Computer Algebra
Independent Integration Tests

Summer 2023 edition with Rubi V 4.17.3

0-Independent-test-suites/4-Charlwood-Problems

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Contents

CHAPTER 1

Introduction

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 [50]. This is test number [4].

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 (50)	0.00 (0)
Fricas	100.00 (50)	0.00 (0)
Rubi	96.00 (48)	4.00 (2)
Giac	82.00 (41)	18.00 (9)
Maple	66.00 (33)	34.00 (17)
Maxima	52.00 (26)	48.00 (24)
Sympy	38.00 (19)	62.00 (31)
Mupad	24.00 (12)	76.00 (38)

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 1. antiderivative contains a hypergeometric function and the optimal antiderivative does not. 2. antiderivative contains a special function and the optimal antiderivative does not. 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.

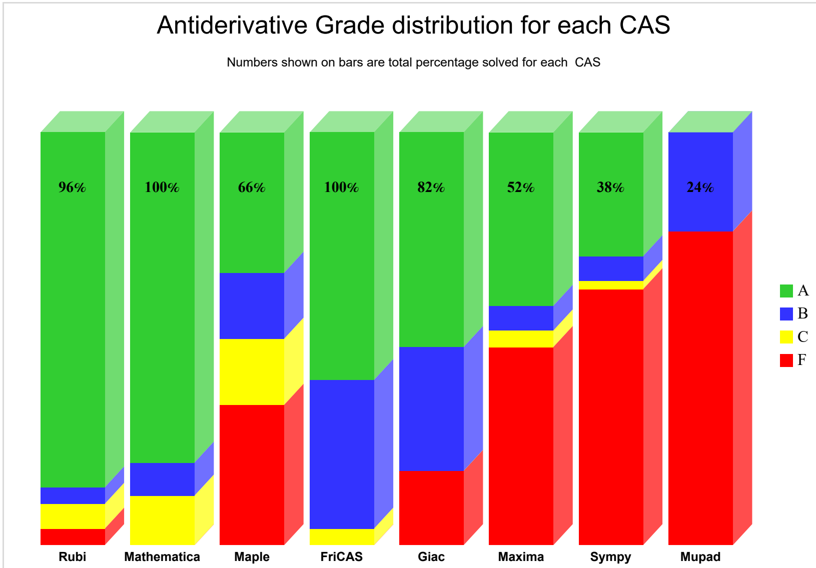
Table 1.2: Description of grading applied to integration result

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

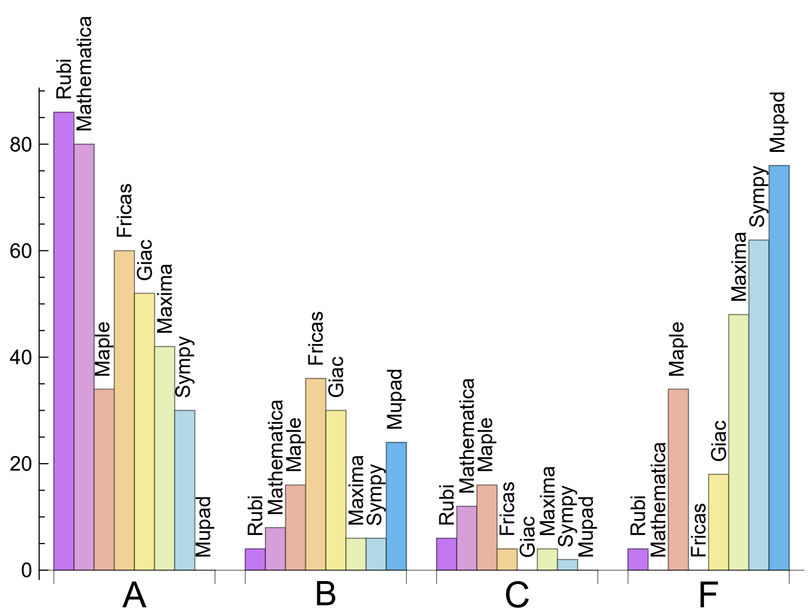
System	% A grade	% B grade	% C grade	% F grade
Rubi	86.000	4.000	6.000	4.000
Mathematica	80.000	8.000	12.000	0.000
Fricas	60.000	36.000	4.000	0.000
Giac	52.000	30.000	0.000	18.000
Maxima	42.000	6.000	4.000	48.000
Maple	34.000	16.000	16.000	34.000
Sympy	30.000	6.000	2.000	62.000
Mupad	0.000	24.000	0.000	76.000

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
Fricas	0	0.00	0.00	0.00
Rubi	2	100.00	0.00	0.00
Giac	9	100.00	0.00	0.00
Maple	17	100.00	0.00	0.00
Maxima	24	100.00	0.00	0.00
Sympy	31	70.97	29.03	0.00
Mupad	38	0.00	100.00	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)
Mathematica	0.21
Giac	0.30
Rubi	0.31
Maxima	0.32
Maple	0.61
Mupad	0.65
Fricas	0.73
Sympy	4.41

Table 1.5: Time performance for each CAS

System	Mean size	Normalized mean	Median size	Normalized median
Sympy	44.32	1.48	31.00	0.98
Rubi	68.42	1.30	42.00	1.00
Fricas	84.74	1.58	50.50	1.35
Giac	88.37	1.61	50.00	1.41
Mathematica	112.46	1.58	45.50	1.00
Maple	152.39	2.27	54.00	1.15
Maxima	220.77	3.04	27.00	0.88
Mupad	223.25	2.82	69.00	1.98

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.

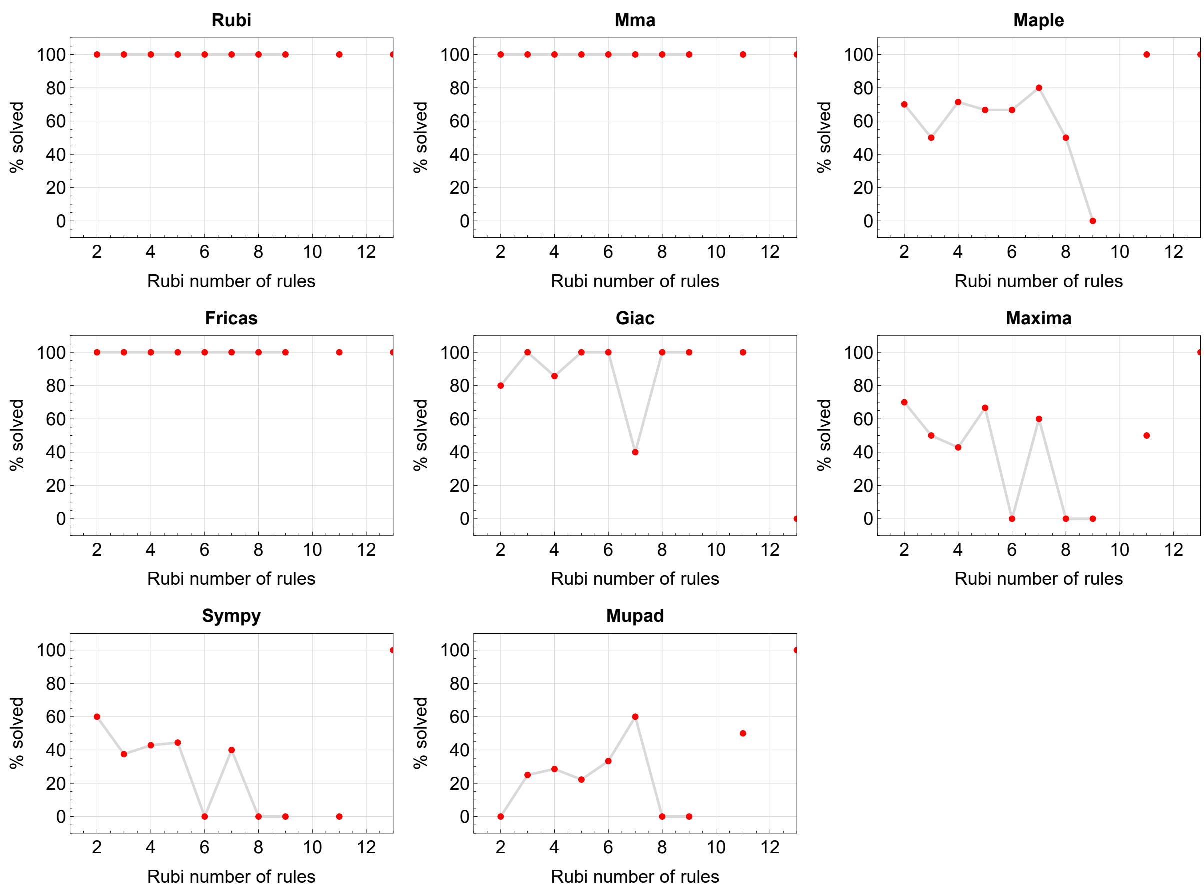


Figure 1.1: Solving statistics per number of Rubi rules used

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.

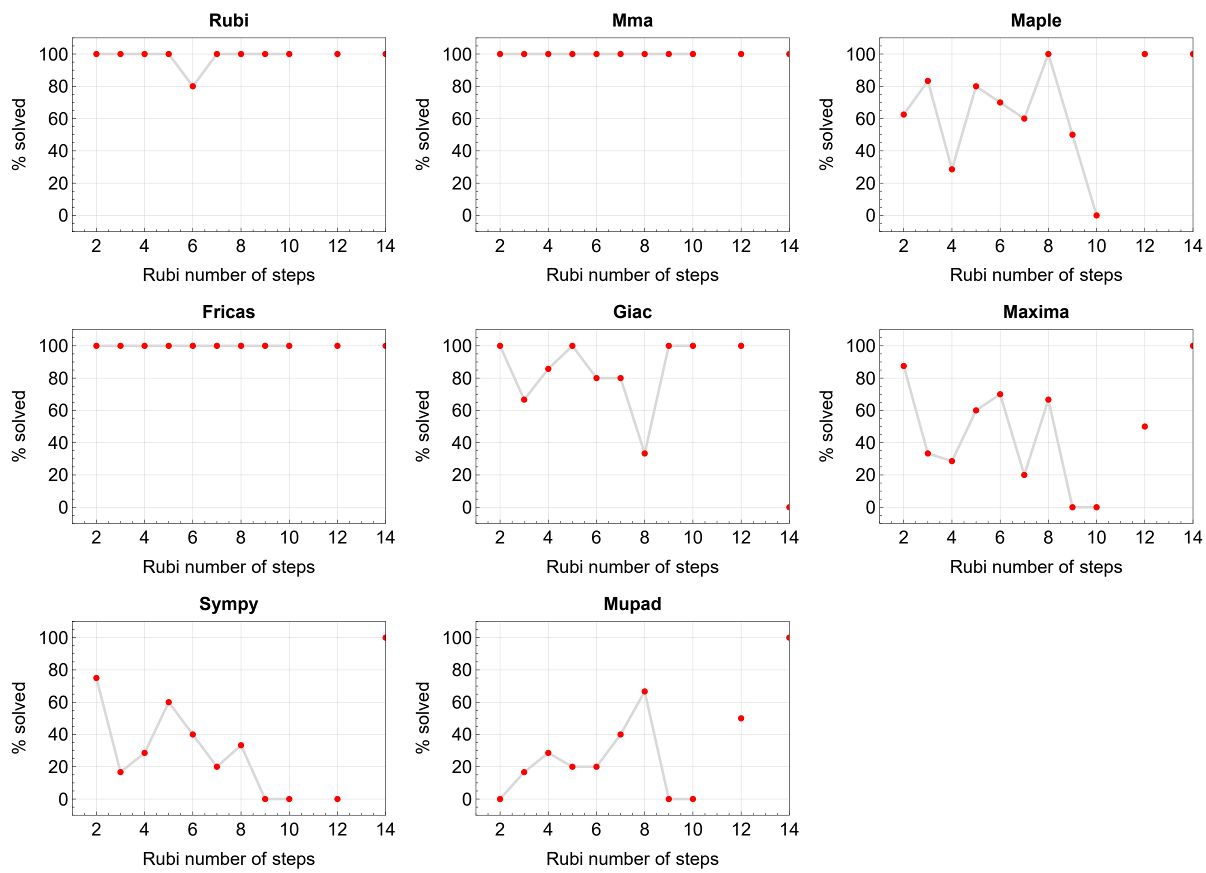


Figure 1.2: Solving statistics per number of Rubi steps used

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.

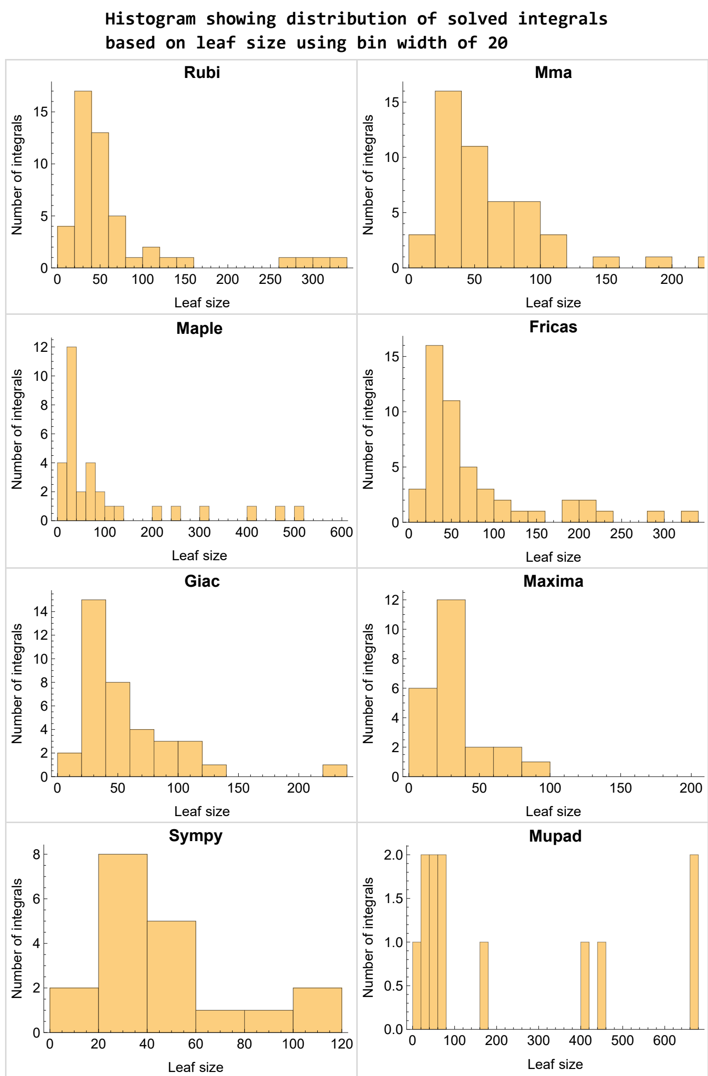


Figure 1.3: Solved integrals based on leaf size distribution

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.

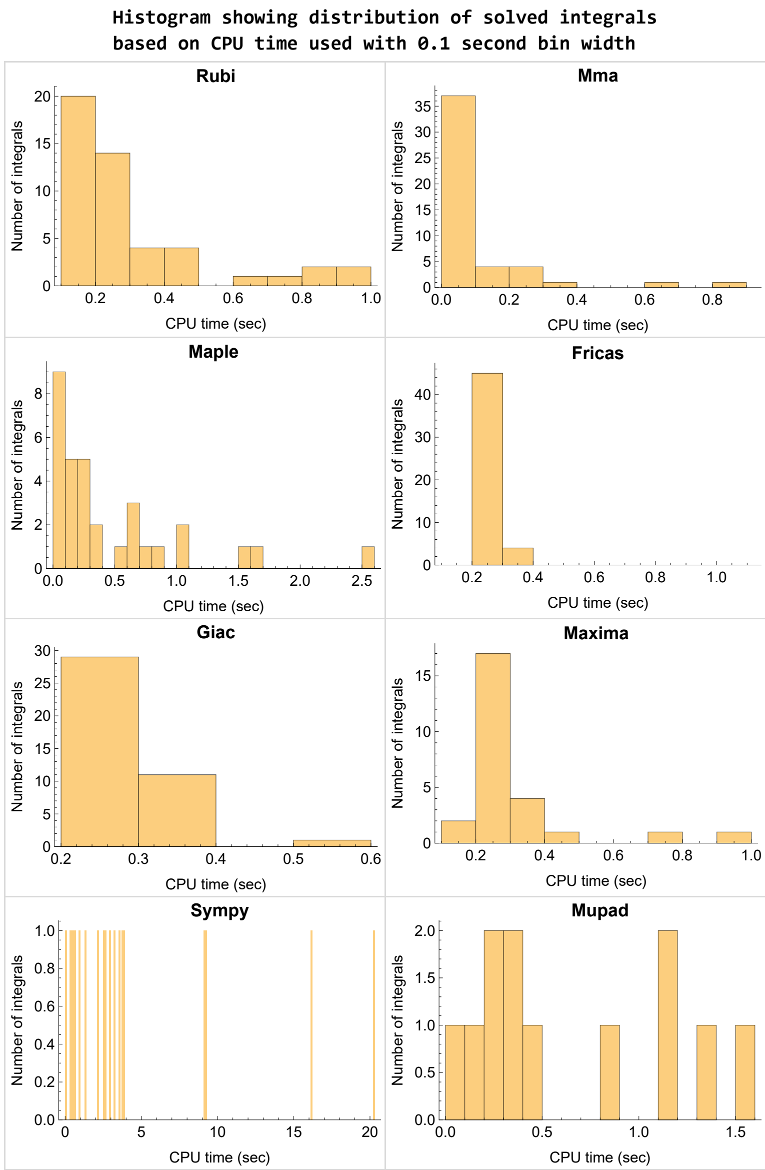


Figure 1.4: Solved integrals histogram based on CPU time used

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.

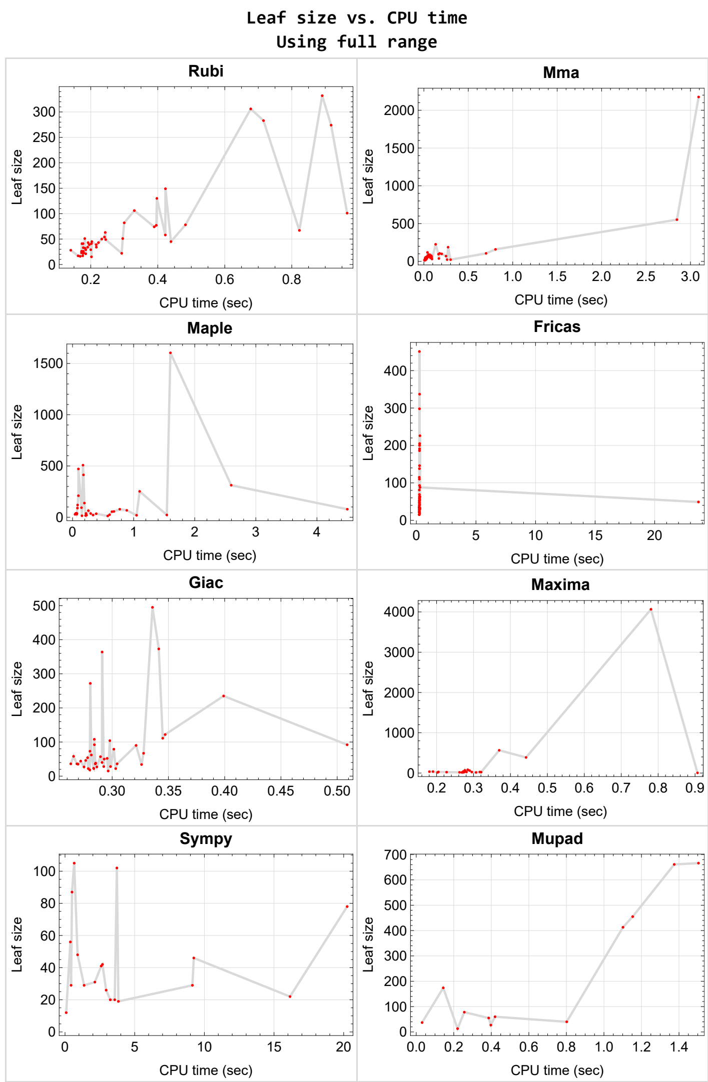


Figure 1.5: Leaf size vs. CPU time. Full range

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 $\{9, 24, 47, 48\}$

Mathematica $\{45\}$

Maple $\{18, 33, 35\}$

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.

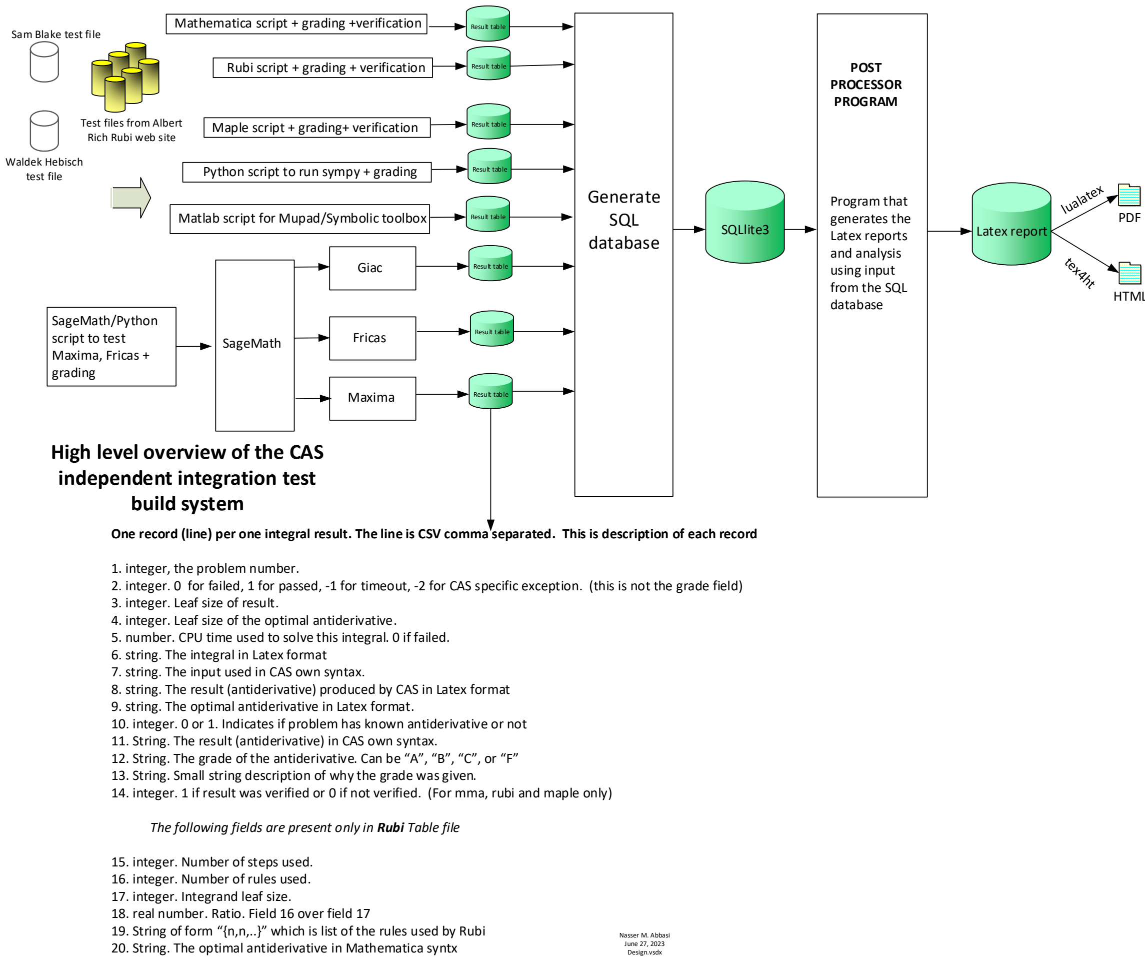
The following is an example of using Matlab's symbolic toolbox (Mupad) to solve an integral

```
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.



CHAPTER 2

DETAILED SUMMARY TABLES OF RESULTS

2.1 List of integrals sorted by grade for each CAS

2.1.1 Rubi

A grade { 1, 2, 6, 7, 8, 9, 10, 11, 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, 43, 44, 46, 47, 48, 49, 50 }

B grade { 4, 42 }

C grade { 5, 12, 13 }

F normal fail { 3, 45 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.2 Mma

A grade { 1, 2, 3, 4, 6, 7, 9, 10, 11, 14, 16, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 42, 43, 44, 45, 46, 48, 49, 50 }

B grade { 15, 17, 21, 41 }

C grade { 5, 8, 12, 13, 37, 47 }

F normal fail { }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.3 Maple

A grade { 2, 6, 7, 9, 19, 24, 27, 32, 34, 36, 37, 38, 39, 40, 43, 46, 48 }

B grade { 1, 4, 8, 42, 44, 47, 49, 50 }

C grade { 3, 5, 12, 18, 28, 31, 33, 35 }

F normal fail { 10, 11, 13, 14, 15, 16, 17, 20, 21, 22, 23, 25, 26, 29, 30, 41, 45 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.4 Fricas

A grade { 1, 2, 3, 5, 9, 10, 11, 12, 13, 14, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 39, 46, 48 }

B grade { 4, 6, 7, 15, 16, 17, 21, 22, 37, 38, 40, 41, 42, 43, 44, 47, 49, 50 }

C grade { 8, 45 }

F normal fail { }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.5 Maxima

A grade { 1, 2, 3, 9, 16, 18, 19, 20, 24, 25, 27, 28, 31, 32, 33, 34, 35, 36, 37, 46, 48 }

B grade { 7, 40, 43 }

C grade { 8, 30 }

F normal fail { 4, 5, 6, 10, 11, 12, 13, 14, 15, 17, 21, 22, 23, 26, 29, 38, 39, 41, 42, 44, 45, 47, 49, 50 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.6 Giac

A grade { 2, 6, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 28, 33, 34, 35, 36, 40, 43, 47, 48, 49, 50 }

B grade { 1, 4, 7, 8, 12, 13, 27, 29, 30, 31, 32, 37, 41, 42, 44 }

C grade { }

F normal fail { 3, 5, 9, 11, 23, 38, 39, 45, 46 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.7 Mupad

A grade { }

B grade { 4, 9, 12, 19, 24, 30, 37, 40, 46, 47, 48, 50 }

C grade { }

F normal fail { }

F(-1) timedout fail { 1, 2, 3, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 38, 39, 41, 42, 43, 44, 45, 49 }

F(-2) exception fail { }

2.1.8 Sympy

A grade { 1, 2, 10, 18, 19, 20, 24, 25, 31, 33, 34, 35, 36, 46, 48 }

B grade { 28, 37, 40 }

C grade { 16 }

F normal fail { 3, 6, 7, 8, 9, 14, 17, 21, 22, 26, 27, 29, 30, 32, 38, 39, 41, 42, 43, 45, 47, 49 }

F(-1) timedout fail { 4, 5, 11, 12, 13, 15, 23, 44, 50 }

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	A	B	A	A	A	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	51	51	52	93	58	54	102	272	0
N.S.	1	1.00	1.02	1.82	1.14	1.06	2.00	5.33	0.00
time (sec)	N/A	0.181	0.018	0.146	0.277	0.263	3.722	0.281	0.000

Problem 2	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	17	17	17	16	15	15	12	15	0
N.S.	1	1.00	1.00	0.94	0.88	0.88	0.71	0.88	0.00
time (sec)	N/A	0.165	0.006	0.213	0.307	0.241	0.084	0.296	0.000

Problem 3	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	F	A	C	A	A	F	F	F(-1)
verified	N/A	N/A	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	69	0	106	252	4	49	0	0	0
N.S.	1	0.00	1.54	3.65	0.06	0.71	0.00	0.00	0.00
time (sec)	N/A	0.000	0.700	1.098	0.907	23.673	0.000	0.000	0.000

Problem 4	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	B	A	B	F	B	F(-1)	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	97	332	188	413	0	451	0	235	666
N.S.	1	3.42	1.94	4.26	0.00	4.65	0.00	2.42	6.87
time (sec)	N/A	0.847	0.273	0.179	0.000	0.255	0.000	0.399	1.504

Problem 5	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	C	C	C	F	A	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	45	306	159	312	0	33	0	0	0
N.S.	1	6.80	3.53	6.93	0.00	0.73	0.00	0.00	0.00
time (sec)	N/A	0.655	0.806	2.597	0.000	0.302	0.000	0.000	0.000

Problem 6	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	F	B	F	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	56	54	74	64	0	88	0	79	0
N.S.	1	0.96	1.32	1.14	0.00	1.57	0.00	1.41	0.00
time (sec)	N/A	0.228	0.084	0.259	0.000	0.308	0.000	0.301	0.000

Problem 7	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	B	B	F	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	15	15	15	12	27	30	0	28	0
N.S.	1	1.00	1.00	0.80	1.80	2.00	0.00	1.87	0.00
time (sec)	N/A	0.194	0.012	0.576	0.205	0.306	0.000	0.299	0.000

Problem 8	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	C	B	C	C	F	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	137	149	99	1604	4065	226	0	495	0
N.S.	1	1.09	0.72	11.71	29.67	1.65	0.00	3.61	0.00
time (sec)	N/A	0.406	0.201	1.602	0.781	0.300	0.000	0.336	0.000

Problem 9	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	F	F	B
verified	N/A	No	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	41	39	70	36	60	32	0	0	60
N.S.	1	0.95	1.71	0.88	1.46	0.78	0.00	0.00	1.46
time (sec)	N/A	0.211	0.249	0.297	0.289	0.258	0.000	0.000	0.420

Problem 10	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	A	A	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	44	67	38	0	0	28	56	46	0
N.S.	1	1.52	0.86	0.00	0.00	0.64	1.27	1.05	0.00
time (sec)	N/A	0.792	0.169	0.000	0.000	0.246	0.383	0.276	0.000

Problem 11	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	A	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	68	74	64	0	0	43	0	0	0
N.S.	1	1.09	0.94	0.00	0.00	0.63	0.00	0.00	0.00
time (sec)	N/A	0.374	0.038	0.000	0.000	0.262	0.000	0.000	0.000

Problem 12	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	C	C	C	F	A	F(-1)	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	141	274	226	471	0	191	0	364	661
N.S.	1	1.94	1.60	3.34	0.00	1.35	0.00	2.58	4.69
time (sec)	N/A	0.880	0.132	0.096	0.000	0.268	0.000	0.291	1.375

Problem 13	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	C	C	F	F	A	F(-1)	B	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	152	283	2175	0	0	200	0	373	0
N.S.	1	1.86	14.31	0.00	0.00	1.32	0.00	2.45	0.00
time (sec)	N/A	0.686	3.092	0.000	0.000	0.266	0.000	0.341	0.000

Problem 14	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	A	F	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	45	51	44	0	0	63	0	57	0
N.S.	1	1.13	0.98	0.00	0.00	1.40	0.00	1.27	0.00
time (sec)	N/A	0.280	0.034	0.000	0.000	0.259	0.000	0.290	0.000

Problem 15	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	B	F	F	B	F(-1)	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	34	34	76	0	0	62	0	36	0
N.S.	1	1.00	2.24	0.00	0.00	1.82	0.00	1.06	0.00
time (sec)	N/A	0.182	0.073	0.000	0.000	0.282	0.000	0.285	0.000

Problem 16	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	A	B	C	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	22	22	22	0	18	56	78	18	0
N.S.	1	1.00	1.00	0.00	0.82	2.55	3.55	0.82	0.00
time (sec)	N/A	0.172	0.020	0.000	0.262	0.275	20.249	0.280	0.000

Problem 17	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	B	F	F	B	F	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	32	32	89	0	0	58	0	36	0
N.S.	1	1.00	2.78	0.00	0.00	1.81	0.00	1.12	0.00
time (sec)	N/A	0.182	0.054	0.000	0.000	0.257	0.000	0.269	0.000

Problem 18	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	C	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	No	TBD	TBD	TBD	TBD	TBD
size	43	43	43	89	41	32	42	62	0
N.S.	1	1.00	1.00	2.07	0.95	0.74	0.98	1.44	0.00
time (sec)	N/A	0.184	0.017	0.080	0.272	0.261	2.687	0.282	0.000

Problem 19	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	A	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	28	28	28	21	34	34	48	35	174
N.S.	1	1.00	1.00	0.75	1.21	1.21	1.71	1.25	6.21
time (sec)	N/A	0.138	0.015	0.336	0.181	0.228	0.901	0.270	0.144

Problem 20	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	26	26	26	0	22	22	20	22	0
N.S.	1	1.00	1.00	0.00	0.85	0.85	0.77	0.85	0.00
time (sec)	N/A	0.166	0.016	0.000	0.227	0.241	3.249	0.284	0.000

Problem 21	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	B	F	F	B	F	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	38	43	85	0	0	138	0	38	0
N.S.	1	1.13	2.24	0.00	0.00	3.63	0.00	1.00	0.00
time (sec)	N/A	0.217	0.053	0.000	0.000	0.259	0.000	0.285	0.000

Problem 22	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	B	F	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	70	82	88	0	0	110	0	52	0
N.S.	1	1.17	1.26	0.00	0.00	1.57	0.00	0.74	0.00
time (sec)	N/A	0.283	0.063	0.000	0.000	0.255	0.000	0.296	0.000

Problem 23	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	A	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	58	58	58	0	0	48	0	0	0
N.S.	1	1.00	1.00	0.00	0.00	0.83	0.00	0.00	0.00
time (sec)	N/A	0.407	0.026	0.000	0.000	0.256	0.000	0.000	0.000

Problem 24	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	A	B
verified	N/A	No	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	55	49	41	37	36	35	31	36	27
N.S.	1	0.89	0.75	0.67	0.65	0.64	0.56	0.65	0.49
time (sec)	N/A	0.233	0.016	0.052	0.190	0.234	2.143	0.263	0.398

Problem 25	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	26	26	26	0	22	22	20	22	0
N.S.	1	1.00	1.00	0.00	0.85	0.85	0.77	0.85	0.00
time (sec)	N/A	0.171	0.015	0.000	0.321	0.244	3.568	0.279	0.000

Problem 26	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	A	F	A	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	78	78	119	0	0	115	0	122	0
N.S.	1	1.00	1.53	0.00	0.00	1.47	0.00	1.56	0.00
time (sec)	N/A	0.457	0.041	0.000	0.000	0.246	0.000	0.347	0.000

Problem 27	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	F	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	39	39	25	35	35	39	0	73	0
N.S.	1	1.00	0.64	0.90	0.90	1.00	0.00	1.87	0.00
time (sec)	N/A	0.196	0.023	0.073	0.274	0.241	0.000	0.280	0.000

Problem 28	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	C	A	A	B	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	17	17	17	54	15	23	29	23	0
N.S.	1	1.00	1.00	3.18	0.88	1.35	1.71	1.35	0.00
time (sec)	N/A	0.170	0.012	0.645	0.268	0.252	0.435	0.284	0.000

Problem 29	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	A	F	B	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	57	63	77	0	0	81	0	104	0
N.S.	1	1.11	1.35	0.00	0.00	1.42	0.00	1.82	0.00
time (sec)	N/A	0.236	0.045	0.000	0.000	0.250	0.000	0.298	0.000

Problem 30	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	C	A	F	B	B
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	45	45	45	0	387	69	0	108	37
N.S.	1	1.00	1.00	0.00	8.60	1.53	0.00	2.40	0.82
time (sec)	N/A	0.203	0.026	0.000	0.442	0.258	0.000	0.284	0.031

Problem 31	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	C	A	A	A	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	29	29	33	56	22	47	19	54	0
N.S.	1	1.00	1.14	1.93	0.76	1.62	0.66	1.86	0.00
time (sec)	N/A	0.196	0.019	0.677	0.272	0.249	3.830	0.278	0.000

Problem 32	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	F	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	21	21	21	20	19	22	0	40	0
N.S.	1	1.00	1.00	0.95	0.90	1.05	0.00	1.90	0.00
time (sec)	N/A	0.182	0.011	0.229	0.272	0.252	0.000	0.291	0.000

Problem 33	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	C	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	No	TBD	TBD	TBD	TBD	TBD
size	34	41	27	119	27	27	29	28	0
N.S.	1	1.21	0.79	3.50	0.79	0.79	0.85	0.82	0.00
time (sec)	N/A	0.175	0.014	0.083	0.281	0.248	1.369	0.293	0.000

Problem 34	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	33	33	21	29	29	33	26	58	0
N.S.	1	1.00	0.64	0.88	0.88	1.00	0.79	1.76	0.00
time (sec)	N/A	0.174	0.019	0.069	0.275	0.244	2.951	0.266	0.000

Problem 35	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	C	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	No	TBD	TBD	TBD	TBD	TBD
size	25	25	35	34	15	15	22	22	0
N.S.	1	1.00	1.40	1.36	0.60	0.60	0.88	0.88	0.00
time (sec)	N/A	0.173	0.031	0.388	0.202	0.245	16.148	0.303	0.000

Problem 36	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	34	41	40	39	25	41	41	44	0
N.S.	1	1.21	1.18	1.15	0.74	1.21	1.21	1.29	0.00
time (sec)	N/A	0.172	0.013	0.064	0.295	0.268	2.595	0.272	0.000

Problem 37	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	C	A	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	16	16	46	14	24	29	46	27	13
N.S.	1	1.00	2.88	0.88	1.50	1.81	2.88	1.69	0.81
time (sec)	N/A	0.163	0.074	0.154	0.274	0.255	9.243	0.275	0.220

Problem 38	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	F	B	F	F	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	23	23	23	22	0	42	0	0	0
N.S.	1	1.00	1.00	0.96	0.00	1.83	0.00	0.00	0.00
time (sec)	N/A	0.168	0.300	1.543	0.000	0.269	0.000	0.000	0.000

Problem 39	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	F	A	F	F	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	23	23	23	19	0	18	0	0	0
N.S.	1	1.00	1.00	0.83	0.00	0.78	0.00	0.00	0.00
time (sec)	N/A	0.169	0.262	1.048	0.000	0.271	0.000	0.000	0.000

Problem 40	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	B	B	B	A	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	22	22	39	24	82	93	105	36	55
N.S.	1	1.00	1.77	1.09	3.73	4.23	4.77	1.64	2.50
time (sec)	N/A	0.279	0.033	0.606	0.284	0.264	0.659	0.304	0.386

Problem 41	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	B	F	F	B	F	B	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	42	45	87	0	0	146	0	90	0
N.S.	1	1.07	2.07	0.00	0.00	3.48	0.00	2.14	0.00
time (sec)	N/A	0.422	0.067	0.000	0.000	0.268	0.000	0.321	0.000

Problem 42	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	B	A	B	F	B	F	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	28	77	45	78	0	54	0	92	0
N.S.	1	2.75	1.61	2.79	0.00	1.93	0.00	3.29	0.00
time (sec)	N/A	0.385	0.028	0.773	0.000	0.279	0.000	0.509	0.000

Problem 43	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	B	B	F	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	34	34	55	37	565	186	0	50	0
N.S.	1	1.00	1.62	1.09	16.62	5.47	0.00	1.47	0.00
time (sec)	N/A	0.210	0.044	0.220	0.370	0.262	0.000	0.293	0.000

Problem 44	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	F	B	F(-1)	B	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	39	50	65	67	0	63	0	67	0
N.S.	1	1.28	1.67	1.72	0.00	1.62	0.00	1.72	0.00
time (sec)	N/A	0.234	0.058	0.888	0.000	0.298	0.000	0.328	0.000

Problem 45	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	F	A	F	F	C	F	F	F(-1)
verified	N/A	N/A	No	N/A	TBD	TBD	TBD	TBD	TBD
size	337	0	552	0	0	337	0	0	0
N.S.	1	0.00	1.64	0.00	0.00	1.00	0.00	0.00	0.00
time (sec)	N/A	0.000	2.848	0.000	0.000	0.272	0.000	0.000	0.000

Problem 46	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	F	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	77	101	58	78	67	52	87	0	78
N.S.	1	1.31	0.75	1.01	0.87	0.68	1.13	0.00	1.01
time (sec)	N/A	0.978	0.088	4.497	0.277	0.247	0.501	0.000	0.256

Problem 47	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	C	B	F	B	F	A	B
verified	N/A	No	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	120	130	95	508	0	298	0	92	413
N.S.	1	1.08	0.79	4.23	0.00	2.48	0.00	0.77	3.44
time (sec)	N/A	0.390	0.165	0.171	0.000	0.261	0.000	0.284	1.102

Problem 48	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	A	A	B
verified	N/A	No	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	31	41	31	28	26	22	29	27	40
N.S.	1	1.32	1.00	0.90	0.84	0.71	0.94	0.87	1.29
time (sec)	N/A	0.195	0.092	0.041	0.317	0.253	9.144	0.286	0.802

Problem 49	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	F	B	F	A	F(-1)
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	29	29	29	138	0	60	0	34	0
N.S.	1	1.00	1.00	4.76	0.00	2.07	0.00	1.17	0.00
time (sec)	N/A	0.180	0.025	0.194	0.000	0.261	0.000	0.326	0.000

Problem 50	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	F	B	F(-1)	A	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	106	106	106	210	0	205	0	111	455
N.S.	1	1.00	1.00	1.98	0.00	1.93	0.00	1.05	4.29
time (sec)	N/A	0.323	0.177	0.096	0.000	0.275	0.000	0.345	1.153

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 [46] had the largest ratio of [1.08332999999999990]

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	2	2	1.00	5	0.400
2	A	2	2	1.00	15	0.133
3	F	0	0	N/A	0.000	N/A
4	B	3	3	3.42	14	0.214
5	C	8	7	6.80	19	0.368
6	A	9	8	0.96	13	0.615
7	A	6	5	1.00	13	0.385
8	A	12	11	1.09	14	0.786
9	A	8	7	0.95	12	0.583
10	A	6	5	1.52	19	0.263
11	A	7	7	1.09	29	0.241
12	C	4	4	1.94	14	0.286
13	C	4	4	1.86	27	0.148
14	A	2	2	1.13	18	0.111
15	A	4	3	1.00	24	0.125
16	A	4	3	1.00	12	0.250
17	A	4	3	1.00	22	0.136
18	A	5	4	1.00	15	0.267
19	A	5	4	1.00	13	0.308
20	A	2	2	1.00	23	0.087
21	A	5	5	1.13	17	0.294
22	A	9	8	1.17	15	0.533

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	4	4	1.00	25	0.160
24	A	6	5	0.89	27	0.185
25	A	2	2	1.00	23	0.087
26	A	3	3	1.00	27	0.111
27	A	3	3	1.00	17	0.176
28	A	2	2	1.00	13	0.154
29	A	7	6	1.11	17	0.353
30	A	6	5	1.00	15	0.333
31	A	5	4	1.00	15	0.267
32	A	2	2	1.00	17	0.118
33	A	6	5	1.21	13	0.385
34	A	3	3	1.00	15	0.200
35	A	2	2	1.00	13	0.154
36	A	6	5	1.21	13	0.385
37	A	4	3	1.00	11	0.273
38	A	3	2	1.00	24	0.083
39	A	3	2	1.00	24	0.083
40	A	7	7	1.00	10	0.700
41	A	10	9	1.07	12	0.750
42	B	7	6	2.75	13	0.462
43	A	6	5	1.00	13	0.385
44	A	6	5	1.28	15	0.333
45	F	0	0	N/A	0.000	N/A
46	A	14	13	1.31	12	1.083
47	A	12	11	1.08	12	0.917
48	A	8	7	1.32	18	0.389
49	A	5	4	1.00	14	0.286
50	A	7	6	1.00	14	0.429

CHAPTER 3

Listing of integrals

3.1 $\int \arcsin(x) \log(x) \, dx$

3.1.1 Optimal result

Integrand size = 5, antiderivative size = 51

$$\int \arcsin(x) \log(x) \, dx = -2\sqrt{1-x^2} + \operatorname{arctanh}\left(\sqrt{1-x^2}\right) - x \arcsin(x)(1-\log(x)) + \sqrt{1-x^2}\log(x)$$

output
```
arctanh((-x^2+1)^(1/2))-x*arcsin(x)*(1-ln(x))-2*(-x^2+1)^(1/2)+ln(x)*(-x^2
+1)^(1/2)
```

3.1.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 52, normalized size of antiderivative = 1.02

$$\int \arcsin(x) \log(x) \, dx = -2\sqrt{1-x^2} + x \arcsin(x)(-1+\log(x)) + \left(-1+\sqrt{1-x^2}\right)\log(x) + \log\left(1+\sqrt{1-x^2}\right)$$

input
```
Integrate[ArcSin[x]*Log[x],x]
```

output
```
-2*Sqrt[1 - x^2] + x*ArcSin[x]*(-1 + Log[x]) + (-1 + Sqrt[1 - x^2])*Log[x]
 + Log[1 + Sqrt[1 - x^2]]
```

3.1.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 51, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.400, Rules used = {2834, 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.

$$\int \arcsin(x)\log(x)\,dx$$

$$\Big\downarrow \text{2834}$$

$$-\int \left(\arcsin(x)+\frac{\sqrt{1-x^2}}{x}\right)dx+x\arcsin(x)\log(x)+\sqrt{1-x^2}\log(x)$$

$$\Big\downarrow \text{2009}$$

$$-x\arcsin(x)+x\arcsin(x)\log(x)+\text{arctanh}\left(\sqrt{1-x^2}\right)-2\sqrt{1-x^2}+\sqrt{1-x^2}\log(x)$$

input
```
Int[ArcSin[x]*Log[x],x]
```

output
```
-2*Sqrt[1 - x^2] - x*ArcSin[x] + ArcTanh[Sqrt[1 - x^2]] + Sqrt[1 - x^2]*Lo
g[x] + x*ArcSin[x]*Log[x]
```

3.1.3.1 Defintions of rubi rules used

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

rule 2834
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(Px_.)*(F_)[(d_.)*((e_.) + (f_.)*
(x_))]^(m_.), x_Symbol] :> With[{u = IntHide[Px*F[d*(e + f*x)]^m, x]}, Simp
[(a + b*Log[c*x^n])   u, x] - Simp[b*n   Int[1/x   u, x], x]] /; FreeQ[{a,
b, c, d, e, f, n}, x] && PolynomialQ[Px, x] && IGtQ[m, 0] && MemberQ[{ArcSi
n, ArcCos, ArcSinh, ArcCosh}, F]
```

3.1.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 92 vs. $2(45) = 90$.

Time = 0.15 (sec) , antiderivative size = 93, normalized size of antiderivative = 1.82

method	result
default	$\frac{2\arcsin(x)\tan\left(\frac{\arcsin(x)}{2}\right)\ln\left(\frac{2\tan\left(\frac{\arcsin(x)}{2}\right)}{1+\tan^2\left(\frac{\arcsin(x)}{2}\right)}\right)-2\left(\tan^2\left(\frac{\arcsin(x)}{2}\right)\right)\ln\left(\frac{2\tan\left(\frac{\arcsin(x)}{2}\right)}{1+\tan^2\left(\frac{\arcsin(x)}{2}\right)}\right)-2\arcsin(x)\tan\left(\frac{\arcsin(x)}{2}\right)-4}{1+\tan^2\left(\frac{\arcsin(x)}{2}\right)} -$

input
```
int(arcsin(x)*ln(x),x,method=_RETURNVERBOSE)
```

output
```
2*(arcsin(x)*tan(1/2*arcsin(x))*ln(2*tan(1/2*arcsin(x))/(1+tan(1/2*arcsin(
x))^2))-tan(1/2*arcsin(x))^2*ln(2*tan(1/2*arcsin(x))/(1+tan(1/2*arcsin(x))
^2))-arcsin(x)*tan(1/2*arcsin(x))-2)/(1+tan(1/2*arcsin(x))^2)-ln(1+tan(1/2
*arcsin(x))^2)
```

3.1.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.06

$$\int \arcsin(x)\log(x)\,dx = x\arcsin(x)\log(x) - x\arcsin(x) + \sqrt{-x^2+1}(\log(x)-2) + \frac{1}{2}\log\left(\sqrt{-x^2+1}+1\right) - \frac{1}{2}\log\left(\sqrt{-x^2+1}-1\right)$$

input
```
integrate(arcsin(x)*log(x),x, algorithm="fricas")
```

output
```
x*arcsin(x)*log(x) - x*arcsin(x) + sqrt(-x^2 + 1)*(log(x) - 2) + 1/2*log(s
qrt(-x^2 + 1) + 1) - 1/2*log(sqrt(-x^2 + 1) - 1)
```

3.1.6 Sympy [A] (verification not implemented)

Time = 3.72 (sec) , antiderivative size = 102, normalized size of antiderivative = 2.00

$$\int \arcsin(x)\log(x)\,dx = x\log(x)\operatorname{asin}(x) - x\operatorname{asin}(x) + \sqrt{1-x^2}\log(x) - \sqrt{1-x^2} - \begin{cases} -\frac{x}{\sqrt{-1+\frac{1}{x^2}}} - \operatorname{acosh}\left(\frac{1}{x}\right) + \frac{1}{x\sqrt{-1+\frac{1}{x^2}}} & \text{for } \frac{1}{|x^2|} > 1 \\ \frac{ix}{\sqrt{1-\frac{1}{x^2}}} + i\operatorname{asin}\left(\frac{1}{x}\right) - \frac{i}{x\sqrt{1-\frac{1}{x^2}}} & \text{otherwise} \end{cases}$$

input
```
integrate(asin(x)*ln(x),x)
```

output
```
x*log(x)*asin(x) - x*asin(x) + sqrt(1 - x**2)*log(x) - sqrt(1 - x**2) - Pi
ecewise((-x/sqrt(-1 + x**(-2)) - acosh(1/x) + 1/(x*sqrt(-1 + x**(-2))), 1/
Abs(x**2) > 1), (I*x/sqrt(1 - 1/x**2) + I*asin(1/x) - I/(x*sqrt(1 - 1/x**2
)), True))
```

3.1.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.14

$$\int \arcsin(x)\log(x)\,dx = (x\log(x) - x)\arcsin(x) + \sqrt{-x^2+1}\log(x) - 2\sqrt{-x^2+1} + \log\left(\frac{2\sqrt{-x^2+1}}{|x|} + \frac{2}{|x|}\right)$$

input
```
integrate(arcsin(x)*log(x),x, algorithm="maxima")
```

output
```
(x*log(x) - x)*arcsin(x) + sqrt(-x^2 + 1)*log(x) - 2*sqrt(-x^2 + 1) + log(
2*sqrt(-x^2 + 1)/abs(x) + 2/abs(x))
```

3.1.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 272 vs. $2(42) = 84$.

Time = 0.28 (sec) , antiderivative size = 272, normalized size of antiderivative = 5.33

$$\int \arcsin(x)\log(x)\,dx = x\arcsin(x)\log(x) + \sqrt{-x^2+1}\log(x) - \frac{2\,x\arcsin(x)}{\left(\sqrt{-x^2+1}+1\right)\left(\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1\right)} + \frac{x^2\log\left(\sqrt{-x^2+1}+1\right)}{\left(\sqrt{-x^2+1}+1\right)^2\left(\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1\right)} + \frac{\log\left(\sqrt{-x^2+1}+1\right)}{\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1} - \frac{x^2\log(|x|)}{\left(\sqrt{-x^2+1}+1\right)^2\left(\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1\right)} - \frac{\log(|x|)}{\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1} + \frac{2\,x^2}{\left(\sqrt{-x^2+1}+1\right)^2\left(\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1\right)} - \frac{2}{\frac{x^2}{\left(\sqrt{-x^2+1}+1\right)^2}+1}$$

input
```
integrate(arcsin(x)*log(x),x, algorithm="giac")
```

output
```
x*arcsin(x)*log(x) + sqrt(-x^2 + 1)*log(x) - 2*x*arcsin(x)/((sqrt(-x^2 + 1
) + 1)*(x^2/(sqrt(-x^2 + 1) + 1)^2 + 1)) + x^2*log(sqrt(-x^2 + 1) + 1)/((s
qrt(-x^2 + 1) + 1)^2*(x^2/(sqrt(-x^2 + 1) + 1)^2 + 1)) + log(sqrt(-x^2 + 1
) + 1)/(x^2/(sqrt(-x^2 + 1) + 1)^2 + 1) - x^2*log(abs(x))/((sqrt(-x^2 + 1)
 + 1)^2*(x^2/(sqrt(-x^2 + 1) + 1)^2 + 1)) - log(abs(x))/(x^2/(sqrt(-x^2 +
1) + 1)^2 + 1) + 2*x^2/((sqrt(-x^2 + 1) + 1)^2*(x^2/(sqrt(-x^2 + 1) + 1)^2
 + 1)) - 2/(x^2/(sqrt(-x^2 + 1) + 1)^2 + 1)
```

3.1.9 Mupad [F(-1)]

Timed out.

$$\int \arcsin(x)\log(x)\,dx = \int \operatorname{asin}(x)\,\ln(x)\,dx$$

input
```
int(asin(x)*log(x),x)
```

output
```
int(asin(x)*log(x), x)
```

3.2 $\int \frac{x \arcsin(x)}{\sqrt{1-x^2}} \, dx$

3.2.1 Optimal result

Integrand size = 15, antiderivative size = 17

$$\int \frac{x \arcsin(x)}{\sqrt{1-x^2}} \, dx = x - \sqrt{1-x^2} \arcsin(x)$$

output
```
x-arcsin(x)*(-x^2+1)^(1/2)
```

3.2.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.00

$$\int \frac{x \arcsin(x)}{\sqrt{1-x^2}} \, dx = x - \sqrt{1-x^2} \arcsin(x)$$

input
```
Integrate[(x*ArcSin[x])/Sqrt[1 - x^2],x]
```

output
```
x - Sqrt[1 - x^2]*ArcSin[x]
```

3.2.3 Rubi [A] (verified)

Time = 0.16 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {5182, 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.

$$\int \frac{x \arcsin(x)}{\sqrt{1-x^2}} \, dx$$

$$\Big\downarrow \text{ 5182}$$

$$\int 1dx - \sqrt{1-x^2} \arcsin(x)$$

$$\Big\downarrow \text{ 24}$$

$$x - \sqrt{1-x^2} \arcsin(x)$$

input
```
Int[(x*ArcSin[x])/Sqrt[1 - x^2],x]
```

output
```
x - Sqrt[1 - x^2]*ArcSin[x]
```

3.2.3.1 Defintions of rubi rules used

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

rule 5182
```
Int[((a_.) + ArcSin[(c_.)*(x_)]*(b_.))^(n_.)*(x_)*((d_) + (e_.)*(x_)^2)^(p_
.), x_Symbol] :> Simp[(d + e*x^2)^(p + 1)*((a + b*ArcSin[c*x])^n/(2*e*(p +
1))), x] + Simp[b*(n/(2*c*(p + 1)))*Simp[(d + e*x^2)^p/(1 - c^2*x^2)^p]   I
nt[(1 - c^2*x^2)^(p + 1/2)*(a + b*ArcSin[c*x])^(n - 1), x], x] /; FreeQ[{a,
 b, c, d, e, p}, x] && EqQ[c^2*d + e, 0] && GtQ[n, 0] && NeQ[p, -1]
```

3.2.4 Maple [A] (verified)

Time = 0.21 (sec) , antiderivative size = 16, normalized size of antiderivative = 0.94

method	result	size
default	$x-\arcsin\left(x\right)\sqrt{-x^{2}+1}$	16

input
```
int(x*arcsin(x)/(-x^2+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
x-arcsin(x)*(-x^2+1)^(1/2)
```

3.2.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.88

$$\int \frac{x\arcsin(x)}{\sqrt{1-x^2}}\,dx=-\sqrt{-x^2+1}\arcsin\left(x\right)+x$$

input
```
integrate(x*arcsin(x)/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-sqrt(-x^2 + 1)*arcsin(x) + x
```

3.2.6 Sympy [A] (verification not implemented)

Time = 0.08 (sec) , antiderivative size = 12, normalized size of antiderivative = 0.71

$$\int \frac{x\arcsin(x)}{\sqrt{1-x^2}}\,dx=x-\sqrt{1-x^2}\,\mathrm{asin}\left(x\right)$$

input
```
integrate(x*asin(x)/(-x**2+1)**(1/2),x)
```

output
```
x - sqrt(1 - x**2)*asin(x)
```

3.2.7 Maxima [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.88

$$\int \frac{x \arcsin(x)}{\sqrt{1-x^2}}\,dx = -\sqrt{-x^2+1}\arcsin(x) + x$$

input
```
integrate(x*arcsin(x)/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(-x^2 + 1)*arcsin(x) + x
```

3.2.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.88

$$\int \frac{x \arcsin(x)}{\sqrt{1-x^2}}\,dx = -\sqrt{-x^2+1}\arcsin(x) + x$$

input
```
integrate(x*arcsin(x)/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
-sqrt(-x^2 + 1)*arcsin(x) + x
```

3.2.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x \arcsin(x)}{\sqrt{1-x^2}}\,dx = \int \frac{x\,\mathrm{asin}(x)}{\sqrt{1-x^2}}\,dx$$

input
```
int((x*asin(x))/(1 - x^2)^(1/2),x)
```

output
```
int((x*asin(x))/(1 - x^2)^(1/2), x)
```

3.3 $\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx$

3.3.1 Optimal result

Integrand size = 18, antiderivative size = 69

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = \frac{\left(\sqrt{x}+3\sqrt{1+x}\right)\sqrt{-x+\sqrt{x}\sqrt{1+x}}}{4\sqrt{2}} - \left(\frac{3}{8}+x\right)\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)$$

output
```
-(3/8+x)*arcsin(x^(1/2)-(1+x)^(1/2))+1/8*(x^(1/2)+3*(1+x)^(1/2))*(-x+x^(1/
2)*(1+x)^(1/2))^(1/2)*2^(1/2)
```

3.3.2 Mathematica [A] (verified)

Time = 0.70 (sec) , antiderivative size = 106, normalized size of antiderivative = 1.54

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = \frac{1}{8}\left(\sqrt{x}+3\sqrt{1+x}\right)\sqrt{-2x+2\sqrt{x}\sqrt{1+x}} - x\arcsin\left(\sqrt{x}-\sqrt{1+x}\right) - \frac{3}{8}\arctan\left(\frac{\sqrt{-2x+2\sqrt{x}\sqrt{1+x}}}{-\sqrt{x}+\sqrt{1+x}}\right)$$

input
```
Integrate[-ArcSin[Sqrt[x] - Sqrt[1 + x]],x]
```

output
```
((Sqrt[x] + 3*Sqrt[1 + x])*Sqrt[-2*x + 2*Sqrt[x]*Sqrt[1 + x]])/8 - x*ArcSi
n[Sqrt[x] - Sqrt[1 + x]] - (3*ArcTan[Sqrt[-2*x + 2*Sqrt[x]*Sqrt[1 + x]]/(-
Sqrt[x] + Sqrt[1 + x])])/8
```

3.3.3 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.

$$\int -\arcsin\left(\sqrt{x}-\sqrt{x+1}\right)dx$$

$$\Big\downarrow \text{ 25}$$

$$-\int \arcsin\left(\sqrt{x}-\sqrt{x+1}\right)dx$$

$$\Big\downarrow \text{ 5339}$$

$$\int \frac{\sqrt{\sqrt{x}\sqrt{x+1}-x}}{2\sqrt{2}\sqrt{x+1}}dx - x\arcsin\left(\sqrt{x}-\sqrt{x+1}\right)$$

$$\Big\downarrow \text{ 27}$$

$$\frac{\int \frac{\sqrt{\sqrt{x}\sqrt{x+1}-x}}{\sqrt{x+1}}dx}{2\sqrt{2}} - x\arcsin\left(\sqrt{x}-\sqrt{x+1}\right)$$

$$\Big\downarrow \text{ 7267}$$

$$\frac{\int \sqrt{\sqrt{x}\sqrt{x+1}-x}d\sqrt{x+1}}{\sqrt{2}} - x\arcsin\left(\sqrt{x}-\sqrt{x+1}\right)$$

$$\Big\downarrow \text{ 7299}$$

$$\frac{\int \sqrt{\sqrt{x}\sqrt{x+1}-x}d\sqrt{x+1}}{\sqrt{2}} - x\arcsin\left(\sqrt{x}-\sqrt{x+1}\right)$$

input
```
Int[-ArcSin[Sqrt[x] - Sqrt[1 + x]],x]
```

output
```
$Aborted
```

3.3.3.1 Defintions of rubi rules used

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

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 5339
```
Int[ArcSin[u_], x_Symbol] :> Simp[x*ArcSin[u], x] - Int[SimplifyIntegrand[x
*(D[u, x]/Sqrt[1 - u^2]), x], x] /; InverseFunctionFreeQ[u, x] &&  !Functio
nOfExponentialQ[u, x]
```

rule 7267
```
Int[u_, x_Symbol] :> With[{lst = SubstForFractionalPowerOfLinear[u, x]}, Si
mp[lst[[2]]*lst[[4]]   Subst[Int[lst[[1]], x], x, lst[[3]]^(1/lst[[2]])], x
] /;  !FalseQ[lst] && SubstForFractionalPowerQ[u, lst[[3]], x]]
```

rule 7299
```
Int[u_, x_] :> CannotIntegrate[u, x]
```

3.3.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 1.10 (sec) , antiderivative size = 252, normalized size of antiderivative = 3.65

method	result
default	$-\frac{\left(2\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)+i\right)\left(2i\sqrt{-2x+2\sqrt{x}\,\sqrt{1+x}}\,\sqrt{1+x}-2i\sqrt{-2x+2\sqrt{x}\,\sqrt{1+x}}\,\sqrt{x}-4\sqrt{x}\,\sqrt{1+x}+4x+1\right)}{32}-\frac{\left(2i\sqrt{-2x+2\sqrt{x}\,\sqrt{}\right.}{}$

input
```
int(-arcsin(x^(1/2)-(1+x)^(1/2)),x,method=_RETURNVERBOSE)
```

output
```
-1/32*(2*arcsin(x^(1/2)-(1+x)^(1/2))+I)*(2*I*(-2*x+2*x^(1/2)*(1+x)^(1/2))^
(1/2)*(1+x)^(1/2)-2*I*(-2*x+2*x^(1/2)*(1+x)^(1/2))^(1/2)*x^(1/2)-4*x^(1/2)
*(1+x)^(1/2)+4*x+1)-1/32*(2*I*(-2*x+2*x^(1/2)*(1+x)^(1/2))^(1/2)*x^(1/2)-2
*I*(-2*x+2*x^(1/2)*(1+x)^(1/2))^(1/2)*(1+x)^(1/2)+4*x-4*x^(1/2)*(1+x)^(1/2
)+1)*(-I+2*arcsin(x^(1/2)-(1+x)^(1/2)))-1/4*(2*x^(1/2)*(1+x)^(1/2)+2*x+1)*
(2*I*x^(1/2)*(1+x)^(1/2)-2*I*x-(1+x)^(1/2)*(-2*x+2*x^(1/2)*(1+x)^(1/2))^(1
/2)+(-2*x+2*x^(1/2)*(1+x)^(1/2))^(1/2)*x^(1/2)+arcsin(x^(1/2)-(1+x)^(1/2))
-I)
```

3.3.5 Fricas [A] (verification not implemented)

Time = 23.67 (sec) , antiderivative size = 49, normalized size of antiderivative = 0.71

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = \frac{1}{8}\,(8\,x+3)\arcsin\left(\sqrt{x+1}-\sqrt{x}\right) + \frac{1}{8}\,\sqrt{2\,\sqrt{x+1}\sqrt{x}-2\,x}\left(3\,\sqrt{x+1}+\sqrt{x}\right)$$

input
```
integrate(-arcsin(x^(1/2)-(1+x)^(1/2)),x, algorithm="fricas")
```

output
```
1/8*(8*x + 3)*arcsin(sqrt(x + 1) - sqrt(x)) + 1/8*sqrt(2*sqrt(x + 1)*sqrt(
x) - 2*x)*(3*sqrt(x + 1) + sqrt(x))
```

