

Computer Algebra Independent Integration Tests

Summer 2023 edition with Rubi V 4.17.3

1-Algebraic-functions/1.1-Binomial-products/1.1.2-Quadratic/23-
1.1.2.6-g-x^m-a+b-x²-^p-c+d-x²-^q-e+f-x²-^r

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CHAPTER 1

INTRODUCTION

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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 [51]. This is test number [23].

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 (51)	0.00 (0)
Rubi	94.12 (48)	5.88 (3)
Sympy	54.90 (28)	45.10 (23)
Maple	27.45 (14)	72.55 (37)
Fricas	27.45 (14)	72.55 (37)
Mupad	27.45 (14)	72.55 (37)
Giac	27.45 (14)	72.55 (37)
Maxima	27.45 (14)	72.55 (37)

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 <ol style="list-style-type: none"> 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.

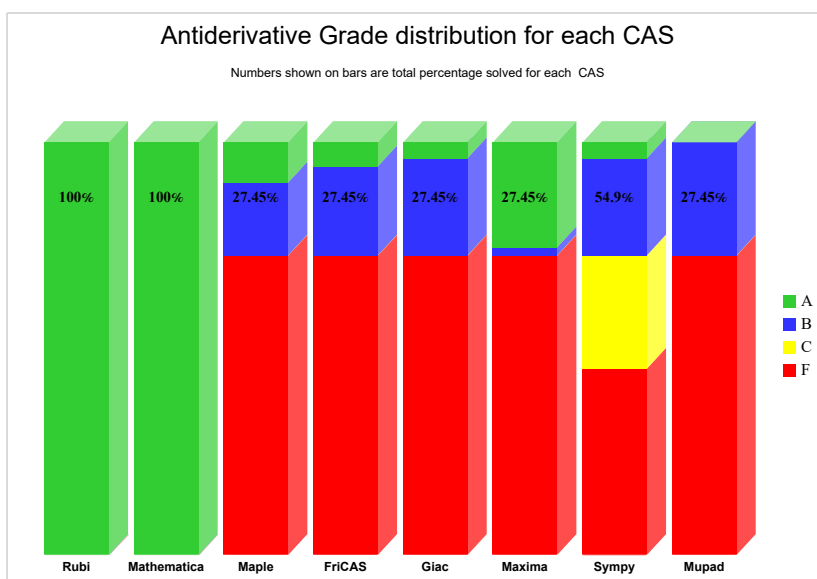
Table 1.2: Description of grading applied to integration result

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

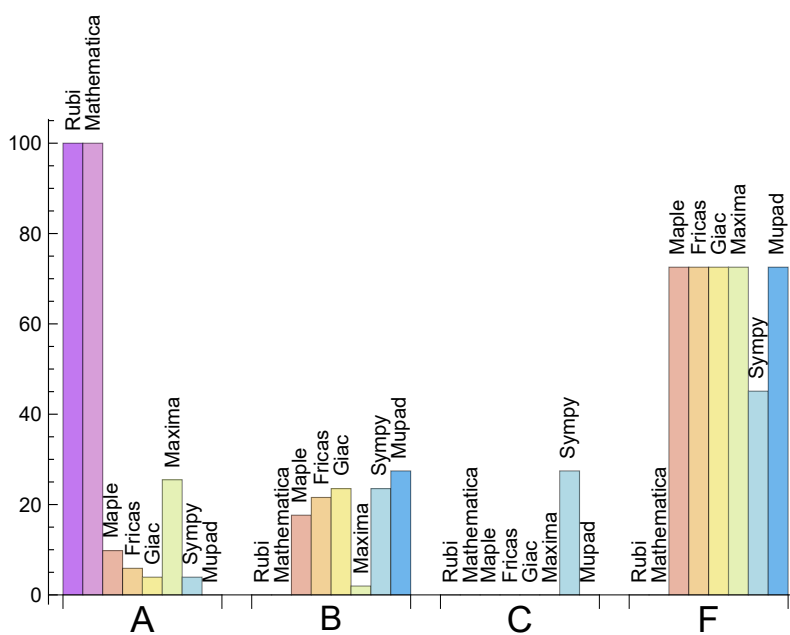
System	% A grade	% B grade	% C grade	% F grade
Mathematica	100.000	0.000	0.000	0.000
Rubi	94.118	0.000	0.000	5.882
Maxima	25.490	1.961	0.000	72.549
Maple	9.804	17.647	0.000	72.549
Fricas	5.882	21.569	0.000	72.549
Giac	3.922	23.529	0.000	72.549
Sympy	3.922	23.529	27.451	45.098
Mupad	0.000	27.451	0.000	72.549

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 time-out failure	Percentage exception failure
Mathematica	0	0.00	0.00	0.00
Rubi	3	100.00	0.00	0.00
Sympy	23	43.48	56.52	0.00
Fricas	37	100.00	0.00	0.00
Maple	37	100.00	0.00	0.00
Mupad	37	0.00	100.00	0.00
Giac	37	100.00	0.00	0.00
Maxima	37	100.00	0.00	0.00

Table 1.4: Failure statistics for each CAS

1.3 Time and leaf size Performance

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

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

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

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

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

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

System	Mean time (sec)
Maxima	0.24
Fricas	0.29
Giac	0.33
Mathematica	0.46
Rubi	0.51
Maple	3.08
Mupad	5.86
Sympy	14.26

Table 1.5: Time performance for each CAS

System	Mean size	Normalized mean	Median size	Normalized median
Mathematica	161.47	0.69	149.00	0.72
Rubi	251.23	1.01	221.00	1.00
Maxima	293.71	1.59	242.00	1.68
Mupad	379.36	2.07	305.00	2.21
Fricas	803.64	3.92	513.50	3.57
Maple	1078.57	4.73	711.00	4.94
Giac	1512.00	7.01	1009.00	7.01
Sympy	3608.89	17.31	1764.50	12.10

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.

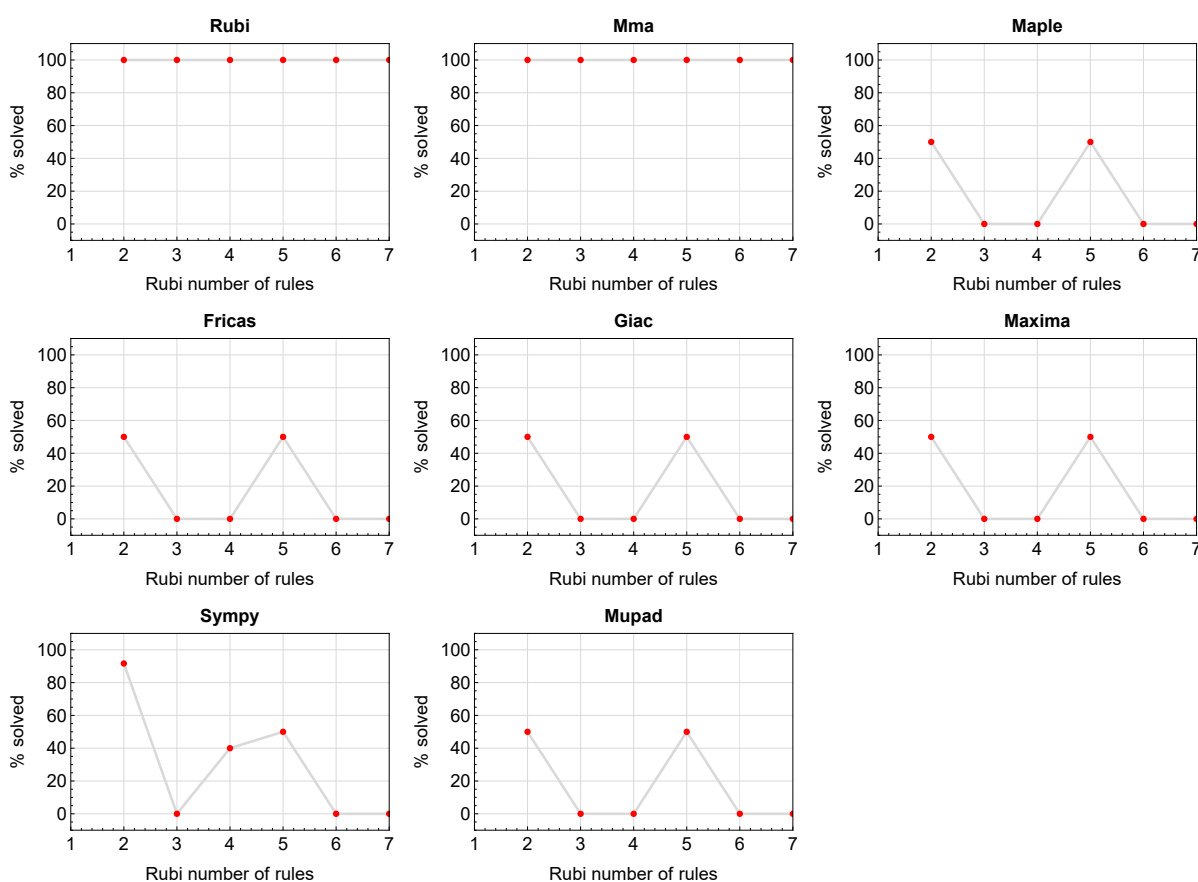


Figure 1.1: Solving statistics per number of Rubi rules used

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.

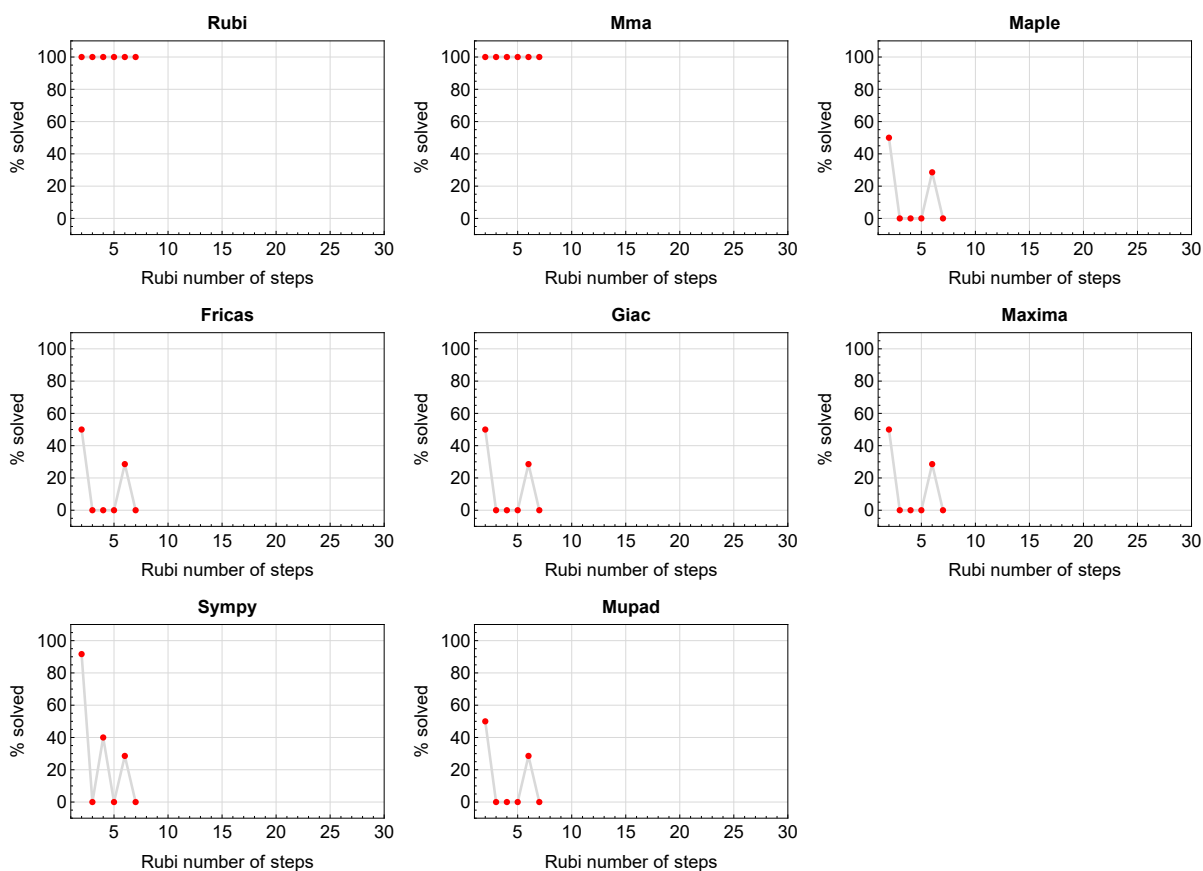


Figure 1.2: Solving statistics per number of Rubi steps used

The above diagram show that the percentage of solved integrals 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.

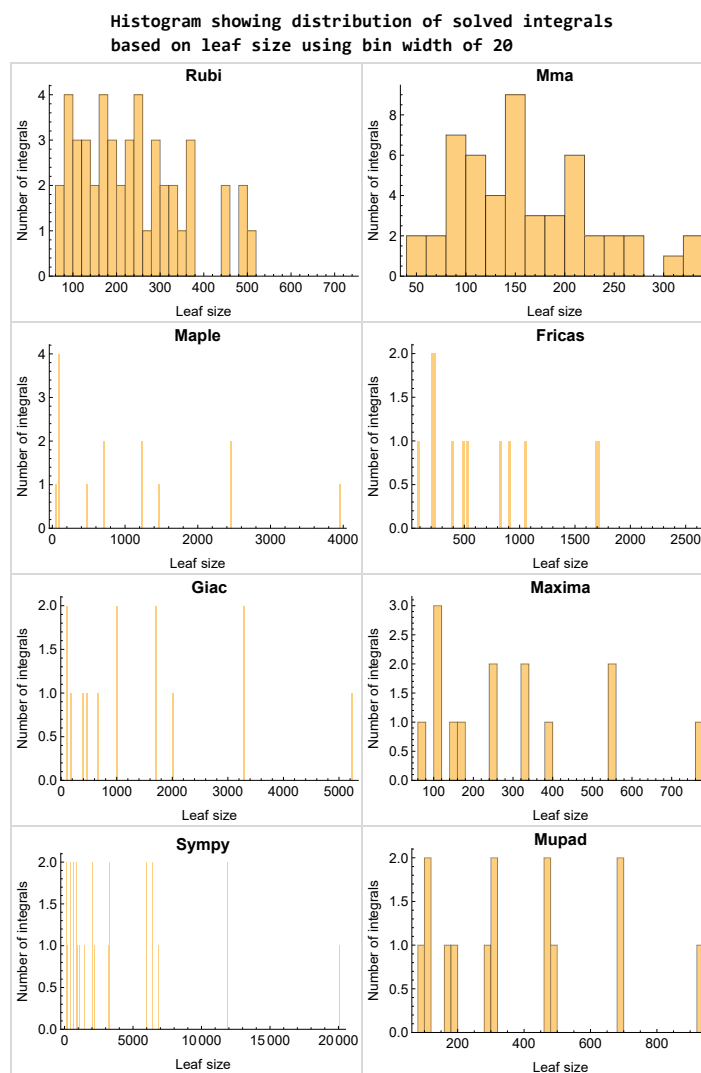


Figure 1.3: Solved integrals based on leaf size distribution

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.

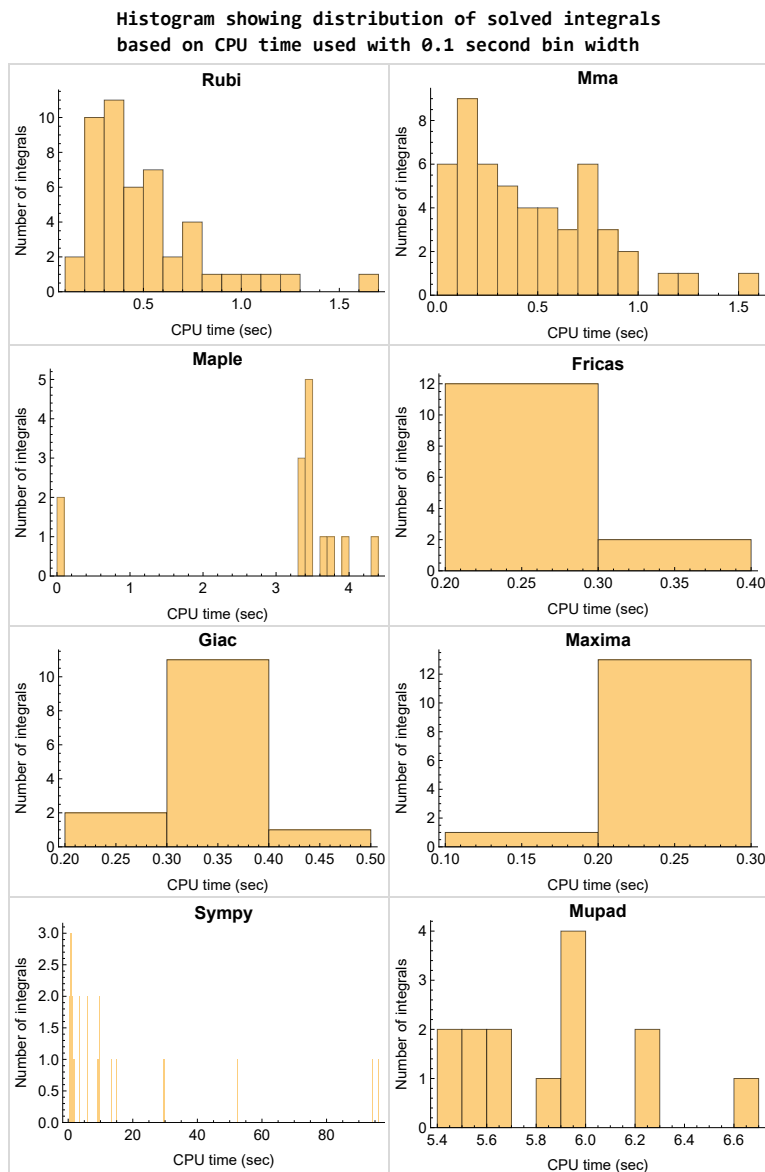


Figure 1.4: Solved integrals histogram based on CPU time used

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.

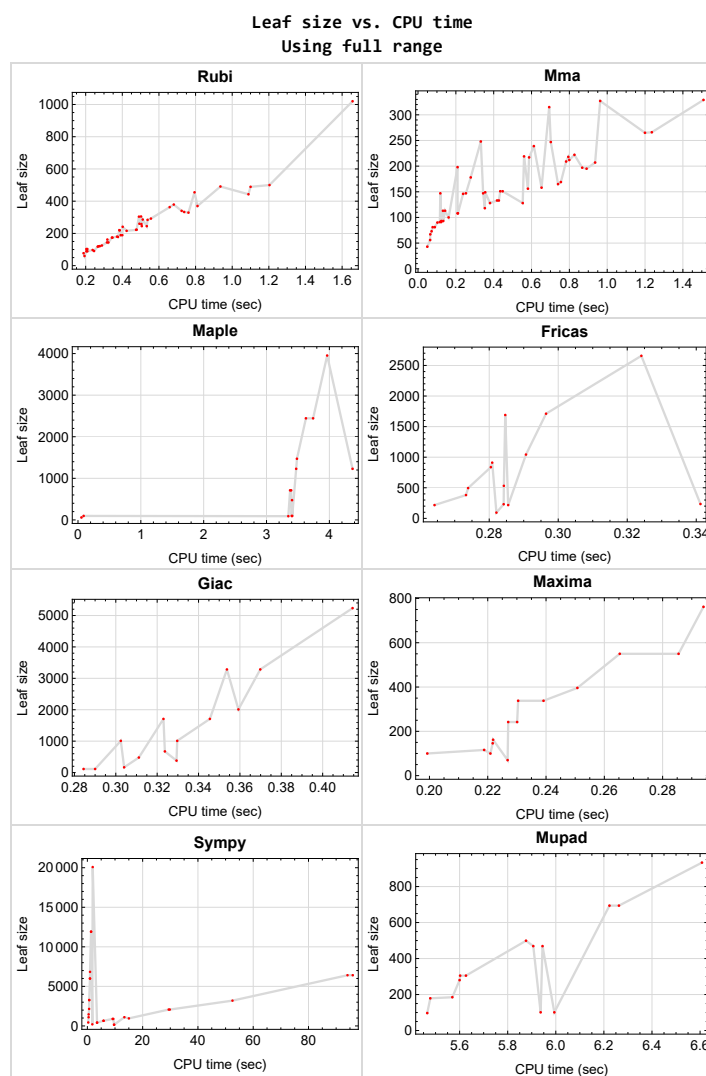


Figure 1.5: Leaf size vs. CPU time. Full range

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 {}

Mathematica {}

Maple {}

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.



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

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

The following fields are present only in Rubi Table file

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

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June 27, 2013
Design v0.01

CHAPTER 2

DETAILED SUMMARY TABLES OF RESULTS

2.1	List of integrals sorted by grade for each CAS	21
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2.1 List of integrals sorted by grade for each CAS

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

2.1.1 Rubi

A grade { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 44, 45, 46, 47, 48, 49, 50, 51 }

B grade { }

C grade { }

F normal fail { 29, 36, 43 }

F(-1) timeout fail { }

F(-2) exception fail { }

2.1.2 Mma

A grade { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51 }

B grade { }

C grade { }

F normal fail { }

F(-1) timeout fail { }

F(-2) exception fail { }

2.1.3 Maple

A grade { 3, 4, 11, 50, 51 }

B grade { 1, 2, 8, 9, 10, 15, 16, 17, 18 }

C grade { }

F normal fail { 5, 6, 7, 12, 13, 14, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.4 Fricas

A grade { 4, 50, 51 }

B grade { 1, 2, 3, 8, 9, 10, 11, 15, 16, 17, 18 }

C grade { }

F normal fail { 5, 6, 7, 12, 13, 14, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.5 Maxima

A grade { 1, 2, 3, 4, 8, 9, 10, 11, 16, 17, 18, 50, 51 }

B grade { 15 }

C grade { }

F normal fail { 5, 6, 7, 12, 13, 14, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 }

F(-1) timedout fail { }

F(-2) exception fail { }

2.1.6 Giac

A grade { 50, 51 }

B grade { 1, 2, 3, 4, 8, 9, 10, 11, 15, 16, 17, 18 }

C grade { }

F normal fail { 5, 6, 7, 12, 13, 14, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 }

F(-1) timeout fail { }

F(-2) exception fail { }

2.1.7 Mupad

A grade { }

B grade { 1, 2, 3, 4, 8, 9, 10, 11, 15, 16, 17, 18, 50, 51 }

C grade { }

F normal fail { }

F(-1) timeout fail { 5, 6, 7, 12, 13, 14, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 }

F(-2) exception fail { }

2.1.8 Sympy

A grade { 50, 51 }

B grade { 1, 2, 3, 4, 8, 9, 10, 11, 15, 16, 17, 18 }

C grade { 5, 6, 7, 12, 19, 22, 23, 24, 25, 26, 32, 33, 39, 40 }

F normal fail { 13, 14, 20, 21, 27, 30, 31, 34, 37, 38 }

F(-1) timeout fail { 28, 29, 35, 36, 41, 42, 43, 44, 45, 46, 47, 48, 49 }

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	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	189	189	151	1229	338	911	5992	1708	469
N.S.	1	1.00	0.80	6.50	1.79	4.82	31.70	9.04	2.48
time (sec)	N/A	0.386	0.447	4.369	0.230	0.281	0.948	0.323	5.945

Problem 2	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	144	144	113	711	242	532	3271	1009	305
N.S.	1	1.00	0.78	4.94	1.68	3.69	22.72	7.01	2.12
time (sec)	N/A	0.320	0.132	3.375	0.227	0.284	0.661	0.302	5.626

Problem 3	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	97	97	73	96	146	235	1460	478	185
N.S.	1	1.00	0.75	0.99	1.51	2.42	15.05	4.93	1.91
time (sec)	N/A	0.240	0.072	0.090	0.222	0.341	0.460	0.311	5.570

Problem 4	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	A	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	60	60	43	59	70	94	439	167	97
N.S.	1	1.00	0.72	0.98	1.17	1.57	7.32	2.78	1.62
time (sec)	N/A	0.198	0.049	0.055	0.227	0.282	0.322	0.304	5.465

Problem 5	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	118	118	93	0	0	0	418	0	0
N.S.	1	1.00	0.79	0.00	0.00	0.00	3.54	0.00	0.00
time (sec)	N/A	0.265	0.133	0.000	0.000	0.000	3.518	0.000	0.000

Problem 6	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	171	174	108	0	0	0	2069	0	0
N.S.	1	1.02	0.63	0.00	0.00	0.00	12.10	0.00	0.00
time (sec)	N/A	0.360	0.211	0.000	0.000	0.000	29.417	0.000	0.000

Problem 7	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	209	220	133	0	0	0	6411	0	0
N.S.	1	1.05	0.64	0.00	0.00	0.00	30.67	0.00	0.00
time (sec)	N/A	0.394	0.418	0.000	0.000	0.000	96.012	0.000	0.000

Problem 8	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	292	292	247	2443	550	1711	11914	3283	694
N.S.	1	1.00	0.85	8.37	1.88	5.86	40.80	11.24	2.38
time (sec)	N/A	0.522	0.702	3.741	0.285	0.296	1.357	0.354	6.223

Problem 9	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	216	216	178	1471	396	1043	6836	2010	499
N.S.	1	1.00	0.82	6.81	1.83	4.83	31.65	9.31	2.31
time (sec)	N/A	0.417	0.279	3.484	0.251	0.291	0.965	0.359	5.876

Problem 10	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	144	144	113	711	242	495	3271	1009	305
N.S.	1	1.00	0.78	4.94	1.68	3.44	22.72	7.01	2.12
time (sec)	N/A	0.309	0.143	3.392	0.230	0.274	0.671	0.330	5.602

Problem 11	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	A	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	91	91	67	90	116	217	1096	380	179
N.S.	1	1.00	0.74	0.99	1.27	2.38	12.04	4.18	1.97
time (sec)	N/A	0.232	0.065	3.347	0.219	0.285	0.444	0.329	5.478

Problem 12	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	178	178	146	0	0	0	649	0	0
N.S.	1	1.00	0.82	0.00	0.00	0.00	3.65	0.00	0.00
time (sec)	N/A	0.364	0.238	0.000	0.000	0.000	5.861	0.000	0.000

Problem 13	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	247	245	156	0	0	0	0	0	0
N.S.	1	0.99	0.63	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.520	0.581	0.000	0.000	0.000	0.000	0.000	0.000

Problem 14	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	292	305	165	0	0	0	0	0	0
N.S.	1	1.04	0.57	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.511	0.740	0.000	0.000	0.000	0.000	0.000	0.000

