x]])])/d)/(4*a^2) - Coth[c + d*x]/(2*d*(a + I*a*Csch[c + d*x
])^(3/2))
```

### 3.55.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4264
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-Cot[c
+ d*x])*((a + b*Csc[c + d*x])^n/(d*(2*n + 1))), x] + Simp[1/(a^2*(2*n + 1))
   Int[(a + b*Csc[c + d*x])^(n + 1)*(a*(2*n + 1) - b*(n + 1)*Csc[c + d*x]),
 x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0] && LeQ[n, -1] && Int
egerQ[2*n]
```

rule 4282
```
Int[csc[(e_.) + (f_.)*(x_)]/Sqrt[csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)], x_S
ymbol] :> Simp[-2/f   Subst[Int[1/(2*a + x^2), x], x, b*(Cot[e + f*x]/Sqrt[
a + b*Csc[e + f*x]])], x] /; FreeQ[{a, b, e, f}, x] && EqQ[a^2 - b^2, 0]
```

rule 4408
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.) + (c_))/Sqrt[csc[(e_.) + (f_.)*(x_)]*(b_
.) + (a_)], x_Symbol] :> Simp[c/a   Int[Sqrt[a + b*Csc[e + f*x]], x], x] -
Simp[(b*c - a*d)/a   Int[Csc[e + f*x]/Sqrt[a + b*Csc[e + f*x]], x], x] /; F
reeQ[{a, b, c, d, e, f}, x] && NeQ[b*c - a*d, 0] && EqQ[a^2 - b^2, 0]
```

### 3.55.4 Maple [F]

$$\int \frac{1}{(a + ia \operatorname{csch}(dx + c))^{\frac{3}{2}}} dx$$

input
```
int(1/(a+I*a*csch(d*x+c))^(3/2),x)
```

output
```
int(1/(a+I*a*csch(d*x+c))^(3/2),x)
```

### 3.55.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 873 vs. $2(96) = 192$.

Time = 0.30 (sec) , antiderivative size = 873, normalized size of antiderivative = 7.10

$$\int \frac{1}{(a + ia\operatorname{csch}(c + dx))^{3/2}} dx = \text{Too large to display}$$

input
```
integrate(1/(a+I*a*csch(d*x+c))^(3/2),x, algorithm="fricas")
```

output
```
-1/4*(5*sqrt(1/2)*(a^2*d*e^(2*d*x + 2*c) + 2*I*a^2*d*e^(d*x + c) - a^2*d)*
sqrt(1/(a^3*d^2))*log(2*(2*sqrt(1/2)*(a^2*d*e^(2*d*x + 2*c) - a^2*d)*sqrt(
a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a^3*d^2)) + a*e^(d*x + c) - I*a)*e^(-d*x
- c)) - 5*sqrt(1/2)*(a^2*d*e^(2*d*x + 2*c) + 2*I*a^2*d*e^(d*x + c) - a^2*d
)*sqrt(1/(a^3*d^2))*log(-2*(2*sqrt(1/2)*(a^2*d*e^(2*d*x + 2*c) - a^2*d)*sq
rt(a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a^3*d^2)) - a*e^(d*x + c) + I*a)*e^(-d
*x - c)) - 2*(a^2*d*e^(2*d*x + 2*c) + 2*I*a^2*d*e^(d*x + c) - a^2*d)*sqrt(
1/(a^3*d^2))*log(2*((a*d*e^(2*d*x + 2*c) - a*d)*sqrt(a/(e^(2*d*x + 2*c) -
1))*sqrt(1/(a^3*d^2)) + e^(d*x + c) + I)*e^(-d*x - c)/(a*d)) + 2*(a^2*d*e^
(2*d*x + 2*c) + 2*I*a^2*d*e^(d*x + c) - a^2*d)*sqrt(1/(a^3*d^2))*log(-2*((
a*d*e^(2*d*x + 2*c) - a*d)*sqrt(a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a^3*d^2))
 - e^(d*x + c) - I)*e^(-d*x - c)/(a*d)) - 2*(a^2*d*e^(2*d*x + 2*c) + 2*I*a
^2*d*e^(d*x + c) - a^2*d)*sqrt(1/(a^3*d^2))*log(2*((a^2*d*e^(2*d*x + 2*c)
- I*a^2*d*e^(d*x + c) - 2*a^2*d)*sqrt(1/(a^3*d^2)) + sqrt(a/(e^(2*d*x + 2*
c) - 1))*(e^(3*d*x + 3*c) - 2*I*e^(2*d*x + 2*c) - e^(d*x + c) + 2*I))*e^(-
2*d*x - 2*c)/(a*d)) + 2*(a^2*d*e^(2*d*x + 2*c) + 2*I*a^2*d*e^(d*x + c) - a
^2*d)*sqrt(1/(a^3*d^2))*log(-2*((a^2*d*e^(2*d*x + 2*c) - I*a^2*d*e^(d*x +
c) - 2*a^2*d)*sqrt(1/(a^3*d^2)) - sqrt(a/(e^(2*d*x + 2*c) - 1))*(e^(3*d*x
+ 3*c) - 2*I*e^(2*d*x + 2*c) - e^(d*x + c) + 2*I))*e^(-2*d*x - 2*c)/(a*d))
 + 2*sqrt(a/(e^(2*d*x + 2*c) - 1))*(e^(3*d*x + 3*c) - I*e^(2*d*x + 2*c)...
```

### 3.55.6 Sympy [F]

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{(ia\,\operatorname{csch}(c+dx)+a)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a+I*a*csch(d*x+c))**(3/2),x)
```

output
```
Integral((I*a*csch(c + d*x) + a)**(-3/2), x)
```

### 3.55.7 Maxima [F]

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{(i\,a\,\operatorname{csch}(dx+c)+a)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a+I*a*csch(d*x+c))^(3/2),x, algorithm="maxima")
```

output
```
integrate((I*a*csch(d*x + c) + a)^(-3/2), x)
```

### 3.55.8 Giac [F]

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{(i\,a\,\operatorname{csch}(dx+c)+a)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/(a+I*a*csch(d*x+c))^(3/2),x, algorithm="giac")
```

output
```
integrate((I*a*csch(d*x + c) + a)^(-3/2), x)
```

### 3.55.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{(a+ia\operatorname{csch}(c+dx))^{3/2}}\,dx = \int \frac{1}{\left(a+\frac{a\,1\mathrm{i}}{\sinh(c+d\,x)}\right)^{3/2}}\,dx$$

input
```
int(1/(a + (a*1i)/sinh(c + d*x))^(3/2),x)
```

output
```
int(1/(a + (a*1i)/sinh(c + d*x))^(3/2), x)
```

# 3.56 $\int \sqrt{a - ia\,\mathbf{csch}(c+dx)}\,dx$


3.56.1 Optimal result . . . . . 390
3.56.2 Mathematica [A] (verified) . . . . . 390
3.56.3 Rubi [A] (verified) . . . . . 391
3.56.4 Maple [F] . . . . . 392
3.56.5 Fricas [B] (verification not implemented) . . . . . 392
3.56.6 Sympy [F] . . . . . 393
3.56.7 Maxima [F] . . . . . 393
3.56.8 Giac [F] . . . . . 394
3.56.9 Mupad [F(-1)] . . . . . 394


## 3.56.1 Optimal result

Integrand size = 17, antiderivative size = 40

$$\int \sqrt{a - ia\,\mathrm{csch}(c+dx)}\,dx = \frac{2\sqrt{a}\,\mathrm{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a-ia\,\mathrm{csch}(c+dx)}}\right)}{d}$$

output
```
2*arctanh(coth(d*x+c)*a^(1/2)/(a-I*a*csch(d*x+c))^(1/2))*a^(1/2)/d
```

## 3.56.2 Mathematica [A] (verified)

Time = 1.01 (sec) , antiderivative size = 80, normalized size of antiderivative = 2.00

$$\int \sqrt{a - ia\,\mathrm{csch}(c+dx)}\,dx = -\frac{2(-1)^{3/4}\arctan\left((-1)^{3/4}\sqrt{-i+\mathrm{csch}(c+dx)}\right)\coth(c+dx)\sqrt{a-ia\,\mathrm{csch}(c+dx)}}{d\sqrt{-i+\mathrm{csch}(c+dx)}(i+\mathrm{csch}(c+dx))}$$

input
```
Integrate[Sqrt[a - I*a*Csch[c + d*x]],x]
```

output
```
(-2*(-1)^(3/4)*ArcTan[(-1)^(3/4)*Sqrt[-I + Csch[c + d*x]]]*Coth[c + d*x]*S
qrt[a - I*a*Csch[c + d*x]])/(d*Sqrt[-I + Csch[c + d*x]]*(I + Csch[c + d*x]
))
```

### 3.56.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.176$, Rules used = {3042, 4261, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{a - ia\operatorname{csch}(c+dx)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{a + a\csc(ic+idx)}dx$$

$$\downarrow 4261$$

$$\frac{2ia\int \frac{1}{a-\frac{a^2\coth^2(c+dx)}{a-ia\operatorname{csch}(c+dx)}} d\left(-\frac{ia\coth(c+dx)}{\sqrt{a-ia\operatorname{csch}(c+dx)}}\right)}{d}$$

$$\downarrow 216$$

$$\frac{2\sqrt{a}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a-ia\operatorname{csch}(c+dx)}}\right)}{d}$$

input
```
Int[Sqrt[a - I*a*Csch[c + d*x]],x]
```

output
```
(2*Sqrt[a]*ArcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a - I*a*Csch[c + d*x]]])/d
```

#### 3.56.3.1 Defintions of rubi rules used

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

### 3.56.4 Maple [F]

$$\int \sqrt{a - ia \operatorname{csch}(dx + c)}\, dx$$

input
```
int((a-I*a*csch(d*x+c))^(1/2),x)
```

output
```
int((a-I*a*csch(d*x+c))^(1/2),x)
```

### 3.56.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 383 vs. $2(32) = 64$.

Time = 0.29 (sec) , antiderivative size = 383, normalized size of antiderivative = 9.58

$$\int \sqrt{a - ia\operatorname{csch}(c + dx)}\, dx$$

$$= \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(\frac{2\left(\left(de^{(2\,dx+2\,c)} - d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{a}{d^2}} + ae^{(dx+c)} - i\,a\right)e^{(-dx-c)}}{d}\right)$$

$$- \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(-\frac{2\left(\left(de^{(2\,dx+2\,c)} - d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{a}{d^2}} - ae^{(dx+c)} + i\,a\right)e^{(-dx-c)}}{d}\right)$$

$$+ \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(\frac{2\left(\left(ae^{(3\,dx+3\,c)} + 2i\,ae^{(2\,dx+2\,c)} - ae^{(dx+c)} - 2i\,a\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}} + \left(ade^{(2\,dx+2\,c)} + i\,ade^{(dx+c)}\right.\right.\right.$$

$$- \frac{1}{2}\sqrt{\frac{a}{d^2}} \log\left(\frac{2\left(\left(ae^{(3\,dx+3\,c)} + 2i\,ae^{(2\,dx+2\,c)} - ae^{(dx+c)} - 2i\,a\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}} - \left(ade^{(2\,dx+2\,c)} + i\,ade^{(dx+c)}\right.\right.\right.$$

input
```
integrate((a-I*a*csch(d*x+c))^(1/2),x, algorithm="fricas")
```

output
```
1/2*sqrt(a/d^2)*log(2*((d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x + 2*c) - 1
))*sqrt(a/d^2) + a*e^(d*x + c) - I*a)*e^(-d*x - c)/d) - 1/2*sqrt(a/d^2)*lo
g(-2*((d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x + 2*c) - 1))*sqrt(a/d^2) -
a*e^(d*x + c) + I*a)*e^(-d*x - c)/d) + 1/2*sqrt(a/d^2)*log(2*((a*e^(3*d*x
+ 3*c) + 2*I*a*e^(2*d*x + 2*c) - a*e^(d*x + c) - 2*I*a)*sqrt(a/(e^(2*d*x +
 2*c) - 1)) + (a*d*e^(2*d*x + 2*c) + I*a*d*e^(d*x + c) - 2*a*d)*sqrt(a/d^2
))*e^(-2*d*x - 2*c)/d) - 1/2*sqrt(a/d^2)*log(2*((a*e^(3*d*x + 3*c) + 2*I*a
*e^(2*d*x + 2*c) - a*e^(d*x + c) - 2*I*a)*sqrt(a/(e^(2*d*x + 2*c) - 1)) -
(a*d*e^(2*d*x + 2*c) + I*a*d*e^(d*x + c) - 2*a*d)*sqrt(a/d^2))*e^(-2*d*x -
 2*c)/d)
```

### 3.56.6 Sympy [F]

$$\int \sqrt{a - ia\operatorname{csch}(c + dx)}\, dx = \int \sqrt{-ia \operatorname{csch}(c + dx) + a}\, dx$$

input
```
integrate((a-I*a*csch(d*x+c))**(1/2),x)
```

output
```
Integral(sqrt(-I*a*csch(c + d*x) + a), x)
```

### 3.56.7 Maxima [F]

$$\int \sqrt{a - ia\operatorname{csch}(c + dx)}\, dx = \int \sqrt{-i\, a \operatorname{csch}(dx + c) + a}\, dx$$

input
```
integrate((a-I*a*csch(d*x+c))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(-I*a*csch(d*x + c) + a), x)
```

### 3.56.8 Giac [F]

$$\int \sqrt{a - ia\operatorname{csch}(c + dx)}\, dx = \int \sqrt{-i\, a \operatorname{csch}(dx + c) + a}\, dx$$

input
```
integrate((a-I*a*csch(d*x+c))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(-I*a*csch(d*x + c) + a), x)
```

### 3.56.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{a - ia\operatorname{csch}(c + dx)}\, dx = \int \sqrt{a - \frac{a\, 1\mathrm{i}}{\sinh(c + d\, x)}}\, dx$$

input
```
int((a - (a*1i)/sinh(c + d*x))^(1/2),x)
```

output
```
int((a - (a*1i)/sinh(c + d*x))^(1/2), x)
```

# 3.57 $\int \frac{1}{\sqrt{a-ia\,\mathbf{csch}(c+dx)}}\,dx$


3.57.1 Optimal result . . . . . 395
3.57.2 Mathematica [A] (verified) . . . . . 395
3.57.3 Rubi [A] (verified) . . . . . 396
3.57.4 Maple [F] . . . . . 398
3.57.5 Fricas [B] (verification not implemented) . . . . . 398
3.57.6 Sympy [F] . . . . . 400
3.57.7 Maxima [F] . . . . . 400
3.57.8 Giac [F] . . . . . 400
3.57.9 Mupad [F(-1)] . . . . . 401


## 3.57.1 Optimal result

Integrand size = 17, antiderivative size = 91

$$\int \frac{1}{\sqrt{a-ia\operatorname{csch}(c+dx)}}\,dx = \frac{2\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a-ia\operatorname{csch}(c+dx)}}\right)}{\sqrt{a}d} - \frac{\sqrt{2}\operatorname{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{2}\sqrt{a-ia\operatorname{csch}(c+dx)}}\right)}{\sqrt{a}d}$$

output
```
2*arctanh(coth(d*x+c)*a^(1/2)/(a-I*a*csch(d*x+c))^(1/2))/d/a^(1/2)-arctanh
(1/2*coth(d*x+c)*a^(1/2)*2^(1/2)/(a-I*a*csch(d*x+c))^(1/2))*2^(1/2)/d/a^(1
/2)
```

## 3.57.2 Mathematica [A] (verified)

Time = 1.76 (sec) , antiderivative size = 117, normalized size of antiderivative = 1.29

$$\int \frac{1}{\sqrt{a-ia\operatorname{csch}(c+dx)}}\,dx = \frac{\sqrt{a}\left(2\arctan\left(\frac{\sqrt{-ia(-i+\operatorname{csch}(c+dx))}}{\sqrt{a}}\right) - \sqrt{2}\arctan\left(\frac{\sqrt{-ia(-i+\operatorname{csch}(c+dx))}}{\sqrt{2}\sqrt{a}}\right)\right)\coth(c+dx)}{d\sqrt{a(-1-i\operatorname{csch}(c+dx))}\sqrt{a-ia\operatorname{csch}(c+dx)}}$$

input
```
Integrate[1/Sqrt[a - I*a*Csch[c + d*x]],x]
```

output
```
(Sqrt[a]*(2*ArcTan[Sqrt[(-I)*a*(-I + Csch[c + d*x])]/Sqrt[a]] - Sqrt[2]*Ar
cTan[Sqrt[(-I)*a*(-I + Csch[c + d*x])]/(Sqrt[2]*Sqrt[a])])*Coth[c + d*x])/
(d*Sqrt[a*(-1 - I*Csch[c + d*x])]*Sqrt[a - I*a*Csch[c + d*x]])
```

### 3.57.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.00, number of steps used = 10, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.529$, Rules used = {3042, 4263, 26, 3042, 26, 4261, 216, 4282, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{a - ia\operatorname{csch}(c+dx)}}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\sqrt{a + a\csc(ic+idx)}}dx$$

$$\downarrow 4263$$

$$\frac{\int \sqrt{a - ia\operatorname{csch}(c+dx)}dx}{a} - \int -\frac{i\operatorname{csch}(c+dx)}{\sqrt{a - ia\operatorname{csch}(c+dx)}}dx$$

$$\downarrow 26$$

$$i\int \frac{\operatorname{csch}(c+dx)}{\sqrt{a - ia\operatorname{csch}(c+dx)}}dx + \frac{\int \sqrt{a - ia\operatorname{csch}(c+dx)}dx}{a}$$

$$\downarrow 3042$$

$$i\int \frac{i\csc(ic+idx)}{\sqrt{\csc(ic+idx)a + a}}dx + \frac{\int \sqrt{\csc(ic+idx)a + a}dx}{a}$$

$$\downarrow 26$$

$$\frac{\int \sqrt{\csc(ic+idx)a + a}dx}{a} - \int \frac{\csc(ic+idx)}{\sqrt{\csc(ic+idx)a + a}}dx$$

$$\downarrow 4261$$

$$\frac{2i\int \frac{1}{a - \frac{a^2\coth^2(c+dx)}{a - ia\operatorname{csch}(c+dx)}}d\left(-\frac{ia\coth(c+dx)}{\sqrt{a - ia\operatorname{csch}(c+dx)}}\right)}{d} - \int \frac{\csc(ic+idx)}{\sqrt{\csc(ic+idx)a + a}}dx$$

$$\downarrow 216$$

$$\frac{2\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a-ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d} - \int \frac{\csc(ic+idx)}{\sqrt{\csc(ic+idx)a+a}}dx$$

$$\downarrow 4282$$

$$\frac{2\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a-ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d} - \frac{2i\int \frac{1}{2a-\frac{a^2\coth^2(c+dx)}{a-ia\text{csch}(c+dx)}}d\left(-\frac{ia\coth(c+dx)}{\sqrt{a-ia\text{csch}(c+dx)}}\right)}{d}$$

$$\downarrow 216$$

$$\frac{2\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{a-ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d} - \frac{\sqrt{2}\text{arctanh}\left(\frac{\sqrt{a}\coth(c+dx)}{\sqrt{2}\sqrt{a-ia\text{csch}(c+dx)}}\right)}{\sqrt{a}d}$$

input
```
Int[1/Sqrt[a - I*a*Csch[c + d*x]],x]
```

output
```
(2*ArcTanh[(Sqrt[a]*Coth[c + d*x])/Sqrt[a - I*a*Csch[c + d*x]]])/(Sqrt[a]*
d) - (Sqrt[2]*ArcTanh[(Sqrt[a]*Coth[c + d*x])/(Sqrt[2]*Sqrt[a - I*a*Csch[c
 + d*x]])])/(Sqrt[a]*d)
```

### 3.57.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4263
```
Int[1/Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[1/a   I
nt[Sqrt[a + b*Csc[c + d*x]], x], x] - Simp[b/a   Int[Csc[c + d*x]/Sqrt[a +
b*Csc[c + d*x]], x], x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

rule 4282
```
Int[csc[(e_.) + (f_.)*(x_)]/Sqrt[csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)], x_S
ymbol] :> Simp[-2/f   Subst[Int[1/(2*a + x^2), x], x, b*(Cot[e + f*x]/Sqrt[
a + b*Csc[e + f*x]])], x] /; FreeQ[{a, b, e, f}, x] && EqQ[a^2 - b^2, 0]
```

### 3.57.4 Maple [F]

$$\int \frac{1}{\sqrt{a - ia \operatorname{csch}(dx + c)}} dx$$

input
```
int(1/(a-I*a*csch(d*x+c))^(1/2),x)
```

output
```
int(1/(a-I*a*csch(d*x+c))^(1/2),x)
```

### 3.57.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 551 vs. $2(72) = 144$.

Time = 0.28 (sec) , antiderivative size = 551, normalized size of antiderivative = 6.05

$$\int \frac{1}{\sqrt{a - ia\operatorname{csch}(c+dx)}}\,dx =$$

$$-\frac{1}{2}\sqrt{2}\sqrt{\frac{1}{ad^2}}\log\left(2\left(\sqrt{2}\left(ade^{(2\,dx+2\,c)}-ad\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}+ae^{(dx+c)}+i\,a\right)e^{(-dx-c)}\right)$$

$$+\frac{1}{2}\sqrt{2}\sqrt{\frac{1}{ad^2}}\log\left(-2\left(\sqrt{2}\left(ade^{(2\,dx+2\,c)}-ad\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}-ae^{(dx+c)}-i\,a\right)e^{(-dx-c)}\right)$$

$$+\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(\frac{2\left(\left(de^{(2\,dx+2\,c)}-d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}+e^{(dx+c)}-i\right)e^{(-dx-c)}}{d}\right)$$

$$-\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(-\frac{2\left(\left(de^{(2\,dx+2\,c)}-d\right)\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\sqrt{\frac{1}{ad^2}}-e^{(dx+c)}+i\right)e^{(-dx-c)}}{d}\right)$$

$$+\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(\frac{2\left(\left(ade^{(2\,dx+2\,c)}+i\,ade^{(dx+c)}-2\,ad\right)\sqrt{\frac{1}{ad^2}}+\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\left(e^{(3\,dx+3\,c)}+2i\,e^{(2\,dx+2\,c)}-e^{(dx+}\right.\right.}{d}\right)$$

$$-\frac{1}{2}\sqrt{\frac{1}{ad^2}}\log\left(-\frac{2\left(\left(ade^{(2\,dx+2\,c)}+i\,ade^{(dx+c)}-2\,ad\right)\sqrt{\frac{1}{ad^2}}-\sqrt{\frac{a}{e^{(2\,dx+2\,c)}-1}}\left(e^{(3\,dx+3\,c)}+2i\,e^{(2\,dx+2\,c)}-e^{(}\right.\right.}{d}\right)$$

input
```
integrate(1/(a-I*a*csch(d*x+c))^(1/2),x, algorithm="fricas")
```

output
```
-1/2*sqrt(2)*sqrt(1/(a*d^2))*log(2*(sqrt(2)*(a*d*e^(2*d*x + 2*c) - a*d)*sq
rt(a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a*d^2)) + a*e^(d*x + c) + I*a)*e^(-d*x
 - c)) + 1/2*sqrt(2)*sqrt(1/(a*d^2))*log(-2*(sqrt(2)*(a*d*e^(2*d*x + 2*c)
- a*d)*sqrt(a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a*d^2)) - a*e^(d*x + c) - I*a
)*e^(-d*x - c)) + 1/2*sqrt(1/(a*d^2))*log(2*((d*e^(2*d*x + 2*c) - d)*sqrt(
a/(e^(2*d*x + 2*c) - 1))*sqrt(1/(a*d^2)) + e^(d*x + c) - I)*e^(-d*x - c)/d
) - 1/2*sqrt(1/(a*d^2))*log(-2*((d*e^(2*d*x + 2*c) - d)*sqrt(a/(e^(2*d*x +
 2*c) - 1))*sqrt(1/(a*d^2)) - e^(d*x + c) + I)*e^(-d*x - c)/d) + 1/2*sqrt(
1/(a*d^2))*log(2*((a*d*e^(2*d*x + 2*c) + I*a*d*e^(d*x + c) - 2*a*d)*sqrt(1
/(a*d^2)) + sqrt(a/(e^(2*d*x + 2*c) - 1))*(e^(3*d*x + 3*c) + 2*I*e^(2*d*x
+ 2*c) - e^(d*x + c) - 2*I))*e^(-2*d*x - 2*c)/d) - 1/2*sqrt(1/(a*d^2))*log
(-2*((a*d*e^(2*d*x + 2*c) + I*a*d*e^(d*x + c) - 2*a*d)*sqrt(1/(a*d^2)) - s
qrt(a/(e^(2*d*x + 2*c) - 1))*(e^(3*d*x + 3*c) + 2*I*e^(2*d*x + 2*c) - e^(d
*x + c) - 2*I))*e^(-2*d*x - 2*c)/d)
```

### 3.57.6 Sympy [F]

$$\int \frac{1}{\sqrt{a - ia\operatorname{csch}(c + dx)}}\,dx = \int \frac{1}{\sqrt{-ia\,\operatorname{csch}(c + dx) + a}}\,dx$$

input
```
integrate(1/(a-I*a*csch(d*x+c))**(1/2),x)
```

output
```
Integral(1/sqrt(-I*a*csch(c + d*x) + a), x)
```

### 3.57.7 Maxima [F]

$$\int \frac{1}{\sqrt{a - ia\operatorname{csch}(c + dx)}}\,dx = \int \frac{1}{\sqrt{-i\,a\,\operatorname{csch}(dx + c) + a}}\,dx$$

input
```
integrate(1/(a-I*a*csch(d*x+c))^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/sqrt(-I*a*csch(d*x + c) + a), x)
```

### 3.57.8 Giac [F]

$$\int \frac{1}{\sqrt{a - ia\operatorname{csch}(c + dx)}}\,dx = \int \frac{1}{\sqrt{-i\,a\,\operatorname{csch}(dx + c) + a}}\,dx$$

input
```
integrate(1/(a-I*a*csch(d*x+c))^(1/2),x, algorithm="giac")
```

output
```
integrate(1/sqrt(-I*a*csch(d*x + c) + a), x)
```

### 3.57.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{a - ia\operatorname{csch}(c+dx)}}\,dx = \int \frac{1}{\sqrt{a - \frac{a\,1\mathrm{i}}{\sinh(c+d\,x)}}}\,dx$$

input
```
int(1/(a - (a*1i)/sinh(c + d*x))^(1/2),x)
```

output
```
int(1/(a - (a*1i)/sinh(c + d*x))^(1/2), x)
```

# 3.58 $\int \sqrt{3+3i\operatorname{csch}(x)}\,dx$

3.58.1 Optimal result . . . . . 402
3.58.2 Mathematica [A] (verified) . . . . . 402
3.58.3 Rubi [A] (verified) . . . . . 403
3.58.4 Maple [F] . . . . . 404
3.58.5 Fricas [B] (verification not implemented) . . . . . 404
3.58.6 Sympy [F] . . . . . 405
3.58.7 Maxima [F] . . . . . 405
3.58.8 Giac [F] . . . . . 405
3.58.9 Mupad [F(-1)] . . . . . 406

## 3.58.1 Optimal result

Integrand size = 12, antiderivative size = 23

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx = 2\sqrt{3}\operatorname{arctanh}\left(\frac{\coth(x)}{\sqrt{1+i\operatorname{csch}(x)}}\right)$$

output
```
2*arctanh(coth(x)/(1+I*csch(x))^(1/2))*3^(1/2)
```

## 3.58.2 Mathematica [A] (verified)

Time = 0.66 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.00

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx = \frac{2\sqrt{3}\arctan\left(\sqrt{-1+i\operatorname{csch}(x)}\right)\coth(x)}{\sqrt{-1+i\operatorname{csch}(x)}\sqrt{1+i\operatorname{csch}(x)}}$$

input
```
Integrate[Sqrt[3 + (3*I)*Csch[x]],x]
```

output
```
(2*Sqrt[3]*ArcTan[Sqrt[-1 + I*Csch[x]]]*Coth[x])/(Sqrt[-1 + I*Csch[x]]*Sqr
t[1 + I*Csch[x]])
```

### 3.58.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.250$, Rules used = {3042, 4261, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{3-3\csc(ix)}dx$$

$$\downarrow 4261$$

$$-6i\int \frac{1}{3-\frac{3\coth^2(x)}{i\operatorname{csch}(x)+1}}d\frac{i\sqrt{3}\coth(x)}{\sqrt{i\operatorname{csch}(x)+1}}$$

$$\downarrow 216$$

$$2\sqrt{3}\operatorname{arctanh}\left(\frac{\coth(x)}{\sqrt{1+i\operatorname{csch}(x)}}\right)$$

input
```
Int[Sqrt[3 + (3*I)*Csch[x]],x]
```

output
```
2*Sqrt[3]*ArcTanh[Coth[x]/Sqrt[1 + I*Csch[x]]]
```

#### 3.58.3.1 Defintions of rubi rules used

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

### 3.58.4 Maple [F]

$$\int \sqrt{3+3i\,\mathrm{csch}\,(x)}dx$$

input
```
int((3+3*I*csch(x))^(1/2),x)
```

output
```
int((3+3*I*csch(x))^(1/2),x)
```

### 3.58.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 212 vs. $2(17) = 34$.

Time $= 0.27$ (sec) , antiderivative size $= 212$, normalized size of antiderivative $= 9.22$

$$\begin{aligned}
&\int \sqrt{3+3i\mathrm{csch}(x)}\,dx \\
&= \frac{1}{2}\sqrt{3}\log\left(2\left(\frac{\sqrt{3}\left(\sqrt{3}e^{(2x)}-\sqrt{3}\right)}{\sqrt{e^{(2x)}-1}}+3\,e^{x}+3i\right)e^{(-x)}\right) \\
&\quad -\frac{1}{2}\sqrt{3}\log\left(-2\left(\frac{\sqrt{3}\left(\sqrt{3}e^{(2x)}-\sqrt{3}\right)}{\sqrt{e^{(2x)}-1}}-3\,e^{x}-3i\right)e^{(-x)}\right) \\
&\quad +\frac{1}{2}\sqrt{3}\log\left(6\left(\sqrt{3}e^{(2x)}-i\sqrt{3}e^{x}+\frac{\sqrt{3}\left(e^{(3x)}-2i\,e^{(2x)}-e^{x}+2i\right)}{\sqrt{e^{(2x)}-1}}-2\sqrt{3}\right)e^{(-2x)}\right) \\
&\quad -\frac{1}{2}\sqrt{3}\log\left(-6\left(\sqrt{3}e^{(2x)}-i\sqrt{3}e^{x}-\frac{\sqrt{3}\left(e^{(3x)}-2i\,e^{(2x)}-e^{x}+2i\right)}{\sqrt{e^{(2x)}-1}}-2\sqrt{3}\right)e^{(-2x)}\right)
\end{aligned}$$

input
```
integrate((3+3*I*csch(x))^(1/2),x, algorithm="fricas")
```

output
```
1/2*sqrt(3)*log(2*(sqrt(3)*(sqrt(3)*e^(2*x) - sqrt(3))/sqrt(e^(2*x) - 1) +
 3*e^x + 3*I)*e^(-x)) - 1/2*sqrt(3)*log(-2*(sqrt(3)*(sqrt(3)*e^(2*x) - sqr
t(3))/sqrt(e^(2*x) - 1) - 3*e^x - 3*I)*e^(-x)) + 1/2*sqrt(3)*log(6*(sqrt(3
)*e^(2*x) - I*sqrt(3)*e^x + sqrt(3)*(e^(3*x) - 2*I*e^(2*x) - e^x + 2*I)/sq
rt(e^(2*x) - 1) - 2*sqrt(3))*e^(-2*x)) - 1/2*sqrt(3)*log(-6*(sqrt(3)*e^(2*
x) - I*sqrt(3)*e^x - sqrt(3)*(e^(3*x) - 2*I*e^(2*x) - e^x + 2*I)/sqrt(e^(2
*x) - 1) - 2*sqrt(3))*e^(-2*x))
```

### 3.58.6 Sympy [F]

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx = \sqrt{3}\int \sqrt{i\operatorname{csch}(x)+1}\,dx$$

input
```
integrate((3+3*I*csch(x))**(1/2),x)
```

output
```
sqrt(3)*Integral(sqrt(I*csch(x) + 1), x)
```

### 3.58.7 Maxima [F]

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx = \int \sqrt{3i\operatorname{csch}(x)+3}\,dx$$

input
```
integrate((3+3*I*csch(x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(3*I*csch(x) + 3), x)
```

### 3.58.8 Giac [F]

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx = \int \sqrt{3i\operatorname{csch}(x)+3}\,dx$$

input
```
integrate((3+3*I*csch(x))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(3*I*csch(x) + 3), x)
```

### 3.58.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{3+3i\operatorname{csch}(x)}\,dx = \int \sqrt{3+\frac{3\mathrm{i}}{\sinh(x)}}\,dx$$

input
```
int((3i/sinh(x) + 3)^(1/2),x)
```

output
```
int((3i/sinh(x) + 3)^(1/2), x)
```

# 3.59 $\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx$

3.59.1 Optimal result . . . 407
3.59.2 Mathematica [A] (verified) . . . 407
3.59.3 Rubi [A] (verified) . . . 408
3.59.4 Maple [F] . . . 409
3.59.5 Fricas [B] (verification not implemented) . . . 409
3.59.6 Sympy [F] . . . 410
3.59.7 Maxima [F] . . . 410
3.59.8 Giac [F] . . . 410
3.59.9 Mupad [F(-1)] . . . 411

## 3.59.1 Optimal result

Integrand size = 12, antiderivative size = 23

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx = 2\sqrt{3}\operatorname{arctanh}\left(\frac{\coth(x)}{\sqrt{1 - i\operatorname{csch}(x)}}\right)$$

output
```
2*arctanh(coth(x)/(1-I*csch(x))^(1/2))*3^(1/2)
```

## 3.59.2 Mathematica [A] (verified)

Time = 0.63 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.00

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx = \frac{2\sqrt{3}\arctan\left(\sqrt{-1 - i\operatorname{csch}(x)}\right)\coth(x)}{\sqrt{-1 - i\operatorname{csch}(x)}\sqrt{1 - i\operatorname{csch}(x)}}$$

input
```
Integrate[Sqrt[3 - (3*I)*Csch[x]],x]
```

output
```
(2*Sqrt[3]*ArcTan[Sqrt[-1 - I*Csch[x]]]*Coth[x])/(Sqrt[-1 - I*Csch[x]]*Sqr
t[1 - I*Csch[x]])
```

### 3.59.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.250$, Rules used = {3042, 4261, 216}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx$$

$$\downarrow 3042$$

$$\int \sqrt{3 + 3\csc(ix)}dx$$

$$\downarrow 4261$$

$$6i \int \frac{1}{3 - \frac{3\coth^2(x)}{1 - i\operatorname{csch}(x)}} d\left(-\frac{i\sqrt{3}\coth(x)}{\sqrt{1 - i\operatorname{csch}(x)}}\right)$$

$$\downarrow 216$$

$$2\sqrt{3}\operatorname{arctanh}\left(\frac{\coth(x)}{\sqrt{1 - i\operatorname{csch}(x)}}\right)$$

input
```
Int[Sqrt[3 - (3*I)*Csch[x]],x]
```

output
```
2*Sqrt[3]*ArcTanh[Coth[x]/Sqrt[1 - I*Csch[x]]]
```

#### 3.59.3.1 Defintions of rubi rules used

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

### 3.59.4 Maple [F]

$$\int \sqrt{3 - 3i \operatorname{csch}(x)}\, dx$$

input
```
int((3-3*I*csch(x))^(1/2),x)
```

output
```
int((3-3*I*csch(x))^(1/2),x)
```

### 3.59.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 212 vs. $2(17) = 34$.

Time $= 0.27$ (sec) , antiderivative size $= 212$, normalized size of antiderivative $= 9.22$

$$\begin{aligned}
&\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx \\
&= \frac{1}{2}\sqrt{3}\log\left(2\left(\frac{\sqrt{3}\left(\sqrt{3}e^{(2x)} - \sqrt{3}\right)}{\sqrt{e^{(2x)} - 1}} + 3\,e^{x} - 3i\right)e^{(-x)}\right) \\
&\quad - \frac{1}{2}\sqrt{3}\log\left(-2\left(\frac{\sqrt{3}\left(\sqrt{3}e^{(2x)} - \sqrt{3}\right)}{\sqrt{e^{(2x)} - 1}} - 3\,e^{x} + 3i\right)e^{(-x)}\right) \\
&\quad + \frac{1}{2}\sqrt{3}\log\left(6\left(\sqrt{3}e^{(2x)} + i\sqrt{3}e^{x} + \frac{\sqrt{3}\left(e^{(3x)} + 2i\,e^{(2x)} - e^{x} - 2i\right)}{\sqrt{e^{(2x)} - 1}} - 2\sqrt{3}\right)e^{(-2x)}\right) \\
&\quad - \frac{1}{2}\sqrt{3}\log\left(-6\left(\sqrt{3}e^{(2x)} + i\sqrt{3}e^{x} - \frac{\sqrt{3}\left(e^{(3x)} + 2i\,e^{(2x)} - e^{x} - 2i\right)}{\sqrt{e^{(2x)} - 1}} - 2\sqrt{3}\right)e^{(-2x)}\right)
\end{aligned}$$

input
```
integrate((3-3*I*csch(x))^(1/2),x, algorithm="fricas")
```

output
```
1/2*sqrt(3)*log(2*(sqrt(3)*(sqrt(3)*e^(2*x) - sqrt(3))/sqrt(e^(2*x) - 1) +
 3*e^x - 3*I)*e^(-x)) - 1/2*sqrt(3)*log(-2*(sqrt(3)*(sqrt(3)*e^(2*x) - sqr
t(3))/sqrt(e^(2*x) - 1) - 3*e^x + 3*I)*e^(-x)) + 1/2*sqrt(3)*log(6*(sqrt(3
)*e^(2*x) + I*sqrt(3)*e^x + sqrt(3)*(e^(3*x) + 2*I*e^(2*x) - e^x - 2*I)/sq
rt(e^(2*x) - 1) - 2*sqrt(3))*e^(-2*x)) - 1/2*sqrt(3)*log(-6*(sqrt(3)*e^(2*
x) + I*sqrt(3)*e^x - sqrt(3)*(e^(3*x) + 2*I*e^(2*x) - e^x - 2*I)/sqrt(e^(2
*x) - 1) - 2*sqrt(3))*e^(-2*x))
```

### 3.59.6 Sympy [F]

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx = \sqrt{3} \int \sqrt{-i \operatorname{csch}(x) + 1}\, dx$$

input
```
integrate((3-3*I*csch(x))**(1/2),x)
```

output
```
sqrt(3)*Integral(sqrt(-I*csch(x) + 1), x)
```

### 3.59.7 Maxima [F]

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx = \int \sqrt{-3i \operatorname{csch}(x) + 3}\, dx$$

input
```
integrate((3-3*I*csch(x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(-3*I*csch(x) + 3), x)
```

### 3.59.8 Giac [F]

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx = \int \sqrt{-3i \operatorname{csch}(x) + 3}\, dx$$

input
```
integrate((3-3*I*csch(x))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(-3*I*csch(x) + 3), x)
```

### 3.59.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{3 - 3i\operatorname{csch}(x)}\, dx = \int \sqrt{3 - \frac{3\mathrm{i}}{\sinh(x)}}\, dx$$

input
```
int((3 - 3i/sinh(x))^(1/2),x)
```

output
```
int((3 - 3i/sinh(x))^(1/2), x)
```

# 3.60 $\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx$

3.60.1 Optimal result . . . 412
3.60.2 Mathematica [A] (verified) . . . 412
3.60.3 Rubi [A] (verified) . . . 413
3.60.4 Maple [F] . . . 414
3.60.5 Fricas [B] (verification not implemented) . . . 414
3.60.6 Sympy [F] . . . 415
3.60.7 Maxima [F] . . . 415
3.60.8 Giac [F] . . . 415
3.60.9 Mupad [F(-1)] . . . 416

## 3.60.1 Optimal result

Integrand size = 12, antiderivative size = 23

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx = -2\sqrt{3}\arctan\left(\frac{\coth(x)}{\sqrt{-1+i\operatorname{csch}(x)}}\right)$$

output
```
-2*arctan(coth(x)/(-1+I*csch(x))^(1/2))*3^(1/2)
```

## 3.60.2 Mathematica [A] (verified)

Time = 0.63 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.00

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx = -\frac{2\sqrt{3}\operatorname{arctanh}\left(\sqrt{1+i\operatorname{csch}(x)}\right)\coth(x)}{\sqrt{-1+i\operatorname{csch}(x)}\sqrt{1+i\operatorname{csch}(x)}}$$

input
```
Integrate[Sqrt[-3 + (3*I)*Csch[x]],x]
```

output
```
(-2*Sqrt[3]*ArcTanh[Sqrt[1 + I*Csch[x]]]*Coth[x])/(Sqrt[-1 + I*Csch[x]]*Sq
rt[1 + I*Csch[x]])
```

### 3.60.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.250$, Rules used = {3042, 4261, 220}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{-3-3\csc(ix)}dx$$

$$\downarrow 4261$$

$$-6i\int \frac{1}{-\frac{3\coth^2(x)}{i\operatorname{csch}(x)-1}-3}d\frac{i\sqrt{3}\coth(x)}{\sqrt{i\operatorname{csch}(x)-1}}$$

$$\downarrow 220$$

$$-2\sqrt{3}\arctan\left(\frac{\coth(x)}{\sqrt{-1+i\operatorname{csch}(x)}}\right)$$

input
```
Int[Sqrt[-3 + (3*I)*Csch[x]],x]
```

output
```
-2*Sqrt[3]*ArcTan[Coth[x]/Sqrt[-1 + I*Csch[x]]]
```

#### 3.60.3.1 Defintions of rubi rules used

rule 220
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(-(Rt[-a, 2]*Rt[b, 2])^(-
1))*ArcTanh[Rt[b, 2]*(x/Rt[-a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] &&
 (LtQ[a, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

### 3.60.4 Maple [F]

$$\int \sqrt{-3+3i\,\mathrm{csch}\,(x)}dx$$

input
```
int((-3+3*I*csch(x))^(1/2),x)
```

output
```
int((-3+3*I*csch(x))^(1/2),x)
```

### 3.60.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 218 vs. $2(17) = 34$.

Time $= 0.28$ (sec) , antiderivative size $= 218$, normalized size of antiderivative $= 9.48$

$$\begin{aligned}\int \sqrt{-3+3i\mathrm{csch}(x)}\,dx &= -\frac{1}{2}i\sqrt{3}\log\left(-2\left(\frac{\sqrt{3}\left(i\sqrt{3}e^{(2x)}-i\sqrt{3}\right)}{\sqrt{e^{(2x)}-1}}-3i\,e^{x}-3\right)e^{(-x)}\right)\\ &+\frac{1}{2}i\sqrt{3}\log\left(-2\left(\frac{\sqrt{3}\left(-i\sqrt{3}e^{(2x)}+i\sqrt{3}\right)}{\sqrt{e^{(2x)}-1}}-3i\,e^{x}-3\right)e^{(-x)}\right)\\ &-\frac{1}{2}i\sqrt{3}\log\left(-6\left(i\sqrt{3}e^{(2x)}-\sqrt{3}e^{x}+\frac{\sqrt{3}\left(-i\,e^{(3x)}+2\,e^{(2x)}+i\,e^{x}-2\right)}{\sqrt{e^{(2x)}-1}}-2i\sqrt{3}\right)e^{(-2x)}\right)\\ &+\frac{1}{2}i\sqrt{3}\log\left(-6\left(-i\sqrt{3}e^{(2x)}+\sqrt{3}e^{x}+\frac{\sqrt{3}\left(-i\,e^{(3x)}+2\,e^{(2x)}+i\,e^{x}-2\right)}{\sqrt{e^{(2x)}-1}}+2i\sqrt{3}\right)e^{(-2x)}\right)\end{aligned}$$

input
```
integrate((-3+3*I*csch(x))^(1/2),x, algorithm="fricas")
```

output
```
-1/2*I*sqrt(3)*log(-2*(sqrt(3)*(I*sqrt(3)*e^(2*x) - I*sqrt(3))/sqrt(e^(2*x
) - 1) - 3*I*e^x - 3)*e^(-x)) + 1/2*I*sqrt(3)*log(-2*(sqrt(3)*(-I*sqrt(3)*
e^(2*x) + I*sqrt(3))/sqrt(e^(2*x) - 1) - 3*I*e^x - 3)*e^(-x)) - 1/2*I*sqrt
(3)*log(-6*(I*sqrt(3)*e^(2*x) - sqrt(3)*e^x + sqrt(3)*(-I*e^(3*x) + 2*e^(2
*x) + I*e^x - 2)/sqrt(e^(2*x) - 1) - 2*I*sqrt(3))*e^(-2*x)) + 1/2*I*sqrt(3
)*log(-6*(-I*sqrt(3)*e^(2*x) + sqrt(3)*e^x + sqrt(3)*(-I*e^(3*x) + 2*e^(2*
x) + I*e^x - 2)/sqrt(e^(2*x) - 1) + 2*I*sqrt(3))*e^(-2*x))
```

### 3.60.6 Sympy [F]

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx = \sqrt{3}\int \sqrt{i\operatorname{csch}(x)-1}\,dx$$

input
```
integrate((-3+3*I*csch(x))**(1/2),x)
```

output
```
sqrt(3)*Integral(sqrt(I*csch(x) - 1), x)
```

### 3.60.7 Maxima [F]

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx = \int \sqrt{3i\ \operatorname{csch}(x)-3}\,dx$$

input
```
integrate((-3+3*I*csch(x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(3*I*csch(x) - 3), x)
```

### 3.60.8 Giac [F]

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx = \int \sqrt{3i\ \operatorname{csch}(x)-3}\,dx$$

input
```
integrate((-3+3*I*csch(x))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(3*I*csch(x) - 3), x)
```

### 3.60.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{-3+3i\operatorname{csch}(x)}\,dx = \int \sqrt{-3+\frac{3\mathrm{i}}{\sinh(x)}}\,dx$$

input
```
int((3i/sinh(x) - 3)^(1/2),x)
```

output
```
int((3i/sinh(x) - 3)^(1/2), x)
```

# 3.61 $\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx$

3.61.1 Optimal result . . . 417
3.61.2 Mathematica [A] (verified) . . . 417
3.61.3 Rubi [A] (verified) . . . 418
3.61.4 Maple [F] . . . 419
3.61.5 Fricas [B] (verification not implemented) . . . 419
3.61.6 Sympy [F] . . . 420
3.61.7 Maxima [F] . . . 420
3.61.8 Giac [F] . . . 420
3.61.9 Mupad [F(-1)] . . . 421

## 3.61.1 Optimal result

Integrand size = 12, antiderivative size = 23

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx = -2\sqrt{3}\arctan\left(\frac{\coth(x)}{\sqrt{-1-i\operatorname{csch}(x)}}\right)$$

output
```
-2*arctan(coth(x)/(-1-I*csch(x))^(1/2))*3^(1/2)
```

## 3.61.2 Mathematica [A] (verified)

Time = 0.60 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.00

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx = -\frac{2\sqrt{3}\operatorname{arctanh}\left(\sqrt{1-i\operatorname{csch}(x)}\right)\coth(x)}{\sqrt{-1-i\operatorname{csch}(x)}\sqrt{1-i\operatorname{csch}(x)}}$$

input
```
Integrate[Sqrt[-3 - (3*I)*Csch[x]],x]
```

output
```
(-2*Sqrt[3]*ArcTanh[Sqrt[1 - I*Csch[x]]]*Coth[x])/(Sqrt[-1 - I*Csch[x]]*Sq
rt[1 - I*Csch[x]])
```

### 3.61.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.250$, Rules used = {3042, 4261, 220}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \sqrt{-3+3\csc(ix)}dx$$

$$\downarrow 4261$$

$$6i\int \frac{1}{-\frac{3\coth^2(x)}{-i\operatorname{csch}(x)-1}-3}d\left(-\frac{i\sqrt{3}\coth(x)}{\sqrt{-i\operatorname{csch}(x)-1}}\right)$$

$$\downarrow 220$$

$$-2\sqrt{3}\arctan\left(\frac{\coth(x)}{\sqrt{-1-i\operatorname{csch}(x)}}\right)$$

input
```
Int[Sqrt[-3 - (3*I)*Csch[x]],x]
```

output
```
-2*Sqrt[3]*ArcTan[Coth[x]/Sqrt[-1 - I*Csch[x]]]
```

#### 3.61.3.1 Defintions of rubi rules used

rule 220
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(-(Rt[-a, 2]*Rt[b, 2])^(-
1))*ArcTanh[Rt[b, 2]*(x/Rt[-a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] &&
 (LtQ[a, 0] || GtQ[b, 0])
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4261
```
Int[Sqrt[csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_)], x_Symbol] :> Simp[-2*(b/d)
  Subst[Int[1/(a + x^2), x], x, b*(Cot[c + d*x]/Sqrt[a + b*Csc[c + d*x]])],
 x] /; FreeQ[{a, b, c, d}, x] && EqQ[a^2 - b^2, 0]
```

### 3.61.4 Maple [F]

$$\int \sqrt{-3-3i\,\mathrm{csch}\,(x)}dx$$

input
```
int((-3-3*I*csch(x))^(1/2),x)
```

output
```
int((-3-3*I*csch(x))^(1/2),x)
```

### 3.61.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 218 vs. $2(17) = 34$.

Time $= 0.30$ (sec) , antiderivative size $= 218$, normalized size of antiderivative $= 9.48$

$$\begin{aligned}\int \sqrt{-3-3i\mathrm{csch}(x)}\,dx &= -\frac{1}{2}i\sqrt{3}\log\left(-2\left(\frac{\sqrt{3}\left(i\sqrt{3}e^{(2x)}-i\sqrt{3}\right)}{\sqrt{e^{(2x)}-1}}-3i\,e^{x}+3\right)e^{(-x)}\right)\\ &+\frac{1}{2}i\sqrt{3}\log\left(-2\left(\frac{\sqrt{3}\left(-i\sqrt{3}e^{(2x)}+i\sqrt{3}\right)}{\sqrt{e^{(2x)}-1}}-3i\,e^{x}+3\right)e^{(-x)}\right)\\ &-\frac{1}{2}i\sqrt{3}\log\left(-6\left(i\sqrt{3}e^{(2x)}+\sqrt{3}e^{x}+\frac{\sqrt{3}\left(-i\,e^{(3x)}-2\,e^{(2x)}+i\,e^{x}+2\right)}{\sqrt{e^{(2x)}-1}}-2i\sqrt{3}\right)e^{(-2x)}\right)\\ &+\frac{1}{2}i\sqrt{3}\log\left(-6\left(-i\sqrt{3}e^{(2x)}-\sqrt{3}e^{x}+\frac{\sqrt{3}\left(-i\,e^{(3x)}-2\,e^{(2x)}+i\,e^{x}+2\right)}{\sqrt{e^{(2x)}-1}}+2i\sqrt{3}\right)e^{(-2x)}\right)\end{aligned}$$

input
```
integrate((-3-3*I*csch(x))^(1/2),x, algorithm="fricas")
```

output
```
-1/2*I*sqrt(3)*log(-2*(sqrt(3)*(I*sqrt(3)*e^(2*x) - I*sqrt(3))/sqrt(e^(2*x
) - 1) - 3*I*e^x + 3)*e^(-x)) + 1/2*I*sqrt(3)*log(-2*(sqrt(3)*(-I*sqrt(3)*
e^(2*x) + I*sqrt(3))/sqrt(e^(2*x) - 1) - 3*I*e^x + 3)*e^(-x)) - 1/2*I*sqrt
(3)*log(-6*(I*sqrt(3)*e^(2*x) + sqrt(3)*e^x + sqrt(3)*(-I*e^(3*x) - 2*e^(2
*x) + I*e^x + 2)/sqrt(e^(2*x) - 1) - 2*I*sqrt(3))*e^(-2*x)) + 1/2*I*sqrt(3
)*log(-6*(-I*sqrt(3)*e^(2*x) - sqrt(3)*e^x + sqrt(3)*(-I*e^(3*x) - 2*e^(2*
x) + I*e^x + 2)/sqrt(e^(2*x) - 1) + 2*I*sqrt(3))*e^(-2*x))
```

### 3.61.6 Sympy [F]

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx = \sqrt{3}\int \sqrt{-i\operatorname{csch}(x)-1}\,dx$$

input
```
integrate((-3-3*I*csch(x))**(1/2),x)
```

output
```
sqrt(3)*Integral(sqrt(-I*csch(x) - 1), x)
```

### 3.61.7 Maxima [F]

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx = \int \sqrt{-3i\operatorname{csch}(x)-3}\,dx$$

input
```
integrate((-3-3*I*csch(x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(-3*I*csch(x) - 3), x)
```

### 3.61.8 Giac [F]

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx = \int \sqrt{-3i\operatorname{csch}(x)-3}\,dx$$

input
```
integrate((-3-3*I*csch(x))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(-3*I*csch(x) - 3), x)
```

### 3.61.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{-3-3i\operatorname{csch}(x)}\,dx = \int \sqrt{-3-\frac{3\mathrm{i}}{\sinh(x)}}\,dx$$

input
```
int((- 3i/sinh(x) - 3)^(1/2),x)
```

output
```
int((- 3i/sinh(x) - 3)^(1/2), x)
```

# 3.62 $\int \frac{\sinh^4(x)}{i+\mathbf{csch}(x)}\,dx$


3.62.1 Optimal result . . . . . 422
3.62.2 Mathematica [A] (verified) . . . . . 422
3.62.3 Rubi [A] (verified) . . . . . 423
3.62.4 Maple [A] (verified) . . . . . 426
3.62.5 Fricas [A] (verification not implemented) . . . . . 426
3.62.6 Sympy [F] . . . . . 427
3.62.7 Maxima [A] (verification not implemented) . . . . . 427
3.62.8 Giac [A] (verification not implemented) . . . . . 427
3.62.9 Mupad [B] (verification not implemented) . . . . . 428


## 3.62.1 Optimal result

Integrand size = 13, antiderivative size = 58

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{15ix}{8} - 4\cosh(x) + \frac{4\cosh^3(x)}{3} + \frac{15}{8}i\cosh(x)\sinh(x) - \frac{5}{4}i\cosh(x)\sinh^3(x) - \frac{\cosh(x)\sinh^3(x)}{i+\operatorname{csch}(x)}$$

output
```
-15/8*I*x-4*cosh(x)+4/3*cosh(x)^3+15/8*I*cosh(x)*sinh(x)-5/4*I*cosh(x)*sin
h(x)^3-cosh(x)*sinh(x)^3/(I+csch(x))
```

## 3.62.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.09

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{96}\left(-180ix - 168\cosh(x) + 8\cosh(3x) + \frac{192\sinh\left(\frac{x}{2}\right)}{-i\cosh\left(\frac{x}{2}\right)+\sinh\left(\frac{x}{2}\right)} + 48i\sinh(2x) - 3i\sinh(4x)\right)$$

input
```
Integrate[Sinh[x]^4/(I + Csch[x]),x]
```

output
```
((-180*I)*x - 168*Cosh[x] + 8*Cosh[3*x] + (192*Sinh[x/2])/((-I)*Cosh[x/2]
+ Sinh[x/2]) + (48*I)*Sinh[2*x] - (3*I)*Sinh[4*x])/96
```

### 3.62.3 Rubi [A] (verified)

Time = 0.45 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.09, number of steps used = 17, number of rules used = 16, $\frac{\text{number of rules}}{\text{integrand size}} = 1.231$, Rules used = {3042, 4306, 25, 3042, 4274, 26, 3042, 26, 3113, 2009, 3115, 25, 3042, 25, 3115, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh^4(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(i\csc(ix)+i)\csc(ix)^4}dx$$

$$\downarrow 4306$$

$$\int -\left((5i-4\operatorname{csch}(x))\sinh^4(x)\right)dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 25$$

$$-\int (5i-4\operatorname{csch}(x))\sinh^4(x)dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3042$$

$$-\int \frac{5i-4i\csc(ix)}{\csc(ix)^4}dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 4274$$

$$-5i\int \sinh^4(x)dx + 4i\int -i\sinh^3(x)dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$-5i\int \sinh^4(x)dx + 4\int \sinh^3(x)dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3042$$

$$4\int i\sin(ix)^3dx - 5i\int \sin(ix)^4dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$4i\int \sin(ix)^3dx - 5i\int \sin(ix)^4dx - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3113$$

$$-5i\int \sin(ix)^4 dx - 4\int \left(1-\cosh^2(x)\right) d\cosh(x) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 2009$$

$$-5i\int \sin(ix)^4 dx - 4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3115$$

$$-5i\left(\frac{3}{4}\int -\sinh^2(x)dx + \frac{1}{4}\sinh^3(x)\cosh(x)\right) - 4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 25$$

$$-5i\left(\frac{1}{4}\sinh^3(x)\cosh(x) - \frac{3}{4}\int \sinh^2(x)dx\right) - 4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3042$$

$$-5i\left(\frac{1}{4}\sinh^3(x)\cosh(x) - \frac{3}{4}\int -\sin(ix)^2 dx\right) - 4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 25$$

$$-5i\left(\frac{1}{4}\sinh^3(x)\cosh(x) + \frac{3}{4}\int \sin(ix)^2 dx\right) - 4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3115$$

$$-5i\left(\frac{3}{4}\left(\frac{\int 1dx}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + \frac{1}{4}\sinh^3(x)\cosh(x)\right) - 4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 24$$

$$-4\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - 5i\left(\frac{1}{4}\sinh^3(x)\cosh(x) + \frac{3}{4}\left(\frac{x}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right)\right) - \frac{\sinh^3(x)\cosh(x)}{\operatorname{csch}(x)+i}$$

input
```
Int[Sinh[x]^4/(I + Csch[x]),x]
```

output
```
-4*(Cosh[x] - Cosh[x]^3/3) - (Cosh[x]*Sinh[x]^3)/(I + Csch[x]) - (5*I)*((C
osh[x]*Sinh[x]^3)/4 + (3*(x/2 - (Cosh[x]*Sinh[x])/2))/4)
```

#### 3.62.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3113
```
Int[sin[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
and[(1 - x^2)^((n - 1)/2), x], x], x, Cos[c + d*x]], x] /; FreeQ[{c, d}, x]
 && IGtQ[(n - 1)/2, 0]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 4274
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_)), x_Symbol] :> Simp[a   Int[(d*Csc[e + f*x])^n, x], x] + Simp[b/d   In
t[(d*Csc[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n}, x]
```

rule 4306
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(f*(a + b*Csc[e +
f*x]))), x] - Simp[1/a^2   Int[(d*Csc[e + f*x])^n*(a*(n - 1) - b*n*Csc[e +
f*x]), x], x] /; FreeQ[{a, b, d, e, f}, x] && EqQ[a^2 - b^2, 0] && LtQ[n, 0
]
```

### 3.62.4 Maple [A] (verified)

Time = 1.66 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.12

| method | result |
|---|---|
| risch | $-\frac{15ix}{8}-\frac{ie^{4x}}{64}+\frac{e^{3x}}{24}+\frac{ie^{2x}}{4}-\frac{7e^{x}}{8}-\frac{7e^{-x}}{8}-\frac{ie^{-2x}}{4}+\frac{e^{-3x}}{24}+\frac{ie^{-4x}}{64}-\frac{2}{e^{x}-i}$ |
| parallelrisch | $\frac{432+360(i-i\cosh(x)-\sinh(x))\ln(1-\coth(x)+\operatorname{csch}(x))+360(-i+i\cosh(x)+\sinh(x))\ln(\coth(x)-\operatorname{csch}(x)+1)-80i\sinh(2x)-4}{192i\sinh(x)-192\cos}$ |
| default | $-\frac{i}{4(\tanh(\frac{x}{2})-1)^4}+\frac{15i\ln(\tanh(\frac{x}{2})-1)}{8}+\frac{\frac{3}{2}+\frac{7i}{8}}{\tanh(\frac{x}{2})-1}+\frac{-\frac{1}{2}+\frac{5i}{8}}{(\tanh(\frac{x}{2})-1)^2}+\frac{-\frac{1}{3}-\frac{i}{2}}{(\tanh(\frac{x}{2})-1)^3}+\frac{2i}{\tanh(\frac{x}{2})-i}-\frac{15i\ln($ |

input
```
int(sinh(x)^4/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-15/8*I*x-1/64*I*exp(x)^4+1/24*exp(x)^3+1/4*I*exp(x)^2-7/8*exp(x)-7/8/exp(
x)-1/4*I/exp(x)^2+1/24/exp(x)^3+1/64*I/exp(x)^4-2/(exp(x)-I)
```

### 3.62.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 79, normalized size of antiderivative = 1.36

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{24\,(15i\,x-7i)e^{(5\,x)}+24\,(15\,x+23)e^{(4\,x)}+3i\,e^{(9\,x)}-5\,e^{(8\,x)}-40i\,e^{(7\,x)}+120\,e^{(6\,x)}-120i\,e^{(3\,x)}+40\,e^{(}}{192\,(e^{(5\,x)}-i\,e^{(4\,x)})}$$

input
```
integrate(sinh(x)^4/(I+csch(x)),x, algorithm="fricas")
```

output
```
-1/192*(24*(15*I*x - 7*I)*e^(5*x) + 24*(15*x + 23)*e^(4*x) + 3*I*e^(9*x) -
 5*e^(8*x) - 40*I*e^(7*x) + 120*e^(6*x) - 120*I*e^(3*x) + 40*e^(2*x) + 5*I
*e^x - 3)/(e^(5*x) - I*e^(4*x))
```

### 3.62.6 Sympy [F]

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\sinh^4(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(sinh(x)**4/(I+csch(x)),x)
```

output
```
Integral(sinh(x)**4/(csch(x) + I), x)
```

### 3.62.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 71, normalized size of antiderivative = 1.22

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{15}{8}i\,x - \frac{-5i\,e^{(-x)} + 40\,e^{(-2\,x)} + 120i\,e^{(-3\,x)} + 552\,e^{(-4\,x)} - 3}{16\,(12i\,e^{(-4\,x)} + 12\,e^{(-5\,x)})} - \frac{7}{8}\,e^{(-x)} - \frac{1}{4}i\,e^{(-2\,x)} + \frac{1}{24}\,e^{(-3\,x)} + \frac{1}{64}i\,e^{(-4\,x)}$$

input
```
integrate(sinh(x)^4/(I+csch(x)),x, algorithm="maxima")
```

output
```
-15/8*I*x - 1/16*(-5*I*e^(-x) + 40*e^(-2*x) + 120*I*e^(-3*x) + 552*e^(-4*x
) - 3)/(12*I*e^(-4*x) + 12*e^(-5*x)) - 7/8*e^(-x) - 1/4*I*e^(-2*x) + 1/24*
e^(-3*x) + 1/64*I*e^(-4*x)
```

### 3.62.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 62, normalized size of antiderivative = 1.07

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{15}{8}i\,x - \frac{\left(552\,e^{(4\,x)} - 120i\,e^{(3\,x)} + 40\,e^{(2\,x)} + 5i\,e^{x} - 3\right)e^{(-4\,x)}}{192\,(e^{x} - i)} - \frac{1}{64}i\,e^{(4\,x)} + \frac{1}{24}\,e^{(3\,x)} + \frac{1}{4}i\,e^{(2\,x)} - \frac{7}{8}\,e^{x}$$

input
```
integrate(sinh(x)^4/(I+csch(x)),x, algorithm="giac")
```

output
```
-15/8*I*x - 1/192*(552*e^(4*x) - 120*I*e^(3*x) + 40*e^(2*x) + 5*I*e^x - 3)
*e^(-4*x)/(e^x - I) - 1/64*I*e^(4*x) + 1/24*e^(3*x) + 1/4*I*e^(2*x) - 7/8*
e^x
```

### 3.62.9 Mupad [B] (verification not implemented)

Time = 2.42 (sec) , antiderivative size = 64, normalized size of antiderivative = 1.10

$$\int \frac{\sinh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{e^{-3x}}{24} - \frac{7e^{-x}}{8} - \frac{e^{-2x}\,1i}{4} + \frac{e^{2x}\,1i}{4} - \frac{x\,15i}{8} + \frac{e^{3x}}{24} + \frac{e^{-4x}\,1i}{64} - \frac{e^{4x}\,1i}{64} - \frac{7e^{x}}{8} - \frac{2}{e^{x}-i}$$

input
```
int(sinh(x)^4/(1/sinh(x) + 1i),x)
```

output
```
(exp(2*x)*1i)/4 - (7*exp(-x))/8 - (exp(-2*x)*1i)/4 - (x*15i)/8 + exp(-3*x)
/24 + exp(3*x)/24 + (exp(-4*x)*1i)/64 - (exp(4*x)*1i)/64 - (7*exp(x))/8 -
2/(exp(x) - 1i)
```

# 3.63 $\int \frac{\sinh^3(x)}{i+\mathbf{csch}(x)}\,dx$

3.63.1 Optimal result . . . . . 429
3.63.2 Mathematica [A] (verified) . . . . . 429
3.63.3 Rubi [A] (verified) . . . . . 430
3.63.4 Maple [A] (verified) . . . . . 433
3.63.5 Fricas [A] (verification not implemented) . . . . . 433
3.63.6 Sympy [F] . . . . . 433
3.63.7 Maxima [A] (verification not implemented) . . . . . 434
3.63.8 Giac [A] (verification not implemented) . . . . . 434
3.63.9 Mupad [B] (verification not implemented) . . . . . 434

## 3.63.1 Optimal result

Integrand size = 13, antiderivative size = 46

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{3x}{2} + 4i\cosh(x) - \frac{4}{3}i\cosh^3(x) + \frac{3}{2}\cosh(x)\sinh(x) - \frac{\cosh(x)\sinh^2(x)}{i+\operatorname{csch}(x)}$$

output
```
-3/2*x+4*I*cosh(x)-4/3*I*cosh(x)^3+3/2*cosh(x)*sinh(x)-cosh(x)*sinh(x)^2/(
I+csch(x))
```

## 3.63.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.22

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{12}\left(21i\cosh(x) - i\cosh(3x) + 3\left(-6x + \frac{8\sinh\left(\frac{x}{2}\right)}{\cosh\left(\frac{x}{2}\right) + i\sinh\left(\frac{x}{2}\right)} + \sinh(2x)\right)\right)$$

input
```
Integrate[Sinh[x]^3/(I + Csch[x]),x]
```

output
```
((21*I)*Cosh[x] - I*Cosh[3*x] + 3*(-6*x + (8*Sinh[x/2])/(Cosh[x/2] + I*Sin
h[x/2]) + Sinh[2*x]))/12
```

### 3.63.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 52, normalized size of antiderivative = 1.13, number of steps used = 18, number of rules used = 17, $\frac{\text{number of rules}}{\text{integrand size}} = 1.308$, Rules used = {3042, 26, 26, 4306, 26, 3042, 26, 4274, 25, 26, 3042, 25, 26, 3113, 2009, 3115, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh^3(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i}{(i\csc(ix)+i)\csc(ix)^3}dx$$

$$\downarrow 26$$

$$i\int -\frac{i}{\csc(ix)^3(\csc(ix)+1)}dx$$

$$\downarrow 26$$

$$\int \frac{1}{\csc(ix)^3(1+\csc(ix))}dx$$

$$\downarrow 4306$$

$$\frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)} - \int i(3i\operatorname{csch}(x)+4)\sinh^3(x)dx$$

$$\downarrow 26$$

$$\frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)} - i\int (3i\operatorname{csch}(x)+4)\sinh^3(x)dx$$

$$\downarrow 3042$$

$$\frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)} - i\int \frac{i(4-3\csc(ix))}{\csc(ix)^3}dx$$

$$\downarrow 26$$

$$\int \frac{4-3\csc(ix)}{\csc(ix)^3}dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 4274$$

$$4\int -i\sinh^3(x)dx - 3\int -\sinh^2(x)dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 25$$

$$4\int -i\sinh^3(x)dx + 3\int \sinh^2(x)dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 26$$

$$-4i\int \sinh^3(x)dx + 3\int \sinh^2(x)dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 3042$$

$$3\int -\sin(ix)^2dx - 4i\int i\sin(ix)^3dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 25$$

$$-3\int \sin(ix)^2dx - 4i\int i\sin(ix)^3dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 26$$

$$-3\int \sin(ix)^2dx + 4\int \sin(ix)^3dx + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 3113$$

$$-3\int \sin(ix)^2dx + 4i\int \left(1-\cosh^2(x)\right)d\cosh(x) + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 2009$$

$$-3\int \sin(ix)^2dx + 4i\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 3115$$

$$-3\left(\frac{\int 1dx}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + 4i\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 24$$

$$4i\left(\cosh(x) - \frac{\cosh^3(x)}{3}\right) - 3\left(\frac{x}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + \frac{i\sinh^2(x)\cosh(x)}{1-i\operatorname{csch}(x)}$$

input
```
Int[Sinh[x]^3/(I + Csch[x]),x]
```

output
```
(4*I)*(Cosh[x] - Cosh[x]^3/3) + (I*Cosh[x]*Sinh[x]^2)/(1 - I*Csch[x]) - 3*
(x/2 - (Cosh[x]*Sinh[x])/2)
```

#### 3.63.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3113
```
Int[sin[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
and[(1 - x^2)^((n - 1)/2), x], x], x, Cos[c + d*x]], x] /; FreeQ[{c, d}, x]
 && IGtQ[(n - 1)/2, 0]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 4274
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_)), x_Symbol] :> Simp[a   Int[(d*Csc[e + f*x])^n, x], x] + Simp[b/d   In
t[(d*Csc[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n}, x]
```

rule 4306
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(f*(a + b*Csc[e +
f*x]))), x] - Simp[1/a^2   Int[(d*Csc[e + f*x])^n*(a*(n - 1) - b*n*Csc[e +
f*x]), x], x] /; FreeQ[{a, b, d, e, f}, x] && EqQ[a^2 - b^2, 0] && LtQ[n, 0
]
```

### 3.63.4 Maple [A] (verified)

Time = 1.07 (sec) , antiderivative size = 53, normalized size of antiderivative = 1.15

| method | result |
|---|---|
| risch | $-\frac{3x}{2}-\frac{ie^{3x}}{24}+\frac{e^{2x}}{8}+\frac{7ie^{x}}{8}+\frac{7ie^{-x}}{8}-\frac{e^{-2x}}{8}-\frac{ie^{-3x}}{24}+\frac{2i}{e^{x}-i}$ |
| default | $\frac{i}{3(\tanh(\frac{x}{2})-1)^3}+\frac{\frac{1}{2}+\frac{i}{2}}{(\tanh(\frac{x}{2})-1)^2}+\frac{\frac{1}{2}-\frac{3i}{2}}{\tanh(\frac{x}{2})-1}+\frac{3\ln(\tanh(\frac{x}{2})-1)}{2}-\frac{i}{3(\tanh(\frac{x}{2})+1)^3}+\frac{\frac{1}{2}+\frac{3i}{2}}{\tanh(\frac{x}{2})+1}+\frac{-\frac{1}{2}+}{(\tanh(\frac{x}{2})}$ |
| parallelrisch | $\frac{(36i\sinh(x)-36\cosh(x)+36)\ln(1-\coth(x)+\operatorname{csch}(x))+(-36i\sinh(x)+36\cosh(x)-36)\ln(\coth(x)-\operatorname{csch}(x)+1)+23i\cosh(x)-2}{24i\sinh(x)-24\cosh(x)+24}$ |

input
```
int(sinh(x)^3/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-3/2*x-1/24*I*exp(x)^3+1/8*exp(x)^2+7/8*I*exp(x)+7/8*I/exp(x)-1/8/exp(x)^2
-1/24*I/exp(x)^3+2*I/(exp(x)-I)
```

### 3.63.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.46

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{3\,(12\,x-7)e^{(4\,x)}+3\,(-12i\,x-23i)e^{(3\,x)}+i\,e^{(7\,x)}-2\,e^{(6\,x)}-18i\,e^{(5\,x)}-18\,e^{(2\,x)}-2i\,e^{x}+1}{24\,(e^{(4\,x)}-i\,e^{(3\,x)})}$$

input
```
integrate(sinh(x)^3/(I+csch(x)),x, algorithm="fricas")
```

output
```
-1/24*(3*(12*x - 7)*e^(4*x) + 3*(-12*I*x - 23*I)*e^(3*x) + I*e^(7*x) - 2*e
^(6*x) - 18*I*e^(5*x) - 18*e^(2*x) - 2*I*e^x + 1)/(e^(4*x) - I*e^(3*x))
```

### 3.63.6 Sympy [F]

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\sinh^3(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(sinh(x)**3/(I+csch(x)),x)
```

output
```
Integral(sinh(x)**3/(csch(x) + I), x)
```

### 3.63.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 59, normalized size of antiderivative = 1.28

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{3}{2}x + \frac{2i\,e^{(-x)} - 18\,e^{(-2x)} + 69i\,e^{(-3x)} + 1}{8\left(3i\,e^{(-3x)} + 3\,e^{(-4x)}\right)} + \frac{7}{8}i\,e^{(-x)} - \frac{1}{8}\,e^{(-2x)} - \frac{1}{24}i\,e^{(-3x)}$$

input
```
integrate(sinh(x)^3/(I+csch(x)),x, algorithm="maxima")
```

output
```
-3/2*x + 1/8*(2*I*e^(-x) - 18*e^(-2*x) + 69*I*e^(-3*x) + 1)/(3*I*e^(-3*x)
+ 3*e^(-4*x)) + 7/8*I*e^(-x) - 1/8*e^(-2*x) - 1/24*I*e^(-3*x)
```

### 3.63.8 Giac [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.09

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{3}{2}x - \frac{\left(-69i\,e^{(3x)} - 18\,e^{(2x)} - 2i\,e^{x} + 1\right)e^{(-3x)}}{24\left(e^{x} - i\right)} - \frac{1}{24}i\,e^{(3x)} + \frac{1}{8}\,e^{(2x)} + \frac{7}{8}i\,e^{x}$$

input
```
integrate(sinh(x)^3/(I+csch(x)),x, algorithm="giac")
```

output
```
-3/2*x - 1/24*(-69*I*e^(3*x) - 18*e^(2*x) - 2*I*e^x + 1)*e^(-3*x)/(e^x - I
) - 1/24*I*e^(3*x) + 1/8*e^(2*x) + 7/8*I*e^x
```

### 3.63.9 Mupad [B] (verification not implemented)

Time = 0.17 (sec) , antiderivative size = 52, normalized size of antiderivative = 1.13

$$\int \frac{\sinh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{2x}}{8} + \frac{\mathrm{e}^{-x}\,7\mathrm{i}}{8} - \frac{\mathrm{e}^{-2x}}{8} - \frac{3x}{2} - \frac{\mathrm{e}^{-3x}\,1\mathrm{i}}{24} - \frac{\mathrm{e}^{3x}\,1\mathrm{i}}{24} + \frac{\mathrm{e}^{x}\,7\mathrm{i}}{8} + \frac{2\mathrm{i}}{\mathrm{e}^{x} - \mathrm{i}}$$

input
```
int(sinh(x)^3/(1/sinh(x) + 1i),x)
```

output
```
(exp(-x)*7i)/8 - (3*x)/2 - exp(-2*x)/8 + exp(2*x)/8 - (exp(-3*x)*1i)/24 -
(exp(3*x)*1i)/24 + (exp(x)*7i)/8 + 2i/(exp(x) - 1i)
```

# 3.64 $\int \frac{\sinh^2(x)}{i+\mathbf{csch}(x)}\,dx$

3.64.1 Optimal result . . . 435
3.64.2 Mathematica [A] (verified) . . . 435
3.64.3 Rubi [A] (verified) . . . 436
3.64.4 Maple [A] (verified) . . . 438
3.64.5 Fricas [B] (verification not implemented) . . . 439
3.64.6 Sympy [F] . . . 439
3.64.7 Maxima [A] (verification not implemented) . . . 440
3.64.8 Giac [A] (verification not implemented) . . . 440
3.64.9 Mupad [B] (verification not implemented) . . . 440

## 3.64.1 Optimal result

Integrand size = 13, antiderivative size = 36

$$\int \frac{\sinh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3ix}{2} + 2\cosh(x) - \frac{3}{2}i\cosh(x)\sinh(x) - \frac{\cosh(x)\sinh(x)}{i+\operatorname{csch}(x)}$$

output
```
3/2*I*x+2*cosh(x)-3/2*I*cosh(x)*sinh(x)-cosh(x)*sinh(x)/(I+csch(x))
```

## 3.64.2 Mathematica [A] (verified)

Time = 0.16 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.28

$$\int \frac{\sinh^2(x)}{i+\operatorname{csch}(x)}\,dx = \cosh(x) + \frac{1}{4}i\left(6x - \frac{8\sinh\left(\frac{x}{2}\right)}{\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)} - \sinh(2x)\right)$$

input
```
Integrate[Sinh[x]^2/(I + Csch[x]),x]
```

output
```
Cosh[x] + (I/4)*(6*x - (8*Sinh[x/2])/(Cosh[x/2] + I*Sinh[x/2]) - Sinh[2*x]
)
```

### 3.64.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.17, number of steps used = 15, number of rules used = 15, $\frac{\text{number of rules}}{\text{integrand size}} = 1.154$, Rules used = {3042, 25, 26, 4306, 3042, 25, 4274, 25, 26, 3042, 25, 26, 3115, 24, 3118}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh^2(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{1}{(i\csc(ix)+i)\csc(ix)^2}dx$$

$$\downarrow 25$$

$$-\int -\frac{i}{\csc(ix)^2(\csc(ix)+1)}dx$$

$$\downarrow 26$$

$$i\int \frac{1}{\csc(ix)^2(\csc(ix)+1)}dx$$

$$\downarrow 4306$$

$$i\left(\frac{\sinh(x)\cosh(x)}{1-i\operatorname{csch}(x)} - \int (2i\operatorname{csch}(x)+3)\sinh^2(x)dx\right)$$

$$\downarrow 3042$$

$$i\left(\frac{\sinh(x)\cosh(x)}{1-i\operatorname{csch}(x)} - \int -\frac{3-2\csc(ix)}{\csc(ix)^2}dx\right)$$

$$\downarrow 25$$

$$i\left(\int \frac{3-2\csc(ix)}{\csc(ix)^2}dx + \frac{\sinh(x)\cosh(x)}{1-i\operatorname{csch}(x)}\right)$$

$$\downarrow 4274$$

$$i\left(3\int -\sinh^2(x)dx - 2\int i\sinh(x)dx + \frac{\sinh(x)\cosh(x)}{1-i\operatorname{csch}(x)}\right)$$

$$\downarrow 25$$

$$i\left(-3\int \sinh^2(x)dx - 2\int i\sinh(x)dx + \frac{\sinh(x)\cosh(x)}{1-i\operatorname{csch}(x)}\right)$$

$$\downarrow 26$$

$$i\left(-3\int \sinh^2(x)dx - 2i\int \sinh(x)dx + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

$$\downarrow 3042$$

$$i\left(-2i\int -i\sin(ix)dx - 3\int -\sin(ix)^2dx + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

$$\downarrow 25$$

$$i\left(-2i\int -i\sin(ix)dx + 3\int \sin(ix)^2dx + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

$$\downarrow 26$$

$$i\left(-2\int \sin(ix)dx + 3\int \sin(ix)^2dx + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

$$\downarrow 3115$$

$$i\left(-2\int \sin(ix)dx + 3\left(\frac{\int 1dx}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

$$\downarrow 24$$

$$i\left(-2\int \sin(ix)dx + 3\left(\frac{x}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

$$\downarrow 3118$$

$$i\left(-2i\cosh(x) + 3\left(\frac{x}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + \frac{\sinh(x)\cosh(x)}{1-i\text{csch}(x)}\right)$$

input
```
Int[Sinh[x]^2/(I + Csch[x]),x]
```

output
```
I*((-2*I)*Cosh[x] + (Cosh[x]*Sinh[x])/(1 - I*Csch[x]) + 3*(x/2 - (Cosh[x]*
Sinh[x])/2))
```

### 3.64.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 3118
```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

rule 4274
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_)), x_Symbol] :> Simp[a   Int[(d*Csc[e + f*x])^n, x], x] + Simp[b/d   In
t[(d*Csc[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n}, x]
```

rule 4306
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(f*(a + b*Csc[e +
f*x]))), x] - Simp[1/a^2   Int[(d*Csc[e + f*x])^n*(a*(n - 1) - b*n*Csc[e +
f*x]), x], x] /; FreeQ[{a, b, d, e, f}, x] && EqQ[a^2 - b^2, 0] && LtQ[n, 0
]
```

### 3.64.4 Maple [A] (verified)

Time = 0.90 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.08

| method | result |
|---|---|
| risch | $\frac{3ix}{2}-\frac{ie^{2x}}{8}+\frac{e^{x}}{2}+\frac{e^{-x}}{2}+\frac{ie^{-2x}}{8}+\frac{2}{e^{x}-i}$ |
| default | $-\frac{3i\ln(\tanh(\frac{x}{2})-1)}{2}-\frac{i}{2(\tanh(\frac{x}{2})-1)^{2}}+\frac{-1-\frac{i}{2}}{\tanh(\frac{x}{2})-1}-\frac{2i}{\tanh(\frac{x}{2})-i}+\frac{i}{2(\tanh(\frac{x}{2})+1)^{2}}+\frac{3i\ln(\tanh(\frac{x}{2})+1)}{2}+\tan$ |
| parallelrisch | $\frac{(12i\cosh(x)-12i+12\sinh(x))\ln(1-\coth(x)+\operatorname{csch}(x))+(-12i\cosh(x)+12i-12\sinh(x))\ln(\coth(x)-\operatorname{csch}(x)+1)+5i\sinh(x)+2}{8i\sinh(x)-8\cosh(x)+8}$ |

input
```
int(sinh(x)^2/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
3/2*I*x-1/8*I*exp(x)^2+1/2*exp(x)+1/2/exp(x)+1/8*I/exp(x)^2+2/(exp(x)-I)
```

### 3.64.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 55 vs. $2(26) = 52$.

Time $= 0.26$ (sec) , antiderivative size $= 55$, normalized size of antiderivative $= 1.53$

$$\int \frac{\sinh^2(x)}{i + \operatorname{csch}(x)}\,dx = -\frac{4\,(-3i\,x + i)e^{(3\,x)} - 4\,(3\,x + 5)e^{(2\,x)} + i\,e^{(5\,x)} - 3\,e^{(4\,x)} + 3i\,e^{x} - 1}{8\,(e^{(3\,x)} - i\,e^{(2\,x)})}$$

input
```
integrate(sinh(x)^2/(I+csch(x)),x, algorithm="fricas")
```

output
```
-1/8*(4*(-3*I*x + I)*e^(3*x) - 4*(3*x + 5)*e^(2*x) + I*e^(5*x) - 3*e^(4*x)
 + 3*I*e^x - 1)/(e^(3*x) - I*e^(2*x))
```

### 3.64.6 Sympy [F]

$$\int \frac{\sinh^2(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\sinh^2(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(sinh(x)**2/(I+csch(x)),x)
```

output
```
Integral(sinh(x)**2/(csch(x) + I), x)
```

### 3.64.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 47, normalized size of antiderivative = 1.31

$$\int \frac{\sinh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3}{2}i\,x + \frac{3i\,e^{(-x)}+20\,e^{(-2\,x)}+1}{4\,(2i\,e^{(-2\,x)}+2\,e^{(-3\,x)})} + \frac{1}{2}\,e^{(-x)} + \frac{1}{8}i\,e^{(-2\,x)}$$

input
```
integrate(sinh(x)^2/(I+csch(x)),x, algorithm="maxima")
```

output
```
3/2*I*x + 1/4*(3*I*e^(-x) + 20*e^(-2*x) + 1)/(2*I*e^(-2*x) + 2*e^(-3*x)) +
 1/2*e^(-x) + 1/8*I*e^(-2*x)
```

### 3.64.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 38, normalized size of antiderivative = 1.06

$$\int \frac{\sinh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3}{2}i\,x + \frac{\left(20\,e^{(2\,x)}-3i\,e^{x}+1\right)e^{(-2\,x)}}{8\,(e^{x}-i)} - \frac{1}{8}i\,e^{(2\,x)} + \frac{1}{2}\,e^{x}$$

input
```
integrate(sinh(x)^2/(I+csch(x)),x, algorithm="giac")
```

output
```
3/2*I*x + 1/8*(20*e^(2*x) - 3*I*e^x + 1)*e^(-2*x)/(e^x - I) - 1/8*I*e^(2*x
) + 1/2*e^x
```

### 3.64.9 Mupad [B] (verification not implemented)

Time = 2.31 (sec) , antiderivative size = 38, normalized size of antiderivative = 1.06

$$\int \frac{\sinh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{x\,3\mathrm{i}}{2} + \frac{\mathrm{e}^{-x}}{2} + \frac{\mathrm{e}^{-2\,x}\,1\mathrm{i}}{8} - \frac{\mathrm{e}^{2\,x}\,1\mathrm{i}}{8} + \frac{\mathrm{e}^{x}}{2} + \frac{2}{\mathrm{e}^{x}-\mathrm{i}}$$

input
```
int(sinh(x)^2/(1/sinh(x) + 1i),x)
```

output
```
(x*3i)/2 + exp(-x)/2 + (exp(-2*x)*1i)/8 - (exp(2*x)*1i)/8 + exp(x)/2 + 2/(
exp(x) - 1i)
```

# 3.65 $\int \frac{\sinh(x)}{i+\mathbf{csch}(x)}\,dx$

3.65.1 Optimal result . . . 441
3.65.2 Mathematica [A] (verified) . . . 441
3.65.3 Rubi [A] (verified) . . . 442
3.65.4 Maple [A] (verified) . . . 444
3.65.5 Fricas [B] (verification not implemented) . . . 444
3.65.6 Sympy [F] . . . 445
3.65.7 Maxima [A] (verification not implemented) . . . 445
3.65.8 Giac [A] (verification not implemented) . . . 445
3.65.9 Mupad [B] (verification not implemented) . . . 446

## 3.65.1 Optimal result

Integrand size = 11, antiderivative size = 20

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = x - 2i\cosh(x) - \frac{\cosh(x)}{i+\operatorname{csch}(x)}$$

output
```
x-2*I*cosh(x)-cosh(x)/(I+csch(x))
```

## 3.65.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.75

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = x - i\cosh(x) - \frac{2\sinh\left(\frac{x}{2}\right)}{\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)}$$

input
```
Integrate[Sinh[x]/(I + Csch[x]),x]
```

output
```
x - I*Cosh[x] - (2*Sinh[x/2])/(Cosh[x/2] + I*Sinh[x/2])
```

### 3.65.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.20, number of steps used = 13, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.182$, Rules used = {3042, 26, 26, 4306, 26, 3042, 26, 4274, 24, 26, 3042, 26, 3118}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i}{(i\csc(ix)+i)\csc(ix)}dx$$

$$\downarrow 26$$

$$-i\int -\frac{i}{\csc(ix)(\csc(ix)+1)}dx$$

$$\downarrow 26$$

$$-\int \frac{1}{\csc(ix)(\csc(ix)+1)}dx$$

$$\downarrow 4306$$

$$\int -i(i\operatorname{csch}(x)+2)\sinh(x)dx+\frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 26$$

$$\frac{i\cosh(x)}{1-i\operatorname{csch}(x)}-i\int (i\operatorname{csch}(x)+2)\sinh(x)dx$$

$$\downarrow 3042$$

$$\frac{i\cosh(x)}{1-i\operatorname{csch}(x)}-i\int -\frac{i(2-\csc(ix))}{\csc(ix)}dx$$

$$\downarrow 26$$

$$\frac{i\cosh(x)}{1-i\operatorname{csch}(x)}-\int \frac{2-\csc(ix)}{\csc(ix)}dx$$

$$\downarrow 4274$$

$$\int 1dx-2\int i\sinh(x)dx+\frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 24$$

$$-2\int i\sinh(x)dx + x + \frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 26$$

$$-2i\int \sinh(x)dx + x + \frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 3042$$

$$-2i\int -i\sin(ix)dx + x + \frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 26$$

$$-2\int \sin(ix)dx + x + \frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

$$\downarrow 3118$$

$$x - 2i\cosh(x) + \frac{i\cosh(x)}{1-i\operatorname{csch}(x)}$$

input
```
Int[Sinh[x]/(I + Csch[x]),x]
```

output
```
x - (2*I)*Cosh[x] + (I*Cosh[x])/(1 - I*Csch[x])
```

### 3.65.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3118
```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

rule 4274
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_)), x_Symbol] :> Simp[a   Int[(d*Csc[e + f*x])^n, x], x] + Simp[b/d   In
t[(d*Csc[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n}, x]
```

rule 4306
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(f*(a + b*Csc[e +
f*x]))), x] - Simp[1/a^2   Int[(d*Csc[e + f*x])^n*(a*(n - 1) - b*n*Csc[e +
f*x]), x], x] /; FreeQ[{a, b, d, e, f}, x] && EqQ[a^2 - b^2, 0] && LtQ[n, 0
]
```

### 3.65.4 Maple [A] (verified)

Time = 0.64 (sec) , antiderivative size = 25, normalized size of antiderivative = 1.25

| method | result | size |
|---|---|---|
| risch | $x-\frac{i\mathrm{e}^{x}}{2}-\frac{i\mathrm{e}^{-x}}{2}-\frac{2i}{\mathrm{e}^{x}-i}$ | 25 |
| parallelrisch | $\frac{i\cosh(2x)+\sinh(2x)+(2ix+6)\sinh(x)-2x\cosh(x)-i+2x}{2i\sinh(x)-2\cosh(x)+2}$ | 46 |
| default | $-\frac{2}{\tanh(\frac{x}{2})-i}-\frac{i}{\tanh(\frac{x}{2})+1}+\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)+\frac{i}{\tanh(\frac{x}{2})-1}-\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)$ | 51 |

input
```
int(sinh(x)/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
x-1/2*I*exp(x)-1/2*I/exp(x)-2*I/(exp(x)-I)
```

### 3.65.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 39 vs. 2(16) = 32.

Time = 0.26 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.95

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = \frac{(2\,x-1)e^{(2\,x)}+(-2i\,x-5i)e^{x}-i\,e^{(3\,x)}-1}{2\left(e^{(2\,x)}-i\,e^{x}\right)}$$

input
```
integrate(sinh(x)/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/2*((2*x - 1)*e^(2*x) + (-2*I*x - 5*I)*e^x - I*e^(3*x) - 1)/(e^(2*x) - I*
e^x)
```

### 3.65.6 Sympy [F]

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\sinh(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(sinh(x)/(I+csch(x)),x)
```

output
```
Integral(sinh(x)/(csch(x) + I), x)
```

### 3.65.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.55

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = x - \frac{5i\,e^{(-x)}-1}{2\,(i\,e^{(-x)}+e^{(-2\,x)})} - \frac{1}{2}i\,e^{(-x)}$$

input
```
integrate(sinh(x)/(I+csch(x)),x, algorithm="maxima")
```

output
```
x - 1/2*(5*I*e^(-x) - 1)/(I*e^(-x) + e^(-2*x)) - 1/2*I*e^(-x)
```

### 3.65.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.20

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = x + \frac{(-5i\,e^{x}-1)e^{(-x)}}{2\,(e^{x}-i)} - \frac{1}{2}i\,e^{x}$$

input
```
integrate(sinh(x)/(I+csch(x)),x, algorithm="giac")
```

output
```
x + 1/2*(-5*I*e^x - 1)*e^(-x)/(e^x - I) - 1/2*I*e^x
```

### 3.65.9 Mupad [B] (verification not implemented)

Time = 2.32 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.20

$$\int \frac{\sinh(x)}{i+\operatorname{csch}(x)}\,dx = x - \frac{\mathrm{e}^{-x}\,1\mathrm{i}}{2} - \frac{\mathrm{e}^{x}\,1\mathrm{i}}{2} - \frac{2\mathrm{i}}{\mathrm{e}^{x}-\mathrm{i}}$$

input
```
int(sinh(x)/(1/sinh(x) + 1i),x)
```

output
```
x - (exp(-x)*1i)/2 - (exp(x)*1i)/2 - 2i/(exp(x) - 1i)
```

# 3.66 $\int \frac{\mathbf{csch}(x)}{i+\mathbf{csch}(x)}\,dx$

3.66.1 Optimal result . . . 447
3.66.2 Mathematica [A] (verified) . . . 447
3.66.3 Rubi [A] (verified) . . . 448
3.66.4 Maple [A] (verified) . . . 449
3.66.5 Fricas [A] (verification not implemented) . . . 449
3.66.6 Sympy [F] . . . 450
3.66.7 Maxima [A] (verification not implemented) . . . 450
3.66.8 Giac [A] (verification not implemented) . . . 450
3.66.9 Mupad [B] (verification not implemented) . . . 451

## 3.66.1 Optimal result

Integrand size = 11, antiderivative size = 14

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{i\coth(x)}{i+\operatorname{csch}(x)}$$

output
```
I*coth(x)/(I+csch(x))
```

## 3.66.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.93

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{2\sinh\left(\frac{x}{2}\right)}{\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)}$$

input
```
Integrate[Csch[x]/(I + Csch[x]),x]
```

output
```
(2*Sinh[x/2])/(Cosh[x/2] + I*Sinh[x/2])
```

### 3.66.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 13, normalized size of antiderivative = 0.93, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.364$, Rules used = {3042, 26, 26, 4281}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{i\csc(ix)}{i\csc(ix)+i}\,dx$$
$$\downarrow 26$$
$$i\int -\frac{i\csc(ix)}{\csc(ix)+1}\,dx$$
$$\downarrow 26$$
$$\int \frac{\csc(ix)}{1+\csc(ix)}\,dx$$
$$\downarrow 4281$$
$$\frac{\coth(x)}{1-i\operatorname{csch}(x)}$$

input
```
Int[Csch[x]/(I + Csch[x]),x]
```

output
```
Coth[x]/(1 - I*Csch[x])
```

#### 3.66.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4281
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[-Cot[e + f*x]/(f*(b + a*Csc[e + f*x])), x] /; FreeQ[{a, b, e, f}
, x] && EqQ[a^2 - b^2, 0]
```

### 3.66.4 Maple [A] (verified)

Time = 0.28 (sec) , antiderivative size = 11, normalized size of antiderivative = 0.79

| method | result | size |
|---|---|---|
| risch | $\frac{2i}{e^x-i}$ | 11 |
| default | $\frac{2}{\tanh(\frac{x}{2})-i}$ | 12 |
| parallelrisch | $-\frac{2}{-\tanh(\frac{x}{2})+i}$ | 14 |

input
```
int(csch(x)/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
2*I/(exp(x)-I)
```

### 3.66.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 8, normalized size of antiderivative = 0.57

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{2i}{e^x-i}$$

input
```
integrate(csch(x)/(I+csch(x)),x, algorithm="fricas")
```

output
```
2*I/(e^x - I)
```

### 3.66.6 Sympy [F]

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(csch(x)/(I+csch(x)),x)
```

output
```
Integral(csch(x)/(csch(x) + I), x)
```

### 3.66.7 Maxima [A] (verification not implemented)

Time = 0.17 (sec) , antiderivative size = 12, normalized size of antiderivative = 0.86

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{2}{i\,e^{(-x)}-1}$$

input
```
integrate(csch(x)/(I+csch(x)),x, algorithm="maxima")
```

output
```
-2/(I*e^(-x) - 1)
```

### 3.66.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 8, normalized size of antiderivative = 0.57

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{2i}{e^{x}-i}$$

input
```
integrate(csch(x)/(I+csch(x)),x, algorithm="giac")
```

output
```
2*I/(e^x - I)
```

### 3.66.9 Mupad [B] (verification not implemented)

Time = 0.07 (sec) , antiderivative size = 10, normalized size of antiderivative = 0.71

$$\int \frac{\operatorname{csch}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{2\mathrm{i}}{\mathrm{e}^x - \mathrm{i}}$$

input
```
int(1/(sinh(x)*(1/sinh(x) + 1i)),x)
```

output
```
2i/(exp(x) - 1i)
```

# 3.67 $\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx$


3.67.1 Optimal result . . . . . 452
3.67.2 Mathematica [B] (verified) . . . . . 452
3.67.3 Rubi [A] (verified) . . . . . 453
3.67.4 Maple [A] (verified) . . . . . 455
3.67.5 Fricas [B] (verification not implemented) . . . . . 455
3.67.6 Sympy [F] . . . . . 455
3.67.7 Maxima [A] (verification not implemented) . . . . . 456
3.67.8 Giac [A] (verification not implemented) . . . . . 456
3.67.9 Mupad [B] (verification not implemented) . . . . . 456


## 3.67.1 Optimal result

Integrand size = 13, antiderivative size = 17

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = -\operatorname{arctanh}(\cosh(x)) + \frac{\coth(x)}{i+\operatorname{csch}(x)}$$

output
```
-arctanh(cosh(x))+coth(x)/(I+csch(x))
```

## 3.67.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 46 vs. 2(17) = 34.

Time = 0.13 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.71

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = -\log\left(\cosh\left(\frac{x}{2}\right)\right) + \log\left(\sinh\left(\frac{x}{2}\right)\right) - \frac{2i\sinh\left(\frac{x}{2}\right)}{\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)}$$

input
```
Integrate[Csch[x]^2/(I + Csch[x]),x]
```

output
```
-Log[Cosh[x/2]] + Log[Sinh[x/2]] - ((2*I)*Sinh[x/2])/(Cosh[x/2] + I*Sinh[x
/2])
```

### 3.67.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.53, number of steps used = 9, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.692$, Rules used = {3042, 25, 26, 4276, 26, 3042, 26, 4257, 4281}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{\csc(ix)^2}{i\csc(ix)+i}dx$$
$$\downarrow 25$$
$$-\int -\frac{i\csc(ix)^2}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$i\int \frac{\csc(ix)^2}{\csc(ix)+1}dx$$
$$\downarrow 4276$$
$$i\left(\int -i\operatorname{csch}(x)dx - \int -\frac{i\operatorname{csch}(x)}{1-i\operatorname{csch}(x)}dx\right)$$
$$\downarrow 26$$
$$i\left(i\int \frac{\operatorname{csch}(x)}{1-i\operatorname{csch}(x)}dx - i\int \operatorname{csch}(x)dx\right)$$
$$\downarrow 3042$$
$$i\left(i\int \frac{i\csc(ix)}{\csc(ix)+1}dx - i\int i\csc(ix)dx\right)$$
$$\downarrow 26$$
$$i\left(\int \csc(ix)dx - \int \frac{\csc(ix)}{\csc(ix)+1}dx\right)$$
$$\downarrow 4257$$
$$i\left(i\operatorname{arctanh}(\cosh(x)) - \int \frac{\csc(ix)}{\csc(ix)+1}dx\right)$$

$$\downarrow 4281$$

$$i\left(i\operatorname{arctanh}(\cosh(x)) - \frac{\coth(x)}{1 - i\operatorname{csch}(x)}\right)$$

input
```
Int[Csch[x]^2/(I + Csch[x]),x]
```

output
```
I*(I*ArcTanh[Cosh[x]] - Coth[x]/(1 - I*Csch[x]))
```

### 3.67.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4276
```
Int[csc[(e_.) + (f_.)*(x_)]^2/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Sym
bol] :> Simp[1/b   Int[Csc[e + f*x], x], x] - Simp[a/b   Int[Csc[e + f*x]/(
a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e, f}, x]
```

rule 4281
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[-Cot[e + f*x]/(f*(b + a*Csc[e + f*x])), x] /; FreeQ[{a, b, e, f}
, x] && EqQ[a^2 - b^2, 0]
```

### 3.67.4 Maple [A] (verified)

Time = 0.45 (sec) , antiderivative size = 19, normalized size of antiderivative = 1.12

| method | result | size |
|---|---|---|
| default | $-\frac{2i}{\tanh\left(\frac{x}{2}\right)-i}+\ln\left(\tanh\left(\frac{x}{2}\right)\right)$ | 19 |
| risch | $\frac{2}{e^x-i}+\ln\left(e^x-1\right)-\ln\left(e^x+1\right)$ | 23 |
| parallelrisch | $\frac{2i+\ln\left(\tanh\left(\frac{x}{2}\right)\right)\left(-\tanh\left(\frac{x}{2}\right)+i\right)}{-\tanh\left(\frac{x}{2}\right)+i}$ | 31 |

input
```
int(csch(x)^2/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-2*I/(tanh(1/2*x)-I)+ln(tanh(1/2*x))
```

### 3.67.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 31 vs. 2(15) = 30.

Time = 0.25 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.82

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{(e^x-i)\log\left(e^x+1\right)-(e^x-i)\log\left(e^x-1\right)-2}{e^x-i}$$

input
```
integrate(csch(x)^2/(I+csch(x)),x, algorithm="fricas")
```

output
```
-((e^x - I)*log(e^x + 1) - (e^x - I)*log(e^x - 1) - 2)/(e^x - I)
```

### 3.67.6 Sympy [F]

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(csch(x)**2/(I+csch(x)),x)
```

output
```
Integral(csch(x)**2/(csch(x) + I), x)
```

### 3.67.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.59

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{2}{e^{(-x)}+i} - \log\left(e^{(-x)}+1\right) + \log\left(e^{(-x)}-1\right)$$

input
```
integrate(csch(x)^2/(I+csch(x)),x, algorithm="maxima")
```

output
```
2/(e^(-x) + I) - log(e^(-x) + 1) + log(e^(-x) - 1)
```

### 3.67.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.29

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{2}{e^{x}-i} - \log\left(e^{x}+1\right) + \log\left(|e^{x}-1|\right)$$

input
```
integrate(csch(x)^2/(I+csch(x)),x, algorithm="giac")
```

output
```
2/(e^x - I) - log(e^x + 1) + log(abs(e^x - 1))
```

### 3.67.9 Mupad [B] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.53

$$\int \frac{\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}\,dx = \ln\left(2-2\,\mathrm{e}^{x}\right) - \ln\left(-2\,\mathrm{e}^{x}-2\right) + \frac{2}{\mathrm{e}^{x}-\mathrm{i}}$$

input
```
int(1/(sinh(x)^2*(1/sinh(x) + 1i)),x)
```

output
```
log(2 - 2*exp(x)) - log(- 2*exp(x) - 2) + 2/(exp(x) - 1i)
```

# 3.68 $\int \frac{\mathbf{csch}^3(x)}{i+\mathbf{csch}(x)}\,dx$

3.68.1 Optimal result . . . 457
3.68.2 Mathematica [B] (verified) . . . 457
3.68.3 Rubi [A] (verified) . . . 458
3.68.4 Maple [A] (verified) . . . 460
3.68.5 Fricas [B] (verification not implemented) . . . 460
3.68.6 Sympy [F] . . . 461
3.68.7 Maxima [B] (verification not implemented) . . . 461
3.68.8 Giac [B] (verification not implemented) . . . 462
3.68.9 Mupad [B] (verification not implemented) . . . 462

## 3.68.1 Optimal result

Integrand size = 13, antiderivative size = 26

$$\int \frac{\operatorname{csch}^3(x)}{i+\operatorname{csch}(x)}\,dx = i\operatorname{arctanh}(\cosh(x)) - \coth(x) - \frac{i\coth(x)}{i+\operatorname{csch}(x)}$$

output
```
I*arctanh(cosh(x))-coth(x)-I*coth(x)/(I+csch(x))
```

## 3.68.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 70 vs. 2(26) = 52.

Time = 0.20 (sec) , antiderivative size = 70, normalized size of antiderivative = 2.69

$$\int \frac{\operatorname{csch}^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{2}\coth\left(\frac{x}{2}\right) + i\log\left(\cosh\left(\frac{x}{2}\right)\right) - i\log\left(\sinh\left(\frac{x}{2}\right)\right) - \frac{2\sinh\left(\frac{x}{2}\right)}{\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)} - \frac{1}{2}\tanh\left(\frac{x}{2}\right)$$

input
```
Integrate[Csch[x]^3/(I + Csch[x]),x]
```

output
```
-1/2*Coth[x/2] + I*Log[Cosh[x/2]] - I*Log[Sinh[x/2]] - (2*Sinh[x/2])/(Cosh
[x/2] + I*Sinh[x/2]) - Tanh[x/2]/2
```

### 3.68.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.00, number of steps used = 13, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 26, 26, 4277, 25, 3042, 25, 4276, 26, 3042, 26, 4257, 4281}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^3(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\csc(ix)^3}{i\csc(ix)+i}dx$$
$$\downarrow 26$$
$$-i\int -\frac{i\csc(ix)^3}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$-\int \frac{\csc(ix)^3}{\csc(ix)+1}dx$$
$$\downarrow 4277$$
$$-\coth(x)+\int -\frac{\operatorname{csch}^2(x)}{1-i\operatorname{csch}(x)}dx$$
$$\downarrow 25$$
$$-\coth(x)-\int \frac{\operatorname{csch}^2(x)}{1-i\operatorname{csch}(x)}dx$$
$$\downarrow 3042$$
$$-\coth(x)-\int -\frac{\csc(ix)^2}{\csc(ix)+1}dx$$
$$\downarrow 25$$
$$-\coth(x)+\int \frac{\csc(ix)^2}{\csc(ix)+1}dx$$
$$\downarrow 4276$$
$$\int -i\operatorname{csch}(x)dx-\int -\frac{i\operatorname{csch}(x)}{1-i\operatorname{csch}(x)}dx-\coth(x)$$

$$\downarrow 26$$

$$-i\int \operatorname{csch}(x)dx + i\int \frac{\operatorname{csch}(x)}{1-i\operatorname{csch}(x)}dx - \coth(x)$$

$$\downarrow 3042$$

$$-i\int i\csc(ix)dx + i\int \frac{i\csc(ix)}{\csc(ix)+1}dx - \coth(x)$$

$$\downarrow 26$$

$$\int \csc(ix)dx - \int \frac{\csc(ix)}{\csc(ix)+1}dx - \coth(x)$$

$$\downarrow 4257$$

$$-\int \frac{\csc(ix)}{\csc(ix)+1}dx + i\operatorname{arctanh}(\cosh(x)) - \coth(x)$$

$$\downarrow 4281$$

$$i\operatorname{arctanh}(\cosh(x)) - \coth(x) - \frac{\coth(x)}{1-i\operatorname{csch}(x)}$$

input
```
Int[Csch[x]^3/(I + Csch[x]),x]
```

output
```
I*ArcTanh[Cosh[x]] - Coth[x] - Coth[x]/(1 - I*Csch[x])
```

### 3.68.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4276
```
Int[csc[(e_.) + (f_.)*(x_)]^2/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Sym
bol] :> Simp[1/b   Int[Csc[e + f*x], x], x] - Simp[a/b   Int[Csc[e + f*x]/(
a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e, f}, x]
```

rule 4277
```
Int[csc[(e_.) + (f_.)*(x_)]^3/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Sym
bol] :> Simp[-Cot[e + f*x]/(b*f), x] - Simp[a/b   Int[Csc[e + f*x]^2/(a + b
*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e, f}, x]
```

rule 4281
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[-Cot[e + f*x]/(f*(b + a*Csc[e + f*x])), x] /; FreeQ[{a, b, e, f}
, x] && EqQ[a^2 - b^2, 0]
```

### 3.68.4 Maple [A] (verified)

Time = 0.77 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.35

| method | result | size |
|---|---|---|
| default | $-\frac{\tanh\left(\frac{x}{2}\right)}{2}-\frac{1}{2\tanh\left(\frac{x}{2}\right)}-i\ln\left(\tanh\left(\frac{x}{2}\right)\right)-\frac{2}{\tanh\left(\frac{x}{2}\right)-i}$ | 35 |
| risch | $-\frac{2i\left(\mathrm{e}^{2x}-2-i\mathrm{e}^{x}\right)}{\left(\mathrm{e}^{2x}-1\right)\left(\mathrm{e}^{x}-i\right)}+i\ln\left(\mathrm{e}^{x}+1\right)-i\ln\left(\mathrm{e}^{x}-1\right)$ | 47 |
| parallelrisch | $\frac{2i\tanh\left(\frac{x}{2}\right)\ln\left(\tanh\left(\frac{x}{2}\right)\right)-i\coth\left(\frac{x}{2}\right)+\tanh\left(\frac{x}{2}\right)^{2}+2\ln\left(\tanh\left(\frac{x}{2}\right)\right)+6}{-2\tanh\left(\frac{x}{2}\right)+2i}$ | 47 |

input
```
int(csch(x)^3/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/2*tanh(1/2*x)-1/2/tanh(1/2*x)-I*ln(tanh(1/2*x))-2/(tanh(1/2*x)-I)
```

### 3.68.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 77 vs. $2(20) = 40$.

Time = 0.27 (sec) , antiderivative size = 77, normalized size of antiderivative = 2.96

$$\int \frac{\operatorname{csch}^3(x)}{i+\operatorname{csch}(x)}\,dx$$
$$=\frac{\left(i\,e^{(3\,x)}+e^{(2\,x)}-i\,e^{x}-1\right)\log\left(e^{x}+1\right)+\left(-i\,e^{(3\,x)}-e^{(2\,x)}+i\,e^{x}+1\right)\log\left(e^{x}-1\right)-2i\,e^{(2\,x)}-2\,e^{x}+4i}{e^{(3\,x)}-i\,e^{(2\,x)}-e^{x}+i}$$

input
```
integrate(csch(x)^3/(I+csch(x)),x, algorithm="fricas")
```

output
```
((I*e^(3*x) + e^(2*x) - I*e^x - 1)*log(e^x + 1) + (-I*e^(3*x) - e^(2*x) +
I*e^x + 1)*log(e^x - 1) - 2*I*e^(2*x) - 2*e^x + 4*I)/(e^(3*x) - I*e^(2*x)
- e^x + I)
```

### 3.68.6 Sympy [F]

$$\int \frac{\operatorname{csch}^3(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}^3(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(csch(x)**3/(I+csch(x)),x)
```

output
```
Integral(csch(x)**3/(csch(x) + I), x)
```

### 3.68.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 53 vs. $2(20) = 40$.

Time $= 0.17$ (sec) , antiderivative size $= 53$, normalized size of antiderivative $= 2.04$

$$\int \frac{\operatorname{csch}^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{2\left(e^{(-x)} - i\,e^{(-2\,x)} + 2i\right)}{e^{(-x)} - i\,e^{(-2\,x)} - e^{(-3\,x)} + i} + i\,\log\left(e^{(-x)}+1\right) - i\,\log\left(e^{(-x)}-1\right)$$

input
```
integrate(csch(x)^3/(I+csch(x)),x, algorithm="maxima")
```

output
```
-2*(e^(-x) - I*e^(-2*x) + 2*I)/(e^(-x) - I*e^(-2*x) - e^(-3*x) + I) + I*lo
g(e^(-x) + 1) - I*log(e^(-x) - 1)
```

### 3.68.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 46 vs. $2(20) = 40$.

Time $= 0.28$ (sec) , antiderivative size $= 46$, normalized size of antiderivative $= 1.77$

$$\int \frac{\operatorname{csch}^3(x)}{i + \operatorname{csch}(x)}\,dx = \frac{2\left(e^{(2\,x)} - i\,e^x - 2\right)}{i\,e^{(3\,x)} + e^{(2\,x)} - i\,e^x - 1} + i\,\log\left(e^x + 1\right) - i\,\log\left(\left|e^x - 1\right|\right)$$

input
```
integrate(csch(x)^3/(I+csch(x)),x, algorithm="giac")
```

output
```
2*(e^(2*x) - I*e^x - 2)/(I*e^(3*x) + e^(2*x) - I*e^x - 1) + I*log(e^x + 1)
 - I*log(abs(e^x - 1))
```

### 3.68.9 Mupad [B] (verification not implemented)

Time $= 2.48$ (sec) , antiderivative size $= 60$, normalized size of antiderivative $= 2.31$

$$\int \frac{\operatorname{csch}^3(x)}{i + \operatorname{csch}(x)}\,dx = -\ln\left(\mathrm{e}^x\,2\mathrm{i} - 2\mathrm{i}\right)\,1\mathrm{i} + \ln\left(\mathrm{e}^x\,2\mathrm{i} + 2\mathrm{i}\right)\,1\mathrm{i} + \frac{\mathrm{e}^{2\,x}\,2\mathrm{i} + 2\,\mathrm{e}^x - 4\mathrm{i}}{\mathrm{e}^{2\,x}\,1\mathrm{i} - \mathrm{e}^{3\,x} + \mathrm{e}^x - \mathrm{i}}$$

input
```
int(1/(sinh(x)^3*(1/sinh(x) + 1i)),x)
```

output
```
log(exp(x)*2i + 2i)*1i - log(exp(x)*2i - 2i)*1i + (exp(2*x)*2i + 2*exp(x)
- 4i)/(exp(2*x)*1i - exp(3*x) + exp(x) - 1i)
```

# 3.69 $\int \frac{\operatorname{csch}^4(x)}{i+\operatorname{csch}(x)}\,dx$


3.69.1 Optimal result . . . . . 463
3.69.2 Mathematica [B] (verified) . . . . . 463
3.69.3 Rubi [A] (verified) . . . . . 464
3.69.4 Maple [A] (verified) . . . . . 467
3.69.5 Fricas [B] (verification not implemented) . . . . . 468
3.69.6 Sympy [F] . . . . . 468
3.69.7 Maxima [B] (verification not implemented) . . . . . 468
3.69.8 Giac [A] (verification not implemented) . . . . . 469
3.69.9 Mupad [B] (verification not implemented) . . . . . 469


## 3.69.1 Optimal result

Integrand size = 13, antiderivative size = 37

$$\int \frac{\operatorname{csch}^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3}{2}\operatorname{arctanh}(\cosh(x)) + 2i\coth(x) - \frac{3}{2}\coth(x)\operatorname{csch}(x) + \frac{\coth(x)\operatorname{csch}^2(x)}{i+\operatorname{csch}(x)}$$

output
```
3/2*arctanh(cosh(x))+2*I*coth(x)-3/2*coth(x)*csch(x)+coth(x)*csch(x)^2/(I+
csch(x))
```

## 3.69.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 90 vs. 2(37) = 74.

Time = 0.24 (sec) , antiderivative size = 90, normalized size of antiderivative = 2.43

$$\int \frac{\operatorname{csch}^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{8}\left(4i\coth\left(\frac{x}{2}\right) - \operatorname{csch}^2\left(\frac{x}{2}\right) + 12\log\left(\cosh\left(\frac{x}{2}\right)\right) - 12\log\left(\sinh\left(\frac{x}{2}\right)\right) - \operatorname{sech}^2\left(\frac{x}{2}\right) + \frac{16\sinh\left(\frac{x}{2}\right)}{-i\cosh\left(\frac{x}{2}\right)+\sinh\left(\frac{x}{2}\right)} + 4i\tanh\left(\frac{x}{2}\right)\right)$$

input
```
Integrate[Csch[x]^4/(I + Csch[x]),x]
```

output
```
((4*I)*Coth[x/2] - Csch[x/2]^2 + 12*Log[Cosh[x/2]] - 12*Log[Sinh[x/2]] - S
ech[x/2]^2 + (16*Sinh[x/2])/((-I)*Cosh[x/2] + Sinh[x/2]) + (4*I)*Tanh[x/2]
)/8
```

### 3.69.3 Rubi [A] (verified)

Time = 0.45 (sec) , antiderivative size = 47, normalized size of antiderivative = 1.27, number of steps used = 20, number of rules used = 19, $\frac{\text{number of rules}}{\text{integrand size}} = 1.462$, Rules used = {3042, 4305, 25, 3042, 25, 26, 4274, 25, 26, 3042, 25, 26, 4254, 24, 4255, 26, 3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^4(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{\csc(ix)^4}{i\csc(ix)+i}dx$$

$$\downarrow 4305$$

$$\int -\left((2i-3\operatorname{csch}(x))\operatorname{csch}^2(x)\right)dx + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 25$$

$$\frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i} - \int (2i-3\operatorname{csch}(x))\operatorname{csch}^2(x)dx$$

$$\downarrow 3042$$

$$\frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i} - \int -\left((2i-3i\csc(ix))\csc(ix)^2\right)dx$$

$$\downarrow 25$$

$$\int i(2-3\csc(ix))\csc(ix)^2dx + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$i\int (2-3\csc(ix))\csc(ix)^2dx + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 4274$$

$$i\left(2\int -\operatorname{csch}^2(x)dx - 3\int i\operatorname{csch}^3(x)dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 25$$

$$i\left(-2\int \operatorname{csch}^2(x)dx - 3\int i\operatorname{csch}^3(x)dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$i\left(-2\int \operatorname{csch}^2(x)dx - 3i\int \operatorname{csch}^3(x)dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3042$$

$$i\left(-2\int -\csc(ix)^2dx - 3i\int -i\csc(ix)^3dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 25$$

$$i\left(2\int \csc(ix)^2dx - 3i\int -i\csc(ix)^3dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$i\left(2\int \csc(ix)^2dx - 3\int \csc(ix)^3dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 4254$$

$$i\left(2i\int 1d(-i\coth(x)) - 3\int \csc(ix)^3dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 24$$

$$i\left(2\coth(x) - 3\int \csc(ix)^3dx\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 4255$$

$$i\left(2\coth(x) - 3\left(\frac{1}{2}\int -i\operatorname{csch}(x)dx - \frac{1}{2}i\coth(x)\operatorname{csch}(x)\right)\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$i\left(2\coth(x) - 3\left(-\frac{1}{2}i\int \operatorname{csch}(x)dx - \frac{1}{2}i\coth(x)\operatorname{csch}(x)\right)\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 3042$$

$$i\left(2\coth(x) - 3\left(-\frac{1}{2}i\int i\csc(ix)dx - \frac{1}{2}i\coth(x)\operatorname{csch}(x)\right)\right) + \frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 26$$

$$i\left(2\coth(x)-3\left(\frac{1}{2}\int \csc(ix)dx-\frac{1}{2}i\coth(x)\operatorname{csch}(x)\right)\right)+\frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

$$\downarrow 4257$$

$$i\left(2\coth(x)-3\left(\frac{1}{2}i\operatorname{arctanh}(\cosh(x))-\frac{1}{2}i\coth(x)\operatorname{csch}(x)\right)\right)+\frac{\coth(x)\operatorname{csch}^2(x)}{\operatorname{csch}(x)+i}$$

input
```
Int[Csch[x]^4/(I + Csch[x]),x]
```

output
```
(Coth[x]*Csch[x]^2)/(I + Csch[x]) + I*(2*Coth[x] - 3*((I/2)*ArcTanh[Cosh[x
]] - (I/2)*Coth[x]*Csch[x]))
```

### 3.69.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4274
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_)), x_Symbol] :> Simp[a   Int[(d*Csc[e + f*x])^n, x], x] + Simp[b/d   In
t[(d*Csc[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n}, x]
```

rule 4305
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[d^2*Cot[e + f*x]*((d*Csc[e + f*x])^(n - 2)/(f*(a +
b*Csc[e + f*x]))), x] - Simp[d^2/(a*b)   Int[(d*Csc[e + f*x])^(n - 2)*(b*(n
 - 2) - a*(n - 1)*Csc[e + f*x]), x], x] /; FreeQ[{a, b, d, e, f}, x] && EqQ
[a^2 - b^2, 0] && GtQ[n, 1]
```

### 3.69.4 Maple [A] (verified)

Time = 0.95 (sec) , antiderivative size = 53, normalized size of antiderivative = 1.43

| method | result | size |
|---|---|---|
| default | $\frac{i\tanh(\frac{x}{2})}{2}+\frac{\tanh(\frac{x}{2})^2}{8}-\frac{1}{8\tanh(\frac{x}{2})^2}+\frac{i}{2\tanh(\frac{x}{2})}-\frac{3\ln(\tanh(\frac{x}{2}))}{2}+\frac{2i}{\tanh(\frac{x}{2})-i}$ | 53 |
| risch | $-\frac{-5e^{2x}-3ie^{3x}+3e^{4x}+4+ie^{x}}{(e^{2x}-1)^2(e^{x}-i)}-\frac{3\ln(e^{x}-1)}{2}+\frac{3\ln(e^{x}+1)}{2}$ | 59 |
| parallelrisch | $\frac{(-12i+12\tanh(\frac{x}{2}))\ln(\tanh(\frac{x}{2}))-i\coth(\frac{x}{2})^2-3i\tanh(\frac{x}{2})^2-\tanh(\frac{x}{2})^3-24i-3\coth(\frac{x}{2})}{-8\tanh(\frac{x}{2})+8i}$ | 63 |

input
```
int(csch(x)^4/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/2*I*tanh(1/2*x)+1/8*tanh(1/2*x)^2-1/8/tanh(1/2*x)^2+1/2*I/tanh(1/2*x)-3/
2*ln(tanh(1/2*x))+2*I/(tanh(1/2*x)-I)
```

### 3.69.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 120 vs. $2(29) = 58$.

Time = 0.25 (sec) , antiderivative size = 120, normalized size of antiderivative = 3.24

$$\int \frac{\operatorname{csch}^4(x)}{i + \operatorname{csch}(x)}\, dx$$
$$= \frac{3\left(e^{(5x)} - i\,e^{(4x)} - 2\,e^{(3x)} + 2i\,e^{(2x)} + e^x - i\right)\log\left(e^x + 1\right) - 3\left(e^{(5x)} - i\,e^{(4x)} - 2\,e^{(3x)} + 2i\,e^{(2x)} + e^x - i\right)}{2\left(e^{(5x)} - i\,e^{(4x)} - 2\,e^{(3x)} + 2i\,e^{(2x)} + e^x - i\right)}$$

input
```
integrate(csch(x)^4/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/2*(3*(e^(5*x) - I*e^(4*x) - 2*e^(3*x) + 2*I*e^(2*x) + e^x - I)*log(e^x +
 1) - 3*(e^(5*x) - I*e^(4*x) - 2*e^(3*x) + 2*I*e^(2*x) + e^x - I)*log(e^x
 - 1) - 6*e^(4*x) + 6*I*e^(3*x) + 10*e^(2*x) - 2*I*e^x - 8)/(e^(5*x) - I*e^
(4*x) - 2*e^(3*x) + 2*I*e^(2*x) + e^x - I)
```

### 3.69.6 Sympy [F]

$$\int \frac{\operatorname{csch}^4(x)}{i + \operatorname{csch}(x)}\, dx = \int \frac{\operatorname{csch}^4(x)}{\operatorname{csch}(x) + i}\, dx$$

input
```
integrate(csch(x)**4/(I+csch(x)),x)
```

output
```
Integral(csch(x)**4/(csch(x) + I), x)
```

### 3.69.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 77 vs. $2(29) = 58$.

Time = 0.17 (sec) , antiderivative size = 77, normalized size of antiderivative = 2.08

$$\int \frac{\operatorname{csch}^4(x)}{i + \operatorname{csch}(x)}\, dx = -\frac{-i\,e^{(-x)} - 5\,e^{(-2x)} + 3i\,e^{(-3x)} + 3\,e^{(-4x)} + 4}{e^{(-x)} - 2i\,e^{(-2x)} - 2\,e^{(-3x)} + i\,e^{(-4x)} + e^{(-5x)} + i} + \frac{3}{2}\log\left(e^{(-x)} + 1\right) - \frac{3}{2}\log\left(e^{(-x)} - 1\right)$$

input
```
integrate(csch(x)^4/(I+csch(x)),x, algorithm="maxima")
```

output
```
-(-I*e^(-x) - 5*e^(-2*x) + 3*I*e^(-3*x) + 3*e^(-4*x) + 4)/(e^(-x) - 2*I*e^
(-2*x) - 2*e^(-3*x) + I*e^(-4*x) + e^(-5*x) + I) + 3/2*log(e^(-x) + 1) - 3
/2*log(e^(-x) - 1)
```

### 3.69.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.35

$$\int \frac{\operatorname{csch}^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{e^{(3\,x)} - 2i\,e^{(2\,x)} + e^x + 2i}{\left(e^{(2\,x)} - 1\right)^2} - \frac{2i}{i\,e^x + 1} + \frac{3}{2}\log\left(e^x + 1\right) - \frac{3}{2}\log\left(|e^x - 1|\right)$$

input
```
integrate(csch(x)^4/(I+csch(x)),x, algorithm="giac")
```

output
```
-(e^(3*x) - 2*I*e^(2*x) + e^x + 2*I)/(e^(2*x) - 1)^2 - 2*I/(I*e^x + 1) + 3
/2*log(e^x + 1) - 3/2*log(abs(e^x - 1))
```

### 3.69.9 Mupad [B] (verification not implemented)

Time = 2.50 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.70

$$\int \frac{\operatorname{csch}^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3\,\ln\left(3\,\mathrm{e}^x + 3\right)}{2} - \frac{3\,\ln\left(3\,\mathrm{e}^x - 3\right)}{2} - \frac{\mathrm{e}^x}{\mathrm{e}^{2\,x} - 1} - \frac{2\,\mathrm{e}^x}{\left(\mathrm{e}^{2\,x} - 1\right)^2} - \frac{2}{\mathrm{e}^x - \mathrm{i}} + \frac{2\mathrm{i}}{\mathrm{e}^{2\,x} - 1}$$

input
```
int(1/(sinh(x)^4*(1/sinh(x) + 1i)),x)
```

output
```
(3*log(3*exp(x) + 3))/2 - (3*log(3*exp(x) - 3))/2 - exp(x)/(exp(2*x) - 1)
- (2*exp(x))/(exp(2*x) - 1)^2 - 2/(exp(x) - 1i) + 2i/(exp(2*x) - 1)
```

# 3.70 $\int (a + b\mathbf{csch}(c + dx))^4\, dx$

3.70.1 Optimal result . . . . . 470
3.70.2 Mathematica [B] (verified) . . . . . 471
3.70.3 Rubi [A] (verified) . . . . . 472
3.70.4 Maple [A] (verified) . . . . . 474
3.70.5 Fricas [B] (verification not implemented) . . . . . 474
3.70.6 Sympy [F] . . . . . 475
3.70.7 Maxima [B] (verification not implemented) . . . . . 476
3.70.8 Giac [A] (verification not implemented) . . . . . 476
3.70.9 Mupad [B] (verification not implemented) . . . . . 477

## 3.70.1 Optimal result

Integrand size = 12, antiderivative size = 109

$$\int (a + b\operatorname{csch}(c + dx))^4\, dx = a^4 x - \frac{2ab(2a^2 - b^2)\operatorname{arctanh}(\cosh(c + dx))}{d} - \frac{b^2(17a^2 - 2b^2)\coth(c + dx)}{3d} - \frac{4ab^3\coth(c + dx)\operatorname{csch}(c + dx)}{3d} - \frac{b^2\coth(c + dx)(a + b\operatorname{csch}(c + dx))^2}{3d}$$

output

```
a^4*x-2*a*b*(2*a^2-b^2)*arctanh(cosh(d*x+c))/d-1/3*b^2*(17*a^2-2*b^2)*coth
(d*x+c)/d-4/3*a*b^3*coth(d*x+c)*csch(d*x+c)/d-1/3*b^2*coth(d*x+c)*(a+b*csc
h(d*x+c))^2/d
```

### 3.70.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 567 vs. $2(109) = 218$.

Time $= 11.82$ (sec) , antiderivative size $= 567$, normalized size of antiderivative $= 5.20$

$$\begin{aligned}
\int (a + b\operatorname{csch}(c+dx))^4\,dx &= \frac{a^4(c+dx)(a+b\operatorname{csch}(c+dx))^4\sinh^4(c+dx)}{d(b+a\sinh(c+dx))^4} \\
&+ \frac{\left(-9a^2b^2\cosh\left(\frac{1}{2}(c+dx)\right) + b^4\cosh\left(\frac{1}{2}(c+dx)\right)\right)\operatorname{csch}\left(\frac{1}{2}(c+dx)\right)(a+b\operatorname{csch}(c+dx))^4\sinh^4(c+dx)}{3d(b+a\sinh(c+dx))^4} \\
&- \frac{ab^3\operatorname{csch}^2\left(\frac{1}{2}(c+dx)\right)(a+b\operatorname{csch}(c+dx))^4\sinh^4(c+dx)}{2d(b+a\sinh(c+dx))^4} \\
&- \frac{b^4\coth\left(\frac{1}{2}(c+dx)\right)\operatorname{csch}^2\left(\frac{1}{2}(c+dx)\right)(a+b\operatorname{csch}(c+dx))^4\sinh^4(c+dx)}{24d(b+a\sinh(c+dx))^4} \\
&+ \frac{2(-2a^3b+ab^3)(a+b\operatorname{csch}(c+dx))^4\log\left(\cosh\left(\frac{1}{2}(c+dx)\right)\right)\sinh^4(c+dx)}{d(b+a\sinh(c+dx))^4} \\
&- \frac{2(-2a^3b+ab^3)(a+b\operatorname{csch}(c+dx))^4\log\left(\sinh\left(\frac{1}{2}(c+dx)\right)\right)\sinh^4(c+dx)}{d(b+a\sinh(c+dx))^4} \\
&- \frac{ab^3(a+b\operatorname{csch}(c+dx))^4\operatorname{sech}^2\left(\frac{1}{2}(c+dx)\right)\sinh^4(c+dx)}{2d(b+a\sinh(c+dx))^4} \\
&+ \frac{(a+b\operatorname{csch}(c+dx))^4\operatorname{sech}\left(\frac{1}{2}(c+dx)\right)\left(-9a^2b^2\sinh\left(\frac{1}{2}(c+dx)\right) + b^4\sinh\left(\frac{1}{2}(c+dx)\right)\right)\sinh^4(c+dx)}{3d(b+a\sinh(c+dx))^4} \\
&+ \frac{b^4(a+b\operatorname{csch}(c+dx))^4\operatorname{sech}^2\left(\frac{1}{2}(c+dx)\right)\sinh^4(c+dx)\tanh\left(\frac{1}{2}(c+dx)\right)}{24d(b+a\sinh(c+dx))^4}
\end{aligned}$$

input
```
Integrate[(a + b*Csch[c + d*x])^4,x]
```

output

```
(a^4*(c + d*x)*(a + b*Csch[c + d*x])^4*Sinh[c + d*x]^4)/(d*(b + a*Sinh[c +
 d*x])^4) + ((-9*a^2*b^2*Cosh[(c + d*x)/2] + b^4*Cosh[(c + d*x)/2])*Csch[(
c + d*x)/2]*(a + b*Csch[c + d*x])^4*Sinh[c + d*x]^4)/(3*d*(b + a*Sinh[c +
d*x])^4) - (a*b^3*Csch[(c + d*x)/2]^2*(a + b*Csch[c + d*x])^4*Sinh[c + d*x
]^4)/(2*d*(b + a*Sinh[c + d*x])^4) - (b^4*Coth[(c + d*x)/2]*Csch[(c + d*x)
/2]^2*(a + b*Csch[c + d*x])^4*Sinh[c + d*x]^4)/(24*d*(b + a*Sinh[c + d*x])
^4) + (2*(-2*a^3*b + a*b^3)*(a + b*Csch[c + d*x])^4*Log[Cosh[(c + d*x)/2]]
*Sinh[c + d*x]^4)/(d*(b + a*Sinh[c + d*x])^4) - (2*(-2*a^3*b + a*b^3)*(a +
 b*Csch[c + d*x])^4*Log[Sinh[(c + d*x)/2]]*Sinh[c + d*x]^4)/(d*(b + a*Sinh
[c + d*x])^4) - (a*b^3*(a + b*Csch[c + d*x])^4*Sech[(c + d*x)/2]^2*Sinh[c
+ d*x]^4)/(2*d*(b + a*Sinh[c + d*x])^4) + ((a + b*Csch[c + d*x])^4*Sech[(c
 + d*x)/2]*(-9*a^2*b^2*Sinh[(c + d*x)/2] + b^4*Sinh[(c + d*x)/2])*Sinh[c +
 d*x]^4)/(3*d*(b + a*Sinh[c + d*x])^4) + (b^4*(a + b*Csch[c + d*x])^4*Sech
[(c + d*x)/2]^2*Sinh[c + d*x]^4*Tanh[(c + d*x)/2])/(24*d*(b + a*Sinh[c + d
*x])^4)
```

### 3.70.3 Rubi [A] (verified)

Time = 0.44 (sec) , antiderivative size = 116, normalized size of antiderivative = 1.06, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.417$, Rules used = {3042, 4269, 3042, 4536, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a + b\text{csch}(c + dx))^4 \, dx$$

$$\downarrow 3042$$

$$\int (a + ib \csc(ic + idx))^4 dx$$

$$\downarrow 4269$$

$$\frac{1}{3}\int (a + b\text{csch}(c + dx)) \left(3a^3 + 8b^2\text{csch}^2(c + dx)a + b\left(9a^2 - 2b^2\right)\text{csch}(c + dx)\right) dx - \frac{b^2 \coth(c + dx)(a + b\text{csch}(c + dx))^2}{3d}$$

$$\downarrow 3042$$

$$-\frac{b^2 \coth(c + dx)(a + b\text{csch}(c + dx))^2}{3d} + \frac{1}{3}\int (a + ib \csc(ic + idx)) \left(3a^3 - 8b^2 \csc(ic + idx)^2 a + ib\left(9a^2 - 2b^2\right)\csc(ic + idx)\right) dx$$

$$\downarrow 4536$$

$$\frac{1}{3}\left(\frac{1}{2}\int \left(6a^4+12b\left(2a^2-b^2\right)\operatorname{csch}(c+dx)a+2b^2\left(17a^2-2b^2\right)\operatorname{csch}^2(c+dx)\right)dx-\frac{4ab^3\coth(c+dx)\operatorname{csch}(c+dx)}{d}\right.$$
$$\left.\frac{b^2\coth(c+dx)(a+b\operatorname{csch}(c+dx))^2}{3d}\right.$$

$$\downarrow 2009$$

$$\frac{1}{3}\left(\frac{1}{2}\left(6a^4x-\frac{12ab\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(c+dx))}{d}-\frac{2b^2\left(17a^2-2b^2\right)\coth(c+dx)}{d}\right)-\frac{4ab^3\coth(c+dx)\operatorname{csch}(\right.$$
$$\left.\frac{b^2\coth(c+dx)(a+b\operatorname{csch}(c+dx))^2}{3d}\right.$$

input
```
Int[(a + b*Csch[c + d*x])^4,x]
```

output
```
-1/3*(b^2*Coth[c + d*x]*(a + b*Csch[c + d*x])^2)/d + ((6*a^4*x - (12*a*b*(
2*a^2 - b^2)*ArcTanh[Cosh[c + d*x]])/d - (2*b^2*(17*a^2 - 2*b^2)*Coth[c +
d*x])/d)/2 - (4*a*b^3*Coth[c + d*x]*Csch[c + d*x])/d)/3
```

### 3.70.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4269
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-b^2)*C
ot[c + d*x]*((a + b*Csc[c + d*x])^(n - 2)/(d*(n - 1))), x] + Simp[1/(n - 1)
   Int[(a + b*Csc[c + d*x])^(n - 3)*Simp[a^3*(n - 1) + (b*(b^2*(n - 2) + 3*
a^2*(n - 1)))*Csc[c + d*x] + (a*b^2*(3*n - 4))*Csc[c + d*x]^2, x], x], x] /
; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && GtQ[n, 2] && IntegerQ[2*n]
```

rule 4536

```
Int[((A_.) + csc[(e_.) + (f_.)*(x_)]*(B_.) + csc[(e_.) + (f_.)*(x_)]^2*(C_.
))*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbol] :> Simp[(-b)*C*Csc[e +
 f*x]*(Cot[e + f*x]/(2*f)), x] + Simp[1/2   Int[Simp[2*A*a + (2*B*a + b*(2*
A + C))*Csc[e + f*x] + 2*(a*C + B*b)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a
, b, e, f, A, B, C}, x]
```

## 3.70.4 Maple [A] (verified)

Time = 1.48 (sec) , antiderivative size = 92, normalized size of antiderivative = 0.84

| method | result |
|---|---|
| derivativedivides | $\frac{a^4(dx+c)-8a^3b\,\operatorname{arctanh}\left(e^{dx+c}\right)-6a^2b^2\coth(dx+c)+4ab^3\left(-\frac{\operatorname{csch}(dx+c)\coth(dx+c)}{2}+\operatorname{arctanh}\left(e^{dx+c}\right)\right)+b^4\left(\frac{2}{3}-\frac{\operatorname{csch}(dx}{3}\right.}{d}$ |
| default | $\frac{a^4(dx+c)-8a^3b\,\operatorname{arctanh}\left(e^{dx+c}\right)-6a^2b^2\coth(dx+c)+4ab^3\left(-\frac{\operatorname{csch}(dx+c)\coth(dx+c)}{2}+\operatorname{arctanh}\left(e^{dx+c}\right)\right)+b^4\left(\frac{2}{3}-\frac{\operatorname{csch}(dx}{3}\right.}{d}$ |
| parts | $x\,a^4+\frac{b^4\left(\frac{2}{3}-\frac{\operatorname{csch}(dx+c)^2}{3}\right)\coth(dx+c)}{d}+\frac{4ab^3\left(-\frac{\operatorname{csch}(dx+c)\coth(dx+c)}{2}+\operatorname{arctanh}\left(e^{dx+c}\right)\right)}{d}-\frac{6a^2b^2\coth(dx+c)}{d}$ |
| parallelrisch | $\frac{48(2a^3b-ab^3)\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)-\coth\left(\frac{dx}{2}+\frac{c}{2}\right)^3b^4-12\coth\left(\frac{dx}{2}+\frac{c}{2}\right)^2ab^3+9\left(-8a^2b^2+b^4\right)\coth\left(\frac{dx}{2}+\frac{c}{2}\right)-\tanh\left(\frac{dx}{2}+\right.}{24d}$ |
| risch | $x\,a^4-\frac{4b^2\left(3ab\,e^{5dx+5c}+9a^2e^{4dx+4c}-18a^2e^{2dx+2c}+3\,e^{2dx+2c}b^2-3\,e^{dx+c}ab+9a^2-b^2\right)}{3d\left(e^{2dx+2c}-1\right)^3}-\frac{4a^3b\ln\left(e^{dx+c}+1\right)}{d}+\frac{2a}{}$ |

input

```
int((a+b*csch(d*x+c))^4,x,method=_RETURNVERBOSE)
```

output

```
1/d*(a^4*(d*x+c)-8*a^3*b*arctanh(exp(d*x+c))-6*a^2*b^2*coth(d*x+c)+4*a*b^3
*(-1/2*csch(d*x+c)*coth(d*x+c)+arctanh(exp(d*x+c)))+b^4*(2/3-1/3*csch(d*x+
c)^2)*coth(d*x+c))
```

## 3.70.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1440 vs. 2(103) = 206.

Time = 0.27 (sec) , antiderivative size = 1440, normalized size of antiderivative = 13.21

$$\int (a+b\operatorname{csch}(c+dx))^4\,dx = \text{Too large to display}$$

input

```
integrate((a+b*csch(d*x+c))^4,x, algorithm="fricas")
```

output

```
1/3*(3*a^4*d*x*cosh(d*x + c)^6 + 3*a^4*d*x*sinh(d*x + c)^6 - 12*a*b^3*cosh
(d*x + c)^5 - 3*a^4*d*x + 6*(3*a^4*d*x*cosh(d*x + c) - 2*a*b^3)*sinh(d*x +
 c)^5 + 12*a*b^3*cosh(d*x + c) - 9*(a^4*d*x + 4*a^2*b^2)*cosh(d*x + c)^4 +
 3*(15*a^4*d*x*cosh(d*x + c)^2 - 3*a^4*d*x - 20*a*b^3*cosh(d*x + c) - 12*a
^2*b^2)*sinh(d*x + c)^4 - 36*a^2*b^2 + 4*b^4 + 12*(5*a^4*d*x*cosh(d*x + c)
^3 - 10*a*b^3*cosh(d*x + c)^2 - 3*(a^4*d*x + 4*a^2*b^2)*cosh(d*x + c))*sin
h(d*x + c)^3 + 3*(3*a^4*d*x + 24*a^2*b^2 - 4*b^4)*cosh(d*x + c)^2 + 3*(15*
a^4*d*x*cosh(d*x + c)^4 - 40*a*b^3*cosh(d*x + c)^3 + 3*a^4*d*x + 24*a^2*b^
2 - 4*b^4 - 18*(a^4*d*x + 4*a^2*b^2)*cosh(d*x + c)^2)*sinh(d*x + c)^2 - 6*
((2*a^3*b - a*b^3)*cosh(d*x + c)^6 + 6*(2*a^3*b - a*b^3)*cosh(d*x + c)*sin
h(d*x + c)^5 + (2*a^3*b - a*b^3)*sinh(d*x + c)^6 - 3*(2*a^3*b - a*b^3)*cos
h(d*x + c)^4 - 3*(2*a^3*b - a*b^3 - 5*(2*a^3*b - a*b^3)*cosh(d*x + c)^2)*s
inh(d*x + c)^4 - 2*a^3*b + a*b^3 + 4*(5*(2*a^3*b - a*b^3)*cosh(d*x + c)^3
 - 3*(2*a^3*b - a*b^3)*cosh(d*x + c))*sinh(d*x + c)^3 + 3*(2*a^3*b - a*b^3)
*cosh(d*x + c)^2 + 3*(5*(2*a^3*b - a*b^3)*cosh(d*x + c)^4 + 2*a^3*b - a*b^
3 - 6*(2*a^3*b - a*b^3)*cosh(d*x + c)^2)*sinh(d*x + c)^2 + 6*((2*a^3*b - a
*b^3)*cosh(d*x + c)^5 - 2*(2*a^3*b - a*b^3)*cosh(d*x + c)^3 + (2*a^3*b - a
*b^3)*cosh(d*x + c))*sinh(d*x + c))*log(cosh(d*x + c) + sinh(d*x + c) + 1)
 + 6*((2*a^3*b - a*b^3)*cosh(d*x + c)^6 + 6*(2*a^3*b - a*b^3)*cosh(d*x + c
)*sinh(d*x + c)^5 + (2*a^3*b - a*b^3)*sinh(d*x + c)^6 - 3*(2*a^3*b - a*...
```

### 3.70.6 Sympy [F]

$$\int (a + b\operatorname{csch}(c + dx))^4 \, dx = \int (a + b \operatorname{csch}(c + dx))^4 \, dx$$

input

```
integrate((a+b*csch(d*x+c))**4,x)
```

output

```
Integral((a + b*csch(c + d*x))**4, x)
```

### 3.70.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 234 vs. 2(103) = 206.

Time = 0.18 (sec) , antiderivative size = 234, normalized size of antiderivative = 2.15

$$\int (a + b\,\mathrm{csch}(c + dx))^4\,dx$$

$$= a^4 x + 2ab^3\left(\frac{\log\left(e^{(-dx-c)}+1\right)}{d} - \frac{\log\left(e^{(-dx-c)}-1\right)}{d} + \frac{2\left(e^{(-dx-c)}+e^{(-3\,dx-3\,c)}\right)}{d(2\,e^{(-2\,dx-2\,c)} - e^{(-4\,dx-4\,c)} - 1)}\right)$$
$$+ \frac{4}{3}b^4\left(\frac{3\,e^{(-2\,dx-2\,c)}}{d(3\,e^{(-2\,dx-2\,c)} - 3\,e^{(-4\,dx-4\,c)} + e^{(-6\,dx-6\,c)} - 1)} - \frac{1}{d(3\,e^{(-2\,dx-2\,c)} - 3\,e^{(-4\,dx-4\,c)} + e^{(-6\,dx-6\,c)} - 1)}\right.$$
$$+ \frac{4\,a^3 b\log\left(\tanh\left(\frac{1}{2}\,dx + \frac{1}{2}\,c\right)\right)}{d} + \frac{12\,a^2 b^2}{d(e^{(-2\,dx-2\,c)} - 1)}$$

input
```
integrate((a+b*csch(d*x+c))^4,x, algorithm="maxima")
```

output
```
a^4*x + 2*a*b^3*(log(e^(-d*x - c) + 1)/d - log(e^(-d*x - c) - 1)/d + 2*(e^
(-d*x - c) + e^(-3*d*x - 3*c))/(d*(2*e^(-2*d*x - 2*c) - e^(-4*d*x - 4*c) -
 1))) + 4/3*b^4*(3*e^(-2*d*x - 2*c)/(d*(3*e^(-2*d*x - 2*c) - 3*e^(-4*d*x -
 4*c) + e^(-6*d*x - 6*c) - 1)) - 1/(d*(3*e^(-2*d*x - 2*c) - 3*e^(-4*d*x -
4*c) + e^(-6*d*x - 6*c) - 1))) + 4*a^3*b*log(tanh(1/2*d*x + 1/2*c))/d + 12
*a^2*b^2/(d*(e^(-2*d*x - 2*c) - 1))
```

### 3.70.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 169, normalized size of antiderivative = 1.55

$$\int (a + b\,\mathrm{csch}(c + dx))^4\,dx$$

$$= \frac{3\,(dx+c)a^4 - 6\,(2\,a^3 b - ab^3)\log\left(e^{(dx+c)}+1\right) + 6\,(2\,a^3 b - ab^3)\log\left(\left|e^{(dx+c)}-1\right|\right) - \frac{4\left(3\,ab^3 e^{(5\,dx+5\,c)} + 9\,a^2 b^2 e^{(}\right.}{3\,d}$$

input
```
integrate((a+b*csch(d*x+c))^4,x, algorithm="giac")
```

output
```
1/3*(3*(d*x + c)*a^4 - 6*(2*a^3*b - a*b^3)*log(e^(d*x + c) + 1) + 6*(2*a^3
*b - a*b^3)*log(abs(e^(d*x + c) - 1)) - 4*(3*a*b^3*e^(5*d*x + 5*c) + 9*a^2
*b^2*e^(4*d*x + 4*c) - 18*a^2*b^2*e^(2*d*x + 2*c) + 3*b^4*e^(2*d*x + 2*c)
- 3*a*b^3*e^(d*x + c) + 9*a^2*b^2 - b^4)/(e^(2*d*x + 2*c) - 1)^3)/d
```

### 3.70.9 Mupad [B] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 239, normalized size of antiderivative = 2.19

$$\int (a+b\operatorname{csch}(c+dx))^4\,dx = a^4 x - \frac{\frac{12a^2b^2}{d} + \frac{4ab^3 e^{c+dx}}{d}}{e^{2c+2dx}-1} - \frac{\frac{4b^4}{d} + \frac{8ab^3 e^{c+dx}}{d}}{e^{4c+4dx} - 2e^{2c+2dx} + 1} - \frac{8b^4}{3d\left(3e^{2c+2dx} - 3e^{4c+4dx} + e^{6c+6dx} - 1\right)} + \frac{4\operatorname{atan}\left(\frac{e^{dx}e^c\left(ab^3\sqrt{-d^2} - 2a^3b\sqrt{-d^2}\right)}{d\sqrt{4a^6b^2 - 4a^4b^4 + a^2b^6}}\right)\sqrt{4a^6b^2 - 4a^4b^4 + a^2b^6}}{\sqrt{-d^2}}$$

input
```
int((a + b/sinh(c + d*x))^4,x)
```

output
```
a^4*x - ((12*a^2*b^2)/d + (4*a*b^3*exp(c + d*x))/d)/(exp(2*c + 2*d*x) - 1)
 - ((4*b^4)/d + (8*a*b^3*exp(c + d*x))/d)/(exp(4*c + 4*d*x) - 2*exp(2*c +
2*d*x) + 1) - (8*b^4)/(3*d*(3*exp(2*c + 2*d*x) - 3*exp(4*c + 4*d*x) + exp(
6*c + 6*d*x) - 1)) + (4*atan((exp(d*x)*exp(c)*(a*b^3*(-d^2)^(1/2) - 2*a^3*
b*(-d^2)^(1/2)))/(d*(a^2*b^6 - 4*a^4*b^4 + 4*a^6*b^2)^(1/2)))*(a^2*b^6 - 4
*a^4*b^4 + 4*a^6*b^2)^(1/2))/(-d^2)^(1/2)
```

# 3.71 $\int (a + b\text{csch}(c + dx))^3\, dx$

3.71.1 Optimal result . . . . . 478
3.71.2 Mathematica [B] (verified) . . . . . 478
3.71.3 Rubi [A] (verified) . . . . . 479
3.71.4 Maple [A] (verified) . . . . . 480
3.71.5 Fricas [B] (verification not implemented) . . . . . 481
3.71.6 Sympy [F] . . . . . 482
3.71.7 Maxima [A] (verification not implemented) . . . . . 482
3.71.8 Giac [A] (verification not implemented) . . . . . 482
3.71.9 Mupad [B] (verification not implemented) . . . . . 483

## 3.71.1 Optimal result

Integrand size = 12, antiderivative size = 75

$$\int (a + b\text{csch}(c + dx))^3\, dx = a^3 x - \frac{b(6a^2 - b^2)\,\text{arctanh}(\cosh(c + dx))}{2d} - \frac{5ab^2 \coth(c + dx)}{2d} - \frac{b^2 \coth(c + dx)(a + b\text{csch}(c + dx))}{2d}$$

output
```
a^3*x-1/2*b*(6*a^2-b^2)*arctanh(cosh(d*x+c))/d-5/2*a*b^2*coth(d*x+c)/d-1/2
*b^2*coth(d*x+c)*(a+b*csch(d*x+c))/d
```

## 3.71.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 151 vs. 2(75) = 150.

Time = 5.87 (sec) , antiderivative size = 151, normalized size of antiderivative = 2.01

$$\int (a + b\text{csch}(c + dx))^3\, dx = -\frac{-8a^3c - 8a^3dx + 12ab^2 \coth\left(\frac{1}{2}(c + dx)\right) + b^3\text{csch}^2\left(\frac{1}{2}(c + dx)\right) + 24a^2b \log\left(\cosh\left(\frac{1}{2}(c + dx)\right)\right) - 4b^3 \log$$

input
```
Integrate[(a + b*Csch[c + d*x])^3,x]
```

output
```
-1/8*(-8*a^3*c - 8*a^3*d*x + 12*a*b^2*Coth[(c + d*x)/2] + b^3*Csch[(c + d*
x)/2]^2 + 24*a^2*b*Log[Cosh[(c + d*x)/2]] - 4*b^3*Log[Cosh[(c + d*x)/2]] -
 24*a^2*b*Log[Sinh[(c + d*x)/2]] + 4*b^3*Log[Sinh[(c + d*x)/2]] + b^3*Sech
[(c + d*x)/2]^2 + 12*a*b^2*Tanh[(c + d*x)/2])/d
```

### 3.71.3 Rubi [A] (verified)

Time = 0.27 (sec) , antiderivative size = 77, normalized size of antiderivative = 1.03, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.250$, Rules used = {3042, 4269, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a + b\operatorname{csch}(c + dx))^3 \, dx$$

$$\downarrow 3042$$

$$\int (a + ib\csc(ic + idx))^3 dx$$

$$\downarrow 4269$$

$$\frac{1}{2}\int \left(2a^3 + 5b^2\operatorname{csch}^2(c + dx)a + b\left(6a^2 - b^2\right)\operatorname{csch}(c + dx)\right) dx - \frac{b^2\coth(c + dx)(a + b\operatorname{csch}(c + dx))}{2d}$$

$$\downarrow 2009$$

$$\frac{1}{2}\left(2a^3x - \frac{b\left(6a^2 - b^2\right)\operatorname{arctanh}(\cosh(c + dx))}{d} - \frac{5ab^2\coth(c + dx)}{d}\right) - \frac{b^2\coth(c + dx)(a + b\operatorname{csch}(c + dx))}{2d}$$

input
```
Int[(a + b*Csch[c + d*x])^3,x]
```

output
```
(2*a^3*x - (b*(6*a^2 - b^2)*ArcTanh[Cosh[c + d*x]])/d - (5*a*b^2*Coth[c +
d*x])/d)/2 - (b^2*Coth[c + d*x]*(a + b*Csch[c + d*x]))/(2*d)
```

#### 3.71.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4269
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[(-b^2)*C
ot[c + d*x]*((a + b*Csc[c + d*x])^(n - 2)/(d*(n - 1))), x] + Simp[1/(n - 1)
   Int[(a + b*Csc[c + d*x])^(n - 3)*Simp[a^3*(n - 1) + (b*(b^2*(n - 2) + 3*
a^2*(n - 1)))*Csc[c + d*x] + (a*b^2*(3*n - 4))*Csc[c + d*x]^2, x], x], x] /
; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && GtQ[n, 2] && IntegerQ[2*n]
```

### 3.71.4 Maple [A] (verified)

Time = 1.11 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.88

| method | result |
|---|---|
| derivativedivides | $\frac{a^3(dx+c)-6a^2b\,\operatorname{arctanh}\left(e^{dx+c}\right)-3\coth(dx+c)a\,b^2+b^3\left(-\frac{\operatorname{csch}(dx+c)\coth(dx+c)}{2}+\operatorname{arctanh}\left(e^{dx+c}\right)\right)}{d}$ |
| default | $\frac{a^3(dx+c)-6a^2b\,\operatorname{arctanh}\left(e^{dx+c}\right)-3\coth(dx+c)a\,b^2+b^3\left(-\frac{\operatorname{csch}(dx+c)\coth(dx+c)}{2}+\operatorname{arctanh}\left(e^{dx+c}\right)\right)}{d}$ |
| parts | $a^3x+\frac{b^3\left(-\frac{\operatorname{csch}(dx+c)\coth(dx+c)}{2}+\operatorname{arctanh}\left(e^{dx+c}\right)\right)}{d}-\frac{3a\,b^2\coth(dx+c)}{d}+\frac{3a^2b\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}$ |
| parallelrisch | $\frac{\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2b^3-\coth\left(\frac{dx}{2}+\frac{c}{2}\right)^2b^3+8a^3dx+24\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)a^2b-4\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)b^3-12\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)a\,b^2-$ |
| risch | $a^3x-\frac{b^2\left(e^{3dx+3c}b+6\,e^{2dx+2c}a+e^{dx+c}b-6a\right)}{d\left(e^{2dx+2c}-1\right)^2}-\frac{3b\ln\left(e^{dx+c}+1\right)a^2}{d}+\frac{b^3\ln\left(e^{dx+c}+1\right)}{2d}+\frac{3b\ln\left(e^{dx+c}-1\right)a^2}{d}-$ |

input
```
int((a+b*csch(d*x+c))^3,x,method=_RETURNVERBOSE)
```

output
```
1/d*(a^3*(d*x+c)-6*a^2*b*arctanh(exp(d*x+c))-3*coth(d*x+c)*a*b^2+b^3*(-1/2
*csch(d*x+c)*coth(d*x+c)+arctanh(exp(d*x+c))))
```

### 3.71.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 769 vs. $2(69) = 138$.

Time $= 0.27$ (sec) , antiderivative size $= 769$, normalized size of antiderivative $= 10.25$

$$\int (a + b\operatorname{csch}(c + dx))^3 \, dx$$

$$= \frac{2\,a^3 dx \cosh(dx+c)^4 + 2\,a^3 dx \sinh(dx+c)^4 - 2\,b^3 \cosh(dx+c)^3 + 2\,a^3 dx - 2\,b^3 \cosh(dx+c) + 2\,(4\,a^3 d$$

input
```
integrate((a+b*csch(d*x+c))^3,x, algorithm="fricas")
```

output
```
1/2*(2*a^3*d*x*cosh(d*x + c)^4 + 2*a^3*d*x*sinh(d*x + c)^4 - 2*b^3*cosh(d*
x + c)^3 + 2*a^3*d*x - 2*b^3*cosh(d*x + c) + 2*(4*a^3*d*x*cosh(d*x + c) -
b^3)*sinh(d*x + c)^3 + 12*a*b^2 - 4*(a^3*d*x + 3*a*b^2)*cosh(d*x + c)^2 +
2*(6*a^3*d*x*cosh(d*x + c)^2 - 2*a^3*d*x - 3*b^3*cosh(d*x + c) - 6*a*b^2)*
sinh(d*x + c)^2 - ((6*a^2*b - b^3)*cosh(d*x + c)^4 + 4*(6*a^2*b - b^3)*cos
h(d*x + c)*sinh(d*x + c)^3 + (6*a^2*b - b^3)*sinh(d*x + c)^4 + 6*a^2*b - b
^3 - 2*(6*a^2*b - b^3)*cosh(d*x + c)^2 - 2*(6*a^2*b - b^3 - 3*(6*a^2*b - b
^3)*cosh(d*x + c)^2)*sinh(d*x + c)^2 + 4*((6*a^2*b - b^3)*cosh(d*x + c)^3
- (6*a^2*b - b^3)*cosh(d*x + c))*sinh(d*x + c))*log(cosh(d*x + c) + sinh(d
*x + c) + 1) + ((6*a^2*b - b^3)*cosh(d*x + c)^4 + 4*(6*a^2*b - b^3)*cosh(d
*x + c)*sinh(d*x + c)^3 + (6*a^2*b - b^3)*sinh(d*x + c)^4 + 6*a^2*b - b^3
- 2*(6*a^2*b - b^3)*cosh(d*x + c)^2 - 2*(6*a^2*b - b^3 - 3*(6*a^2*b - b^3)
*cosh(d*x + c)^2)*sinh(d*x + c)^2 + 4*((6*a^2*b - b^3)*cosh(d*x + c)^3 - (
6*a^2*b - b^3)*cosh(d*x + c))*sinh(d*x + c))*log(cosh(d*x + c) + sinh(d*x
+ c) - 1) + 2*(4*a^3*d*x*cosh(d*x + c)^3 - 3*b^3*cosh(d*x + c)^2 - b^3 - 4
*(a^3*d*x + 3*a*b^2)*cosh(d*x + c))*sinh(d*x + c))/(d*cosh(d*x + c)^4 + 4*
d*cosh(d*x + c)*sinh(d*x + c)^3 + d*sinh(d*x + c)^4 - 2*d*cosh(d*x + c)^2
+ 2*(3*d*cosh(d*x + c)^2 - d)*sinh(d*x + c)^2 + 4*(d*cosh(d*x + c)^3 - d*c
osh(d*x + c))*sinh(d*x + c) + d)
```

### 3.71.6 Sympy [F]

$$\int (a + b\operatorname{csch}(c + dx))^3 \, dx = \int (a + b \operatorname{csch}(c + dx))^3 \, dx$$

input
```
integrate((a+b*csch(d*x+c))**3,x)
```

output
```
Integral((a + b*csch(c + d*x))**3, x)
```

### 3.71.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 136, normalized size of antiderivative = 1.81

$$\begin{aligned}
&\int (a + b\operatorname{csch}(c + dx))^3 \, dx \\
&= a^3 x + \frac{1}{2} b^3 \left( \frac{\log\left(e^{(-dx-c)} + 1\right)}{d} - \frac{\log\left(e^{(-dx-c)} - 1\right)}{d} + \frac{2\left(e^{(-dx-c)} + e^{(-3\,dx-3\,c)}\right)}{d(2\,e^{(-2\,dx-2\,c)} - e^{(-4\,dx-4\,c)} - 1)} \right) \\
&\quad + \frac{3\,a^2 b \log\left(\tanh\left(\frac{1}{2}\,dx + \frac{1}{2}\,c\right)\right)}{d} + \frac{6\,ab^2}{d(e^{(-2\,dx-2\,c)} - 1)}
\end{aligned}$$

input
```
integrate((a+b*csch(d*x+c))^3,x, algorithm="maxima")
```

output
```
a^3*x + 1/2*b^3*(log(e^(-d*x - c) + 1)/d - log(e^(-d*x - c) - 1)/d + 2*(e^
(-d*x - c) + e^(-3*d*x - 3*c))/(d*(2*e^(-2*d*x - 2*c) - e^(-4*d*x - 4*c) -
 1))) + 3*a^2*b*log(tanh(1/2*d*x + 1/2*c))/d + 6*a*b^2/(d*(e^(-2*d*x - 2*c
) - 1))
```

### 3.71.8 Giac [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 122, normalized size of antiderivative = 1.63

$$\begin{aligned}
&\int (a + b\operatorname{csch}(c + dx))^3 \, dx \\
&= \frac{2\,(dx + c)a^3 - (6\,a^2 b - b^3)\log\left(e^{(dx+c)} + 1\right) + (6\,a^2 b - b^3)\log\left(\left|e^{(dx+c)} - 1\right|\right) - \frac{2\left(b^3 e^{(3\,dx+3\,c)} + 6\,ab^2 e^{(2\,dx+2\,c)} + b^3\right.}{\left(e^{(2\,dx+2\,c)} - 1\right)^2}}{2\,d}
\end{aligned}$$

input
```
integrate((a+b*csch(d*x+c))^3,x, algorithm="giac")
```

output
```
1/2*(2*(d*x + c)*a^3 - (6*a^2*b - b^3)*log(e^(d*x + c) + 1) + (6*a^2*b - b
^3)*log(abs(e^(d*x + c) - 1)) - 2*(b^3*e^(3*d*x + 3*c) + 6*a*b^2*e^(2*d*x
+ 2*c) + b^3*e^(d*x + c) - 6*a*b^2)/(e^(2*d*x + 2*c) - 1)^2)/d
```

### 3.71.9 Mupad [B] (verification not implemented)

Time = 0.15 (sec) , antiderivative size = 170, normalized size of antiderivative = 2.27

$$\int (a+b\operatorname{csch}(c+dx))^3\,dx = a^3\,x - \frac{\frac{6\,a\,b^2}{d}+\frac{b^3\,e^{c+d\,x}}{d}}{e^{2\,c+2\,d\,x}-1} + \frac{\operatorname{atan}\left(\frac{e^{d\,x}\,e^{c}\left(b^3\,\sqrt{-d^2}-6\,a^2\,b\,\sqrt{-d^2}\right)}{d\,\sqrt{36\,a^4\,b^2-12\,a^2\,b^4+b^6}}\right)\,\sqrt{36\,a^4\,b^2-12\,a^2\,b^4+b^6}}{\sqrt{-d^2}} - \frac{2\,b^3\,e^{c+d\,x}}{d\,\left(e^{4\,c+4\,d\,x}-2\,e^{2\,c+2\,d\,x}+1\right)}$$

input
```
int((a + b/sinh(c + d*x))^3,x)
```

output
```
a^3*x - ((6*a*b^2)/d + (b^3*exp(c + d*x))/d)/(exp(2*c + 2*d*x) - 1) + (ata
n((exp(d*x)*exp(c)*(b^3*(-d^2)^(1/2) - 6*a^2*b*(-d^2)^(1/2)))/(d*(b^6 - 12
*a^2*b^4 + 36*a^4*b^2)^(1/2)))*(b^6 - 12*a^2*b^4 + 36*a^4*b^2)^(1/2))/(-d^
2)^(1/2) - (2*b^3*exp(c + d*x))/(d*(exp(4*c + 4*d*x) - 2*exp(2*c + 2*d*x)
+ 1))
```

# 3.72 $\int (a + b\text{csch}(c + dx))^2\, dx$

3.72.1 Optimal result . . . 484
3.72.2 Mathematica [B] (verified) . . . 484
3.72.3 Rubi [A] (verified) . . . 485
3.72.4 Maple [A] (verified) . . . 487
3.72.5 Fricas [B] (verification not implemented) . . . 487
3.72.6 Sympy [F] . . . 488
3.72.7 Maxima [A] (verification not implemented) . . . 488
3.72.8 Giac [A] (verification not implemented) . . . 488
3.72.9 Mupad [B] (verification not implemented) . . . 489

## 3.72.1 Optimal result

Integrand size = 12, antiderivative size = 34

$$\int (a + b\text{csch}(c + dx))^2\, dx = a^2 x - \frac{2ab\text{arctanh}(\cosh(c + dx))}{d} - \frac{b^2 \coth(c + dx)}{d}$$

output
```
a^2*x-2*a*b*arctanh(cosh(d*x+c))/d-b^2*coth(d*x+c)/d
```

## 3.72.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 75 vs. 2(34) = 68.

Time = 0.55 (sec) , antiderivative size = 75, normalized size of antiderivative = 2.21

$$\int (a + b\text{csch}(c + dx))^2\, dx = -\frac{b^2 \coth\left(\frac{1}{2}(c + dx)\right) - 2a\left(ac + adx - 2b\log\left(\cosh\left(\frac{1}{2}(c + dx)\right)\right) + 2b\log\left(\sinh\left(\frac{1}{2}(c + dx)\right)\right)\right) + b^2 \tanh($$
$$2d$$

input
```
Integrate[(a + b*Csch[c + d*x])^2,x]
```

output
```
-1/2*(b^2*Coth[(c + d*x)/2] - 2*a*(a*c + a*d*x - 2*b*Log[Cosh[(c + d*x)/2]
] + 2*b*Log[Sinh[(c + d*x)/2]]) + b^2*Tanh[(c + d*x)/2])/d
```

### 3.72.3 Rubi [A] (verified)

Time = 0.30 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.00, number of steps used = 11, number of rules used = 10, $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$, Rules used = {3042, 4260, 25, 26, 3042, 25, 26, 4254, 24, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a + b\text{csch}(c + dx))^2 \, dx$$

$$\downarrow 3042$$

$$\int (a + ib \csc(ic + idx))^2 dx$$

$$\downarrow 4260$$

$$2iab \int -i\text{csch}(c + dx)dx - b^2 \int -\text{csch}^2(c + dx)dx + a^2 x$$

$$\downarrow 25$$

$$2iab \int -i\text{csch}(c + dx)dx + b^2 \int \text{csch}^2(c + dx)dx + a^2 x$$

$$\downarrow 26$$

$$2ab \int \text{csch}(c + dx)dx + b^2 \int \text{csch}^2(c + dx)dx + a^2 x$$

$$\downarrow 3042$$

$$2ab \int i \csc(ic + idx)dx + b^2 \int -\csc(ic + idx)^2 dx + a^2 x$$

$$\downarrow 25$$

$$2ab \int i \csc(ic + idx)dx - b^2 \int \csc(ic + idx)^2 dx + a^2 x$$

$$\downarrow 26$$

$$2iab \int \csc(ic + idx)dx - b^2 \int \csc(ic + idx)^2 dx + a^2 x$$

$$\downarrow 4254$$

$$2iab \int \csc(ic + idx)dx - \frac{ib^2 \int 1d(-i \coth(c + dx))}{d} + a^2 x$$

$$\downarrow 24$$

$$2iab\int \csc(ic+idx)dx + a^2x - \frac{b^2\coth(c+dx)}{d}$$

$$\downarrow 4257$$

$$a^2x - \frac{2ab\operatorname{arctanh}(\cosh(c+dx))}{d} - \frac{b^2\coth(c+dx)}{d}$$

input
```
Int[(a + b*Csch[c + d*x])^2,x]
```

output
```
a^2*x - (2*a*b*ArcTanh[Cosh[c + d*x]])/d - (b^2*Coth[c + d*x])/d
```

### 3.72.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4260
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^2, x_Symbol] :> Simp[a^2*x, x] +
 (Simp[2*a*b   Int[Csc[c + d*x], x], x] + Simp[b^2   Int[Csc[c + d*x]^2, x]
, x]) /; FreeQ[{a, b, c, d}, x]
```