3.3.6 Sympy [F]

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = -\int \operatorname{asin}\left(\sqrt{x}-\sqrt{x+1}\right)\,dx$$

input
```
integrate(-asin(x**(1/2)-(1+x)**(1/2)),x)
```

output
```
-Integral(asin(sqrt(x) - sqrt(x + 1)), x)
```

3.3.7 Maxima [A] (verification not implemented)

Time = 0.91 (sec) , antiderivative size = 4, normalized size of antiderivative = 0.06

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=\frac{1}{2}\,\pi x$$

input
```
integrate(-arcsin(x^(1/2)-(1+x)^(1/2)),x, algorithm="maxima")
```

output
```
1/2*pi*x
```

3.3.8 Giac [F]

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=\int -\arcsin\left(-\sqrt{x+1}+\sqrt{x}\right)\,dx$$

input
```
integrate(-arcsin(x^(1/2)-(1+x)^(1/2)),x, algorithm="giac")
```

output
```
integrate(-arcsin(-sqrt(x + 1) + sqrt(x)), x)
```

3.3.9 Mupad [F(-1)]

Timed out.

$$\int -\arcsin\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=\int \mathrm{asin}\left(\sqrt{x+1}-\sqrt{x}\right)\,dx$$

input
```
int(asin((x + 1)^(1/2) - x^(1/2)),x)
```

output
```
int(asin((x + 1)^(1/2) - x^(1/2)), x)
```

3.4 $\int \log \left(1+x\sqrt{1+x^2}\right) dx$

3.4.1 Optimal result

Integrand size = 14, antiderivative size = 97

$$\int \log \left(1+x\sqrt{1+x^2}\right) dx = -2x+\sqrt{2\left(1+\sqrt{5}\right)}\arctan\left(\sqrt{-2+\sqrt{5}}\left(x+\sqrt{1+x^2}\right)\right) - \sqrt{2\left(-1+\sqrt{5}\right)}\operatorname{arctanh}\left(\sqrt{2+\sqrt{5}}\left(x+\sqrt{1+x^2}\right)\right) + x\log\left(1+x\sqrt{1+x^2}\right)$$

output
```
-2*x+x*ln(1+x*(x^2+1)^(1/2))-arctanh((x+(x^2+1)^(1/2))*(2+5^(1/2))^(1/2))*
(-2+2*5^(1/2))^(1/2)+arctan((x+(x^2+1)^(1/2))*(-2+5^(1/2))^(1/2))*(2+2*5^(
1/2))^(1/2)
```

3.4.2 Mathematica [A] (verified)

Time = 0.27 (sec) , antiderivative size = 188, normalized size of antiderivative = 1.94

$$\int \log \left(1+x\sqrt{1+x^2}\right) \, dx = -2x+\frac{\left(5+\sqrt{5}\right)\arctan\left(\sqrt{\frac{2}{1+\sqrt{5}}}x\right)}{\sqrt{10\left(1+\sqrt{5}\right)}} + \sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\arctan\left(\sqrt{\frac{1}{2}+\frac{\sqrt{5}}{2}}\sqrt{1+x^2}\right) - \frac{\left(-5+\sqrt{5}\right)\operatorname{arctanh}\left(\sqrt{\frac{2}{-1+\sqrt{5}}}x\right)}{\sqrt{10\left(-1+\sqrt{5}\right)}} - \sqrt{\frac{1}{2}\left(-1+\sqrt{5}\right)}\operatorname{arctanh}\left(\sqrt{-\frac{1}{2}+\frac{\sqrt{5}}{2}}\sqrt{1+x^2}\right) + x\log\left(1+x\sqrt{1+x^2}\right)$$

input
```
Integrate[Log[1 + x*Sqrt[1 + x^2]],x]
```

output
```
-2*x + ((5 + Sqrt[5])*ArcTan[Sqrt[2/(1 + Sqrt[5])]*x])/Sqrt[10*(1 + Sqrt[5
])] + Sqrt[(1 + Sqrt[5])/2]*ArcTan[Sqrt[1/2 + Sqrt[5]/2]*Sqrt[1 + x^2]] -
((-5 + Sqrt[5])*ArcTanh[Sqrt[2/(-1 + Sqrt[5])]*x])/Sqrt[10*(-1 + Sqrt[5])]
 - Sqrt[(-1 + Sqrt[5])/2]*ArcTanh[Sqrt[-1/2 + Sqrt[5]/2]*Sqrt[1 + x^2]] +
x*Log[1 + x*Sqrt[1 + x^2]]
```

3.4.3 Rubi [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 332 vs. 2(97) = 194.

Time = 0.85 (sec) , antiderivative size = 332, normalized size of antiderivative = 3.42, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.214$, Rules used = {3028, 7293, 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.

$$\int \log\left(\sqrt{x^2+1}x+1\right) \, dx$$

$$\downarrow \text{3028}$$

$$x\log\left(\sqrt{x^2+1}x+1\right)-\int\frac{x(2x^2+1)}{x^3+x+\sqrt{x^2+1}}dx$$

$$\downarrow \text{7293}$$

$$x\log\left(\sqrt{x^2+1}x+1\right)-\int\left(\frac{2x^3}{x^3+x+\sqrt{x^2+1}}+\frac{x}{x^3+x+\sqrt{x^2+1}}\right)dx$$

$$\downarrow \text{2009}$$

$$\sqrt{\frac{2}{5}\left(\sqrt{5}-1\right)}\arctan\left(\sqrt{\frac{2}{\sqrt{5}-1}}\sqrt{x^2+1}\right)+\sqrt{\frac{2}{5\left(\sqrt{5}-1\right)}}\arctan\left(\sqrt{\frac{2}{\sqrt{5}-1}}\sqrt{x^2+1}\right)+2\sqrt{\frac{1}{5}\left(2+\sqrt{5}\right)}\arctan\left(\sqrt{\frac{2}{1+\sqrt{5}}}x\right)-\sqrt{\frac{1}{10}\left(1+\sqrt{5}\right)}\arctan\left(\sqrt{\frac{2}{1+\sqrt{5}}}x\right)-\sqrt{\frac{2}{5}\left(1+\sqrt{5}\right)}\text{arctanh}\left(\sqrt{\frac{2}{1+\sqrt{5}}}\sqrt{x^2+1}\right)+\sqrt{\frac{2}{5\left(1+\sqrt{5}\right)}}\text{arctanh}\left(\sqrt{\frac{2}{1+\sqrt{5}}}\sqrt{x^2+1}\right)+\sqrt{\frac{1}{10}\left(\sqrt{5}-1\right)}\text{arctanh}\left(\sqrt{\frac{2}{\sqrt{5}-1}}x\right)+2\sqrt{\frac{1}{5}\left(\sqrt{5}-2\right)}\text{arctanh}\left(\sqrt{\frac{2}{\sqrt{5}-1}}x\right)+x\log\left(\sqrt{x^2+1}x+1\right)-2x$$

input
```
Int[Log[1 + x*Sqrt[1 + x^2]],x]
```

output
```
-2*x - Sqrt[(1 + Sqrt[5])/10]*ArcTan[Sqrt[2/(1 + Sqrt[5])]*x] + 2*Sqrt[(2
+ Sqrt[5])/5]*ArcTan[Sqrt[2/(1 + Sqrt[5])]*x] + Sqrt[2/(5*(-1 + Sqrt[5]))]
*ArcTan[Sqrt[2/(-1 + Sqrt[5])]*Sqrt[1 + x^2]] + Sqrt[(2*(-1 + Sqrt[5]))/5]
*ArcTan[Sqrt[2/(-1 + Sqrt[5])]*Sqrt[1 + x^2]] + 2*Sqrt[(-2 + Sqrt[5])/5]*A
rcTanh[Sqrt[2/(-1 + Sqrt[5])]*x] + Sqrt[(-1 + Sqrt[5])/10]*ArcTanh[Sqrt[2/
(-1 + Sqrt[5])]*x] + Sqrt[2/(5*(1 + Sqrt[5]))]*ArcTanh[Sqrt[2/(1 + Sqrt[5]
)]*Sqrt[1 + x^2]] - Sqrt[(2*(1 + Sqrt[5]))/5]*ArcTanh[Sqrt[2/(1 + Sqrt[5])
]*Sqrt[1 + x^2]] + x*Log[1 + x*Sqrt[1 + x^2]]
```

3.4. $\int \log\left(1+x\sqrt{1+x^2}\right)\,dx$

3.4.3.1 Defintions of rubi rules used

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

rule 3028
```
Int[Log[u_], x_Symbol] :> Simp[x*Log[u], x] - Int[SimplifyIntegrand[x*(D[u,
 x]/u), x], x] /; InverseFunctionFreeQ[u, x]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

3.4.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 412 vs. $2(75) = 150$.

Time = 0.18 (sec) , antiderivative size = 413, normalized size of antiderivative = 4.26

method	result
parts	$x\ln\left(1+x\sqrt{x^2+1}\right)-2x+\frac{\left(3+\sqrt{5}\right)\sqrt{5}\,\arctan\left(\frac{2x}{\sqrt{2+2\sqrt{5}}}\right)}{5\sqrt{2+2\sqrt{5}}}-\frac{\left(\sqrt{5}-3\right)\sqrt{5}\,\operatorname{arctanh}\left(\frac{2x}{\sqrt{-2+2\sqrt{5}}}\right)}{5\sqrt{-2+2\sqrt{5}}}-$
default	$x\ln\left(1+x\sqrt{x^2+1}\right)-\frac{\left(\sqrt{5}+1\right)\sqrt{5}\,\arctan\left(\frac{2x}{\sqrt{2+2\sqrt{5}}}\right)}{5\sqrt{2+2\sqrt{5}}}+\frac{\left(\sqrt{5}-1\right)\sqrt{5}\,\operatorname{arctanh}\left(\frac{2x}{\sqrt{-2+2\sqrt{5}}}\right)}{5\sqrt{-2+2\sqrt{5}}}-2x+$

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

output
```
x*ln(1+x*(x^2+1)^(1/2))-2*x+1/5*(3+5^(1/2))*5^(1/2)/(2+2*5^(1/2))^(1/2)*ar
ctan(2*x/(2+2*5^(1/2))^(1/2))-1/5*(5^(1/2)-3)*5^(1/2)/(-2+2*5^(1/2))^(1/2)
*arctanh(2*x/(-2+2*5^(1/2))^(1/2))-1/5*5^(1/2)/(2+5^(1/2))^(1/2)*arctanh((
(x^2+1)^(1/2)-x)/(2+5^(1/2))^(1/2))-1/5*5^(1/2)/(-2+5^(1/2))^(1/2)*arctan(
((x^2+1)^(1/2)-x)/(-2+5^(1/2))^(1/2))-1/5*(-2+5^(1/2))^(1/2)*5^(1/2)*arcta
nh(((x^2+1)^(1/2)-x)/(-2+5^(1/2))^(1/2))+1/5*(2+5^(1/2))^(1/2)*5^(1/2)*arc
tan(((x^2+1)^(1/2)-x)/(2+5^(1/2))^(1/2))+2/5*5^(1/2)/(2+2*5^(1/2))^(1/2)*a
rctan(2*x/(2+2*5^(1/2))^(1/2))+2/5*5^(1/2)/(-2+2*5^(1/2))^(1/2)*arctanh(2*
x/(-2+2*5^(1/2))^(1/2))-1/10*(3+5^(1/2))*5^(1/2)/(2+5^(1/2))^(1/2)*arctanh
(((x^2+1)^(1/2)-x)/(2+5^(1/2))^(1/2))+1/10*(5^(1/2)-3)*5^(1/2)/(-2+5^(1/2)
)^(1/2)*arctan(((x^2+1)^(1/2)-x)/(-2+5^(1/2))^(1/2))-1/10*(5^(1/2)-1)*5^(1
/2)/(-2+5^(1/2))^(1/2)*arctanh(((x^2+1)^(1/2)-x)/(-2+5^(1/2))^(1/2))+1/10*
(5^(1/2)+1)*5^(1/2)/(2+5^(1/2))^(1/2)*arctan(((x^2+1)^(1/2)-x)/(2+5^(1/2))
^(1/2))
```

3.4.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 451 vs. $2(75) = 150$.

Time = 0.26 (sec) , antiderivative size = 451, normalized size of antiderivative = 4.65

$$\int \log\left(1+x\sqrt{1+x^2}\right)\,dx = -\frac{1}{4}\sqrt{2}\sqrt{-\sqrt{5}-1}\log\left(4x^2 - \sqrt{x^2+1}\left(\left(\sqrt{5}\sqrt{2}-\sqrt{2}\right)\sqrt{-\sqrt{5}-1}+4x\right) + \left(\sqrt{5}\sqrt{2}x-\sqrt{2}x\right)\sqrt{-\sqrt{5}-1}+4\right) + \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{5}-1}\log\left(4x^2 + \sqrt{x^2+1}\left(\left(\sqrt{5}\sqrt{2}-\sqrt{2}\right)\sqrt{-\sqrt{5}-1}-4x\right) - \left(\sqrt{5}\sqrt{2}x-\sqrt{2}x\right)\sqrt{-\sqrt{5}-1}+4\right) + \frac{1}{4}\sqrt{2}\sqrt{\sqrt{5}-1}\log\left(4x^2-4\sqrt{x^2+1}x + \left(\sqrt{5}\sqrt{2}x-\sqrt{x^2+1}\left(\sqrt{5}\sqrt{2}+\sqrt{2}\right)+\sqrt{2}x\right)\sqrt{\sqrt{5}-1}+4\right) - \frac{1}{4}\sqrt{2}\sqrt{\sqrt{5}-1}\log\left(4x^2-4\sqrt{x^2+1}x - \left(\sqrt{5}\sqrt{2}x-\sqrt{x^2+1}\left(\sqrt{5}\sqrt{2}+\sqrt{2}\right)+\sqrt{2}x\right)\sqrt{\sqrt{5}-1}+4\right) + x\log\left(\sqrt{x^2+1}x+1\right) + \frac{1}{4}\sqrt{2}\sqrt{\sqrt{5}-1}\log\left(2x+\sqrt{2}\sqrt{\sqrt{5}-1}\right) - \frac{1}{4}\sqrt{2}\sqrt{\sqrt{5}-1}\log\left(2x-\sqrt{2}\sqrt{\sqrt{5}-1}\right) + \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{5}-1}\log\left(2x+\sqrt{2}\sqrt{-\sqrt{5}-1}\right) - \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{5}-1}\log\left(2x-\sqrt{2}\sqrt{-\sqrt{5}-1}\right) - 2x$$

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

output
```
-1/4*sqrt(2)*sqrt(-sqrt(5) - 1)*log(4*x^2 - sqrt(x^2 + 1)*((sqrt(5)*sqrt(2
) - sqrt(2))*sqrt(-sqrt(5) - 1) + 4*x) + (sqrt(5)*sqrt(2)*x - sqrt(2)*x)*s
qrt(-sqrt(5) - 1) + 4) + 1/4*sqrt(2)*sqrt(-sqrt(5) - 1)*log(4*x^2 + sqrt(x
^2 + 1)*((sqrt(5)*sqrt(2) - sqrt(2))*sqrt(-sqrt(5) - 1) - 4*x) - (sqrt(5)*
sqrt(2)*x - sqrt(2)*x)*sqrt(-sqrt(5) - 1) + 4) + 1/4*sqrt(2)*sqrt(sqrt(5)
- 1)*log(4*x^2 - 4*sqrt(x^2 + 1)*x + (sqrt(5)*sqrt(2)*x - sqrt(x^2 + 1)*(s
qrt(5)*sqrt(2) + sqrt(2)) + sqrt(2)*x)*sqrt(sqrt(5) - 1) + 4) - 1/4*sqrt(2
)*sqrt(sqrt(5) - 1)*log(4*x^2 - 4*sqrt(x^2 + 1)*x - (sqrt(5)*sqrt(2)*x - s
qrt(x^2 + 1)*(sqrt(5)*sqrt(2) + sqrt(2)) + sqrt(2)*x)*sqrt(sqrt(5) - 1) +
4) + x*log(sqrt(x^2 + 1)*x + 1) + 1/4*sqrt(2)*sqrt(sqrt(5) - 1)*log(2*x +
sqrt(2)*sqrt(sqrt(5) - 1)) - 1/4*sqrt(2)*sqrt(sqrt(5) - 1)*log(2*x - sqrt(
2)*sqrt(sqrt(5) - 1)) + 1/4*sqrt(2)*sqrt(-sqrt(5) - 1)*log(2*x + sqrt(2)*s
qrt(-sqrt(5) - 1)) - 1/4*sqrt(2)*sqrt(-sqrt(5) - 1)*log(2*x - sqrt(2)*sqrt
(-sqrt(5) - 1)) - 2*x
```

3.4.6 Sympy [F(-1)]

Timed out.

$$\int \log\left(1+x\sqrt{1+x^2}\right)\,dx = \text{Timed out}$$

input
```
integrate(ln(1+x*(x**2+1)**(1/2)),x)
```

output
```
Timed out
```

3.4.7 Maxima [F]

$$\int \log\left(1+x\sqrt{1+x^2}\right)\,dx = \int \log\left(\sqrt{x^2+1}x+1\right)\,dx$$

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

output
```
x*log(sqrt(x^2 + 1)*x + 1) - 2*x + arctan(x) + integrate((2*x^2 + 1)/(x^2
+ (x^3 + x)*sqrt(x^2 + 1) + 1), x)
```

3.4.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 235 vs. $2(75) = 150$.

Time = 0.40 (sec) , antiderivative size = 235, normalized size of antiderivative = 2.42

$$\int \log\left(1+x\sqrt{1+x^2}\right)\,dx$$
$$= x\log\left(\sqrt{x^2+1}x+1\right)+\frac{1}{2}\sqrt{2\sqrt{5}+2}\arctan\left(-\frac{x-\sqrt{x^2+1}+\frac{1}{x-\sqrt{x^2+1}}}{\sqrt{2\sqrt{5}-2}}\right)$$
$$+\frac{1}{2}\sqrt{2\sqrt{5}+2}\arctan\left(\frac{x}{\sqrt{\frac{1}{2}\sqrt{5}+\frac{1}{2}}}\right)$$
$$-\frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(-x+\sqrt{x^2+1}+\sqrt{2\sqrt{5}+2}-\frac{1}{x-\sqrt{x^2+1}}\right)$$
$$+\frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(\left|x+\sqrt{\frac{1}{2}\sqrt{5}-\frac{1}{2}}\right|\right)-\frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(\left|x-\sqrt{\frac{1}{2}\sqrt{5}-\frac{1}{2}}\right|\right)$$
$$+\frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(\left|-x+\sqrt{x^2+1}-\sqrt{2\sqrt{5}+2}-\frac{1}{x-\sqrt{x^2+1}}\right|\right)-2\,x$$

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

output
```
x*log(sqrt(x^2 + 1)*x + 1) + 1/2*sqrt(2*sqrt(5) + 2)*arctan(-(x - sqrt(x^2
 + 1) + 1/(x - sqrt(x^2 + 1)))/sqrt(2*sqrt(5) - 2)) + 1/2*sqrt(2*sqrt(5) +
 2)*arctan(x/sqrt(1/2*sqrt(5) + 1/2)) - 1/4*sqrt(2*sqrt(5) - 2)*log(-x + s
qrt(x^2 + 1) + sqrt(2*sqrt(5) + 2) - 1/(x - sqrt(x^2 + 1))) + 1/4*sqrt(2*s
qrt(5) - 2)*log(abs(x + sqrt(1/2*sqrt(5) - 1/2))) - 1/4*sqrt(2*sqrt(5) - 2
)*log(abs(x - sqrt(1/2*sqrt(5) - 1/2))) + 1/4*sqrt(2*sqrt(5) - 2)*log(abs(
-x + sqrt(x^2 + 1) - sqrt(2*sqrt(5) + 2) - 1/(x - sqrt(x^2 + 1)))) - 2*x
```

3.4.9 Mupad [B] (verification not implemented)

Time = 1.50 (sec) , antiderivative size = 666, normalized size of antiderivative = 6.87

$$\int \log\left(1+x\sqrt{1+x^2}\right)\,dx$$

$$
\begin{aligned}
&= x\,\ln\left(x\,\sqrt{x^2+1}+1\right)-2\,x+\frac{\ln\left(x-\frac{\sqrt{2}\,\sqrt{\sqrt{5}-1}}{2}\right)\,\left(\frac{\sqrt{5}}{2}-\frac{5}{2}\right)}{2\,\sqrt{\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}}-\frac{\ln\left(x+\frac{\sqrt{2}\,\sqrt{\sqrt{5}-1}}{2}\right)\,\left(\frac{\sqrt{5}}{2}-\frac{5}{2}\right)}{2\,\sqrt{\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}} \\
&\quad -\frac{\ln\left(x-\frac{\sqrt{2}\,\sqrt{-\sqrt{5}-1}}{2}\right)\,\left(\frac{\sqrt{5}}{2}+\frac{5}{2}\right)}{2\,\sqrt{-\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(-\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}}+\frac{\ln\left(x+\frac{\sqrt{2}\,\sqrt{-\sqrt{5}-1}}{2}\right)\,\left(\frac{\sqrt{5}}{2}+\frac{5}{2}\right)}{2\,\sqrt{-\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(-\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}} \\
&\quad +\frac{\left(\ln\left(x-\frac{\sqrt{2}\,\sqrt{\sqrt{5}-1}}{2}\right)-\ln\left(\frac{\sqrt{2}\,x\,\sqrt{\sqrt{5}-1}}{2}+\frac{\sqrt{2}\,\sqrt{x^2+1}\,\sqrt{\sqrt{5}+1}}{2}+1\right)\right)\,\left(\sqrt{\frac{\sqrt{5}}{2}-\frac{1}{2}}+2\,{\left(\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)}{\left(2\,\sqrt{\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)\,\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}} \\
&\quad +\frac{\left(\ln\left(x+\frac{\sqrt{2}\,\sqrt{\sqrt{5}-1}}{2}\right)-\ln\left(\frac{\sqrt{2}\,\sqrt{x^2+1}\,\sqrt{\sqrt{5}+1}}{2}-\frac{\sqrt{2}\,x\,\sqrt{\sqrt{5}-1}}{2}+1\right)\right)\,\left(\sqrt{\frac{\sqrt{5}}{2}-\frac{1}{2}}+2\,{\left(\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)}{\left(2\,\sqrt{\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)\,\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}} \\
&\quad -\frac{\left(\ln\left(\frac{\sqrt{2}\,\sqrt{x^2+1}\,\sqrt{1-\sqrt{5}}}{2}-\frac{\sqrt{2}\,x\,\sqrt{-\sqrt{5}-1}}{2}+1\right)-\ln\left(x+\frac{\sqrt{2}\,\sqrt{-\sqrt{5}-1}}{2}\right)\right)\,\left(\sqrt{-\frac{\sqrt{5}}{2}-\frac{1}{2}}+2\,{\left(-\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)}{\left(2\,\sqrt{-\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(-\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)\,\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}} \\
&\quad -\frac{\left(\ln\left(\frac{\sqrt{2}\,x\,\sqrt{-\sqrt{5}-1}}{2}+\frac{\sqrt{2}\,\sqrt{x^2+1}\,\sqrt{1-\sqrt{5}}}{2}+1\right)-\ln\left(x-\frac{\sqrt{2}\,\sqrt{-\sqrt{5}-1}}{2}\right)\right)\,\left(\sqrt{-\frac{\sqrt{5}}{2}-\frac{1}{2}}+2\,{\left(-\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)}{\left(2\,\sqrt{-\frac{\sqrt{5}}{2}-\frac{1}{2}}+4\,{\left(-\frac{\sqrt{5}}{2}-\frac{1}{2}\right)}^{3/2}\right)\,\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}}
\end{aligned}
$$

input
```
int(log(x*(x^2 + 1)^(1/2) + 1),x)
```

output
```
x*log(x*(x^2 + 1)^(1/2) + 1) - 2*x + (log(x - (2^(1/2)*(5^(1/2) - 1)^(1/2)
)/2)*(5^(1/2)/2 - 5/2))/(2*(5^(1/2)/2 - 1/2)^(1/2) + 4*(5^(1/2)/2 - 1/2)^(
3/2)) - (log(x + (2^(1/2)*(5^(1/2) - 1)^(1/2))/2)*(5^(1/2)/2 - 5/2))/(2*(5
^(1/2)/2 - 1/2)^(1/2) + 4*(5^(1/2)/2 - 1/2)^(3/2)) - (log(x - (2^(1/2)*(-
5^(1/2) - 1)^(1/2))/2)*(5^(1/2)/2 + 5/2))/(2*(- 5^(1/2)/2 - 1/2)^(1/2) + 4
*(- 5^(1/2)/2 - 1/2)^(3/2)) + (log(x + (2^(1/2)*(- 5^(1/2) - 1)^(1/2))/2)*
(5^(1/2)/2 + 5/2))/(2*(- 5^(1/2)/2 - 1/2)^(1/2) + 4*(- 5^(1/2)/2 - 1/2)^(3
/2)) + ((log(x - (2^(1/2)*(5^(1/2) - 1)^(1/2))/2) - log((2^(1/2)*x*(5^(1/2
) - 1)^(1/2))/2 + (2^(1/2)*(x^2 + 1)^(1/2)*(5^(1/2) + 1)^(1/2))/2 + 1))*((
5^(1/2)/2 - 1/2)^(1/2) + 2*(5^(1/2)/2 - 1/2)^(3/2)))/((2*(5^(1/2)/2 - 1/2)
^(1/2) + 4*(5^(1/2)/2 - 1/2)^(3/2))*(5^(1/2)/2 + 1/2)^(1/2)) + ((log(x + (
2^(1/2)*(5^(1/2) - 1)^(1/2))/2) - log((2^(1/2)*(x^2 + 1)^(1/2)*(5^(1/2) +
1)^(1/2))/2 - (2^(1/2)*x*(5^(1/2) - 1)^(1/2))/2 + 1))*((5^(1/2)/2 - 1/2)^(
1/2) + 2*(5^(1/2)/2 - 1/2)^(3/2)))/((2*(5^(1/2)/2 - 1/2)^(1/2) + 4*(5^(1/2
)/2 - 1/2)^(3/2))*(5^(1/2)/2 + 1/2)^(1/2)) - ((log((2^(1/2)*(x^2 + 1)^(1/2
)*(1 - 5^(1/2))^(1/2))/2 - (2^(1/2)*x*(- 5^(1/2) - 1)^(1/2))/2 + 1) - log(
x + (2^(1/2)*(- 5^(1/2) - 1)^(1/2))/2))*((- 5^(1/2)/2 - 1/2)^(1/2) + 2*(-
5^(1/2)/2 - 1/2)^(3/2)))/((2*(- 5^(1/2)/2 - 1/2)^(1/2) + 4*(- 5^(1/2)/2 -
1/2)^(3/2))*(1/2 - 5^(1/2)/2)^(1/2)) - ((log((2^(1/2)*x*(- 5^(1/2) - 1)^(1
/2))/2 + (2^(1/2)*(x^2 + 1)^(1/2)*(1 - 5^(1/2))^(1/2))/2 + 1) - log(x -...
```

3.4. $\int \log \left(1+x\sqrt{1+x^2}\right)\,dx$

3.5 $\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}} \, dx$

3.5.1 Optimal result

Integrand size = 19, antiderivative size = 45

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}} \, dx = \frac{x}{3} + \frac{1}{3}\arctan\left(\frac{\cos(x)\left(1+\cos^2(x)\right)\sin(x)}{1+\cos^2(x)\sqrt{1+\cos^2(x)+\cos^4(x)}}\right)$$

output
```
1/3*x+1/3*arctan(cos(x)*(1+cos(x)^2)*sin(x)/(1+cos(x)^2*(1+cos(x)^2+cos(x)
^4)^(1/2)))
```

3.5.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 4 vs. order 3 in optimal.

Time = 0.81 (sec) , antiderivative size = 159, normalized size of antiderivative = 3.53

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}} \, dx = -\frac{2i\cos^2(x)\,\text{EllipticPi}\left(\frac{3}{2}+\frac{i\sqrt{3}}{2}, i\,\text{arcsinh}\left(\sqrt{-\frac{2i}{-3i+\sqrt{3}}}\tan(x)\right), \frac{3i-\sqrt{3}}{3i+\sqrt{3}}\right)\sqrt{1-\frac{2i\tan^2(x)}{-3i+\sqrt{3}}}\sqrt{1+\frac{2i\tan^2(x)}{3i+\sqrt{3}}}}{\sqrt{-\frac{i}{-3i+\sqrt{3}}}\sqrt{15+8\cos(2x)+\cos(4x)}}$$

input
```
Integrate[Cos[x]^2/Sqrt[1 + Cos[x]^2 + Cos[x]^4],x]
```

output
```
((-2*I)*Cos[x]^2*EllipticPi[3/2 + (I/2)*Sqrt[3], I*ArcSinh[Sqrt[(-2*I)/(-3
*I + Sqrt[3])]*Tan[x]], (3*I - Sqrt[3])/(3*I + Sqrt[3])]*Sqrt[1 - ((2*I)*T
an[x]^2)/(-3*I + Sqrt[3])]*Sqrt[1 + ((2*I)*Tan[x]^2)/(3*I + Sqrt[3])])/(Sq
rt[(-I)/(-3*I + Sqrt[3])]*Sqrt[15 + 8*Cos[2*x] + Cos[4*x]])
```

3.5.3 Rubi [C] (verified)

Result contains higher order function than in optimal. Order 4 vs. order 3 in optimal.

Time = 0.65 (sec) , antiderivative size = 306, normalized size of antiderivative = 6.80, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.368, Rules used = {3042, 4889, 7270, 1540, 27, 1416, 2220}

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.

$$\int \frac{\cos^2(x)}{\sqrt{\cos^4(x)+\cos^2(x)+1}}dx$$

$$\Big\downarrow \ 3042$$

$$\int \frac{\cos(x)^2}{\sqrt{\cos(x)^4+\cos(x)^2+1}}dx$$

$$\Big\downarrow \ 4889$$

$$\int \frac{1}{\left(\tan^2(x)+1\right)^2\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{\left(\tan^2(x)+1\right)^2}}}d\tan(x)$$

$$\Big\downarrow \ 7270$$

$$\frac{\sqrt{\tan^4(x)+3\tan^2(x)+3}\int \frac{1}{\left(\tan^2(x)+1\right)\sqrt{\tan^4(x)+3\tan^2(x)+3}}d\tan(x)}{\left(\tan^2(x)+1\right)\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{\left(\tan^2(x)+1\right)^2}}}$$

$$\Big\downarrow \ 1540$$

$$\frac{\sqrt{\tan^4(x)+3\tan^2(x)+3}\left(\frac{1}{2}\left(3+\sqrt{3}\right)\int \frac{\tan^2(x)+\sqrt{3}}{\sqrt{3}\left(\tan^2(x)+1\right)\sqrt{\tan^4(x)+3\tan^2(x)+3}}d\tan(x)-\frac{1}{2}\left(1+\sqrt{3}\right)\int \frac{1}{\sqrt{\tan^4(x)+3\tan^2(x)-}}\right.}{\left(\tan^2(x)+1\right)\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{\left(\tan^2(x)+1\right)^2}}}$$

$$\Big\downarrow \ 27$$

$$\frac{\sqrt{\tan^4(x)+3\tan^2(x)+3}\left(\frac{(3+\sqrt{3})\int \frac{\tan^2(x)+\sqrt{3}}{(\tan^2(x)+1)\sqrt{\tan^4(x)+3\tan^2(x)+3}}d\tan(x)}{2\sqrt{3}}-\frac{1}{2}(1+\sqrt{3})\int \frac{1}{\sqrt{\tan^4(x)+3\tan^2(x)+3}}d\tan(x)\cdots\right.}{(\tan^2(x)+1)\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{(\tan^2(x)+1)^2}}}$$

$$\Big\downarrow \ 1416$$

$$\frac{\sqrt{\tan^4(x)+3\tan^2(x)+3}\left(\frac{(3+\sqrt{3})\int \frac{\tan^2(x)+\sqrt{3}}{(\tan^2(x)+1)\sqrt{\tan^4(x)+3\tan^2(x)+3}}d\tan(x)}{2\sqrt{3}}-\frac{(1+\sqrt{3})(\tan^2(x)+\sqrt{3})\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{(\tan^2(x)+\sqrt{3})^2}}\text{Ellipt}\cdots}{4\sqrt[4]{3}\sqrt{\tan^4(x)+3\tan\cdots}}\right.}{(\tan^2(x)+1)\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{(\tan^2(x)+1)^2}}}$$

$$\Big\downarrow \ 2220$$

$$\frac{\sqrt{\tan^4(x)+3\tan^2(x)+3}\left(\frac{(3+\sqrt{3})\left(\frac{(1+\sqrt{3})(\tan^2(x)+\sqrt{3})\sqrt{\frac{\tan^4(x)+3\tan^2(x)+3}{(\tan^2(x)+\sqrt{3})^2}}\text{EllipticPi}\left(\frac{1}{6}(3-2\sqrt{3}),2\arctan\left(\frac{\tan(x)}{\sqrt[4]{3}}\right),\frac{1}{4}(2-\sqrt{3})\right)}{4\sqrt[4]{3}\sqrt{\tan^4(x)+3\tan^2(x)+3}}-\frac{1}{2}(\cdots\right.}{2\sqrt{3}}\right.}{(\tan^2(x)+1)\sqrt{\frac{\tan^4\cdots}{\cdots}}}$$

input
```
Int[Cos[x]^2/Sqrt[1 + Cos[x]^2 + Cos[x]^4],x]
```

output
```
(Sqrt[3 + 3*Tan[x]^2 + Tan[x]^4]*(-1/4*((1 + Sqrt[3])*EllipticF[2*ArcTan[T
an[x]/3^(1/4)], (2 - Sqrt[3])/4]*(Sqrt[3] + Tan[x]^2)*Sqrt[(3 + 3*Tan[x]^2
 + Tan[x]^4)/(Sqrt[3] + Tan[x]^2)^2])/(3^(1/4)*Sqrt[3 + 3*Tan[x]^2 + Tan[x
]^4]) + ((3 + Sqrt[3])*(-1/2*((1 - Sqrt[3])*ArcTan[Tan[x]/Sqrt[3 + 3*Tan[x
]^2 + Tan[x]^4]]) + ((1 + Sqrt[3])*EllipticPi[(3 - 2*Sqrt[3])/6, 2*ArcTan[
Tan[x]/3^(1/4)], (2 - Sqrt[3])/4]*(Sqrt[3] + Tan[x]^2)*Sqrt[(3 + 3*Tan[x]^
2 + Tan[x]^4)/(Sqrt[3] + Tan[x]^2)^2])/(4*3^(1/4)*Sqrt[3 + 3*Tan[x]^2 + Ta
n[x]^4])))/(2*Sqrt[3])))/((1 + Tan[x]^2)*Sqrt[(3 + 3*Tan[x]^2 + Tan[x]^4)/
(1 + Tan[x]^2)^2])
```

3.5. $\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}}\,dx$

3.5.3.1 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 1416
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2 + (c_.)*(x_)^4], x_Symbol] :> With[{q = Rt[c
/a, 4]}, Simp[(1 + q^2*x^2)*(Sqrt[(a + b*x^2 + c*x^4)/(a*(1 + q^2*x^2)^2)]/
(2*q*Sqrt[a + b*x^2 + c*x^4]))*EllipticF[2*ArcTan[q*x], 1/2 - b*(q^2/(4*c))
], x]] /; FreeQ[{a, b, c}, x] && NeQ[b^2 - 4*a*c, 0] && PosQ[c/a]
```

rule 1540
```
Int[1/(((d_) + (e_.)*(x_)^2)*Sqrt[(a_) + (b_.)*(x_)^2 + (c_.)*(x_)^4]), x_S
ymbol] :> With[{q = Rt[c/a, 2]}, Simp[(c*d + a*e*q)/(c*d^2 - a*e^2)   Int[1
/Sqrt[a + b*x^2 + c*x^4], x], x] - Simp[(a*e*(e + d*q))/(c*d^2 - a*e^2)   I
nt[(1 + q*x^2)/((d + e*x^2)*Sqrt[a + b*x^2 + c*x^4]), x], x]] /; FreeQ[{a,
b, c, d, e}, x] && NeQ[b^2 - 4*a*c, 0] && NeQ[c*d^2 - b*d*e + a*e^2, 0] &&
NeQ[c*d^2 - a*e^2, 0] && PosQ[c/a]
```

rule 2220
```
Int[((A_) + (B_.)*(x_)^2)/(((d_) + (e_.)*(x_)^2)*Sqrt[(a_) + (b_.)*(x_)^2 +
 (c_.)*(x_)^4]), x_Symbol] :> With[{q = Rt[B/A, 2]}, Simp[(-(B*d - A*e))*(A
rcTan[Rt[-b + c*(d/e) + a*(e/d), 2]*(x/Sqrt[a + b*x^2 + c*x^4])]/(2*d*e*Rt[
-b + c*(d/e) + a*(e/d), 2])), x] + Simp[(B*d + A*e)*(1 + q^2*x^2)*(Sqrt[(a
+ b*x^2 + c*x^4)/(a*(1 + q^2*x^2)^2)]/(4*d*e*q*Sqrt[a + b*x^2 + c*x^4]))*El
lipticPi[-(e - d*q^2)^2/(4*d*e*q^2), 2*ArcTan[q*x], 1/2 - b/(4*a*q^2)], x]]
 /; FreeQ[{a, b, c, d, e, A, B}, x] && NeQ[c*d^2 - a*e^2, 0] && PosQ[c/a] &
& EqQ[c*A^2 - a*B^2, 0] && PosQ[B/A] && PosQ[-b + c*(d/e) + a*(e/d)]
```

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

rule 4889
```
Int[u_, x_Symbol] :> With[{v = FunctionOfTrig[u, x]}, With[{d = FreeFactors
[Tan[v], x]}, Simp[d/Coefficient[v, x, 1]   Subst[Int[SubstFor[1/(1 + d^2*x
^2), Tan[v]/d, u, x], x], x, Tan[v]/d], x]] /;  !FalseQ[v] && FunctionOfQ[N
onfreeFactors[Tan[v], x], u, x]] /; InverseFunctionFreeQ[u, x] &&  !MatchQ[
u, (v_.)*((c_.)*tan[w_]^(n_.)*tan[z_]^(n_.))^(p_.) /; FreeQ[{c, p}, x] && I
ntegerQ[n] && LinearQ[w, x] && EqQ[z, 2*w]]
```

rule 7270
```
Int[(u_.)*((a_.)*(v_)^(m_.)*(w_)^(n_.))^(p_), x_Symbol] :> Simp[a^IntPart[p
]*((a*v^m*w^n)^FracPart[p]/(v^(m*FracPart[p])*w^(n*FracPart[p])))   Int[u*v
^(m*p)*w^(n*p), x], x] /; FreeQ[{a, m, n, p}, x] &&  !IntegerQ[p] &&  !Free
Q[v, x] &&  !FreeQ[w, x]
```

3.5.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 4 vs. order 3.

Time = 2.60 (sec) , antiderivative size = 312, normalized size of antiderivative = 6.93

method	result
default	$-\frac{2\sqrt{(7+4\cos(2x)+\cos^2(2x))(\sin^2(2x))}\left(i\sqrt{3}-3\right)\sqrt{\frac{\left(-1+i\sqrt{3}\right)(\cos(2x)-1)}{\left(i\sqrt{3}-3\right)(1+\cos(2x))}}(1+\cos(2x))^2\sqrt{\frac{\cos(2x)+2+i\sqrt{3}}{\left(i\sqrt{3}+3\right)(1+\cos(2x))}}\sqrt{\frac{i\sqrt{3}-\cos(2x)-2}{\left(i\sqrt{3}-3\right)(1+\cos(2x)}}}{\left(-1+i\sqrt{3}\right)\sqrt{(\cos(2x)-1)(1+\cos(2x))\left(\cos(2x)+2+i\sqrt{3}\right)\left(i\sqrt{3}-\cos(2x)-2\right)}\sin(2x)\sqrt{7}}$

input
```
int(cos(x)^2/(1+cos(x)^2+cos(x)^4)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-2*((7+4*cos(2*x)+cos(2*x)^2)*sin(2*x)^2)^(1/2)*(I*3^(1/2)-3)*((-1+I*3^(1/
2))*(cos(2*x)-1)/(I*3^(1/2)-3)/(1+cos(2*x)))^(1/2)*(1+cos(2*x))^2*((cos(2*
x)+2+I*3^(1/2))/(I*3^(1/2)+3)/(1+cos(2*x)))^(1/2)*((I*3^(1/2)-cos(2*x)-2)/
(I*3^(1/2)-3)/(1+cos(2*x)))^(1/2)*EllipticPi(((-1+I*3^(1/2))*(cos(2*x)-1)/
(I*3^(1/2)-3)/(1+cos(2*x)))^(1/2),(I*3^(1/2)-3)/(-1+I*3^(1/2)),((1+I*3^(1/
2))*(I*3^(1/2)-3)/(I*3^(1/2)+3)/(-1+I*3^(1/2)))^(1/2))/(-1+I*3^(1/2))/((co
s(2*x)-1)*(1+cos(2*x))*(cos(2*x)+2+I*3^(1/2))*(I*3^(1/2)-cos(2*x)-2))^(1/2
)/sin(2*x)/(7+4*cos(2*x)+cos(2*x)^2)^(1/2)
```

3.5.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 33, normalized size of antiderivative = 0.73

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}}\,dx = \frac{1}{6}\arctan\left(\frac{2\sqrt{\cos(x)^4+\cos(x)^2+1}\cos(x)^3\sin(x)}{2\cos(x)^6-1}\right)$$

input
```
integrate(cos(x)^2/(1+cos(x)^2+cos(x)^4)^(1/2),x, algorithm="fricas")
```

output
```
1/6*arctan(2*sqrt(cos(x)^4 + cos(x)^2 + 1)*cos(x)^3*sin(x)/(2*cos(x)^6 - 1
))
```

3.5.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}}\,dx = \text{Timed out}$$

input
```
integrate(cos(x)**2/(1+cos(x)**2+cos(x)**4)**(1/2),x)
```

output
```
Timed out
```

3.5.7 Maxima [F]

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}}\,dx = \int \frac{\cos(x)^2}{\sqrt{\cos(x)^4+\cos(x)^2+1}}\,dx$$

input
```
integrate(cos(x)^2/(1+cos(x)^2+cos(x)^4)^(1/2),x, algorithm="maxima")
```

output
```
integrate(cos(x)^2/sqrt(cos(x)^4 + cos(x)^2 + 1), x)
```

3.5.8 Giac [F]

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}}\,dx = \int \frac{\cos(x)^2}{\sqrt{\cos(x)^4+\cos(x)^2+1}}\,dx$$

input
```
integrate(cos(x)^2/(1+cos(x)^2+cos(x)^4)^(1/2),x, algorithm="giac")
```

output
```
integrate(cos(x)^2/sqrt(cos(x)^4 + cos(x)^2 + 1), x)
```

3.5.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\cos^2(x)}{\sqrt{1+\cos^2(x)+\cos^4(x)}}\,dx = \int \frac{\cos(x)^2}{\sqrt{\cos(x)^4+\cos(x)^2+1}}\,dx$$

input
```
int(cos(x)^2/(cos(x)^2 + cos(x)^4 + 1)^(1/2),x)
```

output
```
int(cos(x)^2/(cos(x)^2 + cos(x)^4 + 1)^(1/2), x)
```

3.6 $\int \tan(x)\sqrt{1+\tan^4(x)}\,dx$

3.6.1 Optimal result

Integrand size = 13, antiderivative size = 56

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx = -\frac{1}{2}\operatorname{arcsinh}\left(\tan^2(x)\right) - \frac{\operatorname{arctanh}\left(\frac{1-\tan^2(x)}{\sqrt{2}\sqrt{1+\tan^4(x)}}\right)}{\sqrt{2}} + \frac{1}{2}\sqrt{1+\tan^4(x)}$$

output
```
-1/2*arcsinh(tan(x)^2)-1/2*arctanh(1/2*(1-tan(x)^2)*2^(1/2)/(1+tan(x)^4)^(
1/2))*2^(1/2)+1/2*(1+tan(x)^4)^(1/2)
```

3.6.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.32

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx = \frac{\left(-2\sqrt{2}\operatorname{arcsinh}(\cos(2x))\cos^2(x) - 2\operatorname{arctanh}\left(\frac{2\sin^2(x)}{\sqrt{3+\cos(4x)}}\right)\cos^2(x) + \sqrt{3+\cos(4x)}\right)\sqrt{1+\tan^4(x)}}{2\sqrt{3+\cos(4x)}}$$

input
```
Integrate[Tan[x]*Sqrt[1 + Tan[x]^4],x]
```

output
```
((-2*Sqrt[2]*ArcSinh[Cos[2*x]]*Cos[x]^2 - 2*ArcTanh[(2*Sin[x]^2)/Sqrt[3 +
Cos[4*x]]]*Cos[x]^2 + Sqrt[3 + Cos[4*x]])*Sqrt[1 + Tan[x]^4])/(2*Sqrt[3 +
Cos[4*x]])
```

3.6.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 54, normalized size of antiderivative = 0.96, number of steps used = 9, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.615, Rules used = {3042, 4153, 1577, 493, 719, 222, 488, 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.

$$\int \tan(x)\sqrt{\tan^4(x)+1}\,dx$$

$$\Big\downarrow \ 3042$$

$$\int \tan(x)\sqrt{\tan(x)^4+1}dx$$

$$\Big\downarrow \ 4153$$

$$\int \frac{\tan(x)\sqrt{\tan^4(x)+1}}{\tan^2(x)+1}d\tan(x)$$

$$\Big\downarrow \ 1577$$

$$\frac{1}{2}\int \frac{\sqrt{\tan^4(x)+1}}{\tan^2(x)+1}d\tan^2(x)$$

$$\Big\downarrow \ 493$$

$$\frac{1}{2}\left(\int \frac{1-\tan^2(x)}{\left(\tan^2(x)+1\right)\sqrt{\tan^4(x)+1}}d\tan^2(x)+\sqrt{\tan^4(x)+1}\right)$$

$$\Big\downarrow \ 719$$

$$\frac{1}{2}\left(-\int \frac{1}{\sqrt{\tan^4(x)+1}}d\tan^2(x)+2\int \frac{1}{\left(\tan^2(x)+1\right)\sqrt{\tan^4(x)+1}}d\tan^2(x)+\sqrt{\tan^4(x)+1}\right)$$

$$\Big\downarrow \ 222$$

$$\frac{1}{2}\left(2\int \frac{1}{\left(\tan^2(x)+1\right)\sqrt{\tan^4(x)+1}}d\tan^2(x)-\operatorname{arcsinh}\left(\tan^2(x)\right)+\sqrt{\tan^4(x)+1}\right)$$

$$\Big\downarrow \ 488$$

$$\frac{1}{2}\left(-2\int \frac{1}{2-\tan^4(x)}d\frac{1-\tan^2(x)}{\sqrt{\tan^4(x)+1}}-\operatorname{arcsinh}\left(\tan^2(x)\right)+\sqrt{\tan^4(x)+1}\right)$$

$$\Big\downarrow \ 219$$

$$\frac{1}{2}\left(-\text{arcsinh}\left(\tan^2(x)\right)-\sqrt{2}\text{arctanh}\left(\frac{1-\tan^2(x)}{\sqrt{2}\sqrt{\tan^4(x)+1}}\right)+\sqrt{\tan^4(x)+1}\right)$$

input
```
Int[Tan[x]*Sqrt[1 + Tan[x]^4],x]
```

output
```
(-ArcSinh[Tan[x]^2] - Sqrt[2]*ArcTanh[(1 - Tan[x]^2)/(Sqrt[2]*Sqrt[1 + Tan
[x]^4])] + Sqrt[1 + Tan[x]^4])/2
```

3.6.3.1 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 222
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSinh[Rt[b, 2]*(x/Sqrt
[a])]/Rt[b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && PosQ[b]
```

rule 488
```
Int[1/(((c_) + (d_.)*(x_))*Sqrt[(a_) + (b_.)*(x_)^2]), x_Symbol] :> -Subst[
Int[1/(b*c^2 + a*d^2 - x^2), x], x, (a*d - b*c*x)/Sqrt[a + b*x^2]] /; FreeQ
[{a, b, c, d}, x]
```

rule 493
```
Int[((c_) + (d_.)*(x_))^(n_)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[
(c + d*x)^(n + 1)*((a + b*x^2)^p/(d*(n + 2*p + 1))), x] + Simp[2*(p/(d*(n +
 2*p + 1)))   Int[(c + d*x)^n*(a + b*x^2)^(p - 1)*(a*d - b*c*x), x], x] /;
FreeQ[{a, b, c, d, n}, x] && GtQ[p, 0] && NeQ[n + 2*p + 1, 0] && ( !Rationa
lQ[n] || LtQ[n, 1]) &&  !ILtQ[n + 2*p, 0] && IntQuadraticQ[a, 0, b, c, d, n
, p, x]
```

rule 719
```
Int[((d_.) + (e_.)*(x_))^(m_)*((f_.) + (g_.)*(x_))*((a_) + (c_.)*(x_)^2)^(p
_.), x_Symbol] :> Simp[g/e   Int[(d + e*x)^(m + 1)*(a + c*x^2)^p, x], x] +
Simp[(e*f - d*g)/e   Int[(d + e*x)^m*(a + c*x^2)^p, x], x] /; FreeQ[{a, c,
d, e, f, g, m, p}, x] &&  !IGtQ[m, 0]
```

rule 1577
```
Int[(x_)*((d_) + (e_.)*(x_)^2)^(q_.)*((a_) + (c_.)*(x_)^4)^(p_.), x_Symbol]
 :> Simp[1/2   Subst[Int[(d + e*x)^q*(a + c*x^2)^p, x], x, x^2], x] /; Free
Q[{a, c, d, e, p, q}, x]
```

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

rule 4153
```
Int[((d_.)*tan[(e_.) + (f_.)*(x_)])^(m_.)*((a_) + (b_.)*((c_.)*tan[(e_.) +
(f_.)*(x_)])^(n_))^(p_.), x_Symbol] :> With[{ff = FreeFactors[Tan[e + f*x],
 x]}, Simp[c*(ff/f)   Subst[Int[(d*ff*(x/c))^m*((a + b*(ff*x)^n)^p/(c^2 + f
f^2*x^2)), x], x, c*(Tan[e + f*x]/ff)], x]] /; FreeQ[{a, b, c, d, e, f, m,
n, p}, x] && (IGtQ[p, 0] || EqQ[n, 2] || EqQ[n, 4] || (IntegerQ[p] && Ratio
nalQ[n]))
```

3.6.4 Maple [A] (verified)

Time = 0.26 (sec) , antiderivative size = 64, normalized size of antiderivative = 1.14

method	result	size
derivativedivides	$\frac{\sqrt{\left(1+\tan^2(x)\right)^2-2\left(\tan^2(x)\right)}}{2}-\frac{\operatorname{arcsinh}\left(\tan^2(x)\right)}{2}-\frac{\sqrt{2}\,\operatorname{arctanh}\left(\frac{\left(-2\left(\tan^2(x)\right)+2\right)\sqrt{2}}{4\sqrt{\left(1+\tan^2(x)\right)^2-2\left(\tan^2(x)\right)}}\right)}{2}$	64
default	$\frac{\sqrt{\left(1+\tan^2(x)\right)^2-2\left(\tan^2(x)\right)}}{2}-\frac{\operatorname{arcsinh}\left(\tan^2(x)\right)}{2}-\frac{\sqrt{2}\,\operatorname{arctanh}\left(\frac{\left(-2\left(\tan^2(x)\right)+2\right)\sqrt{2}}{4\sqrt{\left(1+\tan^2(x)\right)^2-2\left(\tan^2(x)\right)}}\right)}{2}$	64

input
```
int((1+tan(x)^4)^(1/2)*tan(x),x,method=_RETURNVERBOSE)
```

output
```
1/2*((1+tan(x)^2)^2-2*tan(x)^2)^(1/2)-1/2*arcsinh(tan(x)^2)-1/2*2^(1/2)*ar
ctanh(1/4*(-2*tan(x)^2+2)*2^(1/2)/((1+tan(x)^2)^2-2*tan(x)^2)^(1/2))
```

3.6.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 88 vs. $2(43) = 86$.

Time = 0.31 (sec) , antiderivative size = 88, normalized size of antiderivative = 1.57

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx$$
$$= \frac{1}{4}\sqrt{2}\log\left(\frac{3\tan(x)^4 - 2\tan(x)^2 + 2\sqrt{\tan(x)^4+1}\left(\sqrt{2}\tan(x)^2 - \sqrt{2}\right) + 3}{\tan(x)^4 + 2\tan(x)^2 + 1}\right) + \frac{1}{2}\sqrt{\tan(x)^4+1} + \frac{1}{2}\log\left(-\tan(x)^2 + \sqrt{\tan(x)^4+1}\right)$$

input
```
integrate((1+tan(x)^4)^(1/2)*tan(x),x, algorithm="fricas")
```

output
```
1/4*sqrt(2)*log((3*tan(x)^4 - 2*tan(x)^2 + 2*sqrt(tan(x)^4 + 1)*(sqrt(2)*t
an(x)^2 - sqrt(2)) + 3)/(tan(x)^4 + 2*tan(x)^2 + 1)) + 1/2*sqrt(tan(x)^4 +
 1) + 1/2*log(-tan(x)^2 + sqrt(tan(x)^4 + 1))
```

3.6.6 Sympy [F]

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx = \int \sqrt{\tan^4(x)+1}\tan(x)\,dx$$

input
```
integrate((1+tan(x)**4)**(1/2)*tan(x),x)
```

output
```
Integral(sqrt(tan(x)**4 + 1)*tan(x), x)
```

3.6.7 Maxima [F]

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx = \int \sqrt{\tan(x)^4+1}\tan(x)\,dx$$

input
```
integrate((1+tan(x)^4)^(1/2)*tan(x),x, algorithm="maxima")
```

output
```
integrate(sqrt(tan(x)^4 + 1)*tan(x), x)
```

3.6.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 79, normalized size of antiderivative = 1.41

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx = \frac{1}{2}\sqrt{2}\log\left(-\frac{\tan(x)^2+\sqrt{2}-\sqrt{\tan(x)^4+1}+1}{\tan(x)^2-\sqrt{2}-\sqrt{\tan(x)^4+1}+1}\right) + \frac{1}{2}\sqrt{\tan(x)^4+1} + \frac{1}{2}\log\left(-\tan(x)^2+\sqrt{\tan(x)^4+1}\right)$$

input
```
integrate((1+tan(x)^4)^(1/2)*tan(x),x, algorithm="giac")
```

output
```
1/2*sqrt(2)*log(-(tan(x)^2 + sqrt(2) - sqrt(tan(x)^4 + 1) + 1)/(tan(x)^2 -
 sqrt(2) - sqrt(tan(x)^4 + 1) + 1)) + 1/2*sqrt(tan(x)^4 + 1) + 1/2*log(-ta
n(x)^2 + sqrt(tan(x)^4 + 1))
```

3.6.9 Mupad [F(-1)]

Timed out.

$$\int \tan(x)\sqrt{1+\tan^4(x)}\,dx = \int \tan(x)\,\sqrt{\tan(x)^4+1}\,dx$$

input
```
int(tan(x)*(tan(x)^4 + 1)^(1/2),x)
```

output
```
int(tan(x)*(tan(x)^4 + 1)^(1/2), x)
```

3.7 $\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx$

3.7.1 Optimal result

Integrand size = 13, antiderivative size = 15

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = -\frac{2}{3}\text{arctanh}\left(\sqrt{1+\sec^3(x)}\right)$$

output
```
-2/3*arctanh((1+sec(x)^3)^(1/2))
```

3.7.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.00

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = -\frac{2}{3}\text{arctanh}\left(\sqrt{1+\sec^3(x)}\right)$$

input
```
Integrate[Tan[x]/Sqrt[1 + Sec[x]^3],x]
```

output
```
(-2*ArcTanh[Sqrt[1 + Sec[x]^3]])/3
```

3.7.3 Rubi [A] (verified)

Time = 0.19 (sec) , antiderivative size = 15, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$, Rules used = {3042, 4627, 798, 73, 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.

$$\int \frac{\tan(x)}{\sqrt{\sec^3(x)+1}}dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\tan(x)}{\sqrt{\sec(x)^3+1}}dx$$

$$\Big\downarrow \text{4627}$$

$$\int \frac{\cos(x)}{\sqrt{\sec^3(x)+1}}d\sec(x)$$

$$\Big\downarrow \text{798}$$

$$\frac{1}{3}\int \frac{\cos(x)}{\sqrt{\sec^3(x)+1}}d\sec^3(x)$$

$$\Big\downarrow \text{73}$$

$$\frac{2}{3}\int \frac{1}{\sec^6(x)-1}d\sqrt{\sec^3(x)+1}$$

$$\Big\downarrow \text{220}$$

$$-\frac{2}{3}\text{arctanh}\left(\sqrt{\sec^3(x)+1}\right)$$

input
```
Int[Tan[x]/Sqrt[1 + Sec[x]^3],x]
```

output
```
(-2*ArcTanh[Sqrt[1 + Sec[x]^3]])/3
```

3.7.3.1 Defintions of rubi rules used

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

rule 4627
```
Int[((a_) + (b_.)*((c_.)*sec[(e_.) + (f_.)*(x_)])^(n_))^(p_.)*tan[(e_.) + (
f_.)*(x_)]^(m_.), x_Symbol] :> With[{ff = FreeFactors[Sec[e + f*x], x]}, Si
mp[1/f   Subst[Int[(-1 + ff^2*x^2)^((m - 1)/2)*((a + b*(c*ff*x)^n)^p/x), x]
, x, Sec[e + f*x]/ff], x]] /; FreeQ[{a, b, c, e, f, n, p}, x] && IntegerQ[(
m - 1)/2] && (GtQ[m, 0] || EqQ[n, 2] || EqQ[n, 4] || IGtQ[p, 0] || Integers
Q[2*n, p])
```

3.7.4 Maple [A] (verified)

Time = 0.58 (sec) , antiderivative size = 12, normalized size of antiderivative = 0.80

method	result	size
derivativedivides	$-\frac{2\,\operatorname{arctanh}\left(\sqrt{1+\sec^3(x)}\right)}{3}$	12
default	$-\frac{2\,\operatorname{arctanh}\left(\sqrt{1+\sec^3(x)}\right)}{3}$	12

input
```
int(tan(x)/(1+sec(x)^3)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-2/3*arctanh((1+sec(x)^3)^(1/2))
```

3.7.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 30 vs. $2(11) = 22$.

Time = 0.31 (sec) , antiderivative size = 30, normalized size of antiderivative = 2.00

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = \frac{1}{3}\log\left(2\sqrt{\frac{\cos(x)^3+1}{\cos(x)^3}}\cos(x)^3 - 2\cos(x)^3 - 1\right)$$

input
```
integrate(tan(x)/(1+sec(x)^3)^(1/2),x, algorithm="fricas")
```

output
```
1/3*log(2*sqrt((cos(x)^3 + 1)/cos(x)^3)*cos(x)^3 - 2*cos(x)^3 - 1)
```

3.7.6 Sympy [F]

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = \int \frac{\tan(x)}{\sqrt{(\sec(x)+1)(\sec^2(x)-\sec(x)+1)}}\,dx$$

input
```
integrate(tan(x)/(1+sec(x)**3)**(1/2),x)
```

output
```
Integral(tan(x)/sqrt((sec(x) + 1)*(sec(x)**2 - sec(x) + 1)), x)
```

3.7.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 27 vs. $2(11) = 22$.

Time = 0.20 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.80

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = -\frac{1}{3}\log\left(\sqrt{\frac{1}{\cos(x)^3}+1}+1\right) + \frac{1}{3}\log\left(\sqrt{\frac{1}{\cos(x)^3}+1}-1\right)$$

input
```
integrate(tan(x)/(1+sec(x)^3)^(1/2),x, algorithm="maxima")
```

output
```
-1/3*log(sqrt(1/cos(x)^3 + 1) + 1) + 1/3*log(sqrt(1/cos(x)^3 + 1) - 1)
```

3.7.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 28 vs. $2(11) = 22$.

Time = 0.30 (sec) , antiderivative size = 28, normalized size of antiderivative = 1.87

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = -\frac{1}{3}\log\left(\sqrt{\frac{1}{\cos(x)^3}+1}+1\right)+\frac{1}{3}\log\left(\left|\sqrt{\frac{1}{\cos(x)^3}+1}-1\right|\right)$$

input
```
integrate(tan(x)/(1+sec(x)^3)^(1/2),x, algorithm="giac")
```

output
```
-1/3*log(sqrt(1/cos(x)^3 + 1) + 1) + 1/3*log(abs(sqrt(1/cos(x)^3 + 1) - 1)
)
```

3.7.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\tan(x)}{\sqrt{1+\sec^3(x)}}\,dx = \int \frac{\tan(x)}{\sqrt{\frac{1}{\cos(x)^3}+1}}\,dx$$

input
```
int(tan(x)/(1/cos(x)^3 + 1)^(1/2),x)
```

output
```
int(tan(x)/(1/cos(x)^3 + 1)^(1/2), x)
```

3.8 $\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx$

3.8.1 Optimal result

Integrand size = 14, antiderivative size = 137

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx$$
$$= \operatorname{arcsinh}(1+\tan(x)) - \sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\arctan\left(\frac{2\sqrt{5}-\left(5+\sqrt{5}\right)\tan(x)}{\sqrt{10\left(1+\sqrt{5}\right)}\sqrt{2+2\tan(x)+\tan^2(x)}}\right)$$
$$-\sqrt{\frac{1}{2}\left(-1+\sqrt{5}\right)}\operatorname{arctanh}\left(\frac{2\sqrt{5}+\left(5-\sqrt{5}\right)\tan(x)}{\sqrt{10\left(-1+\sqrt{5}\right)}\sqrt{2+2\tan(x)+\tan^2(x)}}\right)$$

output
```
arcsinh(1+tan(x))-1/2*arctanh((2*5^(1/2)+(5-5^(1/2))*tan(x))/(-10+10*5^(1/
2))^(1/2)/(2+2*tan(x)+tan(x)^2)^(1/2))*(-2+2*5^(1/2))^(1/2)-1/2*arctan((2*
5^(1/2)-(5+5^(1/2))*tan(x))/(10+10*5^(1/2))^(1/2)/(2+2*tan(x)+tan(x)^2)^(1
/2))*(2+2*5^(1/2))^(1/2)
```

3.8.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.20 (sec) , antiderivative size = 99, normalized size of antiderivative = 0.72

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx = \operatorname{arcsinh}(1+\tan(x))+\frac{1}{2}i\left(\sqrt{1+2i}\operatorname{arctanh}\left(\frac{(2+i)+(1+i)\tan(x)}{\sqrt{1+2i}\sqrt{2+2\tan(x)+\tan^2(x)}}\right)-\sqrt{1-2i}\operatorname{arctanh}\left(\frac{(4-2i)+(2-2i)\tan(x)}{2\sqrt{1-2i}\sqrt{2+2\tan(x)+\tan^2(x)}}\right)\right)$$

input
```
Integrate[Sqrt[2 + 2*Tan[x] + Tan[x]^2],x]
```

output
```
ArcSinh[1 + Tan[x]] + (I/2)*(Sqrt[1 + 2*I]*ArcTanh[((2 + I) + (1 + I)*Tan[
x])/(Sqrt[1 + 2*I]*Sqrt[2 + 2*Tan[x] + Tan[x]^2])] - Sqrt[1 - 2*I]*ArcTanh
[((4 - 2*I) + (2 - 2*I)*Tan[x])/(2*Sqrt[1 - 2*I]*Sqrt[2 + 2*Tan[x] + Tan[x
]^2])])
```

3.8.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 149, normalized size of antiderivative = 1.09, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}} = 0.786$, Rules used = {3042, 4853, 1321, 25, 1090, 222, 1369, 25, 1363, 216, 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.

$$\int \sqrt{\tan^2(x)+2\tan(x)+2}\,dx$$

$$\Big\downarrow \; 3042$$

$$\int \sqrt{\tan(x)^2+2\tan(x)+2}dx$$

$$\Big\downarrow \; 4853$$

$$\int \frac{\sqrt{\tan^2(x)+2\tan(x)+2}}{\tan^2(x)+1}d\tan(x)$$

$$\Big\downarrow \; 1321$$

$$\int \frac{1}{\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)-\int -\frac{2\tan(x)+1}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)$$

$$\Big\downarrow \text{25}$$

$$\int \frac{1}{\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)+\int \frac{2\tan(x)+1}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)$$

$$\Big\downarrow \text{1090}$$

$$\int \frac{2\tan(x)+1}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)+\frac{1}{2}\int \frac{1}{\sqrt{\frac{1}{4}(2\tan(x)+2)^2+1}}d(2\tan(x)+2)$$

$$\Big\downarrow \text{222}$$

$$\int \frac{2\tan(x)+1}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)+\operatorname{arcsinh}\left(\frac{1}{2}(2\tan(x)+2)\right)$$

$$\Big\downarrow \text{1369}$$

$$\frac{\int -\frac{-2\sqrt{5}\tan(x)-\sqrt{5}+5}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)}{2\sqrt{5}}-\frac{\int -\frac{2\sqrt{5}\tan(x)+\sqrt{5}+5}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)}{2\sqrt{5}}+\operatorname{arcsinh}\left(\frac{1}{2}(2\tan(x)+2)\right)$$

$$\Big\downarrow \text{25}$$

$$-\frac{\int \frac{-2\sqrt{5}\tan(x)-\sqrt{5}+5}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)}{2\sqrt{5}}+\frac{\int \frac{2\sqrt{5}\tan(x)+\sqrt{5}+5}{\left(\tan^2(x)+1\right)\sqrt{\tan^2(x)+2\tan(x)+2}}d\tan(x)}{2\sqrt{5}}+\operatorname{arcsinh}\left(\frac{1}{2}(2\tan(x)+2)\right)$$

$$\Big\downarrow \text{1363}$$

$$2\sqrt{5}\left(1-\sqrt{5}\right)\int \frac{1}{\frac{2\left(\left(5-\sqrt{5}\right)\tan(x)+2\sqrt{5}\right)^2}{\tan^2(x)+2\tan(x)+2}+20\left(1-\sqrt{5}\right)}d\left(-\frac{\left(5-\sqrt{5}\right)\tan(x)+2\sqrt{5}}{\sqrt{\tan^2(x)+2\tan(x)+2}}\right)-2\sqrt{5}\left(1+\sqrt{5}\right)\int \frac{1}{\frac{2\left(2\sqrt{5}-\left(5+\sqrt{5}\right)\tan(x)\right)^2}{\tan^2(x)+2\tan(x)+2}+20\left(1+\sqrt{5}\right)}d\frac{2\sqrt{5}-\left(5+\sqrt{5}\right)\tan(x)}{\sqrt{\tan^2(x)+2\tan(x)+2}}+\operatorname{arcsinh}\left(\frac{1}{2}(2\tan(x)+2)\right)$$

$$\Big\downarrow \text{216}$$

$$2\sqrt{5}\left(1-\sqrt{5}\right)\int \frac{1}{\frac{2\left(\left(5-\sqrt{5}\right)\tan(x)+2\sqrt{5}\right)^2}{\tan^2(x)+2\tan(x)+2}+20\left(1-\sqrt{5}\right)}d\left(-\frac{\left(5-\sqrt{5}\right)\tan(x)+2\sqrt{5}}{\sqrt{\tan^2(x)+2\tan(x)+2}}\right)+\operatorname{arcsinh}\left(\frac{1}{2}(2\tan(x)+2)\right)-\sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\arctan\left(\frac{2\sqrt{5}-\left(5+\sqrt{5}\right)\tan(x)}{\sqrt{10\left(1+\sqrt{5}\right)}\sqrt{\tan^2(x)+2\tan(x)+2}}\right)$$

3.8. $\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx$

$$\Big\downarrow \text{220}$$

$$\operatorname{arcsinh}\left(\frac{1}{2}(2\tan(x)+2)\right)-\sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\arctan\left(\frac{2\sqrt{5}-\left(5+\sqrt{5}\right)\tan(x)}{\sqrt{10\left(1+\sqrt{5}\right)}\sqrt{\tan^2(x)+2\tan(x)+2}}\right)+\frac{\left(1-\sqrt{5}\right)\operatorname{arctanh}\left(\frac{\left(5-\sqrt{5}\right)\tan(x)+2\sqrt{5}}{\sqrt{10\left(\sqrt{5}-1\right)}\sqrt{\tan^2(x)+2\tan(x)+2}}\right)}{\sqrt{2\left(\sqrt{5}-1\right)}}$$

input
```
Int[Sqrt[2 + 2*Tan[x] + Tan[x]^2],x]
```

output
```
ArcSinh[(2 + 2*Tan[x])/2] - Sqrt[(1 + Sqrt[5])/2]*ArcTan[(2*Sqrt[5] - (5 +
 Sqrt[5])*Tan[x])/(Sqrt[10*(1 + Sqrt[5])]*Sqrt[2 + 2*Tan[x] + Tan[x]^2])]
+ ((1 - Sqrt[5])*ArcTanh[(2*Sqrt[5] + (5 - Sqrt[5])*Tan[x])/(Sqrt[10*(-1 +
 Sqrt[5])]*Sqrt[2 + 2*Tan[x] + Tan[x]^2])])/Sqrt[2*(-1 + Sqrt[5])]
```

3.8.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], 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 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 222
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSinh[Rt[b, 2]*(x/Sqrt
[a])]/Rt[b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && PosQ[b]
```

rule 1090
```
Int[((a_.) + (b_.)*(x_) + (c_.)*(x_)^2)^(p_), x_Symbol] :> Simp[1/(2*c*(-4*
(c/(b^2 - 4*a*c)))^p)   Subst[Int[Simp[1 - x^2/(b^2 - 4*a*c), x]^p, x], x,
b + 2*c*x], x] /; FreeQ[{a, b, c, p}, x] && GtQ[4*a - b^2/c, 0]
```

rule 1321
```
Int[Sqrt[(a_) + (b_.)*(x_) + (c_.)*(x_)^2]/((d_) + (f_.)*(x_)^2), x_Symbol]
 :> Simp[c/f   Int[1/Sqrt[a + b*x + c*x^2], x], x] - Simp[1/f   Int[(c*d -
a*f - b*f*x)/(Sqrt[a + b*x + c*x^2]*(d + f*x^2)), x], x] /; FreeQ[{a, b, c,
 d, f}, x] && NeQ[b^2 - 4*a*c, 0]
```

rule 1363
```
Int[((g_) + (h_.)*(x_))/(((a_) + (c_.)*(x_)^2)*Sqrt[(d_.) + (e_.)*(x_) + (f
_.)*(x_)^2]), x_Symbol] :> Simp[-2*a*g*h   Subst[Int[1/Simp[2*a^2*g*h*c + a
*e*x^2, x], x], x, Simp[a*h - g*c*x, x]/Sqrt[d + e*x + f*x^2]], x] /; FreeQ
[{a, c, d, e, f, g, h}, x] && EqQ[a*h^2*e + 2*g*h*(c*d - a*f) - g^2*c*e, 0]
```

rule 1369
```
Int[((g_.) + (h_.)*(x_))/(((a_) + (c_.)*(x_)^2)*Sqrt[(d_.) + (e_.)*(x_) + (
f_.)*(x_)^2]), x_Symbol] :> With[{q = Rt[(c*d - a*f)^2 + a*c*e^2, 2]}, Simp
[1/(2*q)   Int[Simp[(-a)*h*e - g*(c*d - a*f - q) + (h*(c*d - a*f + q) - g*c
*e)*x, x]/((a + c*x^2)*Sqrt[d + e*x + f*x^2]), x], x] - Simp[1/(2*q)   Int[
Simp[(-a)*h*e - g*(c*d - a*f + q) + (h*(c*d - a*f - q) - g*c*e)*x, x]/((a +
 c*x^2)*Sqrt[d + e*x + f*x^2]), x], x]] /; FreeQ[{a, c, d, e, f, g, h}, x]
&& NeQ[e^2 - 4*d*f, 0] && NegQ[(-a)*c]
```

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

rule 4853
```
Int[u_, x_Symbol] :> With[{v = FunctionOfTrig[u, x]}, Simp[With[{d = FreeFa
ctors[Tan[v], x]}, d/Coefficient[v, x, 1]   Subst[Int[SubstFor[1/(1 + d^2*x
^2), Tan[v]/d, u, x], x], x, Tan[v]/d]], x] /;  !FalseQ[v] && FunctionOfQ[N
onfreeFactors[Tan[v], x], u, x, True] && TryPureTanSubst[ActivateTrig[u], x
]]
```

3.8.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 1603 vs. $2(105) = 210$.