Problem 15	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	B	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	379	379	327	3953	762	2657	20086	5234	933
N.S.	1	1.00	0.86	10.43	2.01	7.01	53.00	13.81	2.46
time (sec)	N/A	0.652	0.963	3.965	0.294	0.324	1.927	0.414	6.608

Problem 16	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	284	284	239	2443	550	1690	11914	3283	694
N.S.	1	1.00	0.84	8.60	1.94	5.95	41.95	11.56	2.44
time (sec)	N/A	0.522	0.612	3.627	0.265	0.285	1.329	0.370	6.263

Problem 17	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	189	189	151	1229	338	837	5992	1708	469
N.S.	1	1.00	0.80	6.50	1.79	4.43	31.70	9.04	2.48
time (sec)	N/A	0.378	0.435	3.472	0.239	0.280	0.941	0.345	5.906

Problem 18	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	B	A	B	B	B	B
verified	N/A	Yes	Yes	Yes	TBD	TBD	TBD	TBD	TBD
size	121	121	90	475	162	381	2152	673	280
N.S.	1	1.00	0.74	3.93	1.34	3.15	17.79	5.56	2.31
time (sec)	N/A	0.273	0.102	3.406	0.222	0.273	0.632	0.324	5.600

Problem 19	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	258	258	217	0	0	0	887	0	0
N.S.	1	1.00	0.84	0.00	0.00	0.00	3.44	0.00	0.00
time (sec)	N/A	0.506	0.587	0.000	0.000	0.000	9.384	0.000	0.000

Problem 20	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	347	340	209	0	0	0	0	0	0
N.S.	1	0.98	0.60	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.708	0.783	0.000	0.000	0.000	0.000	0.000	0.000

Problem 21	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	480	489	218	0	0	0	0	0	0
N.S.	1	1.02	0.45	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	1.086	0.795	0.000	0.000	0.000	0.000	0.000	0.000

Problem 22	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	363	363	315	0	0	0	1102	0	0
N.S.	1	1.00	0.87	0.00	0.00	0.00	3.04	0.00	0.00
time (sec)	N/A	0.646	0.693	0.000	0.000	0.000	13.386	0.000	0.000

Problem 23	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	260	260	219	0	0	0	887	0	0
N.S.	1	1.00	0.84	0.00	0.00	0.00	3.41	0.00	0.00
time (sec)	N/A	0.490	0.560	0.000	0.000	0.000	9.122	0.000	0.000

Problem 24	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	180	180	147	0	0	0	649	0	0
N.S.	1	1.00	0.82	0.00	0.00	0.00	3.61	0.00	0.00
time (sec)	N/A	0.375	0.253	0.000	0.000	0.000	5.841	0.000	0.000

Problem 25	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	120	120	93	0	0	0	418	0	0
N.S.	1	1.00	0.78	0.00	0.00	0.00	3.48	0.00	0.00
time (sec)	N/A	0.274	0.123	0.000	0.000	0.000	3.501	0.000	0.000

Problem 26	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	77	77	56	0	0	0	201	0	0
N.S.	1	1.00	0.73	0.00	0.00	0.00	2.61	0.00	0.00
time (sec)	N/A	0.197	0.064	0.000	0.000	0.000	1.794	0.000	0.000

Problem 27	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	125	125	100	0	0	0	0	0	0
N.S.	1	1.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.288	0.162	0.000	0.000	0.000	0.000	0.000	0.000

Problem 28	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	206	223	149	0	0	0	0	0	0
N.S.	1	1.08	0.72	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.477	0.355	0.000	0.000	0.000	0.000	0.000	0.000

Problem 29	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	F	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	N/A	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	342	0	195	0	0	0	0	0	0
N.S.	1	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.000	0.891	0.000	0.000	0.000	0.000	0.000	0.000

Problem 30	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	340	333	212	0	0	0	0	0	0
N.S.	1	0.98	0.62	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.733	0.800	0.000	0.000	0.000	0.000	0.000	0.000

Problem 31	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	246	245	158	0	0	0	0	0	0
N.S.	1	1.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.523	0.653	0.000	0.000	0.000	0.000	0.000	0.000

Problem 32	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	171	174	108	0	0	0	2069	0	0
N.S.	1	1.02	0.63	0.00	0.00	0.00	12.10	0.00	0.00
time (sec)	N/A	0.356	0.209	0.000	0.000	0.000	29.820	0.000	0.000

Problem 33	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	103	103	81	0	0	0	954	0	0
N.S.	1	1.00	0.79	0.00	0.00	0.00	9.26	0.00	0.00
time (sec)	N/A	0.212	0.078	0.000	0.000	0.000	15.021	0.000	0.000

Problem 34	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	205	222	147	0	0	0	0	0	0
N.S.	1	1.08	0.72	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.485	0.344	0.000	0.000	0.000	0.000	0.000	0.000

Problem 35	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	304	329	207	0	0	0	0	0	0
N.S.	1	1.08	0.68	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.742	0.936	0.000	0.000	0.000	0.000	0.000	0.000

Problem 36	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	F	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	N/A	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	491	0	265	0	0	0	0	0	0
N.S.	1	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.000	1.200	0.000	0.000	0.000	0.000	0.000	0.000

Problem 37	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	433	443	222	0	0	0	0	0	0
N.S.	1	1.02	0.51	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	1.049	0.827	0.000	0.000	0.000	0.000	0.000	0.000

Problem 38	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	292	304	169	0	0	0	0	0	0
N.S.	1	1.04	0.58	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.515	0.755	0.000	0.000	0.000	0.000	0.000	0.000

Problem 39	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	208	219	133	0	0	0	6411	0	0
N.S.	1	1.05	0.64	0.00	0.00	0.00	30.82	0.00	0.00
time (sec)	N/A	0.400	0.427	0.000	0.000	0.000	94.112	0.000	0.000

Problem 40	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	C	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	103	103	81	0	0	0	3199	0	0
N.S.	1	1.00	0.79	0.00	0.00	0.00	31.06	0.00	0.00
time (sec)	N/A	0.221	0.089	0.000	0.000	0.000	52.496	0.000	0.000

Problem 41	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	333	370	197	0	0	0	0	0	0
N.S.	1	1.11	0.59	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.784	0.868	0.000	0.000	0.000	0.000	0.000	0.000

Problem 42	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	452	500	266	0	0	0	0	0	0
N.S.	1	1.11	0.59	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	1.191	1.236	0.000	0.000	0.000	0.000	0.000	0.000

Problem 43	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	F	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	N/A	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	665	0	329	0	0	0	0	0	0
N.S.	1	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.000	1.509	0.000	0.000	0.000	0.000	0.000	0.000

Problem 44	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	1059	1020	248	0	0	0	0	0	0
N.S.	1	0.96	0.23	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	1.729	0.332	0.000	0.000	0.000	0.000	0.000	0.000

Problem 45	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	495	455	198	0	0	0	0	0	0
N.S.	1	0.92	0.40	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.858	0.209	0.000	0.000	0.000	0.000	0.000	0.000

Problem 46	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	253	241	147	0	0	0	0	0	0
N.S.	1	0.95	0.58	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.426	0.118	0.000	0.000	0.000	0.000	0.000	0.000

Problem 47	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	162	162	118	0	0	0	0	0	0
N.S.	1	1.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.329	0.353	0.000	0.000	0.000	0.000	0.000	0.000

Problem 48	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	295	286	128	0	0	0	0	0	0
N.S.	1	0.97	0.43	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.523	0.380	0.000	0.000	0.000	0.000	0.000	0.000

Problem 49	Optimal	Rubi	MMA	Maple	Maxima	Fricas	Sympy	Giac	Mupad
grade	N/A	A	A	F	F	F	F(-1)	F	F(-1)
verified	N/A	Yes	Yes	N/A	TBD	TBD	TBD	TBD	TBD
size	483	491	128	0	0	0	0	0	0
N.S.	1	1.02	0.27	0.00	0.00	0.00	0.00	0.00	0.00
time (sec)	N/A	0.952	0.553	0.000	0.000	0.000	0.000	0.000	0.000

Problem 50	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	84	89	91	95	100	231	151	113	101
N.S.	1	1.06	1.08	1.13	1.19	2.75	1.80	1.35	1.20
time (sec)	N/A	0.209	0.115	3.401	0.199	0.284	9.664	0.284	5.994

Problem 51	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	84	89	91	95	100	217	151	113	101
N.S.	1	1.06	1.08	1.13	1.19	2.58	1.80	1.35	1.20
time (sec)	N/A	0.218	0.123	3.409	0.221	0.264	9.668	0.290	5.937

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 [42] had the largest ratio of [.225806000000000007]

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	29	0.069
2	A	2	2	1.00	29	0.069
3	A	2	2	1.00	27	0.074
4	A	2	2	1.00	20	0.100
5	A	2	2	1.00	29	0.069
6	A	4	4	1.02	29	0.138
7	A	4	4	1.05	29	0.138
8	A	2	2	1.00	31	0.065
9	A	2	2	1.00	31	0.065
10	A	2	2	1.00	29	0.069
11	A	2	2	1.00	22	0.091
12	A	2	2	1.00	31	0.065
13	A	4	4	0.99	31	0.129
14	A	6	6	1.04	31	0.194
15	A	2	2	1.00	31	0.065
16	A	2	2	1.00	31	0.065
17	A	2	2	1.00	29	0.069
18	A	2	2	1.00	22	0.091
19	A	2	2	1.00	31	0.065
20	A	4	4	0.98	31	0.129
21	A	6	6	1.02	31	0.194
22	A	2	2	1.00	31	0.065

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	2	2	1.00	31	0.065
24	A	2	2	1.00	31	0.065
25	A	2	2	1.00	29	0.069
26	A	2	2	1.00	22	0.091
27	A	2	2	1.00	31	0.065
28	A	3	3	1.08	31	0.097
29	F	0	0	N/A	0.000	N/A
30	A	4	4	0.98	31	0.129
31	A	4	4	1.00	31	0.129
32	A	4	4	1.02	29	0.138
33	A	2	2	1.00	22	0.091
34	A	3	3	1.08	31	0.097
35	A	5	5	1.08	31	0.161
36	F	0	0	N/A	0.000	N/A
37	A	6	6	1.02	31	0.194
38	A	6	6	1.04	31	0.194
39	A	4	4	1.05	29	0.138
40	A	2	2	1.00	22	0.091
41	A	4	4	1.11	31	0.129
42	A	7	7	1.11	31	0.226
43	F	0	0	N/A	0.000	N/A
44	A	7	7	0.96	31	0.226
45	A	6	6	0.92	31	0.194
46	A	5	5	0.95	29	0.172
47	A	2	2	1.00	31	0.065
48	A	3	3	0.97	31	0.097
49	A	4	4	1.02	31	0.129
50	A	6	5	1.06	29	0.172
51	A	6	5	1.06	29	0.172

LISTING OF INTEGRALS

3.1	$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$	41
3.2	$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$	50
3.3	$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx$	57
3.4	$\int (ex)^m (A + Bx^2) (c + dx^2) dx$	63
3.5	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{a+bx^2} dx$	68
3.6	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^2} dx$	73
3.7	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^3} dx$	79
3.8	$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx$	85
3.9	$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx$	95
3.10	$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$	104
3.11	$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx$	111
3.12	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{a+bx^2} dx$	117
3.13	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{(a+bx^2)^2} dx$	123
3.14	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{(a+bx^2)^3} dx$	129
3.15	$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx$	135
3.16	$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx$	146
3.17	$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx$	156
3.18	$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx$	165
3.19	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{a+bx^2} dx$	172
3.20	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^2} dx$	178
3.21	$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^3} dx$	184
3.22	$\int \frac{(ex)^m (a+bx^2)^4 (A+Bx^2)}{c+dx^2} dx$	190
3.23	$\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{c+dx^2} dx$	196
3.24	$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx$	202

3.25	$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{c+dx^2} dx$	208
3.26	$\int \frac{(ex)^m (A+Bx^2)}{c+dx^2} dx$	213
3.27	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)} dx$	217
3.28	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2(c+dx^2)} dx$	221
3.29	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3(c+dx^2)} dx$	226
3.30	$\int \frac{(ex)^m (a+bx^2)^3(A+Bx^2)}{(c+dx^2)^2} dx$	236
3.31	$\int \frac{(ex)^m (a+bx^2)^2(A+Bx^2)}{(c+dx^2)^2} dx$	242
3.32	$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{(c+dx^2)^2} dx$	248
3.33	$\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^2} dx$	254
3.34	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)^2} dx$	259
3.35	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2(c+dx^2)^2} dx$	264
3.36	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3(c+dx^2)^2} dx$	270
3.37	$\int \frac{(ex)^m (a+bx^2)^3(A+Bx^2)}{(c+dx^2)^3} dx$	280
3.38	$\int \frac{(ex)^m (a+bx^2)^2(A+Bx^2)}{(c+dx^2)^3} dx$	286
3.39	$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{(c+dx^2)^3} dx$	292
3.40	$\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^3} dx$	298
3.41	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)^3} dx$	303
3.42	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2(c+dx^2)^3} dx$	309
3.43	$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3(c+dx^2)^3} dx$	316
3.44	$\int (ex)^m (a+bx^2)^p (A+Bx^2) (c+dx^2)^3 dx$	326
3.45	$\int (ex)^m (a+bx^2)^p (A+Bx^2) (c+dx^2)^2 dx$	334
3.46	$\int (ex)^m (a+bx^2)^p (A+Bx^2) (c+dx^2) dx$	340
3.47	$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{c+dx^2} dx$	346
3.48	$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^2} dx$	350
3.49	$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^3} dx$	355
3.50	$\int \frac{\sqrt{a+bx^2} (A+Bx^2) (c+dx^2)}{x} dx$	361
3.51	$\int \frac{(a+bx^2) (A+Bx^2) \sqrt{c+dx^2}}{x} dx$	367

3.1 $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$

3.1.1	Optimal result	41
3.1.2	Mathematica [A] (verified)	42
3.1.3	Rubi [A] (verified)	42
3.1.4	Maple [B] (verified)	43
3.1.5	Fricas [B] (verification not implemented)	44
3.1.6	Sympy [B] (verification not implemented)	45
3.1.7	Maxima [A] (verification not implemented)	46
3.1.8	Giac [B] (verification not implemented)	47
3.1.9	Mupad [B] (verification not implemented)	48

3.1.1 Optimal result

Integrand size = 29, antiderivative size = 189

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx = \frac{a^3 Ac(ex)^{1+m}}{e(1+m)} + \frac{a^2(3Abc + aBc + aAd)(ex)^{3+m}}{e^3(3+m)} + \frac{a(3Ab(bc + ad) + aB(3bc + ad))(ex)^{5+m}}{e^5(5+m)} + \frac{b(3aB(bc + ad) + Ab(bc + 3ad))(ex)^{7+m}}{e^7(7+m)} + \frac{b^2(bBc + Abd + 3aBd)(ex)^{9+m}}{e^9(9+m)} + \frac{b^3 Bd(ex)^{11+m}}{e^{11}(11+m)}$$

```
output a^3*A*c*(e*x)^(1+m)/e/(1+m)+a^2*(A*a*d+3*A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)
)+a*(3*A*b*(a*d+b*c)+a*B*(a*d+3*b*c))*(e*x)^(5+m)/e^5/(5+m)+b*(3*a*B*(a*d+
b*c)+A*b*(3*a*d+b*c))*(e*x)^(7+m)/e^7/(7+m)+b^2*(A*b*d+3*B*a*d+B*b*c)*(e*x
)^(9+m)/e^9/(9+m)+b^3*B*d*(e*x)^(11+m)/e^11/(11+m)
```

3.1.2 Mathematica [A] (verified)

Time = 0.45 (sec) , antiderivative size = 151, normalized size of antiderivative = 0.80

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx = x(ex)^m \left(\frac{a^3 Ac}{1+m} + \frac{a^2(3Abc + aBc + aAd)x^2}{3+m} + \frac{a(3Ab(bc + ad) + aB(3bc + ad))x^4}{5+m} + \frac{b(3aB(bc + ad) + Ab(bc + 3ad))x^6}{7+m} + \frac{b^2(bBc + Abd + 3aBd)x^8}{9+m} + \frac{b^3 Bdx^{10}}{11+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^3*(A + B*x^2)*(c + d*x^2),x]`

output `x*(e*x)^m*((a^3*A*c)/(1 + m) + (a^2*(3*A*b*c + a*B*c + a*A*d)*x^2)/(3 + m) + (a*(3*A*b*(b*c + a*d) + a*B*(3*b*c + a*d))*x^4)/(5 + m) + (b*(3*a*B*(b*c + a*d) + A*b*(b*c + 3*a*d))*x^6)/(7 + m) + (b^2*(b*B*c + A*b*d + 3*a*B*d)*x^8)/(9 + m) + (b^3*B*d*x^10)/(11 + m))`

3.1.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 189, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.069$, Rules used = {437, 2009}

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

$$\int (a + bx^2)^3 (A + Bx^2) (c + dx^2) (ex)^m dx$$

↓ 437

$$\int \left(a^3 Ac(ex)^m + \frac{a^2(ex)^{m+2}(aAd + aBc + 3Abc)}{e^2} + \frac{b^2(ex)^{m+8}(3aBd + Abd + bBc)}{e^8} + \frac{b(ex)^{m+6}(Ab(3ad + bc) + b^2Bd)}{e^6} \right) dx$$

↓ 2009

$$\frac{a^3 Ac(ex)^{m+1}}{e(m+1)} + \frac{a^2(ex)^{m+3}(aAd + aBc + 3Abc)}{e^3(m+3)} + \frac{b^2(ex)^{m+9}(3aBd + Abd + bBc)}{e^9(m+9)} + \frac{b(ex)^{m+7}(Ab(3ad + bc) + 3aB(ad + bc))}{e^7(m+7)} + \frac{a(ex)^{m+5}(3Ab(ad + bc) + aB(ad + 3bc))}{e^5(m+5)} + \frac{b^3 Bd(ex)^{m+11}}{e^{11}(m+11)}$$

input `Int[(e*x)^m*(a + b*x^2)^3*(A + B*x^2)*(c + d*x^2),x]`

output `(a^3*A*c*(e*x)^(1 + m))/(e*(1 + m)) + (a^2*(3*A*b*c + a*B*c + a*A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + (a*(3*A*b*(b*c + a*d) + a*B*(3*b*c + a*d))*(e*x)^(5 + m))/(e^5*(5 + m)) + (b*(3*a*B*(b*c + a*d) + A*b*(b*c + 3*a*d))*(e*x)^(7 + m))/(e^7*(7 + m)) + (b^2*(b*B*c + A*b*d + 3*a*B*d)*(e*x)^(9 + m))/(e^9*(9 + m)) + (b^3*B*d*(e*x)^(11 + m))/(e^11*(11 + m))`

3.1.3.1 Defintions of rubi rules used

rule 437 `Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2)^(r_), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.1.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 1228 vs. $2(189) = 378$.

Time = 4.37 (sec) , antiderivative size = 1229, normalized size of antiderivative = 6.50

method	result	size
gospers	Expression too large to display	1229
risch	Expression too large to display	1229
paralelrisch	Expression too large to display	1709

input `int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c),x,method=_RETURNVERBOSE)`

3.1. $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$

output

```
x*(B*b^3*d*m^5*x^10+25*B*b^3*d*m^4*x^10+A*b^3*d*m^5*x^8+3*B*a*b^2*d*m^5*x^8+B*b^3*c*m^5*x^8+230*B*b^3*d*m^3*x^10+27*A*b^3*d*m^4*x^8+81*B*a*b^2*d*m^4*x^8+27*B*b^3*c*m^4*x^8+950*B*b^3*d*m^2*x^10+3*A*a*b^2*d*m^5*x^6+A*b^3*c*m^5*x^6+262*A*b^3*d*m^3*x^8+3*B*a^2*b*d*m^5*x^6+3*B*a*b^2*c*m^5*x^6+786*B*a*b^2*d*m^3*x^8+262*B*b^3*c*m^3*x^8+1689*B*b^3*d*m*x^10+87*A*a*b^2*d*m^4*x^6+29*A*b^3*c*m^4*x^6+1122*A*b^3*d*m^2*x^8+87*B*a^2*b*d*m^4*x^6+87*B*a*b^2*c*m^4*x^6+3366*B*a*b^2*d*m^2*x^8+1122*B*b^3*c*m^2*x^8+945*B*b^3*d*x^10+3*A*a^2*b*d*m^5*x^4+3*A*a*b^2*c*m^5*x^4+906*A*a*b^2*d*m^3*x^6+302*A*b^3*c*m^3*x^6+2041*A*b^3*d*m*x^8+B*a^3*d*m^5*x^4+3*B*a^2*b*c*m^5*x^4+906*B*a^2*b*d*m^3*x^6+906*B*a*b^2*c*m^3*x^6+6123*B*a*b^2*d*m*x^8+2041*B*b^3*c*m*x^8+93*A*a^2*b*d*m^4*x^4+93*A*a*b^2*c*m^4*x^4+4098*A*a*b^2*d*m^2*x^6+1366*A*b^3*c*m^2*x^6+1155*A*b^3*d*x^8+31*B*a^3*d*m^4*x^4+93*B*a^2*b*c*m^4*x^4+4098*B*a^2*b*d*m^2*x^6+4098*B*a*b^2*c*m^2*x^6+3465*B*a*b^2*d*x^8+1155*B*b^3*c*x^8+A*a^3*d*m^5*x^2+3*A*a^2*b*c*m^5*x^2+1050*A*a^2*b*d*m^3*x^4+1050*A*a*b^2*c*m^3*x^4+7731*A*a*b^2*d*m*x^6+2577*A*b^3*c*m*x^6+B*a^3*c*m^5*x^2+350*B*a^3*d*m^3*x^4+1050*B*a^2*b*c*m^3*x^4+7731*B*a^2*b*d*m*x^6+7731*B*a*b^2*c*m*x^6+33*A*a^3*d*m^4*x^2+99*A*a^2*b*c*m^4*x^2+5190*A*a^2*b*d*m^2*x^4+5190*A*a*b^2*c*m^2*x^4+4455*A*a*b^2*d*x^6+1485*A*b^3*c*x^6+33*B*a^3*c*m^4*x^2+1730*B*a^3*d*m^2*x^4+5190*B*a^2*b*c*m^2*x^4+4455*B*a^2*b*d*x^6+4455*B*a*b^2*c*x^6+A*a^3*c*m^5+406*A*a^3*d*m^3*x^2+1218*A*a^2*b*c*m^3*x^2+10467*A*a^2*b*d...
```

3.1.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 911 vs. $2(189) = 378$.

Time = 0.28 (sec) , antiderivative size = 911, normalized size of antiderivative = 4.82

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$$

$$= \frac{((Bb^3dm^5 + 25Bb^3dm^4 + 230Bb^3dm^3 + 950Bb^3dm^2 + 1689Bb^3dm + 945Bb^3d)x^{11} + ((Bb^3c + (3Bab^2$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c),x, algorithm="fricas")`

3.1. $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$

output

```
((B*b^3*d*m^5 + 25*B*b^3*d*m^4 + 230*B*b^3*d*m^3 + 950*B*b^3*d*m^2 + 1689*
B*b^3*d*m + 945*B*b^3*d)*x^11 + ((B*b^3*c + (3*B*a*b^2 + A*b^3)*d)*m^5 + 1
155*B*b^3*c + 27*(B*b^3*c + (3*B*a*b^2 + A*b^3)*d)*m^4 + 262*(B*b^3*c + (3
*B*a*b^2 + A*b^3)*d)*m^3 + 1122*(B*b^3*c + (3*B*a*b^2 + A*b^3)*d)*m^2 + 11
55*(3*B*a*b^2 + A*b^3)*d + 2041*(B*b^3*c + (3*B*a*b^2 + A*b^3)*d)*m)*x^9 +
(((3*B*a*b^2 + A*b^3)*c + 3*(B*a^2*b + A*a*b^2)*d)*m^5 + 29*((3*B*a*b^2 +
A*b^3)*c + 3*(B*a^2*b + A*a*b^2)*d)*m^4 + 302*((3*B*a*b^2 + A*b^3)*c + 3*
(B*a^2*b + A*a*b^2)*d)*m^3 + 1366*((3*B*a*b^2 + A*b^3)*c + 3*(B*a^2*b + A*
a*b^2)*d)*m^2 + 1485*(3*B*a*b^2 + A*b^3)*c + 4455*(B*a^2*b + A*a*b^2)*d +
2577*((3*B*a*b^2 + A*b^3)*c + 3*(B*a^2*b + A*a*b^2)*d)*m)*x^7 + ((3*(B*a^2
*b + A*a*b^2)*c + (B*a^3 + 3*A*a^2*b)*d)*m^5 + 31*(3*(B*a^2*b + A*a*b^2)*c
+ (B*a^3 + 3*A*a^2*b)*d)*m^4 + 350*(3*(B*a^2*b + A*a*b^2)*c + (B*a^3 + 3*
A*a^2*b)*d)*m^3 + 1730*(3*(B*a^2*b + A*a*b^2)*c + (B*a^3 + 3*A*a^2*b)*d)*m
^2 + 6237*(B*a^2*b + A*a*b^2)*c + 2079*(B*a^3 + 3*A*a^2*b)*d + 3489*(3*(B*
a^2*b + A*a*b^2)*c + (B*a^3 + 3*A*a^2*b)*d)*m)*x^5 + ((A*a^3*d + (B*a^3 +
3*A*a^2*b)*c)*m^5 + 3465*A*a^3*d + 33*(A*a^3*d + (B*a^3 + 3*A*a^2*b)*c)*m^
4 + 406*(A*a^3*d + (B*a^3 + 3*A*a^2*b)*c)*m^3 + 2262*(A*a^3*d + (B*a^3 + 3
*A*a^2*b)*c)*m^2 + 3465*(B*a^3 + 3*A*a^2*b)*c + 5353*(A*a^3*d + (B*a^3 + 3
*A*a^2*b)*c)*m)*x^3 + (A*a^3*c*m^5 + 35*A*a^3*c*m^4 + 470*A*a^3*c*m^3 + 30
10*A*a^3*c*m^2 + 9129*A*a^3*c*m + 10395*A*a^3*c)*x)*(e*x)^m/(m^6 + 36*m...
```

3.1.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 5992 vs. $2(184) = 368$.