### 3.72.4 Maple [A] (verified)

Time = 0.86 (sec) , antiderivative size = 37, normalized size of antiderivative = 1.09

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{a^2(dx+c)-4ab\ \operatorname{arctanh}\left(e^{dx+c}\right)-\coth(dx+c)b^2}{d}$ | 37 |
| default | $\frac{a^2(dx+c)-4ab\ \operatorname{arctanh}\left(e^{dx+c}\right)-\coth(dx+c)b^2}{d}$ | 37 |
| parts | $a^2x-\frac{b^2\coth(dx+c)}{d}+\frac{2ab\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}$ | 38 |
| parallelrisch | $\frac{2a^2dx+4\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)ab-\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)b^2-\coth\left(\frac{dx}{2}+\frac{c}{2}\right)b^2}{2d}$ | 56 |
| risch | $a^2x-\frac{2b^2}{d\left(e^{2dx+2c}-1\right)}-\frac{2ab\ln\left(e^{dx+c}+1\right)}{d}+\frac{2ab\ln\left(e^{dx+c}-1\right)}{d}$ | 60 |

input
```
int((a+b*csch(d*x+c))^2,x,method=_RETURNVERBOSE)
```

output
```
1/d*(a^2*(d*x+c)-4*a*b*arctanh(exp(d*x+c))-coth(d*x+c)*b^2)
```

### 3.72.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 222 vs. 2(34) = 68.

Time = 0.28 (sec) , antiderivative size = 222, normalized size of antiderivative = 6.53

$$\int (a+b\operatorname{csch}(c+dx))^2\,dx$$
$$=\frac{a^2dx\cosh(dx+c)^2+2\,a^2dx\cosh(dx+c)\sinh(dx+c)+a^2dx\sinh(dx+c)^2-a^2dx-2\,b^2-2\,(ab\cosh$$

input
```
integrate((a+b*csch(d*x+c))^2,x, algorithm="fricas")
```

output
```
(a^2*d*x*cosh(d*x + c)^2 + 2*a^2*d*x*cosh(d*x + c)*sinh(d*x + c) + a^2*d*x
*sinh(d*x + c)^2 - a^2*d*x - 2*b^2 - 2*(a*b*cosh(d*x + c)^2 + 2*a*b*cosh(d
*x + c)*sinh(d*x + c) + a*b*sinh(d*x + c)^2 - a*b)*log(cosh(d*x + c) + sin
h(d*x + c) + 1) + 2*(a*b*cosh(d*x + c)^2 + 2*a*b*cosh(d*x + c)*sinh(d*x +
c) + a*b*sinh(d*x + c)^2 - a*b)*log(cosh(d*x + c) + sinh(d*x + c) - 1))/(d
*cosh(d*x + c)^2 + 2*d*cosh(d*x + c)*sinh(d*x + c) + d*sinh(d*x + c)^2 - d
)
```

### 3.72.6 Sympy [F]

$$\int (a + b\operatorname{csch}(c + dx))^2 \, dx = \int (a + b \operatorname{csch}(c + dx))^2 \, dx$$

input
```
integrate((a+b*csch(d*x+c))**2,x)
```

output
```
Integral((a + b*csch(c + d*x))**2, x)
```

### 3.72.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 44, normalized size of antiderivative = 1.29

$$\int (a + b\operatorname{csch}(c + dx))^2 \, dx = a^2 x + \frac{2\,ab \log\left(\tanh\left(\frac{1}{2}\,dx + \frac{1}{2}\,c\right)\right)}{d} + \frac{2\,b^2}{d(e^{(-2\,dx - 2\,c)} - 1)}$$

input
```
integrate((a+b*csch(d*x+c))^2,x, algorithm="maxima")
```

output
```
a^2*x + 2*a*b*log(tanh(1/2*d*x + 1/2*c))/d + 2*b^2/(d*(e^(-2*d*x - 2*c) -
1))
```

### 3.72.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 59, normalized size of antiderivative = 1.74

$$\int (a + b\operatorname{csch}(c + dx))^2 \, dx = \frac{(dx + c)a^2 - 2\,ab \log\left(e^{(dx+c)} + 1\right) + 2\,ab \log\left(\left|e^{(dx+c)} - 1\right|\right) - \frac{2\,b^2}{e^{(2\,dx+2\,c)} - 1}}{d}$$

input
```
integrate((a+b*csch(d*x+c))^2,x, algorithm="giac")
```

output
```
((d*x + c)*a^2 - 2*a*b*log(e^(d*x + c) + 1) + 2*a*b*log(abs(e^(d*x + c) -
1)) - 2*b^2/(e^(2*d*x + 2*c) - 1))/d
```

### 3.72.9 Mupad [B] (verification not implemented)

Time = 2.30 (sec) , antiderivative size = 74, normalized size of antiderivative = 2.18

$$\int (a + b\operatorname{csch}(c + dx))^2\,dx = a^2\,x - \frac{2\,b^2}{d\,(\mathrm{e}^{2\,c+2\,d\,x} - 1)} - \frac{4\operatorname{atan}\left(\frac{a\,b\,\mathrm{e}^{d\,x}\,\mathrm{e}^{c}\,\sqrt{-d^2}}{d\,\sqrt{a^2\,b^2}}\right)\,\sqrt{a^2\,b^2}}{\sqrt{-d^2}}$$

input
```
int((a + b/sinh(c + d*x))^2,x)
```

output
```
a^2*x - (2*b^2)/(d*(exp(2*c + 2*d*x) - 1)) - (4*atan((a*b*exp(d*x)*exp(c)*
(-d^2)^(1/2))/(d*(a^2*b^2)^(1/2)))*(a^2*b^2)^(1/2))/(-d^2)^(1/2)
```

# 3.73 $\int (a + b\mathbf{csch}(c + dx))\, dx$

3.73.1 Optimal result . . . . . 490
3.73.2 Mathematica [B] (verified) . . . . . 490
3.73.3 Rubi [A] (verified) . . . . . 491
3.73.4 Maple [A] (verified) . . . . . 491
3.73.5 Fricas [B] (verification not implemented) . . . . . 492
3.73.6 Sympy [A] (verification not implemented) . . . . . 492
3.73.7 Maxima [A] (verification not implemented) . . . . . 493
3.73.8 Giac [A] (verification not implemented) . . . . . 493
3.73.9 Mupad [B] (verification not implemented) . . . . . 493

## 3.73.1 Optimal result

Integrand size = 10, antiderivative size = 17

$$\int (a + b\operatorname{csch}(c + dx))\, dx = ax - \frac{b\operatorname{arctanh}(\cosh(c + dx))}{d}$$

output
```
a*x-b*arctanh(cosh(d*x+c))/d
```

## 3.73.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 43 vs. $2(17) = 34$.

Time = 0.00 (sec) , antiderivative size = 43, normalized size of antiderivative = 2.53

$$\int (a + b\operatorname{csch}(c + dx))\, dx = ax - \frac{b\log\left(\cosh\left(\frac{c}{2} + \frac{dx}{2}\right)\right)}{d} + \frac{b\log\left(\sinh\left(\frac{c}{2} + \frac{dx}{2}\right)\right)}{d}$$

input
```
Integrate[a + b*Csch[c + d*x],x]
```

output
```
a*x - (b*Log[Cosh[c/2 + (d*x)/2]])/d + (b*Log[Sinh[c/2 + (d*x)/2]])/d
```

### 3.73.3 Rubi [A] (verified)

Time = 0.15 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.00, number of steps used = 1, number of rules used = 1, $\frac{\text{number of rules}}{\text{integrand size}} = 0.100$, Rules used = {2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a + b\text{csch}(c + dx))\, dx$$

$$\downarrow \text{2009}$$

$$ax - \frac{b\text{arctanh}(\cosh(c + dx))}{d}$$

input
```
Int[a + b*Csch[c + d*x],x]
```

output
```
a*x - (b*ArcTanh[Cosh[c + d*x]])/d
```

#### 3.73.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

### 3.73.4 Maple [A] (verified)

Time = 0.13 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.18

| method | result | size |
|---|---|---|
| default | $ax + \frac{b\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}$ | 20 |
| parallelrisch | $ax + \frac{b\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}$ | 20 |
| parts | $ax + \frac{b\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}$ | 20 |
| derivativedivides | $\frac{a(dx+c)+b\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}$ | 25 |
| risch | $ax + \frac{b\ln\left(e^{dx+c}-1\right)}{d} - \frac{b\ln\left(e^{dx+c}+1\right)}{d}$ | 34 |

input
```
int(a+b*csch(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
a*x+b/d*ln(tanh(1/2*d*x+1/2*c))
```

### 3.73.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 44 vs. $2(17) = 34$.

Time $= 0.27$ (sec) , antiderivative size $= 44$, normalized size of antiderivative $= 2.59$

$$\int (a + b\text{csch}(c + dx))\, dx$$
$$= \frac{adx - b\log(\cosh(dx + c) + \sinh(dx + c) + 1) + b\log(\cosh(dx + c) + \sinh(dx + c) - 1)}{d}$$

input
```
integrate(a+b*csch(d*x+c),x, algorithm="fricas")
```

output
```
(a*d*x - b*log(cosh(d*x + c) + sinh(d*x + c) + 1) + b*log(cosh(d*x + c) +
sinh(d*x + c) - 1))/d
```

### 3.73.6 Sympy [A] (verification not implemented)

Time $= 0.24$ (sec) , antiderivative size $= 22$, normalized size of antiderivative $= 1.29$

$$\int (a + b\text{csch}(c + dx))\, dx = ax + b\left(\begin{cases} \frac{\log\left(\tanh\left(\frac{c}{2} + \frac{dx}{2}\right)\right)}{d} & \text{for } d \neq 0 \\ x\,\text{csch}(c) & \text{otherwise} \end{cases}\right)$$

input
```
integrate(a+b*csch(d*x+c),x)
```

output
```
a*x + b*Piecewise((log(tanh(c/2 + d*x/2))/d, Ne(d, 0)), (x*csch(c), True))
```

### 3.73.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 19, normalized size of antiderivative = 1.12

$$\int (a + b\operatorname{csch}(c + dx))\, dx = ax + \frac{b \log\left(\tanh\left(\frac{1}{2}\, dx + \frac{1}{2}\, c\right)\right)}{d}$$

input
```
integrate(a+b*csch(d*x+c),x, algorithm="maxima")
```

output
```
a*x + b*log(tanh(1/2*d*x + 1/2*c))/d
```

### 3.73.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.88

$$\int (a + b\operatorname{csch}(c + dx))\, dx = ax - \frac{b\left(\log\left(e^{(dx+c)} + 1\right) - \log\left(\left|e^{(dx+c)} - 1\right|\right)\right)}{d}$$

input
```
integrate(a+b*csch(d*x+c),x, algorithm="giac")
```

output
```
a*x - b*(log(e^(d*x + c) + 1) - log(abs(e^(d*x + c) - 1)))/d
```

### 3.73.9 Mupad [B] (verification not implemented)

Time = 0.06 (sec) , antiderivative size = 42, normalized size of antiderivative = 2.47

$$\int (a + b\operatorname{csch}(c + dx))\, dx = a\, x - \frac{2 \operatorname{atan}\left(\frac{b\, e^{d\, x}\, e^{c} \sqrt{-d^2}}{d \sqrt{b^2}}\right) \sqrt{b^2}}{\sqrt{-d^2}}$$

input
```
int(a + b/sinh(c + d*x),x)
```

output
```
a*x - (2*atan((b*exp(d*x)*exp(c)*(-d^2)^(1/2))/(d*(b^2)^(1/2)))*(b^2)^(1/2
))/(-d^2)^(1/2)
```

# 3.74 $\int \frac{1}{a+b\operatorname{csch}(c+dx)}\,dx$

3.74.1 Optimal result . . . 494
3.74.2 Mathematica [A] (verified) . . . 494
3.74.3 Rubi [A] (warning: unable to verify) . . . 495
3.74.4 Maple [A] (verified) . . . 496
3.74.5 Fricas [B] (verification not implemented) . . . 497
3.74.6 Sympy [F] . . . 497
3.74.7 Maxima [A] (verification not implemented) . . . 498
3.74.8 Giac [A] (verification not implemented) . . . 498
3.74.9 Mupad [B] (verification not implemented) . . . 498

## 3.74.1 Optimal result

Integrand size = 12, antiderivative size = 54

$$\int \frac{1}{a+b\operatorname{csch}(c+dx)}\,dx = \frac{x}{a} + \frac{2b\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{1}{2}(c+dx)\right)}{\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}d}$$

output
```
x/a+2*b*arctanh((a-b*tanh(1/2*d*x+1/2*c))/(a^2+b^2)^(1/2))/a/d/(a^2+b^2)^(
1/2)
```

## 3.74.2 Mathematica [A] (verified)

Time = 0.20 (sec) , antiderivative size = 64, normalized size of antiderivative = 1.19

$$\int \frac{1}{a+b\operatorname{csch}(c+dx)}\,dx = \frac{\frac{c}{d} + x - \frac{2b\arctan\left(\frac{a-b\tanh\left(\frac{1}{2}(c+dx)\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}d}}{a}$$

input
```
Integrate[(a + b*Csch[c + d*x])^(-1),x]
```

output
```
(c/d + x - (2*b*ArcTan[(a - b*Tanh[(c + d*x)/2])/Sqrt[-a^2 - b^2]])/(Sqrt[
-a^2 - b^2]*d))/a
```

### 3.74.3 Rubi [A] (warning: unable to verify)

Time = 0.30 (sec) , antiderivative size = 53, normalized size of antiderivative = 0.98, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.500$, Rules used = {3042, 4270, 3042, 3139, 1083, 217}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{a+b\operatorname{csch}(c+dx)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{a+ib\csc(ic+idx)}dx$$

$$\downarrow 4270$$

$$\frac{x}{a}-\frac{\int \frac{1}{\frac{a\sinh(c+dx)}{b}+1}dx}{a}$$

$$\downarrow 3042$$

$$\frac{x}{a}-\frac{\int \frac{1}{1-\frac{ia\sin(ic+idx)}{b}}dx}{a}$$

$$\downarrow 3139$$

$$\frac{x}{a}+\frac{2i\int \frac{1}{-\tanh^2\left(\frac{1}{2}(c+dx)\right)+\frac{2a\tanh\left(\frac{1}{2}(c+dx)\right)}{b}+1}d\left(i\tanh\left(\frac{1}{2}(c+dx)\right)\right)}{ad}$$

$$\downarrow 1083$$

$$\frac{x}{a}-\frac{4i\int \frac{1}{\tanh^2\left(\frac{1}{2}(c+dx)\right)-4\left(\frac{a^2}{b^2}+1\right)}d\left(2i\tanh\left(\frac{1}{2}(c+dx)\right)-\frac{2ia}{b}\right)}{ad}$$

$$\downarrow 217$$

$$\frac{x}{a}-\frac{2b\operatorname{arctanh}\left(\frac{b\tanh\left(\frac{1}{2}(c+dx)\right)}{2\sqrt{a^2+b^2}}\right)}{ad\sqrt{a^2+b^2}}$$

input
```
Int[(a + b*Csch[c + d*x])^(-1),x]
```

output
```
x/a - (2*b*ArcTanh[(b*Tanh[(c + d*x)/2])/(2*Sqrt[a^2 + b^2])])/(a*Sqrt[a^2
 + b^2]*d)
```

#### 3.74.3.1 Defintions of rubi rules used

rule 217
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(-(Rt[-a, 2]*Rt[-b, 2])^(
-1))*ArcTan[Rt[-b, 2]*(x/Rt[-a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] &
& (LtQ[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4270
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(-1), x_Symbol] :> Simp[x/a, x]
- Simp[1/a   Int[1/(1 + (a/b)*Sin[c + d*x]), x], x] /; FreeQ[{a, b, c, d},
x] && NeQ[a^2 - b^2, 0]
```

### 3.74.4 Maple [A] (verified)

Time = 0.32 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.52

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{\frac{\ln\left(1+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{a}-\frac{\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)-1\right)}{a}+\frac{2b\ \operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}}{d}$ | 82 |
| default | $\frac{\frac{\ln\left(1+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{a}-\frac{\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)-1\right)}{a}+\frac{2b\ \operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}}{d}$ | 82 |
| risch | $\frac{x}{a}+\frac{b\ln\left(e^{dx+c}+\frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,da}-\frac{b\ln\left(e^{dx+c}+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,da}$ | 124 |

input
```
int(1/(a+b*csch(d*x+c)),x,method=_RETURNVERBOSE)
```

output
```
1/d*(1/a*ln(1+tanh(1/2*d*x+1/2*c))-1/a*ln(tanh(1/2*d*x+1/2*c)-1)+2*b/a/(a^
2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*d*x+1/2*c)+2*a)/(a^2+b^2)^(1/2)))
```

### 3.74.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 186 vs. $2(51) = 102$.

Time = 0.27 (sec) , antiderivative size = 186, normalized size of antiderivative = 3.44

$$\int \frac{1}{a + b\operatorname{csch}(c + dx)}\,dx$$
$$= \frac{(a^2+b^2)dx + \sqrt{a^2+b^2}b\log\left(\frac{a^2\cosh(dx+c)^2+a^2\sinh(dx+c)^2+2\,ab\cosh(dx+c)+a^2+2\,b^2+2\,(a^2\cosh(dx+c)+ab)\sinh(dx+c)+2\sqrt{a^2}}{a\cosh(dx+c)^2+a\sinh(dx+c)^2+2\,b\cosh(dx+c)+2\,(a\cosh(dx+c)+b)\sinh(}\right.}{(a^3+ab^2)d}$$

input
```
integrate(1/(a+b*csch(d*x+c)),x, algorithm="fricas")
```

output
```
((a^2 + b^2)*d*x + sqrt(a^2 + b^2)*b*log((a^2*cosh(d*x + c)^2 + a^2*sinh(d
*x + c)^2 + 2*a*b*cosh(d*x + c) + a^2 + 2*b^2 + 2*(a^2*cosh(d*x + c) + a*b
)*sinh(d*x + c) + 2*sqrt(a^2 + b^2)*(a*cosh(d*x + c) + a*sinh(d*x + c) + b
))/(a*cosh(d*x + c)^2 + a*sinh(d*x + c)^2 + 2*b*cosh(d*x + c) + 2*(a*cosh(
d*x + c) + b)*sinh(d*x + c) - a)))/((a^3 + a*b^2)*d)
```

### 3.74.6 Sympy [F]

$$\int \frac{1}{a + b\operatorname{csch}(c + dx)}\,dx = \int \frac{1}{a + b\,\operatorname{csch}\left(c + dx\right)}\,dx$$

input
```
integrate(1/(a+b*csch(d*x+c)),x)
```

output
```
Integral(1/(a + b*csch(c + d*x)), x)
```

### 3.74.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 85, normalized size of antiderivative = 1.57

$$\int \frac{1}{a+b\text{csch}(c+dx)}\,dx = -\frac{b\log\left(\frac{ae^{(-dx-c)}-b-\sqrt{a^2+b^2}}{ae^{(-dx-c)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}ad} + \frac{dx+c}{ad}$$

input
```
integrate(1/(a+b*csch(d*x+c)),x, algorithm="maxima")
```

output
```
-b*log((a*e^(-d*x - c) - b - sqrt(a^2 + b^2))/(a*e^(-d*x - c) - b + sqrt(a
^2 + b^2)))/(sqrt(a^2 + b^2)*a*d) + (d*x + c)/(a*d)
```

### 3.74.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.56

$$\int \frac{1}{a+b\text{csch}(c+dx)}\,dx = -\frac{\frac{b\log\left(\frac{\left|2ae^{(dx+c)}+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^{(dx+c)}+2b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}a} - \frac{dx+c}{a}}{d}$$

input
```
integrate(1/(a+b*csch(d*x+c)),x, algorithm="giac")
```

output
```
-(b*log(abs(2*a*e^(d*x + c) + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^(d*x + c)
 + 2*b + 2*sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a) - (d*x + c)/a)/d
```

### 3.74.9 Mupad [B] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 121, normalized size of antiderivative = 2.24

$$\int \frac{1}{a+b\text{csch}(c+dx)}\,dx = \frac{x}{a} - \frac{b\,\ln\left(\frac{2\,b\,e^{c+d\,x}}{a^2} - \frac{2\,b\,\left(a-b\,e^{c+d\,x}\right)}{a^2\,\sqrt{a^2+b^2}}\right)}{a\,d\,\sqrt{a^2+b^2}} + \frac{b\,\ln\left(\frac{2\,b\,e^{c+d\,x}}{a^2} + \frac{2\,b\,\left(a-b\,e^{c+d\,x}\right)}{a^2\,\sqrt{a^2+b^2}}\right)}{a\,d\,\sqrt{a^2+b^2}}$$

input
```
int(1/(a + b/sinh(c + d*x)),x)
```

output
```
x/a - (b*log((2*b*exp(c + d*x))/a^2 - (2*b*(a - b*exp(c + d*x)))/(a^2*(a^2
 + b^2)^(1/2))))/(a*d*(a^2 + b^2)^(1/2)) + (b*log((2*b*exp(c + d*x))/a^2 +
 (2*b*(a - b*exp(c + d*x)))/(a^2*(a^2 + b^2)^(1/2))))/(a*d*(a^2 + b^2)^(1/
2))
```

# 3.75 $\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx$


3.75.1 Optimal result . . . . . 499
3.75.2 Mathematica [A] (verified) . . . . . 499
3.75.3 Rubi [A] (warning: unable to verify) . . . . . 500
3.75.4 Maple [A] (verified) . . . . . 503
3.75.5 Fricas [B] (verification not implemented) . . . . . 504
3.75.6 Sympy [F] . . . . . 505
3.75.7 Maxima [A] (verification not implemented) . . . . . 505
3.75.8 Giac [A] (verification not implemented) . . . . . 505
3.75.9 Mupad [B] (verification not implemented) . . . . . 506


## 3.75.1 Optimal result

Integrand size = 12, antiderivative size = 101

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx = \frac{x}{a^2} + \frac{2b(2a^2+b^2)\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{1}{2}(c+dx)\right)}{\sqrt{a^2+b^2}}\right)}{a^2\left(a^2+b^2\right)^{3/2}d} - \frac{b^2\coth(c+dx)}{a\left(a^2+b^2\right)d(a+b\operatorname{csch}(c+dx))}$$

output
```
x/a^2+2*b*(2*a^2+b^2)*arctanh((a-b*tanh(1/2*d*x+1/2*c))/(a^2+b^2)^(1/2))/a
^2/(a^2+b^2)^(3/2)/d-b^2*coth(d*x+c)/a/(a^2+b^2)/d/(a+b*csch(d*x+c))
```

## 3.75.2 Mathematica [A] (verified)

Time = 0.40 (sec) , antiderivative size = 142, normalized size of antiderivative = 1.41

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx = \frac{\operatorname{csch}(c+dx)\left(-\frac{ab^2\coth(c+dx)}{a^2+b^2} + (c+dx)(a+b\operatorname{csch}(c+dx)) + \frac{2b(2a^2+b^2)\arctan\left(\frac{a-b\tanh\left(\frac{1}{2}(c+dx)\right)}{\sqrt{-a^2-b^2}}\right)(a+b\operatorname{csch}(c+dx)}{(-a^2-b^2)^{3/2}}\right.}{a^2d(a+b\operatorname{csch}(c+dx))^2}$$

input
```
Integrate[(a + b*Csch[c + d*x])^(-2),x]
```

output
```
(Csch[c + d*x]*(-((a*b^2*Coth[c + d*x])/(a^2 + b^2)) + (c + d*x)*(a + b*Cs
ch[c + d*x]) + (2*b*(2*a^2 + b^2)*ArcTan[(a - b*Tanh[(c + d*x)/2])/Sqrt[-a
^2 - b^2]]*(a + b*Csch[c + d*x]))/(-a^2 - b^2)^(3/2))*(b + a*Sinh[c + d*x]
))/(a^2*d*(a + b*Csch[c + d*x])^2)
```

### 3.75.3 Rubi [A] (warning: unable to verify)

Time = 0.66 (sec) , antiderivative size = 121, normalized size of antiderivative = 1.20, number of steps used = 14, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.083$, Rules used = {3042, 4272, 25, 3042, 4407, 26, 3042, 26, 4318, 3042, 3139, 1083, 217}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{(a+ib\csc(ic+idx))^2}\,dx$$
$$\downarrow 4272$$
$$-\frac{\int -\frac{a^2-b\operatorname{csch}(c+dx)a+b^2}{a+b\operatorname{csch}(c+dx)}\,dx}{a\left(a^2+b^2\right)} - \frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}$$
$$\downarrow 25$$
$$\frac{\int \frac{a^2-b\operatorname{csch}(c+dx)a+b^2}{a+b\operatorname{csch}(c+dx)}\,dx}{a\left(a^2+b^2\right)} - \frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}$$
$$\downarrow 3042$$
$$-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))} + \frac{\int \frac{a^2-ib\csc(ic+idx)a+b^2}{a+ib\csc(ic+idx)}\,dx}{a\left(a^2+b^2\right)}$$
$$\downarrow 4407$$
$$-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))} + \frac{\frac{x\left(a^2+b^2\right)}{a} - \frac{ib\left(2a^2+b^2\right)\int -\frac{i\operatorname{csch}(c+dx)}{a+b\operatorname{csch}(c+dx)}\,dx}{a}}{a\left(a^2+b^2\right)}$$
$$\downarrow 26$$

$$\frac{\frac{x\left(a^2+b^2\right)}{a}-\frac{b\left(2a^2+b^2\right)\int\frac{\operatorname{csch}(c+dx)}{a+b\operatorname{csch}(c+dx)}dx}{a}}{a\left(a^2+b^2\right)}-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}$$

$$\downarrow 3042$$

$$-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{\frac{x\left(a^2+b^2\right)}{a}-\frac{b\left(2a^2+b^2\right)\int\frac{i\csc(ic+idx)}{a+ib\csc(ic+idx)}dx}{a}}{a\left(a^2+b^2\right)}$$

$$\downarrow 26$$

$$-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{\frac{x\left(a^2+b^2\right)}{a}-\frac{ib\left(2a^2+b^2\right)\int\frac{\csc(ic+idx)}{a+ib\csc(ic+idx)}dx}{a}}{a\left(a^2+b^2\right)}$$

$$\downarrow 4318$$

$$\frac{\frac{x\left(a^2+b^2\right)}{a}-\frac{\left(2a^2+b^2\right)\int\frac{1}{\frac{a\sinh(c+dx)}{b}+1}dx}{a}}{a\left(a^2+b^2\right)}-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}$$

$$\downarrow 3042$$

$$-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{\frac{x\left(a^2+b^2\right)}{a}-\frac{\left(2a^2+b^2\right)\int\frac{1}{1-\frac{ia\sin(ic+idx)}{b}}dx}{a}}{a\left(a^2+b^2\right)}$$

$$\downarrow 3139$$

$$\frac{-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{x\left(a^2+b^2\right)}{a}+\frac{2i\left(2a^2+b^2\right)\int\frac{1}{-\tanh^2\left(\frac{1}{2}(c+dx)\right)+\frac{2a\tanh\left(\frac{1}{2}(c+dx)\right)}{b}+1}d\left(i\tanh\left(\frac{1}{2}(c+dx)\right)\right)}{ad}}{a\left(a^2+b^2\right)}$$

$$\downarrow 1083$$

$$\frac{-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{x\left(a^2+b^2\right)}{a}-\frac{4i\left(2a^2+b^2\right)\int\frac{1}{\tanh^2\left(\frac{1}{2}(c+dx)\right)-4\left(\frac{a^2}{b^2}+1\right)}d\left(2i\tanh\left(\frac{1}{2}(c+dx)\right)-\frac{2ia}{b}\right)}{ad}}{a\left(a^2+b^2\right)}$$

$$\downarrow 217$$

$$\frac{\frac{x\left(a^2+b^2\right)}{a}-\frac{2b\left(2a^2+b^2\right)\operatorname{arctanh}\left(\frac{b\tanh\left(\frac{1}{2}(c+dx)\right)}{2\sqrt{a^2+b^2}}\right)}{ad\sqrt{a^2+b^2}}}{a\left(a^2+b^2\right)}-\frac{b^2\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}$$

input
```
Int[(a + b*Csch[c + d*x])^(-2),x]
```

output
```
(((a^2 + b^2)*x)/a - (2*b*(2*a^2 + b^2)*ArcTanh[(b*Tanh[(c + d*x)/2])/(2*S
qrt[a^2 + b^2])])/(a*Sqrt[a^2 + b^2]*d))/(a*(a^2 + b^2)) - (b^2*Coth[c + d
*x])/(a*(a^2 + b^2)*d*(a + b*Csch[c + d*x]))
```

### 3.75.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 217
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(-(Rt[-a, 2]*Rt[-b, 2])^(
-1))*ArcTan[Rt[-b, 2]*(x/Rt[-a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] &
& (LtQ[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4272
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[b^2*Cot[
c + d*x]*((a + b*Csc[c + d*x])^(n + 1)/(a*d*(n + 1)*(a^2 - b^2))), x] + Sim
p[1/(a*(n + 1)*(a^2 - b^2))   Int[(a + b*Csc[c + d*x])^(n + 1)*Simp[(a^2 -
b^2)*(n + 1) - a*b*(n + 1)*Csc[c + d*x] + b^2*(n + 2)*Csc[c + d*x]^2, x], x
], x] /; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && LtQ[n, -1] && Integ
erQ[2*n]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

rule 4407
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.) + (c_))/(csc[(e_.) + (f_.)*(x_)]*(b_.) +
 (a_)), x_Symbol] :> Simp[c*(x/a), x] - Simp[(b*c - a*d)/a   Int[Csc[e + f*
x]/(a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c
- a*d, 0]
```

### 3.75.4 Maple [A] (verified)

Time = 0.34 (sec) , antiderivative size = 176, normalized size of antiderivative = 1.74

| method | result |
|---|---|
| derivativedivides | $\frac{\ln\left(1+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{a^2}-\frac{\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)-1\right)}{a^2}-\frac{2b\left(\frac{\frac{\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)a^2}{2a^2+2b^2}+\frac{ab}{2a^2+2b^2}}{-\frac{\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2 b}{2}+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)a+\frac{b}{2}}-\frac{2\left(2a^2+b^2\right)\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)+a}{2\sqrt{a^2+b^2}}\right)}{\left(2a^2+2b^2\right)\sqrt{a^2+b^2}}\right)}{a^2}}{d}$ |
| default | $\frac{\ln\left(1+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{a^2}-\frac{\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)-1\right)}{a^2}-\frac{2b\left(\frac{\frac{\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)a^2}{2a^2+2b^2}+\frac{ab}{2a^2+2b^2}}{-\frac{\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2 b}{2}+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)a+\frac{b}{2}}-\frac{2\left(2a^2+b^2\right)\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)+a}{2\sqrt{a^2+b^2}}\right)}{\left(2a^2+2b^2\right)\sqrt{a^2+b^2}}\right)}{a^2}}{d}$ |
| risch | $\frac{x}{a^2}-\frac{2b^2\left(-\mathrm{e}^{dx+c}b+a\right)}{d\,a^2(a^2+b^2)\left(\mathrm{e}^{2dx+2c}a+2\,\mathrm{e}^{dx+c}b-a\right)}+\frac{2b\ln\left(\mathrm{e}^{dx+c}+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}b+a^4+2a^2b^2+b^4}{a\left(a^2+b^2\right)^{\frac{3}{2}}}\right)}{(a^2+b^2)^{\frac{3}{2}}d}+\frac{b^3\ln\left(\mathrm{e}^{dx+c}+\frac{\left(a^2+b^2\right)}{a}\right.}{(a^2+b^2)^{\frac{3}{2}}}$ |

input
```
int(1/(a+b*csch(d*x+c))^2,x,method=_RETURNVERBOSE)
```

output
```
1/d*(1/a^2*ln(1+tanh(1/2*d*x+1/2*c))-1/a^2*ln(tanh(1/2*d*x+1/2*c)-1)-2/a^2
*b*((1/2*a^2/(a^2+b^2)*tanh(1/2*d*x+1/2*c)+1/2*b*a/(a^2+b^2))/(-1/2*tanh(1
/2*d*x+1/2*c)^2*b+tanh(1/2*d*x+1/2*c)*a+1/2*b)-2*(2*a^2+b^2)/(2*a^2+2*b^2)
/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*d*x+1/2*c)+2*a)/(a^2+b^2)^(1/2
))))
```

### 3.75.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 645 vs. $2(98) = 196$.

Time $= 0.28$ (sec) , antiderivative size $= 645$, normalized size of antiderivative $= 6.39$

$$\int \frac{1}{(a + b\operatorname{csch}(c + dx))^2}\,dx =$$
$$-\frac{2\,a^3b^2 + 2\,ab^4 - (a^5 + 2\,a^3b^2 + ab^4)dx\cosh(dx + c)^2 - (a^5 + 2\,a^3b^2 + ab^4)dx\sinh(dx + c)^2 + (a^5 + 2\,a$$

input
```
integrate(1/(a+b*csch(d*x+c))^2,x, algorithm="fricas")
```

output
```
-(2*a^3*b^2 + 2*a*b^4 - (a^5 + 2*a^3*b^2 + a*b^4)*d*x*cosh(d*x + c)^2 - (a
^5 + 2*a^3*b^2 + a*b^4)*d*x*sinh(d*x + c)^2 + (a^5 + 2*a^3*b^2 + a*b^4)*d*
x + (2*a^3*b + a*b^3 - (2*a^3*b + a*b^3)*cosh(d*x + c)^2 - (2*a^3*b + a*b^
3)*sinh(d*x + c)^2 - 2*(2*a^2*b^2 + b^4)*cosh(d*x + c) - 2*(2*a^2*b^2 + b^
4 + (2*a^3*b + a*b^3)*cosh(d*x + c))*sinh(d*x + c))*sqrt(a^2 + b^2)*log((a
^2*cosh(d*x + c)^2 + a^2*sinh(d*x + c)^2 + 2*a*b*cosh(d*x + c) + a^2 + 2*b
^2 + 2*(a^2*cosh(d*x + c) + a*b)*sinh(d*x + c) + 2*sqrt(a^2 + b^2)*(a*cosh
(d*x + c) + a*sinh(d*x + c) + b))/(a*cosh(d*x + c)^2 + a*sinh(d*x + c)^2 +
 2*b*cosh(d*x + c) + 2*(a*cosh(d*x + c) + b)*sinh(d*x + c) - a)) - 2*(a^2*
b^3 + b^5 + (a^4*b + 2*a^2*b^3 + b^5)*d*x)*cosh(d*x + c) - 2*(a^2*b^3 + b^
5 + (a^5 + 2*a^3*b^2 + a*b^4)*d*x*cosh(d*x + c) + (a^4*b + 2*a^2*b^3 + b^5
)*d*x)*sinh(d*x + c))/((a^7 + 2*a^5*b^2 + a^3*b^4)*d*cosh(d*x + c)^2 + (a^
7 + 2*a^5*b^2 + a^3*b^4)*d*sinh(d*x + c)^2 + 2*(a^6*b + 2*a^4*b^3 + a^2*b^
5)*d*cosh(d*x + c) - (a^7 + 2*a^5*b^2 + a^3*b^4)*d + 2*((a^7 + 2*a^5*b^2 +
 a^3*b^4)*d*cosh(d*x + c) + (a^6*b + 2*a^4*b^3 + a^2*b^5)*d)*sinh(d*x + c)
)
```

### 3.75.6 Sympy [F]

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx = \int \frac{1}{\left(a+b\,\operatorname{csch}\left(c+dx\right)\right)^2}\,dx$$

input
```
integrate(1/(a+b*csch(d*x+c))**2,x)
```

output
```
Integral((a + b*csch(c + d*x))**(-2), x)
```

### 3.75.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 187, normalized size of antiderivative = 1.85

$$\begin{aligned}\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx = &-\frac{(2\,a^2b+b^3)\log\left(\frac{ae^{(-dx-c)}-b-\sqrt{a^2+b^2}}{ae^{(-dx-c)}-b+\sqrt{a^2+b^2}}\right)}{(a^4+a^2b^2)\sqrt{a^2+b^2}d}\\ &-\frac{2\left(b^3e^{(-dx-c)}+ab^2\right)}{(a^5+a^3b^2+2\left(a^4b+a^2b^3\right)e^{(-dx-c)}-\left(a^5+a^3b^2\right)e^{(-2\,dx-2\,c)})d}\\ &+\frac{dx+c}{a^2d}\end{aligned}$$

input
```
integrate(1/(a+b*csch(d*x+c))^2,x, algorithm="maxima")
```

output
```
-(2*a^2*b + b^3)*log((a*e^(-d*x - c) - b - sqrt(a^2 + b^2))/(a*e^(-d*x - c
) - b + sqrt(a^2 + b^2)))/((a^4 + a^2*b^2)*sqrt(a^2 + b^2)*d) - 2*(b^3*e^(
-d*x - c) + a*b^2)/((a^5 + a^3*b^2 + 2*(a^4*b + a^2*b^3)*e^(-d*x - c) - (a
^5 + a^3*b^2)*e^(-2*d*x - 2*c))*d) + (d*x + c)/(a^2*d)
```

### 3.75.8 Giac [A] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 161, normalized size of antiderivative = 1.59

$$\begin{aligned}&\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx\\ &= -\frac{\frac{(2\,a^2b+b^3)\log\left(\frac{\left|2\,ae^{(dx+c)}+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^{(dx+c)}+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{(a^4+a^2b^2)\sqrt{a^2+b^2}}-\frac{2\left(b^3e^{(dx+c)}-ab^2\right)}{(a^4+a^2b^2)\left(ae^{(2\,dx+2\,c)}+2\,be^{(dx+c)}-a\right)}-\frac{dx+c}{a^2}}{d}\end{aligned}$$

input
```
integrate(1/(a+b*csch(d*x+c))^2,x, algorithm="giac")
```

output
```
-((2*a^2*b + b^3)*log(abs(2*a*e^(d*x + c) + 2*b - 2*sqrt(a^2 + b^2))/abs(2
*a*e^(d*x + c) + 2*b + 2*sqrt(a^2 + b^2)))/((a^4 + a^2*b^2)*sqrt(a^2 + b^2
)) - 2*(b^3*e^(d*x + c) - a*b^2)/((a^4 + a^2*b^2)*(a*e^(2*d*x + 2*c) + 2*b
*e^(d*x + c) - a)) - (d*x + c)/a^2)/d
```

### 3.75.9 Mupad [B] (verification not implemented)

Time = 2.72 (sec) , antiderivative size = 269, normalized size of antiderivative = 2.66

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^2}\,dx = \frac{x}{a^2} - \frac{\frac{2b^2}{d\,(a^3+a\,b^2)} - \frac{2\,b^3\,\mathrm{e}^{c+d\,x}}{a\,d\,(a^3+a\,b^2)}}{2\,b\,\mathrm{e}^{c+d\,x} - a + a\,\mathrm{e}^{2\,c+2\,d\,x}} - \frac{b\,\ln\left(\frac{2\,\mathrm{e}^{c+d\,x}\,\left(2\,a^2\,b+b^3\right)}{a^3\,\left(a^2+b^2\right)} - \frac{2\,b\,\left(2\,a^2+b^2\right)\,\left(a-b\,\mathrm{e}^{c+d\,x}\right)}{a^3\,\left(a^2+b^2\right)^{3/2}}\right)\,\left(2\,a^2+b^2\right)}{a^2\,d\,\left(a^2+b^2\right)^{3/2}} + \frac{b\,\ln\left(\frac{2\,\mathrm{e}^{c+d\,x}\,\left(2\,a^2\,b+b^3\right)}{a^3\,\left(a^2+b^2\right)} + \frac{2\,b\,\left(2\,a^2+b^2\right)\,\left(a-b\,\mathrm{e}^{c+d\,x}\right)}{a^3\,\left(a^2+b^2\right)^{3/2}}\right)\,\left(2\,a^2+b^2\right)}{a^2\,d\,\left(a^2+b^2\right)^{3/2}}$$

input
```
int(1/(a + b/sinh(c + d*x))^2,x)
```

output
```
x/a^2 - ((2*b^2)/(d*(a*b^2 + a^3)) - (2*b^3*exp(c + d*x))/(a*d*(a*b^2 + a^
3)))/(2*b*exp(c + d*x) - a + a*exp(2*c + 2*d*x)) - (b*log((2*exp(c + d*x)*
(2*a^2*b + b^3))/(a^3*(a^2 + b^2)) - (2*b*(2*a^2 + b^2)*(a - b*exp(c + d*x
)))/(a^3*(a^2 + b^2)^(3/2)))*(2*a^2 + b^2))/(a^2*d*(a^2 + b^2)^(3/2)) + (b
*log((2*exp(c + d*x)*(2*a^2*b + b^3))/(a^3*(a^2 + b^2)) + (2*b*(2*a^2 + b^
2)*(a - b*exp(c + d*x)))/(a^3*(a^2 + b^2)^(3/2)))*(2*a^2 + b^2))/(a^2*d*(a
^2 + b^2)^(3/2))
```

# 3.76 $\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx$

3.76.1 Optimal result . . . 507
3.76.2 Mathematica [A] (verified) . . . 507
3.76.3 Rubi [A] (warning: unable to verify) . . . 508
3.76.4 Maple [B] (verified) . . . 512
3.76.5 Fricas [B] (verification not implemented) . . . 513
3.76.6 Sympy [F] . . . 514
3.76.7 Maxima [B] (verification not implemented) . . . 514
3.76.8 Giac [A] (verification not implemented) . . . 515
3.76.9 Mupad [F(-1)] . . . 515

## 3.76.1 Optimal result

Integrand size = 12, antiderivative size = 163

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx = \frac{x}{a^3} + \frac{b(6a^4+5a^2b^2+2b^4)\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{1}{2}(c+dx)\right)}{\sqrt{a^2+b^2}}\right)}{a^3\left(a^2+b^2\right)^{5/2}d} - \frac{b^2\coth(c+dx)}{2a\left(a^2+b^2\right)d(a+b\operatorname{csch}(c+dx))^2} - \frac{b^2(5a^2+2b^2)\coth(c+dx)}{2a^2\left(a^2+b^2\right)^2 d(a+b\operatorname{csch}(c+dx))}$$

output

```
x/a^3+b*(6*a^4+5*a^2*b^2+2*b^4)*arctanh((a-b*tanh(1/2*d*x+1/2*c))/(a^2+b^2
)^(1/2))/a^3/(a^2+b^2)^(5/2)/d-1/2*b^2*coth(d*x+c)/a/(a^2+b^2)/d/(a+b*csch
(d*x+c))^2-1/2*b^2*(5*a^2+2*b^2)*coth(d*x+c)/a^2/(a^2+b^2)^2/d/(a+b*csch(d
*x+c))
```

## 3.76.2 Mathematica [A] (verified)

Time = 1.29 (sec) , antiderivative size = 213, normalized size of antiderivative = 1.31

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx = \frac{\operatorname{csch}^2(c+dx)(b+a\sinh(c+dx))\left(\frac{ab^3\coth(c+dx)}{a^2+b^2} - \frac{3ab^2\left(2a^2+b^2\right)\coth(c+dx)(b+a\sinh(c+dx))}{\left(a^2+b^2\right)^2} + 2(c+dx)\operatorname{csch}(c+\right.}{2a^3d(a+b\operatorname{csch}(c+$$

input
```
Integrate[(a + b*Csch[c + d*x])^(-3),x]
```

output
```
(Csch[c + d*x]^2*(b + a*Sinh[c + d*x])*((a*b^3*Coth[c + d*x])/(a^2 + b^2)
- (3*a*b^2*(2*a^2 + b^2)*Coth[c + d*x]*(b + a*Sinh[c + d*x]))/(a^2 + b^2)^
2 + 2*(c + d*x)*Csch[c + d*x]*(b + a*Sinh[c + d*x])^2 - (2*b*(6*a^4 + 5*a^
2*b^2 + 2*b^4)*ArcTan[(a - b*Tanh[(c + d*x)/2])/Sqrt[-a^2 - b^2]]*Csch[c +
 d*x]*(b + a*Sinh[c + d*x])^2)/(-a^2 - b^2)^(5/2)))/(2*a^3*d*(a + b*Csch[c
 + d*x])^3)
```

### 3.76.3 Rubi [A] (warning: unable to verify)

Time = 1.06 (sec) , antiderivative size = 202, normalized size of antiderivative = 1.24, number of steps used = 17, number of rules used = 16, $\frac{\text{number of rules}}{\text{integrand size}} = 1.333$, Rules used = {3042, 4272, 25, 3042, 4548, 25, 3042, 4407, 26, 3042, 26, 4318, 3042, 3139, 1083, 217}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{(a+ib\csc(ic+idx))^3}\,dx$$

$$\downarrow 4272$$

$$-\frac{\int -\frac{b^2\operatorname{csch}^2(c+dx)-2ab\operatorname{csch}(c+dx)+2\left(a^2+b^2\right)}{(a+b\operatorname{csch}(c+dx))^2}\,dx}{2a\left(a^2+b^2\right)} - \frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}$$

$$\downarrow 25$$

$$\frac{\int \frac{b^2\operatorname{csch}^2(c+dx)-2ab\operatorname{csch}(c+dx)+2\left(a^2+b^2\right)}{(a+b\operatorname{csch}(c+dx))^2}\,dx}{2a\left(a^2+b^2\right)} - \frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}$$

$$\downarrow 3042$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2} + \frac{\int \frac{-b^2\csc(ic+idx)^2-2iab\csc(ic+idx)+2\left(a^2+b^2\right)}{(a+ib\csc(ic+idx))^2}\,dx}{2a\left(a^2+b^2\right)}$$

$$\downarrow 4548$$

$$\frac{-\frac{\int -\frac{2\left(a^2+b^2\right)^2-ab\left(4a^2+b^2\right)\operatorname{csch}(c+dx)}{a+b\operatorname{csch}(c+dx)}dx}{a\left(a^2+b^2\right)}-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}}{2a\left(a^2+b^2\right)}-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}$$

$$\downarrow 25$$

$$\frac{\frac{\int \frac{2\left(a^2+b^2\right)^2-ab\left(4a^2+b^2\right)\operatorname{csch}(c+dx)}{a+b\operatorname{csch}(c+dx)}dx}{a\left(a^2+b^2\right)}-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}}{2a\left(a^2+b^2\right)}-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}$$

$$\downarrow 3042$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}+\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}+\frac{\int \frac{2\left(a^2+b^2\right)^2-iab\left(4a^2+b^2\right)\csc(ic+idx)}{a+ib\csc(ic+idx)}dx}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 4407$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}+$$

$$\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}+\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{ib\left(6a^4+5a^2b^2+2b^4\right)\int -\frac{i\operatorname{csch}(c+dx)}{a+b\operatorname{csch}(c+dx)}dx}{a}}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 26$$

$$\frac{\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{b\left(6a^4+5a^2b^2+2b^4\right)\int \frac{\operatorname{csch}(c+dx)}{a+b\operatorname{csch}(c+dx)}dx}{a}}{a\left(a^2+b^2\right)}-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}}{2a\left(a^2+b^2\right)}-$$

$$\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}$$

$$\downarrow 3042$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}+$$

$$\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}+\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{b\left(6a^4+5a^2b^2+2b^4\right)\int \frac{i\csc(ic+idx)}{a+ib\csc(ic+idx)}dx}{a}}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 26$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))^2}+$$

$$\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)(a+b\operatorname{csch}(c+dx))}+\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{ib\left(6a^4+5a^2b^2+2b^4\right)\int \frac{\csc(ic+idx)}{a+ib\csc(ic+idx)}dx}{a}}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 4318$$

$$\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{\left(6a^4+5a^2b^2+2b^4\right)\int\frac{1}{\frac{a\sinh(c+dx)}{b}+1}dx}{a}}{a\left(a^2+b^2\right)}-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)^2}$$

$$\downarrow 3042$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)^2}+\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{\left(6a^4+5a^2b^2+2b^4\right)\int\frac{1}{1-\frac{ia\sin(ic+idx)}{b}}dx}{a}}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 3139$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)^2}+\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{\frac{2x\left(a^2+b^2\right)^2}{a}+\frac{2i\left(6a^4+5a^2b^2+2b^4\right)\int\frac{1}{-\tanh^2\left(\frac{1}{2}(c+dx)\right)+\frac{2a\tanh\left(\frac{1}{2}(c+dx)\right)}{b}+1}d\left(i\tanh\left(\frac{1}{2}(c+dx)\right)\right)}{ad}}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 1083$$

$$-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)^2}+\frac{-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}+\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{4i\left(6a^4+5a^2b^2+2b^4\right)\int\frac{1}{\tanh^2\left(\frac{1}{2}(c+dx)\right)-4\left(\frac{a^2}{b^2}+1\right)}d\left(2i\tanh\left(\frac{1}{2}(c+dx)\right)-\frac{2ia}{b}\right)}{ad}}{a\left(a^2+b^2\right)}}{2a\left(a^2+b^2\right)}$$

$$\downarrow 217$$

$$\frac{\frac{2x\left(a^2+b^2\right)^2}{a}-\frac{2b\left(6a^4+5a^2b^2+2b^4\right)\operatorname{arctanh}\left(\frac{b\tanh\left(\frac{1}{2}(c+dx)\right)}{2\sqrt{a^2+b^2}}\right)}{ad\sqrt{a^2+b^2}}}{a\left(a^2+b^2\right)}-\frac{b^2\left(5a^2+2b^2\right)\coth(c+dx)}{ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)}-\frac{b^2\coth(c+dx)}{2ad\left(a^2+b^2\right)\left(a+b\operatorname{csch}(c+dx)\right)^2}$$

input
```
Int[(a + b*Csch[c + d*x])^(-3),x]
```

output
```
-1/2*(b^2*Coth[c + d*x])/(a*(a^2 + b^2)*d*(a + b*Csch[c + d*x])^2) + (((2*
(a^2 + b^2)^2*x)/a - (2*b*(6*a^4 + 5*a^2*b^2 + 2*b^4)*ArcTanh[(b*Tanh[(c +
 d*x)/2])/(2*Sqrt[a^2 + b^2])])/(a*Sqrt[a^2 + b^2]*d))/(a*(a^2 + b^2)) - (
b^2*(5*a^2 + 2*b^2)*Coth[c + d*x])/(a*(a^2 + b^2)*d*(a + b*Csch[c + d*x]))
)/(2*a*(a^2 + b^2))
```

### 3.76.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 217
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(-(Rt[-a, 2]*Rt[-b, 2])^(
-1))*ArcTan[Rt[-b, 2]*(x/Rt[-a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] &
& (LtQ[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4272
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_), x_Symbol] :> Simp[b^2*Cot[
c + d*x]*((a + b*Csc[c + d*x])^(n + 1)/(a*d*(n + 1)*(a^2 - b^2))), x] + Sim
p[1/(a*(n + 1)*(a^2 - b^2))   Int[(a + b*Csc[c + d*x])^(n + 1)*Simp[(a^2 -
b^2)*(n + 1) - a*b*(n + 1)*Csc[c + d*x] + b^2*(n + 2)*Csc[c + d*x]^2, x], x
], x] /; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && LtQ[n, -1] && Integ
erQ[2*n]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

rule 4407
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.) + (c_))/(csc[(e_.) + (f_.)*(x_)]*(b_.) +
 (a_)), x_Symbol] :> Simp[c*(x/a), x] - Simp[(b*c - a*d)/a   Int[Csc[e + f*
x]/(a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c
- a*d, 0]
```

rule 4548
```
Int[((A_.) + csc[(e_.) + (f_.)*(x_)]*(B_.) + csc[(e_.) + (f_.)*(x_)]^2*(C_.
))*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_))^(m_), x_Symbol] :> Simp[(A*b^2 -
a*b*B + a^2*C)*Cot[e + f*x]*((a + b*Csc[e + f*x])^(m + 1)/(a*f*(m + 1)*(a^2
 - b^2))), x] + Simp[1/(a*(m + 1)*(a^2 - b^2))   Int[(a + b*Csc[e + f*x])^(
m + 1)*Simp[A*(a^2 - b^2)*(m + 1) - a*(A*b - a*B + b*C)*(m + 1)*Csc[e + f*x
] + (A*b^2 - a*b*B + a^2*C)*(m + 2)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a,
 b, e, f, A, B, C}, x] && NeQ[a^2 - b^2, 0] && LtQ[m, -1]
```

### 3.76.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 327 vs. $2(154) = 308$.

Time = 0.51 (sec) , antiderivative size = 328, normalized size of antiderivative = 2.01

| method | result |
|---|---|
| derivativedivides | $-\frac{\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)-1\right)}{a^3}+\frac{\ln\left(1+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{a^3}-\frac{2b\left(-\frac{b\,a^2\left(4a^2+b^2\right)\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^3}{2\left(a^4+2a^2b^2+b^4\right)}+\frac{4a\left(10a^4-a^2b^2-2b^4\right)\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2}{8a^4+16a^2b^2+8b^4}+\frac{4a^2}{\left(-\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2b+2\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right.}\right.}{d}$ |
| default | $-\frac{\ln\left(\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)-1\right)}{a^3}+\frac{\ln\left(1+\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{a^3}-\frac{2b\left(-\frac{b\,a^2\left(4a^2+b^2\right)\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^3}{2\left(a^4+2a^2b^2+b^4\right)}+\frac{4a\left(10a^4-a^2b^2-2b^4\right)\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2}{8a^4+16a^2b^2+8b^4}+\frac{4a^2}{\left(-\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)^2b+2\tanh\left(\frac{dx}{2}+\frac{c}{2}\right)\right.}\right.}{d}$ |
| risch | $\frac{x}{a^3}-\frac{b^2\left(-7a^3b\,\mathrm{e}^{3dx+3c}-4a\,b^3\mathrm{e}^{3dx+3c}+6a^4\mathrm{e}^{2dx+2c}-9a^2b^2\mathrm{e}^{2dx+2c}-6b^4\mathrm{e}^{2dx+2c}+17a^3b\,\mathrm{e}^{dx+c}+8\,\mathrm{e}^{dx+c}a\,b^3-6a^4-3a^2\right.}{a^3(a^2+b^2)^2d\left(\mathrm{e}^{2dx+2c}a+2\,\mathrm{e}^{dx+c}b-a\right)^2}$ |

input
```
int(1/(a+b*csch(d*x+c))^3,x,method=_RETURNVERBOSE)
```

output
```
1/d*(-1/a^3*ln(tanh(1/2*d*x+1/2*c)-1)+1/a^3*ln(1+tanh(1/2*d*x+1/2*c))-2/a^
3*b*(4*(-1/8*b*a^2*(4*a^2+b^2)/(a^4+2*a^2*b^2+b^4)*tanh(1/2*d*x+1/2*c)^3+1
/8*a*(10*a^4-a^2*b^2-2*b^4)/(a^4+2*a^2*b^2+b^4)*tanh(1/2*d*x+1/2*c)^2+1/8*
a^2*b*(16*a^2+7*b^2)/(a^4+2*a^2*b^2+b^4)*tanh(1/2*d*x+1/2*c)+1/8*a*b^2*(5*
a^2+2*b^2)/(a^4+2*a^2*b^2+b^4))/(-tanh(1/2*d*x+1/2*c)^2*b+2*tanh(1/2*d*x+1
/2*c)*a+b)^2-2*(6*a^4+5*a^2*b^2+2*b^4)/(4*a^4+8*a^2*b^2+4*b^4)/(a^2+b^2)^(
1/2)*arctanh(1/2*(-2*b*tanh(1/2*d*x+1/2*c)+2*a)/(a^2+b^2)^(1/2))))
```

### 3.76.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2094 vs. $2(156) = 312$.

Time $= 0.32$ (sec) , antiderivative size $= 2094$, normalized size of antiderivative $= 12.85$

$$\int \frac{1}{(a + b\operatorname{csch}(c + dx))^3}\, dx = \text{Too large to display}$$

input
```
integrate(1/(a+b*csch(d*x+c))^3,x, algorithm="fricas")
```

output
```
1/2*(12*a^6*b^2 + 18*a^4*b^4 + 6*a^2*b^6 + 2*(a^8 + 3*a^6*b^2 + 3*a^4*b^4
+ a^2*b^6)*d*x*cosh(d*x + c)^4 + 2*(a^8 + 3*a^6*b^2 + 3*a^4*b^4 + a^2*b^6)
*d*x*sinh(d*x + c)^4 + 2*(7*a^5*b^3 + 11*a^3*b^5 + 4*a*b^7 + 4*(a^7*b + 3*
a^5*b^3 + 3*a^3*b^5 + a*b^7)*d*x)*cosh(d*x + c)^3 + 2*(7*a^5*b^3 + 11*a^3*
b^5 + 4*a*b^7 + 4*(a^8 + 3*a^6*b^2 + 3*a^4*b^4 + a^2*b^6)*d*x*cosh(d*x + c
) + 4*(a^7*b + 3*a^5*b^3 + 3*a^3*b^5 + a*b^7)*d*x)*sinh(d*x + c)^3 + 2*(a^
8 + 3*a^6*b^2 + 3*a^4*b^4 + a^2*b^6)*d*x - 2*(6*a^6*b^2 - 3*a^4*b^4 - 15*a
^2*b^6 - 6*b^8 + 2*(a^8 + a^6*b^2 - 3*a^4*b^4 - 5*a^2*b^6 - 2*b^8)*d*x)*co
sh(d*x + c)^2 - 2*(6*a^6*b^2 - 3*a^4*b^4 - 15*a^2*b^6 - 6*b^8 - 6*(a^8 + 3
*a^6*b^2 + 3*a^4*b^4 + a^2*b^6)*d*x*cosh(d*x + c)^2 + 2*(a^8 + a^6*b^2 - 3
*a^4*b^4 - 5*a^2*b^6 - 2*b^8)*d*x - 3*(7*a^5*b^3 + 11*a^3*b^5 + 4*a*b^7 +
4*(a^7*b + 3*a^5*b^3 + 3*a^3*b^5 + a*b^7)*d*x)*cosh(d*x + c))*sinh(d*x + c
)^2 + (6*a^6*b + 5*a^4*b^3 + 2*a^2*b^5 + (6*a^6*b + 5*a^4*b^3 + 2*a^2*b^5)
*cosh(d*x + c)^4 + (6*a^6*b + 5*a^4*b^3 + 2*a^2*b^5)*sinh(d*x + c)^4 + 4*(
6*a^5*b^2 + 5*a^3*b^4 + 2*a*b^6)*cosh(d*x + c)^3 + 4*(6*a^5*b^2 + 5*a^3*b^
4 + 2*a*b^6 + (6*a^6*b + 5*a^4*b^3 + 2*a^2*b^5)*cosh(d*x + c))*sinh(d*x +
c)^3 - 2*(6*a^6*b - 7*a^4*b^3 - 8*a^2*b^5 - 4*b^7)*cosh(d*x + c)^2 - 2*(6*
a^6*b - 7*a^4*b^3 - 8*a^2*b^5 - 4*b^7 - 3*(6*a^6*b + 5*a^4*b^3 + 2*a^2*b^5
)*cosh(d*x + c)^2 - 6*(6*a^5*b^2 + 5*a^3*b^4 + 2*a*b^6)*cosh(d*x + c))*sin
h(d*x + c)^2 - 4*(6*a^5*b^2 + 5*a^3*b^4 + 2*a*b^6)*cosh(d*x + c) - 4*(6...
```

### 3.76.6 Sympy [F]

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx = \int \frac{1}{\left(a+b\,\mathrm{csch}\left(c+dx\right)\right)^3}\,dx$$

input
```
integrate(1/(a+b*csch(d*x+c))**3,x)
```

output
```
Integral((a + b*csch(c + d*x))**(-3), x)
```

### 3.76.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 373 vs. 2(156) = 312.

Time = 0.31 (sec) , antiderivative size = 373, normalized size of antiderivative = 2.29

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx = -\frac{(6\,a^4b+5\,a^2b^3+2\,b^5)\log\left(\frac{ae^{(-dx-c)}-b-\sqrt{a^2+b^2}}{ae^{(-dx-c)}-b+\sqrt{a^2+b^2}}\right)}{2\,(a^7+2\,a^5b^2+a^3b^4)\sqrt{a^2+b^2}d}$$
$$-\frac{6\,a^4b^2+3\,a^2b^4+(17\,a^3b^3+8\,ab^5)e^{(-dx-c)}-3\,(2\,a^4b^2-3\,a^2b^4-2\,b^6)e^{(-2\,dx-2}}{(a^9+2\,a^7b^2+a^5b^4+4\,(a^8b+2\,a^6b^3+a^4b^5)e^{(-dx-c)}-2\,(a^9-3\,a^5b^4-2\,a^3b^6)e^{(-2\,dx-2\,c)}-4\,(a^8b+2\,a^6$$
$$+\frac{dx+c}{a^3d}$$

input
```
integrate(1/(a+b*csch(d*x+c))^3,x, algorithm="maxima")
```

output
```
-1/2*(6*a^4*b + 5*a^2*b^3 + 2*b^5)*log((a*e^(-d*x - c) - b - sqrt(a^2 + b^
2))/(a*e^(-d*x - c) - b + sqrt(a^2 + b^2)))/((a^7 + 2*a^5*b^2 + a^3*b^4)*s
qrt(a^2 + b^2)*d) - (6*a^4*b^2 + 3*a^2*b^4 + (17*a^3*b^3 + 8*a*b^5)*e^(-d*
x - c) - 3*(2*a^4*b^2 - 3*a^2*b^4 - 2*b^6)*e^(-2*d*x - 2*c) - (7*a^3*b^3 +
 4*a*b^5)*e^(-3*d*x - 3*c))/((a^9 + 2*a^7*b^2 + a^5*b^4 + 4*(a^8*b + 2*a^6
*b^3 + a^4*b^5)*e^(-d*x - c) - 2*(a^9 - 3*a^5*b^4 - 2*a^3*b^6)*e^(-2*d*x -
 2*c) - 4*(a^8*b + 2*a^6*b^3 + a^4*b^5)*e^(-3*d*x - 3*c) + (a^9 + 2*a^7*b^
2 + a^5*b^4)*e^(-4*d*x - 4*c))*d) + (d*x + c)/(a^3*d)
```

### 3.76.8 Giac [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 293, normalized size of antiderivative = 1.80

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx = \frac{(6a^4b+5a^2b^3+2b^5)\log\left(\frac{\left|2ae^{(dx+c)}+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^{(dx+c)}+2b+2\sqrt{a^2+b^2}\right|}\right)}{(a^7+2a^5b^2+a^3b^4)\sqrt{a^2+b^2}} - \frac{2\left(7a^3b^3e^{(3dx+3c)}+4ab^5e^{(3dx+3c)}-6a^4b^2e^{(2dx+2c)}+9a^2b^4e^{(2dx+2c)}+6b^6e^{(2c}\right.}{(a^7+2a^5b^2+a^3b^4)\left(ae^{(2dx+2c)}+2be^{(}\right.}$$
$$-\frac{}{2d}$$

input
```
integrate(1/(a+b*csch(d*x+c))^3,x, algorithm="giac")
```

output
```
-1/2*((6*a^4*b + 5*a^2*b^3 + 2*b^5)*log(abs(2*a*e^(d*x + c) + 2*b - 2*sqrt
(a^2 + b^2))/abs(2*a*e^(d*x + c) + 2*b + 2*sqrt(a^2 + b^2)))/((a^7 + 2*a^5
*b^2 + a^3*b^4)*sqrt(a^2 + b^2)) - 2*(7*a^3*b^3*e^(3*d*x + 3*c) + 4*a*b^5*
e^(3*d*x + 3*c) - 6*a^4*b^2*e^(2*d*x + 2*c) + 9*a^2*b^4*e^(2*d*x + 2*c) +
6*b^6*e^(2*d*x + 2*c) - 17*a^3*b^3*e^(d*x + c) - 8*a*b^5*e^(d*x + c) + 6*a
^4*b^2 + 3*a^2*b^4)/((a^7 + 2*a^5*b^2 + a^3*b^4)*(a*e^(2*d*x + 2*c) + 2*b*
e^(d*x + c) - a)^2) - 2*(d*x + c)/a^3)/d
```

### 3.76.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{(a+b\operatorname{csch}(c+dx))^3}\,dx = \int \frac{1}{\left(a+\frac{b}{\sinh(c+dx)}\right)^3}\,dx$$

input
```
int(1/(a + b/sinh(c + d*x))^3,x)
```

output
```
int(1/(a + b/sinh(c + d*x))^3, x)
```

# 3.77 $\int \frac{\sinh^3(x)}{a+b\mathbf{csch}(x)}\,dx$

3.77.1 Optimal result . . . 516
3.77.2 Mathematica [A] (verified) . . . 516
3.77.3 Rubi [C] (verified) . . . 517
3.77.4 Maple [B] (verified) . . . 528
3.77.5 Fricas [B] (verification not implemented) . . . 529
3.77.6 Sympy [F] . . . 529
3.77.7 Maxima [A] (verification not implemented) . . . 530
3.77.8 Giac [A] (verification not implemented) . . . 530
3.77.9 Mupad [B] (verification not implemented) . . . 531

## 3.77.1 Optimal result

Integrand size = 13, antiderivative size = 107

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b(a^2-2b^2)\,x}{2a^4} - \frac{2b^4\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a^4\sqrt{a^2+b^2}} - \frac{(2a^2-3b^2)\cosh(x)}{3a^3} - \frac{b\cosh(x)\sinh(x)}{2a^2} + \frac{\cosh(x)\sinh^2(x)}{3a}$$

output

```
1/2*b*(a^2-2*b^2)*x/a^4-1/3*(2*a^2-3*b^2)*cosh(x)/a^3-1/2*b*cosh(x)*sinh(x
)/a^2+1/3*cosh(x)*sinh(x)^2/a-2*b^4*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1
/2))/a^4/(a^2+b^2)^(1/2)
```

## 3.77.2 Mathematica [A] (verified)

Time = 1.52 (sec) , antiderivative size = 104, normalized size of antiderivative = 0.97

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{(-9a^3+12ab^2)\cosh(x)+a^3\cosh(3x)+3b\left(2a^2x-4b^2x+\frac{8b^3\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}}-a^2\sinh(2x)\right)}{12a^4}$$

input
```
Integrate[Sinh[x]^3/(a + b*Csch[x]),x]
```

output
```
((-9*a^3 + 12*a*b^2)*Cosh[x] + a^3*Cosh[3*x] + 3*b*(2*a^2*x - 4*b^2*x + (8
*b^3*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[-a^2 - b^2] - a^2*Si
nh[2*x]))/(12*a^4)
```

### 3.77.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 1.05 (sec) , antiderivative size = 146, normalized size of antiderivative = 1.36, number of steps used = 24, number of rules used = 23, $\frac{\text{number of rules}}{\text{integrand size}} = 1.769$, Rules used = {3042, 26, 4340, 26, 3042, 25, 4592, 26, 26, 3042, 26, 4592, 27, 3042, 4407, 26, 3042, 26, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i}{\csc(ix)^3(a+ib\csc(ix))}dx$$

$$\downarrow 26$$

$$i\int \frac{1}{\csc(ix)^3(a+ib\csc(ix))}dx$$

$$\downarrow 4340$$

$$i\left(\frac{\int \frac{i\left(2b\operatorname{csch}^2(x)+2a\operatorname{csch}(x)+3b\right)\sinh^2(x)}{a+b\operatorname{csch}(x)}dx}{3a} - \frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 26$$

$$i\left(\frac{i\int \frac{\left(2b\operatorname{csch}^2(x)+2a\operatorname{csch}(x)+3b\right)\sinh^2(x)}{a+b\operatorname{csch}(x)}dx}{3a} - \frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 3042$$

$$i\left(\frac{i\int -\frac{-2b\csc(ix)^2+2ia\csc(ix)+3b}{\csc(ix)^2(a+ib\csc(ix))}dx}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 25$$

$$i\left(-\frac{i\int \frac{-2b\csc(ix)^2+2ia\csc(ix)+3b}{\csc(ix)^2(a+ib\csc(ix))}dx}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 4592$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}-\frac{\int -\frac{i\left(-3ib^2\text{csch}^2(x)+iab\text{csch}(x)+2\left(2ia^2-3ib^2\right)\right)\sinh(x)}{a+b\text{csch}(x)}dx}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\int \frac{i\left(-3b^2\text{csch}^2(x)+ab\text{csch}(x)+2\left(2a^2-3b^2\right)\right)\sinh(x)}{a+b\text{csch}(x)}dx}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{i\left(-\frac{\int \frac{\left(-3b^2\text{csch}^2(x)+ab\text{csch}(x)+2\left(2a^2-3b^2\right)\right)\sinh(x)}{a+b\text{csch}(x)}dx}{2a}-\frac{3b\sinh(x)\cosh(x)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 3042$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}-\frac{\int -\frac{i\left(3b^2\csc(ix)^2+iab\csc(ix)+2\left(2a^2-3b^2\right)\right)}{\csc(ix)(a+ib\csc(ix))}dx}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\int\frac{3b^2\csc(ix)^2+iab\csc(ix)+2\left(2a^2-3b^2\right)}{\csc(ix)(a+ib\csc(ix))}dx}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 4592$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{\int\frac{3i\left(a\operatorname{csch}(x)b^2+\left(a^2-2b^2\right)b\right)}{a+b\operatorname{csch}(x)}dx}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 27$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\int\frac{a\operatorname{csch}(x)b^2+\left(a^2-2b^2\right)b}{a+b\operatorname{csch}(x)}dx}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 3042$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\int\frac{ia\csc(ix)b^2+\left(a^2-2b^2\right)b}{a+ib\csc(ix)}dx}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 4407$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{bx\left(a^2-2b^2\right)}{a}+\frac{2ib^4\int-\frac{i\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{2b^4\int\frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{a}+\frac{bx\left(a^2-2b^2\right)}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 3042$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{bx\left(a^2-2b^2\right)}{a}+\frac{2b^4\int\frac{i\csc(ix)}{a+ib\csc(ix)}dx}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{bx\left(a^2-2b^2\right)}{a}+\frac{2ib^4\int\frac{\csc(ix)}{a+ib\csc(ix)}dx}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 4318$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{2b^3\int\frac{1}{\frac{a\sinh(x)}{b}+1}dx}{a}+\frac{bx\left(a^2-2b^2\right)}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 3042$$

$$i\left(-\frac{\left(i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{bx\left(a^2-2b^2\right)}{a}+\frac{2b^3\int\frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 3139$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{4b^3\int\frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{a}+\frac{bx\left(a^2-2b^2\right)}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

$$\downarrow 1083$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{bx\left(a^2-2b^2\right)}{a}-\frac{8b^3\int\frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{a}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh\right.$$

$$\left.\right)$$

$$\downarrow 219$$

$$i\left(-\frac{i\left(-\frac{3b\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{2i\left(2a^2-3b^2\right)\cosh(x)}{a}-\frac{3i\left(\frac{bx\left(a^2-2b^2\right)}{a}-\frac{4b^4\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}\right)}{a}\right)}{2a}\right)}{3a}-\frac{i\sinh^2(x)\cosh(x)}{3a}\right)$$

input
```
Int[Sinh[x]^3/(a + b*Csch[x]),x]
```

output
```
I*(((-1/3*I)*Cosh[x]*Sinh[x]^2)/a - ((I/3)*(((I/2)*(((-3*I)*((b*(a^2 - 2*b
^2)*x)/a - (4*b^4*ArcTanh[(b*((2*a)/b - 2*Tanh[x/2]))/(2*Sqrt[a^2 + b^2])]
)/(a*Sqrt[a^2 + b^2])))/a + ((2*I)*(2*a^2 - 3*b^2)*Cosh[x])/a))/a - (3*b*C
osh[x]*Sinh[x])/(2*a)))/a)
```

### 3.77.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

rule 4340
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(a*f*n)), x] - Sim
p[1/(a*d*n)   Int[((d*Csc[e + f*x])^(n + 1)/(a + b*Csc[e + f*x]))*Simp[b*n
- a*(n + 1)*Csc[e + f*x] - b*(n + 1)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a
, b, d, e, f}, x] && NeQ[a^2 - b^2, 0] && LeQ[n, -1] && IntegerQ[2*n]
```

rule 4407
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.) + (c_))/(csc[(e_.) + (f_.)*(x_)]*(b_.) +
 (a_)), x_Symbol] :> Simp[c*(x/a), x] - Simp[(b*c - a*d)/a   Int[Csc[e + f*
x]/(a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c
- a*d, 0]
```

rule 4592
```
Int[((A_.) + csc[(e_.) + (f_.)*(x_)]*(B_.) + csc[(e_.) + (f_.)*(x_)]^2*(C_.
))*(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a
_))^(m_), x_Symbol] :> Simp[A*Cot[e + f*x]*(a + b*Csc[e + f*x])^(m + 1)*((d
*Csc[e + f*x])^n/(a*f*n)), x] + Simp[1/(a*d*n)   Int[(a + b*Csc[e + f*x])^m
*(d*Csc[e + f*x])^(n + 1)*Simp[a*B*n - A*b*(m + n + 1) + a*(A + A*n + C*n)*
Csc[e + f*x] + A*b*(m + n + 2)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a, b, d
, e, f, A, B, C, m}, x] && NeQ[a^2 - b^2, 0] && LeQ[n, -1]
```

### 3.77.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 197 vs. $2(93) = 186$.

Time = 0.42 (sec) , antiderivative size = 198, normalized size of antiderivative = 1.85

| method | result |
|---|---|
| default | $-\frac{2b^4 \operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{a^4\sqrt{a^2+b^2}} + \frac{1}{3a\left(\tanh\left(\frac{x}{2}\right)+1\right)^3} - \frac{a-b}{2a^2\left(\tanh\left(\frac{x}{2}\right)+1\right)^2} - \frac{a^2+ab-2b^2}{2a^3\left(\tanh\left(\frac{x}{2}\right)+1\right)} + \frac{b\left(a^2-2b^2\right)\ln\left(\tanh\left(\frac{x}{2}\right)+1\right.}{2a^4}$ |
| risch | $\frac{bx}{2a^2} - \frac{b^3x}{a^4} + \frac{\mathrm{e}^{3x}}{24a} - \frac{b\,\mathrm{e}^{2x}}{8a^2} - \frac{3\,\mathrm{e}^{x}}{8a} + \frac{\mathrm{e}^{x}b^2}{2a^3} - \frac{3\,\mathrm{e}^{-x}}{8a} + \frac{\mathrm{e}^{-x}b^2}{2a^3} + \frac{b\,\mathrm{e}^{-2x}}{8a^2} + \frac{\mathrm{e}^{-3x}}{24a} + \frac{b^4\ln\left(\mathrm{e}^{x}+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,a^4} - \frac{b^4\ln$ |

input
```
int(sinh(x)^3/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-2*b^4/a^4/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1
/2))+1/3/a/(tanh(1/2*x)+1)^3-1/2*(a-b)/a^2/(tanh(1/2*x)+1)^2-1/2*(a^2+a*b-
2*b^2)/a^3/(tanh(1/2*x)+1)+1/2*b*(a^2-2*b^2)/a^4*ln(tanh(1/2*x)+1)-1/3/a/(
tanh(1/2*x)-1)^3-1/2*(a+b)/a^2/(tanh(1/2*x)-1)^2-1/2*(-a^2+a*b+2*b^2)/a^3/
(tanh(1/2*x)-1)-1/2*b*(a^2-2*b^2)/a^4*ln(tanh(1/2*x)-1)
```

### 3.77.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 807 vs. 2(95) = 190.

Time = 0.29 (sec) , antiderivative size = 807, normalized size of antiderivative = 7.54

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(sinh(x)^3/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/24*((a^5 + a^3*b^2)*cosh(x)^6 + (a^5 + a^3*b^2)*sinh(x)^6 - 3*(a^4*b + a
^2*b^3)*cosh(x)^5 - 3*(a^4*b + a^2*b^3 - 2*(a^5 + a^3*b^2)*cosh(x))*sinh(x
)^5 + a^5 + a^3*b^2 + 12*(a^4*b - a^2*b^3 - 2*b^5)*x*cosh(x)^3 - 3*(3*a^5
- a^3*b^2 - 4*a*b^4)*cosh(x)^4 - 3*(3*a^5 - a^3*b^2 - 4*a*b^4 - 5*(a^5 + a
^3*b^2)*cosh(x)^2 + 5*(a^4*b + a^2*b^3)*cosh(x))*sinh(x)^4 + 2*(10*(a^5 +
a^3*b^2)*cosh(x)^3 - 15*(a^4*b + a^2*b^3)*cosh(x)^2 + 6*(a^4*b - a^2*b^3 -
 2*b^5)*x - 6*(3*a^5 - a^3*b^2 - 4*a*b^4)*cosh(x))*sinh(x)^3 - 3*(3*a^5 -
a^3*b^2 - 4*a*b^4)*cosh(x)^2 - 3*(3*a^5 - a^3*b^2 - 4*a*b^4 - 5*(a^5 + a^3
*b^2)*cosh(x)^4 + 10*(a^4*b + a^2*b^3)*cosh(x)^3 - 12*(a^4*b - a^2*b^3 - 2
*b^5)*x*cosh(x) + 6*(3*a^5 - a^3*b^2 - 4*a*b^4)*cosh(x)^2)*sinh(x)^2 + 24*
(b^4*cosh(x)^3 + 3*b^4*cosh(x)^2*sinh(x) + 3*b^4*cosh(x)*sinh(x)^2 + b^4*s
inh(x)^3)*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(
x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) - 2*sqrt(a^2 + b^2)*(a*co
sh(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*co
sh(x) + b)*sinh(x) - a)) + 3*(a^4*b + a^2*b^3)*cosh(x) + 3*(2*(a^5 + a^3*b
^2)*cosh(x)^5 + a^4*b + a^2*b^3 - 5*(a^4*b + a^2*b^3)*cosh(x)^4 + 12*(a^4*
b - a^2*b^3 - 2*b^5)*x*cosh(x)^2 - 4*(3*a^5 - a^3*b^2 - 4*a*b^4)*cosh(x)^3
 - 2*(3*a^5 - a^3*b^2 - 4*a*b^4)*cosh(x))*sinh(x))/((a^6 + a^4*b^2)*cosh(x
)^3 + 3*(a^6 + a^4*b^2)*cosh(x)^2*sinh(x) + 3*(a^6 + a^4*b^2)*cosh(x)*sinh
(x)^2 + (a^6 + a^4*b^2)*sinh(x)^3)
```

### 3.77.6 Sympy [F]

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(sinh(x)**3/(a+b*csch(x)),x)
```

output
```
Integral(sinh(x)**3/(a + b*csch(x)), x)
```

### 3.77.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 157, normalized size of antiderivative = 1.47

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^4 \log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}a^4} - \frac{\left(3\,abe^{(-x)} - a^2 + 3\,(3\,a^2-4\,b^2)e^{(-2\,x)}\right)e^{(3\,x)}}{24\,a^3} + \frac{3\,abe^{(-2\,x)} + a^2e^{(-3\,x)} - 3\,(3\,a^2-4\,b^2)e^{(-x)}}{24\,a^3} + \frac{(a^2b-2\,b^3)x}{2\,a^4}$$

input
```
integrate(sinh(x)^3/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
b^4*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))
/(sqrt(a^2 + b^2)*a^4) - 1/24*(3*a*b*e^(-x) - a^2 + 3*(3*a^2 - 4*b^2)*e^(-
2*x))*e^(3*x)/a^3 + 1/24*(3*a*b*e^(-2*x) + a^2*e^(-3*x) - 3*(3*a^2 - 4*b^2
)*e^(-x))/a^3 + 1/2*(a^2*b - 2*b^3)*x/a^4
```

### 3.77.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 155, normalized size of antiderivative = 1.45

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^4 \log\left(\frac{\left|2\,ae^x+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^x+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}a^4} + \frac{a^2e^{(3\,x)} - 3\,abe^{(2\,x)} - 9\,a^2e^x + 12\,b^2e^x}{24\,a^3} + \frac{(a^2b-2\,b^3)x}{2\,a^4} + \frac{\left(3\,a^2be^x + a^3 - 3\,(3\,a^3-4\,ab^2)e^{(2\,x)}\right)e^{(-3\,x)}}{24\,a^4}$$

input
```
integrate(sinh(x)^3/(a+b*csch(x)),x, algorithm="giac")
```

output
```
b^4*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(
a^2 + b^2)))/(sqrt(a^2 + b^2)*a^4) + 1/24*(a^2*e^(3*x) - 3*a*b*e^(2*x) - 9
*a^2*e^x + 12*b^2*e^x)/a^3 + 1/2*(a^2*b - 2*b^3)*x/a^4 + 1/24*(3*a^2*b*e^x
 + a^3 - 3*(3*a^3 - 4*a*b^2)*e^(2*x))*e^(-3*x)/a^4
```

### 3.77.9 Mupad [B] (verification not implemented)

Time = 2.53 (sec) , antiderivative size = 199, normalized size of antiderivative = 1.86

$$\int \frac{\sinh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{e^{-3x}}{24a} + \frac{e^{3x}}{24a} + \frac{x\left(a^2 b - 2b^3\right)}{2a^4} - \frac{e^{x}\left(3a^2 - 4b^2\right)}{8a^3} + \frac{b\,e^{-2x}}{8a^2} - \frac{b\,e^{2x}}{8a^2} - \frac{e^{-x}\left(3a^2 - 4b^2\right)}{8a^3} - \frac{b^4 \ln\left(-\frac{2b^4 e^x}{a^5} - \frac{2b^4(a - b e^x)}{a^5\sqrt{a^2+b^2}}\right)}{a^4\sqrt{a^2+b^2}} + \frac{b^4 \ln\left(\frac{2b^4(a-be^x)}{a^5\sqrt{a^2+b^2}} - \frac{2b^4 e^x}{a^5}\right)}{a^4\sqrt{a^2+b^2}}$$

input
```
int(sinh(x)^3/(a + b/sinh(x)),x)
```

output
```
exp(-3*x)/(24*a) + exp(3*x)/(24*a) + (x*(a^2*b - 2*b^3))/(2*a^4) - (exp(x)
*(3*a^2 - 4*b^2))/(8*a^3) + (b*exp(-2*x))/(8*a^2) - (b*exp(2*x))/(8*a^2) -
 (exp(-x)*(3*a^2 - 4*b^2))/(8*a^3) - (b^4*log(- (2*b^4*exp(x))/a^5 - (2*b^
4*(a - b*exp(x)))/(a^5*(a^2 + b^2)^(1/2))))/(a^4*(a^2 + b^2)^(1/2)) + (b^4
*log((2*b^4*(a - b*exp(x)))/(a^5*(a^2 + b^2)^(1/2)) - (2*b^4*exp(x))/a^5))
/(a^4*(a^2 + b^2)^(1/2))
```

# 3.78 $\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx$


3.78.1 Optimal result . . . . . 532
3.78.2 Mathematica [A] (verified) . . . . . 532
3.78.3 Rubi [C] (verified) . . . . . 533
3.78.4 Maple [B] (verified) . . . . . 537
3.78.5 Fricas [B] (verification not implemented) . . . . . 538
3.78.6 Sympy [F] . . . . . 538
3.78.7 Maxima [A] (verification not implemented) . . . . . 539
3.78.8 Giac [A] (verification not implemented) . . . . . 539
3.78.9 Mupad [B] (verification not implemented) . . . . . 540


## 3.78.1 Optimal result

Integrand size = 13, antiderivative size = 80

$$\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{(a^2-2b^2)\,x}{2a^3} + \frac{2b^3\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a^3\sqrt{a^2+b^2}} - \frac{b\cosh(x)}{a^2} + \frac{\cosh(x)\sinh(x)}{2a}$$

output
```
-1/2*(a^2-2*b^2)*x/a^3-b*cosh(x)/a^2+1/2*cosh(x)*sinh(x)/a+2*b^3*arctanh((
a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/a^3/(a^2+b^2)^(1/2)
```

## 3.78.2 Mathematica [A] (verified)

Time = 0.82 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.02

$$\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-2a^2x + 4b^2x - \frac{8b^3\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}} - 4ab\cosh(x) + a^2\sinh(2x)}{4a^3}$$

input
```
Integrate[Sinh[x]^2/(a + b*Csch[x]),x]
```

output
```
(-2*a^2*x + 4*b^2*x - (8*b^3*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/S
qrt[-a^2 - b^2] - 4*a*b*Cosh[x] + a^2*Sinh[2*x])/(4*a^3)
```

### 3.78.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.73 (sec) , antiderivative size = 105, normalized size of antiderivative = 1.31, number of steps used = 18, number of rules used = 17, $\frac{\text{number of rules}}{\text{integrand size}} = 1.308$, Rules used = {3042, 25, 4340, 3042, 26, 4592, 26, 3042, 4407, 26, 3042, 26, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{1}{\csc(ix)^2(a+ib\csc(ix))}dx$$

$$\downarrow 25$$

$$-\int \frac{1}{\csc(ix)^2(a+ib\csc(ix))}dx$$

$$\downarrow 4340$$

$$\frac{\sinh(x)\cosh(x)}{2a} - \frac{\int \frac{\left(b\operatorname{csch}^2(x)+a\operatorname{csch}(x)+2b\right)\sinh(x)}{a+b\operatorname{csch}(x)}dx}{2a}$$

$$\downarrow 3042$$

$$\frac{\sinh(x)\cosh(x)}{2a} - \frac{\int -\frac{i\left(-b\csc(ix)^2+ia\csc(ix)+2b\right)}{\csc(ix)(a+ib\csc(ix))}dx}{2a}$$

$$\downarrow 26$$

$$\frac{\sinh(x)\cosh(x)}{2a} + \frac{i\int \frac{-b\csc(ix)^2+ia\csc(ix)+2b}{\csc(ix)(a+ib\csc(ix))}dx}{2a}$$

$$\downarrow 4592$$

$$\frac{\sinh(x)\cosh(x)}{2a} + \frac{i\left(\frac{2ib\cosh(x)}{a} - \frac{\int -\frac{i\left(a^2+b\operatorname{csch}(x)a-2b^2\right)}{a+b\operatorname{csch}(x)}dx}{a}\right)}{2a}$$

$$\downarrow 26$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\int\frac{a^2+b\operatorname{csch}(x)a-2b^2}{a+b\operatorname{csch}(x)}dx}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 3042$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\int\frac{a^2+ib\csc(ix)a-2b^2}{a+ib\csc(ix)}dx}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 4407$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{x\left(a^2-2b^2\right)}{a}+\frac{2ib^3\int-\frac{i\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 26$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{2b^3\int\frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{a}+\frac{x\left(a^2-2b^2\right)}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 3042$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{x\left(a^2-2b^2\right)}{a}+\frac{2b^3\int\frac{i\csc(ix)}{a+ib\csc(ix)}dx}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 26$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{x\left(a^2-2b^2\right)}{a}+\frac{2ib^3\int\frac{\csc(ix)}{a+ib\csc(ix)}dx}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 4318$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{2b^2\int\frac{1}{\frac{a\sinh(x)}{b}+1}dx}{a}+\frac{x\left(a^2-2b^2\right)}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 3042$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{x\left(a^2-2b^2\right)}{a}+\frac{2b^2\int\frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 3139$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{4b^2\int\frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{a}+\frac{x\left(a^2-2b^2\right)}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 1083$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{x\left(a^2-2b^2\right)}{a}-\frac{8b^2\int\frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{a}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

$$\downarrow 219$$

$$\frac{\sinh(x)\cosh(x)}{2a}+\frac{i\left(\frac{i\left(\frac{x\left(a^2-2b^2\right)}{a}-\frac{4b^3\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}\right)}{a}+\frac{2ib\cosh(x)}{a}\right)}{2a}$$

input
```
Int[Sinh[x]^2/(a + b*Csch[x]),x]
```

## 3.78. $\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx$

output
```
((I/2)*((I*(((a^2 - 2*b^2)*x)/a - (4*b^3*ArcTanh[(b*((2*a)/b - 2*Tanh[x/2]
))/(2*Sqrt[a^2 + b^2])])/(a*Sqrt[a^2 + b^2])))/a + ((2*I)*b*Cosh[x])/a))/a
 + (Cosh[x]*Sinh[x])/(2*a)
```

### 3.78.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

rule 4340
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(a*f*n)), x] - Sim
p[1/(a*d*n)   Int[((d*Csc[e + f*x])^(n + 1)/(a + b*Csc[e + f*x]))*Simp[b*n
- a*(n + 1)*Csc[e + f*x] - b*(n + 1)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a
, b, d, e, f}, x] && NeQ[a^2 - b^2, 0] && LeQ[n, -1] && IntegerQ[2*n]
```

rule 4407
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.) + (c_))/(csc[(e_.) + (f_.)*(x_)]*(b_.) +
 (a_)), x_Symbol] :> Simp[c*(x/a), x] - Simp[(b*c - a*d)/a   Int[Csc[e + f*
x]/(a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c
- a*d, 0]
```

rule 4592
```
Int[((A_.) + csc[(e_.) + (f_.)*(x_)]*(B_.) + csc[(e_.) + (f_.)*(x_)]^2*(C_.
))*(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a
_))^(m_), x_Symbol] :> Simp[A*Cot[e + f*x]*(a + b*Csc[e + f*x])^(m + 1)*((d
*Csc[e + f*x])^n/(a*f*n)), x] + Simp[1/(a*d*n)   Int[(a + b*Csc[e + f*x])^m
*(d*Csc[e + f*x])^(n + 1)*Simp[a*B*n - A*b*(m + n + 1) + a*(A + A*n + C*n)*
Csc[e + f*x] + A*b*(m + n + 2)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a, b, d
, e, f, A, B, C, m}, x] && NeQ[a^2 - b^2, 0] && LeQ[n, -1]
```

### 3.78.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 151 vs. $2(70) = 140$.

Time $= 0.32$ (sec) , antiderivative size $= 152$, normalized size of antiderivative $= 1.90$

| method | result |
|---|---|
| default | $-\frac{1}{2a\left(\tanh\left(\frac{x}{2}\right)+1\right)^2}-\frac{-a+2b}{2a^2\left(\tanh\left(\frac{x}{2}\right)+1\right)}+\frac{\left(-a^2+2b^2\right)\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)}{2a^3}+\frac{2b^3\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{a^3\sqrt{a^2+b^2}}+\frac{1}{2a\left(\tanh\left(\frac{x}{2}\right)-1\right)}$ |
| risch | $-\frac{x}{2a}+\frac{x\,b^2}{a^3}+\frac{\mathrm{e}^{2x}}{8a}-\frac{b\,\mathrm{e}^{x}}{2a^2}-\frac{b\,\mathrm{e}^{-x}}{2a^2}-\frac{\mathrm{e}^{-2x}}{8a}+\frac{b^3\ln\left(\mathrm{e}^{x}+\frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,a^3}-\frac{b^3\ln\left(\mathrm{e}^{x}+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,a^3}$ |

input
```
int(sinh(x)^2/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/2/a/(tanh(1/2*x)+1)^2-1/2*(-a+2*b)/a^2/(tanh(1/2*x)+1)+1/2/a^3*(-a^2+2*
b^2)*ln(tanh(1/2*x)+1)+2*b^3/a^3/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/
2*x)+2*a)/(a^2+b^2)^(1/2))+1/2/a/(tanh(1/2*x)-1)^2+1/2/a^3*(a^2-2*b^2)*ln(
tanh(1/2*x)-1)-1/2*(-a-2*b)/a^2/(tanh(1/2*x)-1)
```

### 3.78.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 456 vs. $2(72) = 144$.

Time $= 0.27$ (sec) , antiderivative size $= 456$, normalized size of antiderivative $= 5.70$

$$\int \frac{\sinh^2(x)}{a + b\operatorname{csch}(x)}\,dx$$

$$= \frac{(a^4 + a^2b^2)\cosh(x)^4 + (a^4 + a^2b^2)\sinh(x)^4 - a^4 - a^2b^2 - 4\,(a^4 - a^2b^2 - 2\,b^4)x\cosh(x)^2 - 4\,(a^3b + ab^3)}{}$$

input
```
integrate(sinh(x)^2/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/8*((a^4 + a^2*b^2)*cosh(x)^4 + (a^4 + a^2*b^2)*sinh(x)^4 - a^4 - a^2*b^2
 - 4*(a^4 - a^2*b^2 - 2*b^4)*x*cosh(x)^2 - 4*(a^3*b + a*b^3)*cosh(x)^3 - 4
*(a^3*b + a*b^3 - (a^4 + a^2*b^2)*cosh(x))*sinh(x)^3 + 2*(3*(a^4 + a^2*b^2
)*cosh(x)^2 - 2*(a^4 - a^2*b^2 - 2*b^4)*x - 6*(a^3*b + a*b^3)*cosh(x))*sin
h(x)^2 + 8*(b^3*cosh(x)^2 + 2*b^3*cosh(x)*sinh(x) + b^3*sinh(x)^2)*sqrt(a^
2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2
+ 2*(a^2*cosh(x) + a*b)*sinh(x) + 2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x)
 + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x
) - a)) - 4*(a^3*b + a*b^3)*cosh(x) - 4*(a^3*b + a*b^3 - (a^4 + a^2*b^2)*c
osh(x)^3 + 2*(a^4 - a^2*b^2 - 2*b^4)*x*cosh(x) + 3*(a^3*b + a*b^3)*cosh(x)
^2)*sinh(x))/((a^5 + a^3*b^2)*cosh(x)^2 + 2*(a^5 + a^3*b^2)*cosh(x)*sinh(x
) + (a^5 + a^3*b^2)*sinh(x)^2)
```

### 3.78.6 Sympy [F]

$$\int \frac{\sinh^2(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\sinh^2(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(sinh(x)**2/(a+b*csch(x)),x)
```

output
```
Integral(sinh(x)**2/(a + b*csch(x)), x)
```

### 3.78.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 116, normalized size of antiderivative = 1.45

$$\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^3 \log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}a^3} - \frac{\left(4\,be^{(-x)}-a\right)e^{(2\,x)}}{8\,a^2} - \frac{4\,be^{(-x)}+ae^{(-2\,x)}}{8\,a^2} - \frac{(a^2-2\,b^2)x}{2\,a^3}$$

input
```
integrate(sinh(x)^2/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-b^3*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2))
)/(sqrt(a^2 + b^2)*a^3) - 1/8*(4*b*e^(-x) - a)*e^(2*x)/a^2 - 1/8*(4*b*e^(-
x) + a*e^(-2*x))/a^2 - 1/2*(a^2 - 2*b^2)*x/a^3
```

### 3.78.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 115, normalized size of antiderivative = 1.44

$$\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^3 \log\left(\left|\frac{2\,ae^x+2\,b-2\sqrt{a^2+b^2}}{2\,ae^x+2\,b+2\sqrt{a^2+b^2}}\right|\right)}{\sqrt{a^2+b^2}a^3} + \frac{ae^{(2\,x)}-4\,be^x}{8\,a^2} - \frac{(a^2-2\,b^2)x}{2\,a^3} - \frac{(4\,abe^x+a^2)e^{(-2\,x)}}{8\,a^3}$$

input
```
integrate(sinh(x)^2/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-b^3*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt
(a^2 + b^2)))/(sqrt(a^2 + b^2)*a^3) + 1/8*(a*e^(2*x) - 4*b*e^x)/a^2 - 1/2*
(a^2 - 2*b^2)*x/a^3 - 1/8*(4*a*b*e^x + a^2)*e^(-2*x)/a^3
```

### 3.78.9 Mupad [B] (verification not implemented)

Time = 2.40 (sec) , antiderivative size = 157, normalized size of antiderivative = 1.96

$$\int \frac{\sinh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{e^{2x}}{8a} - \frac{e^{-2x}}{8a} - \frac{b\,e^{x}}{2a^2} - \frac{b\,e^{-x}}{2a^2} - \frac{x\,(a^2-2b^2)}{2a^3} - \frac{b^3\,\ln\left(\frac{2b^3\,e^{x}}{a^4} - \frac{2b^3\,(a-b\,e^{x})}{a^4\sqrt{a^2+b^2}}\right)}{a^3\sqrt{a^2+b^2}} + \frac{b^3\,\ln\left(\frac{2b^3\,e^{x}}{a^4} + \frac{2b^3\,(a-b\,e^{x})}{a^4\sqrt{a^2+b^2}}\right)}{a^3\sqrt{a^2+b^2}}$$

input

```
int(sinh(x)^2/(a + b/sinh(x)),x)
```

output

```
exp(2*x)/(8*a) - exp(-2*x)/(8*a) - (b*exp(x))/(2*a^2) - (b*exp(-x))/(2*a^2
) - (x*(a^2 - 2*b^2))/(2*a^3) - (b^3*log((2*b^3*exp(x))/a^4 - (2*b^3*(a -
b*exp(x)))/(a^4*(a^2 + b^2)^(1/2))))/(a^3*(a^2 + b^2)^(1/2)) + (b^3*log((2
*b^3*exp(x))/a^4 + (2*b^3*(a - b*exp(x)))/(a^4*(a^2 + b^2)^(1/2))))/(a^3*(
a^2 + b^2)^(1/2))
```

# 3.79 $\int \frac{\sinh(x)}{a+b\mathbf{csch}(x)}\,dx$

3.79.1 Optimal result . . . 541
3.79.2 Mathematica [A] (verified) . . . 541
3.79.3 Rubi [C] (verified) . . . 542
3.79.4 Maple [A] (verified) . . . 545
3.79.5 Fricas [B] (verification not implemented) . . . 545
3.79.6 Sympy [F] . . . 546
3.79.7 Maxima [A] (verification not implemented) . . . 546
3.79.8 Giac [A] (verification not implemented) . . . 547
3.79.9 Mupad [B] (verification not implemented) . . . 547

## 3.79.1 Optimal result

Integrand size = 11, antiderivative size = 57

$$\int \frac{\sinh(x)}{a+b\text{csch}(x)}\,dx = -\frac{bx}{a^2} - \frac{2b^2\text{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a^2\sqrt{a^2+b^2}} + \frac{\cosh(x)}{a}$$

output
```
-b*x/a^2+cosh(x)/a-2*b^2*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/a^2/(a
^2+b^2)^(1/2)
```

## 3.79.2 Mathematica [A] (verified)

Time = 0.29 (sec) , antiderivative size = 61, normalized size of antiderivative = 1.07

$$\int \frac{\sinh(x)}{a+b\text{csch}(x)}\,dx = \frac{b\left(-x + \frac{2b\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}}\right) + a\cosh(x)}{a^2}$$

input
```
Integrate[Sinh[x]/(a + b*Csch[x]),x]
```

output
```
(b*(-x + (2*b*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[-a^2 - b^2]
) + a*Cosh[x])/a^2
```

### 3.79.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.38 (sec) , antiderivative size = 77, normalized size of antiderivative = 1.35, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 26, 4340, 26, 27, 3042, 4270, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sinh(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i}{\csc(ix)(a+ib\csc(ix))}dx$$

$$\downarrow 26$$

$$-i\int \frac{1}{\csc(ix)(a+ib\csc(ix))}dx$$

$$\downarrow 4340$$

$$-i\left(\frac{\int -\frac{ib}{a+b\operatorname{csch}(x)}dx}{a}+\frac{i\cosh(x)}{a}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{i\int \frac{b}{a+b\operatorname{csch}(x)}dx}{a}\right)$$

$$\downarrow 27$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\int \frac{1}{a+b\operatorname{csch}(x)}dx}{a}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\int \frac{1}{a+ib\csc(ix)}dx}{a}\right)$$

$$\downarrow 4270$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\left(\frac{x}{a}-\frac{\int\frac{1}{\frac{a\sinh(x)}{b}+1}dx}{a}\right)}{a}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\left(\frac{x}{a}-\frac{\int\frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{a}\right)}{a}\right)$$

$$\downarrow 3139$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\left(\frac{x}{a}-\frac{2\int\frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{a}\right)}{a}\right)$$

$$\downarrow 1083$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\left(\frac{4\int\frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{a}+\frac{x}{a}\right)}{a}\right)$$

$$\downarrow 219$$

$$-i\left(\frac{i\cosh(x)}{a}-\frac{ib\left(\frac{2b\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{x}{a}\right)}{a}\right)$$

input
```
Int[Sinh[x]/(a + b*Csch[x]),x]
```

output
```
(-I)*(((-I)*b*(x/a + (2*b*ArcTanh[(b*((2*a)/b - 2*Tanh[x/2]))/(2*Sqrt[a^2
+ b^2])])/(a*Sqrt[a^2 + b^2])))/a + (I*Cosh[x])/a)
```

### 3.79.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4270
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(-1), x_Symbol] :> Simp[x/a, x]
- Simp[1/a   Int[1/(1 + (a/b)*Sin[c + d*x]), x], x] /; FreeQ[{a, b, c, d},
x] && NeQ[a^2 - b^2, 0]
```

rule 4340
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[Cot[e + f*x]*((d*Csc[e + f*x])^n/(a*f*n)), x] - Sim
p[1/(a*d*n)   Int[((d*Csc[e + f*x])^(n + 1)/(a + b*Csc[e + f*x]))*Simp[b*n
- a*(n + 1)*Csc[e + f*x] - b*(n + 1)*Csc[e + f*x]^2, x], x], x] /; FreeQ[{a
, b, d, e, f}, x] && NeQ[a^2 - b^2, 0] && LeQ[n, -1] && IntegerQ[2*n]
```

## 3.79.4 Maple [A] (verified)

Time = 0.28 (sec) , antiderivative size = 92, normalized size of antiderivative = 1.61

| method | result | size |
|---|---|---|
| default | $\frac{1}{a(\tanh(\frac{x}{2})+1)} - \frac{b\ln(\tanh(\frac{x}{2})+1)}{a^2} - \frac{2b^2\operatorname{arctanh}\left(\frac{-2b\tanh(\frac{x}{2})+2a}{2\sqrt{a^2+b^2}}\right)}{a^2\sqrt{a^2+b^2}} - \frac{1}{a(\tanh(\frac{x}{2})-1)} + \frac{b\ln(\tanh(\frac{x}{2})-1)}{a^2}$ | 92 |
| risch | $-\frac{bx}{a^2} + \frac{e^x}{2a} + \frac{e^{-x}}{2a} + \frac{b^2\ln\left(e^x + \frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,a^2} - \frac{b^2\ln\left(e^x + \frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,a^2}$ | 132 |

input
```
int(sinh(x)/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/a/(tanh(1/2*x)+1)-1/a^2*b*ln(tanh(1/2*x)+1)-2*b^2/a^2/(a^2+b^2)^(1/2)*ar
ctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2))-1/a/(tanh(1/2*x)-1)+1/a^
2*b*ln(tanh(1/2*x)-1)
```

## 3.79.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 238 vs. 2(53) = 106.

Time = 0.26 (sec) , antiderivative size = 238, normalized size of antiderivative = 4.18

$$\int \frac{\sinh(x)}{a + b\operatorname{csch}(x)}\,dx$$

$$= \frac{a^3 + ab^2 - 2\left(a^2b + b^3\right)x\cosh(x) + \left(a^3 + ab^2\right)\cosh(x)^2 + \left(a^3 + ab^2\right)\sinh(x)^2 + 2\left(b^2\cosh(x) + b^2\sinh(x\right.}{2}$$

input
```
integrate(sinh(x)/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/2*(a^3 + a*b^2 - 2*(a^2*b + b^3)*x*cosh(x) + (a^3 + a*b^2)*cosh(x)^2 + (
a^3 + a*b^2)*sinh(x)^2 + 2*(b^2*cosh(x) + b^2*sinh(x))*sqrt(a^2 + b^2)*log
((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*cos
h(x) + a*b)*sinh(x) - 2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x) + b))/(a*co
sh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x) - a)) - 2*
((a^2*b + b^3)*x - (a^3 + a*b^2)*cosh(x))*sinh(x))/((a^4 + a^2*b^2)*cosh(x
) + (a^4 + a^2*b^2)*sinh(x))
```

### 3.79.6 Sympy [F]

$$\int \frac{\sinh(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\sinh(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(sinh(x)/(a+b*csch(x)),x)
```

output
```
Integral(sinh(x)/(a + b*csch(x)), x)
```

### 3.79.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.47

$$\int \frac{\sinh(x)}{a + b\operatorname{csch}(x)}\,dx = \frac{b^2 \log\left(\frac{a e^{(-x)} - b - \sqrt{a^2+b^2}}{a e^{(-x)} - b + \sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}\,a^2} - \frac{bx}{a^2} + \frac{e^{(-x)}}{2\,a} + \frac{e^x}{2\,a}$$

input
```
integrate(sinh(x)/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
b^2*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))
/(sqrt(a^2 + b^2)*a^2) - b*x/a^2 + 1/2*e^(-x)/a + 1/2*e^x/a
```

### 3.79.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 86, normalized size of antiderivative = 1.51

$$\int \frac{\sinh(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^2 \log\left(\frac{\left|2\,ae^x+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^x+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}a^2} - \frac{bx}{a^2} + \frac{e^{(-x)}}{2\,a} + \frac{e^x}{2\,a}$$

input
```
integrate(sinh(x)/(a+b*csch(x)),x, algorithm="giac")
```

output
```
b^2*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(
a^2 + b^2)))/(sqrt(a^2 + b^2)*a^2) - b*x/a^2 + 1/2*e^(-x)/a + 1/2*e^x/a
```

### 3.79.9 Mupad [B] (verification not implemented)

Time = 2.36 (sec) , antiderivative size = 129, normalized size of antiderivative = 2.26

$$\int \frac{\sinh(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{-x}}{2\,a} + \frac{\mathrm{e}^x}{2\,a} - \frac{b\,x}{a^2} - \frac{b^2\,\ln\left(-\frac{2\,b^2\,\mathrm{e}^x}{a^3} - \frac{2\,b^2\,(a-b\,\mathrm{e}^x)}{a^3\,\sqrt{a^2+b^2}}\right)}{a^2\,\sqrt{a^2+b^2}} + \frac{b^2\,\ln\left(\frac{2\,b^2\,(a-b\,\mathrm{e}^x)}{a^3\,\sqrt{a^2+b^2}} - \frac{2\,b^2\,\mathrm{e}^x}{a^3}\right)}{a^2\,\sqrt{a^2+b^2}}$$

input
```
int(sinh(x)/(a + b/sinh(x)),x)
```

output
```
exp(-x)/(2*a) + exp(x)/(2*a) - (b*x)/a^2 - (b^2*log(- (2*b^2*exp(x))/a^3 -
 (2*b^2*(a - b*exp(x)))/(a^3*(a^2 + b^2)^(1/2))))/(a^2*(a^2 + b^2)^(1/2))
+ (b^2*log((2*b^2*(a - b*exp(x)))/(a^3*(a^2 + b^2)^(1/2)) - (2*b^2*exp(x))
/a^3))/(a^2*(a^2 + b^2)^(1/2))
```

# 3.80 $\int \frac{\mathbf{csch}(x)}{a+b\mathbf{csch}(x)}\,dx$

3.80.1 Optimal result . . . 548
3.80.2 Mathematica [A] (verified) . . . 548
3.80.3 Rubi [A] (verified) . . . 549
3.80.4 Maple [A] (verified) . . . 551
3.80.5 Fricas [B] (verification not implemented) . . . 551
3.80.6 Sympy [F] . . . 552
3.80.7 Maxima [A] (verification not implemented) . . . 552
3.80.8 Giac [A] (verification not implemented) . . . 552
3.80.9 Mupad [B] (verification not implemented) . . . 553

## 3.80.1 Optimal result

Integrand size = 11, antiderivative size = 37

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{2\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}}$$

output
```
-2*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/(a^2+b^2)^(1/2)
```

## 3.80.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.22

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}}$$

input
```
Integrate[Csch[x]/(a + b*Csch[x]),x]
```

output
```
(2*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[-a^2 - b^2]
```

### 3.80.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.22, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.636$, Rules used = {3042, 26, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i\csc(ix)}{a+ib\csc(ix)}dx$$

$$\downarrow 26$$

$$i\int \frac{\csc(ix)}{a+ib\csc(ix)}dx$$

$$\downarrow 4318$$

$$\frac{\int \frac{1}{\frac{a\sinh(x)}{b}+1}dx}{b}$$

$$\downarrow 3042$$

$$\frac{\int \frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{b}$$

$$\downarrow 3139$$

$$\frac{2\int \frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{b}$$

$$\downarrow 1083$$

$$-\frac{4\int \frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{b}$$

$$\downarrow 219$$

$$-\frac{2\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}}$$

input
```
Int[Csch[x]/(a + b*Csch[x]),x]
```

output
```
(-2*ArcTanh[(b*((2*a)/b - 2*Tanh[x/2]))/(2*Sqrt[a^2 + b^2])])/Sqrt[a^2 + b
^2]
```

#### 3.80.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

### 3.80.4 Maple [A] (verified)

Time = 0.10 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.95

| method | result | size |
|---|---|---|
| default | $-\frac{2\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}}$ | 35 |
| risch | $\frac{\ln\left(e^x+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}}-\frac{\ln\left(e^x+\frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}}$ | 97 |

input
```
int(csch(x)/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-2/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2))
```

### 3.80.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 111 vs. 2(33) = 66.

Time = 0.26 (sec) , antiderivative size = 111, normalized size of antiderivative = 3.00

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log\left(\frac{a^2\cosh(x)^2+a^2\sinh(x)^2+2ab\cosh(x)+a^2+2b^2+2\left(a^2\cosh(x)+ab\right)\sinh(x)-2\sqrt{a^2+b^2}\left(a\cosh(x)+a\sinh(x)+b\right)}{a\cosh(x)^2+a\sinh(x)^2+2b\cosh(x)+2\left(a\cosh(x)+b\right)\sinh(x)-a}\right)}{\sqrt{a^2+b^2}}$$

input
```
integrate(csch(x)/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*
cosh(x) + a*b)*sinh(x) - 2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x) + b))/(a
*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x) - a))/s
qrt(a^2 + b^2)
```

### 3.80.6 Sympy [F]

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(csch(x)/(a+b*csch(x)),x)
```

output
```
Integral(csch(x)/(a + b*csch(x)), x)
```

### 3.80.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.46

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}}$$

input
```
integrate(csch(x)/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))/sqr
t(a^2 + b^2)
```

### 3.80.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.51

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log\left(\frac{\left|2\,ae^{x}+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^{x}+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}}$$

input
```
integrate(csch(x)/(a+b*csch(x)),x, algorithm="giac")
```

output
```
log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(a^2
+ b^2)))/sqrt(a^2 + b^2)
```

### 3.80.9 Mupad [B] (verification not implemented)

Time = 0.17 (sec) , antiderivative size = 49, normalized size of antiderivative = 1.32

$$\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2\operatorname{atan}\left(\frac{b}{\sqrt{-a^2-b^2}}+\frac{a\,e^x}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}}$$

input
```
int(1/(sinh(x)*(a + b/sinh(x))),x)
```

output
```
(2*atan(b/(- a^2 - b^2)^(1/2) + (a*exp(x))/(- a^2 - b^2)^(1/2)))/(- a^2 -
b^2)^(1/2)
```

# 3.81 $\int \frac{\mathbf{csch}^2(x)}{a+b\mathbf{csch}(x)}\,dx$

3.81.1 Optimal result . . . 554
3.81.2 Mathematica [A] (verified) . . . 554
3.81.3 Rubi [A] (verified) . . . 555
3.81.4 Maple [A] (verified) . . . 557
3.81.5 Fricas [B] (verification not implemented) . . . 558
3.81.6 Sympy [F] . . . 558
3.81.7 Maxima [A] (verification not implemented) . . . 558
3.81.8 Giac [A] (verification not implemented) . . . 559
3.81.9 Mupad [B] (verification not implemented) . . . 559

## 3.81.1 Optimal result

Integrand size = 13, antiderivative size = 50

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{\operatorname{arctanh}(\cosh(x))}{b} + \frac{2a\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{b\sqrt{a^2+b^2}}$$

output
```
-arctanh(cosh(x))/b+2*a*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/b/(a^2+
b^2)^(1/2)
```

## 3.81.2 Mathematica [A] (verified)

Time = 0.21 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.34

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-\frac{2a\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}} - \log\left(\cosh\left(\frac{x}{2}\right)\right) + \log\left(\sinh\left(\frac{x}{2}\right)\right)}{b}$$

input
```
Integrate[Csch[x]^2/(a + b*Csch[x]),x]
```

output
```
((-2*a*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[-a^2 - b^2] - Log[
Cosh[x/2]] + Log[Sinh[x/2]])/b
```

### 3.81.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.16, number of steps used = 13, number of rules used = 12, $\frac{\text{number of rules}}{\text{integrand size}} = 0.923$, Rules used = {3042, 25, 4276, 26, 3042, 26, 4257, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{\csc(ix)^2}{a+ib\csc(ix)}dx$$

$$\downarrow 25$$

$$-\int \frac{\csc(ix)^2}{a+ib\csc(ix)}dx$$

$$\downarrow 4276$$

$$\frac{i\int -i\operatorname{csch}(x)dx}{b} - \frac{ia\int -\frac{i\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{b}$$

$$\downarrow 26$$

$$\frac{\int \operatorname{csch}(x)dx}{b} - \frac{a\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{b}$$

$$\downarrow 3042$$

$$\frac{\int i\csc(ix)dx}{b} - \frac{a\int \frac{i\csc(ix)}{a+ib\csc(ix)}dx}{b}$$

$$\downarrow 26$$

$$\frac{i\int \csc(ix)dx}{b} - \frac{ia\int \frac{\csc(ix)}{a+ib\csc(ix)}dx}{b}$$

$$\downarrow 4257$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b} - \frac{ia\int \frac{\csc(ix)}{a+ib\csc(ix)}dx}{b}$$

$$\downarrow 4318$$

$$-\frac{a\int \frac{1}{\frac{a\sinh(x)}{b}+1}dx}{b^2} - \frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b}-\frac{a\int\frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{b^2}$$

$$\downarrow 3139$$

$$-\frac{2a\int\frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{b^2}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 1083$$

$$\frac{4a\int\frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{b^2}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 219$$

$$\frac{2a\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{b\sqrt{a^2+b^2}}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

input
```
Int[Csch[x]^2/(a + b*Csch[x]),x]
```

output
```
-(ArcTanh[Cosh[x]]/b) + (2*a*ArcTanh[(b*((2*a)/b - 2*Tanh[x/2]))/(2*Sqrt[a
^2 + b^2])])/(b*Sqrt[a^2 + b^2])
```

### 3.81.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4276
```
Int[csc[(e_.) + (f_.)*(x_)]^2/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Sym
bol] :> Simp[1/b   Int[Csc[e + f*x], x], x] - Simp[a/b   Int[Csc[e + f*x]/(
a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e, f}, x]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

### 3.81.4 Maple [A] (verified)

Time = 0.17 (sec) , antiderivative size = 49, normalized size of antiderivative = 0.98

| method | result | size |
|---|---|---|
| default | $\frac{2a \operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{b\sqrt{a^2+b^2}} + \frac{\ln\left(\tanh\left(\frac{x}{2}\right)\right)}{b}$ | 49 |
| risch | $\frac{\ln(e^x-1)}{b} + \frac{a\ln\left(e^x+\frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,b} - \frac{a\ln\left(e^x+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,b} - \frac{\ln(e^x+1)}{b}$ | 124 |

input
```
int(csch(x)^2/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
2*a/b/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2))+
1/b*ln(tanh(1/2*x))
```

### 3.81.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 156 vs. $2(46) = 92$.

Time $= 0.28$ (sec) , antiderivative size $= 156$, normalized size of antiderivative $= 3.12$

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{\sqrt{a^2+b^2}a\log\left(\frac{a^2\cosh(x)^2+a^2\sinh(x)^2+2ab\cosh(x)+a^2+2b^2+2\left(a^2\cosh(x)+ab\right)\sinh(x)+2\sqrt{a^2+b^2}(a\cosh(x)+a\sinh(x)+b)}{a\cosh(x)^2+a\sinh(x)^2+2b\cosh(x)+2\left(a\cosh(x)+b\right)\sinh(x)-a}\right)-(a^2}{a^2b+b^3}$$

input
```
integrate(csch(x)^2/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
(sqrt(a^2 + b^2)*a*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x) + a^
2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) + 2*sqrt(a^2 + b^2)*(a*cosh(x) +
 a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(x) +
 b)*sinh(x) - a)) - (a^2 + b^2)*log(cosh(x) + sinh(x) + 1) + (a^2 + b^2)*l
og(cosh(x) + sinh(x) - 1))/(a^2*b + b^3)
```

### 3.81.6 Sympy [F]

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(csch(x)**2/(a+b*csch(x)),x)
```

output
```
Integral(csch(x)**2/(a + b*csch(x)), x)
```

### 3.81.7 Maxima [A] (verification not implemented)

Time $= 0.26$ (sec) , antiderivative size $= 83$, normalized size of antiderivative $= 1.66$

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}b} - \frac{\log\left(e^{(-x)}+1\right)}{b} + \frac{\log\left(e^{(-x)}-1\right)}{b}$$

input
```
integrate(csch(x)^2/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-a*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))/
(sqrt(a^2 + b^2)*b) - log(e^(-x) + 1)/b + log(e^(-x) - 1)/b
```

### 3.81.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.64

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a\log\left(\frac{\left|2ae^x+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^x+2b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}b} - \frac{\log\left(e^x+1\right)}{b} + \frac{\log\left(\left|e^x-1\right|\right)}{b}$$

input
```
integrate(csch(x)^2/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(a
^2 + b^2)))/(sqrt(a^2 + b^2)*b) - log(e^x + 1)/b + log(abs(e^x - 1))/b
```

### 3.81.9 Mupad [B] (verification not implemented)

Time = 2.42 (sec) , antiderivative size = 287, normalized size of antiderivative = 5.74

$$\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\ln\left(32\,b-32\,b\,\mathrm{e}^x\right)}{b} - \frac{\ln\left(32\,b+32\,b\,\mathrm{e}^x\right)}{b}$$
$$+\frac{a\,\ln\left(128\,b^5\,\mathrm{e}^x-64\,a^3\,b^2-64\,a\,b^4-128\,b^4\,\mathrm{e}^x\,\sqrt{a^2+b^2}+32\,a^4\,b\,\mathrm{e}^x+160\,a^2\,b^3\,\mathrm{e}^x+64\,a\,b^3\,\sqrt{a^2+b^2}+3\right.}{a^2\,b+b^3}$$
$$-\frac{a\,\ln\left(64\,a\,b^4+64\,a^3\,b^2-128\,b^5\,\mathrm{e}^x-128\,b^4\,\mathrm{e}^x\,\sqrt{a^2+b^2}-32\,a^4\,b\,\mathrm{e}^x-160\,a^2\,b^3\,\mathrm{e}^x+64\,a\,b^3\,\sqrt{a^2+b^2}+3\right.}{a^2\,b+b^3}$$

input
```
int(1/(sinh(x)^2*(a + b/sinh(x))),x)
```

output

```
log(32*b - 32*b*exp(x))/b - log(32*b + 32*b*exp(x))/b + (a*log(128*b^5*exp
(x) - 64*a^3*b^2 - 64*a*b^4 - 128*b^4*exp(x)*(a^2 + b^2)^(1/2) + 32*a^4*b*
exp(x) + 160*a^2*b^3*exp(x) + 64*a*b^3*(a^2 + b^2)^(1/2) + 32*a^3*b*(a^2 +
 b^2)^(1/2) - 96*a^2*b^2*exp(x)*(a^2 + b^2)^(1/2))*(a^2 + b^2)^(1/2))/(a^2
*b + b^3) - (a*log(64*a*b^4 + 64*a^3*b^2 - 128*b^5*exp(x) - 128*b^4*exp(x)
*(a^2 + b^2)^(1/2) - 32*a^4*b*exp(x) - 160*a^2*b^3*exp(x) + 64*a*b^3*(a^2
+ b^2)^(1/2) + 32*a^3*b*(a^2 + b^2)^(1/2) - 96*a^2*b^2*exp(x)*(a^2 + b^2)^
(1/2))*(a^2 + b^2)^(1/2))/(a^2*b + b^3)
```

# 3.82 $\int \frac{\text{csch}^3(x)}{a+b\text{csch}(x)}\,dx$

3.82.1 Optimal result . . . 561
3.82.2 Mathematica [A] (verified) . . . 561
3.82.3 Rubi [C] (verified) . . . 562
3.82.4 Maple [A] (verified) . . . 566
3.82.5 Fricas [B] (verification not implemented) . . . 566
3.82.6 Sympy [F] . . . 567
3.82.7 Maxima [A] (verification not implemented) . . . 567
3.82.8 Giac [A] (verification not implemented) . . . 568
3.82.9 Mupad [B] (verification not implemented) . . . 568

## 3.82.1 Optimal result

Integrand size = 13, antiderivative size = 59

$$\int \frac{\text{csch}^3(x)}{a+b\text{csch}(x)}\,dx = \frac{a\text{arctanh}(\cosh(x))}{b^2} - \frac{2a^2\text{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{b^2\sqrt{a^2+b^2}} - \frac{\coth(x)}{b}$$

output
```
a*arctanh(cosh(x))/b^2-coth(x)/b-2*a^2*arctanh((a-b*tanh(1/2*x))/(a^2+b^2
)^(1/2))/b^2/(a^2+b^2)^(1/2)
```

## 3.82.2 Mathematica [A] (verified)

Time = 0.48 (sec) , antiderivative size = 92, normalized size of antiderivative = 1.56

$$\int \frac{\text{csch}^3(x)}{a+b\text{csch}(x)}\,dx$$
$$= \frac{\text{csch}\left(\frac{x}{2}\right)\text{sech}\left(\frac{x}{2}\right)\left(-b\cosh(x) + a\left(\frac{2a\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}} + \log\left(\cosh\left(\frac{x}{2}\right)\right) - \log\left(\sinh\left(\frac{x}{2}\right)\right)\right)\sinh(x)\right)}{2b^2}$$

input
```
Integrate[Csch[x]^3/(a + b*Csch[x]),x]
```

output
```
(Csch[x/2]*Sech[x/2]*(-(b*Cosh[x]) + a*((2*a*ArcTan[(a - b*Tanh[x/2])/Sqrt
[-a^2 - b^2]])/Sqrt[-a^2 - b^2] + Log[Cosh[x/2]] - Log[Sinh[x/2]])*Sinh[x]
))/(2*b^2)
```

### 3.82.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.55 (sec) , antiderivative size = 79, normalized size of antiderivative = 1.34, number of steps used = 17, number of rules used = 16, $\frac{\text{number of rules}}{\text{integrand size}} = 1.231$, Rules used = {3042, 26, 4277, 25, 3042, 25, 4276, 26, 3042, 26, 4257, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i\csc(ix)^3}{a+ib\csc(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\csc(ix)^3}{a+ib\csc(ix)}dx$$

$$\downarrow 4277$$

$$-i\left(\frac{ia\int -\frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}dx}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 25$$

$$-i\left(-\frac{ia\int \frac{\operatorname{csch}^2(x)}{a+b\operatorname{csch}(x)}dx}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{ia\int -\frac{\csc(ix)^2}{a+ib\csc(ix)}dx}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 25$$

$$-i\left(\frac{ia\int\frac{\csc(ix)^2}{a+ib\csc(ix)}dx}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 4276$$

$$-i\left(\frac{ia\left(\frac{ia\int-\frac{i\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{b}-\frac{i\int-i\operatorname{csch}(x)dx}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{ia\left(\frac{a\int\frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{b}-\frac{\int\operatorname{csch}(x)dx}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{ia\left(\frac{a\int\frac{i\csc(ix)}{a+ib\csc(ix)}dx}{b}-\frac{\int i\csc(ix)dx}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{ia\left(\frac{ia\int\frac{\csc(ix)}{a+ib\csc(ix)}dx}{b}-\frac{i\int\csc(ix)dx}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 4257$$

$$-i\left(\frac{ia\left(\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{ia\int\frac{\csc(ix)}{a+ib\csc(ix)}dx}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 4318$$

$$-i\left(\frac{ia\left(\frac{a\int\frac{1}{\frac{a\sinh(x)}{b}+1}dx}{b^2}+\frac{\operatorname{arctanh}(\cosh(x))}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{ia\left(\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{a\int\frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{b^2}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 3139$$

$$-i\left(\frac{ia\left(\frac{2a\int\frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{b^2}+\frac{\operatorname{arctanh}(\cosh(x))}{b}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 1083$$

$$-i\left(\frac{ia\left(\frac{\operatorname{arctanh}(\cosh(x))}{b}-\frac{4a\int\frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{b^2}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

$$\downarrow 219$$

$$-i\left(\frac{ia\left(\frac{\operatorname{arctanh}(\cosh(x))}{b}-\frac{2a\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{b\sqrt{a^2+b^2}}\right)}{b}-\frac{i\coth(x)}{b}\right)$$

input
```
Int[Csch[x]^3/(a + b*Csch[x]),x]
```

output
```
(-I)*((I*a*(ArcTanh[Cosh[x]]/b - (2*a*ArcTanh[(b*((2*a)/b - 2*Tanh[x/2]))/
(2*Sqrt[a^2 + b^2])])/(b*Sqrt[a^2 + b^2])))/b - (I*Coth[x])/b)
```

#### 3.82.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4276
```
Int[csc[(e_.) + (f_.)*(x_)]^2/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Sym
bol] :> Simp[1/b   Int[Csc[e + f*x], x], x] - Simp[a/b   Int[Csc[e + f*x]/(
a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e, f}, x]
```

rule 4277
```
Int[csc[(e_.) + (f_.)*(x_)]^3/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Sym
bol] :> Simp[-Cot[e + f*x]/(b*f), x] - Simp[a/b   Int[Csc[e + f*x]^2/(a + b
*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e, f}, x]
```

rule 4318

```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

### 3.82.4 Maple [A] (verified)

Time = 0.23 (sec) , antiderivative size = 73, normalized size of antiderivative = 1.24

| method | result | size |
|---|---|---|
| default | $-\frac{\tanh\left(\frac{x}{2}\right)}{2b}-\frac{2a^2\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{b^2\sqrt{a^2+b^2}}-\frac{1}{2b\tanh\left(\frac{x}{2}\right)}-\frac{a\ln\left(\tanh\left(\frac{x}{2}\right)\right)}{b^2}$ | 73 |
| risch | $-\frac{2}{b\left(\mathrm{e}^{2x}-1\right)}+\frac{a^2\ln\left(\mathrm{e}^x+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,b^2}-\frac{a^2\ln\left(\mathrm{e}^x+\frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,b^2}+\frac{a\ln\left(\mathrm{e}^x+1\right)}{b^2}-\frac{a\ln\left(\mathrm{e}^x-1\right)}{b^2}$ | 143 |

input

```
int(csch(x)^3/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output

```
-1/2/b*tanh(1/2*x)-2*a^2/b^2/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)
+2*a)/(a^2+b^2)^(1/2))-1/2/b/tanh(1/2*x)-a/b^2*ln(tanh(1/2*x))
```

### 3.82.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 345 vs. 2(55) = 110.

Time = 0.27 (sec) , antiderivative size = 345, normalized size of antiderivative = 5.85

$$\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$=\frac{2\,a^2b+2\,b^3-\left(a^2\cosh\left(x\right)^2+2\,a^2\cosh\left(x\right)\sinh\left(x\right)+a^2\sinh\left(x\right)^2-a^2\right)\sqrt{a^2+b^2}\log\left(\frac{a^2\cosh(x)^2+a^2\sinh(x)^2+2}{a\,c}\right.}{}$$

input

```
integrate(csch(x)^3/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
(2*a^2*b + 2*b^3 - (a^2*cosh(x)^2 + 2*a^2*cosh(x)*sinh(x) + a^2*sinh(x)^2
- a^2)*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x)
+ a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) - 2*sqrt(a^2 + b^2)*(a*cosh(
x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(
x) + b)*sinh(x) - a)) + (a^3 + a*b^2 - (a^3 + a*b^2)*cosh(x)^2 - 2*(a^3 +
a*b^2)*cosh(x)*sinh(x) - (a^3 + a*b^2)*sinh(x)^2)*log(cosh(x) + sinh(x) +
1) - (a^3 + a*b^2 - (a^3 + a*b^2)*cosh(x)^2 - 2*(a^3 + a*b^2)*cosh(x)*sinh
(x) - (a^3 + a*b^2)*sinh(x)^2)*log(cosh(x) + sinh(x) - 1))/(a^2*b^2 + b^4
- (a^2*b^2 + b^4)*cosh(x)^2 - 2*(a^2*b^2 + b^4)*cosh(x)*sinh(x) - (a^2*b^2
 + b^4)*sinh(x)^2)
```

### 3.82.6 Sympy [F]

$$\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(csch(x)**3/(a+b*csch(x)),x)
```

output
```
Integral(csch(x)**3/(a + b*csch(x)), x)
```

### 3.82.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 100, normalized size of antiderivative = 1.69

$$\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{a^2\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}b^2} + \frac{a\log\left(e^{(-x)}+1\right)}{b^2} - \frac{a\log\left(e^{(-x)}-1\right)}{b^2} + \frac{2}{be^{(-2x)}-b}$$

input
```
integrate(csch(x)^3/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
a^2*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))
/(sqrt(a^2 + b^2)*b^2) + a*log(e^(-x) + 1)/b^2 - a*log(e^(-x) - 1)/b^2 + 2
/(b*e^(-2*x) - b)
```

### 3.82.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 98, normalized size of antiderivative = 1.66

$$\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{a^2 \log\left(\frac{\left|2ae^x+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^x+2b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}b^2} + \frac{a\log\left(e^x+1\right)}{b^2} - \frac{a\log\left(\left|e^x-1\right|\right)}{b^2} - \frac{2}{b(e^{(2x)}-1)}$$

input
```
integrate(csch(x)^3/(a+b*csch(x)),x, algorithm="giac")
```

output
```
a^2*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(
a^2 + b^2)))/(sqrt(a^2 + b^2)*b^2) + a*log(e^x + 1)/b^2 - a*log(abs(e^x -
1))/b^2 - 2/(b*(e^(2*x) - 1))
```

### 3.82.9 Mupad [B] (verification not implemented)

Time = 2.50 (sec) , antiderivative size = 292, normalized size of antiderivative = 4.95

$$\int \frac{\operatorname{csch}^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2}{b-b\,\mathrm{e}^{2x}} - \frac{a\,\ln\left(32\,\mathrm{e}^x-32\right)}{b^2} + \frac{a\,\ln\left(32\,\mathrm{e}^x+32\right)}{b^2} + \frac{a^2\,\ln\left(32\,a^4\,\mathrm{e}^x-64\,a\,b^3-64\,a^3\,b-32\,a^3\sqrt{a^2+b^2}+128\,b^4\,\mathrm{e}^x+128\,b^3\,\mathrm{e}^x\sqrt{a^2+b^2}+160\,a^2\,b^2\,\mathrm{e}^x-64\,a\right.}{a^2\,b^2+b^4} - \frac{a^2\,\ln\left(32\,a^3\sqrt{a^2+b^2}-64\,a\,b^3-64\,a^3\,b+32\,a^4\,\mathrm{e}^x+128\,b^4\,\mathrm{e}^x-128\,b^3\,\mathrm{e}^x\sqrt{a^2+b^2}+160\,a^2\,b^2\,\mathrm{e}^x+64\,a\right.}{a^2\,b^2+b^4}$$

input
```
int(1/(sinh(x)^3*(a + b/sinh(x))),x)
```

output
```
2/(b - b*exp(2*x)) - (a*log(32*exp(x) - 32))/b^2 + (a*log(32*exp(x) + 32))
/b^2 + (a^2*log(32*a^4*exp(x) - 64*a*b^3 - 64*a^3*b - 32*a^3*(a^2 + b^2)^(
1/2) + 128*b^4*exp(x) + 128*b^3*exp(x)*(a^2 + b^2)^(1/2) + 160*a^2*b^2*exp
(x) - 64*a*b^2*(a^2 + b^2)^(1/2) + 96*a^2*b*exp(x)*(a^2 + b^2)^(1/2))*(a^2
 + b^2)^(1/2))/(b^4 + a^2*b^2) - (a^2*log(32*a^3*(a^2 + b^2)^(1/2) - 64*a*
b^3 - 64*a^3*b + 32*a^4*exp(x) + 128*b^4*exp(x) - 128*b^3*exp(x)*(a^2 + b^
2)^(1/2) + 160*a^2*b^2*exp(x) + 64*a*b^2*(a^2 + b^2)^(1/2) - 96*a^2*b*exp(
x)*(a^2 + b^2)^(1/2))*(a^2 + b^2)^(1/2))/(b^4 + a^2*b^2)
```

# 3.83 $\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx$


3.83.1 Optimal result . . . . . 569
3.83.2 Mathematica [A] (verified) . . . . . 569
3.83.3 Rubi [C] (verified) . . . . . 570
3.83.4 Maple [A] (verified) . . . . . 574
3.83.5 Fricas [B] (verification not implemented) . . . . . 575
3.83.6 Sympy [F] . . . . . 575
3.83.7 Maxima [B] (verification not implemented) . . . . . 576
3.83.8 Giac [A] (verification not implemented) . . . . . 576
3.83.9 Mupad [B] (verification not implemented) . . . . . 577


## 3.83.1 Optimal result

Integrand size = 13, antiderivative size = 83

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{(2a^2-b^2)\operatorname{arctanh}(\cosh(x))}{2b^3} + \frac{2a^3\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{b^3\sqrt{a^2+b^2}} + \frac{a\coth(x)}{b^2} - \frac{\coth(x)\operatorname{csch}(x)}{2b}$$

output
```
-1/2*(2*a^2-b^2)*arctanh(cosh(x))/b^3+a*coth(x)/b^2-1/2*coth(x)*csch(x)/b+
2*a^3*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/b^3/(a^2+b^2)^(1/2)
```

## 3.83.2 Mathematica [A] (verified)

Time = 0.63 (sec) , antiderivative size = 148, normalized size of antiderivative = 1.78

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{\frac{16a^3\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}} - 4ab\coth\left(\frac{x}{2}\right) + b^2\operatorname{csch}^2\left(\frac{x}{2}\right) + 8a^2\log\left(\cosh\left(\frac{x}{2}\right)\right) - 4b^2\log\left(\cosh\left(\frac{x}{2}\right)\right) - 8a^2\log($$
$$8b^3$$

input
```
Integrate[Csch[x]^4/(a + b*Csch[x]),x]
```

output
```
-1/8*((16*a^3*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[-a^2 - b^2]
 - 4*a*b*Coth[x/2] + b^2*Csch[x/2]^2 + 8*a^2*Log[Cosh[x/2]] - 4*b^2*Log[Co
sh[x/2]] - 8*a^2*Log[Sinh[x/2]] + 4*b^2*Log[Sinh[x/2]] + b^2*Sech[x/2]^2 -
 4*a*b*Tanh[x/2])/b^3
```

### 3.83.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.79 (sec) , antiderivative size = 111, normalized size of antiderivative = 1.34, number of steps used = 19, number of rules used = 18, $\frac{\text{number of rules}}{\text{integrand size}} = 1.385$, Rules used = {3042, 4338, 26, 3042, 26, 4570, 3042, 26, 4486, 26, 3042, 26, 4257, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{\csc(ix)^4}{a+ib\csc(ix)}dx$$

$$\downarrow 4338$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b} - \frac{i\int -\frac{i\operatorname{csch}(x)\left(2a\operatorname{csch}^2(x)+b\operatorname{csch}(x)+a\right)}{a+b\operatorname{csch}(x)}dx}{2b}$$

$$\downarrow 26$$

$$-\frac{\int \frac{\operatorname{csch}(x)\left(2a\operatorname{csch}^2(x)+b\operatorname{csch}(x)+a\right)}{a+b\operatorname{csch}(x)}dx}{2b} - \frac{\coth(x)\operatorname{csch}(x)}{2b}$$

$$\downarrow 3042$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b} - \frac{\int \frac{i\csc(ix)\left(-2a\csc(ix)^2+ib\csc(ix)+a\right)}{a+ib\csc(ix)}dx}{2b}$$

$$\downarrow 26$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b} - \frac{i\int \frac{\csc(ix)\left(-2a\csc(ix)^2+ib\csc(ix)+a\right)}{a+ib\csc(ix)}dx}{2b}$$

$$\downarrow 4570$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2ia\coth(x)}{b}-\frac{i\int\frac{\operatorname{csch}(x)\left(ab-\left(2a^2-b^2\right)\operatorname{csch}(x)\right)}{a+b\operatorname{csch}(x)}dx}{b}\right)}{2b}$$

$$\downarrow 3042$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2ia\coth(x)}{b}-\frac{i\int\frac{i\csc(ix)\left(ab-i\left(2a^2-b^2\right)\csc(ix)\right)}{a+ib\csc(ix)}dx}{b}\right)}{2b}$$

$$\downarrow 26$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{\int\frac{\csc(ix)\left(ab-i\left(2a^2-b^2\right)\csc(ix)\right)}{a+ib\csc(ix)}dx}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 4486$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2a^3\int-\frac{i\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{b}-\frac{\left(2a^2-b^2\right)\int-i\operatorname{csch}(x)dx}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 26$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{i\left(2a^2-b^2\right)\int\operatorname{csch}(x)dx}{b}-\frac{2ia^3\int\frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 3042$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{i\left(2a^2-b^2\right)\int i\csc(ix)dx}{b}-\frac{2ia^3\int\frac{i\csc(ix)}{a+ib\csc(ix)}dx}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 26$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2a^3\int\frac{\csc(ix)}{a+ib\csc(ix)}dx}{b}-\frac{\left(2a^2-b^2\right)\int\csc(ix)dx}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 4257$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2a^3\int\frac{\csc(ix)}{a+ib\csc(ix)}dx}{b}-\frac{i\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(x))}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 4318$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2ia^3\int\frac{1}{\frac{a\sinh(x)}{b}+1}dx}{b^2}-\frac{i\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(x))}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 3042$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{2ia^3\int\frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{b^2}-\frac{i\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(x))}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 3139$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{4ia^3\int\frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{b^2}-\frac{i\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(x))}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 1083$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{8ia^3\int\frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{b^2}-\frac{i\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(x))}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

$$\downarrow 219$$

$$-\frac{\coth(x)\operatorname{csch}(x)}{2b}-\frac{i\left(\frac{4ia^3\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{b\sqrt{a^2+b^2}}-\frac{i\left(2a^2-b^2\right)\operatorname{arctanh}(\cosh(x))}{b}+\frac{2ia\coth(x)}{b}\right)}{2b}$$

input
```
Int[Csch[x]^4/(a + b*Csch[x]),x]
```

## 3.83. $\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx$

output
```
((-1/2*I)*((((-I)*(2*a^2 - b^2)*ArcTanh[Cosh[x]])/b + ((4*I)*a^3*ArcTanh[(
b*((2*a)/b - 2*Tanh[x/2]))/(2*Sqrt[a^2 + b^2])])/(b*Sqrt[a^2 + b^2]))/b +
((2*I)*a*Coth[x])/b))/b - (Coth[x]*Csch[x])/(2*b)
```

### 3.83.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

rule 4338
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.))^(n_)/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[(-d^3)*Cot[e + f*x]*((d*Csc[e + f*x])^(n - 3)/(b*f*
(n - 2))), x] + Simp[d^3/(b*(n - 2))   Int[(d*Csc[e + f*x])^(n - 3)*(Simp[a
*(n - 3) + b*(n - 3)*Csc[e + f*x] - a*(n - 2)*Csc[e + f*x]^2, x]/(a + b*Csc
[e + f*x])), x], x] /; FreeQ[{a, b, d, e, f}, x] && NeQ[a^2 - b^2, 0] && Gt
Q[n, 3]
```

rule 4486
```
Int[(csc[(e_.) + (f_.)*(x_)]*(csc[(e_.) + (f_.)*(x_)]*(B_.) + (A_)))/(csc[(
e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbol] :> Simp[B/b   Int[Csc[e + f*x],
 x], x] + Simp[(A*b - a*B)/b   Int[Csc[e + f*x]/(a + b*Csc[e + f*x]), x], x
] /; FreeQ[{a, b, e, f, A, B}, x] && NeQ[A*b - a*B, 0]
```

rule 4570
```
Int[csc[(e_.) + (f_.)*(x_)]*((A_.) + csc[(e_.) + (f_.)*(x_)]*(B_.) + csc[(e
_.) + (f_.)*(x_)]^2*(C_.))*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_))^(m_), x_S
ymbol] :> Simp[(-C)*Cot[e + f*x]*((a + b*Csc[e + f*x])^(m + 1)/(b*f*(m + 2)
)), x] + Simp[1/(b*(m + 2))   Int[Csc[e + f*x]*(a + b*Csc[e + f*x])^m*Simp[
b*A*(m + 2) + b*C*(m + 1) + (b*B*(m + 2) - a*C)*Csc[e + f*x], x], x], x] /;
 FreeQ[{a, b, e, f, A, B, C, m}, x] &&  !LtQ[m, -1]
```

### 3.83.4 Maple [A] (verified)

Time = 0.30 (sec) , antiderivative size = 108, normalized size of antiderivative = 1.30

| method | result |
|---|---|
| default | $\frac{\frac{\tanh\left(\frac{x}{2}\right)^2 b}{2}+2a\tanh\left(\frac{x}{2}\right)}{4b^2}+\frac{2a^3\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{b^3\sqrt{a^2+b^2}}-\frac{1}{8b\tanh\left(\frac{x}{2}\right)^2}+\frac{(4a^2-2b^2)\ln\left(\tanh\left(\frac{x}{2}\right)\right)}{4b^3}+\frac{a}{2b^2\tanh\left(\frac{x}{2}\right)}$ |
| risch | $\frac{-\mathrm{e}^{3x}b+2a\,\mathrm{e}^{2x}-\mathrm{e}^{x}b-2a}{\left(\mathrm{e}^{2x}-1\right)^2b^2}+\frac{a^3\ln\left(\mathrm{e}^{x}+\frac{b\sqrt{a^2+b^2}+a^2+b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,b^3}-\frac{a^3\ln\left(\mathrm{e}^{x}+\frac{b\sqrt{a^2+b^2}-a^2-b^2}{\sqrt{a^2+b^2}\,a}\right)}{\sqrt{a^2+b^2}\,b^3}-\frac{\ln(\mathrm{e}^{x}+1)a^2}{b^3}+\frac{\ln(\mathrm{e}^{x}+1)}{2b}+\frac{\ln(\mathrm{e}^{x}}{b}$ |

input
```
int(csch(x)^4/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/4/b^2*(1/2*tanh(1/2*x)^2*b+2*a*tanh(1/2*x))+2/b^3*a^3/(a^2+b^2)^(1/2)*ar
ctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2))-1/8/b/tanh(1/2*x)^2+1/4/
b^3*(4*a^2-2*b^2)*ln(tanh(1/2*x))+1/2*a/b^2/tanh(1/2*x)
```

### 3.83.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 947 vs. 2(75) = 150.

Time = 0.32 (sec) , antiderivative size = 947, normalized size of antiderivative = 11.41

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(csch(x)^4/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-1/2*(4*a^3*b + 4*a*b^3 + 2*(a^2*b^2 + b^4)*cosh(x)^3 + 2*(a^2*b^2 + b^4)*
sinh(x)^3 - 4*(a^3*b + a*b^3)*cosh(x)^2 - 2*(2*a^3*b + 2*a*b^3 - 3*(a^2*b^
2 + b^4)*cosh(x))*sinh(x)^2 - 2*(a^3*cosh(x)^4 + 4*a^3*cosh(x)*sinh(x)^3 +
 a^3*sinh(x)^4 - 2*a^3*cosh(x)^2 + a^3 + 2*(3*a^3*cosh(x)^2 - a^3)*sinh(x)
^2 + 4*(a^3*cosh(x)^3 - a^3*cosh(x))*sinh(x))*sqrt(a^2 + b^2)*log((a^2*cos
h(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*
b)*sinh(x) + 2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x) + b))/(a*cosh(x)^2 +
 a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x) - a)) + 2*(a^2*b^2
+ b^4)*cosh(x) + ((2*a^4 + a^2*b^2 - b^4)*cosh(x)^4 + 4*(2*a^4 + a^2*b^2 -
 b^4)*cosh(x)*sinh(x)^3 + (2*a^4 + a^2*b^2 - b^4)*sinh(x)^4 + 2*a^4 + a^2*
b^2 - b^4 - 2*(2*a^4 + a^2*b^2 - b^4)*cosh(x)^2 - 2*(2*a^4 + a^2*b^2 - b^4
 - 3*(2*a^4 + a^2*b^2 - b^4)*cosh(x)^2)*sinh(x)^2 + 4*((2*a^4 + a^2*b^2 -
b^4)*cosh(x)^3 - (2*a^4 + a^2*b^2 - b^4)*cosh(x))*sinh(x))*log(cosh(x) + s
inh(x) + 1) - ((2*a^4 + a^2*b^2 - b^4)*cosh(x)^4 + 4*(2*a^4 + a^2*b^2 - b^
4)*cosh(x)*sinh(x)^3 + (2*a^4 + a^2*b^2 - b^4)*sinh(x)^4 + 2*a^4 + a^2*b^2
 - b^4 - 2*(2*a^4 + a^2*b^2 - b^4)*cosh(x)^2 - 2*(2*a^4 + a^2*b^2 - b^4 -
3*(2*a^4 + a^2*b^2 - b^4)*cosh(x)^2)*sinh(x)^2 + 4*((2*a^4 + a^2*b^2 - b^4
)*cosh(x)^3 - (2*a^4 + a^2*b^2 - b^4)*cosh(x))*sinh(x))*log(cosh(x) + sinh
(x) - 1) + 2*(a^2*b^2 + b^4 + 3*(a^2*b^2 + b^4)*cosh(x)^2 - 4*(a^3*b + a*b
^3)*cosh(x))*sinh(x))/(a^2*b^3 + b^5 + (a^2*b^3 + b^5)*cosh(x)^4 + 4*(a...
```

### 3.83.6 Sympy [F]

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(csch(x)**4/(a+b*csch(x)),x)
```

output
```
Integral(csch(x)**4/(a + b*csch(x)), x)
```

### 3.83.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 158 vs. 2(75) = 150.

Time = 0.26 (sec) , antiderivative size = 158, normalized size of antiderivative = 1.90

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a^3\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}b^3} + \frac{be^{(-x)}+2\,ae^{(-2\,x)}+be^{(-3\,x)}-2\,a}{2\,b^2e^{(-2\,x)}-b^2e^{(-4\,x)}-b^2} - \frac{(2\,a^2-b^2)\log\left(e^{(-x)}+1\right)}{2\,b^3} + \frac{(2\,a^2-b^2)\log\left(e^{(-x)}-1\right)}{2\,b^3}$$

input
```
integrate(csch(x)^4/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-a^3*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2))
)/(sqrt(a^2 + b^2)*b^3) + (b*e^(-x) + 2*a*e^(-2*x) + b*e^(-3*x) - 2*a)/(2*
b^2*e^(-2*x) - b^2*e^(-4*x) - b^2) - 1/2*(2*a^2 - b^2)*log(e^(-x) + 1)/b^3
 + 1/2*(2*a^2 - b^2)*log(e^(-x) - 1)/b^3
```

### 3.83.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 141, normalized size of antiderivative = 1.70

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a^3\log\left(\frac{\left|2\,ae^x+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^x+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}b^3} - \frac{(2\,a^2-b^2)\log\left(e^x+1\right)}{2\,b^3} + \frac{(2\,a^2-b^2)\log\left(\left|e^x-1\right|\right)}{2\,b^3} - \frac{be^{(3\,x)}-2\,ae^{(2\,x)}+be^x+2\,a}{b^2\left(e^{(2\,x)}-1\right)^2}$$

input
```
integrate(csch(x)^4/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a^3*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt
(a^2 + b^2)))/(sqrt(a^2 + b^2)*b^3) - 1/2*(2*a^2 - b^2)*log(e^x + 1)/b^3 +
 1/2*(2*a^2 - b^2)*log(abs(e^x - 1))/b^3 - (b*e^(3*x) - 2*a*e^(2*x) + b*e^
x + 2*a)/(b^2*(e^(2*x) - 1)^2)
```

### 3.83.9 Mupad [B] (verification not implemented)

Time = 2.84 (sec) , antiderivative size = 617, normalized size of antiderivative = 7.43

$$\int \frac{\operatorname{csch}^4(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$= \frac{e^x}{b-b\,e^{2x}} - \frac{2\,e^x}{b-2\,b\,e^{2x}+b\,e^{4x}} - \frac{\ln\left(24\,a^4+4\,b^4-20\,a^2\,b^2-24\,a^4\,e^x-4\,b^4\,e^x+20\,a^2\,b^2\,e^x\right)}{2\,b}$$
$$+ \frac{\ln\left(24\,a^4+4\,b^4-20\,a^2\,b^2+24\,a^4\,e^x+4\,b^4\,e^x-20\,a^2\,b^2\,e^x\right)}{2\,b} + \frac{2\,a}{b^2\,e^{2x}-b^2}$$
$$+ \frac{a^2\,\ln\left(24\,a^4+4\,b^4-20\,a^2\,b^2-24\,a^4\,e^x-4\,b^4\,e^x+20\,a^2\,b^2\,e^x\right)}{b^3}$$
$$- \frac{a^2\,\ln\left(24\,a^4+4\,b^4-20\,a^2\,b^2+24\,a^4\,e^x+4\,b^4\,e^x-20\,a^2\,b^2\,e^x\right)}{b^3}$$
$$- \frac{a^3\,\ln\left(16\,a\,b^5-24\,a^5\,\sqrt{a^2+b^2}-48\,a^5\,b-32\,a^3\,b^3+24\,a^6\,e^x-32\,b^6\,e^x-40\,a^3\,b^2\,\sqrt{a^2+b^2}-32\,b^5\,e^x\,\sqrt{}\right.}{a^2}$$
$$+ \frac{a^3\,\ln\left(24\,a^5\,\sqrt{a^2+b^2}+16\,a\,b^5-48\,a^5\,b-32\,a^3\,b^3+24\,a^6\,e^x-32\,b^6\,e^x+40\,a^3\,b^2\,\sqrt{a^2+b^2}+32\,b^5\,e^x\,\sqrt{}\right.}{a^2}$$

input
```
int(1/(sinh(x)^4*(a + b/sinh(x))),x)
```

output
```
exp(x)/(b - b*exp(2*x)) - (2*exp(x))/(b - 2*b*exp(2*x) + b*exp(4*x)) - log
(24*a^4 + 4*b^4 - 20*a^2*b^2 - 24*a^4*exp(x) - 4*b^4*exp(x) + 20*a^2*b^2*e
xp(x))/(2*b) + log(24*a^4 + 4*b^4 - 20*a^2*b^2 + 24*a^4*exp(x) + 4*b^4*exp
(x) - 20*a^2*b^2*exp(x))/(2*b) + (2*a)/(b^2*exp(2*x) - b^2) + (a^2*log(24*
a^4 + 4*b^4 - 20*a^2*b^2 - 24*a^4*exp(x) - 4*b^4*exp(x) + 20*a^2*b^2*exp(x
)))/b^3 - (a^2*log(24*a^4 + 4*b^4 - 20*a^2*b^2 + 24*a^4*exp(x) + 4*b^4*exp
(x) - 20*a^2*b^2*exp(x)))/b^3 - (a^3*log(16*a*b^5 - 24*a^5*(a^2 + b^2)^(1/
2) - 48*a^5*b - 32*a^3*b^3 + 24*a^6*exp(x) - 32*b^6*exp(x) - 40*a^3*b^2*(a
^2 + b^2)^(1/2) - 32*b^5*exp(x)*(a^2 + b^2)^(1/2) + 56*a^2*b^4*exp(x) + 11
2*a^4*b^2*exp(x) + 16*a*b^4*(a^2 + b^2)^(1/2) + 72*a^4*b*exp(x)*(a^2 + b^2
)^(1/2) + 72*a^2*b^3*exp(x)*(a^2 + b^2)^(1/2))*(a^2 + b^2)^(1/2))/(b^5 + a
^2*b^3) + (a^3*log(24*a^5*(a^2 + b^2)^(1/2) + 16*a*b^5 - 48*a^5*b - 32*a^3
*b^3 + 24*a^6*exp(x) - 32*b^6*exp(x) + 40*a^3*b^2*(a^2 + b^2)^(1/2) + 32*b
^5*exp(x)*(a^2 + b^2)^(1/2) + 56*a^2*b^4*exp(x) + 112*a^4*b^2*exp(x) - 16*
a*b^4*(a^2 + b^2)^(1/2) - 72*a^4*b*exp(x)*(a^2 + b^2)^(1/2) - 72*a^2*b^3*e
xp(x)*(a^2 + b^2)^(1/2))*(a^2 + b^2)^(1/2))/(b^5 + a^2*b^3)
```

# 3.84 $\int \frac{\cosh^4(x)}{i+\mathbf{csch}(x)}\,dx$


3.84.1 Optimal result . . . . . 578
3.84.2 Mathematica [A] (verified) . . . . . 578
3.84.3 Rubi [A] (verified) . . . . . 579
3.84.4 Maple [B] (verified) . . . . . 582
3.84.5 Fricas [A] (verification not implemented) . . . . . 582
3.84.6 Sympy [F] . . . . . 583
3.84.7 Maxima [A] (verification not implemented) . . . . . 583
3.84.8 Giac [A] (verification not implemented) . . . . . 583
3.84.9 Mupad [B] (verification not implemented) . . . . . 584


## 3.84.1 Optimal result

Integrand size = 13, antiderivative size = 38

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{ix}{8} + \frac{\cosh^3(x)}{3} + \frac{1}{8}i\cosh(x)\sinh(x) - \frac{1}{4}i\cosh^3(x)\sinh(x)$$

output
```
1/8*I*x+1/3*cosh(x)^3+1/8*I*cosh(x)*sinh(x)-1/4*I*cosh(x)^3*sinh(x)
```

## 3.84.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 32, normalized size of antiderivative = 0.84

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{ix}{8} + \frac{\cosh(x)}{4} + \frac{1}{12}\cosh(3x) - \frac{1}{32}i\sinh(4x)$$

input
```
Integrate[Cosh[x]^4/(I + Csch[x]),x]
```

output
```
(I/8)*x + Cosh[x]/4 + Cosh[3*x]/12 - (I/32)*Sinh[4*x]
```

### 3.84.3 Rubi [A] (verified)

Time = 0.45 (sec) , antiderivative size = 43, normalized size of antiderivative = 1.13, number of steps used = 19, number of rules used = 18, $\frac{\text{number of rules}}{\text{integrand size}} = 1.385$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3318, 25, 26, 3042, 25, 26, 3045, 15, 3048, 3042, 3115, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^4(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)^4}{i\csc(ix)+i}dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh^4(x)}{-\sinh(x)+i}dx$$
$$\downarrow 26$$
$$i\int \frac{\cosh^4(x)\sinh(x)}{i-\sinh(x)}dx$$
$$\downarrow 3042$$
$$i\int -\frac{i\cos(ix)^4\sin(ix)}{i\sin(ix)+i}dx$$
$$\downarrow 26$$
$$\int -\frac{i\sin(ix)\cos(ix)^4}{1+\sin(ix)}dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)^4\sin(ix)}{\sin(ix)+1}dx$$
$$\downarrow 3318$$
$$-i\left(-\int -\cosh^2(x)\sinh^2(x)dx+\int i\cosh^2(x)\sinh(x)dx\right)$$
$$\downarrow 25$$
$$-i\left(\int \cosh^2(x)\sinh^2(x)dx+\int i\cosh^2(x)\sinh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \cosh^2(x)\sinh^2(x)dx + i\int \cosh^2(x)\sinh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\cos(ix)^2\sin(ix)dx + \int -\cos(ix)^2\sin(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\cos(ix)^2\sin(ix)dx - \int \cos(ix)^2\sin(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \cos(ix)^2\sin(ix)dx - \int \cos(ix)^2\sin(ix)^2dx\right)$$

$$\downarrow 3045$$

$$-i\left(i\int \cosh^2(x)d\cosh(x) - \int \cos(ix)^2\sin(ix)^2dx\right)$$

$$\downarrow 15$$

$$-i\left(\frac{1}{3}i\cosh^3(x) - \int \cos(ix)^2\sin(ix)^2dx\right)$$

$$\downarrow 3048$$

$$-i\left(-\frac{1}{4}\int \cosh^2(x)dx + \frac{1}{3}i\cosh^3(x) + \frac{1}{4}\sinh(x)\cosh^3(x)\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{1}{4}\int \sin\left(ix+\frac{\pi}{2}\right)^2dx + \frac{1}{3}i\cosh^3(x) + \frac{1}{4}\sinh(x)\cosh^3(x)\right)$$

$$\downarrow 3115$$

$$-i\left(\frac{1}{4}\left(-\frac{\int 1dx}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right) + \frac{1}{3}i\cosh^3(x) + \frac{1}{4}\sinh(x)\cosh^3(x)\right)$$

$$\downarrow 24$$

$$-i\left(\frac{1}{3}i\cosh^3(x) + \frac{1}{4}\sinh(x)\cosh^3(x) + \frac{1}{4}\left(-\frac{x}{2} - \frac{1}{2}\sinh(x)\cosh(x)\right)\right)$$

input
```
Int[Cosh[x]^4/(I + Csch[x]),x]
```

output
```
(-I)*((I/3)*Cosh[x]^3 + (Cosh[x]^3*Sinh[x])/4 + (-1/2*x - (Cosh[x]*Sinh[x]
)/2)/4)
```

### 3.84.3.1 Defintions of rubi rules used

rule 15
```
Int[(a_.)*(x_)^(m_.), x_Symbol] :> Simp[a*(x^(m + 1)/(m + 1)), x] /; FreeQ[
{a, m}, x] && NeQ[m, -1]
```

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3045
```
Int[(cos[(e_.) + (f_.)*(x_)]*(a_.))^(m_.)*sin[(e_.) + (f_.)*(x_)]^(n_.), x_
Symbol] :> Simp[-(a*f)^(-1)   Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x],
x, a*Cos[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] &&
 !(IntegerQ[(m - 1)/2] && GtQ[m, 0] && LeQ[m, n])
```

rule 3048
```
Int[(cos[(e_.) + (f_.)*(x_)]*(b_.))^(n_)*((a_.)*sin[(e_.) + (f_.)*(x_)])^(m
_), x_Symbol] :> Simp[(-a)*(b*Cos[e + f*x])^(n + 1)*((a*Sin[e + f*x])^(m -
1)/(b*f*(m + n))), x] + Simp[a^2*((m - 1)/(m + n))   Int[(b*Cos[e + f*x])^n
*(a*Sin[e + f*x])^(m - 2), x], x] /; FreeQ[{a, b, e, f, n}, x] && GtQ[m, 1]
 && NeQ[m + n, 0] && IntegersQ[2*m, 2*n]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 3318
```
Int[((cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(
n_.))/((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[g^2/a   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^n, x], x] - Simp[g^2/(b*d)   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b,
d, e, f, g, n, p}, x] && EqQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.84.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 115 vs. $2(27) = 54$.