Time = 1.60 (sec) , antiderivative size = 1604, normalized size of antiderivative = 11.71

method	result	size
derivativedivides	Expression too large to display	1604
default	Expression too large to display	1604

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

output
```
arcsinh(tan(x)+1)-1/10*(10*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-t
an(x))^2-2*5^(1/2)*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2
+10+2*5^(1/2))^(1/2)*5^(1/2)*(3*5^(1/2)*(-10+10*5^(1/2))^(1/2)*arctan(1/80
*(-22+10*5^(1/2))^(1/2)*((5-5^(1/2))*(2*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*
5^(1/2)-1/2-tan(x))^2+5^(1/2)+3))^(1/2)*(11*5^(1/2)*(-1/2*5^(1/2)+1/2+tan(
x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2+25*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(
1/2)-1/2-tan(x))^2+4*5^(1/2)+10)*(-1/2*5^(1/2)+1/2+tan(x))/(-1/2*5^(1/2)-1
/2-tan(x))*(5^(1/2)-5)/((-1/2*5^(1/2)+1/2+tan(x))^4/(-1/2*5^(1/2)-1/2-tan(
x))^4+3*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2+1))*(-22+1
0*5^(1/2))^(1/2)+5*(-10+10*5^(1/2))^(1/2)*arctan(1/80*(-22+10*5^(1/2))^(1/
2)*((5-5^(1/2))*(2*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2
+5^(1/2)+3))^(1/2)*(11*5^(1/2)*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1
/2-tan(x))^2+25*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2+4*
5^(1/2)+10)*(-1/2*5^(1/2)+1/2+tan(x))/(-1/2*5^(1/2)-1/2-tan(x))*(5^(1/2)-5
)/((-1/2*5^(1/2)+1/2+tan(x))^4/(-1/2*5^(1/2)-1/2-tan(x))^4+3*(-1/2*5^(1/2)
+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2+1))*(-22+10*5^(1/2))^(1/2)-20*a
rctanh((10*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2-2*5^(1/
2)*(-1/2*5^(1/2)+1/2+tan(x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2+10+2*5^(1/2))^(
1/2)/(-10+10*5^(1/2))^(1/2))*5^(1/2)+60*arctanh((10*(-1/2*5^(1/2)+1/2+tan(
x))^2/(-1/2*5^(1/2)-1/2-tan(x))^2-2*5^(1/2)*(-1/2*5^(1/2)+1/2+tan(x))^2...
```

3.8.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 226, normalized size of antiderivative = 1.65

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx =$$
$$-\frac{1}{4}\sqrt{2i-1}\log\left(\frac{\sqrt{2i-1}\left((9i+13)\tan(x)^2+(7i+24)\tan(x)-15i+20\right)+\sqrt{\tan(x)^2+2\tan(x)+}}{\tan(x)^2+1}\right.$$
$$-\frac{1}{4}\sqrt{-2i-1}\log\left(\frac{\sqrt{-2i-1}\left(-(9i-13)\tan(x)^2-(7i-24)\tan(x)+15i+20\right)+\sqrt{\tan(x)^2+2\tan}}{\tan(x)^2+1}\right.$$
$$+\frac{1}{4}\sqrt{-2i-1}\log\left(\frac{\sqrt{-2i-1}\left((9i-13)\tan(x)^2+(7i-24)\tan(x)-15i-20\right)+\sqrt{\tan(x)^2+2\tan(}}{\tan(x)^2+1}\right.$$
$$+\frac{1}{4}\sqrt{2i-1}\log\left(\frac{\sqrt{2i-1}\left(-(9i+13)\tan(x)^2-(7i+24)\tan(x)+15i-20\right)+\sqrt{\tan(x)^2+2\tan(x)}}{\tan(x)^2+1}\right.$$
$$+\log\left(-\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)-1\right)$$

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

output
```
-1/4*sqrt(2*I - 1)*log((sqrt(2*I - 1)*((9*I + 13)*tan(x)^2 + (7*I + 24)*ta
n(x) - 15*I + 20) + sqrt(tan(x)^2 + 2*tan(x) + 2)*((24*I - 7)*tan(x) + 7*I
 + 24))/(tan(x)^2 + 1)) - 1/4*sqrt(-2*I - 1)*log((sqrt(-2*I - 1)*(-(9*I -
13)*tan(x)^2 - (7*I - 24)*tan(x) + 15*I + 20) + sqrt(tan(x)^2 + 2*tan(x) +
 2)*(-(24*I + 7)*tan(x) - 7*I + 24))/(tan(x)^2 + 1)) + 1/4*sqrt(-2*I - 1)*
log((sqrt(-2*I - 1)*((9*I - 13)*tan(x)^2 + (7*I - 24)*tan(x) - 15*I - 20)
+ sqrt(tan(x)^2 + 2*tan(x) + 2)*(-(24*I + 7)*tan(x) - 7*I + 24))/(tan(x)^2
 + 1)) + 1/4*sqrt(2*I - 1)*log((sqrt(2*I - 1)*(-(9*I + 13)*tan(x)^2 - (7*I
 + 24)*tan(x) + 15*I - 20) + sqrt(tan(x)^2 + 2*tan(x) + 2)*((24*I - 7)*tan
(x) + 7*I + 24))/(tan(x)^2 + 1)) + log(-sqrt(tan(x)^2 + 2*tan(x) + 2) - ta
n(x) - 1)
```

3.8.6 Sympy [F]

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx = \int \sqrt{\tan^2(x)+2\tan(x)+2}\,dx$$

input
```
integrate((2+2*tan(x)+tan(x)**2)**(1/2),x)
```

output
```
Integral(sqrt(tan(x)**2 + 2*tan(x) + 2), x)
```

3.8.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.78 (sec) , antiderivative size = 4065, normalized size of antiderivative = 29.67

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx = \text{Too large to display}$$

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

output
```
-1/400*sqrt(10)*(4*sqrt(10)*(sqrt(5)*sqrt(2)*sqrt(sqrt(5) + 1) - sqrt(5)*s
qrt(2)*sqrt(sqrt(5) - 1))*arctan2(-1/2*sqrt(2)*(6*(2*cos(2*x) - 4*sin(2*x)
 - 1)*cos(4*x) + 5*cos(4*x)^2 + 36*cos(2*x)^2 + 4*(6*cos(2*x) + 3*sin(2*x)
 + 2)*sin(4*x) + 5*sin(4*x)^2 + 36*sin(2*x)^2 + 12*cos(2*x) + 24*sin(2*x)
+ 5)^(1/4)*sqrt(sqrt(5) - 1)*cos(1/2*arctan2(-2*cos(4*x) + sin(4*x) + 6*si
n(2*x) + 2, cos(4*x) + 6*cos(2*x) + 2*sin(4*x) + 1)) + 1/2*sqrt(2)*(6*(2*c
os(2*x) - 4*sin(2*x) - 1)*cos(4*x) + 5*cos(4*x)^2 + 36*cos(2*x)^2 + 4*(6*c
os(2*x) + 3*sin(2*x) + 2)*sin(4*x) + 5*sin(4*x)^2 + 36*sin(2*x)^2 + 12*cos
(2*x) + 24*sin(2*x) + 5)^(1/4)*sqrt(sqrt(5) + 1)*sin(1/2*arctan2(-2*cos(4*
x) + sin(4*x) + 6*sin(2*x) + 2, cos(4*x) + 6*cos(2*x) + 2*sin(4*x) + 1)) -
 2*cos(2*x) + sin(2*x), 1/2*sqrt(2)*(6*(2*cos(2*x) - 4*sin(2*x) - 1)*cos(4
*x) + 5*cos(4*x)^2 + 36*cos(2*x)^2 + 4*(6*cos(2*x) + 3*sin(2*x) + 2)*sin(4
*x) + 5*sin(4*x)^2 + 36*sin(2*x)^2 + 12*cos(2*x) + 24*sin(2*x) + 5)^(1/4)*
sqrt(sqrt(5) + 1)*cos(1/2*arctan2(-2*cos(4*x) + sin(4*x) + 6*sin(2*x) + 2,
 cos(4*x) + 6*cos(2*x) + 2*sin(4*x) + 1)) + 1/2*sqrt(2)*(6*(2*cos(2*x) - 4
*sin(2*x) - 1)*cos(4*x) + 5*cos(4*x)^2 + 36*cos(2*x)^2 + 4*(6*cos(2*x) + 3
*sin(2*x) + 2)*sin(4*x) + 5*sin(4*x)^2 + 36*sin(2*x)^2 + 12*cos(2*x) + 24*
sin(2*x) + 5)^(1/4)*sqrt(sqrt(5) - 1)*sin(1/2*arctan2(-2*cos(4*x) + sin(4*
x) + 6*sin(2*x) + 2, cos(4*x) + 6*cos(2*x) + 2*sin(4*x) + 1)) + cos(2*x) +
 2*sin(2*x) + 3) + 10*sqrt(10)*sqrt(2)*sqrt(sqrt(5) + 1)*arctan2((6*(2*...
```

3.8.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 495 vs. $2(104) = 208$.

Time = 0.34 (sec) , antiderivative size = 495, normalized size of antiderivative = 3.61

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx =$$

$$-\frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(256\left(\sqrt{5}\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)\right)+\sqrt{5}\sqrt{\sqrt{5}-2}-\sqrt{5}-2\sqrt{\tan(x\right.\right.$$

$$+256\left(\sqrt{5}\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)\right)+\sqrt{5}-2\sqrt{\tan(x)^2+2\tan(x)+2}+\sqrt{\sqrt{5}-2+2\right.$$

$$+\frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(256\left(\sqrt{5}\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)\right)-\sqrt{5}\sqrt{\sqrt{5}-2}-\sqrt{5}-2\sqrt{\tan(x\right.\right.$$

$$+256\left(\sqrt{5}\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)\right)+\sqrt{5}-2\sqrt{\tan(x)^2+2\tan(x)+2}-\sqrt{\sqrt{5}-2+2\right.$$

$$+\frac{\left(\pi+4\arctan\left(-\frac{1}{2}\left(2\sqrt{5}\sqrt{\sqrt{5}-2}+\sqrt{5}+4\sqrt{\sqrt{5}-2}+3\right)\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)\right)\right.\right.}{4\left(\sqrt{5}-1\right)}$$

$$-\frac{\left(\pi+4\arctan\left(\frac{1}{2}\left(2\sqrt{5}\sqrt{\sqrt{5}-2}-\sqrt{5}+4\sqrt{\sqrt{5}-2}-3\right)\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)\right)-\right.\right.}{4\left(\sqrt{5}-1\right)}$$

$$-\log\left(\sqrt{\tan(x)^2+2\tan(x)+2}-\tan(x)-1\right)$$

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

output
```
-1/4*sqrt(2*sqrt(5) - 2)*log(256*(sqrt(5)*(sqrt(tan(x)^2 + 2*tan(x) + 2) -
 tan(x)) + sqrt(5)*sqrt(sqrt(5) - 2) - sqrt(5) - 2*sqrt(tan(x)^2 + 2*tan(x
) + 2) - 2*sqrt(sqrt(5) - 2) + 2*tan(x) + 2)^2 + 256*(sqrt(5)*(sqrt(tan(x)
^2 + 2*tan(x) + 2) - tan(x)) + sqrt(5) - 2*sqrt(tan(x)^2 + 2*tan(x) + 2) +
 sqrt(sqrt(5) - 2) + 2*tan(x) - 2)^2) + 1/4*sqrt(2*sqrt(5) - 2)*log(256*(s
qrt(5)*(sqrt(tan(x)^2 + 2*tan(x) + 2) - tan(x)) - sqrt(5)*sqrt(sqrt(5) - 2
) - sqrt(5) - 2*sqrt(tan(x)^2 + 2*tan(x) + 2) + 2*sqrt(sqrt(5) - 2) + 2*ta
n(x) + 2)^2 + 256*(sqrt(5)*(sqrt(tan(x)^2 + 2*tan(x) + 2) - tan(x)) + sqrt
(5) - 2*sqrt(tan(x)^2 + 2*tan(x) + 2) - sqrt(sqrt(5) - 2) + 2*tan(x) - 2)^
2) + 1/4*(pi + 4*arctan(-1/2*(2*sqrt(5)*sqrt(sqrt(5) - 2) + sqrt(5) + 4*sq
rt(sqrt(5) - 2) + 3)*(sqrt(tan(x)^2 + 2*tan(x) + 2) - tan(x)) + 3/2*sqrt(5
)*sqrt(sqrt(5) - 2) + 1/2*sqrt(5) + 7/2*sqrt(sqrt(5) - 2) + 3/2))*sqrt(2*s
qrt(5) - 2)/(sqrt(5) - 1) - 1/4*(pi + 4*arctan(1/2*(2*sqrt(5)*sqrt(sqrt(5)
 - 2) - sqrt(5) + 4*sqrt(sqrt(5) - 2) - 3)*(sqrt(tan(x)^2 + 2*tan(x) + 2)
- tan(x)) - 3/2*sqrt(5)*sqrt(sqrt(5) - 2) + 1/2*sqrt(5) - 7/2*sqrt(sqrt(5)
 - 2) + 3/2))*sqrt(2*sqrt(5) - 2)/(sqrt(5) - 1) - log(sqrt(tan(x)^2 + 2*ta
n(x) + 2) - tan(x) - 1)
```

3.8.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{2+2\tan(x)+\tan^2(x)}\,dx = \int \sqrt{\tan(x)^2+2\tan(x)+2}\,dx$$

input
```
int((2*tan(x) + tan(x)^2 + 2)^(1/2),x)
```

output
```
int((2*tan(x) + tan(x)^2 + 2)^(1/2), x)
```

3.9 $\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx$

3.9.1 Optimal result

Integrand size = 12, antiderivative size = 41

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = \frac{1}{2}\arctan\left(\sqrt{-1+\sec(x)}\right) - \arctan\left(\sqrt{-1+\sec(x)}\right)\cos(x) + \frac{1}{2}\cos(x)\sqrt{-1+\sec(x)}$$

output
```
1/2*arctan((-1+sec(x))^(1/2))-arctan((-1+sec(x))^(1/2))*cos(x)+1/2*cos(x)*
(-1+sec(x))^(1/2)
```

3.9.2 Mathematica [A] (verified)

Time = 0.25 (sec) , antiderivative size = 70, normalized size of antiderivative = 1.71

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = -\arctan\left(\sqrt{-1+\sec(x)}\right)\cos(x) + \frac{1}{2}\left(\cos(x)+\arctan\left(\frac{\tan\left(\frac{x}{2}\right)}{\sqrt{\frac{\cos(x)}{1+\cos(x)}}}\right)\sqrt{\frac{\cos(x)}{1+\cos(x)}}\cot\left(\frac{x}{2}\right)\right)\sqrt{-1+\sec(x)}$$

input
```
Integrate[ArcTan[Sqrt[-1 + Sec[x]]]*Sin[x],x]
```

output
```
-(ArcTan[Sqrt[-1 + Sec[x]]]*Cos[x]) + ((Cos[x] + ArcTan[Tan[x/2]/Sqrt[Cos[
x]/(1 + Cos[x])]]*Sqrt[Cos[x]/(1 + Cos[x])]*Cot[x/2])*Sqrt[-1 + Sec[x]])/2
```

3.9.3 Rubi [A] (warning: unable to verify)

Time = 0.21 (sec) , antiderivative size = 39, normalized size of antiderivative = 0.95, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.583, Rules used = {4835, 5726, 27, 773, 52, 73, 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.

$$\int \sin(x)\arctan\left(\sqrt{\sec(x)-1}\right)dx$$

$$\Big\downarrow \text{4835}$$

$$-\int \arctan\left(\sqrt{\sec(x)-1}\right)d\cos(x)$$

$$\Big\downarrow \text{5726}$$

$$\int -\frac{1}{2\sqrt{\sec(x)-1}}d\cos(x)-\cos(x)\arctan\left(\sqrt{\sec(x)-1}\right)$$

$$\Big\downarrow \text{27}$$

$$\cos(x)\left(-\arctan\left(\sqrt{\sec(x)-1}\right)\right)-\frac{1}{2}\int \frac{1}{\sqrt{\sec(x)-1}}d\cos(x)$$

$$\Big\downarrow \text{773}$$

$$\frac{1}{2}\int \frac{\sec^2(x)}{\sqrt{\sec(x)-1}}d\sec(x)-\cos(x)\arctan\left(\sqrt{\sec(x)-1}\right)$$

$$\Big\downarrow \text{52}$$

$$\frac{1}{2}\left(\frac{1}{2}\int \frac{\sec(x)}{\sqrt{\sec(x)-1}}d\sec(x)+\sqrt{\sec(x)-1}\sec(x)\right)-\cos(x)\arctan\left(\sqrt{\sec(x)-1}\right)$$

$$\Big\downarrow \text{73}$$

$$\frac{1}{2}\left(\int \cos(x)d\sqrt{\sec(x)-1}+\sqrt{\sec(x)-1}\sec(x)\right)-\cos(x)\arctan\left(\sqrt{\sec(x)-1}\right)$$

$$\Big\downarrow \text{216}$$

$$\frac{1}{2}\left(\arctan\left(\sqrt{\sec(x)-1}\right)+\sqrt{\sec(x)-1}\sec(x)\right)-\cos(x)\arctan\left(\sqrt{\sec(x)-1}\right)$$

input
```
Int[ArcTan[Sqrt[-1 + Sec[x]]]*Sin[x],x]
```

output
```
-(ArcTan[Sqrt[-1 + Sec[x]]]*Cos[x]) + (ArcTan[Sqrt[-1 + Sec[x]]] + Sqrt[-1
 + Sec[x]]*Sec[x])/2
```

3.9.3.1 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 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 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 773
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> -Subst[Int[(a + b/x^n)^p/x^
2, x], x, 1/x] /; FreeQ[{a, b, p}, x] && ILtQ[n, 0] &&  !IntegerQ[p]
```

rule 4835
```
Int[(u_)*(F_)[(c_.)*((a_.) + (b_.)*(x_))], x_Symbol] :> With[{d = FreeFacto
rs[Cos[c*(a + b*x)], x]}, Simp[-d/(b*c)   Subst[Int[SubstFor[1, Cos[c*(a +
b*x)]/d, u, x], x], x, Cos[c*(a + b*x)]/d], x] /; FunctionOfQ[Cos[c*(a + b*
x)]/d, u, x, True]] /; FreeQ[{a, b, c}, x] && (EqQ[F, Sin] || EqQ[F, sin])
```

rule 5726
```
Int[ArcTan[u_], x_Symbol] :> Simp[x*ArcTan[u], x] - Int[SimplifyIntegrand[x
*(D[u, x]/(1 + u^2)), x], x] /; InverseFunctionFreeQ[u, x]
```

3.9.4 Maple [A] (verified)

Time = 0.30 (sec) , antiderivative size = 36, normalized size of antiderivative = 0.88

method	result	size
derivativedivides	$-\frac{\arctan\left(\sqrt{-1+\sec(x)}\right)}{\sec(x)}+\frac{\sqrt{-1+\sec(x)}}{2\sec(x)}+\frac{\arctan\left(\sqrt{-1+\sec(x)}\right)}{2}$	36
default	$-\frac{\arctan\left(\sqrt{-1+\sec(x)}\right)}{\sec(x)}+\frac{\sqrt{-1+\sec(x)}}{2\sec(x)}+\frac{\arctan\left(\sqrt{-1+\sec(x)}\right)}{2}$	36

input
```
int(arctan((-1+sec(x))^(1/2))*sin(x),x,method=_RETURNVERBOSE)
```

output
```
-1/sec(x)*arctan((-1+sec(x))^(1/2))+1/2*(-1+sec(x))^(1/2)/sec(x)+1/2*arcta
n((-1+sec(x))^(1/2))
```

3.9.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 32, normalized size of antiderivative = 0.78

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = -\frac{1}{2}\left(2\,\cos\left(x\right)-1\right)\arctan\left(\sqrt{\sec\left(x\right)-1}\right)+\frac{1}{2}\,\sqrt{-\frac{\cos\left(x\right)-1}{\cos\left(x\right)}}\cos\left(x\right)$$

input
```
integrate(arctan((-1+sec(x))^(1/2))*sin(x),x, algorithm="fricas")
```

output
```
-1/2*(2*cos(x) - 1)*arctan(sqrt(sec(x) - 1)) + 1/2*sqrt(-(cos(x) - 1)/cos(
x))*cos(x)
```

3.9.6 Sympy [F]

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = \int \sin(x)\operatorname{atan}\left(\sqrt{\sec(x)-1}\right)dx$$

input
```
integrate(atan((-1+sec(x))**(1/2))*sin(x),x)
```

output
```
Integral(sin(x)*atan(sqrt(sec(x) - 1)), x)
```

3.9.7 Maxima [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.46

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = -\arctan\left(\sqrt{-\frac{\cos(x)-1}{\cos(x)}}\right)\cos(x) - \frac{\sqrt{-\frac{\cos(x)-1}{\cos(x)}}}{2\left(\frac{\cos(x)-1}{\cos(x)}-1\right)} + \frac{1}{2}\arctan\left(\sqrt{-\frac{\cos(x)-1}{\cos(x)}}\right)$$

input
```
integrate(arctan((-1+sec(x))^(1/2))*sin(x),x, algorithm="maxima")
```

output
```
-arctan(sqrt(-(cos(x) - 1)/cos(x)))*cos(x) - 1/2*sqrt(-(cos(x) - 1)/cos(x)
)/((cos(x) - 1)/cos(x) - 1) + 1/2*arctan(sqrt(-(cos(x) - 1)/cos(x)))
```

3.9.8 Giac [F]

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = \int \arctan\left(\sqrt{\sec(x)-1}\right)\sin(x)\,dx$$

input
```
integrate(arctan((-1+sec(x))^(1/2))*sin(x),x, algorithm="giac")
```

output
```
undef
```

3.9.9 Mupad [B] (verification not implemented)

Time = 0.42 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.46

$$\int \arctan\left(\sqrt{-1+\sec(x)}\right)\sin(x)\,dx = -\mathrm{atan}\left(\sqrt{\frac{1}{\cos(x)}-1}\right)\cos(x) - \frac{\cos(x)\left(\frac{3\,\mathrm{asin}\left(\sqrt{\cos(x)}\right)}{2\cos(x)^{3/2}} - \frac{3\sqrt{1-\cos(x)}}{2\cos(x)}\right)\sqrt{1-\cos(x)}}{3\sqrt{\frac{1}{\cos(x)}-1}}$$

input
```
int(atan((1/cos(x) - 1)^(1/2))*sin(x),x)
```

output
```
- atan((1/cos(x) - 1)^(1/2))*cos(x) - (cos(x)*((3*asin(cos(x)^(1/2)))/(2*c
os(x)^(3/2)) - (3*(1 - cos(x))^(1/2))/(2*cos(x)))*(1 - cos(x))^(1/2))/(3*(
1/cos(x) - 1)^(1/2))
```

3.10 $\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx$

3.10.1 Optimal result

Integrand size = 19, antiderivative size = 44

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = \frac{1}{10}e^{\arcsin(x)}\left(3x+x^3-3\sqrt{1-x^2}-3x^2\sqrt{1-x^2}\right)$$

output
```
1/10*exp(arcsin(x))*(3*x+x^3-3*(-x^2+1)^(1/2)-3*x^2*(-x^2+1)^(1/2))
```

3.10.2 Mathematica [A] (verified)

Time = 0.17 (sec) , antiderivative size = 38, normalized size of antiderivative = 0.86

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = -\frac{1}{40}e^{\arcsin(x)}\left(15\left(-x+\sqrt{1-x^2}\right)-3\cos(3\arcsin(x))+\sin(3\arcsin(x))\right)$$

input
```
Integrate[(E^ArcSin[x]*x^3)/Sqrt[1 - x^2],x]
```

output
```
-1/40*(E^ArcSin[x]*(15*(-x + Sqrt[1 - x^2]) - 3*Cos[3*ArcSin[x]] + Sin[3*A
rcSin[x]]))
```

3.10.3 Rubi [A] (verified)

Time = 0.79 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.52, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.263, Rules used = {5335, 7292, 7271, 4934, 4932}

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.

$$\int \frac{x^3 e^{\arcsin(x)}}{\sqrt{1-x^2}} \, dx$$

$$\Big\downarrow \; 5335$$

$$\int x^3 e^{\arcsin(x)} d \arcsin(x)$$

$$\Big\downarrow \; 4934$$

$$\frac{3}{5} \int e^{\arcsin(x)} x d \arcsin(x) + \frac{1}{10} x^3 e^{\arcsin(x)} - \frac{3}{10} \sqrt{1-x^2} x^2 e^{\arcsin(x)}$$

$$\Big\downarrow \; 4932$$

$$\frac{1}{10} x^3 e^{\arcsin(x)} - \frac{3}{10} \sqrt{1-x^2} x^2 e^{\arcsin(x)} + \frac{3}{5} \left(\frac{1}{2} x e^{\arcsin(x)} - \frac{1}{2} \sqrt{1-x^2} e^{\arcsin(x)} \right)$$

input
```
Int[(E^ArcSin[x]*x^3)/Sqrt[1 - x^2],x]
```

output
```
(E^ArcSin[x]*x^3)/10 - (3*E^ArcSin[x]*x^2*Sqrt[1 - x^2])/10 + (3*((E^ArcSi
n[x]*x)/2 - (E^ArcSin[x]*Sqrt[1 - x^2])/2))/5
```

3.10.3.1 Defintions of rubi rules used

rule 4932
```
Int[(F_)^((c_.)*((a_.) + (b_.)*(x_)))*Sin[(d_.) + (e_.)*(x_)], x_Symbol] :>
 Simp[b*c*Log[F]*F^(c*(a + b*x))*(Sin[d + e*x]/(e^2 + b^2*c^2*Log[F]^2)), x
] - Simp[e*F^(c*(a + b*x))*(Cos[d + e*x]/(e^2 + b^2*c^2*Log[F]^2)), x] /; F
reeQ[{F, a, b, c, d, e}, x] && NeQ[e^2 + b^2*c^2*Log[F]^2, 0]
```

rule 4934
```
Int[(F_)^((c_.)*((a_.) + (b_.)*(x_)))*Sin[(d_.) + (e_.)*(x_)]^(n_), x_Symbo
l] :> Simp[b*c*Log[F]*F^(c*(a + b*x))*(Sin[d + e*x]^n/(e^2*n^2 + b^2*c^2*Lo
g[F]^2)), x] + (-Simp[e*n*F^(c*(a + b*x))*Cos[d + e*x]*(Sin[d + e*x]^(n - 1
)/(e^2*n^2 + b^2*c^2*Log[F]^2)), x] + Simp[(n*(n - 1)*e^2)/(e^2*n^2 + b^2*c
^2*Log[F]^2)   Int[F^(c*(a + b*x))*Sin[d + e*x]^(n - 2), x], x]) /; FreeQ[{
F, a, b, c, d, e}, x] && NeQ[e^2*n^2 + b^2*c^2*Log[F]^2, 0] && GtQ[n, 1]
```

rule 5335
```
Int[(u_.)*(f_)^(ArcSin[(a_.) + (b_.)*(x_)]^(n_.)*(c_.)), x_Symbol] :> Simp[
1/b   Subst[Int[(u /. x -> -a/b + Sin[x]/b)*f^(c*x^n)*Cos[x], x], x, ArcSin
[a + b*x]], x] /; FreeQ[{a, b, c, f}, x] && IGtQ[n, 0]
```

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])
```

rule 7292
```
Int[u_, x_Symbol] :> With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v =!
= u]
```

3.10.4 Maple [F]

$$\int \frac{e^{\arcsin(x)} x^3}{\sqrt{-x^2+1}} dx$$

input
```
int(exp(arcsin(x))*x^3/(-x^2+1)^(1/2),x)
```

output
```
int(exp(arcsin(x))*x^3/(-x^2+1)^(1/2),x)
```

3.10.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 28, normalized size of antiderivative = 0.64

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = \frac{1}{10}\left(x^3-3\left(x^2+1\right)\sqrt{-x^2+1}+3\,x\right)e^{\arcsin(x)}$$

input
```
integrate(exp(arcsin(x))*x^3/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
1/10*(x^3 - 3*(x^2 + 1)*sqrt(-x^2 + 1) + 3*x)*e^arcsin(x)
```

3.10.6 Sympy [A] (verification not implemented)

Time = 0.38 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.27

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = \frac{x^3e^{\operatorname{asin}(x)}}{10}-\frac{3x^2\sqrt{1-x^2}e^{\operatorname{asin}(x)}}{10}+\frac{3xe^{\operatorname{asin}(x)}}{10}-\frac{3\sqrt{1-x^2}e^{\operatorname{asin}(x)}}{10}$$

input
```
integrate(exp(asin(x))*x**3/(-x**2+1)**(1/2),x)
```

output
```
x**3*exp(asin(x))/10 - 3*x**2*sqrt(1 - x**2)*exp(asin(x))/10 + 3*x*exp(asi
n(x))/10 - 3*sqrt(1 - x**2)*exp(asin(x))/10
```

3.10.7 Maxima [F]

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = \int \frac{x^3e^{\arcsin(x)}}{\sqrt{-x^2+1}}\,dx$$

input
```
integrate(exp(arcsin(x))*x^3/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
integrate(x^3*e^arcsin(x)/sqrt(-x^2 + 1), x)
```

3.10.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.05

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = \frac{1}{10}\left(x^2-1\right)xe^{\arcsin(x)} + \frac{3}{10}\left(-x^2+1\right)^{\frac{3}{2}}e^{\arcsin(x)} + \frac{2}{5}\,xe^{\arcsin(x)} - \frac{3}{5}\,\sqrt{-x^2+1}e^{\arcsin(x)}$$

input
```
integrate(exp(arcsin(x))*x^3/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
1/10*(x^2 - 1)*x*e^arcsin(x) + 3/10*(-x^2 + 1)^(3/2)*e^arcsin(x) + 2/5*x*e
^arcsin(x) - 3/5*sqrt(-x^2 + 1)*e^arcsin(x)
```

3.10.9 Mupad [F(-1)]

Timed out.

$$\int \frac{e^{\arcsin(x)}x^3}{\sqrt{1-x^2}}\,dx = \int \frac{x^3\,\mathrm{e}^{\mathrm{asin}(x)}}{\sqrt{1-x^2}}\,dx$$

input
```
int((x^3*exp(asin(x)))/(1 - x^2)^(1/2),x)
```

output
```
int((x^3*exp(asin(x)))/(1 - x^2)^(1/2), x)
```

3.11 $\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx$

3.11.1 Optimal result

Integrand size = 29, antiderivative size = 68

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx = 4x - 2\arctan(x) - x\log(1+x^2) - 2\sqrt{1+x^2}\log\left(x+\sqrt{1+x^2}\right) + \sqrt{1+x^2}\log(1+x^2)\log\left(x+\sqrt{1+x^2}\right)$$

output
```
4*x-2*arctan(x)-x*ln(x^2+1)-2*ln(x+(x^2+1)^(1/2))*(x^2+1)^(1/2)+ln(x^2+1)*
ln(x+(x^2+1)^(1/2))*(x^2+1)^(1/2)
```

3.11.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 64, normalized size of antiderivative = 0.94

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx = 4x - 2\arctan(x) - 2\sqrt{1+x^2}\log\left(x+\sqrt{1+x^2}\right) + \log(1+x^2)\left(-x+\sqrt{1+x^2}\log\left(x+\sqrt{1+x^2}\right)\right)$$

input
```
Integrate[(x*Log[1 + x^2]*Log[x + Sqrt[1 + x^2]])/Sqrt[1 + x^2],x]
```

output
```
4*x - 2*ArcTan[x] - 2*Sqrt[1 + x^2]*Log[x + Sqrt[1 + x^2]] + Log[1 + x^2]*
(-x + Sqrt[1 + x^2]*Log[x + Sqrt[1 + x^2]])
```

3.11.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.09, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.241, Rules used = {3037, 27, 2898, 262, 216, 3034, 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.

$$\int \frac{x \log(x^2+1) \log\left(\sqrt{x^2+1}+x\right)}{\sqrt{x^2+1}}dx$$

$$\Big\downarrow \ 3037$$

$$-\int \log(x^2+1)dx - \int \frac{2x\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx + \sqrt{x^2+1}\log(x^2+1)\log\left(\sqrt{x^2+1}+x\right)$$

$$\Big\downarrow \ 27$$

$$-\int \log(x^2+1)dx - 2\int \frac{x\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx + \sqrt{x^2+1}\log(x^2+1)\log\left(\sqrt{x^2+1}+x\right)$$

$$\Big\downarrow \ 2898$$

$$2\int \frac{x^2}{x^2+1}dx - 2\int \frac{x\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx - x\log(x^2+1) + \sqrt{x^2+1}\log\left(\sqrt{x^2+1}+x\right)\log(x^2+1)$$

$$\Big\downarrow \ 262$$

$$2\left(x-\int \frac{1}{x^2+1}dx\right) - 2\int \frac{x\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx - x\log(x^2+1) + \sqrt{x^2+1}\log\left(\sqrt{x^2+1}+x\right)\log(x^2+1)$$

$$\Big\downarrow \ 216$$

$$-2\int \frac{x\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx + 2(x-\arctan(x)) - x\log(x^2+1) + \sqrt{x^2+1}\log(x^2+1)\log\left(\sqrt{x^2+1}+x\right)$$

$$\Big\downarrow \ 3034$$

$$-2\left(\sqrt{x^2+1}\log\left(\sqrt{x^2+1}+x\right) - \int 1dx\right) + 2(x-\arctan(x)) - x\log(x^2+1) + \sqrt{x^2+1}\log(x^2+1)\log\left(\sqrt{x^2+1}+x\right)$$

$$\Big\downarrow 24$$

$$2(x-\arctan(x))-x\log\left(x^2+1\right)+\sqrt{x^2+1}\log\left(x^2+1\right)\log\left(\sqrt{x^2+1}+x\right)-2\left(\sqrt{x^2+1}\log\left(\sqrt{x^2+1}+x\right)-x\right)$$

input
```
Int[(x*Log[1 + x^2]*Log[x + Sqrt[1 + x^2]])/Sqrt[1 + x^2],x]
```

output
```
2*(x - ArcTan[x]) - x*Log[1 + x^2] + Sqrt[1 + x^2]*Log[1 + x^2]*Log[x + Sq
rt[1 + x^2]] - 2*(-x + Sqrt[1 + x^2]*Log[x + Sqrt[1 + x^2]])
```

3.11.3.1 Defintions of rubi rules used

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

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 262
```
Int[((c_.)*(x_))^(m_)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] :> Simp[c*(c*x)
^(m - 1)*((a + b*x^2)^(p + 1)/(b*(m + 2*p + 1))), x] - Simp[a*c^2*((m - 1)/
(b*(m + 2*p + 1)))   Int[(c*x)^(m - 2)*(a + b*x^2)^p, x], x] /; FreeQ[{a, b
, c, p}, x] && GtQ[m, 2 - 1] && NeQ[m + 2*p + 1, 0] && IntBinomialQ[a, b, c
, 2, m, p, x]
```

rule 2898
```
Int[Log[(c_.)*((d_) + (e_.)*(x_)^(n_))^(p_.)], x_Symbol] :> Simp[x*Log[c*(d
 + e*x^n)^p], x] - Simp[e*n*p   Int[x^n/(d + e*x^n), x], x] /; FreeQ[{c, d,
 e, n, p}, x]
```

rule 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

rule 3037
```
Int[Log[v_]*Log[w_]*(u_), x_Symbol] :> With[{z = IntHide[u, x]}, Simp[Log[v
]*Log[w]   z, x] + (-Int[SimplifyIntegrand[z*Log[w]*(D[v, x]/v), x], x] - I
nt[SimplifyIntegrand[z*Log[v]*(D[w, x]/w), x], x]) /; InverseFunctionFreeQ[
z, x]] /; InverseFunctionFreeQ[v, x] && InverseFunctionFreeQ[w, x]
```

3.11.4 Maple [F]

$$\int \frac{x \ln(x^2+1) \ln\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx$$

input
```
int(x*ln(x^2+1)*ln(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x)
```

output
```
int(x*ln(x^2+1)*ln(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x)
```

3.11.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 43, normalized size of antiderivative = 0.63

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} dx = \sqrt{x^2+1}\left(\log\left(x^2+1\right)-2\right) \log\left(x+\sqrt{x^2+1}\right) - x \log\left(x^2+1\right) + 4x - 2 \arctan(x)$$

input
```
integrate(x*log(x^2+1)*log(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x, algorithm="fr
icas")
```

output
```
sqrt(x^2 + 1)*(log(x^2 + 1) - 2)*log(x + sqrt(x^2 + 1)) - x*log(x^2 + 1) +
 4*x - 2*arctan(x)
```

3.11.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} dx = \text{Timed out}$$

input
```
integrate(x*ln(x**2+1)*ln(x+(x**2+1)**(1/2))/(x**2+1)**(1/2),x)
```

output
```
Timed out
```

3.11.7 Maxima [F]

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\, dx = \int \frac{x \log(x^2+1) \log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\, dx$$

input
```
integrate(x*log(x^2+1)*log(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x, algorithm="ma
xima")
```

output
```
-(2*x^2 - (x^2 + 1)*log(x^2 + 1) + 2)*log(x + sqrt(x^2 + 1))/sqrt(x^2 + 1)
 + integrate((log(x^2 + 1) - 2)/(x^2 + sqrt(x^2 + 1)*x), x) - integrate(-(
2*x^2 - (x^2 + 1)*log(x^2 + 1) + 2)/(sqrt(x^2 + 1)*x), x)
```

3.11.8 Giac [F]

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\, dx = \int \frac{x \log(x^2+1) \log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\, dx$$

input
```
integrate(x*log(x^2+1)*log(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x, algorithm="gi
ac")
```

output
```
integrate(x*log(x^2 + 1)*log(x + sqrt(x^2 + 1))/sqrt(x^2 + 1), x)
```

3.11.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x \log(1+x^2) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\, dx = \int \frac{x \ln(x^2+1) \ln\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\, dx$$

input
```
int((x*log(x^2 + 1)*log(x + (x^2 + 1)^(1/2)))/(x^2 + 1)^(1/2),x)
```

output
```
int((x*log(x^2 + 1)*log(x + (x^2 + 1)^(1/2)))/(x^2 + 1)^(1/2), x)
```

3.12 $\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx$

3.12.1 Optimal result

Integrand size = 14, antiderivative size = 141

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx=-\frac{\arcsin(x)}{2}+\frac{1}{4}\sqrt{3}\arctan\left(\frac{-1+\sqrt{3}x}{\sqrt{1-x^2}}\right)+\frac{1}{4}\sqrt{3}\arctan\left(\frac{1+\sqrt{3}x}{\sqrt{1-x^2}}\right)-\frac{1}{4}\sqrt{3}\arctan\left(\frac{-1+2x^2}{\sqrt{3}}\right)+x\arctan\left(x+\sqrt{1-x^2}\right)-\frac{1}{4}\text{arctanh}\left(x\sqrt{1-x^2}\right)-\frac{1}{8}\log\left(1-x^2+x^4\right)$$

output
```
-1/2*arcsin(x)+x*arctan(x+(-x^2+1)^(1/2))-1/4*arctanh(x*(-x^2+1)^(1/2))-1/
8*ln(x^4-x^2+1)-1/4*arctan(1/3*(2*x^2-1)*3^(1/2))*3^(1/2)+1/4*arctan((-1+x
*3^(1/2))/(-x^2+1)^(1/2))*3^(1/2)+1/4*arctan((1+x*3^(1/2))/(-x^2+1)^(1/2))
*3^(1/2)
```

3.12.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 3 in optimal.

Time = 0.13 (sec) , antiderivative size = 226, normalized size of antiderivative = 1.60

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx = -\arctan\left(\frac{x}{-1+\sqrt{1-x^2}}\right)+x\arctan\left(x+\sqrt{1-x^2}\right) - \log(x)+\frac{1}{2}\log\left(-1+\sqrt{1-x^2}\right)-\frac{1}{2}\text{RootSum}\left[1-2\#1+2\#1^2+2\#1^3 +\#1^4\&,\frac{-\log(x)+\log\left(-1+\sqrt{1-x^2}-x\#1\right)-\log(x)\#1+\log\left(-1+\sqrt{1-x^2}-x\#1\right)\#1-3\log(x)}{-1+2\#1+3\#}\right.$$

input
```
Integrate[ArcTan[x + Sqrt[1 - x^2]],x]
```

output
```
-ArcTan[x/(-1 + Sqrt[1 - x^2])] + x*ArcTan[x + Sqrt[1 - x^2]] - Log[x] + L
og[-1 + Sqrt[1 - x^2]]/2 - RootSum[1 - 2*#1 + 2*#1^2 + 2*#1^3 + #1^4 & , (
-Log[x] + Log[-1 + Sqrt[1 - x^2] - x*#1] - Log[x]*#1 + Log[-1 + Sqrt[1 - x
^2] - x*#1]*#1 - 3*Log[x]*#1^2 + 3*Log[-1 + Sqrt[1 - x^2] - x*#1]*#1^2 - L
og[x]*#1^3 + Log[-1 + Sqrt[1 - x^2] - x*#1]*#1^3)/(-1 + 2*#1 + 3*#1^2 + 2*
#1^3) & ]/2
```

3.12.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.88 (sec) , antiderivative size = 274, normalized size of antiderivative = 1.94, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.286, Rules used = {5726, 27, 7293, 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.

$$\int \arctan\left(\sqrt{1-x^2}+x\right)dx$$

$$\Big\downarrow \text{5726}$$

$$x\arctan\left(\sqrt{1-x^2}+x\right)-\int \frac{x\left(1-\frac{x}{\sqrt{1-x^2}}\right)}{2\left(\sqrt{1-x^2}x+1\right)}dx$$

$$\Big\downarrow \; 27$$

$$x \arctan\left(\sqrt{1-x^2}+x\right)-\frac{1}{2}\int \frac{x\left(1-\frac{x}{\sqrt{1-x^2}}\right)}{\sqrt{1-x^2}x+1}dx$$

$$\Big\downarrow \; 7293$$

$$x \arctan\left(\sqrt{1-x^2}+x\right)-\frac{1}{2}\int \left(\frac{x^2}{x^3-x-\sqrt{1-x^2}}+\frac{x}{\sqrt{1-x^2}x+1}\right)dx$$

$$\Big\downarrow \; 2009$$

$$x \arctan\left(\sqrt{1-x^2}+x\right)+$$

$$\frac{1}{2}\left(-\arcsin(x)+\frac{1}{2}\sqrt{3}\arctan\left(\frac{1-2x^2}{\sqrt{3}}\right)+\frac{1}{6}\left(-\sqrt{3}+3i\right)\arctan\left(\frac{x}{\sqrt{-\frac{-\sqrt{3}+i}{\sqrt{3}+i}}\sqrt{1-x^2}}\right)+\frac{2\arctan\left(\frac{x}{\sqrt{-\frac{-\sqrt{3}+i}{\sqrt{3}+i}}\sqrt{}}\right.}{\sqrt{3}}\right.$$

input
```
Int[ArcTan[x + Sqrt[1 - x^2]],x]
```

output
```
x*ArcTan[x + Sqrt[1 - x^2]] + (-ArcSin[x] + (Sqrt[3]*ArcTan[(1 - 2*x^2)/Sq
rt[3]])/2 + (2*ArcTan[x/(Sqrt[-((I - Sqrt[3])/(I + Sqrt[3]))]*Sqrt[1 - x^2
])])/Sqrt[3] + ((3*I - Sqrt[3])*ArcTan[x/(Sqrt[-((I - Sqrt[3])/(I + Sqrt[3
]))]*Sqrt[1 - x^2])])/6 + (2*ArcTan[(Sqrt[-((I - Sqrt[3])/(I + Sqrt[3]))]*
x)/Sqrt[1 - x^2]])/Sqrt[3] - ((3*I + Sqrt[3])*ArcTan[(Sqrt[-((I - Sqrt[3])
/(I + Sqrt[3]))]*x)/Sqrt[1 - x^2]])/6 - Log[1 - x^2 + x^4]/4)/2
```

3.12.3.1 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 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 5726
```
Int[ArcTan[u_], x_Symbol] :> Simp[x*ArcTan[u], x] - Int[SimplifyIntegrand[x
*(D[u, x]/(1 + u^2)), x], x] /; InverseFunctionFreeQ[u, x]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

3.12.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.10 (sec) , antiderivative size = 471, normalized size of antiderivative = 3.34

method	result
default	$x \arctan\left(x+\sqrt{-x^{2}+1}\right)-\frac{\ln\left(x^{4}-x^{2}+1\right)}{8}-\frac{\arctan\left(\frac{\left(2x^{2}-1\right)\sqrt{3}}{3}\right)\sqrt{3}}{4}-\frac{\left(\frac{i\sqrt{3}}{12}+\frac{1}{4}\right)\ln\left(\frac{\left(\sqrt{-x^{2}+1}-1\right)^{2}}{x^{2}}+\frac{\left(1+i\sqrt{3}\right)\left(\sqrt{-\right.}{x}\right.}{2}$
parts	$x \arctan\left(x+\sqrt{-x^{2}+1}\right)-\frac{\ln\left(x^{4}-x^{2}+1\right)}{8}-\frac{\arctan\left(\frac{\left(2x^{2}-1\right)\sqrt{3}}{3}\right)\sqrt{3}}{4}-\frac{\left(\frac{i\sqrt{3}}{12}+\frac{1}{4}\right)\ln\left(\frac{\left(\sqrt{-x^{2}+1}-1\right)^{2}}{x^{2}}+\frac{\left(1+i\sqrt{3}\right)\left(\sqrt{-\right.}{x}\right.}{2}$

input
```
int(arctan(x+(-x^2+1)^(1/2)),x,method=_RETURNVERBOSE)
```

output
```
x*arctan(x+(-x^2+1)^(1/2))-1/8*ln(x^4-x^2+1)-1/4*arctan(1/3*(2*x^2-1)*3^(1
/2))*3^(1/2)-1/2*(1/12*I*3^(1/2)+1/4)*ln(((-x^2+1)^(1/2)-1)^2/x^2+(1+I*3^(
1/2))*((-x^2+1)^(1/2)-1)/x-1)-1/2*(1/4-1/12*I*3^(1/2))*ln(((-x^2+1)^(1/2)-
1)^2/x^2+(1-I*3^(1/2))*((-x^2+1)^(1/2)-1)/x-1)+1/2*(1/12*I*3^(1/2)+1/4)*ln
(((-x^2+1)^(1/2)-1)^2/x^2+(-1-I*3^(1/2))*((-x^2+1)^(1/2)-1)/x-1)+1/2*(1/4-
1/12*I*3^(1/2))*ln(((-x^2+1)^(1/2)-1)^2/x^2+(-1+I*3^(1/2))*((-x^2+1)^(1/2)
-1)/x-1)-1/12*I*3^(1/2)*ln(((-x^2+1)^(1/2)-1)^2/x^2+(1+I*3^(1/2))*((-x^2+1
)^(1/2)-1)/x-1)+1/12*I*3^(1/2)*ln(((-x^2+1)^(1/2)-1)^2/x^2+(1-I*3^(1/2))*(
(-x^2+1)^(1/2)-1)/x-1)+arctan(((-x^2+1)^(1/2)-1)/x)-1/12*I*3^(1/2)*ln(((-x
^2+1)^(1/2)-1)^2/x^2+(-1+I*3^(1/2))*((-x^2+1)^(1/2)-1)/x-1)+1/12*I*3^(1/2)
*ln(((-x^2+1)^(1/2)-1)^2/x^2+(-1-I*3^(1/2))*((-x^2+1)^(1/2)-1)/x-1)
```

3.12.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 191, normalized size of antiderivative = 1.35

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx = x\arctan\left(x+\sqrt{-x^2+1}\right) - \frac{1}{4}\sqrt{3}\arctan\left(\frac{1}{3}\sqrt{3}(2x^2-1)\right) - \frac{1}{8}\sqrt{3}\arctan\left(\frac{4\sqrt{3}\sqrt{-x^2+1}x+\sqrt{3}}{3(2x^2-1)}\right) - \frac{1}{8}\sqrt{3}\arctan\left(\frac{4\sqrt{3}\sqrt{-x^2+1}x-\sqrt{3}}{3(2x^2-1)}\right) + \frac{1}{2}\arctan\left(\frac{\sqrt{-x^2+1}x}{x^2-1}\right) - \frac{1}{8}\log\left(x^4-x^2+1\right) - \frac{1}{16}\log\left(-x^4+x^2+2\sqrt{-x^2+1}x+1\right) + \frac{1}{16}\log\left(-x^4+x^2-2\sqrt{-x^2+1}x+1\right)$$

input
```
integrate(arctan(x+(-x^2+1)^(1/2)),x, algorithm="fricas")
```

output
```
x*arctan(x + sqrt(-x^2 + 1)) - 1/4*sqrt(3)*arctan(1/3*sqrt(3)*(2*x^2 - 1))
 - 1/8*sqrt(3)*arctan(1/3*(4*sqrt(3)*sqrt(-x^2 + 1)*x + sqrt(3))/(2*x^2 -
1)) - 1/8*sqrt(3)*arctan(1/3*(4*sqrt(3)*sqrt(-x^2 + 1)*x - sqrt(3))/(2*x^2
 - 1)) + 1/2*arctan(sqrt(-x^2 + 1)*x/(x^2 - 1)) - 1/8*log(x^4 - x^2 + 1) -
 1/16*log(-x^4 + x^2 + 2*sqrt(-x^2 + 1)*x + 1) + 1/16*log(-x^4 + x^2 - 2*s
qrt(-x^2 + 1)*x + 1)
```

3.12.6 Sympy [F(-1)]

Timed out.

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx = \text{Timed out}$$

input
```
integrate(atan(x+(-x**2+1)**(1/2)),x)
```

output
```
Timed out
```

3.12.7 Maxima [F]

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx = \int \arctan\left(x+\sqrt{-x^2+1}\right)\,dx$$

input
```
integrate(arctan(x+(-x^2+1)^(1/2)),x, algorithm="maxima")
```

output
```
x*arctan(x + sqrt(x + 1)*sqrt(-x + 1)) - integrate((x^3 + x^2*e^(1/2*log(x
 + 1) + 1/2*log(-x + 1)) - x)/(x^4 + (x^2 - 1)*e^(log(x + 1) + log(-x + 1)
) + 2*(x^3 - x)*e^(1/2*log(x + 1) + 1/2*log(-x + 1)) - 1), x)
```

3.12.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 364 vs. $2(110) = 220$.

Time = 0.29 (sec) , antiderivative size = 364, normalized size of antiderivative = 2.58

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx$$
$$= x\arctan\left(x+\sqrt{-x^2+1}\right)-\frac{1}{4}\pi\operatorname{sgn}(x)$$
$$+\frac{1}{8}\sqrt{3}\left(\pi\operatorname{sgn}(x)+2\arctan\left(-\frac{\sqrt{3}x\left(\frac{\sqrt{-x^2+1}-1}{x}+\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-1\right)}{3\left(\sqrt{-x^2+1}-1\right)}\right)\right)$$
$$+\frac{1}{8}\sqrt{3}\left(\pi\operatorname{sgn}(x)+2\arctan\left(\frac{\sqrt{3}x\left(\frac{\sqrt{-x^2+1}-1}{x}-\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}+1\right)}{3\left(\sqrt{-x^2+1}-1\right)}\right)\right)$$
$$-\frac{1}{4}\sqrt{3}\arctan\left(\frac{1}{3}\sqrt{3}(2x^2-1)\right)-\frac{1}{2}\arctan\left(-\frac{x\left(\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-1\right)}{2\left(\sqrt{-x^2+1}-1\right)}\right)$$
$$-\frac{1}{8}\log\left(x^4-x^2+1\right)+\frac{1}{8}\log\left(\left(\frac{x}{\sqrt{-x^2+1}-1}-\frac{\sqrt{-x^2+1}-1}{x}\right)^2+\frac{2x}{\sqrt{-x^2+1}-1}\right.$$
$$\left.-\frac{2\left(\sqrt{-x^2+1}-1\right)}{x}+4\right)-\frac{1}{8}\log\left(\left(\frac{x}{\sqrt{-x^2+1}-1}-\frac{\sqrt{-x^2+1}-1}{x}\right)^2\right.$$
$$\left.-\frac{2x}{\sqrt{-x^2+1}-1}+\frac{2\left(\sqrt{-x^2+1}-1\right)}{x}+4\right)$$

input
```
integrate(arctan(x+(-x^2+1)^(1/2)),x, algorithm="giac")
```

3.12. $\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx$

output
```
x*arctan(x + sqrt(-x^2 + 1)) - 1/4*pi*sgn(x) + 1/8*sqrt(3)*(pi*sgn(x) + 2*
arctan(-1/3*sqrt(3)*x*((sqrt(-x^2 + 1) - 1)/x + (sqrt(-x^2 + 1) - 1)^2/x^2
 - 1)/(sqrt(-x^2 + 1) - 1))) + 1/8*sqrt(3)*(pi*sgn(x) + 2*arctan(1/3*sqrt(
3)*x*((sqrt(-x^2 + 1) - 1)/x - (sqrt(-x^2 + 1) - 1)^2/x^2 + 1)/(sqrt(-x^2
+ 1) - 1))) - 1/4*sqrt(3)*arctan(1/3*sqrt(3)*(2*x^2 - 1)) - 1/2*arctan(-1/
2*x*((sqrt(-x^2 + 1) - 1)^2/x^2 - 1)/(sqrt(-x^2 + 1) - 1)) - 1/8*log(x^4 -
 x^2 + 1) + 1/8*log((x/(sqrt(-x^2 + 1) - 1) - (sqrt(-x^2 + 1) - 1)/x)^2 +
2*x/(sqrt(-x^2 + 1) - 1) - 2*(sqrt(-x^2 + 1) - 1)/x + 4) - 1/8*log((x/(sqr
t(-x^2 + 1) - 1) - (sqrt(-x^2 + 1) - 1)/x)^2 - 2*x/(sqrt(-x^2 + 1) - 1) +
2*(sqrt(-x^2 + 1) - 1)/x + 4)
```

3.12.9 Mupad [B] (verification not implemented)

Time = 1.37 (sec) , antiderivative size = 661, normalized size of antiderivative = 4.69

$$\int \arctan\left(x+\sqrt{1-x^2}\right)\,dx=\text{Too large to display}$$

input
```
int(atan(x + (1 - x^2)^(1/2)),x)
```

output
```
x*atan(x + (1 - x^2)^(1/2)) - asin(x)/2 + (log(x - 3^(1/2)/2 - 1i/2)*(3^(1
/2)/2 + (3^(1/2)/2 + 1i/2)^3 + 1i/2))/(2*3^(1/2) - 8*(3^(1/2)/2 + 1i/2)^3
+ 2i) - (log(x - 3^(1/2)/2 + 1i/2)*(3^(1/2)/2 + (3^(1/2)/2 - 1i/2)^3 - 1i/
2))/(8*(3^(1/2)/2 - 1i/2)^3 - 2*3^(1/2) + 2i) - (log(x + 3^(1/2)/2 - 1i/2)
*(3^(1/2)/2 + (3^(1/2)/2 - 1i/2)^3 - 1i/2))/(8*(3^(1/2)/2 - 1i/2)^3 - 2*3^
(1/2) + 2i) + (log(x + 3^(1/2)/2 + 1i/2)*(3^(1/2)/2 + (3^(1/2)/2 + 1i/2)^3
 + 1i/2))/(2*3^(1/2) - 8*(3^(1/2)/2 + 1i/2)^3 + 2i) + (log((((x*(3^(1/2)/2
 + 1i/2) - 1)*1i)/(1 - (3^(1/2)/2 + 1i/2)^2)^(1/2) - (1 - x^2)^(1/2)*1i)/(
3^(1/2)/2 - x + 1i/2))*((3^(1/2)/2 + 1i/2)^2 + 1))/((1 - (3^(1/2)/2 + 1i/2
)^2)^(1/2)*(2*3^(1/2) - 8*(3^(1/2)/2 + 1i/2)^3 + 2i)) - (log((((x*(3^(1/2)
/2 - 1i/2) - 1)*1i)/(1 - (3^(1/2)/2 - 1i/2)^2)^(1/2) - (1 - x^2)^(1/2)*1i)
/(x - 3^(1/2)/2 + 1i/2))*((3^(1/2)/2 - 1i/2)^2 + 1))/((1 - (3^(1/2)/2 - 1i
/2)^2)^(1/2)*(8*(3^(1/2)/2 - 1i/2)^3 - 2*3^(1/2) + 2i)) + (log((((x*(3^(1/
2)/2 - 1i/2) + 1)*1i)/(1 - (3^(1/2)/2 - 1i/2)^2)^(1/2) + (1 - x^2)^(1/2)*1
i)/(x + 3^(1/2)/2 - 1i/2))*((3^(1/2)/2 - 1i/2)^2 + 1))/((1 - (3^(1/2)/2 -
1i/2)^2)^(1/2)*(8*(3^(1/2)/2 - 1i/2)^3 - 2*3^(1/2) + 2i)) - (log((((x*(3^(
1/2)/2 + 1i/2) + 1)*1i)/(1 - (3^(1/2)/2 + 1i/2)^2)^(1/2) + (1 - x^2)^(1/2)
*1i)/(x + 3^(1/2)/2 + 1i/2))*((3^(1/2)/2 + 1i/2)^2 + 1))/((1 - (3^(1/2)/2
+ 1i/2)^2)^(1/2)*(2*3^(1/2) - 8*(3^(1/2)/2 + 1i/2)^3 + 2i))
```

3.13 $\int \frac{x \arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx$

3.13.1 Optimal result

Integrand size = 27, antiderivative size = 152

$$\begin{aligned}\int \frac{x \arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx = & -\frac{\arcsin(x)}{2} + \frac{1}{4}\sqrt{3}\arctan\left(\frac{-1+\sqrt{3}x}{\sqrt{1-x^2}}\right) \\ & + \frac{1}{4}\sqrt{3}\arctan\left(\frac{1+\sqrt{3}x}{\sqrt{1-x^2}}\right) - \frac{1}{4}\sqrt{3}\arctan\left(\frac{-1+2x^2}{\sqrt{3}}\right) \\ & - \sqrt{1-x^2}\arctan\left(x+\sqrt{1-x^2}\right) \\ & + \frac{1}{4}\operatorname{arctanh}\left(x\sqrt{1-x^2}\right) + \frac{1}{8}\log\left(1-x^2+x^4\right)\end{aligned}$$

output
```
-1/2*arcsin(x)+1/4*arctanh(x*(-x^2+1)^(1/2))+1/8*ln(x^4-x^2+1)-1/4*arctan(
1/3*(2*x^2-1)*3^(1/2))*3^(1/2)+1/4*arctan((-1+x*3^(1/2))/(-x^2+1)^(1/2))*3
^(1/2)+1/4*arctan((1+x*3^(1/2))/(-x^2+1)^(1/2))*3^(1/2)-arctan(x+(-x^2+1)^
(1/2))*(-x^2+1)^(1/2)
```

3.13.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 3.09 (sec) , antiderivative size = 2175, normalized size of antiderivative = 14.31

$$\int \frac{x \arctan \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx = \text{Result too large to show}$$

input
```
Integrate[(x*ArcTan[x + Sqrt[1 - x^2]])/Sqrt[1 - x^2],x]
```

output
```
(-24*ArcSin[x] - 48*Sqrt[1 - x^2]*ArcTan[x + Sqrt[1 - x^2]] + (2*(-3*I + S
qrt[3])*ArcTan[(3 - I*Sqrt[3] + (-3 - I*Sqrt[3])*x^4 + 2*x*(-6*I + 2*Sqrt[
3] - I*Sqrt[2 - (2*I)*Sqrt[3]]*Sqrt[1 - x^2]) - 2*x^3*(6*I + 2*Sqrt[3] + I
*Sqrt[2 - (2*I)*Sqrt[3]]*Sqrt[1 - x^2]) - (2*I)*Sqrt[3]*x^2*(6 + Sqrt[2 -
(2*I)*Sqrt[3]]*Sqrt[1 - x^2]))/(I - Sqrt[3] + (6*I)*(I + Sqrt[3])*x - 2*(-
15*I + Sqrt[3])*x^2 + 6*(1 + (3*I)*Sqrt[3])*x^3 + (11*I + 3*Sqrt[3])*x^4)]
)/Sqrt[(1 - I*Sqrt[3])/6] - (2*(-3*I + Sqrt[3])*ArcTan[(3 - I*Sqrt[3] + (-
3 - I*Sqrt[3])*x^4 + 2*x^3*(6*I + 2*Sqrt[3] + I*Sqrt[2 - (2*I)*Sqrt[3]]*Sq
rt[1 - x^2]) + x*(12*I - 4*Sqrt[3] + (2*I)*Sqrt[2 - (2*I)*Sqrt[3]]*Sqrt[1
- x^2]) - (2*I)*Sqrt[3]*x^2*(6 + Sqrt[2 - (2*I)*Sqrt[3]]*Sqrt[1 - x^2]))/(
I - Sqrt[3] + (6 - (6*I)*Sqrt[3])*x - 2*(-15*I + Sqrt[3])*x^2 + (-6 - (18*
I)*Sqrt[3])*x^3 + (11*I + 3*Sqrt[3])*x^4)])/Sqrt[(1 - I*Sqrt[3])/6] - (2*(
3*I + Sqrt[3])*ArcTan[(-3 - I*Sqrt[3] + (3 - I*Sqrt[3])*x^4 + 2*x^3*(-6*I
+ 2*Sqrt[3] - I*Sqrt[2 + (2*I)*Sqrt[3]]*Sqrt[1 - x^2]) - 2*x*(6*I + 2*Sqrt
[3] + I*Sqrt[2 + (2*I)*Sqrt[3]]*Sqrt[1 - x^2]) - (2*I)*Sqrt[3]*x^2*(6 + Sq
rt[2 + (2*I)*Sqrt[3]]*Sqrt[1 - x^2]))/(-I - Sqrt[3] + (-6 - (6*I)*Sqrt[3])
*x - 2*(15*I + Sqrt[3])*x^2 + 6*(1 - (3*I)*Sqrt[3])*x^3 + (-11*I + 3*Sqrt[
3])*x^4)])/Sqrt[(1 + I*Sqrt[3])/6] + (2*(3*I + Sqrt[3])*ArcTan[(-3 - I*Sqr
t[3] + (3 - I*Sqrt[3])*x^4 + 2*x*(6*I + 2*Sqrt[3] + I*Sqrt[2 + (2*I)*Sqrt[
3]]*Sqrt[1 - x^2]) + x^3*(12*I - 4*Sqrt[3] + (2*I)*Sqrt[2 + (2*I)*Sqrt[...
```

3.13.3 Rubi [C] (verified)

Result contains complex when optimal does not.

Time = 0.69 (sec) , antiderivative size = 283, normalized size of antiderivative = 1.86, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.148, Rules used = {5730, 27, 7293, 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.

3.13. $\int \frac{x \arctan \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx$

$$\int \frac{x \arctan\left(\sqrt{1-x^2}+x\right)}{\sqrt{1-x^2}}dx$$

$$\Big\downarrow \text{5730}$$

$$-\int \frac{x-\sqrt{1-x^2}}{2\left(\sqrt{1-x^2}x+1\right)}dx-\sqrt{1-x^2}\arctan\left(\sqrt{1-x^2}+x\right)$$

$$\Big\downarrow \text{27}$$

$$-\frac{1}{2}\int \frac{x-\sqrt{1-x^2}}{\sqrt{1-x^2}x+1}dx-\sqrt{1-x^2}\arctan\left(\sqrt{1-x^2}+x\right)$$

$$\Big\downarrow \text{7293}$$

$$-\frac{1}{2}\int \left(\frac{x}{\sqrt{1-x^2}x+1}-\frac{\sqrt{1-x^2}}{\sqrt{1-x^2}x+1}\right)dx-\sqrt{1-x^2}\arctan\left(\sqrt{1-x^2}+x\right)$$

$$\Big\downarrow \text{2009}$$

$$-\sqrt{1-x^2}\arctan\left(\sqrt{1-x^2}+x\right)+$$

$$\frac{1}{2}\left(-\arcsin(x)+\frac{1}{2}\sqrt{3}\arctan\left(\frac{1-2x^2}{\sqrt{3}}\right)-\frac{1}{6}\left(-\sqrt{3}+3i\right)\arctan\left(\frac{x}{\sqrt{-\frac{-\sqrt{3}+i}{\sqrt{3}+i}}\sqrt{1-x^2}}\right)+\frac{\arctan\left(\frac{x}{\sqrt{-\frac{-\sqrt{3}+i}{\sqrt{3}+i}}\sqrt{1\right.}}\right.}{\sqrt{3}}\right.$$

input
```
Int[(x*ArcTan[x + Sqrt[1 - x^2]])/Sqrt[1 - x^2],x]
```

output
```
-(Sqrt[1 - x^2]*ArcTan[x + Sqrt[1 - x^2]]) + (-ArcSin[x] + (Sqrt[3]*ArcTan
[(1 - 2*x^2)/Sqrt[3]])/2 + ArcTan[x/(Sqrt[-((I - Sqrt[3])/(I + Sqrt[3]))]*
Sqrt[1 - x^2])]/Sqrt[3] - ((3*I - Sqrt[3])*ArcTan[x/(Sqrt[-((I - Sqrt[3])/
(I + Sqrt[3]))]*Sqrt[1 - x^2])])/6 + ArcTan[(Sqrt[-((I - Sqrt[3])/(I + Sqr
t[3]))]*x)/Sqrt[1 - x^2]]/Sqrt[3] + ((3*I + Sqrt[3])*ArcTan[(Sqrt[-((I - S
qrt[3])/(I + Sqrt[3]))]*x)/Sqrt[1 - x^2]])/6 + Log[1 - x^2 + x^4]/4)/2
```

3.13. $\int \frac{x \arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}dx$

3.13.3.1 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 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 5730
```
Int[((a_.) + ArcTan[u_]*(b_.))*(v_), x_Symbol] :> With[{w = IntHide[v, x]},
 Simp[(a + b*ArcTan[u])   w, x] - Simp[b   Int[SimplifyIntegrand[w*(D[u, x]
/(1 + u^2)), x], x], x] /; InverseFunctionFreeQ[w, x]] /; FreeQ[{a, b}, x]
&& InverseFunctionFreeQ[u, x] &&  !MatchQ[v, ((c_.) + (d_.)*x)^(m_.) /; Fre
eQ[{c, d, m}, x]] && FalseQ[FunctionOfLinear[v*(a + b*ArcTan[u]), x]]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