Time = 0.95 (sec) , antiderivative size = 5992, normalized size of antiderivative = 31.70

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**3*(B*x**2+A)*(d*x**2+c), x)`

output `Piecewise(((-A**3*c/(10*x**10) - A**3*d/(8*x**8) - 3*A**2*b*c/(8*x**8) - A**2*b*d/(2*x**6) - A*b**2*c/(2*x**6) - 3*A*a*b**2*d/(4*x**4) - A*b**3*c/(4*x**4) - A*b**3*d/(2*x**2) - B*a**3*c/(8*x**8) - B*a**3*d/(6*x**6) - B*a**2*b*c/(2*x**6) - 3*B*a**2*b*d/(4*x**4) - 3*B*a*b**2*c/(4*x**4) - 3*B*a*b**2*d/(2*x**2) - B*b**3*c/(2*x**2) + B*b**3*d*log(x))/e**11, Eq(m, -11)), ((-A**3*c/(8*x**8) - A**3*d/(6*x**6) - A**2*b*c/(2*x**6) - 3*A**2*b*d/(4*x**4) - 3*A*a*b**2*c/(4*x**4) - 3*A*a*b**2*d/(2*x**2) - A*b**3*c/(2*x**2) + A*b**3*d*log(x) - B*a**3*c/(6*x**6) - B*a**3*d/(4*x**4) - 3*B*a**2*b*c/(4*x**4) - 3*B*a**2*b*d/(2*x**2) - 3*B*a*b**2*c/(2*x**2) + 3*B*a*b**2*d*log(x) + B*b**3*c*log(x) + B*b**3*d*x**2/2)/e**9, Eq(m, -9)), ((-A**3*c/(6*x**6) - A**3*d/(4*x**4) - 3*A**2*b*c/(4*x**4) - 3*A**2*b*d/(2*x**2) - 3*A*a*b**2*c/(2*x**2) + 3*A*a*b**2*d*log(x) + A*b**3*c*log(x) + A*b**3*d*x**2/2 - B*a**3*c/(4*x**4) - B*a**3*d/(2*x**2) - 3*B*a**2*b*c/(2*x**2) + 3*B*a**2*b*d*log(x) + 3*B*a*b**2*c*log(x) + 3*B*a*b**2*d*x**2/2 + B*b**3*c*x**2/2 + B*b**3*d*x**4/4)/e**7, Eq(m, -7)), ((-A**3*c/(4*x**4) - A**3*d/(2*x**2) - 3*A**2*b*c/(2*x**2) + 3*A**2*b*d*log(x) + 3*A*a*b**2*c*log(x) + 3*A*a*b**2*d*x**2/2 + A*b**3*c*x**2/2 + A*b**3*d*x**4/4 - B*a**3*c/(2*x**2) + B*a**3*d*log(x) + 3*B*a**2*b*c*log(x) + 3*B*a**2*b*d*x**2/2 + 3*B*a*b**2*c*x**2/2 + 3*B*a*b**2*d*x**4/4 + B*b**3*c*x**4/4 + B*b**3*d*x**6/6)/e**5, Eq(m, -5)), ((-A**3*c/(2*x**2) + A**3*d*1...`

3.1.7 Maxima [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 338, normalized size of antiderivative = 1.79

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx = \frac{Bb^3de^m x^{11}x^m}{m+11} + \frac{Bb^3ce^m x^9x^m}{m+9} + \frac{3Bab^2de^m x^9x^m}{m+9} + \frac{Ab^3de^m x^9x^m}{m+9} + \frac{3Bab^2ce^m x^7x^m}{m+7} + \frac{Ab^3ce^m x^7x^m}{m+7} + \frac{3Ba^2bde^m x^7x^m}{m+7} + \frac{3Aab^2de^m x^7x^m}{m+7} + \frac{3Ba^2bce^m x^5x^m}{m+5} + \frac{3Aab^2ce^m x^5x^m}{m+5} + \frac{Ba^3de^m x^5x^m}{m+5} + \frac{3Aa^2bde^m x^5x^m}{m+5} + \frac{Ba^3ce^m x^3x^m}{m+3} + \frac{3Aa^2bce^m x^3x^m}{m+3} + \frac{Aa^3de^m x^3x^m}{m+3} + \frac{(ex)^{m+1} Aa^3c}{e(m+1)}$$

3.1. $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c),x, algorithm="maxima")`

output $B*b^3*d*e^m*x^{11}*x^m/(m + 11) + B*b^3*c*e^m*x^9*x^m/(m + 9) + 3*B*a*b^2*d*e^m*x^9*x^m/(m + 9) + A*b^3*d*e^m*x^9*x^m/(m + 9) + 3*B*a*b^2*c*e^m*x^7*x^m/(m + 7) + A*b^3*c*e^m*x^7*x^m/(m + 7) + 3*B*a^2*b*d*e^m*x^7*x^m/(m + 7) + 3*A*a*b^2*d*e^m*x^7*x^m/(m + 7) + 3*B*a^2*b*c*e^m*x^5*x^m/(m + 5) + 3*A*a*b^2*c*e^m*x^5*x^m/(m + 5) + B*a^3*d*e^m*x^5*x^m/(m + 5) + 3*A*a^2*b*d*e^m*x^5*x^m/(m + 5) + B*a^3*c*e^m*x^3*x^m/(m + 3) + 3*A*a^2*b*c*e^m*x^3*x^m/(m + 3) + A*a^3*d*e^m*x^3*x^m/(m + 3) + (e*x)^{(m + 1)}*A*a^3*c/(e*(m + 1))$

3.1.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1708 vs. $2(189) = 378$.

Time = 0.32 (sec) , antiderivative size = 1708, normalized size of antiderivative = 9.04

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c),x, algorithm="giac")`


```
output ((e*x)^m*B*b^3*d*m^5*x^11 + 25*(e*x)^m*B*b^3*d*m^4*x^11 + (e*x)^m*B*b^3*c*
m^5*x^9 + 3*(e*x)^m*B*a*b^2*d*m^5*x^9 + (e*x)^m*A*b^3*d*m^5*x^9 + 230*(e*x
)^m*B*b^3*d*m^3*x^11 + 27*(e*x)^m*B*b^3*c*m^4*x^9 + 81*(e*x)^m*B*a*b^2*d*m
^4*x^9 + 27*(e*x)^m*A*b^3*d*m^4*x^9 + 950*(e*x)^m*B*b^3*d*m^2*x^11 + 3*(e
x)^m*B*a*b^2*c*m^5*x^7 + (e*x)^m*A*b^3*c*m^5*x^7 + 3*(e*x)^m*B*a^2*b*d*m^5
*x^7 + 3*(e*x)^m*A*a*b^2*d*m^5*x^7 + 262*(e*x)^m*B*b^3*c*m^3*x^9 + 786*(e
x)^m*B*a*b^2*d*m^3*x^9 + 262*(e*x)^m*A*b^3*d*m^3*x^9 + 1689*(e*x)^m*B*b^3
d*m*x^11 + 87*(e*x)^m*B*a*b^2*c*m^4*x^7 + 29*(e*x)^m*A*b^3*c*m^4*x^7 + 87*
(e*x)^m*B*a^2*b*d*m^4*x^7 + 87*(e*x)^m*A*a*b^2*d*m^4*x^7 + 1122*(e*x)^m*B
b^3*c*m^2*x^9 + 3366*(e*x)^m*B*a*b^2*d*m^2*x^9 + 1122*(e*x)^m*A*b^3*d*m^2*
x^9 + 945*(e*x)^m*B*b^3*d*x^11 + 3*(e*x)^m*B*a^2*b*c*m^5*x^5 + 3*(e*x)^m*A
*a*b^2*c*m^5*x^5 + (e*x)^m*B*a^3*d*m^5*x^5 + 3*(e*x)^m*A*a^2*b*d*m^5*x^5 +
906*(e*x)^m*B*a*b^2*c*m^3*x^7 + 302*(e*x)^m*A*b^3*c*m^3*x^7 + 906*(e*x)^m
*B*a^2*b*d*m^3*x^7 + 906*(e*x)^m*A*a*b^2*d*m^3*x^7 + 2041*(e*x)^m*B*b^3*c*
m*x^9 + 6123*(e*x)^m*B*a*b^2*d*m*x^9 + 2041*(e*x)^m*A*b^3*d*m*x^9 + 93*(e
x)^m*B*a^2*b*c*m^4*x^5 + 93*(e*x)^m*A*a*b^2*c*m^4*x^5 + 31*(e*x)^m*B*a^3*d
*m^4*x^5 + 93*(e*x)^m*A*a^2*b*d*m^4*x^5 + 4098*(e*x)^m*B*a*b^2*c*m^2*x^7 +
1366*(e*x)^m*A*b^3*c*m^2*x^7 + 4098*(e*x)^m*B*a^2*b*d*m^2*x^7 + 4098*(e*x
)^m*A*a*b^2*d*m^2*x^7 + 1155*(e*x)^m*B*b^3*c*x^9 + 3465*(e*x)^m*B*a*b^2*d*
x^9 + 1155*(e*x)^m*A*b^3*d*x^9 + (e*x)^m*B*a^3*c*m^5*x^3 + 3*(e*x)^m*A*...
```

3.1.9 Mupad [B] (verification not implemented)

Time = 5.94 (sec) , antiderivative size = 469, normalized size of antiderivative = 2.48

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$$

$$= \frac{a^2 x^3 (ex)^m (Aad + 3Abc + Bac) (m^5 + 33m^4 + 406m^3 + 2262m^2 + 5353m + 3465)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{b^2 x^9 (ex)^m (Abd + 3Bad + Bbc) (m^5 + 27m^4 + 262m^3 + 1122m^2 + 2041m + 1155)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{a x^5 (ex)^m (3Ab^2c + Ba^2d + 3Aabd + 3Babc) (m^5 + 31m^4 + 350m^3 + 1730m^2 + 3489m + 2079)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{b x^7 (ex)^m (Ab^2c + 3Ba^2d + 3Aabd + 3Babc) (m^5 + 29m^4 + 302m^3 + 1366m^2 + 2577m + 1485)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{B b^3 d x^{11} (ex)^m (m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{A a^3 c x (ex)^m (m^5 + 35m^4 + 470m^3 + 3010m^2 + 9129m + 10395)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

```
input int((A + B*x^2)*(e*x)^m*(a + b*x^2)^3*(c + d*x^2),x)
```

$$3.1. \quad \int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2) dx$$

output $(a^2x^3(e^x)^m(Aa^2d + 3Ab^2c + B^2a^2c)(5353m + 2262m^2 + 406m^3 + 33m^4 + m^5 + 3465))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (b^2x^9(e^x)^m(Ab^2d + 3B^2a^2d + B^2b^2c)(2041m + 1122m^2 + 262m^3 + 27m^4 + m^5 + 1155))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (ax^5(e^x)^m(3Ab^2c + B^2a^2d + 3A^2ab^2d + 3B^2a^2b^2c)(3489m + 1730m^2 + 350m^3 + 31m^4 + m^5 + 2079))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (bx^7(e^x)^m(Ab^2c + 3B^2a^2d + 3A^2ab^2d + 3B^2a^2b^2c)(2577m + 1366m^2 + 302m^3 + 29m^4 + m^5 + 1485))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (B^3d^3x^{11}(e^x)^m(1689m + 950m^2 + 230m^3 + 25m^4 + m^5 + 945))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (A^3c^3x(e^x)^m(9129m + 3010m^2 + 470m^3 + 35m^4 + m^5 + 10395))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395)$

3.2 $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$

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3.2.1 Optimal result

Integrand size = 29, antiderivative size = 144

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx = \frac{a^2 Ac(ex)^{1+m}}{e(1+m)} + \frac{a(2Abc + aBc + aAd)(ex)^{3+m}}{e^3(3+m)} + \frac{(aB(2bc + ad) + Ab(bc + 2ad))(ex)^{5+m}}{e^5(5+m)} + \frac{b(bBc + Abd + 2aBd)(ex)^{7+m}}{e^7(7+m)} + \frac{b^2 Bd(ex)^{9+m}}{e^9(9+m)}$$

output `a^2*A*c*(e*x)^(1+m)/e/(1+m)+a*(A*a*d+2*A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)+(a*B*(a*d+2*b*c)+A*b*(2*a*d+b*c))*(e*x)^(5+m)/e^5/(5+m)+b*(A*b*d+2*B*a*d+B*b*c)*(e*x)^(7+m)/e^7/(7+m)+b^2*B*d*(e*x)^(9+m)/e^9/(9+m)`

3.2.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 113, normalized size of antiderivative = 0.78

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx = x(ex)^m \left(\frac{a^2 Ac}{1+m} + \frac{a(2Abc + aBc + aAd)x^2}{3+m} + \frac{(aB(2bc + ad) + Ab(bc + 2ad))x^4}{5+m} + \frac{b(bBc + Abd + 2aBd)x^6}{7+m} + \frac{b^2 Bdx^8}{9+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^2*(A + B*x^2)*(c + d*x^2),x]`

output `x*(e*x)^m*((a^2*A*c)/(1 + m) + (a*(2*A*b*c + a*B*c + a*A*d)*x^2)/(3 + m) + ((a*B*(2*b*c + a*d) + A*b*(b*c + 2*a*d))*x^4)/(5 + m) + (b*(b*B*c + A*b*d + 2*a*B*d)*x^6)/(7 + m) + (b^2*B*d*x^8)/(9 + m))`

3.2.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 144, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.069$, Rules used = {437, 2009}

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

$$\int (a + bx^2)^2 (A + Bx^2) (c + dx^2) (ex)^m dx$$

$$\downarrow 437$$

$$\int \left(a^2 Ac (ex)^m + \frac{b(ex)^{m+6}(2aBd + Abd + bBc)}{e^6} + \frac{(ex)^{m+4}(Ab(2ad + bc) + aB(ad + 2bc))}{e^4} + \frac{a(ex)^{m+2}(aAd + aBc + 2Abc)}{e^2} \right) dx$$

$$\downarrow 2009$$

$$\frac{a^2 Ac (ex)^{m+1}}{e(m+1)} + \frac{b(ex)^{m+7}(2aBd + Abd + bBc)}{e^7(m+7)} + \frac{(ex)^{m+5}(Ab(2ad + bc) + aB(ad + 2bc))}{e^5(m+5)} + \frac{a(ex)^{m+3}(aAd + aBc + 2Abc)}{e^3(m+3)} + \frac{b^2 Bd (ex)^{m+9}}{e^9(m+9)}$$

input `Int[(e*x)^m*(a + b*x^2)^2*(A + B*x^2)*(c + d*x^2),x]`

output `(a^2*A*c*(e*x)^(1 + m))/(e*(1 + m)) + (a*(2*A*b*c + a*B*c + a*A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + ((a*B*(2*b*c + a*d) + A*b*(b*c + 2*a*d))*(e*x)^(5 + m))/(e^5*(5 + m)) + (b*(b*B*c + A*b*d + 2*a*B*d)*(e*x)^(7 + m))/(e^7*(7 + m)) + (b^2*B*d*(e*x)^(9 + m))/(e^9*(9 + m))`

3.2.3.1 Defintions of rubi rules used

```
rule 437 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q
_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(
a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f
, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]
```

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

3.2.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 710 vs. 2(144) = 288.

Time = 3.38 (sec) , antiderivative size = 711, normalized size of antiderivative = 4.94

method	result
gospers	$\frac{x(Bb^2dm^4x^8+16Bb^2dm^3x^8+Ab^2dm^4x^6+2Babdm^4x^6+Bb^2cm^4x^6+86Bb^2dm^2x^8+18Ab^2dm^3x^6+36Babdm^3x^6+18Bb^2cm^3x^6+176Bb^2dm^2x^8+2Aabdm^4x^4+Ab^2cm^4x^4+104Aab^2dm^2x^6+B a^2dm^4x^4+2B aabcm^4x^4+208B aabdm^2x^6+104B b^2cm^2x^6+105B b^2dm^2x^8+40A aabdm^3x^4+20A ab^2cm^3x^4+222A ab^2dm^2x^6+20B a^2dm^3x^4+40B aabcm^3x^4+444B aabdm^2x^6+222B b^2cm^2x^6+A a^2dm^4x^2+2A aabcm^4x^2+260A aabdm^2x^4+130A ab^2cm^2x^4+135A ab^2dm^2x^6+B a^2cm^4x^2+130B a^2dm^2x^4+260B aabcm^2x^4+270B aabdm^2x^6+135B b^2cm^2x^6+22A a^2dm^3x^2+44A aabcm^3x^2+600A aabdm^2x^4+300A ab^2cm^2x^4+22B a^2cm^3x^2+300B a^2dm^2x^4+600B aabcm^2x^2+164A a^2dm^2x^2+328A aabcm^2x^2+378A aabdm^2x^4+189A ab^2cm^2x^2+164B a^2cm^2x^2+189B a^2dm^2x^4+378B aabcm^2x^2+24A a^2cm^3+458A a^2dm^2x^2+916A aabcm^2x^2+458B a^2cm^2x^2+206A a^2cm^2+315A a^2dm^2x^2+630A aabcm^2x^2+315B a^2cm^2x^2+744A a^2cm+945A a^2c)*(e*x)^m/(9+m)/(7+m)/(5+m)/(3+m)/(1+m)$
risch	$\frac{x(Bb^2dm^4x^8+16Bb^2dm^3x^8+Ab^2dm^4x^6+2Babdm^4x^6+Bb^2cm^4x^6+86Bb^2dm^2x^8+18Ab^2dm^3x^6+36Babdm^3x^6+18Bb^2cm^3x^6+176Bb^2dm^2x^8+2Aabdm^4x^4+Ab^2cm^4x^4+104Aab^2dm^2x^6+B a^2dm^4x^4+2B aabcm^4x^4+208B aabdm^2x^6+104B b^2cm^2x^6+105B b^2dm^2x^8+40A aabdm^3x^4+20A ab^2cm^3x^4+222A ab^2dm^2x^6+20B a^2dm^3x^4+40B aabcm^3x^4+444B aabdm^2x^6+222B b^2cm^2x^6+A a^2dm^4x^2+2A aabcm^4x^2+260A aabdm^2x^4+130A ab^2cm^2x^4+135A ab^2dm^2x^6+B a^2cm^4x^2+130B a^2dm^2x^4+260B aabcm^2x^4+270B aabdm^2x^6+135B b^2cm^2x^6+22A a^2dm^3x^2+44A aabcm^3x^2+600A aabdm^2x^4+300A ab^2cm^2x^4+22B a^2cm^3x^2+300B a^2dm^2x^4+600B aabcm^2x^2+164A a^2dm^2x^2+328A aabcm^2x^2+378A aabdm^2x^4+189A ab^2cm^2x^2+164B a^2cm^2x^2+189B a^2dm^2x^4+378B aabcm^2x^2+24A a^2cm^3+458A a^2dm^2x^2+916A aabcm^2x^2+458B a^2cm^2x^2+206A a^2cm^2+315A a^2dm^2x^2+630A aabcm^2x^2+315B a^2cm^2x^2+744A a^2cm+945A a^2c)*(e*x)^m/(9+m)/(7+m)/(5+m)/(3+m)/(1+m)$
parallelrisc	Expression too large to display

```
input int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c),x,method=_RETURNVERBOSE)
```

```
output x*(B*b^2*d*m^4*x^8+16*B*b^2*d*m^3*x^8+A*b^2*d*m^4*x^6+2*B*a*b*d*m^4*x^6+B
b^2*c*m^4*x^6+86*B*b^2*d*m^2*x^8+18*A*b^2*d*m^3*x^6+36*B*a*b*d*m^3*x^6+18*
B*b^2*c*m^3*x^6+176*B*b^2*d*m*x^8+2*A*a*b*d*m^4*x^4+A*b^2*c*m^4*x^4+104*A*
b^2*d*m^2*x^6+B*a^2*d*m^4*x^4+2*B*a*b*c*m^4*x^4+208*B*a*b*d*m^2*x^6+104*B*
b^2*c*m^2*x^6+105*B*b^2*d*x^8+40*A*a*b*d*m^3*x^4+20*A*b^2*c*m^3*x^4+222*A*
b^2*d*m*x^6+20*B*a^2*d*m^3*x^4+40*B*a*b*c*m^3*x^4+444*B*a*b*d*m*x^6+222*B*
b^2*c*m*x^6+A*a^2*d*m^4*x^2+2*A*a*b*c*m^4*x^2+260*A*a*b*d*m^2*x^4+130*A*b^
2*c*m^2*x^4+135*A*b^2*d*x^6+B*a^2*c*m^4*x^2+130*B*a^2*d*m^2*x^4+260*B*a*b*
c*m^2*x^4+270*B*a*b*d*x^6+135*B*b^2*c*x^6+22*A*a^2*d*m^3*x^2+44*A*a*b*c*m^
3*x^2+600*A*a*b*d*m*x^4+300*A*b^2*c*m*x^4+22*B*a^2*c*m^3*x^2+300*B*a^2*d*m
*x^4+600*B*a*b*c*m*x^4+A*a^2*c*m^4+164*A*a^2*d*m^2*x^2+328*A*a*b*c*m^2*x^2
+378*A*a*b*d*x^4+189*A*b^2*c*x^4+164*B*a^2*c*m^2*x^2+189*B*a^2*d*x^4+378*B
*a*b*c*x^4+24*A*a^2*c*m^3+458*A*a^2*d*m*x^2+916*A*a*b*c*m*x^2+458*B*a^2*c*
m*x^2+206*A*a^2*c*m^2+315*A*a^2*d*x^2+630*A*a*b*c*x^2+315*B*a^2*c*x^2+744*
A*a^2*c*m+945*A*a^2*c)*(e*x)^m/(9+m)/(7+m)/(5+m)/(3+m)/(1+m)
```

$$3.2. \int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$$

3.2.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 532 vs. $2(144) = 288$.

Time = 0.28 (sec) , antiderivative size = 532, normalized size of antiderivative = 3.69

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$$

$$= \frac{((Bb^2dm^4 + 16Bb^2dm^3 + 86Bb^2dm^2 + 176Bb^2dm + 105Bb^2d)x^9 + ((Bb^2c + (2Bab + Ab^2)d)m^4 + 135$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c),x, algorithm="fricas")`

output `((B*b^2*d*m^4 + 16*B*b^2*d*m^3 + 86*B*b^2*d*m^2 + 176*B*b^2*d*m + 105*B*b^2*d)*x^9 + ((B*b^2*c + (2*B*a*b + A*b^2)*d)*m^4 + 135*B*b^2*c + 18*(B*b^2*c + (2*B*a*b + A*b^2)*d)*m^3 + 104*(B*b^2*c + (2*B*a*b + A*b^2)*d)*m^2 + 135*(2*B*a*b + A*b^2)*d + 222*(B*b^2*c + (2*B*a*b + A*b^2)*d)*m*x^7 + (((2*B*a*b + A*b^2)*c + (B*a^2 + 2*A*a*b)*d)*m^4 + 20*((2*B*a*b + A*b^2)*c + (B*a^2 + 2*A*a*b)*d)*m^3 + 130*((2*B*a*b + A*b^2)*c + (B*a^2 + 2*A*a*b)*d)*m^2 + 189*(2*B*a*b + A*b^2)*c + 189*(B*a^2 + 2*A*a*b)*d + 300*((2*B*a*b + A*b^2)*c + (B*a^2 + 2*A*a*b)*d)*m*x^5 + ((A*a^2*d + (B*a^2 + 2*A*a*b)*c)*m^4 + 315*A*a^2*d + 22*(A*a^2*d + (B*a^2 + 2*A*a*b)*c)*m^3 + 164*(A*a^2*d + (B*a^2 + 2*A*a*b)*c)*m^2 + 315*(B*a^2 + 2*A*a*b)*c + 458*(A*a^2*d + (B*a^2 + 2*A*a*b)*c)*m*x^3 + (A*a^2*c*m^4 + 24*A*a^2*c*m^3 + 206*A*a^2*c*m^2 + 744*A*a^2*c*m + 945*A*a^2*c)*x)*(e*x)^m/(m^5 + 25*m^4 + 230*m^3 + 950*m^2 + 1689*m + 945)`

3.2.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 3271 vs. $2(139) = 278$.

Time = 0.66 (sec) , antiderivative size = 3271, normalized size of antiderivative = 22.72

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**2*(B*x**2+A)*(d*x**2+c),x)`

output `Piecewise(((-A**2*c/(8*x**8) - A**2*d/(6*x**6) - A*b*c/(3*x**6) - A*b*d/(2*x**4) - B**2*c/(4*x**4) - B**2*d/(2*x**2) - B**2*c/(6*x**6) - B**2*d/(4*x**4) - B*b*c/(2*x**4) - B*b*d/x**2 - B**2*c/(2*x**2) + B**2*d*log(x))/e**9, Eq(m, -9)), ((-A**2*c/(6*x**6) - A**2*d/(4*x**4) - A*b*c/(2*x**4) - A*b*d/x**2 - B**2*c/(2*x**2) + A**2*d*log(x) - B**2*c/(4*x**4) - B**2*d/(2*x**2) - B*b*c/x**2 + 2*B*b*d*log(x) + B**2*c*log(x) + B**2*d*x**2/2)/e**7, Eq(m, -7)), ((-A**2*c/(4*x**4) - A**2*d/(2*x**2) - A*b*c/x**2 + 2*A*b*d*log(x) + A**2*c*log(x) + A**2*d*x**2/2 - B**2*c/(2*x**2) + B**2*d*log(x) + 2*B*b*c*log(x) + B*a*b*d*x**2 + B**2*c*x**2/2 + B**2*d*x**4/4)/e**5, Eq(m, -5)), ((-A**2*c/(2*x**2) + A**2*d*log(x) + 2*A*b*c*log(x) + A*b*d*x**2 + A**2*c*x**2/2 + A**2*d*x**4/4 + B**2*c*log(x) + B**2*d*x**2/2 + B*a*b*c*x**2 + B*a*b*d*x**4/2 + B**2*c*x**4/4 + B**2*d*x**6/6)/e**3, Eq(m, -3)), ((A**2*c*log(x) + A**2*d*x**2/2 + A*b*c*x**2 + A*b*d*x**4/2 + A**2*c*x**4/4 + A**2*d*x**6/6 + B**2*c*x**2/2 + B**2*d*x**4/4 + B*a*b*c*x**4/2 + B*a*b*d*x**6/3 + B**2*c*x**6/6 + B**2*d*x**8/8)/e, Eq(m, -1)), (A**2*c*m**4*x*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 24*A**2*c*m**3*x*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 206*A**2*c*m**2*x*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 744*A**2*c*m*x*(e*x)**m/(m...`

3.2.7 Maxima [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 242, normalized size of antiderivative = 1.68

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx = \frac{Bb^2de^m x^9 x^m}{m+9} + \frac{Bb^2ce^m x^7 x^m}{m+7} + \frac{2Babde^m x^7 x^m}{m+7} + \frac{Ab^2de^m x^7 x^m}{m+7} + \frac{2Babce^m x^5 x^m}{m+5} + \frac{Ab^2ce^m x^5 x^m}{m+5} + \frac{Ba^2de^m x^5 x^m}{m+5} + \frac{2Aabde^m x^5 x^m}{m+5} + \frac{Ba^2ce^m x^3 x^m}{m+3} + \frac{2Aabce^m x^3 x^m}{m+3} + \frac{Aa^2de^m x^3 x^m}{m+3} + \frac{(ex)^{m+1} Aa^2c}{e(m+1)}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c),x, algorithm="maxima")`

3.2. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$

```
output B*b^2*d*e^m*x^9*x^m/(m + 9) + B*b^2*c*e^m*x^7*x^m/(m + 7) + 2*B*a*b*d*e^m*
x^7*x^m/(m + 7) + A*b^2*d*e^m*x^7*x^m/(m + 7) + 2*B*a*b*c*e^m*x^5*x^m/(m +
5) + A*b^2*c*e^m*x^5*x^m/(m + 5) + B*a^2*d*e^m*x^5*x^m/(m + 5) + 2*A*a*b*
d*e^m*x^5*x^m/(m + 5) + B*a^2*c*e^m*x^3*x^m/(m + 3) + 2*A*a*b*c*e^m*x^3*x^
m/(m + 3) + A*a^2*d*e^m*x^3*x^m/(m + 3) + (e*x)^(m + 1)*A*a^2*c/(e*(m + 1)
)
```

3.2.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1009 vs. $2(144) = 288$.