Time $= 0.15$ (sec) , antiderivative size $= 116$, normalized size of antiderivative $= 3.05$

$$-\frac{i\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)}{8}-\frac{i}{4\left(\tanh\left(\frac{x}{2}\right)-1\right)^4}+\frac{-\frac{1}{3}-\frac{i}{2}}{\left(\tanh\left(\frac{x}{2}\right)-1\right)^3}+\frac{-\frac{1}{2}-\frac{3i}{8}}{\left(\tanh\left(\frac{x}{2}\right)-1\right)^2}+\frac{-\frac{1}{2}-\frac{i}{8}}{\tanh\left(\frac{x}{2}\right)-1}+\frac{i}{4\left(\tanh\left(\frac{x}{2}\right)-\right.}$$

input
```
int(cosh(x)^4/(I+csch(x)),x)
```

output
```
-1/8*I*ln(tanh(1/2*x)-1)-1/4*I/(tanh(1/2*x)-1)^4-(1/3+1/2*I)/(tanh(1/2*x)-
1)^3-(1/2+3/8*I)/(tanh(1/2*x)-1)^2-(1/2+1/8*I)/(tanh(1/2*x)-1)+1/4*I/(tanh
(1/2*x)+1)^4+1/8*I*ln(tanh(1/2*x)+1)+(1/3-1/2*I)/(tanh(1/2*x)+1)^3+(1/2-1/
8*I)/(tanh(1/2*x)+1)+(-1/2+3/8*I)/(tanh(1/2*x)+1)^2
```

### 3.84.5 Fricas [A] (verification not implemented)

Time $= 0.25$ (sec) , antiderivative size $= 43$, normalized size of antiderivative $= 1.13$

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{192}\left(24ix e^{(4x)} - 3ie^{(8x)} + 8e^{(7x)} + 24e^{(5x)} + 24e^{(3x)} + 8e^{x} + 3i\right)e^{(-4x)}$$

input
```
integrate(cosh(x)^4/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/192*(24*I*x*e^(4*x) - 3*I*e^(8*x) + 8*e^(7*x) + 24*e^(5*x) + 24*e^(3*x)
+ 8*e^x + 3*I)*e^(-4*x)
```

### 3.84.6 Sympy [F]

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\cosh^4(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(cosh(x)**4/(I+csch(x)),x)
```

output
```
Integral(cosh(x)**4/(csch(x) + I), x)
```

### 3.84.7 Maxima [A] (verification not implemented)

Time = 0.17 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.11

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{192}\left(8\,e^{(-x)} + 24\,e^{(-3\,x)} - 3i\right)e^{(4\,x)} + \frac{1}{8}i\,x + \frac{1}{8}\,e^{(-x)} + \frac{1}{24}\,e^{(-3\,x)} + \frac{1}{64}i\,e^{(-4\,x)}$$

input
```
integrate(cosh(x)^4/(I+csch(x)),x, algorithm="maxima")
```

output
```
1/192*(8*e^(-x) + 24*e^(-3*x) - 3*I)*e^(4*x) + 1/8*I*x + 1/8*e^(-x) + 1/24
*e^(-3*x) + 1/64*I*e^(-4*x)
```

### 3.84.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 38, normalized size of antiderivative = 1.00

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{192}\left(24\,e^{(3\,x)} + 8\,e^{x} + 3i\right)e^{(-4\,x)} + \frac{1}{8}i\,x - \frac{1}{64}i\,e^{(4\,x)} + \frac{1}{24}\,e^{(3\,x)} + \frac{1}{8}\,e^{x}$$

input
```
integrate(cosh(x)^4/(I+csch(x)),x, algorithm="giac")
```

output
```
1/192*(24*e^(3*x) + 8*e^x + 3*I)*e^(-4*x) + 1/8*I*x - 1/64*I*e^(4*x) + 1/2
4*e^(3*x) + 1/8*e^x
```

### 3.84.9 Mupad [B] (verification not implemented)

Time = 2.29 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.08

$$\int \frac{\cosh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{-x}}{8} + \frac{\mathrm{e}^{-3x}}{24} + \frac{\mathrm{e}^{3x}}{24} + \frac{\mathrm{e}^{x}}{8} + \frac{x\,1\mathrm{i}}{8} + \frac{\mathrm{e}^{-4x}\,1\mathrm{i}}{64} - \frac{\mathrm{e}^{4x}\,1\mathrm{i}}{64}$$

input
```
int(cosh(x)^4/(1/sinh(x) + 1i),x)
```

output
```
(x*1i)/8 + exp(-x)/8 + exp(-3*x)/24 + exp(3*x)/24 + (exp(-4*x)*1i)/64 - (e
xp(4*x)*1i)/64 + exp(x)/8
```

# 3.85 $\int \frac{\cosh^3(x)}{i+\mathbf{csch}(x)}\,dx$

3.85.1 Optimal result . . . 585
3.85.2 Mathematica [A] (verified) . . . 585
3.85.3 Rubi [A] (verified) . . . 586
3.85.4 Maple [A] (verified) . . . 588
3.85.5 Fricas [B] (verification not implemented) . . . 589
3.85.6 Sympy [F] . . . 589
3.85.7 Maxima [B] (verification not implemented) . . . 589
3.85.8 Giac [B] (verification not implemented) . . . 590
3.85.9 Mupad [B] (verification not implemented) . . . 590

## 3.85.1 Optimal result

Integrand size = 13, antiderivative size = 19

$$\int \frac{\cosh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\sinh^2(x)}{2} - \frac{1}{3}i\sinh^3(x)$$

output
```
1/2*sinh(x)^2-1/3*I*sinh(x)^3
```

## 3.85.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 19, normalized size of antiderivative = 1.00

$$\int \frac{\cosh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\sinh^2(x)}{2} - \frac{1}{3}i\sinh^3(x)$$

input
```
Integrate[Cosh[x]^3/(I + Csch[x]),x]
```

output
```
Sinh[x]^2/2 - (I/3)*Sinh[x]^3
```

### 3.85.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.21, number of steps used = 15, number of rules used = 14, $\frac{\text{number of rules}}{\text{integrand size}} = 1.077$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3314, 25, 26, 3042, 25, 26, 3044, 15}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^3(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{\cos(ix)^3}{i\csc(ix)+i}dx$$

$$\downarrow 4360$$

$$\int \frac{i\sinh(x)\cosh^3(x)}{-\sinh(x)+i}dx$$

$$\downarrow 26$$

$$i\int \frac{\cosh^3(x)\sinh(x)}{i-\sinh(x)}dx$$

$$\downarrow 3042$$

$$i\int -\frac{i\cos(ix)^3\sin(ix)}{i\sin(ix)+i}dx$$

$$\downarrow 26$$

$$\int -\frac{i\sin(ix)\cos(ix)^3}{1+\sin(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\cos(ix)^3\sin(ix)}{\sin(ix)+1}dx$$

$$\downarrow 3314$$

$$-i\left(-\int -\cosh(x)\sinh^2(x)dx+\int i\cosh(x)\sinh(x)dx\right)$$

$$\downarrow 25$$

$$-i\left(\int \cosh(x)\sinh^2(x)dx+\int i\cosh(x)\sinh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \cosh(x)\sinh^2(x)dx + i\int \cosh(x)\sinh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\cos(ix)\sin(ix)dx + \int -\cos(ix)\sin(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\cos(ix)\sin(ix)dx - \int \cos(ix)\sin(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \cos(ix)\sin(ix)dx - \int \cos(ix)\sin(ix)^2dx\right)$$

$$\downarrow 3044$$

$$-i\left(i\int -\sinh^2(x)d(i\sinh(x)) - i\int i\sinh(x)d(i\sinh(x))\right)$$

$$\downarrow 15$$

$$-i\left(\frac{\sinh^3(x)}{3} + \frac{1}{2}i\sinh^2(x)\right)$$

input
```
Int[Cosh[x]^3/(I + Csch[x]),x]
```

output
```
(-I)*((I/2)*Sinh[x]^2 + Sinh[x]^3/3)
```

### 3.85.3.1 Defintions of rubi rules used

rule 15
```
Int[(a_.)*(x_)^(m_.), x_Symbol] :> Simp[a*(x^(m + 1)/(m + 1)), x] /; FreeQ[
{a, m}, x] && NeQ[m, -1]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3044
```
Int[cos[(e_.) + (f_.)*(x_)]^(n_.)*((a_.)*sin[(e_.) + (f_.)*(x_)])^(m_.), x_
Symbol] :> Simp[1/(a*f)   Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a
*Sin[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] &&  !(I
ntegerQ[(m - 1)/2] && LtQ[0, m, n])
```

rule 3314
```
Int[(cos[(e_.) + (f_.)*(x_)]^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.))/((
a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[1/a   Int[Cos[e + f
*x]^(p - 2)*(d*Sin[e + f*x])^n, x], x] - Simp[1/(b*d)   Int[Cos[e + f*x]^(p
 - 2)*(d*Sin[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n, p}, x] &
& IntegerQ[(p - 1)/2] && EqQ[a^2 - b^2, 0] && IntegerQ[n] && (LtQ[0, n, (p
+ 1)/2] || (LeQ[p, -n] && LtQ[-n, 2*p - 3]) || (GtQ[n, 0] && LeQ[n, -p]))
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.85.4 Maple [A] (verified)

Time = 222.89 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.79

| method | result | size |
|---|---|---|
| derivativedivides | $-\frac{i}{3\operatorname{csch}(x)^3}+\frac{1}{2\operatorname{csch}(x)^2}$ | 15 |
| default | $-\frac{i}{3\operatorname{csch}(x)^3}+\frac{1}{2\operatorname{csch}(x)^2}$ | 15 |
| risch | $-\frac{i\mathrm{e}^{3x}}{24}+\frac{\mathrm{e}^{2x}}{8}+\frac{i\mathrm{e}^{x}}{8}-\frac{i\mathrm{e}^{-x}}{8}+\frac{\mathrm{e}^{-2x}}{8}+\frac{i\mathrm{e}^{-3x}}{24}$ | 40 |

input
```
int(cosh(x)^3/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/3*I/csch(x)^3+1/2/csch(x)^2
```

### 3.85.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 36 vs. 2(13) = 26.

Time = 0.25 (sec) , antiderivative size = 36, normalized size of antiderivative = 1.89

$$\int \frac{\cosh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{24}\left(-i\,e^{(6\,x)} + 3\,e^{(5\,x)} + 3i\,e^{(4\,x)} - 3i\,e^{(2\,x)} + 3\,e^{x} + i\right)e^{(-3\,x)}$$

input
```
integrate(cosh(x)^3/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/24*(-I*e^(6*x) + 3*e^(5*x) + 3*I*e^(4*x) - 3*I*e^(2*x) + 3*e^x + I)*e^(-
3*x)
```

### 3.85.6 Sympy [F]

$$\int \frac{\cosh^3(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\cosh^3(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(cosh(x)**3/(I+csch(x)),x)
```

output
```
Integral(cosh(x)**3/(csch(x) + I), x)
```

### 3.85.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 39 vs. 2(13) = 26.

Time = 0.17 (sec) , antiderivative size = 39, normalized size of antiderivative = 2.05

$$\int \frac{\cosh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{24}\left(3\,e^{(-x)} + 3i\,e^{(-2\,x)} - i\right)e^{(3\,x)} - \frac{1}{8}i\,e^{(-x)} + \frac{1}{8}\,e^{(-2\,x)} + \frac{1}{24}i\,e^{(-3\,x)}$$

input
```
integrate(cosh(x)^3/(I+csch(x)),x, algorithm="maxima")
```

output
```
1/24*(3*e^(-x) + 3*I*e^(-2*x) - I)*e^(3*x) - 1/8*I*e^(-x) + 1/8*e^(-2*x) +
 1/24*I*e^(-3*x)
```

### 3.85.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 35 vs. $2(13) = 26$.

Time $= 0.28$ (sec) , antiderivative size $= 35$, normalized size of antiderivative $= 1.84$

$$\int \frac{\cosh^3(x)}{i + \operatorname{csch}(x)}\,dx = -\frac{1}{24}\left(3i\,e^{(2\,x)} - 3\,e^{x} - i\right)e^{(-3\,x)} - \frac{1}{24}i\,e^{(3\,x)} + \frac{1}{8}\,e^{(2\,x)} + \frac{1}{8}i\,e^{x}$$

input
```
integrate(cosh(x)^3/(I+csch(x)),x, algorithm="giac")
```

output
```
-1/24*(3*I*e^(2*x) - 3*e^x - I)*e^(-3*x) - 1/24*I*e^(3*x) + 1/8*e^(2*x) +
1/8*I*e^x
```

### 3.85.9 Mupad [B] (verification not implemented)

Time $= 2.23$ (sec) , antiderivative size $= 39$, normalized size of antiderivative $= 2.05$

$$\int \frac{\cosh^3(x)}{i + \operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{-2\,x}}{8} - \frac{\mathrm{e}^{-x}\,1\mathrm{i}}{8} + \frac{\mathrm{e}^{2\,x}}{8} + \frac{\mathrm{e}^{-3\,x}\,1\mathrm{i}}{24} - \frac{\mathrm{e}^{3\,x}\,1\mathrm{i}}{24} + \frac{\mathrm{e}^{x}\,1\mathrm{i}}{8}$$

input
```
int(cosh(x)^3/(1/sinh(x) + 1i),x)
```

output
```
exp(-2*x)/8 - (exp(-x)*1i)/8 + exp(2*x)/8 + (exp(-3*x)*1i)/24 - (exp(3*x)*
1i)/24 + (exp(x)*1i)/8
```

# 3.86 $\int \frac{\cosh^2(x)}{i+\mathbf{csch}(x)}\,dx$

3.86.1 Optimal result . . . 591
3.86.2 Mathematica [A] (verified) . . . 591
3.86.3 Rubi [A] (verified) . . . 592
3.86.4 Maple [B] (verified) . . . 594
3.86.5 Fricas [B] (verification not implemented) . . . 595
3.86.6 Sympy [F] . . . 595
3.86.7 Maxima [B] (verification not implemented) . . . 595
3.86.8 Giac [B] (verification not implemented) . . . 596
3.86.9 Mupad [B] (verification not implemented) . . . 596

## 3.86.1 Optimal result

Integrand size = 13, antiderivative size = 20

$$\int \frac{\cosh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{ix}{2} + \cosh(x) - \frac{1}{2}i\cosh(x)\sinh(x)$$

output
```
1/2*I*x+cosh(x)-1/2*I*cosh(x)*sinh(x)
```

## 3.86.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.00

$$\int \frac{\cosh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{ix}{2} + \cosh(x) - \frac{1}{4}i\sinh(2x)$$

input
```
Integrate[Cosh[x]^2/(I + Csch[x]),x]
```

output
```
(I/2)*x + Cosh[x] - (I/4)*Sinh[2*x]
```

### 3.86.3 Rubi [A] (verified)

Time = 0.34 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.20, number of steps used = 15, number of rules used = 15, $\frac{\text{number of rules}}{\text{integrand size}} = 1.154$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3318, 25, 26, 3042, 25, 26, 3115, 24, 3118}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^2(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)^2}{i\csc(ix)+i}dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh^2(x)}{-\sinh(x)+i}dx$$
$$\downarrow 26$$
$$i\int \frac{\cosh^2(x)\sinh(x)}{i-\sinh(x)}dx$$
$$\downarrow 3042$$
$$i\int -\frac{i\cos(ix)^2\sin(ix)}{i\sin(ix)+i}dx$$
$$\downarrow 26$$
$$\int -\frac{i\sin(ix)\cos(ix)^2}{1+\sin(ix)}dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)^2\sin(ix)}{\sin(ix)+1}dx$$
$$\downarrow 3318$$
$$-i\left(-\int -\sinh^2(x)dx+\int i\sinh(x)dx\right)$$
$$\downarrow 25$$
$$-i\left(\int \sinh^2(x)dx+\int i\sinh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \sinh^2(x)dx + i\int \sinh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\sin(ix)dx + \int -\sin(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\sin(ix)dx - \int \sin(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \sin(ix)dx - \int \sin(ix)^2dx\right)$$

$$\downarrow 3115$$

$$-i\left(-\frac{\int 1dx}{2} + \int \sin(ix)dx + \frac{1}{2}\sinh(x)\cosh(x)\right)$$

$$\downarrow 24$$

$$-i\left(\int \sin(ix)dx - \frac{x}{2} + \frac{1}{2}\sinh(x)\cosh(x)\right)$$

$$\downarrow 3118$$

$$-i\left(-\frac{x}{2} + i\cosh(x) + \frac{1}{2}\sinh(x)\cosh(x)\right)$$

input
```
Int[Cosh[x]^2/(I + Csch[x]),x]
```

output
```
(-I)*(-1/2*x + I*Cosh[x] + (Cosh[x]*Sinh[x])/2)
```

### 3.86.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3115
```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Sin[c + d*x])^(n - 1)/(d*n)), x] + Simp[b^2*((n - 1)/n)   Int[(b*Sin
[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[
2*n]
```

rule 3118
```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

rule 3318
```
Int[((cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(
n_.))/((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[g^2/a   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^n, x], x] - Simp[g^2/(b*d)   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b,
d, e, f, g, n, p}, x] && EqQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.86.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 29 vs. $2(14) = 28$.

Time = 9.22 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.50

| method | result | size |
|---|---|---|
| risch | $\frac{ix}{2} - \frac{ie^{2x}}{8} + \frac{e^{x}}{2} + \frac{e^{-x}}{2} + \frac{ie^{-2x}}{8}$ | 30 |
| default | $-\frac{i\ln(\tanh(\frac{x}{2})-1)}{2} - \frac{i}{2(\tanh(\frac{x}{2})-1)^2} + \frac{-1-\frac{i}{2}}{\tanh(\frac{x}{2})-1} + \frac{i}{2(\tanh(\frac{x}{2})+1)^2} + \frac{i\ln(\tanh(\frac{x}{2})+1)}{2} + \frac{1-\frac{i}{2}}{\tanh(\frac{x}{2})+1}$ | 68 |

input
```
int(cosh(x)^2/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/2*I*x-1/8*I*exp(x)^2+1/2*exp(x)+1/2/exp(x)+1/8*I/exp(x)^2
```

### 3.86.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 31 vs. $2(12) = 24$.

Time = 0.25 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.55

$$\int \frac{\cosh^2(x)}{i + \operatorname{csch}(x)}\,dx = \frac{1}{8}\left(4i\,x e^{(2\,x)} - i\,e^{(4\,x)} + 4\,e^{(3\,x)} + 4\,e^{x} + i\right)e^{(-2\,x)}$$

input
```
integrate(cosh(x)^2/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/8*(4*I*x*e^(2*x) - I*e^(4*x) + 4*e^(3*x) + 4*e^x + I)*e^(-2*x)
```

### 3.86.6 Sympy [F]

$$\int \frac{\cosh^2(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\cosh^2(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(cosh(x)**2/(I+csch(x)),x)
```

output
```
Integral(cosh(x)**2/(csch(x) + I), x)
```

### 3.86.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 30 vs. $2(12) = 24$.

Time = 0.17 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.50

$$\int \frac{\cosh^2(x)}{i + \operatorname{csch}(x)}\,dx = \frac{1}{8}\left(4\,e^{(-x)} - i\right)e^{(2\,x)} + \frac{1}{2}i\,x + \frac{1}{2}\,e^{(-x)} + \frac{1}{8}i\,e^{(-2\,x)}$$

input
```
integrate(cosh(x)^2/(I+csch(x)),x, algorithm="maxima")
```

output
```
1/8*(4*e^(-x) - I)*e^(2*x) + 1/2*I*x + 1/2*e^(-x) + 1/8*I*e^(-2*x)
```

### 3.86.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 26 vs. $2(12) = 24$.

Time $= 0.28$ (sec) , antiderivative size $= 26$, normalized size of antiderivative $= 1.30$

$$\int \frac{\cosh^2(x)}{i + \operatorname{csch}(x)}\,dx = \frac{1}{8}\,(4\,e^{x} + i)e^{(-2\,x)} + \frac{1}{2}i\,x - \frac{1}{8}i\,e^{(2\,x)} + \frac{1}{2}\,e^{x}$$

input
```
integrate(cosh(x)^2/(I+csch(x)),x, algorithm="giac")
```

output
```
1/8*(4*e^x + I)*e^(-2*x) + 1/2*I*x - 1/8*I*e^(2*x) + 1/2*e^x
```

### 3.86.9 Mupad [B] (verification not implemented)

Time $= 2.21$ (sec) , antiderivative size $= 29$, normalized size of antiderivative $= 1.45$

$$\int \frac{\cosh^2(x)}{i + \operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{-x}}{2} + \frac{\mathrm{e}^{x}}{2} + \frac{x\,1\mathrm{i}}{2} + \frac{\mathrm{e}^{-2\,x}\,1\mathrm{i}}{8} - \frac{\mathrm{e}^{2\,x}\,1\mathrm{i}}{8}$$

input
```
int(cosh(x)^2/(1/sinh(x) + 1i),x)
```

output
```
(x*1i)/2 + exp(-x)/2 + (exp(-2*x)*1i)/8 - (exp(2*x)*1i)/8 + exp(x)/2
```

# 3.87 $\int \frac{\cosh(x)}{i+\mathbf{csch}(x)}\,dx$

3.87.1 Optimal result . . . . . 597
3.87.2 Mathematica [A] (verified) . . . . . 597
3.87.3 Rubi [A] (verified) . . . . . 598
3.87.4 Maple [A] (verified) . . . . . 600
3.87.5 Fricas [B] (verification not implemented) . . . . . 600
3.87.6 Sympy [F] . . . . . 600
3.87.7 Maxima [A] (verification not implemented) . . . . . 601
3.87.8 Giac [A] (verification not implemented) . . . . . 601
3.87.9 Mupad [B] (verification not implemented) . . . . . 601

## 3.87.1 Optimal result

Integrand size = 11, antiderivative size = 16

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = \log(i-\sinh(x)) - i\sinh(x)$$

output
```
ln(I-sinh(x))-I*sinh(x)
```

## 3.87.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 16, normalized size of antiderivative = 1.00

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = \log(i-\sinh(x)) - i\sinh(x)$$

input
```
Integrate[Cosh[x]/(I + Csch[x]),x]
```

output
```
Log[I - Sinh[x]] - I*Sinh[x]
```

### 3.87.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 16, normalized size of antiderivative = 1.00, number of steps used = 10, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.818$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3312, 49, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)}{i\csc(ix)+i}\,dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh(x)}{-\sinh(x)+i}\,dx$$
$$\downarrow 26$$
$$i\int \frac{\cosh(x)\sinh(x)}{i-\sinh(x)}\,dx$$
$$\downarrow 3042$$
$$i\int -\frac{i\cos(ix)\sin(ix)}{i\sin(ix)+i}\,dx$$
$$\downarrow 26$$
$$\int -\frac{i\sin(ix)\cos(ix)}{1+\sin(ix)}\,dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)\sin(ix)}{\sin(ix)+1}\,dx$$
$$\downarrow 3312$$
$$-\int \frac{i\sinh(x)}{i\sinh(x)+1}\,d(i\sinh(x))$$
$$\downarrow 49$$
$$-\int \left(1+\frac{1}{-i\sinh(x)-1}\right)d(i\sinh(x))$$
$$\downarrow 2009$$

$$\log(1 + i\sinh(x)) - i\sinh(x)$$

input
```
Int[Cosh[x]/(I + Csch[x]),x]
```

output
```
Log[1 + I*Sinh[x]] - I*Sinh[x]
```

### 3.87.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 49
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d}, x]
&& IGtQ[m, 0] && IGtQ[m + n + 2, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3312
```
Int[cos[(e_.) + (f_.)*(x_)]*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_.)*((
c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.), x_Symbol] :> Simp[1/(b*f)   Su
bst[Int[(a + x)^m*(c + (d/b)*x)^n, x], x, b*Sin[e + f*x]], x] /; FreeQ[{a,
b, c, d, e, f, m, n}, x]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.87.4 Maple [A] (verified)

Time = 2.26 (sec) , antiderivative size = 25, normalized size of antiderivative = 1.56

| method | result | size |
|---|---|---|
| risch | $-x-\frac{ie^{x}}{2}+\frac{ie^{-x}}{2}+2\ln\left(e^{x}-i\right)$ | 25 |
| derivativedivides | $-\ln\left(\operatorname{csch}\left(x\right)\right)-\frac{i}{\operatorname{csch}(x)}+\frac{\ln\left(1+\operatorname{csch}(x)^{2}\right)}{2}-i\arctan\left(\operatorname{csch}\left(x\right)\right)$ | 29 |
| default | $-\ln\left(\operatorname{csch}\left(x\right)\right)-\frac{i}{\operatorname{csch}(x)}+\frac{\ln\left(1+\operatorname{csch}(x)^{2}\right)}{2}-i\arctan\left(\operatorname{csch}\left(x\right)\right)$ | 29 |

input
```
int(cosh(x)/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-x-1/2*I*exp(x)+1/2*I/exp(x)+2*ln(exp(x)-I)
```

### 3.87.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 28 vs. 2(12) = 24.

Time = 0.25 (sec) , antiderivative size = 28, normalized size of antiderivative = 1.75

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{2}\left(2\,xe^{x}-4\,e^{x}\log\left(e^{x}-i\right)+i\,e^{(2\,x)}-i\right)e^{(-x)}$$

input
```
integrate(cosh(x)/(I+csch(x)),x, algorithm="fricas")
```

output
```
-1/2*(2*x*e^x - 4*e^x*log(e^x - I) + I*e^(2*x) - I)*e^(-x)
```

### 3.87.6 Sympy [F]

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\cosh\left(x\right)}{\operatorname{csch}\left(x\right)+i}\,dx$$

input
```
integrate(cosh(x)/(I+csch(x)),x)
```

output
```
Integral(cosh(x)/(csch(x) + I), x)
```

### 3.87.7 Maxima [A] (verification not implemented)

Time = 0.17 (sec) , antiderivative size = 21, normalized size of antiderivative = 1.31

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = x + \frac{1}{2}i\,e^{(-x)} - \frac{1}{2}i\,e^{x} + 2\,\log\left(e^{(-x)}+i\right)$$

input
```
integrate(cosh(x)/(I+csch(x)),x, algorithm="maxima")
```

output
```
x + 1/2*I*e^(-x) - 1/2*I*e^x + 2*log(e^(-x) + I)
```

### 3.87.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 21, normalized size of antiderivative = 1.31

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = -x + \frac{1}{2}i\,e^{(-x)} - \frac{1}{2}i\,e^{x} + 2\,\log\left(e^{x}-i\right)$$

input
```
integrate(cosh(x)/(I+csch(x)),x, algorithm="giac")
```

output
```
-x + 1/2*I*e^(-x) - 1/2*I*e^x + 2*log(e^x - I)
```

### 3.87.9 Mupad [B] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 12, normalized size of antiderivative = 0.75

$$\int \frac{\cosh(x)}{i+\operatorname{csch}(x)}\,dx = \ln\left(\sinh(x)-\mathrm{i}\right) - \sinh(x)\ 1\mathrm{i}$$

input
```
int(cosh(x)/(1/sinh(x) + 1i),x)
```

output
```
log(sinh(x) - 1i) - sinh(x)*1i
```

# 3.88 $\int \frac{\mathbf{sech}(x)}{i+\mathbf{csch}(x)}\,dx$

3.88.1 Optimal result . . . 602
3.88.2 Mathematica [A] (verified) . . . 602
3.88.3 Rubi [A] (verified) . . . 603
3.88.4 Maple [A] (verified) . . . 606
3.88.5 Fricas [B] (verification not implemented) . . . 606
3.88.6 Sympy [F] . . . 606
3.88.7 Maxima [B] (verification not implemented) . . . 607
3.88.8 Giac [B] (verification not implemented) . . . 607
3.88.9 Mupad [B] (verification not implemented) . . . 607

## 3.88.1 Optimal result

Integrand size = 11, antiderivative size = 28

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{2}i\arctan(\sinh(x)) - \frac{\operatorname{sech}^2(x)}{2} + \frac{1}{2}i\operatorname{sech}(x)\tanh(x)$$

output
```
-1/2*I*arctan(sinh(x))-1/2*sech(x)^2+1/2*I*sech(x)*tanh(x)
```

## 3.88.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 20, normalized size of antiderivative = 0.71

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{2}i\left(\arctan(\sinh(x)) + \frac{1}{i-\sinh(x)}\right)$$

input
```
Integrate[Sech[x]/(I + Csch[x]),x]
```

output
```
(-1/2*I)*(ArcTan[Sinh[x]] + (I - Sinh[x])^(-1))
```

### 3.88.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.07, number of steps used = 18, number of rules used = 17, $\frac{\text{number of rules}}{\text{integrand size}} = 1.545$, Rules used = {3042, 4359, 26, 3042, 26, 26, 3185, 25, 26, 3042, 25, 26, 3086, 15, 3091, 3042, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)(i\csc(ix)+i)}dx$$

$$\downarrow 4359$$

$$\int \frac{i\tanh(x)}{-\sinh(x)+i}dx$$

$$\downarrow 26$$

$$i\int \frac{\tanh(x)}{i-\sinh(x)}dx$$

$$\downarrow 3042$$

$$i\int -\frac{i\tan(ix)}{i\sin(ix)+i}dx$$

$$\downarrow 26$$

$$\int -\frac{i\tan(ix)}{1+\sin(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\tan(ix)}{\sin(ix)+1}dx$$

$$\downarrow 3185$$

$$-i\left(-\int -\operatorname{sech}(x)\tanh^2(x)dx+\int i\operatorname{sech}^2(x)\tanh(x)dx\right)$$

$$\downarrow 25$$

$$-i\left(\int \operatorname{sech}(x)\tanh^2(x)dx+\int i\operatorname{sech}^2(x)\tanh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \operatorname{sech}(x)\tanh^2(x)dx + i\int \operatorname{sech}^2(x)\tanh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\sec(ix)^2\tan(ix)dx + \int -\sec(ix)\tan(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\sec(ix)^2\tan(ix)dx - \int \sec(ix)\tan(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \sec(ix)^2\tan(ix)dx - \int \sec(ix)\tan(ix)^2dx\right)$$

$$\downarrow 3086$$

$$-i\left(-i\int \operatorname{sech}(x)d\operatorname{sech}(x) - \int \sec(ix)\tan(ix)^2dx\right)$$

$$\downarrow 15$$

$$-i\left(-\int \sec(ix)\tan(ix)^2dx - \frac{1}{2}i\operatorname{sech}^2(x)\right)$$

$$\downarrow 3091$$

$$-i\left(\frac{\int \operatorname{sech}(x)dx}{2} - \frac{1}{2}i\operatorname{sech}^2(x) - \frac{1}{2}\tanh(x)\operatorname{sech}(x)\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{1}{2}\int \csc\left(ix+\frac{\pi}{2}\right)dx - \frac{1}{2}i\operatorname{sech}^2(x) - \frac{1}{2}\tanh(x)\operatorname{sech}(x)\right)$$

$$\downarrow 4257$$

$$-i\left(\frac{1}{2}\arctan(\sinh(x)) - \frac{1}{2}i\operatorname{sech}^2(x) - \frac{1}{2}\tanh(x)\operatorname{sech}(x)\right)$$

input
```
Int[Sech[x]/(I + Csch[x]),x]
```

output
```
(-I)*(ArcTan[Sinh[x]]/2 - (I/2)*Sech[x]^2 - (Sech[x]*Tanh[x])/2)
```

### 3.88.3.1 Defintions of rubi rules used

rule 15
```
Int[(a_.)*(x_)^(m_.), x_Symbol] :> Simp[a*(x^(m + 1)/(m + 1)), x] /; FreeQ[
{a, m}, x] && NeQ[m, -1]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3086
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_.), x_Symbol] :> Simp[a/f   Subst[Int[(a*x)^(m - 1)*(-1 + x^2)^((n - 1)/2
), x], x, Sec[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2
] &&  !(IntegerQ[m/2] && LtQ[0, m, n + 1])
```

rule 3091
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_), x_Symbol] :> Simp[b*(a*Sec[e + f*x])^m*((b*Tan[e + f*x])^(n - 1)/(f*(m
 + n - 1))), x] - Simp[b^2*((n - 1)/(m + n - 1))   Int[(a*Sec[e + f*x])^m*(
b*Tan[e + f*x])^(n - 2), x], x] /; FreeQ[{a, b, e, f, m}, x] && GtQ[n, 1] &
& NeQ[m + n - 1, 0] && IntegersQ[2*m, 2*n]
```

rule 3185
```
Int[((g_.)*tan[(e_.) + (f_.)*(x_)])^(p_.)/((a_) + (b_.)*sin[(e_.) + (f_.)*(
x_)]), x_Symbol] :> Simp[1/a   Int[Sec[e + f*x]^2*(g*Tan[e + f*x])^p, x], x
] - Simp[1/(b*g)   Int[Sec[e + f*x]*(g*Tan[e + f*x])^(p + 1), x], x] /; Fre
eQ[{a, b, e, f, g, p}, x] && EqQ[a^2 - b^2, 0] && NeQ[p, -1]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4359
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_))^(m
_.), x_Symbol] :> Int[Cot[e + f*x]^p*(b + a*Sin[e + f*x])^m, x] /; FreeQ[{a
, b, e, f, p}, x] && IntegerQ[m] && EqQ[m, p]
```

### 3.88.4 Maple [A] (verified)

Time = 1.18 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.07

| method | result | size |
|---|---|---|
| risch | $\frac{ie^x}{(e^x-i)^2}-\frac{\ln(e^x-i)}{2}+\frac{\ln(e^x+i)}{2}$ | 30 |
| default | $\frac{\ln(\tanh(\frac{x}{2})+i)}{2}-\frac{i}{\tanh(\frac{x}{2})-i}+\frac{1}{(\tanh(\frac{x}{2})-i)^2}-\frac{\ln(\tanh(\frac{x}{2})-i)}{2}$ | 43 |

input
```
int(sech(x)/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
I*exp(x)/(exp(x)-I)^2-1/2*ln(exp(x)-I)+1/2*ln(exp(x)+I)
```

### 3.88.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 52 vs. 2(18) = 36.

Time = 0.26 (sec) , antiderivative size = 52, normalized size of antiderivative = 1.86

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\left(e^{(2\,x)}-2i\,e^x-1\right)\log\left(e^x+i\right)-\left(e^{(2\,x)}-2i\,e^x-1\right)\log\left(e^x-i\right)+2i\,e^x}{2\left(e^{(2\,x)}-2i\,e^x-1\right)}$$

input
```
integrate(sech(x)/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/2*((e^(2*x) - 2*I*e^x - 1)*log(e^x + I) - (e^(2*x) - 2*I*e^x - 1)*log(e^
x - I) + 2*I*e^x)/(e^(2*x) - 2*I*e^x - 1)
```

### 3.88.6 Sympy [F]

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(sech(x)/(I+csch(x)),x)
```

output
```
Integral(sech(x)/(csch(x) + I), x)
```

### 3.88.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 41 vs. 2(18) = 36.

Time = 0.17 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.46

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{2i\,e^{(-x)}}{4i\,e^{(-x)}+2\,e^{(-2\,x)}-2} - \frac{1}{2}\log\left(e^{(-x)}+i\right) + \frac{1}{2}\log\left(e^{(-x)}-i\right)$$

input
```
integrate(sech(x)/(I+csch(x)),x, algorithm="maxima")
```

output
```
-2*I*e^(-x)/(4*I*e^(-x) + 2*e^(-2*x) - 2) - 1/2*log(e^(-x) + I) + 1/2*log(
e^(-x) - I)
```

### 3.88.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 51 vs. 2(18) = 36.

Time = 0.29 (sec) , antiderivative size = 51, normalized size of antiderivative = 1.82

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{e^{(-x)}-e^{x}-2i}{4\left(e^{(-x)}-e^{x}+2i\right)} + \frac{1}{4}\log\left(-e^{(-x)}+e^{x}+2i\right) - \frac{1}{4}\log\left(-e^{(-x)}+e^{x}-2i\right)$$

input
```
integrate(sech(x)/(I+csch(x)),x, algorithm="giac")
```

output
```
1/4*(e^(-x) - e^x - 2*I)/(e^(-x) - e^x + 2*I) + 1/4*log(-e^(-x) + e^x + 2*
I) - 1/4*log(-e^(-x) + e^x - 2*I)
```

### 3.88.9 Mupad [B] (verification not implemented)

Time = 0.22 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.64

$$\int \frac{\operatorname{sech}(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\ln\left(-1+\mathrm{e}^{x}\,1\mathrm{i}\right)}{2} - \frac{\ln\left(1+\mathrm{e}^{x}\,1\mathrm{i}\right)}{2} + \frac{1}{1-\mathrm{e}^{2\,x}+\mathrm{e}^{x}\,2\mathrm{i}} + \frac{1\mathrm{i}}{\mathrm{e}^{x}-\mathrm{i}}$$

input
```
int(1/(cosh(x)*(1/sinh(x) + 1i)),x)
```

output
```
log(exp(x)*1i - 1)/2 - log(exp(x)*1i + 1)/2 + 1/(exp(x)*2i - exp(2*x) + 1)
 + 1i/(exp(x) - 1i)
```

# 3.89 $\int \frac{\mathbf{sech}^2(x)}{i+\mathbf{csch}(x)}\,dx$


3.89.1 Optimal result . . . . . 608
3.89.2 Mathematica [B] (verified) . . . . . 608
3.89.3 Rubi [A] (verified) . . . . . 609
3.89.4 Maple [B] (verified) . . . . . 612
3.89.5 Fricas [B] (verification not implemented) . . . . . 612
3.89.6 Sympy [F] . . . . . 612
3.89.7 Maxima [B] (verification not implemented) . . . . . 613
3.89.8 Giac [B] (verification not implemented) . . . . . 613
3.89.9 Mupad [B] (verification not implemented) . . . . . 614


## 3.89.1 Optimal result

Integrand size = 13, antiderivative size = 19

$$\int \frac{\operatorname{sech}^2(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{3}\operatorname{sech}^3(x) - \frac{1}{3}i\tanh^3(x)$$

output
```
-1/3*sech(x)^3-1/3*I*tanh(x)^3
```

## 3.89.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 64 vs. 2(19) = 38.

Time = 0.06 (sec) , antiderivative size = 64, normalized size of antiderivative = 3.37

$$\int \frac{\operatorname{sech}^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{-3+\cosh(x)+\cosh(2x)-2i\sinh(x)+i\cosh(x)\sinh(x)}{6\left(\cosh\left(\frac{x}{2}\right)-i\sinh\left(\frac{x}{2}\right)\right)\left(\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)\right)^3}$$

input
```
Integrate[Sech[x]^2/(I + Csch[x]),x]
```

output
```
(-3 + Cosh[x] + Cosh[2*x] - (2*I)*Sinh[x] + I*Cosh[x]*Sinh[x])/(6*(Cosh[x/
2] - I*Sinh[x/2])*(Cosh[x/2] + I*Sinh[x/2])^3)
```

### 3.89.3 Rubi [A] (verified)

Time = 0.40 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.21, number of steps used = 17, number of rules used = 16, $\frac{\text{number of rules}}{\text{integrand size}} = 1.231$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3318, 25, 26, 3042, 25, 26, 3086, 15, 3087, 15}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^2(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)^2(i\csc(ix)+i)}dx$$

$$\downarrow 4360$$

$$\int \frac{i\tanh(x)\operatorname{sech}(x)}{-\sinh(x)+i}dx$$

$$\downarrow 26$$

$$i\int \frac{\operatorname{sech}(x)\tanh(x)}{i-\sinh(x)}dx$$

$$\downarrow 3042$$

$$i\int -\frac{i\sin(ix)}{\cos(ix)^2(i\sin(ix)+i)}dx$$

$$\downarrow 26$$

$$\int -\frac{i\sin(ix)}{(1+\sin(ix))\cos(ix)^2}dx$$

$$\downarrow 26$$

$$-i\int \frac{\sin(ix)}{\cos(ix)^2(\sin(ix)+1)}dx$$

$$\downarrow 3318$$

$$-i\left(-\int -\operatorname{sech}^2(x)\tanh^2(x)dx+\int i\operatorname{sech}^3(x)\tanh(x)dx\right)$$

$$\downarrow 25$$

$$-i\left(\int \operatorname{sech}^2(x)\tanh^2(x)dx+\int i\operatorname{sech}^3(x)\tanh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \operatorname{sech}^2(x)\tanh^2(x)dx + i\int \operatorname{sech}^3(x)\tanh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\sec(ix)^3\tan(ix)dx + \int -\sec(ix)^2\tan(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\sec(ix)^3\tan(ix)dx - \int \sec(ix)^2\tan(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \sec(ix)^3\tan(ix)dx - \int \sec(ix)^2\tan(ix)^2dx\right)$$

$$\downarrow 3086$$

$$-i\left(-i\int \operatorname{sech}^2(x)d\operatorname{sech}(x) - \int \sec(ix)^2\tan(ix)^2dx\right)$$

$$\downarrow 15$$

$$-i\left(-\int \sec(ix)^2\tan(ix)^2dx - \frac{1}{3}i\operatorname{sech}^3(x)\right)$$

$$\downarrow 3087$$

$$-i\left(i\int -\tanh^2(x)d(i\tanh(x)) - \frac{1}{3}i\operatorname{sech}^3(x)\right)$$

$$\downarrow 15$$

$$-i\left(\frac{\tanh^3(x)}{3} - \frac{1}{3}i\operatorname{sech}^3(x)\right)$$

input
```
Int[Sech[x]^2/(I + Csch[x]),x]
```

output
```
(-I)*((-1/3*I)*Sech[x]^3 + Tanh[x]^3/3)
```

### 3.89.3.1 Defintions of rubi rules used

rule 15
```
Int[(a_.)*(x_)^(m_.), x_Symbol] :> Simp[a*(x^(m + 1)/(m + 1)), x] /; FreeQ[
{a, m}, x] && NeQ[m, -1]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3086
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_.), x_Symbol] :> Simp[a/f   Subst[Int[(a*x)^(m - 1)*(-1 + x^2)^((n - 1)/2
), x], x, Sec[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2
] &&  !(IntegerQ[m/2] && LtQ[0, m, n + 1])
```

rule 3087
```
Int[sec[(e_.) + (f_.)*(x_)]^(m_)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(n_.), x_S
ymbol] :> Simp[1/f   Subst[Int[(b*x)^n*(1 + x^2)^(m/2 - 1), x], x, Tan[e +
f*x]], x] /; FreeQ[{b, e, f, n}, x] && IntegerQ[m/2] &&  !(IntegerQ[(n - 1)
/2] && LtQ[0, n, m - 1])
```

rule 3318
```
Int[((cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(
n_.))/((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[g^2/a   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^n, x], x] - Simp[g^2/(b*d)   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b,
d, e, f, g, n, p}, x] && EqQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.89.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 30 vs. $2(14) = 28$.

Time = 0.61 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.63

| method | result | size |
|---|---|---|
| risch | $\frac{2i(-2ie^x+3e^{2x}-1)}{3(e^x+i)(e^x-i)^3}$ | 31 |
| default | $-\frac{i}{2(\tanh(\frac{x}{2})+i)}+\frac{i}{2\tanh(\frac{x}{2})-2i}-\frac{2i}{3(\tanh(\frac{x}{2})-i)^3}-\frac{1}{(\tanh(\frac{x}{2})-i)^2}$ | 49 |

input
```
int(sech(x)^2/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
2/3*I*(-2*I*exp(x)+3*exp(2*x)-1)/(exp(x)+I)/(exp(x)-I)^3
```

### 3.89.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 32 vs. $2(13) = 26$.

Time = 0.25 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.68

$$\int \frac{\operatorname{sech}^2(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{2\left(-3i\,e^{(2\,x)}-2\,e^x+i\right)}{3\left(e^{(4\,x)}-2i\,e^{(3\,x)}-2i\,e^x-1\right)}$$

input
```
integrate(sech(x)^2/(I+csch(x)),x, algorithm="fricas")
```

output
```
-2/3*(-3*I*e^(2*x) - 2*e^x + I)/(e^(4*x) - 2*I*e^(3*x) - 2*I*e^x - 1)
```

### 3.89.6 Sympy [F]

$$\int \frac{\operatorname{sech}^2(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^2(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(sech(x)**2/(I+csch(x)),x)
```

output
```
Integral(sech(x)**2/(csch(x) + I), x)
```

### 3.89.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 81 vs. $2(13) = 26$.

Time = 0.18 (sec) , antiderivative size = 81, normalized size of antiderivative = 4.26

$$\int \frac{\operatorname{sech}^2(x)}{i + \operatorname{csch}(x)}\,dx = \frac{8\,e^{(-x)}}{12i\,e^{(-x)} + 12i\,e^{(-3\,x)} + 6\,e^{(-4\,x)} - 6} - \frac{12i\,e^{(-2\,x)}}{12i\,e^{(-x)} + 12i\,e^{(-3\,x)} + 6\,e^{(-4\,x)} - 6} + \frac{4i}{12i\,e^{(-x)} + 12i\,e^{(-3\,x)} + 6\,e^{(-4\,x)} - 6}$$

input
```
integrate(sech(x)^2/(I+csch(x)),x, algorithm="maxima")
```

output
```
8*e^(-x)/(12*I*e^(-x) + 12*I*e^(-3*x) + 6*e^(-4*x) - 6) - 12*I*e^(-2*x)/(1
2*I*e^(-x) + 12*I*e^(-3*x) + 6*e^(-4*x) - 6) + 4*I/(12*I*e^(-x) + 12*I*e^(
-3*x) + 6*e^(-4*x) - 6)
```

### 3.89.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 27 vs. $2(13) = 26$.

Time = 0.28 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.42

$$\int \frac{\operatorname{sech}^2(x)}{i + \operatorname{csch}(x)}\,dx = -\frac{i}{2\,(i\,e^x - 1)} + \frac{3\,e^{(2\,x)} - 1}{6\,(e^x - i)^3}$$

input
```
integrate(sech(x)^2/(I+csch(x)),x, algorithm="giac")
```

output
```
-1/2*I/(I*e^x - 1) + 1/6*(3*e^(2*x) - 1)/(e^x - I)^3
```

### 3.89.9 Mupad [B] (verification not implemented)

Time = 2.31 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.63

$$\int \frac{\operatorname{sech}^2(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{\frac{2}{3} - 2\,\mathrm{e}^{2\,x} + \frac{\mathrm{e}^x\,4\mathrm{i}}{3}}{(\mathrm{e}^x + 1\mathrm{i})\,(1+\mathrm{e}^x\,1\mathrm{i})^3}$$

input
```
int(1/(cosh(x)^2*(1/sinh(x) + 1i)),x)
```

output
```
-((exp(x)*4i)/3 - 2*exp(2*x) + 2/3)/((exp(x) + 1i)*(exp(x)*1i + 1)^3)
```

# 3.90 $\int \frac{\mathbf{sech}^3(x)}{i+\mathbf{csch}(x)}\,dx$


3.90.1 Optimal result . . . . . 615
3.90.2 Mathematica [A] (verified) . . . . . 615
3.90.3 Rubi [A] (verified) . . . . . 616
3.90.4 Maple [B] (verified) . . . . . 619
3.90.5 Fricas [B] (verification not implemented) . . . . . 620
3.90.6 Sympy [F] . . . . . 620
3.90.7 Maxima [F(-2)] . . . . . 620
3.90.8 Giac [B] (verification not implemented) . . . . . 621
3.90.9 Mupad [B] (verification not implemented) . . . . . 621


## 3.90.1 Optimal result

Integrand size = 13, antiderivative size = 40

$$\int \frac{\operatorname{sech}^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{8}i\arctan(\sinh(x)) - \frac{\operatorname{sech}^4(x)}{4} - \frac{1}{8}i\operatorname{sech}(x)\tanh(x) + \frac{1}{4}i\operatorname{sech}^3(x)\tanh(x)$$

output
```
-1/8*I*arctan(sinh(x))-1/4*sech(x)^4-1/8*I*sech(x)*tanh(x)+1/4*I*sech(x)^3
*tanh(x)
```

## 3.90.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 32, normalized size of antiderivative = 0.80

$$\int \frac{\operatorname{sech}^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{8}\left(-i\arctan(\sinh(x)) + \frac{1}{(-i+\sinh(x))^2} - \frac{i}{i+\sinh(x)}\right)$$

input
```
Integrate[Sech[x]^3/(I + Csch[x]),x]
```

output
```
((-I)*ArcTan[Sinh[x]] + (-I + Sinh[x])^(-2) - I/(I + Sinh[x]))/8
```

### 3.90.3 Rubi [A] (verified)

Time = 0.53 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.12, number of steps used = 20, number of rules used = 19, $\frac{\text{number of rules}}{\text{integrand size}} = 1.462$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3314, 25, 26, 3042, 25, 26, 3086, 15, 3091, 3042, 4255, 3042, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^3(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)^3(i\csc(ix)+i)}dx$$

$$\downarrow 4360$$

$$\int \frac{i\tanh(x)\operatorname{sech}^2(x)}{-\sinh(x)+i}dx$$

$$\downarrow 26$$

$$i\int \frac{\operatorname{sech}^2(x)\tanh(x)}{i-\sinh(x)}dx$$

$$\downarrow 3042$$

$$i\int -\frac{i\sin(ix)}{\cos(ix)^3(i\sin(ix)+i)}dx$$

$$\downarrow 26$$

$$\int -\frac{i\sin(ix)}{(1+\sin(ix))\cos(ix)^3}dx$$

$$\downarrow 26$$

$$-i\int \frac{\sin(ix)}{\cos(ix)^3(\sin(ix)+1)}dx$$

$$\downarrow 3314$$

$$-i\left(-\int -\operatorname{sech}^3(x)\tanh^2(x)dx+\int i\operatorname{sech}^4(x)\tanh(x)dx\right)$$

$$\downarrow 25$$

$$-i\left(\int \operatorname{sech}^3(x)\tanh^2(x)dx+\int i\operatorname{sech}^4(x)\tanh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \operatorname{sech}^3(x)\tanh^2(x)dx + i\int \operatorname{sech}^4(x)\tanh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\sec(ix)^4\tan(ix)dx + \int -\sec(ix)^3\tan(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\sec(ix)^4\tan(ix)dx - \int \sec(ix)^3\tan(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \sec(ix)^4\tan(ix)dx - \int \sec(ix)^3\tan(ix)^2dx\right)$$

$$\downarrow 3086$$

$$-i\left(-i\int \operatorname{sech}^3(x)d\operatorname{sech}(x) - \int \sec(ix)^3\tan(ix)^2dx\right)$$

$$\downarrow 15$$

$$-i\left(-\int \sec(ix)^3\tan(ix)^2dx - \frac{1}{4}i\operatorname{sech}^4(x)\right)$$

$$\downarrow 3091$$

$$-i\left(\frac{1}{4}\int \operatorname{sech}^3(x)dx - \frac{1}{4}i\operatorname{sech}^4(x) - \frac{1}{4}\tanh(x)\operatorname{sech}^3(x)\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{1}{4}\int \csc\left(ix+\frac{\pi}{2}\right)^3 dx - \frac{1}{4}i\operatorname{sech}^4(x) - \frac{1}{4}\tanh(x)\operatorname{sech}^3(x)\right)$$

$$\downarrow 4255$$

$$-i\left(\frac{1}{4}\left(\frac{\int \operatorname{sech}(x)dx}{2} + \frac{1}{2}\tanh(x)\operatorname{sech}(x)\right) - \frac{1}{4}i\operatorname{sech}^4(x) - \frac{1}{4}\tanh(x)\operatorname{sech}^3(x)\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{1}{4}\left(\frac{1}{2}\tanh(x)\operatorname{sech}(x) + \frac{1}{2}\int \csc\left(ix+\frac{\pi}{2}\right)dx\right) - \frac{1}{4}i\operatorname{sech}^4(x) - \frac{1}{4}\tanh(x)\operatorname{sech}^3(x)\right)$$

$$\downarrow 4257$$

$$-i\left(\frac{1}{4}\left(\frac{1}{2}\arctan(\sinh(x)) + \frac{1}{2}\tanh(x)\operatorname{sech}(x)\right) - \frac{1}{4}i\operatorname{sech}^4(x) - \frac{1}{4}\tanh(x)\operatorname{sech}^3(x)\right)$$

input
```
Int[Sech[x]^3/(I + Csch[x]),x]
```

output
```
(-I)*((-1/4*I)*Sech[x]^4 - (Sech[x]^3*Tanh[x])/4 + (ArcTan[Sinh[x]]/2 + (S
ech[x]*Tanh[x])/2)/4)
```

### 3.90.3.1 Defintions of rubi rules used

rule 15
```
Int[(a_.)*(x_)^(m_.), x_Symbol] :> Simp[a*(x^(m + 1)/(m + 1)), x] /; FreeQ[
{a, m}, x] && NeQ[m, -1]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3086
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_.), x_Symbol] :> Simp[a/f   Subst[Int[(a*x)^(m - 1)*(-1 + x^2)^((n - 1)/2
), x], x, Sec[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2
] &&  !(IntegerQ[m/2] && LtQ[0, m, n + 1])
```

rule 3091
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_), x_Symbol] :> Simp[b*(a*Sec[e + f*x])^m*((b*Tan[e + f*x])^(n - 1)/(f*(m
 + n - 1))), x] - Simp[b^2*((n - 1)/(m + n - 1))   Int[(a*Sec[e + f*x])^m*(
b*Tan[e + f*x])^(n - 2), x], x] /; FreeQ[{a, b, e, f, m}, x] && GtQ[n, 1] &
& NeQ[m + n - 1, 0] && IntegersQ[2*m, 2*n]
```

rule 3314
```
Int[(cos[(e_.) + (f_.)*(x_)]^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.))/((
a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[1/a   Int[Cos[e + f
*x]^(p - 2)*(d*Sin[e + f*x])^n, x], x] - Simp[1/(b*d)   Int[Cos[e + f*x]^(p
 - 2)*(d*Sin[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b, d, e, f, n, p}, x] &
& IntegerQ[(p - 1)/2] && EqQ[a^2 - b^2, 0] && IntegerQ[n] && (LtQ[0, n, (p
+ 1)/2] || (LeQ[p, -n] && LtQ[-n, 2*p - 3]) || (GtQ[n, 0] && LeQ[n, -p]))
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.90.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 60 vs. $2(29) = 58$.

Time = 13.09 (sec) , antiderivative size = 61, normalized size of antiderivative = 1.52

| method | result |
|---|---|
| risch | $-\frac{ie^x(-2ie^{3x}+e^{4x}+2ie^x-10e^{2x}+1)}{4(e^x-i)^4(e^x+i)^2}-\frac{\ln(e^x-i)}{8}+\frac{\ln(e^x+i)}{8}$ |
| default | $\frac{i}{(\tanh(\frac{x}{2})-i)^3}-\frac{i}{2(\tanh(\frac{x}{2})-i)}-\frac{1}{2(\tanh(\frac{x}{2})-i)^4}+\frac{1}{(\tanh(\frac{x}{2})-i)^2}-\frac{\ln(\tanh(\frac{x}{2})-i)}{8}+\frac{i}{4\tanh(\frac{x}{2})+4i}+\frac{1}{4(\tanh(\frac{x}{2})+i)}$ |

input
```
int(sech(x)^3/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/4*I*exp(x)*(-2*I*exp(x)^3+exp(x)^4+2*I*exp(x)-10*exp(x)^2+1)/(exp(x)-I)
^4/(exp(x)+I)^2-1/8*ln(exp(x)-I)+1/8*ln(exp(x)+I)
```

### 3.90.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 142 vs. $2(26) = 52$.

Time = 0.25 (sec) , antiderivative size = 142, normalized size of antiderivative = 3.55

$$\int \frac{\operatorname{sech}^3(x)}{i + \operatorname{csch}(x)}\,dx$$
$$= \frac{\left(e^{(6x)} - 2i\,e^{(5x)} + e^{(4x)} - 4i\,e^{(3x)} - e^{(2x)} - 2i\,e^{x} - 1\right)\log\left(e^{x} + i\right) - \left(e^{(6x)} - 2i\,e^{(5x)} + e^{(4x)} - 4i\,e^{(3x)} - e\right.}{8\left(e^{(6x)} - 2i\,e^{(5x)} + e^{(4x)} - 4i\,e^{(3x)} - e^{(2x)}\right.}$$

input
```
integrate(sech(x)^3/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/8*((e^(6*x) - 2*I*e^(5*x) + e^(4*x) - 4*I*e^(3*x) - e^(2*x) - 2*I*e^x -
1)*log(e^x + I) - (e^(6*x) - 2*I*e^(5*x) + e^(4*x) - 4*I*e^(3*x) - e^(2*x)
 - 2*I*e^x - 1)*log(e^x - I) - 2*I*e^(5*x) - 4*e^(4*x) + 20*I*e^(3*x) + 4*
e^(2*x) - 2*I*e^x)/(e^(6*x) - 2*I*e^(5*x) + e^(4*x) - 4*I*e^(3*x) - e^(2*x
) - 2*I*e^x - 1)
```

### 3.90.6 Sympy [F]

$$\int \frac{\operatorname{sech}^3(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^3(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(sech(x)**3/(I+csch(x)),x)
```

output
```
Integral(sech(x)**3/(csch(x) + I), x)
```

### 3.90.7 Maxima [F(-2)]

Exception generated.

$$\int \frac{\operatorname{sech}^3(x)}{i + \operatorname{csch}(x)}\,dx = \text{Exception raised: RuntimeError}$$

input
```
integrate(sech(x)^3/(I+csch(x)),x, algorithm="maxima")
```

output
```
Exception raised: RuntimeError >> ECL says: THROW: The catch RAT-ERR is un
defined.
```

### 3.90.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 94 vs. $2(26) = 52$.

Time $= 0.28$ (sec) , antiderivative size $= 94$, normalized size of antiderivative $= 2.35$

$$\int \frac{\operatorname{sech}^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{-i\,e^{(-x)}+i\,e^{x}-6}{16\left(-i\,e^{(-x)}+i\,e^{x}-2\right)} + \frac{3\left(e^{(-x)}-e^{x}\right)^2+12i\,e^{(-x)}-12i\,e^{x}+4}{32\left(e^{(-x)}-e^{x}+2i\right)^2} + \frac{1}{16}\log\left(-e^{(-x)}+e^{x}+2i\right) - \frac{1}{16}\log\left(-e^{(-x)}+e^{x}-2i\right)$$

input
```
integrate(sech(x)^3/(I+csch(x)),x, algorithm="giac")
```

output
```
-1/16*(-I*e^(-x) + I*e^x - 6)/(-I*e^(-x) + I*e^x - 2) + 1/32*(3*(e^(-x) -
e^x)^2 + 12*I*e^(-x) - 12*I*e^x + 4)/(e^(-x) - e^x + 2*I)^2 + 1/16*log(-e^
(-x) + e^x + 2*I) - 1/16*log(-e^(-x) + e^x - 2*I)
```

### 3.90.9 Mupad [B] (verification not implemented)

Time $= 2.65$ (sec) , antiderivative size $= 122$, normalized size of antiderivative $= 3.05$

$$\int \frac{\operatorname{sech}^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\ln\left(-\frac{1}{4}+\frac{e^x\,1i}{4}\right)}{8} - \frac{\ln\left(\frac{1}{4}+\frac{e^x\,1i}{4}\right)}{8} - \frac{1i}{e^{2x}\,3i-e^{3x}+3\,e^x-i} - \frac{1}{4\left(e^{2x}-1+e^x\,2i\right)} - \frac{1}{2\left(e^{4x}-6\,e^{2x}+1-e^{3x}\,4i+e^x\,4i\right)} - \frac{1}{2\left(1-e^{2x}+e^x\,2i\right)} - \frac{1i}{4\left(e^x+1i\right)}$$

input
```
int(1/(cosh(x)^3*(1/sinh(x) + 1i)),x)
```

output

```
log((exp(x)*1i)/4 - 1/4)/8 - log((exp(x)*1i)/4 + 1/4)/8 - 1i/(exp(2*x)*3i
- exp(3*x) + 3*exp(x) - 1i) - 1/(4*(exp(2*x) + exp(x)*2i - 1)) - 1/(2*(exp
(4*x) - exp(3*x)*4i - 6*exp(2*x) + exp(x)*4i + 1)) - 1/(2*(exp(x)*2i - exp
(2*x) + 1)) - 1i/(4*(exp(x) + 1i))
```

# 3.91 $\int \frac{\mathbf{sech}^4(x)}{i+\mathbf{csch}(x)}\,dx$


3.91.1 Optimal result . . . . . 623
3.91.2 Mathematica [B] (verified) . . . . . 623
3.91.3 Rubi [A] (verified) . . . . . 624
3.91.4 Maple [B] (verified) . . . . . 627
3.91.5 Fricas [B] (verification not implemented) . . . . . 627
3.91.6 Sympy [F] . . . . . 628
3.91.7 Maxima [F(-2)] . . . . . 628
3.91.8 Giac [B] (verification not implemented) . . . . . 628
3.91.9 Mupad [B] (verification not implemented) . . . . . 629


## 3.91.1 Optimal result

Integrand size = 13, antiderivative size = 29

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1}{5}\operatorname{sech}^5(x) - \frac{1}{3}i\tanh^3(x) + \frac{1}{5}i\tanh^5(x)$$

output
```
-1/5*sech(x)^5-1/3*I*tanh(x)^3+1/5*I*tanh(x)^5
```

## 3.91.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 96 vs. 2(29) = 58.

Time = 0.10 (sec) , antiderivative size = 96, normalized size of antiderivative = 3.31

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{-240 + 54\cosh(x) + 32\cosh(2x) + 18\cosh(3x) + 16\cosh(4x) - 96i\sinh(x) + 18i\sinh(2x) - 32i\sinh(3x)}{960\left(\cosh\left(\frac{x}{2}\right) - i\sinh\left(\frac{x}{2}\right)\right)^3\left(\cosh\left(\frac{x}{2}\right) + i\sinh\left(\frac{x}{2}\right)\right)^5}$$

input
```
Integrate[Sech[x]^4/(I + Csch[x]),x]
```

output
```
(-240 + 54*Cosh[x] + 32*Cosh[2*x] + 18*Cosh[3*x] + 16*Cosh[4*x] - (96*I)*S
inh[x] + (18*I)*Sinh[2*x] - (32*I)*Sinh[3*x] + (9*I)*Sinh[4*x])/(960*(Cosh
[x/2] - I*Sinh[x/2])^3*(Cosh[x/2] + I*Sinh[x/2])^5)
```

### 3.91.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.38, number of steps used = 18, number of rules used = 17, $\frac{\text{number of rules}}{\text{integrand size}} = 1.308$, Rules used = {3042, 4360, 26, 3042, 26, 26, 3318, 25, 26, 3042, 25, 26, 3086, 15, 3087, 244, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^4(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)^4(i\csc(ix)+i)}dx$$

$$\downarrow 4360$$

$$\int \frac{i\tanh(x)\operatorname{sech}^3(x)}{-\sinh(x)+i}dx$$

$$\downarrow 26$$

$$i\int \frac{\operatorname{sech}^3(x)\tanh(x)}{i-\sinh(x)}dx$$

$$\downarrow 3042$$

$$i\int -\frac{i\sin(ix)}{\cos(ix)^4(i\sin(ix)+i)}dx$$

$$\downarrow 26$$

$$\int -\frac{i\sin(ix)}{(1+\sin(ix))\cos(ix)^4}dx$$

$$\downarrow 26$$

$$-i\int \frac{\sin(ix)}{\cos(ix)^4(\sin(ix)+1)}dx$$

$$\downarrow 3318$$

$$-i\left(-\int -\operatorname{sech}^4(x)\tanh^2(x)dx+\int i\operatorname{sech}^5(x)\tanh(x)dx\right)$$

$$\downarrow 25$$

$$-i\left(\int \operatorname{sech}^4(x)\tanh^2(x)dx+\int i\operatorname{sech}^5(x)\tanh(x)dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \operatorname{sech}^4(x)\tanh^2(x)dx + i\int \operatorname{sech}^5(x)\tanh(x)dx\right)$$

$$\downarrow 3042$$

$$-i\left(i\int -i\sec(ix)^5\tan(ix)dx + \int -\sec(ix)^4\tan(ix)^2dx\right)$$

$$\downarrow 25$$

$$-i\left(i\int -i\sec(ix)^5\tan(ix)dx - \int \sec(ix)^4\tan(ix)^2dx\right)$$

$$\downarrow 26$$

$$-i\left(\int \sec(ix)^5\tan(ix)dx - \int \sec(ix)^4\tan(ix)^2dx\right)$$

$$\downarrow 3086$$

$$-i\left(-i\int \operatorname{sech}^4(x)d\operatorname{sech}(x) - \int \sec(ix)^4\tan(ix)^2dx\right)$$

$$\downarrow 15$$

$$-i\left(-\int \sec(ix)^4\tan(ix)^2dx - \frac{1}{5}i\operatorname{sech}^5(x)\right)$$

$$\downarrow 3087$$

$$-i\left(i\int -\tanh^2(x)\left(1-\tanh^2(x)\right)d(i\tanh(x)) - \frac{1}{5}i\operatorname{sech}^5(x)\right)$$

$$\downarrow 244$$

$$-i\left(i\int \left(\tanh^4(x)-\tanh^2(x)\right)d(i\tanh(x)) - \frac{1}{5}i\operatorname{sech}^5(x)\right)$$

$$\downarrow 2009$$

$$-i\left(i\left(\frac{1}{5}i\tanh^5(x) - \frac{1}{3}i\tanh^3(x)\right) - \frac{1}{5}i\operatorname{sech}^5(x)\right)$$

input
```
Int[Sech[x]^4/(I + Csch[x]),x]
```

output
```
(-I)*((-1/5*I)*Sech[x]^5 + I*((-1/3*I)*Tanh[x]^3 + (I/5)*Tanh[x]^5))
```

## 3.91. $\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx$

### 3.91.3.1 Defintions of rubi rules used

rule 15
```
Int[(a_.)*(x_)^(m_.), x_Symbol] :> Simp[a*(x^(m + 1)/(m + 1)), x] /; FreeQ[
{a, m}, x] && NeQ[m, -1]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 244
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.), x_Symbol] :> Int[Expand
Integrand[(c*x)^m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, m}, x] && IGtQ[p
, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3086
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_.), x_Symbol] :> Simp[a/f   Subst[Int[(a*x)^(m - 1)*(-1 + x^2)^((n - 1)/2
), x], x, Sec[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2
] &&  !(IntegerQ[m/2] && LtQ[0, m, n + 1])
```

rule 3087
```
Int[sec[(e_.) + (f_.)*(x_)]^(m_)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(n_.), x_S
ymbol] :> Simp[1/f   Subst[Int[(b*x)^n*(1 + x^2)^(m/2 - 1), x], x, Tan[e +
f*x]], x] /; FreeQ[{b, e, f, n}, x] && IntegerQ[m/2] &&  !(IntegerQ[(n - 1)
/2] && LtQ[0, n, m - 1])
```

rule 3318
```
Int[((cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(
n_.))/((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[g^2/a   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^n, x], x] - Simp[g^2/(b*d)   Int
[(g*Cos[e + f*x])^(p - 2)*(d*Sin[e + f*x])^(n + 1), x], x] /; FreeQ[{a, b,
d, e, f, g, n, p}, x] && EqQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.91.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 92 vs. $2(21) = 42$.

Time = 0.23 (sec) , antiderivative size = 93, normalized size of antiderivative = 3.21

$$-\frac{4i}{3\left(\tanh\left(\frac{x}{2}\right)-i\right)^3}+\frac{3i}{8\left(\tanh\left(\frac{x}{2}\right)-i\right)}+\frac{2i}{5\left(\tanh\left(\frac{x}{2}\right)-i\right)^5}+\frac{1}{\left(\tanh\left(\frac{x}{2}\right)-i\right)^4}-\frac{1}{\left(\tanh\left(\frac{x}{2}\right)-i\right)^2}+\frac{i}{6\left(\tanh\left(\frac{x}{2}\right)\right.}$$

input
```
int(sech(x)^4/(I+csch(x)),x)
```

output
```
-4/3*I/(tanh(1/2*x)-I)^3+3/8*I/(tanh(1/2*x)-I)+2/5*I/(tanh(1/2*x)-I)^5+1/(
tanh(1/2*x)-I)^4-1/(tanh(1/2*x)-I)^2+1/6*I/(tanh(1/2*x)+I)^3-3/8*I/(tanh(1
/2*x)+I)-1/4/(tanh(1/2*x)+I)^2
```

### 3.91.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 68 vs. $2(19) = 38$.

Time = 0.25 (sec) , antiderivative size = 68, normalized size of antiderivative = 2.34

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{4\left(-15i\,e^{(4x)}-6\,e^{(3x)}+2i\,e^{(2x)}-2\,e^x+i\right)}{15\left(e^{(8x)}-2i\,e^{(7x)}+2\,e^{(6x)}-6i\,e^{(5x)}-6i\,e^{(3x)}-2\,e^{(2x)}-2i\,e^x-1\right)}$$

input
```
integrate(sech(x)^4/(I+csch(x)),x, algorithm="fricas")
```

output
```
-4/15*(-15*I*e^(4*x) - 6*e^(3*x) + 2*I*e^(2*x) - 2*e^x + I)/(e^(8*x) - 2*I
*e^(7*x) + 2*e^(6*x) - 6*I*e^(5*x) - 6*I*e^(3*x) - 2*e^(2*x) - 2*I*e^x - 1
)
```

### 3.91.6 Sympy [F]

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^4(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(sech(x)**4/(I+csch(x)),x)
```

output
```
Integral(sech(x)**4/(csch(x) + I), x)
```

### 3.91.7 Maxima [F(-2)]

Exception generated.

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = \text{Exception raised: RuntimeError}$$

input
```
integrate(sech(x)^4/(I+csch(x)),x, algorithm="maxima")
```

output
```
Exception raised: RuntimeError >> ECL says: THROW: The catch RAT-ERR is un
defined.
```

### 3.91.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 55 vs. $2(19) = 38$.

Time $= 0.27$ (sec) , antiderivative size $= 55$, normalized size of antiderivative $= 1.90$

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{-3i\,e^{(2\,x)}+12\,e^x+5i}{24\,(i\,e^x-1)^3} + \frac{15\,e^{(4\,x)}-60i\,e^{(3\,x)}-10\,e^{(2\,x)}+20i\,e^x+7}{120\,(e^x-i)^5}$$

input
```
integrate(sech(x)^4/(I+csch(x)),x, algorithm="giac")
```

output
```
-1/24*(-3*I*e^(2*x) + 12*e^x + 5*I)/(I*e^x - 1)^3 + 1/120*(15*e^(4*x) - 60
*I*e^(3*x) - 10*e^(2*x) + 20*I*e^x + 7)/(e^x - I)^5
```

### 3.91.9 Mupad [B] (verification not implemented)

Time = 2.66 (sec) , antiderivative size = 207, normalized size of antiderivative = 7.14

$$\int \frac{\operatorname{sech}^4(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{1\mathrm{i}}{4\,(\mathrm{e}^{2x}-1+\mathrm{e}^{x}\,2\mathrm{i})} + \frac{1}{20\,(\mathrm{e}^{x}-\mathrm{i})} - \frac{1}{8\,(\mathrm{e}^{x}+1\mathrm{i})} + \frac{\frac{\mathrm{e}^{3x}}{40} - \frac{\mathrm{e}^{2x}\,3\mathrm{i}}{40} + \frac{\mathrm{e}^{x}}{8} + \frac{1}{40}\mathrm{i}}{\mathrm{e}^{4x}-6\,\mathrm{e}^{2x}+1-\mathrm{e}^{3x}\,4\mathrm{i}+\mathrm{e}^{x}\,4\mathrm{i}} - \frac{\frac{\mathrm{e}^{2x}}{40}+\frac{1}{24}-\frac{\mathrm{e}^{x}\,1\mathrm{i}}{20}}{\mathrm{e}^{2x}\,3\mathrm{i}-\mathrm{e}^{3x}+3\,\mathrm{e}^{x}-\mathrm{i}} - \frac{1}{6\,(\mathrm{e}^{2x}\,3\mathrm{i}+\mathrm{e}^{3x}-3\,\mathrm{e}^{x}-\mathrm{i})} + \frac{\frac{\mathrm{e}^{2x}}{4}+\frac{\mathrm{e}^{4x}}{40}+\frac{1}{40}-\frac{\mathrm{e}^{3x}\,1\mathrm{i}}{10}+\frac{\mathrm{e}^{x}\,1\mathrm{i}}{10}}{\mathrm{e}^{2x}\,10\mathrm{i}-10\,\mathrm{e}^{3x}-\mathrm{e}^{4x}\,5\mathrm{i}+\mathrm{e}^{5x}+5\,\mathrm{e}^{x}-\mathrm{i}}$$

input
```
int(1/(cosh(x)^4*(1/sinh(x) + 1i)),x)
```

output
```
1/(20*(exp(x) - 1i)) - 1i/(4*(exp(2*x) + exp(x)*2i - 1)) - 1/(8*(exp(x) +
1i)) + (exp(3*x)/40 - (exp(2*x)*3i)/40 + exp(x)/8 + 1i/40)/(exp(4*x) - exp
(3*x)*4i - 6*exp(2*x) + exp(x)*4i + 1) - (exp(2*x)/40 - (exp(x)*1i)/20 + 1
/24)/(exp(2*x)*3i - exp(3*x) + 3*exp(x) - 1i) - 1/(6*(exp(2*x)*3i + exp(3*
x) - 3*exp(x) - 1i)) + (exp(2*x)/4 - (exp(3*x)*1i)/10 + exp(4*x)/40 + (exp
(x)*1i)/10 + 1/40)/(exp(2*x)*10i - 10*exp(3*x) - exp(4*x)*5i + exp(5*x) +
5*exp(x) - 1i)
```

# 3.92 $\int \frac{\cosh^5(x)}{a+b\mathbf{csch}(x)}\,dx$


3.92.1 Optimal result . . . . . 630
3.92.2 Mathematica [A] (verified) . . . . . 630
3.92.3 Rubi [A] (verified) . . . . . 631
3.92.4 Maple [B] (verified) . . . . . 633
3.92.5 Fricas [B] (verification not implemented) . . . . . 634
3.92.6 Sympy [F] . . . . . 635
3.92.7 Maxima [B] (verification not implemented) . . . . . 635
3.92.8 Giac [B] (verification not implemented) . . . . . 636
3.92.9 Mupad [B] (verification not implemented) . . . . . 636


## 3.92.1 Optimal result

Integrand size = 13, antiderivative size = 102

$$\int \frac{\cosh^5(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b(a^2+b^2)^2\log(b+a\sinh(x))}{a^6} + \frac{(a^2+b^2)^2\sinh(x)}{a^5} - \frac{b(2a^2+b^2)\sinh^2(x)}{2a^4} + \frac{(2a^2+b^2)\sinh^3(x)}{3a^3} - \frac{b\sinh^4(x)}{4a^2} + \frac{\sinh^5(x)}{5a}$$

output
```
-b*(a^2+b^2)^2*ln(b+a*sinh(x))/a^6+(a^2+b^2)^2*sinh(x)/a^5-1/2*b*(2*a^2+b^
2)*sinh(x)^2/a^4+1/3*(2*a^2+b^2)*sinh(x)^3/a^3-1/4*b*sinh(x)^4/a^2+1/5*sin
h(x)^5/a
```

## 3.92.2 Mathematica [A] (verified)

Time = 0.20 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.95

$$\int \frac{\cosh^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-60b(a^2+b^2)^2\log(b+a\sinh(x)) + 60a(a^2+b^2)^2\sinh(x) - 30a^2b(2a^2+b^2)\sinh^2(x) + 20a^3(2a^2+b^2)\sin}{60a^6}$$

input
```
Integrate[Cosh[x]^5/(a + b*Csch[x]),x]
```

output
```
(-60*b*(a^2 + b^2)^2*Log[b + a*Sinh[x]] + 60*a*(a^2 + b^2)^2*Sinh[x] - 30*
a^2*b*(2*a^2 + b^2)*Sinh[x]^2 + 20*a^3*(2*a^2 + b^2)*Sinh[x]^3 - 15*a^4*b*
Sinh[x]^4 + 12*a^5*Sinh[x]^5)/(60*a^6)
```

### 3.92.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 101, normalized size of antiderivative = 0.99, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 0.846$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3316, 26, 27, 522, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^5(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)^5}{a+ib\csc(ix)}\,dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh^5(x)}{ia\sinh(x)+ib}\,dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cosh^5(x)\sinh(x)}{b+a\sinh(x)}\,dx$$
$$\downarrow 26$$
$$\int \frac{\sinh(x)\cosh^5(x)}{a\sinh(x)+b}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\sin(ix)\cos(ix)^5}{b-ia\sin(ix)}\,dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)^5\sin(ix)}{b-ia\sin(ix)}\,dx$$
$$\downarrow 3316$$

$$-\frac{i\int \frac{i\sinh(x)\left(\sinh^2(x)a^2+a^2\right)^2}{b+a\sinh(x)}d(a\sinh(x))}{a^5}$$

$$\downarrow 26$$

$$\frac{\int \frac{\sinh(x)\left(\sinh^2(x)a^2+a^2\right)^2}{b+a\sinh(x)}d(a\sinh(x))}{a^5}$$

$$\downarrow 27$$

$$\frac{\int \frac{a\sinh(x)\left(\sinh^2(x)a^2+a^2\right)^2}{b+a\sinh(x)}d(a\sinh(x))}{a^6}$$

$$\downarrow 522$$

$$\frac{\int \left(a^4\sinh^4(x)-a^3b\sinh^3(x)+a^2\left(2a^2+b^2\right)\sinh^2(x)-ab\left(2a^2+b^2\right)\sinh(x)+\left(a^2+b^2\right)^2-\frac{b\left(a^2+b^2\right)^2}{b+a\sinh(x)}\right)d(a\sinh}{a^6}$$

$$\downarrow 2009$$

$$\frac{\frac{1}{5}a^5\sinh^5(x)-\frac{1}{4}a^4b\sinh^4(x)-\frac{1}{2}a^2b\left(2a^2+b^2\right)\sinh^2(x)+a\left(a^2+b^2\right)^2\sinh(x)-b\left(a^2+b^2\right)^2\log(a\sinh(x)+b)+}{a^6}$$

input
```
Int[Cosh[x]^5/(a + b*Csch[x]),x]
```

output
```
(-(b*(a^2 + b^2)^2*Log[b + a*Sinh[x]]) + a*(a^2 + b^2)^2*Sinh[x] - (a^2*b*
(2*a^2 + b^2)*Sinh[x]^2)/2 + (a^3*(2*a^2 + b^2)*Sinh[x]^3)/3 - (a^4*b*Sinh
[x]^4)/4 + (a^5*Sinh[x]^5)/5)/a^6
```

### 3.92.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 522
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_.
), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x],
x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3316
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_
.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.), x_Symbol] :> Simp[1/(b^p*
f)   Subst[Int[(a + x)^m*(c + (d/b)*x)^n*(b^2 - x^2)^((p - 1)/2), x], x, b*
Sin[e + f*x]], x] /; FreeQ[{a, b, c, d, e, f, m, n}, x] && IntegerQ[(p - 1)
/2] && NeQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.92.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 377 vs. $2(94) = 188$.

Time $= 0.13$ (sec) , antiderivative size $= 378$, normalized size of antiderivative $= 3.71$

$$-\frac{1}{5a\left(\tanh\left(\frac{x}{2}\right)-1\right)^5}-\frac{2a+b}{4a^2\left(\tanh\left(\frac{x}{2}\right)-1\right)^4}-\frac{11a^2+6ab+4b^2}{12a^3\left(\tanh\left(\frac{x}{2}\right)-1\right)^3}-\frac{7a^3+9a^2b+4a\,b^2+4b^3}{8a^4\left(\tanh\left(\frac{x}{2}\right)-1\right)^2}-\frac{8a^4+7a^3b+}{8a^5}$$

input
```
int(cosh(x)^5/(a+b*csch(x)),x)
```

output
```
-1/5/a/(tanh(1/2*x)-1)^5-1/4*(2*a+b)/a^2/(tanh(1/2*x)-1)^4-1/12*(11*a^2+6*
a*b+4*b^2)/a^3/(tanh(1/2*x)-1)^3-1/8*(7*a^3+9*a^2*b+4*a*b^2+4*b^3)/a^4/(ta
nh(1/2*x)-1)^2-1/8*(8*a^4+7*a^3*b+16*a^2*b^2+4*a*b^3+8*b^4)/a^5/(tanh(1/2*
x)-1)+b*(a^4+2*a^2*b^2+b^4)/a^6*ln(tanh(1/2*x)-1)-2*b/a^6*(1/2*a^4+a^2*b^2
+1/2*b^4)*ln(tanh(1/2*x)^2*b-2*a*tanh(1/2*x)-b)-1/5/a/(tanh(1/2*x)+1)^5-1/
4*(-2*a+b)/a^2/(tanh(1/2*x)+1)^4-1/12*(11*a^2-6*a*b+4*b^2)/a^3/(tanh(1/2*x
)+1)^3-1/8*(-7*a^3+9*a^2*b-4*a*b^2+4*b^3)/a^4/(tanh(1/2*x)+1)^2-1/8*(8*a^4
-7*a^3*b+16*a^2*b^2-4*a*b^3+8*b^4)/a^5/(tanh(1/2*x)+1)+b*(a^4+2*a^2*b^2+b^
4)/a^6*ln(tanh(1/2*x)+1)
```

### 3.92.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1398 vs. $2(94) = 188$.

Time $= 0.26$ (sec) , antiderivative size $= 1398$, normalized size of antiderivative $= 13.71$

$$\int \frac{\cosh^5(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(cosh(x)^5/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/960*(6*a^5*cosh(x)^10 + 6*a^5*sinh(x)^10 - 15*a^4*b*cosh(x)^9 + 15*(4*a^
5*cosh(x) - a^4*b)*sinh(x)^9 + 10*(5*a^5 + 4*a^3*b^2)*cosh(x)^8 + 5*(54*a^
5*cosh(x)^2 - 27*a^4*b*cosh(x) + 10*a^5 + 8*a^3*b^2)*sinh(x)^8 - 60*(3*a^4
*b + 2*a^2*b^3)*cosh(x)^7 + 20*(36*a^5*cosh(x)^3 - 27*a^4*b*cosh(x)^2 - 9*
a^4*b - 6*a^2*b^3 + 4*(5*a^5 + 4*a^3*b^2)*cosh(x))*sinh(x)^7 + 960*(a^4*b
+ 2*a^2*b^3 + b^5)*x*cosh(x)^5 + 60*(5*a^5 + 14*a^3*b^2 + 8*a*b^4)*cosh(x)
^6 + 20*(63*a^5*cosh(x)^4 - 63*a^4*b*cosh(x)^3 + 15*a^5 + 42*a^3*b^2 + 24*
a*b^4 + 14*(5*a^5 + 4*a^3*b^2)*cosh(x)^2 - 21*(3*a^4*b + 2*a^2*b^3)*cosh(x
))*sinh(x)^6 - 15*a^4*b*cosh(x) + 2*(756*a^5*cosh(x)^5 - 945*a^4*b*cosh(x)
^4 + 280*(5*a^5 + 4*a^3*b^2)*cosh(x)^3 - 630*(3*a^4*b + 2*a^2*b^3)*cosh(x)
^2 + 480*(a^4*b + 2*a^2*b^3 + b^5)*x + 180*(5*a^5 + 14*a^3*b^2 + 8*a*b^4)*
cosh(x))*sinh(x)^5 - 6*a^5 - 60*(5*a^5 + 14*a^3*b^2 + 8*a*b^4)*cosh(x)^4 +
 10*(126*a^5*cosh(x)^6 - 189*a^4*b*cosh(x)^5 - 30*a^5 - 84*a^3*b^2 - 48*a*
b^4 + 70*(5*a^5 + 4*a^3*b^2)*cosh(x)^4 - 210*(3*a^4*b + 2*a^2*b^3)*cosh(x)
^3 + 480*(a^4*b + 2*a^2*b^3 + b^5)*x*cosh(x) + 90*(5*a^5 + 14*a^3*b^2 + 8*
a*b^4)*cosh(x)^2)*sinh(x)^4 - 60*(3*a^4*b + 2*a^2*b^3)*cosh(x)^3 + 20*(36*
a^5*cosh(x)^7 - 63*a^4*b*cosh(x)^6 + 28*(5*a^5 + 4*a^3*b^2)*cosh(x)^5 - 9*
a^4*b - 6*a^2*b^3 - 105*(3*a^4*b + 2*a^2*b^3)*cosh(x)^4 + 480*(a^4*b + 2*a
^2*b^3 + b^5)*x*cosh(x)^2 + 60*(5*a^5 + 14*a^3*b^2 + 8*a*b^4)*cosh(x)^3 -
12*(5*a^5 + 14*a^3*b^2 + 8*a*b^4)*cosh(x))*sinh(x)^3 - 10*(5*a^5 + 4*a^...
```

### 3.92.6 Sympy [F]

$$\int \frac{\cosh^5(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\cosh^5(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(cosh(x)**5/(a+b*csch(x)),x)
```

output
```
Integral(cosh(x)**5/(a + b*csch(x)), x)
```

### 3.92.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 242 vs. $2(94) = 188$.

Time $= 0.18$ (sec) , antiderivative size $= 242$, normalized size of antiderivative $= 2.37$

$$\int \frac{\cosh^5(x)}{a+b\operatorname{csch}(x)}\,dx =$$
$$-\frac{\left(15\,a^3be^{(-x)} - 6\,a^4 - 10\,(5\,a^4+4\,a^2b^2)e^{(-2\,x)} + 60\,(3\,a^3b+2\,ab^3)e^{(-3\,x)} - 60\,(5\,a^4+14\,a^2b^2+8\,b^4)e^{(-4}\right.}{960\,a^5}$$
$$-\frac{15\,a^3be^{(-4\,x)} + 6\,a^4e^{(-5\,x)} + 60\,(5\,a^4+14\,a^2b^2+8\,b^4)e^{(-x)} + 60\,(3\,a^3b+2\,ab^3)e^{(-2\,x)} + 10\,(5\,a^4+4\,a^2b^2)}{960\,a^5}$$
$$-\frac{(a^4b+2\,a^2b^3+b^5)x}{a^6} - \frac{(a^4b+2\,a^2b^3+b^5)\log\left(-2\,be^{(-x)}+ae^{(-2\,x)}-a\right)}{a^6}$$

input
```
integrate(cosh(x)^5/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-1/960*(15*a^3*b*e^(-x) - 6*a^4 - 10*(5*a^4 + 4*a^2*b^2)*e^(-2*x) + 60*(3*
a^3*b + 2*a*b^3)*e^(-3*x) - 60*(5*a^4 + 14*a^2*b^2 + 8*b^4)*e^(-4*x))*e^(5
*x)/a^5 - 1/960*(15*a^3*b*e^(-4*x) + 6*a^4*e^(-5*x) + 60*(5*a^4 + 14*a^2*b
^2 + 8*b^4)*e^(-x) + 60*(3*a^3*b + 2*a*b^3)*e^(-2*x) + 10*(5*a^4 + 4*a^2*b
^2)*e^(-3*x))/a^5 - (a^4*b + 2*a^2*b^3 + b^5)*x/a^6 - (a^4*b + 2*a^2*b^3 +
 b^5)*log(-2*b*e^(-x) + a*e^(-2*x) - a)/a^6
```

### 3.92.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 194 vs. $2(94) = 188$.

Time $= 0.29$ (sec) , antiderivative size $= 194$, normalized size of antiderivative $= 1.90$

$$\int \frac{\cosh^5(x)}{a + b\operatorname{csch}(x)}\,dx =$$
$$-\frac{6\,a^4\left(e^{(-x)} - e^x\right)^5 + 15\,a^3 b\left(e^{(-x)} - e^x\right)^4 + 80\,a^4\left(e^{(-x)} - e^x\right)^3 + 40\,a^2 b^2\left(e^{(-x)} - e^x\right)^3 + 240\,a^3 b\left(e^{(-x)} - e\right.}{960\,a^5}$$
$$-\frac{\left(a^4 b + 2\,a^2 b^3 + b^5\right)\log\left(\left|-a\left(e^{(-x)} - e^x\right) + 2\,b\right|\right)}{a^6}$$

input
```
integrate(cosh(x)^5/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-1/960*(6*a^4*(e^(-x) - e^x)^5 + 15*a^3*b*(e^(-x) - e^x)^4 + 80*a^4*(e^(-x
) - e^x)^3 + 40*a^2*b^2*(e^(-x) - e^x)^3 + 240*a^3*b*(e^(-x) - e^x)^2 + 12
0*a*b^3*(e^(-x) - e^x)^2 + 480*a^4*(e^(-x) - e^x) + 960*a^2*b^2*(e^(-x) -
e^x) + 480*b^4*(e^(-x) - e^x))/a^5 - (a^4*b + 2*a^2*b^3 + b^5)*log(abs(-a*
(e^(-x) - e^x) + 2*b))/a^6
```

### 3.92.9 Mupad [B] (verification not implemented)

Time $= 2.97$ (sec) , antiderivative size $= 228$, normalized size of antiderivative $= 2.24$

$$\int \frac{\cosh^5(x)}{a + b\operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{5x}}{160\,a} - \frac{\mathrm{e}^{-5x}}{160\,a} - \frac{\mathrm{e}^{-2x}\left(3\,a^2 b + 2\,b^3\right)}{16\,a^4} - \frac{\mathrm{e}^{2x}\left(3\,a^2 b + 2\,b^3\right)}{16\,a^4}$$
$$+ \frac{\mathrm{e}^x\left(5\,a^4 + 14\,a^2 b^2 + 8\,b^4\right)}{16\,a^5} - \frac{b\,\mathrm{e}^{-4x}}{64\,a^2} - \frac{b\,\mathrm{e}^{4x}}{64\,a^2}$$
$$- \frac{\ln\left(2\,b\,\mathrm{e}^x - a + a\,\mathrm{e}^{2x}\right)\left(a^4 b + 2\,a^2 b^3 + b^5\right)}{a^6}$$
$$- \frac{\mathrm{e}^{-x}\left(5\,a^4 + 14\,a^2 b^2 + 8\,b^4\right)}{16\,a^5} - \frac{\mathrm{e}^{-3x}\left(5\,a^2 + 4\,b^2\right)}{96\,a^3}$$
$$+ \frac{\mathrm{e}^{3x}\left(5\,a^2 + 4\,b^2\right)}{96\,a^3} + \frac{b\,x\left(a^2 + b^2\right)^2}{a^6}$$

input
```
int(cosh(x)^5/(a + b/sinh(x)),x)
```

output

```
exp(5*x)/(160*a) - exp(-5*x)/(160*a) - (exp(-2*x)*(3*a^2*b + 2*b^3))/(16*a
^4) - (exp(2*x)*(3*a^2*b + 2*b^3))/(16*a^4) + (exp(x)*(5*a^4 + 8*b^4 + 14*
a^2*b^2))/(16*a^5) - (b*exp(-4*x))/(64*a^2) - (b*exp(4*x))/(64*a^2) - (log
(2*b*exp(x) - a + a*exp(2*x))*(a^4*b + b^5 + 2*a^2*b^3))/a^6 - (exp(-x)*(5
*a^4 + 8*b^4 + 14*a^2*b^2))/(16*a^5) - (exp(-3*x)*(5*a^2 + 4*b^2))/(96*a^3
) + (exp(3*x)*(5*a^2 + 4*b^2))/(96*a^3) + (b*x*(a^2 + b^2)^2)/a^6
```

# 3.93 $\int \frac{\cosh^4(x)}{a+b\mathbf{csch}(x)}\,dx$


3.93.1 Optimal result . . . . . 638
3.93.2 Mathematica [A] (verified) . . . . . 638
3.93.3 Rubi [C] (verified) . . . . . 639
3.93.4 Maple [A] (verified) . . . . . 643
3.93.5 Fricas [B] (verification not implemented) . . . . . 644
3.93.6 Sympy [F] . . . . . 645
3.93.7 Maxima [A] (verification not implemented) . . . . . 645
3.93.8 Giac [A] (verification not implemented) . . . . . 646
3.93.9 Mupad [B] (verification not implemented) . . . . . 646


## 3.93.1 Optimal result

Integrand size = 13, antiderivative size = 125

$$\int \frac{\cosh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\left(3a^4+12a^2b^2+8b^4\right)x}{8a^5} + \frac{2b\left(a^2+b^2\right)^{3/2}\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a^5} - \frac{\cosh^3(x)(4b-3a\sinh(x))}{12a^2} - \frac{\cosh(x)\left(8b\left(a^2+b^2\right)-a\left(3a^2+4b^2\right)\sinh(x)\right)}{8a^4}$$

output
```
1/8*(3*a^4+12*a^2*b^2+8*b^4)*x/a^5+2*b*(a^2+b^2)^(3/2)*arctanh((a-b*tanh(1
/2*x))/(a^2+b^2)^(1/2))/a^5-1/12*cosh(x)^3*(4*b-3*a*sinh(x))/a^2-1/8*cosh(
x)*(8*b*(a^2+b^2)-a*(3*a^2+4*b^2)*sinh(x))/a^4
```

## 3.93.2 Mathematica [A] (verified)

Time = 0.83 (sec) , antiderivative size = 180, normalized size of antiderivative = 1.44

$$\int \frac{\cosh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-24ab\left(5a^2+4b^2\right)\cosh(x) - 8a^3b\cosh(3x) + 3\left(12a^4x+48a^2b^2x+32b^4x+64a^2b\sqrt{-a^2-b^2}\arctan\left(\frac{a-b}{\sqrt{-}}\right.\right.}{96a^5}$$

input
```
Integrate[Cosh[x]^4/(a + b*Csch[x]),x]
```

output
```
(-24*a*b*(5*a^2 + 4*b^2)*Cosh[x] - 8*a^3*b*Cosh[3*x] + 3*(12*a^4*x + 48*a^
2*b^2*x + 32*b^4*x + 64*a^2*b*Sqrt[-a^2 - b^2]*ArcTan[(a - b*Tanh[x/2])/Sq
rt[-a^2 - b^2]] + 64*b^3*Sqrt[-a^2 - b^2]*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a
^2 - b^2]] + 8*a^2*(a^2 + b^2)*Sinh[2*x] + a^4*Sinh[4*x]))/(96*a^5)
```

### 3.93.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.82 (sec) , antiderivative size = 152, normalized size of antiderivative = 1.22, number of steps used = 18, number of rules used = 17, $\frac{\text{number of rules}}{\text{integrand size}} = 1.308$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3344, 26, 3042, 3344, 25, 3042, 3214, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^4(x)}{a + b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)^4}{a + ib\csc(ix)}\,dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh^4(x)}{ia\sinh(x) + ib}\,dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cosh^4(x)\sinh(x)}{b + a\sinh(x)}\,dx$$
$$\downarrow 26$$
$$\int \frac{\sinh(x)\cosh^4(x)}{a\sinh(x) + b}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\sin(ix)\cos(ix)^4}{b - ia\sin(ix)}\,dx$$

$$\downarrow 26$$

$$-i\int \frac{\cos(ix)^4\sin(ix)}{b-ia\sin(ix)}dx$$

$$\downarrow 3344$$

$$-i\left(-\frac{\int \frac{i\cosh^2(x)(ab-(3a^2+4b^2)\sinh(x))}{b+a\sinh(x)}dx}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{i\int \frac{\cosh^2(x)(ab-(3a^2+4b^2)\sinh(x))}{b+a\sinh(x)}dx}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{i\int \frac{\cos(ix)^2(ab+i(3a^2+4b^2)\sin(ix))}{b-ia\sin(ix)}dx}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}\right)$$

$$\downarrow 3344$$

$$-i\left(-\frac{i\left(\frac{\cosh(x)(8b(a^2+b^2)-a(3a^2+4b^2)\sinh(x))}{2a^2}-\frac{\int -\frac{ab\left(5a^2+4b^2\right)-\left(3a^4+12b^2a^2+8b^4\right)\sinh(x)}{b+a\sinh(x)}dx}{2a^2}\right)}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}\right)$$

$$\downarrow 25$$

$$-i\left(-\frac{i\left(\frac{\int \frac{ab\left(5a^2+4b^2\right)-\left(3a^4+12b^2a^2+8b^4\right)\sinh(x)}{b+a\sinh(x)}dx}{2a^2}+\frac{\cosh(x)(8b(a^2+b^2)-a(3a^2+4b^2)\sinh(x))}{2a^2}\right)}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{i\left(\frac{\cosh(x)(8b(a^2+b^2)-a(3a^2+4b^2)\sinh(x))}{2a^2}+\frac{\int \frac{ab\left(5a^2+4b^2\right)+i\left(3a^4+12b^2a^2+8b^4\right)\sin(ix)}{b-ia\sin(ix)}dx}{2a^2}\right)}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}\right)$$

$$\downarrow 3214$$

$$-i\left(-\frac{i\left(\frac{8b\left(a^2+b^2\right)^2\int\frac{1}{b+a\sinh(x)}dx}{a}-\frac{x\left(3a^4+12a^2b^2+8b^4\right)}{a}+\frac{\cosh(x)\left(8b\left(a^2+b^2\right)-a\left(3a^2+4b^2\right)\sinh(x)\right)}{2a^2}\right)}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh($$

$$\downarrow 3042$$

$$-i\left(-\frac{i\left(\frac{\cosh(x)\left(8b\left(a^2+b^2\right)-a\left(3a^2+4b^2\right)\sinh(x)\right)}{2a^2}+\frac{-\frac{x\left(3a^4+12a^2b^2+8b^4\right)}{a}+\frac{8b\left(a^2+b^2\right)^2\int\frac{1}{b-ia\sin(ix)}dx}{a}}{2a^2}\right)}{4a^2}-\frac{i\cosh^3(x)(4b-3a\sinh$$

$$\downarrow 3139$$

$$-i\left(-\frac{i\left(\frac{16b\left(a^2+b^2\right)^2\int\frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{a}-\frac{x\left(3a^4+12a^2b^2+8b^4\right)}{a}+\frac{\cosh(x)\left(8b\left(a^2+b^2\right)-a\left(3a^2+4b^2\right)\sinh(x)\right)}{2a^2}\right)}{4a^2}-\frac{i\cos}$$

$$\downarrow 1083$$

$$-i\left(-\frac{i\left(\frac{32b\left(a^2+b^2\right)^2\int\frac{1}{4\left(a^2+b^2\right)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{a}-\frac{x\left(3a^4+12a^2b^2+8b^4\right)}{a}+\frac{\cosh(x)\left(8b\left(a^2+b^2\right)-a\left(3a^2+4b^2\right)\sinh(x)\right)}{2a^2}\right)}{4a^2}$$

$$\downarrow 219$$

$$-i\left(-\frac{i\cosh^3(x)(4b-3a\sinh(x))}{12a^2}-\frac{i\left(\frac{\cosh(x)\left(8b\left(a^2+b^2\right)-a\left(3a^2+4b^2\right)\sinh(x)\right)}{2a^2}+\frac{-\frac{16b\left(a^2+b^2\right)^{3/2}\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a}-}{2a^2}\right.\right.$$

$$\left.\left.\qquad\qquad 4a^2\right.\right.$$

input
```
Int[Cosh[x]^4/(a + b*Csch[x]),x]
```

output
```
(-I)*(((-1/12*I)*Cosh[x]^3*(4*b - 3*a*Sinh[x]))/a^2 - ((I/4)*((-(((3*a^4 +
 12*a^2*b^2 + 8*b^4)*x)/a) - (16*b*(a^2 + b^2)^(3/2)*ArcTanh[(2*a - 2*b*Ta
nh[x/2])/(2*Sqrt[a^2 + b^2])])/a)/(2*a^2) + (Cosh[x]*(8*b*(a^2 + b^2) - a*
(3*a^2 + 4*b^2)*Sinh[x]))/(2*a^2)))/a^2)
```

### 3.93.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3214
```
Int[((a_.) + (b_.)*sin[(e_.) + (f_.)*(x_)])/((c_.) + (d_.)*sin[(e_.) + (f_.
)*(x_)]), x_Symbol] :> Simp[b*(x/d), x] - Simp[(b*c - a*d)/d   Int[1/(c + d
*Sin[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c - a*d, 0]
```

rule 3344
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x
_)])^(m_.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[g*(g*
Cos[e + f*x])^(p - 1)*(a + b*Sin[e + f*x])^(m + 1)*((b*c*(m + p + 1) - a*d*
p + b*d*(m + p)*Sin[e + f*x])/(b^2*f*(m + p)*(m + p + 1))), x] + Simp[g^2*(
(p - 1)/(b^2*(m + p)*(m + p + 1)))   Int[(g*Cos[e + f*x])^(p - 2)*(a + b*Si
n[e + f*x])^m*Simp[b*(a*d*m + b*c*(m + p + 1)) + (a*b*c*(m + p + 1) - d*(a^
2*p - b^2*(m + p)))*Sin[e + f*x], x], x], x] /; FreeQ[{a, b, c, d, e, f, g,
 m}, x] && NeQ[a^2 - b^2, 0] && GtQ[p, 1] && NeQ[m + p, 0] && NeQ[m + p + 1
, 0] && IntegerQ[2*m]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.93.4 Maple [A] (verified)

Time = 60.04 (sec) , antiderivative size = 215, normalized size of antiderivative = 1.72

| method | result |
|---|---|
| risch | $\frac{3x}{8a}+\frac{3xb^2}{2a^3}+\frac{xb^4}{a^5}+\frac{e^{4x}}{64a}-\frac{be^{3x}}{24a^2}+\frac{e^{2x}}{8a}+\frac{e^{2x}b^2}{8a^3}-\frac{5be^{x}}{8a^2}-\frac{b^3e^{x}}{2a^4}-\frac{5be^{-x}}{8a^2}-\frac{b^3e^{-x}}{2a^4}-\frac{e^{-2x}}{8a}-\frac{e^{-2x}b^2}{8a^3}-\frac{be^{-3x}}{24a^2}$ |
| default | $\frac{1}{4a\left(\tanh\left(\frac{x}{2}\right)-1\right)^4}-\frac{-3a-2b}{6a^2\left(\tanh\left(\frac{x}{2}\right)-1\right)^3}-\frac{-7a^2-4ab-4b^2}{8a^3\left(\tanh\left(\frac{x}{2}\right)-1\right)^2}+\frac{\left(-3a^4-12a^2b^2-8b^4\right)\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)}{8a^5}-\frac{-5a^3-12a^2b-4ab^2-}{8a^4\left(\tanh\left(\frac{x}{2}\right)-1\right)}$ |

input
```
int(cosh(x)^4/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
3/8*x/a+3/2*x/a^3*b^2+x/a^5*b^4+1/64/a*exp(x)^4-1/24/a^2*b*exp(x)^3+1/8/a*
exp(x)^2+1/8/a^3*exp(x)^2*b^2-5/8*b/a^2*exp(x)-1/2*b^3/a^4*exp(x)-5/8*b/a^
2/exp(x)-1/2*b^3/a^4/exp(x)-1/8/a/exp(x)^2-1/8/a^3/exp(x)^2*b^2-1/24/a^2*b
/exp(x)^3-1/64/a/exp(x)^4+(a^2+b^2)^(3/2)*b/a^5*ln(exp(x)+(b+(a^2+b^2)^(1/
2))/a)-(a^2+b^2)^(3/2)*b/a^5*ln(exp(x)-(-b+(a^2+b^2)^(1/2))/a)
```

### 3.93.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 924 vs. $2(114) = 228$.

Time $= 0.26$ (sec) , antiderivative size $= 924$, normalized size of antiderivative $= 7.39$

$$\int \frac{\cosh^4(x)}{a + b\text{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(cosh(x)^4/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/192*(3*a^4*cosh(x)^8 + 3*a^4*sinh(x)^8 - 8*a^3*b*cosh(x)^7 + 8*(3*a^4*co
sh(x) - a^3*b)*sinh(x)^7 + 24*(a^4 + a^2*b^2)*cosh(x)^6 + 4*(21*a^4*cosh(x
)^2 - 14*a^3*b*cosh(x) + 6*a^4 + 6*a^2*b^2)*sinh(x)^6 + 24*(3*a^4 + 12*a^2
*b^2 + 8*b^4)*x*cosh(x)^4 - 24*(5*a^3*b + 4*a*b^3)*cosh(x)^5 + 24*(7*a^4*c
osh(x)^3 - 7*a^3*b*cosh(x)^2 - 5*a^3*b - 4*a*b^3 + 6*(a^4 + a^2*b^2)*cosh(
x))*sinh(x)^5 - 8*a^3*b*cosh(x) + 2*(105*a^4*cosh(x)^4 - 140*a^3*b*cosh(x)
^3 + 180*(a^4 + a^2*b^2)*cosh(x)^2 + 12*(3*a^4 + 12*a^2*b^2 + 8*b^4)*x - 6
0*(5*a^3*b + 4*a*b^3)*cosh(x))*sinh(x)^4 - 3*a^4 - 24*(5*a^3*b + 4*a*b^3)*
cosh(x)^3 + 8*(21*a^4*cosh(x)^5 - 35*a^3*b*cosh(x)^4 - 15*a^3*b - 12*a*b^3
 + 60*(a^4 + a^2*b^2)*cosh(x)^3 + 12*(3*a^4 + 12*a^2*b^2 + 8*b^4)*x*cosh(x
) - 30*(5*a^3*b + 4*a*b^3)*cosh(x)^2)*sinh(x)^3 - 24*(a^4 + a^2*b^2)*cosh(
x)^2 + 12*(7*a^4*cosh(x)^6 - 14*a^3*b*cosh(x)^5 + 30*(a^4 + a^2*b^2)*cosh(
x)^4 - 2*a^4 - 2*a^2*b^2 + 12*(3*a^4 + 12*a^2*b^2 + 8*b^4)*x*cosh(x)^2 - 2
0*(5*a^3*b + 4*a*b^3)*cosh(x)^3 - 6*(5*a^3*b + 4*a*b^3)*cosh(x))*sinh(x)^2
 + 192*((a^2*b + b^3)*cosh(x)^4 + 4*(a^2*b + b^3)*cosh(x)^3*sinh(x) + 6*(a
^2*b + b^3)*cosh(x)^2*sinh(x)^2 + 4*(a^2*b + b^3)*cosh(x)*sinh(x)^3 + (a^2
*b + b^3)*sinh(x)^4)*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 +
2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) + 2*sqrt(a^2 +
 b^2)*(a*cosh(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x
) + 2*(a*cosh(x) + b)*sinh(x) - a)) + 8*(3*a^4*cosh(x)^7 - 7*a^3*b*cosh...
```

### 3.93.6 Sympy [F]

$$\int \frac{\cosh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\cosh^4(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(cosh(x)**4/(a+b*csch(x)),x)
```

output
```
Integral(cosh(x)**4/(a + b*csch(x)), x)
```

### 3.93.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 217, normalized size of antiderivative = 1.74

$$\begin{aligned}\int \frac{\cosh^4(x)}{a+b\operatorname{csch}(x)}\,dx = &-\frac{\left(8\,a^2be^{(-x)} - 3\,a^3 - 24\,(a^3+ab^2)e^{(-2\,x)} + 24\,(5\,a^2b+4\,b^3)e^{(-3\,x)}\right)e^{(4\,x)}}{192\,a^4}\\ &-\frac{8\,a^2be^{(-3\,x)} + 3\,a^3e^{(-4\,x)} + 24\,(5\,a^2b+4\,b^3)e^{(-x)} + 24\,(a^3+ab^2)e^{(-2\,x)}}{192\,a^4}\\ &+\frac{(3\,a^4+12\,a^2b^2+8\,b^4)x}{8\,a^5} - \frac{(a^4b+2\,a^2b^3+b^5)\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}a^5}\end{aligned}$$

input
```
integrate(cosh(x)^4/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-1/192*(8*a^2*b*e^(-x) - 3*a^3 - 24*(a^3 + a*b^2)*e^(-2*x) + 24*(5*a^2*b +
 4*b^3)*e^(-3*x))*e^(4*x)/a^4 - 1/192*(8*a^2*b*e^(-3*x) + 3*a^3*e^(-4*x) +
 24*(5*a^2*b + 4*b^3)*e^(-x) + 24*(a^3 + a*b^2)*e^(-2*x))/a^4 + 1/8*(3*a^4
 + 12*a^2*b^2 + 8*b^4)*x/a^5 - (a^4*b + 2*a^2*b^3 + b^5)*log((a*e^(-x) - b
 - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a^5
)
```

### 3.93.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 221, normalized size of antiderivative = 1.77

$$\int \frac{\cosh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{3\,a^3e^{(4\,x)} - 8\,a^2be^{(3\,x)} + 24\,a^3e^{(2\,x)} + 24\,ab^2e^{(2\,x)} - 120\,a^2be^x - 96\,b^3e^x}{192\,a^4} + \frac{(3\,a^4 + 12\,a^2b^2 + 8\,b^4)x}{8\,a^5} - \frac{\left(8\,a^3be^x + 3\,a^4 + 24\,(5\,a^3b + 4\,ab^3)e^{(3\,x)} + 24\,(a^4 + a^2b^2)e^{(2\,x)}\right)e^{(-4\,x)}}{192\,a^5} - \frac{(a^4b + 2\,a^2b^3 + b^5)\log\left(\frac{\left|2\,ae^x+2\,b-2\,\sqrt{a^2+b^2}\right|}{\left|2\,ae^x+2\,b+2\,\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}\,a^5}$$

input
```
integrate(cosh(x)^4/(a+b*csch(x)),x, algorithm="giac")
```

output
```
1/192*(3*a^3*e^(4*x) - 8*a^2*b*e^(3*x) + 24*a^3*e^(2*x) + 24*a*b^2*e^(2*x)
 - 120*a^2*b*e^x - 96*b^3*e^x)/a^4 + 1/8*(3*a^4 + 12*a^2*b^2 + 8*b^4)*x/a^
5 - 1/192*(8*a^3*b*e^x + 3*a^4 + 24*(5*a^3*b + 4*a*b^3)*e^(3*x) + 24*(a^4
+ a^2*b^2)*e^(2*x))*e^(-4*x)/a^5 - (a^4*b + 2*a^2*b^3 + b^5)*log(abs(2*a*e
^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(a^2 + b^2)))/(sqr
t(a^2 + b^2)*a^5)
```

### 3.93.9 Mupad [B] (verification not implemented)

Time = 2.61 (sec) , antiderivative size = 247, normalized size of antiderivative = 1.98

$$\int \frac{\cosh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{e^{4\,x}}{64\,a} - \frac{e^{-4\,x}}{64\,a} + \frac{x\,(3\,a^4 + 12\,a^2\,b^2 + 8\,b^4)}{8\,a^5} - \frac{e^{-2\,x}\,(a^2+b^2)}{8\,a^3} + \frac{e^{2\,x}\,(a^2+b^2)}{8\,a^3} - \frac{e^{-x}\,(5\,a^2\,b + 4\,b^3)}{8\,a^4} - \frac{b\,e^{-3\,x}}{24\,a^2} - \frac{b\,e^{3\,x}}{24\,a^2} - \frac{e^x\,(5\,a^2\,b + 4\,b^3)}{8\,a^4} - \frac{b\,\ln\left(\frac{2\,b\,e^x\,(a^2+b^2)^2}{a^6} - \frac{2\,b\,(a-b\,e^x)\,(a^2+b^2)^{3/2}}{a^6}\right)(a^2+b^2)^{3/2}}{a^5} + \frac{b\,\ln\left(\frac{2\,b\,(a-b\,e^x)\,(a^2+b^2)^{3/2}}{a^6} + \frac{2\,b\,e^x\,(a^2+b^2)^2}{a^6}\right)(a^2+b^2)^{3/2}}{a^5}$$

input
```
int(cosh(x)^4/(a + b/sinh(x)),x)
```

output

```
exp(4*x)/(64*a) - exp(-4*x)/(64*a) + (x*(3*a^4 + 8*b^4 + 12*a^2*b^2))/(8*a
^5) - (exp(-2*x)*(a^2 + b^2))/(8*a^3) + (exp(2*x)*(a^2 + b^2))/(8*a^3) - (
exp(-x)*(5*a^2*b + 4*b^3))/(8*a^4) - (b*exp(-3*x))/(24*a^2) - (b*exp(3*x))
/(24*a^2) - (exp(x)*(5*a^2*b + 4*b^3))/(8*a^4) - (b*log((2*b*exp(x)*(a^2 +
 b^2)^2)/a^6 - (2*b*(a - b*exp(x))*(a^2 + b^2)^(3/2))/a^6)*(a^2 + b^2)^(3/
2))/a^5 + (b*log((2*b*(a - b*exp(x))*(a^2 + b^2)^(3/2))/a^6 + (2*b*exp(x)*
(a^2 + b^2)^2)/a^6)*(a^2 + b^2)^(3/2))/a^5
```

# 3.94 $\int \frac{\cosh^3(x)}{a+b\mathbf{csch}(x)}\,dx$


3.94.1 Optimal result . . . . . 648
3.94.2 Mathematica [A] (verified) . . . . . 648
3.94.3 Rubi [A] (verified) . . . . . 649
3.94.4 Maple [B] (verified) . . . . . 651
3.94.5 Fricas [B] (verification not implemented) . . . . . 651
3.94.6 Sympy [F] . . . . . 652
3.94.7 Maxima [B] (verification not implemented) . . . . . 652
3.94.8 Giac [A] (verification not implemented) . . . . . 653
3.94.9 Mupad [B] (verification not implemented) . . . . . 653


## 3.94.1 Optimal result

Integrand size = 13, antiderivative size = 57

$$\int \frac{\cosh^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b(a^2+b^2)\log(b+a\sinh(x))}{a^4}+\frac{(a^2+b^2)\sinh(x)}{a^3}-\frac{b\sinh^2(x)}{2a^2}+\frac{\sinh^3(x)}{3a}$$

output
```
-b*(a^2+b^2)*ln(b+a*sinh(x))/a^4+(a^2+b^2)*sinh(x)/a^3-1/2*b*sinh(x)^2/a^2
+1/3*sinh(x)^3/a
```

## 3.94.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.98

$$\int \frac{\cosh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-6b(a^2+b^2)\log(b+a\sinh(x))+6a(a^2+b^2)\sinh(x)-3a^2b\sinh^2(x)+2a^3\sinh^3(x)}{6a^4}$$

input
```
Integrate[Cosh[x]^3/(a + b*Csch[x]),x]
```

output
```
(-6*b*(a^2 + b^2)*Log[b + a*Sinh[x]] + 6*a*(a^2 + b^2)*Sinh[x] - 3*a^2*b*S
inh[x]^2 + 2*a^3*Sinh[x]^3)/(6*a^4)
```

### 3.94.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.98, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 0.846$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3316, 26, 27, 522, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^3(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)^3}{a+ib\csc(ix)}dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh^3(x)}{ia\sinh(x)+ib}dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cosh^3(x)\sinh(x)}{b+a\sinh(x)}dx$$
$$\downarrow 26$$
$$\int \frac{\sinh(x)\cosh^3(x)}{a\sinh(x)+b}dx$$
$$\downarrow 3042$$
$$\int -\frac{i\sin(ix)\cos(ix)^3}{b-ia\sin(ix)}dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)^3\sin(ix)}{b-ia\sin(ix)}dx$$
$$\downarrow 3316$$
$$\frac{i\int -\frac{i\sinh(x)\left(\sinh^2(x)a^2+a^2\right)}{b+a\sinh(x)}d(a\sinh(x))}{a^3}$$
$$\downarrow 26$$
$$\frac{\int \frac{\sinh(x)\left(\sinh^2(x)a^2+a^2\right)}{b+a\sinh(x)}d(a\sinh(x))}{a^3}$$

$$\downarrow 27$$

$$\frac{\int \frac{a\sinh(x)\left(\sinh^2(x)a^2+a^2\right)}{b+a\sinh(x)}d(a\sinh(x))}{a^4}$$

$$\downarrow 522$$

$$\frac{\int \left(\sinh^2(x)a^2+\left(\frac{b^2}{a^2}+1\right)a^2-b\sinh(x)a-\frac{b\left(a^2+b^2\right)}{b+a\sinh(x)}\right)d(a\sinh(x))}{a^4}$$

$$\downarrow 2009$$

$$\frac{\frac{1}{3}a^3\sinh^3(x)+a\left(a^2+b^2\right)\sinh(x)-b\left(a^2+b^2\right)\log(a\sinh(x)+b)-\frac{1}{2}a^2b\sinh^2(x)}{a^4}$$

input
```
Int[Cosh[x]^3/(a + b*Csch[x]),x]
```

output
```
(-(b*(a^2 + b^2)*Log[b + a*Sinh[x]]) + a*(a^2 + b^2)*Sinh[x] - (a^2*b*Sinh
[x]^2)/2 + (a^3*Sinh[x]^3)/3)/a^4
```

### 3.94.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 522
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_.
), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x],
x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3316
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_
.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.), x_Symbol] :> Simp[1/(b^p*
f)   Subst[Int[(a + x)^m*(c + (d/b)*x)^n*(b^2 - x^2)^((p - 1)/2), x], x, b*
Sin[e + f*x]], x] /; FreeQ[{a, b, c, d, e, f, m, n}, x] && IntegerQ[(p - 1)
/2] && NeQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.94.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 135 vs. $2(53) = 106$.

Time = 14.75 (sec) , antiderivative size = 136, normalized size of antiderivative = 2.39

| method | result |
|---|---|
| risch | $\frac{bx}{a^2}+\frac{b^3x}{a^4}+\frac{e^{3x}}{24a}-\frac{be^{2x}}{8a^2}+\frac{3e^x}{8a}+\frac{e^xb^2}{2a^3}-\frac{3e^{-x}}{8a}-\frac{e^{-x}b^2}{2a^3}-\frac{be^{-2x}}{8a^2}-\frac{e^{-3x}}{24a}-\frac{b\ln\left(e^{2x}+\frac{2be^x}{a}-1\right)}{a^2}-\frac{b^3\ln\left(e^{2x}+\frac{2be^x}{a}$ |
| default | $\frac{2b\left(-\frac{a^2}{2}-\frac{b^2}{2}\right)\ln\left(-\tanh\left(\frac{x}{2}\right)^2b+2a\tanh\left(\frac{x}{2}\right)+b\right)}{a^4}-\frac{1}{3a\left(\tanh\left(\frac{x}{2}\right)+1\right)^3}-\frac{-a+b}{2a^2\left(\tanh\left(\frac{x}{2}\right)+1\right)^2}-\frac{2a^2-ab+2b^2}{2a^3\left(\tanh\left(\frac{x}{2}\right)+1\right)}+\frac{(a^2+b^2)b$ |

input
```
int(cosh(x)^3/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
b*x/a^2+1/a^4*b^3*x+1/24/a*exp(3*x)-1/8/a^2*b*exp(2*x)+3/8/a*exp(x)+1/2/a^
3*exp(x)*b^2-3/8/a*exp(-x)-1/2/a^3*exp(-x)*b^2-1/8/a^2*b*exp(-2*x)-1/24/a*
exp(-3*x)-1/a^2*b*ln(exp(2*x)+2*b/a*exp(x)-1)-1/a^4*b^3*ln(exp(2*x)+2*b/a*
exp(x)-1)
```

### 3.94.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 476 vs. $2(53) = 106$.

Time = 0.26 (sec) , antiderivative size = 476, normalized size of antiderivative = 8.35

$$\int \frac{\cosh^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$= \frac{a^3\cosh(x)^6+a^3\sinh(x)^6-3a^2b\cosh(x)^5+3\left(2a^3\cosh(x)-a^2b\right)\sinh(x)^5+24\left(a^2b+b^3\right)x\cosh(x)^3+}{}$$

input
```
integrate(cosh(x)^3/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/24*(a^3*cosh(x)^6 + a^3*sinh(x)^6 - 3*a^2*b*cosh(x)^5 + 3*(2*a^3*cosh(x)
 - a^2*b)*sinh(x)^5 + 24*(a^2*b + b^3)*x*cosh(x)^3 + 3*(3*a^3 + 4*a*b^2)*c
osh(x)^4 + 3*(5*a^3*cosh(x)^2 - 5*a^2*b*cosh(x) + 3*a^3 + 4*a*b^2)*sinh(x)
^4 - 3*a^2*b*cosh(x) + 2*(10*a^3*cosh(x)^3 - 15*a^2*b*cosh(x)^2 + 12*(a^2*
b + b^3)*x + 6*(3*a^3 + 4*a*b^2)*cosh(x))*sinh(x)^3 - a^3 - 3*(3*a^3 + 4*a
*b^2)*cosh(x)^2 + 3*(5*a^3*cosh(x)^4 - 10*a^2*b*cosh(x)^3 - 3*a^3 - 4*a*b^
2 + 24*(a^2*b + b^3)*x*cosh(x) + 6*(3*a^3 + 4*a*b^2)*cosh(x)^2)*sinh(x)^2
- 24*((a^2*b + b^3)*cosh(x)^3 + 3*(a^2*b + b^3)*cosh(x)^2*sinh(x) + 3*(a^2
*b + b^3)*cosh(x)*sinh(x)^2 + (a^2*b + b^3)*sinh(x)^3)*log(2*(a*sinh(x) +
b)/(cosh(x) - sinh(x))) + 3*(2*a^3*cosh(x)^5 - 5*a^2*b*cosh(x)^4 + 24*(a^2
*b + b^3)*x*cosh(x)^2 + 4*(3*a^3 + 4*a*b^2)*cosh(x)^3 - a^2*b - 2*(3*a^3 +
 4*a*b^2)*cosh(x))*sinh(x))/(a^4*cosh(x)^3 + 3*a^4*cosh(x)^2*sinh(x) + 3*a
^4*cosh(x)*sinh(x)^2 + a^4*sinh(x)^3)
```

### 3.94.6 Sympy [F]

$$\int \frac{\cosh^3(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\cosh^3(x)}{a + b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(cosh(x)**3/(a+b*csch(x)),x)
```

output
```
Integral(cosh(x)**3/(a + b*csch(x)), x)
```

### 3.94.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 127 vs. $2(53) = 106$.

Time $= 0.18$ (sec) , antiderivative size $= 127$, normalized size of antiderivative $= 2.23$

$$\begin{aligned}\int \frac{\cosh^3(x)}{a + b\operatorname{csch}(x)}\,dx = &-\frac{\left(3\,abe^{(-x)} - a^2 - 3\,(3\,a^2 + 4\,b^2)e^{(-2\,x)}\right)e^{(3\,x)}}{24\,a^3} \\ &- \frac{3\,abe^{(-2\,x)} + a^2e^{(-3\,x)} + 3\,(3\,a^2 + 4\,b^2)e^{(-x)}}{24\,a^3} \\ &- \frac{(a^2b + b^3)x}{a^4} - \frac{(a^2b + b^3)\log\left(-2\,be^{(-x)} + ae^{(-2\,x)} - a\right)}{a^4}\end{aligned}$$

input
```
integrate(cosh(x)^3/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-1/24*(3*a*b*e^(-x) - a^2 - 3*(3*a^2 + 4*b^2)*e^(-2*x))*e^(3*x)/a^3 - 1/24
*(3*a*b*e^(-2*x) + a^2*e^(-3*x) + 3*(3*a^2 + 4*b^2)*e^(-x))/a^3 - (a^2*b +
 b^3)*x/a^4 - (a^2*b + b^3)*log(-2*b*e^(-x) + a*e^(-2*x) - a)/a^4
```

### 3.94.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.70

$$\int \frac{\cosh^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a^2\left(e^{(-x)}-e^{x}\right)^3+3\,ab\left(e^{(-x)}-e^{x}\right)^2+12\,a^2\left(e^{(-x)}-e^{x}\right)+12\,b^2\left(e^{(-x)}-e^{x}\right)}{24\,a^3} - \frac{(a^2b+b^3)\log\left(\left|-a\left(e^{(-x)}-e^{x}\right)+2\,b\right|\right)}{a^4}$$

input
```
integrate(cosh(x)^3/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-1/24*(a^2*(e^(-x) - e^x)^3 + 3*a*b*(e^(-x) - e^x)^2 + 12*a^2*(e^(-x) - e^
x) + 12*b^2*(e^(-x) - e^x))/a^3 - (a^2*b + b^3)*log(abs(-a*(e^(-x) - e^x)
+ 2*b))/a^4
```

### 3.94.9 Mupad [B] (verification not implemented)

Time = 2.41 (sec) , antiderivative size = 121, normalized size of antiderivative = 2.12

$$\int \frac{\cosh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\mathrm{e}^{3x}}{24\,a} - \frac{\mathrm{e}^{-3x}}{24\,a} + \frac{x\,(a^2\,b+b^3)}{a^4} + \frac{\mathrm{e}^{x}\,(3\,a^2+4\,b^2)}{8\,a^3} - \frac{b\,\mathrm{e}^{-2x}}{8\,a^2} - \frac{b\,\mathrm{e}^{2x}}{8\,a^2} - \frac{\ln\left(2\,b\,\mathrm{e}^{x}-a+a\,\mathrm{e}^{2x}\right)\,(a^2\,b+b^3)}{a^4} - \frac{\mathrm{e}^{-x}\,(3\,a^2+4\,b^2)}{8\,a^3}$$

input
```
int(cosh(x)^3/(a + b/sinh(x)),x)
```

output
```
exp(3*x)/(24*a) - exp(-3*x)/(24*a) + (x*(a^2*b + b^3))/a^4 + (exp(x)*(3*a^
2 + 4*b^2))/(8*a^3) - (b*exp(-2*x))/(8*a^2) - (b*exp(2*x))/(8*a^2) - (log(
2*b*exp(x) - a + a*exp(2*x))*(a^2*b + b^3))/a^4 - (exp(-x)*(3*a^2 + 4*b^2)
)/(8*a^3)
```

# 3.95 $\int \frac{\cosh^2(x)}{a+b\mathbf{csch}(x)}\,dx$

3.95.1 Optimal result . . . 654
3.95.2 Mathematica [A] (verified) . . . 654
3.95.3 Rubi [C] (verified) . . . 655
3.95.4 Maple [A] (verified) . . . 658
3.95.5 Fricas [B] (verification not implemented) . . . 659
3.95.6 Sympy [F] . . . 659
3.95.7 Maxima [A] (verification not implemented) . . . 660
3.95.8 Giac [A] (verification not implemented) . . . 660
3.95.9 Mupad [B] (verification not implemented) . . . 661

## 3.95.1 Optimal result

Integrand size = 13, antiderivative size = 77

$$\int \frac{\cosh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{(a^2+2b^2)\,x}{2a^3} + \frac{2b\sqrt{a^2+b^2}\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a^3} - \frac{\cosh(x)(2b-a\sinh(x))}{2a^2}$$

output
```
1/2*(a^2+2*b^2)*x/a^3-1/2*cosh(x)*(2*b-a*sinh(x))/a^2+2*b*arctanh((a-b*tan
h(1/2*x))/(a^2+b^2)^(1/2))*(a^2+b^2)^(1/2)/a^3
```

## 3.95.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 80, normalized size of antiderivative = 1.04

$$\int \frac{\cosh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2a^2x + 4b^2x + 8b\sqrt{-a^2-b^2}\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right) - 4ab\cosh(x) + a^2\sinh(2x)}{4a^3}$$

input
```
Integrate[Cosh[x]^2/(a + b*Csch[x]),x]
```

output
```
(2*a^2*x + 4*b^2*x + 8*b*Sqrt[-a^2 - b^2]*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a
^2 - b^2]] - 4*a*b*Cosh[x] + a^2*Sinh[2*x])/(4*a^3)
```

### 3.95.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.54 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.25, number of steps used = 15, number of rules used = 14, $\frac{\text{number of rules}}{\text{integrand size}} = 1.077$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3344, 26, 3042, 3214, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{\cos(ix)^2}{a+ib\csc(ix)}dx$$

$$\downarrow 4360$$

$$\int \frac{i\sinh(x)\cosh^2(x)}{ia\sinh(x)+ib}dx$$

$$\downarrow 26$$

$$i\int -\frac{i\cosh^2(x)\sinh(x)}{b+a\sinh(x)}dx$$

$$\downarrow 26$$

$$\int \frac{\sinh(x)\cosh^2(x)}{a\sinh(x)+b}dx$$

$$\downarrow 3042$$

$$\int -\frac{i\sin(ix)\cos(ix)^2}{b-ia\sin(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\cos(ix)^2\sin(ix)}{b-ia\sin(ix)}dx$$

$$\downarrow 3344$$

$$-i\left(-\frac{\int \frac{i(ab-(a^2+2b^2)\sinh(x))}{b+a\sinh(x)}dx}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{i\int\frac{ab-\left(a^2+2b^2\right)\sinh(x)}{b+a\sinh(x)}dx}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{i\int\frac{ab+i\left(a^2+2b^2\right)\sin(ix)}{b-ia\sin(ix)}dx}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 3214$$

$$-i\left(-\frac{i\left(\frac{2b\left(a^2+b^2\right)\int\frac{1}{b+a\sinh(x)}dx}{a}-\frac{x\left(a^2+2b^2\right)}{a}\right)}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{i\left(-\frac{x\left(a^2+2b^2\right)}{a}+\frac{2b\left(a^2+b^2\right)\int\frac{1}{b-ia\sin(ix)}dx}{a}\right)}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 3139$$

$$-i\left(-\frac{i\left(\frac{4b\left(a^2+b^2\right)\int\frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{a}-\frac{x\left(a^2+2b^2\right)}{a}\right)}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 1083$$

$$-i\left(-\frac{i\left(-\frac{8b\left(a^2+b^2\right)\int\frac{1}{4\left(a^2+b^2\right)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{a}-\frac{x\left(a^2+2b^2\right)}{a}\right)}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

$$\downarrow 219$$

$$-i\left(-\frac{i\left(-\frac{4b\sqrt{a^2+b^2}\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a}-\frac{x\left(a^2+2b^2\right)}{a}\right)}{2a^2}-\frac{i\cosh(x)(2b-a\sinh(x))}{2a^2}\right)$$

input
```
Int[Cosh[x]^2/(a + b*Csch[x]),x]
```

output
```
(-I)*(((-1/2*I)*(-(((a^2 + 2*b^2)*x)/a) - (4*b*Sqrt[a^2 + b^2]*ArcTanh[(2*
a - 2*b*Tanh[x/2])/(2*Sqrt[a^2 + b^2])])/a))/a^2 - ((I/2)*Cosh[x]*(2*b - a
*Sinh[x]))/a^2)
```

### 3.95.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3214
```
Int[((a_.) + (b_.)*sin[(e_.) + (f_.)*(x_)])/((c_.) + (d_.)*sin[(e_.) + (f_.
)*(x_)]), x_Symbol] :> Simp[b*(x/d), x] - Simp[(b*c - a*d)/d   Int[1/(c + d
*Sin[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c - a*d, 0]
```

rule 3344
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x
_)])^(m_.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[g*(g*
Cos[e + f*x])^(p - 1)*(a + b*Sin[e + f*x])^(m + 1)*((b*c*(m + p + 1) - a*d*
p + b*d*(m + p)*Sin[e + f*x])/(b^2*f*(m + p)*(m + p + 1))), x] + Simp[g^2*(
(p - 1)/(b^2*(m + p)*(m + p + 1)))   Int[(g*Cos[e + f*x])^(p - 2)*(a + b*Si
n[e + f*x])^m*Simp[b*(a*d*m + b*c*(m + p + 1)) + (a*b*c*(m + p + 1) - d*(a^
2*p - b^2*(m + p)))*Sin[e + f*x], x], x], x] /; FreeQ[{a, b, c, d, e, f, g,
 m}, x] && NeQ[a^2 - b^2, 0] && GtQ[p, 1] && NeQ[m + p, 0] && NeQ[m + p + 1
, 0] && IntegerQ[2*m]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.95.4 Maple [A] (verified)

Time = 3.48 (sec) , antiderivative size = 122, normalized size of antiderivative = 1.58

| method | result |
|---|---|
| risch | $\frac{x}{2a}+\frac{x b^2}{a^3}+\frac{e^{2x}}{8a}-\frac{b e^{x}}{2a^2}-\frac{b e^{-x}}{2a^2}-\frac{e^{-2x}}{8a}+\frac{\sqrt{a^2+b^2}\, b \ln\left(e^{x}+\frac{b+\sqrt{a^2+b^2}}{a}\right)}{a^3}-\frac{\sqrt{a^2+b^2}\, b \ln\left(e^{x}-\frac{-b+\sqrt{a^2+b^2}}{a}\right)}{a^3}$ |
| default | $\frac{2b\sqrt{a^2+b^2}\,\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{a^3}-\frac{1}{2a\left(\tanh\left(\frac{x}{2}\right)+1\right)^2}-\frac{-a+2b}{2a^2\left(\tanh\left(\frac{x}{2}\right)+1\right)}+\frac{\left(a^2+2b^2\right)\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)}{2a^3}+\frac{1}{2a\left(\tanh\left(\frac{x}{2}\right)-$ |

input
```
int(cosh(x)^2/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/2*x/a+x/a^3*b^2+1/8/a*exp(x)^2-1/2*b/a^2*exp(x)-1/2*b/a^2/exp(x)-1/8/a/e
xp(x)^2+(a^2+b^2)^(1/2)*b/a^3*ln(exp(x)+(b+(a^2+b^2)^(1/2))/a)-(a^2+b^2)^(
1/2)*b/a^3*ln(exp(x)-(-b+(a^2+b^2)^(1/2))/a)
```

### 3.95.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 304 vs. $2(68) = 136$.

Time $= 0.26$ (sec) , antiderivative size $= 304$, normalized size of antiderivative $= 3.95$

$$\int \frac{\cosh^2(x)}{a + b\operatorname{csch}(x)}\,dx$$

$$= \frac{a^2\cosh(x)^4 + a^2\sinh(x)^4 - 4ab\cosh(x)^3 + 4(a^2 + 2b^2)x\cosh(x)^2 + 4(a^2\cosh(x) - ab)\sinh(x)^3 - 4a}{}$$

input
```
integrate(cosh(x)^2/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/8*(a^2*cosh(x)^4 + a^2*sinh(x)^4 - 4*a*b*cosh(x)^3 + 4*(a^2 + 2*b^2)*x*c
osh(x)^2 + 4*(a^2*cosh(x) - a*b)*sinh(x)^3 - 4*a*b*cosh(x) + 2*(3*a^2*cosh
(x)^2 - 6*a*b*cosh(x) + 2*(a^2 + 2*b^2)*x)*sinh(x)^2 + 8*(b*cosh(x)^2 + 2*
b*cosh(x)*sinh(x) + b*sinh(x)^2)*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*
sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) +
2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2
+ 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x) - a)) - a^2 + 4*(a^2*cosh(x)^3 -
 3*a*b*cosh(x)^2 + 2*(a^2 + 2*b^2)*x*cosh(x) - a*b)*sinh(x))/(a^3*cosh(x)^
2 + 2*a^3*cosh(x)*sinh(x) + a^3*sinh(x)^2)
```

### 3.95.6 Sympy [F]

$$\int \frac{\cosh^2(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\cosh^2(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(cosh(x)**2/(a+b*csch(x)),x)
```

output
```
Integral(cosh(x)**2/(a + b*csch(x)), x)
```

### 3.95.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 122, normalized size of antiderivative = 1.58

$$\int \frac{\cosh^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{\left(4\,be^{(-x)}-a\right)e^{(2\,x)}}{8\,a^2} - \frac{4\,be^{(-x)}+ae^{(-2\,x)}}{8\,a^2} + \frac{(a^2+2\,b^2)x}{2\,a^3} - \frac{(a^2b+b^3)\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}a^3}$$

input
```
integrate(cosh(x)^2/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-1/8*(4*b*e^(-x) - a)*e^(2*x)/a^2 - 1/8*(4*b*e^(-x) + a*e^(-2*x))/a^2 + 1/
2*(a^2 + 2*b^2)*x/a^3 - (a^2*b + b^3)*log((a*e^(-x) - b - sqrt(a^2 + b^2))
/(a*e^(-x) - b + sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a^3)
```

### 3.95.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 121, normalized size of antiderivative = 1.57

$$\int \frac{\cosh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{ae^{(2\,x)}-4\,be^{x}}{8\,a^2} + \frac{(a^2+2\,b^2)x}{2\,a^3} - \frac{(4\,abe^{x}+a^2)e^{(-2\,x)}}{8\,a^3} - \frac{(a^2b+b^3)\log\left(\frac{\left|2\,ae^{x}+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^{x}+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}a^3}$$

input
```
integrate(cosh(x)^2/(a+b*csch(x)),x, algorithm="giac")
```

output
```
1/8*(a*e^(2*x) - 4*b*e^x)/a^2 + 1/2*(a^2 + 2*b^2)*x/a^3 - 1/8*(4*a*b*e^x +
 a^2)*e^(-2*x)/a^3 - (a^2*b + b^3)*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^
2))/abs(2*a*e^x + 2*b + 2*sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a^3)
```

### 3.95.9 Mupad [B] (verification not implemented)

Time = 2.33 (sec) , antiderivative size = 159, normalized size of antiderivative = 2.06

$$\int \frac{\cosh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{e^{2x}}{8a} - \frac{e^{-2x}}{8a} - \frac{b\,e^{x}}{2a^2} - \frac{b\,e^{-x}}{2a^2} + \frac{x\,(a^2+2b^2)}{2a^3} - \frac{b\,\ln\left(\frac{2b\,e^{x}\,(a^2+b^2)}{a^4} - \frac{2b\,(a-b\,e^{x})\,\sqrt{a^2+b^2}}{a^4}\right)\sqrt{a^2+b^2}}{a^3} + \frac{b\,\ln\left(\frac{2b\,(a-b\,e^{x})\,\sqrt{a^2+b^2}}{a^4} + \frac{2b\,e^{x}\,(a^2+b^2)}{a^4}\right)\sqrt{a^2+b^2}}{a^3}$$

input
```
int(cosh(x)^2/(a + b/sinh(x)),x)
```

output
```
exp(2*x)/(8*a) - exp(-2*x)/(8*a) - (b*exp(x))/(2*a^2) - (b*exp(-x))/(2*a^2
) + (x*(a^2 + 2*b^2))/(2*a^3) - (b*log((2*b*exp(x)*(a^2 + b^2))/a^4 - (2*b
*(a - b*exp(x))*(a^2 + b^2)^(1/2))/a^4)*(a^2 + b^2)^(1/2))/a^3 + (b*log((2
*b*(a - b*exp(x))*(a^2 + b^2)^(1/2))/a^4 + (2*b*exp(x)*(a^2 + b^2))/a^4)*(
a^2 + b^2)^(1/2))/a^3
```

# 3.96 $\int \frac{\cosh(x)}{a+b\mathbf{csch}(x)}\,dx$

3.96.1 Optimal result . . . . . 662
3.96.2 Mathematica [A] (verified) . . . . . 662
3.96.3 Rubi [A] (verified) . . . . . 663
3.96.4 Maple [A] (verified) . . . . . 665
3.96.5 Fricas [B] (verification not implemented) . . . . . 665
3.96.6 Sympy [F] . . . . . 666
3.96.7 Maxima [B] (verification not implemented) . . . . . 666
3.96.8 Giac [A] (verification not implemented) . . . . . 666
3.96.9 Mupad [B] (verification not implemented) . . . . . 667

## 3.96.1 Optimal result

Integrand size = 11, antiderivative size = 20

$$\int \frac{\cosh(x)}{a+b\text{csch}(x)}\,dx = -\frac{b\log(b+a\sinh(x))}{a^2}+\frac{\sinh(x)}{a}$$

output
```
-b*ln(b+a*sinh(x))/a^2+sinh(x)/a
```

## 3.96.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 19, normalized size of antiderivative = 0.95

$$\int \frac{\cosh(x)}{a+b\text{csch}(x)}\,dx = \frac{-b\log(b+a\sinh(x))+a\sinh(x)}{a^2}$$

input
```
Integrate[Cosh[x]/(a + b*Csch[x]),x]
```

output
```
(-(b*Log[b + a*Sinh[x]]) + a*Sinh[x])/a^2
```

### 3.96.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 19, normalized size of antiderivative = 0.95, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3312, 26, 27, 49, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\cosh(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cos(ix)}{a+ib\csc(ix)}\,dx$$
$$\downarrow 4360$$
$$\int \frac{i\sinh(x)\cosh(x)}{ia\sinh(x)+ib}\,dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cosh(x)\sinh(x)}{b+a\sinh(x)}\,dx$$
$$\downarrow 26$$
$$\int \frac{\sinh(x)\cosh(x)}{a\sinh(x)+b}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\sin(ix)\cos(ix)}{b-ia\sin(ix)}\,dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)\sin(ix)}{b-ia\sin(ix)}\,dx$$
$$\downarrow 3312$$
$$-\frac{i\int \frac{i\sinh(x)}{b+a\sinh(x)}\,d(a\sinh(x))}{a}$$
$$\downarrow 26$$
$$\frac{\int \frac{\sinh(x)}{b+a\sinh(x)}\,d(a\sinh(x))}{a}$$

$$\downarrow 27$$

$$\frac{\int \frac{a\sinh(x)}{b+a\sinh(x)} d(a\sinh(x))}{a^2}$$

$$\downarrow 49$$

$$\frac{\int \left(1 - \frac{b}{b+a\sinh(x)}\right) d(a\sinh(x))}{a^2}$$

$$\downarrow 2009$$

$$\frac{a\sinh(x) - b\log(a\sinh(x) + b)}{a^2}$$

input
```
Int[Cosh[x]/(a + b*Csch[x]),x]
```

output
```
(-(b*Log[b + a*Sinh[x]]) + a*Sinh[x])/a^2
```

### 3.96.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 49
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d}, x]
&& IGtQ[m, 0] && IGtQ[m + n + 2, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3312
```
Int[cos[(e_.) + (f_.)*(x_)]*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_.)*((
c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.), x_Symbol] :> Simp[1/(b*f)   Su
bst[Int[(a + x)^m*(c + (d/b)*x)^n, x], x, b*Sin[e + f*x]], x] /; FreeQ[{a,
b, c, d, e, f, m, n}, x]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.96.4 Maple [A] (verified)

Time = 0.66 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.55

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{1}{a\ \mathrm{csch}(x)}+\frac{b\ln(\mathrm{csch}(x))}{a^2}-\frac{b\ln(a+b\ \mathrm{csch}(x))}{a^2}$ | 31 |
| default | $\frac{1}{a\ \mathrm{csch}(x)}+\frac{b\ln(\mathrm{csch}(x))}{a^2}-\frac{b\ln(a+b\ \mathrm{csch}(x))}{a^2}$ | 31 |
| risch | $\frac{bx}{a^2}+\frac{\mathrm{e}^{x}}{2a}-\frac{\mathrm{e}^{-x}}{2a}-\frac{b\ln\left(\mathrm{e}^{2x}+\frac{2b\,\mathrm{e}^{x}}{a}-1\right)}{a^2}$ | 45 |

input
```
int(cosh(x)/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/a/csch(x)+1/a^2*b*ln(csch(x))-1/a^2*b*ln(a+b*csch(x))
```

### 3.96.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 80 vs. $2(20) = 40$.

Time = 0.26 (sec) , antiderivative size = 80, normalized size of antiderivative = 4.00

$$\int \frac{\cosh(x)}{a+b\mathrm{csch}(x)}\,dx$$
$$= \frac{2\,bx\cosh(x)+a\cosh(x)^2+a\sinh(x)^2-2\,(b\cosh(x)+b\sinh(x))\log\left(\frac{2\,(a\sinh(x)+b)}{\cosh(x)-\sinh(x)}\right)+2\,(bx+a\cosh($$
$$2\,(a^2\cosh(x)+a^2\sinh(x))$$

input
```
integrate(cosh(x)/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/2*(2*b*x*cosh(x) + a*cosh(x)^2 + a*sinh(x)^2 - 2*(b*cosh(x) + b*sinh(x))
*log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x))) + 2*(b*x + a*cosh(x))*sinh(x)
- a)/(a^2*cosh(x) + a^2*sinh(x))
```

### 3.96.6 Sympy [F]

$$\int \frac{\cosh(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\cosh(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(cosh(x)/(a+b*csch(x)),x)
```

output
```
Integral(cosh(x)/(a + b*csch(x)), x)
```

### 3.96.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 48 vs. $2(20) = 40$.

Time $= 0.17$ (sec) , antiderivative size $= 48$, normalized size of antiderivative $= 2.40$

$$\int \frac{\cosh(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{bx}{a^2} - \frac{e^{(-x)}}{2\,a} + \frac{e^{x}}{2\,a} - \frac{b\log\left(-2\,be^{(-x)} + ae^{(-2\,x)} - a\right)}{a^2}$$

input
```
integrate(cosh(x)/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-b*x/a^2 - 1/2*e^(-x)/a + 1/2*e^x/a - b*log(-2*b*e^(-x) + a*e^(-2*x) - a)/
a^2
```

### 3.96.8 Giac [A] (verification not implemented)

Time $= 0.27$ (sec) , antiderivative size $= 39$, normalized size of antiderivative $= 1.95$

$$\int \frac{\cosh(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{e^{(-x)} - e^{x}}{2\,a} - \frac{b\log\left(\left|-a\left(e^{(-x)} - e^{x}\right) + 2\,b\right|\right)}{a^2}$$

input
```
integrate(cosh(x)/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-1/2*(e^(-x) - e^x)/a - b*log(abs(-a*(e^(-x) - e^x) + 2*b))/a^2
```

### 3.96.9 Mupad [B] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.00

$$\int \frac{\cosh(x)}{a + b\operatorname{csch}(x)}\,dx = \frac{\sinh(x)}{a} - \frac{b\,\ln\left(b + a\sinh(x)\right)}{a^2}$$

input
```
int(cosh(x)/(a + b/sinh(x)),x)
```

output
```
sinh(x)/a - (b*log(b + a*sinh(x)))/a^2
```

# 3.97 $\int \frac{\mathbf{sech}(x)}{a+b\mathbf{csch}(x)}\,dx$


3.97.1 Optimal result . . . . . 668
3.97.2 Mathematica [A] (verified) . . . . . 668
3.97.3 Rubi [A] (verified) . . . . . 669
3.97.4 Maple [A] (verified) . . . . . 672
3.97.5 Fricas [A] (verification not implemented) . . . . . 672
3.97.6 Sympy [F] . . . . . 672
3.97.7 Maxima [A] (verification not implemented) . . . . . 673
3.97.8 Giac [A] (verification not implemented) . . . . . 673
3.97.9 Mupad [B] (verification not implemented) . . . . . 673


## 3.97.1 Optimal result

Integrand size = 11, antiderivative size = 64

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log(i-\sinh(x))}{2(ia+b)} - \frac{\log(i+\sinh(x))}{2(ia-b)} - \frac{b\log(b+a\sinh(x))}{a^2+b^2}$$

output
```
1/2*ln(I-sinh(x))/(I*a+b)-1/2*ln(I+sinh(x))/(I*a-b)-b*ln(b+a*sinh(x))/(a^2
+b^2)
```

## 3.97.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.88

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{(-ia+b)\log(i-\sinh(x)) + (ia+b)\log(i+\sinh(x)) - 2b\log(b+a\sinh(x))}{2\left(a^2+b^2\right)}$$

input
```
Integrate[Sech[x]/(a + b*Csch[x]),x]
```

output
```
(((-I)*a + b)*Log[I - Sinh[x]] + (I*a + b)*Log[I + Sinh[x]] - 2*b*Log[b +
a*Sinh[x]])/(2*(a^2 + b^2))
```

### 3.97.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 54, normalized size of antiderivative = 0.84, number of steps used = 14, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.182$, Rules used = {3042, 4359, 26, 26, 3042, 26, 3200, 25, 587, 16, 452, 216, 240}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)(a+ib\csc(ix))}dx$$

$$\downarrow 4359$$

$$\int \frac{i\tanh(x)}{ia\sinh(x)+ib}dx$$

$$\downarrow 26$$

$$i\int -\frac{i\tanh(x)}{b+a\sinh(x)}dx$$

$$\downarrow 26$$

$$\int \frac{\tanh(x)}{a\sinh(x)+b}dx$$

$$\downarrow 3042$$

$$\int -\frac{i\tan(ix)}{b-ia\sin(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\tan(ix)}{b-ia\sin(ix)}dx$$

$$\downarrow 3200$$

$$-\int -\frac{a\sinh(x)}{(b+a\sinh(x))\left(\sinh^2(x)a^2+a^2\right)}d(a\sinh(x))$$

$$\downarrow 25$$

$$\int \frac{a\sinh(x)}{\left(a^2\sinh^2(x)+a^2\right)(a\sinh(x)+b)}d(a\sinh(x))$$

$$\downarrow 587$$

$$\frac{\int \frac{a^2+b\sinh(x)a}{\sinh^2(x)a^2+a^2}d(a\sinh(x))}{a^2+b^2} - \frac{b\int \frac{1}{b+a\sinh(x)}d(a\sinh(x))}{a^2+b^2}$$

$$\downarrow 16$$

$$\frac{\int \frac{a^2+b\sinh(x)a}{\sinh^2(x)a^2+a^2}d(a\sinh(x))}{a^2+b^2} - \frac{b\log(a\sinh(x)+b)}{a^2+b^2}$$

$$\downarrow 452$$

$$\frac{b\int \frac{a\sinh(x)}{\sinh^2(x)a^2+a^2}d(a\sinh(x)) + a^2\int \frac{1}{\sinh^2(x)a^2+a^2}d(a\sinh(x))}{a^2+b^2} - \frac{b\log(a\sinh(x)+b)}{a^2+b^2}$$

$$\downarrow 216$$

$$\frac{b\int \frac{a\sinh(x)}{\sinh^2(x)a^2+a^2}d(a\sinh(x)) + a\arctan(\sinh(x))}{a^2+b^2} - \frac{b\log(a\sinh(x)+b)}{a^2+b^2}$$

$$\downarrow 240$$

$$\frac{\frac{1}{2}b\log\left(a^2\sinh^2(x)+a^2\right) + a\arctan(\sinh(x))}{a^2+b^2} - \frac{b\log(a\sinh(x)+b)}{a^2+b^2}$$

input
```
Int[Sech[x]/(a + b*Csch[x]),x]
```

output
```
-((b*Log[b + a*Sinh[x]])/(a^2 + b^2)) + (a*ArcTan[Sinh[x]] + (b*Log[a^2 +
a^2*Sinh[x]^2])/2)/(a^2 + b^2)
```

### 3.97.3.1 Defintions of rubi rules used

rule 16
```
Int[(c_.)/((a_.) + (b_.)*(x_)), x_Symbol] :> Simp[c*(Log[RemoveContent[a +
b*x, x]]/b), x] /; FreeQ[{a, b, c}, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 216
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[b, 2]))*A
rcTan[Rt[b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && PosQ[a/b] && (GtQ[a
, 0] || GtQ[b, 0])
```

rule 240
```
Int[(x_)/((a_) + (b_.)*(x_)^2), x_Symbol] :> Simp[Log[RemoveContent[a + b*x
^2, x]]/(2*b), x] /; FreeQ[{a, b}, x]
```

rule 452
```
Int[((c_) + (d_.)*(x_))/((a_) + (b_.)*(x_)^2), x_Symbol] :> Simp[c   Int[1/
(a + b*x^2), x], x] + Simp[d   Int[x/(a + b*x^2), x], x] /; FreeQ[{a, b, c,
 d}, x] && NeQ[b*c^2 + a*d^2, 0]
```

rule 587
```
Int[(x_.)/(((c_) + (d_.)*(x_))*((a_) + (b_.)*(x_)^2)), x_Symbol] :> Simp[(-
c)*(d/(b*c^2 + a*d^2))   Int[1/(c + d*x), x], x] + Simp[1/(b*c^2 + a*d^2)
 Int[(a*d + b*c*x)/(a + b*x^2), x], x] /; FreeQ[{a, b, c, d}, x] && NeQ[b*c
^2 + a*d^2, 0]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3200
```
Int[((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_.)*tan[(e_.) + (f_.)*(x_)]^(p
_.), x_Symbol] :> Simp[1/f   Subst[Int[(x^p*(a + x)^m)/(b^2 - x^2)^((p + 1)
/2), x], x, b*Sin[e + f*x]], x] /; FreeQ[{a, b, e, f, m}, x] && NeQ[a^2 - b
^2, 0] && IntegerQ[(p + 1)/2]
```

rule 4359
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_))^(m
_.), x_Symbol] :> Int[Cot[e + f*x]^p*(b + a*Sin[e + f*x])^m, x] /; FreeQ[{a
, b, e, f, p}, x] && IntegerQ[m] && EqQ[m, p]
```

### 3.97.4 Maple [A] (verified)

Time = 0.27 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.12

| method | result | size |
|---|---|---|
| default | $\frac{2b\ln\left(1+\tanh\left(\frac{x}{2}\right)^2\right)+4a\arctan\left(\tanh\left(\frac{x}{2}\right)\right)}{2a^2+2b^2}-\frac{2b\ln\left(-\tanh\left(\frac{x}{2}\right)^2b+2a\tanh\left(\frac{x}{2}\right)+b\right)}{2a^2+2b^2}$ | 72 |
| risch | $\frac{i\ln(e^x+i)a}{a^2+b^2}+\frac{\ln(e^x+i)b}{a^2+b^2}-\frac{i\ln(e^x-i)a}{a^2+b^2}+\frac{\ln(e^x-i)b}{a^2+b^2}-\frac{b\ln\left(e^{2x}+\frac{2be^x}{a}-1\right)}{a^2+b^2}$ | 101 |

input
```
int(sech(x)/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
4/(2*a^2+2*b^2)*(1/2*b*ln(1+tanh(1/2*x)^2)+a*arctan(tanh(1/2*x)))-2*b/(2*a
^2+2*b^2)*ln(-tanh(1/2*x)^2*b+2*a*tanh(1/2*x)+b)
```

### 3.97.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 57, normalized size of antiderivative = 0.89

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{2\,a\arctan\left(\cosh\left(x\right)+\sinh\left(x\right)\right)-b\log\left(\frac{2\left(a\sinh(x)+b\right)}{\cosh(x)-\sinh(x)}\right)+b\log\left(\frac{2\cosh(x)}{\cosh(x)-\sinh(x)}\right)}{a^2+b^2}$$

input
```
integrate(sech(x)/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
(2*a*arctan(cosh(x) + sinh(x)) - b*log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x
))) + b*log(2*cosh(x)/(cosh(x) - sinh(x))))/(a^2 + b^2)
```

### 3.97.6 Sympy [F]

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}\left(x\right)}{a+b\operatorname{csch}\left(x\right)}\,dx$$

input
```
integrate(sech(x)/(a+b*csch(x)),x)
```

output
```
Integral(sech(x)/(a + b*csch(x)), x)
```

### 3.97.7 Maxima [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 66, normalized size of antiderivative = 1.03

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{2\,a\arctan\left(e^{(-x)}\right)}{a^2+b^2} - \frac{b\log\left(-2\,be^{(-x)}+ae^{(-2\,x)}-a\right)}{a^2+b^2} + \frac{b\log\left(e^{(-2\,x)}+1\right)}{a^2+b^2}$$

input
```
integrate(sech(x)/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-2*a*arctan(e^(-x))/(a^2 + b^2) - b*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a^2
 + b^2) + b*log(e^(-2*x) + 1)/(a^2 + b^2)
```

### 3.97.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 89, normalized size of antiderivative = 1.39

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{ab\log\left(\left|-a\left(e^{(-x)}-e^{x}\right)+2\,b\right|\right)}{a^3+ab^2} + \frac{\left(\pi+2\arctan\left(\frac{1}{2}\left(e^{(2\,x)}-1\right)e^{(-x)}\right)\right)a}{2\left(a^2+b^2\right)} + \frac{b\log\left(\left(e^{(-x)}-e^{x}\right)^2+4\right)}{2\left(a^2+b^2\right)}$$

input
```
integrate(sech(x)/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a*b*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a^3 + a*b^2) + 1/2*(pi + 2*arctan(
1/2*(e^(2*x) - 1)*e^(-x)))*a/(a^2 + b^2) + 1/2*b*log((e^(-x) - e^x)^2 + 4)
/(a^2 + b^2)
```

### 3.97.9 Mupad [B] (verification not implemented)

Time = 2.99 (sec) , antiderivative size = 93, normalized size of antiderivative = 1.45

$$\int \frac{\operatorname{sech}(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\ln\left(1+\mathrm{e}^{x}\,1\mathrm{i}\right)}{b+a\,1\mathrm{i}} - \frac{b\,\ln\left(a^3\,\mathrm{e}^{2\,x}-4\,a\,b^2-a^3+8\,b^3\,\mathrm{e}^{x}+2\,a^2\,b\,\mathrm{e}^{x}+4\,a\,b^2\,\mathrm{e}^{2\,x}\right)}{a^2+b^2} + \frac{\ln\left(\mathrm{e}^{x}+1\mathrm{i}\right)\,1\mathrm{i}}{a+b\,1\mathrm{i}}$$

input
```
int(1/(cosh(x)*(a + b/sinh(x))),x)
```

output
```
log(exp(x)*1i + 1)/(a*1i + b) + (log(exp(x) + 1i)*1i)/(a + b*1i) - (b*log(
a^3*exp(2*x) - 4*a*b^2 - a^3 + 8*b^3*exp(x) + 2*a^2*b*exp(x) + 4*a*b^2*exp
(2*x)))/(a^2 + b^2)
```

# 3.98 $\int \frac{\mathbf{sech}^2(x)}{a+b\mathbf{csch}(x)}\,dx$


3.98.1 Optimal result . . . . . 675
3.98.2 Mathematica [A] (verified) . . . . . 675
3.98.3 Rubi [C] (verified) . . . . . 676
3.98.4 Maple [A] (verified) . . . . . 679
3.98.5 Fricas [B] (verification not implemented) . . . . . 679
3.98.6 Sympy [F] . . . . . 680
3.98.7 Maxima [A] (verification not implemented) . . . . . 680
3.98.8 Giac [A] (verification not implemented) . . . . . 680
3.98.9 Mupad [B] (verification not implemented) . . . . . 681


## 3.98.1 Optimal result

Integrand size = 13, antiderivative size = 60

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2ab\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{\left(a^2+b^2\right)^{3/2}} - \frac{\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}$$

output
```
2*a*b*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/(a^2+b^2)^(3/2)-sech(x)*(
b-a*sinh(x))/(a^2+b^2)
```

## 3.98.2 Mathematica [A] (verified)

Time = 0.18 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.12

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-b\operatorname{sech}(x) + a\left(-\frac{2b\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}} + \tanh(x)\right)}{a^2+b^2}$$

input
```
Integrate[Sech[x]^2/(a + b*Csch[x]),x]
```

output
```
(-(b*Sech[x]) + a*((-2*b*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[
-a^2 - b^2] + Tanh[x]))/(a^2 + b^2)
```

### 3.98.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.42 (sec) , antiderivative size = 73, normalized size of antiderivative = 1.22, number of steps used = 14, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3345, 26, 27, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)^2(a+ib\csc(ix))}dx$$

$$\downarrow 4360$$

$$\int \frac{i\tanh(x)\operatorname{sech}(x)}{ia\sinh(x)+ib}dx$$

$$\downarrow 26$$

$$i\int -\frac{i\operatorname{sech}(x)\tanh(x)}{b+a\sinh(x)}dx$$

$$\downarrow 26$$

$$\int \frac{\tanh(x)\operatorname{sech}(x)}{a\sinh(x)+b}dx$$

$$\downarrow 3042$$

$$\int -\frac{i\sin(ix)}{\cos(ix)^2(b-ia\sin(ix))}dx$$

$$\downarrow 26$$

$$-i\int \frac{\sin(ix)}{\cos(ix)^2(b-ia\sin(ix))}dx$$

$$\downarrow 3345$$

$$-i\left(-\frac{\int \frac{iab}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{i\int\frac{ab}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

$$\downarrow 27$$

$$-i\left(-\frac{iab\int\frac{1}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{iab\int\frac{1}{b-ia\sin(ix)}dx}{a^2+b^2}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

$$\downarrow 3139$$

$$-i\left(-\frac{2iab\int\frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{a^2+b^2}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

$$\downarrow 1083$$

$$-i\left(\frac{4iab\int\frac{1}{4(a^2+b^2)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{a^2+b^2}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

$$\downarrow 219$$

$$-i\left(\frac{2iab\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{\left(a^2+b^2\right)^{3/2}}-\frac{i\operatorname{sech}(x)(b-a\sinh(x))}{a^2+b^2}\right)$$

input
```
Int[Sech[x]^2/(a + b*Csch[x]),x]
```

output
```
(-I)*(((2*I)*a*b*ArcTanh[(2*a - 2*b*Tanh[x/2])/(2*Sqrt[a^2 + b^2])])/(a^2
+ b^2)^(3/2) - (I*Sech[x]*(b - a*Sinh[x]))/(a^2 + b^2))
```

### 3.98.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3345
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x
_)])^(m_.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[(g*Co
s[e + f*x])^(p + 1)*(a + b*Sin[e + f*x])^(m + 1)*((b*c - a*d - (a*c - b*d)*
Sin[e + f*x])/(f*g*(a^2 - b^2)*(p + 1))), x] + Simp[1/(g^2*(a^2 - b^2)*(p +
 1))   Int[(g*Cos[e + f*x])^(p + 2)*(a + b*Sin[e + f*x])^m*Simp[c*(a^2*(p +
 2) - b^2*(m + p + 2)) + a*b*d*m + b*(a*c - b*d)*(m + p + 3)*Sin[e + f*x],
x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && NeQ[a^2 - b^2, 0] && Lt
Q[p, -1] && IntegerQ[2*m]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.98.4 Maple [A] (verified)

Time = 0.49 (sec) , antiderivative size = 81, normalized size of antiderivative = 1.35

| method | result | size |
|---|---|---|
| default | $\frac{4ab\,\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{(2a^2+2b^2)\sqrt{a^2+b^2}}-\frac{2\left(-a\tanh\left(\frac{x}{2}\right)+b\right)}{(a^2+b^2)\left(1+\tanh\left(\frac{x}{2}\right)^2\right)}$ | 81 |
| risch | $-\frac{2(e^x b+a)}{(1+e^{2x})(a^2+b^2)}+\frac{ba\ln\left(e^x+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}b+a^4+2a^2b^2+b^4}{a\left(a^2+b^2\right)^{\frac{3}{2}}}\right)}{(a^2+b^2)^{\frac{3}{2}}}-\frac{ba\ln\left(e^x+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}b-a^4-2a^2b^2-b^4}{a\left(a^2+b^2\right)^{\frac{3}{2}}}\right)}{(a^2+b^2)^{\frac{3}{2}}}$ | 142 |

input
```
int(sech(x)^2/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
4*a*b/(2*a^2+2*b^2)/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^
2+b^2)^(1/2))-2/(a^2+b^2)*(-a*tanh(1/2*x)+b)/(1+tanh(1/2*x)^2)
```

### 3.98.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 256 vs. 2(56) = 112.

Time = 0.24 (sec) , antiderivative size = 256, normalized size of antiderivative = 4.27

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx =$$
$$-\frac{2\,a^3+2\,ab^2-\left(ab\cosh\left(x\right)^2+2\,ab\cosh\left(x\right)\sinh\left(x\right)+ab\sinh\left(x\right)^2+ab\right)\sqrt{a^2+b^2}\log\left(\frac{a^2\cosh(x)^2+a^2\sinh(x)}{a^4+2\,a^2b^2+b^4+\left(a^4+2\,a^2b^2+b^4\right)\cosh\left(x\right)^2+2\,(a}\right.}$$

input
```
integrate(sech(x)^2/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-(2*a^3 + 2*a*b^2 - (a*b*cosh(x)^2 + 2*a*b*cosh(x)*sinh(x) + a*b*sinh(x)^2
 + a*b)*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x)
 + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) + 2*sqrt(a^2 + b^2)*(a*cosh
(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh
(x) + b)*sinh(x) - a)) + 2*(a^2*b + b^3)*cosh(x) + 2*(a^2*b + b^3)*sinh(x)
)/(a^4 + 2*a^2*b^2 + b^4 + (a^4 + 2*a^2*b^2 + b^4)*cosh(x)^2 + 2*(a^4 + 2*
a^2*b^2 + b^4)*cosh(x)*sinh(x) + (a^4 + 2*a^2*b^2 + b^4)*sinh(x)^2)
```

### 3.98.6 Sympy [F]

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^2(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(sech(x)**2/(a+b*csch(x)),x)
```

output
```
Integral(sech(x)**2/(a + b*csch(x)), x)
```

### 3.98.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.52

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{ab\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{(a^2+b^2)^{\frac{3}{2}}} - \frac{2\left(be^{(-x)}-a\right)}{a^2+b^2+(a^2+b^2)e^{(-2x)}}$$

input
```
integrate(sech(x)^2/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-a*b*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2))
)/(a^2 + b^2)^(3/2) - 2*(b*e^(-x) - a)/(a^2 + b^2 + (a^2 + b^2)*e^(-2*x))
```