3.13.4 Maple [F]

$$\int \frac{x \arctan\left(x+\sqrt{-x^2+1}\right)}{\sqrt{-x^2+1}}dx$$

input
```
int(x*arctan(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x)
```

output
```
int(x*arctan(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x)
```

3.13.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 200, normalized size of antiderivative = 1.32

$$\int \frac{x\arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = -\frac{1}{4}\sqrt{3}\arctan\left(\frac{1}{3}\sqrt{3}(2x^2-1)\right) - \sqrt{-x^2+1}\arctan\left(x+\sqrt{-x^2+1}\right) - \frac{1}{8}\sqrt{3}\arctan\left(\frac{4\sqrt{3}\sqrt{-x^2+1}x+\sqrt{3}}{3(2x^2-1)}\right) - \frac{1}{8}\sqrt{3}\arctan\left(\frac{4\sqrt{3}\sqrt{-x^2+1}x-\sqrt{3}}{3(2x^2-1)}\right) + \frac{1}{2}\arctan\left(\frac{\sqrt{-x^2+1}x}{x^2-1}\right) + \frac{1}{8}\log\left(x^4-x^2+1\right) + \frac{1}{16}\log\left(-x^4+x^2+2\sqrt{-x^2+1}x+1\right) - \frac{1}{16}\log\left(-x^4+x^2-2\sqrt{-x^2+1}x+1\right)$$

input
```
integrate(x*arctan(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-1/4*sqrt(3)*arctan(1/3*sqrt(3)*(2*x^2 - 1)) - sqrt(-x^2 + 1)*arctan(x + s
qrt(-x^2 + 1)) - 1/8*sqrt(3)*arctan(1/3*(4*sqrt(3)*sqrt(-x^2 + 1)*x + sqrt
(3))/(2*x^2 - 1)) - 1/8*sqrt(3)*arctan(1/3*(4*sqrt(3)*sqrt(-x^2 + 1)*x - s
qrt(3))/(2*x^2 - 1)) + 1/2*arctan(sqrt(-x^2 + 1)*x/(x^2 - 1)) + 1/8*log(x^
4 - x^2 + 1) + 1/16*log(-x^4 + x^2 + 2*sqrt(-x^2 + 1)*x + 1) - 1/16*log(-x
^4 + x^2 - 2*sqrt(-x^2 + 1)*x + 1)
```

3.13.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x\arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = \text{Timed out}$$

input
```
integrate(x*atan(x+(-x**2+1)**(1/2))/(-x**2+1)**(1/2),x)
```

output
```
Timed out
```

3.13.7 Maxima [F]

$$\int \frac{x \arctan \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = \int \frac{x \arctan \left(x+\sqrt{-x^2+1}\right)}{\sqrt{-x^2+1}}\,dx$$

input
```
integrate(x*arctan(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(x + 1)*sqrt(-x + 1)*arctan(x + sqrt(x + 1)*sqrt(-x + 1)) - integrate
(x/(x^2 + 2*x*e^(1/2*log(x + 1) + 1/2*log(-x + 1)) + e^(log(x + 1) + log(-
x + 1)) + 1), x)
```

3.13.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 373 vs. $2(119) = 238$.

Time = 0.34 (sec) , antiderivative size = 373, normalized size of antiderivative = 2.45

$$\int \frac{x\arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx$$
$$= -\frac{1}{4}\,\pi\mathrm{sgn}(x)+\frac{1}{8}\,\sqrt{3}\left(\pi\mathrm{sgn}(x)+2\,\arctan\left(-\frac{\sqrt{3}x\left(\frac{\sqrt{-x^2+1}-1}{x}+\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-1\right)}{3\left(\sqrt{-x^2+1}-1\right)}\right)\right)$$
$$+\frac{1}{8}\,\sqrt{3}\left(\pi\mathrm{sgn}(x)+2\,\arctan\left(\frac{\sqrt{3}x\left(\frac{\sqrt{-x^2+1}-1}{x}-\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}+1\right)}{3\left(\sqrt{-x^2+1}-1\right)}\right)\right)$$
$$-\frac{1}{4}\,\sqrt{3}\arctan\left(\frac{1}{3}\,\sqrt{3}(2\,x^2-1)\right)-\sqrt{-x^2+1}\arctan\left(x+\sqrt{-x^2+1}\right)$$
$$-\frac{1}{2}\,\arctan\left(-\frac{x\left(\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-1\right)}{2\left(\sqrt{-x^2+1}-1\right)}\right)+\frac{1}{8}\,\log\left(x^4-x^2+1\right)$$
$$-\frac{1}{8}\,\log\left(\left(\frac{x}{\sqrt{-x^2+1}-1}-\frac{\sqrt{-x^2+1}-1}{x}\right)^2+\frac{2\,x}{\sqrt{-x^2+1}-1}-\frac{2\left(\sqrt{-x^2+1}-1\right)}{x}\right.$$
$$\left.+4\right)+\frac{1}{8}\,\log\left(\left(\frac{x}{\sqrt{-x^2+1}-1}-\frac{\sqrt{-x^2+1}-1}{x}\right)^2-\frac{2\,x}{\sqrt{-x^2+1}-1}\right.$$
$$\left.+\frac{2\left(\sqrt{-x^2+1}-1\right)}{x}+4\right)$$

input
```
integrate(x*arctan(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="giac")
```

3.13. $\int \frac{x\arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx$

output
```
-1/4*pi*sgn(x) + 1/8*sqrt(3)*(pi*sgn(x) + 2*arctan(-1/3*sqrt(3)*x*((sqrt(-
x^2 + 1) - 1)/x + (sqrt(-x^2 + 1) - 1)^2/x^2 - 1)/(sqrt(-x^2 + 1) - 1))) +
 1/8*sqrt(3)*(pi*sgn(x) + 2*arctan(1/3*sqrt(3)*x*((sqrt(-x^2 + 1) - 1)/x -
 (sqrt(-x^2 + 1) - 1)^2/x^2 + 1)/(sqrt(-x^2 + 1) - 1))) - 1/4*sqrt(3)*arct
an(1/3*sqrt(3)*(2*x^2 - 1)) - sqrt(-x^2 + 1)*arctan(x + sqrt(-x^2 + 1)) -
1/2*arctan(-1/2*x*((sqrt(-x^2 + 1) - 1)^2/x^2 - 1)/(sqrt(-x^2 + 1) - 1)) +
 1/8*log(x^4 - x^2 + 1) - 1/8*log((x/(sqrt(-x^2 + 1) - 1) - (sqrt(-x^2 + 1
) - 1)/x)^2 + 2*x/(sqrt(-x^2 + 1) - 1) - 2*(sqrt(-x^2 + 1) - 1)/x + 4) + 1
/8*log((x/(sqrt(-x^2 + 1) - 1) - (sqrt(-x^2 + 1) - 1)/x)^2 - 2*x/(sqrt(-x^
2 + 1) - 1) + 2*(sqrt(-x^2 + 1) - 1)/x + 4)
```

3.13.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x \arctan\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = \int \frac{x\,\mathrm{atan}\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx$$

input
```
int((x*atan(x + (1 - x^2)^(1/2)))/(1 - x^2)^(1/2),x)
```

output
```
int((x*atan(x + (1 - x^2)^(1/2)))/(1 - x^2)^(1/2), x)
```

3.14 $\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx$

3.14.1 Optimal result

Integrand size = 18, antiderivative size = 45

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = -\frac{x\arcsin(x)}{1+\sqrt{1-x^2}}+\frac{\arcsin(x)^2}{2}-\log\left(1+\sqrt{1-x^2}\right)$$

output
```
1/2*arcsin(x)^2-ln(1+(-x^2+1)^(1/2))-x*arcsin(x)/(1+(-x^2+1)^(1/2))
```

3.14.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 44, normalized size of antiderivative = 0.98

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = \frac{\left(-1+\sqrt{1-x^2}\right)\arcsin(x)}{x}+\frac{\arcsin(x)^2}{2}-\log\left(1+\sqrt{1-x^2}\right)$$

input
```
Integrate[ArcSin[x]/(1 + Sqrt[1 - x^2]),x]
```

output
```
((-1 + Sqrt[1 - x^2])*ArcSin[x])/x + ArcSin[x]^2/2 - Log[1 + Sqrt[1 - x^2]
]
```

3.14.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 51, normalized size of antiderivative = 1.13, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.111, Rules used = {5290, 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.

$$\int \frac{\arcsin(x)}{\sqrt{1-x^2}+1} \, dx$$

$$\Big\downarrow \text{5290}$$

$$\int \left(\frac{\arcsin(x)}{x^2}-\frac{\sqrt{1-x^2}\arcsin(x)}{x^2}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{\sqrt{1-x^2}\arcsin(x)}{x}+\frac{\arcsin(x)^2}{2}-\frac{\arcsin(x)}{x}-\text{arctanh}\left(\sqrt{1-x^2}\right)-\log(x)$$

input
```
Int[ArcSin[x]/(1 + Sqrt[1 - x^2]),x]
```

output
```
-(ArcSin[x]/x) + (Sqrt[1 - x^2]*ArcSin[x])/x + ArcSin[x]^2/2 - ArcTanh[Sqr
t[1 - x^2]] - Log[x]
```

3.14.3.1 Defintions of rubi rules used

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

rule 5290
```
Int[((a_.) + ArcSin[(c_.)*(x_)]*(b_.))^(n_.)*(Px_.)*((f_) + (g_.)*((d_) + (
e_.)*(x_)^2)^(p_))^(m_.), x_Symbol] :> With[{u = ExpandIntegrand[Px*(f + g*
(d + e*x^2)^p)^m*(a + b*ArcSin[c*x])^n, x]}, Int[u, x] /; SumQ[u]] /; FreeQ
[{a, b, c, d, e, f, g}, x] && PolynomialQ[Px, x] && EqQ[c^2*d + e, 0] && IG
tQ[p + 1/2, 0] && IntegersQ[m, n]
```

3.14.4 Maple [F]

$$\int \frac{\arcsin(x)}{1+\sqrt{-x^2+1}}dx$$

input
```
int(arcsin(x)/(1+(-x^2+1)^(1/2)),x)
```

output
```
int(arcsin(x)/(1+(-x^2+1)^(1/2)),x)
```

3.14.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.40

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = \frac{x\arcsin(x)^2 - 2\,x\log(x) - x\log\left(\sqrt{-x^2+1}+1\right) + x\log\left(\sqrt{-x^2+1}-1\right) + 2\sqrt{-x^2+1}\arcsin(x) - 2\,a}{2\,x}$$

input
```
integrate(arcsin(x)/(1+(-x^2+1)^(1/2)),x, algorithm="fricas")
```

output
```
1/2*(x*arcsin(x)^2 - 2*x*log(x) - x*log(sqrt(-x^2 + 1) + 1) + x*log(sqrt(-
x^2 + 1) - 1) + 2*sqrt(-x^2 + 1)*arcsin(x) - 2*arcsin(x))/x
```

3.14.6 Sympy [F]

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = \int \frac{\operatorname{asin}(x)}{\sqrt{1-x^2}+1}\,dx$$

input
```
integrate(asin(x)/(1+(-x**2+1)**(1/2)),x)
```

output
```
Integral(asin(x)/(sqrt(1 - x**2) + 1), x)
```

3.14.7 Maxima [F]

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = \int \frac{\arcsin(x)}{\sqrt{-x^2+1}+1}\,dx$$

input
```
integrate(arcsin(x)/(1+(-x^2+1)^(1/2)),x, algorithm="maxima")
```

output
```
integrate(arcsin(x)/(sqrt(-x^2 + 1) + 1), x)
```

3.14.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 57, normalized size of antiderivative = 1.27

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = \frac{1}{2}\arcsin(x)^2 - \frac{x\arcsin(x)}{\sqrt{-x^2+1}+1} - 2\log(2) + \log\left(2\sqrt{-x^2+1}+2\right) - 2\log\left(\sqrt{-x^2+1}+1\right)$$

input
```
integrate(arcsin(x)/(1+(-x^2+1)^(1/2)),x, algorithm="giac")
```

output
```
1/2*arcsin(x)^2 - x*arcsin(x)/(sqrt(-x^2 + 1) + 1) - 2*log(2) + log(2*sqrt
(-x^2 + 1) + 2) - 2*log(sqrt(-x^2 + 1) + 1)
```

3.14.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\arcsin(x)}{1+\sqrt{1-x^2}}\,dx = \int \frac{\mathrm{asin}(x)}{\sqrt{1-x^2}+1}\,dx$$

input
```
int(asin(x)/((1 - x^2)^(1/2) + 1),x)
```

output
```
int(asin(x)/((1 - x^2)^(1/2) + 1), x)
```

3.15 $\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{(1-x^2)^{3/2}}\,dx$

3.15.1 Optimal result

Integrand size = 24, antiderivative size = 34

$$\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{(1-x^2)^{3/2}}\,dx = -\frac{1}{2}\arcsin\left(x^2\right) + \frac{x\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1-x^2}}$$

output
```
-1/2*arcsin(x^2)+x*ln(x+(x^2+1)^(1/2))/(-x^2+1)^(1/2)
```

3.15.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 76 vs. 2(34) = 68.

Time = 0.07 (sec) , antiderivative size = 76, normalized size of antiderivative = 2.24

$$\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{(1-x^2)^{3/2}}\,dx = \sqrt{1-x^2}\left(\frac{\sqrt{1+x^2}\arctan\left(\frac{\sqrt{1-x^4}}{1+x^2}\right)}{\sqrt{1-x^4}} - \frac{x\log\left(x+\sqrt{1+x^2}\right)}{-1+x^2}\right)$$

input
```
Integrate[Log[x + Sqrt[1 + x^2]]/(1 - x^2)^(3/2),x]
```

output
```
Sqrt[1 - x^2]*((Sqrt[1 + x^2]*ArcTan[Sqrt[1 - x^4]/(1 + x^2)])/Sqrt[1 - x^
4] - (x*Log[x + Sqrt[1 + x^2]])/(-1 + x^2))
```

3.15.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.125, Rules used = {3034, 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.

$$\int \frac{\log\left(\sqrt{x^2+1}+x\right)}{(1-x^2)^{3/2}}dx$$

$$\Big\downarrow \text{3034}$$

$$\frac{x\log\left(\sqrt{x^2+1}+x\right)}{\sqrt{1-x^2}}-\int \frac{x}{\sqrt{1-x^4}}dx$$

$$\Big\downarrow \text{807}$$

$$\frac{x\log\left(\sqrt{x^2+1}+x\right)}{\sqrt{1-x^2}}-\frac{1}{2}\int \frac{1}{\sqrt{1-x^4}}dx^2$$

$$\Big\downarrow \text{223}$$

$$\frac{x\log\left(\sqrt{x^2+1}+x\right)}{\sqrt{1-x^2}}-\frac{\arcsin\left(x^2\right)}{2}$$

input
```
Int[Log[x + Sqrt[1 + x^2]]/(1 - x^2)^(3/2),x]
```

output
```
-1/2*ArcSin[x^2] + (x*Log[x + Sqrt[1 + x^2]])/Sqrt[1 - x^2]
```

3.15.3.1 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 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

3.15.4 Maple [F]

$$\int \frac{\ln \left(x+\sqrt{x^2+1}\right)}{\left(-x^2+1\right)^{\frac{3}{2}}} dx$$

input
```
int(ln(x+(x^2+1)^(1/2))/(-x^2+1)^(3/2),x)
```

output
```
int(ln(x+(x^2+1)^(1/2))/(-x^2+1)^(3/2),x)
```

3.15.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 62 vs. $2(28) = 56$.

Time = 0.28 (sec) , antiderivative size = 62, normalized size of antiderivative = 1.82

$$\int \frac{\log \left(x+\sqrt{1+x^2}\right)}{\left(1-x^2\right)^{3/2}} dx = -\frac{\sqrt{-x^2+1}x \log \left(x+\sqrt{x^2+1}\right) - \left(x^2-1\right) \arctan \left(\frac{\sqrt{x^2+1}\sqrt{-x^2+1}-1}{x^2}\right)}{x^2-1}$$

input
```
integrate(log(x+(x^2+1)^(1/2))/(-x^2+1)^(3/2),x, algorithm="fricas")
```

output
```
-(sqrt(-x^2 + 1)*x*log(x + sqrt(x^2 + 1)) - (x^2 - 1)*arctan((sqrt(x^2 + 1
)*sqrt(-x^2 + 1) - 1)/x^2))/(x^2 - 1)
```

3.15.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\log \left(x+\sqrt{1+x^2}\right)}{\left(1-x^2\right)^{3/2}} dx = \text{Timed out}$$

input
```
integrate(ln(x+(x**2+1)**(1/2))/(-x**2+1)**(3/2),x)
```

output
```
Timed out
```

3.15.7 Maxima [F]

$$\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{(1-x^2)^{3/2}}\,dx = \int \frac{\log\left(x+\sqrt{x^2+1}\right)}{(-x^2+1)^{\frac{3}{2}}}\,dx$$

input
```
integrate(log(x+(x^2+1)^(1/2))/(-x^2+1)^(3/2),x, algorithm="maxima")
```

output
```
integrate(log(x + sqrt(x^2 + 1))/(-x^2 + 1)^(3/2), x)
```

3.15.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 36, normalized size of antiderivative = 1.06

$$\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{(1-x^2)^{3/2}}\,dx = -\frac{\sqrt{-x^2+1}x\log\left(x+\sqrt{x^2+1}\right)}{x^2-1} - \frac{1}{2}\arcsin\left(x^2\right)$$

input
```
integrate(log(x+(x^2+1)^(1/2))/(-x^2+1)^(3/2),x, algorithm="giac")
```

output
```
-sqrt(-x^2 + 1)*x*log(x + sqrt(x^2 + 1))/(x^2 - 1) - 1/2*arcsin(x^2)
```

3.15.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\log\left(x+\sqrt{1+x^2}\right)}{(1-x^2)^{3/2}}\,dx = \int \frac{\ln\left(x+\sqrt{x^2+1}\right)}{(1-x^2)^{3/2}}\,dx$$

input
```
int(log(x + (x^2 + 1)^(1/2))/(1 - x^2)^(3/2),x)
```

output
```
int(log(x + (x^2 + 1)^(1/2))/(1 - x^2)^(3/2), x)
```

3.16 $\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx$

3.16.1 Optimal result

Integrand size = 12, antiderivative size = 22

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx=\frac{x\arcsin(x)}{\sqrt{1+x^2}}-\frac{\arcsin(x^2)}{2}$$

output
```
-1/2*arcsin(x^2)+x*arcsin(x)/(x^2+1)^(1/2)
```

3.16.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.00

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx=\frac{x\arcsin(x)}{\sqrt{1+x^2}}-\frac{\arcsin(x^2)}{2}$$

input
```
Integrate[ArcSin[x]/(1 + x^2)^(3/2),x]
```

output
```
(x*ArcSin[x])/Sqrt[1 + x^2] - ArcSin[x^2]/2
```

3.16.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 22, 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 = {5170, 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.

$$\int \frac{\arcsin(x)}{(x^2+1)^{3/2}}\,dx$$
$$\Big\downarrow \text{ 5170}$$
$$\frac{x\arcsin(x)}{\sqrt{x^2+1}}-\int \frac{x}{\sqrt{1-x^4}}dx$$
$$\Big\downarrow \text{ 807}$$
$$\frac{x\arcsin(x)}{\sqrt{x^2+1}}-\frac{1}{2}\int \frac{1}{\sqrt{1-x^4}}dx^2$$
$$\Big\downarrow \text{ 223}$$
$$\frac{x\arcsin(x)}{\sqrt{x^2+1}}-\frac{\arcsin\left(x^2\right)}{2}$$

input
```
Int[ArcSin[x]/(1 + x^2)^(3/2),x]
```

output
```
(x*ArcSin[x])/Sqrt[1 + x^2] - ArcSin[x^2]/2
```

3.16.3.1 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 5170
```
Int[((a_.) + ArcSin[(c_.)*(x_)]*(b_.))*((d_) + (e_.)*(x_)^2)^(p_.), x_Symbo
l] :> With[{u = IntHide[(d + e*x^2)^p, x]}, Simp[(a + b*ArcSin[c*x])   u, x
] - Simp[b*c   Int[SimplifyIntegrand[u/Sqrt[1 - c^2*x^2], x], x], x]] /; Fr
eeQ[{a, b, c, d, e}, x] && NeQ[c^2*d + e, 0] && (IGtQ[p, 0] || ILtQ[p + 1/2
, 0])
```

3.16.4 Maple [F]

$$\int \frac{\arcsin(x)}{(x^2+1)^{\frac{3}{2}}}dx$$

input
```
int(arcsin(x)/(x^2+1)^(3/2),x)
```

output
```
int(arcsin(x)/(x^2+1)^(3/2),x)
```

3.16.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 56 vs. $2(18) = 36$.

Time = 0.28 (sec) , antiderivative size = 56, normalized size of antiderivative = 2.55

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx = \frac{2\sqrt{x^2+1}x\arcsin(x) + (x^2+1)\arctan\left(\frac{\sqrt{x^2+1}\sqrt{-x^2+1}x^2}{x^4-1}\right)}{2(x^2+1)}$$

input
```
integrate(arcsin(x)/(x^2+1)^(3/2),x, algorithm="fricas")
```

output
```
1/2*(2*sqrt(x^2 + 1)*x*arcsin(x) + (x^2 + 1)*arctan(sqrt(x^2 + 1)*sqrt(-x^
2 + 1)*x^2/(x^4 - 1)))/(x^2 + 1)
```

3.16.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 20.25 (sec) , antiderivative size = 78, normalized size of antiderivative = 3.55

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx = \frac{x\,\mathrm{asin}\,(x)}{\sqrt{x^2+1}} + \frac{iG_{6,6}^{6,2}\left(\begin{matrix} \frac{1}{4},\frac{3}{4} & \frac{1}{2},\frac{1}{2},1,1 \\ 0,\frac{1}{4},\frac{1}{2},\frac{3}{4},1,0 & \end{matrix}\middle|\frac{1}{x^4}\right)}{8\pi^{\frac{3}{2}}} - \frac{G_{6,6}^{2,6}\left(\begin{matrix} -\frac{1}{2},-\frac{1}{4},0,\frac{1}{4},\frac{1}{2},1 & \\ -\frac{1}{4},\frac{1}{4} & -\frac{1}{2},0,0,0 \end{matrix}\middle|\frac{e^{-2i\pi}}{x^4}\right)}{8\pi^{\frac{3}{2}}}$$

input
```
integrate(asin(x)/(x**2+1)**(3/2),x)
```

output
```
x*asin(x)/sqrt(x**2 + 1) + I*meijerg(((1/4, 3/4), (1/2, 1/2, 1, 1)), ((0,
1/4, 1/2, 3/4, 1, 0), ()), x**(-4))/(8*pi**(3/2)) - meijerg(((-1/2, -1/4,
0, 1/4, 1/2, 1), ()), ((-1/4, 1/4), (-1/2, 0, 0, 0)), exp_polar(-2*I*pi)/x
**4)/(8*pi**(3/2))
```

3.16.7 Maxima [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 18, normalized size of antiderivative = 0.82

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx = \frac{x\arcsin(x)}{\sqrt{x^2+1}} - \frac{1}{2}\arcsin\left(x^2\right)$$

input
```
integrate(arcsin(x)/(x^2+1)^(3/2),x, algorithm="maxima")
```

output
```
x*arcsin(x)/sqrt(x^2 + 1) - 1/2*arcsin(x^2)
```

3.16.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 18, normalized size of antiderivative = 0.82

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx = \frac{x\arcsin(x)}{\sqrt{x^2+1}} - \frac{1}{2}\arcsin(x^2)$$

input
```
integrate(arcsin(x)/(x^2+1)^(3/2),x, algorithm="giac")
```

output
```
x*arcsin(x)/sqrt(x^2 + 1) - 1/2*arcsin(x^2)
```

3.16.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\arcsin(x)}{(1+x^2)^{3/2}}\,dx = \int \frac{\mathrm{asin}(x)}{(x^2+1)^{3/2}}\,dx$$

input
```
int(asin(x)/(x^2 + 1)^(3/2),x)
```

output
```
int(asin(x)/(x^2 + 1)^(3/2), x)
```

3.17 $\int \frac{\log\left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}}\,dx$

3.17.1 Optimal result

Integrand size = 22, antiderivative size = 32

$$\int \frac{\log\left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}}\,dx=-\frac{1}{2}\text{arccosh}\left(x^2\right)+\frac{x\log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{1+x^2}}$$

output
```
-1/2*arccosh(x^2)+x*ln(x+(x^2-1)^(1/2))/(x^2+1)^(1/2)
```

3.17.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 89 vs. 2(32) = 64.

Time = 0.05 (sec) , antiderivative size = 89, normalized size of antiderivative = 2.78

$$\int \frac{\log\left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}}\,dx=\frac{4x\log\left(x+\sqrt{-1+x^2}\right)+\frac{\sqrt{-1+x^2}\left(1+x^2\right)\left(\log\left(1-\frac{x^2}{\sqrt{-1+x^4}}\right)-\log\left(1+\frac{x^2}{\sqrt{-1+x^4}}\right)\right)}{\sqrt{-1+x^4}}}{4\sqrt{1+x^2}}$$

input
```
Integrate[Log[x + Sqrt[-1 + x^2]]/(1 + x^2)^(3/2),x]
```

output
```
(4*x*Log[x + Sqrt[-1 + x^2]] + (Sqrt[-1 + x^2]*(1 + x^2)*(Log[1 - x^2/Sqrt
[-1 + x^4]] - Log[1 + x^2/Sqrt[-1 + x^4]]))/Sqrt[-1 + x^4])/(4*Sqrt[1 + x^
2])
```

3.17.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.136$, Rules used = {3034, 338, 43}

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.

$$\int \frac{\log\left(\sqrt{x^2-1}+x\right)}{(x^2+1)^{3/2}}dx$$

$$\Big\downarrow \text{3034}$$

$$\frac{x\log\left(\sqrt{x^2-1}+x\right)}{\sqrt{x^2+1}}-\int \frac{x}{\sqrt{x^2-1}\sqrt{x^2+1}}dx$$

$$\Big\downarrow \text{338}$$

$$\frac{x\log\left(\sqrt{x^2-1}+x\right)}{\sqrt{x^2+1}}-\frac{1}{2}\int \frac{1}{\sqrt{x^2-1}\sqrt{x^2+1}}dx^2$$

$$\Big\downarrow \text{43}$$

$$\frac{x\log\left(\sqrt{x^2-1}+x\right)}{\sqrt{x^2+1}}-\frac{\operatorname{arccosh}(x^2)}{2}$$

input
```
Int[Log[x + Sqrt[-1 + x^2]]/(1 + x^2)^(3/2),x]
```

output
```
-1/2*ArcCosh[x^2] + (x*Log[x + Sqrt[-1 + x^2]])/Sqrt[1 + x^2]
```

3.17.3.1 Defintions of rubi rules used

rule 43
```
Int[1/(Sqrt[(a_) + (b_.)*(x_)]*Sqrt[(c_) + (d_.)*(x_)]), x_Symbol] :> Simp[
ArcCosh[b*(x/a)]/(b*Sqrt[d/b]), x] /; FreeQ[{a, b, c, d}, x] && EqQ[b*c + a
*d, 0] && GtQ[a, 0] && GtQ[d/b, 0]
```

rule 338
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_)*((c_) + (d_.)*(x_)^2)^(p_), x_Sym
bol] :> Simp[1/2   Subst[Int[x^((m - 1)/2)*(a + b*x)^p*(c + d*x)^p, x], x,
x^2], x] /; FreeQ[{a, b, c, d, p}, x] && EqQ[b*c + a*d, 0] && IntegerQ[(m -
 1)/2]
```

rule 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

3.17.4 Maple [F]

$$\int \frac{\ln \left(x+\sqrt{x^{2}-1}\right)}{\left(x^{2}+1\right)^{\frac{3}{2}}}dx$$

input
```
int(ln(x+(x^2-1)^(1/2))/(x^2+1)^(3/2),x)
```

output
```
int(ln(x+(x^2-1)^(1/2))/(x^2+1)^(3/2),x)
```

3.17.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 58 vs. $2(26) = 52$.

Time = 0.26 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.81

$$\int \frac{\log \left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}} \, dx = \frac{2 \sqrt{x^{2}+1}x \log \left(x+\sqrt{x^{2}-1}\right)+\left(x^{2}+1\right) \log \left(-x^{2}+\sqrt{x^{2}+1}\sqrt{x^{2}-1}\right)}{2 \left(x^{2}+1\right)}$$

input
```
integrate(log(x+(x^2-1)^(1/2))/(x^2+1)^(3/2),x, algorithm="fricas")
```

output
```
1/2*(2*sqrt(x^2 + 1)*x*log(x + sqrt(x^2 - 1)) + (x^2 + 1)*log(-x^2 + sqrt(
x^2 + 1)*sqrt(x^2 - 1)))/(x^2 + 1)
```

3.17.6 Sympy [F]

$$\int \frac{\log \left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}} \, dx = \int \frac{\log \left(x+\sqrt{x^{2}-1}\right)}{\left(x^{2}+1\right)^{\frac{3}{2}}}\, dx$$

input
```
integrate(ln(x+(x**2-1)**(1/2))/(x**2+1)**(3/2),x)
```

output
```
Integral(log(x + sqrt(x**2 - 1))/(x**2 + 1)**(3/2), x)
```

3.17.7 Maxima [F]

$$\int \frac{\log \left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}}\,dx=\int \frac{\log \left(x+\sqrt{x^2-1}\right)}{\left(x^2+1\right)^{\frac{3}{2}}}\,dx$$

input
```
integrate(log(x+(x^2-1)^(1/2))/(x^2+1)^(3/2),x, algorithm="maxima")
```

output
```
integrate(log(x + sqrt(x^2 - 1))/(x^2 + 1)^(3/2), x)
```

3.17.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 36, normalized size of antiderivative = 1.12

$$\int \frac{\log \left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}}\,dx=\frac{x\log \left(x+\sqrt{x^2-1}\right)}{\sqrt{x^2+1}}+\frac{1}{2}\log \left(x^2-\sqrt{x^4-1}\right)$$

input
```
integrate(log(x+(x^2-1)^(1/2))/(x^2+1)^(3/2),x, algorithm="giac")
```

output
```
x*log(x + sqrt(x^2 - 1))/sqrt(x^2 + 1) + 1/2*log(x^2 - sqrt(x^4 - 1))
```

3.17.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\log \left(x+\sqrt{-1+x^2}\right)}{\left(1+x^2\right)^{3/2}}\,dx=\int \frac{\ln \left(x+\sqrt{x^2-1}\right)}{\left(x^2+1\right)^{3/2}}\,dx$$

input
```
int(log(x + (x^2 - 1)^(1/2))/(x^2 + 1)^(3/2),x)
```

output
```
int(log(x + (x^2 - 1)^(1/2))/(x^2 + 1)^(3/2), x)
```

3.18 $\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx$

3.18.1 Optimal result

Integrand size = 15, antiderivative size = 43

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx = \frac{\sqrt{-1+x^2}}{x} - \operatorname{arctanh}\left(\frac{x}{\sqrt{-1+x^2}}\right) + \frac{\sqrt{-1+x^2}\log(x)}{x}$$

output
```
-arctanh(x/(x^2-1)^(1/2))+(x^2-1)^(1/2)/x+ln(x)*(x^2-1)^(1/2)/x
```

3.18.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 43, normalized size of antiderivative = 1.00

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx = \frac{\sqrt{-1+x^2}}{x} + \frac{\sqrt{-1+x^2}\log(x)}{x} - \log\left(x+\sqrt{-1+x^2}\right)$$

input
```
Integrate[Log[x]/(x^2*Sqrt[-1 + x^2]),x]
```

output
```
Sqrt[-1 + x^2]/x + (Sqrt[-1 + x^2]*Log[x])/x - Log[x + Sqrt[-1 + x^2]]
```

3.18.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 43, 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 = {2773, 247, 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.

$$\int \frac{\log(x)}{x^2\sqrt{x^2-1}}dx$$

$$\Big\downarrow \text{ 2773}$$

$$\frac{\sqrt{x^2-1}\log(x)}{x}-\int \frac{\sqrt{x^2-1}}{x^2}dx$$

$$\Big\downarrow \text{ 247}$$

$$-\int \frac{1}{\sqrt{x^2-1}}dx+\frac{\sqrt{x^2-1}}{x}+\frac{\sqrt{x^2-1}\log(x)}{x}$$

$$\Big\downarrow \text{ 224}$$

$$-\int \frac{1}{1-\frac{x^2}{x^2-1}}d\frac{x}{\sqrt{x^2-1}}+\frac{\sqrt{x^2-1}}{x}+\frac{\sqrt{x^2-1}\log(x)}{x}$$

$$\Big\downarrow \text{ 219}$$

$$-\text{arctanh}\left(\frac{x}{\sqrt{x^2-1}}\right)+\frac{\sqrt{x^2-1}}{x}+\frac{\sqrt{x^2-1}\log(x)}{x}$$

input
```
Int[Log[x]/(x^2*Sqrt[-1 + x^2]),x]
```

output
```
Sqrt[-1 + x^2]/x - ArcTanh[x/Sqrt[-1 + x^2]] + (Sqrt[-1 + x^2]*Log[x])/x
```

3.18.3.1 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 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 2773
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*((f_.)*(x_))^(m_.)*((d_) + (e_.)*
(x_)^(r_.))^(q_), x_Symbol] :> Simp[(f*x)^(m + 1)*(d + e*x^r)^(q + 1)*((a +
 b*Log[c*x^n])/(d*f*(m + 1))), x] - Simp[b*(n/(d*(m + 1)))   Int[(f*x)^m*(d
 + e*x^r)^(q + 1), x], x] /; FreeQ[{a, b, c, d, e, f, m, n, q, r}, x] && Eq
Q[m + r*(q + 1) + 1, 0] && NeQ[m, -1]
```

3.18.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.08 (sec) , antiderivative size = 89, normalized size of antiderivative = 2.07

method	result	size
meijerg	$-\frac{\sqrt{-\operatorname{signum}(x^2-1)}\,\arcsin(x)}{\sqrt{\operatorname{signum}(x^2-1)}}+\frac{-\frac{\sqrt{-\operatorname{signum}\left(x^2-1\right)}\,\sqrt{-x^2+1}}{\sqrt{\operatorname{signum}\left(x^2-1\right)}}-\frac{\sqrt{-\operatorname{signum}\left(x^2-1\right)}\,\ln(x)\sqrt{-x^2+1}}{\sqrt{\operatorname{signum}\left(x^2-1\right)}}}{x}$	89

input
```
int(ln(x)/x^2/(x^2-1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-1/signum(x^2-1)^(1/2)*(-signum(x^2-1))^(1/2)*arcsin(x)+(-1/signum(x^2-1)^
(1/2)*(-signum(x^2-1))^(1/2)*(-x^2+1)^(1/2)-1/signum(x^2-1)^(1/2)*(-signum
(x^2-1))^(1/2)*ln(x)*(-x^2+1)^(1/2))/x
```

3.18.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 32, normalized size of antiderivative = 0.74

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx=\frac{x\log\left(-x+\sqrt{x^2-1}\right)+\sqrt{x^2-1}(\log(x)+1)+x}{x}$$

input
```
integrate(log(x)/x^2/(x^2-1)^(1/2),x, algorithm="fricas")
```

output
```
(x*log(-x + sqrt(x^2 - 1)) + sqrt(x^2 - 1)*(log(x) + 1) + x)/x
```

3.18.6 Sympy [A] (verification not implemented)

Time = 2.69 (sec) , antiderivative size = 42, normalized size of antiderivative = 0.98

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx = \left(\begin{cases} \frac{\sqrt{x^2-1}}{x} & \text{for } x > -1 \wedge x < 1 \end{cases}\right)\log(x) - \begin{cases} \text{NaN} & \text{for } x < -1 \\ \log\left(x+\sqrt{x^2-1}\right) - \frac{\sqrt{x^2-1}}{x} & \text{for } x < 1 \\ \text{NaN} & \text{otherwise} \end{cases}$$

input
```
integrate(ln(x)/x**2/(x**2-1)**(1/2),x)
```

output
```
Piecewise((sqrt(x**2 - 1)/x, (x > -1) & (x < 1)))*log(x) - Piecewise((nan,
 x < -1), (log(x + sqrt(x**2 - 1)) - sqrt(x**2 - 1)/x, x < 1), (nan, True)
)
```

3.18.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 41, normalized size of antiderivative = 0.95

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx = \frac{\sqrt{x^2-1}\log(x)}{x} + \frac{\sqrt{x^2-1}}{x} - \log\left(2x+2\sqrt{x^2-1}\right)$$

input
```
integrate(log(x)/x^2/(x^2-1)^(1/2),x, algorithm="maxima")
```

output
```
sqrt(x^2 - 1)*log(x)/x + sqrt(x^2 - 1)/x - log(2*x + 2*sqrt(x^2 - 1))
```

3.18.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 62, normalized size of antiderivative = 1.44

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx = \frac{2\log(x)}{\left(x-\sqrt{x^2-1}\right)^2+1} + \frac{2}{\left(x-\sqrt{x^2-1}\right)^2+1} + \frac{1}{2}\log\left(\left(x-\sqrt{x^2-1}\right)^2\right) - \log(|x|)$$

input
```
integrate(log(x)/x^2/(x^2-1)^(1/2),x, algorithm="giac")
```

output
```
2*log(x)/((x - sqrt(x^2 - 1))^2 + 1) + 2/((x - sqrt(x^2 - 1))^2 + 1) + 1/2
*log((x - sqrt(x^2 - 1))^2) - log(abs(x))
```

3.18.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\log(x)}{x^2\sqrt{-1+x^2}}\,dx = \int \frac{\ln(x)}{x^2\,\sqrt{x^2-1}}\,dx$$

input
```
int(log(x)/(x^2*(x^2 - 1)^(1/2)),x)
```

output
```
int(log(x)/(x^2*(x^2 - 1)^(1/2)), x)
```

3.19 $\int \frac{\sqrt{1+x^3}}{x} \, dx$

3.19.1 Optimal result

Integrand size = 13, antiderivative size = 28

$$\int \frac{\sqrt{1+x^3}}{x} \, dx = \frac{2\sqrt{1+x^3}}{3} - \frac{2}{3}\text{arctanh}\left(\sqrt{1+x^3}\right)$$

output
```
-2/3*arctanh((x^3+1)^(1/2))+2/3*(x^3+1)^(1/2)
```

3.19.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 28, normalized size of antiderivative = 1.00

$$\int \frac{\sqrt{1+x^3}}{x} \, dx = \frac{2\sqrt{1+x^3}}{3} - \frac{2}{3}\text{arctanh}\left(\sqrt{1+x^3}\right)$$

input
```
Integrate[Sqrt[1 + x^3]/x,x]
```

output
```
(2*Sqrt[1 + x^3])/3 - (2*ArcTanh[Sqrt[1 + x^3]])/3
```

3.19.3 Rubi [A] (verified)

Time = 0.14 (sec) , antiderivative size = 28, 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 = {798, 60, 73, 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.

$$\int \frac{\sqrt{x^3+1}}{x} \, dx$$

$$\Big\downarrow \; 798$$

$$\frac{1}{3} \int \frac{\sqrt{x^3+1}}{x^3} dx^3$$

$$\Big\downarrow \; 60$$

$$\frac{1}{3} \left(\int \frac{1}{x^3 \sqrt{x^3+1}} dx^3 + 2\sqrt{x^3+1} \right)$$

$$\Big\downarrow \; 73$$

$$\frac{1}{3} \left(2 \int \frac{1}{x^6-1} d\sqrt{x^3+1} + 2\sqrt{x^3+1} \right)$$

$$\Big\downarrow \; 220$$

$$\frac{1}{3} \left(2\sqrt{x^3+1} - 2\text{arctanh}\left(\sqrt{x^3+1} \right) \right)$$

input
```
Int[Sqrt[1 + x^3]/x,x]
```

output
```
(2*Sqrt[1 + x^3] - 2*ArcTanh[Sqrt[1 + x^3]])/3
```

3.19.3.1 Defintions of rubi rules used

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 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 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]]
```

3.19.4 Maple [A] (verified)

Time = 0.34 (sec) , antiderivative size = 21, normalized size of antiderivative = 0.75

method	result	size
default	$-\frac{2 \operatorname{arctanh}\left(\sqrt{x^{3}+1}\right)}{3}+\frac{2 \sqrt{x^{3}+1}}{3}$	21
elliptic	$-\frac{2 \operatorname{arctanh}\left(\sqrt{x^{3}+1}\right)}{3}+\frac{2 \sqrt{x^{3}+1}}{3}$	21
trager	$\frac{2 \sqrt{x^{3}+1}}{3}-\frac{\ln\left(-\frac{x^{3}+2 \sqrt{x^{3}+1}+2}{x^{3}}\right)}{3}$	33
pseudoelliptic	$\frac{2 \sqrt{x^{3}+1}}{3}+\frac{\ln\left(\sqrt{x^{3}+1}-1\right)}{3}-\frac{\ln\left(1+\sqrt{x^{3}+1}\right)}{3}$	35
meijerg	$-\frac{-2(2-2\ln(2)+3\ln(x))\sqrt{\pi}+4\sqrt{\pi}-4\sqrt{\pi}\,\sqrt{x^{3}+1}+4\sqrt{\pi}\,\ln\left(\frac{1}{2}+\frac{\sqrt{x^{3}+1}}{2}\right)}{6\sqrt{\pi}}$	56

input
```
int((x^3+1)^(1/2)/x,x,method=_RETURNVERBOSE)
```

output
```
-2/3*arctanh((x^3+1)^(1/2))+2/3*(x^3+1)^(1/2)
```

3.19.5 Fricas [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.21

$$\int \frac{\sqrt{1+x^3}}{x}\,dx = \frac{2}{3}\sqrt{x^3+1} - \frac{1}{3}\log\left(\sqrt{x^3+1}+1\right) + \frac{1}{3}\log\left(\sqrt{x^3+1}-1\right)$$

input
```
integrate((x^3+1)^(1/2)/x,x, algorithm="fricas")
```

output
```
2/3*sqrt(x^3 + 1) - 1/3*log(sqrt(x^3 + 1) + 1) + 1/3*log(sqrt(x^3 + 1) - 1
)
```

3.19.6 Sympy [A] (verification not implemented)

Time = 0.90 (sec) , antiderivative size = 48, normalized size of antiderivative = 1.71

$$\int \frac{\sqrt{1+x^3}}{x}\,dx = \frac{2x^{\frac{3}{2}}}{3\sqrt{1+\frac{1}{x^3}}} - \frac{2\operatorname{asinh}\left(\frac{1}{x^{\frac{3}{2}}}\right)}{3} + \frac{2}{3x^{\frac{3}{2}}\sqrt{1+\frac{1}{x^3}}}$$

input
```
integrate((x**3+1)**(1/2)/x,x)
```

output
```
2*x**(3/2)/(3*sqrt(1 + x**(-3))) - 2*asinh(x**(-3/2))/3 + 2/(3*x**(3/2)*sq
rt(1 + x**(-3)))
```

3.19.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.21

$$\int \frac{\sqrt{1+x^3}}{x}\,dx = \frac{2}{3}\sqrt{x^3+1} - \frac{1}{3}\log\left(\sqrt{x^3+1}+1\right) + \frac{1}{3}\log\left(\sqrt{x^3+1}-1\right)$$

input
```
integrate((x^3+1)^(1/2)/x,x, algorithm="maxima")
```

output
```
2/3*sqrt(x^3 + 1) - 1/3*log(sqrt(x^3 + 1) + 1) + 1/3*log(sqrt(x^3 + 1) - 1
)
```

3.19.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.25

$$\int \frac{\sqrt{1+x^3}}{x}\,dx = \frac{2}{3}\sqrt{x^3+1} - \frac{1}{3}\log\left(\sqrt{x^3+1}+1\right) + \frac{1}{3}\log\left(\left|\sqrt{x^3+1}-1\right|\right)$$

input
```
integrate((x^3+1)^(1/2)/x,x, algorithm="giac")
```

output
```
2/3*sqrt(x^3 + 1) - 1/3*log(sqrt(x^3 + 1) + 1) + 1/3*log(abs(sqrt(x^3 + 1)
 - 1))
```

3.19.9 Mupad [B] (verification not implemented)

Time = 0.14 (sec) , antiderivative size = 174, normalized size of antiderivative = 6.21

$$\int \frac{\sqrt{1+x^3}}{x}\,dx = \frac{2\sqrt{x^3+1}}{3} - \frac{2\left(\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)\sqrt{\frac{x-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}{-\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}}\sqrt{\frac{x+1}{\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}}\sqrt{\frac{\frac{1}{2}-x+\frac{\sqrt{3}\,1\mathrm{i}}{2}}{\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}}\,\Pi\left(\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2};\mathrm{asin}\left(\sqrt{\frac{x+1}{\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}}\right)\middle|-\frac{\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}{-\frac{3}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}}\right)}{\sqrt{x^3+\left(-\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)-1\right)x-\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)}}$$

input
```
int((x^3 + 1)^(1/2)/x,x)
```

output
```
(2*(x^3 + 1)^(1/2))/3 - (2*((3^(1/2)*1i)/2 + 3/2)*((x + (3^(1/2)*1i)/2 - 1
/2)/((3^(1/2)*1i)/2 - 3/2))^(1/2)*((x + 1)/((3^(1/2)*1i)/2 + 3/2))^(1/2)*(
((3^(1/2)*1i)/2 - x + 1/2)/((3^(1/2)*1i)/2 + 3/2))^(1/2)*ellipticPi((3^(1/
2)*1i)/2 + 3/2, asin(((x + 1)/((3^(1/2)*1i)/2 + 3/2))^(1/2)), -((3^(1/2)*1
i)/2 + 3/2)/((3^(1/2)*1i)/2 - 3/2)))/(x^3 - x*(((3^(1/2)*1i)/2 - 1/2)*((3^
(1/2)*1i)/2 + 1/2) + 1) - ((3^(1/2)*1i)/2 - 1/2)*((3^(1/2)*1i)/2 + 1/2))^(
1/2)
```

3.20 $\int \frac{x \log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}}\,dx$

3.20.1 Optimal result

Integrand size = 23, antiderivative size = 26

$$\int \frac{x \log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}}\,dx = -x+\sqrt{-1+x^2}\log\left(x+\sqrt{-1+x^2}\right)$$

output
```
-x+ln(x+(x^2-1)^(1/2))*(x^2-1)^(1/2)
```

3.20.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.00

$$\int \frac{x \log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}}\,dx = -x+\sqrt{-1+x^2}\log\left(x+\sqrt{-1+x^2}\right)$$

input
```
Integrate[(x*Log[x + Sqrt[-1 + x^2]])/Sqrt[-1 + x^2],x]
```

output
```
-x + Sqrt[-1 + x^2]*Log[x + Sqrt[-1 + x^2]]
```

3.20.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.087, Rules used = {3034, 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.

$$\int \frac{x \log \left(\sqrt{x^2-1}+x\right)}{\sqrt{x^2-1}} \, dx$$

$$\Big\downarrow \text{3034}$$

$$\sqrt{x^2-1} \log \left(\sqrt{x^2-1}+x\right)-\int 1dx$$

$$\Big\downarrow \text{24}$$

$$\sqrt{x^2-1} \log \left(\sqrt{x^2-1}+x\right)-x$$

input
```
Int[(x*Log[x + Sqrt[-1 + x^2]])/Sqrt[-1 + x^2],x]
```

output
```
-x + Sqrt[-1 + x^2]*Log[x + Sqrt[-1 + x^2]]
```

3.20.3.1 Defintions of rubi rules used

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

rule 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

3.20.4 Maple [F]

$$\int \frac{x \ln \left(x+\sqrt{x^2-1}\right)}{\sqrt{x^2-1}}dx$$

input
```
int(x*ln(x+(x^2-1)^(1/2))/(x^2-1)^(1/2),x)
```

output
```
int(x*ln(x+(x^2-1)^(1/2))/(x^2-1)^(1/2),x)
```

3.20.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.85

$$\int \frac{x \log \left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}} \, dx = \sqrt{x^2-1} \log \left(x+\sqrt{x^2-1}\right) - x$$

input
```
integrate(x*log(x+(x^2-1)^(1/2))/(x^2-1)^(1/2),x, algorithm="fricas")
```

output
```
sqrt(x^2 - 1)*log(x + sqrt(x^2 - 1)) - x
```

3.20.6 Sympy [A] (verification not implemented)

Time = 3.25 (sec) , antiderivative size = 20, normalized size of antiderivative = 0.77

$$\int \frac{x \log \left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}} \, dx = -x + \sqrt{x^2-1} \log \left(x+\sqrt{x^2-1}\right)$$

input
```
integrate(x*ln(x+(x**2-1)**(1/2))/(x**2-1)**(1/2),x)
```

output
```
-x + sqrt(x**2 - 1)*log(x + sqrt(x**2 - 1))
```

3.20.7 Maxima [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.85

$$\int \frac{x\log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}}\,dx=\sqrt{x^2-1}\log\left(x+\sqrt{x^2-1}\right)-x$$

input
```
integrate(x*log(x+(x^2-1)^(1/2))/(x^2-1)^(1/2),x, algorithm="maxima")
```

output
```
sqrt(x^2 - 1)*log(x + sqrt(x^2 - 1)) - x
```

3.20.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.85

$$\int \frac{x\log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}}\,dx=\sqrt{x^2-1}\log\left(x+\sqrt{x^2-1}\right)-x$$

input
```
integrate(x*log(x+(x^2-1)^(1/2))/(x^2-1)^(1/2),x, algorithm="giac")
```

output
```
sqrt(x^2 - 1)*log(x + sqrt(x^2 - 1)) - x
```

3.20.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\log\left(x+\sqrt{-1+x^2}\right)}{\sqrt{-1+x^2}}\,dx=\int \frac{x\,\ln\left(x+\sqrt{x^2-1}\right)}{\sqrt{x^2-1}}\,dx$$

input
```
int((x*log(x + (x^2 - 1)^(1/2)))/(x^2 - 1)^(1/2),x)
```

output
```
int((x*log(x + (x^2 - 1)^(1/2)))/(x^2 - 1)^(1/2), x)
```

3.21 $\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}} \, dx$

3.21.1 Optimal result

Integrand size = 17, antiderivative size = 38

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}} \, dx = \frac{1}{4}x\sqrt{1+x^2} - \frac{1}{2}\sqrt{1-x^4}\arcsin(x) + \frac{\operatorname{arcsinh}(x)}{4}$$

output
```
1/4*arcsinh(x)+1/4*x*(x^2+1)^(1/2)-1/2*arcsin(x)*(-x^4+1)^(1/2)
```

3.21.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 85 vs. 2(38) = 76.

Time = 0.05 (sec) , antiderivative size = 85, normalized size of antiderivative = 2.24

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}} \, dx = \frac{1}{4}\left(\frac{x\sqrt{1-x^4}}{\sqrt{1-x^2}} - 2\sqrt{1-x^4}\arcsin(x) + \log\left(1-x^2\right) - \log\left(-x+x^3+\sqrt{1-x^2}\sqrt{1-x^4}\right)\right)$$

input
```
Integrate[(x^3*ArcSin[x])/Sqrt[1 - x^4],x]
```

output
```
((x*Sqrt[1 - x^4])/Sqrt[1 - x^2] - 2*Sqrt[1 - x^4]*ArcSin[x] + Log[1 - x^2
] - Log[-x + x^3 + Sqrt[1 - x^2]*Sqrt[1 - x^4]])/4
```

3.21.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 43, normalized size of antiderivative = 1.13, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.294, Rules used = {5286, 27, 1386, 211, 222}

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.

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}} \, dx$$

$$\Big\downarrow \text{ 5286}$$

$$-\int -\frac{\sqrt{1-x^4}}{2\sqrt{1-x^2}}dx-\frac{1}{2}\sqrt{1-x^4}\arcsin(x)$$

$$\Big\downarrow \text{ 27}$$

$$\frac{1}{2}\int \frac{\sqrt{1-x^4}}{\sqrt{1-x^2}}dx-\frac{1}{2}\sqrt{1-x^4}\arcsin(x)$$

$$\Big\downarrow \text{ 1386}$$

$$\frac{1}{2}\int \sqrt{x^2+1}dx-\frac{1}{2}\sqrt{1-x^4}\arcsin(x)$$

$$\Big\downarrow \text{ 211}$$

$$\frac{1}{2}\left(\frac{1}{2}\int \frac{1}{\sqrt{x^2+1}}dx+\frac{1}{2}\sqrt{x^2+1}x\right)-\frac{1}{2}\sqrt{1-x^4}\arcsin(x)$$

$$\Big\downarrow \text{ 222}$$

$$\frac{1}{2}\left(\frac{\operatorname{arcsinh}(x)}{2}+\frac{1}{2}\sqrt{x^2+1}x\right)-\frac{1}{2}\sqrt{1-x^4}\arcsin(x)$$

input
```
Int[(x^3*ArcSin[x])/Sqrt[1 - x^4],x]
```

output
```
-1/2*(Sqrt[1 - x^4]*ArcSin[x]) + ((x*Sqrt[1 + x^2])/2 + ArcSinh[x]/2)/2
```

3.21.3.1 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 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 222
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSinh[Rt[b, 2]*(x/Sqrt
[a])]/Rt[b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && PosQ[b]
```

rule 1386
```
Int[(u_.)*((a_) + (c_.)*(x_)^(n2_.))^(p_.)*((d_) + (e_.)*(x_)^(n_))^(q_.),
x_Symbol] :> Simp[(-e^2/c)^q   Int[u*(d - e*x^n)^p, x], x] /; FreeQ[{a, c,
d, e, n, p, q}, x] && EqQ[n2, 2*n] && EqQ[c*d^2 + a*e^2, 0] && EqQ[p + q, 0
] && GtQ[d, 0] && LtQ[c, 0] && GtQ[e^2, 0]
```

rule 5286
```
Int[((a_.) + ArcSin[(c_.)*(x_)]*(b_.))*(u_), x_Symbol] :> With[{v = IntHide
[u, x]}, Simp[(a + b*ArcSin[c*x])   v, x] - Simp[b*c   Int[SimplifyIntegran
d[v/Sqrt[1 - c^2*x^2], x], x], x] /; InverseFunctionFreeQ[v, x]] /; FreeQ[{
a, b, c}, x]
```

3.21.4 Maple [F]

$$\int \frac{x^3 \arcsin(x)}{\sqrt{-x^4+1}}dx$$

input
```
int(x^3*arcsin(x)/(-x^4+1)^(1/2),x)
```

output
```
int(x^3*arcsin(x)/(-x^4+1)^(1/2),x)
```

3.21.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 138 vs. 2(28) = 56.