Time = 0.30 (sec) , antiderivative size = 1009, normalized size of antiderivative = 7.01

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$$

$$= (ex)^m Bb^2 dm^4 x^9 + 16 (ex)^m Bb^2 dm^3 x^9 + (ex)^m Bb^2 cm^4 x^7 + 2 (ex)^m Babdm^4 x^7 + (ex)^m Ab^2 dm^4 x^7 + 86$$

```
input integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c),x, algorithm="giac")
```

```
output ((e*x)^m*B*b^2*d*m^4*x^9 + 16*(e*x)^m*B*b^2*d*m^3*x^9 + (e*x)^m*B*b^2*c*m^
4*x^7 + 2*(e*x)^m*B*a*b*d*m^4*x^7 + (e*x)^m*A*b^2*d*m^4*x^7 + 86*(e*x)^m*B
*b^2*d*m^2*x^9 + 18*(e*x)^m*B*b^2*c*m^3*x^7 + 36*(e*x)^m*B*a*b*d*m^3*x^7 +
18*(e*x)^m*A*b^2*d*m^3*x^7 + 176*(e*x)^m*B*b^2*d*m*x^9 + 2*(e*x)^m*B*a*b*
c*m^4*x^5 + (e*x)^m*A*b^2*c*m^4*x^5 + (e*x)^m*B*a^2*d*m^4*x^5 + 2*(e*x)^m*
A*a*b*d*m^4*x^5 + 104*(e*x)^m*B*b^2*c*m^2*x^7 + 208*(e*x)^m*B*a*b*d*m^2*x^
7 + 104*(e*x)^m*A*b^2*d*m^2*x^7 + 105*(e*x)^m*B*b^2*d*x^9 + 40*(e*x)^m*B*a
*b*c*m^3*x^5 + 20*(e*x)^m*A*b^2*c*m^3*x^5 + 20*(e*x)^m*B*a^2*d*m^3*x^5 + 4
0*(e*x)^m*A*a*b*d*m^3*x^5 + 222*(e*x)^m*B*b^2*c*m*x^7 + 444*(e*x)^m*B*a*b*
d*m*x^7 + 222*(e*x)^m*A*b^2*d*m*x^7 + (e*x)^m*B*a^2*c*m^4*x^3 + 2*(e*x)^m*
A*a*b*c*m^4*x^3 + (e*x)^m*A*a^2*d*m^4*x^3 + 260*(e*x)^m*B*a*b*c*m^2*x^5 +
130*(e*x)^m*A*b^2*c*m^2*x^5 + 130*(e*x)^m*B*a^2*d*m^2*x^5 + 260*(e*x)^m*A*
a*b*d*m^2*x^5 + 135*(e*x)^m*B*b^2*c*x^7 + 270*(e*x)^m*B*a*b*d*x^7 + 135*(e
*x)^m*A*b^2*d*x^7 + 22*(e*x)^m*B*a^2*c*m^3*x^3 + 44*(e*x)^m*A*a*b*c*m^3*x^
3 + 22*(e*x)^m*A*a^2*d*m^3*x^3 + 600*(e*x)^m*B*a*b*c*m*x^5 + 300*(e*x)^m*A
*b^2*c*m*x^5 + 300*(e*x)^m*B*a^2*d*m*x^5 + 600*(e*x)^m*A*a*b*d*m*x^5 + (e
*x)^m*A*a^2*c*m^4*x + 164*(e*x)^m*B*a^2*c*m^2*x^3 + 328*(e*x)^m*A*a*b*c*m^2
*x^3 + 164*(e*x)^m*A*a^2*d*m^2*x^3 + 378*(e*x)^m*B*a*b*c*x^5 + 189*(e*x)^m
*A*b^2*c*x^5 + 189*(e*x)^m*B*a^2*d*x^5 + 378*(e*x)^m*A*a*b*d*x^5 + 24*(e*x
)^m*A*a^2*c*m^3*x + 458*(e*x)^m*B*a^2*c*m*x^3 + 916*(e*x)^m*A*a*b*c*m*x...
```

3.2. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$

3.2.9 Mupad [B] (verification not implemented)

Time = 5.63 (sec) , antiderivative size = 305, normalized size of antiderivative = 2.12

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2) dx$$

$$= (ex)^m \left(\frac{x^5 (Ab^2c + Ba^2d + 2Aabd + 2Babc) (m^4 + 20m^3 + 130m^2 + 300m + 189)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} \right.$$

$$+ \frac{ax^3 (Aad + 2Abc + Bac) (m^4 + 22m^3 + 164m^2 + 458m + 315)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$+ \frac{bx^7 (Abd + 2Bad + Bbc) (m^4 + 18m^3 + 104m^2 + 222m + 135)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$+ \frac{Aa^2cx (m^4 + 24m^3 + 206m^2 + 744m + 945)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$\left. + \frac{Bb^2dx^9 (m^4 + 16m^3 + 86m^2 + 176m + 105)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} \right)$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^2*(c + d*x^2),x)`

output `(e*x)^m*((x^5*(A*b^2*c + B*a^2*d + 2*A*a*b*d + 2*B*a*b*c)*(300*m + 130*m^2 + 20*m^3 + m^4 + 189))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (a*x^3*(A*a*d + 2*A*b*c + B*a*c)*(458*m + 164*m^2 + 22*m^3 + m^4 + 315))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (b*x^7*(A*b*d + 2*B*a*d + B*b*c)*(222*m + 104*m^2 + 18*m^3 + m^4 + 135))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (A*a^2*c*x*(744*m + 206*m^2 + 24*m^3 + m^4 + 945))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (B*b^2*d*x^9*(176*m + 86*m^2 + 16*m^3 + m^4 + 105))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945))`

3.3 $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx$

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3.3.1 Optimal result

Integrand size = 27, antiderivative size = 97

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx = \frac{aAc(ex)^{1+m}}{e(1+m)} + \frac{(Abc + aBc + aAd)(ex)^{3+m}}{e^3(3+m)} + \frac{(bBc + Abd + aBd)(ex)^{5+m}}{e^5(5+m)} + \frac{bBd(ex)^{7+m}}{e^7(7+m)}$$

```
output a*A*c*(e*x)^(1+m)/e/(1+m)+(A*a*d+A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)+(A*b*d
+B*a*d+B*b*c)*(e*x)^(5+m)/e^5/(5+m)+b*B*d*(e*x)^(7+m)/e^7/(7+m)
```

3.3.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 73, normalized size of antiderivative = 0.75

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx = x(ex)^m \left(\frac{aAc}{1+m} + \frac{(Abc + aBc + aAd)x^2}{3+m} + \frac{(bBc + Abd + aBd)x^4}{5+m} + \frac{bBdx^6}{7+m} \right)$$

```
input Integrate[(e*x)^m*(a + b*x^2)*(A + B*x^2)*(c + d*x^2),x]
```

```
output x*(e*x)^m*((a*A*c)/(1+m) + ((A*b*c + a*B*c + a*A*d)*x^2)/(3+m) + ((b*B
*c + A*b*d + a*B*d)*x^4)/(5+m) + (b*B*d*x^6)/(7+m))
```

3.3.3 Rubi [A] (verified)

Time = 0.24 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.074$, Rules used = {437, 2009}

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

$$\int (a + bx^2) (A + Bx^2) (c + dx^2) (ex)^m dx$$

$$\downarrow 437$$

$$\int \left(\frac{(ex)^{m+4}(aBd + Abd + bBc)}{e^4} + \frac{(ex)^{m+2}(aAd + aBc + Abc)}{e^2} + aAc(ex)^m + \frac{bBd(ex)^{m+6}}{e^6} \right) dx$$

$$\downarrow 2009$$

$$\frac{(ex)^{m+5}(aBd + Abd + bBc)}{e^5(m+5)} + \frac{(ex)^{m+3}(aAd + aBc + Abc)}{e^3(m+3)} + \frac{aAc(ex)^{m+1}}{e(m+1)} + \frac{bBd(ex)^{m+7}}{e^7(m+7)}$$

input `Int[(e*x)^m*(a + b*x^2)*(A + B*x^2)*(c + d*x^2),x]`

output `(a*A*c*(e*x)^(1 + m))/(e*(1 + m)) + ((A*b*c + a*B*c + a*A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + ((b*B*c + A*b*d + a*B*d)*(e*x)^(5 + m))/(e^5*(5 + m)) + (b*B*d*(e*x)^(7 + m))/(e^7*(7 + m))`

3.3.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.3.4 Maple [A] (verified)

Time = 0.09 (sec) , antiderivative size = 96, normalized size of antiderivative = 0.99

method	result
norman	$\frac{(Abd+Bad+Bbc)x^5 e^{m \ln(ex)}}{5+m} + \frac{(Aad+Abc+Bac)x^3 e^{m \ln(ex)}}{3+m} + \frac{Aacx e^{m \ln(ex)}}{1+m} + \frac{Bbdx^7 e^{m \ln(ex)}}{7+m}$
gosper	$x(Bbdm^3x^6+9Bbdm^2x^6+Abdm^3x^4+Badm^3x^4+Bbcm^3x^4+23Bbdm x^6+11Abdm^2x^4+11Badm^2x^4+11Bbcm^2x^4+15Bbdm^2x^6)$
risch	$x(Bbdm^3x^6+9Bbdm^2x^6+Abdm^3x^4+Badm^3x^4+Bbcm^3x^4+23Bbdm x^6+11Abdm^2x^4+11Badm^2x^4+11Bbcm^2x^4+15Bbdm^2x^6)$
parallelrisch	$Ax^3(ex)^m adm^3 + Ax^3(ex)^m bcm^3 + 31Bx^5(ex)^m adm + 31Bx^5(ex)^m bcm + Bx^3(ex)^m acm^3 + 13Ax^3(ex)^m adm^2 + 13Ax^3(ex)^m bcm^2$

input `int((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c),x,method=_RETURNVERBOSE)`

output `(A*b*d+B*a*d+B*b*c)/(5+m)*x^5*exp(m*ln(e*x))+(A*a*d+A*b*c+B*a*c)/(3+m)*x^3*exp(m*ln(e*x))+A*a*c/(1+m)*x*exp(m*ln(e*x))+B*b*d/(7+m)*x^7*exp(m*ln(e*x))`

3.3.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 235 vs. 2(97) = 194.

Time = 0.34 (sec) , antiderivative size = 235, normalized size of antiderivative = 2.42

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx$$

$$= \frac{((Bbdm^3 + 9Bbdm^2 + 23Bbdm + 15Bbd)x^7 + ((Bbc + (Ba + Ab)d)m^3 + 21Bbc + 11(Bbc + (Ba + Ab)d)m^2 + 21Bbc + 11(Bbc + (Ba + Ab)d)m + 15Bbd)x^5 + ((Aad + (Ba + Ab)c)m^3 + 35Aad + 13(Aad + (Ba + Ab)c)m^2 + 35(Ba + Ab)c + 47(Aad + (Ba + Ab)c)m)x^3 + (Aacm^3 + 15Aacm^2 + 71Aacm + 105Aac)x) * (ex)^m / (m^4 + 16m^3 + 86m^2 + 176m + 105)}$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c),x, algorithm="fricas")`

output `((B*b*d*m^3 + 9*B*b*d*m^2 + 23*B*b*d*m + 15*B*b*d)*x^7 + ((B*b*c + (B*a + A*b)*d)*m^3 + 21*B*b*c + 11*(B*b*c + (B*a + A*b)*d)*m^2 + 21*(B*a + A*b)*d + 31*(B*b*c + (B*a + A*b)*d)*m)*x^5 + ((A*a*d + (B*a + A*b)*c)*m^3 + 35*A*a*d + 13*(A*a*d + (B*a + A*b)*c)*m^2 + 35*(B*a + A*b)*c + 47*(A*a*d + (B*a + A*b)*c)*m)*x^3 + (A*a*c*m^3 + 15*A*a*c*m^2 + 71*A*a*c*m + 105*A*a*c)*x*(e*x)^m/(m^4 + 16*m^3 + 86*m^2 + 176*m + 105)`

3.3.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1460 vs. $2(92) = 184$.

Time = 0.46 (sec) , antiderivative size = 1460, normalized size of antiderivative = 15.05

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)*(B*x**2+A)*(d*x**2+c),x)`

output `Piecewise(((-A*a*c/(6*x**6) - A*a*d/(4*x**4) - A*b*c/(4*x**4) - A*b*d/(2*x**2) - B*a*c/(4*x**4) - B*a*d/(2*x**2) - B*b*c/(2*x**2) + B*b*d*log(x))/e**7, Eq(m, -7)), ((-A*a*c/(4*x**4) - A*a*d/(2*x**2) - A*b*c/(2*x**2) + A*b*d*log(x) - B*a*c/(2*x**2) + B*a*d*log(x) + B*b*c*log(x) + B*b*d*x**2/2)/e**5, Eq(m, -5)), ((-A*a*c/(2*x**2) + A*a*d*log(x) + A*b*c*log(x) + A*b*d*x**2/2 + B*a*c*log(x) + B*a*d*x**2/2 + B*b*c*x**2/2 + B*b*d*x**4/4)/e**3, Eq(m, -3)), ((A*a*c*log(x) + A*a*d*x**2/2 + A*b*c*x**2/2 + A*b*d*x**4/4 + B*a*c*x**2/2 + B*a*d*x**4/4 + B*b*c*x**4/4 + B*b*d*x**6/6)/e, Eq(m, -1)), (A*a*c*m**3*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 15*A*a*c*m**2*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 71*A*a*c*m*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 105*A*a*c*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + A*a*d*m**3*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 13*A*a*d*m**2*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 47*A*a*d*m*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 35*A*a*d*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + A*b*c*m**3*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 13*A*b*c*m**2*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 47*A*b*c*m*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 35*A*b*c*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + A*b*d*m**3*x**5*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 11*A*b*d*m...`

3.3.7 Maxima [A] (verification not implemented)

Time = 0.22 (sec) , antiderivative size = 146, normalized size of antiderivative = 1.51

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx = \frac{Bbde^m x^7 x^m}{m+7} + \frac{Bbce^m x^5 x^m}{m+5} + \frac{Bade^m x^5 x^m}{m+5} + \frac{Abde^m x^5 x^m}{m+5} + \frac{Bace^m x^3 x^m}{m+3} + \frac{Abce^m x^3 x^m}{m+3} + \frac{Aade^m x^3 x^m}{m+3} + \frac{(ex)^{m+1} Aac}{e(m+1)}$$

3.3. $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c),x, algorithm="maxima")`

output $B*b*d*e^m*x^7*x^m/(m + 7) + B*b*c*e^m*x^5*x^m/(m + 5) + B*a*d*e^m*x^5*x^m/(m + 5) + A*b*d*e^m*x^5*x^m/(m + 5) + B*a*c*e^m*x^3*x^m/(m + 3) + A*b*c*e^m*x^3*x^m/(m + 3) + A*a*d*e^m*x^3*x^m/(m + 3) + (e*x)^{(m + 1)}*A*a*c/(e*(m + 1))$

3.3.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 478 vs. $2(97) = 194$.

Time = 0.31 (sec) , antiderivative size = 478, normalized size of antiderivative = 4.93

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx$$

$$= \frac{(ex)^m Bbdm^3x^7 + 9(ex)^m Bbdm^2x^7 + (ex)^m Bbcm^3x^5 + (ex)^m Badm^3x^5 + (ex)^m Abdm^3x^5 + 23(ex)^m E}{}$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c),x, algorithm="giac")`

output $((e*x)^m*B*b*d*m^3*x^7 + 9*(e*x)^m*B*b*d*m^2*x^7 + (e*x)^m*B*b*c*m^3*x^5 + (e*x)^m*B*a*d*m^3*x^5 + (e*x)^m*A*b*d*m^3*x^5 + 23*(e*x)^m*B*b*d*m*x^7 + 11*(e*x)^m*B*b*c*m^2*x^5 + 11*(e*x)^m*B*a*d*m^2*x^5 + 11*(e*x)^m*A*b*d*m^2*x^5 + 15*(e*x)^m*B*b*d*x^7 + (e*x)^m*B*a*c*m^3*x^3 + (e*x)^m*A*b*c*m^3*x^3 + (e*x)^m*A*a*d*m^3*x^3 + 31*(e*x)^m*B*b*c*m*x^5 + 31*(e*x)^m*B*a*d*m*x^5 + 31*(e*x)^m*A*b*d*m*x^5 + 13*(e*x)^m*B*a*c*m^2*x^3 + 13*(e*x)^m*A*b*c*m^2*x^3 + 13*(e*x)^m*A*a*d*m^2*x^3 + 21*(e*x)^m*B*b*c*x^5 + 21*(e*x)^m*B*a*d*x^5 + 21*(e*x)^m*A*b*d*x^5 + (e*x)^m*A*a*c*m^3*x + 47*(e*x)^m*B*a*c*m*x^3 + 47*(e*x)^m*A*b*c*m*x^3 + 47*(e*x)^m*A*a*d*m*x^3 + 15*(e*x)^m*A*a*c*m^2*x + 35*(e*x)^m*B*a*c*x^3 + 35*(e*x)^m*A*b*c*x^3 + 35*(e*x)^m*A*a*d*x^3 + 71*(e*x)^m*A*a*c*m*x + 105*(e*x)^m*A*a*c*x)/(m^4 + 16*m^3 + 86*m^2 + 176*m + 105)$

3.3.9 Mupad [B] (verification not implemented)

Time = 5.57 (sec) , antiderivative size = 185, normalized size of antiderivative = 1.91

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2) dx$$

$$= (ex)^m \left(\frac{x^3 (Aad + Abc + Bac) (m^3 + 13m^2 + 47m + 35)}{m^4 + 16m^3 + 86m^2 + 176m + 105} \right. \\ \left. + \frac{x^5 (Abd + Bad + Bbc) (m^3 + 11m^2 + 31m + 21)}{m^4 + 16m^3 + 86m^2 + 176m + 105} \right. \\ \left. + \frac{Bbdx^7 (m^3 + 9m^2 + 23m + 15)}{m^4 + 16m^3 + 86m^2 + 176m + 105} + \frac{Aacx (m^3 + 15m^2 + 71m + 105)}{m^4 + 16m^3 + 86m^2 + 176m + 105} \right)$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)*(c + d*x^2),x)`output `(e*x)^m*((x^3*(A*a*d + A*b*c + B*a*c)*(47*m + 13*m^2 + m^3 + 35))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105) + (x^5*(A*b*d + B*a*d + B*b*c)*(31*m + 11*m^2 + m^3 + 21))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105) + (B*b*d*x^7*(23*m + 9*m^2 + m^3 + 15))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105) + (A*a*c*x*(71*m + 15*m^2 + m^3 + 105))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105))`

3.4 $\int (ex)^m (A + Bx^2) (c + dx^2) dx$

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3.4.1 Optimal result

Integrand size = 20, antiderivative size = 60

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx = \frac{Ac(ex)^{1+m}}{e(1+m)} + \frac{(Bc + Ad)(ex)^{3+m}}{e^3(3+m)} + \frac{Bd(ex)^{5+m}}{e^5(5+m)}$$

output `A*c*(e*x)^(1+m)/e/(1+m)+(A*d+B*c)*(e*x)^(3+m)/e^3/(3+m)+B*d*(e*x)^(5+m)/e^5/(5+m)`

3.4.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 43, normalized size of antiderivative = 0.72

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx = x(ex)^m \left(\frac{Ac}{1+m} + \frac{(Bc + Ad)x^2}{3+m} + \frac{Bdx^4}{5+m} \right)$$

input `Integrate[(e*x)^m*(A + B*x^2)*(c + d*x^2),x]`

output `x*(e*x)^m*((A*c)/(1+m) + ((B*c + A*d)*x^2)/(3+m) + (B*d*x^4)/(5+m))`

3.4.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.100$, Rules used = {355, 2009}

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

$$\int (A + Bx^2) (c + dx^2) (ex)^m dx$$

$$\downarrow \text{355}$$

$$\int \left(\frac{(ex)^{m+2}(Ad + Bc)}{e^2} + Ac(ex)^m + \frac{Bd(ex)^{m+4}}{e^4} \right) dx$$

$$\downarrow \text{2009}$$

$$\frac{(ex)^{m+3}(Ad + Bc)}{e^3(m + 3)} + \frac{Ac(ex)^{m+1}}{e(m + 1)} + \frac{Bd(ex)^{m+5}}{e^5(m + 5)}$$

input `Int[(e*x)^m*(A + B*x^2)*(c + d*x^2),x]`

output `(A*c*(e*x)^(1 + m))/(e*(1 + m)) + ((B*c + A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + (B*d*(e*x)^(5 + m))/(e^5*(5 + m))`

3.4.3.1 Defintions of rubi rules used

rule 355 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^q, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && IGtQ[p, 0] && IGtQ[q, 0]`

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

3.4.4 Maple [A] (verified)

Time = 0.06 (sec) , antiderivative size = 59, normalized size of antiderivative = 0.98

method	result
norman	$\frac{(Ad+Bc)x^3e^{m \ln(ex)}}{3+m} + \frac{Acxe^{m \ln(ex)}}{1+m} + \frac{Bdx^5e^{m \ln(ex)}}{5+m}$
gosper	$\frac{x(Bdm^2x^4+4Bdmx^4+Adm^2x^2+Bcm^2x^2+3Bdx^4+6Admx^2+6Bcmx^2+Ac m^2+5Adx^2+5Bcx^2+8Acm+15Ac)(ex)^m}{(5+m)(3+m)(1+m)}$
risch	$\frac{x(Bdm^2x^4+4Bdmx^4+Adm^2x^2+Bcm^2x^2+3Bdx^4+6Admx^2+6Bcmx^2+Ac m^2+5Adx^2+5Bcx^2+8Acm+15Ac)(ex)^m}{(5+m)(3+m)(1+m)}$
parallelrisch	$\frac{Bx^5(ex)^m dm^2+4Bx^5(ex)^m dm+Ax^3(ex)^m dm^2+3Bx^5(ex)^m d+Bx^3(ex)^m cm^2+6Ax^3(ex)^m dm+6Bx^3(ex)^m cm+5Ax^3}{(5+m)(3+m)(1+m)}$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c),x,method=_RETURNVERBOSE)`

output `(A*d+B*c)/(3+m)*x^3*exp(m*ln(e*x))+A*c/(1+m)*x*exp(m*ln(e*x))+B*d/(5+m)*x^5*exp(m*ln(e*x))`

3.4.5 Fracas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 94, normalized size of antiderivative = 1.57

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx = \frac{((Bdm^2 + 4 Bdm + 3 Bd)x^5 + ((Bc + Ad)m^2 + 5 Bc + 5 Ad + 6 (Bc + Ad)m)x^3 + (Acm^2 + 8 Acm + 15 Ac)) (ex)^m}{m^3 + 9 m^2 + 23 m + 15}$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c),x, algorithm="fracas")`

output `((B*d*m^2 + 4*B*d*m + 3*B*d)*x^5 + ((B*c + A*d)*m^2 + 5*B*c + 5*A*d + 6*(B*c + A*d)*m)*x^3 + (A*c*m^2 + 8*A*c*m + 15*A*c)*x*(e*x)^m/(m^3 + 9*m^2 + 23*m + 15)`

3.4.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 439 vs. $2(51) = 102$.

Time = 0.32 (sec) , antiderivative size = 439, normalized size of antiderivative = 7.32

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx$$

$$= \begin{cases} \frac{-\frac{Ac}{4x^4} - \frac{Ad}{2x^2} - \frac{Bc}{2x^2} + Bd \log(x)}{e^5} \\ \frac{-\frac{Ac}{2x^2} + Ad \log(x) + Bc \log(x) + \frac{Bdx^2}{2}}{e^3} \\ \frac{Ac \log(x) + \frac{Adx^2}{2} + \frac{Bcx^2}{2} + \frac{Bdx^4}{4}}{e} \\ \frac{Ac m^2 x (ex)^m}{m^3 + 9m^2 + 23m + 15} + \frac{8Ac m x (ex)^m}{m^3 + 9m^2 + 23m + 15} + \frac{15Ac x (ex)^m}{m^3 + 9m^2 + 23m + 15} + \frac{Ad m^2 x^3 (ex)^m}{m^3 + 9m^2 + 23m + 15} + \frac{6Ad m x^3 (ex)^m}{m^3 + 9m^2 + 23m + 15} + \frac{5Ad x^3 (ex)^m}{m^3 + 9m^2 + 23m + 15} \end{cases}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c),x)`

output `Piecewise(((-A*c/(4*x**4) - A*d/(2*x**2) - B*c/(2*x**2) + B*d*log(x))/e**5, Eq(m, -5)), ((-A*c/(2*x**2) + A*d*log(x) + B*c*log(x) + B*d*x**2/2)/e**3, Eq(m, -3)), ((A*c*log(x) + A*d*x**2/2 + B*c*x**2/2 + B*d*x**4/4)/e, Eq(m, -1)), (A*c*m**2*x*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 8*A*c*m*x*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 15*A*c*x*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + A*d*m**2*x**3*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 6*A*d*m*x**3*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 5*A*d*x**3*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + B*c*m**2*x**3*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 6*B*c*m*x**3*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 5*B*c*x**3*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + B*d*m**2*x**5*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 4*B*d*m*x**5*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15) + 3*B*d*x**5*(e*x)**m/(m**3 + 9*m**2 + 23*m + 15), True))`

3.4.7 Maxima [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 70, normalized size of antiderivative = 1.17

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx = \frac{Bde^m x^5 x^m}{m+5} + \frac{Bce^m x^3 x^m}{m+3} + \frac{Ade^m x^3 x^m}{m+3} + \frac{(ex)^{m+1} Ac}{e(m+1)}$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c),x, algorithm="maxima")`

output $B*d*e^{m*x^5*x^m}/(m + 5) + B*c*e^{m*x^3*x^m}/(m + 3) + A*d*e^{m*x^3*x^m}/(m + 3) + (e*x)^{(m + 1)}*A*c/(e*(m + 1))$

3.4.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 167 vs. $2(60) = 120$.