### 3.98.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 85, normalized size of antiderivative = 1.42

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{ab\log\left(\frac{\left|2ae^{x}+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^{x}+2b+2\sqrt{a^2+b^2}\right|}\right)}{(a^2+b^2)^{\frac{3}{2}}} - \frac{2\left(be^{x}+a\right)}{(a^2+b^2)(e^{(2x)}+1)}$$

input
```
integrate(sech(x)^2/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a*b*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt
(a^2 + b^2)))/(a^2 + b^2)^(3/2) - 2*(b*e^x + a)/((a^2 + b^2)*(e^(2*x) + 1)
)
```

### 3.98.9 Mupad [B] (verification not implemented)

Time = 2.37 (sec) , antiderivative size = 133, normalized size of antiderivative = 2.22

$$\int \frac{\operatorname{sech}^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{a\,b\,\ln\left(\frac{2\,b\,(a-b\,\mathrm{e}^x)}{(a^2+b^2)^{3/2}}+\frac{2\,b\,\mathrm{e}^x}{a^2+b^2}\right)}{(a^2+b^2)^{3/2}} - \frac{a\,b\,\ln\left(\frac{2\,b\,\mathrm{e}^x}{a^2+b^2}-\frac{2\,b\,(a-b\,\mathrm{e}^x)}{(a^2+b^2)^{3/2}}\right)}{(a^2+b^2)^{3/2}} - \frac{\frac{2\,a}{a^2+b^2}+\frac{2\,b\,\mathrm{e}^x}{a^2+b^2}}{\mathrm{e}^{2\,x}+1}$$

input
```
int(1/(cosh(x)^2*(a + b/sinh(x))),x)
```

output
```
(a*b*log((2*b*(a - b*exp(x)))/(a^2 + b^2)^(3/2) + (2*b*exp(x))/(a^2 + b^2)
))/(a^2 + b^2)^(3/2) - (a*b*log((2*b*exp(x))/(a^2 + b^2) - (2*b*(a - b*exp
(x)))/(a^2 + b^2)^(3/2)))/(a^2 + b^2)^(3/2) - ((2*a)/(a^2 + b^2) + (2*b*ex
p(x))/(a^2 + b^2))/(exp(2*x) + 1)
```

# 3.99 $\int \frac{\mathbf{sech}^3(x)}{a+b\mathbf{csch}(x)}\,dx$


3.99.1 Optimal result . . . . . 682
3.99.2 Mathematica [A] (verified) . . . . . 682
3.99.3 Rubi [A] (verified) . . . . . 683
3.99.4 Maple [A] (verified) . . . . . 686
3.99.5 Fricas [B] (verification not implemented) . . . . . 686
3.99.6 Sympy [F] . . . . . 687
3.99.7 Maxima [B] (verification not implemented) . . . . . 687
3.99.8 Giac [B] (verification not implemented) . . . . . 688
3.99.9 Mupad [B] (verification not implemented) . . . . . 688


## 3.99.1 Optimal result

Integrand size = 13, antiderivative size = 95

$$\int \frac{\operatorname{sech}^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{ia\log(i-\sinh(x))}{4(a-ib)^2} + \frac{ia\log(i+\sinh(x))}{4(a+ib)^2} - \frac{a^2b\log(b+a\sinh(x))}{(a^2+b^2)^2} - \frac{\operatorname{sech}^2(x)(b-a\sinh(x))}{2(a^2+b^2)}$$

output
```
-1/4*I*a*ln(I-sinh(x))/(a-I*b)^2+1/4*I*a*ln(I+sinh(x))/(a+I*b)^2-a^2*b*ln(
b+a*sinh(x))/(a^2+b^2)^2-1/2*sech(x)^2*(b-a*sinh(x))/(a^2+b^2)
```

## 3.99.2 Mathematica [A] (verified)

Time = 0.25 (sec) , antiderivative size = 127, normalized size of antiderivative = 1.34

$$\int \frac{\operatorname{sech}^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{i\operatorname{csch}(x)(b+a\sinh(x))\left(\frac{a\log(i-\sinh(x))}{(a-ib)^2} - \frac{a\log(i+\sinh(x))}{(a+ib)^2} - \frac{4ia^2b\log(b+a\sinh(x))}{(a^2+b^2)^2} + \frac{1}{(ia+b)(i-\sinh(x))} + \frac{i}{(a+ib)(i+\sinh}{4(a+b\operatorname{csch}(x))}$$

input
```
Integrate[Sech[x]^3/(a + b*Csch[x]),x]
```

output
```
((-1/4*I)*Csch[x]*(b + a*Sinh[x])*((a*Log[I - Sinh[x]])/(a - I*b)^2 - (a*L
og[I + Sinh[x]])/(a + I*b)^2 - ((4*I)*a^2*b*Log[b + a*Sinh[x]])/(a^2 + b^2
)^2 + 1/((I*a + b)*(I - Sinh[x])) + I/((a + I*b)*(I + Sinh[x])))/(a + b*C
sch[x])
```

### 3.99.3 Rubi [A] (verified)

Time = 0.44 (sec) , antiderivative size = 123, normalized size of antiderivative = 1.29, number of steps used = 14, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3316, 26, 27, 593, 25, 657, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^3(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{\cos(ix)^3(a+ib\csc(ix))}dx$$
$$\downarrow 4360$$
$$\int \frac{i\tanh(x)\operatorname{sech}^2(x)}{ia\sinh(x)+ib}dx$$
$$\downarrow 26$$
$$i\int -\frac{i\operatorname{sech}^2(x)\tanh(x)}{b+a\sinh(x)}dx$$
$$\downarrow 26$$
$$\int \frac{\tanh(x)\operatorname{sech}^2(x)}{a\sinh(x)+b}dx$$
$$\downarrow 3042$$
$$\int -\frac{i\sin(ix)}{\cos(ix)^3(b-ia\sin(ix))}dx$$
$$\downarrow 26$$
$$-i\int \frac{\sin(ix)}{\cos(ix)^3(b-ia\sin(ix))}dx$$
$$\downarrow 3316$$

$$-ia^3 \int \frac{i \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^2} d(a \sinh(x))$$

$$\downarrow 26$$

$$a^3 \int \frac{\sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^2} d(a \sinh(x))$$

$$\downarrow 27$$

$$a^2 \int \frac{a \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^2} d(a \sinh(x))$$

$$\downarrow 593$$

$$a^2 \left( \frac{\int -\frac{b - a \sinh(x)}{(b + a \sinh(x))\left(\sinh^2(x) a^2 + a^2\right)} d(a \sinh(x))}{2 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{2 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)} \right)$$

$$\downarrow 25$$

$$a^2 \left( -\frac{\int \frac{b - a \sinh(x)}{(b + a \sinh(x))\left(\sinh^2(x) a^2 + a^2\right)} d(a \sinh(x))}{2 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{2 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)} \right)$$

$$\downarrow 657$$

$$a^2 \left( -\frac{\int \left( \frac{2b}{\left(a^2 + b^2\right)(b + a \sinh(x))} + \frac{-a^2 - 2b \sinh(x) a + b^2}{\left(a^2 + b^2\right)\left(\sinh^2(x) a^2 + a^2\right)} \right) d(a \sinh(x))}{2 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{2 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)} \right)$$

$$\downarrow 2009$$

$$a^2 \left( -\frac{-\frac{\left(a^2 - b^2\right) \arctan(\sinh(x))}{a\left(a^2 + b^2\right)} - \frac{b \log\left(a^2 \sinh^2(x) + a^2\right)}{a^2 + b^2} + \frac{2b \log(a \sinh(x) + b)}{a^2 + b^2}}{2 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{2 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)} \right)$$

input
```
Int[Sech[x]^3/(a + b*Csch[x]),x]
```

output
```
a^2*(-1/2*(-(((a^2 - b^2)*ArcTan[Sinh[x]])/(a*(a^2 + b^2))) + (2*b*Log[b +
 a*Sinh[x]])/(a^2 + b^2) - (b*Log[a^2 + a^2*Sinh[x]^2])/(a^2 + b^2))/(a^2
+ b^2) - (b - a*Sinh[x])/(2*(a^2 + b^2)*(a^2 + a^2*Sinh[x]^2)))
```

## 3.99. $\int \frac{\operatorname{sech}^3(x)}{a + b \operatorname{csch}(x)} dx$

### 3.99.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 593
```
Int[(x_)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :>
 Simp[(c + d*x)^(n + 1)*(c - d*x)*((a + b*x^2)^(p + 1)/(2*(p + 1)*(b*c^2 +
a*d^2))), x] - Simp[d/(2*(p + 1)*(b*c^2 + a*d^2))   Int[(c + d*x)^n*(a + b*
x^2)^(p + 1)*(c*n - d*(n + 2*p + 4)*x), x], x] /; FreeQ[{a, b, c, d, n}, x]
 && LtQ[p, -1] && NeQ[b*c^2 + a*d^2, 0]
```

rule 657
```
Int[(((d_.) + (e_.)*(x_))^(m_.)*((f_.) + (g_.)*(x_))^(n_.))/((a_) + (c_.)*(
x_)^2), x_Symbol] :> Int[ExpandIntegrand[(d + e*x)^m*((f + g*x)^n/(a + c*x^
2)), x], x] /; FreeQ[{a, c, d, e, f, g, m}, x] && IntegersQ[n]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3316
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_
.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.), x_Symbol] :> Simp[1/(b^p*
f)   Subst[Int[(a + x)^m*(c + (d/b)*x)^n*(b^2 - x^2)^((p - 1)/2), x], x, b*
Sin[e + f*x]], x] /; FreeQ[{a, b, c, d, e, f, m, n}, x] && IntegerQ[(p - 1)
/2] && NeQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.99.4 Maple [A] (verified)

Time = 2.24 (sec) , antiderivative size = 143, normalized size of antiderivative = 1.51

| method | result |
|---|---|
| default | $\frac{2\left(\left(-\frac{1}{2}a^3-\frac{1}{2}ab^2\right)\tanh\left(\frac{x}{2}\right)^3+\left(a^2b+b^3\right)\tanh\left(\frac{x}{2}\right)^2+\left(\frac{1}{2}a^3+\frac{1}{2}ab^2\right)\tanh\left(\frac{x}{2}\right)\right)}{\left(1+\tanh\left(\frac{x}{2}\right)^2\right)^2}+a\left(ab\ln\left(1+\tanh\left(\frac{x}{2}\right)^2\right)+\left(a^2-b^2\right)\arctan\left(\tanh\left(\frac{x}{2}\right)\right)\right)$ |
| risch | $\frac{e^x\left(a\,e^{2x}-2\,e^x b-a\right)}{\left(1+e^{2x}\right)^2\left(a^2+b^2\right)}-\frac{ia^3\ln\left(e^x-i\right)}{2\left(a^4+2a^2b^2+b^4\right)}+\frac{ia\ln\left(e^x-i\right)b^2}{2a^4+4a^2b^2+2b^4}+\frac{a^2\ln\left(e^x-i\right)b}{a^4+2a^2b^2+b^4}+\frac{ia^3\ln\left(e^x+i\right)}{2a^4+4a^2b^2+2b^4}-\frac{ia\ln\left(e^x+i\right)b^2}{2\left(a^4+2a^2b^2+b^4\right)}+\frac{a^2}{a^4+}$ |

input
```
int(sech(x)^3/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
2/(a^2+b^2)^2*(((-1/2*a^3-1/2*a*b^2)*tanh(1/2*x)^3+(a^2*b+b^3)*tanh(1/2*x)
^2+(1/2*a^3+1/2*a*b^2)*tanh(1/2*x))/(1+tanh(1/2*x)^2)^2+1/2*a*(a*b*ln(1+ta
nh(1/2*x)^2)+(a^2-b^2)*arctan(tanh(1/2*x))))-a^2*b/(a^2+b^2)^2*ln(-tanh(1/
2*x)^2*b+2*a*tanh(1/2*x)+b)
```

### 3.99.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 675 vs. 2(78) = 156.

Time = 0.27 (sec) , antiderivative size = 675, normalized size of antiderivative = 7.11

$$\int \frac{\operatorname{sech}^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$= \frac{(a^3+ab^2)\cosh(x)^3+(a^3+ab^2)\sinh(x)^3-2\,(a^2b+b^3)\cosh(x)^2-(2\,a^2b+2\,b^3-3\,(a^3+ab^2)\cosh(x))}{}$$

input
```
integrate(sech(x)^3/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
((a^3 + a*b^2)*cosh(x)^3 + (a^3 + a*b^2)*sinh(x)^3 - 2*(a^2*b + b^3)*cosh(
x)^2 - (2*a^2*b + 2*b^3 - 3*(a^3 + a*b^2)*cosh(x))*sinh(x)^2 + ((a^3 - a*b
^2)*cosh(x)^4 + 4*(a^3 - a*b^2)*cosh(x)*sinh(x)^3 + (a^3 - a*b^2)*sinh(x)^
4 + a^3 - a*b^2 + 2*(a^3 - a*b^2)*cosh(x)^2 + 2*(a^3 - a*b^2 + 3*(a^3 - a*
b^2)*cosh(x)^2)*sinh(x)^2 + 4*((a^3 - a*b^2)*cosh(x)^3 + (a^3 - a*b^2)*cos
h(x))*sinh(x))*arctan(cosh(x) + sinh(x)) - (a^3 + a*b^2)*cosh(x) - (a^2*b*
cosh(x)^4 + 4*a^2*b*cosh(x)*sinh(x)^3 + a^2*b*sinh(x)^4 + 2*a^2*b*cosh(x)^
2 + a^2*b + 2*(3*a^2*b*cosh(x)^2 + a^2*b)*sinh(x)^2 + 4*(a^2*b*cosh(x)^3 +
 a^2*b*cosh(x))*sinh(x))*log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x))) + (a^2
*b*cosh(x)^4 + 4*a^2*b*cosh(x)*sinh(x)^3 + a^2*b*sinh(x)^4 + 2*a^2*b*cosh(
x)^2 + a^2*b + 2*(3*a^2*b*cosh(x)^2 + a^2*b)*sinh(x)^2 + 4*(a^2*b*cosh(x)^
3 + a^2*b*cosh(x))*sinh(x))*log(2*cosh(x)/(cosh(x) - sinh(x))) - (a^3 + a*
b^2 - 3*(a^3 + a*b^2)*cosh(x)^2 + 4*(a^2*b + b^3)*cosh(x))*sinh(x))/((a^4
+ 2*a^2*b^2 + b^4)*cosh(x)^4 + 4*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)*sinh(x)^3
 + (a^4 + 2*a^2*b^2 + b^4)*sinh(x)^4 + a^4 + 2*a^2*b^2 + b^4 + 2*(a^4 + 2*
a^2*b^2 + b^4)*cosh(x)^2 + 2*(a^4 + 2*a^2*b^2 + b^4 + 3*(a^4 + 2*a^2*b^2 +
 b^4)*cosh(x)^2)*sinh(x)^2 + 4*((a^4 + 2*a^2*b^2 + b^4)*cosh(x)^3 + (a^4 +
 2*a^2*b^2 + b^4)*cosh(x))*sinh(x))
```

### 3.99.6 Sympy [F]

$$\int \frac{\operatorname{sech}^3(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^3(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(sech(x)**3/(a+b*csch(x)),x)
```

output
```
Integral(sech(x)**3/(a + b*csch(x)), x)
```

### 3.99.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 161 vs. $2(78) = 156$.

Time $= 0.27$ (sec) , antiderivative size $= 161$, normalized size of antiderivative $= 1.69$

$$\begin{aligned}\int \frac{\operatorname{sech}^3(x)}{a + b\operatorname{csch}(x)}\,dx = &-\frac{a^2 b \log\left(-2\,be^{(-x)} + ae^{(-2x)} - a\right)}{a^4 + 2\,a^2b^2 + b^4} \\ &+ \frac{a^2 b \log\left(e^{(-2x)} + 1\right)}{a^4 + 2\,a^2b^2 + b^4} - \frac{(a^3 - ab^2)\arctan\left(e^{(-x)}\right)}{a^4 + 2\,a^2b^2 + b^4} \\ &+ \frac{ae^{(-x)} - 2\,be^{(-2x)} - ae^{(-3x)}}{a^2 + b^2 + 2\,(a^2 + b^2)e^{(-2x)} + (a^2 + b^2)e^{(-4x)}}\end{aligned}$$

input
```
integrate(sech(x)^3/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-a^2*b*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a^4 + 2*a^2*b^2 + b^4) + a^2*b*l
og(e^(-2*x) + 1)/(a^4 + 2*a^2*b^2 + b^4) - (a^3 - a*b^2)*arctan(e^(-x))/(a
^4 + 2*a^2*b^2 + b^4) + (a*e^(-x) - 2*b*e^(-2*x) - a*e^(-3*x))/(a^2 + b^2
+ 2*(a^2 + b^2)*e^(-2*x) + (a^2 + b^2)*e^(-4*x))
```

### 3.99.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 218 vs. $2(78) = 156$.

Time $= 0.29$ (sec) , antiderivative size $= 218$, normalized size of antiderivative $= 2.29$

$$\int \frac{\operatorname{sech}^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a^3 b \log\left(\left|-a\left(e^{(-x)}-e^{x}\right)+2\,b\right|\right)}{a^5+2\,a^3b^2+ab^4} + \frac{a^2 b \log\left(\left(e^{(-x)}-e^{x}\right)^2+4\right)}{2\left(a^4+2\,a^2b^2+b^4\right)} + \frac{\left(\pi+2\,\arctan\left(\frac{1}{2}\left(e^{(2\,x)}-1\right)e^{(-x)}\right)\right)\left(a^3-ab^2\right)}{4\left(a^4+2\,a^2b^2+b^4\right)} - \frac{a^2 b\left(e^{(-x)}-e^{x}\right)^2+2\,a^3\left(e^{(-x)}-e^{x}\right)+2\,ab^2\left(e^{(-x)}-e^{x}\right)+8\,a^2b+4\,b^3}{2\left(a^4+2\,a^2b^2+b^4\right)\left(\left(e^{(-x)}-e^{x}\right)^2+4\right)}$$

input
```
integrate(sech(x)^3/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a^3*b*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a^5 + 2*a^3*b^2 + a*b^4) + 1/2*a
^2*b*log((e^(-x) - e^x)^2 + 4)/(a^4 + 2*a^2*b^2 + b^4) + 1/4*(pi + 2*arcta
n(1/2*(e^(2*x) - 1)*e^(-x)))*(a^3 - a*b^2)/(a^4 + 2*a^2*b^2 + b^4) - 1/2*(
a^2*b*(e^(-x) - e^x)^2 + 2*a^3*(e^(-x) - e^x) + 2*a*b^2*(e^(-x) - e^x) + 8
*a^2*b + 4*b^3)/((a^4 + 2*a^2*b^2 + b^4)*((e^(-x) - e^x)^2 + 4))
```

### 3.99.9 Mupad [B] (verification not implemented)

Time $= 3.59$ (sec) , antiderivative size $= 256$, normalized size of antiderivative $= 2.69$

$$\int \frac{\operatorname{sech}^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{2\,b}{a^2+b^2}-\frac{2\,a\,\mathrm{e}^{x}}{a^2+b^2}}{2\,\mathrm{e}^{2\,x}+\mathrm{e}^{4\,x}+1} - \frac{\frac{2\left(a^2\,b+b^3\right)}{\left(a^2+b^2\right)^2}-\frac{\mathrm{e}^{x}\left(a^3+a\,b^2\right)}{\left(a^2+b^2\right)^2}}{\mathrm{e}^{2\,x}+1} + \frac{a\,\ln\left(\mathrm{e}^{x}+1\mathrm{i}\right)}{2\left(-a^2\,1\mathrm{i}+2\,a\,b+b^2\,1\mathrm{i}\right)} - \frac{a^2\,b\,\ln\left(a^6\,\mathrm{e}^{2\,x}-a^6-a^2\,b^4-14\,a^4\,b^2+a^2\,b^4\,\mathrm{e}^{2\,x}+14\,a^4\,b^2\,\mathrm{e}^{2\,x}+2\,a\,b^5\,\mathrm{e}^{x}+2\,a^5\,b\,\mathrm{e}^{x}+28\,a^3\,b^3\,\mathrm{e}^{x}\right)}{a^4+2\,a^2\,b^2+b^4} + \frac{a\,\ln\left(1+\mathrm{e}^{x}\,1\mathrm{i}\right)\,1\mathrm{i}}{2\left(-a^2+a\,b\,2\mathrm{i}+b^2\right)}$$

input
```
int(1/(cosh(x)^3*(a + b/sinh(x))),x)
```

output
```
((2*b)/(a^2 + b^2) - (2*a*exp(x))/(a^2 + b^2))/(2*exp(2*x) + exp(4*x) + 1)
 - ((2*(a^2*b + b^3))/(a^2 + b^2)^2 - (exp(x)*(a*b^2 + a^3))/(a^2 + b^2)^2
)/(exp(2*x) + 1) + (a*log(exp(x)*1i + 1)*1i)/(2*(a*b*2i - a^2 + b^2)) + (a
*log(exp(x) + 1i))/(2*(2*a*b - a^2*1i + b^2*1i)) - (a^2*b*log(a^6*exp(2*x)
 - a^6 - a^2*b^4 - 14*a^4*b^2 + a^2*b^4*exp(2*x) + 14*a^4*b^2*exp(2*x) + 2
*a*b^5*exp(x) + 2*a^5*b*exp(x) + 28*a^3*b^3*exp(x)))/(a^4 + b^4 + 2*a^2*b^
2)
```

# 3.100 $\int \frac{\mathbf{sech}^4(x)}{a+b\mathbf{csch}(x)}\,dx$

3.100.1 Optimal result . . . . . 690
3.100.2 Mathematica [A] (verified) . . . . . 690
3.100.3 Rubi [C] (verified) . . . . . 691
3.100.4 Maple [A] (verified) . . . . . 694
3.100.5 Fricas [B] (verification not implemented) . . . . . 695
3.100.6 Sympy [F] . . . . . 696
3.100.7 Maxima [B] (verification not implemented) . . . . . 696
3.100.8 Giac [A] (verification not implemented) . . . . . 697
3.100.9 Mupad [B] (verification not implemented) . . . . . 697

## 3.100.1 Optimal result

Integrand size = 13, antiderivative size = 104

$$\int \frac{\operatorname{sech}^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2a^3b\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{\left(a^2+b^2\right)^{5/2}} - \frac{\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)} - \frac{\operatorname{sech}(x)\left(3a^2b-a(2a^2-b^2)\sinh(x)\right)}{3\left(a^2+b^2\right)^2}$$

output
```
2*a^3*b*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))/(a^2+b^2)^(5/2)-1/3*sec
h(x)^3*(b-a*sinh(x))/(a^2+b^2)-1/3*sech(x)*(3*a^2*b-a*(2*a^2-b^2)*sinh(x))
/(a^2+b^2)^2
```

## 3.100.2 Mathematica [A] (verified)

Time = 0.51 (sec) , antiderivative size = 114, normalized size of antiderivative = 1.10

$$\int \frac{\operatorname{sech}^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{\frac{6a^3b\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\sqrt{-a^2-b^2}} + 3a^2b\operatorname{sech}(x) + b\left(a^2+b^2\right)\operatorname{sech}^3(x) + \left(-2a^3+ab^2\right)\tanh(x) - a\left(a^2+b^2\right)\operatorname{sech}^2(x$$
$$3\left(a^2+b^2\right)^2$$

input
```
Integrate[Sech[x]^4/(a + b*Csch[x]),x]
```

output
```
-1/3*((6*a^3*b*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/Sqrt[-a^2 - b^2
] + 3*a^2*b*Sech[x] + b*(a^2 + b^2)*Sech[x]^3 + (-2*a^3 + a*b^2)*Tanh[x] -
 a*(a^2 + b^2)*Sech[x]^2*Tanh[x])/(a^2 + b^2)^2
```

### 3.100.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.63 (sec) , antiderivative size = 128, normalized size of antiderivative = 1.23, number of steps used = 16, number of rules used = 15, $\frac{\text{number of rules}}{\text{integrand size}} = 1.154$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3345, 26, 3042, 3345, 27, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^4(x)}{a + b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{1}{\cos(ix)^4(a + ib\csc(ix))}\,dx$$

$$\downarrow 4360$$

$$\int \frac{i\tanh(x)\operatorname{sech}^3(x)}{ia\sinh(x) + ib}\,dx$$

$$\downarrow 26$$

$$i\int -\frac{i\operatorname{sech}^3(x)\tanh(x)}{b + a\sinh(x)}\,dx$$

$$\downarrow 26$$

$$\int \frac{\tanh(x)\operatorname{sech}^3(x)}{a\sinh(x) + b}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i\sin(ix)}{\cos(ix)^4(b - ia\sin(ix))}\,dx$$

$$\downarrow 26$$

$$-i\int \frac{\sin(ix)}{\cos(ix)^4(b-ia\sin(ix))}dx$$

$$\downarrow 3345$$

$$-i\left(-\frac{\int \frac{i\operatorname{sech}^2(x)(ab-2a^2\sinh(x))}{b+a\sinh(x)}dx}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{i\int \frac{\operatorname{sech}^2(x)(ab-2a^2\sinh(x))}{b+a\sinh(x)}dx}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{i\int \frac{2i\sin(ix)a^2+ba}{\cos(ix)^2(b-ia\sin(ix))}dx}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 3345$$

$$-i\left(-\frac{i\left(\frac{\operatorname{sech}(x)\left(3a^2b-a\left(2a^2-b^2\right)\sinh(x)\right)}{a^2+b^2}-\frac{\int -\frac{3a^3b}{b+a\sinh(x)}dx}{a^2+b^2}\right)}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 27$$

$$-i\left(-\frac{i\left(\frac{3a^3b\int \frac{1}{b+a\sinh(x)}dx}{a^2+b^2}+\frac{\operatorname{sech}(x)\left(3a^2b-a\left(2a^2-b^2\right)\sinh(x)\right)}{a^2+b^2}\right)}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{i\left(\frac{\operatorname{sech}(x)\left(3a^2b-a\left(2a^2-b^2\right)\sinh(x)\right)}{a^2+b^2}+\frac{3a^3b\int \frac{1}{b-ia\sin(ix)}dx}{a^2+b^2}\right)}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 3139$$

$$-i\left(-\frac{i\left(\frac{6a^3b\int \frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{a^2+b^2}+\frac{\operatorname{sech}(x)\left(3a^2b-a\left(2a^2-b^2\right)\sinh(x)\right)}{a^2+b^2}\right)}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 1083$$

$$-i\left(-\frac{i\left(\frac{\operatorname{sech}(x)\left(3a^2b-a\left(2a^2-b^2\right)\sinh(x)\right)}{a^2+b^2}-\frac{12a^3b\int\frac{1}{4\left(a^2+b^2\right)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{a^2+b^2}\right)}{3\left(a^2+b^2\right)}-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}\right)$$

$$\downarrow 219$$

$$-i\left(-\frac{i\operatorname{sech}^3(x)(b-a\sinh(x))}{3\left(a^2+b^2\right)}-\frac{i\left(\frac{\operatorname{sech}(x)\left(3a^2b-a\left(2a^2-b^2\right)\sinh(x)\right)}{a^2+b^2}-\frac{6a^3b\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{\left(a^2+b^2\right)^{3/2}}\right)}{3\left(a^2+b^2\right)}\right)$$

input
```
Int[Sech[x]^4/(a + b*Csch[x]),x]
```

output
```
(-I)*(((-1/3*I)*Sech[x]^3*(b - a*Sinh[x]))/(a^2 + b^2) - ((I/3)*((-6*a^3*b
*ArcTanh[(2*a - 2*b*Tanh[x/2])/(2*Sqrt[a^2 + b^2])])/(a^2 + b^2)^(3/2) + (
Sech[x]*(3*a^2*b - a*(2*a^2 - b^2)*Sinh[x]))/(a^2 + b^2)))/(a^2 + b^2))
```

### 3.100.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3345
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x
_)])^(m_.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[(g*Co
s[e + f*x])^(p + 1)*(a + b*Sin[e + f*x])^(m + 1)*((b*c - a*d - (a*c - b*d)*
Sin[e + f*x])/(f*g*(a^2 - b^2)*(p + 1))), x] + Simp[1/(g^2*(a^2 - b^2)*(p +
 1))   Int[(g*Cos[e + f*x])^(p + 2)*(a + b*Sin[e + f*x])^m*Simp[c*(a^2*(p +
 2) - b^2*(m + p + 2)) + a*b*d*m + b*(a*c - b*d)*(m + p + 3)*Sin[e + f*x],
x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && NeQ[a^2 - b^2, 0] && Lt
Q[p, -1] && IntegerQ[2*m]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.100.4 Maple [A] (verified)

Time = 7.65 (sec) , antiderivative size = 170, normalized size of antiderivative = 1.63

| method | result |
|---|---|
| default | $\frac{4a^3b\,\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{(2a^4+4a^2b^2+2b^4)\sqrt{a^2+b^2}} - \frac{2\left(-a^3\tanh\left(\frac{x}{2}\right)^5+\left(2a^2b+b^3\right)\tanh\left(\frac{x}{2}\right)^4+\left(-\frac{2}{3}a^3+\frac{4}{3}a\,b^2\right)\tanh\left(\frac{x}{2}\right)^3+2a^2b\tanh\left(\frac{x}{2}\right)^2-a^3\tanh\right.}{(a^4+2a^2b^2+b^4)\left(1+\tanh\left(\frac{x}{2}\right)^2\right)^3}$ |
| risch | $-\frac{2\left(3a^2b\,\mathrm{e}^{5x}-3a\,b^2\mathrm{e}^{4x}+10a^2b\,\mathrm{e}^{3x}+4b^3\mathrm{e}^{3x}+6a^3\mathrm{e}^{2x}+3a^2b\,\mathrm{e}^{x}+2a^3-a\,b^2\right)}{3(1+\mathrm{e}^{2x})^3(a^2+b^2)^2} + \frac{b\,a^3\ln\left(\mathrm{e}^{x}+\frac{\left(a^2+b^2\right)^{\frac{5}{2}}b+a^6+3a^4b^2+3a^2b^4+b^6}{a\left(a^2+b^2\right)^{\frac{5}{2}}}\right)}{(a^2+b^2)^{\frac{5}{2}}} - \frac{b\,a^3}{}$ |

input
```
int(sech(x)^4/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
4*a^3*b/(2*a^4+4*a^2*b^2+2*b^4)/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2
*x)+2*a)/(a^2+b^2)^(1/2))-2/(a^4+2*a^2*b^2+b^4)*(-a^3*tanh(1/2*x)^5+(2*a^2
*b+b^3)*tanh(1/2*x)^4+(-2/3*a^3+4/3*a*b^2)*tanh(1/2*x)^3+2*a^2*b*tanh(1/2*
x)^2-a^3*tanh(1/2*x)+4/3*a^2*b+1/3*b^3)/(1+tanh(1/2*x)^2)^3
```

### 3.100.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1155 vs. $2(97) = 194$.

Time $= 0.26$ (sec) , antiderivative size $= 1155$, normalized size of antiderivative $= 11.11$

$$\int \frac{\operatorname{sech}^4(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(sech(x)^4/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-1/3*(6*(a^4*b + a^2*b^3)*cosh(x)^5 + 6*(a^4*b + a^2*b^3)*sinh(x)^5 + 4*a^
5 + 2*a^3*b^2 - 2*a*b^4 - 6*(a^3*b^2 + a*b^4)*cosh(x)^4 - 6*(a^3*b^2 + a*b
^4 - 5*(a^4*b + a^2*b^3)*cosh(x))*sinh(x)^4 + 4*(5*a^4*b + 7*a^2*b^3 + 2*b
^5)*cosh(x)^3 + 4*(5*a^4*b + 7*a^2*b^3 + 2*b^5 + 15*(a^4*b + a^2*b^3)*cosh
(x)^2 - 6*(a^3*b^2 + a*b^4)*cosh(x))*sinh(x)^3 + 12*(a^5 + a^3*b^2)*cosh(x
)^2 + 12*(a^5 + a^3*b^2 + 5*(a^4*b + a^2*b^3)*cosh(x)^3 - 3*(a^3*b^2 + a*b
^4)*cosh(x)^2 + (5*a^4*b + 7*a^2*b^3 + 2*b^5)*cosh(x))*sinh(x)^2 - 3*(a^3*
b*cosh(x)^6 + 6*a^3*b*cosh(x)*sinh(x)^5 + a^3*b*sinh(x)^6 + 3*a^3*b*cosh(x
)^4 + 3*a^3*b*cosh(x)^2 + 3*(5*a^3*b*cosh(x)^2 + a^3*b)*sinh(x)^4 + a^3*b
+ 4*(5*a^3*b*cosh(x)^3 + 3*a^3*b*cosh(x))*sinh(x)^3 + 3*(5*a^3*b*cosh(x)^4
 + 6*a^3*b*cosh(x)^2 + a^3*b)*sinh(x)^2 + 6*(a^3*b*cosh(x)^5 + 2*a^3*b*cos
h(x)^3 + a^3*b*cosh(x))*sinh(x))*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*
sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) +
2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2
+ 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x) - a)) + 6*(a^4*b + a^2*b^3)*cosh
(x) + 6*(a^4*b + a^2*b^3 + 5*(a^4*b + a^2*b^3)*cosh(x)^4 - 4*(a^3*b^2 + a*
b^4)*cosh(x)^3 + 2*(5*a^4*b + 7*a^2*b^3 + 2*b^5)*cosh(x)^2 + 4*(a^5 + a^3*
b^2)*cosh(x))*sinh(x))/((a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*cosh(x)^6 + 6*
(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*cosh(x)*sinh(x)^5 + (a^6 + 3*a^4*b^2 +
 3*a^2*b^4 + b^6)*sinh(x)^6 + a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6 + 3*(a^...
```

### 3.100.6 Sympy [F]

$$\int \frac{\operatorname{sech}^4(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^4(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(sech(x)**4/(a+b*csch(x)),x)
```

output
```
Integral(sech(x)**4/(a + b*csch(x)), x)
```

### 3.100.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 226 vs. 2(97) = 194.

Time = 0.29 (sec) , antiderivative size = 226, normalized size of antiderivative = 2.17

$$\int \frac{\operatorname{sech}^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a^3 b \log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{(a^4+2a^2b^2+b^4)\sqrt{a^2+b^2}} - \frac{2\left(3a^2be^{(-x)} - 6a^3e^{(-2x)} + 3ab^2e^{(-4x)} + 3a^2be^{(-5x)} - 2a^3 + ab^2 + 2\left(5a^2b+2b^3\right)e^{(-3x)}\right)}{3\left(a^4+2a^2b^2+b^4+3\left(a^4+2a^2b^2+b^4\right)e^{(-2x)} + 3\left(a^4+2a^2b^2+b^4\right)e^{(-4x)} + \left(a^4+2a^2b^2+b^4\right)e^{(-6x)}\right)}$$

input
```
integrate(sech(x)^4/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-a^3*b*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2
)))/((a^4 + 2*a^2*b^2 + b^4)*sqrt(a^2 + b^2)) - 2/3*(3*a^2*b*e^(-x) - 6*a^
3*e^(-2*x) + 3*a*b^2*e^(-4*x) + 3*a^2*b*e^(-5*x) - 2*a^3 + a*b^2 + 2*(5*a^
2*b + 2*b^3)*e^(-3*x))/(a^4 + 2*a^2*b^2 + b^4 + 3*(a^4 + 2*a^2*b^2 + b^4)*
e^(-2*x) + 3*(a^4 + 2*a^2*b^2 + b^4)*e^(-4*x) + (a^4 + 2*a^2*b^2 + b^4)*e^
(-6*x))
```

### 3.100.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 174, normalized size of antiderivative = 1.67

$$\int \frac{\operatorname{sech}^4(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= -\frac{a^3 b \log\left(\left|\frac{2ae^x+2b-2\sqrt{a^2+b^2}}{2ae^x+2b+2\sqrt{a^2+b^2}}\right|\right)}{(a^4+2a^2b^2+b^4)\sqrt{a^2+b^2}}$$
$$-\frac{2\left(3a^2be^{(5x)}-3ab^2e^{(4x)}+10a^2be^{(3x)}+4b^3e^{(3x)}+6a^3e^{(2x)}+3a^2be^x+2a^3-ab^2\right)}{3\left(a^4+2a^2b^2+b^4\right)\left(e^{(2x)}+1\right)^3}$$

input
```
integrate(sech(x)^4/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a^3*b*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sq
rt(a^2 + b^2)))/((a^4 + 2*a^2*b^2 + b^4)*sqrt(a^2 + b^2)) - 2/3*(3*a^2*b*e
^(5*x) - 3*a*b^2*e^(4*x) + 10*a^2*b*e^(3*x) + 4*b^3*e^(3*x) + 6*a^3*e^(2*x
) + 3*a^2*b*e^x + 2*a^3 - a*b^2)/((a^4 + 2*a^2*b^2 + b^4)*(e^(2*x) + 1)^3)
```

### 3.100.9 Mupad [B] (verification not implemented)

Time = 2.52 (sec) , antiderivative size = 269, normalized size of antiderivative = 2.59

$$\int \frac{\operatorname{sech}^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{2ab^2}{(a^2+b^2)^2}-\frac{2a^2be^x}{(a^2+b^2)^2}}{e^{2x}+1} - \frac{\frac{4(a^3+ab^2)}{(a^2+b^2)^2}+\frac{8e^x(a^2b+b^3)}{3(a^2+b^2)^2}}{2e^{2x}+e^{4x}+1} + \frac{\frac{8a}{3(a^2+b^2)}+\frac{8be^x}{3(a^2+b^2)}}{3e^{2x}+3e^{4x}+e^{6x}+1}$$
$$-\frac{a^3b\ln\left(\frac{2a^2be^x}{(a^2+b^2)^2}-\frac{2a^2b(a-be^x)}{(a^2+b^2)^{5/2}}\right)}{(a^2+b^2)^{5/2}} + \frac{a^3b\ln\left(\frac{2a^2b(a-be^x)}{(a^2+b^2)^{5/2}}+\frac{2a^2be^x}{(a^2+b^2)^2}\right)}{(a^2+b^2)^{5/2}}$$

input
```
int(1/(cosh(x)^4*(a + b/sinh(x))),x)
```

output
```
((2*a*b^2)/(a^2 + b^2)^2 - (2*a^2*b*exp(x))/(a^2 + b^2)^2)/(exp(2*x) + 1)
- ((4*(a*b^2 + a^3))/(a^2 + b^2)^2 + (8*exp(x)*(a^2*b + b^3))/(3*(a^2 + b^
2)^2))/(2*exp(2*x) + exp(4*x) + 1) + ((8*a)/(3*(a^2 + b^2)) + (8*b*exp(x))
/(3*(a^2 + b^2)))/(3*exp(2*x) + 3*exp(4*x) + exp(6*x) + 1) - (a^3*b*log((2
*a^2*b*exp(x))/(a^2 + b^2)^2 - (2*a^2*b*(a - b*exp(x)))/(a^2 + b^2)^(5/2))
)/(a^2 + b^2)^(5/2) + (a^3*b*log((2*a^2*b*(a - b*exp(x)))/(a^2 + b^2)^(5/2
) + (2*a^2*b*exp(x))/(a^2 + b^2)^2))/(a^2 + b^2)^(5/2)
```

# 3.101 $\int \frac{\mathbf{sech}^5(x)}{a+b\mathbf{csch}(x)}\,dx$

3.101.1 Optimal result . . . . . 698
3.101.2 Mathematica [A] (verified) . . . . . 698
3.101.3 Rubi [A] (verified) . . . . . 699
3.101.4 Maple [B] (verified) . . . . . 703
3.101.5 Fricas [B] (verification not implemented) . . . . . 703
3.101.6 Sympy [F] . . . . . 704
3.101.7 Maxima [B] (verification not implemented) . . . . . 705
3.101.8 Giac [B] (verification not implemented) . . . . . 705
3.101.9 Mupad [B] (verification not implemented) . . . . . 706

## 3.101.1 Optimal result

Integrand size = 13, antiderivative size = 149

$$\int \frac{\operatorname{sech}^5(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{a(3ia+b)\log(i-\sinh(x))}{16(a-ib)^3} + \frac{a(3a+ib)\log(i+\sinh(x))}{16(ia-b)^3} - \frac{a^4 b\log(b+a\sinh(x))}{(a^2+b^2)^3} - \frac{\operatorname{sech}^4(x)(b-a\sinh(x))}{4(a^2+b^2)} - \frac{\operatorname{sech}^2(x)\left(4a^2b-a(3a^2-b^2)\sinh(x)\right)}{8(a^2+b^2)^2}$$

output

```
-1/16*a*(3*I*a+b)*ln(I-sinh(x))/(a-I*b)^3+1/16*a*(3*a+I*b)*ln(I+sinh(x))/(
I*a-b)^3-a^4*b*ln(b+a*sinh(x))/(a^2+b^2)^3-1/4*sech(x)^4*(b-a*sinh(x))/(a^
2+b^2)-1/8*sech(x)^2*(4*a^2*b-a*(3*a^2-b^2)*sinh(x))/(a^2+b^2)^2
```

## 3.101.2 Mathematica [A] (verified)

Time = 0.30 (sec) , antiderivative size = 163, normalized size of antiderivative = 1.09

$$\int \frac{\operatorname{sech}^5(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{a(ia-b)^3(3a-ib)\log(i-\sinh(x)) - a(3a+ib)(ia+b)^3\log(i+\sinh(x)) - 16a^4b\log(b+a\sinh(x)) - 8$$

input
```
Integrate[Sech[x]^5/(a + b*Csch[x]),x]
```

output
```
(a*(I*a - b)^3*(3*a - I*b)*Log[I - Sinh[x]] - a*(3*a + I*b)*(I*a + b)^3*Lo
g[I + Sinh[x]] - 16*a^4*b*Log[b + a*Sinh[x]] - 8*a^2*b*(a^2 + b^2)*Sech[x]
^2 - 4*b*(a^2 + b^2)^2*Sech[x]^4 + 2*a*(3*a^4 + 2*a^2*b^2 - b^4)*Sech[x]*T
anh[x] + 4*a*(a^2 + b^2)^2*Sech[x]^3*Tanh[x])/(16*(a^2 + b^2)^3)
```

### 3.101.3 Rubi [A] (verified)

Time = 0.55 (sec) , antiderivative size = 209, normalized size of antiderivative = 1.40, number of steps used = 16, number of rules used = 15, $\frac{\text{number of rules}}{\text{integrand size}} = 1.154$, Rules used = {3042, 4360, 26, 26, 3042, 26, 3316, 26, 27, 593, 25, 686, 25, 657, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{sech}^5(x)}{a + b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{\cos(ix)^5(a + ib\csc(ix))}\,dx$$
$$\downarrow 4360$$
$$\int \frac{i\tanh(x)\operatorname{sech}^4(x)}{ia\sinh(x) + ib}\,dx$$
$$\downarrow 26$$
$$i\int -\frac{i\operatorname{sech}^4(x)\tanh(x)}{b + a\sinh(x)}\,dx$$
$$\downarrow 26$$
$$\int \frac{\tanh(x)\operatorname{sech}^4(x)}{a\sinh(x) + b}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\sin(ix)}{\cos(ix)^5(b - ia\sin(ix))}\,dx$$
$$\downarrow 26$$
$$-i\int \frac{\sin(ix)}{\cos(ix)^5(b - ia\sin(ix))}\,dx$$

$$\downarrow 3316$$

$$ia^5 \int -\frac{i \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^3} d(a \sinh(x))$$

$$\downarrow 26$$

$$a^5 \int \frac{\sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^3} d(a \sinh(x))$$

$$\downarrow 27$$

$$a^4 \int \frac{a \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^3} d(a \sinh(x))$$

$$\downarrow 593$$

$$a^4 \left( \frac{\int -\frac{b - 3a \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^2} d(a \sinh(x))}{4 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{4 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)^2} \right)$$

$$\downarrow 25$$

$$a^4 \left( -\frac{\int \frac{b - 3a \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)^2} d(a \sinh(x))}{4 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{4 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)^2} \right)$$

$$\downarrow 686$$

$$a^4 \left( -\frac{\frac{4a^2 b - a\left(3a^2 - b^2\right) \sinh(x)}{2a^2 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)} - \frac{\int -\frac{b\left(5a^2 + b^2\right) - a\left(3a^2 - b^2\right) \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)} d(a \sinh(x))}{2a^2 \left(a^2 + b^2\right)}}{4 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{4 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)^2} \right)$$

$$\downarrow 25$$

$$a^4 \left( -\frac{\frac{\int \frac{b\left(5a^2 + b^2\right) - a\left(3a^2 - b^2\right) \sinh(x)}{(b + a \sinh(x)) \left(\sinh^2(x) a^2 + a^2\right)} d(a \sinh(x))}{2a^2 \left(a^2 + b^2\right)} + \frac{4a^2 b - a\left(3a^2 - b^2\right) \sinh(x)}{2a^2 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)}}{4 \left(a^2 + b^2\right)} - \frac{b - a \sinh(x)}{4 \left(a^2 + b^2\right) \left(a^2 \sinh^2(x) + a^2\right)^2} \right)$$

$$\downarrow 657$$

$$a^4\left(-\frac{\int\left(\frac{8ba^2}{\left(a^2+b^2\right)(b+a\sinh(x))}+\frac{-3a^4-8b\sinh(x)a^3+6b^2a^2+b^4}{\left(a^2+b^2\right)\left(\sinh^2(x)a^2+a^2\right)}\right)d(a\sinh(x))}{2a^2(a^2+b^2)}+\frac{4a^2b-a\left(3a^2-b^2\right)\sinh(x)}{2a^2(a^2+b^2)(a^2\sinh^2(x)+a^2)}}{4\left(a^2+b^2\right)}-\frac{b-a\sinh(x)}{4\left(a^2+b^2\right)\left(a^2\sinh^2(x)\right.}\right.$$

$$\downarrow 2009$$

$$a^4\left(-\frac{b-a\sinh(x)}{4\left(a^2+b^2\right)\left(a^2\sinh^2(x)+a^2\right)^2}-\frac{\frac{4a^2b-a\left(3a^2-b^2\right)\sinh(x)}{2a^2(a^2+b^2)(a^2\sinh^2(x)+a^2)}+\frac{-\frac{4a^2b\log\left(a^2\sinh^2(x)+a^2\right)}{a^2+b^2}+\frac{8a^2b\log(a\sinh(x)+b)}{a^2+b^2}-\frac{\left(3a^4-6a^2b^2\right.}{}}{2a^2(a^2+b^2)}}{4\left(a^2+b^2\right)}\right.$$

input
```
Int[Sech[x]^5/(a + b*Csch[x]),x]
```

output
```
a^4*(-1/4*(b - a*Sinh[x])/((a^2 + b^2)*(a^2 + a^2*Sinh[x]^2)^2) - ((-(((3*
a^4 - 6*a^2*b^2 - b^4)*ArcTan[Sinh[x]])/(a*(a^2 + b^2))) + (8*a^2*b*Log[b
+ a*Sinh[x]])/(a^2 + b^2) - (4*a^2*b*Log[a^2 + a^2*Sinh[x]^2])/(a^2 + b^2)
)/(2*a^2*(a^2 + b^2)) + (4*a^2*b - a*(3*a^2 - b^2)*Sinh[x])/(2*a^2*(a^2 +
b^2)*(a^2 + a^2*Sinh[x]^2)))/(4*(a^2 + b^2)))
```

### 3.101.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 593
```
Int[(x_)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :>
 Simp[(c + d*x)^(n + 1)*(c - d*x)*((a + b*x^2)^(p + 1)/(2*(p + 1)*(b*c^2 +
a*d^2))), x] - Simp[d/(2*(p + 1)*(b*c^2 + a*d^2))   Int[(c + d*x)^n*(a + b*
x^2)^(p + 1)*(c*n - d*(n + 2*p + 4)*x), x], x] /; FreeQ[{a, b, c, d, n}, x]
 && LtQ[p, -1] && NeQ[b*c^2 + a*d^2, 0]
```

rule 657
```
Int[(((d_.) + (e_.)*(x_))^(m_.)*((f_.) + (g_.)*(x_))^(n_.))/((a_) + (c_.)*(
x_)^2), x_Symbol] :> Int[ExpandIntegrand[(d + e*x)^m*((f + g*x)^n/(a + c*x^
2)), x], x] /; FreeQ[{a, c, d, e, f, g, m}, x] && IntegersQ[n]
```

rule 686
```
Int[((d_.) + (e_.)*(x_))^(m_)*((f_.) + (g_.)*(x_))*((a_) + (c_.)*(x_)^2)^(p
_), x_Symbol] :> Simp[(-(d + e*x)^(m + 1))*(f*a*c*e - a*g*c*d + c*(c*d*f +
a*e*g)*x)*((a + c*x^2)^(p + 1)/(2*a*c*(p + 1)*(c*d^2 + a*e^2))), x] + Simp[
1/(2*a*c*(p + 1)*(c*d^2 + a*e^2))   Int[(d + e*x)^m*(a + c*x^2)^(p + 1)*Sim
p[f*(c^2*d^2*(2*p + 3) + a*c*e^2*(m + 2*p + 3)) - a*c*d*e*g*m + c*e*(c*d*f
+ a*e*g)*(m + 2*p + 4)*x, x], x], x] /; FreeQ[{a, c, d, e, f, g}, x] && LtQ
[p, -1] && (IntegerQ[m] || IntegerQ[p] || IntegersQ[2*m, 2*p])
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3316
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_
.)*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_.), x_Symbol] :> Simp[1/(b^p*
f)   Subst[Int[(a + x)^m*(c + (d/b)*x)^n*(b^2 - x^2)^((p - 1)/2), x], x, b*
Sin[e + f*x]], x] /; FreeQ[{a, b, c, d, e, f, m, n}, x] && IntegerQ[(p - 1)
/2] && NeQ[a^2 - b^2, 0]
```

rule 4360
```
Int[(cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_.)*(csc[(e_.) + (f_.)*(x_)]*(b_.) +
(a_))^(m_.), x_Symbol] :> Int[(g*Cos[e + f*x])^p*((b + a*Sin[e + f*x])^m/Si
n[e + f*x]^m), x] /; FreeQ[{a, b, e, f, g, p}, x] && IntegerQ[m]
```

### 3.101.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 315 vs. $2(135) = 270$.

Time = 23.74 (sec) , antiderivative size = 316, normalized size of antiderivative = 2.12

| method | result |
|---|---|
| default | $\frac{2\left(\left(-\frac{5}{8}a^5-\frac{3}{4}a^3b^2-\frac{1}{8}ab^4\right)\tanh\left(\frac{x}{2}\right)^7+\left(2a^4b+3a^2b^3+b^5\right)\tanh\left(\frac{x}{2}\right)^6+\left(\frac{3}{8}a^5+\frac{5}{4}a^3b^2+\frac{7}{8}ab^4\right)\tanh\left(\frac{x}{2}\right)^5+\left(2a^4b+2a^2b^3\right)\tanh\left(\frac{x}{2}\right)^4+\left(-\frac{3}{8}a^5-\frac{5}{4}a\right.}{\left(1+\tanh\left(\frac{x}{2}\right)^2\right)^4}$ $\frac{}{(a^4+2}$ |
| risch | $\frac{\left(3a^3e^{6x}-ab^2e^{6x}-8a^2be^{5x}+11a^3e^{4x}+7ab^2e^{4x}-32a^2be^{3x}-16b^3e^{3x}-11a^3e^{2x}-7ab^2e^{2x}-8a^2be^x-3a^3+ab^2\right)e^x}{4(a^4+2a^2b^2+b^4)(1+e^{2x})^4}-\frac{3ia^5\ln(e^x}{8(a^6+3a^4b^2+3}$ |

input
```
int(sech(x)^5/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
2/(a^4+2*a^2*b^2+b^4)/(a^2+b^2)*(((-5/8*a^5-3/4*a^3*b^2-1/8*a*b^4)*tanh(1/
2*x)^7+(2*a^4*b+3*a^2*b^3+b^5)*tanh(1/2*x)^6+(3/8*a^5+5/4*a^3*b^2+7/8*a*b^
4)*tanh(1/2*x)^5+(2*a^4*b+2*a^2*b^3)*tanh(1/2*x)^4+(-3/8*a^5-5/4*a^3*b^2-7
/8*a*b^4)*tanh(1/2*x)^3+(2*a^4*b+3*a^2*b^3+b^5)*tanh(1/2*x)^2+(5/8*a^5+3/4
*a^3*b^2+1/8*a*b^4)*tanh(1/2*x))/(1+tanh(1/2*x)^2)^4+1/8*a*(4*a^3*b*ln(1+t
anh(1/2*x)^2)+(3*a^4-6*a^2*b^2-b^4)*arctan(tanh(1/2*x)))-a^4*b/(a^4+2*a^2
*b^2+b^4)/(a^2+b^2)*ln(-tanh(1/2*x)^2*b+2*a*tanh(1/2*x)+b)
```

### 3.101.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2778 vs. $2(130) = 260$.

Time = 0.31 (sec) , antiderivative size = 2778, normalized size of antiderivative = 18.64

$$\int \frac{\operatorname{sech}^5(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(sech(x)^5/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/4*((3*a^5 + 2*a^3*b^2 - a*b^4)*cosh(x)^7 + (3*a^5 + 2*a^3*b^2 - a*b^4)*s
inh(x)^7 - 8*(a^4*b + a^2*b^3)*cosh(x)^6 - (8*a^4*b + 8*a^2*b^3 - 7*(3*a^5
 + 2*a^3*b^2 - a*b^4)*cosh(x))*sinh(x)^6 + (11*a^5 + 18*a^3*b^2 + 7*a*b^4)
*cosh(x)^5 + (11*a^5 + 18*a^3*b^2 + 7*a*b^4 + 21*(3*a^5 + 2*a^3*b^2 - a*b^
4)*cosh(x)^2 - 48*(a^4*b + a^2*b^3)*cosh(x))*sinh(x)^5 - 16*(2*a^4*b + 3*a
^2*b^3 + b^5)*cosh(x)^4 - (32*a^4*b + 48*a^2*b^3 + 16*b^5 - 35*(3*a^5 + 2*
a^3*b^2 - a*b^4)*cosh(x)^3 + 120*(a^4*b + a^2*b^3)*cosh(x)^2 - 5*(11*a^5 +
 18*a^3*b^2 + 7*a*b^4)*cosh(x))*sinh(x)^4 - (11*a^5 + 18*a^3*b^2 + 7*a*b^4
)*cosh(x)^3 - (11*a^5 + 18*a^3*b^2 + 7*a*b^4 - 35*(3*a^5 + 2*a^3*b^2 - a*b
^4)*cosh(x)^4 + 160*(a^4*b + a^2*b^3)*cosh(x)^3 - 10*(11*a^5 + 18*a^3*b^2
+ 7*a*b^4)*cosh(x)^2 + 64*(2*a^4*b + 3*a^2*b^3 + b^5)*cosh(x))*sinh(x)^3 -
 8*(a^4*b + a^2*b^3)*cosh(x)^2 + (21*(3*a^5 + 2*a^3*b^2 - a*b^4)*cosh(x)^5
 - 8*a^4*b - 8*a^2*b^3 - 120*(a^4*b + a^2*b^3)*cosh(x)^4 + 10*(11*a^5 + 18
*a^3*b^2 + 7*a*b^4)*cosh(x)^3 - 96*(2*a^4*b + 3*a^2*b^3 + b^5)*cosh(x)^2 -
 3*(11*a^5 + 18*a^3*b^2 + 7*a*b^4)*cosh(x))*sinh(x)^2 + ((3*a^5 - 6*a^3*b^
2 - a*b^4)*cosh(x)^8 + 8*(3*a^5 - 6*a^3*b^2 - a*b^4)*cosh(x)*sinh(x)^7 + (
3*a^5 - 6*a^3*b^2 - a*b^4)*sinh(x)^8 + 4*(3*a^5 - 6*a^3*b^2 - a*b^4)*cosh(
x)^6 + 4*(3*a^5 - 6*a^3*b^2 - a*b^4 + 7*(3*a^5 - 6*a^3*b^2 - a*b^4)*cosh(x
)^2)*sinh(x)^6 + 8*(7*(3*a^5 - 6*a^3*b^2 - a*b^4)*cosh(x)^3 + 3*(3*a^5 - 6
*a^3*b^2 - a*b^4)*cosh(x))*sinh(x)^5 + 3*a^5 - 6*a^3*b^2 - a*b^4 + 6*(3...
```

### 3.101.6 Sympy [F]

$$\int \frac{\operatorname{sech}^5(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\operatorname{sech}^5(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(sech(x)**5/(a+b*csch(x)),x)
```

output
```
Integral(sech(x)**5/(a + b*csch(x)), x)
```

### 3.101.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 348 vs. $2(130) = 260$.

Time = 0.28 (sec) , antiderivative size = 348, normalized size of antiderivative = 2.34

$$\int \frac{\operatorname{sech}^5(x)}{a + b\operatorname{csch}(x)}\,dx = -\frac{a^4 b \log\left(-2\,be^{(-x)} + ae^{(-2\,x)} - a\right)}{a^6 + 3\,a^4b^2 + 3\,a^2b^4 + b^6}$$
$$+ \frac{a^4 b \log\left(e^{(-2\,x)} + 1\right)}{a^6 + 3\,a^4b^2 + 3\,a^2b^4 + b^6} - \frac{\left(3\,a^5 - 6\,a^3b^2 - ab^4\right)\arctan\left(e^{(-x)}\right)}{4\left(a^6 + 3\,a^4b^2 + 3\,a^2b^4 + b^6\right)}$$
$$- \frac{8\,a^2be^{(-2\,x)} + 8\,a^2be^{(-6\,x)} - (3\,a^3 - ab^2)e^{(-x)} - (11\,a^3 + 7\,ab^2)e^{(-3\,x)} + 16\,(2\,a^2b + b^3)e^{(-4\,x)} + (11\,a^3 + 7}{4\left(a^4 + 2\,a^2b^2 + b^4 + 4\left(a^4 + 2\,a^2b^2 + b^4\right)e^{(-2\,x)} + 6\left(a^4 + 2\,a^2b^2 + b^4\right)e^{(-4\,x)} + 4\left(a^4 + 2\,a^2b^2 + b^4\right)e^{(-6}$$

input
```
integrate(sech(x)^5/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-a^4*b*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^
6) + a^4*b*log(e^(-2*x) + 1)/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6) - 1/4*(3*
a^5 - 6*a^3*b^2 - a*b^4)*arctan(e^(-x))/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6
) - 1/4*(8*a^2*b*e^(-2*x) + 8*a^2*b*e^(-6*x) - (3*a^3 - a*b^2)*e^(-x) - (1
1*a^3 + 7*a*b^2)*e^(-3*x) + 16*(2*a^2*b + b^3)*e^(-4*x) + (11*a^3 + 7*a*b^
2)*e^(-5*x) + (3*a^3 - a*b^2)*e^(-7*x))/(a^4 + 2*a^2*b^2 + b^4 + 4*(a^4 +
2*a^2*b^2 + b^4)*e^(-2*x) + 6*(a^4 + 2*a^2*b^2 + b^4)*e^(-4*x) + 4*(a^4 +
2*a^2*b^2 + b^4)*e^(-6*x) + (a^4 + 2*a^2*b^2 + b^4)*e^(-8*x))
```

### 3.101.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 374 vs. $2(130) = 260$.

Time = 0.29 (sec) , antiderivative size = 374, normalized size of antiderivative = 2.51

$$\int \frac{\operatorname{sech}^5(x)}{a + b\operatorname{csch}(x)}\,dx = -\frac{a^5 b \log\left(\left|-a\left(e^{(-x)} - e^{x}\right) + 2\,b\right|\right)}{a^7 + 3\,a^5b^2 + 3\,a^3b^4 + ab^6} + \frac{a^4 b \log\left(\left(e^{(-x)} - e^{x}\right)^2 + 4\right)}{2\left(a^6 + 3\,a^4b^2 + 3\,a^2b^4 + b^6\right)}$$
$$+ \frac{\left(\pi + 2\,\arctan\left(\frac{1}{2}\left(e^{(2\,x)} - 1\right)e^{(-x)}\right)\right)\left(3\,a^5 - 6\,a^3b^2 - ab^4\right)}{16\left(a^6 + 3\,a^4b^2 + 3\,a^2b^4 + b^6\right)}$$
$$- \frac{3\,a^4b\left(e^{(-x)} - e^{x}\right)^4 + 3\,a^5\left(e^{(-x)} - e^{x}\right)^3 + 2\,a^3b^2\left(e^{(-x)} - e^{x}\right)^3 - ab^4\left(e^{(-x)} - e^{x}\right)^3 + 32\,a^4b\left(e^{(-x)} - e^{x}\right)^2 +}{4\left(a^6 + 3\,a^4b^2 + 3\,a^2b^4}$$

input
```
integrate(sech(x)^5/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a^5*b*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a^7 + 3*a^5*b^2 + 3*a^3*b^4 + a*
b^6) + 1/2*a^4*b*log((e^(-x) - e^x)^2 + 4)/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 +
b^6) + 1/16*(pi + 2*arctan(1/2*(e^(2*x) - 1)*e^(-x)))*(3*a^5 - 6*a^3*b^2 -
 a*b^4)/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6) - 1/4*(3*a^4*b*(e^(-x) - e^x)^
4 + 3*a^5*(e^(-x) - e^x)^3 + 2*a^3*b^2*(e^(-x) - e^x)^3 - a*b^4*(e^(-x) -
e^x)^3 + 32*a^4*b*(e^(-x) - e^x)^2 + 8*a^2*b^3*(e^(-x) - e^x)^2 + 20*a^5*(
e^(-x) - e^x) + 24*a^3*b^2*(e^(-x) - e^x) + 4*a*b^4*(e^(-x) - e^x) + 96*a^
4*b + 64*a^2*b^3 + 16*b^5)/((a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*((e^(-x) -
 e^x)^2 + 4)^2)
```

### 3.101.9 Mupad [B] (verification not implemented)

Time = 6.02 (sec) , antiderivative size = 513, normalized size of antiderivative = 3.44

$$\int \frac{\operatorname{sech}^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{8\,(a^2\,b+b^3)}{(a^2+b^2)^2}-\frac{6\,e^x\,(a^3+a\,b^2)}{(a^2+b^2)^2}}{3\,e^{2\,x}+3\,e^{4\,x}+e^{6\,x}+1}-\frac{\frac{2\,(a^2\,b+2\,b^3)}{(a^2+b^2)^2}-\frac{e^x\,(a^3+5\,a\,b^2)}{2\,(a^2+b^2)^2}}{2\,e^{2\,x}+e^{4\,x}+1}$$
$$-\frac{\frac{4\,b}{a^2+b^2}-\frac{4\,a\,e^x}{a^2+b^2}}{4\,e^{2\,x}+6\,e^{4\,x}+4\,e^{6\,x}+e^{8\,x}+1}-\frac{\frac{2\,(a^4\,b+a^2\,b^3)}{(a^2+b^2)^3}-\frac{e^x\,(3\,a^5+2\,a^3\,b^2-a\,b^4)}{4\,(a^2+b^2)^3}}{e^{2\,x}+1}$$
$$+\frac{\ln\left(e^x+1\mathrm{i}\right)\,\left(a\,b-a^2\,3\mathrm{i}\right)}{8\,\left(-a^3-a^2\,b\,3\mathrm{i}+3\,a\,b^2+b^3\,1\mathrm{i}\right)}+\frac{\ln\left(1+e^x\,1\mathrm{i}\right)\,\left(-3\,a^2+a\,b\,1\mathrm{i}\right)}{8\,\left(-a^3\,1\mathrm{i}-3\,a^2\,b+a\,b^2\,3\mathrm{i}+b^3\right)}$$
$$-\frac{a^4\,b\,\ln\left(9\,a^{10}\,e^{2\,x}-9\,a^{10}-a^2\,b^8-12\,a^4\,b^6-30\,a^6\,b^4-220\,a^8\,b^2+a^2\,b^8\,e^{2\,x}+12\,a^4\,b^6\,e^{2\,x}+30\,a^6\,b^4\,e^{2\,x}\right.}{a^6+3\,a^4\,b^2+3\,a^2\,b^4+b^6}$$

input
```
int(1/(cosh(x)^5*(a + b/sinh(x))),x)
```

output
```
((8*(a^2*b + b^3))/(a^2 + b^2)^2 - (6*exp(x)*(a*b^2 + a^3))/(a^2 + b^2)^2)
/(3*exp(2*x) + 3*exp(4*x) + exp(6*x) + 1) - ((2*(a^2*b + 2*b^3))/(a^2 + b^
2)^2 - (exp(x)*(5*a*b^2 + a^3))/(2*(a^2 + b^2)^2))/(2*exp(2*x) + exp(4*x)
+ 1) - ((4*b)/(a^2 + b^2) - (4*a*exp(x))/(a^2 + b^2))/(4*exp(2*x) + 6*exp(
4*x) + 4*exp(6*x) + exp(8*x) + 1) - ((2*(a^4*b + a^2*b^3))/(a^2 + b^2)^3 -
 (exp(x)*(3*a^5 - a*b^4 + 2*a^3*b^2))/(4*(a^2 + b^2)^3))/(exp(2*x) + 1) +
(log(exp(x) + 1i)*(a*b - a^2*3i))/(8*(3*a*b^2 - a^2*b*3i - a^3 + b^3*1i))
+ (log(exp(x)*1i + 1)*(a*b*1i - 3*a^2))/(8*(a*b^2*3i - 3*a^2*b - a^3*1i +
b^3)) - (a^4*b*log(9*a^10*exp(2*x) - 9*a^10 - a^2*b^8 - 12*a^4*b^6 - 30*a^
6*b^4 - 220*a^8*b^2 + a^2*b^8*exp(2*x) + 12*a^4*b^6*exp(2*x) + 30*a^6*b^4*
exp(2*x) + 220*a^8*b^2*exp(2*x) + 2*a*b^9*exp(x) + 18*a^9*b*exp(x) + 24*a^
3*b^7*exp(x) + 60*a^5*b^5*exp(x) + 440*a^7*b^3*exp(x)))/(a^6 + b^6 + 3*a^2
*b^4 + 3*a^4*b^2)
```

# 3.102 $\int \frac{\tanh^5(x)}{i+\mathbf{csch}(x)}\,dx$

3.102.1 Optimal result . . . 707
3.102.2 Mathematica [A] (verified) . . . 707
3.102.3 Rubi [A] (verified) . . . 708
3.102.4 Maple [A] (verified) . . . 710
3.102.5 Fricas [B] (verification not implemented) . . . 710
3.102.6 Sympy [F] . . . 711
3.102.7 Maxima [B] (verification not implemented) . . . 711
3.102.8 Giac [A] (verification not implemented) . . . 712
3.102.9 Mupad [B] (verification not implemented) . . . 712

## 3.102.1 Optimal result

Integrand size = 13, antiderivative size = 109

$$\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{21}{32}i\log(i-\sinh(x)) - \frac{11}{32}i\log(i+\sinh(x)) + \frac{i}{32(1-i\sinh(x))^2} - \frac{i}{4(1-i\sinh(x))} - \frac{i}{24(1+i\sinh(x))^3} + \frac{9i}{32(1+i\sinh(x))^2} - \frac{15i}{16(1+i\sinh(x))}$$

output
```
-21/32*I*ln(I-sinh(x))-11/32*I*ln(I+sinh(x))+1/32*I/(1-I*sinh(x))^2-1/4*I/
(1-I*sinh(x))-1/24*I/(1+I*sinh(x))^3+9/32*I/(1+I*sinh(x))^2-15/16*I/(1+I*s
inh(x))
```

## 3.102.2 Mathematica [A] (verified)

Time = 0.14 (sec) , antiderivative size = 75, normalized size of antiderivative = 0.69

$$\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{96}\left(-63i\log(i-\sinh(x)) - 33i\log(i+\sinh(x)) - \frac{2\left(44+29i\sinh(x)+79\sinh^2(x)+39i\sinh^3(x)+33\sinh^4(x)\right)}{(-i+\sinh(x))^3(i+\sinh(x))^2}\right)$$

input
```
Integrate[Tanh[x]^5/(I + Csch[x]),x]
```

output
```
((-63*I)*Log[I - Sinh[x]] - (33*I)*Log[I + Sinh[x]] - (2*(44 + (29*I)*Sinh
[x] + 79*Sinh[x]^2 + (39*I)*Sinh[x]^3 + 33*Sinh[x]^4))/((-I + Sinh[x])^3*(
I + Sinh[x])^2))/96
```

### 3.102.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 101, normalized size of antiderivative = 0.93, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 26, 4367, 99, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^5(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i}{\cot(ix)^5(i\csc(ix)+i)}dx$$
$$\downarrow 26$$
$$-i\int -\frac{i}{\cot(ix)^5(\csc(ix)+1)}dx$$
$$\downarrow 26$$
$$-\int \frac{1}{\cot(ix)^5(\csc(ix)+1)}dx$$
$$\downarrow 4367$$
$$i\int -\frac{\sinh^6(x)}{(1-i\sinh(x))^3(i\sinh(x)+1)^4}d(i\sinh(x))$$
$$\downarrow 99$$
$$i\int \left(-\frac{21}{32(i\sinh(x)+1)}+\frac{15}{16(i\sinh(x)+1)^2}-\frac{9}{16(i\sinh(x)+1)^3}+\frac{1}{8(i\sinh(x)+1)^4}-\frac{11}{32(i\sinh(x)-1)}-\frac{}{4(i}\right.$$
$$\downarrow 2009$$

$$i\left(-\frac{1}{4(1-i\sinh(x))}-\frac{15}{16(1+i\sinh(x))}+\frac{1}{32(1-i\sinh(x))^2}+\frac{9}{32(1+i\sinh(x))^2}-\frac{1}{24(1+i\sinh(x))^3}-\frac{11}{32}\log\right.$$

input
```
Int[Tanh[x]^5/(I + Csch[x]),x]
```

output
```
I*((-11*Log[1 - I*Sinh[x]])/32 - (21*Log[1 + I*Sinh[x]])/32 + 1/(32*(1 - I
*Sinh[x])^2) - 1/(4*(1 - I*Sinh[x])) - 1/(24*(1 + I*Sinh[x])^3) + 9/(32*(1
 + I*Sinh[x])^2) - 15/(16*(1 + I*Sinh[x])))
```

### 3.102.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 99
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_)*((e_.) + (f_.)*(x_)
)^(p_), x_] :> Int[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n*(e + f*x)^p, x],
 x] /; FreeQ[{a, b, c, d, e, f, p}, x] && IntegersQ[m, n] && (IntegerQ[p] |
| (GtQ[m, 0] && GeQ[n, -1]))
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4367
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_.), x_Symbol] :> Simp[1/(a^(m - n - 1)*b^n*d)   Subst[Int[(a - b*x)^((m -
1)/2)*((a + b*x)^((m - 1)/2 + n)/x^(m + n)), x], x, Sin[c + d*x]], x] /; Fr
eeQ[{a, b, c, d}, x] && IntegerQ[(m - 1)/2] && EqQ[a^2 - b^2, 0] && Integer
Q[n]
```

### 3.102.4 Maple [A] (verified)

Time = 3.43 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.89

| method | result |
|---|---|
| risch | $ix-\frac{-78ie^{2x}+184e^{3x}+2ie^{4x}+270e^{5x}+33e^{x}-2ie^{6x}+184e^{7x}+78ie^{8x}+33e^{9x}}{24(e^{x}-i)^{6}(e^{x}+i)^{4}}-\frac{11i\ln(e^{x}+i)}{16}-\frac{21i\ln(e^{x}-i)}{16}$ |
| default | $-\frac{21i\ln(\tanh(\frac{x}{2})-i)}{16}+\frac{3i}{8(\tanh(\frac{x}{2})-i)^{2}}+\frac{i}{3(\tanh(\frac{x}{2})-i)^{6}}-\frac{3i}{8(\tanh(\frac{x}{2})-i)^{4}}+\frac{1}{(\tanh(\frac{x}{2})-i)^{5}}+\frac{11}{12(\tanh(\frac{x}{2})-i)^{3}}+\frac{}{\tan}$ |

input
```
int(tanh(x)^5/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
I*x-1/24*(-78*I*exp(x)^2+184*exp(x)^3+2*I*exp(x)^4+270*exp(x)^5+33*exp(x)-
2*I*exp(x)^6+184*exp(x)^7+78*I*exp(x)^8+33*exp(x)^9)/(exp(x)-I)^6/(exp(x)+
I)^4-11/16*I*ln(exp(x)+I)-21/16*I*ln(exp(x)-I)
```

### 3.102.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 304 vs. 2(67) = 134.

Time = 0.26 (sec) , antiderivative size = 304, normalized size of antiderivative = 2.79

$$\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx$$
$$=\frac{48ixe^{(10x)}+6(16x-11)e^{(9x)}-12(-12ix+13i)e^{(8x)}+16(24x-23)e^{(7x)}-4(-24ix-i)e^{(6x)}+36(}{}$$

input
```
integrate(tanh(x)^5/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/48*(48*I*x*e^(10*x) + 6*(16*x - 11)*e^(9*x) - 12*(-12*I*x + 13*I)*e^(8*x
) + 16*(24*x - 23)*e^(7*x) - 4*(-24*I*x - I)*e^(6*x) + 36*(16*x - 15)*e^(5
*x) - 4*(24*I*x + I)*e^(4*x) + 16*(24*x - 23)*e^(3*x) - 12*(12*I*x - 13*I)
*e^(2*x) + 6*(16*x - 11)*e^x - 33*(I*e^(10*x) + 2*e^(9*x) + 3*I*e^(8*x) +
8*e^(7*x) + 2*I*e^(6*x) + 12*e^(5*x) - 2*I*e^(4*x) + 8*e^(3*x) - 3*I*e^(2*
x) + 2*e^x - I)*log(e^x + I) - 63*(I*e^(10*x) + 2*e^(9*x) + 3*I*e^(8*x) +
8*e^(7*x) + 2*I*e^(6*x) + 12*e^(5*x) - 2*I*e^(4*x) + 8*e^(3*x) - 3*I*e^(2*
x) + 2*e^x - I)*log(e^x - I) - 48*I*x)/(e^(10*x) - 2*I*e^(9*x) + 3*e^(8*x)
 - 8*I*e^(7*x) + 2*e^(6*x) - 12*I*e^(5*x) - 2*e^(4*x) - 8*I*e^(3*x) - 3*e^
(2*x) - 2*I*e^x - 1)
```

### 3.102.6 Sympy [F]

$$\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\tanh^5(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(tanh(x)**5/(I+csch(x)),x)
```

output
```
Integral(tanh(x)**5/(csch(x) + I), x)
```

### 3.102.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 144 vs. 2(67) = 134.

Time = 0.19 (sec) , antiderivative size = 144, normalized size of antiderivative = 1.32

$$\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x + \frac{33\,e^{(-x)} + 78i\,e^{(-2x)} + 184\,e^{(-3x)} - 2i\,e^{(-4x)} + 270\,e^{(-5x)} + 2i\,e^{(-6x)} + 184\,e^{(-7x)} - 78i\,e^{(-8x}}{48i\,e^{(-x)} - 72\,e^{(-2x)} + 192i\,e^{(-3x)} - 48\,e^{(-4x)} + 288i\,e^{(-5x)} + 48\,e^{(-6x)} + 192i\,e^{(-7x)} + 72\,e^{(-8x)} + 48i\,e} - \frac{11}{16}i\,\log\left(e^{(-x)} - i\right) - \frac{21}{16}i\,\log\left(i\,e^{(-x)} - 1\right)$$

input
```
integrate(tanh(x)^5/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + (33*e^(-x) + 78*I*e^(-2*x) + 184*e^(-3*x) - 2*I*e^(-4*x) + 270*e^(-
5*x) + 2*I*e^(-6*x) + 184*e^(-7*x) - 78*I*e^(-8*x) + 33*e^(-9*x))/(48*I*e^
(-x) - 72*e^(-2*x) + 192*I*e^(-3*x) - 48*e^(-4*x) + 288*I*e^(-5*x) + 48*e^
(-6*x) + 192*I*e^(-7*x) + 72*e^(-8*x) + 48*I*e^(-9*x) + 24*e^(-10*x) - 24)
 - 11/16*I*log(e^(-x) - I) - 21/16*I*log(I*e^(-x) - 1)
```

### 3.102.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 120, normalized size of antiderivative = 1.10

$$\begin{aligned}
&\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx \\
&= -\frac{33i\left(e^{(-x)}-e^x\right)^2+100\,e^{(-x)}-100\,e^x-76i}{64\left(-i\,e^{(-x)}+i\,e^x-2\right)^2} \\
&\quad -\frac{-231i\left(e^{(-x)}-e^x\right)^3+1026\left(e^{(-x)}-e^x\right)^2+1548i\,e^{(-x)}-1548i\,e^x-776}{192\left(e^{(-x)}-e^x+2i\right)^3} \\
&\quad -\frac{11}{32}i\log\left(-e^{(-x)}+e^x+2i\right)-\frac{21}{32}i\log\left(-e^{(-x)}+e^x-2i\right)
\end{aligned}$$

input
```
integrate(tanh(x)^5/(I+csch(x)),x, algorithm="giac")
```

output
```
-1/64*(33*I*(e^(-x) - e^x)^2 + 100*e^(-x) - 100*e^x - 76*I)/(-I*e^(-x) + I
*e^x - 2)^2 - 1/192*(-231*I*(e^(-x) - e^x)^3 + 1026*(e^(-x) - e^x)^2 + 154
8*I*e^(-x) - 1548*I*e^x - 776)/(e^(-x) - e^x + 2*I)^3 - 11/32*I*log(-e^(-x
) + e^x + 2*I) - 21/32*I*log(-e^(-x) + e^x - 2*I)
```

### 3.102.9 Mupad [B] (verification not implemented)

Time = 4.67 (sec) , antiderivative size = 274, normalized size of antiderivative = 2.51

$$\begin{aligned}
\int \frac{\tanh^5(x)}{i+\operatorname{csch}(x)}\,dx &= x\,1\mathrm{i}-\ln\left(\left(\frac{5\,\mathrm{e}^x}{8}-\frac{5}{8}\mathrm{i}\right)\left(\frac{5\,\mathrm{e}^x}{8}+\frac{5}{8}\mathrm{i}\right)\right)1\mathrm{i}+\frac{5\,\mathrm{atan}(\mathrm{e}^x)}{8} \\
&\quad +\frac{1\mathrm{i}}{3\left(15\,\mathrm{e}^{4x}-15\,\mathrm{e}^{2x}-\mathrm{e}^{6x}+1-\mathrm{e}^{3x}\,20\mathrm{i}+\mathrm{e}^{5x}\,6\mathrm{i}+\mathrm{e}^x\,6\mathrm{i}\right)} \\
&\quad -\frac{1}{\mathrm{e}^{2x}\,10\mathrm{i}-10\,\mathrm{e}^{3x}-\mathrm{e}^{4x}\,5\mathrm{i}+\mathrm{e}^{5x}+5\,\mathrm{e}^x-\mathrm{i}} \\
&\quad -\frac{31}{12\left(\mathrm{e}^{2x}\,3\mathrm{i}-\mathrm{e}^{3x}+3\,\mathrm{e}^x-\mathrm{i}\right)}-\frac{5\mathrm{i}}{8\left(\mathrm{e}^{2x}-1+\mathrm{e}^x\,2\mathrm{i}\right)} \\
&\quad +\frac{17\mathrm{i}}{8\left(\mathrm{e}^{4x}-6\,\mathrm{e}^{2x}+1-\mathrm{e}^{3x}\,4\mathrm{i}+\mathrm{e}^x\,4\mathrm{i}\right)} \\
&\quad +\frac{1\mathrm{i}}{8\left(\mathrm{e}^{4x}-6\,\mathrm{e}^{2x}+1+\mathrm{e}^{3x}\,4\mathrm{i}-\mathrm{e}^x\,4\mathrm{i}\right)}+\frac{3\mathrm{i}}{1-\mathrm{e}^{2x}+\mathrm{e}^x\,2\mathrm{i}} \\
&\quad -\frac{15}{8\left(\mathrm{e}^x-\mathrm{i}\right)}+\frac{1}{2\left(\mathrm{e}^x+1\mathrm{i}\right)}-\frac{1}{4\left(\mathrm{e}^{2x}\,3\mathrm{i}+\mathrm{e}^{3x}-3\,\mathrm{e}^x-\mathrm{i}\right)}
\end{aligned}$$

input
```
int(tanh(x)^5/(1/sinh(x) + 1i),x)
```

output
```
x*1i - log(((5*exp(x))/8 - 5i/8)*((5*exp(x))/8 + 5i/8))*1i + (5*atan(exp(x
)))/8 + 1i/(3*(15*exp(4*x) - exp(3*x)*20i - 15*exp(2*x) + exp(5*x)*6i - ex
p(6*x) + exp(x)*6i + 1)) - 1/(exp(2*x)*10i - 10*exp(3*x) - exp(4*x)*5i + e
xp(5*x) + 5*exp(x) - 1i) - 31/(12*(exp(2*x)*3i - exp(3*x) + 3*exp(x) - 1i)
) - 5i/(8*(exp(2*x) + exp(x)*2i - 1)) + 17i/(8*(exp(4*x) - exp(3*x)*4i - 6
*exp(2*x) + exp(x)*4i + 1)) + 1i/(8*(exp(3*x)*4i - 6*exp(2*x) + exp(4*x) -
 exp(x)*4i + 1)) + 3i/(exp(x)*2i - exp(2*x) + 1) - 15/(8*(exp(x) - 1i)) +
1/(2*(exp(x) + 1i)) - 1/(4*(exp(2*x)*3i + exp(3*x) - 3*exp(x) - 1i))
```

# 3.103 $\int \frac{\tanh^4(x)}{i+\mathbf{csch}(x)}\,dx$

3.103.1 Optimal result . . . 714
3.103.2 Mathematica [B] (verified) . . . 714
3.103.3 Rubi [A] (verified) . . . 715
3.103.4 Maple [A] (verified) . . . 717
3.103.5 Fricas [B] (verification not implemented) . . . 718
3.103.6 Sympy [F] . . . 718
3.103.7 Maxima [B] (verification not implemented) . . . 719
3.103.8 Giac [A] (verification not implemented) . . . 719
3.103.9 Mupad [B] (verification not implemented) . . . 720

## 3.103.1 Optimal result

Integrand size = 13, antiderivative size = 52

$$\int \frac{\tanh^4(x)}{i+\operatorname{csch}(x)}\,dx = -ix + \frac{1}{15}(15i - 8\operatorname{csch}(x))\tanh(x) + \frac{1}{15}(5i - 4\operatorname{csch}(x))\tanh^3(x) + \frac{1}{5}(i - \operatorname{csch}(x))\tanh^5(x)$$

output
```
-I*x+1/15*(15*I-8*csch(x))*tanh(x)+1/15*(5*I-4*csch(x))*tanh(x)^3+1/5*(I-c
sch(x))*tanh(x)^5
```

## 3.103.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 126 vs. 2(52) = 104.

Time = 0.12 (sec) , antiderivative size = 126, normalized size of antiderivative = 2.42

$$\int \frac{\tanh^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{-200 + 6(89 - 120ix)\cosh(x) - 128\cosh(2x) + 178\cosh(3x) - 240ix\cosh(3x) - 184\cosh(4x) + 64i\sin}{960\left(\cosh\left(\frac{x}{2}\right) - i\sinh\left(\frac{x}{2}\right)\right)^3\left(\cosh\left(\frac{}{}\right)\right.}$$

input
```
Integrate[Tanh[x]^4/(I + Csch[x]),x]
```

output
```
(-200 + 6*(89 - (120*I)*x)*Cosh[x] - 128*Cosh[2*x] + 178*Cosh[3*x] - (240*
I)*x*Cosh[3*x] - 184*Cosh[4*x] + (64*I)*Sinh[x] + (178*I)*Sinh[2*x] + 240*
x*Sinh[2*x] + (128*I)*Sinh[3*x] + (89*I)*Sinh[4*x] + 120*x*Sinh[4*x])/(960
*(Cosh[x/2] - I*Sinh[x/2])^3*(Cosh[x/2] + I*Sinh[x/2])^5)
```

### 3.103.3 Rubi [A] (verified)

Time = 0.44 (sec) , antiderivative size = 61, normalized size of antiderivative = 1.17, number of steps used = 13, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}} = 1.000$, Rules used = {3042, 4376, 3042, 25, 26, 4370, 25, 3042, 4370, 3042, 25, 4370, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^4(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{\cot(ix)^4(i\csc(ix)+i)}dx$$
$$\downarrow 4376$$
$$-\int (i-\operatorname{csch}(x))\tanh^6(x)dx$$
$$\downarrow 3042$$
$$-\int -\frac{i-i\csc(ix)}{\cot(ix)^6}dx$$
$$\downarrow 25$$
$$\int \frac{i(1-\csc(ix))}{\cot(ix)^6}dx$$
$$\downarrow 26$$
$$i\int \frac{1-\csc(ix)}{\cot(ix)^6}dx$$
$$\downarrow 4370$$
$$i\left(\frac{1}{5}\int -\left((4i\operatorname{csch}(x)+5)\tanh^4(x)\right)dx+\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))\right)$$
$$\downarrow 25$$

$$i\left(\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))-\frac{1}{5}\int(4i\operatorname{csch}(x)+5)\tanh^4(x)dx\right)$$

$$\downarrow 3042$$

$$i\left(\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))-\frac{1}{5}\int\frac{5-4\csc(ix)}{\cot(ix)^4}dx\right)$$

$$\downarrow 4370$$

$$i\left(\frac{1}{5}\left(\frac{1}{3}\tanh^3(x)(5+4i\operatorname{csch}(x))-\frac{1}{3}\int(8i\operatorname{csch}(x)+15)\tanh^2(x)dx\right)+\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))\right)$$

$$\downarrow 3042$$

$$i\left(\frac{1}{5}\left(\frac{1}{3}\tanh^3(x)(5+4i\operatorname{csch}(x))-\frac{1}{3}\int-\frac{15-8\csc(ix)}{\cot(ix)^2}dx\right)+\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))\right)$$

$$\downarrow 25$$

$$i\left(\frac{1}{5}\left(\frac{1}{3}\int\frac{15-8\csc(ix)}{\cot(ix)^2}dx+\frac{1}{3}\tanh^3(x)(5+4i\operatorname{csch}(x))\right)+\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))\right)$$

$$\downarrow 4370$$

$$i\left(\frac{1}{5}\left(\frac{1}{3}(\int-15dx+\tanh(x)(15+8i\operatorname{csch}(x)))+\frac{1}{3}\tanh^3(x)(5+4i\operatorname{csch}(x))\right)+\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))\right)$$

$$\downarrow 24$$

$$i\left(\frac{1}{5}\tanh^5(x)(1+i\operatorname{csch}(x))+\frac{1}{5}\left(\frac{1}{3}\tanh^3(x)(5+4i\operatorname{csch}(x))+\frac{1}{3}(-15x+\tanh(x)(15+8i\operatorname{csch}(x)))\right)\right)$$

input
```
Int[Tanh[x]^4/(I + Csch[x]),x]
```

output
```
I*(((1 + I*Csch[x])*Tanh[x]^5)/5 + (((5 + (4*I)*Csch[x])*Tanh[x]^3)/3 + (-
15*x + (15 + (8*I)*Csch[x])*Tanh[x])/3)/5)
```

#### 3.103.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4370
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[(-(e*Cot[c + d*x])^(m + 1))*((a + b*Csc[c + d*x])/(
d*e*(m + 1))), x] - Simp[1/(e^2*(m + 1))   Int[(e*Cot[c + d*x])^(m + 2)*(a*
(m + 1) + b*(m + 2)*Csc[c + d*x]), x], x] /; FreeQ[{a, b, c, d, e}, x] && L
tQ[m, -1]
```

rule 4376
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_))^(n_), x_Symbol] :> Simp[a^(2*n)/e^(2*n)   Int[(e*Cot[c + d*x])^(m + 2*
n)/(-a + b*Csc[c + d*x])^n, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && EqQ[a
^2 - b^2, 0] && ILtQ[n, 0]
```

### 3.103.4 Maple [A] (verified)

Time = 2.42 (sec) , antiderivative size = 68, normalized size of antiderivative = 1.31

| method | result |
|---|---|
| risch | $-ix-\frac{2\left(-31ie^{2x}+73e^{3x}+31e^{x}-25ie^{4x}+65e^{5x}-23i+15ie^{6x}+15e^{7x}\right)}{15(e^{x}+i)^{3}(e^{x}-i)^{5}}$ |
| default | $i\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)+\frac{11i}{8(\tanh(\frac{x}{2})-i)}+\frac{2i}{5(\tanh(\frac{x}{2})-i)^{5}}+\frac{1}{(\tanh(\frac{x}{2})-i)^{4}}+\frac{1}{(\tanh(\frac{x}{2})-i)^{2}}+\frac{5i}{8(\tanh(\frac{x}{2})+i)}+\frac{}{6(\text{ta}}$ |

input
```
int(tanh(x)^4/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-I*x-2/15*(-31*I*exp(x)^2+73*exp(x)^3+31*exp(x)-25*I*exp(x)^4+65*exp(x)^5-
23*I+15*I*exp(x)^6+15*exp(x)^7)/(exp(x)+I)^3/(exp(x)-I)^5
```

### 3.103.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 124 vs. $2(36) = 72$.

Time = 0.25 (sec) , antiderivative size = 124, normalized size of antiderivative = 2.38

$$\int \frac{\tanh^4(x)}{i + \operatorname{csch}(x)}\,dx$$
$$= \frac{-15i\,x e^{(8\,x)} - 30\,(x+1)e^{(7\,x)} - 30\,(i\,x+i)e^{(6\,x)} - 10\,(9\,x+13)e^{(5\,x)} - 2\,(45\,x+73)e^{(3\,x)} - 2\,(-15i\,x-31}{15\,(e^{(8\,x)} - 2i\,e^{(7\,x)} + 2\,e^{(6\,x)} - 6i\,e^{(5\,x)} - 6i\,e^{(3\,x)} - 2\,e^{(2\,x)} - 2i\,e}$$

input
```
integrate(tanh(x)^4/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/15*(-15*I*x*e^(8*x) - 30*(x + 1)*e^(7*x) - 30*(I*x + I)*e^(6*x) - 10*(9*
x + 13)*e^(5*x) - 2*(45*x + 73)*e^(3*x) - 2*(-15*I*x - 31*I)*e^(2*x) - 2*(
15*x + 31)*e^x + 15*I*x + 50*I*e^(4*x) + 46*I)/(e^(8*x) - 2*I*e^(7*x) + 2*
e^(6*x) - 6*I*e^(5*x) - 6*I*e^(3*x) - 2*e^(2*x) - 2*I*e^x - 1)
```

### 3.103.6 Sympy [F]

$$\int \frac{\tanh^4(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\tanh^4(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(tanh(x)**4/(I+csch(x)),x)
```

output
```
Integral(tanh(x)**4/(csch(x) + I), x)
```

### 3.103.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 96 vs. $2(36) = 72$.

Time = 0.18 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.85

$$\int \frac{\tanh^4(x)}{i + \operatorname{csch}(x)}\,dx = -i\,x - \frac{2\left(31\,e^{(-x)} + 31i\,e^{(-2\,x)} + 73\,e^{(-3\,x)} + 25i\,e^{(-4\,x)} + 65\,e^{(-5\,x)} - 15i\,e^{(-6\,x)} + 15\,e^{(-7\,x)} + 23i\right)}{30i\,e^{(-x)} - 30\,e^{(-2\,x)} + 90i\,e^{(-3\,x)} + 90i\,e^{(-5\,x)} + 30\,e^{(-6\,x)} + 30i\,e^{(-7\,x)} + 15\,e^{(-8\,x)} - 15}$$

input
```
integrate(tanh(x)^4/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x - 2*(31*e^(-x) + 31*I*e^(-2*x) + 73*e^(-3*x) + 25*I*e^(-4*x) + 65*e^(
-5*x) - 15*I*e^(-6*x) + 15*e^(-7*x) + 23*I)/(30*I*e^(-x) - 30*e^(-2*x) + 9
0*I*e^(-3*x) + 90*I*e^(-5*x) + 30*e^(-6*x) + 30*I*e^(-7*x) + 15*e^(-8*x) -
 15)
```

### 3.103.8 Giac [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.12

$$\int \frac{\tanh^4(x)}{i + \operatorname{csch}(x)}\,dx = -i\,x - \frac{21i\,e^{(2\,x)} - 36\,e^{x} - 19i}{24\,(i\,e^{x} - 1)^3} - \frac{115\,e^{(4\,x)} - 380i\,e^{(3\,x)} - 530\,e^{(2\,x)} + 340i\,e^{x} + 91}{40\,(e^{x} - i)^5}$$

input
```
integrate(tanh(x)^4/(I+csch(x)),x, algorithm="giac")
```

output
```
-I*x - 1/24*(21*I*e^(2*x) - 36*e^x - 19*I)/(I*e^x - 1)^3 - 1/40*(115*e^(4*
x) - 380*I*e^(3*x) - 530*e^(2*x) + 340*I*e^x + 91)/(e^x - I)^5
```

### 3.103.9 Mupad [B] (verification not implemented)

Time = 2.89 (sec) , antiderivative size = 237, normalized size of antiderivative = 4.56

$$\int \frac{\tanh^4(x)}{i+\operatorname{csch}(x)}\,dx = -x\,1\mathrm{i} - \frac{1\mathrm{i}}{4\,(\mathrm{e}^{2\,x}-1+\mathrm{e}^x\,2\mathrm{i})} + \frac{\frac{23\,\mathrm{e}^x}{40}-\frac{3}{8}\mathrm{i}}{1-\mathrm{e}^{2\,x}+\mathrm{e}^x\,2\mathrm{i}} - \frac{23}{40\,(\mathrm{e}^x-\mathrm{i})} + \frac{7}{8\,(\mathrm{e}^x+1\mathrm{i})} + \frac{\frac{\mathrm{e}^{2\,x}\,9\mathrm{i}}{8}-\frac{23\,\mathrm{e}^{3\,x}}{40}+\frac{9\,\mathrm{e}^x}{8}-\frac{3}{8}\mathrm{i}}{\mathrm{e}^{4\,x}-6\,\mathrm{e}^{2\,x}+1-\mathrm{e}^{3\,x}\,4\mathrm{i}+\mathrm{e}^x\,4\mathrm{i}} - \frac{\frac{3}{8}-\frac{23\,\mathrm{e}^{2\,x}}{40}+\frac{\mathrm{e}^x\,3\mathrm{i}}{4}}{\mathrm{e}^{2\,x}\,3\mathrm{i}-\mathrm{e}^{3\,x}+3\,\mathrm{e}^x-\mathrm{i}} - \frac{1}{6\,(\mathrm{e}^{2\,x}\,3\mathrm{i}+\mathrm{e}^{3\,x}-3\,\mathrm{e}^x-\mathrm{i})} - \frac{\frac{23\,\mathrm{e}^{4\,x}}{40}-\frac{9\,\mathrm{e}^{2\,x}}{4}+\frac{23}{40}-\frac{\mathrm{e}^{3\,x}\,3\mathrm{i}}{2}+\frac{\mathrm{e}^x\,3\mathrm{i}}{2}}{\mathrm{e}^{2\,x}\,10\mathrm{i}-10\,\mathrm{e}^{3\,x}-\mathrm{e}^{4\,x}\,5\mathrm{i}+\mathrm{e}^{5\,x}+5\,\mathrm{e}^x-\mathrm{i}}$$

input
```
int(tanh(x)^4/(1/sinh(x) + 1i),x)
```

output
```
((23*exp(x))/40 - 3i/8)/(exp(x)*2i - exp(2*x) + 1) - 1i/(4*(exp(2*x) + exp
(x)*2i - 1)) - x*1i - 23/(40*(exp(x) - 1i)) + 7/(8*(exp(x) + 1i)) + ((exp(
2*x)*9i)/8 - (23*exp(3*x))/40 + (9*exp(x))/8 - 3i/8)/(exp(4*x) - exp(3*x)*
4i - 6*exp(2*x) + exp(x)*4i + 1) - ((exp(x)*3i)/4 - (23*exp(2*x))/40 + 3/8
)/(exp(2*x)*3i - exp(3*x) + 3*exp(x) - 1i) - 1/(6*(exp(2*x)*3i + exp(3*x)
- 3*exp(x) - 1i)) - ((23*exp(4*x))/40 - (exp(3*x)*3i)/2 - (9*exp(2*x))/4 +
 (exp(x)*3i)/2 + 23/40)/(exp(2*x)*10i - 10*exp(3*x) - exp(4*x)*5i + exp(5*
x) + 5*exp(x) - 1i)
```

# 3.104 $\int \frac{\tanh^3(x)}{i+\mathbf{csch}(x)}\,dx$

3.104.1 Optimal result . . . 721
3.104.2 Mathematica [A] (verified) . . . 721
3.104.3 Rubi [A] (verified) . . . 722
3.104.4 Maple [A] (verified) . . . 723
3.104.5 Fricas [B] (verification not implemented) . . . 724
3.104.6 Sympy [F] . . . 724
3.104.7 Maxima [B] (verification not implemented) . . . 725
3.104.8 Giac [A] (verification not implemented) . . . 725
3.104.9 Mupad [B] (verification not implemented) . . . 726

## 3.104.1 Optimal result

Integrand size = 13, antiderivative size = 77

$$\int \frac{\tanh^3(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{11}{16}i\log(i-\sinh(x)) - \frac{5}{16}i\log(i+\sinh(x)) - \frac{i}{8(1-i\sinh(x))} + \frac{i}{8(1+i\sinh(x))^2} - \frac{3i}{4(1+i\sinh(x))}$$

output
```
-11/16*I*ln(I-sinh(x))-5/16*I*ln(I+sinh(x))-1/8*I/(1-I*sinh(x))+1/8*I/(1+I
*sinh(x))^2-3/4*I/(1+I*sinh(x))
```

## 3.104.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 61, normalized size of antiderivative = 0.79

$$\int \frac{\tanh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{16}\left(-11i\log(i-\sinh(x)) - 5i\log(i+\sinh(x)) - \frac{2\left(6+3i\sinh(x)+5\sinh^2(x)\right)}{(-i+\sinh(x))^2(i+\sinh(x))}\right)$$

input
```
Integrate[Tanh[x]^3/(I + Csch[x]),x]
```

output
```
((-11*I)*Log[I - Sinh[x]] - (5*I)*Log[I + Sinh[x]] - (2*(6 + (3*I)*Sinh[x]
 + 5*Sinh[x]^2))/((-I + Sinh[x])^2*(I + Sinh[x])))/16
```

### 3.104.3 Rubi [A] (verified)

Time = 0.26 (sec) , antiderivative size = 73, normalized size of antiderivative = 0.95, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 26, 4367, 99, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^3(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i}{\cot(ix)^3(i\csc(ix)+i)}dx$$

$$\downarrow 26$$

$$i\int -\frac{i}{\cot(ix)^3(\csc(ix)+1)}dx$$

$$\downarrow 26$$

$$\int \frac{1}{\cot(ix)^3(1+\csc(ix))}dx$$

$$\downarrow 4367$$

$$-i\int \frac{\sinh^4(x)}{(1-i\sinh(x))^2(i\sinh(x)+1)^3}d(i\sinh(x))$$

$$\downarrow 99$$

$$-i\int \left(\frac{11}{16(i\sinh(x)+1)}-\frac{3}{4(i\sinh(x)+1)^2}+\frac{1}{4(i\sinh(x)+1)^3}+\frac{5}{16(i\sinh(x)-1)}+\frac{1}{8(i\sinh(x)-1)^2}\right)d(i\sin$$

$$\downarrow 2009$$

$$-i\left(\frac{1}{8(1-i\sinh(x))}+\frac{3}{4(1+i\sinh(x))}-\frac{1}{8(1+i\sinh(x))^2}+\frac{5}{16}\log(1-i\sinh(x))+\frac{11}{16}\log(1+i\sinh(x))\right)$$

input
```
Int[Tanh[x]^3/(I + Csch[x]),x]
```

output
```
(-I)*((5*Log[1 - I*Sinh[x]])/16 + (11*Log[1 + I*Sinh[x]])/16 + 1/(8*(1 - I
*Sinh[x])) - 1/(8*(1 + I*Sinh[x])^2) + 3/(4*(1 + I*Sinh[x])))
```

#### 3.104.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 99
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_)*((e_.) + (f_.)*(x_)
)^(p_), x_] :> Int[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n*(e + f*x)^p, x],
 x] /; FreeQ[{a, b, c, d, e, f, p}, x] && IntegersQ[m, n] && (IntegerQ[p] |
| (GtQ[m, 0] && GeQ[n, -1]))
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4367
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_.), x_Symbol] :> Simp[1/(a^(m - n - 1)*b^n*d)   Subst[Int[(a - b*x)^((m -
1)/2)*((a + b*x)^((m - 1)/2 + n)/x^(m + n)), x], x, Sin[c + d*x]], x] /; Fr
eeQ[{a, b, c, d}, x] && IntegerQ[(m - 1)/2] && EqQ[a^2 - b^2, 0] && Integer
Q[n]
```

### 3.104.4 Maple [A] (verified)

Time = 1.67 (sec) , antiderivative size = 71, normalized size of antiderivative = 0.92

| method | result |
|---|---|
| risch | $ix - \frac{5\,e^{x}-6ie^{2x}+14\,e^{3x}+6ie^{4x}+5\,e^{5x}}{4(e^{x}+i)^{2}(e^{x}-i)^{4}} - \frac{5i\ln(e^{x}+i)}{8} - \frac{11i\ln(e^{x}-i)}{8}$ |
| default | $i\ln\left(\tanh\left(\frac{x}{2}\right)-1\right) - \frac{5i\ln(\tanh(\frac{x}{2})+i)}{8} + \frac{i}{4(\tanh(\frac{x}{2})+i)^{2}} - \frac{1}{4(\tanh(\frac{x}{2})+i)} + i\ln\left(\tanh\left(\frac{x}{2}\right)+1\right) - \frac{11i\ln(\tan$ |

input
```
int(tanh(x)^3/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
I*x-1/4*(5*exp(x)-6*I*exp(x)^2+14*exp(x)^3+6*I*exp(x)^4+5*exp(x)^5)/(exp(x
)+I)^2/(exp(x)-I)^4-5/8*I*ln(exp(x)+I)-11/8*I*ln(exp(x)-I)
```

### 3.104.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 186 vs. $2(47) = 94$.

Time = 0.29 (sec) , antiderivative size = 186, normalized size of antiderivative = 2.42

$$\int \frac{\tanh^3(x)}{i + \operatorname{csch}(x)}\,dx$$
$$= \frac{8i\,x e^{(6\,x)} + 2\,(8\,x-5)e^{(5\,x)} - 4\,(-2i\,x+3i)e^{(4\,x)} + 4\,(8\,x-7)e^{(3\,x)} - 4\,(2i\,x-3i)e^{(2\,x)} + 2\,(8\,x-5)e^{x} - 5}{8\,(e^{(6\,x)}}$$

input
```
integrate(tanh(x)^3/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/8*(8*I*x*e^(6*x) + 2*(8*x - 5)*e^(5*x) - 4*(-2*I*x + 3*I)*e^(4*x) + 4*(8
*x - 7)*e^(3*x) - 4*(2*I*x - 3*I)*e^(2*x) + 2*(8*x - 5)*e^x - 5*(I*e^(6*x)
 + 2*e^(5*x) + I*e^(4*x) + 4*e^(3*x) - I*e^(2*x) + 2*e^x - I)*log(e^x + I)
 - 11*(I*e^(6*x) + 2*e^(5*x) + I*e^(4*x) + 4*e^(3*x) - I*e^(2*x) + 2*e^x -
 I)*log(e^x - I) - 8*I*x)/(e^(6*x) - 2*I*e^(5*x) + e^(4*x) - 4*I*e^(3*x) -
 e^(2*x) - 2*I*e^x - 1)
```

### 3.104.6 Sympy [F]

$$\int \frac{\tanh^3(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\tanh^3(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(tanh(x)**3/(I+csch(x)),x)
```

output
```
Integral(tanh(x)**3/(csch(x) + I), x)
```

### 3.104.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 96 vs. $2(47) = 94$.

Time = 0.20 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.25

$$\int \frac{\tanh^3(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x + \frac{5\,e^{(-x)} + 6i\,e^{(-2\,x)} + 14\,e^{(-3\,x)} - 6i\,e^{(-4\,x)} + 5\,e^{(-5\,x)}}{8i\,e^{(-x)} - 4\,e^{(-2\,x)} + 16i\,e^{(-3\,x)} + 4\,e^{(-4\,x)} + 8i\,e^{(-5\,x)} + 4\,e^{(-6\,x)} - 4} - \frac{5}{8}i\,\log\left(e^{(-x)} - i\right) - \frac{11}{8}i\,\log\left(i\,e^{(-x)} - 1\right)$$

input
```
integrate(tanh(x)^3/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + (5*e^(-x) + 6*I*e^(-2*x) + 14*e^(-3*x) - 6*I*e^(-4*x) + 5*e^(-5*x))
/(8*I*e^(-x) - 4*e^(-2*x) + 16*I*e^(-3*x) + 4*e^(-4*x) + 8*I*e^(-5*x) + 4*
e^(-6*x) - 4) - 5/8*I*log(e^(-x) - I) - 11/8*I*log(I*e^(-x) - 1)
```

### 3.104.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 94, normalized size of antiderivative = 1.22

$$\int \frac{\tanh^3(x)}{i+\operatorname{csch}(x)}\,dx = \frac{5\,e^{(-x)} - 5\,e^{x} - 6i}{16\left(-i\,e^{(-x)} + i\,e^{x} - 2\right)} + \frac{33i\left(e^{(-x)} - e^{x}\right)^2 - 84\,e^{(-x)} + 84\,e^{x} - 52i}{32\left(e^{(-x)} - e^{x} + 2i\right)^2} - \frac{5}{16}i\,\log\left(-e^{(-x)} + e^{x} + 2i\right) - \frac{11}{16}i\,\log\left(-e^{(-x)} + e^{x} - 2i\right)$$

input
```
integrate(tanh(x)^3/(I+csch(x)),x, algorithm="giac")
```

output
```
1/16*(5*e^(-x) - 5*e^x - 6*I)/(-I*e^(-x) + I*e^x - 2) + 1/32*(33*I*(e^(-x)
 - e^x)^2 - 84*e^(-x) + 84*e^x - 52*I)/(e^(-x) - e^x + 2*I)^2 - 5/16*I*log
(-e^(-x) + e^x + 2*I) - 11/16*I*log(-e^(-x) + e^x - 2*I)
```

### 3.104.9 Mupad [B] (verification not implemented)

Time = 0.62 (sec) , antiderivative size = 140, normalized size of antiderivative = 1.82

$$\int \frac{\tanh^3(x)}{i+\operatorname{csch}(x)}\,dx = x\,1\mathrm{i} - \ln\left(\left(\frac{3\,\mathrm{e}^x}{4}-\frac{3}{4}\mathrm{i}\right)\left(\frac{3\,\mathrm{e}^x}{4}+\frac{3}{4}\mathrm{i}\right)\right)1\mathrm{i} + \frac{3\operatorname{atan}(\mathrm{e}^x)}{4} - \frac{1}{\mathrm{e}^{2x}\,3\mathrm{i} - \mathrm{e}^{3x} + 3\,\mathrm{e}^x - \mathrm{i}} - \frac{1\mathrm{i}}{4\,(\mathrm{e}^{2x}-1+\mathrm{e}^x\,2\mathrm{i})} + \frac{1\mathrm{i}}{2\,(\mathrm{e}^{4x}-6\,\mathrm{e}^{2x}+1-\mathrm{e}^{3x}\,4\mathrm{i}+\mathrm{e}^x\,4\mathrm{i})} + \frac{2\mathrm{i}}{1-\mathrm{e}^{2x}+\mathrm{e}^x\,2\mathrm{i}} - \frac{3}{2\,(\mathrm{e}^x-\mathrm{i})} + \frac{1}{4\,(\mathrm{e}^x+1\mathrm{i})}$$

input
```
int(tanh(x)^3/(1/sinh(x) + 1i),x)
```

output
```
x*1i - log(((3*exp(x))/4 - 3i/4)*((3*exp(x))/4 + 3i/4))*1i + (3*atan(exp(x
)))/4 - 1/(exp(2*x)*3i - exp(3*x) + 3*exp(x) - 1i) - 1i/(4*(exp(2*x) + exp
(x)*2i - 1)) + 1i/(2*(exp(4*x) - exp(3*x)*4i - 6*exp(2*x) + exp(x)*4i + 1)
) + 2i/(exp(x)*2i - exp(2*x) + 1) - 3/(2*(exp(x) - 1i)) + 1/(4*(exp(x) + 1
i))
```

# 3.105 $\int \frac{\tanh^2(x)}{i+\mathbf{csch}(x)}\,dx$

3.105.1 Optimal result . . . 727
3.105.2 Mathematica [A] (verified) . . . 727
3.105.3 Rubi [A] (verified) . . . 728
3.105.4 Maple [A] (verified) . . . 730
3.105.5 Fricas [B] (verification not implemented) . . . 730
3.105.6 Sympy [F] . . . 731
3.105.7 Maxima [A] (verification not implemented) . . . 731
3.105.8 Giac [A] (verification not implemented) . . . 731
3.105.9 Mupad [B] (verification not implemented) . . . 732

## 3.105.1 Optimal result

Integrand size = 13, antiderivative size = 36

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = -ix + \frac{1}{3}(3i-2\operatorname{csch}(x))\tanh(x) + \frac{1}{3}(i-\operatorname{csch}(x))\tanh^3(x)$$

output
```
-I*x+1/3*(3*I-2*csch(x))*tanh(x)+1/3*(I-csch(x))*tanh(x)^3
```

## 3.105.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 71, normalized size of antiderivative = 1.97

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{-4\cosh(2x)+2i\sinh(x)+(5i+6x)\cosh(x)(-i+\sinh(x))}{6\left(\cosh\left(\frac{x}{2}\right)-i\sinh\left(\frac{x}{2}\right)\right)\left(\cosh\left(\frac{x}{2}\right)+i\sinh\left(\frac{x}{2}\right)\right)^3}$$

input
```
Integrate[Tanh[x]^2/(I + Csch[x]),x]
```

output
```
(-4*Cosh[2*x] + (2*I)*Sinh[x] + (5*I + 6*x)*Cosh[x]*(-I + Sinh[x]))/(6*(Co
sh[x/2] - I*Sinh[x/2])*(Cosh[x/2] + I*Sinh[x/2])^3)
```

### 3.105.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.14, number of steps used = 11, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 0.846$, Rules used = {3042, 25, 26, 4376, 25, 3042, 4370, 3042, 25, 4370, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^2(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{1}{\cot(ix)^2(i\csc(ix)+i)}dx$$
$$\downarrow 25$$
$$-\int -\frac{i}{\cot(ix)^2(\csc(ix)+1)}dx$$
$$\downarrow 26$$
$$i\int \frac{1}{\cot(ix)^2(\csc(ix)+1)}dx$$
$$\downarrow 4376$$
$$i\int -((i\operatorname{csch}(x)+1)\tanh^4(x))\,dx$$
$$\downarrow 25$$
$$-i\int (i\operatorname{csch}(x)+1)\tanh^4(x)dx$$
$$\downarrow 3042$$
$$-i\int \frac{1-\csc(ix)}{\cot(ix)^4}dx$$
$$\downarrow 4370$$
$$-i\left(\frac{1}{3}\int (2i\operatorname{csch}(x)+3)\tanh^2(x)dx-\frac{1}{3}\tanh^3(x)(1+i\operatorname{csch}(x))\right)$$
$$\downarrow 3042$$
$$-i\left(\frac{1}{3}\int -\frac{3-2\csc(ix)}{\cot(ix)^2}dx-\frac{1}{3}\tanh^3(x)(1+i\operatorname{csch}(x))\right)$$
$$\downarrow 25$$

$$-i\left(-\frac{1}{3}\int\frac{3-2\csc(ix)}{\cot(ix)^2}dx-\frac{1}{3}\tanh^3(x)(1+i\operatorname{csch}(x))\right)$$

$$\downarrow 4370$$

$$-i\left(\frac{1}{3}(-\int-3dx-(\tanh(x)(3+2i\operatorname{csch}(x))))-\frac{1}{3}\tanh^3(x)(1+i\operatorname{csch}(x))\right)$$

$$\downarrow 24$$

$$-i\left(\frac{1}{3}(3x-\tanh(x)(3+2i\operatorname{csch}(x)))-\frac{1}{3}\tanh^3(x)(1+i\operatorname{csch}(x))\right)$$

input
```
Int[Tanh[x]^2/(I + Csch[x]),x]
```

output
```
(-I)*(-1/3*((1 + I*Csch[x])*Tanh[x]^3) + (3*x - (3 + (2*I)*Csch[x])*Tanh[x
])/3)
```

### 3.105.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4370
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[(-(e*Cot[c + d*x])^(m + 1))*((a + b*Csc[c + d*x])/(
d*e*(m + 1))), x] - Simp[1/(e^2*(m + 1))   Int[(e*Cot[c + d*x])^(m + 2)*(a*
(m + 1) + b*(m + 2)*Csc[c + d*x]), x], x] /; FreeQ[{a, b, c, d, e}, x] && L
tQ[m, -1]
```

rule 4376
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_))^(n_), x_Symbol] :> Simp[a^(2*n)/e^(2*n)   Int[(e*Cot[c + d*x])^(m + 2*
n)/(-a + b*Csc[c + d*x])^n, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && EqQ[a
^2 - b^2, 0] && ILtQ[n, 0]
```

### 3.105.4 Maple [A] (verified)

Time = 1.22 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.97

| method | result |
|---|---|
| risch | $-ix-\frac{2(-4i+5\,\mathrm{e}^{x}+3\,\mathrm{e}^{3x})}{3(\mathrm{e}^{x}+i)(\mathrm{e}^{x}-i)^{3}}$ |
| default | $\frac{3i}{2(\tanh(\frac{x}{2})-i)}+\frac{2i}{3(\tanh(\frac{x}{2})-i)^{3}}+\frac{1}{(\tanh(\frac{x}{2})-i)^{2}}-i\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)+\frac{i}{2\tanh(\frac{x}{2})+2i}+i\ln\left(\tanh\left(\frac{x}{2}\right)-1\right.$ |

input
```
int(tanh(x)^2/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-I*x-2/3*(-4*I+5*exp(x)+3*exp(3*x))/(exp(x)+I)/(exp(x)-I)^3
```

### 3.105.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 50 vs. 2(24) = 48.

Time = 0.26 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.39

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = \frac{-3i\,x e^{(4\,x)}-6\,(x+1)e^{(3\,x)}-2\,(3\,x+5)e^{x}+3i\,x+8i}{3\,(e^{(4\,x)}-2i\,e^{(3\,x)}-2i\,e^{x}-1)}$$

input
```
integrate(tanh(x)^2/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/3*(-3*I*x*e^(4*x) - 6*(x + 1)*e^(3*x) - 2*(3*x + 5)*e^x + 3*I*x + 8*I)/(
e^(4*x) - 2*I*e^(3*x) - 2*I*e^x - 1)
```

### 3.105.6 Sympy [F]

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\tanh^2(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(tanh(x)**2/(I+csch(x)),x)
```

output
```
Integral(tanh(x)**2/(csch(x) + I), x)
```

### 3.105.7 Maxima [A] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.17

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x - \frac{2\left(5\,e^{(-x)} + 3\,e^{(-3\,x)} + 4i\right)}{6i\,e^{(-x)} + 6i\,e^{(-3\,x)} + 3\,e^{(-4\,x)} - 3}$$

input
```
integrate(tanh(x)^2/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x - 2*(5*e^(-x) + 3*e^(-3*x) + 4*I)/(6*I*e^(-x) + 6*I*e^(-3*x) + 3*e^(-
4*x) - 3)
```

### 3.105.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 34, normalized size of antiderivative = 0.94

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x + \frac{i}{2\left(i\,e^{x}-1\right)} - \frac{15\,e^{(2\,x)} - 24i\,e^{x} - 13}{6\left(e^{x}-i\right)^3}$$

input
```
integrate(tanh(x)^2/(I+csch(x)),x, algorithm="giac")
```

output
```
-I*x + 1/2*I/(I*e^x - 1) - 1/6*(15*e^(2*x) - 24*I*e^x - 13)/(e^x - I)^3
```

### 3.105.9 Mupad [B] (verification not implemented)

Time = 2.37 (sec) , antiderivative size = 85, normalized size of antiderivative = 2.36

$$\int \frac{\tanh^2(x)}{i+\operatorname{csch}(x)}\,dx = -x\,1\mathrm{i} + \frac{\frac{5\,e^x}{6} - \frac{1}{2}\mathrm{i}}{1 - e^{2\,x} + e^x\,2\mathrm{i}} - \frac{5}{6\,(e^x - \mathrm{i})} + \frac{1}{2\,(e^x + 1\mathrm{i})} - \frac{\frac{5}{6} - \frac{5\,e^{2\,x}}{6} + e^x\,1\mathrm{i}}{e^{2\,x}\,3\mathrm{i} - e^{3\,x} + 3\,e^x - \mathrm{i}}$$

input
```
int(tanh(x)^2/(1/sinh(x) + 1i),x)
```

output
```
((5*exp(x))/6 - 1i/2)/(exp(x)*2i - exp(2*x) + 1) - x*1i - 5/(6*(exp(x) - 1
i)) + 1/(2*(exp(x) + 1i)) - (exp(x)*1i - (5*exp(2*x))/6 + 5/6)/(exp(2*x)*3
i - exp(3*x) + 3*exp(x) - 1i)
```

# 3.106 $\int \frac{\tanh(x)}{i+\mathbf{csch}(x)}\,dx$

3.106.1 Optimal result . . . 733
3.106.2 Mathematica [A] (verified) . . . 733
3.106.3 Rubi [A] (verified) . . . 734
3.106.4 Maple [A] (verified) . . . 735
3.106.5 Fricas [B] (verification not implemented) . . . 736
3.106.6 Sympy [F] . . . 736
3.106.7 Maxima [A] (verification not implemented) . . . 736
3.106.8 Giac [A] (verification not implemented) . . . 737
3.106.9 Mupad [B] (verification not implemented) . . . 737

## 3.106.1 Optimal result

Integrand size = 11, antiderivative size = 45

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx = -\frac{3}{4}i\log(i-\sinh(x)) - \frac{1}{4}i\log(i+\sinh(x)) - \frac{i}{2(1+i\sinh(x))}$$

output
```
-3/4*I*ln(I-sinh(x))-1/4*I*ln(I+sinh(x))-1/2*I/(1+I*sinh(x))
```

## 3.106.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.87

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx = \frac{1}{4}\left(-3i\log(i-\sinh(x)) - i\log(i+\sinh(x)) - \frac{2}{-i+\sinh(x)}\right)$$

input
```
Integrate[Tanh[x]/(I + Csch[x]),x]
```

output
```
((-3*I)*Log[I - Sinh[x]] - I*Log[I + Sinh[x]] - 2/(-I + Sinh[x]))/4
```

### 3.106.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.00, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.545$, Rules used = {3042, 26, 26, 4367, 99, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh(x)}{\operatorname{csch}(x)+i}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i}{\cot(ix)(i\csc(ix)+i)}dx$$

$$\downarrow 26$$

$$-i\int -\frac{i}{\cot(ix)(\csc(ix)+1)}dx$$

$$\downarrow 26$$

$$-\int \frac{1}{\cot(ix)(\csc(ix)+1)}dx$$

$$\downarrow 4367$$

$$i\int -\frac{\sinh^2(x)}{(1-i\sinh(x))(i\sinh(x)+1)^2}d(i\sinh(x))$$

$$\downarrow 99$$

$$i\int \left(-\frac{3}{4(i\sinh(x)+1)}+\frac{1}{2(i\sinh(x)+1)^2}-\frac{1}{4(i\sinh(x)-1)}\right)d(i\sinh(x))$$

$$\downarrow 2009$$

$$i\left(-\frac{1}{2(1+i\sinh(x))}-\frac{1}{4}\log(1-i\sinh(x))-\frac{3}{4}\log(1+i\sinh(x))\right)$$

input
```
Int[Tanh[x]/(I + Csch[x]),x]
```

output
```
I*(-1/4*Log[1 - I*Sinh[x]] - (3*Log[1 + I*Sinh[x]])/4 - 1/(2*(1 + I*Sinh[x
]))
```

### 3.106.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 99
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_)*((e_.) + (f_.)*(x_)
)^(p_), x_] :> Int[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n*(e + f*x)^p, x],
 x] /; FreeQ[{a, b, c, d, e, f, p}, x] && IntegersQ[m, n] && (IntegerQ[p] |
| (GtQ[m, 0] && GeQ[n, -1]))
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4367
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_.), x_Symbol] :> Simp[1/(a^(m - n - 1)*b^n*d)   Subst[Int[(a - b*x)^((m -
1)/2)*((a + b*x)^((m - 1)/2 + n)/x^(m + n)), x], x, Sin[c + d*x]], x] /; Fr
eeQ[{a, b, c, d}, x] && IntegerQ[(m - 1)/2] && EqQ[a^2 - b^2, 0] && Integer
Q[n]
```

## 3.106.4 Maple [A] (verified)

Time = 0.80 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.78

| method | result |
|---|---|
| risch | $ix-\frac{e^x}{(e^x-i)^2}-\frac{i\ln(e^x+i)}{2}-\frac{3i\ln(e^x-i)}{2}$ |
| default | $-\frac{3i\ln(\tanh(\frac{x}{2})-i)}{2}+\frac{i}{(\tanh(\frac{x}{2})-i)^2}+\frac{1}{\tanh(\frac{x}{2})-i}-\frac{i\ln(\tanh(\frac{x}{2})+i)}{2}+i\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)+i\ln\left(\tanh\left(\frac{x}{2}\right)-\right.$ |

input
```
int(tanh(x)/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
I*x-1/(exp(x)-I)^2*exp(x)-1/2*I*ln(exp(x)+I)-3/2*I*ln(exp(x)-I)
```

### 3.106.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 71 vs. 2(27) = 54.

Time = 0.28 (sec) , antiderivative size = 71, normalized size of antiderivative = 1.58

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx$$
$$= \frac{2i\,x e^{(2\,x)} + 2\,(2\,x-1)e^{x} + \left(-i\,e^{(2\,x)} - 2\,e^{x} + i\right)\log\left(e^{x}+i\right) - 3\left(i\,e^{(2\,x)} + 2\,e^{x} - i\right)\log\left(e^{x}-i\right) - 2i\,x}{2\left(e^{(2\,x)} - 2i\,e^{x} - 1\right)}$$

input
```
integrate(tanh(x)/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/2*(2*I*x*e^(2*x) + 2*(2*x - 1)*e^x + (-I*e^(2*x) - 2*e^x + I)*log(e^x +
I) - 3*(I*e^(2*x) + 2*e^x - I)*log(e^x - I) - 2*I*x)/(e^(2*x) - 2*I*e^x -
1)
```

### 3.106.6 Sympy [F]

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\tanh(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(tanh(x)/(I+csch(x)),x)
```

output
```
Integral(tanh(x)/(csch(x) + I), x)
```

### 3.106.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.00

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x + \frac{e^{(-x)}}{2i\,e^{(-x)} + e^{(-2\,x)} - 1} - \frac{1}{2}i\,\log\left(i\,e^{(-x)}+1\right) - \frac{3}{2}i\,\log\left(i\,e^{(-x)}-1\right)$$

input
```
integrate(tanh(x)/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + e^(-x)/(2*I*e^(-x) + e^(-2*x) - 1) - 1/2*I*log(I*e^(-x) + 1) - 3/2*
I*log(I*e^(-x) - 1)
```

### 3.106.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 53, normalized size of antiderivative = 1.18

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3i\,e^{(-x)} - 3i\,e^{x} - 2}{4\left(e^{(-x)} - e^{x} + 2i\right)} - \frac{1}{4}i\,\log\left(-e^{(-x)} + e^{x} + 2i\right) - \frac{3}{4}i\,\log\left(-e^{(-x)} + e^{x} - 2i\right)$$

input
```
integrate(tanh(x)/(I+csch(x)),x, algorithm="giac")
```

output
```
1/4*(3*I*e^(-x) - 3*I*e^x - 2)/(e^(-x) - e^x + 2*I) - 1/4*I*log(-e^(-x) +
e^x + 2*I) - 3/4*I*log(-e^(-x) + e^x - 2*I)
```

### 3.106.9 Mupad [B] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.11

$$\int \frac{\tanh(x)}{i+\operatorname{csch}(x)}\,dx = x\,1\mathrm{i} + \operatorname{atan}(\mathrm{e}^{x}) - \ln\left(\left(\mathrm{e}^{x} - \mathrm{i}\right)\left(\mathrm{e}^{x} + 1\mathrm{i}\right)\right)\,1\mathrm{i} + \frac{1\mathrm{i}}{1 - \mathrm{e}^{2\,x} + \mathrm{e}^{x}\,2\mathrm{i}} - \frac{1}{\mathrm{e}^{x} - \mathrm{i}}$$

input
```
int(tanh(x)/(1/sinh(x) + 1i),x)
```

output
```
x*1i + atan(exp(x)) - log((exp(x) - 1i)*(exp(x) + 1i))*1i + 1i/(exp(x)*2i
- exp(2*x) + 1) - 1/(exp(x) - 1i)
```

# 3.107 $\int \frac{\coth(x)}{i+\mathbf{csch}(x)}\,dx$

3.107.1 Optimal result . . . . . 738
3.107.2 Mathematica [A] (verified) . . . . . 738
3.107.3 Rubi [A] (verified) . . . . . 739
3.107.4 Maple [A] (verified) . . . . . 740
3.107.5 Fricas [A] (verification not implemented) . . . . . 741
3.107.6 Sympy [F] . . . . . 741
3.107.7 Maxima [A] (verification not implemented) . . . . . 741
3.107.8 Giac [A] (verification not implemented) . . . . . 742
3.107.9 Mupad [B] (verification not implemented) . . . . . 742

## 3.107.1 Optimal result

Integrand size = 11, antiderivative size = 13

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = -i\log(i-\sinh(x))$$

output
```
-I*ln(I-sinh(x))
```

## 3.107.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 13, normalized size of antiderivative = 1.00

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = -i\log(i-\sinh(x))$$

input
```
Integrate[Coth[x]/(I + Csch[x]),x]
```

output
```
(-I)*Log[I - Sinh[x]]
```

### 3.107.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 13, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.455$, Rules used = {3042, 26, 26, 4367, 16}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{i\cot(ix)}{i\csc(ix)+i}dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cot(ix)}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$\int \frac{\cot(ix)}{1+\csc(ix)}dx$$
$$\downarrow 4367$$
$$-i\int \frac{1}{i\sinh(x)+1}d(i\sinh(x))$$
$$\downarrow 16$$
$$-i\log(1+i\sinh(x))$$

input
```
Int[Coth[x]/(I + Csch[x]),x]
```

output
```
(-I)*Log[1 + I*Sinh[x]]
```

#### 3.107.3.1 Defintions of rubi rules used

rule 16
```
Int[(c_.)/((a_.) + (b_.)*(x_)), x_Symbol] :> Simp[c*(Log[RemoveContent[a +
b*x, x]]/b), x] /; FreeQ[{a, b, c}, x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4367
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_.), x_Symbol] :> Simp[1/(a^(m - n - 1)*b^n*d)   Subst[Int[(a - b*x)^((m -
1)/2)*((a + b*x)^((m - 1)/2 + n)/x^(m + n)), x], x, Sin[c + d*x]], x] /; Fr
eeQ[{a, b, c, d}, x] && IntegerQ[(m - 1)/2] && EqQ[a^2 - b^2, 0] && Integer
Q[n]
```

### 3.107.4 Maple [A] (verified)

Time = 1.03 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.15

| method | result | size |
|---|---|---|
| risch | $ix - 2i\ln\left(\mathrm{e}^{x} - i\right)$ | 15 |
| derivativedivides | $i\ln\left(\operatorname{csch}\left(x\right)\right) - \frac{i\ln\left(1+\operatorname{csch}(x)^2\right)}{2} - \arctan\left(\operatorname{csch}\left(x\right)\right)$ | 23 |
| default | $i\ln\left(\operatorname{csch}\left(x\right)\right) - \frac{i\ln\left(1+\operatorname{csch}(x)^2\right)}{2} - \arctan\left(\operatorname{csch}\left(x\right)\right)$ | 23 |

input
```
int(coth(x)/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
I*x-2*I*ln(exp(x)-I)
```

### 3.107.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 11, normalized size of antiderivative = 0.85

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = i\,x - 2i\,\log\left(e^x - i\right)$$

input
```
integrate(coth(x)/(I+csch(x)),x, algorithm="fricas")
```

output
```
I*x - 2*I*log(e^x - I)
```

### 3.107.6 Sympy [F]

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\coth\left(x\right)}{\operatorname{csch}\left(x\right)+i}\,dx$$

input
```
integrate(coth(x)/(I+csch(x)),x)
```

output
```
Integral(coth(x)/(csch(x) + I), x)
```

### 3.107.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.15

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x - 2i\,\log\left(i\,e^{(-x)} - 1\right)$$

input
```
integrate(coth(x)/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x - 2*I*log(I*e^(-x) - 1)
```

### 3.107.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 11, normalized size of antiderivative = 0.85

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = i\,x - 2i\,\log\left(e^x - i\right)$$

input
```
integrate(coth(x)/(I+csch(x)),x, algorithm="giac")
```

output
```
I*x - 2*I*log(e^x - I)
```

### 3.107.9 Mupad [B] (verification not implemented)

Time = 2.22 (sec) , antiderivative size = 14, normalized size of antiderivative = 1.08

$$\int \frac{\coth(x)}{i+\operatorname{csch}(x)}\,dx = x\,1\mathrm{i} - \ln\left(\mathrm{e}^x - \mathrm{i}\right)\,2\mathrm{i}$$

input
```
int(coth(x)/(1/sinh(x) + 1i),x)
```

output
```
x*1i - log(exp(x) - 1i)*2i
```

# 3.108 $\int \frac{\coth^2(x)}{i+\mathbf{csch}(x)}\,dx$

3.108.1 Optimal result . . . 743
3.108.2 Mathematica [A] (verified) . . . 743
3.108.3 Rubi [A] (verified) . . . 744
3.108.4 Maple [A] (verified) . . . 745
3.108.5 Fricas [A] (verification not implemented) . . . 746
3.108.6 Sympy [F] . . . 746
3.108.7 Maxima [B] (verification not implemented) . . . 746
3.108.8 Giac [A] (verification not implemented) . . . 747
3.108.9 Mupad [B] (verification not implemented) . . . 747

## 3.108.1 Optimal result

Integrand size = 13, antiderivative size = 11

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = -ix - \operatorname{arctanh}(\cosh(x))$$

output
```
-I*x-arctanh(cosh(x))
```

## 3.108.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 22, normalized size of antiderivative = 2.00

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = -ix - \log\left(\cosh\left(\frac{x}{2}\right)\right) + \log\left(\sinh\left(\frac{x}{2}\right)\right)$$

input
```
Integrate[Coth[x]^2/(I + Csch[x]),x]
```

output
```
(-I)*x - Log[Cosh[x/2]] + Log[Sinh[x/2]]
```

### 3.108.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.36, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$, Rules used = {3042, 25, 26, 4376, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^2(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{\cot(ix)^2}{i\csc(ix)+i}dx$$
$$\downarrow 25$$
$$-\int -\frac{i\cot(ix)^2}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$i\int \frac{\cot(ix)^2}{\csc(ix)+1}dx$$
$$\downarrow 4376$$
$$i\int (-i\operatorname{csch}(x)-1)dx$$
$$\downarrow 2009$$
$$i(-x+i\operatorname{arctanh}(\cosh(x)))$$

input
```
Int[Coth[x]^2/(I + Csch[x]),x]
```

output
```
I*(-x + I*ArcTanh[Cosh[x]])
```

#### 3.108.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4376
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_))^(n_), x_Symbol] :> Simp[a^(2*n)/e^(2*n)   Int[(e*Cot[c + d*x])^(m + 2*
n)/(-a + b*Csc[c + d*x])^n, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && EqQ[a
^2 - b^2, 0] && ILtQ[n, 0]
```

### 3.108.4 Maple [A] (verified)

Time = 1.62 (sec) , antiderivative size = 18, normalized size of antiderivative = 1.64

| method | result | size |
|---|---|---|
| risch | $-ix+\ln\left(\mathrm{e}^{x}-1\right)-\ln\left(\mathrm{e}^{x}+1\right)$ | 18 |
| default | $\ln\left(\tanh\left(\frac{x}{2}\right)\right)-i\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)+i\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)$ | 27 |

input
```
int(coth(x)^2/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-I*x+ln(exp(x)-1)-ln(exp(x)+1)
```

### 3.108.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 16, normalized size of antiderivative = 1.45

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x - \log\left(e^x+1\right) + \log\left(e^x-1\right)$$

input
```
integrate(coth(x)^2/(I+csch(x)),x, algorithm="fricas")
```

output
```
-I*x - log(e^x + 1) + log(e^x - 1)
```

### 3.108.6 Sympy [F]

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\coth^2(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(coth(x)**2/(I+csch(x)),x)
```

output
```
Integral(coth(x)**2/(csch(x) + I), x)
```

### 3.108.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 20 vs. 2(9) = 18.

Time = 0.19 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.82

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x - \log\left(e^{(-x)}+1\right) + \log\left(e^{(-x)}-1\right)$$

input
```
integrate(coth(x)^2/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x - log(e^(-x) + 1) + log(e^(-x) - 1)
```

### 3.108.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.55

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x - \log\left(e^x+1\right) + \log\left(\left|e^x-1\right|\right)$$

input
```
integrate(coth(x)^2/(I+csch(x)),x, algorithm="giac")
```

output
```
-I*x - log(e^x + 1) + log(abs(e^x - 1))
```

### 3.108.9 Mupad [B] (verification not implemented)

Time = 0.16 (sec) , antiderivative size = 21, normalized size of antiderivative = 1.91

$$\int \frac{\coth^2(x)}{i+\operatorname{csch}(x)}\,dx = \ln\left(2-2\,\mathrm{e}^x\right) - \ln\left(-2\,\mathrm{e}^x-2\right) - x\,1\mathrm{i}$$

input
```
int(coth(x)^2/(1/sinh(x) + 1i),x)
```

output
```
log(2 - 2*exp(x)) - log(- 2*exp(x) - 2) - x*1i
```

# 3.109 $\int \frac{\coth^3(x)}{i+\mathbf{csch}(x)}\,dx$

3.109.1 Optimal result . . . 748
3.109.2 Mathematica [A] (verified) . . . 748
3.109.3 Rubi [A] (verified) . . . 749
3.109.4 Maple [A] (verified) . . . 750
3.109.5 Fricas [B] (verification not implemented) . . . 751
3.109.6 Sympy [F] . . . 751
3.109.7 Maxima [B] (verification not implemented) . . . 751
3.109.8 Giac [B] (verification not implemented) . . . 752
3.109.9 Mupad [B] (verification not implemented) . . . 752

## 3.109.1 Optimal result

Integrand size = 13, antiderivative size = 12

$$\int \frac{\coth^3(x)}{i+\operatorname{csch}(x)}\,dx = -\operatorname{csch}(x) - i\log(\sinh(x))$$

output
```
-csch(x)-I*ln(sinh(x))
```

## 3.109.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 12, normalized size of antiderivative = 1.00

$$\int \frac{\coth^3(x)}{i+\operatorname{csch}(x)}\,dx = -\operatorname{csch}(x) - i\log(\sinh(x))$$

input
```
Integrate[Coth[x]^3/(I + Csch[x]),x]
```

output
```
-Csch[x] - I*Log[Sinh[x]]
```

### 3.109.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.67, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 26, 4367, 49, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^3(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\cot(ix)^3}{i\csc(ix)+i}dx$$
$$\downarrow 26$$
$$-i\int -\frac{i\cot(ix)^3}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$-\int \frac{\cot(ix)^3}{\csc(ix)+1}dx$$
$$\downarrow 4367$$
$$i\int -\operatorname{csch}^2(x)(1-i\sinh(x))d(i\sinh(x))$$
$$\downarrow 49$$
$$i\int \left(i\operatorname{csch}(x)-\operatorname{csch}^2(x)\right)d(i\sinh(x))$$
$$\downarrow 2009$$
$$i(i\operatorname{csch}(x)-\log(i\sinh(x)))$$

input
```
Int[Coth[x]^3/(I + Csch[x]),x]
```

output
```
I*(I*Csch[x] - Log[I*Sinh[x]])
```

#### 3.109.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 49
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d}, x]
&& IGtQ[m, 0] && IGtQ[m + n + 2, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4367
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_.), x_Symbol] :> Simp[1/(a^(m - n - 1)*b^n*d)   Subst[Int[(a - b*x)^((m -
1)/2)*((a + b*x)^((m - 1)/2 + n)/x^(m + n)), x], x, Sin[c + d*x]], x] /; Fr
eeQ[{a, b, c, d}, x] && IntegerQ[(m - 1)/2] && EqQ[a^2 - b^2, 0] && Integer
Q[n]
```

### 3.109.4 Maple [A] (verified)

Time = 2.37 (sec) , antiderivative size = 12, normalized size of antiderivative = 1.00

| method | result | size |
|---|---|---|
| derivativedivides | $-\operatorname{csch}(x)+i\ln(\operatorname{csch}(x))$ | 12 |
| default | $-\operatorname{csch}(x)+i\ln(\operatorname{csch}(x))$ | 12 |
| risch | $ix-\frac{2\,\mathrm{e}^{x}}{\mathrm{e}^{2x}-1}-i\ln(\mathrm{e}^{2x}-1)$ | 28 |

input
```
int(coth(x)^3/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-csch(x)+I*ln(csch(x))
```

### 3.109.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 40 vs. $2(10) = 20$.

Time = 0.27 (sec) , antiderivative size = 40, normalized size of antiderivative = 3.33

$$\int \frac{\coth^3(x)}{i + \operatorname{csch}(x)}\,dx = \frac{i\,x e^{(2\,x)} + \left(-i\,e^{(2\,x)} + i\right)\log\left(e^{(2\,x)} - 1\right) - i\,x - 2\,e^{x}}{e^{(2\,x)} - 1}$$

input
```
integrate(coth(x)^3/(I+csch(x)),x, algorithm="fricas")
```

output
```
(I*x*e^(2*x) + (-I*e^(2*x) + I)*log(e^(2*x) - 1) - I*x - 2*e^x)/(e^(2*x) -
 1)
```

### 3.109.6 Sympy [F]

$$\int \frac{\coth^3(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\coth^3(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(coth(x)**3/(I+csch(x)),x)
```

output
```
Integral(coth(x)**3/(csch(x) + I), x)
```

### 3.109.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 36 vs. $2(10) = 20$.

Time = 0.19 (sec) , antiderivative size = 36, normalized size of antiderivative = 3.00

$$\int \frac{\coth^3(x)}{i + \operatorname{csch}(x)}\,dx = -i\,x + \frac{2\,e^{(-x)}}{e^{(-2\,x)} - 1} - i\,\log\left(e^{(-x)} + 1\right) - i\,\log\left(e^{(-x)} - 1\right)$$

input
```
integrate(coth(x)^3/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + 2*e^(-x)/(e^(-2*x) - 1) - I*log(e^(-x) + 1) - I*log(e^(-x) - 1)
```

### 3.109.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 39 vs. $2(10) = 20$.

Time = 0.28 (sec) , antiderivative size = 39, normalized size of antiderivative = 3.25

$$\int \frac{\coth^3(x)}{i + \operatorname{csch}(x)}\,dx = -\frac{-i\,e^{(-x)} + i\,e^x - 2}{e^{(-x)} - e^x} - i\,\log\left(\left|-e^{(-x)} + e^x\right|\right)$$

input
```
integrate(coth(x)^3/(I+csch(x)),x, algorithm="giac")
```

output
```
-(-I*e^(-x) + I*e^x - 2)/(e^(-x) - e^x) - I*log(abs(-e^(-x) + e^x))
```

### 3.109.9 Mupad [B] (verification not implemented)

Time = 2.22 (sec) , antiderivative size = 27, normalized size of antiderivative = 2.25

$$\int \frac{\coth^3(x)}{i + \operatorname{csch}(x)}\,dx = -\frac{2\,\mathrm{e}^x}{\mathrm{e}^{2\,x} - 1} + x\,1\mathrm{i} - \ln\left(\mathrm{e}^{2\,x} - 1\right)\,1\mathrm{i}$$

input
```
int(coth(x)^3/(1/sinh(x) + 1i),x)
```

output
```
x*1i - log(exp(2*x) - 1)*1i - (2*exp(x))/(exp(2*x) - 1)
```

# 3.110 $\int \frac{\coth^4(x)}{i+\mathbf{csch}(x)}\,dx$

3.110.1 Optimal result . . . 753
3.110.2 Mathematica [B] (verified) . . . 753
3.110.3 Rubi [A] (verified) . . . 754
3.110.4 Maple [B] (verified) . . . 755
3.110.5 Fricas [B] (verification not implemented) . . . 756
3.110.6 Sympy [F] . . . 756
3.110.7 Maxima [B] (verification not implemented) . . . 757
3.110.8 Giac [B] (verification not implemented) . . . 757
3.110.9 Mupad [B] (verification not implemented) . . . 757

## 3.110.1 Optimal result

Integrand size = 13, antiderivative size = 27

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx = -ix - \frac{1}{2}\operatorname{arctanh}(\cosh(x)) + \frac{1}{2}\coth(x)(2i-\operatorname{csch}(x))$$

output
```
-I*x-1/2*arctanh(cosh(x))+1/2*coth(x)*(2*I-csch(x))
```

## 3.110.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 76 vs. 2(27) = 54.

Time = 0.05 (sec) , antiderivative size = 76, normalized size of antiderivative = 2.81

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx = -ix + \frac{1}{2}i\coth\left(\frac{x}{2}\right) - \frac{1}{8}\operatorname{csch}^2\left(\frac{x}{2}\right) - \frac{1}{2}\log\left(\cosh\left(\frac{x}{2}\right)\right) + \frac{1}{2}\log\left(\sinh\left(\frac{x}{2}\right)\right) - \frac{1}{8}\operatorname{sech}^2\left(\frac{x}{2}\right) + \frac{1}{2}i\tanh\left(\frac{x}{2}\right)$$

input
```
Integrate[Coth[x]^4/(I + Csch[x]),x]
```

output
```
(-I)*x + (I/2)*Coth[x/2] - Csch[x/2]^2/8 - Log[Cosh[x/2]]/2 + Log[Sinh[x/2
]]/2 - Sech[x/2]^2/8 + (I/2)*Tanh[x/2]
```

### 3.110.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.26, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.538$, Rules used = {3042, 4376, 3042, 25, 26, 4369, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^4(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cot(ix)^4}{i\csc(ix)+i}dx$$
$$\downarrow 4376$$
$$-\int \coth^2(x)(i-\operatorname{csch}(x))dx$$
$$\downarrow 3042$$
$$-\int -\cot(ix)^2(i-i\csc(ix))dx$$
$$\downarrow 25$$
$$\int i\cot(ix)^2(1-\csc(ix))dx$$
$$\downarrow 26$$
$$i\int \cot(ix)^2(1-\csc(ix))dx$$
$$\downarrow 4369$$
$$i\left(\frac{1}{2}\coth(x)(2+i\operatorname{csch}(x))-\frac{1}{2}\int(i\operatorname{csch}(x)+2)dx\right)$$
$$\downarrow 2009$$
$$i\left(\frac{1}{2}(-2x+i\operatorname{arctanh}(\cosh(x)))+\frac{1}{2}\coth(x)(2+i\operatorname{csch}(x))\right)$$

input
```
Int[Coth[x]^4/(I + Csch[x]),x]
```

output
```
I*((-2*x + I*ArcTanh[Cosh[x]])/2 + (Coth[x]*(2 + I*Csch[x]))/2)
```

#### 3.110.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4369
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[(-e)*(e*Cot[c + d*x])^(m - 1)*((a*m + b*(m - 1)*Csc
[c + d*x])/(d*m*(m - 1))), x] - Simp[e^2/m   Int[(e*Cot[c + d*x])^(m - 2)*(
a*m + b*(m - 1)*Csc[c + d*x]), x], x] /; FreeQ[{a, b, c, d, e}, x] && GtQ[m
, 1]
```

rule 4376
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_))^(n_), x_Symbol] :> Simp[a^(2*n)/e^(2*n)   Int[(e*Cot[c + d*x])^(m + 2*
n)/(-a + b*Csc[c + d*x])^n, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && EqQ[a
^2 - b^2, 0] && ILtQ[n, 0]
```

### 3.110.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 45 vs. $2(21) = 42$.

Time = 3.82 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.70

| method | result |
|---|---|
| risch | $-ix - \frac{-2ie^{2x}+e^{3x}+2i+e^{x}}{(e^{2x}-1)^2} + \frac{\ln(e^{x}-1)}{2} - \frac{\ln(e^{x}+1)}{2}$ |
| default | $\frac{i\tanh(\frac{x}{2})}{2} + \frac{\tanh(\frac{x}{2})^2}{8} - i\ln\left(\tanh\left(\frac{x}{2}\right)+1\right) + i\ln\left(\tanh\left(\frac{x}{2}\right)-1\right) - \frac{1}{8\tanh(\frac{x}{2})^2} + \frac{i}{2\tanh(\frac{x}{2})} + \frac{\ln(\tanh(\frac{x}{2})$ |

input
```
int(coth(x)^4/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-I*x-(-2*I*exp(x)^2+exp(x)^3+2*I+exp(x))/(exp(x)^2-1)^2+1/2*ln(exp(x)-1)-1
/2*ln(exp(x)+1)
```

### 3.110.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 86 vs. 2(17) = 34.

Time = 0.28 (sec) , antiderivative size = 86, normalized size of antiderivative = 3.19

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx$$
$$= \frac{-2i\,x e^{(4\,x)} - 4\,(-i\,x-i)e^{(2\,x)} - \left(e^{(4\,x)} - 2\,e^{(2\,x)} + 1\right)\log\left(e^{x}+1\right) + \left(e^{(4\,x)} - 2\,e^{(2\,x)} + 1\right)\log\left(e^{x}-1\right) - 2i\,}{2\left(e^{(4\,x)} - 2\,e^{(2\,x)} + 1\right)}$$

input
```
integrate(coth(x)^4/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/2*(-2*I*x*e^(4*x) - 4*(-I*x - I)*e^(2*x) - (e^(4*x) - 2*e^(2*x) + 1)*log
(e^x + 1) + (e^(4*x) - 2*e^(2*x) + 1)*log(e^x - 1) - 2*I*x - 2*e^(3*x) - 2
*e^x - 4*I)/(e^(4*x) - 2*e^(2*x) + 1)
```

### 3.110.6 Sympy [F]

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\coth^4(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(coth(x)**4/(I+csch(x)),x)
```

output
```
Integral(coth(x)**4/(csch(x) + I), x)
```

### 3.110.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 55 vs. $2(17) = 34$.

Time = 0.18 (sec) , antiderivative size = 55, normalized size of antiderivative = 2.04

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x + \frac{e^{(-x)} + 2i\,e^{(-2\,x)} + e^{(-3\,x)} - 2i}{2\,e^{(-2\,x)} - e^{(-4\,x)} - 1} - \frac{1}{2}\log\left(e^{(-x)}+1\right) + \frac{1}{2}\log\left(e^{(-x)} - 1\right)$$

input
```
integrate(coth(x)^4/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + (e^(-x) + 2*I*e^(-2*x) + e^(-3*x) - 2*I)/(2*e^(-2*x) - e^(-4*x) - 1
) - 1/2*log(e^(-x) + 1) + 1/2*log(e^(-x) - 1)
```

### 3.110.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 43 vs. $2(17) = 34$.

Time = 0.27 (sec) , antiderivative size = 43, normalized size of antiderivative = 1.59

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x - \frac{e^{(3\,x)} - 2i\,e^{(2\,x)} + e^{x} + 2i}{\left(e^{(2\,x)} - 1\right)^2} - \frac{1}{2}\log\left(e^{x}+1\right) + \frac{1}{2}\log\left(\left|e^{x} - 1\right|\right)$$

input
```
integrate(coth(x)^4/(I+csch(x)),x, algorithm="giac")
```

output
```
-I*x - (e^(3*x) - 2*I*e^(2*x) + e^x + 2*I)/(e^(2*x) - 1)^2 - 1/2*log(e^x +
 1) + 1/2*log(abs(e^x - 1))
```

### 3.110.9 Mupad [B] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 56, normalized size of antiderivative = 2.07

$$\int \frac{\coth^4(x)}{i+\operatorname{csch}(x)}\,dx = \frac{\ln\left(1-\mathrm{e}^{x}\right)}{2} - \frac{\ln\left(-\mathrm{e}^{x}-1\right)}{2} - \frac{\mathrm{e}^{x} - 2\mathrm{i}}{\mathrm{e}^{2\,x}-1} - \frac{2\,\mathrm{e}^{x}}{\mathrm{e}^{4\,x} - 2\,\mathrm{e}^{2\,x}+1} - x\,1\mathrm{i}$$

input
```
int(coth(x)^4/(1/sinh(x) + 1i),x)
```

output
```
log(1 - exp(x))/2 - log(- exp(x) - 1)/2 - x*1i - (exp(x) - 2i)/(exp(2*x) -
 1) - (2*exp(x))/(exp(4*x) - 2*exp(2*x) + 1)
```

# 3.111 $\int \frac{\coth^5(x)}{i+\mathbf{csch}(x)}\,dx$

3.111.1 Optimal result . . . 759
3.111.2 Mathematica [A] (verified) . . . 759
3.111.3 Rubi [A] (verified) . . . 760
3.111.4 Maple [B] (verified) . . . 761
3.111.5 Fricas [B] (verification not implemented) . . . 762
3.111.6 Sympy [F] . . . 762
3.111.7 Maxima [B] (verification not implemented) . . . 763
3.111.8 Giac [B] (verification not implemented) . . . 763
3.111.9 Mupad [B] (verification not implemented) . . . 764

## 3.111.1 Optimal result

Integrand size = 13, antiderivative size = 30

$$\int \frac{\coth^5(x)}{i+\operatorname{csch}(x)}\,dx = -\operatorname{csch}(x) + \frac{1}{2}i\operatorname{csch}^2(x) - \frac{\operatorname{csch}^3(x)}{3} - i\log(\sinh(x))$$

output
```
-csch(x)+1/2*I*csch(x)^2-1/3*csch(x)^3-I*ln(sinh(x))
```

## 3.111.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.00

$$\int \frac{\coth^5(x)}{i+\operatorname{csch}(x)}\,dx = -\operatorname{csch}(x) + \frac{1}{2}i\operatorname{csch}^2(x) - \frac{\operatorname{csch}^3(x)}{3} - i\log(\sinh(x))$$

input
```
Integrate[Coth[x]^5/(I + Csch[x]),x]
```

output
```
-Csch[x] + (I/2)*Csch[x]^2 - Csch[x]^3/3 - I*Log[Sinh[x]]
```

### 3.111.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 36, normalized size of antiderivative = 1.20, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 26, 4367, 84, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^5(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int \frac{i\cot(ix)^5}{i\csc(ix)+i}dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cot(ix)^5}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$\int \frac{\cot(ix)^5}{1+\csc(ix)}dx$$
$$\downarrow 4367$$
$$-i\int \operatorname{csch}^4(x)(1-i\sinh(x))^2(i\sinh(x)+1)d(i\sinh(x))$$
$$\downarrow 84$$
$$-i\int \left(\operatorname{csch}^4(x)-i\operatorname{csch}^3(x)+\operatorname{csch}^2(x)-i\operatorname{csch}(x)\right)d(i\sinh(x))$$
$$\downarrow 2009$$
$$-i\left(-\frac{1}{3}i\operatorname{csch}^3(x)-\frac{\operatorname{csch}^2(x)}{2}-i\operatorname{csch}(x)+\log(i\sinh(x))\right)$$

input
```
Int[Coth[x]^5/(I + Csch[x]),x]
```

output
```
(-I)*((-I)*Csch[x] - Csch[x]^2/2 - (I/3)*Csch[x]^3 + Log[I*Sinh[x]])
```

#### 3.111.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 84
```
Int[((d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_))*((e_) + (f_.)*(x_))^(p_.), x_] :
> Int[ExpandIntegrand[(a + b*x)*(d*x)^n*(e + f*x)^p, x], x] /; FreeQ[{a, b,
 d, e, f, n}, x] && IGtQ[p, 0] && EqQ[b*e + a*f, 0] &&  !(ILtQ[n + p + 2, 0
] && GtQ[n + 2*p, 0])
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4367
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_.), x_Symbol] :> Simp[1/(a^(m - n - 1)*b^n*d)   Subst[Int[(a - b*x)^((m -
1)/2)*((a + b*x)^((m - 1)/2 + n)/x^(m + n)), x], x, Sin[c + d*x]], x] /; Fr
eeQ[{a, b, c, d}, x] && IntegerQ[(m - 1)/2] && EqQ[a^2 - b^2, 0] && Integer
Q[n]
```

### 3.111.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 53 vs. $2(24) = 48$.

Time = 6.26 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.80

| method | result |
|---|---|
| risch | $ix - \frac{2\,\mathrm{e}^{x}\left(-3i\mathrm{e}^{3x}+3\,\mathrm{e}^{4x}+3i\mathrm{e}^{x}-2\,\mathrm{e}^{2x}+3\right)}{3\left(\mathrm{e}^{2x}-1\right)^{3}} - i\ln\left(\mathrm{e}^{2x}-1\right)$ |
| default | $\frac{3\tanh\left(\frac{x}{2}\right)}{8} + \frac{\tanh\left(\frac{x}{2}\right)^{3}}{24} + \frac{i\tanh\left(\frac{x}{2}\right)^{2}}{8} - \frac{1}{24\tanh\left(\frac{x}{2}\right)^{3}} - i\ln\left(\tanh\left(\frac{x}{2}\right)\right) + \frac{i}{8\tanh\left(\frac{x}{2}\right)^{2}} - \frac{3}{8\tanh\left(\frac{x}{2}\right)} + i\ln\left(\tanh($ |

input
```
int(coth(x)^5/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
I*x-2/3*exp(x)*(-3*I*exp(3*x)+3*exp(4*x)+3*I*exp(x)-2*exp(2*x)+3)/(exp(2*x
)-1)^3-I*ln(exp(2*x)-1)
```

### 3.111.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 100 vs. $2(22) = 44$.

Time $= 0.26$ (sec) , antiderivative size $= 100$, normalized size of antiderivative $= 3.33$

$$\int \frac{\coth^5(x)}{i + \operatorname{csch}(x)}\,dx$$
$$= \frac{3i\,x e^{(6\,x)} - 3\,(3i\,x - 2i)e^{(4\,x)} - 3\,(-3i\,x + 2i)e^{(2\,x)} - 3\,\left(i\,e^{(6\,x)} - 3i\,e^{(4\,x)} + 3i\,e^{(2\,x)} - i\right)\log\left(e^{(2\,x)} - 1\right) - 3i}{3\,(e^{(6\,x)} - 3\,e^{(4\,x)} + 3\,e^{(2\,x)} - 1)}$$

input
```
integrate(coth(x)^5/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/3*(3*I*x*e^(6*x) - 3*(3*I*x - 2*I)*e^(4*x) - 3*(-3*I*x + 2*I)*e^(2*x) -
3*(I*e^(6*x) - 3*I*e^(4*x) + 3*I*e^(2*x) - I)*log(e^(2*x) - 1) - 3*I*x - 6
*e^(5*x) + 4*e^(3*x) - 6*e^x)/(e^(6*x) - 3*e^(4*x) + 3*e^(2*x) - 1)
```

### 3.111.6 Sympy [F]

$$\int \frac{\coth^5(x)}{i + \operatorname{csch}(x)}\,dx = \int \frac{\coth^5(x)}{\operatorname{csch}(x) + i}\,dx$$

input
```
integrate(coth(x)**5/(I+csch(x)),x)
```

output
```
Integral(coth(x)**5/(csch(x) + I), x)
```

### 3.111.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 75 vs. $2(22) = 44$.

Time = 0.19 (sec) , antiderivative size = 75, normalized size of antiderivative = 2.50

$$\int \frac{\coth^5(x)}{i+\operatorname{csch}(x)}\,dx = -i\,x + \frac{2\left(3\,e^{(-x)} - 3i\,e^{(-2\,x)} - 2\,e^{(-3\,x)} + 3i\,e^{(-4\,x)} + 3\,e^{(-5\,x)}\right)}{3\left(3\,e^{(-2\,x)} - 3\,e^{(-4\,x)} + e^{(-6\,x)} - 1\right)} - i\,\log\left(e^{(-x)}+1\right) - i\,\log\left(e^{(-x)}-1\right)$$

input
```
integrate(coth(x)^5/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + 2/3*(3*e^(-x) - 3*I*e^(-2*x) - 2*e^(-3*x) + 3*I*e^(-4*x) + 3*e^(-5*
x))/(3*e^(-2*x) - 3*e^(-4*x) + e^(-6*x) - 1) - I*log(e^(-x) + 1) - I*log(e
^(-x) - 1)
```

### 3.111.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 65 vs. $2(22) = 44$.

Time = 0.27 (sec) , antiderivative size = 65, normalized size of antiderivative = 2.17

$$\int \frac{\coth^5(x)}{i+\operatorname{csch}(x)}\,dx = \frac{11i\left(e^{(-x)}-e^{x}\right)^3 + 12\left(e^{(-x)}-e^{x}\right)^2 + 12i\,e^{(-x)} - 12i\,e^{x} + 16}{6\left(e^{(-x)}-e^{x}\right)^3} - i\,\log\left(\left|-e^{(-x)}+e^{x}\right|\right)$$

input
```
integrate(coth(x)^5/(I+csch(x)),x, algorithm="giac")
```

output
```
1/6*(11*I*(e^(-x) - e^x)^3 + 12*(e^(-x) - e^x)^2 + 12*I*e^(-x) - 12*I*e^x
+ 16)/(e^(-x) - e^x)^3 - I*log(abs(-e^(-x) + e^x))
```

### 3.111.9 Mupad [B] (verification not implemented)

Time = 2.38 (sec) , antiderivative size = 81, normalized size of antiderivative = 2.70

$$\int \frac{\coth^5(x)}{i+\operatorname{csch}(x)}\,dx = x\,1\mathrm{i} - \ln\left(\mathrm{e}^{2x}-1\right)\,1\mathrm{i} - \frac{8\,\mathrm{e}^{x}}{3\,\left(3\,\mathrm{e}^{2x}-3\,\mathrm{e}^{4x}+\mathrm{e}^{6x}-1\right)} - \frac{\frac{8\,\mathrm{e}^{x}}{3}-2\mathrm{i}}{\mathrm{e}^{4x}-2\,\mathrm{e}^{2x}+1} - \frac{2\,\mathrm{e}^{x}-2\mathrm{i}}{\mathrm{e}^{2x}-1}$$

input
```
int(coth(x)^5/(1/sinh(x) + 1i),x)
```

output
```
x*1i - log(exp(2*x) - 1)*1i - (8*exp(x))/(3*(3*exp(2*x) - 3*exp(4*x) + exp
(6*x) - 1)) - ((8*exp(x))/3 - 2i)/(exp(4*x) - 2*exp(2*x) + 1) - (2*exp(x)
- 2i)/(exp(2*x) - 1)
```

# 3.112 $\int \frac{\coth^6(x)}{i+\mathbf{csch}(x)}\,dx$

3.112.1 Optimal result . . . 765
3.112.2 Mathematica [B] (verified) . . . 765
3.112.3 Rubi [A] (verified) . . . 766
3.112.4 Maple [B] (verified) . . . 768
3.112.5 Fricas [B] (verification not implemented) . . . 769
3.112.6 Sympy [F] . . . 769
3.112.7 Maxima [B] (verification not implemented) . . . 769
3.112.8 Giac [B] (verification not implemented) . . . 770
3.112.9 Mupad [B] (verification not implemented) . . . 771

## 3.112.1 Optimal result

Integrand size = 13, antiderivative size = 43

$$\int \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx = -ix - \frac{3}{8}\operatorname{arctanh}(\cosh(x)) + \frac{1}{12}\coth^3(x)(4i-3\operatorname{csch}(x)) + \frac{1}{8}\coth(x)(8i-3\operatorname{csch}(x))$$

output
```
-I*x-3/8*arctanh(cosh(x))+1/12*coth(x)^3*(4*I-3*csch(x))+1/8*coth(x)*(8*I-
3*csch(x))
```

## 3.112.2 Mathematica [B] (verified)

Both result and optimal contain complex but leaf count is larger than twice the leaf count of optimal. 140 vs. 2(43) = 86.

Time = 0.07 (sec) , antiderivative size = 140, normalized size of antiderivative = 3.26

$$\int \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx = -ix + \frac{2}{3}i\coth\left(\frac{x}{2}\right) - \frac{5}{32}\operatorname{csch}^2\left(\frac{x}{2}\right) + \frac{1}{24}i\coth\left(\frac{x}{2}\right)\operatorname{csch}^2\left(\frac{x}{2}\right) - \frac{1}{64}\operatorname{csch}^4\left(\frac{x}{2}\right) - \frac{3}{8}\log\left(\cosh\left(\frac{x}{2}\right)\right) + \frac{3}{8}\log\left(\sinh\left(\frac{x}{2}\right)\right) - \frac{5}{32}\operatorname{sech}^2\left(\frac{x}{2}\right) + \frac{1}{64}\operatorname{sech}^4\left(\frac{x}{2}\right) + \frac{2}{3}i\tanh\left(\frac{x}{2}\right) - \frac{1}{24}i\operatorname{sech}^2\left(\frac{x}{2}\right)\tanh\left(\frac{x}{2}\right)$$

input
```
Integrate[Coth[x]^6/(I + Csch[x]),x]
```

output
```
(-I)*x + ((2*I)/3)*Coth[x/2] - (5*Csch[x/2]^2)/32 + (I/24)*Coth[x/2]*Csch[
x/2]^2 - Csch[x/2]^4/64 - (3*Log[Cosh[x/2]])/8 + (3*Log[Sinh[x/2]])/8 - (5
*Sech[x/2]^2)/32 + Sech[x/2]^4/64 + ((2*I)/3)*Tanh[x/2] - (I/24)*Sech[x/2]
^2*Tanh[x/2]
```

### 3.112.3 Rubi [A] (verified)

Time = 0.38 (sec) , antiderivative size = 55, normalized size of antiderivative = 1.28, number of steps used = 12, number of rules used = 12, $\frac{\text{number of rules}}{\text{integrand size}} = 0.923$, Rules used = {3042, 25, 26, 4376, 25, 3042, 4369, 25, 3042, 25, 4369, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^6(x)}{\operatorname{csch}(x)+i}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{\cot(ix)^6}{i\csc(ix)+i}dx$$
$$\downarrow 25$$
$$-\int -\frac{i\cot(ix)^6}{\csc(ix)+1}dx$$
$$\downarrow 26$$
$$i\int \frac{\cot(ix)^6}{\csc(ix)+1}dx$$
$$\downarrow 4376$$
$$i\int -\coth^4(x)(i\operatorname{csch}(x)+1)dx$$
$$\downarrow 25$$
$$-i\int \coth^4(x)(i\operatorname{csch}(x)+1)dx$$
$$\downarrow 3042$$
$$-i\int \cot(ix)^4(1-\csc(ix))dx$$

$$\downarrow 4369$$

$$-i\left(-\frac{1}{4}\int -\coth^2(x)(3i\operatorname{csch}(x)+4)dx-\frac{1}{12}\coth^3(x)(4+3i\operatorname{csch}(x))\right)$$

$$\downarrow 25$$

$$-i\left(\frac{1}{4}\int \coth^2(x)(3i\operatorname{csch}(x)+4)dx-\frac{1}{12}\coth^3(x)(4+3i\operatorname{csch}(x))\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{1}{4}\int -\cot(ix)^2(4-3\csc(ix))dx-\frac{1}{12}\coth^3(x)(4+3i\operatorname{csch}(x))\right)$$

$$\downarrow 25$$

$$-i\left(-\frac{1}{4}\int \cot(ix)^2(4-3\csc(ix))dx-\frac{1}{12}\coth^3(x)(4+3i\operatorname{csch}(x))\right)$$

$$\downarrow 4369$$

$$-i\left(\frac{1}{4}\left(\frac{1}{2}\int (3i\operatorname{csch}(x)+8)dx-\frac{1}{2}\coth(x)(8+3i\operatorname{csch}(x))\right)-\frac{1}{12}\coth^3(x)(4+3i\operatorname{csch}(x))\right)$$

$$\downarrow 2009$$

$$-i\left(\frac{1}{4}\left(\frac{1}{2}(8x-3i\operatorname{arctanh}(\cosh(x)))-\frac{1}{2}\coth(x)(8+3i\operatorname{csch}(x))\right)-\frac{1}{12}\coth^3(x)(4+3i\operatorname{csch}(x))\right)$$

input
```
Int[Coth[x]^6/(I + Csch[x]),x]
```

output
```
(-I)*(((8*x - (3*I)*ArcTanh[Cosh[x]])/2 - (Coth[x]*(8 + (3*I)*Csch[x]))/2)
/4 - (Coth[x]^3*(4 + (3*I)*Csch[x]))/12)
```

### 3.112.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4369
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_)), x_Symbol] :> Simp[(-e)*(e*Cot[c + d*x])^(m - 1)*((a*m + b*(m - 1)*Csc
[c + d*x])/(d*m*(m - 1))), x] - Simp[e^2/m   Int[(e*Cot[c + d*x])^(m - 2)*(
a*m + b*(m - 1)*Csc[c + d*x]), x], x] /; FreeQ[{a, b, c, d, e}, x] && GtQ[m
, 1]
```

rule 4376
```
Int[(cot[(c_.) + (d_.)*(x_)]*(e_.))^(m_)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (
a_))^(n_), x_Symbol] :> Simp[a^(2*n)/e^(2*n)   Int[(e*Cot[c + d*x])^(m + 2*
n)/(-a + b*Csc[c + d*x])^n, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && EqQ[a
^2 - b^2, 0] && ILtQ[n, 0]
```

### 3.112.4 Maple [B] (verified)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 75 vs. $2(34) = 68$.

Time = 11.00 (sec) , antiderivative size = 76, normalized size of antiderivative = 1.77

| method | result |
|---|---|
| risch | $-ix - \frac{-48ie^{6x}+15e^{7x}+96ie^{4x}+9e^{5x}-80ie^{2x}+9e^{3x}+32i+15e^{x}}{12(e^{2x}-1)^4} - \frac{3\ln(e^x+1)}{8} + \frac{3\ln(e^x-1)}{8}$ |
| default | $\frac{5i\tanh(\frac{x}{2})}{8} + \frac{\tanh(\frac{x}{2})^4}{64} + \frac{i\tanh(\frac{x}{2})^3}{24} + \frac{\tanh(\frac{x}{2})^2}{8} - \frac{1}{64\tanh(\frac{x}{2})^4} + \frac{5i}{8\tanh(\frac{x}{2})} + \frac{i}{24\tanh(\frac{x}{2})^3} - \frac{1}{8\tanh(\frac{x}{2})^2} + \frac{3\ln(t$ |

input
```
int(coth(x)^6/(I+csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-I*x-1/12*(-48*I*exp(x)^6+15*exp(x)^7+96*I*exp(x)^4+9*exp(x)^5-80*I*exp(x)
^2+9*exp(x)^3+32*I+15*exp(x))/(exp(x)^2-1)^4-3/8*ln(exp(x)+1)+3/8*ln(exp(x
)-1)
```

### 3.112.5 Fricas [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 157 vs. $2(31) = 62$.

Time = 0.27 (sec) , antiderivative size = 157, normalized size of antiderivative = 3.65

$$\int \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx$$
$$= \frac{-24i\,x e^{(8\,x)} - 96\,(-i\,x-i)e^{(6\,x)} - 48\,(3i\,x+4i)e^{(4\,x)} - 32\,(-3i\,x-5i)e^{(2\,x)} - 9\,\left(e^{(8\,x)} - 4\,e^{(6\,x)} + 6\,e^{(4\,x)} -}{24\,(e^{(8}}$$

input
```
integrate(coth(x)^6/(I+csch(x)),x, algorithm="fricas")
```

output
```
1/24*(-24*I*x*e^(8*x) - 96*(-I*x - I)*e^(6*x) - 48*(3*I*x + 4*I)*e^(4*x) -
 32*(-3*I*x - 5*I)*e^(2*x) - 9*(e^(8*x) - 4*e^(6*x) + 6*e^(4*x) - 4*e^(2*x
) + 1)*log(e^x + 1) + 9*(e^(8*x) - 4*e^(6*x) + 6*e^(4*x) - 4*e^(2*x) + 1)*
log(e^x - 1) - 24*I*x - 30*e^(7*x) - 18*e^(5*x) - 18*e^(3*x) - 30*e^x - 64
*I)/(e^(8*x) - 4*e^(6*x) + 6*e^(4*x) - 4*e^(2*x) + 1)
```

### 3.112.6 Sympy [F]

$$\int \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx = \int \frac{\coth^6(x)}{\operatorname{csch}(x)+i}\,dx$$

input
```
integrate(coth(x)**6/(I+csch(x)),x)
```

output
```
Integral(coth(x)**6/(csch(x) + I), x)
```

### 3.112.7 Maxima [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 96 vs. $2(31) = 62$.

Time = 0.19 (sec) , antiderivative size = 96, normalized size of antiderivative = 2.23

$$\begin{aligned}\int & \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx \\ &= -i\,x \\ &\quad + \frac{15\,e^{(-x)} + 80i\,e^{(-2\,x)} + 9\,e^{(-3\,x)} - 96i\,e^{(-4\,x)} + 9\,e^{(-5\,x)} + 48i\,e^{(-6\,x)} + 15\,e^{(-7\,x)} - 32i}{12\left(4\,e^{(-2\,x)} - 6\,e^{(-4\,x)} + 4\,e^{(-6\,x)} - e^{(-8\,x)} - 1\right)} \\ &\quad - \frac{3}{8}\log\left(e^{(-x)}+1\right) + \frac{3}{8}\log\left(e^{(-x)}-1\right)\end{aligned}$$

input
```
integrate(coth(x)^6/(I+csch(x)),x, algorithm="maxima")
```

output
```
-I*x + 1/12*(15*e^(-x) + 80*I*e^(-2*x) + 9*e^(-3*x) - 96*I*e^(-4*x) + 9*e^
(-5*x) + 48*I*e^(-6*x) + 15*e^(-7*x) - 32*I)/(4*e^(-2*x) - 6*e^(-4*x) + 4*
e^(-6*x) - e^(-8*x) - 1) - 3/8*log(e^(-x) + 1) + 3/8*log(e^(-x) - 1)
```

### 3.112.8 Giac [B] (verification not implemented)

Both result and optimal contain complex but leaf count of result is larger than twice the leaf count of optimal. 71 vs. 2(31) = 62.