Time = 0.26 (sec) , antiderivative size = 138, normalized size of antiderivative = 3.63

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}}\,dx = -\frac{4\sqrt{-x^4+1}(x^2-1)\arcsin(x) + 2\sqrt{-x^4+1}\sqrt{-x^2+1}x + (x^2-1)\log\left(\frac{x^3+\sqrt{-x^4+1}\sqrt{-x^2+1}-x}{x^3-x}\right) - (x^2 -}{8(x^2-1)}$$

input
```
integrate(x^3*arcsin(x)/(-x^4+1)^(1/2),x, algorithm="fricas")
```

output
```
-1/8*(4*sqrt(-x^4 + 1)*(x^2 - 1)*arcsin(x) + 2*sqrt(-x^4 + 1)*sqrt(-x^2 +
1)*x + (x^2 - 1)*log((x^3 + sqrt(-x^4 + 1)*sqrt(-x^2 + 1) - x)/(x^3 - x))
- (x^2 - 1)*log(-(x^3 - sqrt(-x^4 + 1)*sqrt(-x^2 + 1) - x)/(x^3 - x)))/(x^
2 - 1)
```

3.21.6 Sympy [F]

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}}\,dx = \int \frac{x^3 \operatorname{asin}(x)}{\sqrt{-(x-1)(x+1)(x^2+1)}}\,dx$$

input
```
integrate(x**3*asin(x)/(-x**4+1)**(1/2),x)
```

output
```
Integral(x**3*asin(x)/sqrt(-(x - 1)*(x + 1)*(x**2 + 1)), x)
```

3.21.7 Maxima [F]

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}}\,dx = \int \frac{x^3 \arcsin(x)}{\sqrt{-x^4+1}}\,dx$$

input
```
integrate(x^3*arcsin(x)/(-x^4+1)^(1/2),x, algorithm="maxima")
```

output
```
-1/2*sqrt(x^2 + 1)*sqrt(x + 1)*sqrt(-x + 1)*arctan2(x, sqrt(x + 1)*sqrt(-x
 + 1)) + integrate(1/2*sqrt(x^2 + 1)/(x^2 + e^(log(x + 1) + log(-x + 1))),
 x)
```

3.21.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 38, normalized size of antiderivative = 1.00

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}}\,dx = \frac{1}{4}\sqrt{x^2+1}x - \frac{1}{2}\sqrt{-x^4+1}\arcsin(x) - \frac{1}{4}\log\left(-x+\sqrt{x^2+1}\right)$$

input
```
integrate(x^3*arcsin(x)/(-x^4+1)^(1/2),x, algorithm="giac")
```

output
```
1/4*sqrt(x^2 + 1)*x - 1/2*sqrt(-x^4 + 1)*arcsin(x) - 1/4*log(-x + sqrt(x^2
 + 1))
```

3.21.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \arcsin(x)}{\sqrt{1-x^4}}\,dx = \int \frac{x^3 \operatorname{asin}(x)}{\sqrt{1-x^4}}\,dx$$

input
```
int((x^3*asin(x))/(1 - x^4)^(1/2),x)
```

output
```
int((x^3*asin(x))/(1 - x^4)^(1/2), x)
```

3.22 $\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}} \, dx$

3.22.1 Optimal result

Integrand size = 15, antiderivative size = 70

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}} \, dx = -\frac{\sqrt{-1+x^4}}{2\sqrt{1-\frac{1}{x^2}}\,x} + \frac{1}{2}\sqrt{-1+x^4}\sec^{-1}(x) + \frac{1}{2}\text{arctanh}\left(\frac{\sqrt{1-\frac{1}{x^2}}\,x}{\sqrt{-1+x^4}}\right)$$

output
```
1/2*arctanh(x*(1-1/x^2)^(1/2)/(x^4-1)^(1/2))+1/2*arcsec(x)*(x^4-1)^(1/2)-1
/2*(x^4-1)^(1/2)/x/(1-1/x^2)^(1/2)
```

3.22.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 88, normalized size of antiderivative = 1.26

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}} \, dx = \frac{1}{2}\left(-\frac{\sqrt{1-\frac{1}{x^2}}\,x\sqrt{-1+x^4}}{-1+x^2} + \sqrt{-1+x^4}\sec^{-1}(x) - \log\left(x-x^3\right) + \log\left(1-x^2-\sqrt{1-\frac{1}{x^2}}\,x\sqrt{-1+x^4}\right)\right)$$

input
```
Integrate[(x^3*ArcSec[x])/Sqrt[-1 + x^4],x]
```

output
```
(-((Sqrt[1 - x^(-2)]*x*Sqrt[-1 + x^4])/(-1 + x^2)) + Sqrt[-1 + x^4]*ArcSec
[x] - Log[x - x^3] + Log[1 - x^2 - Sqrt[1 - x^(-2)]*x*Sqrt[-1 + x^4]])/2
```

3.22.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.17, number of steps used = 9, number of rules used = 8, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.533, Rules used = {5769, 27, 1896, 1396, 243, 60, 73, 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.

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{x^4-1}}dx$$

$$\Big\downarrow \text{5769}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\int \frac{\sqrt{x^4-1}}{2\sqrt{1-\frac{1}{x^2}}x^2}dx$$

$$\Big\downarrow \text{27}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{1}{2}\int \frac{\sqrt{x^4-1}}{\sqrt{1-\frac{1}{x^2}}x^2}dx$$

$$\Big\downarrow \text{1896}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{\sqrt{1-x^2}\int \frac{\sqrt{x^4-1}}{x\sqrt{1-x^2}}dx}{2\sqrt{1-\frac{1}{x^2}}x}$$

$$\Big\downarrow \text{1396}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{\sqrt{x^4-1}\int \frac{\sqrt{-x^2-1}}{x}dx}{2\sqrt{1-\frac{1}{x^2}}x\sqrt{-x^2-1}}$$

$$\Big\downarrow \text{243}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{\sqrt{x^4-1}\int \frac{\sqrt{-x^2-1}}{x^2}dx^2}{4\sqrt{1-\frac{1}{x^2}}x\sqrt{-x^2-1}}$$

$$\Big\downarrow \text{60}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{\sqrt{x^4-1}\left(2\sqrt{-x^2-1}-\int \frac{1}{x^2\sqrt{-x^2-1}}dx^2\right)}{4\sqrt{1-\frac{1}{x^2}}x\sqrt{-x^2-1}}$$

$$\Big\downarrow \text{73}$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{\sqrt{x^4-1}\left(2\int \frac{1}{-x^4-1}d\sqrt{-x^2-1}+2\sqrt{-x^2-1}\right)}{4\sqrt{1-\frac{1}{x^2}}x\sqrt{-x^2-1}}$$

$$\Big\downarrow \; 217$$

$$\frac{1}{2}\sqrt{x^4-1}\sec^{-1}(x)-\frac{\sqrt{x^4-1}\left(2\sqrt{-x^2-1}-2\arctan\left(\sqrt{-x^2-1}\right)\right)}{4\sqrt{1-\frac{1}{x^2}}x\sqrt{-x^2-1}}$$

input
```
Int[(x^3*ArcSec[x])/Sqrt[-1 + x^4],x]
```

output
```
(Sqrt[-1 + x^4]*ArcSec[x])/2 - (Sqrt[-1 + x^4]*(2*Sqrt[-1 - x^2] - 2*ArcTa
n[Sqrt[-1 - x^2]]))/(4*Sqrt[1 - x^(-2)]*x*Sqrt[-1 - x^2])
```

3.22.3.1 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 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 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 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 1396
```
Int[(u_.)*((a_) + (c_.)*(x_)^(n2_.))^(p_)*((d_) + (e_.)*(x_)^(n_))^(q_.), x
_Symbol] :> Simp[(a + c*x^(2*n))^FracPart[p]/((d + e*x^n)^FracPart[p]*(a/d
+ c*(x^n/e))^FracPart[p])   Int[u*(d + e*x^n)^(p + q)*(a/d + (c/e)*x^n)^p,
x], x] /; FreeQ[{a, c, d, e, n, p, q}, x] && EqQ[n2, 2*n] && EqQ[c*d^2 + a*
e^2, 0] &&  !IntegerQ[p] &&  !(EqQ[q, 1] && EqQ[n, 2])
```

rule 1896
```
Int[(x_)^(m_.)*((d_) + (e_.)*(x_)^(mn_.))^(q_)*((a_) + (c_.)*(x_)^(n2_.))^(
p_.), x_Symbol] :> Simp[(e^IntPart[q]*((d + e*x^mn)^FracPart[q]/(1 + d*(1/(
x^mn*e)))^FracPart[q]))/x^(mn*FracPart[q])   Int[x^(m + mn*q)*(1 + d*(1/(x^
mn*e)))^q*(a + c*x^n2)^p, x], x] /; FreeQ[{a, c, d, e, m, mn, p, q}, x] &&
EqQ[n2, -2*mn] &&  !IntegerQ[p] &&  !IntegerQ[q] && PosQ[n2]
```

rule 5769
```
Int[((a_.) + ArcSec[(c_.)*(x_)]*(b_.))*(u_), x_Symbol] :> With[{v = IntHide
[u, x]}, Simp[(a + b*ArcSec[c*x])   v, x] - Simp[b/c   Int[SimplifyIntegran
d[v/(x^2*Sqrt[1 - 1/(c^2*x^2)]), x], x], x] /; InverseFunctionFreeQ[v, x]]
/; FreeQ[{a, b, c}, x]
```

3.22.4 Maple [F]

$$\int \frac{x^3 \operatorname{arcsec}(x)}{\sqrt{x^4-1}}dx$$

input
```
int(x^3*arcsec(x)/(x^4-1)^(1/2),x)
```

output
```
int(x^3*arcsec(x)/(x^4-1)^(1/2),x)
```

3.22.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 110 vs. $2(54) = 108$.

Time = 0.26 (sec) , antiderivative size = 110, normalized size of antiderivative = 1.57

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}}\,dx$$
$$= \frac{(x^2-1)\log\left(\frac{x^2+\sqrt{x^4-1}\sqrt{x^2-1}-1}{x^2-1}\right) - (x^2-1)\log\left(-\frac{x^2-\sqrt{x^4-1}\sqrt{x^2-1}-1}{x^2-1}\right) + 2\sqrt{x^4-1}\left((x^2-1)\operatorname{arcsec}(x) - \sqrt{}\right.}{4(x^2-1)}$$

input
```
integrate(x^3*arcsec(x)/(x^4-1)^(1/2),x, algorithm="fricas")
```

output
```
1/4*((x^2 - 1)*log((x^2 + sqrt(x^4 - 1)*sqrt(x^2 - 1) - 1)/(x^2 - 1)) - (x
^2 - 1)*log(-(x^2 - sqrt(x^4 - 1)*sqrt(x^2 - 1) - 1)/(x^2 - 1)) + 2*sqrt(x
^4 - 1)*((x^2 - 1)*arcsec(x) - sqrt(x^2 - 1)))/(x^2 - 1)
```

3.22.6 Sympy [F]

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}}\,dx = \int \frac{x^3 \operatorname{asec}(x)}{\sqrt{(x-1)(x+1)(x^2+1)}}\,dx$$

input
```
integrate(x**3*asec(x)/(x**4-1)**(1/2),x)
```

output
```
Integral(x**3*asec(x)/sqrt((x - 1)*(x + 1)*(x**2 + 1)), x)
```

3.22.7 Maxima [F]

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}}\,dx = \int \frac{x^3 \operatorname{arcsec}(x)}{\sqrt{x^4-1}}\,dx$$

input
```
integrate(x^3*arcsec(x)/(x^4-1)^(1/2),x, algorithm="maxima")
```

output
```
1/2*sqrt(x^2 + 1)*sqrt(x + 1)*sqrt(x - 1)*arctan(sqrt(x + 1)*sqrt(x - 1))
- integrate((2*(x^3*e^(3/2*log(x + 1) + 3/2*log(x - 1)) + x^3*e^(1/2*log(x
 + 1) + 1/2*log(x - 1)))*sqrt(x^2 + 1)*log(x) + (x^3 + x)*e^(1/2*log(x^2 +
 1) + 3/2*log(x + 1) + 3/2*log(x - 1)))/((x^2 + 1)*(e^(2*log(x + 1) + 2*lo
g(x - 1)) + e^(log(x + 1) + log(x - 1)))), x)
```

3.22.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 52, normalized size of antiderivative = 0.74

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}}\,dx = \frac{1}{2}\sqrt{x^4-1}\arccos\left(\frac{1}{x}\right) - \frac{2\sqrt{x^2+1} - \log\left(\sqrt{x^2+1}+1\right) + \log\left(\sqrt{x^2+1}-1\right)}{4\,\mathrm{sgn}\left(x\right)}$$

input
```
integrate(x^3*arcsec(x)/(x^4-1)^(1/2),x, algorithm="giac")
```

output
```
1/2*sqrt(x^4 - 1)*arccos(1/x) - 1/4*(2*sqrt(x^2 + 1) - log(sqrt(x^2 + 1) +
 1) + log(sqrt(x^2 + 1) - 1))/sgn(x)
```

3.22.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sec^{-1}(x)}{\sqrt{-1+x^4}}\,dx = \int \frac{x^3\,\mathrm{acos}\left(\frac{1}{x}\right)}{\sqrt{x^4-1}}\,dx$$

input
```
int((x^3*acos(1/x))/(x^4 - 1)^(1/2),x)
```

output
```
int((x^3*acos(1/x))/(x^4 - 1)^(1/2), x)
```

3.23 $\int \frac{x \arctan(x) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx$

3.23.1 Optimal result

Integrand size = 25, antiderivative size = 58

$$\begin{aligned}\int \frac{x \arctan(x) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx = & -x \arctan(x) + \frac{1}{2} \log\left(1+x^2\right) \\ & + \sqrt{1+x^2} \arctan(x) \log\left(x+\sqrt{1+x^2}\right) \\ & - \frac{1}{2} \log^2\left(x+\sqrt{1+x^2}\right)\end{aligned}$$

output
```
-x*arctan(x)+1/2*ln(x^2+1)-1/2*ln(x+(x^2+1)^(1/2))^2+arctan(x)*ln(x+(x^2+1
)^(1/2))*(x^2+1)^(1/2)
```

3.23.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.00

$$\begin{aligned}\int \frac{x \arctan(x) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx = & -x \arctan(x) + \frac{1}{2} \log\left(1+x^2\right) \\ & + \sqrt{1+x^2} \arctan(x) \log\left(x+\sqrt{1+x^2}\right) \\ & - \frac{1}{2} \log^2\left(x+\sqrt{1+x^2}\right)\end{aligned}$$

input
```
Integrate[(x*ArcTan[x]*Log[x + Sqrt[1 + x^2]])/Sqrt[1 + x^2],x]
```

output
```
-(x*ArcTan[x]) + Log[1 + x^2]/2 + Sqrt[1 + x^2]*ArcTan[x]*Log[x + Sqrt[1 +
 x^2]] - Log[x + Sqrt[1 + x^2]]^2/2
```

3.23.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.160$, Rules used = {5735, 5345, 240, 7237}

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.

$$\int \frac{x \arctan(x) \log\left(\sqrt{x^2+1}+x\right)}{\sqrt{x^2+1}}dx$$

$$\Big\downarrow \text{5735}$$

$$-\int \arctan(x)dx - \int \frac{\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx + \sqrt{x^2+1}\arctan(x)\log\left(\sqrt{x^2+1}+x\right)$$

$$\Big\downarrow \text{5345}$$

$$\int \frac{x}{x^2+1}dx - \int \frac{\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx + \sqrt{x^2+1}\arctan(x)\log\left(\sqrt{x^2+1}+x\right) - x\arctan(x)$$

$$\Big\downarrow \text{240}$$

$$-\int \frac{\log\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx + \sqrt{x^2+1}\arctan(x)\log\left(\sqrt{x^2+1}+x\right) - x\arctan(x) + \frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{7237}$$

$$\sqrt{x^2+1}\arctan(x)\log\left(\sqrt{x^2+1}+x\right) - x\arctan(x) - \frac{1}{2}\log^2\left(\sqrt{x^2+1}+x\right) + \frac{1}{2}\log\left(x^2+1\right)$$

input
```
Int[(x*ArcTan[x]*Log[x + Sqrt[1 + x^2]])/Sqrt[1 + x^2],x]
```

output
```
-(x*ArcTan[x]) + Log[1 + x^2]/2 + Sqrt[1 + x^2]*ArcTan[x]*Log[x + Sqrt[1 +
 x^2]] - Log[x + Sqrt[1 + x^2]]^2/2
```

3.23.3.1 Defintions of rubi rules used

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 5345
```
Int[((a_.) + ArcTan[(c_.)*(x_)^(n_.)]*(b_.))^(p_.), x_Symbol] :> Simp[x*(a
+ b*ArcTan[c*x^n])^p, x] - Simp[b*c*n*p   Int[x^n*((a + b*ArcTan[c*x^n])^(p
 - 1)/(1 + c^2*x^(2*n))), x], x] /; FreeQ[{a, b, c, n}, x] && IGtQ[p, 0] &&
 (EqQ[n, 1] || EqQ[p, 1])
```

rule 5735
```
Int[ArcTan[v_]*Log[w_]*(u_), x_Symbol] :> With[{z = IntHide[u, x]}, Simp[Ar
cTan[v]*Log[w]   z, x] + (-Int[SimplifyIntegrand[z*Log[w]*(D[v, x]/(1 + v^2
)), x], x] - Int[SimplifyIntegrand[z*ArcTan[v]*(D[w, x]/w), x], x]) /; Inve
rseFunctionFreeQ[z, x]] /; InverseFunctionFreeQ[v, x] && InverseFunctionFre
eQ[w, x]
```

rule 7237
```
Int[(u_)*(y_)^(m_.), x_Symbol] :> With[{q = DerivativeDivides[y, u, x]}, Si
mp[q*(y^(m + 1)/(m + 1)), x] /;  !FalseQ[q]] /; FreeQ[m, x] && NeQ[m, -1]
```

3.23.4 Maple [F]

$$\int \frac{x \arctan (x) \ln \left(x+\sqrt{x^{2}+1}\right)}{\sqrt{x^{2}+1}}dx$$

input
```
int(x*arctan(x)*ln(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x)
```

output
```
int(x*arctan(x)*ln(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x)
```

3.23.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 48, normalized size of antiderivative = 0.83

$$\int \frac{x \arctan(x) \log \left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}} \, dx=\sqrt{x^{2}+1} \arctan \left(x\right) \log \left(x+\sqrt{x^{2}+1}\right)-x \arctan \left(x\right) -\frac{1}{2} \, \log \left(x+\sqrt{x^{2}+1}\right)^{2}+\frac{1}{2} \, \log \left(x^{2}+1\right)$$

input
```
integrate(x*arctan(x)*log(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x, algorithm="fri
cas")
```

output
```
sqrt(x^2 + 1)*arctan(x)*log(x + sqrt(x^2 + 1)) - x*arctan(x) - 1/2*log(x +
 sqrt(x^2 + 1))^2 + 1/2*log(x^2 + 1)
```

3.23.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x \arctan(x) \log \left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\, dx = \text{Timed out}$$

input
```
integrate(x*atan(x)*ln(x+(x**2+1)**(1/2))/(x**2+1)**(1/2),x)
```

output
```
Timed out
```

3.23.7 Maxima [F]

$$\int \frac{x \arctan(x) \log \left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\, dx = \int \frac{x \arctan(x) \log \left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\, dx$$

input
```
integrate(x*arctan(x)*log(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x, algorithm="max
ima")
```

output
```
integrate(x*arctan(x)*log(x + sqrt(x^2 + 1))/sqrt(x^2 + 1), x)
```

3.23.8 Giac [F]

$$\int \frac{x \arctan(x) \log \left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\, dx = \int \frac{x \arctan(x) \log \left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\, dx$$

input
```
integrate(x*arctan(x)*log(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x, algorithm="gia
c")
```

output
```
integrate(x*arctan(x)*log(x + sqrt(x^2 + 1))/sqrt(x^2 + 1), x)
```

3.23.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x \arctan(x) \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx = \int \frac{x\,\mathrm{atan}(x)\,\ln\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\,dx$$

input
```
int((x*atan(x)*log(x + (x^2 + 1)^(1/2)))/(x^2 + 1)^(1/2),x)
```

output
```
int((x*atan(x)*log(x + (x^2 + 1)^(1/2)))/(x^2 + 1)^(1/2), x)
```

3.24 $\int \frac{x \log\left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx$

3.24.1 Optimal result

Integrand size = 27, antiderivative size = 55

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx = \sqrt{1-x^2} - \log\left(1+\sqrt{1-x^2}\right) - \sqrt{1-x^2} \log\left(1+\sqrt{1-x^2}\right)$$

output
```
-ln(1+(-x^2+1)^(1/2))+(-x^2+1)^(1/2)-ln(1+(-x^2+1)^(1/2))*(-x^2+1)^(1/2)
```

3.24.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 41, normalized size of antiderivative = 0.75

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx = \sqrt{1-x^2} - \left(1+\sqrt{1-x^2}\right) \log\left(1+\sqrt{1-x^2}\right)$$

input
```
Integrate[(x*Log[1 + Sqrt[1 - x^2]])/Sqrt[1 - x^2],x]
```

output
```
Sqrt[1 - x^2] - (1 + Sqrt[1 - x^2])*Log[1 + Sqrt[1 - x^2]]
```

3.24.3 Rubi [A] (warning: unable to verify)

Time = 0.23 (sec) , antiderivative size = 49, normalized size of antiderivative = 0.89, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.185, Rules used = {3034, 2024, 774, 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.

$$\int \frac{x \log \left(\sqrt{1-x^2}+1\right)}{\sqrt{1-x^2}} \, dx$$

$$\Big\downarrow \text{3034}$$

$$-\int \frac{x}{\sqrt{1-x^2}+1}dx-\sqrt{1-x^2}\log\left(\sqrt{1-x^2}+1\right)$$

$$\Big\downarrow \text{2024}$$

$$\frac{1}{2}\int \frac{1}{\sqrt{1-x^2}+1}d(1-x^2)-\sqrt{1-x^2}\log\left(\sqrt{1-x^2}+1\right)$$

$$\Big\downarrow \text{774}$$

$$\int \frac{\sqrt{1-x^2}}{2-x^2}d\sqrt{1-x^2}-\sqrt{1-x^2}\log\left(\sqrt{1-x^2}+1\right)$$

$$\Big\downarrow \text{49}$$

$$\int \left(1+\frac{1}{x^2-2}\right)d\sqrt{1-x^2}-\sqrt{1-x^2}\log\left(\sqrt{1-x^2}+1\right)$$

$$\Big\downarrow \text{2009}$$

$$\sqrt{1-x^2}-\log\left(2-x^2\right)-\sqrt{1-x^2}\log\left(\sqrt{1-x^2}+1\right)$$

input
```
Int[(x*Log[1 + Sqrt[1 - x^2]])/Sqrt[1 - x^2],x]
```

output
```
Sqrt[1 - x^2] - Log[2 - x^2] - Sqrt[1 - x^2]*Log[1 + Sqrt[1 - x^2]]
```

3.24.3.1 Defintions of rubi rules used

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 774
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> With[{k = Denominator[n]},
Simp[k   Subst[Int[x^(k - 1)*(a + b*x^(k*n))^p, x], x, x^(1/k)], x]] /; Fre
eQ[{a, b, p}, x] && FractionQ[n]
```

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

rule 2024
```
Int[((a_.) + (b_.)*(Pq_)^(n_.))^(p_.)*(Qr_), x_Symbol] :> With[{q = Expon[P
q, x], r = Expon[Qr, x]}, Simp[Coeff[Qr, x, r]/(q*Coeff[Pq, x, q])   Subst[
Int[(a + b*x^n)^p, x], x, Pq], x] /; EqQ[r, q - 1] && EqQ[Coeff[Qr, x, r]*D
[Pq, x], q*Coeff[Pq, x, q]*Qr]] /; FreeQ[{a, b, n, p}, x] && PolyQ[Pq, x] &
& PolyQ[Qr, x]
```

rule 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

3.24.4 Maple [A] (verified)

Time = 0.05 (sec) , antiderivative size = 37, normalized size of antiderivative = 0.67

method	result	size
derivativedivides	$-\ln\left(1+\sqrt{-x^2+1}\right)\left(1+\sqrt{-x^2+1}\right)+1+\sqrt{-x^2+1}$	37
default	$-\ln\left(1+\sqrt{-x^2+1}\right)\left(1+\sqrt{-x^2+1}\right)+1+\sqrt{-x^2+1}$	37

input
```
int(x*ln(1+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-ln(1+(-x^2+1)^(1/2))*(1+(-x^2+1)^(1/2))+1+(-x^2+1)^(1/2)
```

3.24.5 Fricas [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.64

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\, dx = -\left(\sqrt{-x^2+1}+1\right) \log \left(\sqrt{-x^2+1}+1\right) + \sqrt{-x^2+1}$$

input
```
integrate(x*log(1+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-(sqrt(-x^2 + 1) + 1)*log(sqrt(-x^2 + 1) + 1) + sqrt(-x^2 + 1)
```

3.24.6 Sympy [A] (verification not implemented)

Time = 2.14 (sec) , antiderivative size = 31, normalized size of antiderivative = 0.56

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\, dx = \sqrt{1-x^2} - \left(\sqrt{1-x^2}+1\right) \log \left(\sqrt{1-x^2}+1\right) + 1$$

input
```
integrate(x*ln(1+(-x**2+1)**(1/2))/(-x**2+1)**(1/2),x)
```

output
```
sqrt(1 - x**2) - (sqrt(1 - x**2) + 1)*log(sqrt(1 - x**2) + 1) + 1
```

3.24.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 36, normalized size of antiderivative = 0.65

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\, dx = -\left(\sqrt{-x^2+1}+1\right) \log \left(\sqrt{-x^2+1}+1\right) + \sqrt{-x^2+1} + 1$$

input
```
integrate(x*log(1+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-(sqrt(-x^2 + 1) + 1)*log(sqrt(-x^2 + 1) + 1) + sqrt(-x^2 + 1) + 1
```

3.24.8 Giac [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 36, normalized size of antiderivative = 0.65

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\, dx = -\left(\sqrt{-x^2+1}+1\right)\log\left(\sqrt{-x^2+1}+1\right)+\sqrt{-x^2+1}+1$$

input
```
integrate(x*log(1+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
-(sqrt(-x^2 + 1) + 1)*log(sqrt(-x^2 + 1) + 1) + sqrt(-x^2 + 1) + 1
```

3.24.9 Mupad [B] (verification not implemented)

Time = 0.40 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.49

$$\int \frac{x \log \left(1+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\, dx = -\left(\ln\left(\sqrt{1-x^2}+1\right)-1\right)\left(\sqrt{1-x^2}+1\right)$$

input
```
int((x*log((1 - x^2)^(1/2) + 1))/(1 - x^2)^(1/2),x)
```

output
```
-(log((1 - x^2)^(1/2) + 1) - 1)*((1 - x^2)^(1/2) + 1)
```

3.25 $\int \frac{x \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx$

3.25.1 Optimal result

Integrand size = 23, antiderivative size = 26

$$\int \frac{x \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx=-x+\sqrt{1+x^2}\log\left(x+\sqrt{1+x^2}\right)$$

output
```
-x+ln(x+(x^2+1)^(1/2))*(x^2+1)^(1/2)
```

3.25.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.00

$$\int \frac{x \log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx=-x+\sqrt{1+x^2}\log\left(x+\sqrt{1+x^2}\right)$$

input
```
Integrate[(x*Log[x + Sqrt[1 + x^2]])/Sqrt[1 + x^2],x]
```

output
```
-x + Sqrt[1 + x^2]*Log[x + Sqrt[1 + x^2]]
```

3.25.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 26, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.087, Rules used = {3034, 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.

$$\int \frac{x \log \left(\sqrt{x^2+1}+x\right)}{\sqrt{x^2+1}} \, dx$$

$$\Big\downarrow \text{3034}$$

$$\sqrt{x^2+1} \log \left(\sqrt{x^2+1}+x\right)-\int 1dx$$

$$\Big\downarrow \text{24}$$

$$\sqrt{x^2+1} \log \left(\sqrt{x^2+1}+x\right)-x$$

input
```
Int[(x*Log[x + Sqrt[1 + x^2]])/Sqrt[1 + x^2],x]
```

output
```
-x + Sqrt[1 + x^2]*Log[x + Sqrt[1 + x^2]]
```

3.25.3.1 Defintions of rubi rules used

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

rule 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

3.25.4 Maple [F]

$$\int \frac{x\ln\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}dx$$

input
```
int(x*ln(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x)
```

output
```
int(x*ln(x+(x^2+1)^(1/2))/(x^2+1)^(1/2),x)
```

3.25.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.85

$$\int \frac{x\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\log\left(x+\sqrt{x^2+1}\right)-x$$

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

output
```
sqrt(x^2 + 1)*log(x + sqrt(x^2 + 1)) - x
```

3.25.6 Sympy [A] (verification not implemented)

Time = 3.57 (sec) , antiderivative size = 20, normalized size of antiderivative = 0.77

$$\int \frac{x\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx = -x+\sqrt{x^2+1}\log\left(x+\sqrt{x^2+1}\right)$$

input
```
integrate(x*ln(x+(x**2+1)**(1/2))/(x**2+1)**(1/2),x)
```

output
```
-x + sqrt(x**2 + 1)*log(x + sqrt(x**2 + 1))
```

3.25.7 Maxima [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.85

$$\int \frac{x\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\log\left(x+\sqrt{x^2+1}\right) - x$$

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

output
```
sqrt(x^2 + 1)*log(x + sqrt(x^2 + 1)) - x
```

3.25.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.85

$$\int \frac{x\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\log\left(x+\sqrt{x^2+1}\right) - x$$

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

output
```
sqrt(x^2 + 1)*log(x + sqrt(x^2 + 1)) - x
```

3.25.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\log\left(x+\sqrt{1+x^2}\right)}{\sqrt{1+x^2}}\,dx = \int \frac{x\,\ln\left(x+\sqrt{x^2+1}\right)}{\sqrt{x^2+1}}\,dx$$

input
```
int((x*log(x + (x^2 + 1)^(1/2)))/(x^2 + 1)^(1/2),x)
```

output
```
int((x*log(x + (x^2 + 1)^(1/2)))/(x^2 + 1)^(1/2), x)
```

3.26 $\int \frac{x \log\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx$

3.26.1 Optimal result

Integrand size = 27, antiderivative size = 78

$$\int \frac{x \log\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = \sqrt{1-x^2}+\frac{\operatorname{arctanh}\left(\sqrt{2}x\right)}{\sqrt{2}}-\frac{\operatorname{arctanh}\left(\sqrt{2}\sqrt{1-x^2}\right)}{\sqrt{2}} - \sqrt{1-x^2}\log\left(x+\sqrt{1-x^2}\right)$$

output
```
1/2*arctanh(x*2^(1/2))*2^(1/2)-1/2*arctanh(2^(1/2)*(-x^2+1)^(1/2))*2^(1/2)
+(-x^2+1)^(1/2)-ln(x+(-x^2+1)^(1/2))*(-x^2+1)^(1/2)
```

3.26.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 119, normalized size of antiderivative = 1.53

$$\int \frac{x \log\left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = \frac{1}{4}\left(4\sqrt{1-x^2}+2\sqrt{2}\log\left(\sqrt{2}+2x\right) - \sqrt{2}\log\left(2-\sqrt{2}x+\sqrt{2-2x^2}\right) - \sqrt{2}\log\left(2+\sqrt{2}x+\sqrt{2-2x^2}\right) - 4\sqrt{1-x^2}\log\left(x+\sqrt{1-x^2}\right)\right)$$

input
```
Integrate[(x*Log[x + Sqrt[1 - x^2]])/Sqrt[1 - x^2],x]
```

output
```
(4*Sqrt[1 - x^2] + 2*Sqrt[2]*Log[Sqrt[2] + 2*x] - Sqrt[2]*Log[2 - Sqrt[2]*
x + Sqrt[2 - 2*x^2]] - Sqrt[2]*Log[2 + Sqrt[2]*x + Sqrt[2 - 2*x^2]] - 4*Sq
rt[1 - x^2]*Log[x + Sqrt[1 - x^2]])/4
```

3.26.3 Rubi [A] (verified)

Time = 0.46 (sec) , antiderivative size = 78, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.111$, Rules used = {3034, 7293, 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.

$$\int \frac{x \log \left(\sqrt{1-x^2}+x\right)}{\sqrt{1-x^2}} \, dx$$

$$\Big\downarrow \text{3034}$$

$$-\int \frac{x-\sqrt{1-x^2}}{x+\sqrt{1-x^2}}dx-\sqrt{1-x^2}\log \left(\sqrt{1-x^2}+x\right)$$

$$\Big\downarrow \text{7293}$$

$$-\int \left(\frac{x}{x+\sqrt{1-x^2}}-\frac{\sqrt{1-x^2}}{x+\sqrt{1-x^2}}\right)dx-\sqrt{1-x^2}\log \left(\sqrt{1-x^2}+x\right)$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\text{arctanh}\left(\sqrt{2}\sqrt{1-x^2}\right)}{\sqrt{2}}+\frac{\text{arctanh}\left(\sqrt{2}x\right)}{\sqrt{2}}+\sqrt{1-x^2}-\sqrt{1-x^2}\log \left(\sqrt{1-x^2}+x\right)$$

input
```
Int[(x*Log[x + Sqrt[1 - x^2]])/Sqrt[1 - x^2],x]
```

output
```
Sqrt[1 - x^2] + ArcTanh[Sqrt[2]*x]/Sqrt[2] - ArcTanh[Sqrt[2]*Sqrt[1 - x^2]
]/Sqrt[2] - Sqrt[1 - x^2]*Log[x + Sqrt[1 - x^2]]
```

3.26.3.1 Defintions of rubi rules used

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

rule 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

3.26.4 Maple [F]

$$\int \frac{x \ln \left(x+\sqrt{-x^{2}+1}\right)}{\sqrt{-x^{2}+1}}dx$$

input
```
int(x*ln(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x)
```

output
```
int(x*ln(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x)
```

3.26.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 115, normalized size of antiderivative = 1.47

$$\begin{aligned}\int \frac{x \log \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}} \, dx &= -\sqrt{-x^{2}+1} \log \left(x+\sqrt{-x^{2}+1}\right) \\ &\quad + \frac{1}{4} \sqrt{2} \log \left(\frac{6 \, x^{2}-2 \, \sqrt{2} (2 \, x^{2}-3)+2 \, \sqrt{-x^{2}+1} (3 \, \sqrt{2}-4)-9}{2 \, x^{2}-1}\right) \\ &\quad + \frac{1}{4} \sqrt{2} \log \left(\frac{2 \, x^{2}+2 \, \sqrt{2} x+1}{2 \, x^{2}-1}\right)+\sqrt{-x^{2}+1}\end{aligned}$$

input
```
integrate(x*log(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-sqrt(-x^2 + 1)*log(x + sqrt(-x^2 + 1)) + 1/4*sqrt(2)*log((6*x^2 - 2*sqrt(
2)*(2*x^2 - 3) + 2*sqrt(-x^2 + 1)*(3*sqrt(2) - 4) - 9)/(2*x^2 - 1)) + 1/4*
sqrt(2)*log((2*x^2 + 2*sqrt(2)*x + 1)/(2*x^2 - 1)) + sqrt(-x^2 + 1)
```

3.26.6 Sympy [F]

$$\int \frac{x \log \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx=\int \frac{x \log \left(x+\sqrt{1-x^2}\right)}{\sqrt{-\left(x-1\right)\left(x+1\right)}}\,dx$$

input
```
integrate(x*ln(x+(-x**2+1)**(1/2))/(-x**2+1)**(1/2),x)
```

output
```
Integral(x*log(x + sqrt(1 - x**2))/sqrt(-(x - 1)*(x + 1)), x)
```

3.26.7 Maxima [F]

$$\int \frac{x \log \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx=\int \frac{x \log \left(x+\sqrt{-x^2+1}\right)}{\sqrt{-x^2+1}}\,dx$$

input
```
integrate(x*log(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
(x^2 - 1)*log(x + sqrt(x + 1)*sqrt(-x + 1))/(sqrt(x + 1)*sqrt(-x + 1)) - i
ntegrate((x^2 - 1)*e^(-1/2*log(x + 1) - 1/2*log(-x + 1))/x, x) - integrate
(1/(x^2 + sqrt(x + 1)*x*sqrt(-x + 1)), x)
```

3.26.8 Giac [A] (verification not implemented)

Time = 0.35 (sec) , antiderivative size = 122, normalized size of antiderivative = 1.56

$$\int \frac{x\log \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = -\sqrt{-x^2+1}\log \left(x+\sqrt{-x^2+1}\right) - \frac{1}{4}\sqrt{2}\log \left(\frac{\left|-4\sqrt{2}+\frac{2\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-6\right|}{\left|4\sqrt{2}+\frac{2\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-6\right|}\right) + \frac{1}{4}\sqrt{2}\log \left(\left|x+\frac{1}{2}\sqrt{2}\right|\right) - \frac{1}{4}\sqrt{2}\log \left(\left|x-\frac{1}{2}\sqrt{2}\right|\right) + \sqrt{-x^2+1}$$

input
```
integrate(x*log(x+(-x^2+1)^(1/2))/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
-sqrt(-x^2 + 1)*log(x + sqrt(-x^2 + 1)) - 1/4*sqrt(2)*log(abs(-4*sqrt(2) +
 2*(sqrt(-x^2 + 1) - 1)^2/x^2 - 6)/abs(4*sqrt(2) + 2*(sqrt(-x^2 + 1) - 1)^
2/x^2 - 6)) + 1/4*sqrt(2)*log(abs(x + 1/2*sqrt(2))) - 1/4*sqrt(2)*log(abs(
x - 1/2*sqrt(2))) + sqrt(-x^2 + 1)
```

3.26.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\log \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx = \int \frac{x\,\ln \left(x+\sqrt{1-x^2}\right)}{\sqrt{1-x^2}}\,dx$$

input
```
int((x*log(x + (1 - x^2)^(1/2)))/(1 - x^2)^(1/2),x)
```

output
```
int((x*log(x + (1 - x^2)^(1/2)))/(1 - x^2)^(1/2), x)
```

3.27 $\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx$

3.27.1 Optimal result

Integrand size = 17, antiderivative size = 39

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{1-x^2}}{x} - \arcsin(x) - \frac{\sqrt{1-x^2}\log(x)}{x}$$

output
```
-arcsin(x)-(-x^2+1)^(1/2)/x-ln(x)*(-x^2+1)^(1/2)/x
```

3.27.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 25, normalized size of antiderivative = 0.64

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = -\arcsin(x) - \frac{\sqrt{1-x^2}(1+\log(x))}{x}$$

input
```
Integrate[Log[x]/(x^2*Sqrt[1 - x^2]),x]
```

output
```
-ArcSin[x] - (Sqrt[1 - x^2]*(1 + Log[x]))/x
```

3.27.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.176, Rules used = {2773, 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.

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}dx$$

$$\Big\downarrow \ 2773$$

$$\int \frac{\sqrt{1-x^2}}{x^2}dx-\frac{\sqrt{1-x^2}\log(x)}{x}$$

$$\Big\downarrow \ 247$$

$$-\int \frac{1}{\sqrt{1-x^2}}dx-\frac{\sqrt{1-x^2}}{x}-\frac{\sqrt{1-x^2}\log(x)}{x}$$

$$\Big\downarrow \ 223$$

$$-\arcsin(x)-\frac{\sqrt{1-x^2}}{x}-\frac{\sqrt{1-x^2}\log(x)}{x}$$

input
```
Int[Log[x]/(x^2*Sqrt[1 - x^2]),x]
```

output
```
-(Sqrt[1 - x^2]/x) - ArcSin[x] - (Sqrt[1 - x^2]*Log[x])/x
```

3.27.3.1 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 2773
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*((f_.)*(x_))^(m_.)*((d_) + (e_.)*
(x_)^(r_.))^(q_), x_Symbol] :> Simp[(f*x)^(m + 1)*(d + e*x^r)^(q + 1)*((a +
 b*Log[c*x^n])/(d*f*(m + 1))), x] - Simp[b*(n/(d*(m + 1)))   Int[(f*x)^m*(d
 + e*x^r)^(q + 1), x], x] /; FreeQ[{a, b, c, d, e, f, m, n, q, r}, x] && Eq
Q[m + r*(q + 1) + 1, 0] && NeQ[m, -1]
```

3.27.4 Maple [A] (verified)

Time = 0.07 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.90

method	result	size
meijerg	$-\arcsin\left(x\right)+\frac{-\ln\left(x\right)\sqrt{-x^{2}+1}-\sqrt{-x^{2}+1}}{x}$	35

input
```
int(ln(x)/x^2/(-x^2+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-arcsin(x)+(-ln(x)*(-x^2+1)^(1/2)-(-x^2+1)^(1/2))/x
```

3.27.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.00

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = \frac{2\,x\arctan\left(\frac{\sqrt{-x^2+1}-1}{x}\right)-\sqrt{-x^2+1}(\log\left(x\right)+1)}{x}$$

input
```
integrate(log(x)/x^2/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
(2*x*arctan((sqrt(-x^2 + 1) - 1)/x) - sqrt(-x^2 + 1)*(log(x) + 1))/x
```

3.27.6 Sympy [F]

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = \int \frac{\log(x)}{x^2\sqrt{-(x-1)(x+1)}}\,dx$$

input
```
integrate(ln(x)/x**2/(-x**2+1)**(1/2),x)
```

output
```
Integral(log(x)/(x**2*sqrt(-(x - 1)*(x + 1))), x)
```

3.27.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 35, normalized size of antiderivative = 0.90

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{-x^2+1}\log(x)}{x} - \frac{\sqrt{-x^2+1}}{x} - \arcsin(x)$$

input
```
integrate(log(x)/x^2/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(-x^2 + 1)*log(x)/x - sqrt(-x^2 + 1)/x - arcsin(x)
```

3.27.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 73 vs. $2(35) = 70$.

Time = 0.28 (sec) , antiderivative size = 73, normalized size of antiderivative = 1.87

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = \frac{1}{2}\left(\frac{x}{\sqrt{-x^2+1}-1} - \frac{\sqrt{-x^2+1}-1}{x}\right)\log(x) + \frac{x}{2\left(\sqrt{-x^2+1}-1\right)} - \frac{\sqrt{-x^2+1}-1}{2x} - \arcsin(x)$$

input
```
integrate(log(x)/x^2/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
1/2*(x/(sqrt(-x^2 + 1) - 1) - (sqrt(-x^2 + 1) - 1)/x)*log(x) + 1/2*x/(sqrt
(-x^2 + 1) - 1) - 1/2*(sqrt(-x^2 + 1) - 1)/x - arcsin(x)
```

3.27.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\log(x)}{x^2\sqrt{1-x^2}}\,dx = \int \frac{\ln(x)}{x^2\sqrt{1-x^2}}\,dx$$

input
```
int(log(x)/(x^2*(1 - x^2)^(1/2)),x)
```

output
```
int(log(x)/(x^2*(1 - x^2)^(1/2)), x)
```

3.28 $\int \frac{x \arctan(x)}{\sqrt{1+x^2}} \, dx$

3.28.1 Optimal result

Integrand size = 13, antiderivative size = 17

$$\int \frac{x \arctan(x)}{\sqrt{1+x^2}} \, dx = -\operatorname{arcsinh}(x) + \sqrt{1+x^2} \arctan(x)$$

output
```
-arcsinh(x)+arctan(x)*(x^2+1)^(1/2)
```

3.28.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.00

$$\int \frac{x \arctan(x)}{\sqrt{1+x^2}} \, dx = -\operatorname{arcsinh}(x) + \sqrt{1+x^2} \arctan(x)$$

input
```
Integrate[(x*ArcTan[x])/Sqrt[1 + x^2],x]
```

output
```
-ArcSinh[x] + Sqrt[1 + x^2]*ArcTan[x]
```

3.28.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 17, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.154, Rules used = {5465, 222}

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.

$$\int \frac{x\arctan(x)}{\sqrt{x^2+1}}dx$$

$$\Big\downarrow \ 5465$$

$$\sqrt{x^2+1}\arctan(x)-\int \frac{1}{\sqrt{x^2+1}}dx$$

$$\Big\downarrow \ 222$$

$$\sqrt{x^2+1}\arctan(x)-\operatorname{arcsinh}(x)$$

input
```
Int[(x*ArcTan[x])/Sqrt[1 + x^2],x]
```

output
```
-ArcSinh[x] + Sqrt[1 + x^2]*ArcTan[x]
```

3.28.3.1 Defintions of rubi rules used

rule 222
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSinh[Rt[b, 2]*(x/Sqrt
[a])]/Rt[b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && PosQ[b]
```

rule 5465
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))^(p_.)*(x_)*((d_) + (e_.)*(x_)^2)^(q_
.), x_Symbol] :> Simp[(d + e*x^2)^(q + 1)*((a + b*ArcTan[c*x])^p/(2*e*(q +
1))), x] - Simp[b*(p/(2*c*(q + 1)))   Int[(d + e*x^2)^q*(a + b*ArcTan[c*x])
^(p - 1), x], x] /; FreeQ[{a, b, c, d, e, q}, x] && EqQ[e, c^2*d] && GtQ[p,
 0] && NeQ[q, -1]
```

3.28.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.64 (sec) , antiderivative size = 54, normalized size of antiderivative = 3.18

method	result	size
default	$\sqrt{(x-i)(x+i)}\,\arctan(x)+\ln\left(\frac{ix+1}{\sqrt{x^2+1}}-i\right)-\ln\left(\frac{ix+1}{\sqrt{x^2+1}}+i\right)$	54

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

output
```
((x-I)*(x+I))^(1/2)*arctan(x)+ln((1+I*x)/(x^2+1)^(1/2)-I)-ln((1+I*x)/(x^2+
1)^(1/2)+I)
```

3.28.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.35

$$\int \frac{x\arctan(x)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\arctan(x)+\log\left(-x+\sqrt{x^2+1}\right)$$

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

output
```
sqrt(x^2 + 1)*arctan(x) + log(-x + sqrt(x^2 + 1))
```

3.28.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 29 vs. 2(14) = 28.

Time = 0.44 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.71

$$\int \frac{x\arctan(x)}{\sqrt{1+x^2}}\,dx = \frac{x^2\operatorname{atan}(x)}{\sqrt{x^2+1}}-\operatorname{asinh}(x)+\frac{\operatorname{atan}(x)}{\sqrt{x^2+1}}$$

input
```
integrate(x*atan(x)/(x**2+1)**(1/2),x)
```

output
```
x**2*atan(x)/sqrt(x**2 + 1) - asinh(x) + atan(x)/sqrt(x**2 + 1)
```

3.28.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.88

$$\int \frac{x\arctan(x)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\arctan(x) - \operatorname{arsinh}(x)$$

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

output
```
sqrt(x^2 + 1)*arctan(x) - arcsinh(x)
```

3.28.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.35

$$\int \frac{x\arctan(x)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\arctan(x) + \log\left(-x+\sqrt{x^2+1}\right)$$

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

output
```
sqrt(x^2 + 1)*arctan(x) + log(-x + sqrt(x^2 + 1))
```

3.28.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\arctan(x)}{\sqrt{1+x^2}}\,dx = \int \frac{x\,\mathrm{atan}(x)}{\sqrt{x^2+1}}\,dx$$

input
```
int((x*atan(x))/(x^2 + 1)^(1/2),x)
```

output
```
int((x*atan(x))/(x^2 + 1)^(1/2), x)
```

3.29 $\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx$

3.29.1 Optimal result

Integrand size = 17, antiderivative size = 57

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{1-x^2}\arctan(x)}{x} - \operatorname{arctanh}\left(\sqrt{1-x^2}\right) + \sqrt{2}\operatorname{arctanh}\left(\frac{\sqrt{1-x^2}}{\sqrt{2}}\right)$$

output
```
-arctanh((-x^2+1)^(1/2))+arctanh(1/2*2^(1/2)*(-x^2+1)^(1/2))*2^(1/2)-arcta
n(x)*(-x^2+1)^(1/2)/x
```

3.29.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 77, normalized size of antiderivative = 1.35

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{1-x^2}\arctan(x)}{x} + \log(x) - \frac{\log(1+x^2)}{\sqrt{2}} + \frac{\log\left(3-x^2+2\sqrt{2-2x^2}\right)}{\sqrt{2}} - \log\left(1+\sqrt{1-x^2}\right)$$

input
```
Integrate[ArcTan[x]/(x^2*Sqrt[1 - x^2]),x]
```

output
```
-((Sqrt[1 - x^2]*ArcTan[x])/x) + Log[x] - Log[1 + x^2]/Sqrt[2] + Log[3 - x
^2 + 2*Sqrt[2 - 2*x^2]]/Sqrt[2] - Log[1 + Sqrt[1 - x^2]]
```

3.29.3 Rubi [A] (verified)

Time = 0.24 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.11, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.353, Rules used = {5511, 25, 354, 94, 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.

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}dx$$
$$\Big\downarrow \text{5511}$$
$$-\int -\frac{\sqrt{1-x^2}}{x\left(x^2+1\right)}dx-\frac{\sqrt{1-x^2}\arctan(x)}{x}$$
$$\Big\downarrow \text{25}$$
$$\int \frac{\sqrt{1-x^2}}{x\left(x^2+1\right)}dx-\frac{\sqrt{1-x^2}\arctan(x)}{x}$$
$$\Big\downarrow \text{354}$$
$$\frac{1}{2}\int \frac{\sqrt{1-x^2}}{x^2\left(x^2+1\right)}dx^2-\frac{\sqrt{1-x^2}\arctan(x)}{x}$$
$$\Big\downarrow \text{94}$$
$$\frac{1}{2}\left(\int \frac{1}{x^2\sqrt{1-x^2}}dx^2-2\int \frac{1}{\sqrt{1-x^2}\left(x^2+1\right)}dx^2\right)-\frac{\sqrt{1-x^2}\arctan(x)}{x}$$
$$\Big\downarrow \text{73}$$
$$\frac{1}{2}\left(4\int \frac{1}{2-x^4}d\sqrt{1-x^2}-2\int \frac{1}{1-x^4}d\sqrt{1-x^2}\right)-\frac{\sqrt{1-x^2}\arctan(x)}{x}$$
$$\Big\downarrow \text{219}$$
$$\frac{1}{2}\left(2\sqrt{2}\text{arctanh}\left(\frac{\sqrt{1-x^2}}{\sqrt{2}}\right)-2\text{arctanh}\left(\sqrt{1-x^2}\right)\right)-\frac{\sqrt{1-x^2}\arctan(x)}{x}$$

input
```
Int[ArcTan[x]/(x^2*Sqrt[1 - x^2]),x]
```

output
```
-((Sqrt[1 - x^2]*ArcTan[x])/x) + (-2*ArcTanh[Sqrt[1 - x^2]] + 2*Sqrt[2]*Ar
cTanh[Sqrt[1 - x^2]/Sqrt[2]])/2
```

3.29.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], 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 94
```
Int[((e_.) + (f_.)*(x_))^(p_)/(((a_.) + (b_.)*(x_))*((c_.) + (d_.)*(x_))),
x_] :> Simp[(b*e - a*f)/(b*c - a*d)   Int[(e + f*x)^(p - 1)/(a + b*x), x],
x] - Simp[(d*e - c*f)/(b*c - a*d)   Int[(e + f*x)^(p - 1)/(c + d*x), x], x]
 /; FreeQ[{a, b, c, d, e, f}, x] && LtQ[0, p, 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 354
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.), x_S
ymbol] :> Simp[1/2   Subst[Int[x^((m - 1)/2)*(a + b*x)^p*(c + d*x)^q, x], x
, x^2], x] /; FreeQ[{a, b, c, d, p, q}, x] && NeQ[b*c - a*d, 0] && IntegerQ
[(m - 1)/2]
```

rule 5511
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))*((f_.)*(x_))^(m_.)*((d_.) + (e_.)*(x
_)^2)^(q_.), x_Symbol] :> With[{u = IntHide[(f*x)^m*(d + e*x^2)^q, x]}, Sim
p[(a + b*ArcTan[c*x])   u, x] - Simp[b*c   Int[SimplifyIntegrand[u/(1 + c^2
*x^2), x], x], x]] /; FreeQ[{a, b, c, d, e, f, m, q}, x] && ((IGtQ[q, 0] &&
  !(ILtQ[(m - 1)/2, 0] && GtQ[m + 2*q + 3, 0])) || (IGtQ[(m + 1)/2, 0] &&
!(ILtQ[q, 0] && GtQ[m + 2*q + 3, 0])) || (ILtQ[(m + 2*q + 1)/2, 0] &&  !ILt
Q[(m - 1)/2, 0]))
```

3.29. $\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx$

3.29.4 Maple [F]

$$\int \frac{\arctan(x)}{x^2\sqrt{-x^2+1}}dx$$

input
```
int(arctan(x)/x^2/(-x^2+1)^(1/2),x)
```

output
```
int(arctan(x)/x^2/(-x^2+1)^(1/2),x)
```

3.29.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 81, normalized size of antiderivative = 1.42

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = \frac{\sqrt{2}x\log\left(\frac{x^2-2\sqrt{2}\sqrt{-x^2+1}-3}{x^2+1}\right) - x\log\left(\sqrt{-x^2+1}+1\right) + x\log\left(\sqrt{-x^2+1}-1\right) - 2\sqrt{-x^2+1}\arctan(x)}{2x}$$

input
```
integrate(arctan(x)/x^2/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
1/2*(sqrt(2)*x*log((x^2 - 2*sqrt(2)*sqrt(-x^2 + 1) - 3)/(x^2 + 1)) - x*log
(sqrt(-x^2 + 1) + 1) + x*log(sqrt(-x^2 + 1) - 1) - 2*sqrt(-x^2 + 1)*arctan
(x))/x
```

3.29.6 Sympy [F]

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = \int \frac{\operatorname{atan}(x)}{x^2\sqrt{-(x-1)(x+1)}}\,dx$$

input
```
integrate(atan(x)/x**2/(-x**2+1)**(1/2),x)
```

output
```
Integral(atan(x)/(x**2*sqrt(-(x - 1)*(x + 1))), x)
```

3.29.7 Maxima [F]

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = \int \frac{\arctan(x)}{\sqrt{-x^2+1}x^2}\,dx$$

input
```
integrate(arctan(x)/x^2/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
integrate(arctan(x)/(sqrt(-x^2 + 1)*x^2), x)
```

3.29.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 104 vs. $2(48) = 96$.

Time = 0.30 (sec) , antiderivative size = 104, normalized size of antiderivative = 1.82

$$\begin{aligned}\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = &\frac{1}{2}\left(\frac{x}{\sqrt{-x^2+1}-1} - \frac{\sqrt{-x^2+1}-1}{x}\right)\arctan(x)\\ &- \frac{1}{2}\sqrt{2}\log\left(\frac{\sqrt{2}-\sqrt{-x^2+1}}{\sqrt{2}+\sqrt{-x^2+1}}\right)\\ &- \frac{1}{2}\log\left(\sqrt{-x^2+1}+1\right) + \frac{1}{2}\log\left(-\sqrt{-x^2+1}+1\right)\end{aligned}$$

input
```
integrate(arctan(x)/x^2/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
1/2*(x/(sqrt(-x^2 + 1) - 1) - (sqrt(-x^2 + 1) - 1)/x)*arctan(x) - 1/2*sqrt
(2)*log((sqrt(2) - sqrt(-x^2 + 1))/(sqrt(2) + sqrt(-x^2 + 1))) - 1/2*log(s
qrt(-x^2 + 1) + 1) + 1/2*log(-sqrt(-x^2 + 1) + 1)
```

3.29.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\arctan(x)}{x^2\sqrt{1-x^2}}\,dx = \int \frac{\operatorname{atan}(x)}{x^2\,\sqrt{1-x^2}}\,dx$$

input
```
int(atan(x)/(x^2*(1 - x^2)^(1/2)),x)
```

output
```
int(atan(x)/(x^2*(1 - x^2)^(1/2)), x)
```

3.30 $\int \frac{x \arctan(x)}{\sqrt{1-x^2}} dx$

3.30.1 Optimal result

Integrand size = 15, antiderivative size = 45

$$\int \frac{x \arctan(x)}{\sqrt{1-x^2}} dx = -\arcsin(x) - \sqrt{1-x^2}\arctan(x) + \sqrt{2}\arctan\left(\frac{\sqrt{2}x}{\sqrt{1-x^2}}\right)$$

output
```
-arcsin(x)+arctan(x*2^(1/2)/(-x^2+1)^(1/2))*2^(1/2)-arctan(x)*(-x^2+1)^(1/
2)
```

3.30.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.00

$$\int \frac{x \arctan(x)}{\sqrt{1-x^2}} dx = -\arcsin(x) - \sqrt{1-x^2}\arctan(x) + \sqrt{2}\arctan\left(\frac{\sqrt{2}x}{\sqrt{1-x^2}}\right)$$

input
```
Integrate[(x*ArcTan[x])/Sqrt[1 - x^2],x]
```

output
```
-ArcSin[x] - Sqrt[1 - x^2]*ArcTan[x] + Sqrt[2]*ArcTan[(Sqrt[2]*x)/Sqrt[1 -
 x^2]]
```

3.30.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 45, 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 = {5509, 301, 223, 291, 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.

$$\int \frac{x \arctan(x)}{\sqrt{1-x^2}} \, dx$$

$$\Big\downarrow \text{ 5509}$$

$$\int \frac{\sqrt{1-x^2}}{x^2+1}dx-\sqrt{1-x^2}\arctan(x)$$

$$\Big\downarrow \text{ 301}$$

$$-\int \frac{1}{\sqrt{1-x^2}}dx+2\int \frac{1}{\sqrt{1-x^2}\left(x^2+1\right)}dx-\sqrt{1-x^2}\arctan(x)$$

$$\Big\downarrow \text{ 223}$$

$$2\int \frac{1}{\sqrt{1-x^2}\left(x^2+1\right)}dx-\arcsin(x)-\sqrt{1-x^2}\arctan(x)$$

$$\Big\downarrow \text{ 291}$$

$$2\int \frac{1}{\frac{2x^2}{1-x^2}+1}d\frac{x}{\sqrt{1-x^2}}-\arcsin(x)-\sqrt{1-x^2}\arctan(x)$$

$$\Big\downarrow \text{ 216}$$

$$-\arcsin(x)-\sqrt{1-x^2}\arctan(x)+\sqrt{2}\arctan\left(\frac{\sqrt{2}x}{\sqrt{1-x^2}}\right)$$

input
```
Int[(x*ArcTan[x])/Sqrt[1 - x^2],x]
```

output
```
-ArcSin[x] - Sqrt[1 - x^2]*ArcTan[x] + Sqrt[2]*ArcTan[(Sqrt[2]*x)/Sqrt[1 -
 x^2]]
```

3.30.3.1 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 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 291
```
Int[1/(Sqrt[(a_) + (b_.)*(x_)^2]*((c_) + (d_.)*(x_)^2)), x_Symbol] :> Subst
[Int[1/(c - (b*c - a*d)*x^2), x], x, x/Sqrt[a + b*x^2]] /; FreeQ[{a, b, c,
d}, x] && NeQ[b*c - a*d, 0]
```

rule 301
```
Int[((a_) + (b_.)*(x_)^2)^(p_.)/((c_) + (d_.)*(x_)^2), x_Symbol] :> Simp[b/
d   Int[(a + b*x^2)^(p - 1), x], x] - Simp[(b*c - a*d)/d   Int[(a + b*x^2)^
(p - 1)/(c + d*x^2), x], x] /; FreeQ[{a, b, c, d}, x] && NeQ[b*c - a*d, 0]
&& GtQ[p, 0] && (EqQ[p, 1/2] || EqQ[Denominator[p], 4] || (EqQ[p, 2/3] && E
qQ[b*c + 3*a*d, 0]))
```

rule 5509
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))*(x_)*((d_.) + (e_.)*(x_)^2)^(q_.), x
_Symbol] :> Simp[(d + e*x^2)^(q + 1)*((a + b*ArcTan[c*x])/(2*e*(q + 1))), x
] - Simp[b*(c/(2*e*(q + 1)))   Int[(d + e*x^2)^(q + 1)/(1 + c^2*x^2), x], x
] /; FreeQ[{a, b, c, d, e, q}, x] && NeQ[q, -1]
```

3.30.4 Maple [F]

$$\int \frac{x \arctan(x)}{\sqrt{-x^2+1}} dx$$

input
```
int(x*arctan(x)/(-x^2+1)^(1/2),x)
```

output
```
int(x*arctan(x)/(-x^2+1)^(1/2),x)
```

3.30.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 69, normalized size of antiderivative = 1.53

$$\int \frac{x\arctan(x)}{\sqrt{1-x^2}}\,dx = -\frac{1}{2}\,\sqrt{2}\arctan\left(\frac{\sqrt{2}(3\,x^2-1)\sqrt{-x^2+1}}{4\,(x^3-x)}\right) - \sqrt{-x^2+1}\arctan\left(x\right)+\arctan\left(\frac{\sqrt{-x^2+1}x}{x^2-1}\right)$$

input
```
integrate(x*arctan(x)/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-1/2*sqrt(2)*arctan(1/4*sqrt(2)*(3*x^2 - 1)*sqrt(-x^2 + 1)/(x^3 - x)) - sq
rt(-x^2 + 1)*arctan(x) + arctan(sqrt(-x^2 + 1)*x/(x^2 - 1))
```

3.30.6 Sympy [F]

$$\int \frac{x\arctan(x)}{\sqrt{1-x^2}}\,dx = \int \frac{x\,\mathrm{atan}\,(x)}{\sqrt{-(x-1)\,(x+1)}}\,dx$$

input
```
integrate(x*atan(x)/(-x**2+1)**(1/2),x)
```

output
```
Integral(x*atan(x)/sqrt(-(x - 1)*(x + 1)), x)
```

3.30.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.44 (sec) , antiderivative size = 387, normalized size of antiderivative = 8.60

$$\int \frac{x\arctan(x)}{\sqrt{1-x^2}}\,dx = -\sqrt{-x^2+1}\arctan\left(x\right) + \frac{1}{2}\,\sqrt{2}\arctan\left(\frac{\left(x^4+|i\,x+1|^4-2\,(x^2-1)|i\,x+1|^2+2\,x^2+1\right)^{\frac{1}{4}}\sin\left(\frac{1}{2}\,\arctan\left(\frac{2\,x}{|i\,x+1|^2},-\frac{x^2-|i\,x+1|^2-1}{|i\,x+1|^2}\right)\right)}{|i\,x+1|}\right) + \frac{1}{2}\,\sqrt{2}\arctan\left(\frac{\left(x^4+|i\,x-1|^4-2\,(x^2-1)|i\,x-1|^2+2\,x^2+1\right)^{\frac{1}{4}}\sin\left(\frac{1}{2}\,\arctan\left(\frac{2\,x}{|i\,x-1|^2},-\frac{x^2-|i\,x-1|^2-1}{|i\,x-1|^2}\right)\right)}{|i\,x-1|}\right) - \arctan\left(x,\sqrt{-x^2+1}\right)$$

input
```
integrate(x*arctan(x)/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(-x^2 + 1)*arctan(x) + 1/2*sqrt(2)*arctan2(((x^4 + abs(I*x + 1)^4 - 2
*(x^2 - 1)*abs(I*x + 1)^2 + 2*x^2 + 1)^(1/4)*sin(1/2*arctan2(2*x/abs(I*x +
 1)^2, -(x^2 - abs(I*x + 1)^2 - 1)/abs(I*x + 1)^2)) + x)/abs(I*x + 1), ((x
^4 + abs(I*x + 1)^4 - 2*(x^2 - 1)*abs(I*x + 1)^2 + 2*x^2 + 1)^(1/4)*cos(1/
2*arctan2(2*x/abs(I*x + 1)^2, -(x^2 - abs(I*x + 1)^2 - 1)/abs(I*x + 1)^2))
 + 1)/abs(I*x + 1)) + 1/2*sqrt(2)*arctan2(((x^4 + abs(I*x - 1)^4 - 2*(x^2
- 1)*abs(I*x - 1)^2 + 2*x^2 + 1)^(1/4)*sin(1/2*arctan2(2*x/abs(I*x - 1)^2,
 -(x^2 - abs(I*x - 1)^2 - 1)/abs(I*x - 1)^2)) + x)/abs(I*x - 1), ((x^4 + a
bs(I*x - 1)^4 - 2*(x^2 - 1)*abs(I*x - 1)^2 + 2*x^2 + 1)^(1/4)*cos(1/2*arct
an2(2*x/abs(I*x - 1)^2, -(x^2 - abs(I*x - 1)^2 - 1)/abs(I*x - 1)^2)) + 1)/
abs(I*x - 1)) - arctan2(x, sqrt(-x^2 + 1))
```

3.30.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 108 vs. $2(37) = 74$.