Time = 0.30 (sec) , antiderivative size = 167, normalized size of antiderivative = 2.78

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx = \frac{(ex)^m Bdm^2x^5 + 4(ex)^m Bdmx^5 + (ex)^m Bcm^2x^3 + (ex)^m Adm^2x^3 + 3(ex)^m Bdx^5 + 6(ex)^m Bcmx^3 + 3(ex)^m Acm^2x^3 + 3(ex)^m Admx^3 + 3(ex)^m Acmx + 15(ex)^m Acm}{m^3 + 9m^2 + 23m + 15}$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c),x, algorithm="giac")`

output $((e*x)^m*B*d*m^2*x^5 + 4*(e*x)^m*B*d*m*x^5 + (e*x)^m*B*c*m^2*x^3 + (e*x)^m*A*d*m^2*x^3 + 3*(e*x)^m*B*d*x^5 + 6*(e*x)^m*B*c*m*x^3 + 6*(e*x)^m*A*d*m*x^3 + (e*x)^m*A*c*m^2*x + 5*(e*x)^m*B*c*x^3 + 5*(e*x)^m*A*d*x^3 + 8*(e*x)^m*A*c*m*x + 15*(e*x)^m*A*c*x)/(m^3 + 9*m^2 + 23*m + 15)$

3.4.9 Mupad [B] (verification not implemented)

Time = 5.47 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.62

$$\int (ex)^m (A + Bx^2) (c + dx^2) dx = (ex)^m \left(\frac{x^3 (Ad + Bc) (m^2 + 6m + 5)}{m^3 + 9m^2 + 23m + 15} + \frac{Bdx^5 (m^2 + 4m + 3)}{m^3 + 9m^2 + 23m + 15} + \frac{Acx (m^2 + 8m + 15)}{m^3 + 9m^2 + 23m + 15} \right)$$

input `int((A + B*x^2)*(e*x)^m*(c + d*x^2),x)`

output $(e*x)^m*((x^3*(A*d + B*c)*(6*m + m^2 + 5))/(23*m + 9*m^2 + m^3 + 15) + (B*d*x^5*(4*m + m^2 + 3))/(23*m + 9*m^2 + m^3 + 15) + (A*c*x*(8*m + m^2 + 15))/(23*m + 9*m^2 + m^3 + 15))$

3.5 $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{a+bx^2} dx$

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3.5.1 Optimal result

Integrand size = 29, antiderivative size = 118

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{a + bx^2} dx$$

$$= \frac{(bBc + Abd - aBd)(ex)^{1+m}}{b^2e(1+m)} + \frac{Bd(ex)^{3+m}}{be^3(3+m)}$$

$$+ \frac{(Ab - aB)(bc - ad)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{ab^2e(1+m)}$$

output $(A*b*d-B*a*d+B*b*c)*(e*x)^{(1+m)}/b^2/e/(1+m)+B*d*(e*x)^{(3+m)}/b/e^3/(3+m)+(A*b-B*a)*(-a*d+b*c)*(e*x)^{(1+m)}*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a/b^2/e/(1+m)$

3.5.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 93, normalized size of antiderivative = 0.79

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{a + bx^2} dx$$

$$= \frac{x(ex)^m \left(\frac{bBc+Abd-aBd}{1+m} + \frac{bBdx^2}{3+m} + \frac{(-Ab+aB)(-bc+ad) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a(1+m)} \right)}{b^2}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2))/(a + b*x^2),x]`

output `(x*(e*x)^m*((b*B*c + A*b*d - a*B*d)/(1 + m) + (b*B*d*x^2)/(3 + m) + ((-(A*b) + a*B)*(-b*c) + a*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a]))/(a*(1 + m)))/b^2`

3.5.3 Rubi [A] (verified)

Time = 0.26 (sec) , antiderivative size = 118, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.069$, Rules used = {437, 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.

$$\int \frac{(A + Bx^2)(c + dx^2)(ex)^m}{a + bx^2} dx$$

↓ 437

$$\int \left(\frac{(ex)^m (a^2Bd - aAbd - abBc + Ab^2c)}{b^2(a + bx^2)} + \frac{(ex)^m (-aBd + Abd + bBc)}{b^2} + \frac{Bd(ex)^{m+2}}{be^2} \right) dx$$

↓ 2009

$$\frac{(ex)^{m+1}(Ab - aB)(bc - ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{ab^2e(m+1)} + \frac{(ex)^{m+1}(-aBd + Abd + bBc)}{b^2e(m+1)} + \frac{Bd(ex)^{m+3}}{be^3(m+3)}$$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2))/(a + b*x^2),x]`

output `((b*B*c + A*b*d - a*B*d)*(e*x)^(1 + m))/(b^2*e*(1 + m)) + (B*d*(e*x)^(3 + m))/(b*e^3*(3 + m)) + ((A*b - a*B)*(b*c - a*d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a]))/(a*b^2*e*(1 + m))`

3.5.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.5.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)}{bx^2 + a} dx$$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a),x)`

output `int((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a),x)`

3.5.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a),x, algorithm="fricas")`

output `integral((B*d*x^4 + (B*c + A*d)*x^2 + A*c)*(e*x)^m/(b*x^2 + a), x)`

3.5.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

3.5. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{a+bx^2} dx$

Time = 3.52 (sec) , antiderivative size = 418, normalized size of antiderivative = 3.54

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{a + bx^2} dx = \frac{Ace^m mx^{m+1} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} + \frac{Ace^m x^{m+1} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} + \frac{Ade^m mx^{m+3} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{3Ade^m x^{m+3} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{Bce^m mx^{m+3} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{3Bce^m x^{m+3} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{Bde^m mx^{m+5} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} + \frac{5Bde^m x^{m+5} \Phi\left(\frac{bx^2 e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)/(b*x**2+a),x)`

output `A*c*e**m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*a*gamma(m/2 + 3/2)) + A*c*e**m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*a*gamma(m/2 + 3/2)) + A*d*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + 3*A*d*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + B*c*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + 3*B*c*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + B*d*e**m*x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2)) + 5*B*d*e**m*x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2))`

3.5. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{a+bx^2} dx$

3.5.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(e*x)^m/(b*x^2 + a), x)`

3.5.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(e*x)^m/(b*x^2 + a), x)`

3.5.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{a + bx^2} dx = \int \frac{(Bx^2 + A)(ex)^m (dx^2 + c)}{bx^2 + a} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2))/(a + b*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2))/(a + b*x^2), x)`

$$3.6 \quad \int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^2} dx$$

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3.6.1 Optimal result

Integrand size = 29, antiderivative size = 171

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^2} dx$$

$$= -\frac{d(Ab(1+m) - aB(3+m))(ex)^{1+m}}{2ab^2e(1+m)} + \frac{(Ab - aB)(ex)^{1+m}(c + dx^2)}{2abe(a + bx^2)}$$

$$+ \frac{(aB(bc(1+m) - ad(3+m)) + Ab(ad(1+m) + b(c - cm)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}\right)}{2a^2b^2e(1+m)}$$

```
output -1/2*d*(A*b*(1+m)-a*B*(3+m))*(e*x)^(1+m)/a/b^2/e/(1+m)+1/2*(A*b-B*a)*(e*x)^(1+m)*(d*x^2+c)/a/b/e/(b*x^2+a)+1/2*(a*B*(b*c*(1+m)-a*d*(3+m))+A*b*(a*d*(1+m)+b*(-c*m+c)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-b*x^2/a)/a^2/b^2/e/(1+m)
```

3.6.2 Mathematica [A] (verified)

Time = 0.21 (sec) , antiderivative size = 108, normalized size of antiderivative = 0.63

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^2} dx$$

$$= \frac{x(ex)^m \left(a^2 B d + a(b B c + A b d - 2 a B d) \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{b x^2}{a}\right) + (A b - a B)(b c - a d) \right)}{a^2 b^2 (1+m)}$$

3.6. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^2} dx$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2))/(a + b*x^2)^2,x]`

output `(x*(e*x)^m*(a^2*B*d + a*(b*B*c + A*b*d - 2*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)] + (A*b - a*B)*(b*c - a*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]))/(a^2*b^2*(1 + m))`

3.6.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 174, normalized size of antiderivative = 1.02, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.138$, Rules used = {439, 25, 363, 278}

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.

$$\begin{aligned}
 & \int \frac{(A + Bx^2)(c + dx^2)(ex)^m}{(a + bx^2)^2} dx \\
 & \quad \downarrow 439 \\
 & \frac{(c + dx^2)(ex)^{m+1}(Ab - aB)}{2abe(a + bx^2)} - \int \frac{(ex)^m(c(aB(m+1) + A(b - bm)) - d(Ab(m+1) - aB(m+3))x^2)}{bx^2 + a} dx \\
 & \quad \downarrow 25 \\
 & \frac{\int \frac{(ex)^m(c(aB(m+1) + A(b - bm)) - d(Ab(m+1) - aB(m+3))x^2)}{bx^2 + a} dx}{2ab} + \frac{(c + dx^2)(ex)^{m+1}(Ab - aB)}{2abe(a + bx^2)} \\
 & \quad \downarrow 363 \\
 & \frac{(Ab(ad(m+1) + bc(1 - m)) + aB(bc(m+1) - ad(m+3))) \int \frac{(ex)^m dx}{bx^2 + a} - \frac{d(ex)^{m+1}(Ab(m+1) - aB(m+3))}{be(m+1)}}{2ab} + \\
 & \quad \frac{(c + dx^2)(ex)^{m+1}(Ab - aB)}{2abe(a + bx^2)} \\
 & \quad \downarrow 278 \\
 & \frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)(Ab(ad(m+1) + bc(1 - m)) + aB(bc(m+1) - ad(m+3)))}{abe(m+1)} - \frac{d(ex)^{m+1}(Ab(m+1) - aB(m+3))}{be(m+1)}}{2ab} + \\
 & \quad \frac{(c + dx^2)(ex)^{m+1}(Ab - aB)}{2abe(a + bx^2)}
 \end{aligned}$$

3.6. $\int \frac{(ex)^m(A + Bx^2)(c + dx^2)}{(a + bx^2)^2} dx$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2))/(a + b*x^2)^2,x]`

output `((A*b - a*B)*(e*x)^(1 + m)*(c + d*x^2))/(2*a*b*e*(a + b*x^2)) + (-((d*(A*b*(1 + m) - a*B*(3 + m))*(e*x)^(1 + m))/(b*e*(1 + m))) + ((A*b*(b*c*(1 - m) + a*d*(1 + m)) + a*B*(b*c*(1 + m) - a*d*(3 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*b*e*(1 + m)))/(2*a*b)`

3.6.3.1 Defintions of rubi rules used

rule 25 `Int[-(F*x_), x_Symbol] := Simp[Identity[-1] Int[Fx, x], x]`

rule 278 `Int[((c_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a), x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 363 `Int[((e_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2), x_Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d, 0] && NeQ[m + 2*p + 3, 0]`

rule 439 `Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

3.6. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^2} dx$

3.6.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)}{(bx^2 + a)^2} dx$$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^2,x)`

output `int((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^2,x)`

3.6.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^2,x, algorithm="fricas")`

output `integral((B*d*x^4 + (B*c + A*d)*x^2 + A*c)*(e*x)^m/(b^2*x^4 + 2*a*b*x^2 + a^2), x)`

3.6.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 29.42 (sec) , antiderivative size = 2069, normalized size of antiderivative = 12.10

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)}{(a + bx^2)^2} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)/(b*x**2+a)**2,x)`

output

```

A*c*(-a***m**2*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*a**3*gamma(m/2 + 3/2) + 8*a**2*b*x**2*gamma(m/2 + 3/2)) + 2*a*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(8*a**3*gamma(m/2 + 3/2) + 8*a**2*b*x**2*gamma(m/2 + 3/2)) + a*e**m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*a**3*gamma(m/2 + 3/2) + 8*a**2*b*x**2*gamma(m/2 + 3/2)) + 2*a*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(8*a**3*gamma(m/2 + 3/2) + 8*a**2*b*x**2*gamma(m/2 + 3/2)) - b*e**m**2*x**2*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*a**3*gamma(m/2 + 3/2) + 8*a**2*b*x**2*gamma(m/2 + 3/2)) + b*e**m*x**2*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*a**3*gamma(m/2 + 3/2) + 8*a**2*b*x**2*gamma(m/2 + 3/2)) + A*d*(-a*e**m**2*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*a**3*gamma(m/2 + 5/2) + 8*a**2*b*x**2*gamma(m/2 + 5/2)) - 4*a*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*a**3*gamma(m/2 + 5/2) + 8*a**2*b*x**2*gamma(m/2 + 5/2)) + 2*a*e**m*x**(m + 3)*gamma(m/2 + 3/2)/(8*a**3*gamma(m/2 + 5/2) + 8*a**2*b*x**2*gamma(m/2 + 5/2)) - 3*a*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*a**3*gamma(m/2 + 5/2) + 8*a**2*b*x**2*gamma(m/2 + 5/2)) + 6*a*e**m*x**(m + 3)*gamma(m/2 + 3/2)/(8*a**3*gamma(m/2 + 5/2) + 8*a**2*b*x**2*gamma(m/2 + 5/2)) - b*e**m**2*x**2*x**(m...

```

3.6.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(e*x)^m/(b*x^2 + a)^2, x)`

3.6.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(e*x)^m/(b*x^2 + a)^2, x)`

3.6.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m (dx^2 + c)}{(bx^2 + a)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2))/(a + b*x^2)^2,x)`

output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2))/(a + b*x^2)^2, x)`

$$3.7 \quad \int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^3} dx$$

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3.7.1 Optimal result

Integrand size = 29, antiderivative size = 209

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^3} dx$$

$$= -\frac{(Ab(ad(1 - m) - bc(3 - m)) - aB(bc(1 + m) - ad(3 + m)))(ex)^{1+m}}{8a^2b^2e(a + bx^2)}$$

$$+ \frac{(Ab - aB)(ex)^{1+m}(c + dx^2)}{4abe(a + bx^2)^2}$$

$$+ \frac{(Ab(1 - m)(bc(3 - m) + ad(1 + m)) + aB(1 + m)(ad(3 + m) + b(c - cm)))(ex)^{1+m}}{8a^3b^2e(1 + m)} \text{Hypergeometric2}$$

```
output -1/8*(A*b*(a*d*(1-m)-b*c*(3-m))-a*B*(b*c*(1+m)-a*d*(3+m))*(e*x)^(1+m)/a^2
/b^2/e/(b*x^2+a)+1/4*(A*b-B*a)*(e*x)^(1+m)*(d*x^2+c)/a/b/e/(b*x^2+a)^2+1/8
*(A*b*(1-m)*(b*c*(3-m)+a*d*(1+m))+a*B*(1+m)*(a*d*(3+m)+b*(-c*m+c)))*(e*x)^(
(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-b*x^2/a)/a^3/b^2/e/(1+m)
```


3.7.2 Mathematica [A] (verified)

Time = 0.42 (sec) , antiderivative size = 133, normalized size of antiderivative = 0.64

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^3} dx$$

$$= \frac{x(ex)^m \left(a^2 B d \operatorname{Hypergeometric2F1} \left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a} \right) + a(bBc + Abd - 2aBd) \operatorname{Hypergeometric2F1} \left(2, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a} \right) \right)}{a^3 b^2 (1+m)}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2))/(a + b*x^2)^3,x]`

output `(x*(e*x)^m*(a^2*B*d*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a]) + a*(b*B*c + A*b*d - 2*a*B*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -(b*x^2)/a] + (A*b - a*B)*(b*c - a*d)*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(a^3*b^2*(1 + m))`

3.7.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 220, normalized size of antiderivative = 1.05, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.138$, Rules used = {439, 25, 362, 278}

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.

$$\int \frac{(A + Bx^2)(c + dx^2)(ex)^m}{(a + bx^2)^3} dx$$

$$\downarrow 439$$

$$\frac{(c + dx^2)(ex)^{m+1}(Ab - aB)}{4abe(a + bx^2)^2} - \frac{\int -\frac{(ex)^m(d(aB(m+3) + A(b-bm))x^2 + c(Ab(3-m) + aB(m+1)))}{(bx^2+a)^2} dx}{4ab}$$

$$\downarrow 25$$

$$\frac{\int \frac{(ex)^m(d(aB(m+3) + A(b-bm))x^2 + c(Ab(3-m) + aB(m+1)))}{(bx^2+a)^2} dx}{4ab} + \frac{(c + dx^2)(ex)^{m+1}(Ab - aB)}{4abe(a + bx^2)^2}$$

$$\downarrow 362$$

3.7. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^3} dx$

$$\frac{(Ab(1-m)(ad(m+1)+bc(3-m))+aB(m+1)(ad(m+3)+b(c-cm))) \int \frac{(ex)^m}{bx^2+a} dx}{2ab} - \frac{(ex)^{m+1}(Ab(ad(1-m)-bc(3-m))-aB(bc(m+1)-ad(m+3)))}{2abe(a+bx^2)}$$

$$\frac{(c+dx^2)(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2}$$

↓ 278

$$\frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)(Ab(1-m)(ad(m+1)+bc(3-m))+aB(m+1)(ad(m+3)+b(c-cm)))}{2a^2be(m+1)} - \frac{(ex)^{m+1}(Ab(ad(1-m)-bc(3-m))-aB(bc(m+1)-ad(m+3)))}{4ab}$$

$$\frac{(c+dx^2)(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2}$$

input `Int[((ex)^m*(A + B*x^2)*(c + d*x^2))/(a + b*x^2)^3,x]`

output `((A*b - a*B)*(ex)^(1 + m)*(c + d*x^2))/((4*a*b*e*(a + b*x^2)^2) + (-1/2*((A*b*(a*d*(1 - m) - b*c*(3 - m)) - a*B*(b*c*(1 + m) - a*d*(3 + m)))*(ex)^(1 + m))/(a*b*e*(a + b*x^2)) + ((A*b*(1 - m)*(b*c*(3 - m) + a*d*(1 + m)) + a*B*(1 + m)*(a*d*(3 + m) + b*(c - c*m)))*(ex)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(2*a^2*b*e*(1 + m)))/(4*a*b)`

3.7.3.1 Defintions of rubi rules used

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

rule 278 `Int[((c_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 362 `Int[((e_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[(-(b*c - a*d))*(ex)^(m + 1)*((a + b*x^2)^(p + 1)/(2*a*b*e*(p + 1))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(2*a*b*(p + 1)) Int[(ex)^m*(a + b*x^2)^(p + 1), x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && LtQ[p, -1] && ((!IntegerQ[p + 1/2] && NeQ[p, -5/4]) || !RationalQ[m] || (ILtQ[p + 1/2, 0] && LeQ[-1, m, -2*(p + 1)]))`

3.7. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)}{(a+bx^2)^3} dx$

```
rule 439 Int[((g_)*(x_)^(m_))*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_
.)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p
+ 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(
p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1
))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && G
tQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])
```

3.7.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)}{(bx^2 + a)^3} dx$$

```
input int((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^3,x)
```

```
output int((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^3,x)
```

3.7.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{(bx^2 + a)^3} dx$$

```
input integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^3,x, algorithm="fricas")
```

```
output integral((B*d*x^4 + (B*c + A*d)*x^2 + A*c)*(e*x)^m/(b^3*x^6 + 3*a*b^2*x^4
+ 3*a^2*b*x^2 + a^3), x)
```

3.7.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 96.01 (sec) , antiderivative size = 6411, normalized size of antiderivative = 30.67

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)}{(a + bx^2)^3} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)/(b*x**2+a)**3,x)`

output `A*c*(a**2*e**m*m**3*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) - 3*a**2*e**m*m**2*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) - 2*a**2*e**m*m**2*x**(m + 1)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) - a**2*e**m*m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) + 8*a**2*e**m*m*x**(m + 1)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) + 3*a**2*e**m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) + 10*a**2*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) + 2*a*b*e**m*m**3*x**2*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*a**5*gamma(m/2 + 3/2) + 64*a**4*b*x**2*gamma(m/2 + 3/2) + 32*a**3*b**2*x**4*gamma(m/2 + 3/2)) - 6*a*b*e**m*m**2*x**2*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*g...`

3.7.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(e*x)^m/(b*x^2 + a)^3, x)`

3.7.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)(ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)/(b*x^2+a)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(e*x)^m/(b*x^2 + a)^3, x)`

3.7.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m (dx^2 + c)}{(bx^2 + a)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2))/(a + b*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2))/(a + b*x^2)^3, x)`

3.8 $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx$

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3.8.1 Optimal result

Integrand size = 31, antiderivative size = 292

$$\begin{aligned} & \int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx \\ &= \frac{a^3 Ac^2 (ex)^{1+m}}{e(1+m)} + \frac{a^2 c(3Abc + aBc + 2aAd)(ex)^{3+m}}{e^3(3+m)} \\ &+ \frac{a(aBc(3bc + 2ad) + A(3b^2c^2 + 6abcd + a^2d^2))(ex)^{5+m}}{e^5(5+m)} \\ &+ \frac{(aB(3b^2c^2 + 6abcd + a^2d^2) + Ab(b^2c^2 + 6abcd + 3a^2d^2))(ex)^{7+m}}{e^7(7+m)} \\ &+ \frac{b(3a^2Bd^2 + 3abd(2Bc + Ad) + b^2c(Bc + 2Ad))(ex)^{9+m}}{e^9(9+m)} \\ &+ \frac{b^2d(2bBc + Abd + 3aBd)(ex)^{11+m}}{e^{11}(11+m)} + \frac{b^3Bd^2(ex)^{13+m}}{e^{13}(13+m)} \end{aligned}$$

```
output a^3*A*c^2*(e*x)^(1+m)/e/(1+m)+a^2*c*(2*A*a*d+3*A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)+a*(a*B*c*(2*a*d+3*b*c)+A*(a^2*d^2+6*a*b*c*d+3*b^2*c^2))*(e*x)^(5+m)/e^5/(5+m)+(a*B*(a^2*d^2+6*a*b*c*d+3*b^2*c^2)+A*b*(3*a^2*d^2+6*a*b*c*d+b^2*c^2))*(e*x)^(7+m)/e^7/(7+m)+b*(3*a^2*B*d^2+3*a*b*d*(A*d+2*B*c)+b^2*c*(2*A*d+B*c))*(e*x)^(9+m)/e^9/(9+m)+b^2*d*(A*b*d+3*B*a*d+2*B*b*c)*(e*x)^(11+m)/e^11/(11+m)+b^3*B*d^2*(e*x)^(13+m)/e^13/(13+m)
```

3.8.2 Mathematica [A] (verified)

Time = 0.70 (sec) , antiderivative size = 247, normalized size of antiderivative = 0.85

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx$$

$$= x(ex)^m \left(\frac{a^3 Ac^2}{1+m} + \frac{a^2 c(3Abc + aBc + 2aAd)x^2}{3+m} \right. \\ \left. + \frac{a(aBc(3bc + 2ad) + A(3b^2c^2 + 6abcd + a^2d^2))x^4}{5+m} \right. \\ \left. + \frac{(aB(3b^2c^2 + 6abcd + a^2d^2) + Ab(b^2c^2 + 6abcd + 3a^2d^2))x^6}{7+m} \right. \\ \left. + \frac{b(3a^2Bd^2 + 3abd(2Bc + Ad) + b^2c(Bc + 2Ad))x^8}{9+m} + \frac{b^2d(2bBc + Abd + 3aBd)x^{10}}{11+m} \right. \\ \left. + \frac{b^3Bd^2x^{12}}{13+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^3*(A + B*x^2)*(c + d*x^2)^2,x]`

output `x*(e*x)^m*((a^3*A*c^2)/(1 + m) + (a^2*c*(3*A*b*c + a*B*c + 2*a*A*d)*x^2)/(3 + m) + (a*(a*B*c*(3*b*c + 2*a*d) + A*(3*b^2*c^2 + 6*a*b*c*d + a^2*d^2))*x^4)/(5 + m) + ((a*B*(3*b^2*c^2 + 6*a*b*c*d + a^2*d^2) + A*b*(b^2*c^2 + 6*a*b*c*d + 3*a^2*d^2))*x^6)/(7 + m) + (b*(3*a^2*B*d^2 + 3*a*b*d*(2*B*c + A*d) + b^2*c*(B*c + 2*A*d))*x^8)/(9 + m) + (b^2*d*(2*b*B*c + A*b*d + 3*a*B*d)*x^10)/(11 + m) + (b^3*B*d^2*x^12)/(13 + m))`

3.8.3 Rubi [A] (verified)

Time = 0.52 (sec) , antiderivative size = 292, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 2009}

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

$$\int (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 (ex)^m dx$$

↓ 437

$$\int \left(a^3 A c^2 (ex)^m + \frac{(ex)^{m+6} (Ab(3a^2 d^2 + 6abcd + b^2 c^2) + aB(a^2 d^2 + 6abcd + 3b^2 c^2))}{e^6} + \frac{a(ex)^{m+4} (A(a^2 d^2 + 6abcd + 3b^2 c^2) + aBc(2ad + 3bc))}{e^6} \right) dx$$

↓ 2009

$$\frac{a^3 A c^2 (ex)^{m+1}}{e(m+1)} + \frac{(ex)^{m+7} (Ab(3a^2 d^2 + 6abcd + b^2 c^2) + aB(a^2 d^2 + 6abcd + 3b^2 c^2))}{e^7(m+7)} + \frac{a(ex)^{m+5} (A(a^2 d^2 + 6abcd + 3b^2 c^2) + aBc(2ad + 3bc))}{e^5(m+5)} + \frac{b(ex)^{m+9} (3a^2 B d^2 + 3abd(Ad + 2Bc) + b^2 c(2Ad + Bc))}{e^9(m+9)} + \frac{a^2 c (ex)^{m+3} (2aAd + aBc + 3Abc)}{e^3(m+3)} + \frac{b^2 d (ex)^{m+11} (3aBd + Abd + 2bBc)}{e^{11}(m+11)} + \frac{b^3 B d^2 (ex)^{m+13}}{e^{13}(m+13)}$$

input `Int[(e*x)^m*(a + b*x^2)^3*(A + B*x^2)*(c + d*x^2)^2,x]`

output `(a^3*A*c^2*(e*x)^(1+m))/(e*(1+m)) + (a^2*c*(3*A*b*c + a*B*c + 2*a*A*d)*(e*x)^(3+m))/(e^3*(3+m)) + (a*(a*B*c*(3*b*c + 2*a*d) + A*(3*b^2*c^2 + 6*a*b*c*d + a^2*d^2))*(e*x)^(5+m))/(e^5*(5+m)) + ((a*B*(3*b^2*c^2 + 6*a*b*c*d + a^2*d^2) + A*b*(b^2*c^2 + 6*a*b*c*d + 3*a^2*d^2))*(e*x)^(7+m))/(e^7*(7+m)) + (b*(3*a^2*B*d^2 + 3*a*b*d*(2*B*c + A*d) + b^2*c*(B*c + 2*A*d))*(e*x)^(9+m))/(e^9*(9+m)) + (b^2*d*(2*b*B*c + A*b*d + 3*a*B*d)*(e*x)^(11+m))/(e^11*(11+m)) + (b^3*B*d^2*(e*x)^(13+m))/(e^13*(13+m))`

3.8.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.8.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 2442 vs. $2(292) = 584$.