Time = 0.29 (sec) , antiderivative size = 71, normalized size of antiderivative = 1.65

$$\begin{aligned}\int & \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx \\ &= -i\,x - \frac{15\,e^{(7\,x)} - 48i\,e^{(6\,x)} + 9\,e^{(5\,x)} + 96i\,e^{(4\,x)} + 9\,e^{(3\,x)} - 80i\,e^{(2\,x)} + 15\,e^{x} + 32i}{12\left(e^{(2\,x)}-1\right)^4} \\ &\quad - \frac{3}{8}\log\left(e^{x}+1\right) + \frac{3}{8}\log\left(\left|e^{x}-1\right|\right)\end{aligned}$$

input
```
integrate(coth(x)^6/(I+csch(x)),x, algorithm="giac")
```

output
```
-I*x - 1/12*(15*e^(7*x) - 48*I*e^(6*x) + 9*e^(5*x) + 96*I*e^(4*x) + 9*e^(3
*x) - 80*I*e^(2*x) + 15*e^x + 32*I)/(e^(2*x) - 1)^4 - 3/8*log(e^x + 1) + 3
/8*log(abs(e^x - 1))
```

### 3.112.9 Mupad [B] (verification not implemented)

Time = 2.61 (sec) , antiderivative size = 106, normalized size of antiderivative = 2.47

$$\int \frac{\coth^6(x)}{i+\operatorname{csch}(x)}\,dx = \frac{3\ln\left(\frac{3}{4}-\frac{3e^x}{4}\right)}{8} - x\,1\mathrm{i} - \frac{3\ln\left(\frac{3e^x}{4}+\frac{3}{4}\right)}{8} - \frac{5e^x}{4\left(e^{2x}-1\right)} - \frac{9e^x}{2\left(e^{2x}-1\right)^2} - \frac{6e^x}{\left(e^{2x}-1\right)^3} - \frac{4e^x}{\left(e^{2x}-1\right)^4} + \frac{4\mathrm{i}}{e^{2x}-1} + \frac{4\mathrm{i}}{\left(e^{2x}-1\right)^2} + \frac{8\mathrm{i}}{3\left(e^{2x}-1\right)^3}$$

input
```
int(coth(x)^6/(1/sinh(x) + 1i),x)
```

output
```
(3*log(3/4 - (3*exp(x))/4))/8 - x*1i - (3*log((3*exp(x))/4 + 3/4))/8 - (5*
exp(x))/(4*(exp(2*x) - 1)) - (9*exp(x))/(2*(exp(2*x) - 1)^2) - (6*exp(x))/
(exp(2*x) - 1)^3 - (4*exp(x))/(exp(2*x) - 1)^4 + 4i/(exp(2*x) - 1) + 4i/(e
xp(2*x) - 1)^2 + 8i/(3*(exp(2*x) - 1)^3)
```

# 3.113 $\int \frac{\tanh^5(x)}{a+b\mathbf{csch}(x)}\,dx$

3.113.1 Optimal result . . . 772
3.113.2 Mathematica [C] (verified) . . . 773
3.113.3 Rubi [A] (verified) . . . 773
3.113.4 Maple [A] (verified) . . . 775
3.113.5 Fricas [B] (verification not implemented) . . . 776
3.113.6 Sympy [F] . . . 776
3.113.7 Maxima [B] (verification not implemented) . . . 777
3.113.8 Giac [B] (verification not implemented) . . . 777
3.113.9 Mupad [B] (verification not implemented) . . . 778

## 3.113.1 Optimal result

Integrand size = 13, antiderivative size = 194

$$\begin{aligned}\int \frac{\tanh^5(x)}{a+b\operatorname{csch}(x)}\,dx = &-\frac{b^5\arctan(\sinh(x))}{(a^2+b^2)^3} - \frac{b^3\arctan(\sinh(x))}{2(a^2+b^2)^2}\\ &- \frac{3b\arctan(\sinh(x))}{8(a^2+b^2)} + \frac{b^6\log(a+b\operatorname{csch}(x))}{a(a^2+b^2)^3} + \frac{\log(\sinh(x))}{a}\\ &- \frac{a(a^4+3a^2b^2+3b^4)\log(\tanh(x))}{(a^2+b^2)^3} + \frac{3b\operatorname{sech}(x)\tanh(x)}{8(a^2+b^2)}\\ &- \frac{(a(a^2+2b^2)-b^3\operatorname{csch}(x))\tanh^2(x)}{2(a^2+b^2)^2} - \frac{(a-b\operatorname{csch}(x))\tanh^4(x)}{4(a^2+b^2)}\end{aligned}$$

output

```
-b^5*arctan(sinh(x))/(a^2+b^2)^3-1/2*b^3*arctan(sinh(x))/(a^2+b^2)^2-3/8*b
*arctan(sinh(x))/(a^2+b^2)+b^6*ln(a+b*csch(x))/a/(a^2+b^2)^3+ln(sinh(x))/a
-a*(a^4+3*a^2*b^2+3*b^4)*ln(tanh(x))/(a^2+b^2)^3+3/8*b*sech(x)*tanh(x)/(a^
2+b^2)-1/2*(a*(a^2+2*b^2)-b^3*csch(x))*tanh(x)^2/(a^2+b^2)^2-1/4*(a-b*csch
(x))*tanh(x)^4/(a^2+b^2)
```

### 3.113.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.34 (sec) , antiderivative size = 253, normalized size of antiderivative = 1.30

$$\int \frac{\tanh^5(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{ab(5a^4+14a^2b^2+9b^4)\arctan(\sinh(x)) + 4a(a^5+ia^4b+3a^3b^2+3ia^2b^3+3ab^4+3ib^5)\log(i-\sinh(x)) +$$

input
```
Integrate[Tanh[x]^5/(a + b*Csch[x]),x]
```

output
```
(a*b*(5*a^4 + 14*a^2*b^2 + 9*b^4)*ArcTan[Sinh[x]] + 4*a*(a^5 + I*a^4*b + 3
*a^3*b^2 + (3*I)*a^2*b^3 + 3*a*b^4 + (3*I)*b^5)*Log[I - Sinh[x]] + 4*a*(a^
5 - I*a^4*b + 3*a^3*b^2 - (3*I)*a^2*b^3 + 3*a*b^4 - (3*I)*b^5)*Log[I + Sin
h[x]] + 8*b^6*Log[b + a*Sinh[x]] + 4*a^2*(2*a^4 + 5*a^2*b^2 + 3*b^4)*Sech[
x]^2 - 2*a^2*(a^2 + b^2)^2*Sech[x]^4 + a*b*(5*a^4 + 14*a^2*b^2 + 9*b^4)*Se
ch[x]*Tanh[x] - 2*a*b*(a^2 + b^2)^2*Sech[x]^3*Tanh[x])/(8*a*(a^2 + b^2)^3)
```

### 3.113.3 Rubi [A] (verified)

Time = 0.49 (sec) , antiderivative size = 257, normalized size of antiderivative = 1.32, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 4373, 25, 615, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^5(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i}{\cot(ix)^5(a+ib\csc(ix))}dx$$
$$\downarrow 26$$
$$-i\int \frac{1}{\cot(ix)^5(a+ib\csc(ix))}dx$$
$$\downarrow 4373$$

$$b^6 \int -\frac{\sinh(x)}{b(a+b\operatorname{csch}(x))\left(\operatorname{csch}^2(x)b^2+b^2\right)^3} d(b\operatorname{csch}(x))$$

$$\downarrow 25$$

$$-b^6 \int \frac{\sinh(x)}{b(a+b\operatorname{csch}(x))\left(\operatorname{csch}^2(x)b^2+b^2\right)^3} d(b\operatorname{csch}(x))$$

$$\downarrow 615$$

$$-b^6 \int \left( \frac{-b^2-a\operatorname{csch}(x)b}{b^2\left(a^2+b^2\right)\left(\operatorname{csch}^2(x)b^2+b^2\right)^3} + \frac{\sinh(x)}{ab^7} - \frac{1}{a\left(a^2+b^2\right)^3(a+b\operatorname{csch}(x))} + \frac{-b^6-a\left(a^4+3b^2a^2+3b^4\right)\csc}{b^6\left(a^2+b^2\right)^3\left(\operatorname{csch}^2(x)b^2+\right.}\right.$$

$$\downarrow 2009$$

$$b^6 \left( \frac{\arctan(\operatorname{csch}(x))}{b\left(a^2+b^2\right)^3} + \frac{3\arctan(\operatorname{csch}(x))}{8b^5\left(a^2+b^2\right)} + \frac{\arctan(\operatorname{csch}(x))}{2b^3\left(a^2+b^2\right)^2} - \frac{a-b\operatorname{csch}(x)}{4b^2\left(a^2+b^2\right)\left(b^2\operatorname{csch}^2(x)+b^2\right)^2} + \frac{\log(a+b\operatorname{csch}(x}{a\left(a^2+b^2\right)^3} \right.$$

input
```
Int[Tanh[x]^5/(a + b*Csch[x]),x]
```

output
```
b^6*(ArcTan[Csch[x]]/(b*(a^2 + b^2)^3) + ArcTan[Csch[x]]/(2*b^3*(a^2 + b^2
)^2) + (3*ArcTan[Csch[x]])/(8*b^5*(a^2 + b^2)) - (a - b*Csch[x])/(4*b^2*(a
^2 + b^2)*(b^2 + b^2*Csch[x]^2)^2) + (3*Csch[x])/(8*b^3*(a^2 + b^2)*(b^2 +
 b^2*Csch[x]^2)) - (a*(a^2 + 2*b^2) - b^3*Csch[x])/(2*b^4*(a^2 + b^2)^2*(b
^2 + b^2*Csch[x]^2)) - Log[b*Csch[x]]/(a*b^6) + Log[a + b*Csch[x]]/(a*(a^2
 + b^2)^3) + (a*(a^4 + 3*a^2*b^2 + 3*b^4)*Log[b^2 + b^2*Csch[x]^2])/(2*b^6
*(a^2 + b^2)^3))
```

### 3.113.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 615
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_)*((a_) + (b_.)*(x_)^2)^(p_),
 x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x], x]
 /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

### 3.113.4 Maple [A] (verified)

Time = 0.81 (sec) , antiderivative size = 364, normalized size of antiderivative = 1.88

| method | result |
|---|---|
| default | $\frac{2\left(\left(-\frac{3}{8}a^4b-\frac{5}{4}a^2b^3-\frac{7}{8}b^5\right)\tanh\left(\frac{x}{2}\right)^7+\left(-a^5-3a^3b^2-2ab^4\right)\tanh\left(\frac{x}{2}\right)^6+\left(-\frac{13}{4}a^2b^3-\frac{15}{8}b^5-\frac{11}{8}a^4b\right)\tanh\left(\frac{x}{2}\right)^5+\left(-4a^5-10a^3b^2-6ab^4\right)\tanh\left(\frac{x}{2}\right)$ <br> $\left(1+\tanh\left(\frac{x}{2}\right)^2\right)^4$ |
| risch | $\frac{x}{a}-\frac{2xa^5}{a^6+3a^4b^2+3a^2b^4+b^6}-\frac{6xa^3b^2}{a^6+3a^4b^2+3a^2b^4+b^6}-\frac{6xab^4}{a^6+3a^4b^2+3a^2b^4+b^6}-\frac{2xb^6}{a(a^6+3a^4b^2+3a^2b^4+b^6)}+\frac{(5a^2b\,e^{6x}+9b^3e^{6x}$ |

input
```
int(tanh(x)^5/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
2/(a^4+2*a^2*b^2+b^4)/(a^2+b^2)*(((-3/8*a^4*b-5/4*a^2*b^3-7/8*b^5)*tanh(1/
2*x)^7+(-a^5-3*a^3*b^2-2*a*b^4)*tanh(1/2*x)^6+(-13/4*a^2*b^3-15/8*b^5-11/8
*a^4*b)*tanh(1/2*x)^5+(-4*a^5-10*a^3*b^2-6*a*b^4)*tanh(1/2*x)^4+(13/4*a^2*
b^3+15/8*b^5+11/8*a^4*b)*tanh(1/2*x)^3+(-a^5-3*a^3*b^2-2*a*b^4)*tanh(1/2*x
)^2+(3/8*a^4*b+5/4*a^2*b^3+7/8*b^5)*tanh(1/2*x))/(1+tanh(1/2*x)^2)^4+1/16*
(8*a^5+24*a^3*b^2+24*a*b^4)*ln(1+tanh(1/2*x)^2)+1/8*(-3*a^4*b-10*a^2*b^3-1
5*b^5)*arctan(tanh(1/2*x)))-1/a*ln(tanh(1/2*x)-1)-1/a*ln(tanh(1/2*x)+1)+b^
6/(a^4+2*a^2*b^2+b^4)/(a^2+b^2)/a*ln(-tanh(1/2*x)^2*b+2*a*tanh(1/2*x)+b)
```

### 3.113.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 4025 vs. 2(185) = 370.

Time = 0.37 (sec) , antiderivative size = 4025, normalized size of antiderivative = 20.75

$$\int \frac{\tanh^5(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(tanh(x)^5/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-1/4*(4*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x)^8 + 4*(a^6 + 3*a^4*b
^2 + 3*a^2*b^4 + b^6)*x*sinh(x)^8 - (5*a^5*b + 14*a^3*b^3 + 9*a*b^5)*cosh(
x)^7 - (5*a^5*b + 14*a^3*b^3 + 9*a*b^5 - 32*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 +
 b^6)*x*cosh(x))*sinh(x)^7 - 8*(2*a^6 + 5*a^4*b^2 + 3*a^2*b^4 - 2*(a^6 + 3
*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(x)^6 - (16*a^6 + 40*a^4*b^2 + 24*a^2*b
^4 - 112*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x)^2 - 16*(a^6 + 3*a^4
*b^2 + 3*a^2*b^4 + b^6)*x + 7*(5*a^5*b + 14*a^3*b^3 + 9*a*b^5)*cosh(x))*si
nh(x)^6 + (3*a^5*b + 2*a^3*b^3 - a*b^5)*cosh(x)^5 + (3*a^5*b + 2*a^3*b^3 -
 a*b^5 + 224*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x)^3 - 21*(5*a^5*b
 + 14*a^3*b^3 + 9*a*b^5)*cosh(x)^2 - 48*(2*a^6 + 5*a^4*b^2 + 3*a^2*b^4 - 2
*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(x))*sinh(x)^5 - 8*(2*a^6 + 6*
a^4*b^2 + 4*a^2*b^4 - 3*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(x)^4 -
 (16*a^6 + 48*a^4*b^2 + 32*a^2*b^4 - 280*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^
6)*x*cosh(x)^4 + 35*(5*a^5*b + 14*a^3*b^3 + 9*a*b^5)*cosh(x)^3 + 120*(2*a^
6 + 5*a^4*b^2 + 3*a^2*b^4 - 2*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(
x)^2 - 24*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x - 5*(3*a^5*b + 2*a^3*b^3 -
 a*b^5)*cosh(x))*sinh(x)^4 - (3*a^5*b + 2*a^3*b^3 - a*b^5)*cosh(x)^3 + (22
4*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x)^5 - 3*a^5*b - 2*a^3*b^3 +
a*b^5 - 35*(5*a^5*b + 14*a^3*b^3 + 9*a*b^5)*cosh(x)^4 - 160*(2*a^6 + 5*a^4
*b^2 + 3*a^2*b^4 - 2*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(x)^3 +...
```

### 3.113.6 Sympy [F]

$$\int \frac{\tanh^5(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\tanh^5(x)}{a + b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(tanh(x)**5/(a+b*csch(x)),x)
```

output
```
Integral(tanh(x)**5/(a + b*csch(x)), x)
```

### 3.113.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 383 vs. 2(185) = 370.

Time = 0.29 (sec) , antiderivative size = 383, normalized size of antiderivative = 1.97

$$\int \frac{\tanh^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^6\log\left(-2be^{(-x)}+ae^{(-2x)}-a\right)}{a^7+3a^5b^2+3a^3b^4+ab^6}$$
$$+\frac{\left(3a^4b+10a^2b^3+15b^5\right)\arctan\left(e^{(-x)}\right)}{4\left(a^6+3a^4b^2+3a^2b^4+b^6\right)}+\frac{\left(a^5+3a^3b^2+3ab^4\right)\log\left(e^{(-2x)}+1\right)}{a^6+3a^4b^2+3a^2b^4+b^6}$$
$$+\frac{(5a^2b+9b^3)e^{(-x)}+8\left(2a^3+3ab^2\right)e^{(-2x)}-(3a^2b-b^3)e^{(-3x)}+16\left(a^3+2ab^2\right)e^{(-4x)}+(3a^2b-b^3)e^{(-}}{4\left(a^4+2a^2b^2+b^4+4\left(a^4+2a^2b^2+b^4\right)e^{(-2x)}+6\left(a^4+2a^2b^2+b^4\right)e^{(-4x)}+4\left(a^4+2a^2b^2-\right.\right.}$$
$$+\frac{x}{a}$$

input
```
integrate(tanh(x)^5/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
b^6*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a^7 + 3*a^5*b^2 + 3*a^3*b^4 + a*b^6
) + 1/4*(3*a^4*b + 10*a^2*b^3 + 15*b^5)*arctan(e^(-x))/(a^6 + 3*a^4*b^2 +
3*a^2*b^4 + b^6) + (a^5 + 3*a^3*b^2 + 3*a*b^4)*log(e^(-2*x) + 1)/(a^6 + 3*
a^4*b^2 + 3*a^2*b^4 + b^6) + 1/4*((5*a^2*b + 9*b^3)*e^(-x) + 8*(2*a^3 + 3*
a*b^2)*e^(-2*x) - (3*a^2*b - b^3)*e^(-3*x) + 16*(a^3 + 2*a*b^2)*e^(-4*x) +
 (3*a^2*b - b^3)*e^(-5*x) + 8*(2*a^3 + 3*a*b^2)*e^(-6*x) - (5*a^2*b + 9*b^
3)*e^(-7*x))/(a^4 + 2*a^2*b^2 + b^4 + 4*(a^4 + 2*a^2*b^2 + b^4)*e^(-2*x) +
 6*(a^4 + 2*a^2*b^2 + b^4)*e^(-4*x) + 4*(a^4 + 2*a^2*b^2 + b^4)*e^(-6*x) +
 (a^4 + 2*a^2*b^2 + b^4)*e^(-8*x)) + x/a
```

### 3.113.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 432 vs. 2(185) = 370.

Time = 0.30 (sec) , antiderivative size = 432, normalized size of antiderivative = 2.23

$$\int \frac{\tanh^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^6\log\left(\left|-a\left(e^{(-x)}-e^{x}\right)+2b\right|\right)}{a^7+3a^5b^2+3a^3b^4+ab^6}$$
$$-\frac{\left(\pi+2\arctan\left(\frac{1}{2}\left(e^{(2x)}-1\right)e^{(-x)}\right)\right)\left(3a^4b+10a^2b^3+15b^5\right)}{16\left(a^6+3a^4b^2+3a^2b^4+b^6\right)}$$
$$+\frac{\left(a^5+3a^3b^2+3ab^4\right)\log\left(\left(e^{(-x)}-e^{x}\right)^2+4\right)}{2\left(a^6+3a^4b^2+3a^2b^4+b^6\right)}$$
$$-\frac{3a^5\left(e^{(-x)}-e^{x}\right)^4+9a^3b^2\left(e^{(-x)}-e^{x}\right)^4+9ab^4\left(e^{(-x)}-e^{x}\right)^4+5a^4b\left(e^{(-x)}-e^{x}\right)^3+14a^2b^3\left(e^{(-x)}-e^{x}\right)^3}$$

input
```
integrate(tanh(x)^5/(a+b*csch(x)),x, algorithm="giac")
```

output
```
b^6*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a^7 + 3*a^5*b^2 + 3*a^3*b^4 + a*b^6
) - 1/16*(pi + 2*arctan(1/2*(e^(2*x) - 1)*e^(-x)))*(3*a^4*b + 10*a^2*b^3 +
 15*b^5)/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6) + 1/2*(a^5 + 3*a^3*b^2 + 3*a*
b^4)*log((e^(-x) - e^x)^2 + 4)/(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6) - 1/4*(
3*a^5*(e^(-x) - e^x)^4 + 9*a^3*b^2*(e^(-x) - e^x)^4 + 9*a*b^4*(e^(-x) - e^
x)^4 + 5*a^4*b*(e^(-x) - e^x)^3 + 14*a^2*b^3*(e^(-x) - e^x)^3 + 9*b^5*(e^(
-x) - e^x)^3 + 8*a^5*(e^(-x) - e^x)^2 + 32*a^3*b^2*(e^(-x) - e^x)^2 + 48*a
*b^4*(e^(-x) - e^x)^2 + 12*a^4*b*(e^(-x) - e^x) + 40*a^2*b^3*(e^(-x) - e^x
) + 28*b^5*(e^(-x) - e^x) + 16*a^3*b^2 + 64*a*b^4)/((a^6 + 3*a^4*b^2 + 3*a
^2*b^4 + b^6)*((e^(-x) - e^x)^2 + 4)^2)
```

### 3.113.9 Mupad [B] (verification not implemented)

Time = 7.33 (sec) , antiderivative size = 611, normalized size of antiderivative = 3.15

$$\int \frac{\tanh^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{6\,e^x\,(a^2\,b+b^3)}{(a^2+b^2)^2}+\frac{8\,(a^4+a^2\,b^2)}{a\,(a^2+b^2)^2}}{3\,e^{2\,x}+3\,e^{4\,x}+e^{6\,x}+1}$$
$$-\frac{\frac{4\,a}{a^2+b^2}+\frac{4\,b\,e^x}{a^2+b^2}}{4\,e^{2\,x}+6\,e^{4\,x}+4\,e^{6\,x}+e^{8\,x}+1}-\frac{x}{a}-\frac{\frac{e^x\,(9\,a^2\,b+13\,b^3)}{2\,(a^2+b^2)^2}+\frac{2\,(4\,a^4+5\,a^2\,b^2)}{a\,(a^2+b^2)^2}}{2\,e^{2\,x}+e^{4\,x}+1}$$
$$+\frac{\frac{e^x\,(5\,a^4\,b+14\,a^2\,b^3+9\,b^5)}{4\,(a^2+b^2)^3}+\frac{2\,(2\,a^6+5\,a^4\,b^2+3\,a^2\,b^4)}{a\,(a^2+b^2)^3}}{e^{2\,x}+1}+\frac{\ln\left(1+e^x\,1\mathrm{i}\right)\,\left(-8\,a^2+a\,b\,21\mathrm{i}+15\,b^2\right)}{8\,\left(-a^3+a^2\,b\,3\mathrm{i}+3\,a\,b^2-b^3\,1\mathrm{i}\right)}$$
$$+\frac{b^6\,\ln\left(64\,a^{13}\,e^{2\,x}-64\,a\,b^{12}-64\,a^{13}+159\,a^3\,b^{10}-492\,a^5\,b^8-1214\,a^7\,b^6-1020\,a^9\,b^4-393\,a^{11}\,b^2+128\right.}{}$$
$$+\frac{\ln\left(e^x+1\mathrm{i}\right)\,\left(-a^2\,8\mathrm{i}+21\,a\,b+b^2\,15\mathrm{i}\right)}{8\,\left(-a^3\,1\mathrm{i}+3\,a^2\,b+a\,b^2\,3\mathrm{i}-b^3\right)}$$

input
```
int(tanh(x)^5/(a + b/sinh(x)),x)
```

output

```
((6*exp(x)*(a^2*b + b^3))/(a^2 + b^2)^2 + (8*(a^4 + a^2*b^2))/(a*(a^2 + b^
2)^2))/(3*exp(2*x) + 3*exp(4*x) + exp(6*x) + 1) - ((4*a)/(a^2 + b^2) + (4*
b*exp(x))/(a^2 + b^2))/(4*exp(2*x) + 6*exp(4*x) + 4*exp(6*x) + exp(8*x) +
1) - x/a - ((exp(x)*(9*a^2*b + 13*b^3))/(2*(a^2 + b^2)^2) + (2*(4*a^4 + 5*
a^2*b^2))/(a*(a^2 + b^2)^2))/(2*exp(2*x) + exp(4*x) + 1) + ((exp(x)*(5*a^4
*b + 9*b^5 + 14*a^2*b^3))/(4*(a^2 + b^2)^3) + (2*(2*a^6 + 3*a^2*b^4 + 5*a^
4*b^2))/(a*(a^2 + b^2)^3))/(exp(2*x) + 1) + (log(exp(x)*1i + 1)*(a*b*21i -
 8*a^2 + 15*b^2))/(8*(3*a*b^2 + a^2*b*3i - a^3 - b^3*1i)) + (b^6*log(64*a^
13*exp(2*x) - 64*a*b^12 - 64*a^13 + 159*a^3*b^10 - 492*a^5*b^8 - 1214*a^7*
b^6 - 1020*a^9*b^4 - 393*a^11*b^2 + 128*b^13*exp(x) - 159*a^3*b^10*exp(2*x
) + 492*a^5*b^8*exp(2*x) + 1214*a^7*b^6*exp(2*x) + 1020*a^9*b^4*exp(2*x) +
 393*a^11*b^2*exp(2*x) + 128*a^12*b*exp(x) + 64*a*b^12*exp(2*x) - 318*a^2*
b^11*exp(x) + 984*a^4*b^9*exp(x) + 2428*a^6*b^7*exp(x) + 2040*a^8*b^5*exp(
x) + 786*a^10*b^3*exp(x)))/(a*b^6 + a^7 + 3*a^3*b^4 + 3*a^5*b^2) + (log(ex
p(x) + 1i)*(21*a*b - a^2*8i + b^2*15i))/(8*(a*b^2*3i + 3*a^2*b - a^3*1i -
b^3))
```

# 3.114 $\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx$

3.114.1 Optimal result . . . 780
3.114.2 Mathematica [A] (verified) . . . 781
3.114.3 Rubi [F] . . . 781
3.114.4 Maple [A] (verified) . . . 789
3.114.5 Fricas [B] (verification not implemented) . . . 790
3.114.6 Sympy [F] . . . 791
3.114.7 Maxima [A] (verification not implemented) . . . 791
3.114.8 Giac [A] (verification not implemented) . . . 792
3.114.9 Mupad [B] (verification not implemented) . . . 792

## 3.114.1 Optimal result

Integrand size = 13, antiderivative size = 183

$$\begin{aligned}\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx = {}& \frac{ab^2x}{(a^2+b^2)^2} + \frac{b^4x}{a(a^2+b^2)^2} + \frac{ax}{a^2+b^2} \\ & + \frac{2b^5\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a(a^2+b^2)^{5/2}} + \frac{b^3\operatorname{sech}(x)}{(a^2+b^2)^2} + \frac{b\operatorname{sech}(x)}{a^2+b^2} \\ & - \frac{b\operatorname{sech}^3(x)}{3(a^2+b^2)} - \frac{ab^2\tanh(x)}{(a^2+b^2)^2} - \frac{a\tanh(x)}{a^2+b^2} - \frac{a\tanh^3(x)}{3(a^2+b^2)}\end{aligned}$$

output

```
a*b^2*x/(a^2+b^2)^2+b^4*x/a/(a^2+b^2)^2+a*x/(a^2+b^2)+2*b^5*arctanh((a-b*t
anh(1/2*x))/(a^2+b^2)^(1/2))/a/(a^2+b^2)^(5/2)+b^3*sech(x)/(a^2+b^2)^2+b*s
ech(x)/(a^2+b^2)-1/3*b*sech(x)^3/(a^2+b^2)-a*b^2*tanh(x)/(a^2+b^2)^2-a*tan
h(x)/(a^2+b^2)-1/3*a*tanh(x)^3/(a^2+b^2)
```

### 3.114.2 Mathematica [A] (verified)

Time = 0.62 (sec) , antiderivative size = 141, normalized size of antiderivative = 0.77

$$\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{1}{3}\left(\frac{3\left(x - \frac{2b^5 \arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{(-a^2-b^2)^{5/2}}\right)}{a} + \frac{3b(a^2+2b^2)\operatorname{sech}(x)}{(a^2+b^2)^2} - \frac{b\operatorname{sech}^3(x)}{a^2+b^2} - \frac{a(4a^2+7b^2)\tanh(x)}{(a^2+b^2)^2} + \frac{a\operatorname{sech}^2(x)\tanh(x)}{a^2+b^2}\right)$$

input
```
Integrate[Tanh[x]^4/(a + b*Csch[x]),x]
```

output
```
((3*(x - (2*b^5*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/(-a^2 - b^2)^(
5/2)))/a + (3*b*(a^2 + 2*b^2)*Sech[x])/(a^2 + b^2)^2 - (b*Sech[x]^3)/(a^2
+ b^2) - (a*(4*a^2 + 7*b^2)*Tanh[x])/(a^2 + b^2)^2 + (a*Sech[x]^2*Tanh[x])
/(a^2 + b^2))/3
```

### 3.114.3 Rubi [F]

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{1}{\cot(ix)^4(a+ib\csc(ix))}dx$$
$$\downarrow 4386$$
$$\int \frac{i\sinh(x)\tanh^4(x)}{ia\sinh(x)+ib}dx$$

$$\downarrow 26$$

$$i\int -\frac{i\sinh(x)\tanh^4(x)}{b+a\sinh(x)}dx$$

$$\downarrow 26$$

$$\int \frac{\sinh(x)\tanh^4(x)}{a\sinh(x)+b}dx$$

$$\downarrow 3042$$

$$\int -\frac{i\sin(ix)^5}{\cos(ix)^4(b-ia\sin(ix))}dx$$

$$\downarrow 26$$

$$-i\int \frac{\sin(ix)^5}{\cos(ix)^4(b-ia\sin(ix))}dx$$

$$\downarrow 3381$$

$$-i\left(\frac{ia\int \tanh^4(x)dx}{a^2+b^2}-\frac{b^2\int -\frac{i\sinh(x)\tanh^2(x)}{b+a\sinh(x)}dx}{a^2+b^2}+\frac{b\int -i\operatorname{sech}(x)\tanh^3(x)dx}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{ia\int \tanh^4(x)dx}{a^2+b^2}+\frac{ib^2\int \frac{\sinh(x)\tanh^2(x)}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{ib\int \operatorname{sech}(x)\tanh^3(x)dx}{a^2+b^2}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{ia\int \tan(ix)^4dx}{a^2+b^2}+\frac{ib^2\int \frac{i\sin(ix)^3}{\cos(ix)^2(b-ia\sin(ix))}dx}{a^2+b^2}-\frac{ib\int i\sec(ix)\tan(ix)^3dx}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{ia\int \tan(ix)^4dx}{a^2+b^2}-\frac{b^2\int \frac{\sin(ix)^3}{\cos(ix)^2(b-ia\sin(ix))}dx}{a^2+b^2}+\frac{b\int \sec(ix)\tan(ix)^3dx}{a^2+b^2}\right)$$

$$\downarrow 3086$$

$$-i\left(\frac{ia\int \tan(ix)^4dx}{a^2+b^2}-\frac{ib\int \left(\operatorname{sech}^2(x)-1\right)d\operatorname{sech}(x)}{a^2+b^2}-\frac{b^2\int \frac{\sin(ix)^3}{\cos(ix)^2(b-ia\sin(ix))}dx}{a^2+b^2}\right)$$

$$\downarrow 2009$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\int\frac{\sin(ix)^3}{\cos(ix)^2(b-ia\sin(ix))}dx}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 3381$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\int\frac{i\sinh(x)}{b+a\sinh(x)}dx}{a^2+b^2}+\frac{ia\int-\tanh^2(x)dx}{a^2+b^2}+\frac{b\int i\text{sech}(x)\tanh(x)dx}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 25$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\int\frac{i\sinh(x)}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{ia\int\tanh^2(x)dx}{a^2+b^2}+\frac{b\int i\text{sech}(x)\tanh(x)dx}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{ib^2\int\frac{\sinh(x)}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{ia\int\tanh^2(x)dx}{a^2+b^2}+\frac{ib\int\text{sech}(x)\tanh(x)dx}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{ib^2\int-\frac{i\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}-\frac{ia\int-\tan(ix)^2dx}{a^2+b^2}+\frac{ib\int-i\sec(ix)\tan(ix)dx}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 25$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{ib^2\int-\frac{i\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}+\frac{ib\int-i\sec(ix)\tan(ix)dx}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\int\frac{\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}+\frac{b\int\sec(ix)\tan(ix)dx}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 3086$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\int\frac{\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{ib\int 1d\text{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 24$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\int\frac{\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 3214$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{ix}{a}-\frac{ib\int\frac{1}{b+a\sinh(x)}dx}{a}\right)}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\left(\frac{ix}{a}-\frac{ib\int\frac{1}{b-ia\sin(ix)}dx}{a}\right)}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\text{sech}^3(x)}{3}-\text{sech}(x)\right)}{a^2+b^2}\right)$$

$$\downarrow 3139$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{ix}{a}-\frac{2ib\int\frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{a}\right)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\frac{\operatorname{sech}^3(x)}{3}\right.}{a^2+}\right)$$

$$\downarrow 1083$$

$$-i\left(\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{b^2\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{4ib\int\frac{1}{4\left(a^2+b^2\right)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{a}+\frac{ix}{a}\right)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\right.}{}\right)$$

$$\downarrow 219$$

$$-i\left(-\frac{b^2\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}+\frac{ia\int\tan(ix)^4dx}{a^2+b^2}-\frac{ib\left(\frac{\operatorname{sech}^3(x)}{3}-\operatorname{sech}\right.}{a^2+b^2}\right)$$

$$\downarrow 3954$$

$$-i\left(-\frac{b^2\left(\frac{ia(\tanh(x)-\int 1dx)}{a^2+b^2}-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}+\frac{ia\left(-\int-\tanh^2(x)dx-\frac{1}{3}\tanh^3(x)\right.}{a^2+b^2}\right.$$

$$\downarrow 24$$

$$-i\left(\frac{ia\left(-\int-\tanh^2(x)dx-\frac{1}{3}\tanh^3(x)\right)}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}+\frac{ia(\tanh(x)-x)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\right.$$

$$\downarrow 25$$

$$-i\left(\frac{ia\left(\int\tanh^2(x)dx-\frac{\tanh^3(x)}{3}\right)}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}+\frac{ia(\tanh(x)-x)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib\left(\operatorname{se}\right.}{a^2+b^2}\right.$$

$$\downarrow 3042$$

$$-i\left(\frac{ia\left(-\frac{\tanh^3(x)}{3}+\int-\tan(ix)^2dx\right)}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}+\frac{ia(\tanh(x)-x)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib}{}\right.$$

$$\downarrow 25$$

$$-i\left(\frac{ia\left(-\frac{1}{3}\tanh^3(x)-\int\tan(ix)^2dx\right)}{a^2+b^2}-\frac{b^2\left(-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}+\frac{ia(\tanh(x)-x)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)}{a^2+b^2}-\frac{ib}{}\right.$$

input
```
Int[Tanh[x]^4/(a + b*Csch[x]),x]
```

output
```
$Aborted
```

### 3.114.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3086
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_.), x_Symbol] :> Simp[a/f   Subst[Int[(a*x)^(m - 1)*(-1 + x^2)^((n - 1)/2
), x], x, Sec[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2
] &&  !(IntegerQ[m/2] && LtQ[0, m, n + 1])
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3214
```
Int[((a_.) + (b_.)*sin[(e_.) + (f_.)*(x_)])/((c_.) + (d_.)*sin[(e_.) + (f_.
)*(x_)]), x_Symbol] :> Simp[b*(x/d), x] - Simp[(b*c - a*d)/d   Int[1/(c + d
*Sin[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c - a*d, 0]
```

rule 3381
```
Int[((cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(
n_))/((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[a*(d^2/(a^2
- b^2))   Int[(g*Cos[e + f*x])^p*(d*Sin[e + f*x])^(n - 2), x], x] + (-Simp[
b*(d/(a^2 - b^2))   Int[(g*Cos[e + f*x])^p*(d*Sin[e + f*x])^(n - 1), x], x]
 - Simp[a^2*(d^2/(g^2*(a^2 - b^2)))   Int[(g*Cos[e + f*x])^(p + 2)*((d*Sin[
e + f*x])^(n - 2)/(a + b*Sin[e + f*x])), x], x]) /; FreeQ[{a, b, d, e, f, g
}, x] && NeQ[a^2 - b^2, 0] && IntegersQ[2*n, 2*p] && LtQ[p, -1] && GtQ[n, 1
]
```

rule 3954
```
Int[((b_.)*tan[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[b*((b*Tan[c + d
*x])^(n - 1)/(d*(n - 1))), x] - Simp[b^2   Int[(b*Tan[c + d*x])^(n - 2), x]
, x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
```

rule 4386
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Int[Cos[c + d*x]^m*((b + a*Sin[c + d*x])^n/Sin[c + d*x]^(m
 + n)), x] /; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && IntegerQ[n] &&
 IntegerQ[m] && (IntegerQ[m/2] || LeQ[m, 1])
```

### 3.114.4 Maple [A] (verified)

Time = 0.47 (sec) , antiderivative size = 207, normalized size of antiderivative = 1.13

| method | result |
|---|---|
| default | $-\frac{\ln(\tanh(\frac{x}{2})-1)}{a}+\frac{\ln(\tanh(\frac{x}{2})+1)}{a}+\frac{2(-a^3-2ab^2)\tanh(\frac{x}{2})^5+2b^3\tanh(\frac{x}{2})^4+2(-\frac{10}{3}a^3-\frac{16}{3}ab^2)\tanh(\frac{x}{2})^3+2(2a^2b+4b^3)\tan$ <br> $(a^4+2a^2b^2+b^4)\left(1+\tanh(\frac{x}{2})^2\right)^3$ |
| risch | $\frac{x}{a}+\frac{2a^2b\,e^{5x}+4b^3e^{5x}+4a^3e^{4x}+6ab^2e^{4x}+\frac{4a^2b\,e^{3x}}{3}+\frac{16b^3e^{3x}}{3}+4a^3e^{2x}+8ab^2e^{2x}+2a^2b\,e^x+4b^3e^x+\frac{8a^3}{3}+\frac{14ab^2}{3}}{(a^4+2a^2b^2+b^4)(1+e^{2x})^3}+\frac{b^5\ln\left(e^x+\frac{(a^2+}{}\right.}{}$ |

input
```
int(tanh(x)^4/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/a*ln(tanh(1/2*x)-1)+1/a*ln(tanh(1/2*x)+1)+2/(a^4+2*a^2*b^2+b^4)*((-a^3-
2*a*b^2)*tanh(1/2*x)^5+b^3*tanh(1/2*x)^4+(-10/3*a^3-16/3*a*b^2)*tanh(1/2*x
)^3+(2*a^2*b+4*b^3)*tanh(1/2*x)^2+(-a^3-2*a*b^2)*tanh(1/2*x)+2/3*a^2*b+5/3
*b^3)/(1+tanh(1/2*x)^2)^3+2/a*b^5/(a^4+2*a^2*b^2+b^4)/(a^2+b^2)^(1/2)*arct
anh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2))
```

### 3.114.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1746 vs. $2(175) = 350$.

Time = 0.30 (sec) , antiderivative size = 1746, normalized size of antiderivative = 9.54

$$\int \frac{\tanh^4(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(tanh(x)^4/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/3*(3*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x)^6 + 3*(a^6 + 3*a^4*b^
2 + 3*a^2*b^4 + b^6)*x*sinh(x)^6 + 8*a^6 + 22*a^4*b^2 + 14*a^2*b^4 + 6*(a^
5*b + 3*a^3*b^3 + 2*a*b^5)*cosh(x)^5 + 6*(a^5*b + 3*a^3*b^3 + 2*a*b^5 + 3*
(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x))*sinh(x)^5 + 3*(4*a^6 + 10*a
^4*b^2 + 6*a^2*b^4 + 3*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(x)^4 +
3*(4*a^6 + 10*a^4*b^2 + 6*a^2*b^4 + 15*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)
*x*cosh(x)^2 + 3*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x + 10*(a^5*b + 3*a^3
*b^3 + 2*a*b^5)*cosh(x))*sinh(x)^4 + 4*(a^5*b + 5*a^3*b^3 + 4*a*b^5)*cosh(
x)^3 + 4*(a^5*b + 5*a^3*b^3 + 4*a*b^5 + 15*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 +
b^6)*x*cosh(x)^3 + 15*(a^5*b + 3*a^3*b^3 + 2*a*b^5)*cosh(x)^2 + 3*(4*a^6 +
 10*a^4*b^2 + 6*a^2*b^4 + 3*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x)*cosh(x)
)*sinh(x)^3 + 3*(4*a^6 + 12*a^4*b^2 + 8*a^2*b^4 + 3*(a^6 + 3*a^4*b^2 + 3*a
^2*b^4 + b^6)*x)*cosh(x)^2 + 3*(4*a^6 + 12*a^4*b^2 + 8*a^2*b^4 + 15*(a^6 +
 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x*cosh(x)^4 + 20*(a^5*b + 3*a^3*b^3 + 2*a*b^
5)*cosh(x)^3 + 6*(4*a^6 + 10*a^4*b^2 + 6*a^2*b^4 + 3*(a^6 + 3*a^4*b^2 + 3*
a^2*b^4 + b^6)*x)*cosh(x)^2 + 3*(a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*x + 4*
(a^5*b + 5*a^3*b^3 + 4*a*b^5)*cosh(x))*sinh(x)^2 + 3*(b^5*cosh(x)^6 + 6*b^
5*cosh(x)*sinh(x)^5 + b^5*sinh(x)^6 + 3*b^5*cosh(x)^4 + 3*b^5*cosh(x)^2 +
b^5 + 3*(5*b^5*cosh(x)^2 + b^5)*sinh(x)^4 + 4*(5*b^5*cosh(x)^3 + 3*b^5*cos
h(x))*sinh(x)^3 + 3*(5*b^5*cosh(x)^4 + 6*b^5*cosh(x)^2 + b^5)*sinh(x)^2...
```

### 3.114.6 Sympy [F]

$$\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\tanh^4(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(tanh(x)**4/(a+b*csch(x)),x)
```

output
```
Integral(tanh(x)**4/(a + b*csch(x)), x)
```

### 3.114.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 261, normalized size of antiderivative = 1.43

$$\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^5 \log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{(a^5+2a^3b^2+ab^4)\sqrt{a^2+b^2}}$$
$$-\frac{2\left(4a^3+7ab^2-3(a^2b+2b^3)e^{(-x)}+6(a^3+2ab^2)e^{(-2x)}-2(a^2b+4b^3)e^{(-3x)}+3(2a^3+3ab^2)e^{(-4x)}\right.}{3(a^4+2a^2b^2+b^4+3(a^4+2a^2b^2+b^4)e^{(-2x)}+3(a^4+2a^2b^2+b^4)e^{(-4x)}+(a^4+2a^2b^2+}$$
$$+\frac{x}{a}$$

input
```
integrate(tanh(x)^4/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-b^5*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2))
)/((a^5 + 2*a^3*b^2 + a*b^4)*sqrt(a^2 + b^2)) - 2/3*(4*a^3 + 7*a*b^2 - 3*(
a^2*b + 2*b^3)*e^(-x) + 6*(a^3 + 2*a*b^2)*e^(-2*x) - 2*(a^2*b + 4*b^3)*e^(
-3*x) + 3*(2*a^3 + 3*a*b^2)*e^(-4*x) - 3*(a^2*b + 2*b^3)*e^(-5*x))/(a^4 +
2*a^2*b^2 + b^4 + 3*(a^4 + 2*a^2*b^2 + b^4)*e^(-2*x) + 3*(a^4 + 2*a^2*b^2
+ b^4)*e^(-4*x) + (a^4 + 2*a^2*b^2 + b^4)*e^(-6*x)) + x/a
```

### 3.114.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 215, normalized size of antiderivative = 1.17

$$\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^5 \log\left(\frac{\left|2ae^x+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^x+2b+2\sqrt{a^2+b^2}\right|}\right)}{(a^5+2a^3b^2+ab^4)\sqrt{a^2+b^2}} + \frac{x}{a}$$
$$+\frac{2\left(3a^2be^{(5x)}+6b^3e^{(5x)}+6a^3e^{(4x)}+9ab^2e^{(4x)}+2a^2be^{(3x)}+8b^3e^{(3x)}+6a^3e^{(2x)}+12ab^2e^{(2x)}+3a^2b\right.}{3\left(a^4+2a^2b^2+b^4\right)\left(e^{(2x)}+1\right)^3}$$

input
```
integrate(tanh(x)^4/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-b^5*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt
(a^2 + b^2)))/((a^5 + 2*a^3*b^2 + a*b^4)*sqrt(a^2 + b^2)) + x/a + 2/3*(3*a
^2*b*e^(5*x) + 6*b^3*e^(5*x) + 6*a^3*e^(4*x) + 9*a*b^2*e^(4*x) + 2*a^2*b*e
^(3*x) + 8*b^3*e^(3*x) + 6*a^3*e^(2*x) + 12*a*b^2*e^(2*x) + 3*a^2*b*e^x +
6*b^3*e^x + 4*a^3 + 7*a*b^2)/((a^4 + 2*a^2*b^2 + b^4)*(e^(2*x) + 1)^3)
```

### 3.114.9 Mupad [B] (verification not implemented)

Time = 3.70 (sec) , antiderivative size = 707, normalized size of antiderivative = 3.86

$$\int \frac{\tanh^4(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{x}{a} + \frac{\frac{8a}{3\left(a^2+b^2\right)}+\frac{8b\,e^x}{3\left(a^2+b^2\right)}}{3\,e^{2x}+3\,e^{4x}+e^{6x}+1} - \frac{\frac{8e^x\left(a^2b+b^3\right)}{3\left(a^2+b^2\right)^2}+\frac{4\left(a^4+a^2b^2\right)}{a\left(a^2+b^2\right)^2}}{2\,e^{2x}+e^{4x}+1} + \frac{\frac{2e^x\left(a^2b+2b^3\right)}{\left(a^2+b^2\right)^2}+\frac{2\left(2a^4+3a^2b^2\right)}{a\left(a^2+b^2\right)^2}}{e^{2x}+1}$$
$$+\frac{2\operatorname{atan}\left(\left(e^x\left(\frac{2b^5}{a^3\sqrt{b^{10}}\left(a^2+b^2\right)^2\left(a^5+2a^3b^2+ab^4\right)}+\frac{2\left(2a^3b^3\sqrt{b^{10}}+ab^5\sqrt{b^{10}}+a^5b\sqrt{b^{10}}\right)}{a^2b^4\sqrt{-a^2\left(a^2+b^2\right)^5\left(a^5+2a^3b^2+ab^4\right)}\sqrt{-a^{12}-5a^{10}b^2-10a^8b^4-10a^6b^6-5a}}\right.\right.\right.}{}$$

input
```
int(tanh(x)^4/(a + b/sinh(x)),x)
```

output

```
x/a + ((8*a)/(3*(a^2 + b^2)) + (8*b*exp(x))/(3*(a^2 + b^2)))/(3*exp(2*x) +
 3*exp(4*x) + exp(6*x) + 1) - ((8*exp(x)*(a^2*b + b^3))/(3*(a^2 + b^2)^2)
+ (4*(a^4 + a^2*b^2))/(a*(a^2 + b^2)^2))/(2*exp(2*x) + exp(4*x) + 1) + ((2
*exp(x)*(a^2*b + 2*b^3))/(a^2 + b^2)^2 + (2*(2*a^4 + 3*a^2*b^2))/(a*(a^2 +
 b^2)^2))/(exp(2*x) + 1) + (2*atan((exp(x)*((2*b^5)/(a^3*(b^10)^(1/2)*(a^2
 + b^2)^2*(a*b^4 + a^5 + 2*a^3*b^2)) + (2*(2*a^3*b^3*(b^10)^(1/2) + a*b^5*
(b^10)^(1/2) + a^5*b*(b^10)^(1/2)))/(a^2*b^4*(-a^2*(a^2 + b^2)^5)^(1/2)*(a
*b^4 + a^5 + 2*a^3*b^2)*(- a^12 - a^2*b^10 - 5*a^4*b^8 - 10*a^6*b^6 - 10*a
^8*b^4 - 5*a^10*b^2)^(1/2))) - (2*(a^6*(b^10)^(1/2) + a^2*b^4*(b^10)^(1/2)
 + 2*a^4*b^2*(b^10)^(1/2)))/(a^2*b^4*(-a^2*(a^2 + b^2)^5)^(1/2)*(a*b^4 + a
^5 + 2*a^3*b^2)*(- a^12 - a^2*b^10 - 5*a^4*b^8 - 10*a^6*b^6 - 10*a^8*b^4 -
 5*a^10*b^2)^(1/2)))*((a^6*(- a^12 - a^2*b^10 - 5*a^4*b^8 - 10*a^6*b^6 - 1
0*a^8*b^4 - 5*a^10*b^2)^(1/2))/2 + (a^2*b^4*(- a^12 - a^2*b^10 - 5*a^4*b^8
 - 10*a^6*b^6 - 10*a^8*b^4 - 5*a^10*b^2)^(1/2))/2 + a^4*b^2*(- a^12 - a^2*
b^10 - 5*a^4*b^8 - 10*a^6*b^6 - 10*a^8*b^4 - 5*a^10*b^2)^(1/2)))*(b^10)^(1
/2))/(- a^12 - a^2*b^10 - 5*a^4*b^8 - 10*a^6*b^6 - 10*a^8*b^4 - 5*a^10*b^2
)^(1/2)
```

# 3.115 $\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx$

3.115.1 Optimal result . . . 794
3.115.2 Mathematica [C] (verified) . . . 794
3.115.3 Rubi [A] (verified) . . . 795
3.115.4 Maple [A] (verified) . . . 796
3.115.5 Fricas [B] (verification not implemented) . . . 797
3.115.6 Sympy [F] . . . 798
3.115.7 Maxima [A] (verification not implemented) . . . 798
3.115.8 Giac [B] (verification not implemented) . . . 798
3.115.9 Mupad [B] (verification not implemented) . . . 799

## 3.115.1 Optimal result

Integrand size = 13, antiderivative size = 113

$$\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^3\arctan(\sinh(x))}{(a^2+b^2)^2} - \frac{b\arctan(\sinh(x))}{2(a^2+b^2)} + \frac{b^4\log(a+b\operatorname{csch}(x))}{a(a^2+b^2)^2} + \frac{\log(\sinh(x))}{a} - \frac{a(a^2+2b^2)\log(\tanh(x))}{(a^2+b^2)^2} - \frac{(a-b\operatorname{csch}(x))\tanh^2(x)}{2(a^2+b^2)}$$

output
```
-b^3*arctan(sinh(x))/(a^2+b^2)^2-1/2*b*arctan(sinh(x))/(a^2+b^2)+b^4*ln(a+
b*csch(x))/a/(a^2+b^2)^2+ln(sinh(x))/a-a*(a^2+2*b^2)*ln(tanh(x))/(a^2+b^2)
^2-1/2*(a-b*csch(x))*tanh(x)^2/(a^2+b^2)
```

## 3.115.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.13 (sec) , antiderivative size = 191, normalized size of antiderivative = 1.69

$$\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{ab(a^2+b^2)\arctan(\sinh(x)) + a^4\log(i-\sinh(x)) + ia^3b\log(i-\sinh(x)) + 2a^2b^2\log(i-\sinh(x)) + 2iab^3$$

input
```
Integrate[Tanh[x]^3/(a + b*Csch[x]),x]
```

output
```
(a*b*(a^2 + b^2)*ArcTan[Sinh[x]] + a^4*Log[I - Sinh[x]] + I*a^3*b*Log[I -
Sinh[x]] + 2*a^2*b^2*Log[I - Sinh[x]] + (2*I)*a*b^3*Log[I - Sinh[x]] + a^4
*Log[I + Sinh[x]] - I*a^3*b*Log[I + Sinh[x]] + 2*a^2*b^2*Log[I + Sinh[x]]
- (2*I)*a*b^3*Log[I + Sinh[x]] + 2*b^4*Log[b + a*Sinh[x]] + a^2*(a^2 + b^2
)*Sech[x]^2 + a*b*(a^2 + b^2)*Sech[x]*Tanh[x])/(2*a*(a^2 + b^2)^2)
```

### 3.115.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 151, normalized size of antiderivative = 1.34, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$, Rules used = {3042, 26, 4373, 615, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i}{\cot(ix)^3(a+ib\csc(ix))}dx$$

$$\downarrow 26$$

$$i\int \frac{1}{\cot(ix)^3(a+ib\csc(ix))}dx$$

$$\downarrow 4373$$

$$-b^4\int \frac{\sinh(x)}{b(a+b\operatorname{csch}(x))\left(\operatorname{csch}^2(x)b^2+b^2\right)^2}d(b\operatorname{csch}(x))$$

$$\downarrow 615$$

$$-b^4\int\left(\frac{-b^2-a\operatorname{csch}(x)b}{b^2\left(a^2+b^2\right)\left(\operatorname{csch}^2(x)b^2+b^2\right)^2}+\frac{\sinh(x)}{ab^5}-\frac{1}{a\left(a^2+b^2\right)^2(a+b\operatorname{csch}(x))}+\frac{-b^4-a\left(a^2+2b^2\right)\operatorname{csch}(x)b}{b^4\left(a^2+b^2\right)^2\left(\operatorname{csch}^2(x)b^2+b^2\right)}\right.$$

$$\downarrow 2009$$

$$-b^4\left(-\frac{\arctan(\operatorname{csch}(x))}{b\left(a^2+b^2\right)^2}-\frac{\arctan(\operatorname{csch}(x))}{2b^3\left(a^2+b^2\right)}+\frac{a-b\operatorname{csch}(x)}{2b^2\left(a^2+b^2\right)\left(b^2\operatorname{csch}^2(x)+b^2\right)}-\frac{\log(a+b\operatorname{csch}(x))}{a\left(a^2+b^2\right)^2}-\frac{a\left(a^2+2b^2\right)}{2b^4}\right.$$

input
```
Int[Tanh[x]^3/(a + b*Csch[x]),x]
```

output
```
-(b^4*(-(ArcTan[Csch[x]]/(b*(a^2 + b^2)^2)) - ArcTan[Csch[x]]/(2*b^3*(a^2
+ b^2)) + (a - b*Csch[x])/(2*b^2*(a^2 + b^2)*(b^2 + b^2*Csch[x]^2)) + Log[
b*Csch[x]]/(a*b^4) - Log[a + b*Csch[x]]/(a*(a^2 + b^2)^2) - (a*(a^2 + 2*b^
2)*Log[b^2 + b^2*Csch[x]^2])/(2*b^4*(a^2 + b^2)^2)))
```

### 3.115.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 615
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_)*((a_) + (b_.)*(x_)^2)^(p_),
 x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x], x]
 /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

## 3.115.4 Maple [A] (verified)

Time = 0.45 (sec) , antiderivative size = 182, normalized size of antiderivative = 1.61

| method | result |
|---|---|
| default | $-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)}{a}-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)}{a}+\frac{b^4\ln\left(-\tanh\left(\frac{x}{2}\right)^2b+2a\tanh\left(\frac{x}{2}\right)+b\right)}{a\left(a^2+b^2\right)^2}+\frac{2\left(\left(-\frac{1}{2}a^2b-\frac{1}{2}b^3\right)\tanh\left(\frac{x}{2}\right)^3+\left(-a^3-a\,b^2\right)\tanh\left(\frac{x}{2}\right)$ … $\left(1+\tanh\left(\frac{x}{2}\right)^2\right)^2$ |
| risch | $\frac{x}{a}-\frac{2x\,a^3}{a^4+2a^2b^2+b^4}-\frac{4xa\,b^2}{a^4+2a^2b^2+b^4}-\frac{2x\,b^4}{a\left(a^4+2a^2b^2+b^4\right)}+\frac{\mathrm{e}^x\left(b\,\mathrm{e}^{2x}+2a\,\mathrm{e}^x-b\right)}{\left(1+\mathrm{e}^{2x}\right)^2\left(a^2+b^2\right)}+\frac{i\ln\left(\mathrm{e}^x-i\right)a^2b}{2a^4+4a^2b^2+2b^4}+\frac{3i\ln\left(\mathrm{e}^x-i\right)b^3}{2\left(a^4+2a^2b^2+b^4\right)}+$ … |

input
```
int(tanh(x)^3/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/a*ln(tanh(1/2*x)+1)-1/a*ln(tanh(1/2*x)-1)+b^4/a/(a^2+b^2)^2*ln(-tanh(1/
2*x)^2*b+2*a*tanh(1/2*x)+b)+2/(a^2+b^2)^2*(((-1/2*a^2*b-1/2*b^3)*tanh(1/2*
x)^3+(-a^3-a*b^2)*tanh(1/2*x)^2+(1/2*a^2*b+1/2*b^3)*tanh(1/2*x))/(1+tanh(1
/2*x)^2)^2+1/4*(2*a^3+4*a*b^2)*ln(1+tanh(1/2*x)^2)+1/2*(-a^2*b-3*b^3)*arct
an(tanh(1/2*x)))
```

### 3.115.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 965 vs. $2(110) = 220$.

Time = 0.30 (sec) , antiderivative size = 965, normalized size of antiderivative = 8.54

$$\int \frac{\tanh^3(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(tanh(x)^3/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-((a^4 + 2*a^2*b^2 + b^4)*x*cosh(x)^4 + (a^4 + 2*a^2*b^2 + b^4)*x*sinh(x)^
4 - (a^3*b + a*b^3)*cosh(x)^3 - (a^3*b + a*b^3 - 4*(a^4 + 2*a^2*b^2 + b^4)
*x*cosh(x))*sinh(x)^3 - 2*(a^4 + a^2*b^2 - (a^4 + 2*a^2*b^2 + b^4)*x)*cosh
(x)^2 - (2*a^4 + 2*a^2*b^2 - 6*(a^4 + 2*a^2*b^2 + b^4)*x*cosh(x)^2 - 2*(a^
4 + 2*a^2*b^2 + b^4)*x + 3*(a^3*b + a*b^3)*cosh(x))*sinh(x)^2 + (a^4 + 2*a
^2*b^2 + b^4)*x + ((a^3*b + 3*a*b^3)*cosh(x)^4 + 4*(a^3*b + 3*a*b^3)*cosh(
x)*sinh(x)^3 + (a^3*b + 3*a*b^3)*sinh(x)^4 + a^3*b + 3*a*b^3 + 2*(a^3*b +
3*a*b^3)*cosh(x)^2 + 2*(a^3*b + 3*a*b^3 + 3*(a^3*b + 3*a*b^3)*cosh(x)^2)*s
inh(x)^2 + 4*((a^3*b + 3*a*b^3)*cosh(x)^3 + (a^3*b + 3*a*b^3)*cosh(x))*sin
h(x))*arctan(cosh(x) + sinh(x)) + (a^3*b + a*b^3)*cosh(x) - (b^4*cosh(x)^4
 + 4*b^4*cosh(x)*sinh(x)^3 + b^4*sinh(x)^4 + 2*b^4*cosh(x)^2 + b^4 + 2*(3*
b^4*cosh(x)^2 + b^4)*sinh(x)^2 + 4*(b^4*cosh(x)^3 + b^4*cosh(x))*sinh(x))*
log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x))) - ((a^4 + 2*a^2*b^2)*cosh(x)^4
+ 4*(a^4 + 2*a^2*b^2)*cosh(x)*sinh(x)^3 + (a^4 + 2*a^2*b^2)*sinh(x)^4 + a^
4 + 2*a^2*b^2 + 2*(a^4 + 2*a^2*b^2)*cosh(x)^2 + 2*(a^4 + 2*a^2*b^2 + 3*(a^
4 + 2*a^2*b^2)*cosh(x)^2)*sinh(x)^2 + 4*((a^4 + 2*a^2*b^2)*cosh(x)^3 + (a^
4 + 2*a^2*b^2)*cosh(x))*sinh(x))*log(2*cosh(x)/(cosh(x) - sinh(x))) + (4*(
a^4 + 2*a^2*b^2 + b^4)*x*cosh(x)^3 + a^3*b + a*b^3 - 3*(a^3*b + a*b^3)*cos
h(x)^2 - 4*(a^4 + a^2*b^2 - (a^4 + 2*a^2*b^2 + b^4)*x)*cosh(x))*sinh(x))/(
a^5 + 2*a^3*b^2 + a*b^4 + (a^5 + 2*a^3*b^2 + a*b^4)*cosh(x)^4 + 4*(a^5 ...
```

### 3.115.6 Sympy [F]

$$\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\tanh^3(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(tanh(x)**3/(a+b*csch(x)),x)
```

output
```
Integral(tanh(x)**3/(a + b*csch(x)), x)
```

### 3.115.7 Maxima [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 172, normalized size of antiderivative = 1.52

$$\begin{aligned}\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx = {} & \frac{b^4\log\left(-2\,be^{(-x)}+ae^{(-2\,x)}-a\right)}{a^5+2\,a^3b^2+ab^4} \\ & + \frac{\left(a^2b+3\,b^3\right)\arctan\left(e^{(-x)}\right)}{a^4+2\,a^2b^2+b^4} + \frac{\left(a^3+2\,ab^2\right)\log\left(e^{(-2\,x)}+1\right)}{a^4+2\,a^2b^2+b^4} \\ & + \frac{be^{(-x)}+2\,ae^{(-2\,x)}-be^{(-3\,x)}}{a^2+b^2+2\left(a^2+b^2\right)e^{(-2\,x)}+\left(a^2+b^2\right)e^{(-4\,x)}} + \frac{x}{a}\end{aligned}$$

input
```
integrate(tanh(x)^3/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
b^4*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a^5 + 2*a^3*b^2 + a*b^4) + (a^2*b +
 3*b^3)*arctan(e^(-x))/(a^4 + 2*a^2*b^2 + b^4) + (a^3 + 2*a*b^2)*log(e^(-2
*x) + 1)/(a^4 + 2*a^2*b^2 + b^4) + (b*e^(-x) + 2*a*e^(-2*x) - b*e^(-3*x))/
(a^2 + b^2 + 2*(a^2 + b^2)*e^(-2*x) + (a^2 + b^2)*e^(-4*x)) + x/a
```

### 3.115.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 234 vs. 2(110) = 220.

Time = 0.27 (sec) , antiderivative size = 234, normalized size of antiderivative = 2.07

$$\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{b^4 \log\left(\left|-a\left(e^{(-x)}-e^x\right)+2b\right|\right)}{a^5+2a^3b^2+ab^4} - \frac{\left(\pi+2\arctan\left(\frac{1}{2}\left(e^{(2x)}-1\right)e^{(-x)}\right)\right)\left(a^2b+3b^3\right)}{4\left(a^4+2a^2b^2+b^4\right)}$$
$$+ \frac{\left(a^3+2ab^2\right)\log\left(\left(e^{(-x)}-e^x\right)^2+4\right)}{2\left(a^4+2a^2b^2+b^4\right)}$$
$$- \frac{a^3\left(e^{(-x)}-e^x\right)^2+2ab^2\left(e^{(-x)}-e^x\right)^2+2a^2b\left(e^{(-x)}-e^x\right)+2b^3\left(e^{(-x)}-e^x\right)+4ab^2}{2\left(a^4+2a^2b^2+b^4\right)\left(\left(e^{(-x)}-e^x\right)^2+4\right)}$$

input
```
integrate(tanh(x)^3/(a+b*csch(x)),x, algorithm="giac")
```

output
```
b^4*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a^5 + 2*a^3*b^2 + a*b^4) - 1/4*(pi
+ 2*arctan(1/2*(e^(2*x) - 1)*e^(-x)))*(a^2*b + 3*b^3)/(a^4 + 2*a^2*b^2 + b
^4) + 1/2*(a^3 + 2*a*b^2)*log((e^(-x) - e^x)^2 + 4)/(a^4 + 2*a^2*b^2 + b^4
) - 1/2*(a^3*(e^(-x) - e^x)^2 + 2*a*b^2*(e^(-x) - e^x)^2 + 2*a^2*b*(e^(-x)
 - e^x) + 2*b^3*(e^(-x) - e^x) + 4*a*b^2)/((a^4 + 2*a^2*b^2 + b^4)*((e^(-x
) - e^x)^2 + 4))
```

## 3.115.9 Mupad [B] (verification not implemented)

Time = 4.35 (sec) , antiderivative size = 335, normalized size of antiderivative = 2.96

$$\int \frac{\tanh^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{e^x\left(a^2b+b^3\right)}{\left(a^2+b^2\right)^2}+\frac{2\left(a^4+a^2b^2\right)}{a\left(a^2+b^2\right)^2}}{e^{2x}+1} - \frac{\frac{2a}{a^2+b^2}+\frac{2be^x}{a^2+b^2}}{2e^{2x}+e^{4x}+1} - \frac{x}{a}$$
$$+ \frac{b^4\ln\left(4a^9e^{2x}-4ab^8-4a^9+7a^3b^6-14a^5b^4-17a^7b^2+8b^9e^x-7a^3b^6e^{2x}+14a^5b^4e^{2x}+17a^7b\right.}{a^5+2a^3b^2+ab^4}$$
$$+ \frac{\ln\left(1+e^x\,1i\right)\left(3b+a\,2i\right)}{2\left(a^2\,1i+2ab-b^2\,1i\right)} + \frac{\ln\left(e^x+1i\right)\left(2a+b\,3i\right)}{2\left(a^2+ab\,2i-b^2\right)}$$

input
```
int(tanh(x)^3/(a + b/sinh(x)),x)
```

output

```
((exp(x)*(a^2*b + b^3))/(a^2 + b^2)^2 + (2*(a^4 + a^2*b^2))/(a*(a^2 + b^2)
^2))/(exp(2*x) + 1) - ((2*a)/(a^2 + b^2) + (2*b*exp(x))/(a^2 + b^2))/(2*ex
p(2*x) + exp(4*x) + 1) - x/a + (b^4*log(4*a^9*exp(2*x) - 4*a*b^8 - 4*a^9 +
 7*a^3*b^6 - 14*a^5*b^4 - 17*a^7*b^2 + 8*b^9*exp(x) - 7*a^3*b^6*exp(2*x) +
 14*a^5*b^4*exp(2*x) + 17*a^7*b^2*exp(2*x) + 8*a^8*b*exp(x) + 4*a*b^8*exp(
2*x) - 14*a^2*b^7*exp(x) + 28*a^4*b^5*exp(x) + 34*a^6*b^3*exp(x)))/(a*b^4
+ a^5 + 2*a^3*b^2) + (log(exp(x)*1i + 1)*(a*2i + 3*b))/(2*(2*a*b + a^2*1i
- b^2*1i)) + (log(exp(x) + 1i)*(2*a + b*3i))/(2*(a*b*2i + a^2 - b^2))
```

# 3.116 $\int \frac{\tanh^2(x)}{a+b\mathbf{csch}(x)}\,dx$

3.116.1 Optimal result . . . 801
3.116.2 Mathematica [A] (verified) . . . 801
3.116.3 Rubi [C] (verified) . . . 802
3.116.4 Maple [A] (verified) . . . 807
3.116.5 Fricas [B] (verification not implemented) . . . 807
3.116.6 Sympy [F] . . . 808
3.116.7 Maxima [A] (verification not implemented) . . . 808
3.116.8 Giac [A] (verification not implemented) . . . 808
3.116.9 Mupad [B] (verification not implemented) . . . 809

## 3.116.1 Optimal result

Integrand size = 13, antiderivative size = 100

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{ax}{a^2+b^2} + \frac{b^2x}{a\left(a^2+b^2\right)} + \frac{2b^3\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{a\left(a^2+b^2\right)^{3/2}} + \frac{b\operatorname{sech}(x)}{a^2+b^2} - \frac{a\tanh(x)}{a^2+b^2}$$

output
```
a*x/(a^2+b^2)+b^2*x/a/(a^2+b^2)+2*b^3*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^
(1/2))/a/(a^2+b^2)^(3/2)+b*sech(x)/(a^2+b^2)-a*tanh(x)/(a^2+b^2)
```

## 3.116.2 Mathematica [A] (verified)

Time = 0.38 (sec) , antiderivative size = 82, normalized size of antiderivative = 0.82

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x + \frac{2b^3\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)}{\left(-a^2-b^2\right)^{3/2}}}{a} + \frac{b\operatorname{sech}(x)}{a^2+b^2} - \frac{a\tanh(x)}{a^2+b^2}$$

input
```
Integrate[Tanh[x]^2/(a + b*Csch[x]),x]
```

output
```
(x + (2*b^3*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]])/(-a^2 - b^2)^(3/2)
)/a + (b*Sech[x])/(a^2 + b^2) - (a*Tanh[x])/(a^2 + b^2)
```

### 3.116.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.68 (sec) , antiderivative size = 112, normalized size of antiderivative = 1.12, number of steps used = 23, number of rules used = 22, $\frac{\text{number of rules}}{\text{integrand size}} = 1.692$, Rules used = {3042, 25, 4386, 26, 26, 3042, 26, 3381, 25, 26, 3042, 25, 26, 3086, 24, 3214, 3042, 3139, 1083, 219, 3954, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{1}{\cot(ix)^2(a+ib\csc(ix))}dx$$

$$\downarrow 25$$

$$-\int \frac{1}{\cot(ix)^2(a+ib\csc(ix))}dx$$

$$\downarrow 4386$$

$$-\int -\frac{i\sinh(x)\tanh^2(x)}{ib+ia\sinh(x)}dx$$

$$\downarrow 26$$

$$i\int -\frac{i\sinh(x)\tanh^2(x)}{b+a\sinh(x)}dx$$

$$\downarrow 26$$

$$\int \frac{\sinh(x)\tanh^2(x)}{a\sinh(x)+b}dx$$

$$\downarrow 3042$$

$$\int \frac{i\sin(ix)^3}{\cos(ix)^2(b-ia\sin(ix))}dx$$

$$\downarrow 26$$

$$i\int \frac{\sin(ix)^3}{\cos(ix)^2(b-ia\sin(ix))}dx$$

$$\downarrow 3381$$

$$i\left(-\frac{b^2\int\frac{i\sinh(x)}{b+a\sinh(x)}dx}{a^2+b^2}+\frac{ia\int-\tanh^2(x)dx}{a^2+b^2}+\frac{b\int i\operatorname{sech}(x)\tanh(x)dx}{a^2+b^2}\right)$$

$$\downarrow 25$$

$$i\left(-\frac{b^2\int\frac{i\sinh(x)}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{ia\int\tanh^2(x)dx}{a^2+b^2}+\frac{b\int i\operatorname{sech}(x)\tanh(x)dx}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{ib^2\int\frac{\sinh(x)}{b+a\sinh(x)}dx}{a^2+b^2}-\frac{ia\int\tanh^2(x)dx}{a^2+b^2}+\frac{ib\int\operatorname{sech}(x)\tanh(x)dx}{a^2+b^2}\right)$$

$$\downarrow 3042$$

$$i\left(-\frac{ib^2\int-\frac{i\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}-\frac{ia\int-\tan(ix)^2dx}{a^2+b^2}+\frac{ib\int-i\sec(ix)\tan(ix)dx}{a^2+b^2}\right)$$

$$\downarrow 25$$

$$i\left(-\frac{ib^2\int-\frac{i\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}+\frac{ib\int-i\sec(ix)\tan(ix)dx}{a^2+b^2}\right)$$

$$\downarrow 26$$

$$i\left(-\frac{b^2\int\frac{\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}+\frac{b\int\sec(ix)\tan(ix)dx}{a^2+b^2}\right)$$

$$\downarrow 3086$$

$$i\left(-\frac{b^2\int\frac{\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{ib\int 1d\operatorname{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 24$$

$$i\left(-\frac{b^2\int\frac{\sin(ix)}{b-ia\sin(ix)}dx}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 3214$$

$$i\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{ix}{a}-\frac{ib\int\frac{1}{b+a\sinh(x)}dx}{a}\right)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 3042$$

$$i\left(-\frac{b^2\left(\frac{ix}{a}-\frac{ib\int\frac{1}{b-ia\sin(ix)}dx}{a}\right)}{a^2+b^2}+\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 3139$$

$$i\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{ix}{a}-\frac{2ib\int\frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{a}\right)}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 1083$$

$$i\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{4ib\int\frac{1}{4\left(a^2+b^2\right)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{a}+\frac{ix}{a}\right)}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 219$$

$$i\left(\frac{ia\int\tan(ix)^2dx}{a^2+b^2}-\frac{b^2\left(\frac{2ib\text{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 3954$$

$$i\left(\frac{ia(\tanh(x)-\int 1dx)}{a^2+b^2}-\frac{b^2\left(\frac{2ib\text{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}-\frac{ib\text{sech}(x)}{a^2+b^2}\right)$$

$$\downarrow 24$$

$$i\left(-\frac{b^2\left(\frac{2ib\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{a\sqrt{a^2+b^2}}+\frac{ix}{a}\right)}{a^2+b^2}+\frac{ia(\tanh(x)-x)}{a^2+b^2}-\frac{ib\operatorname{sech}(x)}{a^2+b^2}\right)$$

input
```
Int[Tanh[x]^2/(a + b*Csch[x]),x]
```

output
```
I*(-((b^2*((I*x)/a + ((2*I)*b*ArcTanh[(2*a - 2*b*Tanh[x/2])/(2*Sqrt[a^2 +
b^2])])/(a*Sqrt[a^2 + b^2])))/(a^2 + b^2)) - (I*b*Sech[x])/(a^2 + b^2) + (
I*a*(-x + Tanh[x]))/(a^2 + b^2))
```

### 3.116.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3086
```
Int[((a_.)*sec[(e_.) + (f_.)*(x_)])^(m_.)*((b_.)*tan[(e_.) + (f_.)*(x_)])^(
n_.), x_Symbol] :> Simp[a/f   Subst[Int[(a*x)^(m - 1)*(-1 + x^2)^((n - 1)/2
), x], x, Sec[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2
] &&  !(IntegerQ[m/2] && LtQ[0, m, n + 1])
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3214
```
Int[((a_.) + (b_.)*sin[(e_.) + (f_.)*(x_)])/((c_.) + (d_.)*sin[(e_.) + (f_.
)*(x_)]), x_Symbol] :> Simp[b*(x/d), x] - Simp[(b*c - a*d)/d   Int[1/(c + d
*Sin[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c - a*d, 0]
```

rule 3381
```
Int[((cos[(e_.) + (f_.)*(x_)]*(g_.))^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(
n_))/((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]), x_Symbol] :> Simp[a*(d^2/(a^2
- b^2))   Int[(g*Cos[e + f*x])^p*(d*Sin[e + f*x])^(n - 2), x], x] + (-Simp[
b*(d/(a^2 - b^2))   Int[(g*Cos[e + f*x])^p*(d*Sin[e + f*x])^(n - 1), x], x]
 - Simp[a^2*(d^2/(g^2*(a^2 - b^2)))   Int[(g*Cos[e + f*x])^(p + 2)*((d*Sin[
e + f*x])^(n - 2)/(a + b*Sin[e + f*x])), x], x]) /; FreeQ[{a, b, d, e, f, g
}, x] && NeQ[a^2 - b^2, 0] && IntegersQ[2*n, 2*p] && LtQ[p, -1] && GtQ[n, 1
]
```

rule 3954
```
Int[((b_.)*tan[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> Simp[b*((b*Tan[c + d
*x])^(n - 1)/(d*(n - 1))), x] - Simp[b^2   Int[(b*Tan[c + d*x])^(n - 2), x]
, x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
```

rule 4386
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Int[Cos[c + d*x]^m*((b + a*Sin[c + d*x])^n/Sin[c + d*x]^(m
 + n)), x] /; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && IntegerQ[n] &&
 IntegerQ[m] && (IntegerQ[m/2] || LeQ[m, 1])
```

### 3.116.4 Maple [A] (verified)

Time = 0.28 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.95

| method | result | size |
|---|---|---|
| default | $-\frac{\ln(\tanh(\frac{x}{2})-1)}{a}+\frac{\ln(\tanh(\frac{x}{2})+1)}{a}+\frac{-2a\tanh(\frac{x}{2})+2b}{(a^2+b^2)\left(1+\tanh(\frac{x}{2})^2\right)}+\frac{2b^3\operatorname{arctanh}\left(\frac{-2b\tanh(\frac{x}{2})+2a}{2\sqrt{a^2+b^2}}\right)}{a(a^2+b^2)^{\frac{3}{2}}}$ | 95 |
| risch | $\frac{x}{a}+\frac{2e^x b+2a}{(1+e^{2x})(a^2+b^2)}+\frac{b^3\ln\left(e^x+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}b+a^4+2a^2b^2+b^4}{a\left(a^2+b^2\right)^{\frac{3}{2}}}\right)}{(a^2+b^2)^{\frac{3}{2}}a}-\frac{b^3\ln\left(e^x+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}b-a^4-2a^2b^2-b^4}{a\left(a^2+b^2\right)^{\frac{3}{2}}}\right)}{(a^2+b^2)^{\frac{3}{2}}a}$ | 155 |

input
```
int(tanh(x)^2/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/a*ln(tanh(1/2*x)-1)+1/a*ln(tanh(1/2*x)+1)+2/(a^2+b^2)*(-a*tanh(1/2*x)+b
)/(1+tanh(1/2*x)^2)+2/a*b^3/(a^2+b^2)^(3/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+
2*a)/(a^2+b^2)^(1/2))
```

### 3.116.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 349 vs. 2(96) = 192.

Time = 0.26 (sec) , antiderivative size = 349, normalized size of antiderivative = 3.49

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$= \frac{2\,a^4+2\,a^2b^2+(a^4+2\,a^2b^2+b^4)x\cosh(x)^2+(a^4+2\,a^2b^2+b^4)x\sinh(x)^2+\left(b^3\cosh(x)^2+2\,b^3\cosh(x)\right.}{}$$

input
```
integrate(tanh(x)^2/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
(2*a^4 + 2*a^2*b^2 + (a^4 + 2*a^2*b^2 + b^4)*x*cosh(x)^2 + (a^4 + 2*a^2*b^
2 + b^4)*x*sinh(x)^2 + (b^3*cosh(x)^2 + 2*b^3*cosh(x)*sinh(x) + b^3*sinh(x
)^2 + b^3)*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh
(x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) + 2*sqrt(a^2 + b^2)*(a*c
osh(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*c
osh(x) + b)*sinh(x) - a)) + (a^4 + 2*a^2*b^2 + b^4)*x + 2*(a^3*b + a*b^3)*
cosh(x) + 2*(a^3*b + a*b^3 + (a^4 + 2*a^2*b^2 + b^4)*x*cosh(x))*sinh(x))/(
a^5 + 2*a^3*b^2 + a*b^4 + (a^5 + 2*a^3*b^2 + a*b^4)*cosh(x)^2 + 2*(a^5 + 2
*a^3*b^2 + a*b^4)*cosh(x)*sinh(x) + (a^5 + 2*a^3*b^2 + a*b^4)*sinh(x)^2)
```

### 3.116.6 Sympy [F]

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\tanh^2(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(tanh(x)**2/(a+b*csch(x)),x)
```

output
```
Integral(tanh(x)**2/(a + b*csch(x)), x)
```

### 3.116.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 108, normalized size of antiderivative = 1.08

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^3\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{(a^3+ab^2)\sqrt{a^2+b^2}} + \frac{2\left(be^{(-x)}-a\right)}{a^2+b^2+(a^2+b^2)e^{(-2x)}} + \frac{x}{a}$$

input
```
integrate(tanh(x)^2/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-b^3*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2))
)/((a^3 + a*b^2)*sqrt(a^2 + b^2)) + 2*(b*e^(-x) - a)/(a^2 + b^2 + (a^2 + b
^2)*e^(-2*x)) + x/a
```

### 3.116.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 102, normalized size of antiderivative = 1.02

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b^3\log\left(\left|\frac{2ae^x+2b-2\sqrt{a^2+b^2}}{2ae^x+2b+2\sqrt{a^2+b^2}}\right|\right)}{(a^3+ab^2)\sqrt{a^2+b^2}} + \frac{x}{a} + \frac{2\left(be^x+a\right)}{(a^2+b^2)(e^{(2x)}+1)}$$

input
```
integrate(tanh(x)^2/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-b^3*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt
(a^2 + b^2)))/((a^3 + a*b^2)*sqrt(a^2 + b^2)) + x/a + 2*(b*e^x + a)/((a^2
+ b^2)*(e^(2*x) + 1))
```

### 3.116.9 Mupad [B] (verification not implemented)

Time = 3.10 (sec) , antiderivative size = 376, normalized size of antiderivative = 3.76

$$\int \frac{\tanh^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x}{a} + \frac{\frac{2a}{a^2+b^2} + \frac{2b\,e^x}{a^2+b^2}}{e^{2x}+1}$$
$$+ \frac{2\operatorname{atan}\left(\left(\frac{a^4\sqrt{-a^8-3a^6b^2-3a^4b^4-a^2b^6}}{2} + \frac{a^2b^2\sqrt{-a^8-3a^6b^2-3a^4b^4-a^2b^6}}{2}\right)\left(e^x\left(\frac{2b^3}{a^3(a^3+ab^2)\sqrt{b^6}(a^2+b^2)} + \frac{}{a^2b^2\sqrt{-a^2(}\right.\right.\right.}{\sqrt{-a^8-3a^6b^2-3a^6}}$$

input
```
int(tanh(x)^2/(a + b/sinh(x)),x)
```

output
```
x/a + ((2*a)/(a^2 + b^2) + (2*b*exp(x))/(a^2 + b^2))/(exp(2*x) + 1) + (2*a
tan(((a^4*(- a^8 - a^2*b^6 - 3*a^4*b^4 - 3*a^6*b^2)^(1/2))/2 + (a^2*b^2*(-
 a^8 - a^2*b^6 - 3*a^4*b^4 - 3*a^6*b^2)^(1/2))/2)*(exp(x)*((2*b^3)/(a^3*(a
*b^2 + a^3)*(b^6)^(1/2)*(a^2 + b^2)) + (2*(a*b^3*(b^6)^(1/2) + a^3*b*(b^6)
^(1/2)))/(a^2*b^2*(-a^2*(a^2 + b^2)^3)^(1/2)*(a*b^2 + a^3)*(- a^8 - a^2*b^
6 - 3*a^4*b^4 - 3*a^6*b^2)^(1/2))) - (2*(a^4*(b^6)^(1/2) + a^2*b^2*(b^6)^(
1/2)))/(a^2*b^2*(-a^2*(a^2 + b^2)^3)^(1/2)*(a*b^2 + a^3)*(- a^8 - a^2*b^6
 - 3*a^4*b^4 - 3*a^6*b^2)^(1/2))))*(b^6)^(1/2))/(- a^8 - a^2*b^6 - 3*a^4*b^
4 - 3*a^6*b^2)^(1/2)
```

# 3.117 $\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx$

3.117.1 Optimal result . . . 810
3.117.2 Mathematica [C] (verified) . . . 810
3.117.3 Rubi [A] (verified) . . . 811
3.117.4 Maple [A] (verified) . . . 812
3.117.5 Fricas [A] (verification not implemented) . . . 813
3.117.6 Sympy [F] . . . 813
3.117.7 Maxima [A] (verification not implemented) . . . 814
3.117.8 Giac [A] (verification not implemented) . . . 814
3.117.9 Mupad [B] (verification not implemented) . . . 814

## 3.117.1 Optimal result

Integrand size = 11, antiderivative size = 61

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{b\arctan(\sinh(x))}{a^2+b^2} + \frac{b^2\log(a+b\operatorname{csch}(x))}{a\left(a^2+b^2\right)} + \frac{\log(\sinh(x))}{a} - \frac{a\log(\tanh(x))}{a^2+b^2}$$

output
```
-b*arctan(sinh(x))/(a^2+b^2)+b^2*ln(a+b*csch(x))/a/(a^2+b^2)+ln(sinh(x))/a
-a*ln(tanh(x))/(a^2+b^2)
```

## 3.117.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.04 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.03

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{a(a+ib)\log(i-\sinh(x)) + a(a-ib)\log(i+\sinh(x)) + 2b^2\log(b+a\sinh(x))}{2a\left(a^2+b^2\right)}$$

input
```
Integrate[Tanh[x]/(a + b*Csch[x]),x]
```

output
```
(a*(a + I*b)*Log[I - Sinh[x]] + a*(a - I*b)*Log[I + Sinh[x]] + 2*b^2*Log[b
 + a*Sinh[x]])/(2*a*(a^2 + b^2))
```

### 3.117.3 Rubi [A] (verified)

Time = 0.30 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.38, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.545$, Rules used = {3042, 26, 4373, 25, 615, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i}{\cot(ix)(a+ib\csc(ix))}dx$$

$$\downarrow 26$$

$$-i\int \frac{1}{\cot(ix)(a+ib\csc(ix))}dx$$

$$\downarrow 4373$$

$$b^2\int -\frac{\sinh(x)}{b(a+b\operatorname{csch}(x))\left(\operatorname{csch}^2(x)b^2+b^2\right)}d(b\operatorname{csch}(x))$$

$$\downarrow 25$$

$$-b^2\int \frac{\sinh(x)}{b(a+b\operatorname{csch}(x))\left(\operatorname{csch}^2(x)b^2+b^2\right)}d(b\operatorname{csch}(x))$$

$$\downarrow 615$$

$$-b^2\int \left(\frac{-b^2-a\operatorname{csch}(x)b}{b^2\left(a^2+b^2\right)\left(\operatorname{csch}^2(x)b^2+b^2\right)}+\frac{\sinh(x)}{ab^3}-\frac{1}{a\left(a^2+b^2\right)(a+b\operatorname{csch}(x))}\right)d(b\operatorname{csch}(x))$$

$$\downarrow 2009$$

$$b^2\left(\frac{\arctan(\operatorname{csch}(x))}{b\left(a^2+b^2\right)}+\frac{a\log\left(b^2\operatorname{csch}^2(x)+b^2\right)}{2b^2\left(a^2+b^2\right)}+\frac{\log(a+b\operatorname{csch}(x))}{a\left(a^2+b^2\right)}-\frac{\log(b\operatorname{csch}(x))}{ab^2}\right)$$

input
```
Int[Tanh[x]/(a + b*Csch[x]),x]
```

output
```
b^2*(ArcTan[Csch[x]]/(b*(a^2 + b^2)) - Log[b*Csch[x]]/(a*b^2) + Log[a + b*
Csch[x]]/(a*(a^2 + b^2)) + (a*Log[b^2 + b^2*Csch[x]^2])/(2*b^2*(a^2 + b^2)
))
```

### 3.117.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 615
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_)*((a_) + (b_.)*(x_)^2)^(p_),
 x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x], x]
 /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

## 3.117.4 Maple [A] (verified)

Time = 0.30 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.59

| method | result | siz |
|---|---|---|
| default | $\frac{4a\ln\left(1+\tanh\left(\frac{x}{2}\right)^2\right)-8b\arctan\left(\tanh\left(\frac{x}{2}\right)\right)}{4a^2+4b^2}+\frac{b^2\ln\left(-\tanh\left(\frac{x}{2}\right)^2b+2a\tanh\left(\frac{x}{2}\right)+b\right)}{a(a^2+b^2)}-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)}{a}-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)}{a}$ | 97 |
| risch | $\frac{x}{a}-\frac{2ax}{a^2+b^2}-\frac{2b^2x}{a(a^2+b^2)}+\frac{i\ln(\mathrm{e}^x-i)b}{a^2+b^2}+\frac{\ln(\mathrm{e}^x-i)a}{a^2+b^2}-\frac{i\ln(\mathrm{e}^x+i)b}{a^2+b^2}+\frac{\ln(\mathrm{e}^x+i)a}{a^2+b^2}+\frac{b^2\ln\left(\mathrm{e}^{2x}+\frac{2b\mathrm{e}^x}{a}-1\right)}{a(a^2+b^2)}$ | 14 |

input
```
int(tanh(x)/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
8/(4*a^2+4*b^2)*(1/2*a*ln(1+tanh(1/2*x)^2)-b*arctan(tanh(1/2*x)))+b^2/a/(a
^2+b^2)*ln(-tanh(1/2*x)^2*b+2*a*tanh(1/2*x)+b)-1/a*ln(tanh(1/2*x)-1)-1/a*l
n(tanh(1/2*x)+1)
```

### 3.117.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 75, normalized size of antiderivative = 1.23

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{2\,ab\arctan\left(\cosh\left(x\right)+\sinh\left(x\right)\right)-b^2\log\left(\frac{2\,(a\sinh(x)+b)}{\cosh(x)-\sinh(x)}\right)-a^2\log\left(\frac{2\,\cosh(x)}{\cosh(x)-\sinh(x)}\right)+(a^2+b^2)x}{a^3+ab^2}$$

input
```
integrate(tanh(x)/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-(2*a*b*arctan(cosh(x) + sinh(x)) - b^2*log(2*(a*sinh(x) + b)/(cosh(x) - s
inh(x))) - a^2*log(2*cosh(x)/(cosh(x) - sinh(x))) + (a^2 + b^2)*x)/(a^3 +
a*b^2)
```

### 3.117.6 Sympy [F]

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\tanh\left(x\right)}{a+b\,\operatorname{csch}\left(x\right)}\,dx$$

input
```
integrate(tanh(x)/(a+b*csch(x)),x)
```

output
```
Integral(tanh(x)/(a + b*csch(x)), x)
```

### 3.117.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.21

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^2\log\left(-2\,be^{(-x)}+ae^{(-2\,x)}-a\right)}{a^3+ab^2} + \frac{2\,b\arctan\left(e^{(-x)}\right)}{a^2+b^2} + \frac{a\log\left(e^{(-2\,x)}+1\right)}{a^2+b^2} + \frac{x}{a}$$

input
```
integrate(tanh(x)/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
b^2*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a^3 + a*b^2) + 2*b*arctan(e^(-x))/(
a^2 + b^2) + a*log(e^(-2*x) + 1)/(a^2 + b^2) + x/a
```

### 3.117.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 89, normalized size of antiderivative = 1.46

$$\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{b^2\log\left(\left|-a\left(e^{(-x)}-e^{x}\right)+2\,b\right|\right)}{a^3+ab^2} - \frac{\left(\pi+2\arctan\left(\frac{1}{2}\left(e^{(2\,x)}-1\right)e^{(-x)}\right)\right)b}{2\left(a^2+b^2\right)} + \frac{a\log\left(\left(e^{(-x)}-e^{x}\right)^2+4\right)}{2\left(a^2+b^2\right)}$$

input
```
integrate(tanh(x)/(a+b*csch(x)),x, algorithm="giac")
```

output
```
b^2*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a^3 + a*b^2) - 1/2*(pi + 2*arctan(1
/2*(e^(2*x) - 1)*e^(-x)))*b/(a^2 + b^2) + 1/2*a*log((e^(-x) - e^x)^2 + 4)/
(a^2 + b^2)
```

### 3.117.9 Mupad [B] (verification not implemented)

Time = 3.16 (sec) , antiderivative size = 132, normalized size of antiderivative = 2.16

$$\begin{aligned}\int \frac{\tanh(x)}{a+b\operatorname{csch}(x)}\,dx &= \frac{\ln\left(1+\mathrm{e}^{x}\,1\mathrm{i}\right)}{a-b\,1\mathrm{i}} - \frac{x}{a} \\ &+ \frac{b^2\,\ln\left(a^5\,\mathrm{e}^{2\,x}-a\,b^4-a^5+a^3\,b^2+2\,b^5\,\mathrm{e}^{x}-a^3\,b^2\,\mathrm{e}^{2\,x}+2\,a^4\,b\,\mathrm{e}^{x}+a\,b^4\,\mathrm{e}^{2\,x}-2\,a^2\,b^3\,\mathrm{e}^{x}\right)}{a^3+a\,b^2} \\ &+ \frac{\ln\left(\mathrm{e}^{x}+1\mathrm{i}\right)\,1\mathrm{i}}{-b+a\,1\mathrm{i}}\end{aligned}$$

input
```
int(tanh(x)/(a + b/sinh(x)),x)
```

output
```
log(exp(x)*1i + 1)/(a - b*1i) + (log(exp(x) + 1i)*1i)/(a*1i - b) - x/a + (
b^2*log(a^5*exp(2*x) - a*b^4 - a^5 + a^3*b^2 + 2*b^5*exp(x) - a^3*b^2*exp(
2*x) + 2*a^4*b*exp(x) + a*b^4*exp(2*x) - 2*a^2*b^3*exp(x)))/(a*b^2 + a^3)
```

# 3.118 $\int \frac{\coth(x)}{a+b\mathbf{csch}(x)}\,dx$

3.118.1 Optimal result . . . 816
3.118.2 Mathematica [A] (verified) . . . 816
3.118.3 Rubi [A] (verified) . . . 817
3.118.4 Maple [A] (verified) . . . 818
3.118.5 Fricas [A] (verification not implemented) . . . 819
3.118.6 Sympy [F] . . . 819
3.118.7 Maxima [A] (verification not implemented) . . . 819
3.118.8 Giac [A] (verification not implemented) . . . 820
3.118.9 Mupad [B] (verification not implemented) . . . 820

## 3.118.1 Optimal result

Integrand size = 11, antiderivative size = 19

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log(a+b\operatorname{csch}(x))}{a} + \frac{\log(\sinh(x))}{a}$$

output
```
ln(a+b*csch(x))/a+ln(sinh(x))/a
```

## 3.118.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 11, normalized size of antiderivative = 0.58

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log(b+a\sinh(x))}{a}$$

input
```
Integrate[Coth[x]/(a + b*Csch[x]),x]
```

output
```
Log[b + a*Sinh[x]]/a
```

### 3.118.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.16, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.545$, Rules used = {3042, 26, 4373, 47, 14, 16}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth(x)}{a + b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i\cot(ix)}{a + ib\csc(ix)}\,dx$$

$$\downarrow 26$$

$$i\int \frac{\cot(ix)}{a + ib\csc(ix)}\,dx$$

$$\downarrow 4373$$

$$-\int \frac{\sinh(x)}{b(a + b\operatorname{csch}(x))}\,d(b\operatorname{csch}(x))$$

$$\downarrow 47$$

$$\frac{\int \frac{1}{a+b\operatorname{csch}(x)}\,d(b\operatorname{csch}(x))}{a} - \frac{\int \frac{\sinh(x)}{b}\,d(b\operatorname{csch}(x))}{a}$$

$$\downarrow 14$$

$$\frac{\int \frac{1}{a+b\operatorname{csch}(x)}\,d(b\operatorname{csch}(x))}{a} - \frac{\log(b\operatorname{csch}(x))}{a}$$

$$\downarrow 16$$

$$\frac{\log(a + b\operatorname{csch}(x))}{a} - \frac{\log(b\operatorname{csch}(x))}{a}$$

input
```
Int[Coth[x]/(a + b*Csch[x]),x]
```

output
```
-(Log[b*Csch[x]]/a) + Log[a + b*Csch[x]]/a
```

#### 3.118.3.1 Defintions of rubi rules used

rule 14
```
Int[(a_.)/(x_), x_Symbol] :> Simp[a*Log[x], x] /; FreeQ[a, x]
```

rule 16
```
Int[(c_.)/((a_.) + (b_.)*(x_)), x_Symbol] :> Simp[c*(Log[RemoveContent[a +
b*x, x]]/b), x] /; FreeQ[{a, b, c}, x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 47
```
Int[1/(((a_.) + (b_.)*(x_))*((c_.) + (d_.)*(x_))), x_Symbol] :> Simp[b/(b*c
 - a*d)   Int[1/(a + b*x), x], x] - Simp[d/(b*c - a*d)   Int[1/(c + d*x), x
], x] /; FreeQ[{a, b, c, d}, x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

### 3.118.4 Maple [A] (verified)

Time = 0.32 (sec) , antiderivative size = 21, normalized size of antiderivative = 1.11

| method | result | size |
|---|---|---|
| derivativedivides | $-\frac{\ln(\operatorname{csch}(x))}{a}+\frac{\ln(a+b\ \operatorname{csch}(x))}{a}$ | 21 |
| default | $-\frac{\ln(\operatorname{csch}(x))}{a}+\frac{\ln(a+b\ \operatorname{csch}(x))}{a}$ | 21 |
| risch | $-\frac{x}{a}+\frac{\ln\left(\mathrm{e}^{2x}+\frac{2b\,\mathrm{e}^{x}}{a}-1\right)}{a}$ | 27 |

input
```
int(coth(x)/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-1/a*ln(csch(x))+ln(a+b*csch(x))/a
```

### 3.118.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.42

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{x-\log\left(\frac{2\,(a\sinh(x)+b)}{\cosh(x)-\sinh(x)}\right)}{a}$$

input
```
integrate(coth(x)/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-(x - log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x))))/a
```

### 3.118.6 Sympy [F]

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(coth(x)/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)/(a + b*csch(x)), x)
```

### 3.118.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 28, normalized size of antiderivative = 1.47

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x}{a} + \frac{\log\left(-2\,be^{(-x)} + ae^{(-2\,x)} - a\right)}{a}$$

input
```
integrate(coth(x)/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
x/a + log(-2*b*e^(-x) + a*e^(-2*x) - a)/a
```

### 3.118.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.16

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\log\left(\left|-a\left(e^{(-x)}-e^{x}\right)+2\,b\right|\right)}{a}$$

input
```
integrate(coth(x)/(a+b*csch(x)),x, algorithm="giac")
```

output
```
log(abs(-a*(e^(-x) - e^x) + 2*b))/a
```

### 3.118.9 Mupad [B] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 25, normalized size of antiderivative = 1.32

$$\int \frac{\coth(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{x-\ln\left(2\,b\,\mathrm{e}^{x}-a+a\,\mathrm{e}^{2\,x}\right)}{a}$$

input
```
int(coth(x)/(a + b/sinh(x)),x)
```

output
```
-(x - log(2*b*exp(x) - a + a*exp(2*x)))/a
```

# 3.119 $\int \frac{\coth^2(x)}{a+b\mathbf{csch}(x)}\,dx$

3.119.1 Optimal result . . . 821
3.119.2 Mathematica [A] (verified) . . . 821
3.119.3 Rubi [A] (verified) . . . 822
3.119.4 Maple [A] (verified) . . . 825
3.119.5 Fricas [B] (verification not implemented) . . . 826
3.119.6 Sympy [F] . . . 826
3.119.7 Maxima [A] (verification not implemented) . . . 827
3.119.8 Giac [A] (verification not implemented) . . . 827
3.119.9 Mupad [B] (verification not implemented) . . . 827

## 3.119.1 Optimal result

Integrand size = 13, antiderivative size = 57

$$\int \frac{\coth^2(x)}{a+b\text{csch}(x)}\,dx = \frac{x}{a} - \frac{\text{arctanh}(\cosh(x))}{b} + \frac{2\sqrt{a^2+b^2}\,\text{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{ab}$$

output
```
x/a-arctanh(cosh(x))/b+2*arctanh((a-b*tanh(1/2*x))/(a^2+b^2)^(1/2))*(a^2+b
^2)^(1/2)/a/b
```

## 3.119.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 75, normalized size of antiderivative = 1.32

$$\int \frac{\coth^2(x)}{a+b\text{csch}(x)}\,dx = \frac{bx + 2\sqrt{-a^2-b^2}\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right) - a\log\left(\cosh\left(\frac{x}{2}\right)\right) + a\log\left(\sinh\left(\frac{x}{2}\right)\right)}{ab}$$

input
```
Integrate[Coth[x]^2/(a + b*Csch[x]),x]
```

output
```
(b*x + 2*Sqrt[-a^2 - b^2]*ArcTan[(a - b*Tanh[x/2])/Sqrt[-a^2 - b^2]] - a*L
og[Cosh[x/2]] + a*Log[Sinh[x/2]])/(a*b)
```

### 3.119.3 Rubi [A] (verified)

Time = 0.63 (sec) , antiderivative size = 68, normalized size of antiderivative = 1.19, number of steps used = 19, number of rules used = 18, $\frac{\text{number of rules}}{\text{integrand size}} = 1.385$, Rules used = {3042, 25, 4382, 3042, 4539, 26, 3042, 26, 4257, 4407, 26, 3042, 26, 4318, 3042, 3139, 1083, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^2(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{\cot(ix)^2}{a+ib\csc(ix)}\,dx$$

$$\downarrow 25$$

$$-\int \frac{\cot(ix)^2}{a+ib\csc(ix)}\,dx$$

$$\downarrow 4382$$

$$-\int \frac{-\operatorname{csch}^2(x)-1}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$-\int \frac{\csc(ix)^2-1}{a+ib\csc(ix)}\,dx$$

$$\downarrow 4539$$

$$\frac{i\int -\frac{i(b-a\operatorname{csch}(x))}{a+b\operatorname{csch}(x)}\,dx}{b}+\frac{i\int -i\operatorname{csch}(x)\,dx}{b}$$

$$\downarrow 26$$

$$\frac{\int \frac{b-a\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}\,dx}{b}+\frac{\int \operatorname{csch}(x)\,dx}{b}$$

$$\downarrow 3042$$

$$\frac{\int \frac{b-ia\csc(ix)}{a+ib\csc(ix)}\,dx}{b}+\frac{\int i\csc(ix)\,dx}{b}$$

$$\downarrow 26$$

$$\frac{\int \frac{b-ia\csc(ix)}{a+ib\csc(ix)}dx}{b}+\frac{i\int \csc(ix)dx}{b}$$

$$\downarrow 4257$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{\int \frac{b-ia\csc(ix)}{a+ib\csc(ix)}dx}{b}$$

$$\downarrow 4407$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{\frac{bx}{a}-\frac{i(a^2+b^2)\int -\frac{i\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{a}}{b}$$

$$\downarrow 26$$

$$\frac{\frac{bx}{a}-\frac{(a^2+b^2)\int \frac{\operatorname{csch}(x)}{a+b\operatorname{csch}(x)}dx}{a}}{b}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{\frac{bx}{a}-\frac{(a^2+b^2)\int \frac{i\csc(ix)}{a+ib\csc(ix)}dx}{a}}{b}$$

$$\downarrow 26$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{\frac{bx}{a}-\frac{i(a^2+b^2)\int \frac{\csc(ix)}{a+ib\csc(ix)}dx}{a}}{b}$$

$$\downarrow 4318$$

$$\frac{\frac{bx}{a}-\frac{(a^2+b^2)\int \frac{1}{\frac{a\sinh(x)}{b}+1}dx}{ab}}{b}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 3042$$

$$-\frac{\operatorname{arctanh}(\cosh(x))}{b}+\frac{\frac{bx}{a}-\frac{(a^2+b^2)\int \frac{1}{1-\frac{ia\sin(ix)}{b}}dx}{ab}}{b}$$

$$\downarrow 3139$$

$$\frac{\frac{bx}{a}-\frac{2(a^2+b^2)\int \frac{1}{-\tanh^2\left(\frac{x}{2}\right)+\frac{2a\tanh\left(\frac{x}{2}\right)}{b}+1}d\tanh\left(\frac{x}{2}\right)}{ab}}{b}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 1083$$

$$\frac{\frac{4(a^2+b^2)\int \frac{1}{4\left(\frac{a^2}{b^2}+1\right)-\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)^2}d\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{ab}+\frac{bx}{a}}{b}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

$$\downarrow 219$$

$$\frac{\frac{2\sqrt{a^2+b^2}\operatorname{arctanh}\left(\frac{b\left(\frac{2a}{b}-2\tanh\left(\frac{x}{2}\right)\right)}{2\sqrt{a^2+b^2}}\right)}{a}+\frac{bx}{a}}{b}-\frac{\operatorname{arctanh}(\cosh(x))}{b}$$

input
```
Int[Coth[x]^2/(a + b*Csch[x]),x]
```

output
```
-(ArcTanh[Cosh[x]]/b) + ((b*x)/a + (2*Sqrt[a^2 + b^2]*ArcTanh[(b*((2*a)/b
- 2*Tanh[x/2]))/(2*Sqrt[a^2 + b^2])])/a)/b
```

### 3.119.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4318
```
Int[csc[(e_.) + (f_.)*(x_)]/(csc[(e_.) + (f_.)*(x_)]*(b_.) + (a_)), x_Symbo
l] :> Simp[1/b   Int[1/(1 + (a/b)*Sin[e + f*x]), x], x] /; FreeQ[{a, b, e,
f}, x] && NeQ[a^2 - b^2, 0]
```

rule 4382
```
Int[cot[(c_.) + (d_.)*(x_)]^2*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n_),
x_Symbol] :> Int[(-1 + Csc[c + d*x]^2)*(a + b*Csc[c + d*x])^n, x] /; FreeQ[
{a, b, c, d, n}, x] && NeQ[a^2 - b^2, 0]
```

rule 4407
```
Int[(csc[(e_.) + (f_.)*(x_)]*(d_.) + (c_))/(csc[(e_.) + (f_.)*(x_)]*(b_.) +
 (a_)), x_Symbol] :> Simp[c*(x/a), x] - Simp[(b*c - a*d)/a   Int[Csc[e + f*
x]/(a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && NeQ[b*c
- a*d, 0]
```

rule 4539
```
Int[((A_.) + csc[(e_.) + (f_.)*(x_)]^2*(C_.))/(csc[(e_.) + (f_.)*(x_)]*(b_.
) + (a_)), x_Symbol] :> Simp[C/b   Int[Csc[e + f*x], x], x] + Simp[1/b   In
t[(A*b - a*C*Csc[e + f*x])/(a + b*Csc[e + f*x]), x], x] /; FreeQ[{a, b, e,
f, A, C}, x]
```

### 3.119.4 Maple [A] (verified)

Time = 0.46 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.47

| method | result | size |
|---|---|---|
| default | $\frac{\ln(\tanh(\frac{x}{2})+1)}{a}+\frac{\ln(\tanh(\frac{x}{2}))}{b}-\frac{\ln(\tanh(\frac{x}{2})-1)}{a}+\frac{(2a^2+2b^2)\operatorname{arctanh}\left(\frac{-2b\tanh(\frac{x}{2})+2a}{2\sqrt{a^2+b^2}}\right)}{ab\sqrt{a^2+b^2}}$ | 84 |
| risch | $\frac{x}{a}+\frac{\sqrt{a^2+b^2}\ln\left(e^x+\frac{b+\sqrt{a^2+b^2}}{a}\right)}{ba}-\frac{\sqrt{a^2+b^2}\ln\left(e^x-\frac{-b+\sqrt{a^2+b^2}}{a}\right)}{ba}+\frac{\ln(e^x-1)}{b}-\frac{\ln(e^x+1)}{b}$ | 100 |

input
```
int(coth(x)^2/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/a*ln(tanh(1/2*x)+1)+1/b*ln(tanh(1/2*x))-1/a*ln(tanh(1/2*x)-1)+(2*a^2+2*b
^2)/a/b/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2)
)
```

### 3.119.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 141 vs. $2(53) = 106$.

Time $= 0.27$ (sec) , antiderivative size $= 141$, normalized size of antiderivative $= 2.47$

$$\int \frac{\coth^2(x)}{a + b\operatorname{csch}(x)}\,dx$$
$$= \frac{bx - a\log(\cosh(x) + \sinh(x) + 1) + a\log(\cosh(x) + \sinh(x) - 1) + \sqrt{a^2+b^2}\log\left(\frac{a^2\cosh(x)^2+a^2\sinh(x)^2+2}{a\,c}\right.}{ab}$$

input
```
integrate(coth(x)^2/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
(b*x - a*log(cosh(x) + sinh(x) + 1) + a*log(cosh(x) + sinh(x) - 1) + sqrt(
a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^
2 + 2*(a^2*cosh(x) + a*b)*sinh(x) + 2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(
x) + b))/(a*cosh(x)^2 + a*sinh(x)^2 + 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh
(x) - a)))/(a*b)
```

### 3.119.6 Sympy [F]

$$\int \frac{\coth^2(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\coth^2(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(coth(x)**2/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)**2/(a + b*csch(x)), x)
```

### 3.119.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 90, normalized size of antiderivative = 1.58

$$\int \frac{\coth^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x}{a} - \frac{\log\left(e^{(-x)}+1\right)}{b} + \frac{\log\left(e^{(-x)}-1\right)}{b} - \frac{\sqrt{a^2+b^2}\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{ab}$$

input
```
integrate(coth(x)^2/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
x/a - log(e^(-x) + 1)/b + log(e^(-x) - 1)/b - sqrt(a^2 + b^2)*log((a*e^(-x
) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))/(a*b)
```

### 3.119.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 89, normalized size of antiderivative = 1.56

$$\int \frac{\coth^2(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x}{a} - \frac{\log\left(e^x+1\right)}{b} + \frac{\log\left(\left|e^x-1\right|\right)}{b} - \frac{\sqrt{a^2+b^2}\log\left(\frac{\left|2ae^x+2b-2\sqrt{a^2+b^2}\right|}{\left|2ae^x+2b+2\sqrt{a^2+b^2}\right|}\right)}{ab}$$

input
```
integrate(coth(x)^2/(a+b*csch(x)),x, algorithm="giac")
```

output
```
x/a - log(e^x + 1)/b + log(abs(e^x - 1))/b - sqrt(a^2 + b^2)*log(abs(2*a*e
^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt(a^2 + b^2)))/(a*b
)
```

### 3.119.9 Mupad [B] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 316, normalized size of antiderivative = 5.54

$$\begin{aligned}
&\int \frac{\coth^2(x)}{a+b\operatorname{csch}(x)}\,dx \\
&= \frac{x}{a} + \frac{\ln\left(32a^2b+32b^3-32b^3\,\mathrm{e}^x-32a^2b\,\mathrm{e}^x\right)}{b} - \frac{\ln\left(32a^2b+32b^3+32b^3\,\mathrm{e}^x+32a^2b\,\mathrm{e}^x\right)}{b} \\
&\quad + \frac{\ln\left(128b^5\,\mathrm{e}^x-64a^3b^2-64ab^4-128b^4\,\mathrm{e}^x\sqrt{a^2+b^2}+32a^4b\,\mathrm{e}^x+160a^2b^3\,\mathrm{e}^x+64ab^3\sqrt{a^2+b^2}+32a\right.}{ab} \\
&\quad - \frac{\ln\left(128b^5\,\mathrm{e}^x-64a^3b^2-64ab^4+128b^4\,\mathrm{e}^x\sqrt{a^2+b^2}+32a^4b\,\mathrm{e}^x+160a^2b^3\,\mathrm{e}^x-64ab^3\sqrt{a^2+b^2}-32a\right.}{ab}
\end{aligned}$$

input
```
int(coth(x)^2/(a + b/sinh(x)),x)
```

output
```
x/a + log(32*a^2*b + 32*b^3 - 32*b^3*exp(x) - 32*a^2*b*exp(x))/b - log(32*
a^2*b + 32*b^3 + 32*b^3*exp(x) + 32*a^2*b*exp(x))/b + (log(128*b^5*exp(x)
- 64*a^3*b^2 - 64*a*b^4 - 128*b^4*exp(x)*(a^2 + b^2)^(1/2) + 32*a^4*b*exp(
x) + 160*a^2*b^3*exp(x) + 64*a*b^3*(a^2 + b^2)^(1/2) + 32*a^3*b*(a^2 + b^2
)^(1/2) - 96*a^2*b^2*exp(x)*(a^2 + b^2)^(1/2))*(a^2 + b^2)^(1/2))/(a*b) -
(log(128*b^5*exp(x) - 64*a^3*b^2 - 64*a*b^4 + 128*b^4*exp(x)*(a^2 + b^2)^(
1/2) + 32*a^4*b*exp(x) + 160*a^2*b^3*exp(x) - 64*a*b^3*(a^2 + b^2)^(1/2) -
 32*a^3*b*(a^2 + b^2)^(1/2) + 96*a^2*b^2*exp(x)*(a^2 + b^2)^(1/2))*(a^2 +
b^2)^(1/2))/(a*b)
```

# 3.120 $\int \frac{\coth^3(x)}{a+b\mathbf{csch}(x)}\,dx$

3.120.1 Optimal result . . . 829
3.120.2 Mathematica [A] (verified) . . . 829
3.120.3 Rubi [A] (verified) . . . 830
3.120.4 Maple [B] (verified) . . . 831
3.120.5 Fricas [B] (verification not implemented) . . . 832
3.120.6 Sympy [F] . . . 832
3.120.7 Maxima [B] (verification not implemented) . . . 833
3.120.8 Giac [B] (verification not implemented) . . . 833
3.120.9 Mupad [B] (verification not implemented) . . . 834

## 3.120.1 Optimal result

Integrand size = 13, antiderivative size = 32

$$\int \frac{\coth^3(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{\operatorname{csch}(x)}{b} + \left(\frac{1}{a}+\frac{a}{b^2}\right)\log(a+b\operatorname{csch}(x)) + \frac{\log(\sinh(x))}{a}$$

output
```
-csch(x)/b+(1/a+a/b^2)*ln(a+b*csch(x))+ln(sinh(x))/a
```

## 3.120.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 37, normalized size of antiderivative = 1.16

$$\int \frac{\coth^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-ab\operatorname{csch}(x) - a^2\log(\sinh(x)) + (a^2+b^2)\log(b+a\sinh(x))}{ab^2}$$

input
```
Integrate[Coth[x]^3/(a + b*Csch[x]),x]
```

output
```
(-(a*b*Csch[x]) - a^2*Log[Sinh[x]] + (a^2 + b^2)*Log[b + a*Sinh[x]])/(a*b^
2)
```

### 3.120.3 Rubi [A] (verified)

Time = 0.27 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.28, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 4373, 25, 522, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^3(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i\cot(ix)^3}{a+ib\csc(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\cot(ix)^3}{a+ib\csc(ix)}dx$$

$$\downarrow 4373$$

$$\frac{\int -\frac{\left(\operatorname{csch}^2(x)b^2+b^2\right)\sinh(x)}{b(a+b\operatorname{csch}(x))}d(b\operatorname{csch}(x))}{b^2}$$

$$\downarrow 25$$

$$-\frac{\int \frac{\left(\operatorname{csch}^2(x)b^2+b^2\right)\sinh(x)}{b(a+b\operatorname{csch}(x))}d(b\operatorname{csch}(x))}{b^2}$$

$$\downarrow 522$$

$$-\frac{\int \left(\frac{-a^2-b^2}{a(a+b\operatorname{csch}(x))}+\frac{b\sinh(x)}{a}+1\right)d(b\operatorname{csch}(x))}{b^2}$$

$$\downarrow 2009$$

$$\frac{\left(a^2+b^2\right)\log(a+b\operatorname{csch}(x))}{a}-\frac{b^2\log(b\operatorname{csch}(x))}{a}-b\operatorname{csch}(x)}{b^2}$$

input
```
Int[Coth[x]^3/(a + b*Csch[x]),x]
```

output
```
(-(b*Csch[x]) - (b^2*Log[b*Csch[x]])/a + ((a^2 + b^2)*Log[a + b*Csch[x]])/
a)/b^2
```

#### 3.120.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 522
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_.
), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x],
x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

### 3.120.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 74 vs. $2(32) = 64$.

Time $= 0.67$ (sec) , antiderivative size $= 75$, normalized size of antiderivative $= 2.34$

| method | result |
|---|---|
| risch | $-\frac{x}{a} - \frac{2\,\mathrm{e}^{x}}{b(\mathrm{e}^{2x}-1)} + \frac{a\ln\left(\mathrm{e}^{2x}+\frac{2b\,\mathrm{e}^{x}}{a}-1\right)}{b^2} + \frac{\ln\left(\mathrm{e}^{2x}+\frac{2b\,\mathrm{e}^{x}}{a}-1\right)}{a} - \frac{a\ln(\mathrm{e}^{2x}-1)}{b^2}$ |
| default | $\frac{\tanh\left(\frac{x}{2}\right)}{2b} + \frac{(2a^2+2b^2)\ln\left(-\tanh\left(\frac{x}{2}\right)^2 b+2a\tanh\left(\frac{x}{2}\right)+b\right)}{2a\,b^2} - \frac{1}{2b\tanh\left(\frac{x}{2}\right)} - \frac{a\ln\left(\tanh\left(\frac{x}{2}\right)\right)}{b^2} - \frac{\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)}{a} - \frac{\ln\left(\tanh\left(\frac{x}{2}\right)+\right.}{a}$ |

input
```
int(coth(x)^3/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-x/a-2*exp(x)/b/(exp(2*x)-1)+a/b^2*ln(exp(2*x)+2*b/a*exp(x)-1)+1/a*ln(exp(
2*x)+2*b/a*exp(x)-1)-a/b^2*ln(exp(2*x)-1)
```

### 3.120.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 199 vs. $2(32) = 64$.

Time $= 0.28$ (sec) , antiderivative size $= 199$, normalized size of antiderivative $= 6.22$

$$\int \frac{\coth^3(x)}{a + b\operatorname{csch}(x)}\,dx =$$
$$-\frac{b^2 x\cosh(x)^2 + b^2 x\sinh(x)^2 - b^2 x + 2ab\cosh(x) - \left((a^2+b^2)\cosh(x)^2 + 2(a^2+b^2)\cosh(x)\sinh(x)\right.}{}$$

input
```
integrate(coth(x)^3/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-(b^2*x*cosh(x)^2 + b^2*x*sinh(x)^2 - b^2*x + 2*a*b*cosh(x) - ((a^2 + b^2)
*cosh(x)^2 + 2*(a^2 + b^2)*cosh(x)*sinh(x) + (a^2 + b^2)*sinh(x)^2 - a^2 -
 b^2)*log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x))) + (a^2*cosh(x)^2 + 2*a^2*
cosh(x)*sinh(x) + a^2*sinh(x)^2 - a^2)*log(2*sinh(x)/(cosh(x) - sinh(x)))
+ 2*(b^2*x*cosh(x) + a*b)*sinh(x))/(a*b^2*cosh(x)^2 + 2*a*b^2*cosh(x)*sinh
(x) + a*b^2*sinh(x)^2 - a*b^2)
```

### 3.120.6 Sympy [F]

$$\int \frac{\coth^3(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\coth^3(x)}{a + b\operatorname{csch}(x)}\,dx$$

input
```
integrate(coth(x)**3/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)**3/(a + b*csch(x)), x)
```

### 3.120.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 82 vs. $2(32) = 64$.

Time $= 0.19$ (sec) , antiderivative size $= 82$, normalized size of antiderivative $= 2.56$

$$\int \frac{\coth^3(x)}{a + b\operatorname{csch}(x)}\,dx = \frac{x}{a} + \frac{2\,e^{(-x)}}{be^{(-2\,x)} - b} - \frac{a\log\left(e^{(-x)} + 1\right)}{b^2} - \frac{a\log\left(e^{(-x)} - 1\right)}{b^2} + \frac{(a^2 + b^2)\log\left(-2\,be^{(-x)} + ae^{(-2\,x)} - a\right)}{ab^2}$$

input
```
integrate(coth(x)^3/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
x/a + 2*e^(-x)/(b*e^(-2*x) - b) - a*log(e^(-x) + 1)/b^2 - a*log(e^(-x) - 1
)/b^2 + (a^2 + b^2)*log(-2*b*e^(-x) + a*e^(-2*x) - a)/(a*b^2)
```

### 3.120.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 80 vs. $2(32) = 64$.

Time $= 0.28$ (sec) , antiderivative size $= 80$, normalized size of antiderivative $= 2.50$

$$\int \frac{\coth^3(x)}{a + b\operatorname{csch}(x)}\,dx = -\frac{a\log\left(\left|-e^{(-x)} + e^{x}\right|\right)}{b^2} + \frac{(a^2 + b^2)\log\left(\left|-a\left(e^{(-x)} - e^{x}\right) + 2\,b\right|\right)}{ab^2} + \frac{a\left(e^{(-x)} - e^{x}\right) + 2\,b}{b^2\left(e^{(-x)} - e^{x}\right)}$$

input
```
integrate(coth(x)^3/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-a*log(abs(-e^(-x) + e^x))/b^2 + (a^2 + b^2)*log(abs(-a*(e^(-x) - e^x) + 2
*b))/(a*b^2) + (a*(e^(-x) - e^x) + 2*b)/(b^2*(e^(-x) - e^x))
```

### 3.120.9 Mupad [B] (verification not implemented)

Time = 2.44 (sec) , antiderivative size = 261, normalized size of antiderivative = 8.16

$$\int \frac{\coth^3(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{2\,e^x}{b-b\,e^{2x}} - \frac{x}{a} + \frac{\ln\left(16\,a^5\,e^{2x} - 4\,a\,b^4 - 16\,a^5 - 16\,a^3\,b^2 + 8\,b^5\,e^x + 16\,a^3\,b^2\,e^{2x} + 32\,a^4\,b\,e^x + 4\,a\,b^4\,e^{2x} + 32\,a^2\,b^3\,e^x\right)}{a} + \frac{a\,\ln\left(16\,a^5\,e^{2x} - 4\,a\,b^4 - 16\,a^5 - 16\,a^3\,b^2 + 8\,b^5\,e^x + 16\,a^3\,b^2\,e^{2x} + 32\,a^4\,b\,e^x + 4\,a\,b^4\,e^{2x} + 32\,a^2\,b^3\,e^x\right)}{b^2} - \frac{a\,\ln\left(16\,a^6\,e^{2x} + 4\,b^6\,e^{2x} - 16\,a^6 - 4\,b^6 - 20\,a^2\,b^4 - 32\,a^4\,b^2 + 20\,a^2\,b^4\,e^{2x} + 32\,a^4\,b^2\,e^{2x}\right)}{b^2}$$

input
```
int(coth(x)^3/(a + b/sinh(x)),x)
```

output
```
(2*exp(x))/(b - b*exp(2*x)) - x/a + log(16*a^5*exp(2*x) - 4*a*b^4 - 16*a^5
 - 16*a^3*b^2 + 8*b^5*exp(x) + 16*a^3*b^2*exp(2*x) + 32*a^4*b*exp(x) + 4*a
*b^4*exp(2*x) + 32*a^2*b^3*exp(x))/a + (a*log(16*a^5*exp(2*x) - 4*a*b^4 -
16*a^5 - 16*a^3*b^2 + 8*b^5*exp(x) + 16*a^3*b^2*exp(2*x) + 32*a^4*b*exp(x)
 + 4*a*b^4*exp(2*x) + 32*a^2*b^3*exp(x)))/b^2 - (a*log(16*a^6*exp(2*x) + 4
*b^6*exp(2*x) - 16*a^6 - 4*b^6 - 20*a^2*b^4 - 32*a^4*b^2 + 20*a^2*b^4*exp(
2*x) + 32*a^4*b^2*exp(2*x)))/b^2
```

# 3.121 $\int \frac{\coth^4(x)}{a+b\mathbf{csch}(x)}\,dx$

3.121.1 Optimal result . . . 835
3.121.2 Mathematica [A] (verified) . . . 835
3.121.3 Rubi [C] (verified) . . . 836
3.121.4 Maple [A] (verified) . . . 840
3.121.5 Fricas [B] (verification not implemented) . . . 841
3.121.6 Sympy [F] . . . 841
3.121.7 Maxima [B] (verification not implemented) . . . 842
3.121.8 Giac [B] (verification not implemented) . . . 842
3.121.9 Mupad [B] (verification not implemented) . . . 843

## 3.121.1 Optimal result

Integrand size = 13, antiderivative size = 88

$$\int \frac{\coth^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x}{a} - \frac{(2a^2+3b^2)\operatorname{arctanh}(\cosh(x))}{2b^3} + \frac{2(a^2+b^2)^{3/2}\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{ab^3} + \frac{a\coth(x)}{b^2} - \frac{\coth(x)\operatorname{csch}(x)}{2b}$$

output
```
x/a-1/2*(2*a^2+3*b^2)*arctanh(cosh(x))/b^3+2*(a^2+b^2)^(3/2)*arctanh((a-b*
tanh(1/2*x))/(a^2+b^2)^(1/2))/a/b^3+a*coth(x)/b^2-1/2*coth(x)*csch(x)/b
```

## 3.121.2 Mathematica [A] (verified)

Time = 0.55 (sec) , antiderivative size = 172, normalized size of antiderivative = 1.95

$$\int \frac{\coth^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\operatorname{csch}(x)(b+a\sinh(x))\left(8b^3x - 16(-a^2-b^2)^{3/2}\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right) + 4a^2b\coth\left(\frac{x}{2}\right) - ab^2\operatorname{csch}^2\left(\frac{x}{2}\right) - 4a(\right.}{8ab^3(a+b\operatorname{csch}(x)}$$

input
```
Integrate[Coth[x]^4/(a + b*Csch[x]),x]
```

output
```
(Csch[x]*(b + a*Sinh[x])*(8*b^3*x - 16*(-a^2 - b^2)^(3/2)*ArcTan[(a - b*Ta
nh[x/2])/Sqrt[-a^2 - b^2]] + 4*a^2*b*Coth[x/2] - a*b^2*Csch[x/2]^2 - 4*a*(
2*a^2 + 3*b^2)*Log[Cosh[x/2]] + 4*a*(2*a^2 + 3*b^2)*Log[Sinh[x/2]] - a*b^2
*Sech[x/2]^2 + 4*a^2*b*Tanh[x/2]))/(8*a*b^3*(a + b*Csch[x]))
```

### 3.121.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.74 (sec) , antiderivative size = 118, normalized size of antiderivative = 1.34, number of steps used = 19, number of rules used = 18, $\frac{\text{number of rules}}{\text{integrand size}} = 1.385$, Rules used = {3042, 4386, 26, 26, 3042, 26, 3372, 26, 3042, 26, 3536, 26, 3042, 26, 3139, 1083, 219, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^4(x)}{a + b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int \frac{\cot(ix)^4}{a + ib\csc(ix)}\,dx$$
$$\downarrow 4386$$
$$\int \frac{i\cosh(x)\coth^3(x)}{ia\sinh(x) + ib}\,dx$$
$$\downarrow 26$$
$$i\int -\frac{i\cosh(x)\coth^3(x)}{b + a\sinh(x)}\,dx$$
$$\downarrow 26$$
$$\int \frac{\cosh(x)\coth^3(x)}{a\sinh(x) + b}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{i\cos(ix)^4}{\sin(ix)^3(b - ia\sin(ix))}\,dx$$
$$\downarrow 26$$
$$-i\int \frac{\cos(ix)^4}{\sin(ix)^3(b - ia\sin(ix))}\,dx$$

$$\downarrow 3372$$

$$-i\left(-\frac{\int -\frac{i\operatorname{csch}(x)\left(2a^2-b\sinh(x)a+3b^2+2b^2\sinh^2(x)\right)}{b+a\sinh(x)}dx}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 26$$

$$-i\left(\frac{i\int \frac{\operatorname{csch}(x)\left(2a^2-b\sinh(x)a+3b^2+2b^2\sinh^2(x)\right)}{b+a\sinh(x)}dx}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 3042$$

$$-i\left(\frac{i\int \frac{i\left(2a^2+ib\sin(ix)a+3b^2-2b^2\sin(ix)^2\right)}{\sin(ix)(b-ia\sin(ix))}dx}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{\int \frac{2a^2+ib\sin(ix)a+3b^2-2b^2\sin(ix)^2}{\sin(ix)(b-ia\sin(ix))}dx}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 3536$$

$$-i\left(-\frac{\frac{2i\left(a^2+b^2\right)^2\int \frac{1}{b+a\sinh(x)}dx}{ab}+\frac{\left(2a^2+3b^2\right)\int -i\operatorname{csch}(x)dx}{b}-\frac{2ib^2x}{a}}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{\frac{2i\left(a^2+b^2\right)^2\int \frac{1}{b+a\sinh(x)}dx}{ab}-\frac{i\left(2a^2+3b^2\right)\int \operatorname{csch}(x)dx}{b}-\frac{2ib^2x}{a}}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 3042$$

$$-i\left(-\frac{\frac{2i\left(a^2+b^2\right)^2\int \frac{1}{b-ia\sin(ix)}dx}{ab}-\frac{i\left(2a^2+3b^2\right)\int i\csc(ix)dx}{b}-\frac{2ib^2x}{a}}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 26$$

$$-i\left(-\frac{\frac{2i\left(a^2+b^2\right)^2\int \frac{1}{b-ia\sin(ix)}dx}{ab}+\frac{\left(2a^2+3b^2\right)\int \csc(ix)dx}{b}-\frac{2ib^2x}{a}}{2b^2}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 3139$$

$$-i\left(-\frac{\left(2a^2+3b^2\right)\int \csc(ix)dx}{b}+\frac{4i\left(a^2+b^2\right)^2\int \frac{1}{-b\tanh^2\left(\frac{x}{2}\right)+2a\tanh\left(\frac{x}{2}\right)+b}d\tanh\left(\frac{x}{2}\right)}{ab}-\frac{2ib^2x}{a}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 1083$$

$$-i\left(-\frac{\left(2a^2+3b^2\right)\int \csc(ix)dx}{b}-\frac{8i\left(a^2+b^2\right)^2\int \frac{1}{4\left(a^2+b^2\right)-\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)^2}d\left(2a-2b\tanh\left(\frac{x}{2}\right)\right)}{ab}-\frac{2ib^2x}{a}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}}{2b}\right)$$

$$\downarrow 219$$

$$-i\left(-\frac{\left(2a^2+3b^2\right)\int \csc(ix)dx}{b}-\frac{4i\left(a^2+b^2\right)^{3/2}\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{ab}-\frac{2ib^2x}{a}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

$$\downarrow 4257$$

$$-i\left(-\frac{i\left(2a^2+3b^2\right)\operatorname{arctanh}(\cosh(x))}{b}-\frac{4i\left(a^2+b^2\right)^{3/2}\operatorname{arctanh}\left(\frac{2a-2b\tanh\left(\frac{x}{2}\right)}{2\sqrt{a^2+b^2}}\right)}{ab}-\frac{2ib^2x}{a}+\frac{ia\coth(x)}{b^2}-\frac{i\coth(x)\operatorname{csch}(x)}{2b}\right)$$

input
```
Int[Coth[x]^4/(a + b*Csch[x]),x]
```

output
```
(-I)*(-1/2*(((-2*I)*b^2*x)/a + (I*(2*a^2 + 3*b^2)*ArcTanh[Cosh[x]])/b - ((
4*I)*(a^2 + b^2)^(3/2)*ArcTanh[(2*a - 2*b*Tanh[x/2])/(2*Sqrt[a^2 + b^2])])
/(a*b))/b^2 + (I*a*Coth[x])/b^2 - ((I/2)*Coth[x]*Csch[x])/b)
```

### 3.121.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 1083
```
Int[((a_) + (b_.)*(x_) + (c_.)*(x_)^2)^(-1), x_Symbol] :> Simp[-2   Subst[I
nt[1/Simp[b^2 - 4*a*c - x^2, x], x], x, b + 2*c*x], x] /; FreeQ[{a, b, c},
x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3139
```
Int[((a_) + (b_.)*sin[(c_.) + (d_.)*(x_)])^(-1), x_Symbol] :> With[{e = Fre
eFactors[Tan[(c + d*x)/2], x]}, Simp[2*(e/d)   Subst[Int[1/(a + 2*b*e*x + a
*e^2*x^2), x], x, Tan[(c + d*x)/2]/e], x]] /; FreeQ[{a, b, c, d}, x] && NeQ
[a^2 - b^2, 0]
```

rule 3372
```
Int[cos[(e_.) + (f_.)*(x_)]^4*((d_.)*sin[(e_.) + (f_.)*(x_)])^(n_)*((a_) +
(b_.)*sin[(e_.) + (f_.)*(x_)])^(m_), x_Symbol] :> Simp[Cos[e + f*x]*(a + b*
Sin[e + f*x])^(m + 1)*((d*Sin[e + f*x])^(n + 1)/(a*d*f*(n + 1))), x] + (-Si
mp[b*(m + n + 2)*Cos[e + f*x]*(a + b*Sin[e + f*x])^(m + 1)*((d*Sin[e + f*x]
)^(n + 2)/(a^2*d^2*f*(n + 1)*(n + 2))), x] - Simp[1/(a^2*d^2*(n + 1)*(n + 2
))   Int[(a + b*Sin[e + f*x])^m*(d*Sin[e + f*x])^(n + 2)*Simp[a^2*n*(n + 2)
 - b^2*(m + n + 2)*(m + n + 3) + a*b*m*Sin[e + f*x] - (a^2*(n + 1)*(n + 2)
- b^2*(m + n + 2)*(m + n + 4))*Sin[e + f*x]^2, x], x], x]) /; FreeQ[{a, b,
d, e, f, m}, x] && NeQ[a^2 - b^2, 0] && (IGtQ[m, 0] || IntegersQ[2*m, 2*n])
 &&  !m < -1 && LtQ[n, -1] && (LtQ[n, -2] || EqQ[m + n + 4, 0])
```

rule 3536
```
Int[((A_.) + (B_.)*sin[(e_.) + (f_.)*(x_)] + (C_.)*sin[(e_.) + (f_.)*(x_)]^
2)/(((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)])*((c_.) + (d_.)*sin[(e_.) + (f_.)
*(x_)])), x_Symbol] :> Simp[C*(x/(b*d)), x] + (Simp[(A*b^2 - a*b*B + a^2*C)
/(b*(b*c - a*d))   Int[1/(a + b*Sin[e + f*x]), x], x] - Simp[(c^2*C - B*c*d
 + A*d^2)/(d*(b*c - a*d))   Int[1/(c + d*Sin[e + f*x]), x], x]) /; FreeQ[{a
, b, c, d, e, f, A, B, C}, x] && NeQ[b*c - a*d, 0] && NeQ[a^2 - b^2, 0] &&
NeQ[c^2 - d^2, 0]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

rule 4386
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Int[Cos[c + d*x]^m*((b + a*Sin[c + d*x])^n/Sin[c + d*x]^(m
 + n)), x] /; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && IntegerQ[n] &&
 IntegerQ[m] && (IntegerQ[m/2] || LeQ[m, 1])
```

### 3.121.4 Maple [A] (verified)

Time = 1.13 (sec) , antiderivative size = 150, normalized size of antiderivative = 1.70

| method | result |
|---|---|
| default | $\frac{\frac{\tanh\left(\frac{x}{2}\right)^2 b}{2}+2a\tanh\left(\frac{x}{2}\right)}{4b^2}-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)-1\right)}{a}+\frac{\left(8a^4+16a^2b^2+8b^4\right)\operatorname{arctanh}\left(\frac{-2b\tanh\left(\frac{x}{2}\right)+2a}{2\sqrt{a^2+b^2}}\right)}{4a\,b^3\sqrt{a^2+b^2}}-\frac{1}{8b\tanh\left(\frac{x}{2}\right)^2}+\frac{\left(4a^2+6b^2\right)\ln$ |
| risch | $\frac{x}{a}+\frac{-\mathrm{e}^{3x}b+2a\,\mathrm{e}^{2x}-\mathrm{e}^{x}b-2a}{\left(\mathrm{e}^{2x}-1\right)^2b^2}-\frac{\ln\left(\mathrm{e}^{x}+1\right)a^2}{b^3}-\frac{3\ln\left(\mathrm{e}^{x}+1\right)}{2b}+\frac{\ln\left(\mathrm{e}^{x}-1\right)a^2}{b^3}+\frac{3\ln\left(\mathrm{e}^{x}-1\right)}{2b}+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}\ln\left(\mathrm{e}^{x}+\frac{\left(a^2+b^2\right)^{\frac{3}{2}}+a^2b}{\left(a^2+b^2\right)a}\right.}{b^3a}$ |

input
```
int(coth(x)^4/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/4/b^2*(1/2*tanh(1/2*x)^2*b+2*a*tanh(1/2*x))-1/a*ln(tanh(1/2*x)-1)+1/4*(8
*a^4+16*a^2*b^2+8*b^4)/a/b^3/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)
+2*a)/(a^2+b^2)^(1/2))-1/8/b/tanh(1/2*x)^2+1/4/b^3*(4*a^2+6*b^2)*ln(tanh(1
/2*x))+1/2*a/b^2/tanh(1/2*x)+1/a*ln(tanh(1/2*x)+1)
```

### 3.121.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 831 vs. 2(80) = 160.

Time = 0.34 (sec) , antiderivative size = 831, normalized size of antiderivative = 9.44

$$\int \frac{\coth^4(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(coth(x)^4/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/2*(2*b^3*x*cosh(x)^4 + 2*b^3*x*sinh(x)^4 - 2*a*b^2*cosh(x)^3 + 2*b^3*x -
 2*a*b^2*cosh(x) + 2*(4*b^3*x*cosh(x) - a*b^2)*sinh(x)^3 - 4*a^2*b - 4*(b^
3*x - a^2*b)*cosh(x)^2 + 2*(6*b^3*x*cosh(x)^2 - 2*b^3*x - 3*a*b^2*cosh(x)
+ 2*a^2*b)*sinh(x)^2 + 2*((a^2 + b^2)*cosh(x)^4 + 4*(a^2 + b^2)*cosh(x)*si
nh(x)^3 + (a^2 + b^2)*sinh(x)^4 - 2*(a^2 + b^2)*cosh(x)^2 + 2*(3*(a^2 + b^
2)*cosh(x)^2 - a^2 - b^2)*sinh(x)^2 + a^2 + b^2 + 4*((a^2 + b^2)*cosh(x)^3
 - (a^2 + b^2)*cosh(x))*sinh(x))*sqrt(a^2 + b^2)*log((a^2*cosh(x)^2 + a^2*
sinh(x)^2 + 2*a*b*cosh(x) + a^2 + 2*b^2 + 2*(a^2*cosh(x) + a*b)*sinh(x) +
2*sqrt(a^2 + b^2)*(a*cosh(x) + a*sinh(x) + b))/(a*cosh(x)^2 + a*sinh(x)^2
+ 2*b*cosh(x) + 2*(a*cosh(x) + b)*sinh(x) - a)) - ((2*a^3 + 3*a*b^2)*cosh(
x)^4 + 4*(2*a^3 + 3*a*b^2)*cosh(x)*sinh(x)^3 + (2*a^3 + 3*a*b^2)*sinh(x)^4
 + 2*a^3 + 3*a*b^2 - 2*(2*a^3 + 3*a*b^2)*cosh(x)^2 - 2*(2*a^3 + 3*a*b^2 -
3*(2*a^3 + 3*a*b^2)*cosh(x)^2)*sinh(x)^2 + 4*((2*a^3 + 3*a*b^2)*cosh(x)^3
- (2*a^3 + 3*a*b^2)*cosh(x))*sinh(x))*log(cosh(x) + sinh(x) + 1) + ((2*a^3
 + 3*a*b^2)*cosh(x)^4 + 4*(2*a^3 + 3*a*b^2)*cosh(x)*sinh(x)^3 + (2*a^3 + 3
*a*b^2)*sinh(x)^4 + 2*a^3 + 3*a*b^2 - 2*(2*a^3 + 3*a*b^2)*cosh(x)^2 - 2*(2
*a^3 + 3*a*b^2 - 3*(2*a^3 + 3*a*b^2)*cosh(x)^2)*sinh(x)^2 + 4*((2*a^3 + 3*
a*b^2)*cosh(x)^3 - (2*a^3 + 3*a*b^2)*cosh(x))*sinh(x))*log(cosh(x) + sinh(
x) - 1) + 2*(4*b^3*x*cosh(x)^3 - 3*a*b^2*cosh(x)^2 - a*b^2 - 4*(b^3*x - a^
2*b)*cosh(x))*sinh(x))/(a*b^3*cosh(x)^4 + 4*a*b^3*cosh(x)*sinh(x)^3 + a...
```