Time = 0.28 (sec) , antiderivative size = 108, normalized size of antiderivative = 2.40

$$\int \frac{x\arctan(x)}{\sqrt{1-x^2}}\,dx = -\frac{1}{2}\,\pi\mathrm{sgn}(x) + \frac{1}{2}\sqrt{2}\left(\pi\mathrm{sgn}(x) + 2\,\arctan\left(-\frac{\sqrt{2}x\left(\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-1\right)}{4\left(\sqrt{-x^2+1}-1\right)}\right)\right) - \sqrt{-x^2+1}\arctan(x) - \arctan\left(-\frac{x\left(\frac{\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-1\right)}{2\left(\sqrt{-x^2+1}-1\right)}\right)$$

input
```
integrate(x*arctan(x)/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
-1/2*pi*sgn(x) + 1/2*sqrt(2)*(pi*sgn(x) + 2*arctan(-1/4*sqrt(2)*x*((sqrt(-
x^2 + 1) - 1)^2/x^2 - 1)/(sqrt(-x^2 + 1) - 1))) - sqrt(-x^2 + 1)*arctan(x)
 - arctan(-1/2*x*((sqrt(-x^2 + 1) - 1)^2/x^2 - 1)/(sqrt(-x^2 + 1) - 1))
```

3.30.9 Mupad [B] (verification not implemented)

Time = 0.03 (sec) , antiderivative size = 37, normalized size of antiderivative = 0.82

$$\int \frac{x \arctan(x)}{\sqrt{1-x^2}}\,dx = \sqrt{2}\,\mathrm{atan}\left(\frac{\sqrt{2}\,x}{\sqrt{1-x^2}}\right) - \mathrm{atan}(x)\,\sqrt{1-x^2} - \mathrm{asin}(x)$$

input
```
int((x*atan(x))/(1 - x^2)^(1/2),x)
```

output
```
2^(1/2)*atan((2^(1/2)*x)/(1 - x^2)^(1/2)) - atan(x)*(1 - x^2)^(1/2) - asin
(x)
```

3.31 $\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx$

3.31.1 Optimal result

Integrand size = 15, antiderivative size = 29

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{\sqrt{1+x^2}\arctan(x)}{x} - \operatorname{arctanh}\left(\sqrt{1+x^2}\right)$$

output
```
-arctanh((x^2+1)^(1/2))-arctan(x)*(x^2+1)^(1/2)/x
```

3.31.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 33, normalized size of antiderivative = 1.14

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{\sqrt{1+x^2}\arctan(x)}{x} + \log(x) - \log\left(1+\sqrt{1+x^2}\right)$$

input
```
Integrate[ArcTan[x]/(x^2*Sqrt[1 + x^2]),x]
```

output
```
-((Sqrt[1 + x^2]*ArcTan[x])/x) + Log[x] - Log[1 + Sqrt[1 + x^2]]
```

3.31.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 29, 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 = {5479, 243, 73, 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.

$$\int \frac{\arctan(x)}{x^2\sqrt{x^2+1}}dx$$

$$\Big\downarrow \text{5479}$$

$$\int \frac{1}{x\sqrt{x^2+1}}dx-\frac{\sqrt{x^2+1}\arctan(x)}{x}$$

$$\Big\downarrow \text{243}$$

$$\frac{1}{2}\int \frac{1}{x^2\sqrt{x^2+1}}dx^2-\frac{\sqrt{x^2+1}\arctan(x)}{x}$$

$$\Big\downarrow \text{73}$$

$$\int \frac{1}{x^4-1}d\sqrt{x^2+1}-\frac{\sqrt{x^2+1}\arctan(x)}{x}$$

$$\Big\downarrow \text{220}$$

$$-\frac{\sqrt{x^2+1}\arctan(x)}{x}-\text{arctanh}\left(\sqrt{x^2+1}\right)$$

input
```
Int[ArcTan[x]/(x^2*Sqrt[1 + x^2]),x]
```

output
```
-((Sqrt[1 + x^2]*ArcTan[x])/x) - ArcTanh[Sqrt[1 + x^2]]
```

3.31.3.1 Defintions of rubi rules used

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 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 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 5479
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))^(p_.)*((f_.)*(x_))^(m_.)*((d_) + (e_
.)*(x_)^2)^(q_.), x_Symbol] :> Simp[(f*x)^(m + 1)*(d + e*x^2)^(q + 1)*((a +
 b*ArcTan[c*x])^p/(d*f*(m + 1))), x] - Simp[b*c*(p/(f*(m + 1)))   Int[(f*x)
^(m + 1)*(d + e*x^2)^q*(a + b*ArcTan[c*x])^(p - 1), x], x] /; FreeQ[{a, b,
c, d, e, f, m, q}, x] && EqQ[e, c^2*d] && EqQ[m + 2*q + 3, 0] && GtQ[p, 0]
&& NeQ[m, -1]
```

3.31.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.68 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.93

method	result	size
default	$-\frac{\sqrt{(x-i)(x+i)}\,\arctan(x)}{x}+\ln\left(\frac{ix+1}{\sqrt{x^2+1}}-1\right)-\ln\left(\frac{ix+1}{\sqrt{x^2+1}}+1\right)$	56

input
```
int(arctan(x)/x^2/(x^2+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-((x-I)*(x+I))^(1/2)*arctan(x)/x+ln((1+I*x)/(x^2+1)^(1/2)-1)-ln((1+I*x)/(x
^2+1)^(1/2)+1)
```

3.31.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 47, normalized size of antiderivative = 1.62

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{x\log\left(-x+\sqrt{x^2+1}+1\right)-x\log\left(-x+\sqrt{x^2+1}-1\right)+\sqrt{x^2+1}\arctan\left(x\right)}{x}$$

input
```
integrate(arctan(x)/x^2/(x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-(x*log(-x + sqrt(x^2 + 1) + 1) - x*log(-x + sqrt(x^2 + 1) - 1) + sqrt(x^2
 + 1)*arctan(x))/x
```

3.31.6 Sympy [A] (verification not implemented)

Time = 3.83 (sec) , antiderivative size = 19, normalized size of antiderivative = 0.66

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = -\operatorname{asinh}\left(\frac{1}{x}\right)-\frac{\sqrt{x^2+1}\operatorname{atan}\left(x\right)}{x}$$

input
```
integrate(atan(x)/x**2/(x**2+1)**(1/2),x)
```

output
```
-asinh(1/x) - sqrt(x**2 + 1)*atan(x)/x
```

3.31.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.76

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{\sqrt{x^2+1}\arctan\left(x\right)}{x}-\operatorname{arsinh}\left(\frac{1}{|x|}\right)$$

input
```
integrate(arctan(x)/x^2/(x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(x^2 + 1)*arctan(x)/x - arcsinh(1/abs(x))
```

3.31.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 54 vs. $2(25) = 50$.

Time = 0.28 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.86

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = \frac{2\arctan(x)}{\left(x-\sqrt{x^2+1}\right)^2-1} + \arctan(x) - \log\left(\left|-x+\sqrt{x^2+1}+1\right|\right) + \log\left(\left|-x+\sqrt{x^2+1}-1\right|\right)$$

input
```
integrate(arctan(x)/x^2/(x^2+1)^(1/2),x, algorithm="giac")
```

output
```
2*arctan(x)/((x - sqrt(x^2 + 1))^2 - 1) + arctan(x) - log(abs(-x + sqrt(x^
2 + 1) + 1)) + log(abs(-x + sqrt(x^2 + 1) - 1))
```

3.31.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\arctan(x)}{x^2\sqrt{1+x^2}}\,dx = \int \frac{\mathrm{atan}(x)}{x^2\,\sqrt{x^2+1}}\,dx$$

input
```
int(atan(x)/(x^2*(x^2 + 1)^(1/2)),x)
```

output
```
int(atan(x)/(x^2*(x^2 + 1)^(1/2)), x)
```

3.32 $\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx$

3.32.1 Optimal result

Integrand size = 17, antiderivative size = 21

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{1-x^2}\arcsin(x)}{x} + \log(x)$$

output
```
ln(x)-arcsin(x)*(-x^2+1)^(1/2)/x
```

3.32.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 21, normalized size of antiderivative = 1.00

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{1-x^2}\arcsin(x)}{x} + \log(x)$$

input
```
Integrate[ArcSin[x]/(x^2*Sqrt[1 - x^2]),x]
```

output
```
-((Sqrt[1 - x^2]*ArcSin[x])/x) + Log[x]
```

3.32.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 21, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {5186, 14}

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.

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}dx$$

$$\Big\downarrow \; 5186$$

$$\int \frac{1}{x}dx - \frac{\sqrt{1-x^2}\arcsin(x)}{x}$$

$$\Big\downarrow \; 14$$

$$\log(x) - \frac{\sqrt{1-x^2}\arcsin(x)}{x}$$

input
```
Int[ArcSin[x]/(x^2*Sqrt[1 - x^2]),x]
```

output
```
-((Sqrt[1 - x^2]*ArcSin[x])/x) + Log[x]
```

3.32.3.1 Defintions of rubi rules used

rule 14
```
Int[(a_.)/(x_), x_Symbol] :> Simp[a*Log[x], x] /; FreeQ[a, x]
```

rule 5186
```
Int[((a_.) + ArcSin[(c_.)*(x_)]*(b_.))^(n_.)*((f_.)*(x_))^(m_)*((d_) + (e_.
)*(x_)^2)^(p_), x_Symbol] :> Simp[(f*x)^(m + 1)*(d + e*x^2)^(p + 1)*((a + b
*ArcSin[c*x])^n/(d*f*(m + 1))), x] - Simp[b*c*(n/(f*(m + 1)))*Simp[(d + e*x
^2)^p/(1 - c^2*x^2)^p]   Int[(f*x)^(m + 1)*(1 - c^2*x^2)^(p + 1/2)*(a + b*A
rcSin[c*x])^(n - 1), x], x] /; FreeQ[{a, b, c, d, e, f, m, p}, x] && EqQ[c^
2*d + e, 0] && GtQ[n, 0] && EqQ[m + 2*p + 3, 0] && NeQ[m, -1]
```

3.32.4 Maple [A] (verified)

Time = 0.23 (sec) , antiderivative size = 20, normalized size of antiderivative = 0.95

method	result	size
default	$\ln(x)-\frac{\arcsin(x)\sqrt{-x^2+1}}{x}$	20

input
```
int(arcsin(x)/x^2/(-x^2+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
ln(x)-arcsin(x)*(-x^2+1)^(1/2)/x
```

3.32.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.05

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx=\frac{x\log(x)-\sqrt{-x^2+1}\arcsin(x)}{x}$$

input
```
integrate(arcsin(x)/x^2/(-x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
(x*log(x) - sqrt(-x^2 + 1)*arcsin(x))/x
```

3.32.6 Sympy [F]

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx=\int \frac{\operatorname{asin}(x)}{x^2\sqrt{-(x-1)(x+1)}}\,dx$$

input
```
integrate(asin(x)/x**2/(-x**2+1)**(1/2),x)
```

output
```
Integral(asin(x)/(x**2*sqrt(-(x - 1)*(x + 1))), x)
```

3.32.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 19, normalized size of antiderivative = 0.90

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx = -\frac{\sqrt{-x^2+1}\arcsin{(x)}}{x} + \log{(x)}$$

input
```
integrate(arcsin(x)/x^2/(-x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(-x^2 + 1)*arcsin(x)/x + log(x)
```

3.32.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 40 vs. 2(19) = 38.

Time = 0.29 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.90

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx = \frac{1}{2}\left(\frac{x}{\sqrt{-x^2+1}-1} - \frac{\sqrt{-x^2+1}-1}{x}\right)\arcsin{(x)} + \log{(|x|)}$$

input
```
integrate(arcsin(x)/x^2/(-x^2+1)^(1/2),x, algorithm="giac")
```

output
```
1/2*(x/(sqrt(-x^2 + 1) - 1) - (sqrt(-x^2 + 1) - 1)/x)*arcsin(x) + log(abs(
x))
```

3.32.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\arcsin(x)}{x^2\sqrt{1-x^2}}\,dx = \int \frac{\mathrm{asin}(x)}{x^2\,\sqrt{1-x^2}}\,dx$$

input
```
int(asin(x)/(x^2*(1 - x^2)^(1/2)),x)
```

output
```
int(asin(x)/(x^2*(1 - x^2)^(1/2)), x)
```

3.33 $\int \frac{x \log(x)}{\sqrt{-1+x^2}}\, dx$

3.33.1 Optimal result

Integrand size = 13, antiderivative size = 34

$$\int \frac{x \log(x)}{\sqrt{-1+x^2}}\, dx = -\sqrt{-1+x^2} + \arctan\left(\sqrt{-1+x^2}\right) + \sqrt{-1+x^2}\log(x)$$

output
```
arctan((x^2-1)^(1/2))-(x^2-1)^(1/2)+ln(x)*(x^2-1)^(1/2)
```

3.33.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.79

$$\int \frac{x \log(x)}{\sqrt{-1+x^2}}\, dx = -\arctan\left(\frac{1}{\sqrt{-1+x^2}}\right) + \sqrt{-1+x^2}(-1+\log(x))$$

input
```
Integrate[(x*Log[x])/Sqrt[-1 + x^2],x]
```

output
```
-ArcTan[1/Sqrt[-1 + x^2]] + Sqrt[-1 + x^2]*(-1 + Log[x])
```

3.33.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.21, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.385, Rules used = {2776, 243, 60, 73, 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.

$$\int \frac{x\log(x)}{\sqrt{x^2-1}}dx$$

$$\Big\downarrow \text{2776}$$

$$\sqrt{x^2-1}\log(x)-\int \frac{\sqrt{x^2-1}}{x}dx$$

$$\Big\downarrow \text{243}$$

$$\sqrt{x^2-1}\log(x)-\frac{1}{2}\int \frac{\sqrt{x^2-1}}{x^2}dx^2$$

$$\Big\downarrow \text{60}$$

$$\frac{1}{2}\left(\int \frac{1}{x^2\sqrt{x^2-1}}dx^2-2\sqrt{x^2-1}\right)+\sqrt{x^2-1}\log(x)$$

$$\Big\downarrow \text{73}$$

$$\frac{1}{2}\left(2\int \frac{1}{x^4+1}d\sqrt{x^2-1}-2\sqrt{x^2-1}\right)+\sqrt{x^2-1}\log(x)$$

$$\Big\downarrow \text{216}$$

$$\frac{1}{2}\left(2\arctan\left(\sqrt{x^2-1}\right)-2\sqrt{x^2-1}\right)+\sqrt{x^2-1}\log(x)$$

input
```
Int[(x*Log[x])/Sqrt[-1 + x^2],x]
```

output
```
(-2*Sqrt[-1 + x^2] + 2*ArcTan[Sqrt[-1 + x^2]])/2 + Sqrt[-1 + x^2]*Log[x]
```

3.33.3.1 Defintions of rubi rules used

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 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 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 2776
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((f_.)*(x_))^(m_.)*((d_) +
(e_.)*(x_)^(r_))^(q_.), x_Symbol] :> Simp[f^m*(d + e*x^r)^(q + 1)*((a + b*L
og[c*x^n])^p/(e*r*(q + 1))), x] - Simp[b*f^m*n*(p/(e*r*(q + 1)))   Int[(d +
 e*x^r)^(q + 1)*((a + b*Log[c*x^n])^(p - 1)/x), x], x] /; FreeQ[{a, b, c, d
, e, f, m, n, q, r}, x] && EqQ[m, r - 1] && IGtQ[p, 0] && (IntegerQ[m] || G
tQ[f, 0]) && NeQ[r, n] && NeQ[q, -1]
```

3.33.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.08 (sec) , antiderivative size = 119, normalized size of antiderivative = 3.50

method	result
meijerg	$-\frac{\sqrt{-\operatorname{signum}(x^2-1)}\left(2-2\sqrt{-x^2+1}\right)}{4\sqrt{\operatorname{signum}(x^2-1)}}+\frac{\sqrt{-\operatorname{signum}(x^2-1)}\ln(x)\left(2-2\sqrt{-x^2+1}\right)}{2\sqrt{\operatorname{signum}(x^2-1)}}+\frac{\sqrt{-\operatorname{signum}(x^2-1)}\left(-16+16\sqrt{-x^2+1}-32\right.}{32\sqrt{\operatorname{signum}(x^2-1)}}$

input
```
int(x*ln(x)/(x^2-1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-1/4/signum(x^2-1)^(1/2)*(-signum(x^2-1))^(1/2)*(2-2*(-x^2+1)^(1/2))+1/2/s
ignum(x^2-1)^(1/2)*(-signum(x^2-1))^(1/2)*ln(x)*(2-2*(-x^2+1)^(1/2))+1/32/
signum(x^2-1)^(1/2)*(-signum(x^2-1))^(1/2)*(-16+16*(-x^2+1)^(1/2)-32*ln(1/
2+1/2*(-x^2+1)^(1/2)))
```

3.33.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.79

$$\int \frac{x\log(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}(\log(x)-1)+2\arctan\left(-x+\sqrt{x^2-1}\right)$$

input
```
integrate(x*log(x)/(x^2-1)^(1/2),x, algorithm="fricas")
```

output
```
sqrt(x^2 - 1)*(log(x) - 1) + 2*arctan(-x + sqrt(x^2 - 1))
```

3.33.6 Sympy [A] (verification not implemented)

Time = 1.37 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.85

$$\int \frac{x\log(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\log(x)-\begin{cases}\sqrt{x^2-1}-\operatorname{acos}\left(\frac{1}{x}\right) & \text{for } x>-1\wedge x<1\end{cases}$$

input
```
integrate(x*ln(x)/(x**2-1)**(1/2),x)
```

output
```
sqrt(x**2 - 1)*log(x) - Piecewise((sqrt(x**2 - 1) - acos(1/x), (x > -1) &
(x < 1)))
```

3.33.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.79

$$\int \frac{x\log(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\log{(x)} - \sqrt{x^2-1} - \arcsin\left(\frac{1}{|x|}\right)$$

input
```
integrate(x*log(x)/(x^2-1)^(1/2),x, algorithm="maxima")
```

output
```
sqrt(x^2 - 1)*log(x) - sqrt(x^2 - 1) - arcsin(1/abs(x))
```

3.33.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 28, normalized size of antiderivative = 0.82

$$\int \frac{x\log(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\log{(x)} - \sqrt{x^2-1} + \arctan\left(\sqrt{x^2-1}\right)$$

input
```
integrate(x*log(x)/(x^2-1)^(1/2),x, algorithm="giac")
```

output
```
sqrt(x^2 - 1)*log(x) - sqrt(x^2 - 1) + arctan(sqrt(x^2 - 1))
```

3.33.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\log(x)}{\sqrt{-1+x^2}}\,dx = \int \frac{x\,\ln{(x)}}{\sqrt{x^2-1}}\,dx$$

input
```
int((x*log(x))/(x^2 - 1)^(1/2),x)
```

output
```
int((x*log(x))/(x^2 - 1)^(1/2), x)
```

3.34 $\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx$

3.34.1 Optimal result

Integrand size = 15, antiderivative size = 33

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{\sqrt{1+x^2}}{x} + \operatorname{arcsinh}(x) - \frac{\sqrt{1+x^2}\log(x)}{x}$$

output
```
arcsinh(x)-(x^2+1)^(1/2)/x-ln(x)*(x^2+1)^(1/2)/x
```

3.34.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 21, normalized size of antiderivative = 0.64

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = \operatorname{arcsinh}(x) - \frac{\sqrt{1+x^2}(1+\log(x))}{x}$$

input
```
Integrate[Log[x]/(x^2*Sqrt[1 + x^2]),x]
```

output
```
ArcSinh[x] - (Sqrt[1 + x^2]*(1 + Log[x]))/x
```

3.34.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 33, 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 = {2773, 247, 222}

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.

$$\int \frac{\log(x)}{x^2\sqrt{x^2+1}}dx$$

$$\Big\downarrow \text{2773}$$

$$\int \frac{\sqrt{x^2+1}}{x^2}dx - \frac{\sqrt{x^2+1}\log(x)}{x}$$

$$\Big\downarrow \text{247}$$

$$\int \frac{1}{\sqrt{x^2+1}}dx - \frac{\sqrt{x^2+1}}{x} - \frac{\sqrt{x^2+1}\log(x)}{x}$$

$$\Big\downarrow \text{222}$$

$$\text{arcsinh}(x) - \frac{\sqrt{x^2+1}}{x} - \frac{\sqrt{x^2+1}\log(x)}{x}$$

input
```
Int[Log[x]/(x^2*Sqrt[1 + x^2]),x]
```

output
```
-(Sqrt[1 + x^2]/x) + ArcSinh[x] - (Sqrt[1 + x^2]*Log[x])/x
```

3.34.3.1 Defintions of rubi rules used

rule 222
```
Int[1/Sqrt[(a_) + (b_.)*(x_)^2], x_Symbol] :> Simp[ArcSinh[Rt[b, 2]*(x/Sqrt
[a])]/Rt[b, 2], x] /; FreeQ[{a, b}, x] && GtQ[a, 0] && PosQ[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 2773
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*((f_.)*(x_))^(m_.)*((d_) + (e_.)*
(x_)^(r_.))^(q_), x_Symbol] :> Simp[(f*x)^(m + 1)*(d + e*x^r)^(q + 1)*((a +
 b*Log[c*x^n])/(d*f*(m + 1))), x] - Simp[b*(n/(d*(m + 1)))   Int[(f*x)^m*(d
 + e*x^r)^(q + 1), x], x] /; FreeQ[{a, b, c, d, e, f, m, n, q, r}, x] && Eq
Q[m + r*(q + 1) + 1, 0] && NeQ[m, -1]
```

3.34.4 Maple [A] (verified)

Time = 0.07 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.88

method	result	size
meijerg	$\operatorname{arcsinh}(x)+\frac{-\ln(x)\sqrt{x^2+1}-\sqrt{x^2+1}}{x}$	29

input
```
int(ln(x)/x^2/(x^2+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
arcsinh(x)+(-ln(x)*(x^2+1)^(1/2)-(x^2+1)^(1/2))/x
```

3.34.5 Fricas [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 33, normalized size of antiderivative = 1.00

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{x\log\left(-x+\sqrt{x^2+1}\right)+\sqrt{x^2+1}(\log(x)+1)+x}{x}$$

input
```
integrate(log(x)/x^2/(x^2+1)^(1/2),x, algorithm="fricas")
```

output
```
-(x*log(-x + sqrt(x^2 + 1)) + sqrt(x^2 + 1)*(log(x) + 1) + x)/x
```

3.34.6 Sympy [A] (verification not implemented)

Time = 2.95 (sec) , antiderivative size = 26, normalized size of antiderivative = 0.79

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = \operatorname{asinh}(x) - \frac{\sqrt{x^2+1}\log(x)}{x} - \frac{\sqrt{x^2+1}}{x}$$

input
```
integrate(ln(x)/x**2/(x**2+1)**(1/2),x)
```

output
```
asinh(x) - sqrt(x**2 + 1)*log(x)/x - sqrt(x**2 + 1)/x
```

3.34.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.88

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = -\frac{\sqrt{x^2+1}\log(x)}{x} - \frac{\sqrt{x^2+1}}{x} + \operatorname{arsinh}(x)$$

input
```
integrate(log(x)/x^2/(x^2+1)^(1/2),x, algorithm="maxima")
```

output
```
-sqrt(x^2 + 1)*log(x)/x - sqrt(x^2 + 1)/x + arcsinh(x)
```

3.34.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.76

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = \frac{2\log(x)}{\left(x-\sqrt{x^2+1}\right)^2-1} + \frac{2}{\left(x-\sqrt{x^2+1}\right)^2-1} - \log\left(-x+\sqrt{x^2+1}\right) + \log(|x|)$$

input
```
integrate(log(x)/x^2/(x^2+1)^(1/2),x, algorithm="giac")
```

output
```
2*log(x)/((x - sqrt(x^2 + 1))^2 - 1) + 2/((x - sqrt(x^2 + 1))^2 - 1) - log
(-x + sqrt(x^2 + 1)) + log(abs(x))
```

3.34.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\log(x)}{x^2\sqrt{1+x^2}}\,dx = \int \frac{\ln(x)}{x^2\,\sqrt{x^2+1}}\,dx$$

input
```
int(log(x)/(x^2*(x^2 + 1)^(1/2)),x)
```

output
```
int(log(x)/(x^2*(x^2 + 1)^(1/2)), x)
```

3.35 $\int \frac{x \sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx$

3.35.1 Optimal result

Integrand size = 13, antiderivative size = 25

$$\int \frac{x \sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{-1+x^2}\sec^{-1}(x) - \frac{x\log(x)}{\sqrt{x^2}}$$

output
```
-x*ln(x)/(x^2)^(1/2)+arcsec(x)*(x^2-1)^(1/2)
```

3.35.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.40

$$\int \frac{x \sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \frac{(-1+x^2)\sec^{-1}(x) - \sqrt{1-\frac{1}{x^2}}\,x\log(x)}{\sqrt{-1+x^2}}$$

input
```
Integrate[(x*ArcSec[x])/Sqrt[-1 + x^2],x]
```

output
```
((-1 + x^2)*ArcSec[x] - Sqrt[1 - x^(-2)]*x*Log[x])/Sqrt[-1 + x^2]
```

3.35.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 25, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.154, Rules used = {5759, 14}

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.

$$\int \frac{x\sec^{-1}(x)}{\sqrt{x^2-1}}dx$$

$$\Big\downarrow \text{ 5759}$$

$$\sqrt{x^2-1}\sec^{-1}(x)-\frac{x\int \frac{1}{x}dx}{\sqrt{x^2}}$$

$$\Big\downarrow \text{ 14}$$

$$\sqrt{x^2-1}\sec^{-1}(x)-\frac{x\log(x)}{\sqrt{x^2}}$$

input
```
Int[(x*ArcSec[x])/Sqrt[-1 + x^2],x]
```

output
```
Sqrt[-1 + x^2]*ArcSec[x] - (x*Log[x])/Sqrt[x^2]
```

3.35.3.1 Defintions of rubi rules used

rule 14
```
Int[(a_.)/(x_), x_Symbol] :> Simp[a*Log[x], x] /; FreeQ[a, x]
```

rule 5759
```
Int[((a_.) + ArcSec[(c_.)*(x_)]*(b_.))*(x_)*((d_.) + (e_.)*(x_)^2)^(p_.), x
_Symbol] :> Simp[(d + e*x^2)^(p + 1)*((a + b*ArcSec[c*x])/(2*e*(p + 1))), x
] - Simp[b*c*(x/(2*e*(p + 1)*Sqrt[c^2*x^2]))   Int[(d + e*x^2)^(p + 1)/(x*S
qrt[c^2*x^2 - 1]), x], x] /; FreeQ[{a, b, c, d, e, p}, x] && NeQ[p, -1]
```

3.35.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 3.

Time = 0.39 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.36

method	result	size
default	$\operatorname{csgn}\left(x\sqrt{1-\frac{1}{x^2}}\right)\left(\operatorname{arcsec}(x)\,x\sqrt{\frac{x^2-1}{x^2}}+\ln\left(\frac{1}{x}\right)\right)$	34

input
```
int(x*arcsec(x)/(x^2-1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
csgn(x*(1-1/x^2)^(1/2))*(arcsec(x)*x*((x^2-1)/x^2)^(1/2)+ln(1/x))
```

3.35.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.60

$$\int \frac{x\sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\operatorname{arcsec}(x) - \log(x)$$

input
```
integrate(x*arcsec(x)/(x^2-1)^(1/2),x, algorithm="fricas")
```

output
```
sqrt(x^2 - 1)*arcsec(x) - log(x)
```

3.35.6 Sympy [A] (verification not implemented)

Time = 16.15 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.88

$$\int \frac{x\sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\operatorname{asec}(x) - \begin{cases} -\log\left(\frac{1}{x}\right) & \text{for } x > -1 \wedge x < 1 \end{cases}$$

input
```
integrate(x*asec(x)/(x**2-1)**(1/2),x)
```

output
```
sqrt(x**2 - 1)*asec(x) - Piecewise((-log(1/x), (x > -1) & (x < 1)))
```

3.35.7 Maxima [A] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 15, normalized size of antiderivative = 0.60

$$\int \frac{x \sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\,\mathrm{arcsec}\,(x) - \log\,(x)$$

input
```
integrate(x*arcsec(x)/(x^2-1)^(1/2),x, algorithm="maxima")
```

output
```
sqrt(x^2 - 1)*arcsec(x) - log(x)
```

3.35.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.88

$$\int \frac{x \sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \sqrt{x^2-1}\,\arccos\left(\frac{1}{x}\right) - \frac{\log\,(|x|)}{\mathrm{sgn}\,(x)}$$

input
```
integrate(x*arcsec(x)/(x^2-1)^(1/2),x, algorithm="giac")
```

output
```
sqrt(x^2 - 1)*arccos(1/x) - log(abs(x))/sgn(x)
```

3.35.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x \sec^{-1}(x)}{\sqrt{-1+x^2}}\,dx = \int \frac{x\,\mathrm{acos}\left(\frac{1}{x}\right)}{\sqrt{x^2-1}}\,dx$$

input
```
int((x*acos(1/x))/(x^2 - 1)^(1/2),x)
```

output
```
int((x*acos(1/x))/(x^2 - 1)^(1/2), x)
```

3.36 $\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx$

3.36.1 Optimal result

Integrand size = 13, antiderivative size = 34

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = -\sqrt{1+x^2} + \operatorname{arctanh}\left(\sqrt{1+x^2}\right) + \sqrt{1+x^2}\log(x)$$

output
```
arctanh((x^2+1)^(1/2))-(x^2+1)^(1/2)+ln(x)*(x^2+1)^(1/2)
```

3.36.2 Mathematica [A] (verified)

Time = 0.01 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.18

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = -\sqrt{1+x^2} - \log(x) + \sqrt{1+x^2}\log(x) + \log\left(1+\sqrt{1+x^2}\right)$$

input
```
Integrate[(x*Log[x])/Sqrt[1 + x^2],x]
```

output
```
-Sqrt[1 + x^2] - Log[x] + Sqrt[1 + x^2]*Log[x] + Log[1 + Sqrt[1 + x^2]]
```

3.36.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.21, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$, Rules used = {2776, 243, 60, 73, 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.

$$\int \frac{x\log(x)}{\sqrt{x^2+1}}dx$$

$$\Big\downarrow \text{2776}$$

$$\sqrt{x^2+1}\log(x)-\int \frac{\sqrt{x^2+1}}{x}dx$$

$$\Big\downarrow \text{243}$$

$$\sqrt{x^2+1}\log(x)-\frac{1}{2}\int \frac{\sqrt{x^2+1}}{x^2}dx^2$$

$$\Big\downarrow \text{60}$$

$$\frac{1}{2}\left(-\int \frac{1}{x^2\sqrt{x^2+1}}dx^2-2\sqrt{x^2+1}\right)+\sqrt{x^2+1}\log(x)$$

$$\Big\downarrow \text{73}$$

$$\frac{1}{2}\left(-2\int \frac{1}{x^4-1}d\sqrt{x^2+1}-2\sqrt{x^2+1}\right)+\sqrt{x^2+1}\log(x)$$

$$\Big\downarrow \text{220}$$

$$\frac{1}{2}\left(2\text{arctanh}\left(\sqrt{x^2+1}\right)-2\sqrt{x^2+1}\right)+\sqrt{x^2+1}\log(x)$$

input
```
Int[(x*Log[x])/Sqrt[1 + x^2],x]
```

output
```
(-2*Sqrt[1 + x^2] + 2*ArcTanh[Sqrt[1 + x^2]])/2 + Sqrt[1 + x^2]*Log[x]
```