Time = 3.74 (sec) , antiderivative size = 2443, normalized size of antiderivative = 8.37

method	result	size
gospers	Expression too large to display	2443
risch	Expression too large to display	2443
parallelrisch	Expression too large to display	3284

```
input int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^2,x,method=_RETURNVERBOSE)
```

```
output x*(B*b^3*d^2*m^6*x^12+36*B*b^3*d^2*m^5*x^12+A*b^3*d^2*m^6*x^10+3*B*a*b^2*d^2*m^6*x^10+2*B*b^3*c*d*m^6*x^10+505*B*b^3*d^2*m^4*x^12+38*A*b^3*d^2*m^5*x^10+114*B*a*b^2*d^2*m^5*x^10+76*B*b^3*c*d*m^5*x^10+3480*B*b^3*d^2*m^3*x^12+3*A*a*b^2*d^2*m^6*x^8+2*A*b^3*c*d*m^6*x^8+555*A*b^3*d^2*m^4*x^10+3*B*a^2*b*d^2*m^6*x^8+6*B*a*b^2*c*d*m^6*x^8+1665*B*a*b^2*d^2*m^4*x^10+B*b^3*c^2*m^6*x^8+1110*B*b^3*c*d*m^4*x^10+12139*B*b^3*d^2*m^2*x^12+120*A*a*b^2*d^2*m^5*x^8+80*A*b^3*c*d*m^5*x^8+3940*A*b^3*d^2*m^3*x^10+120*B*a^2*b*d^2*m^5*x^8+240*B*a*b^2*c*d*m^5*x^8+11820*B*a*b^2*d^2*m^3*x^10+40*B*b^3*c^2*m^5*x^8+7880*B*b^3*c*d*m^3*x^10+19524*B*b^3*d^2*m*x^12+3*A*a^2*b*d^2*m^6*x^6+6*A*a*b^2*c*d*m^6*x^6+1839*A*a*b^2*d^2*m^4*x^8+A*b^3*c^2*m^6*x^6+1226*A*b^3*c*d*m^4*x^8+14039*A*b^3*d^2*m^2*x^10+B*a^3*d^2*m^6*x^6+6*B*a^2*b*c*d*m^6*x^6+1839*B*a^2*b*d^2*m^4*x^8+3*B*a*b^2*c^2*m^6*x^6+3678*B*a*b^2*c*d*m^4*x^8+42117*B*a*b^2*d^2*m^2*x^10+613*B*b^3*c^2*m^4*x^8+28078*B*b^3*c*d*m^2*x^10+10395*B*b^3*d^2*x^12+126*A*a^2*b*d^2*m^5*x^6+252*A*a*b^2*c*d*m^5*x^6+13584*A*a*b^2*d^2*m^3*x^8+42*A*b^3*c^2*m^5*x^6+9056*A*b^3*c*d*m^3*x^8+22902*A*b^3*d^2*m*x^10+42*B*a^3*d^2*m^5*x^6+252*B*a^2*b*c*d*m^5*x^6+13584*B*a^2*b*d^2*m^3*x^8+126*B*a*b^2*c^2*m^5*x^6+27168*B*a*b^2*c*d*m^3*x^8+68706*B*a*b^2*d^2*m*x^10+4528*B*b^3*c^2*m^3*x^8+45804*B*b^3*c*d*m*x^10+A*a^3*d^2*m^6*x^4+6*A*a^2*b*c*d*m^6*x^4+2037*A*a^2*b*d^2*m^4*x^6+3*A*a*b^2*c^2*m^6*x^4+4074*A*a*b^2*c*d*m^4*x^6+49881*A*a*b^2*d^2*m^2*x^8+679*A*b^3*c^2*m^4*x^6+33254...
```

3.8.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1711 vs. $2(292) = 584$.

Time = 0.30 (sec) , antiderivative size = 1711, normalized size of antiderivative = 5.86

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="fricas")`

output `((B*b^3*d^2*m^6 + 36*B*b^3*d^2*m^5 + 505*B*b^3*d^2*m^4 + 3480*B*b^3*d^2*m^3 + 12139*B*b^3*d^2*m^2 + 19524*B*b^3*d^2*m + 10395*B*b^3*d^2)*x^13 + ((2*B*b^3*c*d + (3*B*a*b^2 + A*b^3)*d^2)*m^6 + 24570*B*b^3*c*d + 38*(2*B*b^3*c*d + (3*B*a*b^2 + A*b^3)*d^2)*m^5 + 555*(2*B*b^3*c*d + (3*B*a*b^2 + A*b^3)*d^2)*m^4 + 3940*(2*B*b^3*c*d + (3*B*a*b^2 + A*b^3)*d^2)*m^3 + 12285*(3*B*a*b^2 + A*b^3)*d^2 + 14039*(2*B*b^3*c*d + (3*B*a*b^2 + A*b^3)*d^2)*m^2 + 22902*(2*B*b^3*c*d + (3*B*a*b^2 + A*b^3)*d^2)*m)*x^11 + ((B*b^3*c^2 + 2*(3*B*a*b^2 + A*b^3)*c*d + 3*(B*a^2*b + A*a*b^2)*d^2)*m^6 + 15015*B*b^3*c^2 + 40*(B*b^3*c^2 + 2*(3*B*a*b^2 + A*b^3)*c*d + 3*(B*a^2*b + A*a*b^2)*d^2)*m^5 + 613*(B*b^3*c^2 + 2*(3*B*a*b^2 + A*b^3)*c*d + 3*(B*a^2*b + A*a*b^2)*d^2)*m^4 + 4528*(B*b^3*c^2 + 2*(3*B*a*b^2 + A*b^3)*c*d + 3*(B*a^2*b + A*a*b^2)*d^2)*m^3 + 30030*(3*B*a*b^2 + A*b^3)*c*d + 45045*(B*a^2*b + A*a*b^2)*d^2 + 16627*(B*b^3*c^2 + 2*(3*B*a*b^2 + A*b^3)*c*d + 3*(B*a^2*b + A*a*b^2)*d^2)*m^2 + 27688*(B*b^3*c^2 + 2*(3*B*a*b^2 + A*b^3)*c*d + 3*(B*a^2*b + A*a*b^2)*d^2)*m)*x^9 + (((3*B*a*b^2 + A*b^3)*c^2 + 6*(B*a^2*b + A*a*b^2)*c*d + (B*a^3 + 3*A*a^2*b)*d^2)*m^6 + 42*((3*B*a*b^2 + A*b^3)*c^2 + 6*(B*a^2*b + A*a*b^2)*c*d + (B*a^3 + 3*A*a^2*b)*d^2)*m^5 + 679*((3*B*a*b^2 + A*b^3)*c^2 + 6*(B*a^2*b + A*a*b^2)*c*d + (B*a^3 + 3*A*a^2*b)*d^2)*m^4 + 5292*((3*B*a*b^2 + A*b^3)*c^2 + 6*(B*a^2*b + A*a*b^2)*c*d + (B*a^3 + 3*A*a^2*b)*d^2)*m^3 + 19305*(3*B*a*b^2 + A*b^3)*c^2 + 115830*(B*a^2*b + A*a*b^2)*c*d + 19...`

3.8.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 11914 vs. $2(294) = 588$.

Time = 1.36 (sec) , antiderivative size = 11914, normalized size of antiderivative = 40.80

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**3*(B*x**2+A)*(d*x**2+c)**2,x)`

output `Piecewise(((-A*a**3*c**2/(12*x**12) - A*a**3*c*d/(5*x**10) - A*a**3*d**2/(8*x**8) - 3*A*a**2*b*c**2/(10*x**10) - 3*A*a**2*b*c*d/(4*x**8) - A*a**2*b*d**2/(2*x**6) - 3*A*a*b**2*c**2/(8*x**8) - A*a*b**2*c*d/x**6 - 3*A*a*b**2*d**2/(4*x**4) - A*b**3*c**2/(6*x**6) - A*b**3*c*d/(2*x**4) - A*b**3*d**2/(2*x**2) - B*a**3*c**2/(10*x**10) - B*a**3*c*d/(4*x**8) - B*a**3*d**2/(6*x**6) - 3*B*a**2*b*c**2/(8*x**8) - B*a**2*b*c*d/x**6 - 3*B*a**2*b*d**2/(4*x**4) - B*a*b**2*c**2/(2*x**6) - 3*B*a*b**2*c*d/(2*x**4) - 3*B*a*b**2*d**2/(2*x**2) - B*b**3*c**2/(4*x**4) - B*b**3*c*d/x**2 + B*b**3*d**2*log(x))/e**13, Eq(m, -13)), ((-A*a**3*c**2/(10*x**10) - A*a**3*c*d/(4*x**8) - A*a**3*d**2/(6*x**6) - 3*A*a**2*b*c**2/(8*x**8) - A*a**2*b*c*d/x**6 - 3*A*a**2*b*d**2/(4*x**4) - A*a*b**2*c**2/(2*x**6) - 3*A*a*b**2*c*d/(2*x**4) - 3*A*a*b**2*d**2/(2*x**2) - A*b**3*c**2/(4*x**4) - A*b**3*c*d/x**2 + A*b**3*d**2*log(x) - B*a**3*c**2/(8*x**8) - B*a**3*c*d/(3*x**6) - B*a**3*d**2/(4*x**4) - B*a**2*b*c**2/(2*x**6) - 3*B*a**2*b*c*d/(2*x**4) - 3*B*a**2*b*d**2/(2*x**2) - 3*B*a*b**2*c**2/(4*x**4) - 3*B*a*b**2*c*d/x**2 + 3*B*a*b**2*d**2*log(x) - B*b**3*c**2/(2*x**2) + 2*B*b**3*c*d*log(x) + B*b**3*d**2*x**2/2)/e**11, Eq(m, -11)), ((-A*a**3*c**2/(8*x**8) - A*a**3*c*d/(3*x**6) - A*a**3*d**2/(4*x**4) - A*a**2*b*c**2/(2*x**6) - 3*A*a**2*b*c*d/(2*x**4) - 3*A*a**2*b*d**2/(2*x**2) - 3*A*a*b**2*c**2/(4*x**4) - 3*A*a*b**2*c*d/x**2 + 3*A*a*b**2*d**2*log(x) - A*b**3*c**2/(2*x**2) + 2*A*b**3*c*d*log(x) + A*b**3*d...`

3.8. $\int (ex)^m (a + bx^2)^3 (A + Bx^2)(c + dx^2)^2 dx$

3.8.7 Maxima [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 550, normalized size of antiderivative = 1.88

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx = \frac{Bb^3d^2e^mx^{13}x^m}{m+13} + \frac{2Bb^3cde^mx^{11}x^m}{m+11} + \frac{3Bab^2d^2e^mx^{11}x^m}{m+11} + \frac{Ab^3d^2e^mx^{11}x^m}{m+11} + \frac{Bb^3c^2e^mx^9x^m}{m+9} + \frac{6Bab^2cde^mx^9x^m}{m+9} + \frac{2Ab^3cde^mx^9x^m}{m+9} + \frac{3Ba^2bd^2e^mx^9x^m}{m+9} + \frac{3Aab^2d^2e^mx^9x^m}{m+9} + \frac{3Bab^2c^2e^mx^7x^m}{m+7} + \frac{Ab^3c^2e^mx^7x^m}{m+7} + \frac{6Ba^2bcde^mx^7x^m}{m+7} + \frac{6Aab^2cde^mx^7x^m}{m+7} + \frac{Ba^3d^2e^mx^7x^m}{m+7} + \frac{3Aa^2bd^2e^mx^7x^m}{m+7} + \frac{3Ba^2bc^2e^mx^5x^m}{m+5} + \frac{3Aab^2c^2e^mx^5x^m}{m+5} + \frac{2Ba^3cde^mx^5x^m}{m+5} + \frac{6Aa^2bcde^mx^5x^m}{m+5} + \frac{Aa^3d^2e^mx^5x^m}{m+5} + \frac{Ba^3c^2e^mx^3x^m}{m+3} + \frac{3Aa^2bc^2e^mx^3x^m}{m+3} + \frac{2Aa^3cde^mx^3x^m}{m+3} + \frac{(ex)^{m+1}Aa^3c^2}{e(m+1)}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="maxima")`

output $B*b^3*d^2*e^m*x^{13}*x^m/(m + 13) + 2*B*b^3*c*d*e^m*x^{11}*x^m/(m + 11) + 3*B*a*b^2*d^2*e^m*x^{11}*x^m/(m + 11) + A*b^3*d^2*e^m*x^{11}*x^m/(m + 11) + B*b^3*c^2*e^m*x^9*x^m/(m + 9) + 6*B*a*b^2*c*d*e^m*x^9*x^m/(m + 9) + 2*A*b^3*c*d*e^m*x^9*x^m/(m + 9) + 3*B*a^2*b*d^2*e^m*x^9*x^m/(m + 9) + 3*A*a*b^2*d^2*e^m*x^9*x^m/(m + 9) + 3*B*a*b^2*c^2*e^m*x^7*x^m/(m + 7) + A*b^3*c^2*e^m*x^7*x^m/(m + 7) + 6*B*a^2*b*c*d*e^m*x^7*x^m/(m + 7) + 6*A*a*b^2*c*d*e^m*x^7*x^m/(m + 7) + B*a^3*d^2*e^m*x^7*x^m/(m + 7) + 3*A*a^2*b*d^2*e^m*x^7*x^m/(m + 7) + 3*B*a^2*b*c^2*e^m*x^5*x^m/(m + 5) + 3*A*a*b^2*c^2*e^m*x^5*x^m/(m + 5) + 2*B*a^3*c*d*e^m*x^5*x^m/(m + 5) + 6*A*a^2*b*c*d*e^m*x^5*x^m/(m + 5) + A*a^3*d^2*e^m*x^5*x^m/(m + 5) + B*a^3*c^2*e^m*x^3*x^m/(m + 3) + 3*A*a^2*b*c^2*e^m*x^3*x^m/(m + 3) + 2*A*a^3*c*d*e^m*x^3*x^m/(m + 3) + (e*x)^(m + 1)*A*a^3*c^2/(e*(m + 1))$

3.8.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 3283 vs. $2(292) = 584$.

Time = 0.35 (sec) , antiderivative size = 3283, normalized size of antiderivative = 11.24

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="giac")`

output $((e^x)^m B^3 b^3 d^2 m^6 x^{13} + 36(e^x)^m B^3 b^3 d^2 m^5 x^{13} + 2(e^x)^m B^3 b^3 c d m^6 x^{11} + 3(e^x)^m B^3 a b^2 d^2 m^6 x^{11} + (e^x)^m A^3 b^3 d^2 m^6 x^{11} + 505(e^x)^m B^3 b^3 d^2 m^4 x^{13} + 76(e^x)^m B^3 b^3 c d m^5 x^{11} + 114(e^x)^m B^3 a b^2 d^2 m^5 x^{11} + 38(e^x)^m A^3 b^3 d^2 m^5 x^{11} + 3480(e^x)^m B^3 b^3 d^2 m^3 x^{13} + (e^x)^m B^3 b^3 c^2 m^6 x^9 + 6(e^x)^m B^3 a b^2 c d m^6 x^9 + 2(e^x)^m A^3 c d m^6 x^9 + 3(e^x)^m B^3 a^2 b d^2 m^6 x^9 + 3(e^x)^m A^3 a b^2 d^2 m^6 x^9 + 1110(e^x)^m B^3 b^3 c d m^4 x^{11} + 1665(e^x)^m B^3 a b^2 d^2 m^4 x^{11} + 555(e^x)^m A^3 b^3 d^2 m^4 x^{11} + 12139(e^x)^m B^3 b^3 d^2 m^2 x^{13} + 40(e^x)^m B^3 b^3 c^2 m^5 x^9 + 240(e^x)^m B^3 a b^2 c d m^5 x^9 + 80(e^x)^m A^3 c d m^5 x^9 + 120(e^x)^m B^3 a^2 b d^2 m^5 x^9 + 120(e^x)^m A^3 a b^2 d^2 m^5 x^9 + 7880(e^x)^m B^3 b^3 c d m^3 x^{11} + 11820(e^x)^m B^3 a b^2 d^2 m^3 x^{11} + 3940(e^x)^m A^3 b^3 d^2 m^3 x^{11} + 19524(e^x)^m B^3 b^3 d^2 m x^{13} + 3(e^x)^m B^3 a b^2 c^2 m^6 x^7 + (e^x)^m A^3 b^3 c^2 m^6 x^7 + 6(e^x)^m B^3 a^2 b c d m^6 x^7 + 6(e^x)^m A^3 a b^2 c d m^6 x^7 + (e^x)^m B^3 a^3 d^2 m^6 x^7 + 3(e^x)^m A^3 a^2 b d^2 m^6 x^7 + 613(e^x)^m B^3 b^3 c^2 m^4 x^9 + 3678(e^x)^m B^3 a b^2 c d m^4 x^9 + 1226(e^x)^m A^3 b^3 c d m^4 x^9 + 1839(e^x)^m B^3 a^2 b d^2 m^4 x^9 + 1839(e^x)^m A^3 a b^2 d^2 m^4 x^9 + 28078(e^x)^m B^3 b^3 c d m^2 x^{11} + 42117(e^x)^m B^3 a b^2 d^2 m^2 x^{11} + 14039(e^x)^m A^3 b^3 d^2 m^2 x^{11} + 10395(e^x)^m B^3 b^3 d^2 m^2 x^{13} + 126(e^x)^m B^3 a b^2 c^2 m^5 x^7 + 42(e^x)^m A^3 b^3 c^2 m^5 x^7 + 252(\dots$

3.8.9 Mupad [B] (verification not implemented)

Time = 6.22 (sec) , antiderivative size = 694, normalized size of antiderivative = 2.38

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx$$

$$= \frac{x^7 (ex)^m (Ba^3 d^2 + 6Ba^2 bcd + 3Aa^2 bd^2 + 3Bab^2 c^2 + 6Aab^2 cd + Ab^3 c^2) (m^6 + 42m^5 + 679m^4 + m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

$$+ \frac{ax^5 (ex)^m (2Ba^2 cd + Aa^2 d^2 + 3Babc^2 + 6Aabcd + 3Ab^2 c^2) (m^6 + 44m^5 + 753m^4 + 6280m^3 + m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

$$+ \frac{bx^9 (ex)^m (3Ba^2 d^2 + 6Babcd + 3Aabd^2 + Bb^2 c^2 + 2Ab^2 cd) (m^6 + 40m^5 + 613m^4 + 4528m^3 + m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

$$+ \frac{Aa^3 c^2 x (ex)^m (m^6 + 48m^5 + 925m^4 + 9120m^3 + 48259m^2 + 129072m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

$$+ \frac{a^2 cx^3 (ex)^m (2Aad + 3Abc + Bac) (m^6 + 46m^5 + 835m^4 + 7540m^3 + 34759m^2 + 73054m + 45000)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

$$+ \frac{b^2 dx^{11} (ex)^m (Abd + 3Bad + 2Bbc) (m^6 + 38m^5 + 555m^4 + 3940m^3 + 14039m^2 + 22902m + 12000)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

$$+ \frac{Bb^3 d^2 x^{13} (ex)^m (m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}$$

3.8. $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^2 dx$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^3*(c + d*x^2)^2,x)`

output `(x^7*(e*x)^m*(A*b^3*c^2 + B*a^3*d^2 + 3*A*a^2*b*d^2 + 3*B*a*b^2*c^2 + 6*A*a*b^2*c*d + 6*B*a^2*b*c*d)*(34986*m + 20335*m^2 + 5292*m^3 + 679*m^4 + 42*m^5 + m^6 + 19305))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (a*x^5*(e*x)^m*(A*a^2*d^2 + 3*A*b^2*c^2 + 3*B*a*b*c^2 + 2*B*a^2*c*d + 6*A*a*b*c*d)*(47436*m + 25979*m^2 + 6280*m^3 + 753*m^4 + 44*m^5 + m^6 + 27027))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (b*x^9*(e*x)^m*(3*B*a^2*d^2 + B*b^2*c^2 + 3*A*a*b*d^2 + 2*A*b^2*c*d + 6*B*a*b*c*d)*(27688*m + 16627*m^2 + 4528*m^3 + 613*m^4 + 40*m^5 + m^6 + 15015))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (A*a^3*c^2*x*(e*x)^m*(129072*m + 48259*m^2 + 9120*m^3 + 925*m^4 + 48*m^5 + m^6 + 135135))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (a^2*c*x^3*(e*x)^m*(2*A*a*d + 3*A*b*c + B*a*c)*(73054*m + 34759*m^2 + 7540*m^3 + 835*m^4 + 46*m^5 + m^6 + 45045))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (b^2*d*x^11*(e*x)^m*(A*b*d + 3*B*a*d + 2*B*b*c)*(22902*m + 14039*m^2 + 3940*m^3 + 555*m^4 + 38*m^5 + m^6 + 12285))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (B*b^3*d^2*x^13*(e*x)^m*(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135)`

3.9 $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx$

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3.9.1 Optimal result

Integrand size = 31, antiderivative size = 216

$$\begin{aligned} & \int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx \\ &= \frac{a^2Ac^2(ex)^{1+m}}{e(1+m)} + \frac{ac(aBc + 2A(bc + ad))(ex)^{3+m}}{e^3(3+m)} \\ &+ \frac{(2aBc(bc + ad) + A(b^2c^2 + 4abcd + a^2d^2))(ex)^{5+m}}{e^5(5+m)} \\ &+ \frac{(a^2Bd^2 + 2abd(2Bc + Ad) + b^2c(Bc + 2Ad))(ex)^{7+m}}{e^7(7+m)} \\ &+ \frac{bd(2bBc + Abd + 2aBd)(ex)^{9+m}}{e^9(9+m)} + \frac{b^2Bd^2(ex)^{11+m}}{e^{11}(11+m)} \end{aligned}$$

output

```
a^2*A*c^2*(e*x)^(1+m)/e/(1+m)+a*c*(B*a*c+2*A*(a*d+b*c))*(e*x)^(3+m)/e^3/(3+m)+(2*a*B*c*(a*d+b*c)+A*(a^2*d^2+4*a*b*c*d+b^2*c^2))*(e*x)^(5+m)/e^5/(5+m)+(a^2*B*d^2+2*a*b*d*(A*d+2*B*c)+b^2*c*(2*A*d+B*c))*(e*x)^(7+m)/e^7/(7+m)+b*d*(A*b*d+2*B*a*d+2*B*b*c)*(e*x)^(9+m)/e^9/(9+m)+b^2*B*d^2*(e*x)^(11+m)/e^11/(11+m)
```


3.9.2 Mathematica [A] (verified)

Time = 0.28 (sec) , antiderivative size = 178, normalized size of antiderivative = 0.82

$$\begin{aligned} & \int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx \\ &= x(ex)^m \left(\frac{a^2 Ac^2}{1+m} + \frac{ac(aBc + 2A(bc + ad))x^2}{3+m} \right. \\ & \quad \left. + \frac{(2aBc(bc + ad) + A(b^2c^2 + 4abcd + a^2d^2))x^4}{5+m} \right. \\ & \quad \left. + \frac{(a^2Bd^2 + 2abd(2Bc + Ad) + b^2c(Bc + 2Ad))x^6}{7+m} + \frac{bd(2bBc + Abd + 2aBd)x^8}{9+m} \right. \\ & \quad \left. + \frac{b^2Bd^2x^{10}}{11+m} \right) \end{aligned}$$

input `Integrate[(e*x)^m*(a + b*x^2)^2*(A + B*x^2)*(c + d*x^2)^2,x]`

output `x*(e*x)^m*((a^2*A*c^2)/(1 + m) + (a*c*(a*B*c + 2*A*(b*c + a*d))*x^2)/(3 + m) + ((2*a*B*c*(b*c + a*d) + A*(b^2*c^2 + 4*a*b*c*d + a^2*d^2))*x^4)/(5 + m) + ((a^2*B*d^2 + 2*a*b*d*(2*B*c + A*d) + b^2*c*(B*c + 2*A*d))*x^6)/(7 + m) + (b*d*(2*b*B*c + A*b*d + 2*a*B*d)*x^8)/(9 + m) + (b^2*B*d^2*x^10)/(11 + m))`

3.9.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 216, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 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.

$$\begin{aligned} & \int (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 (ex)^m dx \\ & \quad \downarrow 437 \\ & \int \left(\frac{(ex)^{m+4} (A(a^2d^2 + 4abcd + b^2c^2) + 2aBc(ad + bc))}{e^4} + \frac{(ex)^{m+6} (a^2Bd^2 + 2abd(Ad + 2Bc) + b^2c(2Ad + Bc))}{e^6} \right) dx \\ & \quad \downarrow 2009 \end{aligned}$$

3.9. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx$

$$\frac{(ex)^{m+5} (A(a^2d^2 + 4abcd + b^2c^2) + 2aBc(ad + bc))}{e^5(m+5)} + \frac{(ex)^{m+7} (a^2Bd^2 + 2abd(Ad + 2Bc) + b^2c(2Ad + Bc))}{e^7(m+7)} + \frac{a^2Ac^2(ex)^{m+1}}{e(m+1)} + \frac{bd(ex)^{m+9}(2aBd + Abd + 2bBc)}{e^9(m+9)} + \frac{ac(ex)^{m+3}(2A(ad + bc) + aBc)}{e^3(m+3)} + \frac{b^2Bd^2(ex)^{m+11}}{e^{11}(m+11)}$$

input `Int[(e*x)^m*(a + b*x^2)^2*(A + B*x^2)*(c + d*x^2)^2,x]`

output $(a^2Ac^2(e^x)^{(1+m)})/(e^{(1+m)}) + (a*c*(a*B*c + 2*A*(b*c + a*d))*(e^x)^{(3+m)}/(e^{3*(3+m)}) + ((2*a*B*c*(b*c + a*d) + A*(b^2*c^2 + 4*a*b*c*d + a^2*d^2))*(e^x)^{(5+m)}/(e^{5*(5+m)}) + ((a^2*B*d^2 + 2*a*b*d*(2*B*c + A*d) + b^2*c*(B*c + 2*A*d))*(e^x)^{(7+m)}/(e^{7*(7+m)}) + (b*d*(2*b*B*c + A*b*d + 2*a*B*d)*(e^x)^{(9+m)}/(e^{9*(9+m)}) + (b^2*B*d^2*(e^x)^{(11+m)})/(e^{11*(11+m)})$

3.9.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.9.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 1470 vs. $2(216) = 432$.