### 3.121.6 Sympy [F]

$$\int \frac{\coth^4(x)}{a + b\operatorname{csch}(x)}\,dx = \int \frac{\coth^4(x)}{a + b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(coth(x)**4/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)**4/(a + b*csch(x)), x)
```

### 3.121.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 178 vs. 2(80) = 160.

Time = 0.28 (sec) , antiderivative size = 178, normalized size of antiderivative = 2.02

$$\int \frac{\coth^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{be^{(-x)}+2\,ae^{(-2\,x)}+be^{(-3\,x)}-2\,a}{2\,b^2e^{(-2\,x)}-b^2e^{(-4\,x)}-b^2}+\frac{x}{a}-\frac{(2\,a^2+3\,b^2)\log\left(e^{(-x)}+1\right)}{2\,b^3}$$
$$+\frac{(2\,a^2+3\,b^2)\log\left(e^{(-x)}-1\right)}{2\,b^3}-\frac{(a^4+2\,a^2b^2+b^4)\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}ab^3}$$

input
```
integrate(coth(x)^4/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
(b*e^(-x) + 2*a*e^(-2*x) + b*e^(-3*x) - 2*a)/(2*b^2*e^(-2*x) - b^2*e^(-4*x
) - b^2) + x/a - 1/2*(2*a^2 + 3*b^2)*log(e^(-x) + 1)/b^3 + 1/2*(2*a^2 + 3*
b^2)*log(e^(-x) - 1)/b^3 - (a^4 + 2*a^2*b^2 + b^4)*log((a*e^(-x) - b - sqr
t(a^2 + b^2))/(a*e^(-x) - b + sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a*b^3)
```

### 3.121.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 161 vs. 2(80) = 160.

Time = 0.29 (sec) , antiderivative size = 161, normalized size of antiderivative = 1.83

$$\int \frac{\coth^4(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{x}{a}-\frac{(2\,a^2+3\,b^2)\log\left(e^x+1\right)}{2\,b^3}+\frac{(2\,a^2+3\,b^2)\log\left(\left|e^x-1\right|\right)}{2\,b^3}$$
$$-\frac{(a^4+2\,a^2b^2+b^4)\log\left(\frac{\left|2\,ae^x+2\,b-2\sqrt{a^2+b^2}\right|}{\left|2\,ae^x+2\,b+2\sqrt{a^2+b^2}\right|}\right)}{\sqrt{a^2+b^2}ab^3}$$
$$-\frac{be^{(3\,x)}-2\,ae^{(2\,x)}+be^x+2\,a}{b^2\left(e^{(2\,x)}-1\right)^2}$$

input
```
integrate(coth(x)^4/(a+b*csch(x)),x, algorithm="giac")
```

output
```
x/a - 1/2*(2*a^2 + 3*b^2)*log(e^x + 1)/b^3 + 1/2*(2*a^2 + 3*b^2)*log(abs(e
^x - 1))/b^3 - (a^4 + 2*a^2*b^2 + b^4)*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2
+ b^2))/abs(2*a*e^x + 2*b + 2*sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a*b^3) -
(b*e^(3*x) - 2*a*e^(2*x) + b*e^x + 2*a)/(b^2*(e^(2*x) - 1)^2)
```

### 3.121.9 Mupad [B] (verification not implemented)

Time = 3.19 (sec) , antiderivative size = 378, normalized size of antiderivative = 4.30

$$\int \frac{\coth^4(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{\frac{2a}{b^2}-\frac{e^x}{b}}{e^{2x}-1}+\frac{x}{a}+\frac{\ln\left(e^x-1\right)\left(2a^2+3b^2\right)}{2b^3}-\frac{\ln\left(e^x+1\right)\left(2a^2+3b^2\right)}{2b^3}-\frac{2e^x}{b\left(e^{4x}-2e^{2x}+1\right)}$$
$$+\frac{\ln\left(a^3\sqrt{\left(a^2+b^2\right)^3}-2a^5b-2ab^5-4a^3b^3+a^6e^x+4b^6e^x+2ab^2\sqrt{\left(a^2+b^2\right)^3}-4b^3e^x\sqrt{\left(a^2+b^2\right)^3}\right.}{ab^3}$$
$$-\frac{\ln\left(a^6e^x-2a^5b-a^3\sqrt{\left(a^2+b^2\right)^3}-4a^3b^3-2ab^5+4b^6e^x-2ab^2\sqrt{\left(a^2+b^2\right)^3}+4b^3e^x\sqrt{\left(a^2+b^2\right)^3}\right.}{ab^3}$$

input
```
int(coth(x)^4/(a + b/sinh(x)),x)
```

output
```
((2*a)/b^2 - exp(x)/b)/(exp(2*x) - 1) + x/a + (log(exp(x) - 1)*(2*a^2 + 3*
b^2))/(2*b^3) - (log(exp(x) + 1)*(2*a^2 + 3*b^2))/(2*b^3) - (2*exp(x))/(b*
(exp(4*x) - 2*exp(2*x) + 1)) + (log(a^3*((a^2 + b^2)^3)^(1/2) - 2*a^5*b -
2*a*b^5 - 4*a^3*b^3 + a^6*exp(x) + 4*b^6*exp(x) + 2*a*b^2*((a^2 + b^2)^3)^
(1/2) - 4*b^3*exp(x)*((a^2 + b^2)^3)^(1/2) + 9*a^2*b^4*exp(x) + 6*a^4*b^2*
exp(x) - 3*a^2*b*exp(x)*((a^2 + b^2)^3)^(1/2))*((a^2 + b^2)^3)^(1/2))/(a*b
^3) - (log(a^6*exp(x) - 2*a^5*b - a^3*((a^2 + b^2)^3)^(1/2) - 4*a^3*b^3 -
2*a*b^5 + 4*b^6*exp(x) - 2*a*b^2*((a^2 + b^2)^3)^(1/2) + 4*b^3*exp(x)*((a^
2 + b^2)^3)^(1/2) + 9*a^2*b^4*exp(x) + 6*a^4*b^2*exp(x) + 3*a^2*b*exp(x)*(
(a^2 + b^2)^3)^(1/2))*((a^2 + b^2)^3)^(1/2))/(a*b^3)
```

# 3.122 $\int \frac{\coth^5(x)}{a+b\mathbf{csch}(x)}\,dx$

3.122.1 Optimal result . . . 844
3.122.2 Mathematica [A] (verified) . . . 844
3.122.3 Rubi [A] (verified) . . . 845
3.122.4 Maple [B] (verified) . . . 846
3.122.5 Fricas [B] (verification not implemented) . . . 847
3.122.6 Sympy [F] . . . 848
3.122.7 Maxima [B] (verification not implemented) . . . 848
3.122.8 Giac [B] (verification not implemented) . . . 849
3.122.9 Mupad [B] (verification not implemented) . . . 849

## 3.122.1 Optimal result

Integrand size = 13, antiderivative size = 70

$$\int \frac{\coth^5(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{(a^2+2b^2)\operatorname{csch}(x)}{b^3} + \frac{a\operatorname{csch}^2(x)}{2b^2} - \frac{\operatorname{csch}^3(x)}{3b} + \frac{(a^2+b^2)^2\log(a+b\operatorname{csch}(x))}{ab^4} + \frac{\log(\sinh(x))}{a}$$

output
```
-(a^2+2*b^2)*csch(x)/b^3+1/2*a*csch(x)^2/b^2-1/3*csch(x)^3/b+(a^2+b^2)^2*l
n(a+b*csch(x))/a/b^4+ln(sinh(x))/a
```

## 3.122.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 83, normalized size of antiderivative = 1.19

$$\int \frac{\coth^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-6ab(a^2+2b^2)\operatorname{csch}(x) + 3a^2b^2\operatorname{csch}^2(x) - 2ab^3\operatorname{csch}^3(x) - 6a^2(a^2+2b^2)\log(\sinh(x)) + 6(a^2+b^2)^2\log(b+$$

input
```
Integrate[Coth[x]^5/(a + b*Csch[x]),x]
```

output
```
(-6*a*b*(a^2 + 2*b^2)*Csch[x] + 3*a^2*b^2*Csch[x]^2 - 2*a*b^3*Csch[x]^3 -
6*a^2*(a^2 + 2*b^2)*Log[Sinh[x]] + 6*(a^2 + b^2)^2*Log[b + a*Sinh[x]])/(6*
a*b^4)
```

### 3.122.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 75, normalized size of antiderivative = 1.07, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$, Rules used = {3042, 26, 4373, 522, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^5(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int \frac{i\cot(ix)^5}{a+ib\csc(ix)}dx$$

$$\downarrow 26$$

$$i\int \frac{\cot(ix)^5}{a+ib\csc(ix)}dx$$

$$\downarrow 4373$$

$$-\frac{\int \frac{\left(\operatorname{csch}^2(x)b^2+b^2\right)^2\sinh(x)}{b(a+b\operatorname{csch}(x))}d(b\operatorname{csch}(x))}{b^4}$$

$$\downarrow 522$$

$$-\frac{\int \left(\frac{\sinh(x)b^3}{a}+\operatorname{csch}^2(x)b^2-a\operatorname{csch}(x)b+a^2\left(\frac{2b^2}{a^2}+1\right)-\frac{\left(a^2+b^2\right)^2}{a(a+b\operatorname{csch}(x))}\right)d(b\operatorname{csch}(x))}{b^4}$$

$$\downarrow 2009$$

$$-\frac{b\left(a^2+2b^2\right)\operatorname{csch}(x)-\frac{\left(a^2+b^2\right)^2\log(a+b\operatorname{csch}(x))}{a}+\frac{b^4\log(b\operatorname{csch}(x))}{a}-\frac{1}{2}ab^2\operatorname{csch}^2(x)+\frac{1}{3}b^3\operatorname{csch}^3(x)}{b^4}$$

input
```
Int[Coth[x]^5/(a + b*Csch[x]),x]
```

output
```
-((b*(a^2 + 2*b^2)*Csch[x] - (a*b^2*Csch[x]^2)/2 + (b^3*Csch[x]^3)/3 + (b^
4*Log[b*Csch[x]])/a - ((a^2 + b^2)^2*Log[a + b*Csch[x]])/a)/b^4)
```

#### 3.122.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 522
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_.
), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x],
x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

### 3.122.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 173 vs. $2(66) = 132$.

Time = 1.60 (sec) , antiderivative size = 174, normalized size of antiderivative = 2.49

| method | result |
|---|---|
| risch | $-\frac{x}{a}-\frac{2\mathrm{e}^{x}\left(3a^{2}\mathrm{e}^{4x}+6b^{2}\mathrm{e}^{4x}-3ab\,\mathrm{e}^{3x}-6a^{2}\mathrm{e}^{2x}-8b^{2}\mathrm{e}^{2x}+3b\,\mathrm{e}^{x}a+3a^{2}+6b^{2}\right)}{3b^{3}\left(\mathrm{e}^{2x}-1\right)^{3}}-\frac{a^{3}\ln\left(\mathrm{e}^{2x}-1\right)}{b^{4}}-\frac{2a\ln\left(\mathrm{e}^{2x}-1\right)}{b^{2}}+\frac{a^{3}\ln\left(\mathrm{e}^{2x}+\frac{2b\,\mathrm{e}^{x}}{a}\right.}{b^{4}}$ |
| default | $\frac{\frac{\tanh\left(\frac{x}{2}\right)^{3}b^{2}}{3}+\tanh\left(\frac{x}{2}\right)^{2}ab+4a^{2}\tanh\left(\frac{x}{2}\right)+7b^{2}\tanh\left(\frac{x}{2}\right)}{8b^{3}}+\frac{\left(8a^{4}+16a^{2}b^{2}+8b^{4}\right)\ln\left(-\tanh\left(\frac{x}{2}\right)^{2}b+2a\tanh\left(\frac{x}{2}\right)+b\right)}{8b^{4}a}-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)+\right.}{a}$ |

input
```
int(coth(x)^5/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
-x/a-2/3*exp(x)*(3*a^2*exp(4*x)+6*b^2*exp(4*x)-3*a*b*exp(3*x)-6*a^2*exp(2*
x)-8*b^2*exp(2*x)+3*b*exp(x)*a+3*a^2+6*b^2)/b^3/(exp(2*x)-1)^3-1/b^4*a^3*l
n(exp(2*x)-1)-2*a/b^2*ln(exp(2*x)-1)+a^3/b^4*ln(exp(2*x)+2*b/a*exp(x)-1)+2
*a/b^2*ln(exp(2*x)+2*b/a*exp(x)-1)+1/a*ln(exp(2*x)+2*b/a*exp(x)-1)
```

### 3.122.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1288 vs. $2(66) = 132$.

Time $= 0.28$ (sec) , antiderivative size $= 1288$, normalized size of antiderivative $= 18.40$

$$\int \frac{\coth^5(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(coth(x)^5/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-1/3*(3*b^4*x*cosh(x)^6 + 3*b^4*x*sinh(x)^6 + 6*(a^3*b + 2*a*b^3)*cosh(x)^
5 + 6*(3*b^4*x*cosh(x) + a^3*b + 2*a*b^3)*sinh(x)^5 - 3*b^4*x - 3*(3*b^4*x
 + 2*a^2*b^2)*cosh(x)^4 + 3*(15*b^4*x*cosh(x)^2 - 3*b^4*x - 2*a^2*b^2 + 10
*(a^3*b + 2*a*b^3)*cosh(x))*sinh(x)^4 - 4*(3*a^3*b + 4*a*b^3)*cosh(x)^3 +
4*(15*b^4*x*cosh(x)^3 - 3*a^3*b - 4*a*b^3 + 15*(a^3*b + 2*a*b^3)*cosh(x)^2
 - 3*(3*b^4*x + 2*a^2*b^2)*cosh(x))*sinh(x)^3 + 3*(3*b^4*x + 2*a^2*b^2)*co
sh(x)^2 + 3*(15*b^4*x*cosh(x)^4 + 3*b^4*x + 2*a^2*b^2 + 20*(a^3*b + 2*a*b^
3)*cosh(x)^3 - 6*(3*b^4*x + 2*a^2*b^2)*cosh(x)^2 - 4*(3*a^3*b + 4*a*b^3)*c
osh(x))*sinh(x)^2 + 6*(a^3*b + 2*a*b^3)*cosh(x) - 3*((a^4 + 2*a^2*b^2 + b^
4)*cosh(x)^6 + 6*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)*sinh(x)^5 + (a^4 + 2*a^2*
b^2 + b^4)*sinh(x)^6 - 3*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)^4 - 3*(a^4 + 2*a^
2*b^2 + b^4 - 5*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)^2)*sinh(x)^4 - a^4 - 2*a^2
*b^2 - b^4 + 4*(5*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)^3 - 3*(a^4 + 2*a^2*b^2 +
 b^4)*cosh(x))*sinh(x)^3 + 3*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)^2 + 3*(5*(a^4
 + 2*a^2*b^2 + b^4)*cosh(x)^4 + a^4 + 2*a^2*b^2 + b^4 - 6*(a^4 + 2*a^2*b^2
 + b^4)*cosh(x)^2)*sinh(x)^2 + 6*((a^4 + 2*a^2*b^2 + b^4)*cosh(x)^5 - 2*(a
^4 + 2*a^2*b^2 + b^4)*cosh(x)^3 + (a^4 + 2*a^2*b^2 + b^4)*cosh(x))*sinh(x)
)*log(2*(a*sinh(x) + b)/(cosh(x) - sinh(x))) + 3*((a^4 + 2*a^2*b^2)*cosh(x
)^6 + 6*(a^4 + 2*a^2*b^2)*cosh(x)*sinh(x)^5 + (a^4 + 2*a^2*b^2)*sinh(x)^6
- 3*(a^4 + 2*a^2*b^2)*cosh(x)^4 - 3*(a^4 + 2*a^2*b^2 - 5*(a^4 + 2*a^2*b...
```

### 3.122.6 Sympy [F]

$$\int \frac{\coth^5(x)}{a+b\text{csch}(x)}\,dx = \int \frac{\coth^5(x)}{a+b\,\text{csch}(x)}\,dx$$

input
```
integrate(coth(x)**5/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)**5/(a + b*csch(x)), x)
```

### 3.122.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 190 vs. $2(66) = 132$.

Time = 0.19 (sec) , antiderivative size = 190, normalized size of antiderivative = 2.71

$$\begin{aligned}\int \frac{\coth^5(x)}{a+b\text{csch}(x)}\,dx = &\\ &-\frac{2\left(3\,abe^{(-2\,x)} - 3\,abe^{(-4\,x)} - 3\,(a^2+2\,b^2)e^{(-x)} + 2\,(3\,a^2+4\,b^2)e^{(-3\,x)} - 3\,(a^2+2\,b^2)e^{(-5\,x)}\right)}{3\left(3\,b^3e^{(-2\,x)} - 3\,b^3e^{(-4\,x)} + b^3e^{(-6\,x)} - b^3\right)}\\ &+\frac{x}{a} - \frac{(a^3+2\,ab^2)\log\left(e^{(-x)}+1\right)}{b^4} - \frac{(a^3+2\,ab^2)\log\left(e^{(-x)}-1\right)}{b^4}\\ &+\frac{(a^4+2\,a^2b^2+b^4)\log\left(-2\,be^{(-x)}+ae^{(-2\,x)}-a\right)}{ab^4}\end{aligned}$$

input
```
integrate(coth(x)^5/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-2/3*(3*a*b*e^(-2*x) - 3*a*b*e^(-4*x) - 3*(a^2 + 2*b^2)*e^(-x) + 2*(3*a^2
+ 4*b^2)*e^(-3*x) - 3*(a^2 + 2*b^2)*e^(-5*x))/(3*b^3*e^(-2*x) - 3*b^3*e^(-
4*x) + b^3*e^(-6*x) - b^3) + x/a - (a^3 + 2*a*b^2)*log(e^(-x) + 1)/b^4 - (
a^3 + 2*a*b^2)*log(e^(-x) - 1)/b^4 + (a^4 + 2*a^2*b^2 + b^4)*log(-2*b*e^(-
x) + a*e^(-2*x) - a)/(a*b^4)
```

### 3.122.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 170 vs. 2(66) = 132.

Time = 0.28 (sec) , antiderivative size = 170, normalized size of antiderivative = 2.43

$$\int \frac{\coth^5(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= -\frac{(a^3+2ab^2)\log\left(\left|-e^{(-x)}+e^x\right|\right)}{b^4} + \frac{(a^4+2a^2b^2+b^4)\log\left(\left|-a\left(e^{(-x)}-e^x\right)+2b\right|\right)}{ab^4}$$
$$+\frac{11a^3\left(e^{(-x)}-e^x\right)^3+22ab^2\left(e^{(-x)}-e^x\right)^3+12a^2b\left(e^{(-x)}-e^x\right)^2+24b^3\left(e^{(-x)}-e^x\right)^2+12ab^2\left(e^{(-x)}-e^x\right.}{6b^4\left(e^{(-x)}-e^x\right)^3}$$

input
```
integrate(coth(x)^5/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-(a^3 + 2*a*b^2)*log(abs(-e^(-x) + e^x))/b^4 + (a^4 + 2*a^2*b^2 + b^4)*log
(abs(-a*(e^(-x) - e^x) + 2*b))/(a*b^4) + 1/6*(11*a^3*(e^(-x) - e^x)^3 + 22
*a*b^2*(e^(-x) - e^x)^3 + 12*a^2*b*(e^(-x) - e^x)^2 + 24*b^3*(e^(-x) - e^x
)^2 + 12*a*b^2*(e^(-x) - e^x) + 16*b^3)/(b^4*(e^(-x) - e^x)^3)
```

### 3.122.9 Mupad [B] (verification not implemented)

Time = 2.61 (sec) , antiderivative size = 155, normalized size of antiderivative = 2.21

$$\int \frac{\coth^5(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{2a}{b^2}-\frac{2e^x\left(a^2+2b^2\right)}{b^3}}{e^{2x}-1} - \frac{x}{a} + \frac{\frac{2a}{b^2}-\frac{8e^x}{3b}}{e^{4x}-2e^{2x}+1} - \frac{8e^x}{3b\left(3e^{2x}-3e^{4x}+e^{6x}-1\right)}$$
$$-\frac{\ln\left(e^{2x}-1\right)\left(a^3+2ab^2\right)}{b^4} + \frac{\ln\left(2be^x-a+ae^{2x}\right)\left(a^4+2a^2b^2+b^4\right)}{ab^4}$$

input
```
int(coth(x)^5/(a + b/sinh(x)),x)
```

output
```
((2*a)/b^2 - (2*exp(x)*(a^2 + 2*b^2))/b^3)/(exp(2*x) - 1) - x/a + ((2*a)/b
^2 - (8*exp(x))/(3*b))/(exp(4*x) - 2*exp(2*x) + 1) - (8*exp(x))/(3*b*(3*ex
p(2*x) - 3*exp(4*x) + exp(6*x) - 1)) - (log(exp(2*x) - 1)*(2*a*b^2 + a^3))
/b^4 + (log(2*b*exp(x) - a + a*exp(2*x))*(a^4 + b^4 + 2*a^2*b^2))/(a*b^4)
```

# 3.123 $\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx$

3.123.1 Optimal result . . . 850
3.123.2 Mathematica [A] (verified) . . . 851
3.123.3 Rubi [C] (verified) . . . 851
3.123.4 Maple [A] (verified) . . . 853
3.123.5 Fricas [B] (verification not implemented) . . . 854
3.123.6 Sympy [F] . . . 855
3.123.7 Maxima [A] (verification not implemented) . . . 855
3.123.8 Giac [A] (verification not implemented) . . . 856
3.123.9 Mupad [B] (verification not implemented) . . . 856

## 3.123.1 Optimal result

Integrand size = 13, antiderivative size = 183

$$\begin{aligned}\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx = {} & \frac{x}{a} - \frac{3\operatorname{arctanh}(\cosh(x))}{8b} + \frac{(a^2+3b^2)\operatorname{arctanh}(\cosh(x))}{2b^3} \\ & - \frac{(a^4+3a^2b^2+3b^4)\operatorname{arctanh}(\cosh(x))}{b^5} \\ & + \frac{2(a^2+b^2)^{5/2}\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{ab^5} - \frac{a\coth(x)}{b^2} \\ & + \frac{a(a^2+3b^2)\coth(x)}{b^4} + \frac{a\coth^3(x)}{3b^2} + \frac{3\coth(x)\operatorname{csch}(x)}{8b} \\ & - \frac{(a^2+3b^2)\coth(x)\operatorname{csch}(x)}{2b^3} - \frac{\coth(x)\operatorname{csch}^3(x)}{4b}\end{aligned}$$

output

```
x/a-3/8*arctanh(cosh(x))/b+1/2*(a^2+3*b^2)*arctanh(cosh(x))/b^3-(a^4+3*a^2
*b^2+3*b^4)*arctanh(cosh(x))/b^5+2*(a^2+b^2)^(5/2)*arctanh((a-b*tanh(1/2*x
))/(a^2+b^2)^(1/2))/a/b^5-a*coth(x)/b^2+a*(a^2+3*b^2)*coth(x)/b^4+1/3*a*co
th(x)^3/b^2+3/8*coth(x)*csch(x)/b-1/2*(a^2+3*b^2)*coth(x)*csch(x)/b^3-1/4*
coth(x)*csch(x)^3/b
```

### 3.123.2 Mathematica [A] (verified)

Time = 1.35 (sec) , antiderivative size = 298, normalized size of antiderivative = 1.63

$$\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{\operatorname{csch}(x)(b+a\sinh(x))\left(192b^5x+384(-a^2-b^2)^{5/2}\arctan\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{-a^2-b^2}}\right)+32a^2b(3a^2+7b^2)\coth\left(\frac{x}{2}\right)-6a\right.}{}$$

input
```
Integrate[Coth[x]^6/(a + b*Csch[x]),x]
```

output
```
(Csch[x]*(b + a*Sinh[x])*(192*b^5*x + 384*(-a^2 - b^2)^(5/2)*ArcTan[(a - b
*Tanh[x/2])/Sqrt[-a^2 - b^2]] + 32*a^2*b*(3*a^2 + 7*b^2)*Coth[x/2] - 6*a*b
^2*(4*a^2 + 9*b^2)*Csch[x/2]^2 - 3*a*b^4*Csch[x/2]^4 - 24*a*(8*a^4 + 20*a^
2*b^2 + 15*b^4)*Log[Cosh[x/2]] + 24*a*(8*a^4 + 20*a^2*b^2 + 15*b^4)*Log[Si
nh[x/2]] - 6*a*b^2*(4*a^2 + 9*b^2)*Sech[x/2]^2 + 3*a*b^4*Sech[x/2]^4 - 64*
a^2*b^3*Csch[x]^3*Sinh[x/2]^4 + 4*a^2*b^3*Csch[x/2]^4*Sinh[x] + 32*a^2*b*(
3*a^2 + 7*b^2)*Tanh[x/2]))/(192*a*b^5*(a + b*Csch[x]))
```

### 3.123.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.60 (sec) , antiderivative size = 211, normalized size of antiderivative = 1.15, number of steps used = 9, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.692$, Rules used = {3042, 25, 4386, 26, 26, 3042, 26, 3376, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$\downarrow 3042$$
$$\int -\frac{\cot(ix)^6}{a+ib\csc(ix)}dx$$
$$\downarrow 25$$
$$-\int \frac{\cot(ix)^6}{a+ib\csc(ix)}dx$$

$$\downarrow 4386$$

$$-\int -\frac{i\cosh(x)\coth^5(x)}{ib+ia\sinh(x)}dx$$

$$\downarrow 26$$

$$i\int -\frac{i\cosh(x)\coth^5(x)}{b+a\sinh(x)}dx$$

$$\downarrow 26$$

$$\int \frac{\cosh(x)\coth^5(x)}{a\sinh(x)+b}dx$$

$$\downarrow 3042$$

$$\int \frac{i\cos(ix)^6}{\sin(ix)^5(b-ia\sin(ix))}dx$$

$$\downarrow 26$$

$$i\int \frac{\cos(ix)^6}{\sin(ix)^5(b-ia\sin(ix))}dx$$

$$\downarrow 3376$$

$$i\int \left(-\frac{i\operatorname{csch}^5(x)}{b}+\frac{ia\operatorname{csch}^4(x)}{b^2}+\frac{i\left(-a^2-3b^2\right)\operatorname{csch}^3(x)}{b^3}+\frac{i\left(a^3+3b^2a\right)\operatorname{csch}^2(x)}{b^4}-\frac{i\left(a^4+3b^2a^2+3b^4\right)\operatorname{csch}(x)}{b^5}-\right.$$

$$\downarrow 2009$$

$$i\left(-\frac{2i\left(a^2+b^2\right)^{5/2}\operatorname{arctanh}\left(\frac{a-b\tanh\left(\frac{x}{2}\right)}{\sqrt{a^2+b^2}}\right)}{ab^5}-\frac{i\left(a^2+3b^2\right)\operatorname{arctanh}(\cosh(x))}{2b^3}-\frac{ia\left(a^2+3b^2\right)\coth(x)}{b^4}+\frac{i\left(a^2+3b^2\right)\text{c}}{2}\right.$$

input
```
Int[Coth[x]^6/(a + b*Csch[x]),x]
```

output
```
I*(((-I)*x)/a + (((3*I)/8)*ArcTanh[Cosh[x]])/b - ((I/2)*(a^2 + 3*b^2)*ArcT
anh[Cosh[x]])/b^3 + (I*(a^4 + 3*a^2*b^2 + 3*b^4)*ArcTanh[Cosh[x]])/b^5 - (
(2*I)*(a^2 + b^2)^(5/2)*ArcTanh[(a - b*Tanh[x/2])/Sqrt[a^2 + b^2]])/(a*b^5
) + (I*a*Coth[x])/b^2 - (I*a*(a^2 + 3*b^2)*Coth[x])/b^4 - ((I/3)*a*Coth[x]
^3)/b^2 - (((3*I)/8)*Coth[x]*Csch[x])/b + ((I/2)*(a^2 + 3*b^2)*Coth[x]*Csc
h[x])/b^3 + ((I/4)*Coth[x]*Csch[x]^3)/b)
```

3.123. $\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx$

#### 3.123.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3376
```
Int[cos[(e_.) + (f_.)*(x_)]^(p_)*((d_.)*sin[(e_.) + (f_.)*(x_)])^(n_)*((a_)
 + (b_.)*sin[(e_.) + (f_.)*(x_)])^(m_), x_Symbol] :> Int[ExpandTrig[(d*sin[
e + f*x])^n*(a + b*sin[e + f*x])^m*(1 - sin[e + f*x]^2)^(p/2), x], x] /; Fr
eeQ[{a, b, d, e, f}, x] && NeQ[a^2 - b^2, 0] && IntegersQ[m, 2*n, p/2] && (
LtQ[m, -1] || (EqQ[m, -1] && GtQ[p, 0]))
```

rule 4386
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Int[Cos[c + d*x]^m*((b + a*Sin[c + d*x])^n/Sin[c + d*x]^(m
 + n)), x] /; FreeQ[{a, b, c, d}, x] && NeQ[a^2 - b^2, 0] && IntegerQ[n] &&
 IntegerQ[m] && (IntegerQ[m/2] || LeQ[m, 1])
```

### 3.123.4 Maple [A] (verified)

Time = 2.58 (sec) , antiderivative size = 260, normalized size of antiderivative = 1.42

| method | result |
|---|---|
| default | $\frac{\frac{b^3\tanh\left(\frac{x}{2}\right)^4}{4}+\frac{2a\tanh\left(\frac{x}{2}\right)^3b^2}{3}+2a^2b\tanh\left(\frac{x}{2}\right)^2+4b^3\tanh\left(\frac{x}{2}\right)^2+8a^3\tanh\left(\frac{x}{2}\right)+18ab^2\tanh\left(\frac{x}{2}\right)}{16b^4}+\frac{\ln\left(\tanh\left(\frac{x}{2}\right)+1\right)}{a}-\frac{\ln\left(\tanh\left(\frac{x}{2}\right)-1\right.}{a}$ |
| risch | $\frac{x}{a}+\frac{-12a^2b\mathrm{e}^{7x}-27b^3\mathrm{e}^{7x}+24a^3\mathrm{e}^{6x}+72ab^2\mathrm{e}^{6x}+12a^2b\mathrm{e}^{5x}+3b^3\mathrm{e}^{5x}-72a^3\mathrm{e}^{4x}-168ab^2\mathrm{e}^{4x}+12a^2b\mathrm{e}^{3x}+3b^3\mathrm{e}^{3x}+72a^3\mathrm{e}^{2x}+152ab^2\mathrm{e}^2}{12b^4(\mathrm{e}^{2x}-1)^4}$ |

input
```
int(coth(x)^6/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/16/b^4*(1/4*b^3*tanh(1/2*x)^4+2/3*a*tanh(1/2*x)^3*b^2+2*a^2*b*tanh(1/2*x
)^2+4*b^3*tanh(1/2*x)^2+8*a^3*tanh(1/2*x)+18*a*b^2*tanh(1/2*x))+1/a*ln(tan
h(1/2*x)+1)-1/a*ln(tanh(1/2*x)-1)+1/16*(32*a^6+96*a^4*b^2+96*a^2*b^4+32*b^
6)/a/b^5/(a^2+b^2)^(1/2)*arctanh(1/2*(-2*b*tanh(1/2*x)+2*a)/(a^2+b^2)^(1/2
))-1/64/b/tanh(1/2*x)^4-1/32*(4*a^2+8*b^2)/b^3/tanh(1/2*x)^2+1/16/b^5*(16*
a^4+40*a^2*b^2+30*b^4)*ln(tanh(1/2*x))+1/24*a/b^2/tanh(1/2*x)^3+1/8*a*(4*a
^2+9*b^2)/b^4/tanh(1/2*x)
```

### 3.123.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 3160 vs. $2(167) = 334$.

Time = 0.41 (sec) , antiderivative size = 3160, normalized size of antiderivative = 17.27

$$\int \frac{\coth^6(x)}{a + b\operatorname{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(coth(x)^6/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
1/24*(24*b^5*x*cosh(x)^8 + 24*b^5*x*sinh(x)^8 - 6*(4*a^3*b^2 + 9*a*b^4)*co
sh(x)^7 + 6*(32*b^5*x*cosh(x) - 4*a^3*b^2 - 9*a*b^4)*sinh(x)^7 - 48*(2*b^5
*x - a^4*b - 3*a^2*b^3)*cosh(x)^6 + 6*(112*b^5*x*cosh(x)^2 - 16*b^5*x + 8*
a^4*b + 24*a^2*b^3 - 7*(4*a^3*b^2 + 9*a*b^4)*cosh(x))*sinh(x)^6 + 24*b^5*x
 + 6*(4*a^3*b^2 + a*b^4)*cosh(x)^5 + 6*(224*b^5*x*cosh(x)^3 + 4*a^3*b^2 +
a*b^4 - 21*(4*a^3*b^2 + 9*a*b^4)*cosh(x)^2 - 48*(2*b^5*x - a^4*b - 3*a^2*b
^3)*cosh(x))*sinh(x)^5 - 48*a^4*b - 112*a^2*b^3 + 48*(3*b^5*x - 3*a^4*b -
7*a^2*b^3)*cosh(x)^4 + 6*(280*b^5*x*cosh(x)^4 + 24*b^5*x - 24*a^4*b - 56*a
^2*b^3 - 35*(4*a^3*b^2 + 9*a*b^4)*cosh(x)^3 - 120*(2*b^5*x - a^4*b - 3*a^2
*b^3)*cosh(x)^2 + 5*(4*a^3*b^2 + a*b^4)*cosh(x))*sinh(x)^4 + 6*(4*a^3*b^2
+ a*b^4)*cosh(x)^3 + 6*(224*b^5*x*cosh(x)^5 + 4*a^3*b^2 + a*b^4 - 35*(4*a^
3*b^2 + 9*a*b^4)*cosh(x)^4 - 160*(2*b^5*x - a^4*b - 3*a^2*b^3)*cosh(x)^3 +
 10*(4*a^3*b^2 + a*b^4)*cosh(x)^2 + 32*(3*b^5*x - 3*a^4*b - 7*a^2*b^3)*cos
h(x))*sinh(x)^3 - 16*(6*b^5*x - 9*a^4*b - 19*a^2*b^3)*cosh(x)^2 + 2*(336*b
^5*x*cosh(x)^6 - 48*b^5*x - 63*(4*a^3*b^2 + 9*a*b^4)*cosh(x)^5 + 72*a^4*b
+ 152*a^2*b^3 - 360*(2*b^5*x - a^4*b - 3*a^2*b^3)*cosh(x)^4 + 30*(4*a^3*b^
2 + a*b^4)*cosh(x)^3 + 144*(3*b^5*x - 3*a^4*b - 7*a^2*b^3)*cosh(x)^2 + 9*(
4*a^3*b^2 + a*b^4)*cosh(x))*sinh(x)^2 + 24*((a^4 + 2*a^2*b^2 + b^4)*cosh(x
)^8 + 8*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)*sinh(x)^7 + (a^4 + 2*a^2*b^2 + b^4
)*sinh(x)^8 - 4*(a^4 + 2*a^2*b^2 + b^4)*cosh(x)^6 - 4*(a^4 + 2*a^2*b^2 ...
```

### 3.123.6 Sympy [F]

$$\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\coth^6(x)}{a+b\,\operatorname{csch}(x)}\,dx$$

input
```
integrate(coth(x)**6/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)**6/(a + b*csch(x)), x)
```

### 3.123.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 330, normalized size of antiderivative = 1.80

$$\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx =$$
$$-\frac{24\,a^3+56\,ab^2-3\,(4\,a^2b+9\,b^3)e^{(-x)}-8\,(9\,a^3+19\,ab^2)e^{(-2\,x)}+3\,(4\,a^2b+b^3)e^{(-3\,x)}+24\,(3\,a^3+7\,ab^2)e}{12\,(4\,b^4e^{(-2\,x)}-6\,b^4e^{(-4\,x)}+4\,b^4e^{(-6\,x)}-b}$$
$$+\frac{x}{a}-\frac{(8\,a^4+20\,a^2b^2+15\,b^4)\log\left(e^{(-x)}+1\right)}{8\,b^5}+\frac{(8\,a^4+20\,a^2b^2+15\,b^4)\log\left(e^{(-x)}-1\right)}{8\,b^5}$$
$$-\frac{(a^6+3\,a^4b^2+3\,a^2b^4+b^6)\log\left(\frac{ae^{(-x)}-b-\sqrt{a^2+b^2}}{ae^{(-x)}-b+\sqrt{a^2+b^2}}\right)}{\sqrt{a^2+b^2}ab^5}$$

input
```
integrate(coth(x)^6/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
-1/12*(24*a^3 + 56*a*b^2 - 3*(4*a^2*b + 9*b^3)*e^(-x) - 8*(9*a^3 + 19*a*b^
2)*e^(-2*x) + 3*(4*a^2*b + b^3)*e^(-3*x) + 24*(3*a^3 + 7*a*b^2)*e^(-4*x) +
 3*(4*a^2*b + b^3)*e^(-5*x) - 24*(a^3 + 3*a*b^2)*e^(-6*x) - 3*(4*a^2*b + 9
*b^3)*e^(-7*x))/(4*b^4*e^(-2*x) - 6*b^4*e^(-4*x) + 4*b^4*e^(-6*x) - b^4*e^
(-8*x) - b^4) + x/a - 1/8*(8*a^4 + 20*a^2*b^2 + 15*b^4)*log(e^(-x) + 1)/b^
5 + 1/8*(8*a^4 + 20*a^2*b^2 + 15*b^4)*log(e^(-x) - 1)/b^5 - (a^6 + 3*a^4*b
^2 + 3*a^2*b^4 + b^6)*log((a*e^(-x) - b - sqrt(a^2 + b^2))/(a*e^(-x) - b +
 sqrt(a^2 + b^2)))/(sqrt(a^2 + b^2)*a*b^5)
```

### 3.123.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 305, normalized size of antiderivative = 1.67

$$\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{x}{a} - \frac{(8a^4+20a^2b^2+15b^4)\log(e^x+1)}{8b^5} + \frac{(8a^4+20a^2b^2+15b^4)\log(|e^x-1|)}{8b^5}$$
$$- \frac{(a^6+3a^4b^2+3a^2b^4+b^6)\log\left(\left|\frac{2ae^x+2b-2\sqrt{a^2+b^2}}{2ae^x+2b+2\sqrt{a^2+b^2}}\right|\right)}{\sqrt{a^2+b^2}ab^5}$$
$$- \frac{12a^2be^{(7x)}+27b^3e^{(7x)}-24a^3e^{(6x)}-72ab^2e^{(6x)}-12a^2be^{(5x)}-3b^3e^{(5x)}+72a^3e^{(4x)}+168ab^2e^{(4x)}-}{12b^4(e^{(2x)}-1)^4}$$

input
```
integrate(coth(x)^6/(a+b*csch(x)),x, algorithm="giac")
```

output
```
x/a - 1/8*(8*a^4 + 20*a^2*b^2 + 15*b^4)*log(e^x + 1)/b^5 + 1/8*(8*a^4 + 20
*a^2*b^2 + 15*b^4)*log(abs(e^x - 1))/b^5 - (a^6 + 3*a^4*b^2 + 3*a^2*b^4 +
b^6)*log(abs(2*a*e^x + 2*b - 2*sqrt(a^2 + b^2))/abs(2*a*e^x + 2*b + 2*sqrt
(a^2 + b^2)))/(sqrt(a^2 + b^2)*a*b^5) - 1/12*(12*a^2*b*e^(7*x) + 27*b^3*e^
(7*x) - 24*a^3*e^(6*x) - 72*a*b^2*e^(6*x) - 12*a^2*b*e^(5*x) - 3*b^3*e^(5*
x) + 72*a^3*e^(4*x) + 168*a*b^2*e^(4*x) - 12*a^2*b*e^(3*x) - 3*b^3*e^(3*x)
 - 72*a^3*e^(2*x) - 152*a*b^2*e^(2*x) + 12*a^2*b*e^x + 27*b^3*e^x + 24*a^3
 + 56*a*b^2)/(b^4*(e^(2*x) - 1)^4)
```

### 3.123.9 Mupad [B] (verification not implemented)

Time = 3.37 (sec) , antiderivative size = 543, normalized size of antiderivative = 2.97

$$\int \frac{\coth^6(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{8a}{3b^2}-\frac{6e^x}{b}}{3e^{2x}-3e^{4x}+e^{6x}-1} - \frac{\frac{e^x(4a^2+9b^2)}{4b^3}-\frac{2(a^4+3a^2b^2)}{ab^4}}{e^{2x}-1}$$
$$+ \frac{\frac{4a}{b^2}-\frac{e^x(4a^2+13b^2)}{2b^3}}{e^{4x}-2e^{2x}+1} + \frac{x}{a} + \frac{\ln(e^x-1)\,(8a^4+20a^2b^2+15b^4)}{8b^5}$$
$$- \frac{\ln(e^x+1)\,(8a^4+20a^2b^2+15b^4)}{8b^5} - \frac{4e^x}{b\,(6e^{4x}-4e^{2x}-4e^{6x}+e^{8x}+1)}$$
$$+ \frac{\ln\left(a^3\sqrt{(a^2+b^2)^5}-2a^7b-2ab^7-6a^3b^5-6a^5b^3+a^8e^x+4b^8e^x+2ab^2\sqrt{(a^2+b^2)^5}-4b^3e^x\sqrt{\right.}}{ab^5}$$
$$- \frac{\ln\left(a^8e^x-2a^7b-a^3\sqrt{(a^2+b^2)^5}-6a^3b^5-6a^5b^3-2ab^7+4b^8e^x-2ab^2\sqrt{(a^2+b^2)^5}+4b^3e^x\sqrt{\right.}}{ab^5}$$

input
```
int(coth(x)^6/(a + b/sinh(x)),x)
```

output
```
((8*a)/(3*b^2) - (6*exp(x))/b)/(3*exp(2*x) - 3*exp(4*x) + exp(6*x) - 1) -
((exp(x)*(4*a^2 + 9*b^2))/(4*b^3) - (2*(a^4 + 3*a^2*b^2))/(a*b^4))/(exp(2*
x) - 1) + ((4*a)/b^2 - (exp(x)*(4*a^2 + 13*b^2))/(2*b^3))/(exp(4*x) - 2*ex
p(2*x) + 1) + x/a + (log(exp(x) - 1)*(8*a^4 + 15*b^4 + 20*a^2*b^2))/(8*b^5
) - (log(exp(x) + 1)*(8*a^4 + 15*b^4 + 20*a^2*b^2))/(8*b^5) - (4*exp(x))/(
b*(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + exp(8*x) + 1)) + (log(a^3*((a^2
+ b^2)^5)^(1/2) - 2*a^7*b - 2*a*b^7 - 6*a^3*b^5 - 6*a^5*b^3 + a^8*exp(x) +
 4*b^8*exp(x) + 2*a*b^2*((a^2 + b^2)^5)^(1/2) - 4*b^3*exp(x)*((a^2 + b^2)^
5)^(1/2) + 13*a^2*b^6*exp(x) + 15*a^4*b^4*exp(x) + 7*a^6*b^2*exp(x) - 3*a^
2*b*exp(x)*((a^2 + b^2)^5)^(1/2))*((a^2 + b^2)^5)^(1/2))/(a*b^5) - (log(a^
8*exp(x) - 2*a^7*b - a^3*((a^2 + b^2)^5)^(1/2) - 6*a^3*b^5 - 6*a^5*b^3 - 2
*a*b^7 + 4*b^8*exp(x) - 2*a*b^2*((a^2 + b^2)^5)^(1/2) + 4*b^3*exp(x)*((a^2
 + b^2)^5)^(1/2) + 13*a^2*b^6*exp(x) + 15*a^4*b^4*exp(x) + 7*a^6*b^2*exp(x
) + 3*a^2*b*exp(x)*((a^2 + b^2)^5)^(1/2))*((a^2 + b^2)^5)^(1/2))/(a*b^5)
```

# 3.124 $\int \frac{\coth^7(x)}{a+b\mathbf{csch}(x)}\,dx$

3.124.1 Optimal result . . . 858
3.124.2 Mathematica [A] (verified) . . . 858
3.124.3 Rubi [A] (verified) . . . 859
3.124.4 Maple [B] (verified) . . . 861
3.124.5 Fricas [B] (verification not implemented) . . . 861
3.124.6 Sympy [F] . . . 862
3.124.7 Maxima [B] (verification not implemented) . . . 863
3.124.8 Giac [B] (verification not implemented) . . . 863
3.124.9 Mupad [B] (verification not implemented) . . . 864

## 3.124.1 Optimal result

Integrand size = 13, antiderivative size = 119

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{(a^4+3a^2b^2+3b^4)\operatorname{csch}(x)}{b^5} + \frac{a(a^2+3b^2)\operatorname{csch}^2(x)}{2b^4} - \frac{(a^2+3b^2)\operatorname{csch}^3(x)}{3b^3} + \frac{a\operatorname{csch}^4(x)}{4b^2} - \frac{\operatorname{csch}^5(x)}{5b} + \frac{(a^2+b^2)^3\log(a+b\operatorname{csch}(x))}{ab^6} + \frac{\log(\sinh(x))}{a}$$

output
```
-(a^4+3*a^2*b^2+3*b^4)*csch(x)/b^5+1/2*a*(a^2+3*b^2)*csch(x)^2/b^4-1/3*(a^
2+3*b^2)*csch(x)^3/b^3+1/4*a*csch(x)^4/b^2-1/5*csch(x)^5/b+(a^2+b^2)^3*ln(
a+b*csch(x))/a/b^6+ln(sinh(x))/a
```

## 3.124.2 Mathematica [A] (verified)

Time = 0.17 (sec) , antiderivative size = 130, normalized size of antiderivative = 1.09

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{-60b(a^4+3a^2b^2+3b^4)\operatorname{csch}(x)+30ab^2(a^2+3b^2)\operatorname{csch}^2(x)-20b^3(a^2+3b^2)\operatorname{csch}^3(x)+15ab^4\operatorname{csch}^4(x)-}{60b^6}$$

input
```
Integrate[Coth[x]^7/(a + b*Csch[x]),x]
```

output
```
(-60*b*(a^4 + 3*a^2*b^2 + 3*b^4)*Csch[x] + 30*a*b^2*(a^2 + 3*b^2)*Csch[x]^
2 - 20*b^3*(a^2 + 3*b^2)*Csch[x]^3 + 15*a*b^4*Csch[x]^4 - 12*b^5*Csch[x]^5
 - 60*a*(a^4 + 3*a^2*b^2 + 3*b^4)*Log[Sinh[x]] + (60*(a^2 + b^2)^3*Log[b +
 a*Sinh[x]])/a)/(60*b^6)
```

### 3.124.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 124, normalized size of antiderivative = 1.04, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.462$, Rules used = {3042, 26, 4373, 25, 522, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx$$

$$\downarrow 3042$$

$$\int -\frac{i\cot(ix)^7}{a+ib\csc(ix)}dx$$

$$\downarrow 26$$

$$-i\int \frac{\cot(ix)^7}{a+ib\csc(ix)}dx$$

$$\downarrow 4373$$

$$\frac{\int -\frac{\left(\operatorname{csch}^2(x)b^2+b^2\right)^3\sinh(x)}{b(a+b\operatorname{csch}(x))}d(b\operatorname{csch}(x))}{b^6}$$

$$\downarrow 25$$

$$-\frac{\int \frac{\left(\operatorname{csch}^2(x)b^2+b^2\right)^3\sinh(x)}{b(a+b\operatorname{csch}(x))}d(b\operatorname{csch}(x))}{b^6}$$

$$\downarrow 522$$

$$-\frac{\int \left(\frac{\sinh(x)b^5}{a}+\operatorname{csch}^4(x)b^4-a\operatorname{csch}^3(x)b^3+\left(a^2+3b^2\right)\operatorname{csch}^2(x)b^2-a\left(a^2+3b^2\right)\operatorname{csch}(x)b+a^4\left(\frac{3(a^2+b^2)b^2}{a^4}+1\right)-\right.}{b^6}$$

$$\downarrow 2009$$

$$\frac{\frac{1}{2}ab^2\left(a^2+3b^2\right)\operatorname{csch}^2(x)+\frac{\left(a^2+b^2\right)^3\log(a+b\operatorname{csch}(x))}{a}-\frac{1}{3}b^3\left(a^2+3b^2\right)\operatorname{csch}^3(x)-b\left(a^4+3a^2b^2+3b^4\right)\operatorname{csch}(x)-\frac{b^6\log(}{b^6}$$

input
```
Int[Coth[x]^7/(a + b*Csch[x]),x]
```

output
```
(-(b*(a^4 + 3*a^2*b^2 + 3*b^4)*Csch[x]) + (a*b^2*(a^2 + 3*b^2)*Csch[x]^2)/
2 - (b^3*(a^2 + 3*b^2)*Csch[x]^3)/3 + (a*b^4*Csch[x]^4)/4 - (b^5*Csch[x]^5
)/5 - (b^6*Log[b*Csch[x]])/a + ((a^2 + b^2)^3*Log[a + b*Csch[x]])/a)/b^6
```

### 3.124.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 522
```
Int[((e_.)*(x_))^(m_.)*((c_) + (d_.)*(x_))^(n_.)*((a_) + (b_.)*(x_)^2)^(p_.
), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(c + d*x)^n*(a + b*x^2)^p, x],
x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4373
```
Int[cot[(c_.) + (d_.)*(x_)]^(m_.)*(csc[(c_.) + (d_.)*(x_)]*(b_.) + (a_))^(n
_), x_Symbol] :> Simp[-(-1)^((m - 1)/2)/(d*b^(m - 1))   Subst[Int[(b^2 - x^
2)^((m - 1)/2)*((a + x)^n/x), x], x, b*Csc[c + d*x]], x] /; FreeQ[{a, b, c,
 d, n}, x] && IntegerQ[(m - 1)/2] && NeQ[a^2 - b^2, 0]
```

### 3.124.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 313 vs. $2(111) = 222$.

Time = 3.74 (sec) , antiderivative size = 314, normalized size of antiderivative = 2.64

| method | result |
|---|---|
| default | $\frac{b^4 \tanh\left(\frac{x}{2}\right)^5}{5}+\frac{a \tanh\left(\frac{x}{2}\right)^4 b^3}{2}+\frac{4a^2b^2 \tanh\left(\frac{x}{2}\right)^3}{3}+3\tanh\left(\frac{x}{2}\right)^3 b^4+4a^3 b \tanh\left(\frac{x}{2}\right)^2+10b^3 \tanh\left(\frac{x}{2}\right)^2 a+16a^4 \tanh\left(\frac{x}{2}\right)+44a^2b^2 \tanh\left(\frac{x}{2}\right)+3$ $\frac{}{32b^5}$ |
| risch | $-\frac{x}{a}-\frac{2\,\mathrm{e}^x\left(15a^4\mathrm{e}^{8x}+45a^2b^2\mathrm{e}^{8x}+45b^4\mathrm{e}^{8x}-15a^3b\,\mathrm{e}^{7x}-45a\,b^3\mathrm{e}^{7x}-60a^4\mathrm{e}^{6x}-160a^2b^2\mathrm{e}^{6x}-120b^4\mathrm{e}^{6x}+45a^3b\,\mathrm{e}^{5x}+105a\,b^3\mathrm{e}^{5x}+90a^4\mathrm{e}\right.}{15b^5}$ |

input
```
int(coth(x)^7/(a+b*csch(x)),x,method=_RETURNVERBOSE)
```

output
```
1/32/b^5*(1/5*b^4*tanh(1/2*x)^5+1/2*a*tanh(1/2*x)^4*b^3+4/3*a^2*b^2*tanh(1
/2*x)^3+3*tanh(1/2*x)^3*b^4+4*a^3*b*tanh(1/2*x)^2+10*b^3*tanh(1/2*x)^2*a+1
6*a^4*tanh(1/2*x)+44*a^2*b^2*tanh(1/2*x)+38*tanh(1/2*x)*b^4)+1/32/a/b^6*(3
2*a^6+96*a^4*b^2+96*a^2*b^4+32*b^6)*ln(-tanh(1/2*x)^2*b+2*a*tanh(1/2*x)+b)
-1/a*ln(tanh(1/2*x)+1)-1/160/b/tanh(1/2*x)^5-1/96/b^3*(4*a^2+9*b^2)/tanh(1
/2*x)^3-1/32*(16*a^4+44*a^2*b^2+38*b^4)/b^5/tanh(1/2*x)+1/64*a/b^2/tanh(1/
2*x)^4+1/16*a/b^4*(2*a^2+5*b^2)/tanh(1/2*x)^2-1/b^6*a*(a^4+3*a^2*b^2+3*b^4
)*ln(tanh(1/2*x))-1/a*ln(tanh(1/2*x)-1)
```

### 3.124.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 4024 vs. $2(111) = 222$.

Time = 0.31 (sec) , antiderivative size = 4024, normalized size of antiderivative = 33.82

$$\int \frac{\coth^7(x)}{a + b\mathrm{csch}(x)}\,dx = \text{Too large to display}$$

input
```
integrate(coth(x)^7/(a+b*csch(x)),x, algorithm="fricas")
```

output
```
-1/15*(15*b^6*x*cosh(x)^10 + 15*b^6*x*sinh(x)^10 + 30*(a^5*b + 3*a^3*b^3 +
 3*a*b^5)*cosh(x)^9 + 30*(5*b^6*x*cosh(x) + a^5*b + 3*a^3*b^3 + 3*a*b^5)*s
inh(x)^9 - 15*(5*b^6*x + 2*a^4*b^2 + 6*a^2*b^4)*cosh(x)^8 + 15*(45*b^6*x*c
osh(x)^2 - 5*b^6*x - 2*a^4*b^2 - 6*a^2*b^4 + 18*(a^5*b + 3*a^3*b^3 + 3*a*b
^5)*cosh(x))*sinh(x)^8 - 40*(3*a^5*b + 8*a^3*b^3 + 6*a*b^5)*cosh(x)^7 + 40
*(45*b^6*x*cosh(x)^3 - 3*a^5*b - 8*a^3*b^3 - 6*a*b^5 + 27*(a^5*b + 3*a^3*b
^3 + 3*a*b^5)*cosh(x)^2 - 3*(5*b^6*x + 2*a^4*b^2 + 6*a^2*b^4)*cosh(x))*sin
h(x)^7 - 15*b^6*x + 30*(5*b^6*x + 3*a^4*b^2 + 7*a^2*b^4)*cosh(x)^6 + 10*(3
15*b^6*x*cosh(x)^4 + 15*b^6*x + 9*a^4*b^2 + 21*a^2*b^4 + 252*(a^5*b + 3*a^
3*b^3 + 3*a*b^5)*cosh(x)^3 - 42*(5*b^6*x + 2*a^4*b^2 + 6*a^2*b^4)*cosh(x)^
2 - 28*(3*a^5*b + 8*a^3*b^3 + 6*a*b^5)*cosh(x))*sinh(x)^6 + 4*(45*a^5*b +
115*a^3*b^3 + 99*a*b^5)*cosh(x)^5 + 4*(945*b^6*x*cosh(x)^5 + 45*a^5*b + 11
5*a^3*b^3 + 99*a*b^5 + 945*(a^5*b + 3*a^3*b^3 + 3*a*b^5)*cosh(x)^4 - 210*(
5*b^6*x + 2*a^4*b^2 + 6*a^2*b^4)*cosh(x)^3 - 210*(3*a^5*b + 8*a^3*b^3 + 6*
a*b^5)*cosh(x)^2 + 45*(5*b^6*x + 3*a^4*b^2 + 7*a^2*b^4)*cosh(x))*sinh(x)^5
 - 30*(5*b^6*x + 3*a^4*b^2 + 7*a^2*b^4)*cosh(x)^4 + 10*(315*b^6*x*cosh(x)^
6 - 15*b^6*x - 9*a^4*b^2 - 21*a^2*b^4 + 378*(a^5*b + 3*a^3*b^3 + 3*a*b^5)*
cosh(x)^5 - 105*(5*b^6*x + 2*a^4*b^2 + 6*a^2*b^4)*cosh(x)^4 - 140*(3*a^5*b
 + 8*a^3*b^3 + 6*a*b^5)*cosh(x)^3 + 45*(5*b^6*x + 3*a^4*b^2 + 7*a^2*b^4)*c
osh(x)^2 + 2*(45*a^5*b + 115*a^3*b^3 + 99*a*b^5)*cosh(x))*sinh(x)^4 - 4...
```

### 3.124.6 Sympy [F]

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx = \int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx$$

input
```
integrate(coth(x)**7/(a+b*csch(x)),x)
```

output
```
Integral(coth(x)**7/(a + b*csch(x)), x)
```

### 3.124.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 364 vs. $2(111) = 222$.

Time = 0.21 (sec) , antiderivative size = 364, normalized size of antiderivative = 3.06

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx$$
$$= \frac{2\left(15\left(a^4+3a^2b^2+3b^4\right)e^{(-x)} - 15\left(a^3b+3ab^3\right)e^{(-2x)} - 20\left(3a^4+8a^2b^2+6b^4\right)e^{(-3x)} + 15\left(3a^3b+7ab^3\right.\right.}{15\left(5b^5e^{(}\right.}$$
$$+ \frac{x}{a} - \frac{\left(a^5+3a^3b^2+3ab^4\right)\log\left(e^{(-x)}+1\right)}{b^6} - \frac{\left(a^5+3a^3b^2+3ab^4\right)\log\left(e^{(-x)}-1\right)}{b^6}$$
$$+ \frac{\left(a^6+3a^4b^2+3a^2b^4+b^6\right)\log\left(-2be^{(-x)}+ae^{(-2x)}-a\right)}{ab^6}$$

input
```
integrate(coth(x)^7/(a+b*csch(x)),x, algorithm="maxima")
```

output
```
2/15*(15*(a^4 + 3*a^2*b^2 + 3*b^4)*e^(-x) - 15*(a^3*b + 3*a*b^3)*e^(-2*x)
- 20*(3*a^4 + 8*a^2*b^2 + 6*b^4)*e^(-3*x) + 15*(3*a^3*b + 7*a*b^3)*e^(-4*x
) + 2*(45*a^4 + 115*a^2*b^2 + 99*b^4)*e^(-5*x) - 15*(3*a^3*b + 7*a*b^3)*e^
(-6*x) - 20*(3*a^4 + 8*a^2*b^2 + 6*b^4)*e^(-7*x) + 15*(a^3*b + 3*a*b^3)*e^
(-8*x) + 15*(a^4 + 3*a^2*b^2 + 3*b^4)*e^(-9*x))/(5*b^5*e^(-2*x) - 10*b^5*e
^(-4*x) + 10*b^5*e^(-6*x) - 5*b^5*e^(-8*x) + b^5*e^(-10*x) - b^5) + x/a -
(a^5 + 3*a^3*b^2 + 3*a*b^4)*log(e^(-x) + 1)/b^6 - (a^5 + 3*a^3*b^2 + 3*a*b
^4)*log(e^(-x) - 1)/b^6 + (a^6 + 3*a^4*b^2 + 3*a^2*b^4 + b^6)*log(-2*b*e^(
-x) + a*e^(-2*x) - a)/(a*b^6)
```

### 3.124.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 295 vs. $2(111) = 222$.

Time = 0.28 (sec) , antiderivative size = 295, normalized size of antiderivative = 2.48

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx = -\frac{\left(a^5+3a^3b^2+3ab^4\right)\log\left(\left|-e^{(-x)}+e^x\right|\right)}{b^6}$$
$$+ \frac{\left(a^6+3a^4b^2+3a^2b^4+b^6\right)\log\left(\left|-a\left(e^{(-x)}-e^x\right)+2b\right|\right)}{ab^6}$$
$$+ \frac{137a^5\left(e^{(-x)}-e^x\right)^5 + 411a^3b^2\left(e^{(-x)}-e^x\right)^5 + 411ab^4\left(e^{(-x)}-e^x\right)^5 + 120a^4b\left(e^{(-x)}-e^x\right)^4 + 360a^2b^3(e}{}$$

input
```
integrate(coth(x)^7/(a+b*csch(x)),x, algorithm="giac")
```

output
```
-(a^5 + 3*a^3*b^2 + 3*a*b^4)*log(abs(-e^(-x) + e^x))/b^6 + (a^6 + 3*a^4*b^
2 + 3*a^2*b^4 + b^6)*log(abs(-a*(e^(-x) - e^x) + 2*b))/(a*b^6) + 1/60*(137
*a^5*(e^(-x) - e^x)^5 + 411*a^3*b^2*(e^(-x) - e^x)^5 + 411*a*b^4*(e^(-x) -
 e^x)^5 + 120*a^4*b*(e^(-x) - e^x)^4 + 360*a^2*b^3*(e^(-x) - e^x)^4 + 360*
b^5*(e^(-x) - e^x)^4 + 120*a^3*b^2*(e^(-x) - e^x)^3 + 360*a*b^4*(e^(-x) -
e^x)^3 + 160*a^2*b^3*(e^(-x) - e^x)^2 + 480*b^5*(e^(-x) - e^x)^2 + 240*a*b
^4*(e^(-x) - e^x) + 384*b^5)/(b^6*(e^(-x) - e^x)^5)
```

### 3.124.9 Mupad [B] (verification not implemented)

Time = 2.78 (sec) , antiderivative size = 317, normalized size of antiderivative = 2.66

$$\int \frac{\coth^7(x)}{a+b\operatorname{csch}(x)}\,dx = \frac{\frac{4a}{b^2}-\frac{64\,e^x}{5b}}{6\,e^{4x}-4\,e^{2x}-4\,e^{6x}+e^{8x}+1}+\frac{\frac{8a}{b^2}-\frac{8\,e^x\,\left(5a^2+27b^2\right)}{15b^3}}{3\,e^{2x}-3\,e^{4x}+e^{6x}-1}$$
$$-\frac{\frac{8\,e^x\,\left(a^2+3b^2\right)}{3b^3}-\frac{2\,\left(a^4+5a^2b^2\right)}{ab^4}}{e^{4x}-2\,e^{2x}+1}-\frac{x}{a}-\frac{\frac{2\,e^x\,\left(a^4+3a^2b^2+3b^4\right)}{b^5}-\frac{2\,\left(a^4+3a^2b^2\right)}{ab^4}}{e^{2x}-1}$$
$$-\frac{32\,e^x}{5b\,\left(5\,e^{2x}-10\,e^{4x}+10\,e^{6x}-5\,e^{8x}+e^{10x}-1\right)}$$
$$-\frac{\ln\left(e^{2x}-1\right)\,\left(a^5+3a^3b^2+3ab^4\right)}{b^6}$$
$$+\frac{\ln\left(2be^x-a+ae^{2x}\right)\,\left(a^6+3a^4b^2+3a^2b^4+b^6\right)}{ab^6}$$

input
```
int(coth(x)^7/(a + b/sinh(x)),x)
```

output
```
((4*a)/b^2 - (64*exp(x))/(5*b))/(6*exp(4*x) - 4*exp(2*x) - 4*exp(6*x) + ex
p(8*x) + 1) + ((8*a)/b^2 - (8*exp(x)*(5*a^2 + 27*b^2))/(15*b^3))/(3*exp(2*
x) - 3*exp(4*x) + exp(6*x) - 1) - ((8*exp(x)*(a^2 + 3*b^2))/(3*b^3) - (2*(
a^4 + 5*a^2*b^2))/(a*b^4))/(exp(4*x) - 2*exp(2*x) + 1) - x/a - ((2*exp(x)*
(a^4 + 3*b^4 + 3*a^2*b^2))/b^5 - (2*(a^4 + 3*a^2*b^2))/(a*b^4))/(exp(2*x)
- 1) - (32*exp(x))/(5*b*(5*exp(2*x) - 10*exp(4*x) + 10*exp(6*x) - 5*exp(8*
x) + exp(10*x) - 1)) - (log(exp(2*x) - 1)*(3*a*b^4 + a^5 + 3*a^3*b^2))/b^6
 + (log(2*b*exp(x) - a + a*exp(2*x))*(a^6 + b^6 + 3*a^2*b^4 + 3*a^4*b^2))/
(a*b^6)
```

# 3.125 $\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx$

3.125.1 Optimal result . . . 865
3.125.2 Mathematica [A] (verified) . . . 865
3.125.3 Rubi [A] (verified) . . . 866
3.125.4 Maple [C] (warning: unable to verify) . . . 868
3.125.5 Fricas [B] (verification not implemented) . . . 868
3.125.6 Sympy [F] . . . 869
3.125.7 Maxima [B] (verification not implemented) . . . 870
3.125.8 Giac [A] (verification not implemented) . . . 870
3.125.9 Mupad [B] (verification not implemented) . . . 871

## 3.125.1 Optimal result

Integrand size = 25, antiderivative size = 199

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx = -\frac{32\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{3bc\left(1-e^{2c(a+bx)}\right)^6} + \frac{192\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{5bc\left(1-e^{2c(a+bx)}\right)^5} - \frac{48\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{bc\left(1-e^{2c(a+bx)}\right)^4} + \frac{64\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{3bc\left(1-e^{2c(a+bx)}\right)^3}$$

output

```
-32/3*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^6
+192/5*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^
5-48*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^4+
64/3*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^3
```

## 3.125.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 84, normalized size of antiderivative = 0.42

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx = -\frac{16\left(-1+6e^{2c(a+bx)}-15e^{4c(a+bx)}+20e^{6c(a+bx)}\right)\sqrt{\operatorname{csch}^2(c(a+bx))}\sinh(c(a+bx))}{15bc\left(-1+e^{2c(a+bx)}\right)^6}$$

input
```
Integrate[E^(c*(a + b*x))*(Csch[a*c + b*c*x]^2)^(7/2),x]
```

output
```
(-16*(-1 + 6*E^(2*c*(a + b*x)) - 15*E^(4*c*(a + b*x)) + 20*E^(6*c*(a + b*x
)))*Sqrt[Csch[c*(a + b*x)]^2]*Sinh[c*(a + b*x)])/(15*b*c*(-1 + E^(2*c*(a +
 b*x)))^6)
```

### 3.125.3 Rubi [A] (verified)

Time = 0.46 (sec) , antiderivative size = 113, normalized size of antiderivative = 0.57, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.240$, Rules used = {7271, 2720, 27, 243, 53, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx$$

$$\downarrow 7271$$

$$\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int e^{c(a+bx)}\operatorname{csch}^7(ac+bxc)dx$$

$$\downarrow 2720$$

$$\frac{\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int -\frac{128e^{7c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^7}de^{c(a+bx)}}{bc}$$

$$\downarrow 27$$

$$-\frac{128\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \frac{e^{7c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^7}de^{c(a+bx)}}{bc}$$

$$\downarrow 243$$

$$-\frac{64\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \frac{e^{3c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^7}de^{2c(a+bx)}}{bc}$$

$$\downarrow 53$$

$$-\frac{64\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \left(-\frac{1}{\left(-1+e^{2c(a+bx)}\right)^4}-\frac{3}{\left(-1+e^{2c(a+bx)}\right)^5}-\frac{3}{\left(-1+e^{2c(a+bx)}\right)^6}-\frac{1}{\left(-1+e^{2c(a+bx)}\right)^7}\right)de^{}}{bc}$$

$$\downarrow 2009$$

$$-\frac{64\left(-\frac{1}{3\left(1-e^{2c(a+bx)}\right)^3}+\frac{3}{4\left(1-e^{2c(a+bx)}\right)^4}-\frac{3}{5\left(1-e^{2c(a+bx)}\right)^5}+\frac{1}{6\left(1-e^{2c(a+bx)}\right)^6}\right)\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}}{bc}$$

input
```
Int[E^(c*(a + b*x))*(Csch[a*c + b*c*x]^2)^(7/2),x]
```

output
```
(-64*(1/(6*(1 - E^(2*c*(a + b*x)))^6) - 3/(5*(1 - E^(2*c*(a + b*x)))^5) +
3/(4*(1 - E^(2*c*(a + b*x)))^4) - 1/(3*(1 - E^(2*c*(a + b*x)))^3))*Sqrt[Cs
ch[a*c + b*c*x]^2]*Sinh[a*c + b*c*x])/(b*c)
```

### 3.125.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 53
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d, n},
x] && IGtQ[m, 0] && ( !IntegerQ[n] || (EqQ[c, 0] && LeQ[7*m + 4*n + 4, 0])
|| LtQ[9*m + 5*(n + 1), 0] || GtQ[m + n + 2, 0])
```

rule 243
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[1/2   Subst[In
t[x^((m - 1)/2)*(a + b*x)^p, x], x, x^2], x] /; FreeQ[{a, b, m, p}, x] && I
ntegerQ[(m - 1)/2]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.125.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 1.37 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.44

| method | result | siz |
|---|---|---|
| default | $-\frac{\operatorname{csgn}(\operatorname{csch}(c(bx+a)))\left(\frac{\coth(c(bx+a))^6}{6}+\frac{\coth(c(bx+a))^5}{5}-\frac{\coth(c(bx+a))^4}{2}-\frac{2\coth(c(bx+a))^3}{3}+\frac{\coth(c(bx+a))^2}{2}+\coth(c(bx+a))\right)}{cb}$ | 87 |
| risch | $-\frac{16\left(20\,\mathrm{e}^{6c(bx+a)}-15\,\mathrm{e}^{4c(bx+a)}+6\,\mathrm{e}^{2c(bx+a)}-1\right)\sqrt{\frac{\mathrm{e}^{2c(bx+a)}}{\left(\mathrm{e}^{2c(bx+a)}-1\right)^2}}\,\mathrm{e}^{-c(bx+a)}}{15bc\left(\mathrm{e}^{2c(bx+a)}-1\right)^5}$ | 91 |

input
```
int(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(7/2),x,method=_RETURNVERBOSE)
```

output
```
-csgn(csch(c*(b*x+a)))/c/b*(1/6*coth(c*(b*x+a))^6+1/5*coth(c*(b*x+a))^5-1/
2*coth(c*(b*x+a))^4-2/3*coth(c*(b*x+a))^3+1/2*coth(c*(b*x+a))^2+coth(c*(b*
x+a)))
```

### 3.125.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 592 vs. 2(173) = 346.

Time = 0.26 (sec) , antiderivative size = 592, normalized size of antiderivative = 2.97

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx =$$

$$-\frac{}{15\left(bc\cosh\left(bcx+ac\right)^9+9\,bc\cosh\left(bcx+ac\right)\sinh\left(bcx+ac\right)^8+bc\sinh\left(bcx+ac\right)^9-6\,bc\cosh\left(bcx+ac\right)^7\right.}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(7/2),x, algorithm="fricas")
```

output
```
-16/15*(19*cosh(b*c*x + a*c)^3 + 57*cosh(b*c*x + a*c)*sinh(b*c*x + a*c)^2
+ 21*sinh(b*c*x + a*c)^3 + 21*(3*cosh(b*c*x + a*c)^2 - 1)*sinh(b*c*x + a*c
) - 9*cosh(b*c*x + a*c))/(b*c*cosh(b*c*x + a*c)^9 + 9*b*c*cosh(b*c*x + a*c
)*sinh(b*c*x + a*c)^8 + b*c*sinh(b*c*x + a*c)^9 - 6*b*c*cosh(b*c*x + a*c)^
7 + 6*(6*b*c*cosh(b*c*x + a*c)^2 - b*c)*sinh(b*c*x + a*c)^7 + 15*b*c*cosh(
b*c*x + a*c)^5 + 42*(2*b*c*cosh(b*c*x + a*c)^3 - b*c*cosh(b*c*x + a*c))*si
nh(b*c*x + a*c)^6 + 3*(42*b*c*cosh(b*c*x + a*c)^4 - 42*b*c*cosh(b*c*x + a*
c)^2 + 5*b*c)*sinh(b*c*x + a*c)^5 - 19*b*c*cosh(b*c*x + a*c)^3 + 3*(42*b*c
*cosh(b*c*x + a*c)^5 - 70*b*c*cosh(b*c*x + a*c)^3 + 25*b*c*cosh(b*c*x + a*
c))*sinh(b*c*x + a*c)^4 + 3*(28*b*c*cosh(b*c*x + a*c)^6 - 70*b*c*cosh(b*c*
x + a*c)^4 + 50*b*c*cosh(b*c*x + a*c)^2 - 7*b*c)*sinh(b*c*x + a*c)^3 + 9*b
*c*cosh(b*c*x + a*c) + 3*(12*b*c*cosh(b*c*x + a*c)^7 - 42*b*c*cosh(b*c*x +
 a*c)^5 + 50*b*c*cosh(b*c*x + a*c)^3 - 19*b*c*cosh(b*c*x + a*c))*sinh(b*c*
x + a*c)^2 + 3*(3*b*c*cosh(b*c*x + a*c)^8 - 14*b*c*cosh(b*c*x + a*c)^6 + 2
5*b*c*cosh(b*c*x + a*c)^4 - 21*b*c*cosh(b*c*x + a*c)^2 + 7*b*c)*sinh(b*c*x
 + a*c))
```

### 3.125.6 Sympy [F]

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx = e^{ac}\int \left(\operatorname{csch}^2(ac+bcx)\right)^{\frac{7}{2}} e^{bcx}\,dx$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)**2)**(7/2),x)
```

output
```
exp(a*c)*Integral((csch(a*c + b*c*x)**2)**(7/2)*exp(b*c*x), x)
```

### 3.125.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 386 vs. $2(173) = 346$.

Time = 0.28 (sec) , antiderivative size = 386, normalized size of antiderivative = 1.94

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx =$$

$$-\frac{64\,e^{(6\,bcx+6\,ac)}}{3\,bc(e^{(12\,bcx+12\,ac)}-6\,e^{(10\,bcx+10\,ac)}+15\,e^{(8\,bcx+8\,ac)}-20\,e^{(6\,bcx+6\,ac)}+15\,e^{(4\,bcx+4\,ac)}-6\,e^{(2\,bcx+2\,ac)}+1)}$$
$$+\frac{16\,e^{(4\,bcx+4\,ac)}}{bc(e^{(12\,bcx+12\,ac)}-6\,e^{(10\,bcx+10\,ac)}+15\,e^{(8\,bcx+8\,ac)}-20\,e^{(6\,bcx+6\,ac)}+15\,e^{(4\,bcx+4\,ac)}-6\,e^{(2\,bcx+2\,ac)}+1)}$$
$$-\frac{32\,e^{(2\,bcx+2\,ac)}}{5\,bc(e^{(12\,bcx+12\,ac)}-6\,e^{(10\,bcx+10\,ac)}+15\,e^{(8\,bcx+8\,ac)}-20\,e^{(6\,bcx+6\,ac)}+15\,e^{(4\,bcx+4\,ac)}-6\,e^{(2\,bcx+2\,ac)}+1)}$$
$$+\frac{16}{15\,bc(e^{(12\,bcx+12\,ac)}-6\,e^{(10\,bcx+10\,ac)}+15\,e^{(8\,bcx+8\,ac)}-20\,e^{(6\,bcx+6\,ac)}+15\,e^{(4\,bcx+4\,ac)}-6\,e^{(2\,bcx+2\,ac)}+1)}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(7/2),x, algorithm="maxima")
```

output
```
-64/3*e^(6*b*c*x + 6*a*c)/(b*c*(e^(12*b*c*x + 12*a*c) - 6*e^(10*b*c*x + 10
*a*c) + 15*e^(8*b*c*x + 8*a*c) - 20*e^(6*b*c*x + 6*a*c) + 15*e^(4*b*c*x +
4*a*c) - 6*e^(2*b*c*x + 2*a*c) + 1)) + 16*e^(4*b*c*x + 4*a*c)/(b*c*(e^(12*
b*c*x + 12*a*c) - 6*e^(10*b*c*x + 10*a*c) + 15*e^(8*b*c*x + 8*a*c) - 20*e^
(6*b*c*x + 6*a*c) + 15*e^(4*b*c*x + 4*a*c) - 6*e^(2*b*c*x + 2*a*c) + 1)) -
 32/5*e^(2*b*c*x + 2*a*c)/(b*c*(e^(12*b*c*x + 12*a*c) - 6*e^(10*b*c*x + 10
*a*c) + 15*e^(8*b*c*x + 8*a*c) - 20*e^(6*b*c*x + 6*a*c) + 15*e^(4*b*c*x +
4*a*c) - 6*e^(2*b*c*x + 2*a*c) + 1)) + 16/15/(b*c*(e^(12*b*c*x + 12*a*c) -
 6*e^(10*b*c*x + 10*a*c) + 15*e^(8*b*c*x + 8*a*c) - 20*e^(6*b*c*x + 6*a*c)
 + 15*e^(4*b*c*x + 4*a*c) - 6*e^(2*b*c*x + 2*a*c) + 1))
```

### 3.125.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 90, normalized size of antiderivative = 0.45

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{7/2}\,dx = -\frac{16\left(20\,e^{(6\,bcx+6\,ac)}-15\,e^{(4\,bcx+4\,ac)}+6\,e^{(2\,bcx+2\,ac)}-1\right)}{15\,bc(e^{(2\,bcx+2\,ac)}-1)^6\operatorname{sgn}\left(e^{(bcx+ac)}-e^{(-bcx-ac)}\right)}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(7/2),x, algorithm="giac")
```

output
```
-16/15*(20*e^(6*b*c*x + 6*a*c) - 15*e^(4*b*c*x + 4*a*c) + 6*e^(2*b*c*x + 2
*a*c) - 1)/(b*c*(e^(2*b*c*x + 2*a*c) - 1)^6*sgn(e^(b*c*x + a*c) - e^(-b*c*
x - a*c)))
```

### 3.125.9 Mupad [B] (verification not implemented)

Time = 2.28 (sec) , antiderivative size = 413, normalized size of antiderivative = 2.08

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac + bcx)^{7/2}\,dx = \frac{32\sqrt{\frac{1}{\left(\frac{e^{ac+bcx}}{2}-\frac{e^{-ac-bcx}}{2}\right)^2}}\left(e^{4ac+4bcx}-2e^{2ac+2bcx}+1\right)}{3bc\left(e^{ac+bcx}-e^{3ac+3bcx}\right)\left(e^{2ac+2bcx}-1\right)^3} + \frac{24\sqrt{\frac{1}{\left(\frac{e^{ac+bcx}}{2}-\frac{e^{-ac-bcx}}{2}\right)^2}}\left(e^{4ac+4bcx}-2e^{2ac+2bcx}+1\right)}{bc\left(e^{ac+bcx}-e^{3ac+3bcx}\right)\left(e^{2ac+2bcx}-1\right)^4} + \frac{96\sqrt{\frac{1}{\left(\frac{e^{ac+bcx}}{2}-\frac{e^{-ac-bcx}}{2}\right)^2}}\left(e^{4ac+4bcx}-2e^{2ac+2bcx}+1\right)}{5bc\left(e^{ac+bcx}-e^{3ac+3bcx}\right)\left(e^{2ac+2bcx}-1\right)^5} + \frac{16\sqrt{\frac{1}{\left(\frac{e^{ac+bcx}}{2}-\frac{e^{-ac-bcx}}{2}\right)^2}}\left(e^{4ac+4bcx}-2e^{2ac+2bcx}+1\right)}{3bc\left(e^{ac+bcx}-e^{3ac+3bcx}\right)\left(e^{2ac+2bcx}-1\right)^6}$$

input
```
int(exp(c*(a + b*x))*(1/sinh(a*c + b*c*x)^2)^(7/2),x)
```

output
```
(32*(1/(exp(a*c + b*c*x)/2 - exp(- a*c - b*c*x)/2)^2)^(1/2)*(exp(4*a*c + 4
*b*c*x) - 2*exp(2*a*c + 2*b*c*x) + 1))/(3*b*c*(exp(a*c + b*c*x) - exp(3*a*
c + 3*b*c*x))*(exp(2*a*c + 2*b*c*x) - 1)^3) + (24*(1/(exp(a*c + b*c*x)/2 -
 exp(- a*c - b*c*x)/2)^2)^(1/2)*(exp(4*a*c + 4*b*c*x) - 2*exp(2*a*c + 2*b*
c*x) + 1))/(b*c*(exp(a*c + b*c*x) - exp(3*a*c + 3*b*c*x))*(exp(2*a*c + 2*b
*c*x) - 1)^4) + (96*(1/(exp(a*c + b*c*x)/2 - exp(- a*c - b*c*x)/2)^2)^(1/2
)*(exp(4*a*c + 4*b*c*x) - 2*exp(2*a*c + 2*b*c*x) + 1))/(5*b*c*(exp(a*c + b
*c*x) - exp(3*a*c + 3*b*c*x))*(exp(2*a*c + 2*b*c*x) - 1)^5) + (16*(1/(exp(
a*c + b*c*x)/2 - exp(- a*c - b*c*x)/2)^2)^(1/2)*(exp(4*a*c + 4*b*c*x) - 2*
exp(2*a*c + 2*b*c*x) + 1))/(3*b*c*(exp(a*c + b*c*x) - exp(3*a*c + 3*b*c*x)
)*(exp(2*a*c + 2*b*c*x) - 1)^6)
```

# 3.126 $\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx$

3.126.1 Optimal result . . . 872
3.126.2 Mathematica [A] (verified) . . . 872
3.126.3 Rubi [A] (verified) . . . 873
3.126.4 Maple [C] (warning: unable to verify) . . . 875
3.126.5 Fricas [B] (verification not implemented) . . . 875
3.126.6 Sympy [F] . . . 876
3.126.7 Maxima [A] (verification not implemented) . . . 876
3.126.8 Giac [A] (verification not implemented) . . . 877
3.126.9 Mupad [B] (verification not implemented) . . . 877

## 3.126.1 Optimal result

Integrand size = 25, antiderivative size = 147

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx = -\frac{4\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{bc\left(1-e^{2c(a+bx)}\right)^4} + \frac{32\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{3bc\left(1-e^{2c(a+bx)}\right)^3} - \frac{8\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{bc\left(1-e^{2c(a+bx)}\right)^2}$$

output
```
-4*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^4+32
/3*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^3-8*
sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2*c*(b*x+a)))^2
```

## 3.126.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 72, normalized size of antiderivative = 0.49

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx = -\frac{4\left(1-4e^{2c(a+bx)}+6e^{4c(a+bx)}\right)\sqrt{\operatorname{csch}^2(c(a+bx))}\sinh(c(a+bx))}{3bc\left(-1+e^{2c(a+bx)}\right)^4}$$

input
```
Integrate[E^(c*(a + b*x))*(Csch[a*c + b*c*x]^2)^(5/2),x]
```

output
```
(-4*(1 - 4*E^(2*c*(a + b*x)) + 6*E^(4*c*(a + b*x)))*Sqrt[Csch[c*(a + b*x)]
^2]*Sinh[c*(a + b*x)])/(3*b*c*(-1 + E^(2*c*(a + b*x)))^4)
```

### 3.126.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 93, normalized size of antiderivative = 0.63, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.240$, Rules used = {7271, 2720, 27, 243, 53, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx$$

$$\downarrow 7271$$

$$\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int e^{c(a+bx)}\operatorname{csch}^5(ac+bxc)dx$$

$$\downarrow 2720$$

$$\frac{\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int -\frac{32e^{5c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^5}de^{c(a+bx)}}{bc}$$

$$\downarrow 27$$

$$-\frac{32\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \frac{e^{5c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^5}de^{c(a+bx)}}{bc}$$

$$\downarrow 243$$

$$-\frac{16\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \frac{e^{2c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^5}de^{2c(a+bx)}}{bc}$$

$$\downarrow 53$$

$$-\frac{16\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \left(-\frac{1}{\left(-1+e^{2c(a+bx)}\right)^3}-\frac{2}{\left(-1+e^{2c(a+bx)}\right)^4}-\frac{1}{\left(-1+e^{2c(a+bx)}\right)^5}\right)de^{2c(a+bx)}}{bc}$$

$$\downarrow 2009$$

$$-\frac{16\left(\frac{1}{2\left(1-e^{2c(a+bx)}\right)^2}-\frac{2}{3\left(1-e^{2c(a+bx)}\right)^3}+\frac{1}{4\left(1-e^{2c(a+bx)}\right)^4}\right)\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}}{bc}$$

input
```
Int[E^(c*(a + b*x))*(Csch[a*c + b*c*x]^2)^(5/2),x]
```

output
```
(-16*(1/(4*(1 - E^(2*c*(a + b*x)))^4) - 2/(3*(1 - E^(2*c*(a + b*x)))^3) +
1/(2*(1 - E^(2*c*(a + b*x)))^2))*Sqrt[Csch[a*c + b*c*x]^2]*Sinh[a*c + b*c*
x])/(b*c)
```

#### 3.126.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 53
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d, n},
x] && IGtQ[m, 0] && ( !IntegerQ[n] || (EqQ[c, 0] && LeQ[7*m + 4*n + 4, 0])
|| LtQ[9*m + 5*(n + 1), 0] || GtQ[m + n + 2, 0])
```

rule 243
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[1/2   Subst[In
t[x^((m - 1)/2)*(a + b*x)^p, x], x, x^2], x] /; FreeQ[{a, b, m, p}, x] && I
ntegerQ[(m - 1)/2]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.126.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 1.28 (sec) , antiderivative size = 65, normalized size of antiderivative = 0.44

| method | result | size |
|---|---|---|
| default | $-\frac{\operatorname{csgn}(\operatorname{csch}(c(bx+a)))\left(\frac{\coth(c(bx+a))^4}{4}+\frac{\coth(c(bx+a))^3}{3}-\frac{\coth(c(bx+a))^2}{2}-\coth(c(bx+a))\right)}{cb}$ | 65 |
| risch | $-\frac{4\left(6\,e^{4c(bx+a)}-4\,e^{2c(bx+a)}+1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}\,e^{-c(bx+a)}}{3bc\left(e^{2c(bx+a)}-1\right)^3}$ | 80 |

input
```
int(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
-csgn(csch(c*(b*x+a)))/c/b*(1/4*coth(c*(b*x+a))^4+1/3*coth(c*(b*x+a))^3-1/
2*coth(c*(b*x+a))^2-coth(c*(b*x+a)))
```

### 3.126.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 315 vs. $2(130) = 260$.

Time = 0.25 (sec) , antiderivative size = 315, normalized size of antiderivative = 2.14

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx =$$

$$-\frac{}{3\left(bc\cosh\left(bcx+ac\right)^6+6\,bc\cosh\left(bcx+ac\right)\sinh\left(bcx+ac\right)^5+bc\sinh\left(bcx+ac\right)^6-4\,bc\cosh\left(bcx+ac\right)^4-\right.}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(5/2),x, algorithm="fricas")
```

output
```
-4/3*(7*cosh(b*c*x + a*c)^2 + 10*cosh(b*c*x + a*c)*sinh(b*c*x + a*c) + 7*s
inh(b*c*x + a*c)^2 - 4)/(b*c*cosh(b*c*x + a*c)^6 + 6*b*c*cosh(b*c*x + a*c)
*sinh(b*c*x + a*c)^5 + b*c*sinh(b*c*x + a*c)^6 - 4*b*c*cosh(b*c*x + a*c)^4
 + (15*b*c*cosh(b*c*x + a*c)^2 - 4*b*c)*sinh(b*c*x + a*c)^4 + 7*b*c*cosh(b
*c*x + a*c)^2 + 4*(5*b*c*cosh(b*c*x + a*c)^3 - 4*b*c*cosh(b*c*x + a*c))*si
nh(b*c*x + a*c)^3 + (15*b*c*cosh(b*c*x + a*c)^4 - 24*b*c*cosh(b*c*x + a*c)
^2 + 7*b*c)*sinh(b*c*x + a*c)^2 - 4*b*c + 2*(3*b*c*cosh(b*c*x + a*c)^5 - 8
*b*c*cosh(b*c*x + a*c)^3 + 5*b*c*cosh(b*c*x + a*c))*sinh(b*c*x + a*c))
```

### 3.126.6 Sympy [F]

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx = e^{ac}\int \left(\operatorname{csch}^2(ac+bcx)\right)^{\frac{5}{2}} e^{bcx}\,dx$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)**2)**(5/2),x)
```

output
```
exp(a*c)*Integral((csch(a*c + b*c*x)**2)**(5/2)*exp(b*c*x), x)
```

### 3.126.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 209, normalized size of antiderivative = 1.42

$$\begin{aligned}\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx = &\\ -\frac{8\,e^{(4\,bcx+4\,ac)}}{bc(e^{(8\,bcx+8\,ac)}-4\,e^{(6\,bcx+6\,ac)}+6\,e^{(4\,bcx+4\,ac)}-4\,e^{(2\,bcx+2\,ac)}+1)}&\\ +\frac{16\,e^{(2\,bcx+2\,ac)}}{3\,bc(e^{(8\,bcx+8\,ac)}-4\,e^{(6\,bcx+6\,ac)}+6\,e^{(4\,bcx+4\,ac)}-4\,e^{(2\,bcx+2\,ac)}+1)}&\\ -\frac{4}{3\,bc(e^{(8\,bcx+8\,ac)}-4\,e^{(6\,bcx+6\,ac)}+6\,e^{(4\,bcx+4\,ac)}-4\,e^{(2\,bcx+2\,ac)}+1)}&\end{aligned}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(5/2),x, algorithm="maxima")
```

output
```
-8*e^(4*b*c*x + 4*a*c)/(b*c*(e^(8*b*c*x + 8*a*c) - 4*e^(6*b*c*x + 6*a*c) +
 6*e^(4*b*c*x + 4*a*c) - 4*e^(2*b*c*x + 2*a*c) + 1)) + 16/3*e^(2*b*c*x + 2
*a*c)/(b*c*(e^(8*b*c*x + 8*a*c) - 4*e^(6*b*c*x + 6*a*c) + 6*e^(4*b*c*x + 4
*a*c) - 4*e^(2*b*c*x + 2*a*c) + 1)) - 4/3/(b*c*(e^(8*b*c*x + 8*a*c) - 4*e^
(6*b*c*x + 6*a*c) + 6*e^(4*b*c*x + 4*a*c) - 4*e^(2*b*c*x + 2*a*c) + 1))
```

### 3.126.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 77, normalized size of antiderivative = 0.52

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx = -\frac{4\left(6\,e^{(4\,bcx+4\,ac)}-4\,e^{(2\,bcx+2\,ac)}+1\right)}{3\,bc(e^{(2\,bcx+2\,ac)}-1)^4\operatorname{sgn}\left(e^{(bcx+ac)}-e^{(-bcx-ac)}\right)}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(5/2),x, algorithm="giac")
```

output
```
-4/3*(6*e^(4*b*c*x + 4*a*c) - 4*e^(2*b*c*x + 2*a*c) + 1)/(b*c*(e^(2*b*c*x
+ 2*a*c) - 1)^4*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)))
```

### 3.126.9 Mupad [B] (verification not implemented)

Time = 2.18 (sec) , antiderivative size = 91, normalized size of antiderivative = 0.62

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{5/2}\,dx = -\frac{2\,\mathrm{e}^{-a\,c-b\,c\,x}\,\sqrt{\frac{1}{\left(\frac{\mathrm{e}^{a\,c+b\,c\,x}}{2}-\frac{\mathrm{e}^{-a\,c-b\,c\,x}}{2}\right)^2}}\left(6\,\mathrm{e}^{4\,a\,c+4\,b\,c\,x}-4\,\mathrm{e}^{2\,a\,c+2\,b\,c\,x}+1\right)}{3\,b\,c\left(\mathrm{e}^{2\,a\,c+2\,b\,c\,x}-1\right)^3}$$

input
```
int(exp(c*(a + b*x))*(1/sinh(a*c + b*c*x)^2)^(5/2),x)
```

output
```
-(2*exp(- a*c - b*c*x)*(1/(exp(a*c + b*c*x)/2 - exp(- a*c - b*c*x)/2)^2)^(
1/2)*(6*exp(4*a*c + 4*b*c*x) - 4*exp(2*a*c + 2*b*c*x) + 1))/(3*b*c*(exp(2*
a*c + 2*b*c*x) - 1)^3)
```

# 3.127 $\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx$

3.127.1 Optimal result . . . . . 878
3.127.2 Mathematica [A] (verified) . . . . . 878
3.127.3 Rubi [A] (verified) . . . . . 879
3.127.4 Maple [C] (warning: unable to verify) . . . . . 880
3.127.5 Fricas [B] (verification not implemented) . . . . . 881
3.127.6 Sympy [F] . . . . . 881
3.127.7 Maxima [A] (verification not implemented) . . . . . 881
3.127.8 Giac [A] (verification not implemented) . . . . . 882
3.127.9 Mupad [B] (verification not implemented) . . . . . 882

## 3.127.1 Optimal result

Integrand size = 25, antiderivative size = 58

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx = -\frac{2e^{4c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\sinh(ac+bcx)}{bc\left(1-e^{2c(a+bx)}\right)^2}$$

output
```
-2*exp(4*c*(b*x+a))*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c/(1-exp(2
*c*(b*x+a)))^2
```

## 3.127.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.97

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx = -\frac{2e^{4c(a+bx)}\operatorname{csch}^2(c(a+bx))^{3/2}\sinh^3(c(a+bx))}{bc\left(-1+e^{2c(a+bx)}\right)^2}$$

input
```
Integrate[E^(c*(a + b*x))*(Csch[a*c + b*c*x]^2)^(3/2),x]
```

output
```
(-2*E^(4*c*(a + b*x))*(Csch[c*(a + b*x)]^2)^(3/2)*Sinh[c*(a + b*x)]^3)/(b*
c*(-1 + E^(2*c*(a + b*x)))^2)
```

### 3.127.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.160$, Rules used = {7271, 2720, 27, 242}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx$$

$$\downarrow 7271$$

$$\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int e^{c(a+bx)}\operatorname{csch}^3(ac+bxc)dx$$

$$\downarrow 2720$$

$$\frac{\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int -\frac{8e^{3c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^3}de^{c(a+bx)}}{bc}$$

$$\downarrow 27$$

$$-\frac{8\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \frac{e^{3c(a+bx)}}{\left(1-e^{2c(a+bx)}\right)^3}de^{c(a+bx)}}{bc}$$

$$\downarrow 242$$

$$-\frac{2e^{4c(a+bx)}\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}}{bc\left(1-e^{2c(a+bx)}\right)^2}$$

input
```
Int[E^(c*(a + b*x))*(Csch[a*c + b*c*x]^2)^(3/2),x]
```

output
```
(-2*E^(4*c*(a + b*x))*Sqrt[Csch[a*c + b*c*x]^2]*Sinh[a*c + b*c*x])/(b*c*(1
 - E^(2*c*(a + b*x)))^2)
```

#### 3.127.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 242
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(c*x)^
(m + 1)*((a + b*x^2)^(p + 1)/(a*c*(m + 1))), x] /; FreeQ[{a, b, c, m, p}, x
] && EqQ[m + 2*p + 3, 0] && NeQ[m, -1]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.127.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.36 (sec) , antiderivative size = 40, normalized size of antiderivative = 0.69

| method | result | size |
|---|---|---|
| default | $\frac{\operatorname{csgn}(\operatorname{csch}(c(bx+a)))\left(-\frac{\coth(c(bx+a))^2}{2}-\coth(c(bx+a))\right)}{cb}$ | 40 |
| risch | $-\frac{2\left(2\,\mathrm{e}^{2c(bx+a)}-1\right)\sqrt{\frac{\mathrm{e}^{2c(bx+a)}}{\left(\mathrm{e}^{2c(bx+a)}-1\right)^2}}\,\mathrm{e}^{-c(bx+a)}}{bc\left(\mathrm{e}^{2c(bx+a)}-1\right)}$ | 69 |

input
```
int(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
csgn(csch(c*(b*x+a)))/c/b*(-1/2*coth(c*(b*x+a))^2-coth(c*(b*x+a)))
```

### 3.127.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 121 vs. $2(52) = 104$.

Time = 0.25 (sec) , antiderivative size = 121, normalized size of antiderivative = 2.09

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx =$$

$$-\frac{2\left(\cosh\left(bcx+ac\right)+3\sinh\left(bcx+ac\right)\right)}{bc\cosh\left(bcx+ac\right)^3+3\,bc\cosh\left(bcx+ac\right)\sinh\left(bcx+ac\right)^2+bc\sinh\left(bcx+ac\right)^3-bc\cosh\left(bcx+ac\right)+3\,(b}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(3/2),x, algorithm="fricas")
```

output
```
-2*(cosh(b*c*x + a*c) + 3*sinh(b*c*x + a*c))/(b*c*cosh(b*c*x + a*c)^3 + 3*
b*c*cosh(b*c*x + a*c)*sinh(b*c*x + a*c)^2 + b*c*sinh(b*c*x + a*c)^3 - b*c*
cosh(b*c*x + a*c) + 3*(b*c*cosh(b*c*x + a*c)^2 - b*c)*sinh(b*c*x + a*c))
```

### 3.127.6 Sympy [F]

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx = e^{ac}\int \left(\operatorname{csch}^2\left(ac+bcx\right)\right)^{\frac{3}{2}} e^{bcx}\,dx$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)**2)**(3/2),x)
```

output
```
exp(a*c)*Integral((csch(a*c + b*c*x)**2)**(3/2)*exp(b*c*x), x)
```

### 3.127.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.45

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx = -\frac{4\,e^{(2\,bcx+2\,ac)}}{bc(e^{(4\,bcx+4\,ac)}-2\,e^{(2\,bcx+2\,ac)}+1)} + \frac{2}{bc(e^{(4\,bcx+4\,ac)}-2\,e^{(2\,bcx+2\,ac)}+1)}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(3/2),x, algorithm="maxima")
```

output
```
-4*e^(2*b*c*x + 2*a*c)/(b*c*(e^(4*b*c*x + 4*a*c) - 2*e^(2*b*c*x + 2*a*c) +
 1)) + 2/(b*c*(e^(4*b*c*x + 4*a*c) - 2*e^(2*b*c*x + 2*a*c) + 1))
```

### 3.127.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 64, normalized size of antiderivative = 1.10

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx = -\frac{2\left(2\,e^{(2\,bcx+2\,ac)}-1\right)}{bc(e^{(2\,bcx+2\,ac)}-1)^2\operatorname{sgn}\left(e^{(bcx+ac)}-e^{(-bcx-ac)}\right)}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(3/2),x, algorithm="giac")
```

output
```
-2*(2*e^(2*b*c*x + 2*a*c) - 1)/(b*c*(e^(2*b*c*x + 2*a*c) - 1)^2*sgn(e^(b*c
*x + a*c) - e^(-b*c*x - a*c)))
```

### 3.127.9 Mupad [B] (verification not implemented)

Time = 2.16 (sec) , antiderivative size = 78, normalized size of antiderivative = 1.34

$$\int e^{c(a+bx)}\operatorname{csch}^2(ac+bcx)^{3/2}\,dx = -\frac{\mathrm{e}^{-a\,c-b\,c\,x}\left(2\,\mathrm{e}^{2\,a\,c+2\,b\,c\,x}-1\right)\sqrt{\frac{1}{\left(\frac{\mathrm{e}^{a\,c+b\,c\,x}}{2}-\frac{\mathrm{e}^{-a\,c-b\,c\,x}}{2}\right)^2}}}{b\,c\,\left(\mathrm{e}^{2\,a\,c+2\,b\,c\,x}-1\right)}$$

input
```
int(exp(c*(a + b*x))*(1/sinh(a*c + b*c*x)^2)^(3/2),x)
```

output
```
-(exp(- a*c - b*c*x)*(2*exp(2*a*c + 2*b*c*x) - 1)*(1/(exp(a*c + b*c*x)/2 -
 exp(- a*c - b*c*x)/2)^2)^(1/2))/(b*c*(exp(2*a*c + 2*b*c*x) - 1))
```

# 3.128 $\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx$

3.128.1 Optimal result . . . . . 883
3.128.2 Mathematica [A] (verified) . . . . . 883
3.128.3 Rubi [A] (verified) . . . . . 884
3.128.4 Maple [C] (warning: unable to verify) . . . . . 885
3.128.5 Fricas [A] (verification not implemented) . . . . . 886
3.128.6 Sympy [F] . . . . . 886
3.128.7 Maxima [A] (verification not implemented) . . . . . 886
3.128.8 Giac [A] (verification not implemented) . . . . . 887
3.128.9 Mupad [F(-1)] . . . . . 887

## 3.128.1 Optimal result

Integrand size = 25, antiderivative size = 46

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = \frac{\sqrt{\operatorname{csch}^2(ac+bcx)}\log\left(1-e^{2c(a+bx)}\right)\sinh(ac+bcx)}{bc}$$

output
```
ln(1-exp(2*c*(b*x+a)))*sinh(b*c*x+a*c)*(csch(b*c*x+a*c)^2)^(1/2)/b/c
```

## 3.128.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 44, normalized size of antiderivative = 0.96

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = \frac{\sqrt{\operatorname{csch}^2(c(a+bx))}\log\left(1-e^{2c(a+bx)}\right)\sinh(c(a+bx))}{bc}$$

input
```
Integrate[E^(c*(a + b*x))*Sqrt[Csch[a*c + b*c*x]^2],x]
```

output
```
(Sqrt[Csch[c*(a + b*x)]^2]*Log[1 - E^(2*c*(a + b*x))]*Sinh[c*(a + b*x)])/(
b*c)
```

### 3.128.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.160$, Rules used = {7271, 2720, 27, 240}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx$$

$$\downarrow 7271$$

$$\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int e^{c(a+bx)}\operatorname{csch}(ac+bxc)dx$$

$$\downarrow 2720$$

$$\frac{\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int -\frac{2e^{c(a+bx)}}{1-e^{2c(a+bx)}}de^{c(a+bx)}}{bc}$$

$$\downarrow 27$$

$$-\frac{2\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}\int \frac{e^{c(a+bx)}}{1-e^{2c(a+bx)}}de^{c(a+bx)}}{bc}$$

$$\downarrow 240$$

$$\frac{\log\left(1-e^{2c(a+bx)}\right)\sinh(ac+bcx)\sqrt{\operatorname{csch}^2(ac+bcx)}}{bc}$$

input
```
Int[E^(c*(a + b*x))*Sqrt[Csch[a*c + b*c*x]^2],x]
```

output
```
(Sqrt[Csch[a*c + b*c*x]^2]*Log[1 - E^(2*c*(a + b*x))]*Sinh[a*c + b*c*x])/(
b*c)
```

#### 3.128.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 240
```
Int[(x_)/((a_) + (b_.)*(x_)^2), x_Symbol] :> Simp[Log[RemoveContent[a + b*x
^2, x]]/(2*b), x] /; FreeQ[{a, b}, x]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.128.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.32 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.63

| method | result | size |
|---|---|---|
| default | $\operatorname{csgn}\left(\operatorname{csch}\left(c(bx+a)\right)\right)\left(x+\frac{\ln(\sinh(c(bx+a)))}{cb}\right)$ | 29 |
| risch | $\frac{\ln\left(\mathrm{e}^{2bcx}-\mathrm{e}^{-2ac}\right)\left(\mathrm{e}^{2c(bx+a)}-1\right)\sqrt{\frac{\mathrm{e}^{2c(bx+a)}}{\left(\mathrm{e}^{2c(bx+a)}-1\right)^2}}\,\mathrm{e}^{-c(bx+a)}}{bc}$ | 68 |

input
```
int(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
csgn(csch(c*(b*x+a)))*(x+1/c/b*ln(sinh(c*(b*x+a))))
```

### 3.128.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 42, normalized size of antiderivative = 0.91

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = \frac{\log\left(\frac{2\sinh(bcx+ac)}{\cosh(bcx+ac)-\sinh(bcx+ac)}\right)}{bc}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(1/2),x, algorithm="fricas")
```

output
```
log(2*sinh(b*c*x + a*c)/(cosh(b*c*x + a*c) - sinh(b*c*x + a*c)))/(b*c)
```

### 3.128.6 Sympy [F]

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = e^{ac}\int \sqrt{\operatorname{csch}^2(ac+bcx)}e^{bcx}\,dx$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)**2)**(1/2),x)
```

output
```
exp(a*c)*Integral(sqrt(csch(a*c + b*c*x)**2)*exp(b*c*x), x)
```

### 3.128.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.85

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = \frac{\log\left(e^{(bcx+ac)}+1\right)}{bc} + \frac{\log\left(e^{(bcx+ac)}-1\right)}{bc}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(1/2),x, algorithm="maxima")
```

output
```
log(e^(b*c*x + a*c) + 1)/(b*c) + log(e^(b*c*x + a*c) - 1)/(b*c)
```

### 3.128.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 48, normalized size of antiderivative = 1.04

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = \frac{\log\left(\left|e^{(2\,bcx+2\,ac)}-1\right|\right)}{bc\operatorname{sgn}\left(e^{(bcx+ac)}-e^{(-bcx-ac)}\right)}$$

input
```
integrate(exp(c*(b*x+a))*(csch(b*c*x+a*c)^2)^(1/2),x, algorithm="giac")
```

output
```
log(abs(e^(2*b*c*x + 2*a*c) - 1))/(b*c*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a
*c)))
```

### 3.128.9 Mupad [F(-1)]

Timed out.

$$\int e^{c(a+bx)}\sqrt{\operatorname{csch}^2(ac+bcx)}\,dx = \int e^{c\,(a+b\,x)}\sqrt{\frac{1}{\sinh\left(a\,c+b\,c\,x\right)^2}}\,dx$$

input
```
int(exp(c*(a + b*x))*(1/sinh(a*c + b*c*x)^2)^(1/2),x)
```

output
```
int(exp(c*(a + b*x))*(1/sinh(a*c + b*c*x)^2)^(1/2), x)
```

# 3.129 $\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx$

3.129.1 Optimal result . . . 888
3.129.2 Mathematica [A] (verified) . . . 888
3.129.3 Rubi [A] (verified) . . . 889
3.129.4 Maple [C] (warning: unable to verify) . . . 890
3.129.5 Fricas [A] (verification not implemented) . . . 891
3.129.6 Sympy [F] . . . 891
3.129.7 Maxima [A] (verification not implemented) . . . 891
3.129.8 Giac [A] (verification not implemented) . . . 892
3.129.9 Mupad [F(-1)] . . . 892

## 3.129.1 Optimal result

Integrand size = 25, antiderivative size = 74

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = \frac{e^{2c(a+bx)}\operatorname{csch}(ac+bcx)}{4bc\sqrt{\operatorname{csch}^2(ac+bcx)}} - \frac{x\operatorname{csch}(ac+bcx)}{2\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

output
```
1/4*exp(2*c*(b*x+a))*csch(b*c*x+a*c)/b/c/(csch(b*c*x+a*c)^2)^(1/2)-1/2*x*c
sch(b*c*x+a*c)/(csch(b*c*x+a*c)^2)^(1/2)
```

## 3.129.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 48, normalized size of antiderivative = 0.65

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = \frac{\left(e^{2c(a+bx)} - 2bcx\right)\operatorname{csch}(c(a+bx))}{4bc\sqrt{\operatorname{csch}^2(c(a+bx))}}$$

input
```
Integrate[E^(c*(a + b*x))/Sqrt[Csch[a*c + b*c*x]^2],x]
```

output
```
((E^(2*c*(a + b*x)) - 2*b*c*x)*Csch[c*(a + b*x)])/(4*b*c*Sqrt[Csch[c*(a +
b*x)]^2])
```

### 3.129.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 61, normalized size of antiderivative = 0.82, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {7271, 2720, 27, 244, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx$$

$$\downarrow 7271$$

$$\frac{\operatorname{csch}(ac+bcx)\int e^{c(a+bx)}\sinh(ac+bxc)dx}{\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 2720$$

$$\frac{\operatorname{csch}(ac+bcx)\int -\frac{1}{2}e^{-c(a+bx)}\left(1-e^{2c(a+bx)}\right)de^{c(a+bx)}}{bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 27$$

$$-\frac{\operatorname{csch}(ac+bcx)\int e^{-c(a+bx)}\left(1-e^{2c(a+bx)}\right)de^{c(a+bx)}}{2bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 244$$

$$-\frac{\operatorname{csch}(ac+bcx)\int \left(e^{-c(a+bx)}-e^{c(a+bx)}\right)de^{c(a+bx)}}{2bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 2009$$

$$\frac{\left(\frac{1}{2}e^{2c(a+bx)}-\log\left(e^{c(a+bx)}\right)\right)\operatorname{csch}(ac+bcx)}{2bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

input
```
Int[E^(c*(a + b*x))/Sqrt[Csch[a*c + b*c*x]^2],x]
```

output
```
(Csch[a*c + b*c*x]*(E^(2*c*(a + b*x))/2 - Log[E^(c*(a + b*x))]))/(2*b*c*Sq
rt[Csch[a*c + b*c*x]^2])
```

#### 3.129.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 244
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.), x_Symbol] :> Int[Expand
Integrand[(c*x)^m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, m}, x] && IGtQ[p
, 0]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.129.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.42 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.81

| method | result | size |
|---|---|---|
| default | $\frac{\operatorname{csgn}(\operatorname{csch}(c(bx+a)))\left(\frac{\sinh(bcx+ac)\cosh(bcx+ac)}{2}-\frac{bcx}{2}-\frac{ac}{2}+\frac{\cosh(bcx+ac)^2}{2}\right)}{cb}$ | 60 |
| risch | $-\frac{x\,\mathrm{e}^{c(bx+a)}}{2\left(\mathrm{e}^{2c(bx+a)}-1\right)\sqrt{\frac{\mathrm{e}^{2c(bx+a)}}{\left(\mathrm{e}^{2c(bx+a)}-1\right)^2}}}+\frac{\mathrm{e}^{3c(bx+a)}}{4bc\left(\mathrm{e}^{2c(bx+a)}-1\right)\sqrt{\frac{\mathrm{e}^{2c(bx+a)}}{\left(\mathrm{e}^{2c(bx+a)}-1\right)^2}}}$ | 106 |

input
```
int(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
csgn(csch(c*(b*x+a)))/c/b*(1/2*sinh(b*c*x+a*c)*cosh(b*c*x+a*c)-1/2*b*c*x-1
/2*a*c+1/2*cosh(b*c*x+a*c)^2)
```

### 3.129.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.89

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = -\frac{(2\,bcx-1)\cosh(bcx+ac)-(2\,bcx+1)\sinh(bcx+ac)}{4\,(bc\cosh(bcx+ac)-bc\sinh(bcx+ac))}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2),x, algorithm="fricas")
```

output
```
-1/4*((2*b*c*x - 1)*cosh(b*c*x + a*c) - (2*b*c*x + 1)*sinh(b*c*x + a*c))/(
b*c*cosh(b*c*x + a*c) - b*c*sinh(b*c*x + a*c))
```

### 3.129.6 Sympy [F]

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = e^{ac}\int \frac{e^{bcx}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)**2)**(1/2),x)
```

output
```
exp(a*c)*Integral(exp(b*c*x)/sqrt(csch(a*c + b*c*x)**2), x)
```

### 3.129.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 36, normalized size of antiderivative = 0.49

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = -\frac{bcx+ac}{2\,bc} + \frac{e^{(2\,bcx+2\,ac)}}{4\,bc}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2),x, algorithm="maxima")
```

output
```
-1/2*(b*c*x + a*c)/(b*c) + 1/4*e^(2*b*c*x + 2*a*c)/(b*c)
```

### 3.129.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 71, normalized size of antiderivative = 0.96

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = -\frac{1}{2}\,x\operatorname{sgn}\left(e^{(bcx+ac)} - e^{(-bcx-ac)}\right) + \frac{e^{(2\,bcx+2\,ac)}\operatorname{sgn}\left(e^{(bcx+ac)} - e^{(-bcx-ac)}\right)}{4\,bc}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2),x, algorithm="giac")
```

output
```
-1/2*x*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)) + 1/4*e^(2*b*c*x + 2*a*c)*s
gn(e^(b*c*x + a*c) - e^(-b*c*x - a*c))/(b*c)
```

### 3.129.9 Mupad [F(-1)]

Timed out.

$$\int \frac{e^{c(a+bx)}}{\sqrt{\operatorname{csch}^2(ac+bcx)}}\,dx = \int \frac{\mathrm{e}^{c\,(a+b\,x)}}{\sqrt{\frac{1}{\sinh(a\,c+b\,c\,x)^2}}}\,dx$$

input
```
int(exp(c*(a + b*x))/(1/sinh(a*c + b*c*x)^2)^(1/2),x)
```

output
```
int(exp(c*(a + b*x))/(1/sinh(a*c + b*c*x)^2)^(1/2), x)
```

# 3.130 $\int \frac{e^{c(a+bx)}}{\text{csch}^2(ac+bcx)^{3/2}}\,dx$

3.130.1 Optimal result . . . . . 893
3.130.2 Mathematica [A] (verified) . . . . . 893
3.130.3 Rubi [A] (warning: unable to verify) . . . . . 894
3.130.4 Maple [C] (warning: unable to verify) . . . . . 896
3.130.5 Fricas [A] (verification not implemented) . . . . . 896
3.130.6 Sympy [F] . . . . . 897
3.130.7 Maxima [A] (verification not implemented) . . . . . 897
3.130.8 Giac [A] (verification not implemented) . . . . . 897
3.130.9 Mupad [F(-1)] . . . . . 898

## 3.130.1 Optimal result

Integrand size = 25, antiderivative size = 162

$$\int \frac{e^{c(a+bx)}}{\text{csch}^2(ac+bcx)^{3/2}}\,dx = \frac{e^{-2c(a+bx)}\text{csch}(ac+bcx)}{16bc\sqrt{\text{csch}^2(ac+bcx)}} - \frac{3e^{2c(a+bx)}\text{csch}(ac+bcx)}{16bc\sqrt{\text{csch}^2(ac+bcx)}} + \frac{e^{4c(a+bx)}\text{csch}(ac+bcx)}{32bc\sqrt{\text{csch}^2(ac+bcx)}} + \frac{3x\text{csch}(ac+bcx)}{8\sqrt{\text{csch}^2(ac+bcx)}}$$

output

```
1/16*csch(b*c*x+a*c)/b/c/exp(2*c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2)-3/16*e
xp(2*c*(b*x+a))*csch(b*c*x+a*c)/b/c/(csch(b*c*x+a*c)^2)^(1/2)+1/32*exp(4*c
*(b*x+a))*csch(b*c*x+a*c)/b/c/(csch(b*c*x+a*c)^2)^(1/2)+3/8*x*csch(b*c*x+a
*c)/(csch(b*c*x+a*c)^2)^(1/2)
```

## 3.130.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 76, normalized size of antiderivative = 0.47

$$\int \frac{e^{c(a+bx)}}{\text{csch}^2(ac+bcx)^{3/2}}\,dx = \frac{\left(e^{-2c(a+bx)} - 3e^{2c(a+bx)} + \frac{1}{2}e^{4c(a+bx)} + 6bcx\right)\text{csch}^3(c(a+bx))}{16bc\text{csch}^2(c(a+bx))^{3/2}}$$

input

```
Integrate[E^(c*(a + b*x))/(Csch[a*c + b*c*x]^2)^(3/2),x]
```

output

```
((E^(-2*c*(a + b*x)) - 3*E^(2*c*(a + b*x)) + E^(4*c*(a + b*x))/2 + 6*b*c*x
)*Csch[c*(a + b*x)]^3)/(16*b*c*(Csch[c*(a + b*x)]^2)^(3/2))
```

### 3.130.3 Rubi [A] (warning: unable to verify)

Time = 0.36 (sec) , antiderivative size = 74, normalized size of antiderivative = 0.46, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.240$, Rules used = {7271, 2720, 27, 243, 49, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx$$

$$\downarrow 7271$$

$$\frac{\operatorname{csch}(ac+bcx)\int e^{c(a+bx)}\sinh^3(ac+bxc)dx}{\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 2720$$

$$\frac{\operatorname{csch}(ac+bcx)\int -\frac{1}{8}e^{-3c(a+bx)}\left(1-e^{2c(a+bx)}\right)^3 de^{c(a+bx)}}{bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 27$$

$$-\frac{\operatorname{csch}(ac+bcx)\int e^{-3c(a+bx)}\left(1-e^{2c(a+bx)}\right)^3 de^{c(a+bx)}}{8bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 243$$

$$-\frac{\operatorname{csch}(ac+bcx)\int e^{-2c(a+bx)}\left(1-e^{2c(a+bx)}\right)^3 de^{2c(a+bx)}}{16bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 49$$

$$-\frac{\operatorname{csch}(ac+bcx)\int \left(3+e^{-2c(a+bx)}-3e^{-c(a+bx)}-e^{2c(a+bx)}\right) de^{2c(a+bx)}}{16bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 2009$$

$$-\frac{\left(-e^{-c(a+bx)}+\frac{5}{2}e^{2c(a+bx)}-3\log\left(e^{2c(a+bx)}\right)\right)\operatorname{csch}(ac+bcx)}{16bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

input
```
Int[E^(c*(a + b*x))/(Csch[a*c + b*c*x]^2)^(3/2),x]
```

output
```
-1/16*(Csch[a*c + b*c*x]*(-E^(-(c*(a + b*x))) + (5*E^(2*c*(a + b*x)))/2 -
3*Log[E^(2*c*(a + b*x))]))/(b*c*Sqrt[Csch[a*c + b*c*x]^2])
```

### 3.130.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 49
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d}, x]
&& IGtQ[m, 0] && IGtQ[m + n + 2, 0]
```

rule 243
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[1/2   Subst[In
t[x^((m - 1)/2)*(a + b*x)^p, x], x, x^2], x] /; FreeQ[{a, b, m, p}, x] && I
ntegerQ[(m - 1)/2]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.130.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.72 (sec) , antiderivative size = 75, normalized size of antiderivative = 0.46

| method | result |
|---|---|
| default | $\frac{\operatorname{csgn}(\operatorname{csch}(c(bx+a)))\left(\left(\frac{\sinh(bcx+ac)^3}{4}-\frac{3\sinh(bcx+ac)}{8}\right)\cosh(bcx+ac)+\frac{3bcx}{8}+\frac{3ac}{8}+\frac{\sinh(bcx+ac)^4}{4}\right)}{cb}$ |
| risch | $\frac{3x\,e^{c(bx+a)}}{8\left(e^{2c(bx+a)}-1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}}+\frac{e^{5c(bx+a)}}{32bc\left(e^{2c(bx+a)}-1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}}-\frac{3\,e^{3c(bx+a)}}{16bc\left(e^{2c(bx+a)}-1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}}+\frac{}{16bc\left(e^{2c}\right.}$ |

input
```
int(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(3/2),x,method=_RETURNVERBOSE)
```

output
```
csgn(csch(c*(b*x+a)))/c/b*((1/4*sinh(b*c*x+a*c)^3-3/8*sinh(b*c*x+a*c))*cos
h(b*c*x+a*c)+3/8*b*c*x+3/8*a*c+1/4*sinh(b*c*x+a*c)^4)
```

### 3.130.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 126, normalized size of antiderivative = 0.78

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx = \frac{3\cosh(bcx+ac)^3+9\cosh(bcx+ac)\sinh(bcx+ac)^2-\sinh(bcx+ac)^3+6(2}{32\,(bc\cosh(bcx+ac)-}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(3/2),x, algorithm="fricas")
```

output
```
1/32*(3*cosh(b*c*x + a*c)^3 + 9*cosh(b*c*x + a*c)*sinh(b*c*x + a*c)^2 - si
nh(b*c*x + a*c)^3 + 6*(2*b*c*x - 1)*cosh(b*c*x + a*c) - 3*(4*b*c*x + cosh(
b*c*x + a*c)^2 + 2)*sinh(b*c*x + a*c))/(b*c*cosh(b*c*x + a*c) - b*c*sinh(b
*c*x + a*c))
```

### 3.130.6 Sympy [F]

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx = e^{ac}\int \frac{e^{bcx}}{\left(\operatorname{csch}^2(ac+bcx)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)**2)**(3/2),x)
```

output
```
exp(a*c)*Integral(exp(b*c*x)/(csch(a*c + b*c*x)**2)**(3/2), x)
```

### 3.130.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 62, normalized size of antiderivative = 0.38

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx = \frac{\left(e^{(6\,bcx+6\,ac)} - 6\,e^{(4\,bcx+4\,ac)} + 2\right)e^{(-2\,bcx-2\,ac)}}{32\,bc} + \frac{3\,(bcx+ac)}{8\,bc}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(3/2),x, algorithm="maxima")
```

output
```
1/32*(e^(6*b*c*x + 6*a*c) - 6*e^(4*b*c*x + 4*a*c) + 2)*e^(-2*b*c*x - 2*a*c
)/(b*c) + 3/8*(b*c*x + a*c)/(b*c)
```

### 3.130.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 204, normalized size of antiderivative = 1.26

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx = \frac{\left(12\,bcxe^{(-ac)}\operatorname{sgn}\left(e^{(bcx+ac)} - e^{(-bcx-ac)}\right) - 2\left(3\,e^{(2\,bcx+2\,ac)}\operatorname{sgn}\left(e^{(bcx+ac)} - e^{(-bcx-ac}\right.\right.\right.$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(3/2),x, algorithm="giac")
```

output
```
1/32*(12*b*c*x*e^(-a*c)*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)) - 2*(3*e^(
2*b*c*x + 2*a*c)*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)) - sgn(e^(b*c*x +
a*c) - e^(-b*c*x - a*c)))*e^(-2*b*c*x - 3*a*c) + (e^(4*b*c*x + 9*a*c)*sgn(
e^(b*c*x + a*c) - e^(-b*c*x - a*c)) - 6*e^(2*b*c*x + 7*a*c)*sgn(e^(b*c*x +
 a*c) - e^(-b*c*x - a*c)))*e^(-6*a*c))*e^(a*c)/(b*c)
```

### 3.130.9 Mupad [F(-1)]

Timed out.

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{3/2}}\,dx = \int \frac{\mathrm{e}^{c\,(a+b\,x)}}{\left(\frac{1}{\sinh(a\,c+b\,c\,x)^2}\right)^{3/2}}\,dx$$

input
```
int(exp(c*(a + b*x))/(1/sinh(a*c + b*c*x)^2)^(3/2),x)
```

output
```
int(exp(c*(a + b*x))/(1/sinh(a*c + b*c*x)^2)^(3/2), x)
```

# 3.131 $\int \frac{e^{c(a+bx)}}{\text{csch}^2(ac+bcx)^{5/2}}\,dx$

3.131.1 Optimal result . . . 899
3.131.2 Mathematica [A] (verified) . . . 900
3.131.3 Rubi [A] (warning: unable to verify) . . . 900
3.131.4 Maple [C] (warning: unable to verify) . . . 902
3.131.5 Fricas [A] (verification not implemented) . . . 902
3.131.6 Sympy [F] . . . 903
3.131.7 Maxima [A] (verification not implemented) . . . 903
3.131.8 Giac [A] (verification not implemented) . . . 904
3.131.9 Mupad [F(-1)] . . . 904

## 3.131.1 Optimal result

Integrand size = 25, antiderivative size = 250

$$\int \frac{e^{c(a+bx)}}{\text{csch}^2(ac+bcx)^{5/2}}\,dx = \frac{e^{-4c(a+bx)}\text{csch}(ac+bcx)}{128bc\sqrt{\text{csch}^2(ac+bcx)}} - \frac{5e^{-2c(a+bx)}\text{csch}(ac+bcx)}{64bc\sqrt{\text{csch}^2(ac+bcx)}} + \frac{5e^{2c(a+bx)}\text{csch}(ac+bcx)}{32bc\sqrt{\text{csch}^2(ac+bcx)}} - \frac{5e^{4c(a+bx)}\text{csch}(ac+bcx)}{128bc\sqrt{\text{csch}^2(ac+bcx)}} + \frac{e^{6c(a+bx)}\text{csch}(ac+bcx)}{192bc\sqrt{\text{csch}^2(ac+bcx)}} - \frac{5x\text{csch}(ac+bcx)}{16\sqrt{\text{csch}^2(ac+bcx)}}$$

output

```
1/128*csch(b*c*x+a*c)/b/c/exp(4*c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2)-5/64*
csch(b*c*x+a*c)/b/c/exp(2*c*(b*x+a))/(csch(b*c*x+a*c)^2)^(1/2)+5/32*exp(2*
c*(b*x+a))*csch(b*c*x+a*c)/b/c/(csch(b*c*x+a*c)^2)^(1/2)-5/128*exp(4*c*(b*
x+a))*csch(b*c*x+a*c)/b/c/(csch(b*c*x+a*c)^2)^(1/2)+1/192*exp(6*c*(b*x+a))
*csch(b*c*x+a*c)/b/c/(csch(b*c*x+a*c)^2)^(1/2)-5/16*x*csch(b*c*x+a*c)/(csc
h(b*c*x+a*c)^2)^(1/2)
```

### 3.131.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 109, normalized size of antiderivative = 0.44

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx = \frac{\left(\frac{1}{128}e^{-4c(a+bx)} - \frac{5}{64}e^{-2c(a+bx)} + \frac{5}{32}e^{2c(a+bx)} - \frac{5}{128}e^{4c(a+bx)} + \frac{1}{192}e^{6c(a+bx)} - \frac{5bcx}{16}\right)\csc}{bc\operatorname{csch}^2(c(a+bx))^{5/2}}$$

input
```
Integrate[E^(c*(a + b*x))/(Csch[a*c + b*c*x]^2)^(5/2),x]
```

output
```
((1/(128*E^(4*c*(a + b*x))) - 5/(64*E^(2*c*(a + b*x))) + (5*E^(2*c*(a + b*
x)))/32 - (5*E^(4*c*(a + b*x)))/128 + E^(6*c*(a + b*x))/192 - (5*b*c*x)/16
)*Csch[c*(a + b*x)]^5)/(b*c*(Csch[c*(a + b*x)]^2)^(5/2))
```

### 3.131.3 Rubi [A] (warning: unable to verify)

Time = 0.45 (sec) , antiderivative size = 102, normalized size of antiderivative = 0.41, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.240$, Rules used = {7271, 2720, 27, 243, 49, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx$$

$$\downarrow 7271$$

$$\frac{\operatorname{csch}(ac+bcx)\int e^{c(a+bx)}\sinh^5(ac+bxc)dx}{\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 2720$$

$$\frac{\operatorname{csch}(ac+bcx)\int -\frac{1}{32}e^{-5c(a+bx)}\left(1-e^{2c(a+bx)}\right)^5 de^{c(a+bx)}}{bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 27$$

$$-\frac{\operatorname{csch}(ac+bcx)\int e^{-5c(a+bx)}\left(1-e^{2c(a+bx)}\right)^5 de^{c(a+bx)}}{32bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 243$$

$$-\frac{\operatorname{csch}(ac+bcx)\int e^{-3c(a+bx)}\left(1-e^{2c(a+bx)}\right)^5 de^{2c(a+bx)}}{64bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 49$$

$$-\frac{\operatorname{csch}(ac+bcx)\int\left(-10+e^{-3c(a+bx)}-5e^{-2c(a+bx)}+10e^{-c(a+bx)}+4e^{2c(a+bx)}\right) de^{2c(a+bx)}}{64bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

$$\downarrow 2009$$

$$-\frac{\left(-\frac{1}{2}e^{-2c(a+bx)}+5e^{-c(a+bx)}-\frac{15}{2}e^{2c(a+bx)}-\frac{1}{3}e^{3c(a+bx)}+10\log\left(e^{2c(a+bx)}\right)\right)\operatorname{csch}(ac+bcx)}{64bc\sqrt{\operatorname{csch}^2(ac+bcx)}}$$

input
```
Int[E^(c*(a + b*x))/(Csch[a*c + b*c*x]^2)^(5/2),x]
```

output
```
-1/64*(Csch[a*c + b*c*x]*(-1/2*1/E^(2*c*(a + b*x)) + 5/E^(c*(a + b*x)) - (
15*E^(2*c*(a + b*x)))/2 - E^(3*c*(a + b*x))/3 + 10*Log[E^(2*c*(a + b*x))])
)/(b*c*Sqrt[Csch[a*c + b*c*x]^2])
```

### 3.131.3.1 Defintions of rubi rules used

rule 27
```
Int[(a_)*(Fx_), x_Symbol] :> Simp[a   Int[Fx, x], x] /; FreeQ[a, x] &&  !Ma
tchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]
```

rule 49
```
Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.), x_Symbol] :> Int
[ExpandIntegrand[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d}, x]
&& IGtQ[m, 0] && IGtQ[m + n + 2, 0]
```

rule 243
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[1/2   Subst[In
t[x^((m - 1)/2)*(a + b*x)^p, x], x, x^2], x] /; FreeQ[{a, b, m, p}, x] && I
ntegerQ[(m - 1)/2]
```

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 2720
```
Int[u_, x_Symbol] :> With[{v = FunctionOfExponential[u, x]}, Simp[v/D[v, x]
   Subst[Int[FunctionOfExponentialFunction[u, x]/x, x], x, v], x]] /; Funct
ionOfExponentialQ[u, x] &&  !MatchQ[u, (w_)*((a_.)*(v_)^(n_))^(m_) /; FreeQ
[{a, m, n}, x] && IntegerQ[m*n]] &&  !MatchQ[u, E^((c_.)*((a_.) + (b_.)*x))
*(F_)[v_] /; FreeQ[{a, b, c}, x] && InverseFunctionQ[F[x]]]
```

rule 7271
```
Int[(u_.)*((a_.)*(v_)^(m_.))^(p_), x_Symbol] :> Simp[a^IntPart[p]*((a*v^m)^
FracPart[p]/v^(m*FracPart[p]))   Int[u*v^(m*p), x], x] /; FreeQ[{a, m, p},
x] &&  !IntegerQ[p] &&  !FreeQ[v, x] &&  !(EqQ[a, 1] && EqQ[m, 1]) &&  !(Eq
Q[v, x] && EqQ[m, 1])
```

### 3.131.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.73 (sec) , antiderivative size = 88, normalized size of antiderivative = 0.35

| method | result |
|---|---|
| default | $\frac{\operatorname{csgn}(\operatorname{csch}(c(bx+a)))\left(\left(\frac{\sinh(bcx+ac)^5}{6}-\frac{5\sinh(bcx+ac)^3}{24}+\frac{5\sinh(bcx+ac)}{16}\right)\cosh(bcx+ac)-\frac{5bcx}{16}-\frac{5ac}{16}+\frac{\sinh(bcx+ac)^6}{6}\right)}{cb}$ |
| risch | $-\frac{5x\,e^{c(bx+a)}}{16\left(e^{2c(bx+a)}-1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}}+\frac{e^{7c(bx+a)}}{192bc\left(e^{2c(bx+a)}-1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}}-\frac{5\,e^{5c(bx+a)}}{128bc\left(e^{2c(bx+a)}-1\right)\sqrt{\frac{e^{2c(bx+a)}}{\left(e^{2c(bx+a)}-1\right)^2}}}+\frac{}{32}$ |

input
```
int(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(5/2),x,method=_RETURNVERBOSE)
```

output
```
csgn(csch(c*(b*x+a)))/c/b*((1/6*sinh(b*c*x+a*c)^5-5/24*sinh(b*c*x+a*c)^3+5
/16*sinh(b*c*x+a*c))*cosh(b*c*x+a*c)-5/16*b*c*x-5/16*a*c+1/6*sinh(b*c*x+a*
c)^6)
```

### 3.131.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 218, normalized size of antiderivative = 0.87

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx = \frac{5\cosh(bcx+ac)^5+25\cosh(bcx+ac)\sinh(bcx+ac)^4-\sinh(bcx+ac)^5-5($$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(5/2),x, algorithm="fricas")
```

output
```
1/384*(5*cosh(b*c*x + a*c)^5 + 25*cosh(b*c*x + a*c)*sinh(b*c*x + a*c)^4 -
sinh(b*c*x + a*c)^5 - 5*(2*cosh(b*c*x + a*c)^2 - 3)*sinh(b*c*x + a*c)^3 -
45*cosh(b*c*x + a*c)^3 + 5*(10*cosh(b*c*x + a*c)^3 - 27*cosh(b*c*x + a*c))
*sinh(b*c*x + a*c)^2 - 60*(2*b*c*x - 1)*cosh(b*c*x + a*c) - 5*(cosh(b*c*x
+ a*c)^4 - 24*b*c*x - 9*cosh(b*c*x + a*c)^2 - 12)*sinh(b*c*x + a*c))/(b*c*
cosh(b*c*x + a*c) - b*c*sinh(b*c*x + a*c))
```

### 3.131.6 Sympy [F]

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx = e^{ac}\int \frac{e^{bcx}}{\left(\operatorname{csch}^2(ac+bcx)\right)^{\frac{5}{2}}}\,dx$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)**2)**(5/2),x)
```

output
```
exp(a*c)*Integral(exp(b*c*x)/(csch(a*c + b*c*x)**2)**(5/2), x)
```

### 3.131.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 90, normalized size of antiderivative = 0.36

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx = \frac{\left(2\,e^{(10\,bcx+10\,ac)} - 15\,e^{(8\,bcx+8\,ac)} + 60\,e^{(6\,bcx+6\,ac)} - 30\,e^{(2\,bcx+2\,ac)} + 3\right)e^{(-4\,bcx-4\,ac)}}{384\,bc} - \frac{5\,(bcx+ac)}{16\,bc}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(5/2),x, algorithm="maxima")
```

output
```
1/384*(2*e^(10*b*c*x + 10*a*c) - 15*e^(8*b*c*x + 8*a*c) + 60*e^(6*b*c*x +
6*a*c) - 30*e^(2*b*c*x + 2*a*c) + 3)*e^(-4*b*c*x - 4*a*c)/(b*c) - 5/16*(b*
c*x + a*c)/(b*c)
```

### 3.131.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 278, normalized size of antiderivative = 1.11

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx =$$
$$-\frac{\left(120\,bcxe^{(-ac)}\operatorname{sgn}\left(e^{(bcx+ac)}-e^{(-bcx-ac)}\right)-3\left(30\,e^{(4\,bcx+4\,ac)}\operatorname{sgn}\left(e^{(bcx+ac)}-e^{(-bcx-ac)}\right)-10\,e^{(2\,bcx+2\,ac)}\operatorname{sgn}\left(e\right.\right.\right.}{}$$

input
```
integrate(exp(c*(b*x+a))/(csch(b*c*x+a*c)^2)^(5/2),x, algorithm="giac")
```

output
```
-1/384*(120*b*c*x*e^(-a*c)*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)) - 3*(30
*e^(4*b*c*x + 4*a*c)*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)) - 10*e^(2*b*c
*x + 2*a*c)*sgn(e^(b*c*x + a*c) - e^(-b*c*x - a*c)) + sgn(e^(b*c*x + a*c)
- e^(-b*c*x - a*c)))*e^(-4*b*c*x - 5*a*c) - (2*e^(6*b*c*x + 20*a*c)*sgn(e^
(b*c*x + a*c) - e^(-b*c*x - a*c)) - 15*e^(4*b*c*x + 18*a*c)*sgn(e^(b*c*x +
 a*c) - e^(-b*c*x - a*c)) + 60*e^(2*b*c*x + 16*a*c)*sgn(e^(b*c*x + a*c) -
e^(-b*c*x - a*c)))*e^(-15*a*c))*e^(a*c)/(b*c)
```

### 3.131.9 Mupad [F(-1)]

Timed out.

$$\int \frac{e^{c(a+bx)}}{\operatorname{csch}^2(ac+bcx)^{5/2}}\,dx = \int \frac{\mathrm{e}^{c\,(a+b\,x)}}{\left(\frac{1}{\sinh(a\,c+b\,c\,x)^2}\right)^{5/2}}\,dx$$

input
```
int(exp(c*(a + b*x))/(1/sinh(a*c + b*c*x)^2)^(5/2),x)
```

output
```
int(exp(c*(a + b*x))/(1/sinh(a*c + b*c*x)^2)^(5/2), x)
```

# 3.132 $\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$

3.132.1 Optimal result . . . 905
3.132.2 Mathematica [C] (verified) . . . 905
3.132.3 Rubi [A] (warning: unable to verify) . . . 906
3.132.4 Maple [A] (verified) . . . 908
3.132.5 Fricas [A] (verification not implemented) . . . 908
3.132.6 Sympy [F] . . . 908
3.132.7 Maxima [F] . . . 909
3.132.8 Giac [F] . . . 909
3.132.9 Mupad [F(-1)] . . . 909

## 3.132.1 Optimal result

Integrand size = 15, antiderivative size = 81

$$\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = -\frac{2x^2}{21c^4\sqrt{\operatorname{csch}(2\log(cx))}} + \frac{x^6}{7\sqrt{\operatorname{csch}(2\log(cx))}} + \frac{2\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{21c^7\sqrt{1-\frac{1}{c^4x^4}}\,x\sqrt{\operatorname{csch}(2\log(cx))}}$$

output
```
-2/21*x^2/c^4/csch(2*ln(c*x))^(1/2)+1/7*x^6/csch(2*ln(c*x))^(1/2)+2/21*Ell
ipticF(1/c/x,I)/c^7/x/(1-1/c^4/x^4)^(1/2)/csch(2*ln(c*x))^(1/2)
```

## 3.132.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.13 (sec) , antiderivative size = 80, normalized size of antiderivative = 0.99

$$\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x^2\left(-(1-c^4x^4)^{3/2} + \text{Hypergeometric2F1}\left(-\frac{1}{2},\frac{1}{4},\frac{5}{4},c^4x^4\right)\right)}{7c^4\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^5/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
(x^2*(-(1 - c^4*x^4)^(3/2) + Hypergeometric2F1[-1/2, 1/4, 5/4, c^4*x^4]))/
(7*c^4*Sqrt[2 - 2*c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.132.3 Rubi [A] (warning: unable to verify)

Time = 0.32 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.25, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {6086, 6084, 858, 809, 847, 762}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^5x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}d(cx)}{c^6}$$

$$\downarrow 6084$$

$$\frac{\int c^6\sqrt{1-\frac{1}{c^4x^4}}x^6d(cx)}{c^7x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\sqrt{1-c^4x^4}}{c^8x^8}d\frac{1}{cx}}{c^7x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 809$$

$$-\frac{-\frac{2}{7}\int \frac{1}{c^4x^4\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{7c^7x^7}}{c^7x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 847$$

$$-\frac{-\frac{2}{7}\left(\frac{1}{3}\int \frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{3c^3x^3}\right)-\frac{\sqrt{1-c^4x^4}}{7c^7x^7}}{c^7x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 762$$

$$-\frac{-\frac{2}{7}\left(\frac{1}{3}\operatorname{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)-\frac{\sqrt{1-c^4x^4}}{3c^3x^3}\right)-\frac{\sqrt{1-c^4x^4}}{7c^7x^7}}{c^7x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[x^5/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
-((-1/7*Sqrt[1 - c^4*x^4]/(c^7*x^7) - (2*(-1/3*Sqrt[1 - c^4*x^4]/(c^3*x^3)
 + EllipticF[ArcSin[1/(c*x)], -1]/3))/7)/(c^7*Sqrt[1 - 1/(c^4*x^4)]*x*Sqrt
[Csch[2*Log[c*x]]]))
```

#### 3.132.3.1 Defintions of rubi rules used

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 847
```
Int[((c_.)*(x_))^(m_)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*x
)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] - Simp[b*((m + n*(p + 1)
+ 1)/(a*c^n*(m + 1)))   Int[(c*x)^(m + n)*(a + b*x^n)^p, x], x] /; FreeQ[{a
, b, c, p}, x] && IGtQ[n, 0] && LtQ[m, -1] && IntBinomialQ[a, b, c, n, m, p
, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.132.4 Maple [A] (verified)

Time = 0.82 (sec) , antiderivative size = 125, normalized size of antiderivative = 1.54

| method | result | size |
|---|---|---|
| risch | $\frac{x^2(3c^4x^4-2)\sqrt{2}}{42c^4\sqrt{\frac{c^2x^2}{c^4x^4-1}}} - \frac{\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\,\text{EllipticF}\left(x\sqrt{-c^2},i\right)\sqrt{2}\,x}{21c^4\sqrt{-c^2}\,(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 125 |

input
```
int(x^5/csch(2*ln(c*x))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/42*x^2*(3*c^4*x^4-2)/c^4*2^(1/2)/(c^2*x^2/(c^4*x^4-1))^(1/2)-1/21/c^4/(-
c^2)^(1/2)*(c^2*x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)*EllipticF(x*(-
c^2)^(1/2),I)*2^(1/2)*x/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.132.5 Fricas [A] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 72, normalized size of antiderivative = 0.89

$$\int \frac{x^5}{\sqrt{\text{csch}(2\log(cx))}}\,dx = \frac{\sqrt{2}(3\,c^{10}x^8 - 5\,c^6x^4 + 2\,c^2)\sqrt{\frac{c^2x^2}{c^4x^4-1}} + 2\,\sqrt{2}\sqrt{c^4}F(\arcsin\left(\frac{1}{cx}\right)\,|\,-1)}{42\,c^8}$$

input
```
integrate(x^5/csch(2*log(c*x))^(1/2),x, algorithm="fricas")
```

output
```
1/42*(sqrt(2)*(3*c^10*x^8 - 5*c^6*x^4 + 2*c^2)*sqrt(c^2*x^2/(c^4*x^4 - 1))
 + 2*sqrt(2)*sqrt(c^4)*elliptic_f(arcsin(1/(c*x)), -1))/c^8
```

### 3.132.6 Sympy [F]

$$\int \frac{x^5}{\sqrt{\text{csch}(2\log(cx))}}\,dx = \int \frac{x^5}{\sqrt{\text{csch}\left(2\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x**5/csch(2*ln(c*x))**(1/2),x)
```

output
```
Integral(x**5/sqrt(csch(2*log(c*x))), x)
```

### 3.132.7 Maxima [F]

$$\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^5}{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x^5/csch(2*log(c*x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(x^5/sqrt(csch(2*log(c*x))), x)
```

### 3.132.8 Giac [F]

$$\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^5}{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x^5/csch(2*log(c*x))^(1/2),x, algorithm="giac")
```

output
```
integrate(x^5/sqrt(csch(2*log(c*x))), x)
```

### 3.132.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^5}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^5}{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}\,dx$$

input
```
int(x^5/(1/sinh(2*log(c*x)))^(1/2),x)
```

output
```
int(x^5/(1/sinh(2*log(c*x)))^(1/2), x)
```

# 3.133 $\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$

3.133.1 Optimal result . . . 910
3.133.2 Mathematica [A] (verified) . . . 910
3.133.3 Rubi [A] (verified) . . . 911
3.133.4 Maple [A] (verified) . . . 912
3.133.5 Fricas [A] (verification not implemented) . . . 912
3.133.6 Sympy [F] . . . 913
3.133.7 Maxima [A] (verification not implemented) . . . 913
3.133.8 Giac [F] . . . 913
3.133.9 Mupad [B] (verification not implemented) . . . 914

## 3.133.1 Optimal result

Integrand size = 15, antiderivative size = 30

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{\left(c^4-\frac{1}{x^4}\right)x^5}{6c^4\sqrt{\operatorname{csch}(2\log(cx))}}$$

output
```
1/6*(c^4-1/x^4)*x^5/c^4/csch(2*ln(c*x))^(1/2)
```

## 3.133.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 44, normalized size of antiderivative = 1.47

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{\left(-1+c^4x^4\right)^2\sqrt{\frac{c^2x^2}{-2+2c^4x^4}}}{6c^6x}$$

input
```
Integrate[x^4/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
((-1 + c^4*x^4)^2*Sqrt[(c^2*x^2)/(-2 + 2*c^4*x^4)])/(6*c^6*x)
```

### 3.133.3 Rubi [A] (verified)

Time = 0.26 (sec) , antiderivative size = 28, normalized size of antiderivative = 0.93, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {6086, 6084, 796}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^4x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}d(cx)}{c^5}$$

$$\downarrow 6084$$

$$\frac{\int c^5\sqrt{1-\frac{1}{c^4x^4}}x^5 d(cx)}{c^6x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 796$$

$$\frac{x^5\left(1-\frac{1}{c^4x^4}\right)}{6\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[x^4/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
((1 - 1/(c^4*x^4))*x^5)/(6*Sqrt[Csch[2*Log[c*x]]])
```

#### 3.133.3.1 Defintions of rubi rules used

rule 796
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] /; FreeQ[{a, b, c, m, n,
 p}, x] && EqQ[(m + 1)/n + p + 1, 0] && NeQ[m, -1]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.133.4 Maple [A] (verified)

Time = 0.16 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.30

| method | result | size |
|---|---|---|
| risch | $\frac{\sqrt{2}\,x\,(c^4x^4-1)}{12\sqrt{\frac{c^2x^2}{c^4x^4-1}}\,c^4}$ | 39 |

input
```
int(x^4/csch(2*ln(c*x))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/12*2^(1/2)*x/(c^2*x^2/(c^4*x^4-1))^(1/2)*(c^4*x^4-1)/c^4
```

### 3.133.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 48, normalized size of antiderivative = 1.60

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{\sqrt{2}(c^8x^8 - 2\,c^4x^4 + 1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{12\,c^6x}$$

input
```
integrate(x^4/csch(2*log(c*x))^(1/2),x, algorithm="fricas")
```

output
```
1/12*sqrt(2)*(c^8*x^8 - 2*c^4*x^4 + 1)*sqrt(c^2*x^2/(c^4*x^4 - 1))/(c^6*x)
```

### 3.133.6 Sympy [F]

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^4}{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x**4/csch(2*ln(c*x))**(1/2),x)
```

output
```
Integral(x**4/sqrt(csch(2*log(c*x))), x)
```

### 3.133.7 Maxima [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.53

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{\left(\sqrt{2}c^4x^4-\sqrt{2}\right)\sqrt{c^2x^2+1}\sqrt{cx+1}\sqrt{cx-1}}{12\,c^5}$$

input
```
integrate(x^4/csch(2*log(c*x))^(1/2),x, algorithm="maxima")
```

output
```
1/12*(sqrt(2)*c^4*x^4 - sqrt(2))*sqrt(c^2*x^2 + 1)*sqrt(c*x + 1)*sqrt(c*x
- 1)/c^5
```

### 3.133.8 Giac [F]

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^4}{\sqrt{\operatorname{csch}\left(2\ \log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x^4/csch(2*log(c*x))^(1/2),x, algorithm="giac")
```

output
```
integrate(x^4/sqrt(csch(2*log(c*x))), x)
```

### 3.133.9 Mupad [B] (verification not implemented)

Time = 2.83 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.40

$$\int \frac{x^4}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{\left(c^4x^4-1\right)^2\sqrt{\frac{2c^2x^2}{c^4x^4-1}}}{12c^6x}$$

input
```
int(x^4/(1/sinh(2*log(c*x)))^(1/2),x)
```

output
```
((c^4*x^4 - 1)^2*((2*c^2*x^2)/(c^4*x^4 - 1))^(1/2))/(12*c^6*x)
```

# 3.134 $\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$

3.134.1 Optimal result . . . 915
3.134.2 Mathematica [C] (verified) . . . 915
3.134.3 Rubi [A] (warning: unable to verify) . . . 916
3.134.4 Maple [A] (verified) . . . 919
3.134.5 Fricas [A] (verification not implemented) . . . 919
3.134.6 Sympy [F] . . . 920
3.134.7 Maxima [F] . . . 920
3.134.8 Giac [F(-2)] . . . 920
3.134.9 Mupad [F(-1)] . . . 921

## 3.134.1 Optimal result

Integrand size = 15, antiderivative size = 119

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = -\frac{2}{5c^4\sqrt{\operatorname{csch}(2\log(cx))}} + \frac{x^4}{5\sqrt{\operatorname{csch}(2\log(cx))}} - \frac{2E\left(\csc^{-1}(cx)\middle|-1\right)}{5c^5\sqrt{1-\frac{1}{c^4x^4}}x\sqrt{\operatorname{csch}(2\log(cx))}} + \frac{2\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{5c^5\sqrt{1-\frac{1}{c^4x^4}}x\sqrt{\operatorname{csch}(2\log(cx))}}$$

output

```
-2/5/c^4/csch(2*ln(c*x))^(1/2)+1/5*x^4/csch(2*ln(c*x))^(1/2)-2/5*EllipticE
(1/c/x,I)/c^5/x/(1-1/c^4/x^4)^(1/2)/csch(2*ln(c*x))^(1/2)+2/5*EllipticF(1/
c/x,I)/c^5/x/(1-1/c^4/x^4)^(1/2)/csch(2*ln(c*x))^(1/2)
```

## 3.134.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.09 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.50

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x^4\,\text{Hypergeometric2F1}\left(-\frac{1}{2},\frac{3}{4},\frac{7}{4},c^4x^4\right)}{3\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^3/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
(x^4*Hypergeometric2F1[-1/2, 3/4, 7/4, c^4*x^4])/(3*Sqrt[2 - 2*c^4*x^4]*Sq
rt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.134.3 Rubi [A] (warning: unable to verify)

Time = 0.36 (sec) , antiderivative size = 107, normalized size of antiderivative = 0.90, number of steps used = 10, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.600$, Rules used = {6086, 6084, 858, 809, 847, 836, 762, 1388, 327}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^3x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}d(cx)}{c^4}$$

$$\downarrow 6084$$

$$\frac{\int c^4\sqrt{1-\frac{1}{c^4x^4}}x^4d(cx)}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\sqrt{1-c^4x^4}}{c^6x^6}d\frac{1}{cx}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 809$$

$$-\frac{-\frac{2}{5}\int \frac{1}{c^2x^2\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 847$$

$$-\frac{-\frac{2}{5}\left(-\int \frac{c^2x^2}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 836$$

$$-\frac{-\frac{2}{5}\left(\int \frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx} - \int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}d\frac{1}{cx} - \frac{\sqrt{1-c^4x^4}}{cx}\right) - \frac{\sqrt{1-c^4x^4}}{5c^5x^5}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 762$$

$$-\frac{-\frac{2}{5}\left(-\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}d\frac{1}{cx} + \text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right) - \frac{\sqrt{1-c^4x^4}}{cx}\right) - \frac{\sqrt{1-c^4x^4}}{5c^5x^5}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 1388$$

$$-\frac{-\frac{2}{5}\left(-\int \frac{\sqrt{c^2x^2+1}}{\sqrt{1-c^2x^2}}d\frac{1}{cx} + \text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right) - \frac{\sqrt{1-c^4x^4}}{cx}\right) - \frac{\sqrt{1-c^4x^4}}{5c^5x^5}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 327$$

$$-\frac{-\frac{2}{5}\left(\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right) - E\left(\arcsin\left(\frac{1}{cx}\right)\middle|-1\right) - \frac{\sqrt{1-c^4x^4}}{cx}\right) - \frac{\sqrt{1-c^4x^4}}{5c^5x^5}}{c^5x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[x^3/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
-((-1/5*Sqrt[1 - c^4*x^4]/(c^5*x^5) - (2*(-(Sqrt[1 - c^4*x^4]/(c*x)) - Ell
ipticE[ArcSin[1/(c*x)], -1] + EllipticF[ArcSin[1/(c*x)], -1]))/5)/(c^5*Sqr
t[1 - 1/(c^4*x^4)]*x*Sqrt[Csch[2*Log[c*x]]]))
```

### 3.134.3.1 Defintions of rubi rules used

rule 327
```
Int[Sqrt[(a_) + (b_.)*(x_)^2]/Sqrt[(c_) + (d_.)*(x_)^2], x_Symbol] :> Simp[
(Sqrt[a]/(Sqrt[c]*Rt[-d/c, 2]))*EllipticE[ArcSin[Rt[-d/c, 2]*x], b*(c/(a*d)
)], x] /; FreeQ[{a, b, c, d}, x] && NegQ[d/c] && GtQ[c, 0] && GtQ[a, 0]
```

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 836
```
Int[(x_)^2/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> With[{q = Rt[-b/a, 2]},
Simp[-q^(-1)   Int[1/Sqrt[a + b*x^4], x], x] + Simp[1/q   Int[(1 + q*x^2)/S
qrt[a + b*x^4], x], x]] /; FreeQ[{a, b}, x] && NegQ[b/a]
```

rule 847
```
Int[((c_.)*(x_))^(m_)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*x
)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] - Simp[b*((m + n*(p + 1)
+ 1)/(a*c^n*(m + 1)))   Int[(c*x)^(m + n)*(a + b*x^n)^p, x], x] /; FreeQ[{a
, b, c, p}, x] && IGtQ[n, 0] && LtQ[m, -1] && IntBinomialQ[a, b, c, n, m, p
, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 1388
```
Int[(u_.)*((a_) + (c_.)*(x_)^(n2_.))^(p_.)*((d_) + (e_.)*(x_)^(n_))^(q_.),
x_Symbol] :> Int[u*(d + e*x^n)^(p + q)*(a/d + (c/e)*x^n)^p, x] /; FreeQ[{a,
 c, d, e, n, p, q}, x] && EqQ[n2, 2*n] && EqQ[c*d^2 + a*e^2, 0] && (Integer
Q[p] || (GtQ[a, 0] && GtQ[d, 0]))
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

3.134. $\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$

### 3.134.4 Maple [A] (verified)

Time = 0.65 (sec) , antiderivative size = 127, normalized size of antiderivative = 1.07

| method | result | size |
|---|---|---|
| risch | $\frac{\sqrt{2}\,x^4}{10\sqrt{\frac{c^2x^2}{c^4x^4-1}}} - \frac{\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\left(\text{EllipticF}\left(x\sqrt{-c^2},i\right)-\text{EllipticE}\left(x\sqrt{-c^2},i\right)\right)\sqrt{2}\,x}{5\sqrt{-c^2}\,(c^4x^4-1)c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 127 |

input
```
int(x^3/csch(2*ln(c*x))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/10*2^(1/2)*x^4/(c^2*x^2/(c^4*x^4-1))^(1/2)-1/5/(-c^2)^(1/2)*(c^2*x^2+1)^
(1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)/c^2*(EllipticF(x*(-c^2)^(1/2),I)-Elli
pticE(x*(-c^2)^(1/2),I))*2^(1/2)*x/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.134.5 Fricas [A] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.82

$$\int \frac{x^3}{\sqrt{\text{csch}(2\log(cx))}}\,dx$$
$$= \frac{\sqrt{2}(c^{10}x^8 - 3\,c^6x^4 + 2\,c^2)\sqrt{\frac{c^2x^2}{c^4x^4-1}} - 2\sqrt{c^4}\left(\sqrt{2}x^2E(\arcsin\left(\frac{1}{cx}\right)\mid -1) - \sqrt{2}x^2F(\arcsin\left(\frac{1}{cx}\right)\mid -1)\right)}{10\,c^8x^2}$$

input
```
integrate(x^3/csch(2*log(c*x))^(1/2),x, algorithm="fricas")
```

output
```
1/10*(sqrt(2)*(c^10*x^8 - 3*c^6*x^4 + 2*c^2)*sqrt(c^2*x^2/(c^4*x^4 - 1)) -
 2*sqrt(c^4)*(sqrt(2)*x^2*elliptic_e(arcsin(1/(c*x)), -1) - sqrt(2)*x^2*el
liptic_f(arcsin(1/(c*x)), -1)))/(c^8*x^2)
```

### 3.134.6 Sympy [F]

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^3}{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x**3/csch(2*ln(c*x))**(1/2),x)
```

output
```
Integral(x**3/sqrt(csch(2*log(c*x))), x)
```

### 3.134.7 Maxima [F]

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^3}{\sqrt{\operatorname{csch}\left(2\ \log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x^3/csch(2*log(c*x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(x^3/sqrt(csch(2*log(c*x))), x)
```

### 3.134.8 Giac [F(-2)]

Exception generated.

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \text{Exception raised: TypeError}$$

input
```
integrate(x^3/csch(2*log(c*x))^(1/2),x, algorithm="giac")
```

output
```
Exception raised: TypeError >> an error occurred running a Giac command:IN
PUT:sage2:=int(sage0,sageVARx):;OUTPUT:sym2poly exception caught Unable to
 convert to real %%{poly1[1.0000000000000000000000000000000,0.000000000000
000000000
```

### 3.134.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^3}{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}\,dx$$

input
```
int(x^3/(1/sinh(2*log(c*x)))^(1/2),x)
```

output
```
int(x^3/(1/sinh(2*log(c*x)))^(1/2), x)
```

# 3.135 $\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$

3.135.1 Optimal result . . . 922
3.135.2 Mathematica [A] (verified) . . . 922
3.135.3 Rubi [A] (warning: unable to verify) . . . 923
3.135.4 Maple [A] (verified) . . . 925
3.135.5 Fricas [A] (verification not implemented) . . . 925
3.135.6 Sympy [F] . . . 925
3.135.7 Maxima [F] . . . 926
3.135.8 Giac [F] . . . 926
3.135.9 Mupad [F(-1)] . . . 926

## 3.135.1 Optimal result

Integrand size = 15, antiderivative size = 69

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x^3}{4\sqrt{\operatorname{csch}(2\log(cx))}} - \frac{\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)}{4c^4\sqrt{1-\frac{1}{c^4x^4}}x\sqrt{\operatorname{csch}(2\log(cx))}}$$

output
```
1/4*x^3/csch(2*ln(c*x))^(1/2)-1/4*arctanh((1-1/c^4/x^4)^(1/2))/c^4/x/(1-1/
c^4/x^4)^(1/2)/csch(2*ln(c*x))^(1/2)
```

## 3.135.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.07

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x\left(c^2x^2\sqrt{1-c^4x^4} + \arcsin\left(c^2x^2\right)\right)}{4c^2\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^2/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
(x*(c^2*x^2*Sqrt[1 - c^4*x^4] + ArcSin[c^2*x^2]))/(4*c^2*Sqrt[2 - 2*c^4*x^
4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.135.3 Rubi [A] (warning: unable to verify)

Time = 0.29 (sec) , antiderivative size = 73, normalized size of antiderivative = 1.06, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {6086, 6084, 798, 51, 73, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^2x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}d(cx)}{c^3}$$

$$\downarrow 6084$$

$$\frac{\int c^3\sqrt{1-\frac{1}{c^4x^4}}x^3d(cx)}{c^4x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 798$$

$$-\frac{\int \frac{\sqrt{1-\frac{1}{c^4x^4}}}{c^2x^2}d\frac{1}{c^4x^4}}{4c^4x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 51$$

$$-\frac{-\frac{1}{2}\int \frac{1}{c\sqrt{1-\frac{1}{c^4x^4}}x}d\frac{1}{c^4x^4}-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}}{4c^4x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 73$$

$$-\frac{\int \frac{1}{1-c^2x^2}d\sqrt{1-\frac{1}{c^4x^4}}-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}}{4c^4x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 219$$

$$-\frac{\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}}{4c^4x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[x^2/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
-1/4*(-(Sqrt[1 - 1/(c^4*x^4)]/(c*x)) + ArcTanh[Sqrt[1 - 1/(c^4*x^4)]])/(c^
4*Sqrt[1 - 1/(c^4*x^4)]*x*Sqrt[Csch[2*Log[c*x]]])
```

### 3.135.3.1 Defintions of rubi rules used

rule 51
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> Simp[
(a + b*x)^(m + 1)*((c + d*x)^n/(b*(m + 1))), x] - Simp[d*(n/(b*(m + 1)))
Int[(a + b*x)^(m + 1)*(c + d*x)^(n - 1), x], x] /; FreeQ[{a, b, c, d, n}, x
] && ILtQ[m, -1] && FractionQ[n] && GtQ[n, 0]
```

rule 73
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> With[
{p = Denominator[m]}, Simp[p/b   Subst[Int[x^(p*(m + 1) - 1)*(c - a*(d/b) +
 d*(x^p/b))^n, x], x, (a + b*x)^(1/p)], x]] /; FreeQ[{a, b, c, d}, x] && Lt
Q[-1, m, 0] && LeQ[-1, n, 0] && LeQ[Denominator[n], Denominator[m]] && IntL
inearQ[a, b, c, d, m, n, x]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 798
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[1/n   Subst
[Int[x^(Simplify[(m + 1)/n] - 1)*(a + b*x)^p, x], x, x^n], x] /; FreeQ[{a,
b, m, n, p}, x] && IntegerQ[Simplify[(m + 1)/n]]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.135.4 Maple [A] (verified)

Time = 0.20 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.41

| method | result | size |
|---|---|---|
| risch | $\frac{\sqrt{2}\,x^3}{8\sqrt{\frac{c^2x^2}{c^4x^4-1}}} - \frac{\ln\left(\frac{c^4x^2}{\sqrt{c^4}}+\sqrt{c^4x^4-1}\right)\sqrt{2}\,x}{8\sqrt{c^4}\,\sqrt{\frac{c^2x^2}{c^4x^4-1}}\,\sqrt{c^4x^4-1}}$ | 97 |

input
```
int(x^2/csch(2*ln(c*x))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/8*2^(1/2)*x^3/(c^2*x^2/(c^4*x^4-1))^(1/2)-1/8*ln(c^4*x^2/(c^4)^(1/2)+(c^
4*x^4-1)^(1/2))/(c^4)^(1/2)*2^(1/2)*x/(c^2*x^2/(c^4*x^4-1))^(1/2)/(c^4*x^4
-1)^(1/2)
```

### 3.135.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 92, normalized size of antiderivative = 1.33

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$
$$= \frac{2\sqrt{2}(c^5x^5 - cx)\sqrt{\frac{c^2x^2}{c^4x^4-1}} + \sqrt{2}\log\left(2\,c^4x^4 - 2\,(c^5x^5 - cx)\sqrt{\frac{c^2x^2}{c^4x^4-1}} - 1\right)}{16\,c^3}$$

input
```
integrate(x^2/csch(2*log(c*x))^(1/2),x, algorithm="fricas")
```

output
```
1/16*(2*sqrt(2)*(c^5*x^5 - c*x)*sqrt(c^2*x^2/(c^4*x^4 - 1)) + sqrt(2)*log(
2*c^4*x^4 - 2*(c^5*x^5 - c*x)*sqrt(c^2*x^2/(c^4*x^4 - 1)) - 1))/c^3
```

### 3.135.6 Sympy [F]

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^2}{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x**2/csch(2*ln(c*x))**(1/2),x)
```

output
```
Integral(x**2/sqrt(csch(2*log(c*x))), x)
```

### 3.135.7 Maxima [F]

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^2}{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x^2/csch(2*log(c*x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(x^2/sqrt(csch(2*log(c*x))), x)
```

### 3.135.8 Giac [F]

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^2}{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x^2/csch(2*log(c*x))^(1/2),x, algorithm="giac")
```

output
```
integrate(x^2/sqrt(csch(2*log(c*x))), x)
```

### 3.135.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x^2}{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}\,dx$$

input
```
int(x^2/(1/sinh(2*log(c*x)))^(1/2),x)
```

output
```
int(x^2/(1/sinh(2*log(c*x)))^(1/2), x)
```

# 3.136 $\int \frac{x}{\sqrt{\mathbf{csch}(2\log(cx))}}\,dx$

3.136.1 Optimal result . . . 927
3.136.2 Mathematica [C] (verified) . . . 927
3.136.3 Rubi [A] (warning: unable to verify) . . . 928
3.136.4 Maple [A] (verified) . . . 929
3.136.5 Fricas [A] (verification not implemented) . . . 930
3.136.6 Sympy [F] . . . 930
3.136.7 Maxima [F] . . . 930
3.136.8 Giac [F(-2)] . . . 931
3.136.9 Mupad [F(-1)] . . . 931

## 3.136.1 Optimal result

Integrand size = 13, antiderivative size = 60

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x^2}{3\sqrt{\operatorname{csch}(2\log(cx))}} + \frac{2\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{3c^3\sqrt{1-\frac{1}{c^4x^4}}x\sqrt{\operatorname{csch}(2\log(cx))}}$$

output
```
1/3*x^2/csch(2*ln(c*x))^(1/2)+2/3*EllipticF(1/c/x,I)/c^3/x/(1-1/c^4/x^4)^(
1/2)/csch(2*ln(c*x))^(1/2)
```

## 3.136.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.12 (sec) , antiderivative size = 57, normalized size of antiderivative = 0.95

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x^2\,\text{Hypergeometric2F1}\left(-\frac{1}{2},\frac{1}{4},\frac{5}{4},c^4x^4\right)}{\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
(x^2*Hypergeometric2F1[-1/2, 1/4, 5/4, c^4*x^4])/(Sqrt[2 - 2*c^4*x^4]*Sqrt
[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.136.3 Rubi [A] (warning: unable to verify)

Time = 0.27 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.20, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$, Rules used = {6086, 6084, 858, 809, 762}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{cx}{\sqrt{\operatorname{csch}(2\log(cx))}} d(cx)}{c^2}$$

$$\downarrow 6084$$

$$\frac{\int c^2\sqrt{1-\frac{1}{c^4x^4}}x^2 d(cx)}{c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\sqrt{1-c^4x^4}}{c^4x^4} d\frac{1}{cx}}{c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 809$$

$$-\frac{-\frac{2}{3}\int \frac{1}{\sqrt{1-c^4x^4}} d\frac{1}{cx} - \frac{\sqrt{1-c^4x^4}}{3c^3x^3}}{c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 762$$

$$-\frac{-\frac{2}{3}\operatorname{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right) - \frac{\sqrt{1-c^4x^4}}{3c^3x^3}}{c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[x/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
-((-1/3*Sqrt[1 - c^4*x^4]/(c^3*x^3) - (2*EllipticF[ArcSin[1/(c*x)], -1])/3
)/(c^3*Sqrt[1 - 1/(c^4*x^4)]*x*Sqrt[Csch[2*Log[c*x]]]))
```

#### 3.136.3.1 Defintions of rubi rules used

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.136.4 Maple [A] (verified)

Time = 0.56 (sec) , antiderivative size = 109, normalized size of antiderivative = 1.82

| method | result | size |
|---|---|---|
| risch | $\frac{\sqrt{2}\,x^2}{6\sqrt{\frac{c^2x^2}{c^4x^4-1}}} - \frac{\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\,\mathrm{EllipticF}\left(x\sqrt{-c^2},i\right)\sqrt{2}\,x}{3\sqrt{-c^2}\,(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 109 |

input
```
int(x/csch(2*ln(c*x))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/6*2^(1/2)*x^2/(c^2*x^2/(c^4*x^4-1))^(1/2)-1/3/(-c^2)^(1/2)*(c^2*x^2+1)^(
1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)*EllipticF(x*(-c^2)^(1/2),I)*2^(1/2)*x/
(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.136.5 Fricas [A] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.05

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{\sqrt{2}(c^6x^4-c^2)\sqrt{\frac{c^2x^2}{c^4x^4-1}}+2\sqrt{2}\sqrt{c^4}F(\arcsin\left(\frac{1}{cx}\right)\,|\,-1)}{6\,c^4}$$

input
```
integrate(x/csch(2*log(c*x))^(1/2),x, algorithm="fricas")
```

output
```
1/6*(sqrt(2)*(c^6*x^4 - c^2)*sqrt(c^2*x^2/(c^4*x^4 - 1)) + 2*sqrt(2)*sqrt(
c^4)*elliptic_f(arcsin(1/(c*x)), -1))/c^4
```

### 3.136.6 Sympy [F]

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x}{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x/csch(2*ln(c*x))**(1/2),x)
```

output
```
Integral(x/sqrt(csch(2*log(c*x))), x)
```

### 3.136.7 Maxima [F]

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x}{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(x/csch(2*log(c*x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(x/sqrt(csch(2*log(c*x))), x)
```

### 3.136.8 Giac [F(-2)]

Exception generated.