3.36.3.1 Defintions of rubi rules used

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 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 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 2776
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((f_.)*(x_))^(m_.)*((d_) +
(e_.)*(x_)^(r_))^(q_.), x_Symbol] :> Simp[f^m*(d + e*x^r)^(q + 1)*((a + b*L
og[c*x^n])^p/(e*r*(q + 1))), x] - Simp[b*f^m*n*(p/(e*r*(q + 1)))   Int[(d +
 e*x^r)^(q + 1)*((a + b*Log[c*x^n])^(p - 1)/x), x], x] /; FreeQ[{a, b, c, d
, e, f, m, n, q, r}, x] && EqQ[m, r - 1] && IGtQ[p, 0] && (IntegerQ[m] || G
tQ[f, 0]) && NeQ[r, n] && NeQ[q, -1]
```

3.36.4 Maple [A] (verified)

Time = 0.06 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.15

method	result	size
meijerg	$1-\sqrt{x^2+1}+\frac{\ln(x)\left(-2+2\sqrt{x^2+1}\right)}{2}+\ln\left(\frac{1}{2}+\frac{\sqrt{x^2+1}}{2}\right)$	39

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

output
```
1-(x^2+1)^(1/2)+1/2*ln(x)*(-2+2*(x^2+1)^(1/2))+ln(1/2+1/2*(x^2+1)^(1/2))
```

3.36.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.21

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}(\log(x)-1)+\log\left(-x+\sqrt{x^2+1}+1\right)-\log\left(-x+\sqrt{x^2+1}-1\right)$$

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

output
```
sqrt(x^2 + 1)*(log(x) - 1) + log(-x + sqrt(x^2 + 1) + 1) - log(-x + sqrt(x
^2 + 1) - 1)
```

3.36.6 Sympy [A] (verification not implemented)

Time = 2.60 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.21

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = -\frac{x}{\sqrt{1+\frac{1}{x^2}}}+\sqrt{x^2+1}\log(x)+\operatorname{asinh}\left(\frac{1}{x}\right)-\frac{1}{x\sqrt{1+\frac{1}{x^2}}}$$

input
```
integrate(x*ln(x)/(x**2+1)**(1/2),x)
```

output
```
-x/sqrt(1 + x**(-2)) + sqrt(x**2 + 1)*log(x) + asinh(1/x) - 1/(x*sqrt(1 +
x**(-2)))
```

3.36.7 Maxima [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 25, normalized size of antiderivative = 0.74

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\log(x) - \sqrt{x^2+1} + \operatorname{arsinh}\left(\frac{1}{|x|}\right)$$

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

output
```
sqrt(x^2 + 1)*log(x) - sqrt(x^2 + 1) + arcsinh(1/abs(x))
```

3.36.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 44, normalized size of antiderivative = 1.29

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = \sqrt{x^2+1}\log(x) - \sqrt{x^2+1} + \frac{1}{2}\log\left(\sqrt{x^2+1}+1\right) - \frac{1}{2}\log\left(\sqrt{x^2+1}-1\right)$$

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

output
```
sqrt(x^2 + 1)*log(x) - sqrt(x^2 + 1) + 1/2*log(sqrt(x^2 + 1) + 1) - 1/2*lo
g(sqrt(x^2 + 1) - 1)
```

3.36.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\log(x)}{\sqrt{1+x^2}}\,dx = \int \frac{x\,\ln(x)}{\sqrt{x^2+1}}\,dx$$

input
```
int((x*log(x))/(x^2 + 1)^(1/2),x)
```

output
```
int((x*log(x))/(x^2 + 1)^(1/2), x)
```

3.37 $\int \frac{\sin(x)}{1+\sin^2(x)}\,dx$

3.37.1 Optimal result

Integrand size = 11, antiderivative size = 16

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = -\frac{\operatorname{arctanh}\left(\frac{\cos(x)}{\sqrt{2}}\right)}{\sqrt{2}}$$

output
```
-1/2*arctanh(1/2*cos(x)*2^(1/2))*2^(1/2)
```

3.37.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.07 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.88

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = -\frac{i\left(\arctan\left(\frac{-i+\tan\left(\frac{x}{2}\right)}{\sqrt{2}}\right)-\arctan\left(\frac{i+\tan\left(\frac{x}{2}\right)}{\sqrt{2}}\right)\right)}{\sqrt{2}}$$

input
```
Integrate[Sin[x]/(1 + Sin[x]^2),x]
```

output
```
((-I)*(ArcTan[(-I + Tan[x/2])/Sqrt[2]] - ArcTan[(I + Tan[x/2])/Sqrt[2]]))/
Sqrt[2]
```

3.37.3 Rubi [A] (verified)

Time = 0.16 (sec) , antiderivative size = 16, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.273, Rules used = {3042, 3665, 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.

$$\int \frac{\sin(x)}{\sin^2(x)+1}\,dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\sin(x)}{\sin(x)^2+1}dx$$

$$\Big\downarrow \text{3665}$$

$$-\int \frac{1}{2-\cos^2(x)}d\cos(x)$$

$$\Big\downarrow \text{219}$$

$$-\frac{\operatorname{arctanh}\left(\frac{\cos(x)}{\sqrt{2}}\right)}{\sqrt{2}}$$

input
```
Int[Sin[x]/(1 + Sin[x]^2),x]
```

output
```
-(ArcTanh[Cos[x]/Sqrt[2]]/Sqrt[2])
```

3.37.3.1 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 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3665
```
Int[sin[(e_.) + (f_.)*(x_)]^(m_.)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]^2)^
(p_.), x_Symbol] :> With[{ff = FreeFactors[Cos[e + f*x], x]}, Simp[-ff/f
Subst[Int[(1 - ff^2*x^2)^((m - 1)/2)*(a + b - b*ff^2*x^2)^p, x], x, Cos[e +
 f*x]/ff], x]] /; FreeQ[{a, b, e, f, p}, x] && IntegerQ[(m - 1)/2]
```

3.37.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 14, normalized size of antiderivative = 0.88

method	result	size
default	$-\frac{\operatorname{arctanh}\left(\frac{\cos(x)\sqrt{2}}{2}\right)\sqrt{2}}{2}$	14
risch	$\frac{\sqrt{2}\,\ln\left(\mathrm{e}^{2ix}-2\sqrt{2}\,\mathrm{e}^{ix}+1\right)}{4}-\frac{\sqrt{2}\,\ln\left(\mathrm{e}^{2ix}+2\sqrt{2}\,\mathrm{e}^{ix}+1\right)}{4}$	48

input
```
int(sin(x)/(1+sin(x)^2),x,method=_RETURNVERBOSE)
```

output
```
-1/2*arctanh(1/2*cos(x)*2^(1/2))*2^(1/2)
```

3.37.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 29 vs. 2(13) = 26.

Time = 0.26 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.81

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = \frac{1}{4}\sqrt{2}\log\left(-\frac{\cos(x)^2-2\sqrt{2}\cos(x)+2}{\cos(x)^2-2}\right)$$

input
```
integrate(sin(x)/(1+sin(x)^2),x, algorithm="fricas")
```

output
```
1/4*sqrt(2)*log(-(cos(x)^2 - 2*sqrt(2)*cos(x) + 2)/(cos(x)^2 - 2))
```

3.37.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 46 vs. 2(19) = 38.

Time = 9.24 (sec) , antiderivative size = 46, normalized size of antiderivative = 2.88

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = \frac{\sqrt{2}\log\left(\tan^2\left(\frac{x}{2}\right)-2\sqrt{2}+3\right)}{4} - \frac{\sqrt{2}\log\left(\tan^2\left(\frac{x}{2}\right)+2\sqrt{2}+3\right)}{4}$$

input
```
integrate(sin(x)/(1+sin(x)**2),x)
```

output
```
sqrt(2)*log(tan(x/2)**2 - 2*sqrt(2) + 3)/4 - sqrt(2)*log(tan(x/2)**2 + 2*s
qrt(2) + 3)/4
```

3.37.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.50

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = \frac{1}{4}\sqrt{2}\log\left(-\frac{\sqrt{2}-\cos(x)}{\sqrt{2}+\cos(x)}\right)$$

input
```
integrate(sin(x)/(1+sin(x)^2),x, algorithm="maxima")
```

output
```
1/4*sqrt(2)*log(-(sqrt(2) - cos(x))/(sqrt(2) + cos(x)))
```

3.37.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 27 vs. 2(13) = 26.

Time = 0.27 (sec) , antiderivative size = 27, normalized size of antiderivative = 1.69

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = -\frac{1}{4}\sqrt{2}\log\left(\sqrt{2}+\cos(x)\right)+\frac{1}{4}\sqrt{2}\log\left(\sqrt{2}-\cos(x)\right)$$

input
```
integrate(sin(x)/(1+sin(x)^2),x, algorithm="giac")
```

output
```
-1/4*sqrt(2)*log(sqrt(2) + cos(x)) + 1/4*sqrt(2)*log(sqrt(2) - cos(x))
```

3.37.9 Mupad [B] (verification not implemented)

Time = 0.22 (sec) , antiderivative size = 13, normalized size of antiderivative = 0.81

$$\int \frac{\sin(x)}{1+\sin^2(x)}\,dx = -\frac{\sqrt{2}\,\mathrm{atanh}\left(\frac{\sqrt{2}\,\cos(x)}{2}\right)}{2}$$

input
```
int(sin(x)/(sin(x)^2 + 1),x)
```

output
```
-(2^(1/2)*atanh((2^(1/2)*cos(x))/2))/2
```

3.38 $\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx$

3.38.1 Optimal result

Integrand size = 24, antiderivative size = 23

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = \frac{\operatorname{arctanh}\left(\frac{\sqrt{2}x}{\sqrt{1+x^4}}\right)}{\sqrt{2}}$$

output
```
1/2*arctanh(x*2^(1/2)/(x^4+1)^(1/2))*2^(1/2)
```

3.38.2 Mathematica [A] (verified)

Time = 0.30 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = \frac{\operatorname{arctanh}\left(\frac{\sqrt{2}x}{\sqrt{1+x^4}}\right)}{\sqrt{2}}$$

input
```
Integrate[(1 + x^2)/((1 - x^2)*Sqrt[1 + x^4]),x]
```

output
```
ArcTanh[(Sqrt[2]*x)/Sqrt[1 + x^4]]/Sqrt[2]
```

3.38.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.083, Rules used = {2213, 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.

$$\int \frac{x^2+1}{(1-x^2)\sqrt{x^4+1}}dx$$
$$\Big\downarrow \text{ 2213}$$
$$\int \frac{1}{1-\frac{2x^2}{x^4+1}}d\frac{x}{\sqrt{x^4+1}}$$
$$\Big\downarrow \text{ 219}$$
$$\frac{\operatorname{arctanh}\left(\frac{\sqrt{2}x}{\sqrt{x^4+1}}\right)}{\sqrt{2}}$$

input
```
Int[(1 + x^2)/((1 - x^2)*Sqrt[1 + x^4]),x]
```

output
```
ArcTanh[(Sqrt[2]*x)/Sqrt[1 + x^4]]/Sqrt[2]
```

3.38.3.1 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 2213
```
Int[((A_) + (B_.)*(x_)^2)/(((d_) + (e_.)*(x_)^2)*Sqrt[(a_) + (c_.)*(x_)^4])
, x_Symbol] :> Simp[A   Subst[Int[1/(d + 2*a*e*x^2), x], x, x/Sqrt[a + c*x^
4]], x] /; FreeQ[{a, c, d, e, A, B}, x] && EqQ[c*d^2 - a*e^2, 0] && EqQ[B*d
 + A*e, 0]
```

3.38.4 Maple [A] (verified)

Time = 1.54 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.96

method	result	size
elliptic	$\frac{\operatorname{arctanh}\left(\frac{\sqrt{2}\,\sqrt{x^4+1}}{2x}\right)\sqrt{2}}{2}$	22
trager	$-\frac{\operatorname{RootOf}\left(\_Z^2-2\right)\ln\left(\frac{\operatorname{RootOf}\left(\_Z^2-2\right)x-\sqrt{x^4+1}}{(-1+x)(1+x)}\right)}{2}$	39
default	$\frac{\sqrt{2}\left(\operatorname{arctanh}\left(\frac{\left(x^2-x+1\right)\sqrt{2}}{\sqrt{x^4+1}}\right)-\operatorname{arctanh}\left(\frac{\left(x^2+x+1\right)\sqrt{2}}{\sqrt{x^4+1}}\right)\right)}{4}$	47
pseudoelliptic	$\frac{\sqrt{2}\left(\operatorname{arctanh}\left(\frac{\left(x^2-x+1\right)\sqrt{2}}{\sqrt{x^4+1}}\right)-\operatorname{arctanh}\left(\frac{\left(x^2+x+1\right)\sqrt{2}}{\sqrt{x^4+1}}\right)\right)}{4}$	47

input
```
int((x^2+1)/(-x^2+1)/(x^4+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/2*arctanh(1/2/x*2^(1/2)*(x^4+1)^(1/2))*2^(1/2)
```

3.38.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 42 vs. $2(18) = 36$.

Time = 0.27 (sec) , antiderivative size = 42, normalized size of antiderivative = 1.83

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = \frac{1}{4}\sqrt{2}\log\left(\frac{x^4+2\sqrt{2}\sqrt{x^4+1}x+2x^2+1}{x^4-2x^2+1}\right)$$

input
```
integrate((x^2+1)/(-x^2+1)/(x^4+1)^(1/2),x, algorithm="fricas")
```

output
```
1/4*sqrt(2)*log((x^4 + 2*sqrt(2)*sqrt(x^4 + 1)*x + 2*x^2 + 1)/(x^4 - 2*x^2
 + 1))
```

3.38.6 Sympy [F]

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = -\int \frac{x^2}{x^2\sqrt{x^4+1}-\sqrt{x^4+1}}\,dx - \int \frac{1}{x^2\sqrt{x^4+1}-\sqrt{x^4+1}}\,dx$$

input
```
integrate((x**2+1)/(-x**2+1)/(x**4+1)**(1/2),x)
```

output
```
-Integral(x**2/(x**2*sqrt(x**4 + 1) - sqrt(x**4 + 1)), x) - Integral(1/(x*
*2*sqrt(x**4 + 1) - sqrt(x**4 + 1)), x)
```

3.38.7 Maxima [F]

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = \int -\frac{x^2+1}{\sqrt{x^4+1}(x^2-1)}\,dx$$

input
```
integrate((x^2+1)/(-x^2+1)/(x^4+1)^(1/2),x, algorithm="maxima")
```

output
```
-integrate((x^2 + 1)/(sqrt(x^4 + 1)*(x^2 - 1)), x)
```

3.38.8 Giac [F]

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = \int -\frac{x^2+1}{\sqrt{x^4+1}(x^2-1)}\,dx$$

input
```
integrate((x^2+1)/(-x^2+1)/(x^4+1)^(1/2),x, algorithm="giac")
```

output
```
integrate(-(x^2 + 1)/(sqrt(x^4 + 1)*(x^2 - 1)), x)
```

3.38.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1+x^2}{(1-x^2)\sqrt{1+x^4}}\,dx = \int -\frac{x^2+1}{(x^2-1)\sqrt{x^4+1}}\,dx$$

input
```
int(-(x^2 + 1)/((x^2 - 1)*(x^4 + 1)^(1/2)),x)
```

output
```
int(-(x^2 + 1)/((x^2 - 1)*(x^4 + 1)^(1/2)), x)
```

3.39 $\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx$

3.39.1 Optimal result

Integrand size = 24, antiderivative size = 23

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = \frac{\arctan\left(\frac{\sqrt{2}x}{\sqrt{1+x^4}}\right)}{\sqrt{2}}$$

output
```
1/2*arctan(x*2^(1/2)/(x^4+1)^(1/2))*2^(1/2)
```

3.39.2 Mathematica [A] (verified)

Time = 0.26 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = \frac{\arctan\left(\frac{\sqrt{2}x}{\sqrt{1+x^4}}\right)}{\sqrt{2}}$$

input
```
Integrate[(1 - x^2)/((1 + x^2)*Sqrt[1 + x^4]),x]
```

output
```
ArcTan[(Sqrt[2]*x)/Sqrt[1 + x^4]]/Sqrt[2]
```

3.39.3 Rubi [A] (verified)

Time = 0.17 (sec) , antiderivative size = 23, normalized size of antiderivative = 1.00, number of steps used = 3, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.083$, Rules used = {2213, 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.

$$\int \frac{1-x^2}{(x^2+1)\sqrt{x^4+1}}dx$$

$$\Big\downarrow \text{2213}$$

$$\int \frac{1}{\frac{2x^2}{x^4+1}+1}d\frac{x}{\sqrt{x^4+1}}$$

$$\Big\downarrow \text{216}$$

$$\frac{\arctan\left(\frac{\sqrt{2}x}{\sqrt{x^4+1}}\right)}{\sqrt{2}}$$

input
```
Int[(1 - x^2)/((1 + x^2)*Sqrt[1 + x^4]),x]
```

output
```
ArcTan[(Sqrt[2]*x)/Sqrt[1 + x^4]]/Sqrt[2]
```

3.39.3.1 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 2213
```
Int[((A_) + (B_.)*(x_)^2)/(((d_) + (e_.)*(x_)^2)*Sqrt[(a_) + (c_.)*(x_)^4])
, x_Symbol] :> Simp[A   Subst[Int[1/(d + 2*a*e*x^2), x], x, x/Sqrt[a + c*x^
4]], x] /; FreeQ[{a, c, d, e, A, B}, x] && EqQ[c*d^2 - a*e^2, 0] && EqQ[B*d
 + A*e, 0]
```

3.39.4 Maple [A] (verified)

Time = 1.05 (sec) , antiderivative size = 19, normalized size of antiderivative = 0.83

method	result	size
default	$\frac{\arctan\left(\frac{x\sqrt{2}}{\sqrt{x^4+1}}\right)\sqrt{2}}{2}$	19
pseudoelliptic	$\frac{\arctan\left(\frac{x\sqrt{2}}{\sqrt{x^4+1}}\right)\sqrt{2}}{2}$	19
elliptic	$-\frac{\arctan\left(\frac{\sqrt{2}\sqrt{x^4+1}}{2x}\right)\sqrt{2}}{2}$	22
trager	$\frac{\operatorname{RootOf}\left(\_Z^2+2\right)\ln\left(-\frac{\operatorname{RootOf}\left(\_Z^2+2\right)x-\sqrt{x^4+1}}{x^2+1}\right)}{2}$	37

input
```
int((-x^2+1)/(x^2+1)/(x^4+1)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/2*arctan(x*2^(1/2)/(x^4+1)^(1/2))*2^(1/2)
```

3.39.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 18, normalized size of antiderivative = 0.78

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = \frac{1}{2}\sqrt{2}\arctan\left(\frac{\sqrt{2}x}{\sqrt{x^4+1}}\right)$$

input
```
integrate((-x^2+1)/(x^2+1)/(x^4+1)^(1/2),x, algorithm="fricas")
```

output
```
1/2*sqrt(2)*arctan(sqrt(2)*x/sqrt(x^4 + 1))
```

3.39.6 Sympy [F]

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = -\int \frac{x^2}{x^2\sqrt{x^4+1}+\sqrt{x^4+1}}\,dx - \int \left(-\frac{1}{x^2\sqrt{x^4+1}+\sqrt{x^4+1}}\right)dx$$

input
```
integrate((-x**2+1)/(x**2+1)/(x**4+1)**(1/2),x)
```

output
```
-Integral(x**2/(x**2*sqrt(x**4 + 1) + sqrt(x**4 + 1)), x) - Integral(-1/(x
**2*sqrt(x**4 + 1) + sqrt(x**4 + 1)), x)
```

3.39.7 Maxima [F]

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = \int -\frac{x^2-1}{\sqrt{x^4+1}(x^2+1)}\,dx$$

input
```
integrate((-x^2+1)/(x^2+1)/(x^4+1)^(1/2),x, algorithm="maxima")
```

output
```
-integrate((x^2 - 1)/(sqrt(x^4 + 1)*(x^2 + 1)), x)
```

3.39.8 Giac [F]

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = \int -\frac{x^2-1}{\sqrt{x^4+1}(x^2+1)}\,dx$$

input
```
integrate((-x^2+1)/(x^2+1)/(x^4+1)^(1/2),x, algorithm="giac")
```

output
```
integrate(-(x^2 - 1)/(sqrt(x^4 + 1)*(x^2 + 1)), x)
```

3.39.9 Mupad [F(-1)]

Timed out.

$$\int \frac{1-x^2}{(1+x^2)\sqrt{1+x^4}}\,dx = -\int \frac{x^2-1}{(x^2+1)\sqrt{x^4+1}}\,dx$$

input
```
int(-(x^2 - 1)/((x^2 + 1)*(x^4 + 1)^(1/2)),x)
```

output
```
-int((x^2 - 1)/((x^2 + 1)*(x^4 + 1)^(1/2)), x)
```

3.40 $\int \frac{\log(\sin(x))}{1+\sin(x)} \, dx$

3.40.1 Optimal result

Integrand size = 10, antiderivative size = 22

$$\int \frac{\log(\sin(x))}{1+\sin(x)} \, dx = -x - \operatorname{arctanh}(\cos(x)) - \frac{\cos(x)\log(\sin(x))}{1+\sin(x)}$$

output
```
-x-arctanh(cos(x))-cos(x)*ln(sin(x))/(1+sin(x))
```

3.40.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 39, normalized size of antiderivative = 1.77

$$\int \frac{\log(\sin(x))}{1+\sin(x)} \, dx = -x - 2\log\left(\cos\left(\frac{x}{2}\right)\right) + \frac{2\log(\sin(x))\sin\left(\frac{x}{2}\right)}{\cos\left(\frac{x}{2}\right)+\sin\left(\frac{x}{2}\right)}$$

input
```
Integrate[Log[Sin[x]]/(1 + Sin[x]),x]
```

output
```
-x - 2*Log[Cos[x/2]] + (2*Log[Sin[x]]*Sin[x/2])/(Cos[x/2] + Sin[x/2])
```

3.40.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 22, normalized size of antiderivative = 1.00, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.700$, Rules used = {3034, 25, 3042, 3318, 24, 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.

$$\int \frac{\log(\sin(x))}{\sin(x)+1}dx$$

$$\Big\downarrow \text{3034}$$

$$-\int -\frac{\cos(x)\cot(x)}{\sin(x)+1}dx-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

$$\Big\downarrow \text{25}$$

$$\int \frac{\cos(x)\cot(x)}{\sin(x)+1}dx-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\cos(x)^2}{\sin(x)(\sin(x)+1)}dx-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

$$\Big\downarrow \text{3318}$$

$$-\int 1dx+\int \csc(x)dx-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

$$\Big\downarrow \text{24}$$

$$\int \csc(x)dx-x-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

$$\Big\downarrow \text{3042}$$

$$\int \csc(x)dx-x-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

$$\Big\downarrow \text{4257}$$

$$-\text{arctanh}(\cos(x))-x-\frac{\cos(x)\log(\sin(x))}{\sin(x)+1}$$

input
```
Int[Log[Sin[x]]/(1 + Sin[x]),x]
```

output
```
-x - ArcTanh[Cos[x]] - (Cos[x]*Log[Sin[x]])/(1 + Sin[x])
```

3.40.3.1 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 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, 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 4257
```
Int[csc[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-ArcTanh[Cos[c + d*x]]/d, x]
 /; FreeQ[{c, d}, x]
```

3.40.4 Maple [A] (verified)

Time = 0.61 (sec) , antiderivative size = 24, normalized size of antiderivative = 1.09

method	result
parallelrisch	$\ln(\csc(x) - \cot(x)) + (-\sec(x) + \tan(x))\ln(\sin(x)) - x$
norman	$\frac{-x - x\tan\left(\frac{x}{2}\right) + 2\tan\left(\frac{x}{2}\right)\ln\left(\frac{2\tan\left(\frac{x}{2}\right)}{1+\tan^2\left(\frac{x}{2}\right)}\right)}{1+\tan\left(\frac{x}{2}\right)} + \ln\left(1 + \tan^2\left(\frac{x}{2}\right)\right)$
risch	$\frac{2\ln(e^{ix})}{i+e^{ix}} + \frac{-2\ln(e^{2ix}-1)+\ln(e^{ix}+1)+\ln(e^{ix}-1)-2ix-i\pi\,\mathrm{csgn}(i\sin(x))^2-i\ln(e^{ix}+1)e^{ix}-i\ln(e^{ix}-1)e^{ix}-i\pi\,\mathrm{csgn}(ie^{-ix}}{}$

input
```
int(ln(sin(x))/(sin(x)+1),x,method=_RETURNVERBOSE)
```

output
```
ln(csc(x)-cot(x))+(-sec(x)+tan(x))*ln(sin(x))-x
```

3.40.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 93 vs. 2(22) = 44.

Time = 0.26 (sec) , antiderivative size = 93, normalized size of antiderivative = 4.23

$$\int \frac{\log(\sin(x))}{1+\sin(x)}\, dx = -\frac{4\left(\cos\left(x\right) + \sin\left(x\right) + 1\right)\arctan\left(-\frac{\cos(x)+\sin(x)+1}{\cos(x)-\sin(x)+1}\right) + 4\,x\cos\left(x\right) + \left(\cos\left(x\right) + \sin\left(x\right) + 1\right)\log\left(\frac{1}{2}\cos\left(x\right) + \right.}{2\left(\cos\left(x\right)\right.}$$

input
```
integrate(log(sin(x))/(1+sin(x)),x, algorithm="fricas")
```

output
```
-1/2*(4*(cos(x) + sin(x) + 1)*arctan(-(cos(x) + sin(x) + 1)/(cos(x) - sin(
x) + 1)) + 4*x*cos(x) + (cos(x) + sin(x) + 1)*log(1/2*cos(x) + 1/2) - (cos
(x) + sin(x) + 1)*log(-1/2*cos(x) + 1/2) + 2*(cos(x) - sin(x) + 1)*log(sin
(x)) + 4*x*sin(x) + 4*x)/(cos(x) + sin(x) + 1)
```

3.40.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 105 vs. 2(20) = 40.

Time = 0.66 (sec) , antiderivative size = 105, normalized size of antiderivative = 4.77

$$\int \frac{\log(\sin(x))}{1+\sin(x)}\, dx = -\frac{x\tan\left(\frac{x}{2}\right)}{\tan\left(\frac{x}{2}\right)+1} - \frac{x}{\tan\left(\frac{x}{2}\right)+1} + \frac{2\log\left(\frac{\tan\left(\frac{x}{2}\right)}{\tan^{2}\left(\frac{x}{2}\right)+1}\right)\tan\left(\frac{x}{2}\right)}{\tan\left(\frac{x}{2}\right)+1} + \frac{\log\left(\tan^{2}\left(\frac{x}{2}\right)+1\right)\tan\left(\frac{x}{2}\right)}{\tan\left(\frac{x}{2}\right)+1} + \frac{\log\left(\tan^{2}\left(\frac{x}{2}\right)+1\right)}{\tan\left(\frac{x}{2}\right)+1} + \frac{2\log\left(2\right)\tan\left(\frac{x}{2}\right)}{\tan\left(\frac{x}{2}\right)+1}$$

input
```
integrate(ln(sin(x))/(1+sin(x)),x)
```

output
```
-x*tan(x/2)/(tan(x/2) + 1) - x/(tan(x/2) + 1) + 2*log(tan(x/2)/(tan(x/2)**
2 + 1))*tan(x/2)/(tan(x/2) + 1) + log(tan(x/2)**2 + 1)*tan(x/2)/(tan(x/2)
+ 1) + log(tan(x/2)**2 + 1)/(tan(x/2) + 1) + 2*log(2)*tan(x/2)/(tan(x/2) +
 1)
```

3.40.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 82 vs. $2(22) = 44$.

Time = 0.28 (sec) , antiderivative size = 82, normalized size of antiderivative = 3.73

$$\int \frac{\log(\sin(x))}{1+\sin(x)}\,dx = -\frac{2\,\log\left(\frac{2\,\sin(x)}{\left(\frac{\sin(x)^2}{(\cos(x)+1)^2}+1\right)(\cos(x)+1)}\right)}{\frac{\sin(x)}{\cos(x)+1}+1} - 2\,\arctan\left(\frac{\sin(x)}{\cos(x)+1}\right) + 2\,\log\left(\frac{\sin(x)}{\cos(x)+1}\right) - \log\left(\frac{\sin(x)^2}{(\cos(x)+1)^2}+1\right)$$

input
```
integrate(log(sin(x))/(1+sin(x)),x, algorithm="maxima")
```

output
```
-2*log(2*sin(x)/((sin(x)^2/(cos(x) + 1)^2 + 1)*(cos(x) + 1)))/(sin(x)/(cos
(x) + 1) + 1) - 2*arctan(sin(x)/(cos(x) + 1)) + 2*log(sin(x)/(cos(x) + 1))
 - log(sin(x)^2/(cos(x) + 1)^2 + 1)
```

3.40.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 36, normalized size of antiderivative = 1.64

$$\int \frac{\log(\sin(x))}{1+\sin(x)}\,dx = -x - \frac{2\,\log(\sin(x))}{\tan\left(\frac{1}{2}\,x\right)+1} - 2\,\log\left(\tan\left(\frac{1}{4}\,x\right)^2+1\right) + 2\,\log\left(\left|\tan\left(\frac{1}{4}\,x\right)\right|\right)$$

input
```
integrate(log(sin(x))/(1+sin(x)),x, algorithm="giac")
```

output
```
-x - 2*log(sin(x))/(tan(1/2*x) + 1) - 2*log(tan(1/4*x)^2 + 1) + 2*log(abs(
tan(1/4*x)))
```

3.40.9 Mupad [B] (verification not implemented)

Time = 0.39 (sec) , antiderivative size = 55, normalized size of antiderivative = 2.50

$$\int \frac{\log(\sin(x))}{1+\sin(x)}\,dx = -2\,x + \ln\left(2\,\sin\left(x\right) - \cos\left(x\right)\,2\mathrm{i} - 2\mathrm{i}\right)\,\left(-1-\mathrm{i}\right) + \ln\left(2\,\sin\left(x\right) - \cos\left(x\right)\,2\mathrm{i} + 2\mathrm{i}\right)\,\left(1-\mathrm{i}\right) - \frac{2\,\ln\left(\sin\left(x\right)\right)}{\cos\left(x\right) + \sin\left(x\right)\,1\mathrm{i} + 1\mathrm{i}}$$

input
```
int(log(sin(x))/(sin(x) + 1),x)
```

output
```
log(2*sin(x) - cos(x)*2i + 2i)*(1 - 1i) - log(2*sin(x) - cos(x)*2i - 2i)*(
1 + 1i) - 2*x - (2*log(sin(x)))/(cos(x) + sin(x)*1i + 1i)
```

3.41 $\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx$

3.41.1 Optimal result

Integrand size = 12, antiderivative size = 42

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx = -4\text{arctanh}\left(\frac{\cos(x)}{\sqrt{1+\sin(x)}}\right) + \frac{4\cos(x)}{\sqrt{1+\sin(x)}} - \frac{2\cos(x)\log(\sin(x))}{\sqrt{1+\sin(x)}}$$

output
```
-4*arctanh(cos(x)/(1+sin(x))^(1/2))+4*cos(x)/(1+sin(x))^(1/2)-2*cos(x)*ln(
sin(x))/(1+sin(x))^(1/2)
```

3.41.2 Mathematica [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 87 vs. 2(42) = 84.

Time = 0.07 (sec) , antiderivative size = 87, normalized size of antiderivative = 2.07

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx = \frac{2\left(-\log\left(1+\cos\left(\frac{x}{2}\right)-\sin\left(\frac{x}{2}\right)\right)+\log\left(1-\cos\left(\frac{x}{2}\right)+\sin\left(\frac{x}{2}\right)\right)-\cos\left(\frac{x}{2}\right)(-2+\log(\sin(x)))+(-2+\log(s\right.}{\cos\left(\frac{x}{2}\right)+\sin\left(\frac{x}{2}\right)}$$

input
```
Integrate[Log[Sin[x]]*Sqrt[1 + Sin[x]],x]
```

output
```
(2*(-Log[1 + Cos[x/2] - Sin[x/2]] + Log[1 - Cos[x/2] + Sin[x/2]] - Cos[x/2
]*(-2 + Log[Sin[x]]) + (-2 + Log[Sin[x]])*Sin[x/2])*Sqrt[1 + Sin[x]])/(Cos
[x/2] + Sin[x/2])
```

3.41.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.07, number of steps used = 10, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.750$, Rules used = {3034, 27, 3042, 3353, 3042, 3460, 3042, 3252, 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.

$$\int \sqrt{\sin(x)+1}\log(\sin(x))\,dx$$

$$\Big\downarrow \text{3034}$$

$$-\int -\frac{2\cos(x)\cot(x)}{\sqrt{\sin(x)+1}}dx-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{27}$$

$$2\int \frac{\cos(x)\cot(x)}{\sqrt{\sin(x)+1}}dx-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{3042}$$

$$2\int \frac{\cos(x)^2}{\sin(x)\sqrt{\sin(x)+1}}dx-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{3353}$$

$$2\int \csc(x)(1-\sin(x))\sqrt{\sin(x)+1}dx-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{3042}$$

$$2\int \frac{(1-\sin(x))\sqrt{\sin(x)+1}}{\sin(x)}dx-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{3460}$$

$$2\left(\int \csc(x)\sqrt{\sin(x)+1}dx+\frac{2\cos(x)}{\sqrt{\sin(x)+1}}\right)-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{3042}$$

$$2\left(\int \frac{\sqrt{\sin(x)+1}}{\sin(x)}dx+\frac{2\cos(x)}{\sqrt{\sin(x)+1}}\right)-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{3252}$$

$$2\left(\frac{2\cos(x)}{\sqrt{\sin(x)+1}}-2\int \frac{1}{1-\frac{\cos^2(x)}{\sin(x)+1}}d\frac{\cos(x)}{\sqrt{\sin(x)+1}}\right)-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

$$\Big\downarrow \text{219}$$

$$2\left(\frac{2\cos(x)}{\sqrt{\sin(x)+1}}-2\text{arctanh}\left(\frac{\cos(x)}{\sqrt{\sin(x)+1}}\right)\right)-\frac{2\cos(x)\log(\sin(x))}{\sqrt{\sin(x)+1}}$$

input
```
Int[Log[Sin[x]]*Sqrt[1 + Sin[x]],x]
```

output
```
(-2*Cos[x]*Log[Sin[x]])/Sqrt[1 + Sin[x]] + 2*(-2*ArcTanh[Cos[x]/Sqrt[1 + S
in[x]]] + (2*Cos[x])/Sqrt[1 + Sin[x]])
```

3.41.3.1 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 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 3034
```
Int[Log[u_]*(v_), x_Symbol] :> With[{w = IntHide[v, x]}, Simp[Log[u]   w, x
] - Int[SimplifyIntegrand[w*(D[u, x]/u), x], x] /; InverseFunctionFreeQ[w,
x]] /; InverseFunctionFreeQ[u, x]
```

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

rule 3252
```
Int[Sqrt[(a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]]/((c_.) + (d_.)*sin[(e_.) + (
f_.)*(x_)]), x_Symbol] :> Simp[-2*(b/f)   Subst[Int[1/(b*c + a*d - d*x^2),
x], x, b*(Cos[e + f*x]/Sqrt[a + b*Sin[e + f*x]])], x] /; FreeQ[{a, b, c, d,
 e, f}, x] && NeQ[b*c - a*d, 0] && EqQ[a^2 - b^2, 0] && NeQ[c^2 - d^2, 0]
```

rule 3353
```
Int[cos[(e_.) + (f_.)*(x_)]^2*((d_.)*sin[(e_.) + (f_.)*(x_)])^(n_)*((a_) +
(b_.)*sin[(e_.) + (f_.)*(x_)])^(m_), x_Symbol] :> Simp[1/b^2   Int[(d*Sin[e
 + f*x])^n*(a + b*Sin[e + f*x])^(m + 1)*(a - b*Sin[e + f*x]), x], x] /; Fre
eQ[{a, b, d, e, f, m, n}, x] && EqQ[a^2 - b^2, 0] && (ILtQ[m, 0] ||  !IGtQ[
n, 0])
```

rule 3460
```
Int[Sqrt[(a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]]*((A_.) + (B_.)*sin[(e_.) + (
f_.)*(x_)])*((c_.) + (d_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol] :> Simp
[-2*b*B*Cos[e + f*x]*((c + d*Sin[e + f*x])^(n + 1)/(d*f*(2*n + 3)*Sqrt[a +
b*Sin[e + f*x]])), x] + Simp[(A*b*d*(2*n + 3) - B*(b*c - 2*a*d*(n + 1)))/(b
*d*(2*n + 3))   Int[Sqrt[a + b*Sin[e + f*x]]*(c + d*Sin[e + f*x])^n, x], x]
 /; FreeQ[{a, b, c, d, e, f, A, B, n}, x] && NeQ[b*c - a*d, 0] && EqQ[a^2 -
 b^2, 0] && NeQ[c^2 - d^2, 0] &&  !LtQ[n, -1]
```

3.41.4 Maple [F]

$$\int \ln\left(\sin\left(x\right)\right)\sqrt{\sin\left(x\right)+1}dx$$

input
```
int(ln(sin(x))*(sin(x)+1)^(1/2),x)
```

output
```
int(ln(sin(x))*(sin(x)+1)^(1/2),x)
```

3.41.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 146 vs. $2(36) = 72$.

Time = 0.27 (sec) , antiderivative size = 146, normalized size of antiderivative = 3.48

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx =$$

$$-\frac{(\cos(x)+\sin(x)+1)\log\left(\frac{\cos(x)^2-(\cos(x)-1)\sin(x)+2(\cos(x)-\sin(x)+1)\sqrt{\sin(x)+1}+2\cos(x)+1}{2(\cos(x)+\sin(x)+1)}\right)-(\cos(x)+\sin(x)}{}$$

input
```
integrate(log(sin(x))*(1+sin(x))^(1/2),x, algorithm="fricas")
```

output
```
-((cos(x) + sin(x) + 1)*log(1/2*(cos(x)^2 - (cos(x) - 1)*sin(x) + 2*(cos(x
) - sin(x) + 1)*sqrt(sin(x) + 1) + 2*cos(x) + 1)/(cos(x) + sin(x) + 1)) -
(cos(x) + sin(x) + 1)*log(1/2*(cos(x)^2 - (cos(x) - 1)*sin(x) - 2*(cos(x)
- sin(x) + 1)*sqrt(sin(x) + 1) + 2*cos(x) + 1)/(cos(x) + sin(x) + 1)) + 2*
((cos(x) - sin(x) + 1)*log(sin(x)) - 2*cos(x) + 2*sin(x) - 2)*sqrt(sin(x)
+ 1))/(cos(x) + sin(x) + 1)
```

3.41.6 Sympy [F]

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx = \int \sqrt{\sin(x)+1}\log(\sin(x))\,dx$$

input
```
integrate(ln(sin(x))*(1+sin(x))**(1/2),x)
```

output
```
Integral(sqrt(sin(x) + 1)*log(sin(x)), x)
```

3.41.7 Maxima [F]

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx = \int \sqrt{\sin(x)+1}\log(\sin(x))\,dx$$

input
```
integrate(log(sin(x))*(1+sin(x))^(1/2),x, algorithm="maxima")
```

output
```
integrate(sqrt(sin(x) + 1)*log(sin(x)), x)
```

3.41.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 90 vs. $2(36) = 72$.

Time = 0.32 (sec) , antiderivative size = 90, normalized size of antiderivative = 2.14

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx$$
$$=\sqrt{2}\left(2\,\log\left(\sin\left(x\right)\right)\operatorname{sgn}\left(\cos\left(-\frac{1}{4}\,\pi+\frac{1}{2}\,x\right)\right)\sin\left(-\frac{1}{4}\,\pi+\frac{1}{2}\,x\right)+\left(\sqrt{2}\log\left(\frac{\left|-2\,\sqrt{2}+4\,\sin\left(\frac{1}{4}\,\pi-\frac{1}{2}\,x\right)\right|}{\left|2\,\sqrt{2}+4\,\sin\left(\frac{1}{4}\,\pi-\frac{1}{2}\,x\right)\right|}\right.\right.\right.$$

input
```
integrate(log(sin(x))*(1+sin(x))^(1/2),x, algorithm="giac")
```

output
```
sqrt(2)*(2*log(sin(x))*sgn(cos(-1/4*pi + 1/2*x))*sin(-1/4*pi + 1/2*x) + (s
qrt(2)*log(abs(-2*sqrt(2) + 4*sin(1/4*pi - 1/2*x))/abs(2*sqrt(2) + 4*sin(1
/4*pi - 1/2*x))) + 4*sin(1/4*pi - 1/2*x))*sgn(cos(-1/4*pi + 1/2*x)))
```

3.41.9 Mupad [F(-1)]

Timed out.

$$\int \log(\sin(x))\sqrt{1+\sin(x)}\,dx = \int \ln\left(\sin\left(x\right)\right)\,\sqrt{\sin\left(x\right)+1}\,dx$$

input
```
int(log(sin(x))*(sin(x) + 1)^(1/2),x)
```

output
```
int(log(sin(x))*(sin(x) + 1)^(1/2), x)
```

3.42 $\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}} \, dx$

3.42.1 Optimal result

Integrand size = 13, antiderivative size = 28

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}} \, dx = -\frac{\operatorname{arctanh}\left(\frac{\cos(x)\cot(x)\sqrt{-1+\sec^4(x)}}{\sqrt{2}}\right)}{\sqrt{2}}$$

output
```
-1/2*arctanh(1/2*cos(x)*cot(x)*(-1+sec(x)^4)^(1/2)*2^(1/2))*2^(1/2)
```

3.42.2 Mathematica [A] (verified)

Time = 0.03 (sec) , antiderivative size = 45, normalized size of antiderivative = 1.61

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}} \, dx = -\frac{\operatorname{arctanh}\left(\frac{1}{2}\sqrt{4-2\sin^2(x)}\right)\sqrt{3+\cos(2x)}\sec(x)\tan(x)}{2\sqrt{-1+\sec^4(x)}}$$

input
```
Integrate[Sec[x]/Sqrt[-1 + Sec[x]^4],x]
```

output
```
-1/2*(ArcTanh[Sqrt[4 - 2*Sin[x]^2]/2]*Sqrt[3 + Cos[2*x]]*Sec[x]*Tan[x])/Sq
rt[-1 + Sec[x]^4]
```

3.42.3 Rubi [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 77 vs. 2(28) = 56.

Time = 0.39 (sec) , antiderivative size = 77, normalized size of antiderivative = 2.75, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.462, Rules used = {3042, 4636, 7273, 2085, 1400, 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.

$$\int \frac{\sec(x)}{\sqrt{\sec^4(x)-1}}dx$$
$$\Big\downarrow \text{ 3042}$$
$$\int \frac{\sec(x)}{\sqrt{\sec(x)^4-1}}dx$$
$$\Big\downarrow \text{ 4636}$$
$$\int \frac{1}{\left(1-\sin^2(x)\right)\sqrt{\frac{1}{\left(1-\sin^2(x)\right)^2}-1}}d\sin(x)$$
$$\Big\downarrow \text{ 7273}$$
$$\frac{\sqrt{1-\left(1-\sin^2(x)\right)^2}\int \frac{1}{\sqrt{1-\left(1-\sin^2(x)\right)^2}}d\sin(x)}{\left(1-\sin^2(x)\right)\sqrt{\frac{1}{\left(1-\sin^2(x)\right)^2}-1}}$$
$$\Big\downarrow \text{ 2085}$$
$$\frac{\sqrt{1-\left(1-\sin^2(x)\right)^2}\int \frac{1}{\sqrt{2\sin^2(x)-\sin^4(x)}}d\sin(x)}{\left(1-\sin^2(x)\right)\sqrt{\frac{1}{\left(1-\sin^2(x)\right)^2}-1}}$$
$$\Big\downarrow \text{ 1400}$$
$$-\frac{\sqrt{1-\left(1-\sin^2(x)\right)^2}\int \frac{1}{1-\frac{2\sin^2(x)}{2\sin^2(x)-\sin^4(x)}}d\frac{\sin(x)}{\sqrt{2\sin^2(x)-\sin^4(x)}}}{\left(1-\sin^2(x)\right)\sqrt{\frac{1}{\left(1-\sin^2(x)\right)^2}-1}}$$
$$\Big\downarrow \text{ 219}$$
$$-\frac{\sqrt{1-\left(1-\sin^2(x)\right)^2}\text{arctanh}\left(\frac{\sqrt{2}\sin(x)}{\sqrt{2\sin^2(x)-\sin^4(x)}}\right)}{\sqrt{2}\left(1-\sin^2(x)\right)\sqrt{\frac{1}{\left(1-\sin^2(x)\right)^2}-1}}$$

input
```
Int[Sec[x]/Sqrt[-1 + Sec[x]^4],x]
```

output
```
-((ArcTanh[(Sqrt[2]*Sin[x])/Sqrt[2*Sin[x]^2 - Sin[x]^4]]*Sqrt[1 - (1 - Sin
[x]^2)^2])/(Sqrt[2]*(1 - Sin[x]^2)*Sqrt[-1 + (1 - Sin[x]^2)^(-2)]))
```

3.42.3.1 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 1400
```
Int[1/Sqrt[(b_.)*(x_)^2 + (c_.)*(x_)^4], x_Symbol] :> -Subst[Int[1/(1 - b*x
^2), x], x, x/Sqrt[b*x^2 + c*x^4]] /; FreeQ[{b, c}, x]
```

rule 2085
```
Int[(u_)^(p_), x_Symbol] :> Int[ExpandToSum[u, x]^p, x] /; FreeQ[p, x] && T
rinomialQ[u, x] &&  !TrinomialMatchQ[u, x]
```

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

rule 4636
```
Int[sec[(e_.) + (f_.)*(x_)]^(m_.)*((a_) + (b_.)*sec[(e_.) + (f_.)*(x_)]^(n_
))^(p_), x_Symbol] :> With[{ff = FreeFactors[Sin[e + f*x], x]}, Simp[ff/f
 Subst[Int[(a + b/(1 - ff^2*x^2)^(n/2))^p/(1 - ff^2*x^2)^((m + 1)/2), x], x
, Sin[e + f*x]/ff], x]] /; FreeQ[{a, b, e, f, p}, x] && IntegerQ[(m - 1)/2]
 && IntegerQ[n/2] &&  !IntegerQ[p]
```

rule 7273
```
Int[(u_.)*((a_.) + (b_.)*(v_)^(n_))^(p_), x_Symbol] :> Simp[(a + b*v^n)^Fra
cPart[p]/(v^(n*FracPart[p])*(b + a/v^n)^FracPart[p])   Int[u*v^(n*p)*(b + a
/v^n)^p, x], x] /; FreeQ[{a, b, p}, x] &&  !IntegerQ[p] && ILtQ[n, 0] && Bi
nomialQ[v, x] &&  !LinearQ[v, x]
```

3.42.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 77 vs. 2(23) = 46.

Time = 0.77 (sec) , antiderivative size = 78, normalized size of antiderivative = 2.79

method	result	size
default	$\frac{\left(\operatorname{arcsinh}\left(\frac{-1+\cos(x)}{\cos(x)+1}\right)-\operatorname{arctanh}\left(\frac{\sqrt{2}}{2\sqrt{\frac{1+\cos^{2}(x)}{(\cos(x)+1)^{2}}}}\right)\right)\sqrt{\frac{1+\cos^{2}(x)}{(\cos(x)+1)^{2}}}\,(\tan(x)+\sec(x)\tan(x))\sqrt{8}}{8\sqrt{(\tan^{2}(x))(\sec^{2}(x)+1)}}$	78

input
```
int(sec(x)/(-1+sec(x)^4)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
1/8*(arcsinh((-1+cos(x))/(cos(x)+1))-arctanh(1/2/((1+cos(x)^2)/(cos(x)+1)^
2)^(1/2)*2^(1/2)))*((1+cos(x)^2)/(cos(x)+1)^2)^(1/2)/(tan(x)^2*(sec(x)^2+1
))^(1/2)*(tan(x)+sec(x)*tan(x))*8^(1/2)
```

3.42.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 54 vs. 2(23) = 46.

Time = 0.28 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.93

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}}\,dx = \frac{1}{4}\sqrt{2}\log\left(-\frac{2\left(2\sqrt{2}\sqrt{-\frac{\cos(x)^4-1}{\cos(x)^4}}\cos(x)^2-\left(\cos(x)^2+3\right)\sin(x)\right)}{\left(\cos(x)^2-1\right)\sin(x)}\right)$$

input
```
integrate(sec(x)/(-1+sec(x)^4)^(1/2),x, algorithm="fricas")
```

output
```
1/4*sqrt(2)*log(-2*(2*sqrt(2)*sqrt(-(cos(x)^4 - 1)/cos(x)^4)*cos(x)^2 - (c
os(x)^2 + 3)*sin(x))/((cos(x)^2 - 1)*sin(x)))
```

3.42.6 Sympy [F]

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}}\,dx = \int \frac{\sec(x)}{\sqrt{(\sec(x)-1)(\sec(x)+1)(\sec^2(x)+1)}}\,dx$$

input
```
integrate(sec(x)/(-1+sec(x)**4)**(1/2),x)
```

output
```
Integral(sec(x)/sqrt((sec(x) - 1)*(sec(x) + 1)*(sec(x)**2 + 1)), x)
```

3.42.7 Maxima [F]

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}}\,dx = \int \frac{\sec(x)}{\sqrt{\sec(x)^4-1}}\,dx$$

input
```
integrate(sec(x)/(-1+sec(x)^4)^(1/2),x, algorithm="maxima")
```

output
```
integrate(sec(x)/sqrt(sec(x)^4 - 1), x)
```

3.42.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 92 vs. $2(23) = 46$.

Time = 0.51 (sec) , antiderivative size = 92, normalized size of antiderivative = 3.29

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}}\,dx$$
$$= \frac{\sqrt{2}\left(\log\left(\tan\left(\frac{1}{2}x\right)^2-\sqrt{\tan\left(\frac{1}{2}x\right)^4+1}+1\right)-\log\left(-\tan\left(\frac{1}{2}x\right)^2+\sqrt{\tan\left(\frac{1}{2}x\right)^4+1}+1\right)+\log\left(-\tan\right.\right.}{4\,\mathrm{sgn}\left(\tan\left(\frac{1}{2}x\right)^5+2\tan\left(\frac{1}{2}x\right)^3+\tan\left(\frac{1}{2}x\right)\right)}$$

input
```
integrate(sec(x)/(-1+sec(x)^4)^(1/2),x, algorithm="giac")
```

output
```
1/4*sqrt(2)*(log(tan(1/2*x)^2 - sqrt(tan(1/2*x)^4 + 1) + 1) - log(-tan(1/2
*x)^2 + sqrt(tan(1/2*x)^4 + 1) + 1) + log(-tan(1/2*x)^2 + sqrt(tan(1/2*x)^
4 + 1)))/sgn(tan(1/2*x)^5 + 2*tan(1/2*x)^3 + tan(1/2*x))
```

3.42.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sec(x)}{\sqrt{-1+\sec^4(x)}}\,dx = \int \frac{1}{\cos(x)\,\sqrt{\frac{1}{\cos(x)^4}-1}}\,dx$$

input
```
int(1/(cos(x)*(1/cos(x)^4 - 1)^(1/2)),x)
```

output
```
int(1/(cos(x)*(1/cos(x)^4 - 1)^(1/2)), x)
```

3.43 $\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx$

3.43.1 Optimal result

Integrand size = 13, antiderivative size = 34

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx = -\frac{\operatorname{arctanh}\left(\frac{1-\tan^2(x)}{\sqrt{2}\sqrt{1+\tan^4(x)}}\right)}{2\sqrt{2}}$$

output
```
-1/4*arctanh(1/2*(1-tan(x)^2)*2^(1/2)/(1+tan(x)^4)^(1/2))*2^(1/2)
```

3.43.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 55, normalized size of antiderivative = 1.62

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx = -\frac{\sqrt{3+\cos(4x)}\log\left(\sqrt{2}\cos(2x)+\sqrt{3+\cos(4x)}\right)\sec^2(x)}{4\sqrt{2}\sqrt{1+\tan^4(x)}}$$

input
```
Integrate[Tan[x]/Sqrt[1 + Tan[x]^4],x]
```

output
```
-1/4*(Sqrt[3 + Cos[4*x]]*Log[Sqrt[2]*Cos[2*x] + Sqrt[3 + Cos[4*x]]]*Sec[x]
^2)/(Sqrt[2]*Sqrt[1 + Tan[x]^4])
```

3.43.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.00, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.385, Rules used = {3042, 4153, 1577, 488, 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.

$$\int \frac{\tan(x)}{\sqrt{\tan^4(x)+1}}dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\tan(x)}{\sqrt{\tan(x)^4+1}}dx$$

$$\Big\downarrow \text{4153}$$

$$\int \frac{\tan(x)}{(\tan^2(x)+1)\sqrt{\tan^4(x)+1}}d\tan(x)$$

$$\Big\downarrow \text{1577}$$

$$\frac{1}{2}\int \frac{1}{(\tan^2(x)+1)\sqrt{\tan^4(x)+1}}d\tan^2(x)$$

$$\Big\downarrow \text{488}$$

$$-\frac{1}{2}\int \frac{1}{2-\tan^4(x)}d\frac{1-\tan^2(x)}{\sqrt{\tan^4(x)+1}}$$

$$\Big\downarrow \text{219}$$

$$-\frac{\operatorname{arctanh}\left(\frac{1-\tan^2(x)}{\sqrt{2}\sqrt{\tan^4(x)+1}}\right)}{2\sqrt{2}}$$

input
```
Int[Tan[x]/Sqrt[1 + Tan[x]^4],x]
```

output
```
-1/2*ArcTanh[(1 - Tan[x]^2)/(Sqrt[2]*Sqrt[1 + Tan[x]^4])]/Sqrt[2]
```

3.43.3.1 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 488
```
Int[1/(((c_) + (d_.)*(x_))*Sqrt[(a_) + (b_.)*(x_)^2]), x_Symbol] :> -Subst[
Int[1/(b*c^2 + a*d^2 - x^2), x], x, (a*d - b*c*x)/Sqrt[a + b*x^2]] /; FreeQ
[{a, b, c, d}, x]
```

rule 1577
```
Int[(x_)*((d_) + (e_.)*(x_)^2)^(q_.)*((a_) + (c_.)*(x_)^4)^(p_.), x_Symbol]
 :> Simp[1/2   Subst[Int[(d + e*x)^q*(a + c*x^2)^p, x], x, x^2], x] /; Free
Q[{a, c, d, e, p, q}, x]
```

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

rule 4153
```
Int[((d_.)*tan[(e_.) + (f_.)*(x_)])^(m_.)*((a_) + (b_.)*((c_.)*tan[(e_.) +
(f_.)*(x_)])^(n_))^(p_.), x_Symbol] :> With[{ff = FreeFactors[Tan[e + f*x],
 x]}, Simp[c*(ff/f)   Subst[Int[(d*ff*(x/c))^m*((a + b*(ff*x)^n)^p/(c^2 + f
f^2*x^2)), x], x, c*(Tan[e + f*x]/ff)], x]] /; FreeQ[{a, b, c, d, e, f, m,
n, p}, x] && (IGtQ[p, 0] || EqQ[n, 2] || EqQ[n, 4] || (IntegerQ[p] && Ratio
nalQ[n]))
```

3.43.4 Maple [A] (verified)

Time = 0.22 (sec) , antiderivative size = 37, normalized size of antiderivative = 1.09

method	result	size
derivativedivides	$-\frac{\sqrt{2}\,\operatorname{arctanh}\left(\frac{\left(-2\left(\tan^2(x)\right)+2\right)\sqrt{2}}{4\sqrt{\left(1+\tan^2(x)\right)^2-2\left(\tan^2(x)\right)}}\right)}{4}$	37
default	$-\frac{\sqrt{2}\,\operatorname{arctanh}\left(\frac{\left(-2\left(\tan^2(x)\right)+2\right)\sqrt{2}}{4\sqrt{\left(1+\tan^2(x)\right)^2-2\left(\tan^2(x)\right)}}\right)}{4}$	37

input
```
int(tan(x)/(1+tan(x)^4)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-1/4*2^(1/2)*arctanh(1/4*(-2*tan(x)^2+2)*2^(1/2)/((1+tan(x)^2)^2-2*tan(x)^
2)^(1/2))
```

3.43.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 186 vs. $2(25) = 50$.

Time = 0.26 (sec) , antiderivative size = 186, normalized size of antiderivative = 5.47

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx$$
$$= \frac{1}{32}\sqrt{2}\log\left(\frac{577\tan(x)^{16} - 1912\tan(x)^{14} + 4124\tan(x)^{12} - 6216\tan(x)^{10} + 7110\tan(x)^{8} - 6216\tan}{\mathrm{t}}\right.$$

input
```
integrate(tan(x)/(1+tan(x)^4)^(1/2),x, algorithm="fricas")
```

output
```
1/32*sqrt(2)*log((577*tan(x)^16 - 1912*tan(x)^14 + 4124*tan(x)^12 - 6216*t
an(x)^10 + 7110*tan(x)^8 - 6216*tan(x)^6 + 4124*tan(x)^4 - 1912*tan(x)^2 +
 8*(51*sqrt(2)*tan(x)^14 - 169*sqrt(2)*tan(x)^12 + 339*sqrt(2)*tan(x)^10 -
 465*sqrt(2)*tan(x)^8 + 465*sqrt(2)*tan(x)^6 - 339*sqrt(2)*tan(x)^4 + 169*
sqrt(2)*tan(x)^2 - 51*sqrt(2))*sqrt(tan(x)^4 + 1) + 577)/(tan(x)^16 + 8*ta
n(x)^14 + 28*tan(x)^12 + 56*tan(x)^10 + 70*tan(x)^8 + 56*tan(x)^6 + 28*tan
(x)^4 + 8*tan(x)^2 + 1))
```

3.43.6 Sympy [F]

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx = \int \frac{\tan(x)}{\sqrt{\tan^4(x)+1}}\,dx$$

input
```
integrate(tan(x)/(1+tan(x)**4)**(1/2),x)
```

output
```
Integral(tan(x)/sqrt(tan(x)**4 + 1), x)
```

3.43.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 565 vs. 2(25) = 50.

Time = 0.37 (sec) , antiderivative size = 565, normalized size of antiderivative = 16.62

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx = \text{Too large to display}$$

input
```
integrate(tan(x)/(1+tan(x)^4)^(1/2),x, algorithm="maxima")
```

output
```
-1/16*sqrt(2)*(log(4*sqrt(2*(6*cos(4*x) + 1)*cos(8*x) + cos(8*x)^2 + 36*co
s(4*x)^2 + sin(8*x)^2 + 12*sin(8*x)*sin(4*x) + 36*sin(4*x)^2 + 12*cos(4*x)
 + 1)*cos(1/2*arctan2(sin(8*x) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1))^2
 + 4*sqrt(2*(6*cos(4*x) + 1)*cos(8*x) + cos(8*x)^2 + 36*cos(4*x)^2 + sin(8
*x)^2 + 12*sin(8*x)*sin(4*x) + 36*sin(4*x)^2 + 12*cos(4*x) + 1)*sin(1/2*ar
ctan2(sin(8*x) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1))^2 + 32*(2*(6*cos(
4*x) + 1)*cos(8*x) + cos(8*x)^2 + 36*cos(4*x)^2 + sin(8*x)^2 + 12*sin(8*x)
*sin(4*x) + 36*sin(4*x)^2 + 12*cos(4*x) + 1)^(1/4)*cos(1/2*arctan2(sin(8*x
) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1)) + 64) + log(4*cos(4*x)^2 + 4*s
in(4*x)^2 + 4*sqrt(2*(6*cos(4*x) + 1)*cos(8*x) + cos(8*x)^2 + 36*cos(4*x)^
2 + sin(8*x)^2 + 12*sin(8*x)*sin(4*x) + 36*sin(4*x)^2 + 12*cos(4*x) + 1)*(
cos(1/2*arctan2(sin(8*x) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1))^2 + sin
(1/2*arctan2(sin(8*x) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1))^2) + 8*(2*
(6*cos(4*x) + 1)*cos(8*x) + cos(8*x)^2 + 36*cos(4*x)^2 + sin(8*x)^2 + 12*s
in(8*x)*sin(4*x) + 36*sin(4*x)^2 + 12*cos(4*x) + 1)^(1/4)*((cos(4*x) + 3)*
cos(1/2*arctan2(sin(8*x) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1)) + sin(4
*x)*sin(1/2*arctan2(sin(8*x) + 6*sin(4*x), cos(8*x) + 6*cos(4*x) + 1))) +
24*cos(4*x) + 36))
```

3.43.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.47

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx = \frac{1}{4}\sqrt{2}\log\left(-\frac{\tan(x)^2+\sqrt{2}-\sqrt{\tan(x)^4+1}+1}{\tan(x)^2-\sqrt{2}-\sqrt{\tan(x)^4+1}+1}\right)$$

input
```
integrate(tan(x)/(1+tan(x)^4)^(1/2),x, algorithm="giac")
```

output
```
1/4*sqrt(2)*log(-(tan(x)^2 + sqrt(2) - sqrt(tan(x)^4 + 1) + 1)/(tan(x)^2 -
 sqrt(2) - sqrt(tan(x)^4 + 1) + 1))
```

3.43.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\tan(x)}{\sqrt{1+\tan^4(x)}}\,dx = \int \frac{\tan(x)}{\sqrt{\tan(x)^4+1}}\,dx$$

input
```
int(tan(x)/(tan(x)^4 + 1)^(1/2),x)
```

output
```
int(tan(x)/(tan(x)^4 + 1)^(1/2), x)
```

3.44 $\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx$

3.44.1 Optimal result

Integrand size = 15, antiderivative size = 39

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx = \frac{\operatorname{arctanh}\left(\frac{\sqrt{3}\cos(x)(1+\sin^2(x))}{2\sqrt{1-\sin^6(x)}}\right)}{2\sqrt{3}}$$

output
```
1/6*arctanh(1/2*cos(x)*(1+sin(x)^2)*3^(1/2)/(1-sin(x)^6)^(1/2))*3^(1/2)
```

3.44.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.67

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx = -\frac{\operatorname{arctanh}\left(\frac{\sqrt{\frac{3}{2}}(-3+\cos(2x))}{\sqrt{15-8\cos(2x)+\cos(4x)}}\right)\cos(x)\sqrt{15-8\cos(2x)+\cos(4x)}}{4\sqrt{6-6\sin^6(x)}}$$

input
```
Integrate[Sin[x]/Sqrt[1 - Sin[x]^6],x]
```

output
```
-1/4*(ArcTanh[(Sqrt[3/2]*(-3 + Cos[2*x]))/Sqrt[15 - 8*Cos[2*x] + Cos[4*x]]
]*Cos[x]*Sqrt[15 - 8*Cos[2*x] + Cos[4*x]])/Sqrt[6 - 6*Sin[x]^6]
```

3.44.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 50, normalized size of antiderivative = 1.28, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.333, Rules used = {3042, 3695, 2093, 1951, 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.

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\sin(x)}{\sqrt{1-\sin(x)^6}}dx$$

$$\Big\downarrow \text{3695}$$

$$-\int \frac{1}{\sqrt{1-\left(1-\cos^2(x)\right)^3}}d\cos(x)$$

$$\Big\downarrow \text{2093}$$

$$-\int \frac{1}{\sqrt{\cos^6(x)-3\cos^4(x)+3\cos^2(x)}}d\cos(x)$$

$$\Big\downarrow \text{1951}$$

$$\int \frac{1}{12-\frac{9\cos^2(x)\left(2-\cos^2(x)\right)^2}{\cos^6(x)-3\cos^4(x)+3\cos^2(x)}}d\frac{3\cos(x)\left(2-\cos^2(x)\right)}{\sqrt{\cos^6(x)-3\cos^4(x)+3\cos^2(x)}}$$

$$\Big\downarrow \text{219}$$

$$\frac{\text{arctanh}\left(\frac{\sqrt{3}\cos(x)\left(2-\cos^2(x)\right)}{2\sqrt{\cos^6(x)-3\cos^4(x)+3\cos^2(x)}}\right)}{2\sqrt{3}}$$

input
```
Int[Sin[x]/Sqrt[1 - Sin[x]^6],x]
```

output
```
ArcTanh[(Sqrt[3]*Cos[x]*(2 - Cos[x]^2))/(2*Sqrt[3*Cos[x]^2 - 3*Cos[x]^4 +
Cos[x]^6])]/(2*Sqrt[3])
```

3.44.3.1 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 1951
```
Int[1/Sqrt[(a_.)*(x_)^2 + (b_.)*(x_)^(n_.) + (c_.)*(x_)^(r_.)], x_Symbol] :
> Simp[-2/(n - 2)   Subst[Int[1/(4*a - x^2), x], x, x*((2*a + b*x^(n - 2))/
Sqrt[a*x^2 + b*x^n + c*x^r])], x] /; FreeQ[{a, b, c, n, r}, x] && EqQ[r, 2*
n - 2] && PosQ[n - 2] && NeQ[b^2 - 4*a*c, 0]
```

rule 2093
```
Int[(u_)^(p_), x_Symbol] :> Int[ExpandToSum[u, x]^p, x] /; FreeQ[p, x] && G
eneralizedTrinomialQ[u, x] &&  !GeneralizedTrinomialMatchQ[u, x]
```

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

rule 3695
```
Int[sin[(e_.) + (f_.)*(x_)]^(m_.)*((a_) + (b_.)*sin[(e_.) + (f_.)*(x_)]^(n_
))^(p_.), x_Symbol] :> With[{ff = FreeFactors[Cos[e + f*x], x]}, Simp[-ff/f
   Subst[Int[(1 - ff^2*x^2)^((m - 1)/2)*(a + b*(1 - ff^2*x^2)^(n/2))^p, x],
 x, Cos[e + f*x]/ff], x]] /; FreeQ[{a, b, e, f, p}, x] && IntegerQ[(m - 1)/
2] && IntegerQ[n/2]
```

3.44.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 66 vs. $2(29) = 58$.

Time = 0.89 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.72

method	result	size
default	$-\frac{\cos(x)\sqrt{\cos^4(x)-3(\cos^2(x))+3}\,\sqrt{3}\,\operatorname{arctanh}\left(\frac{\left(\cos^2(x)-2\right)\sqrt{3}}{2\sqrt{\cos^4(x)-3\left(\cos^2(x)\right)+3}}\right)}{6\sqrt{\cos^6(x)-3(\cos^4(x))+3(\cos^2(x))}}$	67

input
```
int(sin(x)/(1-sin(x)^6)^(1/2),x,method=_RETURNVERBOSE)
```

output
```
-1/6/(cos(x)^6-3*cos(x)^4+3*cos(x)^2)^(1/2)*cos(x)*(cos(x)^4-3*cos(x)^2+3)
^(1/2)*3^(1/2)*arctanh(1/2*(cos(x)^2-2)*3^(1/2)/(cos(x)^4-3*cos(x)^2+3)^(1
/2))
```

3.44.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 63 vs. 2(29) = 58.

Time = 0.30 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.62

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx$$
$$= \frac{1}{12}\sqrt{3}\log\left(\frac{7\cos(x)^5 - 24\cos(x)^3 - 4\sqrt{\cos(x)^6 - 3\cos(x)^4 + 3\cos(x)^2}\left(\sqrt{3}\cos(x)^2 - 2\sqrt{3}\right) + 24\,\mathrm{co}}{\cos(x)^5}\right.$$

input
```
integrate(sin(x)/(1-sin(x)^6)^(1/2),x, algorithm="fricas")
```

output
```
1/12*sqrt(3)*log((7*cos(x)^5 - 24*cos(x)^3 - 4*sqrt(cos(x)^6 - 3*cos(x)^4
+ 3*cos(x)^2)*(sqrt(3)*cos(x)^2 - 2*sqrt(3)) + 24*cos(x))/cos(x)^5)
```

3.44.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx = \text{Timed out}$$

input
```
integrate(sin(x)/(1-sin(x)**6)**(1/2),x)
```

output
```
Timed out
```

3.44.7 Maxima [F]

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx = \int \frac{\sin{(x)}}{\sqrt{-\sin{(x)}^6+1}}\,dx$$

input
```
integrate(sin(x)/(1-sin(x)^6)^(1/2),x, algorithm="maxima")
```

output
```
integrate(sin(x)/sqrt(-sin(x)^6 + 1), x)
```

3.44.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 67 vs. 2(29) = 58.

Time = 0.33 (sec) , antiderivative size = 67, normalized size of antiderivative = 1.72

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx = -\frac{\sqrt{3}\log\left(\cos{(x)}^2+\sqrt{3}-\sqrt{\cos{(x)}^4-3\cos{(x)}^2+3}\right)-\sqrt{3}\log\left(-\cos{(x)}^2+\sqrt{3}+\sqrt{\cos{(x)}^4-3\cos}\right.}{6\,\mathrm{sgn}\left(\cos{(x)}\right)}$$

input
```
integrate(sin(x)/(1-sin(x)^6)^(1/2),x, algorithm="giac")
```

output
```
-1/6*(sqrt(3)*log(cos(x)^2 + sqrt(3) - sqrt(cos(x)^4 - 3*cos(x)^2 + 3)) -
sqrt(3)*log(-cos(x)^2 + sqrt(3) + sqrt(cos(x)^4 - 3*cos(x)^2 + 3)))/sgn(co
s(x))
```

3.44.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(x)}{\sqrt{1-\sin^6(x)}}\,dx = \int \frac{\sin{(x)}}{\sqrt{1-\sin{(x)}^6}}\,dx$$

input
```
int(sin(x)/(1 - sin(x)^6)^(1/2),x)
```

output
```
int(sin(x)/(1 - sin(x)^6)^(1/2), x)
```

3.45 $\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx$

3.45.1 Optimal result

Integrand size = 23, antiderivative size = 337

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx$$
$$= \sqrt{2}\left(\sqrt{-1+\sqrt{2}}\arctan\left(\frac{\sqrt{-2+2\sqrt{2}}\left(-\sqrt{2}-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}\right)}{2\sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}}\right)\right.$$
$$-\sqrt{1+\sqrt{2}}\arctan\left(\frac{\sqrt{2+2\sqrt{2}}\left(-\sqrt{2}-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}\right)}{2\sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}}\right)$$
$$-\sqrt{1+\sqrt{2}}\operatorname{arctanh}\left(\frac{\sqrt{-2+2\sqrt{2}}\sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}}{\sqrt{2}-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\right)$$
$$\left.+\sqrt{-1+\sqrt{2}}\operatorname{arctanh}\left(\frac{\sqrt{2+2\sqrt{2}}\sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}}{\sqrt{2}-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\right)\right)\cot(x)\sqrt{-1+\sec(x)}\sqrt{1+\sec(x)}$$

output
```
cot(x)*2^(1/2)*(-1+sec(x))^(1/2)*(1+sec(x))^(1/2)*(arctan(1/2*(-2^(1/2)-(-
1+sec(x))^(1/2)+(1+sec(x))^(1/2))*(-2+2*2^(1/2))^(1/2)/(-(-1+sec(x))^(1/2)
+(1+sec(x))^(1/2))^(1/2))*(2^(1/2)-1)^(1/2)+arctanh((2+2*2^(1/2))^(1/2)*(-
(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(1/2)/(2^(1/2)-(-1+sec(x))^(1/2)+(1+se
c(x))^(1/2)))*(2^(1/2)-1)^(1/2)-arctan(1/2*(-2^(1/2)-(-1+sec(x))^(1/2)+(1+
sec(x))^(1/2))*(2+2*2^(1/2))^(1/2)/(-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(
1/2))*(1+2^(1/2))^(1/2)-arctanh((-2+2*2^(1/2))^(1/2)*(-(-1+sec(x))^(1/2)+(
1+sec(x))^(1/2))^(1/2)/(2^(1/2)-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2)))*(1+2^
(1/2))^(1/2))
```

3.45.2 Mathematica [A] (warning: unable to verify)

Time = 2.85 (sec) , antiderivative size = 552, normalized size of antiderivative = 1.64

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx$$
$$= \frac{\sqrt[4]{2}\cos(x)\left(\sqrt{-1+\sec(x)}-\sqrt{1+\sec(x)}\right)^2\left(2\arctan\left(\cot\left(\frac{\pi}{8}\right)-\frac{\csc\left(\frac{\pi}{8}\right)\sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}}{\sqrt[4]{2}}\right)\cos\left(\frac{\pi}{8}\right)\right.}{}$$

input
```
Integrate[Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]],x]
```

output
```
(2^(1/4)*Cos[x]*(Sqrt[-1 + Sec[x]] - Sqrt[1 + Sec[x]])^2*(2*ArcTan[Cot[Pi/
8] - (Csc[Pi/8]*Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]])/2^(1/4)]*Cos[
Pi/8] - 2*ArcTan[Cot[Pi/8] + (Csc[Pi/8]*Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 +
 Sec[x]]])/2^(1/4)]*Cos[Pi/8] + Cos[Pi/8]*Log[2 + Sqrt[2]*(-Sqrt[-1 + Sec[
x]] + Sqrt[1 + Sec[x]]) - 2*2^(3/4)*Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec
[x]]]*Sin[Pi/8]] - Cos[Pi/8]*Log[2 + Sqrt[2]*(-Sqrt[-1 + Sec[x]] + Sqrt[1
+ Sec[x]]) + 2*2^(3/4)*Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]]*Sin[Pi/
8]] + 2*ArcTan[(Sec[Pi/8]*Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]])/2^(
1/4) - Tan[Pi/8]]*Sin[Pi/8] + 2*ArcTan[(Sec[Pi/8]*Sqrt[-Sqrt[-1 + Sec[x]]
+ Sqrt[1 + Sec[x]]])/2^(1/4) + Tan[Pi/8]]*Sin[Pi/8] - Log[2 - 2*2^(3/4)*Co
s[Pi/8]*Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]] + Sqrt[2]*(-Sqrt[-1 +
Sec[x]] + Sqrt[1 + Sec[x]])]*Sin[Pi/8] + Log[2 + 2^(1/4)*Csc[Pi/8]*Sqrt[-S
qrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]] + Sqrt[2]*(-Sqrt[-1 + Sec[x]] + Sqrt[
1 + Sec[x]])]*Sin[Pi/8])*Sin[x])/(-1 + Cos[2*x] + 2*Cos[x]*Sqrt[-1 + Sec[x
]]*Sqrt[1 + Sec[x]])
```

3.45.3 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.

$$\int \sqrt{\sqrt{\sec(x)+1}-\sqrt{\sec(x)-1}}\,dx$$

$$\Big\downarrow \ 3042$$

$$\int \sqrt{\sqrt{\sec(x)+1}-\sqrt{\sec(x)-1}}dx$$

$$\Big\downarrow \ 4902$$

$$2\int \frac{\sqrt[4]{2}\sqrt{\sqrt{\frac{1}{1-\tan^2\left(\frac{x}{2}\right)}}-\sqrt{\frac{\tan^2\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}}}}{\tan^2\left(\frac{x}{2}\right)+1}d\tan\left(\frac{x}{2}\right)$$

$$\Big\downarrow \ 27$$

$$2\sqrt[4]{2}\int \frac{\sqrt{\sqrt{\frac{1}{1-\tan^2\left(\frac{x}{2}\right)}}-\sqrt{\frac{\tan^2\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}}}}{\tan^2\left(\frac{x}{2}\right)+1}d\tan\left(\frac{x}{2}\right)$$

$$\Big\downarrow \ 7276$$

$$2\sqrt[4]{2}\int \left(\frac{i\sqrt{\sqrt{\frac{1}{1-\tan^2\left(\frac{x}{2}\right)}}-\sqrt{\frac{\tan^2\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}}}}{2\left(i-\tan\left(\frac{x}{2}\right)\right)}+\frac{i\sqrt{\sqrt{\frac{1}{1-\tan^2\left(\frac{x}{2}\right)}}-\sqrt{\frac{\tan^2\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}}}}{2\left(\tan\left(\frac{x}{2}\right)+i\right)}\right)d\tan\left(\frac{x}{2}\right)$$

$$\Big\downarrow \ 2009$$

$$2\sqrt[4]{2}\left(\frac{1}{2}i\int \frac{\sqrt{\sqrt{\frac{1}{1-\tan^2\left(\frac{x}{2}\right)}}-\sqrt{\frac{\tan^2\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}}}}{i-\tan\left(\frac{x}{2}\right)}d\tan\left(\frac{x}{2}\right)+\frac{1}{2}i\int \frac{\sqrt{\sqrt{\frac{1}{1-\tan^2\left(\frac{x}{2}\right)}}-\sqrt{\frac{\tan^2\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}}}}{\tan\left(\frac{x}{2}\right)+i}d\tan\left(\frac{x}{2}\right)\right)$$

input
```
Int[Sqrt[-Sqrt[-1 + Sec[x]] + Sqrt[1 + Sec[x]]],x]
```

output
```
$Aborted
```

3.45. $\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx$

3.45.3.1 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 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 4902
```
Int[u_, x_Symbol] :> With[{w = Block[{$ShowSteps = False, $StepCounter = Nu
ll}, Int[SubstFor[1/(1 + FreeFactors[Tan[FunctionOfTrig[u, x]/2], x]^2*x^2)
, Tan[FunctionOfTrig[u, x]/2]/FreeFactors[Tan[FunctionOfTrig[u, x]/2], x],
u, x], x]]}, Module[{v = FunctionOfTrig[u, x], d}, Simp[d = FreeFactors[Tan
[v/2], x]; 2*(d/Coefficient[v, x, 1])   Subst[Int[SubstFor[1/(1 + d^2*x^2),
 Tan[v/2]/d, u, x], x], x, Tan[v/2]/d], x]] /; CalculusFreeQ[w, x]] /; Inve
rseFunctionFreeQ[u, x] &&  !FalseQ[FunctionOfTrig[u, x]]
```

rule 7276
```
Int[(u_)/((a_) + (b_.)*(x_)^(n_)), x_Symbol] :> With[{v = RationalFunctionE
xpand[u/(a + b*x^n), x]}, Int[v, x] /; SumQ[v]] /; FreeQ[{a, b}, x] && IGtQ
[n, 0]
```

3.45.4 Maple [F]

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}dx$$

input
```
int((-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(1/2),x)
```

output
```
int((-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(1/2),x)
```

3.45.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 337, normalized size of antiderivative = 1.00

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx = \frac{1}{2}\sqrt{4i+4}\log\left(i\sqrt{4i+4} + 2\sqrt{\frac{\sqrt{\frac{\cos(x)+1}{\cos(x)}}(\cos(x)-\sin(x)+1)}{\cos(x)+1}}\right) - \frac{1}{2}\sqrt{4i+4}\log\left(-i\sqrt{4i+4} + 2\sqrt{\frac{\sqrt{\frac{\cos(x)+1}{\cos(x)}}(\cos(x)-\sin(x)+1)}{\cos(x)+1}}\right) - \frac{1}{2}\sqrt{-4i+4}\log\left(i\sqrt{-4i+4} + 2\sqrt{\frac{\sqrt{\frac{\cos(x)+1}{\cos(x)}}(\cos(x)-\sin(x)+1)}{\cos(x)+1}}\right) + \frac{1}{2}\sqrt{-4i+4}\log\left(-i\sqrt{-4i+4} + 2\sqrt{\frac{\sqrt{\frac{\cos(x)+1}{\cos(x)}}(\cos(x)-\sin(x)+1)}{\cos(x)+1}}\right) - \frac{1}{2}\sqrt{4i-4}\log\left(i\sqrt{4i-4} + 2\sqrt{\frac{\sqrt{\frac{\cos(x)+1}{\cos(x)}}(\cos(x)-\sin(x)+1)}{\cos(x)+1}}\right) + \frac{1}{2}\sqrt{4i-4}\log\left(-i\sqrt{4i-4} \right.$$

$$\sqrt{\frac{\cos(x)+1}{\ldots}}(\cos(x) - \sin(x) + 1)$$

3.45. $\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx$

input
```
integrate((-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(1/2),x, algorithm="fricas
")
```

output
```
1/2*sqrt(4*I + 4)*log(I*sqrt(4*I + 4) + 2*sqrt(sqrt((cos(x) + 1)/cos(x))*(
cos(x) - sin(x) + 1)/(cos(x) + 1))) - 1/2*sqrt(4*I + 4)*log(-I*sqrt(4*I +
4) + 2*sqrt(sqrt((cos(x) + 1)/cos(x))*(cos(x) - sin(x) + 1)/(cos(x) + 1)))
 - 1/2*sqrt(-4*I + 4)*log(I*sqrt(-4*I + 4) + 2*sqrt(sqrt((cos(x) + 1)/cos(
x))*(cos(x) - sin(x) + 1)/(cos(x) + 1))) + 1/2*sqrt(-4*I + 4)*log(-I*sqrt(
-4*I + 4) + 2*sqrt(sqrt((cos(x) + 1)/cos(x))*(cos(x) - sin(x) + 1)/(cos(x)
 + 1))) - 1/2*sqrt(4*I - 4)*log(I*sqrt(4*I - 4) + 2*sqrt(sqrt((cos(x) + 1)
/cos(x))*(cos(x) - sin(x) + 1)/(cos(x) + 1))) + 1/2*sqrt(4*I - 4)*log(-I*s
qrt(4*I - 4) + 2*sqrt(sqrt((cos(x) + 1)/cos(x))*(cos(x) - sin(x) + 1)/(cos
(x) + 1))) + 1/2*sqrt(-4*I - 4)*log(I*sqrt(-4*I - 4) + 2*sqrt(sqrt((cos(x)
 + 1)/cos(x))*(cos(x) - sin(x) + 1)/(cos(x) + 1))) - 1/2*sqrt(-4*I - 4)*lo
g(-I*sqrt(-4*I - 4) + 2*sqrt(sqrt((cos(x) + 1)/cos(x))*(cos(x) - sin(x) +
1)/(cos(x) + 1)))
```

3.45.6 Sympy [F]

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx = \int \sqrt{-\sqrt{\sec{(x)}-1}+\sqrt{\sec{(x)}+1}}\,dx$$

input
```
integrate((-(-1+sec(x))**(1/2)+(1+sec(x))**(1/2))**(1/2),x)
```

output
```
Integral(sqrt(-sqrt(sec(x) - 1) + sqrt(sec(x) + 1)), x)
```

3.45.7 Maxima [F]

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx = \int \sqrt{\sqrt{\sec{(x)}+1}-\sqrt{\sec{(x)}-1}}\,dx$$

input
```
integrate((-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(1/2),x, algorithm="maxima
")
```

output
```
integrate(sqrt(sqrt(sec(x) + 1) - sqrt(sec(x) - 1)), x)
```

3.45.8 Giac [F]

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx = \int \sqrt{\sqrt{\sec(x)+1}-\sqrt{\sec(x)-1}}\,dx$$

input
```
integrate((-(-1+sec(x))^(1/2)+(1+sec(x))^(1/2))^(1/2),x, algorithm="giac")
```

output
```
integrate(sqrt(sqrt(sec(x) + 1) - sqrt(sec(x) - 1)), x)
```

3.45.9 Mupad [F(-1)]

Timed out.

$$\int \sqrt{-\sqrt{-1+\sec(x)}+\sqrt{1+\sec(x)}}\,dx = \int \sqrt{\sqrt{\frac{1}{\cos(x)}+1}-\sqrt{\frac{1}{\cos(x)}-1}}\,dx$$

input
```
int(((1/cos(x) + 1)^(1/2) - (1/cos(x) - 1)^(1/2))^(1/2),x)
```

output
```
int(((1/cos(x) + 1)^(1/2) - (1/cos(x) - 1)^(1/2))^(1/2), x)
```

3.46 $\int x \arctan(x)^2 \log(1+x^2)\, dx$

3.46.1 Optimal result

Integrand size = 12, antiderivative size = 77

$$\int x \arctan(x)^2 \log(1+x^2)\, dx = 3x\arctan(x) - \frac{3\arctan(x)^2}{2} - \frac{1}{2}x^2\arctan(x)^2 - \frac{3}{2}\log(1+x^2) - x\arctan(x)\log(1+x^2) + \frac{1}{2}(1+x^2)\arctan(x)^2\log(1+x^2) + \frac{1}{4}\log^2(1+x^2)$$

output
```
3*x*arctan(x)-3/2*arctan(x)^2-1/2*x^2*arctan(x)^2-3/2*ln(x^2+1)-x*arctan(x
)*ln(x^2+1)+1/2*(x^2+1)*arctan(x)^2*ln(x^2+1)+1/4*ln(x^2+1)^2
```

3.46.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 58, normalized size of antiderivative = 0.75

$$\int x \arctan(x)^2 \log(1+x^2)\, dx = \frac{1}{4}\left(-4x\arctan(x)\left(-3+\log(1+x^2)\right) + \left(-6+\log(1+x^2)\right)\log(1+x^2) + 2\arctan(x)^2\left(-3-x^2+(1+x^2)\log(1+x^2)\right)\right)$$

input
```
Integrate[x*ArcTan[x]^2*Log[1 + x^2],x]
```

output
```
(-4*x*ArcTan[x]*(-3 + Log[1 + x^2]) + (-6 + Log[1 + x^2])*Log[1 + x^2] + 2
*ArcTan[x]^2*(-3 - x^2 + (1 + x^2)*Log[1 + x^2]))/4
```

3.46.3 Rubi [A] (verified)

Time = 0.98 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.31, number of steps used = 14, number of rules used = 13, $\frac{\text{number of rules}}{\text{integrand size}}$ = 1.083, Rules used = {5558, 5451, 5345, 240, 5419, 5544, 2925, 2837, 2738, 5451, 5345, 240, 5419}

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.

$$\int x\arctan(x)^2\log\left(x^2+1\right)\,dx$$

$$\Big\downarrow \text{5558}$$

$$\int \frac{x^2\arctan(x)}{x^2+1}dx-\int \arctan(x)\log\left(x^2+1\right)dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5451}$$

$$-\int \frac{\arctan(x)}{x^2+1}dx-\int \arctan(x)\log\left(x^2+1\right)dx+\int \arctan(x)dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5345}$$

$$-\int \frac{\arctan(x)}{x^2+1}dx-\int \arctan(x)\log\left(x^2+1\right)dx-\int \frac{x}{x^2+1}dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)+x\arctan(x)$$

$$\Big\downarrow \text{240}$$

$$-\int \frac{\arctan(x)}{x^2+1}dx-\int \arctan(x)\log\left(x^2+1\right)dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)+x\arctan(x)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5419}$$

$$-\int \arctan(x)\log\left(x^2+1\right)dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5544}$$

$$2\int \frac{x^2\arctan(x)}{x^2+1}dx+\int \frac{x\log\left(x^2+1\right)}{x^2+1}dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{2925}$$

$$2\int \frac{x^2\arctan(x)}{x^2+1}dx+\frac{1}{2}\int \frac{\log\left(x^2+1\right)}{x^2+1}dx^2-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{2837}$$

$$2\int \frac{x^2\arctan(x)}{x^2+1}dx+\frac{1}{2}\int \frac{\log\left(x^2+1\right)}{x^2}d\left(x^2+1\right)-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{2738}$$

$$2\int \frac{x^2\arctan(x)}{x^2+1}dx-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)+\frac{1}{4}\log^2\left(x^2+1\right)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5451}$$

$$2\left(\int \arctan(x)dx-\int \frac{\arctan(x)}{x^2+1}dx\right)-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)+\frac{1}{4}\log^2\left(x^2+1\right)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5345}$$

$$2\left(-\int \frac{\arctan(x)}{x^2+1}dx-\int \frac{x}{x^2+1}dx+x\arctan(x)\right)-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)+\frac{1}{4}\log^2\left(x^2+1\right)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{240}$$

$$2\left(-\int \frac{\arctan(x)}{x^2+1}dx+x\arctan(x)-\frac{1}{2}\log\left(x^2+1\right)\right)-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}\left(x^2+1\right)\arctan(x)^2\log\left(x^2+1\right)-x\arctan(x)\log\left(x^2+1\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)+\frac{1}{4}\log^2\left(x^2+1\right)-\frac{1}{2}\log\left(x^2+1\right)$$

$$\Big\downarrow \text{5419}$$

3.46. $\int x\arctan(x)^2\log\left(1+x^2\right)\,dx$

$$-\frac{1}{2}x^2\arctan(x)^2+\frac{1}{2}(x^2+1)\arctan(x)^2\log(x^2+1)-x\arctan(x)\log(x^2+1)+2\left(-\frac{1}{2}\arctan(x)^2+x\arctan(x)-\frac{1}{2}\log(x^2+1)\right)-\frac{\arctan(x)^2}{2}+x\arctan(x)+\frac{1}{4}\log^2(x^2+1)-\frac{1}{2}\log(x^2+1)$$

input
```
Int[x*ArcTan[x]^2*Log[1 + x^2],x]
```

output
```
x*ArcTan[x] - ArcTan[x]^2/2 - (x^2*ArcTan[x]^2)/2 + 2*(x*ArcTan[x] - ArcTa
n[x]^2/2 - Log[1 + x^2]/2) - Log[1 + x^2]/2 - x*ArcTan[x]*Log[1 + x^2] + (
(1 + x^2)*ArcTan[x]^2*Log[1 + x^2])/2 + Log[1 + x^2]^2/4
```

3.46.3.1 Defintions of rubi rules used

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 2738
```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))/(x_), x_Symbol] :> Simp[(a + b*Lo
g[c*x^n])^2/(2*b*n), x] /; FreeQ[{a, b, c, n}, x]
```

rule 2837
```
Int[((a_.) + Log[(c_.)*((d_) + (e_.)*(x_))^(n_.)]*(b_.))^(p_.)*((f_) + (g_.
)*(x_))^(q_.), x_Symbol] :> Simp[1/e   Subst[Int[(f*(x/d))^q*(a + b*Log[c*x
^n])^p, x], x, d + e*x], x] /; FreeQ[{a, b, c, d, e, f, g, n, p, q}, x] &&
EqQ[e*f - d*g, 0]
```

rule 2925
```
Int[((a_.) + Log[(c_.)*((d_) + (e_.)*(x_)^(n_))^(p_.)]*(b_.))^(q_.)*(x_)^(m
_.)*((f_) + (g_.)*(x_)^(s_))^(r_.), x_Symbol] :> Simp[1/n   Subst[Int[x^(Si
mplify[(m + 1)/n] - 1)*(f + g*x^(s/n))^r*(a + b*Log[c*(d + e*x)^p])^q, x],
x, x^n], x] /; FreeQ[{a, b, c, d, e, f, g, m, n, p, q, r, s}, x] && Integer
Q[r] && IntegerQ[s/n] && IntegerQ[Simplify[(m + 1)/n]] && (GtQ[(m + 1)/n, 0
] || IGtQ[q, 0])
```

rule 5345
```
Int[((a_.) + ArcTan[(c_.)*(x_)^(n_.)]*(b_.))^(p_.), x_Symbol] :> Simp[x*(a
+ b*ArcTan[c*x^n])^p, x] - Simp[b*c*n*p   Int[x^n*((a + b*ArcTan[c*x^n])^(p
 - 1)/(1 + c^2*x^(2*n))), x], x] /; FreeQ[{a, b, c, n}, x] && IGtQ[p, 0] &&
 (EqQ[n, 1] || EqQ[p, 1])
```

rule 5419
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))^(p_.)/((d_) + (e_.)*(x_)^2), x_Symbo
l] :> Simp[(a + b*ArcTan[c*x])^(p + 1)/(b*c*d*(p + 1)), x] /; FreeQ[{a, b,
c, d, e, p}, x] && EqQ[e, c^2*d] && NeQ[p, -1]
```

rule 5451
```
Int[(((a_.) + ArcTan[(c_.)*(x_)]*(b_.))^(p_.)*((f_.)*(x_))^(m_))/((d_) + (e
_.)*(x_)^2), x_Symbol] :> Simp[f^2/e   Int[(f*x)^(m - 2)*(a + b*ArcTan[c*x]
)^p, x], x] - Simp[d*(f^2/e)   Int[(f*x)^(m - 2)*((a + b*ArcTan[c*x])^p/(d
+ e*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f}, x] && GtQ[p, 0] && GtQ[m, 1]
```