Time = 3.48 (sec) , antiderivative size = 1471, normalized size of antiderivative = 6.81

method	result	size
gospers	Expression too large to display	1471
risch	Expression too large to display	1471
parallelrisch	Expression too large to display	2011

input `int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^2,x,method=_RETURNVERBOSE)`

3.9. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx$

output

```
x*(B*b^2*d^2*m^5*x^10+25*B*b^2*d^2*m^4*x^10+A*b^2*d^2*m^5*x^8+2*B*a*b*d^2*
m^5*x^8+2*B*b^2*c*d*m^5*x^8+230*B*b^2*d^2*m^3*x^10+27*A*b^2*d^2*m^4*x^8+54
*B*a*b*d^2*m^4*x^8+54*B*b^2*c*d*m^4*x^8+950*B*b^2*d^2*m^2*x^10+2*A*a*b*d^2
*m^5*x^6+2*A*b^2*c*d*m^5*x^6+262*A*b^2*d^2*m^3*x^8+B*a^2*d^2*m^5*x^6+4*B*a
*b*c*d*m^5*x^6+524*B*a*b*d^2*m^3*x^8+B*b^2*c^2*m^5*x^6+524*B*b^2*c*d*m^3*x
^8+1689*B*b^2*d^2*m*x^10+58*A*a*b*d^2*m^4*x^6+58*A*b^2*c*d*m^4*x^6+1122*A*
b^2*d^2*m^2*x^8+29*B*a^2*d^2*m^4*x^6+116*B*a*b*c*d*m^4*x^6+2244*B*a*b*d^2*
m^2*x^8+29*B*b^2*c^2*m^4*x^6+2244*B*b^2*c*d*m^2*x^8+945*B*b^2*d^2*x^10+A*a
^2*d^2*m^5*x^4+4*A*a*b*c*d*m^5*x^4+604*A*a*b*d^2*m^3*x^6+A*b^2*c^2*m^5*x^4
+604*A*b^2*c*d*m^3*x^6+2041*A*b^2*d^2*m*x^8+2*B*a^2*c*d*m^5*x^4+302*B*a^2*
d^2*m^3*x^6+2*B*a*b*c^2*m^5*x^4+1208*B*a*b*c*d*m^3*x^6+4082*B*a*b*d^2*m*x^
8+302*B*b^2*c^2*m^3*x^6+4082*B*b^2*c*d*m*x^8+31*A*a^2*d^2*m^4*x^4+124*A*a*
b*c*d*m^4*x^4+2732*A*a*b*d^2*m^2*x^6+31*A*b^2*c^2*m^4*x^4+2732*A*b^2*c*d*m
^2*x^6+1155*A*b^2*d^2*x^8+62*B*a^2*c*d*m^4*x^4+1366*B*a^2*d^2*m^2*x^6+62*B
*a*b*c^2*m^4*x^4+5464*B*a*b*c*d*m^2*x^6+2310*B*a*b*d^2*x^8+1366*B*b^2*c^2*
m^2*x^6+2310*B*b^2*c*d*x^8+2*A*a^2*c*d*m^5*x^2+350*A*a^2*d^2*m^3*x^4+2*A*a
*b*c^2*m^5*x^2+1400*A*a*b*c*d*m^3*x^4+5154*A*a*b*d^2*m*x^6+350*A*b^2*c^2*m
^3*x^4+5154*A*b^2*c*d*m*x^6+B*a^2*c^2*m^5*x^2+700*B*a^2*c*d*m^3*x^4+2577*B
*a^2*d^2*m*x^6+700*B*a*b*c^2*m^3*x^4+10308*B*a*b*c*d*m*x^6+2577*B*b^2*c^2*
m*x^6+66*A*a^2*c*d*m^4*x^2+1730*A*a^2*d^2*m^2*x^4+66*A*a*b*c^2*m^4*x^2+...
```

3.9.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1043 vs. $2(216) = 432$.

Time = 0.29 (sec) , antiderivative size = 1043, normalized size of antiderivative = 4.83

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="fricas")`

output

```

((B*b^2*d^2*m^5 + 25*B*b^2*d^2*m^4 + 230*B*b^2*d^2*m^3 + 950*B*b^2*d^2*m^2
+ 1689*B*b^2*d^2*m + 945*B*b^2*d^2)*x^11 + ((2*B*b^2*c*d + (2*B*a*b + A*b
^2)*d^2)*m^5 + 2310*B*b^2*c*d + 27*(2*B*b^2*c*d + (2*B*a*b + A*b^2)*d^2)*m
^4 + 262*(2*B*b^2*c*d + (2*B*a*b + A*b^2)*d^2)*m^3 + 1155*(2*B*a*b + A*b^2
)*d^2 + 1122*(2*B*b^2*c*d + (2*B*a*b + A*b^2)*d^2)*m^2 + 2041*(2*B*b^2*c*d
+ (2*B*a*b + A*b^2)*d^2)*m)*x^9 + ((B*b^2*c^2 + 2*(2*B*a*b + A*b^2)*c*d +
(B*a^2 + 2*A*a*b)*d^2)*m^5 + 1485*B*b^2*c^2 + 29*(B*b^2*c^2 + 2*(2*B*a*b
+ A*b^2)*c*d + (B*a^2 + 2*A*a*b)*d^2)*m^4 + 302*(B*b^2*c^2 + 2*(2*B*a*b +
A*b^2)*c*d + (B*a^2 + 2*A*a*b)*d^2)*m^3 + 2970*(2*B*a*b + A*b^2)*c*d + 148
5*(B*a^2 + 2*A*a*b)*d^2 + 1366*(B*b^2*c^2 + 2*(2*B*a*b + A*b^2)*c*d + (B*a
^2 + 2*A*a*b)*d^2)*m^2 + 2577*(B*b^2*c^2 + 2*(2*B*a*b + A*b^2)*c*d + (B*a^
2 + 2*A*a*b)*d^2)*m)*x^7 + ((A*a^2*d^2 + (2*B*a*b + A*b^2)*c^2 + 2*(B*a^2
+ 2*A*a*b)*c*d)*m^5 + 2079*A*a^2*d^2 + 31*(A*a^2*d^2 + (2*B*a*b + A*b^2)*c
^2 + 2*(B*a^2 + 2*A*a*b)*c*d)*m^4 + 350*(A*a^2*d^2 + (2*B*a*b + A*b^2)*c^2
+ 2*(B*a^2 + 2*A*a*b)*c*d)*m^3 + 2079*(2*B*a*b + A*b^2)*c^2 + 4158*(B*a^2
+ 2*A*a*b)*c*d + 1730*(A*a^2*d^2 + (2*B*a*b + A*b^2)*c^2 + 2*(B*a^2 + 2*A
*a*b)*c*d)*m^2 + 3489*(A*a^2*d^2 + (2*B*a*b + A*b^2)*c^2 + 2*(B*a^2 + 2*A
*a*b)*c*d)*m)*x^5 + ((2*A*a^2*c*d + (B*a^2 + 2*A*a*b)*c^2)*m^5 + 6930*A*a^2
*c*d + 33*(2*A*a^2*c*d + (B*a^2 + 2*A*a*b)*c^2)*m^4 + 406*(2*A*a^2*c*d + (
B*a^2 + 2*A*a*b)*c^2)*m^3 + 3465*(B*a^2 + 2*A*a*b)*c^2 + 2262*(2*A*a^2*...

```

3.9.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 6836 vs. $2(211) = 422$.

Time = 0.96 (sec) , antiderivative size = 6836, normalized size of antiderivative = 31.65

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**2*(B*x**2+A)*(d*x**2+c)**2,x)`

output `Piecewise(((-A**2*c**2/(10*x**10) - A**2*c*d/(4*x**8) - A**2*d**2/(6*x**6) - A*b*c**2/(4*x**8) - 2*A*a*b*c*d/(3*x**6) - A*a*b*d**2/(2*x**4) - A*b**2*c**2/(6*x**6) - A*b**2*c*d/(2*x**4) - A*b**2*d**2/(2*x**2) - B*a**2*c**2/(8*x**8) - B*a**2*c*d/(3*x**6) - B*a**2*d**2/(4*x**4) - B*a*b*c**2/(3*x**6) - B*a*b*c*d/x**4 - B*a*b*d**2/x**2 - B*b**2*c**2/(4*x**4) - B*b**2*c*d/x**2 + B*b**2*d**2*log(x))/e**11, Eq(m, -11)), ((-A**2*c**2/(8*x**8) - A**2*c*d/(3*x**6) - A**2*d**2/(4*x**4) - A*a*b*c**2/(3*x**6) - A*a*b*c*d/x**4 - A*a*b*d**2/x**2 - A*b**2*c**2/(4*x**4) - A*b**2*c*d/x**2 + A*b**2*d**2*log(x) - B*a**2*c**2/(6*x**6) - B*a**2*c*d/(2*x**4) - B*a**2*d**2/(2*x**2) - B*a*b*c**2/(2*x**4) - 2*B*a*b*c*d/x**2 + 2*B*a*b*d**2*log(x) - B*b**2*c**2/(2*x**2) + 2*B*b**2*c*d*log(x) + B*b**2*d**2*x**2/2)/e**9, Eq(m, -9)), ((-A**2*c**2/(6*x**6) - A**2*c*d/(2*x**4) - A**2*d**2/(2*x**2) - A*a*b*c**2/(2*x**4) - 2*A*a*b*c*d/x**2 + 2*A*a*b*d**2*log(x) - A*b**2*c**2/(2*x**2) + 2*A*b**2*c*d*log(x) + A*b**2*d**2*x**2/2 - B*a**2*c**2/(4*x**4) - B*a**2*c*d/x**2 + B*a**2*d**2*log(x) - B*a*b*c**2/x**2 + 4*B*a*b*c*d*log(x) + B*a*b*d**2*x**2 + B*b**2*c**2*log(x) + B*b**2*c*d*x**2 + B*b**2*d**2*x**4/4)/e**7, Eq(m, -7)), ((-A**2*c**2/(4*x**4) - A**2*c*d/x**2 + A**2*d**2*log(x) - A*a*b*c**2/x**2 + 4*A*a*b*c*d*log(x) + A*a*b*d**2*x**2 + A*b**2*c**2*log(x) + A*b**2*c*d*x**2 + A*b**2*d**2*x**4/4 - B*a**2*c**2/(2*x**2) + 2*B*a**2*c*d*log(x) + B*a**2*d**2*x**2/2 + 2*B*a...`

3.9.7 Maxima [A] (verification not implemented)

Time = 0.25 (sec) , antiderivative size = 396, normalized size of antiderivative = 1.83

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx = \frac{Bb^2d^2e^m x^{11}x^m}{m+11} + \frac{2Bb^2cde^m x^9x^m}{m+9} + \frac{2Babd^2e^m x^9x^m}{m+9} + \frac{Ab^2d^2e^m x^9x^m}{m+9} + \frac{Bb^2c^2e^m x^7x^m}{m+7} + \frac{4Babcde^m x^7x^m}{m+7} + \frac{2Ab^2cde^m x^7x^m}{m+7} + \frac{Ba^2d^2e^m x^7x^m}{m+7} + \frac{2Aabd^2e^m x^7x^m}{m+7} + \frac{2Babc^2e^m x^5x^m}{m+5} + \frac{Ab^2c^2e^m x^5x^m}{m+5} + \frac{2Ba^2cde^m x^5x^m}{m+5} + \frac{4Aabcde^m x^5x^m}{m+5} + \frac{Aa^2d^2e^m x^5x^m}{m+5} + \frac{Ba^2c^2e^m x^3x^m}{m+3} + \frac{2Aabc^2e^m x^3x^m}{m+3} + \frac{2Aa^2cde^m x^3x^m}{m+3} + \frac{(ex)^{m+1} Aa^2c^2}{e(m+1)}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="maxima")`

output `B*b^2*d^2*e^m*x^11*x^m/(m + 11) + 2*B*b^2*c*d*e^m*x^9*x^m/(m + 9) + 2*B*a*b*d^2*e^m*x^9*x^m/(m + 9) + A*b^2*d^2*e^m*x^9*x^m/(m + 9) + B*b^2*c^2*e^m*x^7*x^m/(m + 7) + 4*B*a*b*c*d*e^m*x^7*x^m/(m + 7) + 2*A*b^2*c*d*e^m*x^7*x^m/(m + 7) + B*a^2*d^2*e^m*x^7*x^m/(m + 7) + 2*A*a*b*d^2*e^m*x^7*x^m/(m + 7) + 2*B*a*b*c^2*e^m*x^5*x^m/(m + 5) + A*b^2*c^2*e^m*x^5*x^m/(m + 5) + 2*B*a^2*c*d*e^m*x^5*x^m/(m + 5) + 4*A*a*b*c*d*e^m*x^5*x^m/(m + 5) + A*a^2*d^2*e^m*x^5*x^m/(m + 5) + B*a^2*c^2*e^m*x^3*x^m/(m + 3) + 2*A*a*b*c^2*e^m*x^3*x^m/(m + 3) + 2*A*a^2*c*d*e^m*x^3*x^m/(m + 3) + (e*x)^(m + 1)*A*a^2*c^2/(e*(m + 1))`

3.9.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2010 vs. $2(216) = 432$.

Time = 0.36 (sec) , antiderivative size = 2010, normalized size of antiderivative = 9.31

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="giac")`

output `((e*x)^m*B*b^2*d^2*m^5*x^11 + 25*(e*x)^m*B*b^2*d^2*m^4*x^11 + 2*(e*x)^m*B*b^2*c*d*m^5*x^9 + 2*(e*x)^m*B*a*b*d^2*m^5*x^9 + (e*x)^m*A*b^2*d^2*m^5*x^9 + 230*(e*x)^m*B*b^2*d^2*m^3*x^11 + 54*(e*x)^m*B*b^2*c*d*m^4*x^9 + 54*(e*x)^m*B*a*b*d^2*m^4*x^9 + 27*(e*x)^m*A*b^2*d^2*m^4*x^9 + 950*(e*x)^m*B*b^2*d^2*m^2*x^11 + (e*x)^m*B*b^2*c^2*m^5*x^7 + 4*(e*x)^m*B*a*b*c*d*m^5*x^7 + 2*(e*x)^m*A*b^2*c*d*m^5*x^7 + (e*x)^m*B*a^2*d^2*m^5*x^7 + 2*(e*x)^m*A*a*b*d^2*m^5*x^7 + 524*(e*x)^m*B*b^2*c*d*m^3*x^9 + 524*(e*x)^m*B*a*b*d^2*m^3*x^9 + 262*(e*x)^m*A*b^2*d^2*m^3*x^9 + 1689*(e*x)^m*B*b^2*d^2*m*x^11 + 29*(e*x)^m*B*b^2*c^2*m^4*x^7 + 116*(e*x)^m*B*a*b*c*d*m^4*x^7 + 58*(e*x)^m*A*b^2*c*d*m^4*x^7 + 29*(e*x)^m*B*a^2*d^2*m^4*x^7 + 58*(e*x)^m*A*a*b*d^2*m^4*x^7 + 2244*(e*x)^m*B*b^2*c*d*m^2*x^9 + 2244*(e*x)^m*B*a*b*d^2*m^2*x^9 + 1122*(e*x)^m*A*b^2*d^2*m^2*x^9 + 945*(e*x)^m*B*b^2*d^2*x^11 + 2*(e*x)^m*B*a*b*c^2*m^5*x^5 + (e*x)^m*A*b^2*c^2*m^5*x^5 + 2*(e*x)^m*B*a^2*c*d*m^5*x^5 + 4*(e*x)^m*A*a*b*c*d*m^5*x^5 + (e*x)^m*A*a^2*d^2*m^5*x^5 + 302*(e*x)^m*B*b^2*c^2*m^3*x^7 + 1208*(e*x)^m*B*a*b*c*d*m^3*x^7 + 604*(e*x)^m*A*b^2*c*d*m^3*x^7 + 302*(e*x)^m*B*a^2*d^2*m^3*x^7 + 604*(e*x)^m*A*a*b*d^2*m^3*x^7 + 4082*(e*x)^m*B*b^2*c*d*m*x^9 + 4082*(e*x)^m*B*a*b*d^2*m*x^9 + 2041*(e*x)^m*A*b^2*d^2*m*x^9 + 62*(e*x)^m*B*a*b*c^2*m^4*x^5 + 31*(e*x)^m*A*b^2*c^2*m^4*x^5 + 62*(e*x)^m*B*a^2*c*d*m^4*x^5 + 124*(e*x)^m*A*a*b*c*d*m^4*x^5 + 31*(e*x)^m*A*a^2*d^2*m^4*x^5 + 1366*(e*x)^m*B*b^2*c^2*m^2*x^7 + 5464*(e*x)^m*B*a*b*c*...`

3.9.9 Mupad [B] (verification not implemented)

Time = 5.88 (sec) , antiderivative size = 499, normalized size of antiderivative = 2.31

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^2 dx$$

$$= \frac{x^5 (ex)^m (2Ba^2cd + Aa^2d^2 + 2Babc^2 + 4Aabcd + Ab^2c^2) (m^5 + 31m^4 + 350m^3 + 1730m^2 + 3489m + 2079)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{x^7 (ex)^m (Ba^2d^2 + 4Babcd + 2Aabd^2 + Bb^2c^2 + 2Ab^2cd) (m^5 + 29m^4 + 302m^3 + 1366m^2 + 2577m + 1485)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{acx^3 (ex)^m (2Aad + 2Abc + Bac) (m^5 + 33m^4 + 406m^3 + 2262m^2 + 5353m + 3465)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{bdx^9 (ex)^m (Abd + 2Bad + 2Bbc) (m^5 + 27m^4 + 262m^3 + 1122m^2 + 2041m + 1155)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{Aa^2c^2x (ex)^m (m^5 + 35m^4 + 470m^3 + 3010m^2 + 9129m + 10395)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

$$+ \frac{Bb^2d^2x^{11} (ex)^m (m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^2*(c + d*x^2)^2,x)`

output `(x^5*(e*x)^m*(A*a^2*d^2 + A*b^2*c^2 + 2*B*a*b*c^2 + 2*B*a^2*c*d + 4*A*a*b*c*d)*(3489*m + 1730*m^2 + 350*m^3 + 31*m^4 + m^5 + 2079))/(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395) + (x^7*(e*x)^m*(B*a^2*d^2 + B*b^2*c^2 + 2*A*a*b*d^2 + 2*A*b^2*c*d + 4*B*a*b*c*d)*(2577*m + 1366*m^2 + 302*m^3 + 29*m^4 + m^5 + 1485))/(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395) + (a*c*x^3*(e*x)^m*(2*A*a*d + 2*A*b*c + B*a*c)*(5353*m + 2262*m^2 + 406*m^3 + 33*m^4 + m^5 + 3465))/(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395) + (b*d*x^9*(e*x)^m*(A*b*d + 2*B*a*d + 2*B*b*c)*(2041*m + 1122*m^2 + 262*m^3 + 27*m^4 + m^5 + 1155))/(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395) + (A*a^2*c^2*x*(e*x)^m*(9129*m + 3010*m^2 + 470*m^3 + 35*m^4 + m^5 + 10395))/(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395) + (B*b^2*d^2*x^11*(e*x)^m*(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945))/(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395)`

3.10 $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$

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3.10.1 Optimal result

Integrand size = 29, antiderivative size = 144

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx = \frac{aAc^2(ex)^{1+m}}{e(1+m)} + \frac{c(ABC + aBc + 2aAd)(ex)^{3+m}}{e^3(3+m)} + \frac{(ad(2Bc + Ad) + bc(Bc + 2Ad))(ex)^{5+m}}{e^5(5+m)} + \frac{d(2bBc + Abd + aBd)(ex)^{7+m}}{e^7(7+m)} + \frac{bBd^2(ex)^{9+m}}{e^9(9+m)}$$

output

```
a*A*c^2*(e*x)^(1+m)/e/(1+m)+c*(2*A*a*d+A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)+
(a*d*(A*d+2*B*c)+b*c*(2*A*d+B*c))*(e*x)^(5+m)/e^5/(5+m)+d*(A*b*d+B*a*d+2*B
*b*c)*(e*x)^(7+m)/e^7/(7+m)+b*B*d^2*(e*x)^(9+m)/e^9/(9+m)
```

3.10.2 Mathematica [A] (verified)

Time = 0.14 (sec) , antiderivative size = 113, normalized size of antiderivative = 0.78

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx = x(ex)^m \left(\frac{aAc^2}{1+m} + \frac{c(ABC + aBc + 2aAd)x^2}{3+m} + \frac{(ad(2Bc + Ad) + bc(Bc + 2Ad))x^4}{5+m} + \frac{d(2bBc + Abd + aBd)x^6}{7+m} + \frac{bBd^2x^8}{9+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)*(A + B*x^2)*(c + d*x^2)^2,x]`

output `x*(e*x)^m*((a*A*c^2)/(1 + m) + (c*(A*b*c + a*B*c + 2*a*A*d)*x^2)/(3 + m) + ((a*d*(2*B*c + A*d) + b*c*(B*c + 2*A*d))*x^4)/(5 + m) + (d*(2*b*B*c + A*b*d + a*B*d)*x^6)/(7 + m) + (b*B*d^2*x^8)/(9 + m))`

3.10.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 144, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.069$, Rules used = {437, 2009}

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

$$\int (a + bx^2) (A + Bx^2) (c + dx^2)^2 (ex)^m dx$$

$$\downarrow 437$$

$$\int \left(\frac{d(ex)^{m+6}(aBd + Abd + 2bBc)}{e^6} + \frac{(ex)^{m+4}(ad(Ad + 2Bc) + bc(2Ad + Bc))}{e^4} + \frac{c(ex)^{m+2}(2aAd + aBc + Abc)}{e^2} \right) dx$$

$$\downarrow 2009$$

$$\frac{d(ex)^{m+7}(aBd + Abd + 2bBc)}{e^7(m+7)} + \frac{(ex)^{m+5}(ad(Ad + 2Bc) + bc(2Ad + Bc))}{e^5(m+5)} + \frac{c(ex)^{m+3}(2aAd + aBc + Abc)}{e^3(m+3)} + \frac{aAc^2(ex)^{m+1}}{e(m+1)} + \frac{bBd^2(ex)^{m+9}}{e^9(m+9)}$$

input `Int[(e*x)^m*(a + b*x^2)*(A + B*x^2)*(c + d*x^2)^2,x]`

output `(a*A*c^2*(e*x)^(1 + m))/(e*(1 + m)) + (c*(A*b*c + a*B*c + 2*a*A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + ((a*d*(2*B*c + A*d) + b*c*(B*c + 2*A*d))*(e*x)^(5 + m))/(e^5*(5 + m)) + (d*(2*b*B*c + A*b*d + a*B*d)*(e*x)^(7 + m))/(e^7*(7 + m)) + (b*B*d^2*(e*x)^(9 + m))/(e^9*(9 + m))`

3.10.3.1 Defintions of rubi rules used

```
rule 437 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q
_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(
a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f
, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]
```

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

3.10.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 710 vs. 2(144) = 288.