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \text{Exception raised: TypeError}$$

input
```
integrate(x/csch(2*log(c*x))^(1/2),x, algorithm="giac")
```

output
```
Exception raised: TypeError >> an error occurred running a Giac command:IN
PUT:sage2:=int(sage0,sageVARx):;OUTPUT:sym2poly exception caught Unable to
 convert to real %%{poly1[1.0000000000000000000000000000000,0.000000000000
000000000
```

### 3.136.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{x}{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}\,dx$$

input
```
int(x/(1/sinh(2*log(c*x)))^(1/2),x)
```

output
```
int(x/(1/sinh(2*log(c*x)))^(1/2), x)
```

# 3.137 $\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$

3.137.1 Optimal result . . . 932
3.137.2 Mathematica [A] (verified) . . . 932
3.137.3 Rubi [A] (warning: unable to verify) . . . 933
3.137.4 Maple [F] . . . 935
3.137.5 Fricas [A] (verification not implemented) . . . 935
3.137.6 Sympy [F] . . . 935
3.137.7 Maxima [F] . . . 936
3.137.8 Giac [F(-1)] . . . 936
3.137.9 Mupad [F(-1)] . . . 936

## 3.137.1 Optimal result

Integrand size = 11, antiderivative size = 60

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x}{2\sqrt{\operatorname{csch}(2\log(cx))}} + \frac{\csc^{-1}\left(c^2x^2\right)}{2c^2\sqrt{1-\frac{1}{c^4x^4}}x\sqrt{\operatorname{csch}(2\log(cx))}}$$

output
```
1/2*x/csch(2*ln(c*x))^(1/2)+1/2*arccsc(c^2*x^2)/c^2/x/(1-1/c^4/x^4)^(1/2)/
csch(2*ln(c*x))^(1/2)
```

## 3.137.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 75, normalized size of antiderivative = 1.25

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \frac{x\left(\sqrt{-1+c^4x^4} - \arctan\left(\sqrt{-1+c^4x^4}\right)\right)}{2\sqrt{2}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\sqrt{-1+c^4x^4}}$$

input
```
Integrate[1/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
(x*(Sqrt[-1 + c^4*x^4] - ArcTan[Sqrt[-1 + c^4*x^4]]))/(2*Sqrt[2]*Sqrt[(c^2
*x^2)/(-1 + c^4*x^4)]*Sqrt[-1 + c^4*x^4])
```

### 3.137.3 Rubi [A] (warning: unable to verify)

Time = 0.26 (sec) , antiderivative size = 68, normalized size of antiderivative = 1.13, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.545$, Rules used = {6080, 6078, 858, 807, 247, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx$$

$$\downarrow 6080$$

$$\frac{\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}} d(cx)}{c}$$

$$\downarrow 6078$$

$$\frac{\int c\sqrt{1-\frac{1}{c^4x^4}}\,x\,d(cx)}{c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\sqrt{1-c^4x^4}}{c^3x^3} d\frac{1}{cx}}{c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 807$$

$$-\frac{\int \frac{\sqrt{1-c^2x^2}}{c^2x^2} d\left(c^2x^2\right)}{2c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 247$$

$$-\frac{-\int \frac{1}{\sqrt{1-c^2x^2}} d\left(c^2x^2\right) - c^2x^2\sqrt{1-c^2x^2}}{2c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 223$$

$$-\frac{-\arcsin\left(c^2x^2\right) - c^2x^2\sqrt{1-c^2x^2}}{2c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[1/Sqrt[Csch[2*Log[c*x]]],x]
```

output
```
-1/2*(-(c^2*x^2*Sqrt[1 - c^2*x^2]) - ArcSin[c^2*x^2])/(c^2*Sqrt[1 - 1/(c^4
*x^4)]*x*Sqrt[Csch[2*Log[c*x]]])
```

### 3.137.3.1 Defintions of rubi rules used

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 247
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(c*x)^
(m + 1)*((a + b*x^2)^p/(c*(m + 1))), x] - Simp[2*b*(p/(c^2*(m + 1)))   Int[
(c*x)^(m + 2)*(a + b*x^2)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && GtQ[p,
0] && LtQ[m, -1] &&  !ILtQ[(m + 2*p + 3)/2, 0] && IntBinomialQ[a, b, c, 2,
m, p, x]
```

rule 807
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> With[{k = GCD[m
+ 1, n]}, Simp[1/k   Subst[Int[x^((m + 1)/k - 1)*(a + b*x^(n/k))^p, x], x,
x^k], x] /; k != 1] /; FreeQ[{a, b, p}, x] && IGtQ[n, 0] && IntegerQ[m]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6078
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.), x_Symbol] :> Simp[Csch[d*(a
+ b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*d*p))   Int[1/(x^(b
*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p), x], x] /; FreeQ[{a, b, d, p}, x] &&
  !IntegerQ[p]
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

### 3.137.4 Maple [F]

$$\int \frac{1}{\sqrt{\operatorname{csch}\left(2\ln\left(cx\right)\right)}}dx$$

input
```
int(1/csch(2*ln(c*x))^(1/2),x)
```

output
```
int(1/csch(2*ln(c*x))^(1/2),x)
```

### 3.137.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 86, normalized size of antiderivative = 1.43

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = -\frac{\sqrt{2}cx\arctan\left(\frac{(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{cx}\right) - \sqrt{2}(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{4\,c^2x}$$

input
```
integrate(1/csch(2*log(c*x))^(1/2),x, algorithm="fricas")
```

output
```
-1/4*(sqrt(2)*c*x*arctan((c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1))/(c*x))
- sqrt(2)*(c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1)))/(c^2*x)
```

### 3.137.6 Sympy [F]

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{1}{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(1/csch(2*ln(c*x))**(1/2),x)
```

output
```
Integral(1/sqrt(csch(2*log(c*x))), x)
```

### 3.137.7 Maxima [F]

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{1}{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}\,dx$$

input
```
integrate(1/csch(2*log(c*x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/sqrt(csch(2*log(c*x))), x)
```

### 3.137.8 Giac [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \text{Timed out}$$

input
```
integrate(1/csch(2*log(c*x))^(1/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.137.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}\,dx = \int \frac{1}{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}\,dx$$

input
```
int(1/(1/sinh(2*log(c*x)))^(1/2),x)
```

output
```
int(1/(1/sinh(2*log(c*x)))^(1/2), x)
```

# 3.138 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx$

3.138.1 Optimal result . . . 937
3.138.2 Mathematica [A] (verified) . . . 937
3.138.3 Rubi [A] (verified) . . . 938
3.138.4 Maple [A] (verified) . . . 939
3.138.5 Fricas [A] (verification not implemented) . . . 940
3.138.6 Sympy [F] . . . 940
3.138.7 Maxima [F] . . . 940
3.138.8 Giac [F(-1)] . . . 941
3.138.9 Mupad [F(-1)] . . . 941

## 3.138.1 Optimal result

Integrand size = 15, antiderivative size = 46

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = i\sqrt{\operatorname{csch}(2\log(cx))}\,\operatorname{EllipticF}\left(\frac{\pi}{4} - i\log(cx), 2\right)\sqrt{i\sinh(2\log(cx))}$$

output
```
I*(sin(1/4*Pi+I*ln(c*x))^2)^(1/2)/sin(1/4*Pi+I*ln(c*x))*EllipticF(cos(1/4*
Pi+I*ln(c*x)),2^(1/2))*csch(2*ln(c*x))^(1/2)*(I*sinh(2*ln(c*x)))^(1/2)
```

## 3.138.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 43, normalized size of antiderivative = 0.93

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = \operatorname{csch}^{\frac{3}{2}}(2\log(cx))\,\operatorname{EllipticF}\left(\frac{\pi}{4} - i\log(cx), 2\right)(i\sinh(2\log(cx)))^{3/2}$$

input
```
Integrate[Sqrt[Csch[2*Log[c*x]]]/x,x]
```

output
```
Csch[2*Log[c*x]]^(3/2)*EllipticF[Pi/4 - I*Log[c*x], 2]*(I*Sinh[2*Log[c*x]]
)^(3/2)
```

### 3.138.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$, Rules used = {3039, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx$$

$$\downarrow 3039$$

$$\int \sqrt{\operatorname{csch}(2\log(cx))}\,d\log(cx)$$

$$\downarrow 3042$$

$$\int \sqrt{i\csc(2i\log(cx))}\,d\log(cx)$$

$$\downarrow 4258$$

$$\sqrt{i\sinh(2\log(cx))}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{\sqrt{i\sinh(2\log(cx))}}\,d\log(cx)$$

$$\downarrow 3042$$

$$\sqrt{i\sinh(2\log(cx))}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{\sqrt{\sin(2i\log(cx))}}\,d\log(cx)$$

$$\downarrow 3120$$

$$i\sqrt{i\sinh(2\log(cx))}\sqrt{\operatorname{csch}(2\log(cx))}\,\text{EllipticF}\left(\frac{\pi}{4}-i\log(cx),2\right)$$

input
```
Int[Sqrt[Csch[2*Log[c*x]]]/x,x]
```

output
```
I*Sqrt[Csch[2*Log[c*x]]]*EllipticF[Pi/4 - I*Log[c*x], 2]*Sqrt[I*Sinh[2*Log
[c*x]]]
```

### 3.138.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]  Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n  Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

## 3.138.4 Maple [A] (verified)

Time = 0.42 (sec) , antiderivative size = 90, normalized size of antiderivative = 1.96

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{i\sqrt{-i(\sinh(2\ln(cx))+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(2\ln(cx))+i)}\,\sqrt{i\sinh(2\ln(cx))}\,\text{EllipticF}\left(\sqrt{-i(\sinh(2\ln(cx))+i)},\frac{\sqrt{2}}{2}\right)}{2\cosh(2\ln(cx))\sqrt{\sinh(2\ln(cx))}}$ | 90 |
| default | $\frac{i\sqrt{-i(\sinh(2\ln(cx))+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(2\ln(cx))+i)}\,\sqrt{i\sinh(2\ln(cx))}\,\text{EllipticF}\left(\sqrt{-i(\sinh(2\ln(cx))+i)},\frac{\sqrt{2}}{2}\right)}{2\cosh(2\ln(cx))\sqrt{\sinh(2\ln(cx))}}$ | 90 |

input
```
int(csch(2*ln(c*x))^(1/2)/x,x,method=_RETURNVERBOSE)
```

output
```
1/2*I*(-I*(sinh(2*ln(c*x))+I))^(1/2)*2^(1/2)*(-I*(-sinh(2*ln(c*x))+I))^(1/
2)*(I*sinh(2*ln(c*x)))^(1/2)*EllipticF((-I*(sinh(2*ln(c*x))+I))^(1/2),1/2*
2^(1/2))/cosh(2*ln(c*x))/sinh(2*ln(c*x))^(1/2)
```

### 3.138.5 Fricas [A] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 11, normalized size of antiderivative = 0.24

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = -i\sqrt{2}F(\arcsin(cx)\mid -1)$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x,x, algorithm="fricas")
```

output
```
-I*sqrt(2)*elliptic_f(arcsin(c*x), -1)
```

### 3.138.6 Sympy [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = \int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(1/2)/x,x)
```

output
```
Integral(sqrt(csch(2*log(c*x)))/x, x)
```

### 3.138.7 Maxima [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = \int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x,x, algorithm="maxima")
```

output
```
integrate(sqrt(csch(2*log(c*x)))/x, x)
```

### 3.138.8 Giac [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x,x, algorithm="giac")
```

output
```
Timed out
```

### 3.138.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x}\,dx = \int \frac{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}{x}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(1/2)/x,x)
```

output
```
int((1/sinh(2*log(c*x)))^(1/2)/x, x)
```

# 3.139 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx$

3.139.1 Optimal result . . . 942
3.139.2 Mathematica [A] (verified) . . . 942
3.139.3 Rubi [A] (warning: unable to verify) . . . 943
3.139.4 Maple [F] . . . 944
3.139.5 Fricas [A] (verification not implemented) . . . 945
3.139.6 Sympy [F] . . . 945
3.139.7 Maxima [F] . . . 945
3.139.8 Giac [F(-1)] . . . 946
3.139.9 Mupad [F(-1)] . . . 946

## 3.139.1 Optimal result

Integrand size = 15, antiderivative size = 41

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = -\frac{1}{2}c^2\sqrt{1-\frac{1}{c^4x^4}}\,x\csc^{-1}\left(c^2x^2\right)\sqrt{\operatorname{csch}(2\log(cx))}$$

output
```
-1/2*c^2*x*arccsc(c^2*x^2)*(1-1/c^4/x^4)^(1/2)*csch(2*ln(c*x))^(1/2)
```

## 3.139.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.32

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = \frac{\sqrt{-1+c^4x^4}\sqrt{\frac{c^2x^2}{-2+2c^4x^4}}\arctan\left(\sqrt{-1+c^4x^4}\right)}{x}$$

input
```
Integrate[Sqrt[Csch[2*Log[c*x]]]/x^2,x]
```

output
```
(Sqrt[-1 + c^4*x^4]*Sqrt[(c^2*x^2)/(-2 + 2*c^4*x^4)]*ArcTan[Sqrt[-1 + c^4*
x^4]])/x
```

### 3.139.3 Rubi [A] (warning: unable to verify)

Time = 0.27 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$, Rules used = {6086, 6084, 858, 807, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx$$

$$\downarrow 6086$$

$$c\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{c^2x^2}\,d(cx)$$

$$\downarrow 6084$$

$$c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{c^3\sqrt{1-\frac{1}{c^4x^4}}x^3}\,d(cx)$$

$$\downarrow 858$$

$$-c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{cx\sqrt{1-c^4x^4}}\,d\frac{1}{cx}$$

$$\downarrow 807$$

$$-\frac{1}{2}c^2x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{\sqrt{1-c^2x^2}}\,d(c^2x^2)$$

$$\downarrow 223$$

$$-\frac{1}{2}c^2x\sqrt{1-\frac{1}{c^4x^4}}\arcsin\left(c^2x^2\right)\sqrt{\operatorname{csch}(2\log(cx))}$$

input
```
Int[Sqrt[Csch[2*Log[c*x]]]/x^2,x]
```

output
```
-1/2*(c^2*Sqrt[1 - 1/(c^4*x^4)]*x*ArcSin[c^2*x^2]*Sqrt[Csch[2*Log[c*x]]])
```

#### 3.139.3.1 Defintions of rubi rules used

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 807
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> With[{k = GCD[m
+ 1, n]}, Simp[1/k   Subst[Int[x^((m + 1)/k - 1)*(a + b*x^(n/k))^p, x], x,
x^k], x] /; k != 1] /; FreeQ[{a, b, p}, x] && IGtQ[n, 0] && IntegerQ[m]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.139.4 Maple [F]

$$\int \frac{\sqrt{\operatorname{csch}\left(2\ln\left(cx\right)\right)}}{x^2}dx$$

input
```
int(csch(2*ln(c*x))^(1/2)/x^2,x)
```

output
```
int(csch(2*ln(c*x))^(1/2)/x^2,x)
```

### 3.139.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 43, normalized size of antiderivative = 1.05

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = \frac{1}{2}\sqrt{2}c\arctan\left(\frac{(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{cx}\right)$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^2,x, algorithm="fricas")
```

output
```
1/2*sqrt(2)*c*arctan((c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1))/(c*x))
```

### 3.139.6 Sympy [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = \int \frac{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}{x^2}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(1/2)/x**2,x)
```

output
```
Integral(sqrt(csch(2*log(c*x)))/x**2, x)
```

### 3.139.7 Maxima [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = \int \frac{\sqrt{\operatorname{csch}\left(2\ \log\left(cx\right)\right)}}{x^2}\,dx$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^2,x, algorithm="maxima")
```

output
```
integrate(sqrt(csch(2*log(c*x)))/x^2, x)
```

### 3.139.8 Giac [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^2,x, algorithm="giac")
```

output
```
Timed out
```

### 3.139.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^2}\,dx = \int \frac{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}{x^2}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(1/2)/x^2,x)
```

output
```
int((1/sinh(2*log(c*x)))^(1/2)/x^2, x)
```

# 3.140 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx$

3.140.1 Optimal result . . . 947
3.140.2 Mathematica [C] (verified) . . . 947
3.140.3 Rubi [A] (verified) . . . 948
3.140.4 Maple [A] (verified) . . . 950
3.140.5 Fricas [A] (verification not implemented) . . . 950
3.140.6 Sympy [F] . . . 950
3.140.7 Maxima [F] . . . 951
3.140.8 Giac [F(-1)] . . . 951
3.140.9 Mupad [F(-1)] . . . 951

## 3.140.1 Optimal result

Integrand size = 15, antiderivative size = 74

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx = -c^3\sqrt{1-\frac{1}{c^4x^4}}\,x\sqrt{\operatorname{csch}(2\log(cx))}\,E\left(\csc^{-1}(cx)\middle|-1\right) + c^3\sqrt{1-\frac{1}{c^4x^4}}\,x\sqrt{\operatorname{csch}(2\log(cx))}\,\operatorname{EllipticF}\left(\csc^{-1}(cx),-1\right)$$

output
```
-c^3*x*EllipticE(1/c/x,I)*(1-1/c^4/x^4)^(1/2)*csch(2*ln(c*x))^(1/2)+c^3*x*
EllipticF(1/c/x,I)*(1-1/c^4/x^4)^(1/2)*csch(2*ln(c*x))^(1/2)
```

## 3.140.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.07 (sec) , antiderivative size = 58, normalized size of antiderivative = 0.78

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx = -\frac{\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\operatorname{Hypergeometric2F1}\left(-\frac{1}{4},\frac{1}{2},\frac{3}{4},c^4x^4\right)}{x^2}$$

input
```
Integrate[Sqrt[Csch[2*Log[c*x]]]/x^3,x]
```

output
```
-((Sqrt[2 - 2*c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)]*Hypergeometric2F1[-1
/4, 1/2, 3/4, c^4*x^4])/x^2)
```

### 3.140.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 54, normalized size of antiderivative = 0.73, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.467$, Rules used = {6086, 6084, 858, 836, 762, 1388, 327}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx$$

$$\downarrow 6086$$

$$c^2\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{c^3x^3}\,d(cx)$$

$$\downarrow 6084$$

$$c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{c^4\sqrt{1-\frac{1}{c^4x^4}}x^4}\,d(cx)$$

$$\downarrow 858$$

$$-c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{c^2x^2}{\sqrt{1-c^4x^4}}\,d\frac{1}{cx}$$

$$\downarrow 836$$

$$-c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\left(\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}\,d\frac{1}{cx}-\int \frac{1}{\sqrt{1-c^4x^4}}\,d\frac{1}{cx}\right)$$

$$\downarrow 762$$

$$-c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\left(\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}\,d\frac{1}{cx}-\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)$$

$$\downarrow 1388$$

$$-c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\left(\int \frac{\sqrt{c^2x^2+1}}{\sqrt{1-c^2x^2}}\,d\frac{1}{cx}-\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)$$

$$\downarrow 327$$

$$-c^3x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\left(E\left(\arcsin\left(\frac{1}{cx}\right)\middle|-1\right)-\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)$$

input
```
Int[Sqrt[Csch[2*Log[c*x]]]/x^3,x]
```

output
```
-(c^3*Sqrt[1 - 1/(c^4*x^4)]*x*Sqrt[Csch[2*Log[c*x]]]*(EllipticE[ArcSin[1/(
c*x)], -1] - EllipticF[ArcSin[1/(c*x)], -1]))
```

### 3.140.3.1 Defintions of rubi rules used

rule 327
```
Int[Sqrt[(a_) + (b_.)*(x_)^2]/Sqrt[(c_) + (d_.)*(x_)^2], x_Symbol] :> Simp[
(Sqrt[a]/(Sqrt[c]*Rt[-d/c, 2]))*EllipticE[ArcSin[Rt[-d/c, 2]*x], b*(c/(a*d)
)], x] /; FreeQ[{a, b, c, d}, x] && NegQ[d/c] && GtQ[c, 0] && GtQ[a, 0]
```

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 836
```
Int[(x_)^2/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> With[{q = Rt[-b/a, 2]},
Simp[-q^(-1)   Int[1/Sqrt[a + b*x^4], x], x] + Simp[1/q   Int[(1 + q*x^2)/S
qrt[a + b*x^4], x], x]] /; FreeQ[{a, b}, x] && NegQ[b/a]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 1388
```
Int[(u_.)*((a_) + (c_.)*(x_)^(n2_.))^(p_.)*((d_) + (e_.)*(x_)^(n_))^(q_.),
x_Symbol] :> Int[u*(d + e*x^n)^(p + q)*(a/d + (c/e)*x^n)^p, x] /; FreeQ[{a,
 c, d, e, n, p, q}, x] && EqQ[n2, 2*n] && EqQ[c*d^2 + a*e^2, 0] && (Integer
Q[p] || (GtQ[a, 0] && GtQ[d, 0]))
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.140.4 Maple [A] (verified)

Time = 0.68 (sec) , antiderivative size = 126, normalized size of antiderivative = 1.70

| method | result | size |
|---|---|---|
| risch | $\frac{(c^4x^4-1)\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{x^2} - \frac{c^2\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\left(\text{EllipticF}\left(x\sqrt{-c^2},i\right)-\text{EllipticE}\left(x\sqrt{-c^2},i\right)\right)\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{\sqrt{-c^2}\,x}$ | 126 |

input
```
int(csch(2*ln(c*x))^(1/2)/x^3,x,method=_RETURNVERBOSE)
```

output
```
(c^4*x^4-1)/x^2*2^(1/2)*(c^2*x^2/(c^4*x^4-1))^(1/2)-c^2/(-c^2)^(1/2)*(c^2*
x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)*(EllipticF(x*(-c^2)^(1/2),I)-EllipticE(x*(
-c^2)^(1/2),I))*2^(1/2)*(c^2*x^2/(c^4*x^4-1))^(1/2)/x
```

### 3.140.5 Fricas [A] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 72, normalized size of antiderivative = 0.97

$$\int \frac{\sqrt{\text{csch}(2\log(cx))}}{x^3}\,dx$$
$$= \frac{i\sqrt{2}c^4x^2E(\arcsin(cx)\mid -1) - i\sqrt{2}c^4x^2F(\arcsin(cx)\mid -1) + \sqrt{2}(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{x^2}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^3,x, algorithm="fricas")
```

output
```
(I*sqrt(2)*c^4*x^2*elliptic_e(arcsin(c*x), -1) - I*sqrt(2)*c^4*x^2*ellipti
c_f(arcsin(c*x), -1) + sqrt(2)*(c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1)))/
x^2
```

### 3.140.6 Sympy [F]

$$\int \frac{\sqrt{\text{csch}(2\log(cx))}}{x^3}\,dx = \int \frac{\sqrt{\text{csch}\left(2\log\left(cx\right)\right)}}{x^3}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(1/2)/x**3,x)
```

output
```
Integral(sqrt(csch(2*log(c*x)))/x**3, x)
```

### 3.140.7 Maxima [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx = \int \frac{\sqrt{\operatorname{csch}\left(2\,\log\left(cx\right)\right)}}{x^3}\,dx$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^3,x, algorithm="maxima")
```

output
```
integrate(sqrt(csch(2*log(c*x)))/x^3, x)
```

### 3.140.8 Giac [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^3,x, algorithm="giac")
```

output
```
Timed out
```

### 3.140.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^3}\,dx = \int \frac{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}{x^3}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(1/2)/x^3,x)
```

output
```
int((1/sinh(2*log(c*x)))^(1/2)/x^3, x)
```

# 3.141 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx$

3.141.1 Optimal result . . . 952
3.141.2 Mathematica [A] (verified) . . . 952
3.141.3 Rubi [A] (verified) . . . 953
3.141.4 Maple [A] (verified) . . . 954
3.141.5 Fricas [A] (verification not implemented) . . . 954
3.141.6 Sympy [F] . . . 955
3.141.7 Maxima [B] (verification not implemented) . . . 955
3.141.8 Giac [F(-1)] . . . 955
3.141.9 Mupad [B] (verification not implemented) . . . 956

## 3.141.1 Optimal result

Integrand size = 15, antiderivative size = 25

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx = \frac{1}{2}\left(c^4 - \frac{1}{x^4}\right) x\sqrt{\operatorname{csch}(2\log(cx))}$$

output
```
1/2*(c^4-1/x^4)*x*csch(2*ln(c*x))^(1/2)
```

## 3.141.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 33, normalized size of antiderivative = 1.32

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx = \frac{c^2}{2x\sqrt{\frac{c^2x^2}{-2+2c^4x^4}}}$$

input
```
Integrate[Sqrt[Csch[2*Log[c*x]]]/x^4,x]
```

output
```
c^2/(2*x*Sqrt[(c^2*x^2)/(-2 + 2*c^4*x^4)])
```

### 3.141.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.16, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {6086, 6084, 793}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx$$

$$\downarrow 6086$$

$$c^3 \int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{c^4x^4}\,d(cx)$$

$$\downarrow 6084$$

$$c^4x\sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{c^5\sqrt{1-\frac{1}{c^4x^4}}x^5}\,d(cx)$$

$$\downarrow 793$$

$$\frac{1}{2}c^4x\left(1-\frac{1}{c^4x^4}\right)\sqrt{\operatorname{csch}(2\log(cx))}$$

input
```
Int[Sqrt[Csch[2*Log[c*x]]]/x^4,x]
```

output
```
(c^4*(1 - 1/(c^4*x^4))*x*Sqrt[Csch[2*Log[c*x]]])/2
```

#### 3.141.3.1 Defintions of rubi rules used

rule 793
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(a + b*x^n)
^(p + 1)/(b*n*(p + 1)), x] /; FreeQ[{a, b, m, n, p}, x] && EqQ[m, n - 1] &&
 NeQ[p, -1]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.141.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 38, normalized size of antiderivative = 1.52

| method | result | size |
|---|---|---|
| risch | $\frac{(c^4x^4-1)\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{2x^3}$ | 38 |

input
```
int(csch(2*ln(c*x))^(1/2)/x^4,x,method=_RETURNVERBOSE)
```

output
```
1/2*(c^4*x^4-1)/x^3*2^(1/2)*(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.141.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 37, normalized size of antiderivative = 1.48

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx = \frac{\sqrt{2}(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{2\,x^3}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^4,x, algorithm="fricas")
```

output
```
1/2*sqrt(2)*(c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1))/x^3
```

### 3.141.6 Sympy [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx = \int \frac{\sqrt{\operatorname{csch}\left(2\log\left(cx\right)\right)}}{x^4}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(1/2)/x**4,x)
```

output
```
Integral(sqrt(csch(2*log(c*x)))/x**4, x)
```

### 3.141.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 89 vs. 2(21) = 42.

Time = 0.29 (sec) , antiderivative size = 89, normalized size of antiderivative = 3.56

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx$$
$$= \frac{1}{2}c^3\left(\frac{\sqrt{2}}{\sqrt{\frac{1}{cx}+1}\sqrt{-\frac{1}{cx}+1}\sqrt{\frac{1}{c^2x^2}+1}} - \frac{\sqrt{2}}{c^4x^4\sqrt{\frac{1}{cx}+1}\sqrt{-\frac{1}{cx}+1}\sqrt{\frac{1}{c^2x^2}+1}}\right)$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^4,x, algorithm="maxima")
```

output
```
1/2*c^3*(sqrt(2)/(sqrt(1/(c*x) + 1)*sqrt(-1/(c*x) + 1)*sqrt(1/(c^2*x^2) +
1)) - sqrt(2)/(c^4*x^4*sqrt(1/(c*x) + 1)*sqrt(-1/(c*x) + 1)*sqrt(1/(c^2*x^
2) + 1)))
```

### 3.141.8 Giac [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^4,x, algorithm="giac")
```

output
```
Timed out
```

### 3.141.9 Mupad [B] (verification not implemented)

Time = 2.12 (sec) , antiderivative size = 58, normalized size of antiderivative = 2.32

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^4}\,dx = \frac{c^4\,x\,\sqrt{\frac{2\,c^2\,x^2}{c^4\,x^4-1}}}{2} - \frac{\sqrt{\frac{2\,c^2\,x^2}{c^4\,x^4-1}}}{2\,x^3}$$

input
```
int((1/sinh(2*log(c*x)))^(1/2)/x^4,x)
```

output
```
(c^4*x*((2*c^2*x^2)/(c^4*x^4 - 1))^(1/2))/2 - ((2*c^2*x^2)/(c^4*x^4 - 1))^
(1/2)/(2*x^3)
```

# 3.142 $\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx$

3.142.1 Optimal result . . . 957
3.142.2 Mathematica [C] (verified) . . . 957
3.142.3 Rubi [A] (warning: unable to verify) . . . 958
3.142.4 Maple [A] (verified) . . . 959
3.142.5 Fricas [A] (verification not implemented) . . . 960
3.142.6 Sympy [F] . . . 960
3.142.7 Maxima [F] . . . 960
3.142.8 Giac [F(-1)] . . . 961
3.142.9 Mupad [F(-1)] . . . 961

## 3.142.1 Optimal result

Integrand size = 15, antiderivative size = 64

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = \frac{1}{3}\left(c^4 - \frac{1}{x^4}\right)\sqrt{\operatorname{csch}(2\log(cx))} - \frac{1}{3}c^5\sqrt{1-\frac{1}{c^4x^4}}\,x\sqrt{\operatorname{csch}(2\log(cx))}\,\operatorname{EllipticF}\left(\csc^{-1}(cx),-1\right)$$

output
```
1/3*(c^4-1/x^4)*csch(2*ln(c*x))^(1/2)-1/3*c^5*x*EllipticF(1/c/x,I)*(1-1/c^
4/x^4)^(1/2)*csch(2*ln(c*x))^(1/2)
```

## 3.142.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.07 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.94

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = -\frac{\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\operatorname{Hypergeometric2F1}\left(-\frac{3}{4},\frac{1}{2},\frac{1}{4},c^4x^4\right)}{3x^4}$$

input
```
Integrate[Sqrt[Csch[2*Log[c*x]]]/x^5,x]
```

output
```
-1/3*(Sqrt[2 - 2*c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)]*Hypergeometric2F1
[-3/4, 1/2, 1/4, c^4*x^4])/x^4
```

### 3.142.3 Rubi [A] (warning: unable to verify)

Time = 0.29 (sec) , antiderivative size = 70, normalized size of antiderivative = 1.09, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$, Rules used = {6086, 6084, 858, 843, 762}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx$$

$$\downarrow 6086$$

$$c^4 \int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{c^5 x^5} d(cx)$$

$$\downarrow 6084$$

$$c^5 x \sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{1}{c^6\sqrt{1-\frac{1}{c^4x^4}}x^6} d(cx)$$

$$\downarrow 858$$

$$-c^5 x \sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\int \frac{c^4x^4}{\sqrt{1-c^4x^4}} d\frac{1}{cx}$$

$$\downarrow 843$$

$$-c^5 x \sqrt{1-\frac{1}{c^4x^4}}\sqrt{\operatorname{csch}(2\log(cx))}\left(\frac{1}{3}\int \frac{1}{\sqrt{1-c^4x^4}} d\frac{1}{cx} - \frac{\sqrt{1-c^4x^4}}{3cx}\right)$$

$$\downarrow 762$$

$$-c^5 x \sqrt{1-\frac{1}{c^4x^4}}\left(\frac{1}{3}\operatorname{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right) - \frac{\sqrt{1-c^4x^4}}{3cx}\right)\sqrt{\operatorname{csch}(2\log(cx))}$$

input
```
Int[Sqrt[Csch[2*Log[c*x]]]/x^5,x]
```

output
```
-(c^5*Sqrt[1 - 1/(c^4*x^4)]*x*Sqrt[Csch[2*Log[c*x]]]*(-1/3*Sqrt[1 - c^4*x^
4]/(c*x) + EllipticF[ArcSin[1/(c*x)], -1]/3))
```

#### 3.142.3.1 Defintions of rubi rules used

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 843
```
Int[((c_.)*(x_))^(m_)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[c^(n
 - 1)*(c*x)^(m - n + 1)*((a + b*x^n)^(p + 1)/(b*(m + n*p + 1))), x] - Simp[
a*c^n*((m - n + 1)/(b*(m + n*p + 1)))   Int[(c*x)^(m - n)*(a + b*x^n)^p, x]
, x] /; FreeQ[{a, b, c, p}, x] && IGtQ[n, 0] && GtQ[m, n - 1] && NeQ[m + n*
p + 1, 0] && IntBinomialQ[a, b, c, n, m, p, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.142.4 Maple [A] (verified)

Time = 0.57 (sec) , antiderivative size = 112, normalized size of antiderivative = 1.75

| method | result | size |
|---|---|---|
| risch | $\frac{(c^4x^4-1)\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{3x^4}+\frac{c^4\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\,\text{EllipticF}\left(x\sqrt{-c^2},i\right)\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{3\sqrt{-c^2}\,x}$ | 112 |

input
```
int(csch(2*ln(c*x))^(1/2)/x^5,x,method=_RETURNVERBOSE)
```

output
```
1/3*(c^4*x^4-1)/x^4*2^(1/2)*(c^2*x^2/(c^4*x^4-1))^(1/2)+1/3*c^4/(-c^2)^(1/
2)*(c^2*x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)*EllipticF(x*(-c^2)^(1/2),I)*2^(1/2
)*(c^2*x^2/(c^4*x^4-1))^(1/2)/x
```

### 3.142.5 Fricas [A] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.88

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = \frac{-i\sqrt{2}c^4x^4F(\arcsin(cx)\mid -1) + \sqrt{2}(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{3\,x^4}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^5,x, algorithm="fricas")
```

output
```
1/3*(-I*sqrt(2)*c^4*x^4*elliptic_f(arcsin(c*x), -1) + sqrt(2)*(c^4*x^4 - 1
)*sqrt(c^2*x^2/(c^4*x^4 - 1)))/x^4
```

### 3.142.6 Sympy [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = \int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(1/2)/x**5,x)
```

output
```
Integral(sqrt(csch(2*log(c*x)))/x**5, x)
```

### 3.142.7 Maxima [F]

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = \int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^5,x, algorithm="maxima")
```

output
```
integrate(sqrt(csch(2*log(c*x)))/x^5, x)
```

### 3.142.8 Giac [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(1/2)/x^5,x, algorithm="giac")
```

output
```
Timed out
```

### 3.142.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}(2\log(cx))}}{x^5}\,dx = \int \frac{\sqrt{\frac{1}{\sinh(2\,\ln(c\,x))}}}{x^5}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(1/2)/x^5,x)
```

output
```
int((1/sinh(2*log(c*x)))^(1/2)/x^5, x)
```

# 3.143 $\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.143.1 Optimal result . . . 962
3.143.2 Mathematica [A] (verified) . . . 962
3.143.3 Rubi [A] (warning: unable to verify) . . . 963
3.143.4 Maple [A] (verified) . . . 965
3.143.5 Fricas [A] (verification not implemented) . . . 966
3.143.6 Sympy [F] . . . 966
3.143.7 Maxima [F] . . . 966
3.143.8 Giac [F(-1)] . . . 967
3.143.9 Mupad [F(-1)] . . . 967

## 3.143.1 Optimal result

Integrand size = 15, antiderivative size = 128

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{x}{32c^4\left(c^4-\frac{1}{x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{x^5}{16\left(c^4-\frac{1}{x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{x^9}{12\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)}{32c^{12}\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
1/32*x/c^4/(c^4-1/x^4)/csch(2*ln(c*x))^(3/2)-1/16*x^5/(c^4-1/x^4)/csch(2*l
n(c*x))^(3/2)+1/12*x^9/csch(2*ln(c*x))^(3/2)+1/32*arctanh((1-1/c^4/x^4)^(1
/2))/c^12/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)
```

## 3.143.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.74

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{c^3x^3\sqrt{1-c^4x^4}(3-14c^4x^4+8c^8x^8) - 3cx\arcsin\left(c^2x^2\right)}{192c^9\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^8/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
(c^3*x^3*Sqrt[1 - c^4*x^4]*(3 - 14*c^4*x^4 + 8*c^8*x^8) - 3*c*x*ArcSin[c^2
*x^2])/(192*c^9*Sqrt[2 - 2*c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.143.3 Rubi [A] (warning: unable to verify)

Time = 0.32 (sec) , antiderivative size = 133, normalized size of antiderivative = 1.04, number of steps used = 9, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}} = 0.533$, Rules used = {6086, 6084, 798, 51, 51, 52, 73, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^8x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^9}$$

$$\downarrow 6084$$

$$\frac{\int c^{11}\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^{11}d(cx)}{c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 798$$

$$-\frac{\int \frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{c^4x^4}d\frac{1}{c^4x^4}}{4c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 51$$

$$-\frac{-\frac{1}{2}\int \frac{\sqrt{1-\frac{1}{c^4x^4}}}{c^3x^3}d\frac{1}{c^4x^4}-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{3c^3x^3}}{4c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 51$$

$$-\frac{\frac{1}{2}\left(\frac{1}{4}\int \frac{1}{c^2\sqrt{1-\frac{1}{c^4x^4}}x^2}d\frac{1}{c^4x^4}+\frac{\sqrt{1-\frac{1}{c^4x^4}}}{2c^2x^2}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{3c^3x^3}}{4c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 52$$

$$-\frac{\frac{1}{2}\left(\frac{1}{4}\left(\frac{1}{2}\int \frac{1}{c\sqrt{1-\frac{1}{c^4x^4}}x}d\frac{1}{c^4x^4}-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\right)+\frac{\sqrt{1-\frac{1}{c^4x^4}}}{2c^2x^2}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{3c^3x^3}}{4c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 73$$

$$-\frac{\frac{1}{2}\left(\frac{1}{4}\left(-\int \frac{1}{1-c^2x^2}d\sqrt{1-\frac{1}{c^4x^4}}-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\right)+\frac{\sqrt{1-\frac{1}{c^4x^4}}}{2c^2x^2}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{3c^3x^3}}{4c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 219$$

$$-\frac{\frac{1}{2}\left(\frac{1}{4}\left(-\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\right)+\frac{\sqrt{1-\frac{1}{c^4x^4}}}{2c^2x^2}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{3c^3x^3}}{4c^{12}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^8/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-1/4*(-1/3*(1 - 1/(c^4*x^4))^(3/2)/(c^3*x^3) + (Sqrt[1 - 1/(c^4*x^4)]/(2*c
^2*x^2) + (-(Sqrt[1 - 1/(c^4*x^4)]/(c*x)) - ArcTanh[Sqrt[1 - 1/(c^4*x^4)]]
)/4)/2)/(c^12*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch[2*Log[c*x]]^(3/2))
```

### 3.143.3.1 Defintions of rubi rules used

rule 51
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> Simp[
(a + b*x)^(m + 1)*((c + d*x)^n/(b*(m + 1))), x] - Simp[d*(n/(b*(m + 1)))
Int[(a + b*x)^(m + 1)*(c + d*x)^(n - 1), x], x] /; FreeQ[{a, b, c, d, n}, x
] && ILtQ[m, -1] && FractionQ[n] && GtQ[n, 0]
```

rule 52
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> Simp[
(a + b*x)^(m + 1)*((c + d*x)^(n + 1)/((b*c - a*d)*(m + 1))), x] - Simp[d*((
m + n + 2)/((b*c - a*d)*(m + 1)))   Int[(a + b*x)^(m + 1)*(c + d*x)^n, x],
x] /; FreeQ[{a, b, c, d, n}, x] && ILtQ[m, -1] && FractionQ[n] && LtQ[n, 0]
```

rule 73
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> With[
{p = Denominator[m]}, Simp[p/b   Subst[Int[x^(p*(m + 1) - 1)*(c - a*(d/b) +
 d*(x^p/b))^n, x], x, (a + b*x)^(1/p)], x]] /; FreeQ[{a, b, c, d}, x] && Lt
Q[-1, m, 0] && LeQ[-1, n, 0] && LeQ[Denominator[n], Denominator[m]] && IntL
inearQ[a, b, c, d, m, n, x]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 798
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[1/n   Subst
[Int[x^(Simplify[(m + 1)/n] - 1)*(a + b*x)^p, x], x, x^n], x] /; FreeQ[{a,
b, m, n, p}, x] && IntegerQ[Simplify[(m + 1)/n]]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.143.4 Maple [A] (verified)

Time = 0.20 (sec) , antiderivative size = 121, normalized size of antiderivative = 0.95

| method | result | size |
|---|---|---|
| risch | $\frac{x^3\left(8c^8x^8-14c^4x^4+3\right)\sqrt{2}}{384c^6\sqrt{\frac{c^2x^2}{c^4x^4-1}}}+\frac{\ln\left(\frac{c^4x^2}{\sqrt{c^4}}+\sqrt{c^4x^4-1}\right)\sqrt{2}\,x}{128c^6\sqrt{c^4}\,\sqrt{c^4x^4-1}\,\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 121 |

input
```
int(x^8/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/384*x^3*(8*c^8*x^8-14*c^4*x^4+3)/c^6*2^(1/2)/(c^2*x^2/(c^4*x^4-1))^(1/2)
+1/128/c^6*ln(c^4*x^2/(c^4)^(1/2)+(c^4*x^4-1)^(1/2))/(c^4)^(1/2)*2^(1/2)*x
/(c^4*x^4-1)^(1/2)/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.143.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 110, normalized size of antiderivative = 0.86

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$
$$= \frac{2\sqrt{2}(8\,c^{13}x^{13} - 22\,c^9x^9 + 17\,c^5x^5 - 3\,cx)\sqrt{\frac{c^2x^2}{c^4x^4-1}} + 3\sqrt{2}\log\left(2\,c^4x^4 + 2\,(c^5x^5 - cx)\sqrt{\frac{c^2x^2}{c^4x^4-1}} - 1\right)}{768\,c^9}$$

input
```
integrate(x^8/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/768*(2*sqrt(2)*(8*c^13*x^13 - 22*c^9*x^9 + 17*c^5*x^5 - 3*c*x)*sqrt(c^2*
x^2/(c^4*x^4 - 1)) + 3*sqrt(2)*log(2*c^4*x^4 + 2*(c^5*x^5 - c*x)*sqrt(c^2*
x^2/(c^4*x^4 - 1)) - 1))/c^9
```

### 3.143.6 Sympy [F]

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x**8/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**8/csch(2*log(c*x))**(3/2), x)
```

### 3.143.7 Maxima [F]

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^8}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x^8/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x^8/csch(2*log(c*x))^(3/2), x)
```

### 3.143.8 Giac [F(-1)]

Timed out.

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x^8/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.143.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^8}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^8}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x^8/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x^8/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.144 $\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.144.1 Optimal result . . . 968
3.144.2 Mathematica [C] (verified) . . . 968
3.144.3 Rubi [A] (warning: unable to verify) . . . 969
3.144.4 Maple [A] (verified) . . . 971
3.144.5 Fricas [A] (verification not implemented) . . . 971
3.144.6 Sympy [F] . . . 972
3.144.7 Maxima [F] . . . 972
3.144.8 Giac [F(-1)] . . . 972
3.144.9 Mupad [F(-1)] . . . 973

## 3.144.1 Optimal result

Integrand size = 15, antiderivative size = 118

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{4}{77c^4\left(c^4-\frac{1}{x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{6x^4}{77\left(c^4-\frac{1}{x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{x^8}{11\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{4\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{77c^{11}\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
4/77/c^4/(c^4-1/x^4)/csch(2*ln(c*x))^(3/2)-6/77*x^4/(c^4-1/x^4)/csch(2*ln(
c*x))^(3/2)+1/11*x^8/csch(2*ln(c*x))^(3/2)-4/77*EllipticF(1/c/x,I)/c^11/(1
-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)
```

## 3.144.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.12 (sec) , antiderivative size = 80, normalized size of antiderivative = 0.68

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{x^2\left(\left(1-c^4x^4\right)^{5/2} - \text{Hypergeometric2F1}\left(-\frac{3}{2},\frac{1}{4},\frac{5}{4},c^4x^4\right)\right)}{22c^6\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^7/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
(x^2*((1 - c^4*x^4)^(5/2) - Hypergeometric2F1[-3/2, 1/4, 5/4, c^4*x^4]))/(
22*c^6*Sqrt[2 - 2*c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.144.3 Rubi [A] (warning: unable to verify)

Time = 0.33 (sec) , antiderivative size = 130, normalized size of antiderivative = 1.10, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.467$, Rules used = {6086, 6084, 858, 809, 809, 847, 762}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^7x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^8}$$

$$\downarrow 6084$$

$$\frac{\int c^{10}\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^{10}d(cx)}{c^{11}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\left(1-c^4x^4\right)^{3/2}}{c^{12}x^{12}}d\frac{1}{cx}}{c^{11}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{6}{11}\int \frac{\sqrt{1-c^4x^4}}{c^8x^8}d\frac{1}{cx}-\frac{\left(1-c^4x^4\right)^{3/2}}{11c^{11}x^{11}}}{c^{11}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{6}{11}\left(-\frac{2}{7}\int \frac{1}{c^4x^4\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{7c^7x^7}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{11c^{11}x^{11}}}{c^{11}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 847$$

$$-\frac{-\frac{6}{11}\left(-\frac{2}{7}\left(\frac{1}{3}\int\frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{3c^3x^3}\right)-\frac{\sqrt{1-c^4x^4}}{7c^7x^7}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{11c^{11}x^{11}}}{c^{11}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 762$$

$$-\frac{-\frac{6}{11}\left(-\frac{2}{7}\left(\frac{1}{3}\operatorname{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)-\frac{\sqrt{1-c^4x^4}}{3c^3x^3}\right)-\frac{\sqrt{1-c^4x^4}}{7c^7x^7}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{11c^{11}x^{11}}}{c^{11}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^7/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-((-1/11*(1 - c^4*x^4)^(3/2)/(c^11*x^11) - (6*(-1/7*Sqrt[1 - c^4*x^4]/(c^7
*x^7) - (2*(-1/3*Sqrt[1 - c^4*x^4]/(c^3*x^3) + EllipticF[ArcSin[1/(c*x)],
-1]/3))/7))/11)/(c^11*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch[2*Log[c*x]]^(3/2)))
```

### 3.144.3.1 Defintions of rubi rules used

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 847
```
Int[((c_.)*(x_))^(m_)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*x
)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] - Simp[b*((m + n*(p + 1)
+ 1)/(a*c^n*(m + 1)))   Int[(c*x)^(m + n)*(a + b*x^n)^p, x], x] /; FreeQ[{a
, b, c, p}, x] && IGtQ[n, 0] && LtQ[m, -1] && IntBinomialQ[a, b, c, n, m, p
, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.144.4 Maple [A] (verified)

Time = 0.57 (sec) , antiderivative size = 133, normalized size of antiderivative = 1.13

| method | result | size |
|---|---|---|
| risch | $\frac{x^2(7c^8x^8-13c^4x^4+4)\sqrt{2}}{308c^6\sqrt{\frac{c^2x^2}{c^4x^4-1}}}+\frac{\sqrt{c^2x^2+1}\sqrt{-c^2x^2+1}\,\text{EllipticF}\left(x\sqrt{-c^2},i\right)\sqrt{2}\,x}{77c^6\sqrt{-c^2}\,(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 133 |

input
```
int(x^7/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/308*x^2*(7*c^8*x^8-13*c^4*x^4+4)/c^6*2^(1/2)/(c^2*x^2/(c^4*x^4-1))^(1/2)
+1/77/c^6/(-c^2)^(1/2)*(c^2*x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)*El
lipticF(x*(-c^2)^(1/2),I)*2^(1/2)*x/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.144.5 Fricas [A] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 80, normalized size of antiderivative = 0.68

$$\int \frac{x^7}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$
$$= \frac{\sqrt{2}(7\,c^{14}x^{12}-20\,c^{10}x^8+17\,c^6x^4-4\,c^2)\sqrt{\frac{c^2x^2}{c^4x^4-1}}-4\,\sqrt{2}\sqrt{c^4}F(\arcsin\left(\frac{1}{cx}\right)\,|\,-1)}{308\,c^{10}}$$

input
```
integrate(x^7/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/308*(sqrt(2)*(7*c^14*x^12 - 20*c^10*x^8 + 17*c^6*x^4 - 4*c^2)*sqrt(c^2*x
^2/(c^4*x^4 - 1)) - 4*sqrt(2)*sqrt(c^4)*elliptic_f(arcsin(1/(c*x)), -1))/c
^10
```

### 3.144.6 Sympy [F]

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x**7/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**7/csch(2*log(c*x))**(3/2), x)
```

### 3.144.7 Maxima [F]

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^7}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x^7/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x^7/csch(2*log(c*x))^(3/2), x)
```

### 3.144.8 Giac [F(-1)]

Timed out.

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x^7/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.144.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^7}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^7}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x^7/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x^7/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.145 $\int \frac{x^6}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.145.1 Optimal result . . . 974
3.145.2 Mathematica [A] (verified) . . . 974
3.145.3 Rubi [A] (verified) . . . 975
3.145.4 Maple [A] (verified) . . . 976
3.145.5 Fricas [B] (verification not implemented) . . . 976
3.145.6 Sympy [F] . . . 977
3.145.7 Maxima [A] (verification not implemented) . . . 977
3.145.8 Giac [F(-1)] . . . 977
3.145.9 Mupad [B] (verification not implemented) . . . 978

## 3.145.1 Optimal result

Integrand size = 15, antiderivative size = 30

$$\int \frac{x^6}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\left(c^4-\frac{1}{x^4}\right)x^7}{10c^4\text{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
1/10*(c^4-1/x^4)*x^7/c^4/csch(2*ln(c*x))^(3/2)
```

## 3.145.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 44, normalized size of antiderivative = 1.47

$$\int \frac{x^6}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\left(-1+c^4x^4\right)^3\sqrt{\frac{c^2x^2}{-2+2c^4x^4}}}{20c^8x}$$

input
```
Integrate[x^6/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
((-1 + c^4*x^4)^3*Sqrt[(c^2*x^2)/(-2 + 2*c^4*x^4)])/(20*c^8*x)
```

### 3.145.3 Rubi [A] (verified)

Time = 0.26 (sec) , antiderivative size = 28, normalized size of antiderivative = 0.93, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {6086, 6084, 796}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^6}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^6x^6}{\text{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^7}$$

$$\downarrow 6084$$

$$\frac{\int c^9\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^9 d(cx)}{c^{10}x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\text{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 796$$

$$\frac{x^7\left(1-\frac{1}{c^4x^4}\right)}{10\text{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^6/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
((1 - 1/(c^4*x^4))*x^7)/(10*Csch[2*Log[c*x]]^(3/2))
```

#### 3.145.3.1 Defintions of rubi rules used

rule 796
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] /; FreeQ[{a, b, c, m, n,
 p}, x] && EqQ[(m + 1)/n + p + 1, 0] && NeQ[m, -1]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.145.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 47, normalized size of antiderivative = 1.57

| method | result | size |
|---|---|---|
| risch | $\frac{\sqrt{2}\,x\left(c^8x^8-2c^4x^4+1\right)}{40c^6\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 47 |

input
```
int(x^6/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/40*2^(1/2)/c^6*x/(c^2*x^2/(c^4*x^4-1))^(1/2)*(c^8*x^8-2*c^4*x^4+1)
```

### 3.145.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 56 vs. $2(26) = 52$.

Time = 0.26 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.87

$$\int \frac{x^6}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\sqrt{2}(c^{12}x^{12}-3\,c^8x^8+3\,c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{40\,c^8x}$$

input
```
integrate(x^6/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/40*sqrt(2)*(c^12*x^12 - 3*c^8*x^8 + 3*c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4
 - 1))/(c^8*x)
```

### 3.145.6 Sympy [F]

$$\int \frac{x^6}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^6}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x**6/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**6/csch(2*log(c*x))**(3/2), x)
```

### 3.145.7 Maxima [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.53

$$\int \frac{x^6}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\left(\sqrt{2}c^4x^4-\sqrt{2}\right)\left(c^2x^2+1\right)^{\frac{3}{2}}(cx+1)^{\frac{3}{2}}(cx-1)^{\frac{3}{2}}}{40\,c^7}$$

input
```
integrate(x^6/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
1/40*(sqrt(2)*c^4*x^4 - sqrt(2))*(c^2*x^2 + 1)^(3/2)*(c*x + 1)^(3/2)*(c*x
- 1)^(3/2)/c^7
```

### 3.145.8 Giac [F(-1)]

Timed out.

$$\int \frac{x^6}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x^6/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.145.9 Mupad [B] (verification not implemented)

Time = 2.30 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.40

$$\int \frac{x^6}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\left(c^4x^4-1\right)^3\sqrt{\frac{2c^2x^2}{c^4x^4-1}}}{40c^8x}$$

input
```
int(x^6/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
((c^4*x^4 - 1)^3*((2*c^2*x^2)/(c^4*x^4 - 1))^(1/2))/(40*c^8*x)
```

# 3.146 $\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.146.1 Optimal result . . . 979
3.146.2 Mathematica [C] (verified) . . . 979
3.146.3 Rubi [A] (warning: unable to verify) . . . 980
3.146.4 Maple [A] (verified) . . . 983
3.146.5 Fricas [A] (verification not implemented) . . . 983
3.146.6 Sympy [F] . . . 984
3.146.7 Maxima [F] . . . 984
3.146.8 Giac [F(-1)] . . . 984
3.146.9 Mupad [F(-1)] . . . 985

## 3.146.1 Optimal result

Integrand size = 15, antiderivative size = 162

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{4}{15c^4\left(c^4-\frac{1}{x^4}\right)x^2\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{2x^2}{15\left(c^4-\frac{1}{x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{x^6}{9\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{4E(\csc^{-1}(cx)|-1)}{15c^9\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{4\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{15c^9\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output

```
4/15/c^4/(c^4-1/x^4)/x^2/csch(2*ln(c*x))^(3/2)-2/15*x^2/(c^4-1/x^4)/csch(2
*ln(c*x))^(3/2)+1/9*x^6/csch(2*ln(c*x))^(3/2)+4/15*EllipticE(1/c/x,I)/c^9/
(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)-4/15*EllipticF(1/c/x,I)/c^9/
(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)
```

## 3.146.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.09 (sec) , antiderivative size = 63, normalized size of antiderivative = 0.39

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = -\frac{x^4\,\text{Hypergeometric2F1}\left(-\frac{3}{2},\frac{3}{4},\frac{7}{4},c^4x^4\right)}{6c^2\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^5/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-1/6*(x^4*Hypergeometric2F1[-3/2, 3/4, 7/4, c^4*x^4])/(c^2*Sqrt[2 - 2*c^4*
x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.146.3 Rubi [A] (warning: unable to verify)

Time = 0.39 (sec) , antiderivative size = 136, normalized size of antiderivative = 0.84, number of steps used = 11, number of rules used = 10, $\frac{\text{number of rules}}{\text{integrand size}} = 0.667$, Rules used = {6086, 6084, 858, 809, 809, 847, 836, 762, 1388, 327}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^5x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^6}$$

$$\downarrow 6084$$

$$\frac{\int c^8\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^8 d(cx)}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\left(1-c^4x^4\right)^{3/2}}{c^{10}x^{10}}d\frac{1}{cx}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{2}{3}\int \frac{\sqrt{1-c^4x^4}}{c^6x^6}d\frac{1}{cx}-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{2}{3}\left(-\frac{2}{5}\int \frac{1}{c^2x^2\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 847$$

$$-\frac{-\frac{2}{3}\left(-\frac{2}{5}\left(-\int \frac{c^2x^2}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 836$$

$$-\frac{-\frac{2}{3}\left(-\frac{2}{5}\left(\int \frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 762$$

$$-\frac{-\frac{2}{3}\left(-\frac{2}{5}\left(-\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}+\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 1388$$

$$-\frac{-\frac{2}{3}\left(-\frac{2}{5}\left(-\int \frac{\sqrt{c^2x^2+1}}{\sqrt{1-c^2x^2}}d\frac{1}{cx}+\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 327$$

$$-\frac{-\frac{2}{3}\left(-\frac{2}{5}\left(\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)-E\left(\arcsin\left(\frac{1}{cx}\right)\middle|-1\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{5c^5x^5}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{9c^9x^9}}{c^9x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^5/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-((-1/9*(1 - c^4*x^4)^(3/2)/(c^9*x^9) - (2*(-1/5*Sqrt[1 - c^4*x^4]/(c^5*x^
5) - (2*(-(Sqrt[1 - c^4*x^4]/(c*x)) - EllipticE[ArcSin[1/(c*x)], -1] + Ell
ipticF[ArcSin[1/(c*x)], -1]))/5))/3)/(c^9*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch
[2*Log[c*x]]^(3/2)))
```

### 3.146.3.1 Defintions of rubi rules used

rule 327
```
Int[Sqrt[(a_) + (b_.)*(x_)^2]/Sqrt[(c_) + (d_.)*(x_)^2], x_Symbol] :> Simp[
(Sqrt[a]/(Sqrt[c]*Rt[-d/c, 2]))*EllipticE[ArcSin[Rt[-d/c, 2]*x], b*(c/(a*d)
)], x] /; FreeQ[{a, b, c, d}, x] && NegQ[d/c] && GtQ[c, 0] && GtQ[a, 0]
```

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 836
```
Int[(x_)^2/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> With[{q = Rt[-b/a, 2]},
Simp[-q^(-1)   Int[1/Sqrt[a + b*x^4], x], x] + Simp[1/q   Int[(1 + q*x^2)/S
qrt[a + b*x^4], x], x]] /; FreeQ[{a, b}, x] && NegQ[b/a]
```

rule 847
```
Int[((c_.)*(x_))^(m_)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*x
)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] - Simp[b*((m + n*(p + 1)
+ 1)/(a*c^n*(m + 1)))   Int[(c*x)^(m + n)*(a + b*x^n)^p, x], x] /; FreeQ[{a
, b, c, p}, x] && IGtQ[n, 0] && LtQ[m, -1] && IntBinomialQ[a, b, c, n, m, p
, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 1388
```
Int[(u_.)*((a_) + (c_.)*(x_)^(n2_.))^(p_.)*((d_) + (e_.)*(x_)^(n_))^(q_.),
x_Symbol] :> Int[u*(d + e*x^n)^(p + q)*(a/d + (c/e)*x^n)^p, x] /; FreeQ[{a,
 c, d, e, n, p, q}, x] && EqQ[n2, 2*n] && EqQ[c*d^2 + a*e^2, 0] && (Integer
Q[p] || (GtQ[a, 0] && GtQ[d, 0]))
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

3.146. $\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.146.4 Maple [A] (verified)

Time = 0.66 (sec) , antiderivative size = 140, normalized size of antiderivative = 0.86

| method | result | size |
|---|---|---|
| risch | $\frac{x^4(5c^4x^4-11)\sqrt{2}}{180c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}}+\frac{\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\left(\text{EllipticF}\left(x\sqrt{-c^2},i\right)-\text{EllipticE}\left(x\sqrt{-c^2},i\right)\right)\sqrt{2}\,x}{15\sqrt{-c^2}\,(c^4x^4-1)c^4\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 140 |

input
```
int(x^5/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/180*x^4*(5*c^4*x^4-11)*2^(1/2)/c^2/(c^2*x^2/(c^4*x^4-1))^(1/2)+1/15/(-c^
2)^(1/2)*(c^2*x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)/c^4*(EllipticF(x
*(-c^2)^(1/2),I)-EllipticE(x*(-c^2)^(1/2),I))*2^(1/2)*x/(c^2*x^2/(c^4*x^4-
1))^(1/2)
```

### 3.146.5 Fricas [A] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 106, normalized size of antiderivative = 0.65

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$
$$= \frac{\sqrt{2}(5\,c^{14}x^{12}-16\,c^{10}x^8+23\,c^6x^4-12\,c^2)\sqrt{\frac{c^2x^2}{c^4x^4-1}}+12\sqrt{c^4}\left(\sqrt{2}x^2E(\arcsin\left(\frac{1}{cx}\right)\mid -1)-\sqrt{2}x^2F(\arcsin\left(\frac{1}{c}\right.\right.}{180\,c^{10}x^2}$$

input
```
integrate(x^5/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/180*(sqrt(2)*(5*c^14*x^12 - 16*c^10*x^8 + 23*c^6*x^4 - 12*c^2)*sqrt(c^2*
x^2/(c^4*x^4 - 1)) + 12*sqrt(c^4)*(sqrt(2)*x^2*elliptic_e(arcsin(1/(c*x)),
 -1) - sqrt(2)*x^2*elliptic_f(arcsin(1/(c*x)), -1)))/(c^10*x^2)
```

### 3.146.6 Sympy [F]

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x**5/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**5/csch(2*log(c*x))**(3/2), x)
```

### 3.146.7 Maxima [F]

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^5}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x^5/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x^5/csch(2*log(c*x))^(3/2), x)
```

### 3.146.8 Giac [F(-1)]

Timed out.

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x^5/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.146.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^5}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^5}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x^5/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x^5/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.147 $\int \frac{x^4}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.147.1 Optimal result . . . 986
3.147.2 Mathematica [A] (verified) . . . 986
3.147.3 Rubi [A] (warning: unable to verify) . . . 987
3.147.4 Maple [A] (verified) . . . 989
3.147.5 Fricas [A] (verification not implemented) . . . 989
3.147.6 Sympy [F] . . . 990
3.147.7 Maxima [F] . . . 990
3.147.8 Giac [F(-1)] . . . 990
3.147.9 Mupad [F(-1)] . . . 991

## 3.147.1 Optimal result

Integrand size = 15, antiderivative size = 96

$$\int \frac{x^4}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = -\frac{3x}{16\left(c^4-\frac{1}{x^4}\right)\text{csch}^{\frac{3}{2}}(2\log(cx))}+\frac{x^5}{8\text{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{3\text{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)}{16c^8\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\text{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
-3/16*x/(c^4-1/x^4)/csch(2*ln(c*x))^(3/2)+1/8*x^5/csch(2*ln(c*x))^(3/2)+3/
16*arctanh((1-1/c^4/x^4)^(1/2))/c^8/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x)
)^(3/2)
```

## 3.147.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.91

$$\int \frac{x^4}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{c^3x^3\sqrt{1-c^4x^4}(-5+2c^4x^4)-3cx\arcsin\left(c^2x^2\right)}{32c^5\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x^4/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
(c^3*x^3*Sqrt[1 - c^4*x^4]*(-5 + 2*c^4*x^4) - 3*c*x*ArcSin[c^2*x^2])/(32*c
^5*Sqrt[2 - 2*c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.147.3 Rubi [A] (warning: unable to verify)

Time = 0.29 (sec) , antiderivative size = 102, normalized size of antiderivative = 1.06, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.467$, Rules used = {6086, 6084, 798, 51, 51, 73, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^4x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^5}$$

$$\downarrow 6084$$

$$\frac{\int c^7\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^7 d(cx)}{c^8x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 798$$

$$-\frac{\int \frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{c^3x^3}d\frac{1}{c^4x^4}}{4c^8x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 51$$

$$-\frac{-\frac{3}{4}\int \frac{\sqrt{1-\frac{1}{c^4x^4}}}{c^2x^2}d\frac{1}{c^4x^4}-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{2c^2x^2}}{4c^8x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 51$$

$$-\frac{-\frac{3}{4}\left(-\frac{1}{2}\int \frac{1}{c\sqrt{1-\frac{1}{c^4x^4}}x}d\frac{1}{c^4x^4}-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{2c^2x^2}}{4c^8x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 73$$

$$-\frac{-\frac{3}{4}\left(\int \frac{1}{1-c^2x^2}d\sqrt{1-\frac{1}{c^4x^4}}-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{2c^2x^2}}{4c^8x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 219$$

$$-\frac{-\frac{3}{4}\left(\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)-\frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{2c^2x^2}}{4c^8x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^4/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-1/4*(-1/2*(1 - 1/(c^4*x^4))^(3/2)/(c^2*x^2) - (3*(-(Sqrt[1 - 1/(c^4*x^4)]
/(c*x)) + ArcTanh[Sqrt[1 - 1/(c^4*x^4)]]))/4)/(c^8*(1 - 1/(c^4*x^4))^(3/2)
*x^3*Csch[2*Log[c*x]]^(3/2))
```

### 3.147.3.1 Defintions of rubi rules used

rule 51
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> Simp[
(a + b*x)^(m + 1)*((c + d*x)^n/(b*(m + 1))), x] - Simp[d*(n/(b*(m + 1)))
Int[(a + b*x)^(m + 1)*(c + d*x)^(n - 1), x], x] /; FreeQ[{a, b, c, d, n}, x
] && ILtQ[m, -1] && FractionQ[n] && GtQ[n, 0]
```

rule 73
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> With[
{p = Denominator[m]}, Simp[p/b   Subst[Int[x^(p*(m + 1) - 1)*(c - a*(d/b) +
 d*(x^p/b))^n, x], x, (a + b*x)^(1/p)], x]] /; FreeQ[{a, b, c, d}, x] && Lt
Q[-1, m, 0] && LeQ[-1, n, 0] && LeQ[Denominator[n], Denominator[m]] && IntL
inearQ[a, b, c, d, m, n, x]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 798
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[1/n   Subst
[Int[x^(Simplify[(m + 1)/n] - 1)*(a + b*x)^p, x], x, x^n], x] /; FreeQ[{a,
b, m, n, p}, x] && IntegerQ[Simplify[(m + 1)/n]]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.147.4 Maple [A] (verified)

Time = 0.20 (sec) , antiderivative size = 113, normalized size of antiderivative = 1.18

| method | result | size |
|---|---|---|
| risch | $\frac{x^3(2c^4x^4-5)\sqrt{2}}{64c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}}+\frac{3\ln\left(\frac{c^4x^2}{\sqrt{c^4}}+\sqrt{c^4x^4-1}\right)\sqrt{2}\,x}{64\sqrt{c^4}\,c^2\sqrt{c^4x^4-1}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 113 |

input
```
int(x^4/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/64*x^3*(2*c^4*x^4-5)*2^(1/2)/c^2/(c^2*x^2/(c^4*x^4-1))^(1/2)+3/64*ln(c^4
*x^2/(c^4)^(1/2)+(c^4*x^4-1)^(1/2))/(c^4)^(1/2)*2^(1/2)/c^2*x/(c^4*x^4-1)^
(1/2)/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.147.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 102, normalized size of antiderivative = 1.06

$$\int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$
$$= \frac{2\sqrt{2}(2\,c^9x^9-7\,c^5x^5+5\,cx)\sqrt{\frac{c^2x^2}{c^4x^4-1}}+3\sqrt{2}\log\left(2\,c^4x^4+2\,(c^5x^5-cx)\sqrt{\frac{c^2x^2}{c^4x^4-1}}-1\right)}{128\,c^5}$$

input
```
integrate(x^4/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/128*(2*sqrt(2)*(2*c^9*x^9 - 7*c^5*x^5 + 5*c*x)*sqrt(c^2*x^2/(c^4*x^4 - 1
)) + 3*sqrt(2)*log(2*c^4*x^4 + 2*(c^5*x^5 - c*x)*sqrt(c^2*x^2/(c^4*x^4 - 1
)) - 1))/c^5
```

### 3.147.6 Sympy [F]

$$\int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x**4/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**4/csch(2*log(c*x))**(3/2), x)
```

### 3.147.7 Maxima [F]

$$\int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^4}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x^4/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x^4/csch(2*log(c*x))^(3/2), x)
```

### 3.147.8 Giac [F(-1)]

Timed out.

$$\int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x^4/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.147.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^4}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^4}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x^4/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x^4/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.148 $\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.148.1 Optimal result . . . 992
3.148.2 Mathematica [C] (verified) . . . 992
3.148.3 Rubi [A] (warning: unable to verify) . . . 993
3.148.4 Maple [A] (verified) . . . 995
3.148.5 Fricas [A] (verification not implemented) . . . 995
3.148.6 Sympy [F] . . . 995
3.148.7 Maxima [F] . . . 996
3.148.8 Giac [F(-2)] . . . 996
3.148.9 Mupad [F(-1)] . . . 996

## 3.148.1 Optimal result

Integrand size = 15, antiderivative size = 86

$$\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = -\frac{2}{7\left(c^4-\frac{1}{x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}+\frac{x^4}{7\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{4\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{7c^7\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
-2/7/(c^4-1/x^4)/csch(2*ln(c*x))^(3/2)+1/7*x^4/csch(2*ln(c*x))^(3/2)-4/7*E
llipticF(1/c/x,I)/c^7/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)
```

## 3.148.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.09 (sec) , antiderivative size = 65, normalized size of antiderivative = 0.76

$$\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\sqrt{1-c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\,\text{Hypergeometric2F1}\left(-\frac{3}{2},\frac{1}{4},\frac{5}{4},c^4x^4\right)}{2\sqrt{2}c^4}$$

input
```
Integrate[x^3/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
(Sqrt[1 - c^4*x^4]*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)]*Hypergeometric2F1[-3/2,
1/4, 5/4, c^4*x^4])/(2*Sqrt[2]*c^4)
```

### 3.148.3 Rubi [A] (warning: unable to verify)

Time = 0.31 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.17, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {6086, 6084, 858, 809, 809, 762}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^3x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^4}$$

$$\downarrow 6084$$

$$\frac{\int c^6\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^6 d(cx)}{c^7x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\left(1-c^4x^4\right)^{3/2}}{c^8x^8}d\frac{1}{cx}}{c^7x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{6}{7}\int \frac{\sqrt{1-c^4x^4}}{c^4x^4}d\frac{1}{cx}-\frac{\left(1-c^4x^4\right)^{3/2}}{7c^7x^7}}{c^7x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{6}{7}\left(-\frac{2}{3}\int \frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{3c^3x^3}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{7c^7x^7}}{c^7x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 762$$

$$-\frac{-\frac{6}{7}\left(-\frac{2}{3}\operatorname{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)-\frac{\sqrt{1-c^4x^4}}{3c^3x^3}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{7c^7x^7}}{c^7x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^3/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-((-1/7*(1 - c^4*x^4)^(3/2)/(c^7*x^7) - (6*(-1/3*Sqrt[1 - c^4*x^4]/(c^3*x^
3) - (2*EllipticF[ArcSin[1/(c*x)], -1])/3))/7)/(c^7*(1 - 1/(c^4*x^4))^(3/2
)*x^3*Csch[2*Log[c*x]]^(3/2)))
```

### 3.148.3.1 Defintions of rubi rules used

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.148.4 Maple [A] (verified)

Time = 0.55 (sec) , antiderivative size = 124, normalized size of antiderivative = 1.44

| method | result | size |
|---|---|---|
| risch | $\frac{x^2(c^4x^4-3)\sqrt{2}}{28c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}}+\frac{\sqrt{c^2x^2+1}\sqrt{-c^2x^2+1}\,\text{EllipticF}\left(x\sqrt{-c^2},i\right)\sqrt{2}\,x}{7\sqrt{-c^2}\,(c^4x^4-1)c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 124 |

input
```
int(x^3/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/28*x^2*(c^4*x^4-3)*2^(1/2)/c^2/(c^2*x^2/(c^4*x^4-1))^(1/2)+1/7/(-c^2)^(1
/2)*(c^2*x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)*EllipticF(x*(-c^2)^(1
/2),I)*2^(1/2)/c^2*x/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.148.5 Fricas [A] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 71, normalized size of antiderivative = 0.83

$$\int \frac{x^3}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\sqrt{2}(c^{10}x^8-4\,c^6x^4+3\,c^2)\sqrt{\frac{c^2x^2}{c^4x^4-1}}-4\,\sqrt{2}\sqrt{c^4}F(\arcsin\left(\frac{1}{cx}\right)\,|\,-1)}{28\,c^6}$$

input
```
integrate(x^3/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/28*(sqrt(2)*(c^10*x^8 - 4*c^6*x^4 + 3*c^2)*sqrt(c^2*x^2/(c^4*x^4 - 1)) -
 4*sqrt(2)*sqrt(c^4)*elliptic_f(arcsin(1/(c*x)), -1))/c^6
```

### 3.148.6 Sympy [F]

$$\int \frac{x^3}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^3}{\text{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x**3/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**3/csch(2*log(c*x))**(3/2), x)
```

### 3.148.7 Maxima [F]

$$\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^3}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x^3/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x^3/csch(2*log(c*x))^(3/2), x)
```

### 3.148.8 Giac [F(-2)]

Exception generated.

$$\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Exception raised: TypeError}$$

input
```
integrate(x^3/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Exception raised: TypeError >> an error occurred running a Giac command:IN
PUT:sage2:=int(sage0,sageVARx):;OUTPUT:sym2poly exception caught Unable to
 convert to real %%{poly1[1.0000000000000000000000000000000,0.000000000000
000000000
```

### 3.148.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^3}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x^3/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x^3/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.149 $\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.149.1 Optimal result . . . 997
3.149.2 Mathematica [A] (verified) . . . 997
3.149.3 Rubi [A] (warning: unable to verify) . . . 998
3.149.4 Maple [F] . . . 1000
3.149.5 Fricas [A] (verification not implemented) . . . 1000
3.149.6 Sympy [F] . . . 1000
3.149.7 Maxima [F] . . . 1001
3.149.8 Giac [F(-1)] . . . 1001
3.149.9 Mupad [F(-1)] . . . 1001

## 3.149.1 Optimal result

Integrand size = 15, antiderivative size = 91

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = -\frac{1}{2\left(c^4-\frac{1}{x^4}\right)x\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}+\frac{x^3}{6\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{\csc^{-1}\left(c^2x^2\right)}{2c^6\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
-1/2/(c^4-1/x^4)/x/csch(2*ln(c*x))^(3/2)+1/6*x^3/csch(2*ln(c*x))^(3/2)-1/2
*arccsc(c^2*x^2)/c^6/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)
```

## 3.149.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 88, normalized size of antiderivative = 0.97

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{x\left(\left(-4+c^4x^4\right)\sqrt{-1+c^4x^4}+3\arctan\left(\sqrt{-1+c^4x^4}\right)\right)}{12\sqrt{2}c^2\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\sqrt{-1+c^4x^4}}$$

input
```
Integrate[x^2/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
(x*((-4 + c^4*x^4)*Sqrt[-1 + c^4*x^4] + 3*ArcTan[Sqrt[-1 + c^4*x^4]]))/(12
*Sqrt[2]*c^2*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)]*Sqrt[-1 + c^4*x^4])
```

### 3.149.3 Rubi [A] (warning: unable to verify)

Time = 0.30 (sec) , antiderivative size = 89, normalized size of antiderivative = 0.98, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.467$, Rules used = {6086, 6084, 858, 807, 247, 247, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{c^2x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}d(cx)}{c^3}$$

$$\downarrow 6084$$

$$\frac{\int c^5\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^5 d(cx)}{c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\left(1-c^4x^4\right)^{3/2}}{c^7x^7}d\frac{1}{cx}}{c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 807$$

$$-\frac{\int \frac{\left(1-c^2x^2\right)^{3/2}}{c^4x^4}d\left(c^2x^2\right)}{2c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 247$$

$$-\frac{-\int \frac{\sqrt{1-c^2x^2}}{c^2x^2}d\left(c^2x^2\right)-\frac{\left(1-c^2x^2\right)^{3/2}}{3c^3x^3}}{2c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 247$$

$$-\frac{\int \frac{1}{\sqrt{1-c^2x^2}}d\left(c^2x^2\right)+c^2x^2\sqrt{1-c^2x^2}-\frac{\left(1-c^2x^2\right)^{3/2}}{3c^3x^3}}{2c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 223$$

$$-\frac{\arcsin\left(c^2x^2\right)+c^2x^2\sqrt{1-c^2x^2}-\frac{\left(1-c^2x^2\right)^{3/2}}{3c^3x^3}}{2c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x^2/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-1/2*(c^2*x^2*Sqrt[1 - c^2*x^2] - (1 - c^2*x^2)^(3/2)/(3*c^3*x^3) + ArcSin
[c^2*x^2])/(c^6*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch[2*Log[c*x]]^(3/2))
```

### 3.149.3.1 Defintions of rubi rules used

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 247
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[(c*x)^
(m + 1)*((a + b*x^2)^p/(c*(m + 1))), x] - Simp[2*b*(p/(c^2*(m + 1)))   Int[
(c*x)^(m + 2)*(a + b*x^2)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && GtQ[p,
0] && LtQ[m, -1] &&  !ILtQ[(m + 2*p + 3)/2, 0] && IntBinomialQ[a, b, c, 2,
m, p, x]
```

rule 807
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> With[{k = GCD[m
+ 1, n]}, Simp[1/k   Subst[Int[x^((m + 1)/k - 1)*(a + b*x^(n/k))^p, x], x,
x^k], x] /; k != 1] /; FreeQ[{a, b, p}, x] && IGtQ[n, 0] && IntegerQ[m]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.149.4 Maple [F]

$$\int \frac{x^2}{\operatorname{csch}\left(2\ln\left(cx\right)\right)^{\frac{3}{2}}}dx$$

input
```
int(x^2/csch(2*ln(c*x))^(3/2),x)
```

output
```
int(x^2/csch(2*ln(c*x))^(3/2),x)
```

### 3.149.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 94, normalized size of antiderivative = 1.03

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}dx = \frac{3\sqrt{2}cx\arctan\left(\frac{(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{cx}\right) + \sqrt{2}(c^8x^8 - 5\,c^4x^4 + 4)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{24\,c^4x}$$

input
```
integrate(x^2/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/24*(3*sqrt(2)*c*x*arctan((c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1))/(c*x)
) + sqrt(2)*(c^8*x^8 - 5*c^4*x^4 + 4)*sqrt(c^2*x^2/(c^4*x^4 - 1)))/(c^4*x)
```

### 3.149.6 Sympy [F]

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}dx = \int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}dx$$

input
```
integrate(x**2/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x**2/csch(2*log(c*x))**(3/2), x)
```

### 3.149.7 Maxima [F]

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^2}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x^2/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x^2/csch(2*log(c*x))^(3/2), x)
```

### 3.149.8 Giac [F(-1)]

Timed out.

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x^2/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.149.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x^2}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x^2/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x^2/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.150 $\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.150.1 Optimal result . . . . . 1002
3.150.2 Mathematica [C] (verified) . . . . . 1002
3.150.3 Rubi [A] (warning: unable to verify) . . . . . 1003
3.150.4 Maple [A] (verified) . . . . . 1006
3.150.5 Fricas [F] . . . . . 1006
3.150.6 Sympy [F] . . . . . 1006
3.150.7 Maxima [F] . . . . . 1007
3.150.8 Giac [F(-1)] . . . . . 1007
3.150.9 Mupad [F(-1)] . . . . . 1007

## 3.150.1 Optimal result

Integrand size = 13, antiderivative size = 130

$$\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = -\frac{6}{5\left(c^4-\frac{1}{x^4}\right)x^2\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{x^2}{5\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{12E(\csc^{-1}(cx)|-1)}{5c^5\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{12\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)}{5c^5\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
-6/5/(c^4-1/x^4)/x^2/csch(2*ln(c*x))^(3/2)+1/5*x^2/csch(2*ln(c*x))^(3/2)-1
2/5*EllipticE(1/c/x,I)/c^5/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)+1
2/5*EllipticF(1/c/x,I)/c^5/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(3/2)
```

## 3.150.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.12 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.46

$$\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\text{Hypergeometric2F1}\left(-\frac{3}{2},-\frac{1}{4},\frac{3}{4},c^4x^4\right)}{2c^2\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[x/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
Hypergeometric2F1[-3/2, -1/4, 3/4, c^4*x^4]/(2*c^2*Sqrt[2 - 2*c^4*x^4]*Sqr
t[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.150.3 Rubi [A] (warning: unable to verify)

Time = 0.35 (sec) , antiderivative size = 110, normalized size of antiderivative = 0.85, number of steps used = 10, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.692$, Rules used = {6086, 6084, 858, 809, 809, 836, 762, 1388, 327}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6086$$

$$\frac{\int \frac{cx}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,d(cx)}{c^2}$$

$$\downarrow 6084$$

$$\frac{\int c^4\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^4\,d(cx)}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 858$$

$$-\frac{\int \frac{\left(1-c^4x^4\right)^{3/2}}{c^6x^6}\,d\frac{1}{cx}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{6}{5}\int \frac{\sqrt{1-c^4x^4}}{c^2x^2}\,d\frac{1}{cx}-\frac{\left(1-c^4x^4\right)^{3/2}}{5c^5x^5}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 809$$

$$-\frac{-\frac{6}{5}\left(-2\int \frac{c^2x^2}{\sqrt{1-c^4x^4}}\,d\frac{1}{cx}-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{5c^5x^5}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 836$$

$$-\frac{-\frac{6}{5}\left(-2\left(\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\int \frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{5c^5x^5}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 762$$

$$-\frac{-\frac{6}{5}\left(-2\left(\int \frac{c^2x^2+1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}-\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{5c^5x^5}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 1388$$

$$-\frac{-\frac{6}{5}\left(-2\left(\int \frac{\sqrt{c^2x^2+1}}{\sqrt{1-c^2x^2}}d\frac{1}{cx}-\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{5c^5x^5}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 327$$

$$-\frac{-\frac{6}{5}\left(-2\left(E\left(\arcsin\left(\frac{1}{cx}\right)\middle|-1\right)-\text{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)-\frac{\sqrt{1-c^4x^4}}{cx}\right)-\frac{\left(1-c^4x^4\right)^{3/2}}{5c^5x^5}}{c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[x/Csch[2*Log[c*x]]^(3/2),x]
```

output
```
-((-1/5*(1 - c^4*x^4)^(3/2)/(c^5*x^5) - (6*(-(Sqrt[1 - c^4*x^4]/(c*x)) - 2
*(EllipticE[ArcSin[1/(c*x)], -1] - EllipticF[ArcSin[1/(c*x)], -1])))/5)/(c
^5*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch[2*Log[c*x]]^(3/2)))
```

### 3.150.3.1 Defintions of rubi rules used

rule 327
```
Int[Sqrt[(a_) + (b_.)*(x_)^2]/Sqrt[(c_) + (d_.)*(x_)^2], x_Symbol] :> Simp[
(Sqrt[a]/(Sqrt[c]*Rt[-d/c, 2]))*EllipticE[ArcSin[Rt[-d/c, 2]*x], b*(c/(a*d)
)], x] /; FreeQ[{a, b, c, d}, x] && NegQ[d/c] && GtQ[c, 0] && GtQ[a, 0]
```

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 809
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^p/(c*(m + 1))), x] - Simp[b*n*(p/(c^n*(m + 1)))   I
nt[(c*x)^(m + n)*(a + b*x^n)^(p - 1), x], x] /; FreeQ[{a, b, c}, x] && IGtQ
[n, 0] && GtQ[p, 0] && LtQ[m, -1] &&  !ILtQ[(m + n*p + n + 1)/n, 0] && IntB
inomialQ[a, b, c, n, m, p, x]
```

rule 836
```
Int[(x_)^2/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> With[{q = Rt[-b/a, 2]},
Simp[-q^(-1)   Int[1/Sqrt[a + b*x^4], x], x] + Simp[1/q   Int[(1 + q*x^2)/S
qrt[a + b*x^4], x], x]] /; FreeQ[{a, b}, x] && NegQ[b/a]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 1388
```
Int[(u_.)*((a_) + (c_.)*(x_)^(n2_.))^(p_.)*((d_) + (e_.)*(x_)^(n_))^(q_.),
x_Symbol] :> Int[u*(d + e*x^n)^(p + q)*(a/d + (c/e)*x^n)^p, x] /; FreeQ[{a,
 c, d, e, n, p, q}, x] && EqQ[n2, 2*n] && EqQ[c*d^2 + a*e^2, 0] && (Integer
Q[p] || (GtQ[a, 0] && GtQ[d, 0]))
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

3.150. $\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

### 3.150.4 Maple [A] (verified)

Time = 0.65 (sec) , antiderivative size = 152, normalized size of antiderivative = 1.17

| method | result | size |
|---|---|---|
| risch | $\frac{(c^8x^8+4c^4x^4-5)\sqrt{2}}{20(c^4x^4-1)c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}} - \frac{3\sqrt{c^2x^2+1}\,\sqrt{-c^2x^2+1}\left(\text{EllipticF}\left(x\sqrt{-c^2},i\right)-\text{EllipticE}\left(x\sqrt{-c^2},i\right)\right)\sqrt{2}\,x}{5\sqrt{-c^2}\,(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 152 |

input
```
int(x/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/20*(c^8*x^8+4*c^4*x^4-5)/(c^4*x^4-1)*2^(1/2)/c^2/(c^2*x^2/(c^4*x^4-1))^(
1/2)-3/5/(-c^2)^(1/2)*(c^2*x^2+1)^(1/2)*(-c^2*x^2+1)^(1/2)/(c^4*x^4-1)*(El
lipticF(x*(-c^2)^(1/2),I)-EllipticE(x*(-c^2)^(1/2),I))*2^(1/2)*x/(c^2*x^2/
(c^4*x^4-1))^(1/2)
```

### 3.150.5 Fricas [F]

$$\int \frac{x}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x}{\text{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
integral(x/csch(2*log(c*x))^(3/2), x)
```

### 3.150.6 Sympy [F]

$$\int \frac{x}{\text{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x}{\text{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(x/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(x/csch(2*log(c*x))**(3/2), x)
```

### 3.150.7 Maxima [F]

$$\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(x/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(x/csch(2*log(c*x))^(3/2), x)
```

### 3.150.8 Giac [F(-1)]

Timed out.

$$\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(x/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.150.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{x}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(x/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(x/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.151 $\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$

3.151.1 Optimal result . . . . . 1008
3.151.2 Mathematica [C] (verified) . . . . . 1008
3.151.3 Rubi [A] (warning: unable to verify) . . . . . 1009
3.151.4 Maple [A] (verified) . . . . . 1011
3.151.5 Fricas [A] (verification not implemented) . . . . . 1012
3.151.6 Sympy [F] . . . . . 1012
3.151.7 Maxima [F] . . . . . 1012
3.151.8 Giac [F(-1)] . . . . . 1013
3.151.9 Mupad [F(-1)] . . . . . 1013

## 3.151.1 Optimal result

Integrand size = 11, antiderivative size = 96

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{3}{4\left(c^4-\frac{1}{x^4}\right)x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} + \frac{x}{4\operatorname{csch}^{\frac{3}{2}}(2\log(cx))} - \frac{3\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)}{4c^4\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

output
```
3/4/(c^4-1/x^4)/x^3/csch(2*ln(c*x))^(3/2)+1/4*x/csch(2*ln(c*x))^(3/2)-3/4*
arctanh((1-1/c^4/x^4)^(1/2))/c^4/(1-1/c^4/x^4)^(3/2)/x^3/csch(2*ln(c*x))^(
3/2)
```

## 3.151.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 3 in optimal.

Time = 0.08 (sec) , antiderivative size = 63, normalized size of antiderivative = 0.66

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{\text{Hypergeometric2F1}\left(-\frac{3}{2},-\frac{1}{2},\frac{1}{2},c^4x^4\right)}{4c^2x\sqrt{2-2c^4x^4}\sqrt{\frac{c^2x^2}{-1+c^4x^4}}}$$

input
```
Integrate[Csch[2*Log[c*x]]^(-3/2),x]
```

output
```
Hypergeometric2F1[-3/2, -1/2, 1/2, c^4*x^4]/(4*c^2*x*Sqrt[2 - 2*c^4*x^4]*S
qrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.151.3 Rubi [A] (warning: unable to verify)

Time = 0.27 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.00, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.636$, Rules used = {6080, 6078, 798, 51, 60, 73, 219}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx$$

$$\downarrow 6080$$

$$\frac{\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,d(cx)}{c}$$

$$\downarrow 6078$$

$$\frac{\int c^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\,d(cx)}{c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 798$$

$$-\frac{\int \frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{c^2x^2}\,d\frac{1}{c^4x^4}}{4c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 51$$

$$-\frac{-\frac{3}{2}\int \frac{\sqrt{1-\frac{1}{c^4x^4}}}{cx}\,d\frac{1}{c^4x^4}-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{cx}}{4c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 60$$

$$-\frac{-\frac{3}{2}\left(\int \frac{1}{c\sqrt{1-\frac{1}{c^4x^4}}x}\,d\frac{1}{c^4x^4}+2\sqrt{1-\frac{1}{c^4x^4}}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{cx}}{4c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 73$$

$$-\frac{-\frac{3}{2}\left(2\sqrt{1-\frac{1}{c^4x^4}}-2\int\frac{1}{1-c^2x^2}d\sqrt{1-\frac{1}{c^4x^4}}\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{cx}}{4c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

$$\downarrow 219$$

$$-\frac{-\frac{3}{2}\left(2\sqrt{1-\frac{1}{c^4x^4}}-2\operatorname{arctanh}\left(\sqrt{1-\frac{1}{c^4x^4}}\right)\right)-\frac{\left(1-\frac{1}{c^4x^4}\right)^{3/2}}{cx}}{4c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}$$

input
```
Int[Csch[2*Log[c*x]]^(-3/2),x]
```

output
```
-1/4*(-((1 - 1/(c^4*x^4))^(3/2)/(c*x)) - (3*(2*Sqrt[1 - 1/(c^4*x^4)] - 2*A
rcTanh[Sqrt[1 - 1/(c^4*x^4)]]))/2)/(c^4*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch[2
*Log[c*x]]^(3/2))
```

### 3.151.3.1 Defintions of rubi rules used

rule 51
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> Simp[
(a + b*x)^(m + 1)*((c + d*x)^n/(b*(m + 1))), x] - Simp[d*(n/(b*(m + 1)))
Int[(a + b*x)^(m + 1)*(c + d*x)^(n - 1), x], x] /; FreeQ[{a, b, c, d, n}, x
] && ILtQ[m, -1] && FractionQ[n] && GtQ[n, 0]
```

rule 60
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> Simp[
(a + b*x)^(m + 1)*((c + d*x)^n/(b*(m + n + 1))), x] + Simp[n*((b*c - a*d)/(
b*(m + n + 1)))   Int[(a + b*x)^m*(c + d*x)^(n - 1), x], x] /; FreeQ[{a, b,
 c, d}, x] && GtQ[n, 0] && NeQ[m + n + 1, 0] &&  !(IGtQ[m, 0] && ( !Integer
Q[n] || (GtQ[m, 0] && LtQ[m - n, 0]))) &&  !ILtQ[m + n + 2, 0] && IntLinear
Q[a, b, c, d, m, n, x]
```

rule 73
```
Int[((a_.) + (b_.)*(x_))^(m_)*((c_.) + (d_.)*(x_))^(n_), x_Symbol] :> With[
{p = Denominator[m]}, Simp[p/b   Subst[Int[x^(p*(m + 1) - 1)*(c - a*(d/b) +
 d*(x^p/b))^n, x], x, (a + b*x)^(1/p)], x]] /; FreeQ[{a, b, c, d}, x] && Lt
Q[-1, m, 0] && LeQ[-1, n, 0] && LeQ[Denominator[n], Denominator[m]] && IntL
inearQ[a, b, c, d, m, n, x]
```

rule 219
```
Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] :> Simp[(1/(Rt[a, 2]*Rt[-b, 2]))*
ArcTanh[Rt[-b, 2]*(x/Rt[a, 2])], x] /; FreeQ[{a, b}, x] && NegQ[a/b] && (Gt
Q[a, 0] || LtQ[b, 0])
```

rule 798
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[1/n  Subst
[Int[x^(Simplify[(m + 1)/n] - 1)*(a + b*x)^p, x], x, x^n], x] /; FreeQ[{a,
b, m, n, p}, x] && IntegerQ[Simplify[(m + 1)/n]]
```

rule 6078
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.), x_Symbol] :> Simp[Csch[d*(a
+ b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*d*p))  Int[1/(x^(b
*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p), x], x] /; FreeQ[{a, b, d, p}, x] &&
  !IntegerQ[p]
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))  Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

### 3.151.4 Maple [A] (verified)

Time = 0.19 (sec) , antiderivative size = 130, normalized size of antiderivative = 1.35

| method | result | size |
|---|---|---|
| risch | $\frac{(c^8x^8+c^4x^4-2)\sqrt{2}}{16x(c^4x^4-1)c^2\sqrt{\frac{c^2x^2}{c^4x^4-1}}}-\frac{3c^2\ln\left(\frac{c^4x^2}{\sqrt{c^4}}+\sqrt{c^4x^4-1}\right)\sqrt{2}x}{16\sqrt{c^4}\sqrt{c^4x^4-1}\sqrt{\frac{c^2x^2}{c^4x^4-1}}}$ | 130 |

input
```
int(1/csch(2*ln(c*x))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/16*(c^8*x^8+c^4*x^4-2)/x/(c^4*x^4-1)*2^(1/2)/c^2/(c^2*x^2/(c^4*x^4-1))^(
1/2)-3/16*c^2*ln(c^4*x^2/(c^4)^(1/2)+(c^4*x^4-1)^(1/2))/(c^4)^(1/2)*2^(1/2
)*x/(c^4*x^4-1)^(1/2)/(c^2*x^2/(c^4*x^4-1))^(1/2)
```

### 3.151.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 106, normalized size of antiderivative = 1.10

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \frac{3\sqrt{2}c^3x^3\log\left(2c^4x^4 - 2\left(c^5x^5 - cx\right)\sqrt{\frac{c^2x^2}{c^4x^4-1}} - 1\right) + 2\sqrt{2}(c^8x^8 + c^4x^4 - 2)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{32\,c^4x^3}$$

input
```
integrate(1/csch(2*log(c*x))^(3/2),x, algorithm="fricas")
```

output
```
1/32*(3*sqrt(2)*c^3*x^3*log(2*c^4*x^4 - 2*(c^5*x^5 - c*x)*sqrt(c^2*x^2/(c^
4*x^4 - 1)) - 1) + 2*sqrt(2)*(c^8*x^8 + c^4*x^4 - 2)*sqrt(c^2*x^2/(c^4*x^4
 - 1)))/(c^4*x^3)
```

### 3.151.6 Sympy [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{1}{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}\,dx$$

input
```
integrate(1/csch(2*ln(c*x))**(3/2),x)
```

output
```
Integral(csch(2*log(c*x))**(-3/2), x)
```

### 3.151.7 Maxima [F]

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{1}{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/csch(2*log(c*x))^(3/2),x, algorithm="maxima")
```

output
```
integrate(csch(2*log(c*x))^(-3/2), x)
```

### 3.151.8 Giac [F(-1)]

Timed out.

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \text{Timed out}$$

input
```
integrate(1/csch(2*log(c*x))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.151.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}\,dx = \int \frac{1}{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}\,dx$$

input
```
int(1/(1/sinh(2*log(c*x)))^(3/2),x)
```

output
```
int(1/(1/sinh(2*log(c*x)))^(3/2), x)
```

# 3.152 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx$

3.152.1 Optimal result . . . . . 1014
3.152.2 Mathematica [A] (verified) . . . . . 1014
3.152.3 Rubi [A] (verified) . . . . . 1015
3.152.4 Maple [A] (verified) . . . . . 1016
3.152.5 Fricas [A] (verification not implemented) . . . . . 1017
3.152.6 Sympy [F] . . . . . 1017
3.152.7 Maxima [F] . . . . . 1018
3.152.8 Giac [F(-1)] . . . . . 1018
3.152.9 Mupad [F(-1)] . . . . . 1018

## 3.152.1 Optimal result

Integrand size = 15, antiderivative size = 67

$$\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = -\cosh(2\log(cx))\sqrt{\text{csch}(2\log(cx))} + \frac{iE\left(\frac{\pi}{4} - i\log(cx)\middle|2\right)}{\sqrt{\text{csch}(2\log(cx))}\sqrt{i\sinh(2\log(cx))}}$$

output
```
-cosh(2*ln(c*x))*csch(2*ln(c*x))^(1/2)+I*(sin(1/4*Pi+I*ln(c*x))^2)^(1/2)/s
in(1/4*Pi+I*ln(c*x))*EllipticE(cos(1/4*Pi+I*ln(c*x)),2^(1/2))/csch(2*ln(c*
x))^(1/2)/(I*sinh(2*ln(c*x)))^(1/2)
```

## 3.152.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 54, normalized size of antiderivative = 0.81

$$\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = \sqrt{\text{csch}(2\log(cx))}\left(-\cosh(2\log(cx)) + E\left(\frac{\pi}{4} - i\log(cx)\middle|2\right)\sqrt{i\sinh(2\log(cx))}\right)$$

input
```
Integrate[Csch[2*Log[c*x]]^(3/2)/x,x]
```

output
```
Sqrt[Csch[2*Log[c*x]]]*(-Cosh[2*Log[c*x]] + EllipticE[Pi/4 - I*Log[c*x], 2
]*Sqrt[I*Sinh[2*Log[c*x]]])
```

### 3.152.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.00, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.467$, Rules used = {3039, 3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx$$

$$\downarrow 3039$$

$$\int \operatorname{csch}^{\frac{3}{2}}(2\log(cx))\,d\log(cx)$$

$$\downarrow 3042$$

$$\int (i\csc(2i\log(cx)))^{3/2}\,d\log(cx)$$

$$\downarrow 4255$$

$$\int \frac{1}{\sqrt{\operatorname{csch}(2\log(cx))}}d\log(cx) - \cosh(2\log(cx))\sqrt{\operatorname{csch}(2\log(cx))}$$

$$\downarrow 3042$$

$$-\cosh(2\log(cx))\sqrt{\operatorname{csch}(2\log(cx))} + \int \frac{1}{\sqrt{i\csc(2i\log(cx))}}d\log(cx)$$

$$\downarrow 4258$$

$$-\cosh(2\log(cx))\sqrt{\operatorname{csch}(2\log(cx))} + \frac{\int \sqrt{i\sinh(2\log(cx))}\,d\log(cx)}{\sqrt{i\sinh(2\log(cx))}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 3042$$

$$-\cosh(2\log(cx))\sqrt{\operatorname{csch}(2\log(cx))} + \frac{\int \sqrt{\sin(2i\log(cx))}\,d\log(cx)}{\sqrt{i\sinh(2\log(cx))}\sqrt{\operatorname{csch}(2\log(cx))}}$$

$$\downarrow 3119$$

$$-\cosh(2\log(cx))\sqrt{\operatorname{csch}(2\log(cx))} + \frac{iE\left(\frac{\pi}{4} - i\log(cx)\middle|\, 2\right)}{\sqrt{i\sinh(2\log(cx))}\sqrt{\operatorname{csch}(2\log(cx))}}$$

input
```
Int[Csch[2*Log[c*x]]^(3/2)/x,x]
```

output
```
-(Cosh[2*Log[c*x]]*Sqrt[Csch[2*Log[c*x]]]) + (I*EllipticE[Pi/4 - I*Log[c*x
], 2])/(Sqrt[Csch[2*Log[c*x]]]*Sqrt[I*Sinh[2*Log[c*x]]])
```

#### 3.152.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.152.4 Maple [A] (verified)

Time = 0.45 (sec) , antiderivative size = 163, normalized size of antiderivative = 2.43

| method | result |
|---|---|
| derivativedivides | $\frac{2\sqrt{1-i\sinh(2\ln(cx))}\,\sqrt{2}\,\sqrt{i\sinh(2\ln(cx))+1}\,\sqrt{i\sinh(2\ln(cx))}\,\text{EllipticE}\left(\sqrt{1-i\sinh(2\ln(cx))},\frac{\sqrt{2}}{2}\right)-\sqrt{1-i\sinh(2\ln(c}}{2\cosh(2\ln(cx))\sqrt{\sinh(2}$ |
| default | $\frac{2\sqrt{1-i\sinh(2\ln(cx))}\,\sqrt{2}\,\sqrt{i\sinh(2\ln(cx))+1}\,\sqrt{i\sinh(2\ln(cx))}\,\text{EllipticE}\left(\sqrt{1-i\sinh(2\ln(cx))},\frac{\sqrt{2}}{2}\right)-\sqrt{1-i\sinh(2\ln(c}}{2\cosh(2\ln(cx))\sqrt{\sinh(2}$ |

input
```
int(csch(2*ln(c*x))^(3/2)/x,x,method=_RETURNVERBOSE)
```

output
```
1/2*(2*(1-I*sinh(2*ln(c*x)))^(1/2)*2^(1/2)*(I*sinh(2*ln(c*x))+1)^(1/2)*(I*
sinh(2*ln(c*x)))^(1/2)*EllipticE((1-I*sinh(2*ln(c*x)))^(1/2),1/2*2^(1/2))-
(1-I*sinh(2*ln(c*x)))^(1/2)*2^(1/2)*(I*sinh(2*ln(c*x))+1)^(1/2)*(I*sinh(2*
ln(c*x)))^(1/2)*EllipticF((1-I*sinh(2*ln(c*x)))^(1/2),1/2*2^(1/2))-2*cosh(
2*ln(c*x))^2)/cosh(2*ln(c*x))/sinh(2*ln(c*x))^(1/2)
```

### 3.152.5 Fricas [A] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.90

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = -\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}c^2x^2 - i\sqrt{2}c^2E(\arcsin(cx)\,|\,-1) + i\sqrt{2}c^2F(\arcsin(cx)\,|\,-1)$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x,x, algorithm="fricas")
```

output
```
-sqrt(2)*sqrt(c^2*x^2/(c^4*x^4 - 1))*c^2*x^2 - I*sqrt(2)*c^2*elliptic_e(ar
csin(c*x), -1) + I*sqrt(2)*c^2*elliptic_f(arcsin(c*x), -1)
```

### 3.152.6 Sympy [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = \int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(3/2)/x,x)
```

output
```
Integral(csch(2*log(c*x))**(3/2)/x, x)
```

### 3.152.7 Maxima [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = \int \frac{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}{x}\,dx$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x,x, algorithm="maxima")
```

output
```
integrate(csch(2*log(c*x))^(3/2)/x, x)
```

### 3.152.8 Giac [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x,x, algorithm="giac")
```

output
```
Timed out
```

### 3.152.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x}\,dx = \int \frac{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}{x}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(3/2)/x,x)
```

output
```
int((1/sinh(2*log(c*x)))^(3/2)/x, x)
```

# 3.153 $\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx$

3.153.1 Optimal result . . . . . 1019
3.153.2 Mathematica [A] (verified) . . . . . 1019
3.153.3 Rubi [A] (verified) . . . . . 1020
3.153.4 Maple [F] . . . . . 1021
3.153.5 Fricas [A] (verification not implemented) . . . . . 1021
3.153.6 Sympy [F] . . . . . 1021
3.153.7 Maxima [B] (verification not implemented) . . . . . 1022
3.153.8 Giac [F(-1)] . . . . . 1022
3.153.9 Mupad [B] (verification not implemented) . . . . . 1022

## 3.153.1 Optimal result

Integrand size = 15, antiderivative size = 27

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx = -\frac{1}{2}\left(c^4-\frac{1}{x^4}\right)x^3\operatorname{csch}^{\frac{3}{2}}(2\log(cx))$$

output
```
-1/2*(c^4-1/x^4)*x^3*csch(2*ln(c*x))^(3/2)
```

## 3.153.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 33, normalized size of antiderivative = 1.22

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx = -\sqrt{2}c^2x\sqrt{\frac{c^2x^2}{-1+c^4x^4}}$$

input
```
Integrate[Csch[2*Log[c*x]]^(3/2)/x^2,x]
```

output
```
-(Sqrt[2]*c^2*x*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)])
```

### 3.153.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.15, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {6086, 6084, 793}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx$$

$$\downarrow 6086$$

$$c\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{c^2x^2}d(cx)$$

$$\downarrow 6084$$

$$c^4x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\int \frac{1}{c^5\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^5}d(cx)$$

$$\downarrow 793$$

$$-\frac{1}{2}c^4x^3\left(1-\frac{1}{c^4x^4}\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))$$

input
```
Int[Csch[2*Log[c*x]]^(3/2)/x^2,x]
```

output
```
-1/2*(c^4*(1 - 1/(c^4*x^4))*x^3*Csch[2*Log[c*x]]^(3/2))
```

#### 3.153.3.1 Defintions of rubi rules used

rule 793
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(a + b*x^n)
^(p + 1)/(b*n*(p + 1)), x] /; FreeQ[{a, b, m, n, p}, x] && EqQ[m, n - 1] &&
 NeQ[p, -1]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.153.4 Maple [F]

$$\int \frac{\operatorname{csch}\left(2\ln\left(cx\right)\right)^{\frac{3}{2}}}{x^2}dx$$

input
```
int(csch(2*ln(c*x))^(3/2)/x^2,x)
```

output
```
int(csch(2*ln(c*x))^(3/2)/x^2,x)
```

### 3.153.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.07

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx = -\sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}c^2x$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^2,x, algorithm="fricas")
```

output
```
-sqrt(2)*sqrt(c^2*x^2/(c^4*x^4 - 1))*c^2*x
```

### 3.153.6 Sympy [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx = \int \frac{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}{x^2}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(3/2)/x**2,x)
```

output
```
Integral(csch(2*log(c*x))**(3/2)/x**2, x)
```

### 3.153.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 87 vs. $2(23) = 46$.

Time = 0.29 (sec) , antiderivative size = 87, normalized size of antiderivative = 3.22

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx$$
$$= -c\left(\frac{\sqrt{2}}{\left(\frac{1}{cx}+1\right)^{\frac{3}{2}}\left(-\frac{1}{cx}+1\right)^{\frac{3}{2}}\left(\frac{1}{c^2x^2}+1\right)^{\frac{3}{2}}} - \frac{\sqrt{2}}{c^4x^4\left(\frac{1}{cx}+1\right)^{\frac{3}{2}}\left(-\frac{1}{cx}+1\right)^{\frac{3}{2}}\left(\frac{1}{c^2x^2}+1\right)^{\frac{3}{2}}}\right)$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^2,x, algorithm="maxima")
```

output
```
-c*(sqrt(2)/((1/(c*x) + 1)^(3/2)*(-1/(c*x) + 1)^(3/2)*(1/(c^2*x^2) + 1)^(3
/2)) - sqrt(2)/(c^4*x^4*(1/(c*x) + 1)^(3/2)*(-1/(c*x) + 1)^(3/2)*(1/(c^2*x
^2) + 1)^(3/2)))
```

### 3.153.8 Giac [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^2,x, algorithm="giac")
```

output
```
Timed out
```

### 3.153.9 Mupad [B] (verification not implemented)

Time = 2.17 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.07

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^2}\,dx = -c^2\,x\sqrt{\frac{2\,c^2\,x^2}{c^4\,x^4-1}}$$

input
```
int((1/sinh(2*log(c*x)))^(3/2)/x^2,x)
```

output
```
-c^2*x*((2*c^2*x^2)/(c^4*x^4 - 1))^(1/2)
```

# 3.154 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx$

3.154.1 Optimal result . . . . . 1023
3.154.2 Mathematica [C] (verified) . . . . . 1023
3.154.3 Rubi [A] (warning: unable to verify) . . . . . 1024
3.154.4 Maple [F] . . . . . 1025
3.154.5 Fricas [A] (verification not implemented) . . . . . 1026
3.154.6 Sympy [F] . . . . . 1026
3.154.7 Maxima [F] . . . . . 1026
3.154.8 Giac [F(-1)] . . . . . 1027
3.154.9 Mupad [F(-1)] . . . . . 1027

## 3.154.1 Optimal result

Integrand size = 15, antiderivative size = 69

$$\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = -\frac{1}{2}\left(c^4-\frac{1}{x^4}\right)x^2\text{csch}^{\frac{3}{2}}(2\log(cx)) + \frac{1}{2}c^5\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\text{csch}^{\frac{3}{2}}(2\log(cx))\,\text{EllipticF}\left(\csc^{-1}(cx),-1\right)$$

output
```
-1/2*(c^4-1/x^4)*x^2*csch(2*ln(c*x))^(3/2)+1/2*c^5*(1-1/c^4/x^4)^(3/2)*x^3
*csch(2*ln(c*x))^(3/2)*EllipticF(1/c/x,I)
```

## 3.154.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 4 in optimal.

Time = 0.09 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.96

$$\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = -\sqrt{2}c^2\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\left(1 + \sqrt{1-c^4x^4}\,\text{Hypergeometric2F1}\left(\frac{1}{4},\frac{1}{2},\frac{5}{4},c^4x^4\right)\right)$$

input
```
Integrate[Csch[2*Log[c*x]]^(3/2)/x^3,x]
```

output
```
-(Sqrt[2]*c^2*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)]*(1 + Sqrt[1 - c^4*x^4]*Hyperg
eometric2F1[1/4, 1/2, 5/4, c^4*x^4]))
```

### 3.154.3 Rubi [A] (warning: unable to verify)

Time = 0.28 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.04, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$, Rules used = {6086, 6084, 858, 817, 762}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx$$

$$\downarrow 6086$$

$$c^2\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{c^3x^3}d(cx)$$

$$\downarrow 6084$$

$$c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\int \frac{1}{c^6\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^6}d(cx)$$

$$\downarrow 858$$

$$-c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\int \frac{c^4x^4}{\left(1-c^4x^4\right)^{3/2}}d\frac{1}{cx}$$

$$\downarrow 817$$

$$-c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\left(\frac{1}{2cx\sqrt{1-c^4x^4}}-\frac{1}{2}\int \frac{1}{\sqrt{1-c^4x^4}}d\frac{1}{cx}\right)$$

$$\downarrow 762$$

$$-c^5x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\left(\frac{1}{2cx\sqrt{1-c^4x^4}}-\frac{1}{2}\operatorname{EllipticF}\left(\arcsin\left(\frac{1}{cx}\right),-1\right)\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))$$

input
```
Int[Csch[2*Log[c*x]]^(3/2)/x^3,x]
```

output
```
-(c^5*(1 - 1/(c^4*x^4))^(3/2)*x^3*Csch[2*Log[c*x]]^(3/2)*(1/(2*c*x*Sqrt[1
- c^4*x^4]) - EllipticF[ArcSin[1/(c*x)], -1]/2))
```

#### 3.154.3.1 Defintions of rubi rules used

rule 762
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^4], x_Symbol] :> Simp[(1/(Sqrt[a]*Rt[-b/a, 4])
)*EllipticF[ArcSin[Rt[-b/a, 4]*x], -1], x] /; FreeQ[{a, b}, x] && NegQ[b/a]
 && GtQ[a, 0]
```

rule 817
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[c^(
n - 1)*(c*x)^(m - n + 1)*((a + b*x^n)^(p + 1)/(b*n*(p + 1))), x] - Simp[c^n
*((m - n + 1)/(b*n*(p + 1)))   Int[(c*x)^(m - n)*(a + b*x^n)^(p + 1), x], x
] /; FreeQ[{a, b, c}, x] && IGtQ[n, 0] && LtQ[p, -1] && GtQ[m + 1, n] &&  !
ILtQ[(m + n*(p + 1) + 1)/n, 0] && IntBinomialQ[a, b, c, n, m, p, x]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.154.4 Maple [F]

$$\int \frac{\operatorname{csch}\left(2\ln\left(cx\right)\right)^{\frac{3}{2}}}{x^3}dx$$

input
```
int(csch(2*ln(c*x))^(3/2)/x^3,x)
```

output
```
int(csch(2*ln(c*x))^(3/2)/x^3,x)
```

### 3.154.5 Fricas [A] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 43, normalized size of antiderivative = 0.62

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = i\sqrt{2}c^2F(\arcsin(cx)\mid -1) - \sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}c^2$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^3,x, algorithm="fricas")
```

output
```
I*sqrt(2)*c^2*elliptic_f(arcsin(c*x), -1) - sqrt(2)*sqrt(c^2*x^2/(c^4*x^4
- 1))*c^2
```

### 3.154.6 Sympy [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = \int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(3/2)/x**3,x)
```

output
```
Integral(csch(2*log(c*x))**(3/2)/x**3, x)
```

### 3.154.7 Maxima [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = \int \frac{\operatorname{csch}(2\log(cx))^{\frac{3}{2}}}{x^3}\,dx$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^3,x, algorithm="maxima")
```

output
```
integrate(csch(2*log(c*x))^(3/2)/x^3, x)
```

### 3.154.8 Giac [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^3,x, algorithm="giac")
```

output
```
Timed out
```

### 3.154.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^3}\,dx = \int \frac{\left(\frac{1}{\sinh(2\,\ln(c\,x))}\right)^{3/2}}{x^3}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(3/2)/x^3,x)
```

output
```
int((1/sinh(2*log(c*x)))^(3/2)/x^3, x)
```

# 3.155 $\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx$

3.155.1 Optimal result . . . . . 1028
3.155.2 Mathematica [C] (verified) . . . . . 1028
3.155.3 Rubi [A] (warning: unable to verify) . . . . . 1029
3.155.4 Maple [F] . . . . . 1031
3.155.5 Fricas [A] (verification not implemented) . . . . . 1031
3.155.6 Sympy [F] . . . . . 1031
3.155.7 Maxima [F] . . . . . 1032
3.155.8 Giac [F(-1)] . . . . . 1032
3.155.9 Mupad [F(-1)] . . . . . 1032

## 3.155.1 Optimal result

Integrand size = 15, antiderivative size = 69

$$\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = -\frac{1}{2}\left(c^4-\frac{1}{x^4}\right)x\text{csch}^{\frac{3}{2}}(2\log(cx)) + \frac{1}{2}c^6\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^3\csc^{-1}\left(c^2x^2\right)\text{csch}^{\frac{3}{2}}(2\log(cx))$$

output
```
-1/2*(c^4-1/x^4)*x*csch(2*ln(c*x))^(3/2)+1/2*c^6*(1-1/c^4/x^4)^(3/2)*x^3*a
rccsc(c^2*x^2)*csch(2*ln(c*x))^(3/2)
```

## 3.155.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 3 in optimal.

Time = 0.08 (sec) , antiderivative size = 53, normalized size of antiderivative = 0.77

$$\int \frac{\text{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = -\frac{\sqrt{2}c^2\sqrt{\frac{c^2x^2}{-1+c^4x^4}}\,\text{Hypergeometric2F1}\left(-\frac{1}{2},1,\frac{1}{2},1-c^4x^4\right)}{x}$$

input
```
Integrate[Csch[2*Log[c*x]]^(3/2)/x^4,x]
```

output
```
-((Sqrt[2]*c^2*Sqrt[(c^2*x^2)/(-1 + c^4*x^4)]*Hypergeometric2F1[-1/2, 1, 1
/2, 1 - c^4*x^4])/x)
```

### 3.155.3 Rubi [A] (warning: unable to verify)

Time = 0.29 (sec) , antiderivative size = 67, normalized size of antiderivative = 0.97, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.400$, Rules used = {6086, 6084, 858, 807, 252, 223}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx$$

$$\downarrow 6086$$

$$c^3\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{c^4x^4}\,d(cx)$$

$$\downarrow 6084$$

$$c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\int \frac{1}{c^7\left(1-\frac{1}{c^4x^4}\right)^{3/2}x^7}\,d(cx)$$

$$\downarrow 858$$

$$-c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\int \frac{c^5x^5}{(1-c^4x^4)^{3/2}}\,d\frac{1}{cx}$$

$$\downarrow 807$$

$$-\frac{1}{2}c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\int \frac{c^2x^2}{(1-c^2x^2)^{3/2}}\,d(c^2x^2)$$

$$\downarrow 252$$

$$-\frac{1}{2}c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\operatorname{csch}^{\frac{3}{2}}(2\log(cx))\left(\frac{c^2x^2}{\sqrt{1-c^2x^2}}-\int \frac{1}{\sqrt{1-c^2x^2}}\,d(c^2x^2)\right)$$

$$\downarrow 223$$

$$-\frac{1}{2}c^6x^3\left(1-\frac{1}{c^4x^4}\right)^{3/2}\left(\frac{c^2x^2}{\sqrt{1-c^2x^2}}-\arcsin\left(c^2x^2\right)\right)\operatorname{csch}^{\frac{3}{2}}(2\log(cx))$$

input
```
Int[Csch[2*Log[c*x]]^(3/2)/x^4,x]
```

output
```
-1/2*(c^6*(1 - 1/(c^4*x^4))^(3/2)*x^3*((c^2*x^2)/Sqrt[1 - c^2*x^2] - ArcSi
n[c^2*x^2])*Csch[2*Log[c*x]]^(3/2))
```

### 3.155.3.1 Defintions of rubi rules used

rule 223
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSin[Rt[-b, 2]*(x/Sqrt
[a])]/Rt[-b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && NegQ[b]
```

rule 252
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[c*(c*x
)^(m - 1)*((a + b*x^2)^(p + 1)/(2*b*(p + 1))), x] - Simp[c^2*((m - 1)/(2*b*
(p + 1)))   Int[(c*x)^(m - 2)*(a + b*x^2)^(p + 1), x], x] /; FreeQ[{a, b, c
}, x] && LtQ[p, -1] && GtQ[m, 1] &&  !ILtQ[(m + 2*p + 3)/2, 0] && IntBinomi
alQ[a, b, c, 2, m, p, x]
```

rule 807
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> With[{k = GCD[m
+ 1, n]}, Simp[1/k   Subst[Int[x^((m + 1)/k - 1)*(a + b*x^(n/k))^p, x], x,
x^k], x] /; k != 1] /; FreeQ[{a, b, p}, x] && IGtQ[n, 0] && IntegerQ[m]
```

rule 858
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a +
b/x^n)^p/x^(m + 2), x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] && Int
egerQ[m]
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

rule 6086
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m
_.), x_Symbol] :> Simp[(e*x)^(m + 1)/(e*n*(c*x^n)^((m + 1)/n))   Subst[Int[
x^((m + 1)/n - 1)*Csch[d*(a + b*Log[x])]^p, x], x, c*x^n], x] /; FreeQ[{a,
b, c, d, e, m, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1])
```

### 3.155.4 Maple [F]

$$\int \frac{\operatorname{csch}\left(2\ln\left(cx\right)\right)^{\frac{3}{2}}}{x^4}dx$$

input
```
int(csch(2*ln(c*x))^(3/2)/x^4,x)
```

output
```
int(csch(2*ln(c*x))^(3/2)/x^4,x)
```

### 3.155.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 78, normalized size of antiderivative = 1.13

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = -\frac{\sqrt{2}c^3 x \arctan\left(\frac{(c^4x^4-1)\sqrt{\frac{c^2x^2}{c^4x^4-1}}}{cx}\right) + \sqrt{2}\sqrt{\frac{c^2x^2}{c^4x^4-1}}c^2}{x}$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^4,x, algorithm="fricas")
```

output
```
-(sqrt(2)*c^3*x*arctan((c^4*x^4 - 1)*sqrt(c^2*x^2/(c^4*x^4 - 1))/(c*x)) +
sqrt(2)*sqrt(c^2*x^2/(c^4*x^4 - 1))*c^2)/x
```

### 3.155.6 Sympy [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = \int \frac{\operatorname{csch}^{\frac{3}{2}}\left(2\log\left(cx\right)\right)}{x^4}\,dx$$

input
```
integrate(csch(2*ln(c*x))**(3/2)/x**4,x)
```

output
```
Integral(csch(2*log(c*x))**(3/2)/x**4, x)
```

### 3.155.7 Maxima [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = \int \frac{\operatorname{csch}\left(2\,\log\left(cx\right)\right)^{\frac{3}{2}}}{x^4}\,dx$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^4,x, algorithm="maxima")
```

output
```
integrate(csch(2*log(c*x))^(3/2)/x^4, x)
```

### 3.155.8 Giac [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = \text{Timed out}$$

input
```
integrate(csch(2*log(c*x))^(3/2)/x^4,x, algorithm="giac")
```

output
```
Timed out
```

### 3.155.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(2\log(cx))}{x^4}\,dx = \int \frac{\left(\frac{1}{\sinh(2\,\ln(cx))}\right)^{3/2}}{x^4}\,dx$$

input
```
int((1/sinh(2*log(c*x)))^(3/2)/x^4,x)
```

output
```
int((1/sinh(2*log(c*x)))^(3/2)/x^4, x)
```

# 3.156 $\int \operatorname{csch}(a + b \log(cx^n))\, dx$

3.156.1 Optimal result . . . . . 1033
3.156.2 Mathematica [A] (verified) . . . . . 1033
3.156.3 Rubi [A] (verified) . . . . . 1034
3.156.4 Maple [F] . . . . . 1035
3.156.5 Fricas [F] . . . . . 1035
3.156.6 Sympy [F] . . . . . 1036
3.156.7 Maxima [F] . . . . . 1036
3.156.8 Giac [F] . . . . . 1036
3.156.9 Mupad [F(-1)] . . . . . 1037

## 3.156.1 Optimal result

Integrand size = 11, antiderivative size = 62

$$\int \operatorname{csch}(a + b \log(cx^n))\, dx = -\frac{2e^a x (cx^n)^b \operatorname{Hypergeometric2F1}\left(1, \frac{b+\frac{1}{n}}{2b}, \frac{1}{2}\left(3 + \frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{1 + bn}$$

output
```
-2*exp(a)*x*(c*x^n)^b*hypergeom([1, 1/2*(b+1/n)/b],[3/2+1/2/b/n],exp(2*a)*
(c*x^n)^(2*b))/(b*n+1)
```

## 3.156.2 Mathematica [A] (verified)

Time = 0.78 (sec) , antiderivative size = 62, normalized size of antiderivative = 1.00

$$\int \operatorname{csch}(a + b \log(cx^n))\, dx = -\frac{2e^a x (cx^n)^b \operatorname{Hypergeometric2F1}\left(1, \frac{1}{2}\left(1 + \frac{1}{bn}\right), \frac{1}{2}\left(3 + \frac{1}{bn}\right), e^{2(a+b\log(cx^n))}\right)}{1 + bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]],x]
```

output
```
(-2*E^a*x*(c*x^n)^b*Hypergeometric2F1[1, (1 + 1/(b*n))/2, (3 + 1/(b*n))/2,
 E^(2*(a + b*Log[c*x^n]))])/(1 + b*n)
```

### 3.156.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 62, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.364$, Rules used = {6080, 6082, 795, 888}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}(a + b\log(cx^n))\,dx$$

$$\downarrow 6080$$

$$\frac{x(cx^n)^{-1/n}\int (cx^n)^{\frac{1}{n}-1}\operatorname{csch}(a + b\log(cx^n))\,d(cx^n)}{n}$$

$$\downarrow 6082$$

$$\frac{2e^{-a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{-b+\frac{1}{n}-1}}{1-e^{-2a}(cx^n)^{-2b}}d(cx^n)}{n}$$

$$\downarrow 795$$

$$\frac{2e^{-a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{b+\frac{1}{n}-1}}{(cx^n)^{2b}-e^{-2a}}d(cx^n)}{n}$$

$$\downarrow 888$$

$$-\frac{2e^{a}x(cx^n)^{b}\operatorname{Hypergeometric2F1}\left(1, \frac{b+\frac{1}{n}}{2b}, \frac{1}{2}\left(3+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{bn+1}$$

input
```
Int[Csch[a + b*Log[c*x^n]],x]
```

output
```
(-2*E^a*x*(c*x^n)^b*Hypergeometric2F1[1, (b + n^(-1))/(2*b), (3 + 1/(b*n))
/2, E^(2*a)*(c*x^n)^(2*b)])/(1 + b*n)
```

#### 3.156.3.1 Defintions of rubi rules used

rule 795
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int[x^(m + n*p)*
(b + a/x^n)^p, x] /; FreeQ[{a, b, m, n}, x] && IntegerQ[p] && NegQ[n]
```

rule 888
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[a^p
*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/n, (m + 1)/n + 1
, (-b)*(x^n/a)], x] /; FreeQ[{a, b, c, m, n, p}, x] &&  !IGtQ[p, 0] && (ILt
Q[p, 0] || GtQ[a, 0])
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6082
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[2^p/E^(a*d*p)   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b
*d)))^p)), x], x] /; FreeQ[{a, b, d, e, m}, x] && IntegerQ[p]
```

### 3.156.4 Maple [F]

$$\int \operatorname{csch}\left(a+b\ln\left(c\,x^{n}\right)\right)dx$$

input
```
int(csch(a+b*ln(c*x^n)),x)
```

output
```
int(csch(a+b*ln(c*x^n)),x)
```

### 3.156.5 Fricas [F]

$$\int \operatorname{csch}(a+b\log\left(cx^{n}\right))\,dx=\int \operatorname{csch}\left(b\log\left(cx^{n}\right)+a\right)\,dx$$

input
```
integrate(csch(a+b*log(c*x^n)),x, algorithm="fricas")
```

output
```
integral(csch(b*log(c*x^n) + a), x)
```

### 3.156.6 Sympy [F]

$$\int \operatorname{csch}(a + b \log(cx^n))\, dx = \int \operatorname{csch}(a + b \log(cx^n))\, dx$$

input
```
integrate(csch(a+b*ln(c*x**n)),x)
```

output
```
Integral(csch(a + b*log(c*x**n)), x)
```

### 3.156.7 Maxima [F]

$$\int \operatorname{csch}(a + b \log(cx^n))\, dx = \int \operatorname{csch}(b \log(cx^n) + a)\, dx$$

input
```
integrate(csch(a+b*log(c*x^n)),x, algorithm="maxima")
```

output
```
integrate(csch(b*log(c*x^n) + a), x)
```

### 3.156.8 Giac [F]

$$\int \operatorname{csch}(a + b \log(cx^n))\, dx = \int \operatorname{csch}(b \log(cx^n) + a)\, dx$$

input
```
integrate(csch(a+b*log(c*x^n)),x, algorithm="giac")
```

output
```
integrate(csch(b*log(c*x^n) + a), x)
```

### 3.156.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}(a + b \log(cx^n))\, dx = \int \frac{1}{\sinh(a + b \ln(c\, x^n))}\, dx$$

input
```
int(1/sinh(a + b*log(c*x^n)),x)
```

output
```
int(1/sinh(a + b*log(c*x^n)), x)
```

# 3.157 $\int \operatorname{csch}^2(a + b\log(cx^n))\,dx$

3.157.1 Optimal result . . . . . 1038
3.157.2 Mathematica [A] (verified) . . . . . 1038
3.157.3 Rubi [A] (verified) . . . . . 1039
3.157.4 Maple [F] . . . . . 1040
3.157.5 Fricas [F] . . . . . 1040
3.157.6 Sympy [F] . . . . . 1041
3.157.7 Maxima [F] . . . . . 1041
3.157.8 Giac [F] . . . . . 1041
3.157.9 Mupad [F(-1)] . . . . . 1042

## 3.157.1 Optimal result

Integrand size = 13, antiderivative size = 68

$$\int \operatorname{csch}^2(a + b\log(cx^n))\,dx = \frac{4e^{2a}x(cx^n)^{2b}\,\text{Hypergeometric2F1}\left(2, \frac{1}{2}\left(2+\frac{1}{bn}\right), \frac{1}{2}\left(4+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{1+2bn}$$

output
```
4*exp(2*a)*x*(c*x^n)^(2*b)*hypergeom([2, 1+1/2/b/n],[2+1/2/b/n],exp(2*a)*(
c*x^n)^(2*b))/(2*b*n+1)
```

## 3.157.2 Mathematica [A] (verified)

Time = 2.86 (sec) , antiderivative size = 126, normalized size of antiderivative = 1.85

$$\int \operatorname{csch}^2(a + b\log(cx^n))\,dx = \frac{x\left(-\coth(a+b\log(cx^n)) - \frac{e^{2a}(cx^n)^{2b}\,\text{Hypergeometric2F1}\left(1,1+\frac{1}{2bn},2+\frac{1}{2bn},e^{2(a+b\log(cx^n))}\right)}{1+2bn} - \text{Hypergeometric2F1}\left(1,\right.\right.}{bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^2,x]
```

output
```
(x*(-Coth[a + b*Log[c*x^n]] - (E^(2*a)*(c*x^n)^(2*b)*Hypergeometric2F1[1,
1 + 1/(2*b*n), 2 + 1/(2*b*n), E^(2*(a + b*Log[c*x^n]))])/(1 + 2*b*n) - Hyp
ergeometric2F1[1, 1/(2*b*n), 1 + 1/(2*b*n), E^(2*(a + b*Log[c*x^n]))]))/(b
*n)
```

### 3.157.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 68, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.308$, Rules used = {6080, 6082, 795, 888}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^2(a + b\log(cx^n))\,dx$$

$$\downarrow 6080$$

$$\frac{x(cx^n)^{-1/n}\int (cx^n)^{\frac{1}{n}-1}\operatorname{csch}^2(a + b\log(cx^n))\,d(cx^n)}{n}$$

$$\downarrow 6082$$

$$\frac{4e^{-2a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{-2b+\frac{1}{n}-1}}{\left(1-e^{-2a}(cx^n)^{-2b}\right)^2}d(cx^n)}{n}$$

$$\downarrow 795$$

$$\frac{4e^{-2a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{2b+\frac{1}{n}-1}}{\left((cx^n)^{2b}-e^{-2a}\right)^2}d(cx^n)}{n}$$

$$\downarrow 888$$

$$\frac{4e^{2a}x(cx^n)^{2b}\operatorname{Hypergeometric2F1}\left(2, \frac{1}{2}\left(2+\frac{1}{bn}\right), \frac{1}{2}\left(4+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{2bn+1}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^2,x]
```

output
```
(4*E^(2*a)*x*(c*x^n)^(2*b)*Hypergeometric2F1[2, (2 + 1/(b*n))/2, (4 + 1/(b
*n))/2, E^(2*a)*(c*x^n)^(2*b)])/(1 + 2*b*n)
```

#### 3.157.3.1 Defintions of rubi rules used

rule 795
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int[x^(m + n*p)*
(b + a/x^n)^p, x] /; FreeQ[{a, b, m, n}, x] && IntegerQ[p] && NegQ[n]
```

rule 888
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[a^p
*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/n, (m + 1)/n + 1
, (-b)*(x^n/a)], x] /; FreeQ[{a, b, c, m, n, p}, x] &&  !IGtQ[p, 0] && (ILt
Q[p, 0] || GtQ[a, 0])
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6082
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[2^p/E^(a*d*p)   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b
*d)))^p)), x], x] /; FreeQ[{a, b, d, e, m}, x] && IntegerQ[p]
```

### 3.157.4 Maple [F]

$$\int \operatorname{csch}\left(a+b\ln\left(c\,x^{n}\right)\right)^{2}dx$$

input
```
int(csch(a+b*ln(c*x^n))^2,x)
```

output
```
int(csch(a+b*ln(c*x^n))^2,x)
```

### 3.157.5 Fricas [F]

$$\int \operatorname{csch}^{2}(a+b\log\left(cx^{n}\right))\,dx = \int \operatorname{csch}\left(b\log\left(cx^{n}\right)+a\right)^{2}\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^2,x, algorithm="fricas")
```

output
```
integral(csch(b*log(c*x^n) + a)^2, x)
```

### 3.157.6 Sympy [F]

$$\int \operatorname{csch}^2(a + b\log(cx^n))\, dx = \int \operatorname{csch}^2(a + b\log(cx^n))\, dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**2,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**2, x)
```

### 3.157.7 Maxima [F]

$$\int \operatorname{csch}^2(a + b\log(cx^n))\, dx = \int \operatorname{csch}(b\log(cx^n) + a)^2\, dx$$

input
```
integrate(csch(a+b*log(c*x^n))^2,x, algorithm="maxima")
```

output
```
-2*x/(b*c^(2*b)*n*e^(2*b*log(x^n) + 2*a) - b*n) - 4*integrate(1/4/(b*c^b*n
*e^(b*log(x^n) + a) + b*n), x) + 4*integrate(1/4/(b*c^b*n*e^(b*log(x^n) +
a) - b*n), x)
```

### 3.157.8 Giac [F]

$$\int \operatorname{csch}^2(a + b\log(cx^n))\, dx = \int \operatorname{csch}(b\log(cx^n) + a)^2\, dx$$

input
```
integrate(csch(a+b*log(c*x^n))^2,x, algorithm="giac")
```

output
```
integrate(csch(b*log(c*x^n) + a)^2, x)
```

### 3.157.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^2(a + b\log(cx^n))\,dx = \int \frac{1}{\sinh(a + b\,\ln(c\,x^n))^2}\,dx$$

input
```
int(1/sinh(a + b*log(c*x^n))^2,x)
```

output
```
int(1/sinh(a + b*log(c*x^n))^2, x)
```

# 3.158 $\int \operatorname{csch}^3(a + b\log(cx^n))\,dx$

3.158.1 Optimal result . . . . . 1043
3.158.2 Mathematica [A] (verified) . . . . . 1043
3.158.3 Rubi [A] (verified) . . . . . 1044
3.158.4 Maple [F] . . . . . 1045
3.158.5 Fricas [F] . . . . . 1045
3.158.6 Sympy [F] . . . . . 1046
3.158.7 Maxima [F] . . . . . 1046
3.158.8 Giac [F] . . . . . 1046
3.158.9 Mupad [F(-1)] . . . . . 1047

## 3.158.1 Optimal result

Integrand size = 13, antiderivative size = 69

$$\int \operatorname{csch}^3(a + b\log(cx^n))\,dx = -\frac{8e^{3a}x(cx^n)^{3b}\,\text{Hypergeometric2F1}\left(3, \frac{3b+\frac{1}{n}}{2b}, \frac{1}{2}\left(5+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{1+3bn}$$

output
```
-8*exp(3*a)*x*(c*x^n)^(3*b)*hypergeom([3, 1/2*(3*b+1/n)/b],[5/2+1/2/b/n],e
xp(2*a)*(c*x^n)^(2*b))/(3*b*n+1)
```

## 3.158.2 Mathematica [A] (verified)

Time = 4.01 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.46

$$\int \operatorname{csch}^3(a + b\log(cx^n))\,dx = \frac{-4x(1+bn\coth(a+b\log(cx^n)))\operatorname{csch}(a+b\log(cx^n)) + 8e^a(-1+bn)x(cx^n)^b\,\text{Hypergeometric2F1}\left(1, \frac{1}{2}\right.}{8b^2n^2}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^3,x]
```

output
```
(-4*x*(1 + b*n*Coth[a + b*Log[c*x^n]])*Csch[a + b*Log[c*x^n]] + 8*E^a*(-1
+ b*n)*x*(c*x^n)^b*Hypergeometric2F1[1, (1 + 1/(b*n))/2, (3 + 1/(b*n))/2,
E^(2*(a + b*Log[c*x^n]))])/(8*b^2*n^2)
```

### 3.158.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 69, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.308$, Rules used = {6080, 6082, 795, 888}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^3(a + b\log(cx^n))\,dx$$

$$\downarrow 6080$$

$$\frac{x(cx^n)^{-1/n}\int (cx^n)^{\frac{1}{n}-1}\operatorname{csch}^3(a + b\log(cx^n))\,d(cx^n)}{n}$$

$$\downarrow 6082$$

$$\frac{8e^{-3a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{-3b+\frac{1}{n}-1}}{\left(1-e^{-2a}(cx^n)^{-2b}\right)^3}d(cx^n)}{n}$$

$$\downarrow 795$$

$$\frac{8e^{-3a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{3b+\frac{1}{n}-1}}{\left((cx^n)^{2b}-e^{-2a}\right)^3}d(cx^n)}{n}$$

$$\downarrow 888$$

$$-\frac{8e^{3a}x(cx^n)^{3b}\operatorname{Hypergeometric2F1}\left(3, \frac{3b+\frac{1}{n}}{2b}, \frac{1}{2}\left(5+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{3bn+1}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^3,x]
```

output
```
(-8*E^(3*a)*x*(c*x^n)^(3*b)*Hypergeometric2F1[3, (3*b + n^(-1))/(2*b), (5
+ 1/(b*n))/2, E^(2*a)*(c*x^n)^(2*b)])/(1 + 3*b*n)
```

#### 3.158.3.1 Defintions of rubi rules used

rule 795
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int[x^(m + n*p)*
(b + a/x^n)^p, x] /; FreeQ[{a, b, m, n}, x] && IntegerQ[p] && NegQ[n]
```

rule 888
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[a^p
*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/n, (m + 1)/n + 1
, (-b)*(x^n/a)], x] /; FreeQ[{a, b, c, m, n, p}, x] &&  !IGtQ[p, 0] && (ILt
Q[p, 0] || GtQ[a, 0])
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6082
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[2^p/E^(a*d*p)   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b
*d)))^p)), x], x] /; FreeQ[{a, b, d, e, m}, x] && IntegerQ[p]
```

### 3.158.4 Maple [F]

$$\int \operatorname{csch}\left(a+b\ln\left(c\,x^{n}\right)\right)^{3}dx$$

input
```
int(csch(a+b*ln(c*x^n))^3,x)
```

output
```
int(csch(a+b*ln(c*x^n))^3,x)
```

### 3.158.5 Fricas [F]

$$\int \operatorname{csch}^{3}(a+b\log\left(cx^{n}\right))\,dx = \int \operatorname{csch}\left(b\log\left(cx^{n}\right)+a\right)^{3}\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^3,x, algorithm="fricas")
```

output
```
integral(csch(b*log(c*x^n) + a)^3, x)
```

### 3.158.6 Sympy [F]

$$\int \operatorname{csch}^3(a+b\log(cx^n))\,dx = \int \operatorname{csch}^3(a+b\log(cx^n))\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**3,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**3, x)
```

### 3.158.7 Maxima [F]

$$\int \operatorname{csch}^3(a+b\log(cx^n))\,dx = \int \operatorname{csch}(b\log(cx^n)+a)^3\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^3,x, algorithm="maxima")
```

output
```
-8*(b^2*n^2 - 1)*integrate(1/16/(b^2*c^b*n^2*e^(b*log(x^n) + a) + b^2*n^2)
, x) - 8*(b^2*n^2 - 1)*integrate(1/16/(b^2*c^b*n^2*e^(b*log(x^n) + a) - b^
2*n^2), x) - ((b*c^(3*b)*n + c^(3*b))*x*e^(3*b*log(x^n) + 3*a) + (b*c^b*n
- c^b)*x*e^(b*log(x^n) + a))/(b^2*c^(4*b)*n^2*e^(4*b*log(x^n) + 4*a) - 2*b
^2*c^(2*b)*n^2*e^(2*b*log(x^n) + 2*a) + b^2*n^2)
```

### 3.158.8 Giac [F]

$$\int \operatorname{csch}^3(a+b\log(cx^n))\,dx = \int \operatorname{csch}(b\log(cx^n)+a)^3\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^3,x, algorithm="giac")
```

output
```
integrate(csch(b*log(c*x^n) + a)^3, x)
```

### 3.158.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^3(a + b\log(cx^n))\,dx = \int \frac{1}{\sinh(a + b\,\ln(c\,x^n))^3}\,dx$$

input
```
int(1/sinh(a + b*log(c*x^n))^3,x)
```

output
```
int(1/sinh(a + b*log(c*x^n))^3, x)
```

# 3.159 $\int \operatorname{csch}^4(a + b\log(cx^n))\,dx$

3.159.1 Optimal result . . . . . 1048
3.159.2 Mathematica [B] (verified) . . . . . 1048
3.159.3 Rubi [A] (verified) . . . . . 1049
3.159.4 Maple [F] . . . . . 1050
3.159.5 Fricas [F] . . . . . 1051
3.159.6 Sympy [F] . . . . . 1051
3.159.7 Maxima [F] . . . . . 1051
3.159.8 Giac [F] . . . . . 1052
3.159.9 Mupad [F(-1)] . . . . . 1052

## 3.159.1 Optimal result

Integrand size = 13, antiderivative size = 68

$$\int \operatorname{csch}^4(a + b\log(cx^n))\,dx = \frac{16e^{4a}x(cx^n)^{4b}\,\text{Hypergeometric2F1}\left(4, \frac{1}{2}\left(4+\frac{1}{bn}\right), \frac{1}{2}\left(6+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{1+4bn}$$

output
```
16*exp(4*a)*x*(c*x^n)^(4*b)*hypergeom([4, 2+1/2/b/n],[3+1/2/b/n],exp(2*a)*
(c*x^n)^(2*b))/(4*b*n+1)
```

## 3.159.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 200 vs. 2(68) = 136.

Time = 5.65 (sec) , antiderivative size = 200, normalized size of antiderivative = 2.94

$$\int \operatorname{csch}^4(a + b\log(cx^n))\,dx = \frac{x\left(4e^{2a}(-1+2bn)(cx^n)^{2b}\,\text{Hypergeometric2F1}\left(1, 1+\frac{1}{2bn}, 2+\frac{1}{2bn}, e^{2(a+b\log(cx^n))}\right) + 4(-1+4b^2n^2)\,\text{Hyperg}\right.}{}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^4,x]
```

output
```
(x*(4*E^(2*a)*(-1 + 2*b*n)*(c*x^n)^(2*b)*Hypergeometric2F1[1, 1 + 1/(2*b*n
), 2 + 1/(2*b*n), E^(2*(a + b*Log[c*x^n]))] + 4*(-1 + 4*b^2*n^2)*Hypergeom
etric2F1[1, 1/(2*b*n), 1 + 1/(2*b*n), E^(2*(a + b*Log[c*x^n]))] + Csch[a +
 b*Log[c*x^n]]^3*((1 - 12*b^2*n^2)*Cosh[a + b*Log[c*x^n]] + (-1 + 4*b^2*n^
2)*Cosh[3*(a + b*Log[c*x^n])] - 4*b*n*Sinh[a + b*Log[c*x^n]])))/(24*b^3*n^
3)
```

### 3.159.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 68, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.308$, Rules used = {6080, 6082, 795, 888}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^4(a + b\log(cx^n))\,dx$$

$$\downarrow 6080$$

$$\frac{x(cx^n)^{-1/n}\int (cx^n)^{\frac{1}{n}-1}\operatorname{csch}^4(a + b\log(cx^n))\,d(cx^n)}{n}$$

$$\downarrow 6082$$

$$\frac{16e^{-4a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{-4b+\frac{1}{n}-1}}{\left(1-e^{-2a}(cx^n)^{-2b}\right)^4}d(cx^n)}{n}$$

$$\downarrow 795$$

$$\frac{16e^{-4a}x(cx^n)^{-1/n}\int \frac{(cx^n)^{4b+\frac{1}{n}-1}}{\left((cx^n)^{2b}-e^{-2a}\right)^4}d(cx^n)}{n}$$

$$\downarrow 888$$

$$\frac{16e^{4a}x(cx^n)^{4b}\operatorname{Hypergeometric2F1}\left(4, \frac{1}{2}\left(4+\frac{1}{bn}\right), \frac{1}{2}\left(6+\frac{1}{bn}\right), e^{2a}(cx^n)^{2b}\right)}{4bn+1}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^4,x]
```

output
```
(16*E^(4*a)*x*(c*x^n)^(4*b)*Hypergeometric2F1[4, (4 + 1/(b*n))/2, (6 + 1/(
b*n))/2, E^(2*a)*(c*x^n)^(2*b)])/(1 + 4*b*n)
```

#### 3.159.3.1 Defintions of rubi rules used

rule 795
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int[x^(m + n*p)*
(b + a/x^n)^p, x] /; FreeQ[{a, b, m, n}, x] && IntegerQ[p] && NegQ[n]
```

rule 888
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[a^p
*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/n, (m + 1)/n + 1
, (-b)*(x^n/a)], x] /; FreeQ[{a, b, c, m, n, p}, x] &&  !IGtQ[p, 0] && (ILt
Q[p, 0] || GtQ[a, 0])
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6082
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[2^p/E^(a*d*p)   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b
*d)))^p)), x], x] /; FreeQ[{a, b, d, e, m}, x] && IntegerQ[p]
```

### 3.159.4 Maple [F]

$$\int \operatorname{csch}\left(a+b\ln\left(c\,x^{n}\right)\right)^{4}dx$$

input
```
int(csch(a+b*ln(c*x^n))^4,x)
```

output
```
int(csch(a+b*ln(c*x^n))^4,x)
```

### 3.159.5 Fricas [F]

$$\int \operatorname{csch}^4(a + b\log(cx^n))\, dx = \int \operatorname{csch}(b\log(cx^n) + a)^4\, dx$$

input
```
integrate(csch(a+b*log(c*x^n))^4,x, algorithm="fricas")
```

output
```
integral(csch(b*log(c*x^n) + a)^4, x)
```

### 3.159.6 Sympy [F]

$$\int \operatorname{csch}^4(a + b\log(cx^n))\, dx = \int \operatorname{csch}^4(a + b\log(cx^n))\, dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**4,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**4, x)
```

### 3.159.7 Maxima [F]

$$\int \operatorname{csch}^4(a + b\log(cx^n))\, dx = \int \operatorname{csch}(b\log(cx^n) + a)^4\, dx$$

input
```
integrate(csch(a+b*log(c*x^n))^4,x, algorithm="maxima")
```

output
```
16*(4*b^2*n^2 - 1)*integrate(1/96/(b^3*c^b*n^3*e^(b*log(x^n) + a) + b^3*n^
3), x) - 16*(4*b^2*n^2 - 1)*integrate(1/96/(b^3*c^b*n^3*e^(b*log(x^n) + a)
 - b^3*n^3), x) - 1/3*((2*b*c^(4*b)*n + c^(4*b))*x*e^(4*b*log(x^n) + 4*a)
+ 2*(6*b^2*c^(2*b)*n^2 - b*c^(2*b)*n - c^(2*b))*x*e^(2*b*log(x^n) + 2*a) -
 (4*b^2*n^2 - 1)*x)/(b^3*c^(6*b)*n^3*e^(6*b*log(x^n) + 6*a) - 3*b^3*c^(4*b
)*n^3*e^(4*b*log(x^n) + 4*a) + 3*b^3*c^(2*b)*n^3*e^(2*b*log(x^n) + 2*a) -
b^3*n^3)
```

### 3.159.8 Giac [F]

$$\int \operatorname{csch}^4(a + b\log(cx^n))\,dx = \int \operatorname{csch}(b\log(cx^n) + a)^4\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^4,x, algorithm="giac")
```

output
```
integrate(csch(b*log(c*x^n) + a)^4, x)
```

### 3.159.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^4(a + b\log(cx^n))\,dx = \int \frac{1}{\sinh(a + b\,\ln(c\,x^n))^4}\,dx$$

input
```
int(1/sinh(a + b*log(c*x^n))^4,x)
```

output
```
int(1/sinh(a + b*log(c*x^n))^4, x)
```

# 3.160 $\int \left(-((1-b^2n^2)\,\mathbf{csch}(a+b\log(cx^n))) + 2b^2n^2\mathbf{csch}\right.$

3.160.1 Optimal result . . . . . 1053
3.160.2 Mathematica [A] (verified) . . . . . 1053
3.160.3 Rubi [C] (verified) . . . . . 1054
3.160.4 Maple [A] (verified) . . . . . 1055
3.160.5 Fricas [B] (verification not implemented) . . . . . 1055
3.160.6 Sympy [F] . . . . . 1056
3.160.7 Maxima [B] (verification not implemented) . . . . . 1056
3.160.8 Giac [B] (verification not implemented) . . . . . 1057
3.160.9 Mupad [B] (verification not implemented) . . . . . 1057

## 3.160.1 Optimal result

Integrand size = 45, antiderivative size = 42

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log(cx^n))\right) + 2b^2n^2\operatorname{csch}^3(a+b\log(cx^n))\right)\,dx$$
$$= -x\operatorname{csch}(a+b\log(cx^n)) - bnx\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))$$

output
```
-x*csch(a+b*ln(c*x^n))-b*n*x*coth(a+b*ln(c*x^n))*csch(a+b*ln(c*x^n))
```

## 3.160.2 Mathematica [A] (verified)

Time = 0.30 (sec) , antiderivative size = 30, normalized size of antiderivative = 0.71

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log(cx^n))\right) + 2b^2n^2\operatorname{csch}^3(a+b\log(cx^n))\right)\,dx$$
$$= -x(1+bn\coth(a+b\log(cx^n)))\operatorname{csch}(a+b\log(cx^n))$$

input
```
Integrate[-((1 - b^2*n^2)*Csch[a + b*Log[c*x^n]]) + 2*b^2*n^2*Csch[a + b*L
og[c*x^n]]^3,x]
```

output
```
-(x*(1 + b*n*Coth[a + b*Log[c*x^n]])*Csch[a + b*Log[c*x^n]])
```

### 3.160.3 Rubi [C] (verified)

Result contains higher order function than in optimal. Order 5 vs. order 3 in optimal.