rule 5544
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))*((d_.) + Log[(f_.) + (g_.)*(x_)^2]*(
e_.)), x_Symbol] :> Simp[x*(d + e*Log[f + g*x^2])*(a + b*ArcTan[c*x]), x] +
 (-Simp[b*c   Int[x*((d + e*Log[f + g*x^2])/(1 + c^2*x^2)), x], x] - Simp[2
*e*g   Int[x^2*((a + b*ArcTan[c*x])/(f + g*x^2)), x], x]) /; FreeQ[{a, b, c
, d, e, f, g}, x]
```

rule 5558
```
Int[((a_.) + ArcTan[(c_.)*(x_)]*(b_.))^2*((d_.) + Log[(f_) + (g_.)*(x_)^2]*
(e_.))*(x_), x_Symbol] :> Simp[(f + g*x^2)*(d + e*Log[f + g*x^2])*((a + b*A
rcTan[c*x])^2/(2*g)), x] + (-Simp[e*x^2*((a + b*ArcTan[c*x])^2/2), x] - Sim
p[b/c   Int[(d + e*Log[f + g*x^2])*(a + b*ArcTan[c*x]), x], x] + Simp[b*c*e
   Int[x^2*((a + b*ArcTan[c*x])/(1 + c^2*x^2)), x], x]) /; FreeQ[{a, b, c,
d, e, f, g}, x] && EqQ[g, c^2*f]
```

3.46.4 Maple [A] (verified)

Time = 4.50 (sec) , antiderivative size = 78, normalized size of antiderivative = 1.01

method	result
parallelrisch	$\frac{\ln(x^2+1)\arctan(x)^2x^2}{2}-\frac{x^2\arctan(x)^2}{2}-x\arctan(x)\ln(x^2+1)+\frac{\arctan(x)^2\ln(x^2+1)}{2}+3x\arctan(x)$
default	Expression too large to display
risch	Expression too large to display

input
```
int(x*arctan(x)^2*ln(x^2+1),x,method=_RETURNVERBOSE)
```

output
```
1/2*ln(x^2+1)*arctan(x)^2*x^2-1/2*x^2*arctan(x)^2-x*arctan(x)*ln(x^2+1)+1/
2*arctan(x)^2*ln(x^2+1)+3*x*arctan(x)-3/2*arctan(x)^2+1/4*ln(x^2+1)^2-3/2*
ln(x^2+1)
```

3.46.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 52, normalized size of antiderivative = 0.68

$$\int x\arctan(x)^2\log\left(1+x^2\right)\,dx = -\frac{1}{2}\left(x^2+3\right)\arctan\left(x\right)^2+3\,x\arctan\left(x\right) + \frac{1}{2}\left(\left(x^2+1\right)\arctan\left(x\right)^2-2\,x\arctan\left(x\right)-3\right)\log\left(x^2+1\right) + \frac{1}{4}\log\left(x^2+1\right)^2$$

input
```
integrate(x*arctan(x)^2*log(x^2+1),x, algorithm="fricas")
```

output
```
-1/2*(x^2 + 3)*arctan(x)^2 + 3*x*arctan(x) + 1/2*((x^2 + 1)*arctan(x)^2 -
2*x*arctan(x) - 3)*log(x^2 + 1) + 1/4*log(x^2 + 1)^2
```

3.46.6 Sympy [A] (verification not implemented)

Time = 0.50 (sec) , antiderivative size = 87, normalized size of antiderivative = 1.13

$$\int x\arctan(x)^2\log\left(1+x^2\right)\,dx = \frac{x^2\log\left(x^2+1\right)\operatorname{atan}^2\left(x\right)}{2}-\frac{x^2\operatorname{atan}^2\left(x\right)}{2} - x\log\left(x^2+1\right)\operatorname{atan}\left(x\right)+3x\operatorname{atan}\left(x\right)+\frac{\log\left(x^2+1\right)^2}{4} + \frac{\log\left(x^2+1\right)\operatorname{atan}^2\left(x\right)}{2}-\frac{3\log\left(x^2+1\right)}{2}-\frac{3\operatorname{atan}^2\left(x\right)}{2}$$

input
```
integrate(x*atan(x)**2*ln(x**2+1),x)
```

output
```
x**2*log(x**2 + 1)*atan(x)**2/2 - x**2*atan(x)**2/2 - x*log(x**2 + 1)*atan
(x) + 3*x*atan(x) + log(x**2 + 1)**2/4 + log(x**2 + 1)*atan(x)**2/2 - 3*lo
g(x**2 + 1)/2 - 3*atan(x)**2/2
```

3.46.7 Maxima [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 67, normalized size of antiderivative = 0.87

$$\int x\arctan(x)^2\log\left(1+x^2\right)\,dx = -\frac{1}{2}\left(x^2-\left(x^2+1\right)\log\left(x^2+1\right)+1\right)\arctan\left(x\right)^2 - \left(x\log\left(x^2+1\right)-3\,x+2\,\arctan\left(x\right)\right)\arctan\left(x\right) + \arctan\left(x\right)^2+\frac{1}{4}\,\log\left(x^2+1\right)^2-\frac{3}{2}\,\log\left(x^2+1\right)$$

input
```
integrate(x*arctan(x)^2*log(x^2+1),x, algorithm="maxima")
```

output
```
-1/2*(x^2 - (x^2 + 1)*log(x^2 + 1) + 1)*arctan(x)^2 - (x*log(x^2 + 1) - 3*
x + 2*arctan(x))*arctan(x) + arctan(x)^2 + 1/4*log(x^2 + 1)^2 - 3/2*log(x^
2 + 1)
```

3.46.8 Giac [F]

$$\int x\arctan(x)^2\log\left(1+x^2\right)\,dx = \int x\arctan\left(x\right)^2\log\left(x^2+1\right)\,dx$$

input
```
integrate(x*arctan(x)^2*log(x^2+1),x, algorithm="giac")
```

output
```
integrate(x*arctan(x)^2*log(x^2 + 1), x)
```

3.46.9 Mupad [B] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 78, normalized size of antiderivative = 1.01

$$\int x\arctan(x)^2\log\left(1+x^2\right)\,dx = \frac{\ln\left(x^2+1\right)^2}{4}-\frac{3\,\ln\left(x^2+1\right)}{2} - \frac{3\,\mathrm{atan}(x)^2}{2}+\frac{\ln\left(x^2+1\right)\,\mathrm{atan}(x)^2}{2} + x\left(3\,\mathrm{atan}(x)-\ln\left(x^2+1\right)\,\mathrm{atan}(x)\right) - x^2\left(\frac{\mathrm{atan}(x)^2}{2}-\frac{\ln\left(x^2+1\right)\,\mathrm{atan}(x)^2}{2}\right)$$

input
```
int(x*log(x^2 + 1)*atan(x)^2,x)
```

output
```
log(x^2 + 1)^2/4 - (3*log(x^2 + 1))/2 - (3*atan(x)^2)/2 + (log(x^2 + 1)*at
an(x)^2)/2 + x*(3*atan(x) - log(x^2 + 1)*atan(x)) - x^2*(atan(x)^2/2 - (lo
g(x^2 + 1)*atan(x)^2)/2)
```

3.46. $\int x \arctan(x)^2 \log(1+x^2) \, dx$

3.47 $\int \arctan \left(x\sqrt{1+x^2}\right) \, dx$

3.47.1 Optimal result

Integrand size = 12, antiderivative size = 120

$$
\begin{aligned}
\int \arctan \left(x\sqrt{1+x^2}\right) \, dx = {} & x \arctan \left(x\sqrt{1+x^2}\right) + \frac{1}{2} \arctan \left(\sqrt{3} - 2\sqrt{1+x^2}\right) \\
& - \frac{1}{2} \arctan \left(\sqrt{3} + 2\sqrt{1+x^2}\right) - \frac{1}{4}\sqrt{3} \log \left(2+x^2-\sqrt{3}\sqrt{1+x^2}\right) \\
& + \frac{1}{4}\sqrt{3} \log \left(2+x^2+\sqrt{3}\sqrt{1+x^2}\right)
\end{aligned}
$$

output
```
-1/2*arctan(-3^(1/2)+2*(x^2+1)^(1/2))+x*arctan(x*(x^2+1)^(1/2))-1/2*arctan
(3^(1/2)+2*(x^2+1)^(1/2))-1/4*ln(2+x^2-3^(1/2)*(x^2+1)^(1/2))*3^(1/2)+1/4*
ln(2+x^2+3^(1/2)*(x^2+1)^(1/2))*3^(1/2)
```

3.47.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.16 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.79

$$
\begin{aligned}
\int \arctan \left(x\sqrt{1+x^2}\right) \, dx = {} & -\frac{1}{2}\left(1-i\sqrt{3}\right) \arctan \left(\frac{1}{2}\left(1-i\sqrt{3}\right)\sqrt{1+x^2}\right) \\
& - \frac{1}{2}\left(1+i\sqrt{3}\right) \arctan \left(\frac{1}{2}\left(1+i\sqrt{3}\right)\sqrt{1+x^2}\right) \\
& + x \arctan \left(x\sqrt{1+x^2}\right)
\end{aligned}
$$

input
```
Integrate[ArcTan[x*Sqrt[1 + x^2]],x]
```

output
```
-1/2*((1 - I*Sqrt[3])*ArcTan[((1 - I*Sqrt[3])*Sqrt[1 + x^2])/2]) - ((1 + I
*Sqrt[3])*ArcTan[((1 + I*Sqrt[3])*Sqrt[1 + x^2])/2])/2 + x*ArcTan[x*Sqrt[1
 + x^2]]
```

3.47.3 Rubi [A] (warning: unable to verify)

Time = 0.39 (sec) , antiderivative size = 130, normalized size of antiderivative = 1.08, number of steps used = 12, number of rules used = 11, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.917, Rules used = {5726, 2238, 1197, 25, 1483, 27, 1142, 25, 1083, 217, 1103}

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.

$$\int \arctan\left(x\sqrt{x^2+1}\right)dx$$

$$\Big\downarrow \text{5726}$$

$$x\arctan\left(x\sqrt{x^2+1}\right)-\int \frac{x(2x^2+1)}{\sqrt{x^2+1}(x^4+x^2+1)}dx$$

$$\Big\downarrow \text{2238}$$

$$x\arctan\left(x\sqrt{x^2+1}\right)-\frac{1}{2}\int \frac{2x^2+1}{\sqrt{x^2+1}(x^4+x^2+1)}dx^2$$

$$\Big\downarrow \text{1197}$$

$$x\arctan\left(x\sqrt{x^2+1}\right)-\int -\frac{1-2x^4}{x^8-x^4+1}d\sqrt{x^2+1}$$

$$\Big\downarrow \text{25}$$

$$\int \frac{1-2x^4}{x^8-x^4+1}d\sqrt{x^2+1}+x\arctan\left(x\sqrt{x^2+1}\right)$$

$$\Big\downarrow \text{1483}$$

$$\frac{\int \frac{\sqrt{3}-3\sqrt{x^2+1}}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}}{2\sqrt{3}}+\frac{\int \frac{\sqrt{3}\left(\sqrt{3}\sqrt{x^2+1}+1\right)}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}}{2\sqrt{3}}+x\arctan\left(x\sqrt{x^2+1}\right)$$

$$\Big\downarrow \text{27}$$

$$\frac{\int \frac{\sqrt{3}-3\sqrt{x^2+1}}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}}{2\sqrt{3}}+\frac{1}{2}\int \frac{\sqrt{3}\sqrt{x^2+1}+1}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}+x\arctan\left(x\sqrt{x^2+1}\right)$$

$\Big\downarrow$ 1142

$$\frac{-\frac{1}{2}\sqrt{3}\int \frac{1}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}-\frac{3}{2}\int -\frac{\sqrt{3}-2\sqrt{x^2+1}}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}}{2\sqrt{3}}+\frac{1}{2}\left(\frac{1}{2}\sqrt{3}\int \frac{2\sqrt{x^2+1}+\sqrt{3}}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}-\frac{1}{2}\int \frac{1}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}\right)+x\arctan\left(x\sqrt{x^2+1}\right)$$

$\Big\downarrow$ 25

$$\frac{\frac{3}{2}\int \frac{\sqrt{3}-2\sqrt{x^2+1}}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}-\frac{1}{2}\sqrt{3}\int \frac{1}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}}{2\sqrt{3}}+\frac{1}{2}\left(\frac{1}{2}\sqrt{3}\int \frac{2\sqrt{x^2+1}+\sqrt{3}}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}-\frac{1}{2}\int \frac{1}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}\right)+x\arctan\left(x\sqrt{x^2+1}\right)$$

$\Big\downarrow$ 1083

$$\frac{\sqrt{3}\int \frac{1}{-x^4-1}d\left(2\sqrt{x^2+1}-\sqrt{3}\right)+\frac{3}{2}\int \frac{\sqrt{3}-2\sqrt{x^2+1}}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}}{2\sqrt{3}}+\frac{1}{2}\left(\int \frac{1}{-x^4-1}d\left(2\sqrt{x^2+1}+\sqrt{3}\right)+\frac{1}{2}\sqrt{3}\int \frac{2\sqrt{x^2+1}+\sqrt{3}}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}\right)+x\arctan\left(x\sqrt{x^2+1}\right)$$

$\Big\downarrow$ 217

$$\frac{\frac{3}{2}\int \frac{\sqrt{3}-2\sqrt{x^2+1}}{x^4-\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}+\sqrt{3}\arctan\left(\sqrt{3}-2\sqrt{x^2+1}\right)}{2\sqrt{3}}+\frac{1}{2}\left(\frac{1}{2}\sqrt{3}\int \frac{2\sqrt{x^2+1}+\sqrt{3}}{x^4+\sqrt{3}\sqrt{x^2+1}+1}d\sqrt{x^2+1}-\arctan\left(2\sqrt{x^2+1}+\sqrt{3}\right)\right)+x\arctan\left(x\sqrt{x^2+1}\right)$$

$\Big\downarrow$ 1103

$$x\arctan\left(x\sqrt{x^2+1}\right)+\frac{\sqrt{3}\arctan\left(\sqrt{3}-2\sqrt{x^2+1}\right)-\frac{3}{2}\log\left(x^4-\sqrt{3}\sqrt{x^2+1}+1\right)}{2\sqrt{3}}+\frac{1}{2}\left(\frac{1}{2}\sqrt{3}\log\left(x^4+\sqrt{3}\sqrt{x^2+1}+1\right)-\arctan\left(2\sqrt{x^2+1}+\sqrt{3}\right)\right)$$

input
```
Int[ArcTan[x*Sqrt[1 + x^2]],x]
```

3.47. $\int \arctan\left(x\sqrt{1+x^2}\right)\,dx$

output
```
x*ArcTan[x*Sqrt[1 + x^2]] + (Sqrt[3]*ArcTan[Sqrt[3] - 2*Sqrt[1 + x^2]] - (
3*Log[1 + x^4 - Sqrt[3]*Sqrt[1 + x^2]])/2)/(2*Sqrt[3]) + (-ArcTan[Sqrt[3]
+ 2*Sqrt[1 + x^2]] + (Sqrt[3]*Log[1 + x^4 + Sqrt[3]*Sqrt[1 + x^2]])/2)/2
```

3.47.3.1 Defintions of rubi rules used

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

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 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 1103
```
Int[((d_) + (e_.)*(x_))/((a_.) + (b_.)*(x_) + (c_.)*(x_)^2), x_Symbol] :> S
imp[d*(Log[RemoveContent[a + b*x + c*x^2, x]]/b), x] /; FreeQ[{a, b, c, d,
e}, x] && EqQ[2*c*d - b*e, 0]
```

rule 1142
```
Int[((d_.) + (e_.)*(x_))/((a_) + (b_.)*(x_) + (c_.)*(x_)^2), x_Symbol] :> S
imp[(2*c*d - b*e)/(2*c)   Int[1/(a + b*x + c*x^2), x], x] + Simp[e/(2*c)
Int[(b + 2*c*x)/(a + b*x + c*x^2), x], x] /; FreeQ[{a, b, c, d, e}, x]
```

rule 1197
```
Int[((f_.) + (g_.)*(x_))/(Sqrt[(d_.) + (e_.)*(x_)]*((a_.) + (b_.)*(x_) + (c
_.)*(x_)^2)), x_Symbol] :> Simp[2   Subst[Int[(e*f - d*g + g*x^2)/(c*d^2 -
b*d*e + a*e^2 - (2*c*d - b*e)*x^2 + c*x^4), x], x, Sqrt[d + e*x]], x] /; Fr
eeQ[{a, b, c, d, e, f, g}, x]
```

rule 1483
```
Int[((d_) + (e_.)*(x_)^2)/((a_) + (b_.)*(x_)^2 + (c_.)*(x_)^4), x_Symbol] :
> With[{q = Rt[a/c, 2]}, With[{r = Rt[2*q - b/c, 2]}, Simp[1/(2*c*q*r)   In
t[(d*r - (d - e*q)*x)/(q - r*x + x^2), x], x] + Simp[1/(2*c*q*r)   Int[(d*r
 + (d - e*q)*x)/(q + r*x + x^2), x], x]]] /; FreeQ[{a, b, c, d, e}, x] && N
eQ[b^2 - 4*a*c, 0] && NeQ[c*d^2 - b*d*e + a*e^2, 0] && NegQ[b^2 - 4*a*c]
```

rule 2238
```
Int[(Px_)*(x_)*((d_) + (e_.)*(x_)^2)^(q_.)*((a_) + (b_.)*(x_)^2 + (c_.)*(x_
)^4)^(p_.), x_Symbol] :> Simp[1/2   Subst[Int[(Px /. x -> Sqrt[x])*(d + e*x
)^q*(a + b*x + c*x^2)^p, x], x, x^2], x] /; FreeQ[{a, b, c, d, e, p, q}, x]
 && PolyQ[Px, x^2]
```

rule 5726
```
Int[ArcTan[u_], x_Symbol] :> Simp[x*ArcTan[u], x] - Int[SimplifyIntegrand[x
*(D[u, x]/(1 + u^2)), x], x] /; InverseFunctionFreeQ[u, x]
```

3.47.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 507 vs. $2(92) = 184$.

Time = 0.17 (sec) , antiderivative size = 508, normalized size of antiderivative = 4.23

method	result
default	$x\arctan\left(x\sqrt{x^2+1}\right)+\frac{\sqrt{2}\,\sqrt{\frac{2(-1+x)^2}{(-1-x)^2}+2\sqrt{3}}\,\operatorname{arctanh}\left(\frac{\sqrt{\frac{2(-1+x)^2}{(-1-x)^2}}+2\sqrt{3}}{2}\right)}{3\sqrt{\frac{\frac{(-1+x)^2}{(-1-x)^2}+1}{\left(\frac{-1+x}{-1-x}+1\right)^2}}\left(\frac{-1+x}{-1-x}+1\right)}+\frac{\sqrt{2}\,\sqrt{\frac{2(1+x)^2}{(1-x)^2}+2\sqrt{3}}\,\operatorname{arctanh}\left(\frac{\sqrt{\frac{2(1+x)^2}{(1-x)^2}}}{2}\right.}{3\sqrt{\frac{\frac{(1+x)^2}{(1-x)^2}+1}{\left(\frac{1+x}{1-x}+1\right)^2}}\left(\frac{1+x}{1-x}+1\right)}$
parts	$x\arctan\left(x\sqrt{x^2+1}\right)+\frac{\sqrt{2}\,\sqrt{\frac{2(-1+x)^2}{(-1-x)^2}+2\sqrt{3}}\,\operatorname{arctanh}\left(\frac{\sqrt{\frac{2(-1+x)^2}{(-1-x)^2}}+2\sqrt{3}}{2}\right)}{3\sqrt{\frac{\frac{(-1+x)^2}{(-1-x)^2}+1}{\left(\frac{-1+x}{-1-x}+1\right)^2}}\left(\frac{-1+x}{-1-x}+1\right)}+\frac{\sqrt{2}\,\sqrt{\frac{2(1+x)^2}{(1-x)^2}+2\sqrt{3}}\,\operatorname{arctanh}\left(\frac{\sqrt{\frac{2(1+x)^2}{(1-x)^2}}}{2}\right.}{3\sqrt{\frac{\frac{(1+x)^2}{(1-x)^2}+1}{\left(\frac{1+x}{1-x}+1\right)^2}}\left(\frac{1+x}{1-x}+1\right)}$

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

output
```
x*arctan(x*(x^2+1)^(1/2))+1/3*2^(1/2)/(((-1+x)^2/(-1-x)^2+1)/((-1+x)/(-1-x
)+1)^2)^(1/2)/((-1+x)/(-1-x)+1)*(2*(-1+x)^2/(-1-x)^2+2)^(1/2)*3^(1/2)*arct
anh(1/2*(2*(-1+x)^2/(-1-x)^2+2)^(1/2)*3^(1/2))+1/3*2^(1/2)/(((1+x)^2/(1-x)
^2+1)/((1+x)/(1-x)+1)^2)^(1/2)/((1+x)/(1-x)+1)*(2*(1+x)^2/(1-x)^2+2)^(1/2)
*3^(1/2)*arctanh(1/2*(2*(1+x)^2/(1-x)^2+2)^(1/2)*3^(1/2))-1/12*2^(1/2)*(2*
(-1+x)^2/(-1-x)^2+2)^(1/2)*(3^(1/2)*arctanh(1/2*(2*(-1+x)^2/(-1-x)^2+2)^(1
/2)*3^(1/2))-3*arctan(1/((-1+x)^2/(-1-x)^2+1)*(2*(-1+x)^2/(-1-x)^2+2)^(1/2
)*(-1+x)/(-1-x)))/(((-1+x)^2/(-1-x)^2+1)/((-1+x)/(-1-x)+1)^2)^(1/2)/((-1+x
)/(-1-x)+1)-1/12*2^(1/2)*(2*(1+x)^2/(1-x)^2+2)^(1/2)*(3^(1/2)*arctanh(1/2*
(2*(1+x)^2/(1-x)^2+2)^(1/2)*3^(1/2))-3*arctan(1/((1+x)^2/(1-x)^2+1)*(2*(1+
x)^2/(1-x)^2+2)^(1/2)*(1+x)/(1-x)))/(((1+x)^2/(1-x)^2+1)/((1+x)/(1-x)+1)^2
)^(1/2)/((1+x)/(1-x)+1)
```

3.47.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 298 vs. $2(92) = 184$.

Time = 0.26 (sec) , antiderivative size = 298, normalized size of antiderivative = 2.48

$$
\begin{aligned}
\int \arctan\left(x\sqrt{1+x^2}\right)\,dx = {} & x\arctan\left(\sqrt{x^2+1}x\right) \\
& - \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{-3}+1}\log\Big(4\,x^2+\sqrt{2}(\sqrt{-3}x+x)\sqrt{-\sqrt{-3}+1} \\
& - \sqrt{x^2+1}\left(\sqrt{2}(\sqrt{-3}+1)\sqrt{-\sqrt{-3}+1}+4\,x\right)+4\Big) \\
& + \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{-3}+1}\log\Big(4\,x^2-\sqrt{2}(\sqrt{-3}x+x)\sqrt{-\sqrt{-3}+1} \\
& + \sqrt{x^2+1}\left(\sqrt{2}(\sqrt{-3}+1)\sqrt{-\sqrt{-3}+1}-4\,x\right)+4\Big) \\
& - \frac{1}{4}\sqrt{2}\sqrt{\sqrt{-3}+1}\log\Big(4\,x^2-4\sqrt{x^2+1}x \\
& + \left(\sqrt{2}\sqrt{x^2+1}(\sqrt{-3}-1)-\sqrt{2}(\sqrt{-3}x-x)\right)\sqrt{\sqrt{-3}+1}+4\Big) \\
& + \frac{1}{4}\sqrt{2}\sqrt{\sqrt{-3}+1}\log\Big(4\,x^2-4\sqrt{x^2+1}x \\
& - \left(\sqrt{2}\sqrt{x^2+1}(\sqrt{-3}-1)-\sqrt{2}(\sqrt{-3}x-x)\right)\sqrt{\sqrt{-3}+1}+4\Big)
\end{aligned}
$$

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

output
```
x*arctan(sqrt(x^2 + 1)*x) - 1/4*sqrt(2)*sqrt(-sqrt(-3) + 1)*log(4*x^2 + sq
rt(2)*(sqrt(-3)*x + x)*sqrt(-sqrt(-3) + 1) - sqrt(x^2 + 1)*(sqrt(2)*(sqrt(
-3) + 1)*sqrt(-sqrt(-3) + 1) + 4*x) + 4) + 1/4*sqrt(2)*sqrt(-sqrt(-3) + 1)
*log(4*x^2 - sqrt(2)*(sqrt(-3)*x + x)*sqrt(-sqrt(-3) + 1) + sqrt(x^2 + 1)*
(sqrt(2)*(sqrt(-3) + 1)*sqrt(-sqrt(-3) + 1) - 4*x) + 4) - 1/4*sqrt(2)*sqrt
(sqrt(-3) + 1)*log(4*x^2 - 4*sqrt(x^2 + 1)*x + (sqrt(2)*sqrt(x^2 + 1)*(sqr
t(-3) - 1) - sqrt(2)*(sqrt(-3)*x - x))*sqrt(sqrt(-3) + 1) + 4) + 1/4*sqrt(
2)*sqrt(sqrt(-3) + 1)*log(4*x^2 - 4*sqrt(x^2 + 1)*x - (sqrt(2)*sqrt(x^2 +
1)*(sqrt(-3) - 1) - sqrt(2)*(sqrt(-3)*x - x))*sqrt(sqrt(-3) + 1) + 4)
```

3.47.6 Sympy [F]

$$\int \arctan\left(x\sqrt{1+x^2}\right) dx = \int \operatorname{atan}\left(x\sqrt{x^2+1}\right) dx$$

input
```
integrate(atan(x*(x**2+1)**(1/2)),x)
```

output
```
Integral(atan(x*sqrt(x**2 + 1)), x)
```

3.47.7 Maxima [F]

$$\int \arctan\left(x\sqrt{1+x^2}\right) dx = \int \arctan\left(\sqrt{x^2+1}x\right) dx$$

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

output
```
x*arctan(sqrt(x^2 + 1)*x) - integrate((2*x^3 + x)*sqrt(x^2 + 1)/((x^4 + x^
2)*(x^2 + 1) + x^2 + 1), x)
```

3.47.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 92, normalized size of antiderivative = 0.77

$$\int \arctan\left(x\sqrt{1+x^2}\right)\,dx = x\arctan\left(\sqrt{x^2+1}x\right) + \frac{1}{4}\sqrt{3}\log\left(x^2+\sqrt{3}\sqrt{x^2+1}+2\right) - \frac{1}{4}\sqrt{3}\log\left(x^2-\sqrt{3}\sqrt{x^2+1}+2\right) - \frac{1}{2}\arctan\left(\sqrt{3}+2\sqrt{x^2+1}\right) - \frac{1}{2}\arctan\left(-\sqrt{3}+2\sqrt{x^2+1}\right)$$

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

output
```
x*arctan(sqrt(x^2 + 1)*x) + 1/4*sqrt(3)*log(x^2 + sqrt(3)*sqrt(x^2 + 1) +
2) - 1/4*sqrt(3)*log(x^2 - sqrt(3)*sqrt(x^2 + 1) + 2) - 1/2*arctan(sqrt(3)
 + 2*sqrt(x^2 + 1)) - 1/2*arctan(-sqrt(3) + 2*sqrt(x^2 + 1))
```

3.47.9 Mupad [B] (verification not implemented)

Time = 1.10 (sec) , antiderivative size = 413, normalized size of antiderivative = 3.44

$$\int \arctan\left(x\sqrt{1+x^2}\right)\,dx = x\,\mathrm{atan}\left(x\sqrt{x^2+1}\right) - \frac{\left(\ln\left(x-\frac{1}{2}-\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)-\ln\left(\frac{x}{2}+\left(\frac{\sqrt{3}}{2}+\frac{1}{2}\mathrm{i}\right)\sqrt{x^2+1}+1+\frac{\sqrt{3}\,x\,1\mathrm{i}}{2}\right)\right)\left(2\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3+\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)}{\sqrt{\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^2+1}\left(4\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3+1+\sqrt{3}\,1\mathrm{i}\right)} - \frac{\left(\ln\left(x+\frac{1}{2}-\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)-\ln\left(1+\left(\frac{\sqrt{3}}{2}-\frac{1}{2}\mathrm{i}\right)\sqrt{x^2+1}-\frac{x}{2}+\frac{\sqrt{3}\,x\,1\mathrm{i}}{2}\right)\right)\left(2\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)}{\sqrt{\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^2+1}\left(4\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3-1+\sqrt{3}\,1\mathrm{i}\right)} - \frac{\left(\ln\left(x-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)-\ln\left(\frac{x}{2}+\left(\frac{\sqrt{3}}{2}-\frac{1}{2}\mathrm{i}\right)\sqrt{x^2+1}+1-\frac{\sqrt{3}\,x\,1\mathrm{i}}{2}\right)\right)\left(2\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)}{\sqrt{\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^2+1}\left(4\left(-\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3-1+\sqrt{3}\,1\mathrm{i}\right)} - \frac{\left(\ln\left(x+\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)-\ln\left(1+\left(\frac{\sqrt{3}}{2}+\frac{1}{2}\mathrm{i}\right)\sqrt{x^2+1}-\frac{x}{2}-\frac{\sqrt{3}\,x\,1\mathrm{i}}{2}\right)\right)\left(2\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3+\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)}{\sqrt{\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^2+1}\left(4\left(\frac{1}{2}+\frac{\sqrt{3}\,1\mathrm{i}}{2}\right)^3+1+\sqrt{3}\,1\mathrm{i}\right)}$$

input
```
int(atan(x*(x^2 + 1)^(1/2)),x)
```

output
```
x*atan(x*(x^2 + 1)^(1/2)) - ((log(x - (3^(1/2)*1i)/2 - 1/2) - log(x/2 + (3
^(1/2)/2 + 1i/2)*(x^2 + 1)^(1/2) + (3^(1/2)*x*1i)/2 + 1))*((3^(1/2)*1i)/2
+ 2*((3^(1/2)*1i)/2 + 1/2)^3 + 1/2))/((((3^(1/2)*1i)/2 + 1/2)^2 + 1)^(1/2)
*(3^(1/2)*1i + 4*((3^(1/2)*1i)/2 + 1/2)^3 + 1)) - ((log(x - (3^(1/2)*1i)/2
 + 1/2) - log((3^(1/2)/2 - 1i/2)*(x^2 + 1)^(1/2) - x/2 + (3^(1/2)*x*1i)/2
+ 1))*((3^(1/2)*1i)/2 + 2*((3^(1/2)*1i)/2 - 1/2)^3 - 1/2))/((((3^(1/2)*1i)
/2 - 1/2)^2 + 1)^(1/2)*(3^(1/2)*1i + 4*((3^(1/2)*1i)/2 - 1/2)^3 - 1)) - ((
log(x + (3^(1/2)*1i)/2 - 1/2) - log(x/2 + (3^(1/2)/2 - 1i/2)*(x^2 + 1)^(1/
2) - (3^(1/2)*x*1i)/2 + 1))*((3^(1/2)*1i)/2 + 2*((3^(1/2)*1i)/2 - 1/2)^3 -
 1/2))/((((3^(1/2)*1i)/2 - 1/2)^2 + 1)^(1/2)*(3^(1/2)*1i + 4*((3^(1/2)*1i)
/2 - 1/2)^3 - 1)) - ((log(x + (3^(1/2)*1i)/2 + 1/2) - log((3^(1/2)/2 + 1i/
2)*(x^2 + 1)^(1/2) - x/2 - (3^(1/2)*x*1i)/2 + 1))*((3^(1/2)*1i)/2 + 2*((3^
(1/2)*1i)/2 + 1/2)^3 + 1/2))/((((3^(1/2)*1i)/2 + 1/2)^2 + 1)^(1/2)*(3^(1/2
)*1i + 4*((3^(1/2)*1i)/2 + 1/2)^3 + 1))
```

3.47. $\int \arctan \left(x\sqrt{1+x^2}\right)\, dx$

3.48 $\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx$

3.48.1 Optimal result

Integrand size = 18, antiderivative size = 31

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=\frac{\sqrt{x}}{2}-(1+x)\arctan\left(\sqrt{x}-\sqrt{1+x}\right)$$

output
```
-(1+x)*arctan(x^(1/2)-(1+x)^(1/2))+1/2*x^(1/2)
```

3.48.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.00

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=\frac{\sqrt{x}}{2}-(1+x)\arctan\left(\sqrt{x}-\sqrt{1+x}\right)$$

input
```
Integrate[-ArcTan[Sqrt[x] - Sqrt[1 + x]],x]
```

output
```
Sqrt[x]/2 - (1 + x)*ArcTan[Sqrt[x] - Sqrt[1 + x]]
```

3.48.3 Rubi [A] (warning: unable to verify)

Time = 0.19 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.32, number of steps used = 8, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.389, Rules used = {25, 5682, 24, 5345, 60, 73, 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.

$$\int -\arctan\left(\sqrt{x}-\sqrt{x+1}\right)dx$$

$$\Big\downarrow \text{ 25}$$

$$-\int \arctan\left(\sqrt{x}-\sqrt{x+1}\right)dx$$

$$\Big\downarrow \text{ 5682}$$

$$\frac{\pi \int 1dx}{4}-\frac{1}{2}\int \arctan\left(\sqrt{x}\right)dx$$

$$\Big\downarrow \text{ 24}$$

$$\frac{\pi x}{4}-\frac{1}{2}\int \arctan\left(\sqrt{x}\right)dx$$

$$\Big\downarrow \text{ 5345}$$

$$\frac{1}{2}\left(\frac{1}{2}\int \frac{\sqrt{x}}{x+1}dx-x\arctan\left(\sqrt{x}\right)\right)+\frac{\pi x}{4}$$

$$\Big\downarrow \text{ 60}$$

$$\frac{1}{2}\left(\frac{1}{2}\left(2\sqrt{x}-\int \frac{1}{\sqrt{x}(x+1)}dx\right)-x\arctan\left(\sqrt{x}\right)\right)+\frac{\pi x}{4}$$

$$\Big\downarrow \text{ 73}$$

$$\frac{1}{2}\left(\frac{1}{2}\left(2\sqrt{x}-2\int \frac{1}{x+1}d\sqrt{x}\right)-x\arctan\left(\sqrt{x}\right)\right)+\frac{\pi x}{4}$$

$$\Big\downarrow \text{ 216}$$

$$\frac{1}{2}\left(\frac{1}{2}\left(2\sqrt{x}-2\arctan\left(\sqrt{x}\right)\right)-x\arctan\left(\sqrt{x}\right)\right)+\frac{\pi x}{4}$$

input
```
Int[-ArcTan[Sqrt[x] - Sqrt[1 + x]],x]
```

output
```
(Pi*x)/4 + ((2*Sqrt[x] - 2*ArcTan[Sqrt[x]])/2 - x*ArcTan[Sqrt[x]])/2
```

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 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 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 5345
```
Int[((a_.) + ArcTan[(c_.)*(x_)^(n_.)]*(b_.))^(p_.), x_Symbol] :> Simp[x*(a
+ b*ArcTan[c*x^n])^p, x] - Simp[b*c*n*p   Int[x^n*((a + b*ArcTan[c*x^n])^(p
 - 1)/(1 + c^2*x^(2*n))), x], x] /; FreeQ[{a, b, c, n}, x] && IGtQ[p, 0] &&
 (EqQ[n, 1] || EqQ[p, 1])
```

rule 5682
```
Int[ArcTan[(v_) + (s_.)*Sqrt[w_]]*(u_.), x_Symbol] :> Simp[Pi*(s/4)   Int[u
, x], x] + Simp[1/2   Int[u*ArcTan[v], x], x] /; EqQ[s^2, 1] && EqQ[w, v^2
+ 1]
```

3.48.4 Maple [A] (verified)

Time = 0.04 (sec) , antiderivative size = 28, normalized size of antiderivative = 0.90

method	result	size
default	$-x\arctan\left(\sqrt{x}-\sqrt{1+x}\right)+\frac{\sqrt{x}}{2}-\frac{\arctan\left(\sqrt{x}\right)}{2}$	28
parts	$-x\arctan\left(\sqrt{x}-\sqrt{1+x}\right)+\frac{\sqrt{x}}{2}-\frac{\arctan\left(\sqrt{x}\right)}{2}$	28

input
```
int(-arctan(x^(1/2)-(1+x)^(1/2)),x,method=_RETURNVERBOSE)
```

output
```
-x*arctan(x^(1/2)-(1+x)^(1/2))+1/2*x^(1/2)-1/2*arctan(x^(1/2))
```

3.48.5 Fricas [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 22, normalized size of antiderivative = 0.71

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=(x+1)\arctan\left(\sqrt{x+1}-\sqrt{x}\right)+\frac{1}{2}\sqrt{x}$$

input
```
integrate(-arctan(x^(1/2)-(1+x)^(1/2)),x, algorithm="fricas")
```

output
```
(x + 1)*arctan(sqrt(x + 1) - sqrt(x)) + 1/2*sqrt(x)
```

3.48.6 Sympy [A] (verification not implemented)

Time = 9.14 (sec) , antiderivative size = 29, normalized size of antiderivative = 0.94

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx=\frac{\sqrt{x}}{2}-x\,\mathrm{atan}\left(\sqrt{x}-\sqrt{x+1}\right)-\frac{\mathrm{atan}\left(\sqrt{x}\right)}{2}$$

input
```
integrate(-atan(x**(1/2)-(1+x)**(1/2)),x)
```

output
```
sqrt(x)/2 - x*atan(sqrt(x) - sqrt(x + 1)) - atan(sqrt(x))/2
```

3.48.7 Maxima [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 26, normalized size of antiderivative = 0.84

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = x\arctan\left(\sqrt{x+1}-\sqrt{x}\right)+\frac{1}{2}\sqrt{x}-\frac{1}{2}\arctan\left(\sqrt{x}\right)$$

input
```
integrate(-arctan(x^(1/2)-(1+x)^(1/2)),x, algorithm="maxima")
```

output
```
x*arctan(sqrt(x + 1) - sqrt(x)) + 1/2*sqrt(x) - 1/2*arctan(sqrt(x))
```

3.48.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.87

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = -x\arctan\left(-\sqrt{x+1}+\sqrt{x}\right)+\frac{1}{2}\sqrt{x}-\frac{1}{2}\arctan\left(\sqrt{x}\right)$$

input
```
integrate(-arctan(x^(1/2)-(1+x)^(1/2)),x, algorithm="giac")
```

output
```
-x*arctan(-sqrt(x + 1) + sqrt(x)) + 1/2*sqrt(x) - 1/2*arctan(sqrt(x))
```

3.48.9 Mupad [B] (verification not implemented)

Time = 0.80 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.29

$$\int -\arctan\left(\sqrt{x}-\sqrt{1+x}\right)\,dx = x\,\mathrm{atan}\left(\sqrt{x+1}-\sqrt{x}\right)+\frac{\sqrt{x}}{2}-\frac{\ln\left(\frac{\left(-1+\sqrt{x}\,1i\right)^2}{x+1}\right)\,1i}{4}$$

input
```
int(atan((x + 1)^(1/2) - x^(1/2)),x)
```

output
```
x*atan((x + 1)^(1/2) - x^(1/2)) - (log((x^(1/2)*1i - 1)^2/(x + 1))*1i)/4 +
 x^(1/2)/2
```

3.49 $\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx$

3.49.1 Optimal result

Integrand size = 14, antiderivative size = 29

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx = x \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) + \arctan\left(\sqrt{1-2x^2}\right)$$

output
```
x*arcsin(x/(-x^2+1)^(1/2))+arctan((-2*x^2+1)^(1/2))
```

3.49.2 Mathematica [A] (verified)

Time = 0.02 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.00

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx = x \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) + \arctan\left(\sqrt{1-2x^2}\right)$$

input
```
Integrate[ArcSin[x/Sqrt[1 - x^2]],x]
```

output
```
x*ArcSin[x/Sqrt[1 - x^2]] + ArcTan[Sqrt[1 - 2*x^2]]
```

3.49.3 Rubi [A] (verified)

Time = 0.18 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.286, Rules used = {5339, 353, 73, 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.

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right)dx$$

$$\Big\downarrow \text{ 5339}$$

$$x\arcsin\left(\frac{x}{\sqrt{1-x^2}}\right)-\int \frac{x}{\sqrt{1-2x^2}\,(1-x^2)}dx$$

$$\Big\downarrow \text{ 353}$$

$$x\arcsin\left(\frac{x}{\sqrt{1-x^2}}\right)-\frac{1}{2}\int \frac{1}{\sqrt{1-2x^2}\,(1-x^2)}dx^2$$

$$\Big\downarrow \text{ 73}$$

$$\frac{1}{2}\int \frac{1}{\frac{x^4}{2}+\frac{1}{2}}d\sqrt{1-2x^2}+x\arcsin\left(\frac{x}{\sqrt{1-x^2}}\right)$$

$$\Big\downarrow \text{ 216}$$

$$x\arcsin\left(\frac{x}{\sqrt{1-x^2}}\right)+\arctan\left(\sqrt{1-2x^2}\right)$$

input
```
Int[ArcSin[x/Sqrt[1 - x^2]],x]
```

output
```
x*ArcSin[x/Sqrt[1 - x^2]] + ArcTan[Sqrt[1 - 2*x^2]]
```

3.49.3.1 Defintions of rubi rules used

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 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 353
```
Int[(x_)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.), x_Symbol]
 :> Simp[1/2   Subst[Int[(a + b*x)^p*(c + d*x)^q, x], x, x^2], x] /; FreeQ[
{a, b, c, d, p, q}, x] && NeQ[b*c - a*d, 0]
```

rule 5339
```
Int[ArcSin[u_], x_Symbol] :> Simp[x*ArcSin[u], x] - Int[SimplifyIntegrand[x
*(D[u, x]/Sqrt[1 - u^2]), x], x] /; InverseFunctionFreeQ[u, x] &&  !Functio
nOfExponentialQ[u, x]
```

3.49.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 137 vs. $2(25) = 50$.

Time = 0.19 (sec) , antiderivative size = 138, normalized size of antiderivative = 4.76

method	result
default	$x\arcsin\left(\frac{x}{\sqrt{-x^2+1}}\right)+\frac{\sqrt{\frac{2x^2-1}{x^2-1}}\left(\sqrt{-2x^2+1}+\arctan\left(\frac{2x-1}{\sqrt{-2x^2+1}}\right)-\arctan\left(\frac{1+2x}{\sqrt{-2x^2+1}}\right)\right)\sqrt{-x^2+1}}{\sqrt{-2x^2+1}\left(2+\sqrt{2}\right)\left(-2+\sqrt{2}\right)}+\frac{\sqrt{\frac{2x^2-1}{x^2-1}}\sqrt{-x^2+1}}{2}$
parts	$x\arcsin\left(\frac{x}{\sqrt{-x^2+1}}\right)+\frac{\sqrt{\frac{2x^2-1}{x^2-1}}\left(\sqrt{-2x^2+1}+\arctan\left(\frac{2x-1}{\sqrt{-2x^2+1}}\right)-\arctan\left(\frac{1+2x}{\sqrt{-2x^2+1}}\right)\right)\sqrt{-x^2+1}}{\sqrt{-2x^2+1}\left(2+\sqrt{2}\right)\left(-2+\sqrt{2}\right)}+\frac{\sqrt{\frac{2x^2-1}{x^2-1}}\sqrt{-x^2+1}}{2}$

input
```
int(arcsin(1/(-x^2+1)^(1/2)*x),x,method=_RETURNVERBOSE)
```

output
```
x*arcsin(1/(-x^2+1)^(1/2)*x)+((2*x^2-1)/(x^2-1))^(1/2)*((-2*x^2+1)^(1/2)+a
rctan((2*x-1)/(-2*x^2+1)^(1/2))-arctan((1+2*x)/(-2*x^2+1)^(1/2)))*(-x^2+1)
^(1/2)/(-2*x^2+1)^(1/2)/(2+2^(1/2))/(-2+2^(1/2))+1/2*((2*x^2-1)/(x^2-1))^(
1/2)*(-x^2+1)^(1/2)
```

3.49.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 60 vs. $2(25) = 50$.

Time = 0.26 (sec) , antiderivative size = 60, normalized size of antiderivative = 2.07

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx$$
$$= -x\arcsin\left(\frac{\sqrt{-x^2+1}x}{x^2-1}\right) + \arctan\left(\frac{x^2+\sqrt{-x^2+1}\sqrt{\frac{2x^2-1}{x^2-1}}-1}{x^2}\right)$$

input
```
integrate(arcsin(x/(-x^2+1)^(1/2)),x, algorithm="fricas")
```

output
```
-x*arcsin(sqrt(-x^2 + 1)*x/(x^2 - 1)) + arctan((x^2 + sqrt(-x^2 + 1)*sqrt(
(2*x^2 - 1)/(x^2 - 1)) - 1)/x^2)
```

3.49.6 Sympy [F]

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx = \int \operatorname{asin}\left(\frac{x}{\sqrt{1-x^2}}\right) dx$$

input
```
integrate(asin(x/(-x**2+1)**(1/2)),x)
```

output
```
Integral(asin(x/sqrt(1 - x**2)), x)
```

3.49.7 Maxima [F]

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx = \int \arcsin\left(\frac{x}{\sqrt{-x^2+1}}\right) dx$$

input
```
integrate(arcsin(x/(-x^2+1)^(1/2)),x, algorithm="maxima")
```

output
```
integrate(arcsin(x/sqrt(-x^2 + 1)), x)
```

3.49.8 Giac [A] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 34, normalized size of antiderivative = 1.17

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx = x \arcsin\left(\frac{x}{\sqrt{-x^2+1}}\right) + \frac{\arctan\left(\sqrt{-2x^2+1}\right)}{\operatorname{sgn}(x^2-1)}$$

input
```
integrate(arcsin(x/(-x^2+1)^(1/2)),x, algorithm="giac")
```

output
```
x*arcsin(x/sqrt(-x^2 + 1)) + arctan(sqrt(-2*x^2 + 1))/sgn(x^2 - 1)
```

3.49.9 Mupad [F(-1)]

Timed out.

$$\int \arcsin\left(\frac{x}{\sqrt{1-x^2}}\right) dx = \int \operatorname{asin}\left(\frac{x}{\sqrt{1-x^2}}\right) dx$$

input
```
int(asin(x/(1 - x^2)^(1/2)),x)
```

output
```
int(asin(x/(1 - x^2)^(1/2)), x)
```

3.50 $\int \arctan\left(x\sqrt{1-x^2}\right)\,dx$

3.50.1 Optimal result

Integrand size = 14, antiderivative size = 106

$$\int \arctan\left(x\sqrt{1-x^2}\right)\,dx = -\sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\arctan\left(\sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\sqrt{1-x^2}\right) + x\arctan\left(x\sqrt{1-x^2}\right) + \sqrt{\frac{1}{2}\left(-1+\sqrt{5}\right)}\operatorname{arctanh}\left(\sqrt{\frac{1}{2}\left(-1+\sqrt{5}\right)}\sqrt{1-x^2}\right)$$

output
```
x*arctan(x*(-x^2+1)^(1/2))+1/2*arctanh(1/2*(-x^2+1)^(1/2)*(-2+2*5^(1/2))^(
1/2))*(-2+2*5^(1/2))^(1/2)-1/2*arctan(1/2*(-x^2+1)^(1/2)*(2+2*5^(1/2))^(1/
2))*(2+2*5^(1/2))^(1/2)
```

3.50.2 Mathematica [A] (verified)

Time = 0.18 (sec) , antiderivative size = 106, normalized size of antiderivative = 1.00

$$\int \arctan\left(x\sqrt{1-x^2}\right)\,dx = x\arctan\left(x\sqrt{1-x^2}\right) - \frac{\sqrt{1+\sqrt{5}}\arctan\left(\sqrt{\frac{1}{2}\left(1+\sqrt{5}\right)}\sqrt{1-x^2}\right) - \sqrt{-1+\sqrt{5}}\operatorname{arctanh}\left(\sqrt{\frac{1}{2}\left(-1+\sqrt{5}\right)}\sqrt{1-x^2}\right)}{\sqrt{2}}$$

input
```
Integrate[ArcTan[x*Sqrt[1 - x^2]],x]
```

output
```
x*ArcTan[x*Sqrt[1 - x^2]] - (Sqrt[1 + Sqrt[5]]*ArcTan[Sqrt[(1 + Sqrt[5])/2
]*Sqrt[1 - x^2]] - Sqrt[-1 + Sqrt[5]]*ArcTanh[Sqrt[(-1 + Sqrt[5])/2]*Sqrt[
1 - x^2]])/Sqrt[2]
```

3.50.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 106, normalized size of antiderivative = 1.00, number of steps used = 7, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.429$, Rules used = {5726, 2238, 1197, 1480, 217, 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.

$$\int \arctan \left(x\sqrt{1-x^2}\right) \, dx$$

$$\Big\downarrow \text{ 5726}$$

$$x \arctan \left(x\sqrt{1-x^2}\right)-\int \frac{x \left(1-2 x^2\right)}{\sqrt{1-x^2} \left(-x^4+x^2+1\right)}dx$$

$$\Big\downarrow \text{ 2238}$$

$$x \arctan \left(x\sqrt{1-x^2}\right)-\frac{1}{2} \int \frac{1-2 x^2}{\sqrt{1-x^2} \left(-x^4+x^2+1\right)}dx^2$$

$$\Big\downarrow \text{ 1197}$$

$$x \arctan \left(x\sqrt{1-x^2}\right)-\int \frac{1-2 x^4}{-x^8+x^4+1}d\sqrt{1-x^2}$$

$$\Big\downarrow \text{ 1480}$$

$$\int \frac{1}{\frac{1}{2} \left(1-\sqrt{5}\right)-x^4}d\sqrt{1-x^2}+\int \frac{1}{\frac{1}{2} \left(1+\sqrt{5}\right)-x^4}d\sqrt{1-x^2}+x \arctan \left(x\sqrt{1-x^2}\right)$$

$$\Big\downarrow \text{ 217}$$

$$\int \frac{1}{\frac{1}{2} \left(1+\sqrt{5}\right)-x^4}d\sqrt{1-x^2}-\sqrt{\frac{2}{\sqrt{5}-1}} \arctan \left(\sqrt{\frac{2}{\sqrt{5}-1}}\sqrt{1-x^2}\right)+x \arctan \left(x\sqrt{1-x^2}\right)$$

$$\Big\downarrow \text{ 219}$$

$$-\sqrt{\frac{2}{\sqrt{5}-1}}\arctan\left(\sqrt{\frac{2}{\sqrt{5}-1}}\sqrt{1-x^2}\right)+x\arctan\left(x\sqrt{1-x^2}\right)+\sqrt{\frac{2}{1+\sqrt{5}}}\text{arctanh}\left(\sqrt{\frac{2}{1+\sqrt{5}}}\sqrt{1-x^2}\right)$$

input
```
Int[ArcTan[x*Sqrt[1 - x^2]],x]
```

output
```
-(Sqrt[2/(-1 + Sqrt[5])]*ArcTan[Sqrt[2/(-1 + Sqrt[5])]*Sqrt[1 - x^2]]) + x
*ArcTan[x*Sqrt[1 - x^2]] + Sqrt[2/(1 + Sqrt[5])]*ArcTanh[Sqrt[2/(1 + Sqrt[
5])]*Sqrt[1 - x^2]]
```

3.50.3.1 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 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 1197
```
Int[((f_.) + (g_.)*(x_))/(Sqrt[(d_.) + (e_.)*(x_)]*((a_.) + (b_.)*(x_) + (c
_.)*(x_)^2)), x_Symbol] :> Simp[2   Subst[Int[(e*f - d*g + g*x^2)/(c*d^2 -
b*d*e + a*e^2 - (2*c*d - b*e)*x^2 + c*x^4), x], x, Sqrt[d + e*x]], x] /; Fr
eeQ[{a, b, c, d, e, f, g}, x]
```

rule 1480
```
Int[((d_) + (e_.)*(x_)^2)/((a_) + (b_.)*(x_)^2 + (c_.)*(x_)^4), x_Symbol] :
> With[{q = Rt[b^2 - 4*a*c, 2]}, Simp[(e/2 + (2*c*d - b*e)/(2*q))   Int[1/(
b/2 - q/2 + c*x^2), x], x] + Simp[(e/2 - (2*c*d - b*e)/(2*q))   Int[1/(b/2
+ q/2 + c*x^2), x], x]] /; FreeQ[{a, b, c, d, e}, x] && NeQ[b^2 - 4*a*c, 0]
 && NeQ[c*d^2 - a*e^2, 0] && PosQ[b^2 - 4*a*c]
```

rule 2238
```
Int[(Px_)*(x_)*((d_) + (e_.)*(x_)^2)^(q_.)*((a_) + (b_.)*(x_)^2 + (c_.)*(x_
)^4)^(p_.), x_Symbol] :> Simp[1/2   Subst[Int[(Px /. x -> Sqrt[x])*(d + e*x
)^q*(a + b*x + c*x^2)^p, x], x, x^2], x] /; FreeQ[{a, b, c, d, e, p, q}, x]
 && PolyQ[Px, x^2]
```

rule 5726
```
Int[ArcTan[u_], x_Symbol] :> Simp[x*ArcTan[u], x] - Int[SimplifyIntegrand[x
*(D[u, x]/(1 + u^2)), x], x] /; InverseFunctionFreeQ[u, x]
```

3.50.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 209 vs. $2(79) = 158$.

Time = 0.10 (sec) , antiderivative size = 210, normalized size of antiderivative = 1.98

method	result
default	$x \arctan\left(x\sqrt{-x^2+1}\right) + \frac{\sqrt{5}\,\arctan\left(\frac{\frac{2\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-2\sqrt{5}+4}{4\sqrt{-2+\sqrt{5}}}\right)}{5\sqrt{-2+\sqrt{5}}} + \frac{\sqrt{5}\,\operatorname{arctanh}\left(\frac{\frac{2\left(\sqrt{-x^2+1}-1\right)^2}{x^2}+4+2\sqrt{5}}{4\sqrt{2+\sqrt{5}}}\right)}{5\sqrt{2+\sqrt{5}}} + \frac{\left(-\frac{1}{2}+\right.}{}$
parts	$x \arctan\left(x\sqrt{-x^2+1}\right) + \frac{\sqrt{5}\,\arctan\left(\frac{\frac{2\left(\sqrt{-x^2+1}-1\right)^2}{x^2}-2\sqrt{5}+4}{4\sqrt{-2+\sqrt{5}}}\right)}{5\sqrt{-2+\sqrt{5}}} + \frac{\sqrt{5}\,\operatorname{arctanh}\left(\frac{\frac{2\left(\sqrt{-x^2+1}-1\right)^2}{x^2}+4+2\sqrt{5}}{4\sqrt{2+\sqrt{5}}}\right)}{5\sqrt{2+\sqrt{5}}} + \frac{\left(-\frac{1}{2}+\right.}{}$

input
```
int(arctan(x*(-x^2+1)^(1/2)),x,method=_RETURNVERBOSE)
```

output
```
x*arctan(x*(-x^2+1)^(1/2))+1/5*5^(1/2)/(-2+5^(1/2))^(1/2)*arctan(1/4*(2*((
-x^2+1)^(1/2)-1)^2/x^2-2*5^(1/2)+4)/(-2+5^(1/2))^(1/2))+1/5*5^(1/2)/(2+5^(
1/2))^(1/2)*arctanh(1/4*(2*((-x^2+1)^(1/2)-1)^2/x^2+4+2*5^(1/2))/(2+5^(1/2
))^(1/2))+(-1/2+3/10*5^(1/2))/(-2+5^(1/2))^(1/2)*arctan(1/4*(2*((-x^2+1)^(
1/2)-1)^2/x^2-2*5^(1/2)+4)/(-2+5^(1/2))^(1/2))+(1/2+3/10*5^(1/2))/(2+5^(1/
2))^(1/2)*arctanh(1/4*(2*((-x^2+1)^(1/2)-1)^2/x^2+4+2*5^(1/2))/(2+5^(1/2))
^(1/2))
```

3.50.5 Fricas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 205 vs. $2(79) = 158$.

Time = 0.27 (sec) , antiderivative size = 205, normalized size of antiderivative = 1.93

$$\int \arctan\left(x\sqrt{1-x^2}\right)\,dx = x\arctan\left(\sqrt{-x^2+1}x\right) + \frac{1}{4}\sqrt{2}\sqrt{\sqrt{5}-1}\log\left(\left(\sqrt{5}\sqrt{2}+\sqrt{2}\right)\sqrt{\sqrt{5}-1}+4\sqrt{-x^2+1}\right) - \frac{1}{4}\sqrt{2}\sqrt{\sqrt{5}-1}\log\left(-\left(\sqrt{5}\sqrt{2}+\sqrt{2}\right)\sqrt{\sqrt{5}-1} + 4\sqrt{-x^2+1}\right) - \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{5}-1}\log\left(\left(\sqrt{5}\sqrt{2}-\sqrt{2}\right)\sqrt{-\sqrt{5}-1} + 4\sqrt{-x^2+1}\right) + \frac{1}{4}\sqrt{2}\sqrt{-\sqrt{5}-1}\log\left(-\left(\sqrt{5}\sqrt{2}-\sqrt{2}\right)\sqrt{-\sqrt{5}-1} + 4\sqrt{-x^2+1}\right)$$

input
```
integrate(arctan(x*(-x^2+1)^(1/2)),x, algorithm="fricas")
```

output
```
x*arctan(sqrt(-x^2 + 1)*x) + 1/4*sqrt(2)*sqrt(sqrt(5) - 1)*log((sqrt(5)*sq
rt(2) + sqrt(2))*sqrt(sqrt(5) - 1) + 4*sqrt(-x^2 + 1)) - 1/4*sqrt(2)*sqrt(
sqrt(5) - 1)*log(-(sqrt(5)*sqrt(2) + sqrt(2))*sqrt(sqrt(5) - 1) + 4*sqrt(-
x^2 + 1)) - 1/4*sqrt(2)*sqrt(-sqrt(5) - 1)*log((sqrt(5)*sqrt(2) - sqrt(2))
*sqrt(-sqrt(5) - 1) + 4*sqrt(-x^2 + 1)) + 1/4*sqrt(2)*sqrt(-sqrt(5) - 1)*l
og(-(sqrt(5)*sqrt(2) - sqrt(2))*sqrt(-sqrt(5) - 1) + 4*sqrt(-x^2 + 1))
```

3.50.6 Sympy [F(-1)]

Timed out.

$$\int \arctan\left(x\sqrt{1-x^2}\right)\,dx = \text{Timed out}$$

input
```
integrate(atan(x*(-x**2+1)**(1/2)),x)
```

output
```
Timed out
```

3.50.7 Maxima [F]

$$\int \arctan\left(x\sqrt{1-x^2}\right)\,dx = \int \arctan\left(\sqrt{-x^2+1}x\right)\,dx$$

input
```
integrate(arctan(x*(-x^2+1)^(1/2)),x, algorithm="maxima")
```

output
```
x*arctan(sqrt(x + 1)*x*sqrt(-x + 1)) - integrate((2*x^3 - x)*e^(1/2*log(x
+ 1) + 1/2*log(-x + 1))/(x^2 + (x^4 - x^2)*e^(log(x + 1) + log(-x + 1)) -
1), x)
```

3.50.8 Giac [A] (verification not implemented)

Time = 0.34 (sec) , antiderivative size = 111, normalized size of antiderivative = 1.05

$$\begin{aligned}\int \arctan\left(x\sqrt{1-x^2}\right)\,dx &= x\arctan\left(\sqrt{-x^2+1}x\right) - \frac{1}{2}\sqrt{2\sqrt{5}+2}\arctan\left(\frac{\sqrt{-x^2+1}}{\sqrt{\frac{1}{2}\sqrt{5}-\frac{1}{2}}}\right)\\ &\quad + \frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(\sqrt{-x^2+1}+\sqrt{\frac{1}{2}\sqrt{5}+\frac{1}{2}}\right)\\ &\quad - \frac{1}{4}\sqrt{2\sqrt{5}-2}\log\left(\left|\sqrt{-x^2+1}-\sqrt{\frac{1}{2}\sqrt{5}+\frac{1}{2}}\right|\right)\end{aligned}$$

input
```
integrate(arctan(x*(-x^2+1)^(1/2)),x, algorithm="giac")
```

output
```
x*arctan(sqrt(-x^2 + 1)*x) - 1/2*sqrt(2*sqrt(5) + 2)*arctan(sqrt(-x^2 + 1)
/sqrt(1/2*sqrt(5) - 1/2)) + 1/4*sqrt(2*sqrt(5) - 2)*log(sqrt(-x^2 + 1) + s
qrt(1/2*sqrt(5) + 1/2)) - 1/4*sqrt(2*sqrt(5) - 2)*log(abs(sqrt(-x^2 + 1) -
 sqrt(1/2*sqrt(5) + 1/2)))
```

3.50.9 Mupad [B] (verification not implemented)

Time = 1.15 (sec) , antiderivative size = 455, normalized size of antiderivative = 4.29

$$\int \arctan\left(x\sqrt{1-x^2}\right)\,dx = x\,\mathrm{atan}\left(x\sqrt{1-x^2}\right) + \frac{\ln\left(\frac{\frac{\left(x\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}-1\right)1\mathrm{i}}{\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}}-\sqrt{1-x^2}\,1\mathrm{i}}{x-\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}}\right)\left(\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}-2\left(\frac{\sqrt{5}}{2}+\frac{1}{2}\right)^{3/2}\right)}{\left(2\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}-4\left(\frac{\sqrt{5}}{2}+\frac{1}{2}\right)^{3/2}\right)\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}} + \frac{\ln\left(\frac{\frac{\left(x\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}-1\right)1\mathrm{i}}{\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}}-\sqrt{1-x^2}\,1\mathrm{i}}{x-\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}}\right)\left(\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}-2\left(\frac{1}{2}-\frac{\sqrt{5}}{2}\right)^{3/2}\right)}{\left(2\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}-4\left(\frac{1}{2}-\frac{\sqrt{5}}{2}\right)^{3/2}\right)\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}} + \frac{\ln\left(\frac{\frac{\left(x\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}+1\right)1\mathrm{i}}{\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}}+\sqrt{1-x^2}\,1\mathrm{i}}{x+\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}}\right)\left(\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}-2\left(\frac{\sqrt{5}}{2}+\frac{1}{2}\right)^{3/2}\right)}{\left(2\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}-4\left(\frac{\sqrt{5}}{2}+\frac{1}{2}\right)^{3/2}\right)\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}} + \frac{\ln\left(\frac{\frac{\left(x\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}+1\right)1\mathrm{i}}{\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}}+\sqrt{1-x^2}\,1\mathrm{i}}{x+\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}}\right)\left(\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}-2\left(\frac{1}{2}-\frac{\sqrt{5}}{2}\right)^{3/2}\right)}{\left(2\sqrt{\frac{1}{2}-\frac{\sqrt{5}}{2}}-4\left(\frac{1}{2}-\frac{\sqrt{5}}{2}\right)^{3/2}\right)\sqrt{\frac{\sqrt{5}}{2}+\frac{1}{2}}}$$

input
```
int(atan(x*(1 - x^2)^(1/2)),x)
```

output
```
x*atan(x*(1 - x^2)^(1/2)) + (log((((x*(5^(1/2)/2 + 1/2)^(1/2) - 1)*1i)/(1/
2 - 5^(1/2)/2)^(1/2) - (1 - x^2)^(1/2)*1i)/(x - (5^(1/2)/2 + 1/2)^(1/2)))*
((5^(1/2)/2 + 1/2)^(1/2) - 2*(5^(1/2)/2 + 1/2)^(3/2)))/((2*(5^(1/2)/2 + 1/
2)^(1/2) - 4*(5^(1/2)/2 + 1/2)^(3/2))*(1/2 - 5^(1/2)/2)^(1/2)) + (log((((x
*(1/2 - 5^(1/2)/2)^(1/2) - 1)*1i)/(5^(1/2)/2 + 1/2)^(1/2) - (1 - x^2)^(1/2
)*1i)/(x - (1/2 - 5^(1/2)/2)^(1/2)))*((1/2 - 5^(1/2)/2)^(1/2) - 2*(1/2 - 5
^(1/2)/2)^(3/2)))/((2*(1/2 - 5^(1/2)/2)^(1/2) - 4*(1/2 - 5^(1/2)/2)^(3/2))
*(5^(1/2)/2 + 1/2)^(1/2)) + (log((((x*(5^(1/2)/2 + 1/2)^(1/2) + 1)*1i)/(1/
2 - 5^(1/2)/2)^(1/2) + (1 - x^2)^(1/2)*1i)/(x + (5^(1/2)/2 + 1/2)^(1/2)))*
((5^(1/2)/2 + 1/2)^(1/2) - 2*(5^(1/2)/2 + 1/2)^(3/2)))/((2*(5^(1/2)/2 + 1/
2)^(1/2) - 4*(5^(1/2)/2 + 1/2)^(3/2))*(1/2 - 5^(1/2)/2)^(1/2)) + (log((((x
*(1/2 - 5^(1/2)/2)^(1/2) + 1)*1i)/(5^(1/2)/2 + 1/2)^(1/2) + (1 - x^2)^(1/2
)*1i)/(x + (1/2 - 5^(1/2)/2)^(1/2)))*((1/2 - 5^(1/2)/2)^(1/2) - 2*(1/2 - 5
^(1/2)/2)^(3/2)))/((2*(1/2 - 5^(1/2)/2)^(1/2) - 4*(1/2 - 5^(1/2)/2)^(3/2))
*(5^(1/2)/2 + 1/2)^(1/2))
```

3.50. $\int \arctan \left(x\sqrt{1-x^2}\right)\,dx$

CHAPTER 4

Appendix

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

```python
#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
```