Time = 0.34 (sec) , antiderivative size = 137, normalized size of antiderivative = 3.26, number of steps used = 1, number of rules used = 1, $\frac{\text{number of rules}}{\text{integrand size}} = 0.022$, Rules used = {2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(2b^2n^2\operatorname{csch}^3(a+b\log\left(cx^n\right)) - \left(1-b^2n^2\right)\operatorname{csch}(a+b\log\left(cx^n\right))\right)\,dx$$

$$\downarrow \text{2009}$$

$$2e^a x(1-bn)\left(cx^n\right)^b \operatorname{Hypergeometric2F1}\left(1, \frac{b+\frac{1}{n}}{2b}, \frac{1}{2}\left(3+\frac{1}{bn}\right), e^{2a}\left(cx^n\right)^{2b}\right) - \frac{16e^{3a}b^2n^2x\left(cx^n\right)^{3b}\operatorname{Hypergeometric2F1}\left(3, \frac{3b+\frac{1}{n}}{2b}, \frac{1}{2}\left(5+\frac{1}{bn}\right), e^{2a}\left(cx^n\right)^{2b}\right)}{3bn+1}$$

input
```
Int[-((1 - b^2*n^2)*Csch[a + b*Log[c*x^n]]) + 2*b^2*n^2*Csch[a + b*Log[c*x
^n]]^3,x]
```

output
```
2*E^a*(1 - b*n)*x*(c*x^n)^b*Hypergeometric2F1[1, (b + n^(-1))/(2*b), (3 +
1/(b*n))/2, E^(2*a)*(c*x^n)^(2*b)] - (16*b^2*E^(3*a)*n^2*x*(c*x^n)^(3*b)*H
ypergeometric2F1[3, (3*b + n^(-1))/(2*b), (5 + 1/(b*n))/2, E^(2*a)*(c*x^n)
^(2*b)])/(1 + 3*b*n)
```

### 3.160.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

## 3.160.4 Maple [A] (verified)

Time = 21.34 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.95

| method | result |
|---|---|
| parallelrisch | $\frac{x\left(\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^4 bn+2\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^3-bn-2\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)\right)}{4\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^2}$ |
| risch | $-\frac{2c^b(x^n)^b x\left(nb(x^n)^{2b}c^{2b}e^{3a}e^{\frac{3ib\pi\ \mathrm{csgn}\left(ix^n\right)}{2}\mathrm{csgn}\left(icx^n\right)^2}e^{-\frac{3ib\pi\ \mathrm{csgn}\left(ix^n\right)\mathrm{csgn}\left(icx^n\right)\mathrm{csgn}(ic)}{2}}e^{-\frac{3ib\pi\,\mathrm{csgn}\left(icx^n\right)^3}{2}}e^{\frac{3ib\pi\,\mathrm{csgn}\left(icx^n\right)}{2}}$ |

input
```
int(-(-b^2*n^2+1)*csch(a+b*ln(c*x^n))+2*b^2*n^2*csch(a+b*ln(c*x^n))^3,x,me
thod=_RETURNVERBOSE)
```

output
```
1/4*x*(tanh(1/2*a+b*ln((c*x^n)^(1/2)))^4*b*n+2*tanh(1/2*a+b*ln((c*x^n)^(1/
2)))^3-b*n-2*tanh(1/2*a+b*ln((c*x^n)^(1/2))))/tanh(1/2*a+b*ln((c*x^n)^(1/2
)))^2
```

## 3.160.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 187 vs. 2(42) = 84.

Time = 0.25 (sec) , antiderivative size = 187, normalized size of antiderivative = 4.45

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log\left(cx^n\right)\right)\right)+2b^2n^2\operatorname{csch}^3(a+b\log\left(cx^n\right))\right)\,dx =$$

$$-\frac{2\left((bn+1)x\cosh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)^2+2\left(bn+1\right)x\cosh\left(bn\log\right.}{\cosh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)^3+3\,\cosh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)\sinh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)^2+}$$

input
```
integrate(-(-b^2*n^2+1)*csch(a+b*log(c*x^n))+2*b^2*n^2*csch(a+b*log(c*x^n)
)^3,x, algorithm="fricas")
```

output
```
-2*((b*n + 1)*x*cosh(b*n*log(x) + b*log(c) + a)^2 + 2*(b*n + 1)*x*cosh(b*n
*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a) + (b*n + 1)*x*sinh
(b*n*log(x) + b*log(c) + a)^2 + (b*n - 1)*x)/(cosh(b*n*log(x) + b*log(c) +
 a)^3 + 3*cosh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a)^
2 + sinh(b*n*log(x) + b*log(c) + a)^3 + 3*(cosh(b*n*log(x) + b*log(c) + a)
^2 - 1)*sinh(b*n*log(x) + b*log(c) + a) - cosh(b*n*log(x) + b*log(c) + a))
```

### 3.160.6 Sympy [F]

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log\left(cx^n\right)\right)\right)+2b^2n^2\operatorname{csch}^3(a+b\log\left(cx^n\right))\right)\,dx$$
$$=\int \left(2b^2n^2\operatorname{csch}^2\left(a+b\log\left(cx^n\right)\right)+b^2n^2-1\right)\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)dx$$

input
```
integrate(-(-b**2*n**2+1)*csch(a+b*ln(c*x**n))+2*b**2*n**2*csch(a+b*ln(c*x
**n))**3,x)
```

output
```
Integral((2*b**2*n**2*csch(a + b*log(c*x**n))**2 + b**2*n**2 - 1)*csch(a +
 b*log(c*x**n)), x)
```

### 3.160.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 95 vs. $2(42) = 84$.

Time $= 0.39$ (sec) , antiderivative size $= 95$, normalized size of antiderivative $= 2.26$

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log\left(cx^n\right)\right)\right)+2b^2n^2\operatorname{csch}^3(a+b\log\left(cx^n\right))\right)\,dx$$
$$=-\frac{2\left(\left(bc^{3\,b}n+c^{3\,b}\right)xe^{(3\,b\log(x^n)+3\,a)}+\left(bc^bn-c^b\right)xe^{(b\log(x^n)+a)}\right)}{c^{4\,b}e^{(4\,b\log(x^n)+4\,a)}-2\,c^{2\,b}e^{(2\,b\log(x^n)+2\,a)}+1}$$

input
```
integrate(-(-b^2*n^2+1)*csch(a+b*log(c*x^n))+2*b^2*n^2*csch(a+b*log(c*x^n)
)^3,x, algorithm="maxima")
```

output
```
-2*((b*c^(3*b)*n + c^(3*b))*x*e^(3*b*log(x^n) + 3*a) + (b*c^b*n - c^b)*x*e
^(b*log(x^n) + a))/(c^(4*b)*e^(4*b*log(x^n) + 4*a) - 2*c^(2*b)*e^(2*b*log(
x^n) + 2*a) + 1)
```

### 3.160.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 215 vs. $2(42) = 84$.

Time = 0.49 (sec) , antiderivative size = 215, normalized size of antiderivative = 5.12

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log\left(cx^n\right)\right)\right)+2b^2n^2\operatorname{csch}^3(a+b\log\left(cx^n\right))\right)\,dx$$
$$=-\frac{2\,bc^{3\,b}nxx^{3\,bn}e^{(3\,a)}}{c^{4\,b}x^{4\,bn}e^{(4\,a)}-2\,c^{2\,b}x^{2\,bn}e^{(2\,a)}+1}-\frac{2\,bc^{b}nxx^{bn}e^{a}}{c^{4\,b}x^{4\,bn}e^{(4\,a)}-2\,c^{2\,b}x^{2\,bn}e^{(2\,a)}+1}$$
$$-\frac{2\,c^{3\,b}xx^{3\,bn}e^{(3\,a)}}{c^{4\,b}x^{4\,bn}e^{(4\,a)}-2\,c^{2\,b}x^{2\,bn}e^{(2\,a)}+1}+\frac{2\,c^{b}xx^{bn}e^{a}}{c^{4\,b}x^{4\,bn}e^{(4\,a)}-2\,c^{2\,b}x^{2\,bn}e^{(2\,a)}+1}$$

input
```
integrate(-(-b^2*n^2+1)*csch(a+b*log(c*x^n))+2*b^2*n^2*csch(a+b*log(c*x^n)
)^3,x, algorithm="giac")
```

output
```
-2*b*c^(3*b)*n*x*x^(3*b*n)*e^(3*a)/(c^(4*b)*x^(4*b*n)*e^(4*a) - 2*c^(2*b)*
x^(2*b*n)*e^(2*a) + 1) - 2*b*c^b*n*x*x^(b*n)*e^a/(c^(4*b)*x^(4*b*n)*e^(4*a
) - 2*c^(2*b)*x^(2*b*n)*e^(2*a) + 1) - 2*c^(3*b)*x*x^(3*b*n)*e^(3*a)/(c^(4
*b)*x^(4*b*n)*e^(4*a) - 2*c^(2*b)*x^(2*b*n)*e^(2*a) + 1) + 2*c^b*x*x^(b*n)
*e^a/(c^(4*b)*x^(4*b*n)*e^(4*a) - 2*c^(2*b)*x^(2*b*n)*e^(2*a) + 1)
```

### 3.160.9 Mupad [B] (verification not implemented)

Time = 2.20 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.55

$$\int \left(-\left(\left(1-b^2n^2\right)\operatorname{csch}(a+b\log\left(cx^n\right)\right)\right)+2b^2n^2\operatorname{csch}^3(a+b\log\left(cx^n\right))\right)\,dx$$
$$=-\frac{2\,x\,\mathrm{e}^{a}\left(c\,x^{n}\right)^{b}\left(b\,n+\mathrm{e}^{2\,a}\left(c\,x^{n}\right)^{2\,b}+b\,n\,\mathrm{e}^{2\,a}\left(c\,x^{n}\right)^{2\,b}-1\right)}{\left(\mathrm{e}^{2\,a}\left(c\,x^{n}\right)^{2\,b}-1\right)^{2}}$$

input
```
int((b^2*n^2 - 1)/sinh(a + b*log(c*x^n)) + (2*b^2*n^2)/sinh(a + b*log(c*x^
n))^3,x)
```

output
```
-(2*x*exp(a)*(c*x^n)^b*(b*n + exp(2*a)*(c*x^n)^(2*b) + b*n*exp(2*a)*(c*x^n
)^(2*b) - 1))/(exp(2*a)*(c*x^n)^(2*b) - 1)^2
```

# 3.161 $\int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx$

3.161.1 Optimal result . . . . . 1058
3.161.2 Mathematica [B] (verified) . . . . . 1058
3.161.3 Rubi [A] (verified) . . . . . 1059
3.161.4 Maple [F] . . . . . 1060
3.161.5 Fricas [A] (verification not implemented) . . . . . 1060
3.161.6 Sympy [F] . . . . . 1060
3.161.7 Maxima [B] (verification not implemented) . . . . . 1061
3.161.8 Giac [A] (verification not implemented) . . . . . 1061
3.161.9 Mupad [B] (verification not implemented) . . . . . 1061

## 3.161.1 Optimal result

Integrand size = 15, antiderivative size = 26

$$\int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx = -\frac{2c^6e^{-a}}{\left(c^4-\frac{e^{-2a}}{x^2}\right)^2}$$

output
```
-2*c^6/exp(a)/(c^4-1/exp(2*a)/x^2)^2
```

## 3.161.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 62 vs. 2(26) = 52.

Time = 0.14 (sec) , antiderivative size = 62, normalized size of antiderivative = 2.38

$$\int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx = \frac{2(\cosh(a)-\sinh(a))\left(-2c^4x^2+\cosh^2(a)-2\cosh(a)\sinh(a)+\sinh^2(a)\right)}{c^2\left(\left(-1+c^4x^2\right)\cosh(a)+\left(1+c^4x^2\right)\sinh(a)\right)^2}$$

input
```
Integrate[Csch[a + 2*Log[c*Sqrt[x]]]^3,x]
```

output
```
(2*(Cosh[a] - Sinh[a])*(-2*c^4*x^2 + Cosh[a]^2 - 2*Cosh[a]*Sinh[a] + Sinh[
a]^2))/(c^2*((-1 + c^4*x^2)*Cosh[a] + (1 + c^4*x^2)*Sinh[a])^2)
```

### 3.161.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.04, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.200$, Rules used = {6080, 6082, 793}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx$$

$$\downarrow 6080$$

$$\frac{2\int c\sqrt{x}\operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,d\left(c\sqrt{x}\right)}{c^2}$$

$$\downarrow 6082$$

$$\frac{16e^{-3a}\int \frac{1}{c^5\left(1-\frac{e^{-2a}}{c^4x^2}\right)^3 x^{5/2}}d\left(c\sqrt{x}\right)}{c^2}$$

$$\downarrow 793$$

$$-\frac{2e^{-a}}{c^2\left(1-\frac{e^{-2a}}{c^4x^2}\right)^2}$$

input
```
Int[Csch[a + 2*Log[c*Sqrt[x]]]^3,x]
```

output
```
-2/(c^2*E^a*(1 - 1/(c^4*E^(2*a)*x^2))^2)
```

#### 3.161.3.1 Defintions of rubi rules used

rule 793
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(a + b*x^n)
^(p + 1)/(b*n*(p + 1)), x] /; FreeQ[{a, b, m, n, p}, x] && EqQ[m, n - 1] &&
 NeQ[p, -1]
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6082
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[2^p/E^(a*d*p)   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b
*d)))^p)), x], x] /; FreeQ[{a, b, d, e, m}, x] && IntegerQ[p]
```

### 3.161.4 Maple [F]

$$\int \operatorname{csch}\left(a+2\ln\left(c\sqrt{x}\right)\right)^3\,dx$$

input
```
int(csch(a+2*ln(c*x^(1/2)))^3,x)
```

output
```
int(csch(a+2*ln(c*x^(1/2)))^3,x)
```

### 3.161.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 48, normalized size of antiderivative = 1.85

$$\int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx = -\frac{2\left(2\,c^4x^2e^{(2\,a)}-1\right)}{c^{10}x^4e^{(5\,a)}-2\,c^6x^2e^{(3\,a)}+c^2e^a}$$

input
```
integrate(csch(a+2*log(c*x^(1/2)))^3,x, algorithm="fricas")
```

output
```
-2*(2*c^4*x^2*e^(2*a) - 1)/(c^10*x^4*e^(5*a) - 2*c^6*x^2*e^(3*a) + c^2*e^a
)
```

### 3.161.6 Sympy [F]

$$\int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx = \int \operatorname{csch}^3\left(a+2\log\left(c\sqrt{x}\right)\right)\,dx$$

input
```
integrate(csch(a+2*ln(c*x**(1/2)))**3,x)
```

output
```
Integral(csch(a + 2*log(c*sqrt(x)))**3, x)
```

### 3.161.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 76 vs. $2(24) = 48$.

Time $= 0.19$ (sec) , antiderivative size $= 76$, normalized size of antiderivative $= 2.92$

$$\int \operatorname{csch}^3\left(a + 2\log\left(c\sqrt{x}\right)\right)\,dx = -\frac{2\left(\frac{2c^4x^2e^{(2a)}}{c^8x^4e^{(5a)} - 2c^4x^2e^{(3a)} + e^a} - \frac{1}{c^8x^4e^{(5a)} - 2c^4x^2e^{(3a)} + e^a}\right)}{c^2}$$

input
```
integrate(csch(a+2*log(c*x^(1/2)))^3,x, algorithm="maxima")
```

output
```
-2*(2*c^4*x^2*e^(2*a)/(c^8*x^4*e^(5*a) - 2*c^4*x^2*e^(3*a) + e^a) - 1/(c^8
*x^4*e^(5*a) - 2*c^4*x^2*e^(3*a) + e^a))/c^2
```

### 3.161.8 Giac [A] (verification not implemented)

Time $= 0.29$ (sec) , antiderivative size $= 38$, normalized size of antiderivative $= 1.46$

$$\int \operatorname{csch}^3\left(a + 2\log\left(c\sqrt{x}\right)\right)\,dx = -\frac{2\left(2c^4x^2e^{(2a)} - 1\right)e^{(-a)}}{\left(c^4x^2e^{(2a)} - 1\right)^2c^2}$$

input
```
integrate(csch(a+2*log(c*x^(1/2)))^3,x, algorithm="giac")
```

output
```
-2*(2*c^4*x^2*e^(2*a) - 1)*e^(-a)/((c^4*x^2*e^(2*a) - 1)^2*c^2)
```

### 3.161.9 Mupad [B] (verification not implemented)

Time $= 2.38$ (sec) , antiderivative size $= 48$, normalized size of antiderivative $= 1.85$

$$\int \operatorname{csch}^3\left(a + 2\log\left(c\sqrt{x}\right)\right)\,dx = \frac{\frac{2\,\mathrm{e}^{-a}}{c^2} - 4\,c^2\,x^2\,\mathrm{e}^a}{\mathrm{e}^{4\,a}\,c^8\,x^4 - 2\,\mathrm{e}^{2\,a}\,c^4\,x^2 + 1}$$

input
```
int(1/sinh(a + 2*log(c*x^(1/2)))^3,x)
```

output
```
((2*exp(-a))/c^2 - 4*c^2*x^2*exp(a))/(c^8*x^4*exp(4*a) - 2*c^4*x^2*exp(2*a
) + 1)
```

# 3.162 $\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx$

3.162.1 Optimal result . . . . . 1062
3.162.2 Mathematica [B] (verified) . . . . . 1062
3.162.3 Rubi [A] (verified) . . . . . 1063
3.162.4 Maple [F] . . . . . 1064
3.162.5 Fricas [A] (verification not implemented) . . . . . 1064
3.162.6 Sympy [F] . . . . . 1065
3.162.7 Maxima [A] (verification not implemented) . . . . . 1065
3.162.8 Giac [A] (verification not implemented) . . . . . 1065
3.162.9 Mupad [B] (verification not implemented) . . . . . 1066

## 3.162.1 Optimal result

Integrand size = 15, antiderivative size = 26

$$\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx = \frac{2c^2e^{-3a}}{\left(e^{-2a}-\frac{c^4}{x^2}\right)^2}$$

output
```
2*c^2/exp(3*a)/(exp(-2*a)-c^4/x^2)^2
```

## 3.162.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 65 vs. 2(26) = 52.

Time = 0.07 (sec) , antiderivative size = 65, normalized size of antiderivative = 2.50

$$\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx = -\frac{2c^6\left(\left(c^4-2x^2\right)\cosh(a)+\left(c^4+2x^2\right)\sinh(a)\right)\left(\cosh(2a)+\sinh(2a)\right)}{\left(\left(-c^4+x^2\right)\cosh(a)-\left(c^4+x^2\right)\sinh(a)\right)^2}$$

input
```
Integrate[Csch[a + 2*Log[c/Sqrt[x]]]^3,x]
```

output
```
(-2*c^6*((c^4 - 2*x^2)*Cosh[a] + (c^4 + 2*x^2)*Sinh[a])*(Cosh[2*a] + Sinh[
2*a]))/((-c^4 + x^2)*Cosh[a] - (c^4 + x^2)*Sinh[a])^2
```

### 3.162.3 Rubi [A] (verified)

Time = 0.26 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.267$, Rules used = {6080, 6082, 795, 793}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^3\left(a + 2\log\left(\frac{c}{\sqrt{x}}\right)\right) dx$$

$$\downarrow 6080$$

$$-2c^2 \int \frac{x^{3/2}\operatorname{csch}^3\left(a + 2\log\left(\frac{c}{\sqrt{x}}\right)\right)}{c^3} d\frac{c}{\sqrt{x}}$$

$$\downarrow 6082$$

$$-16e^{-3a}c^2 \int \frac{x^{9/2}}{c^9\left(1 - \frac{e^{-2a}x^2}{c^4}\right)^3} d\frac{c}{\sqrt{x}}$$

$$\downarrow 795$$

$$-16e^{-3a}c^2 \int \frac{c^3}{\left(\frac{c^4}{x^2} - e^{-2a}\right)^3 x^{3/2}} d\frac{c}{\sqrt{x}}$$

$$\downarrow 793$$

$$\frac{2e^{-3a}c^2}{\left(e^{-2a} - \frac{c^4}{x^2}\right)^2}$$

input
```
Int[Csch[a + 2*Log[c/Sqrt[x]]]^3,x]
```

output
```
(2*c^2)/(E^(3*a)*(E^(-2*a) - c^4/x^2)^2)
```

#### 3.162.3.1 Defintions of rubi rules used

rule 793
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(a + b*x^n)
^(p + 1)/(b*n*(p + 1)), x] /; FreeQ[{a, b, m, n, p}, x] && EqQ[m, n - 1] &&
 NeQ[p, -1]
```

rule 795
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int[x^(m + n*p)*
(b + a/x^n)^p, x] /; FreeQ[{a, b, m, n}, x] && IntegerQ[p] && NegQ[n]
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6082
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[2^p/E^(a*d*p)   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b
*d)))^p)), x], x] /; FreeQ[{a, b, d, e, m}, x] && IntegerQ[p]
```

### 3.162.4 Maple [F]

$$\int \operatorname{csch}\left(a+2\ln\left(\frac{c}{\sqrt{x}}\right)\right)^3 dx$$

input
```
int(csch(a+2*ln(c/x^(1/2)))^3,x)
```

output
```
int(csch(a+2*ln(c/x^(1/2)))^3,x)
```

### 3.162.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 49, normalized size of antiderivative = 1.88

$$\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right) dx = -\frac{2\left(c^{10}e^{(5\,a)}-2\,c^6x^2e^{(3\,a)}\right)}{c^8e^{(4\,a)}-2\,c^4x^2e^{(2\,a)}+x^4}$$

input
```
integrate(csch(a+2*log(c/x^(1/2)))^3,x, algorithm="fricas")
```

output
```
-2*(c^10*e^(5*a) - 2*c^6*x^2*e^(3*a))/(c^8*e^(4*a) - 2*c^4*x^2*e^(2*a) + x
^4)
```

### 3.162.6 Sympy [F]

$$\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx = \int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx$$

input
```
integrate(csch(a+2*ln(c/x**(1/2)))**3,x)
```

output
```
Integral(csch(a + 2*log(c/sqrt(x)))**3, x)
```

### 3.162.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 49, normalized size of antiderivative = 1.88

$$\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx = -\frac{2\left(c^{10}e^{(5\,a)}-2\,c^6x^2e^{(3\,a)}\right)}{c^8e^{(4\,a)}-2\,c^4x^2e^{(2\,a)}+x^4}$$

input
```
integrate(csch(a+2*log(c/x^(1/2)))^3,x, algorithm="maxima")
```

output
```
-2*(c^10*e^(5*a) - 2*c^6*x^2*e^(3*a))/(c^8*e^(4*a) - 2*c^4*x^2*e^(2*a) + x
^4)
```

### 3.162.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.50

$$\int \operatorname{csch}^3\left(a+2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx = -\frac{2\left(c^{10}e^{(5\,a)}-2\,c^6x^2e^{(3\,a)}\right)}{\left(c^4e^{(2\,a)}-x^2\right)^2}$$

input
```
integrate(csch(a+2*log(c/x^(1/2)))^3,x, algorithm="giac")
```

output
```
-2*(c^10*e^(5*a) - 2*c^6*x^2*e^(3*a))/(c^4*e^(2*a) - x^2)^2
```

### 3.162.9 Mupad [B] (verification not implemented)

Time = 2.31 (sec) , antiderivative size = 36, normalized size of antiderivative = 1.38

$$\int \operatorname{csch}^3\left(a + 2\log\left(\frac{c}{\sqrt{x}}\right)\right)\,dx = \frac{2\,c^2\,x^4\,\mathrm{e}^a}{\mathrm{e}^{4\,a}\,c^8 - 2\,\mathrm{e}^{2\,a}\,c^4\,x^2 + x^4}$$

input
```
int(1/sinh(a + 2*log(c/x^(1/2)))^3,x)
```

output
```
(2*c^2*x^4*exp(a))/(c^8*exp(4*a) + x^4 - 2*c^4*x^2*exp(2*a))
```

# 3.163 $\int \operatorname{csch}^p\left(a+\frac{\log(cx^n)}{n(-2+p)}\right)\,dx$

3.163.1 Optimal result . . . . . 1067
3.163.2 Mathematica [A] (verified) . . . . . 1067
3.163.3 Rubi [A] (verified) . . . . . 1068
3.163.4 Maple [F] . . . . . 1069
3.163.5 Fricas [B] (verification not implemented) . . . . . 1069
3.163.6 Sympy [F] . . . . . 1070
3.163.7 Maxima [F] . . . . . 1070
3.163.8 Giac [F(-1)] . . . . . 1071
3.163.9 Mupad [F(-1)] . . . . . 1071

## 3.163.1 Optimal result

Integrand size = 20, antiderivative size = 90

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = -\frac{e^{2a}(2-p)x\left(cx^n\right)^{-\frac{2}{n(2-p)}}\left(1-e^{-2a}\left(cx^n\right)^{\frac{2}{n(2-p)}}\right)\operatorname{csch}^p\left(a-\frac{\log(cx^n)}{n(2-p)}\right)}{2(1-p)}$$

output
```
-1/2*exp(2*a)*(2-p)*x*(1-(c*x^n)^(2/n/(2-p))/exp(2*a))*csch(a-ln(c*x^n)/n/
(2-p))^p/(1-p)/((c*x^n)^(2/n/(2-p)))
```

## 3.163.2 Mathematica [A] (verified)

Time = 1.54 (sec) , antiderivative size = 115, normalized size of antiderivative = 1.28

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \frac{2^{-1+p}(-2+p)x\left(\frac{e^a\left(cx^n\right)^{\frac{1}{n(-2+p)}}}{-1+e^{2a}\left(cx^n\right)^{\frac{2}{n(-2+p)}}}\right)^p\left(1+e^{2a}\left(cx^n\right)^{\frac{2}{n(-2+p)}}\left(-1+\left(1-e^{-2a}\left(cx^n\right)^{-\frac{2}{n(-2+p)}}\right)^p\right)\right)}{-1+p}$$

input
```
Integrate[Csch[a + Log[c*x^n]/(n*(-2 + p))]^p,x]
```

output
```
(2^(-1 + p)*(-2 + p)*x*((E^a*(c*x^n)^(1/(n*(-2 + p))))/(-1 + E^(2*a)*(c*x^
n)^(2/(n*(-2 + p)))))^p*(1 + E^(2*a)*(c*x^n)^(2/(n*(-2 + p)))*(-1 + (1 - 1
/(E^(2*a)*(c*x^n)^(2/(n*(-2 + p)))))^p)))/(-1 + p)
```

### 3.163.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.08, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.150$, Rules used = {6080, 6084, 793}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(p-2)}\right)\,dx$$

$$\downarrow 6080$$

$$\frac{x(cx^n)^{-1/n}\int (cx^n)^{\frac{1}{n}-1}\operatorname{csch}^p\left(a-\frac{\log(cx^n)}{n(2-p)}\right)\,d(cx^n)}{n}$$

$$\downarrow 6084$$

$$\frac{x(cx^n)^{-\frac{p}{n(2-p)}-\frac{1}{n}}\left(1-e^{-2a}(cx^n)^{\frac{2}{n(2-p)}}\right)^p\operatorname{csch}^p\left(a-\frac{\log(cx^n)}{n(2-p)}\right)\int (cx^n)^{\frac{p}{2n-np}+\frac{1}{n}-1}\left(1-e^{-2a}(cx^n)^{\frac{2}{n(2-p)}}\right)^{-p}\,d(cx^n)}{n}$$

$$\downarrow 793$$

$$-\frac{e^{2a}(2-p)x(cx^n)^{-\frac{p}{n(2-p)}-\frac{1}{n}}\left(1-e^{-2a}(cx^n)^{\frac{2}{n(2-p)}}\right)\operatorname{csch}^p\left(a-\frac{\log(cx^n)}{n(2-p)}\right)}{2(1-p)}$$

input
```
Int[Csch[a + Log[c*x^n]/(n*(-2 + p))]^p,x]
```

output
```
-1/2*(E^(2*a)*(2 - p)*x*(c*x^n)^(-n^(-1) - p/(n*(2 - p)))*(1 - (c*x^n)^(2/
(n*(2 - p)))/E^(2*a))*Csch[a - Log[c*x^n]/(n*(2 - p))]^p)/(1 - p)
```

#### 3.163.3.1 Defintions of rubi rules used

rule 793
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(a + b*x^n)
^(p + 1)/(b*n*(p + 1)), x] /; FreeQ[{a, b, m, n, p}, x] && EqQ[m, n - 1] &&
 NeQ[p, -1]
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

### 3.163.4 Maple [F]

$$\int \operatorname{csch}\left(a+\frac{\ln\left(c\,x^{n}\right)}{n\left(-2+p\right)}\right)^{p}dx$$

input
```
int(csch(a+ln(c*x^n)/n/(-2+p))^p,x)
```

output
```
int(csch(a+ln(c*x^n)/n/(-2+p))^p,x)
```

### 3.163.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 475 vs. $2(76)=152$.

Time $=0.27$ (sec) , antiderivative size $=475$, normalized size of antiderivative $=5.28$

$$\int \operatorname{csch}^{p}\left(a+\frac{\log\left(cx^{n}\right)}{n(-2+p)}\right)\,dx=$$

$$-\frac{(p-2)x\cosh\left(p\log\left(\frac{2\left(\cosh\left(\frac{anp-2\,an+n\log(x)+\log(c)}{np-2\,n}\right)+\sinh\left(\frac{anp-2\,an+n\log(x)+\log(c)}{np-2\,n}\right)\right)}{\cosh\left(\frac{anp-2\,an+n\log(x)+\log(c)}{np-2\,n}\right)^{2}+2\cosh\left(\frac{anp-2\,an+n\log(x)+\log(c)}{np-2\,n}\right)\sinh\left(\frac{anp-2\,an+n\log(x)+\log(c)}{np-2\,n}\right)+\sinh\left(\frac{a}{}\right.\right.\right.}$$

input
```
integrate(csch(a+log(c*x^n)/n/(-2+p))^p,x, algorithm="fricas")
```

output
```
-((p - 2)*x*cosh(p*log(2*(cosh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*p -
2*n)) + sinh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n)))/(cosh((a*n*
p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n))^2 + 2*cosh((a*n*p - 2*a*n + n*
log(x) + log(c))/(n*p - 2*n))*sinh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*
p - 2*n)) + sinh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n))^2 - 1)))
*sinh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n)) + (p - 2)*x*sinh(p*
log(2*(cosh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n)) + sinh((a*n*p
 - 2*a*n + n*log(x) + log(c))/(n*p - 2*n)))/(cosh((a*n*p - 2*a*n + n*log(x
) + log(c))/(n*p - 2*n))^2 + 2*cosh((a*n*p - 2*a*n + n*log(x) + log(c))/(n
*p - 2*n))*sinh((a*n*p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n)) + sinh((a
*n*p - 2*a*n + n*log(x) + log(c))/(n*p - 2*n))^2 - 1)))*sinh((a*n*p - 2*a*
n + n*log(x) + log(c))/(n*p - 2*n)))/((p - 1)*cosh((a*n*p - 2*a*n + n*log(
x) + log(c))/(n*p - 2*n)) - (p - 1)*sinh((a*n*p - 2*a*n + n*log(x) + log(c
))/(n*p - 2*n)))
```

### 3.163.6 Sympy [F]

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n\left(p-2\right)}\right)\,dx$$

input
```
integrate(csch(a+ln(c*x**n)/n/(-2+p))**p,x)
```

output
```
Integral(csch(a + log(c*x**n)/(n*(p - 2)))**p, x)
```

### 3.163.7 Maxima [F]

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \int \operatorname{csch}\left(a+\frac{\log\left(cx^n\right)}{n(p-2)}\right)^p\,dx$$

input
```
integrate(csch(a+log(c*x^n)/n/(-2+p))^p,x, algorithm="maxima")
```

output
```
integrate(csch(a + log(c*x^n)/(n*(p - 2)))^p, x)
```

### 3.163.8 Giac [F(-1)]

Timed out.

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \text{Timed out}$$

input
```
integrate(csch(a+log(c*x^n)/n/(-2+p))^p,x, algorithm="giac")
```

output
```
Timed out
```

### 3.163.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^p\left(a+\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \int \left(\frac{1}{\sinh\left(a+\frac{\ln(c\,x^n)}{n\,(p-2)}\right)}\right)^p\,dx$$

input
```
int((1/sinh(a + log(c*x^n)/(n*(p - 2))))^p,x)
```

output
```
int((1/sinh(a + log(c*x^n)/(n*(p - 2))))^p, x)
```

# 3.164 $\int \operatorname{csch}^p\left(a - \frac{\log(cx^n)}{n(-2+p)}\right)\,dx$

3.164.1 Optimal result . . . 1072
3.164.2 Mathematica [B] (warning: unable to verify) . . . 1072
3.164.3 Rubi [A] (verified) . . . 1073
3.164.4 Maple [F] . . . 1074
3.164.5 Fricas [B] (verification not implemented) . . . 1074
3.164.6 Sympy [F] . . . 1075
3.164.7 Maxima [F] . . . 1075
3.164.8 Giac [F] . . . 1076
3.164.9 Mupad [F(-1)] . . . 1076

## 3.164.1 Optimal result

Integrand size = 21, antiderivative size = 66

$$\int \operatorname{csch}^p\left(a - \frac{\log(cx^n)}{n(-2+p)}\right)\,dx = \frac{(2-p)x\left(1 - e^{-2a}(cx^n)^{-\frac{2}{n(2-p)}}\right)\operatorname{csch}^p\left(a + \frac{\log(cx^n)}{n(2-p)}\right)}{2(1-p)}$$

output
```
1/2*(2-p)*x*(1-1/exp(2*a)/((c*x^n)^(2/n/(2-p))))*csch(a+ln(c*x^n)/n/(2-p))
^p/(1-p)
```

## 3.164.2 Mathematica [B] (warning: unable to verify)

Leaf count is larger than twice the leaf count of optimal. 140 vs. 2(66) = 132.

Time = 0.87 (sec) , antiderivative size = 140, normalized size of antiderivative = 2.12

$$\int \operatorname{csch}^p\left(a - \frac{\log(cx^n)}{n(-2+p)}\right)\,dx = \frac{2^{-1+p}e^{-\frac{2ap}{-2+p}}(-2+p)x\left(e^{\frac{2ap}{-2+p}} - e^{\frac{4a}{-2+p}}(cx^n)^{\frac{2}{n(-2+p)}}\right)\left(-\frac{e^{\frac{a(2+p)}{-2+p}}(cx^n)^{\frac{1}{n(-2+p)}}}{-e^{\frac{2ap}{-2+p}} + e^{\frac{4a}{-2+p}}(cx^n)^{\frac{2}{n(-2+p)}}}\right)^p}{-1+p}$$

input
```
Integrate[Csch[a - Log[c*x^n]/(n*(-2 + p))]^p,x]
```

output
```
(2^(-1 + p)*(-2 + p)*x*(E^((2*a*p)/(-2 + p)) - E^((4*a)/(-2 + p))*(c*x^n)^
(2/(n*(-2 + p))))*(-((E^((a*(2 + p))/(-2 + p))*(c*x^n)^(1/(n*(-2 + p))))/(
-E^((2*a*p)/(-2 + p)) + E^((4*a)/(-2 + p))*(c*x^n)^(2/(n*(-2 + p))))))^p)/
(E^((2*a*p)/(-2 + p))*(-1 + p))
```

### 3.164.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 107, normalized size of antiderivative = 1.62, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.143$, Rules used = {6080, 6084, 796}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \operatorname{csch}^p\left(a - \frac{\log\left(cx^n\right)}{n(p-2)}\right) dx$$

$$\downarrow 6080$$

$$\frac{x(cx^n)^{-1/n} \int (cx^n)^{\frac{1}{n}-1} \operatorname{csch}^p\left(a + \frac{\log(cx^n)}{n(2-p)}\right) d(cx^n)}{n}$$

$$\downarrow 6084$$

$$\frac{x(cx^n)^{\frac{p}{n(2-p)}-\frac{1}{n}} \left(1 - e^{-2a}(cx^n)^{-\frac{2}{n(2-p)}}\right)^p \operatorname{csch}^p\left(a + \frac{\log(cx^n)}{n(2-p)}\right) \int (cx^n)^{\frac{1-\frac{p}{2-p}}{n}-1} \left(1 - e^{-2a}(cx^n)^{-\frac{2}{n(2-p)}}\right)^{-p} d(cx^n)}{n}$$

$$\downarrow 796$$

$$\frac{(2-p)x(cx^n)^{\frac{2(1-p)}{n(2-p)}+\frac{p}{n(2-p)}-\frac{1}{n}} \left(1 - e^{-2a}(cx^n)^{-\frac{2}{n(2-p)}}\right) \operatorname{csch}^p\left(a + \frac{\log(cx^n)}{n(2-p)}\right)}{2(1-p)}$$

input
```
Int[Csch[a - Log[c*x^n]/(n*(-2 + p))]^p,x]
```

output
```
((2 - p)*x*(c*x^n)^(-n^(-1) + (2*(1 - p))/(n*(2 - p)) + p/(n*(2 - p)))*(1
- 1/(E^(2*a)*(c*x^n)^(2/(n*(2 - p))))))*Csch[a + Log[c*x^n]/(n*(2 - p))]^p)
/(2*(1 - p))
```

#### 3.164.3.1 Defintions of rubi rules used

rule 796
```
Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Simp[(c*
x)^(m + 1)*((a + b*x^n)^(p + 1)/(a*c*(m + 1))), x] /; FreeQ[{a, b, c, m, n,
 p}, x] && EqQ[(m + 1)/n + p + 1, 0] && NeQ[m, -1]
```

rule 6080
```
Int[Csch[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]^(p_.), x_Symbol] :> S
imp[x/(n*(c*x^n)^(1/n))   Subst[Int[x^(1/n - 1)*Csch[d*(a + b*Log[x])]^p, x
], x, c*x^n], x] /; FreeQ[{a, b, c, d, n, p}, x] && (NeQ[c, 1] || NeQ[n, 1]
)
```

rule 6084
```
Int[Csch[((a_.) + Log[x_]*(b_.))*(d_.)]^(p_.)*((e_.)*(x_))^(m_.), x_Symbol]
 :> Simp[Csch[d*(a + b*Log[x])]^p*((1 - 1/(E^(2*a*d)*x^(2*b*d)))^p/x^((-b)*
d*p))   Int[(e*x)^m*(1/(x^(b*d*p)*(1 - 1/(E^(2*a*d)*x^(2*b*d)))^p)), x], x]
 /; FreeQ[{a, b, d, e, m, p}, x] &&  !IntegerQ[p]
```

### 3.164.4 Maple [F]

$$\int \operatorname{csch}\left(a-\frac{\ln\left(c\,x^{n}\right)}{n\left(-2+p\right)}\right)^{p}dx$$

input
```
int(csch(a-ln(c*x^n)/n/(-2+p))^p,x)
```

output
```
int(csch(a-ln(c*x^n)/n/(-2+p))^p,x)
```

### 3.164.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 539 vs. $2(55)=110$.

Time $=0.27$ (sec) , antiderivative size $=539$, normalized size of antiderivative $=8.17$

$$\int \operatorname{csch}^{p}\left(a-\frac{\log\left(cx^{n}\right)}{n(-2+p)}\right)\,dx=$$

$$-\frac{(p-2)x\cosh\left(p\log\left(-\frac{2\left(\cosh\left(-\frac{anp-2\,an-n\log(x)-\log(c)}{np-2\,n}\right)+\sinh\left(-\frac{anp-2\,an-n\log(x)-\log(c)}{np-2\,n}\right)\right.}{\cosh\left(-\frac{anp-2\,an-n\log(x)-\log(c)}{np-2\,n}\right)^{2}+2\cosh\left(-\frac{anp-2\,an-n\log(x)-\log(c)}{np-2\,n}\right)\sinh\left(-\frac{anp-2\,an-n\log(x)-\log(c)}{np-2\,n}\right)}\right.}$$

input
```
integrate(csch(a-log(c*x^n)/n/(-2+p))^p,x, algorithm="fricas")
```

output
```
-((p - 2)*x*cosh(p*log(-2*(cosh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p
- 2*n)) + sinh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n)))/(cosh(-(
a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n))^2 + 2*cosh(-(a*n*p - 2*a*n
 - n*log(x) - log(c))/(n*p - 2*n))*sinh(-(a*n*p - 2*a*n - n*log(x) - log(c
))/(n*p - 2*n)) + sinh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n))^2
 - 1)))*sinh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n)) + (p - 2)*x
*sinh(p*log(-2*(cosh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n)) + s
inh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n)))/(cosh(-(a*n*p - 2*a
*n - n*log(x) - log(c))/(n*p - 2*n))^2 + 2*cosh(-(a*n*p - 2*a*n - n*log(x)
 - log(c))/(n*p - 2*n))*sinh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2
*n)) + sinh(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n))^2 - 1)))*sin
h(-(a*n*p - 2*a*n - n*log(x) - log(c))/(n*p - 2*n)))/((p - 1)*cosh(-(a*n*p
 - 2*a*n - n*log(x) - log(c))/(n*p - 2*n)) - (p - 1)*sinh(-(a*n*p - 2*a*n
- n*log(x) - log(c))/(n*p - 2*n)))
```

### 3.164.6 Sympy [F]

$$\int \operatorname{csch}^p\left(a - \frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \int \operatorname{csch}^p\left(a - \frac{\log\left(cx^n\right)}{n\left(p-2\right)}\right)\,dx$$

input
```
integrate(csch(a-ln(c*x**n)/n/(-2+p))**p,x)
```

output
```
Integral(csch(a - log(c*x**n)/(n*(p - 2)))**p, x)
```

### 3.164.7 Maxima [F]

$$\int \operatorname{csch}^p\left(a - \frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx = \int \operatorname{csch}\left(a - \frac{\log\left(cx^n\right)}{n(p-2)}\right)^p\,dx$$

input
```
integrate(csch(a-log(c*x^n)/n/(-2+p))^p,x, algorithm="maxima")
```

output
```
integrate((-csch(-a + log(c*x^n)/(n*(p - 2))))^p, x)
```

### 3.164.8 Giac [F]

$$\int \operatorname{csch}^p\left(a-\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx=\int \operatorname{csch}\left(a-\frac{\log\left(cx^n\right)}{n(p-2)}\right)^p\,dx$$

input
```
integrate(csch(a-log(c*x^n)/n/(-2+p))^p,x, algorithm="giac")
```

output
```
integrate(csch(a - log(c*x^n)/(n*(p - 2)))^p, x)
```

### 3.164.9 Mupad [F(-1)]

Timed out.

$$\int \operatorname{csch}^p\left(a-\frac{\log\left(cx^n\right)}{n(-2+p)}\right)\,dx=\int \left(\frac{1}{\sinh\left(a-\frac{\ln\left(c\,x^n\right)}{n\,(p-2)}\right)}\right)^p\,dx$$

input
```
int((1/sinh(a - log(c*x^n)/(n*(p - 2))))^p,x)
```

output
```
int((1/sinh(a - log(c*x^n)/(n*(p - 2))))^p, x)
```

# 3.165 $\int \frac{\mathbf{csch}(a+b\log(cx^n))}{x}\,dx$

3.165.1 Optimal result . . . . . 1077
3.165.2 Mathematica [B] (verified) . . . . . 1077
3.165.3 Rubi [A] (verified) . . . . . 1078
3.165.4 Maple [A] (verified) . . . . . 1079
3.165.5 Fricas [B] (verification not implemented) . . . . . 1079
3.165.6 Sympy [A] (verification not implemented) . . . . . 1080
3.165.7 Maxima [A] (verification not implemented) . . . . . 1080
3.165.8 Giac [B] (verification not implemented) . . . . . 1081
3.165.9 Mupad [B] (verification not implemented) . . . . . 1081

## 3.165.1 Optimal result

Integrand size = 15, antiderivative size = 20

$$\int \frac{\operatorname{csch}(a+b\log(cx^n))}{x}\,dx = -\frac{\operatorname{arctanh}(\cosh(a+b\log(cx^n)))}{bn}$$

output
```
-arctanh(cosh(a+b*ln(c*x^n)))/b/n
```

## 3.165.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 54 vs. $2(20) = 40$.

Time = 0.04 (sec) , antiderivative size = 54, normalized size of antiderivative = 2.70

$$\int \frac{\operatorname{csch}(a+b\log(cx^n))}{x}\,dx = -\frac{\log\left(\cosh\left(\frac{a}{2}+\frac{1}{2}b\log(cx^n)\right)\right)}{bn} + \frac{\log\left(\sinh\left(\frac{a}{2}+\frac{1}{2}b\log(cx^n)\right)\right)}{bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]/x,x]
```

output
```
-(Log[Cosh[a/2 + (b*Log[c*x^n])/2]]/(b*n)) + Log[Sinh[a/2 + (b*Log[c*x^n])
/2]]/(b*n)
```

### 3.165.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.267$, Rules used = {3039, 3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}(a+b\log(cx^n))}{x}\,dx$$
$$\downarrow 3039$$
$$\frac{\int \operatorname{csch}(a+b\log(cx^n))\,d\log(cx^n)}{n}$$
$$\downarrow 3042$$
$$\frac{\int i\csc(ia+ib\log(cx^n))\,d\log(cx^n)}{n}$$
$$\downarrow 26$$
$$\frac{i\int \csc(ia+ib\log(cx^n))\,d\log(cx^n)}{n}$$
$$\downarrow 4257$$
$$-\frac{\operatorname{arctanh}(\cosh(a+b\log(cx^n)))}{bn}$$

input
```
Int[Csch[a + b*Log[c*x^n]]/x,x]
```

output
```
-(ArcTanh[Cosh[a + b*Log[c*x^n]]]/(b*n))
```

#### 3.165.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

### 3.165.4 Maple [A] (verified)

Time = 0.26 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.15

| method | result |
|---|---|
| derivativedivides | $\frac{\ln\left(\tanh\left(\frac{a}{2}+\frac{b\ln(cx^n)}{2}\right)\right)}{nb}$ |
| default | $\frac{\ln\left(\tanh\left(\frac{a}{2}+\frac{b\ln(cx^n)}{2}\right)\right)}{nb}$ |
| parallelrisch | $\frac{\ln\left(\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)\right)}{nb}$ |
| risch | $\frac{\ln\left(c^b(x^n)^b e^a e^{\frac{ib\pi\ \mathrm{csgn}(ix^n)\,\mathrm{csgn}(icx^n)^2}{2}} e^{-\frac{ib\pi\ \mathrm{csgn}(ix^n)\,\mathrm{csgn}(icx^n)\,\mathrm{csgn}(ic)}{2}} e^{-\frac{ib\pi\,\mathrm{csgn}(icx^n)^3}{2}} e^{\frac{ib\pi\,\mathrm{csgn}(icx^n)^2\,\mathrm{csgn}(ic)}{2}} -1\right.$ |
| | $bn$ |

input
```
int(csch(a+b*ln(c*x^n))/x,x,method=_RETURNVERBOSE)
```

output
```
1/n/b*ln(tanh(1/2*a+1/2*b*ln(c*x^n)))
```

### 3.165.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 65 vs. 2(20) = 40.

Time = 0.26 (sec) , antiderivative size = 65, normalized size of antiderivative = 3.25

$$\int \frac{\mathrm{csch}(a+b\log(cx^n))}{x}\,dx =$$
$$-\frac{\log\left(\cosh\left(bn\log(x)+b\log(c)+a\right)+\sinh\left(bn\log(x)+b\log(c)+a\right)+1\right)-\log\left(\cosh\left(bn\log(x)+b\log\right.\right.}{bn}$$

input
```
integrate(csch(a+b*log(c*x^n))/x,x, algorithm="fricas")
```

output
```
-(log(cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a) +
1) - log(cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)
 - 1))/(b*n)
```

### 3.165.6 Sympy [A] (verification not implemented)

Time = 0.44 (sec) , antiderivative size = 42, normalized size of antiderivative = 2.10

$$\int \frac{\operatorname{csch}(a+b\log(cx^n))}{x}\,dx = -\begin{cases} -\log(x)\operatorname{csch}(a) & \text{for } b=0 \\ -\log(x)\operatorname{csch}(a+b\log(c)) & \text{for } n=0 \\ -\frac{\log\left(\tanh\left(\frac{a}{2}+\frac{b\log(cx^n)}{2}\right)\right)}{bn} & \text{otherwise} \end{cases}$$

input
```
integrate(csch(a+b*ln(c*x**n))/x,x)
```

output
```
-Piecewise((-log(x)*csch(a), Eq(b, 0)), (-log(x)*csch(a + b*log(c)), Eq(n,
 0)), (-log(tanh(a/2 + b*log(c*x**n)/2))/(b*n), True))
```

### 3.165.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.10

$$\int \frac{\operatorname{csch}(a+b\log(cx^n))}{x}\,dx = \frac{\log\left(\tanh\left(\frac{1}{2}\,b\log(cx^n)+\frac{1}{2}\,a\right)\right)}{bn}$$

input
```
integrate(csch(a+b*log(c*x^n))/x,x, algorithm="maxima")
```

output
```
log(tanh(1/2*b*log(c*x^n) + 1/2*a))/(b*n)
```

### 3.165.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 145 vs. $2(20) = 40$.

Time = 0.31 (sec) , antiderivative size = 145, normalized size of antiderivative = 7.25

$$\int \frac{\operatorname{csch}(a + b\log(cx^n))}{x}\,dx =$$

$$-c^b\left(\frac{c^b e^{(-a)}\log\left(\sqrt{2\,x^{bn}|c|^b\cos\left(-\frac{1}{2}\,\pi b\operatorname{sgn}(c)+\frac{1}{2}\,\pi b\right)e^a + x^{2\,bn}|c|^{2\,b}e^{(2\,a)}+1}\right)}{bc^{2\,b}n} - \frac{c^b e^{(-a)}\log\left(\sqrt{-2\,x^{bn}|}\right.\right.$$

input
```
integrate(csch(a+b*log(c*x^n))/x,x, algorithm="giac")
```

output
```
-c^b*(c^b*e^(-a)*log(sqrt(2*x^(b*n)*abs(c)^b*cos(-1/2*pi*b*sgn(c) + 1/2*pi
*b)*e^a + x^(2*b*n)*abs(c)^(2*b)*e^(2*a) + 1))/(b*c^(2*b)*n) - c^b*e^(-a)*
log(sqrt(-2*x^(b*n)*abs(c)^b*cos(-1/2*pi*b*sgn(c) + 1/2*pi*b)*e^a + x^(2*b
*n)*abs(c)^(2*b)*e^(2*a) + 1))/(b*c^(2*b)*n))*e^a
```

### 3.165.9 Mupad [B] (verification not implemented)

Time = 2.41 (sec) , antiderivative size = 43, normalized size of antiderivative = 2.15

$$\int \frac{\operatorname{csch}(a + b\log(cx^n))}{x}\,dx = -\frac{2\operatorname{atan}\left(\frac{e^{-a}\sqrt{-b^2n^2}}{bn(cx^n)^b}\right)}{\sqrt{-b^2n^2}}$$

input
```
int(1/(x*sinh(a + b*log(c*x^n))),x)
```

output
```
-(2*atan((exp(-a)*(-b^2*n^2)^(1/2))/(b*n*(c*x^n)^b)))/(-b^2*n^2)^(1/2)
```

# 3.166 $\int \frac{\text{csch}^2(a+b\log(cx^n))}{x}\,dx$

3.166.1 Optimal result . . . . . 1082
3.166.2 Mathematica [A] (verified) . . . . . 1082
3.166.3 Rubi [A] (verified) . . . . . 1083
3.166.4 Maple [A] (verified) . . . . . 1084
3.166.5 Fricas [B] (verification not implemented) . . . . . 1085
3.166.6 Sympy [F] . . . . . 1085
3.166.7 Maxima [A] (verification not implemented) . . . . . 1085
3.166.8 Giac [A] (verification not implemented) . . . . . 1086
3.166.9 Mupad [B] (verification not implemented) . . . . . 1086

## 3.166.1 Optimal result

Integrand size = 17, antiderivative size = 19

$$\int \frac{\text{csch}^2(a+b\log(cx^n))}{x}\,dx = -\frac{\coth(a+b\log(cx^n))}{bn}$$

output
```
-coth(a+b*ln(c*x^n))/b/n
```

## 3.166.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 19, normalized size of antiderivative = 1.00

$$\int \frac{\text{csch}^2(a+b\log(cx^n))}{x}\,dx = -\frac{\coth(a+b\log(cx^n))}{bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^2/x,x]
```

output
```
-(Coth[a + b*Log[c*x^n]]/(b*n))
```

### 3.166.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 19, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$, Rules used = {3039, 3042, 25, 4254, 24}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^2(a+b\log(cx^n))}{x}\,dx$$
$$\downarrow 3039$$
$$\frac{\int \operatorname{csch}^2(a+b\log(cx^n))\,d\log(cx^n)}{n}$$
$$\downarrow 3042$$
$$\frac{\int -\csc(ia+ib\log(cx^n))^2\,d\log(cx^n)}{n}$$
$$\downarrow 25$$
$$-\frac{\int \csc(ia+ib\log(cx^n))^2\,d\log(cx^n)}{n}$$
$$\downarrow 4254$$
$$-\frac{i\int 1d(-i\coth(a+b\log(cx^n)))}{bn}$$
$$\downarrow 24$$
$$-\frac{\coth(a+b\log(cx^n))}{bn}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^2/x,x]
```

output
```
-(Coth[a + b*Log[c*x^n]]/(b*n))
```

### 3.166.3.1 Defintions of rubi rules used

rule 24
```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

## 3.166.4 Maple [A] (verified)

Time = 1.10 (sec) , antiderivative size = 20, normalized size of antiderivative = 1.05

| method | result |
|---|---|
| derivativedivides | $-\frac{\coth(a+b\ln(c\,x^n))}{bn}$ |
| default | $-\frac{\coth(a+b\ln(c\,x^n))}{bn}$ |
| parallelrisch | $\frac{-\coth\left(\frac{a}{2}+b\ln\left(\sqrt{c\,x^n}\right)\right)-\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{c\,x^n}\right)\right)}{2bn}$ |
| risch | $-\frac{2}{bn\left((x^n)^{2b}c^{2b}\mathrm{e}^{2a}\mathrm{e}^{ib\pi\ \mathrm{csgn}(ix^n)\,\mathrm{csgn}(ic\,x^n)^2}\mathrm{e}^{-ib\pi\ \mathrm{csgn}(ix^n)\,\mathrm{csgn}(ic\,x^n)\,\mathrm{csgn}(ic)}\mathrm{e}^{-ib\pi\,\mathrm{csgn}(ic\,x^n)^3}\mathrm{e}^{ib\pi\,\mathrm{csgn}(ic\,x^n)^2\,\mathrm{csgn}(ic)}\right.$ |

input
```
int(csch(a+b*ln(c*x^n))^2/x,x,method=_RETURNVERBOSE)
```

output
```
-coth(a+b*ln(c*x^n))/b/n
```

### 3.166.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 71 vs. $2(19) = 38$.

Time = 0.25 (sec) , antiderivative size = 71, normalized size of antiderivative = 3.74

$$\int \frac{\operatorname{csch}^2(a + b\log(cx^n))}{x}\,dx =$$

$$-\frac{2}{bn\cosh(bn\log(x) + b\log(c) + a)^2 + 2\,bn\cosh(bn\log(x) + b\log(c) + a)\sinh(bn\log(x) + b\log(c) + a)}$$

input
```
integrate(csch(a+b*log(c*x^n))^2/x,x, algorithm="fricas")
```

output
```
-2/(b*n*cosh(b*n*log(x) + b*log(c) + a)^2 + 2*b*n*cosh(b*n*log(x) + b*log(
c) + a)*sinh(b*n*log(x) + b*log(c) + a) + b*n*sinh(b*n*log(x) + b*log(c) +
 a)^2 - b*n)
```

### 3.166.6 Sympy [F]

$$\int \frac{\operatorname{csch}^2(a + b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}^2(a + b\log(cx^n))}{x}\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**2/x,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**2/x, x)
```

### 3.166.7 Maxima [A] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.53

$$\int \frac{\operatorname{csch}^2(a + b\log(cx^n))}{x}\,dx = -\frac{2}{bc^{2\,b}ne^{(2\,b\log(x^n)+2\,a)} - bn}$$

input
```
integrate(csch(a+b*log(c*x^n))^2/x,x, algorithm="maxima")
```

output
```
-2/(b*c^(2*b)*n*e^(2*b*log(x^n) + 2*a) - b*n)
```

### 3.166.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 28, normalized size of antiderivative = 1.47

$$\int \frac{\operatorname{csch}^2(a+b\log(cx^n))}{x}\,dx = -\frac{2}{(c^{2b}x^{2bn}e^{(2a)}-1)bn}$$

input
```
integrate(csch(a+b*log(c*x^n))^2/x,x, algorithm="giac")
```

output
```
-2/((c^(2*b)*x^(2*b*n)*e^(2*a) - 1)*b*n)
```

### 3.166.9 Mupad [B] (verification not implemented)

Time = 2.18 (sec) , antiderivative size = 25, normalized size of antiderivative = 1.32

$$\int \frac{\operatorname{csch}^2(a+b\log(cx^n))}{x}\,dx = \frac{2}{b\,n-b\,n\,\mathrm{e}^{2\,a}\,(c\,x^n)^{2\,b}}$$

input
```
int(1/(x*sinh(a + b*log(c*x^n))^2),x)
```

output
```
2/(b*n - b*n*exp(2*a)*(c*x^n)^(2*b))
```

# 3.167 $\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx$

3.167.1 Optimal result . . . . . 1087
3.167.2 Mathematica [A] (verified) . . . . . 1087
3.167.3 Rubi [C] (verified) . . . . . 1088
3.167.4 Maple [A] (verified) . . . . . 1090
3.167.5 Fricas [B] (verification not implemented) . . . . . 1090
3.167.6 Sympy [F] . . . . . 1091
3.167.7 Maxima [B] (verification not implemented) . . . . . 1092
3.167.8 Giac [B] (verification not implemented) . . . . . 1092
3.167.9 Mupad [B] (verification not implemented) . . . . . 1093

## 3.167.1 Optimal result

Integrand size = 17, antiderivative size = 55

$$\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx = \frac{\operatorname{arctanh}(\cosh(a+b\log(cx^n)))}{2bn} - \frac{\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2bn}$$

output
```
1/2*arctanh(cosh(a+b*ln(c*x^n)))/b/n-1/2*coth(a+b*ln(c*x^n))*csch(a+b*ln(c
*x^n))/b/n
```

## 3.167.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 107, normalized size of antiderivative = 1.95

$$\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx = -\frac{\operatorname{csch}^2\left(\frac{1}{2}(a+b\log(cx^n))\right)}{8bn} + \frac{\log\left(\cosh\left(\frac{1}{2}(a+b\log(cx^n))\right)\right)}{2bn} - \frac{\log\left(\sinh\left(\frac{1}{2}(a+b\log(cx^n))\right)\right)}{2bn} - \frac{\operatorname{sech}^2\left(\frac{1}{2}(a+b\log(cx^n))\right)}{8bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^3/x,x]
```

output
```
-1/8*Csch[(a + b*Log[c*x^n])/2]^2/(b*n) + Log[Cosh[(a + b*Log[c*x^n])/2]]/
(2*b*n) - Log[Sinh[(a + b*Log[c*x^n])/2]]/(2*b*n) - Sech[(a + b*Log[c*x^n]
)/2]^2/(8*b*n)
```

### 3.167.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.09, number of steps used = 9, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}} = 0.471$, Rules used = {3039, 3042, 26, 4255, 26, 3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \operatorname{csch}^3(a+b\log(cx^n))\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int -i\csc(ia+ib\log(cx^n))^3\,d\log(cx^n)}{n}$$

$$\downarrow 26$$

$$-\frac{i\int \csc(ia+ib\log(cx^n))^3\,d\log(cx^n)}{n}$$

$$\downarrow 4255$$

$$-\frac{i\left(\frac{1}{2}\int -i\operatorname{csch}(a+b\log(cx^n))\,d\log(cx^n) - \frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)}{n}$$

$$\downarrow 26$$

$$-\frac{i\left(-\frac{1}{2}i\int \operatorname{csch}(a+b\log(cx^n))\,d\log(cx^n) - \frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)}{n}$$

$$\downarrow 3042$$

$$-\frac{i\left(-\frac{1}{2}i\int i\csc(ia+ib\log(cx^n))\,d\log(cx^n) - \frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)}{n}$$

$$\downarrow 26$$

$$-\frac{i\left(\frac{1}{2}\int \csc(ia+ib\log(cx^n))\,d\log(cx^n) - \frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)}{n}$$

$$\downarrow 4257$$

$$-\frac{i\left(\frac{i\operatorname{arctanh}(\cosh(a+b\log(cx^n)))}{2b}-\frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)}{n}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^3/x,x]
```

output
```
((-I)*(((I/2)*ArcTanh[Cosh[a + b*Log[c*x^n]]])/b - ((I/2)*Coth[a + b*Log[c
*x^n]]*Csch[a + b*Log[c*x^n]])/b))/n
```

### 3.167.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

### 3.167.4 Maple [A] (verified)

Time = 2.37 (sec) , antiderivative size = 45, normalized size of antiderivative = 0.82

| method | result |
|---|---|
| derivativedivides | $\frac{-\frac{\operatorname{csch}(a+b\ln(cx^n))\coth(a+b\ln(cx^n))}{2}+\operatorname{arctanh}\left(e^{a+b\ln(cx^n)}\right)}{nb}$ |
| default | $\frac{-\frac{\operatorname{csch}(a+b\ln(cx^n))\coth(a+b\ln(cx^n))}{2}+\operatorname{arctanh}\left(e^{a+b\ln(cx^n)}\right)}{nb}$ |
| parallelrisch | $\frac{-\coth\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^2+\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^2-4\ln\left(\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)\right)}{8bn}$ |
| risch | $-\frac{c^b(x^n)^b\left((x^n)^{2b}c^{2b}e^{3a}e^{\frac{3ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)^2}{2}}e^{-\frac{3ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)\operatorname{csgn}(ic)}{2}}e^{-\frac{3ib\pi\operatorname{csgn}(icx^n)^3}{2}}e^{\frac{3ib\pi\operatorname{csgn}(ic}$ <br> $bn\left((x^n)^{2b}c^{2b}e^{2a}e^{ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)^2}e^{-ib\pi\ \operatorname{csgn}(ix^n)}\right.$ |

input
```
int(csch(a+b*ln(c*x^n))^3/x,x,method=_RETURNVERBOSE)
```

output
```
1/n/b*(-1/2*csch(a+b*ln(c*x^n))*coth(a+b*ln(c*x^n))+arctanh(exp(a+b*ln(c*x
^n))))
```

### 3.167.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 643 vs. 2(51) = 102.

Time = 0.28 (sec) , antiderivative size = 643, normalized size of antiderivative = 11.69

$$\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx = \text{Too large to display}$$

input
```
integrate(csch(a+b*log(c*x^n))^3/x,x, algorithm="fricas")
```

output
```
-1/2*(2*cosh(b*n*log(x) + b*log(c) + a)^3 + 6*cosh(b*n*log(x) + b*log(c) +
 a)*sinh(b*n*log(x) + b*log(c) + a)^2 + 2*sinh(b*n*log(x) + b*log(c) + a)^
3 - (cosh(b*n*log(x) + b*log(c) + a)^4 + 4*cosh(b*n*log(x) + b*log(c) + a)
*sinh(b*n*log(x) + b*log(c) + a)^3 + sinh(b*n*log(x) + b*log(c) + a)^4 + 2
*(3*cosh(b*n*log(x) + b*log(c) + a)^2 - 1)*sinh(b*n*log(x) + b*log(c) + a)
^2 - 2*cosh(b*n*log(x) + b*log(c) + a)^2 + 4*(cosh(b*n*log(x) + b*log(c) +
 a)^3 - cosh(b*n*log(x) + b*log(c) + a))*sinh(b*n*log(x) + b*log(c) + a) +
 1)*log(cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)
+ 1) + (cosh(b*n*log(x) + b*log(c) + a)^4 + 4*cosh(b*n*log(x) + b*log(c) +
 a)*sinh(b*n*log(x) + b*log(c) + a)^3 + sinh(b*n*log(x) + b*log(c) + a)^4
+ 2*(3*cosh(b*n*log(x) + b*log(c) + a)^2 - 1)*sinh(b*n*log(x) + b*log(c) +
 a)^2 - 2*cosh(b*n*log(x) + b*log(c) + a)^2 + 4*(cosh(b*n*log(x) + b*log(c
) + a)^3 - cosh(b*n*log(x) + b*log(c) + a))*sinh(b*n*log(x) + b*log(c) + a
) + 1)*log(cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) +
a) - 1) + 2*(3*cosh(b*n*log(x) + b*log(c) + a)^2 + 1)*sinh(b*n*log(x) + b*
log(c) + a) + 2*cosh(b*n*log(x) + b*log(c) + a))/(b*n*cosh(b*n*log(x) + b*
log(c) + a)^4 + 4*b*n*cosh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*
log(c) + a)^3 + b*n*sinh(b*n*log(x) + b*log(c) + a)^4 - 2*b*n*cosh(b*n*log
(x) + b*log(c) + a)^2 + 2*(3*b*n*cosh(b*n*log(x) + b*log(c) + a)^2 - b*n)*
sinh(b*n*log(x) + b*log(c) + a)^2 + b*n + 4*(b*n*cosh(b*n*log(x) + b*lo...
```

### 3.167.6 Sympy [F]

$$\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**3/x,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**3/x, x)
```

### 3.167.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 150 vs. $2(51) = 102$.

Time = 0.20 (sec) , antiderivative size = 150, normalized size of antiderivative = 2.73

$$\int \frac{\operatorname{csch}^3(a + b\log(cx^n))}{x}\,dx = -\frac{c^{3b}e^{(3b\log(x^n)+3a)} + c^b e^{(b\log(x^n)+a)}}{bc^{4b}ne^{(4b\log(x^n)+4a)} - 2bc^{2b}ne^{(2b\log(x^n)+2a)} + bn} + \frac{\log\left(\frac{\left(c^b e^{(b\log(x^n)+a)}+1\right)e^{(-a)}}{c^b}\right)}{2bn} - \frac{\log\left(\frac{\left(c^b e^{(b\log(x^n)+a)}-1\right)e^{(-a)}}{c^b}\right)}{2bn}$$

input
```
integrate(csch(a+b*log(c*x^n))^3/x,x, algorithm="maxima")
```

output
```
-(c^(3*b)*e^(3*b*log(x^n) + 3*a) + c^b*e^(b*log(x^n) + a))/(b*c^(4*b)*n*e^
(4*b*log(x^n) + 4*a) - 2*b*c^(2*b)*n*e^(2*b*log(x^n) + 2*a) + b*n) + 1/2*l
og((c^b*e^(b*log(x^n) + a) + 1)*e^(-a)/c^b)/(b*n) - 1/2*log((c^b*e^(b*log(
x^n) + a) - 1)*e^(-a)/c^b)/(b*n)
```

### 3.167.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 210 vs. $2(51) = 102$.

Time = 0.34 (sec) , antiderivative size = 210, normalized size of antiderivative = 3.82

$$\int \frac{\operatorname{csch}^3(a + b\log(cx^n))}{x}\,dx = \frac{1}{2}c^{3b}\left(\frac{c^b e^{(-3a)}\log\left(\sqrt{2\,x^{bn}|c|^b\cos\left(-\frac{1}{2}\,\pi b\operatorname{sgn}(c) + \frac{1}{2}\,\pi b\right)e^a + x^{2bn}|c|^{2b}e^{(2a)} + 1}\right)}{bc^{4b}n} - \frac{c^b e^{(-3a)}\log\left(\sqrt{-2\,x\right.}\right.$$

input
```
integrate(csch(a+b*log(c*x^n))^3/x,x, algorithm="giac")
```

output
```
1/2*c^(3*b)*(c^b*e^(-3*a)*log(sqrt(2*x^(b*n)*abs(c)^b*cos(-1/2*pi*b*sgn(c)
 + 1/2*pi*b)*e^a + x^(2*b*n)*abs(c)^(2*b)*e^(2*a) + 1))/(b*c^(4*b)*n) - c^
b*e^(-3*a)*log(sqrt(-2*x^(b*n)*abs(c)^b*cos(-1/2*pi*b*sgn(c) + 1/2*pi*b)*e
^a + x^(2*b*n)*abs(c)^(2*b)*e^(2*a) + 1))/(b*c^(4*b)*n) - 2*(c^(2*b)*x^(3*
b*n)*e^(2*a) + x^(b*n))*e^(-2*a)/((c^(2*b)*x^(2*b*n)*e^(2*a) - 1)^2*b*c^(2
*b)*n))*e^(3*a)
```

### 3.167.9 Mupad [B] (verification not implemented)

Time = 2.16 (sec) , antiderivative size = 140, normalized size of antiderivative = 2.55

$$\int \frac{\operatorname{csch}^3(a+b\log(cx^n))}{x}\,dx = \frac{\operatorname{atan}\left(\frac{e^{-a}\sqrt{-b^2n^2}}{bn(cx^n)^b}\right)}{\sqrt{-b^2n^2}} + \frac{e^{-a}}{(cx^n)^b\left(bn-\frac{bne^{-2a}}{(cx^n)^{2b}}\right)} - \frac{2e^{-a}}{(cx^n)^b\left(bn-\frac{2bne^{-2a}}{(cx^n)^{2b}}+\frac{bne^{-4a}}{(cx^n)^{4b}}\right)}$$

input
```
int(1/(x*sinh(a + b*log(c*x^n))^3),x)
```

output
```
atan((exp(-a)*(-b^2*n^2)^(1/2))/(b*n*(c*x^n)^b))/(-b^2*n^2)^(1/2) + exp(-a
)/((c*x^n)^b*(b*n - (b*n*exp(-2*a))/(c*x^n)^(2*b))) - (2*exp(-a))/((c*x^n)
^b*(b*n - (2*b*n*exp(-2*a))/(c*x^n)^(2*b) + (b*n*exp(-4*a))/(c*x^n)^(4*b))
)
```

# 3.168 $\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx$

3.168.1 Optimal result . . . . . 1094
3.168.2 Mathematica [A] (verified) . . . . . 1094
3.168.3 Rubi [C] (verified) . . . . . 1095
3.168.4 Maple [A] (verified) . . . . . 1096
3.168.5 Fricas [B] (verification not implemented) . . . . . 1096
3.168.6 Sympy [F] . . . . . 1097
3.168.7 Maxima [B] (verification not implemented) . . . . . 1097
3.168.8 Giac [A] (verification not implemented) . . . . . 1098
3.168.9 Mupad [B] (verification not implemented) . . . . . 1098

## 3.168.1 Optimal result

Integrand size = 17, antiderivative size = 42

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx = \frac{\coth(a+b\log(cx^n))}{bn} - \frac{\coth^3(a+b\log(cx^n))}{3bn}$$

output
```
coth(a+b*ln(c*x^n))/b/n-1/3*coth(a+b*ln(c*x^n))^3/b/n
```

## 3.168.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.33

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx = \frac{2\coth(a+b\log(cx^n))}{3bn} - \frac{\coth(a+b\log(cx^n))\operatorname{csch}^2(a+b\log(cx^n))}{3bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^4/x,x]
```

output
```
(2*Coth[a + b*Log[c*x^n]])/(3*b*n) - (Coth[a + b*Log[c*x^n]]*Csch[a + b*Lo
g[c*x^n]]^2)/(3*b*n)
```

### 3.168.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.25 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.07, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.235$, Rules used = {3039, 3042, 4254, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx$$
$$\downarrow 3039$$
$$\frac{\int \operatorname{csch}^4(a+b\log(cx^n))\,d\log(cx^n)}{n}$$
$$\downarrow 3042$$
$$\frac{\int \csc(ia+ib\log(cx^n))^4\,d\log(cx^n)}{n}$$
$$\downarrow 4254$$
$$\frac{i\int \left(1-\coth^2(a+b\log(cx^n))\right)d(-i\coth(a+b\log(cx^n)))}{bn}$$
$$\downarrow 2009$$
$$\frac{i\left(\frac{1}{3}i\coth^3(a+b\log(cx^n))-i\coth(a+b\log(cx^n))\right)}{bn}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^4/x,x]
```

output
```
(I*((-I)*Coth[a + b*Log[c*x^n]] + (I/3)*Coth[a + b*Log[c*x^n]]^3))/(b*n)
```

#### 3.168.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4254
```
Int[csc[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> Simp[-d^(-1)   Subst[Int[Exp
andIntegrand[(1 + x^2)^(n/2 - 1), x], x], x, Cot[c + d*x]], x] /; FreeQ[{c,
 d}, x] && IGtQ[n/2, 0]
```

### 3.168.4 Maple [A] (verified)

Time = 6.92 (sec) , antiderivative size = 36, normalized size of antiderivative = 0.86

| method | result |
|---|---|
| derivativedivides | $\frac{\left(\frac{2}{3}-\frac{\operatorname{csch}(a+b\ln(cx^n))^2}{3}\right)\coth(a+b\ln(cx^n))}{nb}$ |
| default | $\frac{\left(\frac{2}{3}-\frac{\operatorname{csch}(a+b\ln(cx^n))^2}{3}\right)\coth(a+b\ln(cx^n))}{nb}$ |
| parallelrisch | $\frac{-\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^3-\coth\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^3+9\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)+9\coth\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)}{24bn}$ |
| risch | $-\frac{4\left(3(x^n)^{2b}c^{2b}e^{2a}e^{ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)^2}e^{-ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)\operatorname{csgn}(ic)}e^{-ib\pi\operatorname{csgn}(icx^n)^3}e^{ib\pi\operatorname{csgn}(icx^n)^2\operatorname{csgn}(ic}\right.}{3bn\left((x^n)^{2b}c^{2b}e^{2a}e^{ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)^2}e^{-ib\pi\ \operatorname{csgn}(ix^n)\operatorname{csgn}(icx^n)\operatorname{csgn}(ic)}e^{-ib\pi\operatorname{csgn}(icx^n)^3}e^{ib\pi\operatorname{csgn}(icx^n)^2\operatorname{csgn}(ic)}\right.}$ |

input
```
int(csch(a+b*ln(c*x^n))^4/x,x,method=_RETURNVERBOSE)
```

output
```
1/n/b*(2/3-1/3*csch(a+b*ln(c*x^n))^2)*coth(a+b*ln(c*x^n))
```

### 3.168.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 272 vs. 2(40) = 80.

Time = 0.26 (sec) , antiderivative size = 272, normalized size of antiderivative = 6.48

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx =$$

$$-\frac{}{3\left(bn\cosh\left(bn\log(x)+b\log(c)+a\right)^5+5\,bn\cosh\left(bn\log(x)+b\log(c)+a\right)\sinh\left(bn\log(x)+b\log(c)+\right.}$$

input
```
integrate(csch(a+b*log(c*x^n))^4/x,x, algorithm="fricas")
```

output
```
-8/3*(cosh(b*n*log(x) + b*log(c) + a) + 2*sinh(b*n*log(x) + b*log(c) + a))
/(b*n*cosh(b*n*log(x) + b*log(c) + a)^5 + 5*b*n*cosh(b*n*log(x) + b*log(c)
 + a)*sinh(b*n*log(x) + b*log(c) + a)^4 + b*n*sinh(b*n*log(x) + b*log(c) +
 a)^5 - 3*b*n*cosh(b*n*log(x) + b*log(c) + a)^3 + (10*b*n*cosh(b*n*log(x)
+ b*log(c) + a)^2 - 3*b*n)*sinh(b*n*log(x) + b*log(c) + a)^3 + 2*b*n*cosh(
b*n*log(x) + b*log(c) + a) + (10*b*n*cosh(b*n*log(x) + b*log(c) + a)^3 - 9
*b*n*cosh(b*n*log(x) + b*log(c) + a))*sinh(b*n*log(x) + b*log(c) + a)^2 +
(5*b*n*cosh(b*n*log(x) + b*log(c) + a)^4 - 9*b*n*cosh(b*n*log(x) + b*log(c
) + a)^2 + 4*b*n)*sinh(b*n*log(x) + b*log(c) + a))
```

### 3.168.6 Sympy [F]

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**4/x,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**4/x, x)
```

### 3.168.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 92 vs. $2(40) = 80$.

Time $= 0.20$ (sec) , antiderivative size $= 92$, normalized size of antiderivative $= 2.19$

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx$$
$$= -\frac{4\left(3\,c^{2\,b}e^{(2\,b\log(x^n)+2\,a)}-1\right)}{3\left(bc^{6\,b}ne^{(6\,b\log(x^n)+6\,a)}-3\,bc^{4\,b}ne^{(4\,b\log(x^n)+4\,a)}+3\,bc^{2\,b}ne^{(2\,b\log(x^n)+2\,a)}-bn\right)}$$

input
```
integrate(csch(a+b*log(c*x^n))^4/x,x, algorithm="maxima")
```

output
```
-4/3*(3*c^(2*b)*e^(2*b*log(x^n) + 2*a) - 1)/(b*c^(6*b)*n*e^(6*b*log(x^n) +
 6*a) - 3*b*c^(4*b)*n*e^(4*b*log(x^n) + 4*a) + 3*b*c^(2*b)*n*e^(2*b*log(x^
n) + 2*a) - b*n)
```

### 3.168.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 47, normalized size of antiderivative = 1.12

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx = -\frac{4\left(3\,c^{2\,b}x^{2\,bn}e^{(2\,a)}-1\right)}{3\left(c^{2\,b}x^{2\,bn}e^{(2\,a)}-1\right)^3 bn}$$

input
```
integrate(csch(a+b*log(c*x^n))^4/x,x, algorithm="giac")
```

output
```
-4/3*(3*c^(2*b)*x^(2*b*n)*e^(2*a) - 1)/((c^(2*b)*x^(2*b*n)*e^(2*a) - 1)^3*
b*n)
```

### 3.168.9 Mupad [B] (verification not implemented)

Time = 2.29 (sec) , antiderivative size = 55, normalized size of antiderivative = 1.31

$$\int \frac{\operatorname{csch}^4(a+b\log(cx^n))}{x}\,dx = \frac{4\,\mathrm{e}^{4\,a}\left(c\,x^n\right)^{4\,b}\left(\mathrm{e}^{2\,a}\left(c\,x^n\right)^{2\,b}-3\right)}{3\,b\,n\left(\mathrm{e}^{2\,a}\left(c\,x^n\right)^{2\,b}-1\right)^3}$$

input
```
int(1/(x*sinh(a + b*log(c*x^n))^4),x)
```

output
```
(4*exp(4*a)*(c*x^n)^(4*b)*(exp(2*a)*(c*x^n)^(2*b) - 3))/(3*b*n*(exp(2*a)*(
c*x^n)^(2*b) - 1)^3)
```

# 3.169 $\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx$

3.169.1 Optimal result . . . 1099
3.169.2 Mathematica [A] (verified) . . . 1099
3.169.3 Rubi [C] (verified) . . . 1100
3.169.4 Maple [A] (verified) . . . 1103
3.169.5 Fricas [B] (verification not implemented) . . . 1103
3.169.6 Sympy [F] . . . 1104
3.169.7 Maxima [B] (verification not implemented) . . . 1105
3.169.8 Giac [B] (verification not implemented) . . . 1105
3.169.9 Mupad [B] (verification not implemented) . . . 1106

## 3.169.1 Optimal result

Integrand size = 17, antiderivative size = 89

$$\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx = -\frac{3\operatorname{arctanh}(\cosh(a+b\log(cx^n)))}{8bn} + \frac{3\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{8bn} - \frac{\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4bn}$$

output
```
-3/8*arctanh(cosh(a+b*ln(c*x^n)))/b/n+3/8*coth(a+b*ln(c*x^n))*csch(a+b*ln(
c*x^n))/b/n-1/4*coth(a+b*ln(c*x^n))*csch(a+b*ln(c*x^n))^3/b/n
```

## 3.169.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 161, normalized size of antiderivative = 1.81

$$\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx = \frac{3\operatorname{csch}^2\left(\frac{1}{2}(a+b\log(cx^n))\right)}{32bn} - \frac{\operatorname{csch}^4\left(\frac{1}{2}(a+b\log(cx^n))\right)}{64bn} - \frac{3\log\left(\cosh\left(\frac{1}{2}(a+b\log(cx^n))\right)\right)}{8bn} + \frac{3\log\left(\sinh\left(\frac{1}{2}(a+b\log(cx^n))\right)\right)}{8bn} + \frac{3\operatorname{sech}^2\left(\frac{1}{2}(a+b\log(cx^n))\right)}{32bn} + \frac{\operatorname{sech}^4\left(\frac{1}{2}(a+b\log(cx^n))\right)}{64bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^5/x,x]
```

output
```
(3*Csch[(a + b*Log[c*x^n])/2]^2)/(32*b*n) - Csch[(a + b*Log[c*x^n])/2]^4/(
64*b*n) - (3*Log[Cosh[(a + b*Log[c*x^n])/2]])/(8*b*n) + (3*Log[Sinh[(a + b
*Log[c*x^n])/2]])/(8*b*n) + (3*Sech[(a + b*Log[c*x^n])/2]^2)/(32*b*n) + Se
ch[(a + b*Log[c*x^n])/2]^4/(64*b*n)
```

### 3.169.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.40 (sec) , antiderivative size = 98, normalized size of antiderivative = 1.10, number of steps used = 13, number of rules used = 12, $\frac{\text{number of rules}}{\text{integrand size}} = 0.706$, Rules used = {3039, 3042, 26, 4255, 26, 3042, 26, 4255, 26, 3042, 26, 4257}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \operatorname{csch}^5(a+b\log(cx^n))\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int i\csc(ia+ib\log(cx^n))^5\,d\log(cx^n)}{n}$$

$$\downarrow 26$$

$$\frac{i\int \csc(ia+ib\log(cx^n))^5\,d\log(cx^n)}{n}$$

$$\downarrow 4255$$

$$\frac{i\left(\frac{3}{4}\int i\operatorname{csch}^3(a+b\log(cx^n))\,d\log(cx^n)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4b}\right)}{n}$$

$$\downarrow 26$$

$$\frac{i\left(\frac{3}{4}i\int \operatorname{csch}^3(a+b\log(cx^n))\,d\log(cx^n)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4b}\right)}{n}$$

$$\downarrow 3042$$

$$\frac{i\left(\frac{3}{4}i\int -i\csc\left(ia+ib\log\left(cx^n\right)\right)^3 d\log\left(cx^n\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4b}\right)}{n}$$

$$\downarrow 26$$

$$\frac{i\left(\frac{3}{4}\int \csc\left(ia+ib\log\left(cx^n\right)\right)^3 d\log\left(cx^n\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4b}\right)}{n}$$

$$\downarrow 4255$$

$$\frac{i\left(\frac{3}{4}\left(\frac{1}{2}\int -i\operatorname{csch}(a+b\log\left(cx^n\right))\, d\log\left(cx^n\right)-\frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n}{4b}\right.}{n}$$

$$\downarrow 26$$

$$\frac{i\left(\frac{3}{4}\left(-\frac{1}{2}i\int \operatorname{csch}(a+b\log\left(cx^n\right))\, d\log\left(cx^n\right)-\frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n}{4b}\right.}{n}$$

$$\downarrow 3042$$

$$\frac{i\left(\frac{3}{4}\left(-\frac{1}{2}i\int i\csc\left(ia+ib\log\left(cx^n\right)\right) d\log\left(cx^n\right)-\frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n}{4b}\right.}{n}$$

$$\downarrow 26$$

$$\frac{i\left(\frac{3}{4}\left(\frac{1}{2}\int \csc\left(ia+ib\log\left(cx^n\right)\right) d\log\left(cx^n\right)-\frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4b}\right.}{n}$$

$$\downarrow 4257$$

$$\frac{i\left(\frac{3}{4}\left(\frac{i\operatorname{arctanh}(\cosh(a+b\log(cx^n)))}{2b}-\frac{i\coth(a+b\log(cx^n))\operatorname{csch}(a+b\log(cx^n))}{2b}\right)+\frac{i\coth(a+b\log(cx^n))\operatorname{csch}^3(a+b\log(cx^n))}{4b}\right)}{n}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^5/x,x]
```

## 3.169. $\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\, dx$

output
```
(I*(((I/4)*Coth[a + b*Log[c*x^n]]*Csch[a + b*Log[c*x^n]]^3)/b + (3*(((I/2)
*ArcTanh[Cosh[a + b*Log[c*x^n]]])/b - ((I/2)*Coth[a + b*Log[c*x^n]]*Csch[a
 + b*Log[c*x^n]])/b))/4))/n
```

### 3.169.3.1 Defintions of rubi rules used

rule 26
```
Int[(Complex[0, a_])*(Fx_), x_Symbol] :> Simp[(Complex[Identity[0], a])   I
nt[Fx, x], x] /; FreeQ[a, x] && EqQ[a^2, 1]
```

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

### 3.169.4 Maple [A] (verified)

Time = 21.53 (sec) , antiderivative size = 64, normalized size of antiderivative = 0.72

| method | result |
|---|---|
| derivativedivides | $\frac{\left(-\frac{\operatorname{csch}(a+b\ln(cx^n))^3}{4}+\frac{3\operatorname{csch}(a+b\ln(cx^n))}{8}\right)\coth(a+b\ln(cx^n))-\frac{3\operatorname{arctanh}\left(e^{a+b\ln(cx^n)}\right)}{4}}{nb}$ |
| default | $\frac{\left(-\frac{\operatorname{csch}(a+b\ln(cx^n))^3}{4}+\frac{3\operatorname{csch}(a+b\ln(cx^n))}{8}\right)\coth(a+b\ln(cx^n))-\frac{3\operatorname{arctanh}\left(e^{a+b\ln(cx^n)}\right)}{4}}{nb}$ |
| parallelrisch | $\frac{-\coth\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^4+\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^4-8\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)^2+24\ln\left(\tanh\left(\frac{a}{2}+b\ln\left(\sqrt{cx^n}\right)\right)\right)+8\coth\left(\frac{a}{2}+\right.}{64bn}$ |
| risch | Expression too large to display |

input
```
int(csch(a+b*ln(c*x^n))^5/x,x,method=_RETURNVERBOSE)
```

output
```
1/n/b*((-1/4*csch(a+b*ln(c*x^n))^3+3/8*csch(a+b*ln(c*x^n)))*coth(a+b*ln(c*
x^n))-3/4*arctanh(exp(a+b*ln(c*x^n))))
```

### 3.169.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1806 vs. 2(83) = 166.

Time = 0.27 (sec) , antiderivative size = 1806, normalized size of antiderivative = 20.29

$$\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx = \text{Too large to display}$$

input
```
integrate(csch(a+b*log(c*x^n))^5/x,x, algorithm="fricas")
```

output

```
1/8*(6*cosh(b*n*log(x) + b*log(c) + a)^7 + 42*cosh(b*n*log(x) + b*log(c) +
 a)*sinh(b*n*log(x) + b*log(c) + a)^6 + 6*sinh(b*n*log(x) + b*log(c) + a)^
7 + 2*(63*cosh(b*n*log(x) + b*log(c) + a)^2 - 11)*sinh(b*n*log(x) + b*log(
c) + a)^5 - 22*cosh(b*n*log(x) + b*log(c) + a)^5 + 10*(21*cosh(b*n*log(x)
+ b*log(c) + a)^3 - 11*cosh(b*n*log(x) + b*log(c) + a))*sinh(b*n*log(x) +
b*log(c) + a)^4 + 2*(105*cosh(b*n*log(x) + b*log(c) + a)^4 - 110*cosh(b*n*
log(x) + b*log(c) + a)^2 - 11)*sinh(b*n*log(x) + b*log(c) + a)^3 - 22*cosh
(b*n*log(x) + b*log(c) + a)^3 + 2*(63*cosh(b*n*log(x) + b*log(c) + a)^5 -
110*cosh(b*n*log(x) + b*log(c) + a)^3 - 33*cosh(b*n*log(x) + b*log(c) + a)
)*sinh(b*n*log(x) + b*log(c) + a)^2 - 3*(cosh(b*n*log(x) + b*log(c) + a)^8
 + 8*cosh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a)^7 + s
inh(b*n*log(x) + b*log(c) + a)^8 + 4*(7*cosh(b*n*log(x) + b*log(c) + a)^2
- 1)*sinh(b*n*log(x) + b*log(c) + a)^6 - 4*cosh(b*n*log(x) + b*log(c) + a)
^6 + 8*(7*cosh(b*n*log(x) + b*log(c) + a)^3 - 3*cosh(b*n*log(x) + b*log(c)
 + a))*sinh(b*n*log(x) + b*log(c) + a)^5 + 2*(35*cosh(b*n*log(x) + b*log(c
) + a)^4 - 30*cosh(b*n*log(x) + b*log(c) + a)^2 + 3)*sinh(b*n*log(x) + b*l
og(c) + a)^4 + 6*cosh(b*n*log(x) + b*log(c) + a)^4 + 8*(7*cosh(b*n*log(x)
+ b*log(c) + a)^5 - 10*cosh(b*n*log(x) + b*log(c) + a)^3 + 3*cosh(b*n*log(
x) + b*log(c) + a))*sinh(b*n*log(x) + b*log(c) + a)^3 + 4*(7*cosh(b*n*log(
x) + b*log(c) + a)^6 - 15*cosh(b*n*log(x) + b*log(c) + a)^4 + 9*cosh(b*...
```

### 3.169.6 Sympy [F]

$$\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx$$

input

```
integrate(csch(a+b*ln(c*x**n))**5/x,x)
```

output

```
Integral(csch(a + b*log(c*x**n))**5/x, x)
```

### 3.169.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 232 vs. $2(83) = 166$.

Time = 0.21 (sec) , antiderivative size = 232, normalized size of antiderivative = 2.61

$$\int \frac{\operatorname{csch}^5(a + b\log(cx^n))}{x}\,dx$$
$$= \frac{3\,c^{7\,b}e^{(7\,b\log(x^n)+7\,a)} - 11\,c^{5\,b}e^{(5\,b\log(x^n)+5\,a)} - 11\,c^{3\,b}e^{(3\,b\log(x^n)+3\,a)} + 3\,c^{b}e^{(b\log(x^n)+a)}}{4\left(bc^{8\,b}ne^{(8\,b\log(x^n)+8\,a)} - 4\,bc^{6\,b}ne^{(6\,b\log(x^n)+6\,a)} + 6\,bc^{4\,b}ne^{(4\,b\log(x^n)+4\,a)} - 4\,bc^{2\,b}ne^{(2\,b\log(x^n)+2\,a)} + bn\right)}$$
$$- \frac{3\log\left(\frac{\left(c^b e^{(b\log(x^n)+a)}+1\right)e^{(-a)}}{c^b}\right)}{8\,bn} + \frac{3\log\left(\frac{\left(c^b e^{(b\log(x^n)+a)}-1\right)e^{(-a)}}{c^b}\right)}{8\,bn}$$

input
```
integrate(csch(a+b*log(c*x^n))^5/x,x, algorithm="maxima")
```

output
```
1/4*(3*c^(7*b)*e^(7*b*log(x^n) + 7*a) - 11*c^(5*b)*e^(5*b*log(x^n) + 5*a)
- 11*c^(3*b)*e^(3*b*log(x^n) + 3*a) + 3*c^b*e^(b*log(x^n) + a))/(b*c^(8*b)
*n*e^(8*b*log(x^n) + 8*a) - 4*b*c^(6*b)*n*e^(6*b*log(x^n) + 6*a) + 6*b*c^(
4*b)*n*e^(4*b*log(x^n) + 4*a) - 4*b*c^(2*b)*n*e^(2*b*log(x^n) + 2*a) + b*n
) - 3/8*log((c^b*e^(b*log(x^n) + a) + 1)*e^(-a)/c^b)/(b*n) + 3/8*log((c^b*
e^(b*log(x^n) + a) - 1)*e^(-a)/c^b)/(b*n)
```

### 3.169.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 248 vs. $2(83) = 166$.

Time = 0.35 (sec) , antiderivative size = 248, normalized size of antiderivative = 2.79

$$\int \frac{\operatorname{csch}^5(a + b\log(cx^n))}{x}\,dx =$$
$$-\frac{1}{8}c^{5\,b}\left(\frac{3\,c^b e^{(-5\,a)}\log\left(\sqrt{2\,x^{bn}|c|^b\cos\left(-\frac{1}{2}\,\pi b\operatorname{sgn}(c)+\frac{1}{2}\,\pi b\right)e^a + x^{2\,bn}|c|^{2\,b}e^{(2\,a)}+1}\right)}{bc^{6\,b}n} - \frac{3\,c^b e^{(-5\,a)}\log\left(\sqrt{}\right.}{}\right.$$

input
```
integrate(csch(a+b*log(c*x^n))^5/x,x, algorithm="giac")
```

output
```
-1/8*c^(5*b)*(3*c^b*e^(-5*a)*log(sqrt(2*x^(b*n)*abs(c)^b*cos(-1/2*pi*b*sgn
(c) + 1/2*pi*b)*e^a + x^(2*b*n)*abs(c)^(2*b)*e^(2*a) + 1))/(b*c^(6*b)*n) -
 3*c^b*e^(-5*a)*log(sqrt(-2*x^(b*n)*abs(c)^b*cos(-1/2*pi*b*sgn(c) + 1/2*pi
*b)*e^a + x^(2*b*n)*abs(c)^(2*b)*e^(2*a) + 1))/(b*c^(6*b)*n) - 2*(3*c^(6*b
)*x^(7*b*n)*e^(6*a) - 11*c^(4*b)*x^(5*b*n)*e^(4*a) - 11*c^(2*b)*x^(3*b*n)*
e^(2*a) + 3*x^(b*n))*e^(-4*a)/((c^(2*b)*x^(2*b*n)*e^(2*a) - 1)^4*b*c^(4*b)
*n))*e^(5*a)
```

### 3.169.9 Mupad [B] (verification not implemented)

Time = 2.23 (sec) , antiderivative size = 318, normalized size of antiderivative = 3.57

$$\int \frac{\operatorname{csch}^5(a+b\log(cx^n))}{x}\,dx = \frac{2\,\mathrm{e}^{-a}}{(cx^n)^b\left(bn-\frac{3bn\mathrm{e}^{-2a}}{(cx^n)^{2b}}+\frac{3bn\mathrm{e}^{-4a}}{(cx^n)^{4b}}-\frac{bn\mathrm{e}^{-6a}}{(cx^n)^{6b}}\right)} - \frac{3\operatorname{atan}\left(\frac{\mathrm{e}^{-a}\sqrt{-b^2n^2}}{bn(cx^n)^b}\right)}{4\sqrt{-b^2n^2}} - \frac{3\,\mathrm{e}^{-a}}{4(cx^n)^b\left(bn-\frac{bn\mathrm{e}^{-2a}}{(cx^n)^{2b}}\right)} - \frac{4\,\mathrm{e}^{-3a}}{(cx^n)^{3b}\left(bn-\frac{4bn\mathrm{e}^{-2a}}{(cx^n)^{2b}}+\frac{6bn\mathrm{e}^{-4a}}{(cx^n)^{4b}}-\frac{4bn\mathrm{e}^{-6a}}{(cx^n)^{6b}}+\frac{bn\mathrm{e}^{-8a}}{(cx^n)^{8b}}\right)} - \frac{\mathrm{e}^{-a}}{2(cx^n)^b\left(bn-\frac{2bn\mathrm{e}^{-2a}}{(cx^n)^{2b}}+\frac{bn\mathrm{e}^{-4a}}{(cx^n)^{4b}}\right)}$$

input
```
int(1/(x*sinh(a + b*log(c*x^n))^5),x)
```

output
```
(2*exp(-a))/((c*x^n)^b*(b*n - (3*b*n*exp(-2*a))/(c*x^n)^(2*b) + (3*b*n*exp
(-4*a))/(c*x^n)^(4*b) - (b*n*exp(-6*a))/(c*x^n)^(6*b))) - (3*atan((exp(-a)
*(-b^2*n^2)^(1/2))/(b*n*(c*x^n)^b)))/(4*(-b^2*n^2)^(1/2)) - (3*exp(-a))/(4
*(c*x^n)^b*(b*n - (b*n*exp(-2*a))/(c*x^n)^(2*b))) - (4*exp(-3*a))/((c*x^n)
^(3*b)*(b*n - (4*b*n*exp(-2*a))/(c*x^n)^(2*b) + (6*b*n*exp(-4*a))/(c*x^n)^
(4*b) - (4*b*n*exp(-6*a))/(c*x^n)^(6*b) + (b*n*exp(-8*a))/(c*x^n)^(8*b)))
- exp(-a)/(2*(c*x^n)^b*(b*n - (2*b*n*exp(-2*a))/(c*x^n)^(2*b) + (b*n*exp(-
4*a))/(c*x^n)^(4*b)))
```

# 3.170 $\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx$

3.170.1 Optimal result . . . . . 1107
3.170.2 Mathematica [A] (verified) . . . . . 1107
3.170.3 Rubi [A] (verified) . . . . . 1108
3.170.4 Maple [A] (verified) . . . . . 1110
3.170.5 Fricas [C] (verification not implemented) . . . . . 1110
3.170.6 Sympy [F] . . . . . 1111
3.170.7 Maxima [F] . . . . . 1111
3.170.8 Giac [F(-1)] . . . . . 1112
3.170.9 Mupad [F(-1)] . . . . . 1112

## 3.170.1 Optimal result

Integrand size = 19, antiderivative size = 111

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx = -\frac{2\cosh(a+b\log(cx^n))\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{3bn} + \frac{2i\sqrt{\operatorname{csch}(a+b\log(cx^n))}\,\text{EllipticF}\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ib\log(cx^n)\right),2\right)\sqrt{i\sinh(a+b\log(cx^n))}}{3bn}$$

output
```
-2/3*cosh(a+b*ln(c*x^n))*csch(a+b*ln(c*x^n))^(3/2)/b/n-2/3*I*(sin(1/2*I*a+
1/4*Pi+1/2*I*b*ln(c*x^n))^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n))*E
llipticF(cos(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n)),2^(1/2))*csch(a+b*ln(c*x^n)
)^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)/b/n
```

## 3.170.2 Mathematica [A] (verified)

Time = 0.14 (sec) , antiderivative size = 84, normalized size of antiderivative = 0.76

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx = -\frac{2\sqrt{\operatorname{csch}(a+b\log(cx^n))}\left(\coth(a+b\log(cx^n)) + i\,\text{EllipticF}\left(\frac{1}{4}(-2ia+\pi-2ib\log(cx^n)),2\right)\sqrt{i\sinh(}\right.}{3bn}$$

input
```
Integrate[Csch[a + b*Log[c*x^n]]^(5/2)/x,x]
```

output
```
(-2*Sqrt[Csch[a + b*Log[c*x^n]]]*(Coth[a + b*Log[c*x^n]] + I*EllipticF[((-
2*I)*a + Pi - (2*I)*b*Log[c*x^n])/4, 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]]))/(
3*b*n)
```

### 3.170.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 109, normalized size of antiderivative = 0.98, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.368$, Rules used = {3039, 3042, 4255, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int (i\csc(ia+ib\log(cx^n)))^{5/2}\,d\log(cx^n)}{n}$$

$$\downarrow 4255$$

$$\frac{-\frac{1}{3}\int \sqrt{\operatorname{csch}(a+b\log(cx^n))}d\log(cx^n) - \frac{2\cosh(a+b\log(cx^n))\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{3b}}{n}$$

$$\downarrow 3042$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{3b} - \frac{1}{3}\int \sqrt{i\csc(ia+ib\log(cx^n))}d\log(cx^n)}{n}$$

$$\downarrow 4258$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{3b} - \frac{1}{3}\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\int \frac{1}{\sqrt{i\sinh(a+b\log(cx^n))}}d\log$$

$$\downarrow 3042$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{3b} - \frac{1}{3}\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\int \frac{1}{\sqrt{\sin(ia+ib\log(cx^n))}}d\log($$

$$\downarrow 3120$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{3b}+\frac{2i\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\,\text{EllipticF}\left(\frac{1}{2}(ia+ib\log(cx^n)-\frac{\pi}{2}),2\right)}{3b}}{n}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^(5/2)/x,x]
```

output
```
((-2*Cosh[a + b*Log[c*x^n]]*Csch[a + b*Log[c*x^n]]^(3/2))/(3*b) + (((2*I)/
3)*Sqrt[Csch[a + b*Log[c*x^n]]]*EllipticF[(I*a - Pi/2 + I*b*Log[c*x^n])/2,
 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]])/b)/n
```

### 3.170.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.170.4 Maple [A] (verified)

Time = 1.59 (sec) , antiderivative size = 144, normalized size of antiderivative = 1.30

| method | result |
|---|---|
| derivativedivides | $-\frac{i\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticF}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{}}{2}\right.}{3n\sinh(a+b\ln(cx^n))^{\frac{3}{2}}\cosh(a+b\ln(cx^n))b}$ |
| default | $-\frac{i\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticF}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{}}{2}\right.}{3n\sinh(a+b\ln(cx^n))^{\frac{3}{2}}\cosh(a+b\ln(cx^n))b}$ |

input
```
int(csch(a+b*ln(c*x^n))^(5/2)/x,x,method=_RETURNVERBOSE)
```

output
```
-1/3/n/sinh(a+b*ln(c*x^n))^(3/2)*(I*(1-I*sinh(a+b*ln(c*x^n)))^(1/2)*2^(1/2
)*(1+I*sinh(a+b*ln(c*x^n)))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticF(
(1-I*sinh(a+b*ln(c*x^n)))^(1/2),1/2*2^(1/2))*sinh(a+b*ln(c*x^n))+2*cosh(a+
b*ln(c*x^n))^2)/cosh(a+b*ln(c*x^n))/b
```

### 3.170.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 318, normalized size of antiderivative = 2.86

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx =$$

$$-\frac{2\left(\sqrt{2}\left(\cosh(bn\log(x)+b\log(c)+a)^2+2\cosh(bn\log(x)+b\log(c)+a)\sinh(bn\log(x)+b\log(c)+\right.\right.}{}$$

input
```
integrate(csch(a+b*log(c*x^n))^(5/2)/x,x, algorithm="fricas")
```

output
```
-2/3*(sqrt(2)*(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*cosh(b*n*log(x) + b*l
og(c) + a)*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) +
a)^2 + 1)*sqrt((cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(
c) + a))/(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*cosh(b*n*log(x) + b*log(c)
 + a)*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)^2
- 1)) + (sqrt(2)*cosh(b*n*log(x) + b*log(c) + a)^2 + 2*sqrt(2)*cosh(b*n*lo
g(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a) + sqrt(2)*sinh(b*n*lo
g(x) + b*log(c) + a)^2 - sqrt(2))*weierstrassPInverse(4, 0, cosh(b*n*log(x
) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)))/(b*n*cosh(b*n*log(x)
 + b*log(c) + a)^2 + 2*b*n*cosh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x)
 + b*log(c) + a) + b*n*sinh(b*n*log(x) + b*log(c) + a)^2 - b*n)
```

### 3.170.6 Sympy [F]

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**(5/2)/x,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**(5/2)/x, x)
```

### 3.170.7 Maxima [F]

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}\left(b\log(cx^n)+a\right)^{\frac{5}{2}}}{x}\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^(5/2)/x,x, algorithm="maxima")
```

output
```
integrate(csch(b*log(c*x^n) + a)^(5/2)/x, x)
```

### 3.170.8 Giac [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx = \text{Timed out}$$

input
```
integrate(csch(a+b*log(c*x^n))^(5/2)/x,x, algorithm="giac")
```

output
```
Timed out
```

### 3.170.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}{x}\,dx = \int \frac{\left(\frac{1}{\sinh(a+b\,\ln(c\,x^n))}\right)^{5/2}}{x}\,dx$$

input
```
int((1/sinh(a + b*log(c*x^n)))^(5/2)/x,x)
```

output
```
int((1/sinh(a + b*log(c*x^n)))^(5/2)/x, x)
```

# 3.171 $\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx$

3.171.1 Optimal result . . . . . 1113
3.171.2 Mathematica [A] (verified) . . . . . 1113
3.171.3 Rubi [A] (verified) . . . . . 1114
3.171.4 Maple [A] (verified) . . . . . 1116
3.171.5 Fricas [C] (verification not implemented) . . . . . 1116
3.171.6 Sympy [F] . . . . . 1117
3.171.7 Maxima [F] . . . . . 1117
3.171.8 Giac [F(-1)] . . . . . 1117
3.171.9 Mupad [F(-1)] . . . . . 1118

## 3.171.1 Optimal result

Integrand size = 19, antiderivative size = 107

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = -\frac{2\cosh(a+b\log(cx^n))\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{bn} - \frac{2iE\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ib\log(cx^n)\right)\middle|2\right)}{bn\sqrt{\operatorname{csch}(a+b\log(cx^n))}\sqrt{i\sinh(a+b\log(cx^n))}}$$

output

```
-2*cosh(a+b*ln(c*x^n))*csch(a+b*ln(c*x^n))^(1/2)/b/n+2*I*(sin(1/2*I*a+1/4*
Pi+1/2*I*b*ln(c*x^n))^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n))*Ellip
ticE(cos(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n)),2^(1/2))/b/n/csch(a+b*ln(c*x^n)
)^(1/2)/(I*sinh(a+b*ln(c*x^n)))^(1/2)
```

## 3.171.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 80, normalized size of antiderivative = 0.75

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = -\frac{2\sqrt{\operatorname{csch}(a+b\log(cx^n))}\left(\cosh(a+b\log(cx^n)) - E\left(\frac{1}{4}(-2ia+\pi-2ib\log(cx^n))\middle|2\right)\sqrt{i\sinh(a+b\log}\right.}{bn}$$

input

```
Integrate[Csch[a + b*Log[c*x^n]]^(3/2)/x,x]
```

output
```
(-2*Sqrt[Csch[a + b*Log[c*x^n]]]*(Cosh[a + b*Log[c*x^n]] - EllipticE[((-2*
I)*a + Pi - (2*I)*b*Log[c*x^n])/4, 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]]))/(b*
n)
```

### 3.171.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 105, normalized size of antiderivative = 0.98, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.368$, Rules used = {3039, 3042, 4255, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int (i\csc(ia+ib\log(cx^n)))^{3/2}\,d\log(cx^n)}{n}$$

$$\downarrow 4255$$

$$\frac{\int \frac{1}{\sqrt{\operatorname{csch}(a+b\log(cx^n))}}d\log(cx^n) - \frac{2\cosh(a+b\log(cx^n))\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{b}}{n}$$

$$\downarrow 3042$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{b} + \int \frac{1}{\sqrt{i\csc(ia+ib\log(cx^n))}}d\log(cx^n)}{n}$$

$$\downarrow 4258$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{b} + \frac{\int \sqrt{i\sinh(a+b\log(cx^n))}d\log(cx^n)}{\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}}{n}$$

$$\downarrow 3042$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{b}+\frac{\int\sqrt{\sin(ia+ib\log(cx^n))}d\log(cx^n)}{\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}}{n}$$

$$\downarrow 3119$$

$$\frac{-\frac{2\cosh(a+b\log(cx^n))\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{b}-\frac{2iE\left(\frac{1}{2}(ia+ib\log(cx^n)-\frac{\pi}{2})|2\right)}{b\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}}{n}$$

input
```
Int[Csch[a + b*Log[c*x^n]]^(3/2)/x,x]
```

output
```
((-2*Cosh[a + b*Log[c*x^n]]*Sqrt[Csch[a + b*Log[c*x^n]]])/b - ((2*I)*Ellip
ticE[(I*a - Pi/2 + I*b*Log[c*x^n])/2, 2])/(b*Sqrt[Csch[a + b*Log[c*x^n]]]*
Sqrt[I*Sinh[a + b*Log[c*x^n]]]))/n
```

### 3.171.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4255
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(-b)*Cos[c + d*
x]*((b*Csc[c + d*x])^(n - 1)/(d*(n - 1))), x] + Simp[b^2*((n - 2)/(n - 1))
  Int[(b*Csc[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1]
&& IntegerQ[2*n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.171.4 Maple [A] (verified)

Time = 0.90 (sec) , antiderivative size = 212, normalized size of antiderivative = 1.98

| method | result |
|---|---|
| derivativedivides | $\frac{2\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticE}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{2}}{2}\right)}{n\cosh(a+$ |
| default | $\frac{2\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticE}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{2}}{2}\right)}{n\cosh(a+$ |

input
```
int(csch(a+b*ln(c*x^n))^(3/2)/x,x,method=_RETURNVERBOSE)
```

output
```
1/n*(2*(1-I*sinh(a+b*ln(c*x^n)))^(1/2)*2^(1/2)*(1+I*sinh(a+b*ln(c*x^n)))^(
1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticE((1-I*sinh(a+b*ln(c*x^n)))^(1/
2),1/2*2^(1/2))-(1-I*sinh(a+b*ln(c*x^n)))^(1/2)*2^(1/2)*(1+I*sinh(a+b*ln(c
*x^n)))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticF((1-I*sinh(a+b*ln(c*x
^n)))^(1/2),1/2*2^(1/2))-2*cosh(a+b*ln(c*x^n))^2)/cosh(a+b*ln(c*x^n))/sinh
(a+b*ln(c*x^n))^(1/2)/b
```

### 3.171.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 159, normalized size of antiderivative = 1.49

$$\int \frac{\text{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = -\frac{2\left(\sqrt{2}\sqrt{\frac{\cosh(bn\log(x)+b\log(c)+a)+\sinh(bn\log(x)+b\log(c)+a)}{\cosh(bn\log(x)+b\log(c)+a)^2+2\cosh(bn\log(x)+b\log(c)+a)\sinh(bn\log(x)+b\log(c)+a)+\sinh(bn\log(x)+b\log(c)+a)^2-1}}(\cosh$$

input
```
integrate(csch(a+b*log(c*x^n))^(3/2)/x,x, algorithm="fricas")
```

output
```
-2*(sqrt(2)*sqrt((cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*lo
g(c) + a))/(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*cosh(b*n*log(x) + b*log(
c) + a)*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)^
2 - 1))*(cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)
) + sqrt(2)*weierstrassZeta(4, 0, weierstrassPInverse(4, 0, cosh(b*n*log(x
) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a))))/(b*n)
```

### 3.171.6 Sympy [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**(3/2)/x,x)
```

output
```
Integral(csch(a + b*log(c*x**n))**(3/2)/x, x)
```

### 3.171.7 Maxima [F]

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = \int \frac{\operatorname{csch}(b\log(cx^n)+a)^{\frac{3}{2}}}{x}\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^(3/2)/x,x, algorithm="maxima")
```

output
```
integrate(csch(b*log(c*x^n) + a)^(3/2)/x, x)
```

### 3.171.8 Giac [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = \text{Timed out}$$

input
```
integrate(csch(a+b*log(c*x^n))^(3/2)/x,x, algorithm="giac")
```

output
```
Timed out
```

### 3.171.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}{x}\,dx = \int \frac{\left(\frac{1}{\sinh(a+b\,\ln(cx^n))}\right)^{3/2}}{x}\,dx$$

input
```
int((1/sinh(a + b*log(c*x^n)))^(3/2)/x,x)
```

output
```
int((1/sinh(a + b*log(c*x^n)))^(3/2)/x, x)
```

# 3.172 $\int \frac{\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{x}\,dx$

3.172.1 Optimal result . . . . . 1119
3.172.2 Mathematica [A] (verified) . . . . . 1119
3.172.3 Rubi [A] (verified) . . . . . 1120
3.172.4 Maple [A] (verified) . . . . . 1121
3.172.5 Fricas [C] (verification not implemented) . . . . . 1122
3.172.6 Sympy [F] . . . . . 1122
3.172.7 Maxima [F] . . . . . 1122
3.172.8 Giac [F(-1)] . . . . . 1123
3.172.9 Mupad [F(-1)] . . . . . 1123

## 3.172.1 Optimal result

Integrand size = 19, antiderivative size = 72

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx = -\frac{2i\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}\,\operatorname{EllipticF}\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ib\log\left(cx^n\right)\right),2\right)\sqrt{i\sinh\left(a+b\log\left(cx^n\right)\right)}}{bn}$$

output
```
2*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n))^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2
*I*b*ln(c*x^n))*EllipticF(cos(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n)),2^(1/2))*c
sch(a+b*ln(c*x^n))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)/b/n
```

## 3.172.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.92

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx = \frac{2\operatorname{csch}^{\frac{3}{2}}\left(a+b\log\left(cx^n\right)\right)\operatorname{EllipticF}\left(\frac{1}{4}\left(-2ia+\pi-2ib\log\left(cx^n\right)\right),2\right)\left(i\sinh\left(a+b\log\left(cx^n\right)\right)\right)^{3/2}}{bn}$$

input
```
Integrate[Sqrt[Csch[a + b*Log[c*x^n]]]/x,x]
```

output
```
(2*Csch[a + b*Log[c*x^n]]^(3/2)*EllipticF[((-2*I)*a + Pi - (2*I)*b*Log[c*x
^n])/4, 2]*(I*Sinh[a + b*Log[c*x^n]])^(3/2))/(b*n)
```

### 3.172.3 Rubi [A] (verified)

Time = 0.30 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$, Rules used = {3039, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sqrt{\operatorname{csch}(a+b\log(cx^n))}}{x}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \sqrt{\operatorname{csch}(a+b\log(cx^n))}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int \sqrt{i\csc(ia+ib\log(cx^n))}\,d\log(cx^n)}{n}$$

$$\downarrow 4258$$

$$\frac{\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\int \frac{1}{\sqrt{i\sinh(a+b\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\int \frac{1}{\sqrt{\sin(ia+ib\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 3120$$

$$-\frac{2i\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\operatorname{EllipticF}\left(\frac{1}{2}\left(ia+ib\log(cx^n)-\frac{\pi}{2}\right),2\right)}{bn}$$

input
```
Int[Sqrt[Csch[a + b*Log[c*x^n]]]/x,x]
```

output
```
((-2*I)*Sqrt[Csch[a + b*Log[c*x^n]]]*EllipticF[(I*a - Pi/2 + I*b*Log[c*x^n
])/2, 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]])/(b*n)
```

#### 3.172.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]  Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n  Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.172.4 Maple [A] (verified)

Time = 0.82 (sec) , antiderivative size = 120, normalized size of antiderivative = 1.67

| method | result |
|---|---|
| derivativedivides | $\frac{i\sqrt{-i(\sinh(a+b\ln(cx^n))+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(a+b\ln(cx^n))+i)}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticF}\left(\sqrt{-i(\sinh(a+b\ln(cx^n}\right.$ $\overline{n\cosh(a+b\ln(cx^n))\sqrt{\sinh(a+b\ln(cx^n))}\,b}$ |
| default | $\frac{i\sqrt{-i(\sinh(a+b\ln(cx^n))+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(a+b\ln(cx^n))+i)}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticF}\left(\sqrt{-i(\sinh(a+b\ln(cx^n}\right.$ $\overline{n\cosh(a+b\ln(cx^n))\sqrt{\sinh(a+b\ln(cx^n))}\,b}$ |

input
```
int(csch(a+b*ln(c*x^n))^(1/2)/x,x,method=_RETURNVERBOSE)
```

output
```
I/n*(-I*(sinh(a+b*ln(c*x^n))+I))^(1/2)*2^(1/2)*(-I*(-sinh(a+b*ln(c*x^n))+I
))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticF((-I*(sinh(a+b*ln(c*x^n))+
I))^(1/2),1/2*2^(1/2))/cosh(a+b*ln(c*x^n))/sinh(a+b*ln(c*x^n))^(1/2)/b
```

### 3.172.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.08 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.54

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx$$
$$= \frac{2\sqrt{2}\text{weierstrassPInverse}(4,0,\cosh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)+\sinh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right))}{bn}$$

input
```
integrate(csch(a+b*log(c*x^n))^(1/2)/x,x, algorithm="fricas")
```

output
```
2*sqrt(2)*weierstrassPInverse(4, 0, cosh(b*n*log(x) + b*log(c) + a) + sinh
(b*n*log(x) + b*log(c) + a))/(b*n)
```

### 3.172.6 Sympy [F]

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx = \int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx$$

input
```
integrate(csch(a+b*ln(c*x**n))**(1/2)/x,x)
```

output
```
Integral(sqrt(csch(a + b*log(c*x**n)))/x, x)
```

### 3.172.7 Maxima [F]

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx = \int \frac{\sqrt{\operatorname{csch}\left(b\log\left(cx^n\right)+a\right)}}{x}\,dx$$

input
```
integrate(csch(a+b*log(c*x^n))^(1/2)/x,x, algorithm="maxima")
```

output
```
integrate(sqrt(csch(b*log(c*x^n) + a))/x, x)
```

### 3.172.8 Giac [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx = \text{Timed out}$$

input
```
integrate(csch(a+b*log(c*x^n))^(1/2)/x,x, algorithm="giac")
```

output
```
Timed out
```

### 3.172.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}{x}\,dx = \int \frac{\sqrt{\frac{1}{\sinh(a+b\,\ln(c\,x^n))}}}{x}\,dx$$

input
```
int((1/sinh(a + b*log(c*x^n)))^(1/2)/x,x)
```

output
```
int((1/sinh(a + b*log(c*x^n)))^(1/2)/x, x)
```

# 3.173 $\int \frac{1}{x\sqrt{\mathbf{csch}(a+b\log(cx^n))}}\,dx$

3.173.1 Optimal result . . . . . 1124
3.173.2 Mathematica [A] (verified) . . . . . 1124
3.173.3 Rubi [A] (verified) . . . . . 1125
3.173.4 Maple [A] (verified) . . . . . 1126
3.173.5 Fricas [C] (verification not implemented) . . . . . 1127
3.173.6 Sympy [F] . . . . . 1127
3.173.7 Maxima [F] . . . . . 1128
3.173.8 Giac [F(-1)] . . . . . 1128
3.173.9 Mupad [F(-1)] . . . . . 1128

## 3.173.1 Optimal result

Integrand size = 19, antiderivative size = 72

$$\int \frac{1}{x\sqrt{\operatorname{csch}(a+b\log(cx^n))}}\,dx = -\frac{2iE\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ib\log(cx^n)\right)\middle|2\right)}{bn\sqrt{\operatorname{csch}(a+b\log(cx^n))}\sqrt{i\sinh(a+b\log(cx^n))}}$$

output
```
2*I*(sin(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n))^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2
*I*b*ln(c*x^n))*EllipticE(cos(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n)),2^(1/2))/b
/n/csch(a+b*ln(c*x^n))^(1/2)/(I*sinh(a+b*ln(c*x^n)))^(1/2)
```

## 3.173.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 68, normalized size of antiderivative = 0.94

$$\int \frac{1}{x\sqrt{\operatorname{csch}(a+b\log(cx^n))}}\,dx = \frac{2\sqrt{\operatorname{csch}(a+b\log(cx^n))}E\left(\frac{1}{2}\left(\frac{\pi}{2}-i(a+b\log(cx^n))\right)\middle|2\right)\sqrt{i\sinh(a+b\log(cx^n))}}{bn}$$

input
```
Integrate[1/(x*Sqrt[Csch[a + b*Log[c*x^n]]]),x]
```

output
```
(2*Sqrt[Csch[a + b*Log[c*x^n]]]*EllipticE[(Pi/2 - I*(a + b*Log[c*x^n]))/2,
 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]])/(b*n)
```

### 3.173.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$, Rules used = {3039, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{x\sqrt{\operatorname{csch}(a+b\log(cx^n))}}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \frac{1}{\sqrt{\operatorname{csch}(a+b\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int \frac{1}{\sqrt{i\csc(ia+ib\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 4258$$

$$\frac{\int \sqrt{i\sinh(a+b\log(cx^n))}\,d\log(cx^n)}{n\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}$$

$$\downarrow 3042$$

$$\frac{\int \sqrt{\sin(ia+ib\log(cx^n))}\,d\log(cx^n)}{n\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}$$

$$\downarrow 3119$$

$$-\frac{2iE\left(\frac{1}{2}(ia+ib\log(cx^n)-\frac{\pi}{2})\middle|2\right)}{bn\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}$$

input
```
Int[1/(x*Sqrt[Csch[a + b*Log[c*x^n]]]),x]
```

output
```
((-2*I)*EllipticE[(I*a - Pi/2 + I*b*Log[c*x^n])/2, 2])/(b*n*Sqrt[Csch[a +
b*Log[c*x^n]]]*Sqrt[I*Sinh[a + b*Log[c*x^n]]])
```

#### 3.173.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.173.4 Maple [A] (verified)

Time = 0.96 (sec) , antiderivative size = 146, normalized size of antiderivative = 2.03

| method | result |
|---|---|
| derivativedivides | $\frac{\sqrt{-i(\sinh(a+b\ln(cx^n))+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(a+b\ln(cx^n))+i)}\,\sqrt{i\sinh(a+b\ln(cx^n))}\left(2\,\mathrm{EllipticE}\left(\sqrt{1-i\sinh(a+b\ln(c$ <br> $\frac{}{n\cosh(a+b\ln(cx^n))\sqrt{\sinh(a+b\ln(cx^n))}\,b}$ |
| default | $\frac{\sqrt{-i(\sinh(a+b\ln(cx^n))+i)}\,\sqrt{2}\,\sqrt{-i(-\sinh(a+b\ln(cx^n))+i)}\,\sqrt{i\sinh(a+b\ln(cx^n))}\left(2\,\mathrm{EllipticE}\left(\sqrt{1-i\sinh(a+b\ln(c$ <br> $\frac{}{n\cosh(a+b\ln(cx^n))\sqrt{\sinh(a+b\ln(cx^n))}\,b}$ |

input
```
int(1/x/csch(a+b*ln(c*x^n))^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/n*(-I*(sinh(a+b*ln(c*x^n))+I))^(1/2)*2^(1/2)*(-I*(-sinh(a+b*ln(c*x^n))+I
))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*(2*EllipticE((1-I*sinh(a+b*ln(c*x^n
)))^(1/2),1/2*2^(1/2))-EllipticF((1-I*sinh(a+b*ln(c*x^n)))^(1/2),1/2*2^(1/
2)))/cosh(a+b*ln(c*x^n))/sinh(a+b*ln(c*x^n))^(1/2)/b
```

### 3.173.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 248, normalized size of antiderivative = 3.44

$$\int \frac{1}{x\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}\,dx =$$

$$-\frac{\sqrt{2}\left(\cosh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)^2+2\cosh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)\sinh\left(bn\log\left(x\right)+b\log\left(c\right)+a\right)\right.$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(1/2),x, algorithm="fricas")
```

output
```
-(sqrt(2)*(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*cosh(b*n*log(x) + b*log(c
) + a)*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)^2
 - 1)*sqrt((cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) +
 a))/(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*cosh(b*n*log(x) + b*log(c) + a
)*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)^2 - 1)
) + 2*(sqrt(2)*cosh(b*n*log(x) + b*log(c) + a) + sqrt(2)*sinh(b*n*log(x) +
 b*log(c) + a))*weierstrassZeta(4, 0, weierstrassPInverse(4, 0, cosh(b*n*l
og(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a))))/(b*n*cosh(b*n*l
og(x) + b*log(c) + a) + b*n*sinh(b*n*log(x) + b*log(c) + a))
```

### 3.173.6 Sympy [F]

$$\int \frac{1}{x\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}\,dx = \int \frac{1}{x\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}\,dx$$

input
```
integrate(1/x/csch(a+b*ln(c*x**n))**(1/2),x)
```

output
```
Integral(1/(x*sqrt(csch(a + b*log(c*x**n)))), x)
```

### 3.173.7 Maxima [F]

$$\int \frac{1}{x\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}\,dx = \int \frac{1}{x\sqrt{\operatorname{csch}\left(b\log\left(cx^n\right)+a\right)}}\,dx$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(1/2),x, algorithm="maxima")
```

output
```
integrate(1/(x*sqrt(csch(b*log(c*x^n) + a))), x)
```

### 3.173.8 Giac [F(-1)]

Timed out.

$$\int \frac{1}{x\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}\,dx = \text{Timed out}$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(1/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.173.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{x\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}}\,dx = \int \frac{1}{x\sqrt{\frac{1}{\sinh(a+b\,\ln(c\,x^n))}}}\,dx$$

input
```
int(1/(x*(1/sinh(a + b*log(c*x^n)))^(1/2)),x)
```

output
```
int(1/(x*(1/sinh(a + b*log(c*x^n)))^(1/2)), x)
```

# 3.174 $\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx$

3.174.1 Optimal result . . . . . 1129
3.174.2 Mathematica [A] (verified) . . . . . 1129
3.174.3 Rubi [A] (verified) . . . . . 1130
3.174.4 Maple [A] (verified) . . . . . 1132
3.174.5 Fricas [C] (verification not implemented) . . . . . 1132
3.174.6 Sympy [F] . . . . . 1133
3.174.7 Maxima [F] . . . . . 1133
3.174.8 Giac [F(-1)] . . . . . 1134
3.174.9 Mupad [F(-1)] . . . . . 1134

## 3.174.1 Optimal result

Integrand size = 19, antiderivative size = 111

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx = \frac{2\cosh(a+b\log(cx^n))}{3bn\sqrt{\operatorname{csch}(a+b\log(cx^n))}} + \frac{2i\sqrt{\operatorname{csch}(a+b\log(cx^n))}\,\operatorname{EllipticF}\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ib\log(cx^n)\right),2\right)\sqrt{i\sinh(a+b\log(cx^n))}}{3bn}$$

output
```
2/3*cosh(a+b*ln(c*x^n))/b/n/csch(a+b*ln(c*x^n))^(1/2)-2/3*I*(sin(1/2*I*a+1
/4*Pi+1/2*I*b*ln(c*x^n))^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n))*El
lipticF(cos(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n)),2^(1/2))*csch(a+b*ln(c*x^n))
^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)/b/n
```

## 3.174.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 86, normalized size of antiderivative = 0.77

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx = \frac{\sqrt{\operatorname{csch}(a+b\log(cx^n))}\left(-2i\operatorname{EllipticF}\left(\frac{1}{4}(-2ia+\pi-2ib\log(cx^n)),2\right)\sqrt{i\sinh(a+b\log(cx^n))}+\sinh(2\right.}{3bn}$$

input
```
Integrate[1/(x*Csch[a + b*Log[c*x^n]]^(3/2)),x]
```

output
```
(Sqrt[Csch[a + b*Log[c*x^n]]]*((-2*I)*EllipticF[((-2*I)*a + Pi - (2*I)*b*L
og[c*x^n])/4, 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]] + Sinh[2*(a + b*Log[c*x^n]
)]))/(3*b*n)
```

### 3.174.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 109, normalized size of antiderivative = 0.98, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.368$, Rules used = {3039, 3042, 4256, 3042, 4258, 3042, 3120}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \frac{1}{\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int \frac{1}{(i\csc(ia+ib\log(cx^n)))^{3/2}}\,d\log(cx^n)}{n}$$

$$\downarrow 4256$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{3b\sqrt{\operatorname{csch}(a+b\log(cx^n))}} - \frac{1}{3}\int \sqrt{\operatorname{csch}(a+b\log(cx^n))}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{3b\sqrt{\operatorname{csch}(a+b\log(cx^n))}} - \frac{1}{3}\int \sqrt{i\csc(ia+ib\log(cx^n))}\,d\log(cx^n)}{n}$$

$$\downarrow 4258$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{3b\sqrt{\operatorname{csch}(a+b\log(cx^n))}} - \frac{1}{3}\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\int \frac{1}{\sqrt{i\sinh(a+b\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{3b\sqrt{\operatorname{csch}(a+b\log(cx^n))}}-\frac{1}{3}\sqrt{i\sinh\left(a+b\log\left(cx^n\right)\right)}\sqrt{\operatorname{csch}\left(a+b\log\left(cx^n\right)\right)}\int\frac{1}{\sqrt{\sin(ia+ib\log(cx^n))}}d\log\left(cx^n\right)}{n}$$

$$\downarrow 3120$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{3b\sqrt{\operatorname{csch}(a+b\log(cx^n))}}+\frac{2i\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}\,\text{EllipticF}\left(\frac{1}{2}\left(ia+ib\log(cx^n)-\frac{\pi}{2}\right),2\right)}{3b}}{n}$$

input
```
Int[1/(x*Csch[a + b*Log[c*x^n]]^(3/2)),x]
```

output
```
((2*Cosh[a + b*Log[c*x^n]])/(3*b*Sqrt[Csch[a + b*Log[c*x^n]]]) + (((2*I)/3
)*Sqrt[Csch[a + b*Log[c*x^n]]]*EllipticF[(I*a - Pi/2 + I*b*Log[c*x^n])/2,
2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]])/b)/n
```

### 3.174.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3120
```
Int[1/Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticF[(1/2
)*(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.174.4 Maple [A] (verified)

Time = 0.94 (sec) , antiderivative size = 143, normalized size of antiderivative = 1.29

| method | result |
|---|---|
| derivativedivides | $-\frac{i\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticF}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{2}}{2}\right)}{3}+\frac{2\cosh(a+b}$ |
| default | $-\frac{i\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticF}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{2}}{2}\right)}{3}+\frac{2\cosh(a+b}$ |

input
```
int(1/x/csch(a+b*ln(c*x^n))^(3/2),x,method=_RETURNVERBOSE)
```

output
```
1/n*(-1/3*I*(1-I*sinh(a+b*ln(c*x^n)))^(1/2)*2^(1/2)*(1+I*sinh(a+b*ln(c*x^n
)))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticF((1-I*sinh(a+b*ln(c*x^n))
)^(1/2),1/2*2^(1/2))+2/3*cosh(a+b*ln(c*x^n))^2*sinh(a+b*ln(c*x^n)))/cosh(a
+b*ln(c*x^n))/sinh(a+b*ln(c*x^n))^(1/2)/b
```

### 3.174.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 370, normalized size of antiderivative = 3.33

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx$$
$$= \frac{\sqrt{2}\big(\cosh(bn\log(x)+b\log(c)+a)^4+4\cosh(bn\log(x)+b\log(c)+a)^3\sinh(bn\log(x)+b\log(c)+a)+$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(3/2),x, algorithm="fricas")
```

output
```
1/6*(sqrt(2)*(cosh(b*n*log(x) + b*log(c) + a)^4 + 4*cosh(b*n*log(x) + b*lo
g(c) + a)^3*sinh(b*n*log(x) + b*log(c) + a) + 6*cosh(b*n*log(x) + b*log(c)
 + a)^2*sinh(b*n*log(x) + b*log(c) + a)^2 + 4*cosh(b*n*log(x) + b*log(c) +
 a)*sinh(b*n*log(x) + b*log(c) + a)^3 + sinh(b*n*log(x) + b*log(c) + a)^4
- 1)*sqrt((cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) +
a))/(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*cosh(b*n*log(x) + b*log(c) + a)
*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*log(x) + b*log(c) + a)^2 - 1))
 - 4*(sqrt(2)*cosh(b*n*log(x) + b*log(c) + a)^2 + 2*sqrt(2)*cosh(b*n*log(x
) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a) + sqrt(2)*sinh(b*n*log(x
) + b*log(c) + a)^2)*weierstrassPInverse(4, 0, cosh(b*n*log(x) + b*log(c)
+ a) + sinh(b*n*log(x) + b*log(c) + a)))/(b*n*cosh(b*n*log(x) + b*log(c) +
 a)^2 + 2*b*n*cosh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) +
 a) + b*n*sinh(b*n*log(x) + b*log(c) + a)^2)
```

### 3.174.6 Sympy [F]

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx = \int \frac{1}{x\,\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx$$

input
```
integrate(1/x/csch(a+b*ln(c*x**n))**(3/2),x)
```

output
```
Integral(1/(x*csch(a + b*log(c*x**n))**(3/2)), x)
```

### 3.174.7 Maxima [F]

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx = \int \frac{1}{x\,\operatorname{csch}\left(b\log(cx^n)+a\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(3/2),x, algorithm="maxima")
```

output
```
integrate(1/(x*csch(b*log(c*x^n) + a)^(3/2)), x)
```

### 3.174.8 Giac [F(-1)]

Timed out.

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx = \text{Timed out}$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(3/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.174.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{x\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}\,dx = \int \frac{1}{x\left(\frac{1}{\sinh(a+b\,\ln(c\,x^n))}\right)^{3/2}}\,dx$$

input
```
int(1/(x*(1/sinh(a + b*log(c*x^n)))^(3/2)),x)
```

output
```
int(1/(x*(1/sinh(a + b*log(c*x^n)))^(3/2)), x)
```

# 3.175 $\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx$

3.175.1 Optimal result . . . . . 1135
3.175.2 Mathematica [A] (verified) . . . . . 1135
3.175.3 Rubi [A] (verified) . . . . . 1136
3.175.4 Maple [A] (verified) . . . . . 1138
3.175.5 Fricas [C] (verification not implemented) . . . . . 1138
3.175.6 Sympy [F] . . . . . 1139
3.175.7 Maxima [F] . . . . . 1140
3.175.8 Giac [F(-1)] . . . . . 1140
3.175.9 Mupad [F(-1)] . . . . . 1140

## 3.175.1 Optimal result

Integrand size = 19, antiderivative size = 111

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx = \frac{2\cosh(a+b\log(cx^n))}{5bn\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))} + \frac{6iE\left(\frac{1}{2}\left(ia-\frac{\pi}{2}+ib\log(cx^n)\right)\middle|2\right)}{5bn\sqrt{\operatorname{csch}(a+b\log(cx^n))}\sqrt{i\sinh(a+b\log(cx^n))}}$$

output
```
2/5*cosh(a+b*ln(c*x^n))/b/n/csch(a+b*ln(c*x^n))^(3/2)-6/5*I*(sin(1/2*I*a+1
/4*Pi+1/2*I*b*ln(c*x^n))^2)^(1/2)/sin(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n))*El
lipticE(cos(1/2*I*a+1/4*Pi+1/2*I*b*ln(c*x^n)),2^(1/2))/b/n/csch(a+b*ln(c*x
^n))^(1/2)/(I*sinh(a+b*ln(c*x^n)))^(1/2)
```

## 3.175.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.86

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx = \frac{2\left(\cosh(a+b\log(cx^n)) - 3\operatorname{csch}^2(a+b\log(cx^n))\,E\left(\frac{1}{4}(-2ia+\pi-2ib\log(cx^n))\middle|2\right)\sqrt{i\sinh(a+b\log(c$$

$$5bn\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))$$

input
```
Integrate[1/(x*Csch[a + b*Log[c*x^n]]^(5/2)),x]
```

output
```
(2*(Cosh[a + b*Log[c*x^n]] - 3*Csch[a + b*Log[c*x^n]]^2*EllipticE[((-2*I)*
a + Pi - (2*I)*b*Log[c*x^n])/4, 2]*Sqrt[I*Sinh[a + b*Log[c*x^n]]]))/(5*b*n
*Csch[a + b*Log[c*x^n]]^(3/2))
```

### 3.175.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 109, normalized size of antiderivative = 0.98, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.368$, Rules used = {3039, 3042, 4256, 3042, 4258, 3042, 3119}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx$$

$$\downarrow 3039$$

$$\frac{\int \frac{1}{\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\int \frac{1}{(i\csc(ia+ib\log(cx^n)))^{5/2}}\,d\log(cx^n)}{n}$$

$$\downarrow 4256$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{5b\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))} - \frac{3}{5}\int \frac{1}{\sqrt{\operatorname{csch}(a+b\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 3042$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{5b\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))} - \frac{3}{5}\int \frac{1}{\sqrt{i\csc(ia+ib\log(cx^n))}}\,d\log(cx^n)}{n}$$

$$\downarrow 4258$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{5b\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))} - \frac{3\int \sqrt{i\sinh(a+b\log(cx^n))}\,d\log(cx^n)}{5\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}}{n}$$

$$\downarrow 3042$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{5b\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))} - \frac{3\int \sqrt{\sin(ia+ib\log(cx^n))}\,d\log(cx^n)}{5\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}}{n}$$

$$\downarrow 3119$$

$$\frac{\frac{2\cosh(a+b\log(cx^n))}{5b\operatorname{csch}^{\frac{3}{2}}(a+b\log(cx^n))}+\frac{6iE\left(\frac{1}{2}(ia+ib\log(cx^n)-\frac{\pi}{2})|2\right)}{5b\sqrt{i\sinh(a+b\log(cx^n))}\sqrt{\operatorname{csch}(a+b\log(cx^n))}}}{n}$$

input
```
Int[1/(x*Csch[a + b*Log[c*x^n]]^(5/2)),x]
```

output
```
((2*Cosh[a + b*Log[c*x^n]])/(5*b*Csch[a + b*Log[c*x^n]]^(3/2)) + (((6*I)/5
)*EllipticE[(I*a - Pi/2 + I*b*Log[c*x^n])/2, 2])/(b*Sqrt[Csch[a + b*Log[c*
x^n]]]*Sqrt[I*Sinh[a + b*Log[c*x^n]]]))/n
```

### 3.175.3.1 Defintions of rubi rules used

rule 3039
```
Int[u_, x_Symbol] :> With[{lst = FunctionOfLog[Cancel[x*u], x]}, Simp[1/lst
[[3]]   Subst[Int[lst[[1]], x], x, Log[lst[[2]]]], x] /;  !FalseQ[lst]] /;
NonsumQ[u]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3119
```
Int[Sqrt[sin[(c_.) + (d_.)*(x_)]], x_Symbol] :> Simp[(2/d)*EllipticE[(1/2)*
(c - Pi/2 + d*x), 2], x] /; FreeQ[{c, d}, x]
```

rule 4256
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[Cos[c + d*x]*((
b*Csc[c + d*x])^(n + 1)/(b*d*n)), x] + Simp[(n + 1)/(b^2*n)   Int[(b*Csc[c
+ d*x])^(n + 2), x], x] /; FreeQ[{b, c, d}, x] && LtQ[n, -1] && IntegerQ[2*
n]
```

rule 4258
```
Int[(csc[(c_.) + (d_.)*(x_)]*(b_.))^(n_), x_Symbol] :> Simp[(b*Csc[c + d*x]
)^n*Sin[c + d*x]^n   Int[1/Sin[c + d*x]^n, x], x] /; FreeQ[{b, c, d}, x] &&
 EqQ[n^2, 1/4]
```

### 3.175.4 Maple [A] (verified)

Time = 0.93 (sec) , antiderivative size = 227, normalized size of antiderivative = 2.05

| method | result |
|---|---|
| derivativedivides | $-\frac{6\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticE}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{2}}{2}\right)}{5}+\frac{3\sqrt{1-i\sin}}{n\cosh(a+b}$ |
| default | $-\frac{6\sqrt{1-i\sinh(a+b\ln(cx^n))}\,\sqrt{2}\,\sqrt{1+i\sinh(a+b\ln(cx^n))}\,\sqrt{i\sinh(a+b\ln(cx^n))}\,\text{EllipticE}\left(\sqrt{1-i\sinh(a+b\ln(cx^n))},\frac{\sqrt{2}}{2}\right)}{5}+\frac{3\sqrt{1-i\sin}}{n\cosh(a+b}$ |

input
```
int(1/x/csch(a+b*ln(c*x^n))^(5/2),x,method=_RETURNVERBOSE)
```

output
```
1/n*(-6/5*(1-I*sinh(a+b*ln(c*x^n)))^(1/2)*2^(1/2)*(1+I*sinh(a+b*ln(c*x^n))
)^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticE((1-I*sinh(a+b*ln(c*x^n)))^
(1/2),1/2*2^(1/2))+3/5*(1-I*sinh(a+b*ln(c*x^n)))^(1/2)*2^(1/2)*(1+I*sinh(a
+b*ln(c*x^n)))^(1/2)*(I*sinh(a+b*ln(c*x^n)))^(1/2)*EllipticF((1-I*sinh(a+b
*ln(c*x^n)))^(1/2),1/2*2^(1/2))+2/5*cosh(a+b*ln(c*x^n))^4-2/5*cosh(a+b*ln(
c*x^n))^2)/cosh(a+b*ln(c*x^n))/sinh(a+b*ln(c*x^n))^(1/2)/b
```

### 3.175.5 Fricas [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.09 (sec) , antiderivative size = 602, normalized size of antiderivative = 5.42

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}\left(a+b\log\left(cx^n\right)\right)}\,dx = \text{Too large to display}$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(5/2),x, algorithm="fricas")
```

output
```
1/20*(sqrt(2)*(cosh(b*n*log(x) + b*log(c) + a)^6 + 6*cosh(b*n*log(x) + b*l
og(c) + a)*sinh(b*n*log(x) + b*log(c) + a)^5 + sinh(b*n*log(x) + b*log(c)
+ a)^6 + (15*cosh(b*n*log(x) + b*log(c) + a)^2 + 11)*sinh(b*n*log(x) + b*l
og(c) + a)^4 + 11*cosh(b*n*log(x) + b*log(c) + a)^4 + 4*(5*cosh(b*n*log(x)
 + b*log(c) + a)^3 + 11*cosh(b*n*log(x) + b*log(c) + a))*sinh(b*n*log(x) +
 b*log(c) + a)^3 + (15*cosh(b*n*log(x) + b*log(c) + a)^4 + 66*cosh(b*n*log
(x) + b*log(c) + a)^2 - 13)*sinh(b*n*log(x) + b*log(c) + a)^2 - 13*cosh(b*
n*log(x) + b*log(c) + a)^2 + 2*(3*cosh(b*n*log(x) + b*log(c) + a)^5 + 22*c
osh(b*n*log(x) + b*log(c) + a)^3 - 13*cosh(b*n*log(x) + b*log(c) + a))*sin
h(b*n*log(x) + b*log(c) + a) + 1)*sqrt((cosh(b*n*log(x) + b*log(c) + a) +
sinh(b*n*log(x) + b*log(c) + a))/(cosh(b*n*log(x) + b*log(c) + a)^2 + 2*co
sh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a) + sinh(b*n*l
og(x) + b*log(c) + a)^2 - 1)) + 24*(sqrt(2)*cosh(b*n*log(x) + b*log(c) + a
)^3 + 3*sqrt(2)*cosh(b*n*log(x) + b*log(c) + a)^2*sinh(b*n*log(x) + b*log(
c) + a) + 3*sqrt(2)*cosh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*lo
g(c) + a)^2 + sqrt(2)*sinh(b*n*log(x) + b*log(c) + a)^3)*weierstrassZeta(4
, 0, weierstrassPInverse(4, 0, cosh(b*n*log(x) + b*log(c) + a) + sinh(b*n*
log(x) + b*log(c) + a))))/(b*n*cosh(b*n*log(x) + b*log(c) + a)^3 + 3*b*n*c
osh(b*n*log(x) + b*log(c) + a)^2*sinh(b*n*log(x) + b*log(c) + a) + 3*b*n*c
osh(b*n*log(x) + b*log(c) + a)*sinh(b*n*log(x) + b*log(c) + a)^2 + b*n*...
```

### 3.175.6 Sympy [F]

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx = \int \frac{1}{x\,\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx$$

input
```
integrate(1/x/csch(a+b*ln(c*x**n))**(5/2),x)
```

output
```
Integral(1/(x*csch(a + b*log(c*x**n))**(5/2)), x)
```

### 3.175.7 Maxima [F]

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx = \int \frac{1}{x\,\operatorname{csch}(b\log(cx^n)+a)^{\frac{5}{2}}}\,dx$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(5/2),x, algorithm="maxima")
```

output
```
integrate(1/(x*csch(b*log(c*x^n) + a)^(5/2)), x)
```

### 3.175.8 Giac [F(-1)]

Timed out.

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx = \text{Timed out}$$

input
```
integrate(1/x/csch(a+b*log(c*x^n))^(5/2),x, algorithm="giac")
```

output
```
Timed out
```

### 3.175.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1}{x\operatorname{csch}^{\frac{5}{2}}(a+b\log(cx^n))}\,dx = \int \frac{1}{x\left(\frac{1}{\sinh(a+b\,\ln(c\,x^n))}\right)^{5/2}}\,dx$$

input
```
int(1/(x*(1/sinh(a + b*log(c*x^n)))^(5/2)),x)
```

output
```
int(1/(x*(1/sinh(a + b*log(c*x^n)))^(5/2)), x)
```

CHAPTER 4

# Appendix

4.1 Listing of Grading functions . . . . . 1141

## 4.1 Listing of Grading functions

The following are the current version of the grading functions used for grading the quality of the antiderivative with reference to the optimal antiderivative included in the test suite.

There is a version for Maple and for Mathematica/Rubi. There is a version for grading Sympy and version for use with Sagemath.

The following are links to the current source code.

The following are the listings of source code of the grading functions.

### 4.1.1 Mathematica and Rubi grading function

```
(* Original version thanks to Albert Rich emailed on 03/21/2017 *)
(* ::Package:: *)

(* Nasser: April 7,2022. add second output which gives reason for the grade *)
(*                       Small rewrite of logic in main function to make it*)
(*                       match Maple's logic. No change in functionality otherwise*)

(* ::Subsection:: *)
(*GradeAntiderivative[result,optimal]*)


(* ::Text:: *)
(*If result and optimal are mathematical expressions, *)
(*          GradeAntiderivative[result,optimal] returns*)
```

```
(*  "F" if the result fails to integrate an expression that*)
(*      is integrable*)
(*  "C" if result involves higher level functions than necessary*)
(*  "B" if result is more than twice the size of the optimal*)
(*      antiderivative*)
(*  "A" if result can be considered optimal*)


GradeAntiderivative[result_,optimal_] := Module[{expnResult,expnOptimal,leafCountResult,leafC
    expnResult  = ExpnType[result];
    expnOptimal = ExpnType[optimal];
    leafCountResult = LeafCount[result];
    leafCountOptimal = LeafCount[optimal];

    (*Print["expnResult=",expnResult," expnOptimal=",expnOptimal];*)
    If[expnResult<=expnOptimal,
        If[Not[FreeQ[result,Complex]], (*result contains complex*)
            If[Not[FreeQ[optimal,Complex]], (*optimal contains complex*)
                If[leafCountResult<=2*leafCountOptimal,
                    finalresult={"A"," "}
                    ,(*ELSE*)
                    finalresult={"B","Both result and optimal contain complex but leaf count
                  ]
            ,(*ELSE*)
                finalresult={"C","Result contains complex when optimal does not."}
            ]
        ,(*ELSE*)(*result does not contains complex*)
            If[leafCountResult<=2*leafCountOptimal,
               finalresult={"A"," "}
            ,(*ELSE*)
               finalresult={"B","Leaf count is larger than twice the leaf count of optimal. $
              ]
        ]
    ,(*ELSE*) (*expnResult>expnOptimal*)
        If[FreeQ[result,Integrate] && FreeQ[result,Int],
            finalresult={"C","Result contains higher order function than in optimal. Order "<
            ,
            finalresult={"F","Contains unresolved integral."}
        ]
    ];

    finalresult
]
```

```
(* ::Text:: *)
(*The following summarizes the type number assigned an *)
(*expression based on the functions it involves*)
(*1 = rational function*)
(*2 = algebraic function*)
(*3 = elementary function*)
(*4 = special function*)
(*5 = hyperpergeometric function*)
(*6 = appell function*)
(*7 = rootsum function*)
(*8 = integrate function*)
(*9 = unknown function*)


ExpnType[expn_] :=
  If[AtomQ[expn],
    1,
  If[ListQ[expn],
    Max[Map[ExpnType,expn]],
  If[Head[expn]===Power,
    If[IntegerQ[expn[[2]]],
      ExpnType[expn[[1]]],
    If[Head[expn[[2]]]===Rational,
      If[IntegerQ[expn[[1]]] || Head[expn[[1]]]===Rational,
        1,
      Max[ExpnType[expn[[1]]],2]],
    Max[ExpnType[expn[[1]]],ExpnType[expn[[2]]],3]]],
  If[Head[expn]===Plus || Head[expn]===Times,
    Max[ExpnType[First[expn]],ExpnType[Rest[expn]]],
  If[ElementaryFunctionQ[Head[expn]],
    Max[3,ExpnType[expn[[1]]]],
  If[SpecialFunctionQ[Head[expn]],
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],4]],
  If[HypergeometricFunctionQ[Head[expn]],
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],5]],
  If[AppellFunctionQ[Head[expn]],
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],6]],
  If[Head[expn]===RootSum,
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],7]],
  If[Head[expn]===Integrate || Head[expn]===Int,
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],8]],
  9]]]]]]]]]]
```

```
ElementaryFunctionQ[func_] :=
  MemberQ[{
  Exp,Log,
  Sin,Cos,Tan,Cot,Sec,Csc,
  ArcSin,ArcCos,ArcTan,ArcCot,ArcSec,ArcCsc,
  Sinh,Cosh,Tanh,Coth,Sech,Csch,
  ArcSinh,ArcCosh,ArcTanh,ArcCoth,ArcSech,ArcCsch
},func]


SpecialFunctionQ[func_] :=
  MemberQ[{
  Erf, Erfc, Erfi,
  FresnelS, FresnelC,
  ExpIntegralE, ExpIntegralEi, LogIntegral,
  SinIntegral, CosIntegral, SinhIntegral, CoshIntegral,
  Gamma, LogGamma, PolyGamma,
  Zeta, PolyLog, ProductLog,
  EllipticF, EllipticE, EllipticPi
},func]


HypergeometricFunctionQ[func_] :=
  MemberQ[{Hypergeometric1F1,Hypergeometric2F1,HypergeometricPFQ},func]


AppellFunctionQ[func_] :=
  MemberQ[{AppellF1},func]
```

### 4.1.2 Maple grading function

```
# File: GradeAntiderivative.mpl
# Original version thanks to Albert Rich emailed on 03/21/2017

#Nasser 03/22/2017  Use Maple leaf count instead since buildin
#Nasser 03/23/2017  missing 'ln' for ElementaryFunctionQ added
#Nasser 03/24/2017  corrected the check for complex result
#Nasser 10/27/2017  check for leafsize and do not call ExpnType()
#                   if leaf size is "too large". Set at 500,000
```

```
#Nasser 12/22/2019  Added debug flag, added 'dilog' to special functions
#                   see problem 156, file Apostol_Problems
#Nasser 4/07/2022   add second output which gives reason for the grade

GradeAntiderivative := proc(result,optimal)
local leaf_count_result,
        leaf_count_optimal,
        ExpnType_result,
        ExpnType_optimal,
        debug:=false;

        leaf_count_result:=leafcount(result);
        #do NOT call ExpnType() if leaf size is too large. Recursion problem
        if leaf_count_result > 500000 then
            return "B","result has leaf size over 500,000. Avoiding possible recursion issues
        fi;

        leaf_count_optimal := leafcount(optimal);
        ExpnType_result  := ExpnType(result);
        ExpnType_optimal := ExpnType(optimal);

        if debug then
            print("ExpnType_result",ExpnType_result," ExpnType_optimal=",ExpnType_optimal);
        fi;

# If result and optimal are mathematical expressions,
#  GradeAntiderivative[result,optimal] returns
#   "F" if the result fails to integrate an expression that
#       is integrable
#   "C" if result involves higher level functions than necessary
#   "B" if result is more than twice the size of the optimal
#       antiderivative
#   "A" if result can be considered optimal

    #This check below actually is not needed, since I only
    #call this grading only for passed integrals. i.e. I check
    #for "F" before calling this. But no harm of keeping it here.
    #just in case.


    if not type(result,freeof('int')) then
        return "F","Result contains unresolved integral";
    fi;
```

```
if ExpnType_result<=ExpnType_optimal then
    if debug then
         print("ExpnType_result<=ExpnType_optimal");
    fi;
    if is_contains_complex(result) then
        if is_contains_complex(optimal) then
            if debug then
                    print("both result and optimal complex");
            fi;
            if leaf_count_result<=2*leaf_count_optimal then
                return "A"," ";
            else
               return "B",cat("Both result and optimal contain complex but leaf count of
                               convert(leaf_count_result,string)," vs. $2 (",
                               convert(leaf_count_optimal,string)," ) = ",convert(2*leaf_
            end if
        else #result contains complex but optimal is not
            if debug then
                    print("result contains complex but optimal is not");
            fi;
            return "C","Result contains complex when optimal does not.";
        fi;
    else # result do not contain complex
         # this assumes optimal do not as well. No check is needed here.
        if debug then
               print("result do not contain complex, this assumes optimal do not as well"
        fi;
        if leaf_count_result<=2*leaf_count_optimal then
            if debug then
                print("leaf_count_result<=2*leaf_count_optimal");
            fi;
            return "A"," ";
        else
            if debug then
                print("leaf_count_result>2*leaf_count_optimal");
            fi;
            return "B",cat("Leaf count of result is larger than twice the leaf count of o
                           convert(leaf_count_result,string),"$ vs. $2(",
                           convert(leaf_count_optimal,string),")=",convert(2*leaf_cou
        fi;
    fi;
```

```
    else #ExpnType(result) > ExpnType(optimal)
        if debug then
            print("ExpnType(result) > ExpnType(optimal)");
        fi;
        return "C",cat("Result contains higher order function than in optimal. Order ",
                       convert(ExpnType_result,string)," vs. order ",
                       convert(ExpnType_optimal,string),".");
    fi;

end proc:

#
# is_contains_complex(result)
# takes expressions and returns true if it contains "I" else false
#
#Nasser 032417
is_contains_complex:= proc(expression)
  return (has(expression,I));
end proc:

# The following summarizes the type number assigned an expression
# based on the functions it involves
# 1 = rational function
# 2 = algebraic function
# 3 = elementary function
# 4 = special function
# 5 = hyperpergeometric function
# 6 = appell function
# 7 = rootsum function
# 8 = integrate function
# 9 = unknown function

ExpnType := proc(expn)
  if type(expn,'atomic') then
    1
  elif type(expn,'list') then
    apply(max,map(ExpnType,expn))
  elif type(expn,'sqrt') then
    if type(op(1,expn),'rational') then
       1
    else
       max(2,ExpnType(op(1,expn)))
    end if
```

```
  elif type(expn,`^`) then
    if type(op(2,expn),'integer') then
      ExpnType(op(1,expn))
    elif type(op(2,expn),'rational') then
      if type(op(1,expn),'rational') then
         1
      else
         max(2,ExpnType(op(1,expn)))
      end if
    else
         max(3,ExpnType(op(1,expn)),ExpnType(op(2,expn)))
    end if
  elif type(expn,`+`) or type(expn,`*`) then
    max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
  elif ElementaryFunctionQ(op(0,expn)) then
    max(3,ExpnType(op(1,expn)))
  elif SpecialFunctionQ(op(0,expn)) then
    max(4,apply(max,map(ExpnType,[op(expn)])))
  elif HypergeometricFunctionQ(op(0,expn)) then
    max(5,apply(max,map(ExpnType,[op(expn)])))
  elif AppellFunctionQ(op(0,expn)) then
    max(6,apply(max,map(ExpnType,[op(expn)])))
  elif op(0,expn)='int' then
    max(8,apply(max,map(ExpnType,[op(expn)]))) else
  9
  end if
end proc:


ElementaryFunctionQ := proc(func)
  member(func,[
        exp,log,ln,
        sin,cos,tan,cot,sec,csc,
        arcsin,arccos,arctan,arccot,arcsec,arccsc,
        sinh,cosh,tanh,coth,sech,csch,
        arcsinh,arccosh,arctanh,arccoth,arcsech,arccsch])
end proc:

SpecialFunctionQ := proc(func)
  member(func,[
        erf,erfc,erfi,
        FresnelS,FresnelC,
        Ei,Ei,Li,Si,Ci,Shi,Chi,
```

```
        GAMMA,lnGAMMA,Psi,Zeta,polylog,dilog,LambertW,
        EllipticF,EllipticE,EllipticPi])
end proc:

HypergeometricFunctionQ := proc(func)
  member(func,[Hypergeometric1F1,hypergeom,HypergeometricPFQ])
end proc:

AppellFunctionQ := proc(func)
  member(func,[AppellF1])
end proc:

# u is a sum or product.  rest(u) returns all but the
# first term or factor of u.
rest := proc(u) local v;
  if nops(u)=2 then
     op(2,u)
  else
     apply(op(0,u),op(2..nops(u),u))
  end if
end proc:

#leafcount(u) returns the number of nodes in u.
#Nasser 3/23/17  Replaced by build-in leafCount from package in Maple
leafcount := proc(u)
   MmaTranslator[Mma][LeafCount](u);
end proc:
```

### 4.1.3 Sympy grading function

```
#Dec 24, 2019. Nasser M. Abbasi:
#            Port of original Maple grading function by
#            Albert Rich to use with Sympy/Python
#Dec 27, 2019  Nasser. Added `RootSum`. See problem 177, Timofeev file
#            added 'exp_polar'
from sympy import *

def leaf_count(expr):
   #sympy do not have leaf count function. This is approximation
   return round(1.7*count_ops(expr))

def is_sqrt(expr):
```

```
    if isinstance(expr,Pow):
        if expr.args[1] == Rational(1,2):
            return True
        else:
            return False
    else:
        return False

def is_elementary_function(func):
    return func in [exp,log,ln,sin,cos,tan,cot,sec,csc,
            asin,acos,atan,acot,asec,acsc,sinh,cosh,tanh,coth,sech,csch,
            asinh,acosh,atanh,acoth,asech,acsch
        ]

def is_special_function(func):
    return func in [ erf,erfc,erfi,
             fresnels,fresnelc,Ei,Ei,Li,Si,Ci,Shi,Chi,
             gamma,loggamma,digamma,zeta,polylog,LambertW,
             elliptic_f,elliptic_e,elliptic_pi,exp_polar
         ]

def is_hypergeometric_function(func):
    return func in [hyper]

def is_appell_function(func):
    return func in [appellf1]

def is_atom(expn):
    try:
        if expn.isAtom or isinstance(expn,int) or isinstance(expn,float):
            return True
        else:
            return False

    except AttributeError as error:
        return False

def expnType(expn):
    debug=False
    if debug:
        print("expn=",expn,"type(expn)=",type(expn))

    if is_atom(expn):
```

```
    return 1
  elif isinstance(expn,list):
    return max(map(expnType, expn))    #apply(max,map(ExpnType,expn))
  elif  is_sqrt(expn):
    if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
      return 1
    else:
      return max(2,expnType(expn.args[0]))  #max(2,ExpnType(op(1,expn)))
  elif isinstance(expn,Pow):   #type(expn,'^')
    if isinstance(expn.args[1],Integer):  #type(op(2,expn),'integer')
      return expnType(expn.args[0])   #ExpnType(op(1,expn))
    elif isinstance(expn.args[1],Rational):  #type(op(2,expn),'rational')
      if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
        return 1
      else:
        return max(2,expnType(expn.args[0]))  #max(2,ExpnType(op(1,expn)))
    else:
      return max(3,expnType(expn.args[0]),expnType(expn.args[1])) #max(3,ExpnType(op(1,expn)),ExpnT
  elif isinstance(expn,Add) or isinstance(expn,Mul): #type(expn,'+') or type(expn,'*')
    m1 = expnType(expn.args[0])
    m2 = expnType(list(expn.args[1:]))
    return max(m1,m2)  #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
  elif is_elementary_function(expn.func):  #ElementaryFunctionQ(op(0,expn))
    return max(3,expnType(expn.args[0]))  #max(3,ExpnType(op(1,expn)))
  elif is_special_function(expn.func): #SpecialFunctionQ(op(0,expn))
    m1 = max(map(expnType, list(expn.args)))
    return max(4,m1)   #max(4,apply(max,map(ExpnType,[op(expn)])))
  elif is_hypergeometric_function(expn.func): #HypergeometricFunctionQ(op(0,expn))
    m1 = max(map(expnType, list(expn.args)))
    return max(5,m1)   #max(5,apply(max,map(ExpnType,[op(expn)])))
  elif is_appell_function(expn.func):
    m1 = max(map(expnType, list(expn.args)))
    return max(6,m1)   #max(5,apply(max,map(ExpnType,[op(expn)])))
  elif isinstance(expn,RootSum):
    m1 = max(map(expnType, list(expn.args))) #Apply[Max,Append[Map[ExpnType,Apply[List,expn]],7]],
    return max(7,m1)
  elif str(expn).find("Integral") != -1:
    m1 = max(map(expnType, list(expn.args)))
    return max(8,m1)   #max(5,apply(max,map(ExpnType,[op(expn)])))
  else:
    return 9

#main function
```

```
def grade_antiderivative(result,optimal):

    #print ("Enter grade_antiderivative for sagemath")
    #print("Enter grade_antiderivative, result=",result," optimal=",optimal)

    leaf_count_result  = leaf_count(result)
    leaf_count_optimal = leaf_count(optimal)

    #print("leaf_count_result=",leaf_count_result)
    #print("leaf_count_optimal=",leaf_count_optimal)

    expnType_result  = expnType(result)
    expnType_optimal = expnType(optimal)

    if str(result).find("Integral") != -1:
        grade = "F"
        grade_annotation =""
    else:
        if expnType_result <= expnType_optimal:
            if result.has(I):
                if optimal.has(I): #both result and optimal complex
                    if leaf_count_result <= 2*leaf_count_optimal:
                        grade = "A"
                        grade_annotation =""
                    else:
                        grade = "B"
                        grade_annotation ="Both result and optimal contain complex but leaf count of result is large
                else: #result contains complex but optimal is not
                    grade = "C"
                    grade_annotation ="Result contains complex when optimal does not."
            else: # result do not contain complex, this assumes optimal do not as well
                if leaf_count_result <= 2*leaf_count_optimal:
                    grade = "A"
                    grade_annotation =""
                else:
                    grade = "B"
                    grade_annotation ="Leaf count of result is larger than twice the leaf count of optimal. "+str(le
        else:
            grade = "C"
            grade_annotation ="Result contains higher order function than in optimal. Order "+str(ExpnType_


    #print("Before returning. grade=",grade, " grade_annotation=",grade_annotation)
```

```
    return grade, grade_annotation
```

### 4.1.4 SageMath grading function

```
#Dec 24, 2019. Nasser: Ported original Maple grading function by
#              Albert Rich to use with Sagemath. This is used to
#              grade Fricas, Giac and Maxima results.
#Dec 24, 2019. Nasser: Added 'exp_integral_e' and 'sng', 'sin_integral'
#              'arctan2','floor','abs','log_integral'
#June 4, 2022  Made default grade_annotation "none" instead of "" due
#              issue later when reading the file.
#July 14, 2022. Added ellipticF. This is until they fix sagemath, then remove it.

from sage.all import *
from sage.symbolic.operators import add_vararg, mul_vararg

debug=False;

def tree_size(expr):
    r"""
    Return the tree size of this expression.
    """
    #print("Enter tree_size, expr is ",expr)

    if expr not in SR:
        # deal with lists, tuples, vectors
        return 1 + sum(tree_size(a) for a in expr)
    expr = SR(expr)
    x, aa = expr.operator(), expr.operands()
    if x is None:
        return 1
    else:
        return 1 + sum(tree_size(a) for a in aa)

def is_sqrt(expr):
    if expr.operator() == operator.pow:    #isinstance(expr,Pow):
        if expr.operands()[1]==1/2: #expr.args[1] == Rational(1,2):
            if debug: print ("expr is sqrt")
            return True
        else:
```

```
        return False
    else:
        return False

def is_elementary_function(func):
    #debug=False
    m = func.name() in ['exp','log','ln',
            'sin','cos','tan','cot','sec','csc',
            'arcsin','arccos','arctan','arccot','arcsec','arccsc',
            'sinh','cosh','tanh','coth','sech','csch',
            'arcsinh','arccosh','arctanh','arccoth','arcsech','arccsch','sgn',
        'arctan2','floor','abs'
        ]
    if debug:
        if m:
            print ("func ", func , " is elementary_function")
        else:
            print ("func ", func , " is NOT elementary_function")


    return m

def is_special_function(func):
    #debug=False
    if debug:
        print ("type(func)=", type(func))

    m= func.name() in ['erf','erfc','erfi','fresnel_sin','fresnel_cos','Ei',
          'Ei','Li','Si','sin_integral','Ci','cos_integral','Shi','sinh_integral'
          'Chi','cosh_integral','gamma','log_gamma','psi,zeta',
          'polylog','lambert_w','elliptic_f','elliptic_e','ellipticF',
          'elliptic_pi','exp_integral_e','log_integral']

    if debug:
        print ("m=",m)
        if m:
            print ("func ", func ," is special_function")
        else:
            print ("func ", func ," is NOT special_function")


    return m
```

```
def is_hypergeometric_function(func):
   return func.name() in ['hypergeometric','hypergeometric_M','hypergeometric_U']

def is_appell_function(func):
   return func.name() in ['hypergeometric']   #[appellf1] can't find this in sagemath

def is_atom(expn):

   #debug=False
   if debug:
       print ("Enter is_atom, expn=",expn)

   if  not hasattr(expn, 'parent'):
      return False


   #thanks to answer at https://ask.sagemath.org/question/49179/what-is-sagemath-equivalent-to-atomic-
   try:
      if expn.parent() is SR:
         return expn.operator() is None
      if expn.parent() in (ZZ, QQ, AA, QQbar):
         return expn in expn.parent() # Should always return True
      if hasattr(expn.parent(),"base_ring") and hasattr(expn.parent(),"gens"):
         return expn in expn.parent().base_ring() or expn in expn.parent().gens()

      return False

   except AttributeError as error:
      print("Exception,AttributeError in  is_atom")
      print ("cought exception" , type(error).__name__ )
      return False


def expnType(expn):

   if debug:
      print (">>>>>Enter expnType, expn=", expn)
      print (">>>>>is_atom(expn)=", is_atom(expn))

   if is_atom(expn):
      return 1
   elif type(expn)==list:   #isinstance(expn,list):
```

```
    return max(map(expnType, expn))   #apply(max,map(ExpnType,expn))
  elif is_sqrt(expn):
    if type(expn.operands()[0])==Rational: #type(isinstance(expn.args[0],Rational):
      return 1
    else:
      return max(2,expnType(expn.operands()[0]))  #max(2,expnType(expn.args[0]))
  elif expn.operator() == operator.pow:   #isinstance(expn,Pow)
    if type(expn.operands()[1])==Integer:  #isinstance(expn.args[1],Integer)
      return expnType(expn.operands()[0])   #expnType(expn.args[0])
    elif type(expn.operands()[1])==Rational:  #isinstance(expn.args[1],Rational)
      if type(expn.operands()[0])==Rational: #isinstance(expn.args[0],Rational)
        return 1
      else:
        return max(2,expnType(expn.operands()[0]))  #max(2,expnType(expn.args[0]))
    else:
      return max(3,expnType(expn.operands()[0]),expnType(expn.operands()[1])) #max(3,expnType(expn.
  elif expn.operator() == add_vararg or expn.operator() == mul_vararg: #isinstance(expn,Add) or isinst
    m1 = expnType(expn.operands()[0]) #expnType(expn.args[0])
    m2 = expnType(expn.operands()[1:]) #expnType(list(expn.args[1:]))
    return max(m1,m2)  #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
  elif is_elementary_function(expn.operator()):  #is_elementary_function(expn.func)
    return max(3,expnType(expn.operands()[0]))
  elif is_special_function(expn.operator()): #is_special_function(expn.func)
    m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
    return max(4,m1)   #max(4,m1)
  elif is_hypergeometric_function(expn.operator()): #is_hypergeometric_function(expn.func)
    m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
    return max(5,m1)   #max(5,m1)
  elif is_appell_function(expn.operator()):
    m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
    return max(6,m1)   #max(6,m1)
  elif str(expn).find("Integral") != -1: #this will never happen, since it
        #is checked before calling the grading function that is passed.
        #but kept it here.
    m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
    return max(8,m1)   #max(5,apply(max,map(ExpnType,[op(expn)])))
  else:
    return 9

#main function
def grade_antiderivative(result,optimal):
```

```
if debug:
    print ("Enter grade_antiderivative for sagemath")
    print("Enter grade_antiderivative, result=",result)
    print("Enter grade_antiderivative, optimal=",optimal)
    print("type(anti)=",type(result))
    print("type(optimal)=",type(optimal))

leaf_count_result  = tree_size(result) #leaf_count(result)
leaf_count_optimal = tree_size(optimal) #leaf_count(optimal)

#if debug: print ("leaf_count_result=", leaf_count_result, "leaf_count_optimal=",leaf_count_optimal)


expnType_result  = expnType(result)
expnType_optimal = expnType(optimal)

if debug: print ("expnType_result=", expnType_result, "expnType_optimal=",expnType_optimal)

if expnType_result <= expnType_optimal:
    if result.has(I):
        if optimal.has(I): #both result and optimal complex
            if leaf_count_result <= 2*leaf_count_optimal:
                grade = "A"
                grade_annotation =" "
            else:
                grade = "B"
                grade_annotation ="Both result and optimal contain complex but leaf count of result is larger t
        else: #result contains complex but optimal is not
            grade = "C"
            grade_annotation ="Result contains complex when optimal does not."
    else: # result do not contain complex, this assumes optimal do not as well
        if leaf_count_result <= 2*leaf_count_optimal:
            grade = "A"
            grade_annotation =" "
        else:
            grade = "B"
            grade_annotation ="Leaf count of result is larger than twice the leaf count of optimal. "+str(leaf_
else:
    grade = "C"
    grade_annotation ="Result contains higher order function than in optimal. Order "+str(expnType_resu


print("Before returning. grade=",grade, " grade_annotation=",grade_annotation)
```

```
    return grade, grade_annotation
```