Time = 3.39 (sec) , antiderivative size = 711, normalized size of antiderivative = 4.94

method	result
gospers	$\frac{x(Bb d^2 m^4 x^8 + 16 B b d^2 m^3 x^8 + A b d^2 m^4 x^6 + B a d^2 m^4 x^6 + 2 B b c d m^4 x^6 + 86 B b d^2 m^2 x^8 + 18 A b d^2 m^3 x^6 + 18 B a d^2 m^3 x^6 + 36 B b c d m^3 x^6 + 176 B b d^2 m^2 x^8 + A a d^2 m^4 x^4 + 2 A b c d m^4 x^4 + 104 A a b d^2 m^2 x^6 + 2 B a c d m^4 x^4 + 104 B a d^2 m^2 x^6 + B b c^2 m^4 x^4 + 208 B b c d m^2 x^6 + 105 B b d^2 x^8 + 20 A a d^2 m^3 x^4 + 40 A b c d m^3 x^4 + 222 A a b d^2 m x^6 + 40 B a c d m^3 x^4 + 222 B a d^2 m x^6 + 20 B b c^2 m^3 x^4 + 444 B b c d m x^6 + 2 A a c d m^4 x^2 + 130 A a d^2 m^2 x^4 + A b c^2 m^4 x^2 + 260 A a b c d m^2 x^4 + 135 A b d^2 x^6 + B a c^2 m^4 x^2 + 260 B a c d m^2 x^4 + 135 B a d^2 x^6 + 130 B b c^2 m^2 x^4 + 270 B b c d x^6 + 44 A a c d m^3 x^2 + 300 A a d^2 m x^4 + 22 A b c^2 m^3 x^2 + 600 A b c d m x^4 + 22 B a c^2 m^3 x^2 + 600 B a c d m x^4 + 300 B b c^2 m x^4 + A a c^2 m^4 + 328 A a c d m^2 x^2 + 189 A a d^2 x^4 + 164 A a b c^2 m^2 x^2 + 378 A b c d x^4 + 164 B a c^2 m^2 x^2 + 378 B a c d x^4 + 189 B b c^2 x^4 + 24 A a c^2 m^3 + 916 A a c d m x^2 + 458 A b c^2 m x^2 + 458 B a c^2 m x^2 + 206 A a c^2 m^2 + 630 A a c d x^2 + 315 A b c^2 x^2 + 315 B a c^2 x^2 + 744 A a c^2 m + 945 A a c^2) * (e*x)^m / ((9+m) * (7+m) * (5+m) * (3+m) * (1+m))$
risch	$\frac{x(Bb d^2 m^4 x^8 + 16 B b d^2 m^3 x^8 + A b d^2 m^4 x^6 + B a d^2 m^4 x^6 + 2 B b c d m^4 x^6 + 86 B b d^2 m^2 x^8 + 18 A b d^2 m^3 x^6 + 18 B a d^2 m^3 x^6 + 36 B b c d m^3 x^6 + 176 B b d^2 m^2 x^8 + A a d^2 m^4 x^4 + 2 A b c d m^4 x^4 + 104 A a b d^2 m^2 x^6 + 2 B a c d m^4 x^4 + 104 B a d^2 m^2 x^6 + B b c^2 m^4 x^4 + 208 B b c d m^2 x^6 + 105 B b d^2 x^8 + 20 A a d^2 m^3 x^4 + 40 A b c d m^3 x^4 + 222 A a b d^2 m x^6 + 40 B a c d m^3 x^4 + 222 B a d^2 m x^6 + 20 B b c^2 m^3 x^4 + 444 B b c d m x^6 + 2 A a c d m^4 x^2 + 130 A a d^2 m^2 x^4 + A b c^2 m^4 x^2 + 260 A a b c d m^2 x^4 + 135 A b d^2 x^6 + B a c^2 m^4 x^2 + 260 B a c d m^2 x^4 + 135 B a d^2 x^6 + 130 B b c^2 m^2 x^4 + 270 B b c d x^6 + 44 A a c d m^3 x^2 + 300 A a d^2 m x^4 + 22 A b c^2 m^3 x^2 + 600 A b c d m x^4 + 22 B a c^2 m^3 x^2 + 600 B a c d m x^4 + 300 B b c^2 m x^4 + A a c^2 m^4 + 328 A a c d m^2 x^2 + 189 A a d^2 x^4 + 164 A a b c^2 m^2 x^2 + 378 A b c d x^4 + 164 B a c^2 m^2 x^2 + 378 B a c d x^4 + 189 B b c^2 x^4 + 24 A a c^2 m^3 + 916 A a c d m x^2 + 458 A b c^2 m x^2 + 458 B a c^2 m x^2 + 206 A a c^2 m^2 + 630 A a c d x^2 + 315 A b c^2 x^2 + 315 B a c^2 x^2 + 744 A a c^2 m + 945 A a c^2) * (e*x)^m / ((9+m) * (7+m) * (5+m) * (3+m) * (1+m))$
parallelrisc	Expression too large to display

```
input int((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^2,x,method=_RETURNVERBOSE)
```

```
output x*(B*b*d^2*m^4*x^8+16*B*b*d^2*m^3*x^8+A*b*d^2*m^4*x^6+B*a*d^2*m^4*x^6+2*B*
b*c*d*m^4*x^6+86*B*b*d^2*m^2*x^8+18*A*b*d^2*m^3*x^6+18*B*a*d^2*m^3*x^6+36*
B*b*c*d*m^3*x^6+176*B*b*d^2*m*x^8+A*a*d^2*m^4*x^4+2*A*b*c*d*m^4*x^4+104*A*
b*d^2*m^2*x^6+2*B*a*c*d*m^4*x^4+104*B*a*d^2*m^2*x^6+B*b*c^2*m^4*x^4+208*B*
b*c*d*m^2*x^6+105*B*b*d^2*x^8+20*A*a*d^2*m^3*x^4+40*A*b*c*d*m^3*x^4+222*A*
b*d^2*m*x^6+40*B*a*c*d*m^3*x^4+222*B*a*d^2*m*x^6+20*B*b*c^2*m^3*x^4+444*B*
b*c*d*m*x^6+2*A*a*c*d*m^4*x^2+130*A*a*d^2*m^2*x^4+A*b*c^2*m^4*x^2+260*A*b*
c*d*m^2*x^4+135*A*b*d^2*x^6+B*a*c^2*m^4*x^2+260*B*a*c*d*m^2*x^4+135*B*a*d^
2*x^6+130*B*b*c^2*m^2*x^4+270*B*b*c*d*x^6+44*A*a*c*d*m^3*x^2+300*A*a*d^2*m
*x^4+22*A*b*c^2*m^3*x^2+600*A*b*c*d*m*x^4+22*B*a*c^2*m^3*x^2+600*B*a*c*d*m
*x^4+300*B*b*c^2*m*x^4+A*a*c^2*m^4+328*A*a*c*d*m^2*x^2+189*A*a*d^2*x^4+164
*A*b*c^2*m^2*x^2+378*A*b*c*d*x^4+164*B*a*c^2*m^2*x^2+378*B*a*c*d*x^4+189*B
*b*c^2*x^4+24*A*a*c^2*m^3+916*A*a*c*d*m*x^2+458*A*b*c^2*m*x^2+458*B*a*c^2*
m*x^2+206*A*a*c^2*m^2+630*A*a*c*d*x^2+315*A*b*c^2*x^2+315*B*a*c^2*x^2+744*
A*a*c^2*m+945*A*a*c^2)*(e*x)^m/(9+m)/(7+m)/(5+m)/(3+m)/(1+m)
```

$$3.10. \int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$$

3.10.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 495 vs. $2(144) = 288$.

Time = 0.27 (sec) , antiderivative size = 495, normalized size of antiderivative = 3.44

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$$

$$= \frac{((Bbd^2m^4 + 16Bbd^2m^3 + 86Bbd^2m^2 + 176Bbd^2m + 105Bbd^2)x^9 + ((2Bbcd + (Ba + Ab)d^2)m^4 + 270$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="fracas")`

output `((B*b*d^2*m^4 + 16*B*b*d^2*m^3 + 86*B*b*d^2*m^2 + 176*B*b*d^2*m + 105*B*b*d^2)*x^9 + ((2*B*b*c*d + (B*a + A*b)*d^2)*m^4 + 270*B*b*c*d + 18*(2*B*b*c*d + (B*a + A*b)*d^2)*m^3 + 135*(B*a + A*b)*d^2 + 104*(2*B*b*c*d + (B*a + A*b)*d^2)*m^2 + 222*(2*B*b*c*d + (B*a + A*b)*d^2)*m)*x^7 + ((B*b*c^2 + A*a*d^2 + 2*(B*a + A*b)*c*d)*m^4 + 189*B*b*c^2 + 189*A*a*d^2 + 20*(B*b*c^2 + A*a*d^2 + 2*(B*a + A*b)*c*d)*m^3 + 378*(B*a + A*b)*c*d + 130*(B*b*c^2 + A*a*d^2 + 2*(B*a + A*b)*c*d)*m^2 + 300*(B*b*c^2 + A*a*d^2 + 2*(B*a + A*b)*c*d)*m)*x^5 + ((2*A*a*c*d + (B*a + A*b)*c^2)*m^4 + 630*A*a*c*d + 22*(2*A*a*c*d + (B*a + A*b)*c^2)*m^3 + 315*(B*a + A*b)*c^2 + 164*(2*A*a*c*d + (B*a + A*b)*c^2)*m^2 + 458*(2*A*a*c*d + (B*a + A*b)*c^2)*m)*x^3 + (A*a*c^2*m^4 + 24*A*a*c^2*m^3 + 206*A*a*c^2*m^2 + 744*A*a*c^2*m + 945*A*a*c^2)*x)*(e*x)^m/(m^5 + 25*m^4 + 230*m^3 + 950*m^2 + 1689*m + 945)`

3.10.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 3271 vs. $2(139) = 278$.

Time = 0.67 (sec) , antiderivative size = 3271, normalized size of antiderivative = 22.72

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)*(B*x**2+A)*(d*x**2+c)**2,x)`

```
output Piecewise((( -A*a*c**2/(8*x**8) - A*a*c*d/(3*x**6) - A*a*d**2/(4*x**4) - A*
b*c**2/(6*x**6) - A*b*c*d/(2*x**4) - A*b*d**2/(2*x**2) - B*a*c**2/(6*x**6)
- B*a*c*d/(2*x**4) - B*a*d**2/(2*x**2) - B*b*c**2/(4*x**4) - B*b*c*d/x**2
+ B*b*d**2*log(x))/e**9, Eq(m, -9)), (( -A*a*c**2/(6*x**6) - A*a*c*d/(2*x
**4) - A*a*d**2/(2*x**2) - A*b*c**2/(4*x**4) - A*b*c*d/x**2 + A*b*d**2*log(
x) - B*a*c**2/(4*x**4) - B*a*c*d/x**2 + B*a*d**2*log(x) - B*b*c**2/(2*x**2
) + 2*B*b*c*d*log(x) + B*b*d**2*x**2/2)/e**7, Eq(m, -7)), (( -A*a*c**2/(4*x
**4) - A*a*c*d/x**2 + A*a*d**2*log(x) - A*b*c**2/(2*x**2) + 2*A*b*c*d*log(
x) + A*b*d**2*x**2/2 - B*a*c**2/(2*x**2) + 2*B*a*c*d*log(x) + B*a*d**2*x**
2/2 + B*b*c**2*log(x) + B*b*c*d*x**2 + B*b*d**2*x**4/4)/e**5, Eq(m, -5)),
(( -A*a*c**2/(2*x**2) + 2*A*a*c*d*log(x) + A*a*d**2*x**2/2 + A*b*c**2*log(x)
) + A*b*c*d*x**2 + A*b*d**2*x**4/4 + B*a*c**2*log(x) + B*a*c*d*x**2 + B*a
d**2*x**4/4 + B*b*c**2*x**2/2 + B*b*c*d*x**4/2 + B*b*d**2*x**6/6)/e**3, Eq
(m, -3)), ((A*a*c**2*log(x) + A*a*c*d*x**2 + A*a*d**2*x**4/4 + A*b*c**2*x
**2/2 + A*b*c*d*x**4/2 + A*b*d**2*x**6/6 + B*a*c**2*x**2/2 + B*a*c*d*x**4/2
+ B*a*d**2*x**6/6 + B*b*c**2*x**4/4 + B*b*c*d*x**6/3 + B*b*d**2*x**8/8)/e
, Eq(m, -1)), (A*a*c**2*m**4*x*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m
**2 + 1689*m + 945) + 24*A*a*c**2*m**3*x*(e*x)**m/(m**5 + 25*m**4 + 230*m
**3 + 950*m**2 + 1689*m + 945) + 206*A*a*c**2*m**2*x*(e*x)**m/(m**5 + 25*m
**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 744*A*a*c**2*m*x*(e*x)**m/(m...
```

3.10.7 Maxima [A] (verification not implemented)

Time = 0.23 (sec) , antiderivative size = 242, normalized size of antiderivative = 1.68

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx = \frac{Bbd^2 e^m x^9 x^m}{m+9} + \frac{2 Bbcde^m x^7 x^m}{m+7} + \frac{Bad^2 e^m x^7 x^m}{m+7} + \frac{Abd^2 e^m x^7 x^m}{m+7} + \frac{Bbc^2 e^m x^5 x^m}{m+5} + \frac{2 Bacde^m x^5 x^m}{m+5} + \frac{2 Abcde^m x^5 x^m}{m+5} + \frac{Aad^2 e^m x^5 x^m}{m+5} + \frac{Bac^2 e^m x^3 x^m}{m+3} + \frac{Abc^2 e^m x^3 x^m}{m+3} + \frac{2 Aacde^m x^3 x^m}{m+3} + \frac{(ex)^{m+1} Aac^2}{e(m+1)}$$

```
input integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="maxima")
```

3.10. $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$

```
output B*b*d^2*e^m*x^9*x^m/(m + 9) + 2*B*b*c*d*e^m*x^7*x^m/(m + 7) + B*a*d^2*e^m*
x^7*x^m/(m + 7) + A*b*d^2*e^m*x^7*x^m/(m + 7) + B*b*c^2*e^m*x^5*x^m/(m + 5
) + 2*B*a*c*d*e^m*x^5*x^m/(m + 5) + 2*A*b*c*d*e^m*x^5*x^m/(m + 5) + A*a*d^
2*e^m*x^5*x^m/(m + 5) + B*a*c^2*e^m*x^3*x^m/(m + 3) + A*b*c^2*e^m*x^3*x^m/
(m + 3) + 2*A*a*c*d*e^m*x^3*x^m/(m + 3) + (e*x)^(m + 1)*A*a*c^2/(e*(m + 1)
)
```

3.10.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1009 vs. $2(144) = 288$.

Time = 0.33 (sec) , antiderivative size = 1009, normalized size of antiderivative = 7.01

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$$

$$= \frac{(ex)^m Bbd^2m^4x^9 + 16(ex)^m Bbd^2m^3x^9 + 2(ex)^m Bbcm^4x^7 + (ex)^m Bad^2m^4x^7 + (ex)^m Abd^2m^4x^7 + 86}{}$$

```
input integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="giac")
```

```
output ((e*x)^m*B*b*d^2*m^4*x^9 + 16*(e*x)^m*B*b*d^2*m^3*x^9 + 2*(e*x)^m*B*b*c*d*
m^4*x^7 + (e*x)^m*B*a*d^2*m^4*x^7 + (e*x)^m*A*b*d^2*m^4*x^7 + 86*(e*x)^m*B
*b*d^2*m^2*x^9 + 36*(e*x)^m*B*b*c*d*m^3*x^7 + 18*(e*x)^m*B*a*d^2*m^3*x^7 +
18*(e*x)^m*A*b*d^2*m^3*x^7 + 176*(e*x)^m*B*b*d^2*m*x^9 + (e*x)^m*B*b*c^2*
m^4*x^5 + 2*(e*x)^m*B*a*c*d*m^4*x^5 + 2*(e*x)^m*A*b*c*d*m^4*x^5 + (e*x)^m*
A*a*d^2*m^4*x^5 + 208*(e*x)^m*B*b*c*d*m^2*x^7 + 104*(e*x)^m*B*a*d^2*m^2*x^
7 + 104*(e*x)^m*A*b*d^2*m^2*x^7 + 105*(e*x)^m*B*b*d^2*x^9 + 20*(e*x)^m*B*b
*c^2*m^3*x^5 + 40*(e*x)^m*B*a*c*d*m^3*x^5 + 40*(e*x)^m*A*b*c*d*m^3*x^5 + 2
0*(e*x)^m*A*a*d^2*m^3*x^5 + 444*(e*x)^m*B*b*c*d*m*x^7 + 222*(e*x)^m*B*a*d^
2*m*x^7 + 222*(e*x)^m*A*b*d^2*m*x^7 + (e*x)^m*B*a*c^2*m^4*x^3 + (e*x)^m*A*
b*c^2*m^4*x^3 + 2*(e*x)^m*A*a*c*d*m^4*x^3 + 130*(e*x)^m*B*b*c^2*m^2*x^5 +
260*(e*x)^m*B*a*c*d*m^2*x^5 + 260*(e*x)^m*A*b*c*d*m^2*x^5 + 130*(e*x)^m*A*
a*d^2*m^2*x^5 + 270*(e*x)^m*B*b*c*d*x^7 + 135*(e*x)^m*B*a*d^2*x^7 + 135*(e
*x)^m*A*b*d^2*x^7 + 22*(e*x)^m*B*a*c^2*m^3*x^3 + 22*(e*x)^m*A*b*c^2*m^3*x^
3 + 44*(e*x)^m*A*a*c*d*m^3*x^3 + 300*(e*x)^m*B*b*c^2*m*x^5 + 600*(e*x)^m*B
*a*c*d*m*x^5 + 600*(e*x)^m*A*b*c*d*m*x^5 + 300*(e*x)^m*A*a*d^2*m*x^5 + (e
*x)^m*A*a*c^2*m^4*x + 164*(e*x)^m*B*a*c^2*m^2*x^3 + 164*(e*x)^m*A*b*c^2*m^2
*x^3 + 328*(e*x)^m*A*a*c*d*m^2*x^3 + 189*(e*x)^m*B*b*c^2*x^5 + 378*(e*x)^m
*B*a*c*d*x^5 + 378*(e*x)^m*A*b*c*d*x^5 + 189*(e*x)^m*A*a*d^2*x^5 + 24*(e*x
)^m*A*a*c^2*m^3*x + 458*(e*x)^m*B*a*c^2*m*x^3 + 458*(e*x)^m*A*b*c^2*m*x...
```

$$3.10. \quad \int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$$

3.10.9 Mupad [B] (verification not implemented)

Time = 5.60 (sec) , antiderivative size = 305, normalized size of antiderivative = 2.12

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^2 dx$$

$$= (ex)^m \left(\frac{x^5 (Aa d^2 + Bb c^2 + 2Abcd + 2Bacd) (m^4 + 20m^3 + 130m^2 + 300m + 189)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} \right.$$

$$+ \frac{cx^3 (2Aad + Abc + Bac) (m^4 + 22m^3 + 164m^2 + 458m + 315)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$+ \frac{dx^7 (Abd + Bad + 2Bbc) (m^4 + 18m^3 + 104m^2 + 222m + 135)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$+ \frac{Aac^2 x (m^4 + 24m^3 + 206m^2 + 744m + 945)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$\left. + \frac{Bbd^2 x^9 (m^4 + 16m^3 + 86m^2 + 176m + 105)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} \right)$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)*(c + d*x^2)^2,x)`output `(e*x)^m*((x^5*(A*a*d^2 + B*b*c^2 + 2*A*b*c*d + 2*B*a*c*d)*(300*m + 130*m^2 + 20*m^3 + m^4 + 189))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (c*x^3*(2*A*a*d + A*b*c + B*a*c)*(458*m + 164*m^2 + 22*m^3 + m^4 + 315))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (d*x^7*(A*b*d + B*a*d + 2*B*b*c)*(222*m + 104*m^2 + 18*m^3 + m^4 + 135))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (A*a*c^2*x*(744*m + 206*m^2 + 24*m^3 + m^4 + 945))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (B*b*d^2*x^9*(176*m + 86*m^2 + 16*m^3 + m^4 + 105))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945))`

3.11 $\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx$

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3.11.1 Optimal result

Integrand size = 22, antiderivative size = 91

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx = \frac{Ac^2(ex)^{1+m}}{e(1+m)} + \frac{c(Bc + 2Ad)(ex)^{3+m}}{e^3(3+m)} + \frac{d(2Bc + Ad)(ex)^{5+m}}{e^5(5+m)} + \frac{Bd^2(ex)^{7+m}}{e^7(7+m)}$$

output $A*c^2*(e*x)^{(1+m)}/e/(1+m)+c*(2*A*d+B*c)*(e*x)^{(3+m)}/e^3/(3+m)+d*(A*d+2*B*c)*(e*x)^{(5+m)}/e^5/(5+m)+B*d^2*(e*x)^{(7+m)}/e^7/(7+m)$

3.11.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 67, normalized size of antiderivative = 0.74

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx = x(ex)^m \left(\frac{Ac^2}{1+m} + \frac{c(Bc + 2Ad)x^2}{3+m} + \frac{d(2Bc + Ad)x^4}{5+m} + \frac{Bd^2x^6}{7+m} \right)$$

input `Integrate[(e*x)^m*(A + B*x^2)*(c + d*x^2)^2,x]`

output $x*(e*x)^m*((A*c^2)/(1+m) + (c*(B*c + 2*A*d)*x^2)/(3+m) + (d*(2*B*c + A*d)*x^4)/(5+m) + (B*d^2*x^6)/(7+m))$

3.11.3 Rubi [A] (verified)

Time = 0.23 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.091$, Rules used = {355, 2009}

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

$$\int (A + Bx^2) (c + dx^2)^2 (ex)^m dx$$

↓ 355

$$\int \left(\frac{d(ex)^{m+4}(Ad + 2Bc)}{e^4} + \frac{c(ex)^{m+2}(2Ad + Bc)}{e^2} + Ac^2(ex)^m + \frac{Bd^2(ex)^{m+6}}{e^6} \right) dx$$

↓ 2009

$$\frac{d(ex)^{m+5}(Ad + 2Bc)}{e^5(m+5)} + \frac{c(ex)^{m+3}(2Ad + Bc)}{e^3(m+3)} + \frac{Ac^2(ex)^{m+1}}{e(m+1)} + \frac{Bd^2(ex)^{m+7}}{e^7(m+7)}$$

input `Int[(e*x)^m*(A + B*x^2)*(c + d*x^2)^2,x]`

output `(A*c^2*(e*x)^(1 + m))/(e*(1 + m)) + (c*(B*c + 2*A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + (d*(2*B*c + A*d)*(e*x)^(5 + m))/(e^5*(5 + m)) + (B*d^2*(e*x)^(7 + m))/(e^7*(7 + m))`

3.11.3.1 Defintions of rubi rules used

rule 355 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.), x_Symbol] :> Int[ExpandIntegrand[(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^q, x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && IGtQ[p, 0] && IGtQ[q, 0]`

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

3.11.4 Maple [A] (verified)

Time = 3.35 (sec) , antiderivative size = 90, normalized size of antiderivative = 0.99

method	result
norman	$\frac{A c^2 x e^{m \ln(ex)}}{1+m} + \frac{B d^2 x^7 e^{m \ln(ex)}}{7+m} + \frac{c(2Ad+Bc)x^3 e^{m \ln(ex)}}{3+m} + \frac{d(Ad+2Bc)x^5 e^{m \ln(ex)}}{5+m}$
gospers	$\frac{x(B d^2 m^3 x^6 + 9 B d^2 m^2 x^6 + A d^2 m^3 x^4 + 2 B c d m^3 x^4 + 23 m x^6 B d^2 + 11 A d^2 m^2 x^4 + 22 B c d m^2 x^4 + 15 B d^2 x^6 + 2 A c d m^3 x^2 + 31 A c d m^3 x^2)}{...}$
risch	$\frac{x(B d^2 m^3 x^6 + 9 B d^2 m^2 x^6 + A d^2 m^3 x^4 + 2 B c d m^3 x^4 + 23 m x^6 B d^2 + 11 A d^2 m^2 x^4 + 22 B c d m^2 x^4 + 15 B d^2 x^6 + 2 A c d m^3 x^2 + 31 A c d m^3 x^2)}{...}$
parallelrisch	$\frac{62 B x^5 (ex)^m c d m + 2 B x^5 (ex)^m c d m^3 + 35 B x^3 (ex)^m c^2 + 105 A x (ex)^m c^2 + 22 B x^5 (ex)^m c d m^2 + 15 B x^7 (ex)^m d^2 + 21 A x^5 (ex)^m d^2}{...}$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2,x,method=_RETURNVERBOSE)`

output `A*c^2/(1+m)*x*exp(m*ln(e*x))+B*d^2/(7+m)*x^7*exp(m*ln(e*x))+c*(2*A*d+B*c)/(3+m)*x^3*exp(m*ln(e*x))+d*(A*d+2*B*c)/(5+m)*x^5*exp(m*ln(e*x))`

3.11.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 217 vs. 2(91) = 182.

Time = 0.29 (sec) , antiderivative size = 217, normalized size of antiderivative = 2.38

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx = \frac{((Bd^2m^3 + 9 Bd^2m^2 + 23 Bd^2m + 15 Bd^2)x^7 + ((2 Bcd + Ad^2)m^3 + 42 Bcd + 21 Ad^2 + 11 (2 Bcd + Ad^2)m^2)x^5 + ((Bc^2 + 2A*c*d)m^3 + 35B*c^2 + 70A*c*d + 13*(Bc^2 + 2A*c*d)m^2 + 47*(Bc^2 + 2A*c*d)m)x^3 + (A*c^2*m^3 + 15A*c^2*m^2 + 71A*c^2*m + 105A*c^2)*x)*(e*x)^m/(m^4 + 16*m^3 + 86*m^2 + 176*m + 105)}$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="fracas")`

output `((B*d^2*m^3 + 9*B*d^2*m^2 + 23*B*d^2*m + 15*B*d^2)*x^7 + ((2*B*c*d + A*d^2)*m^3 + 42*B*c*d + 21*A*d^2 + 11*(2*B*c*d + A*d^2)*m^2 + 31*(2*B*c*d + A*d^2)*m)*x^5 + ((B*c^2 + 2*A*c*d)*m^3 + 35*B*c^2 + 70*A*c*d + 13*(B*c^2 + 2*A*c*d)*m^2 + 47*(B*c^2 + 2*A*c*d)*m)*x^3 + (A*c^2*m^3 + 15*A*c^2*m^2 + 71*A*c^2*m + 105*A*c^2)*x*(e*x)^m/(m^4 + 16*m^3 + 86*m^2 + 176*m + 105)`

3.11.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1096 vs. $2(82) = 164$.

Time = 0.44 (sec) , antiderivative size = 1096, normalized size of antiderivative = 12.04

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**2,x)`

output `Piecewise(((-A*c**2/(6*x**6) - A*c*d/(2*x**4) - A*d**2/(2*x**2) - B*c**2/(4*x**4) - B*c*d/x**2 + B*d**2*log(x))/e**7, Eq(m, -7)), ((-A*c**2/(4*x**4) - A*c*d/x**2 + A*d**2*log(x) - B*c**2/(2*x**2) + 2*B*c*d*log(x) + B*d**2*x**2/2)/e**5, Eq(m, -5)), ((-A*c**2/(2*x**2) + 2*A*c*d*log(x) + A*d**2*x**2/2 + B*c**2*log(x) + B*c*d*x**2 + B*d**2*x**4/4)/e**3, Eq(m, -3)), ((A*c**2*log(x) + A*c*d*x**2 + A*d**2*x**4/4 + B*c**2*x**2/2 + B*c*d*x**4/2 + B*d**2*x**6/6)/e, Eq(m, -1)), (A*c**2*m**3*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 15*A*c**2*m**2*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 71*A*c**2*m*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 105*A*c**2*x*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 2*A*c*d*m**3*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 26*A*c*d*m**2*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 94*A*c*d*m*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 70*A*c*d*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + A*d**2*m**3*x**5*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 11*A*d**2*m**2*x**5*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 31*A*d**2*m*x**5*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 21*A*d**2*x**5*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + B*c**2*m**3*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 13*B*c**2*m**2*x**3*(e*x)**m/(m**4 + 16*m**3 + 86*m**2 + 176*m + 105) + 47*B*c**2*m*x**3*(e*x)**m/(m**4 + 16*m**3 + 8...`

3.11.7 Maxima [A] (verification not implemented)

Time = 0.22 (sec) , antiderivative size = 116, normalized size of antiderivative = 1.27

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx = \frac{Bd^2e^m x^7 x^m}{m+7} + \frac{2Bcde^m x^5 x^m}{m+5} + \frac{Ad^2e^m x^5 x^m}{m+5} + \frac{Bc^2e^m x^3 x^m}{m+3} + \frac{2Acde^m x^3 x^m}{m+3} + \frac{(ex)^{m+1} Ac^2}{e(m+1)}$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="maxima")`

output $Bd^2e^m x^7 x^m / (m + 7) + 2Bc d e^m x^5 x^m / (m + 5) + Ad^2 e^m x^5 x^m / (m + 5) + Bc^2 e^m x^3 x^m / (m + 3) + 2A c d e^m x^3 x^m / (m + 3) + (e x)^{(m + 1)} A c^2 / (e (m + 1))$

3.11.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 380 vs. $2(91) = 182$.

Time = 0.33 (sec) , antiderivative size = 380, normalized size of antiderivative = 4.18

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx$$

$$= \frac{(ex)^m B d^2 m^3 x^7 + 9 (ex)^m B d^2 m^2 x^7 + 2 (ex)^m B c d m^3 x^5 + (ex)^m A d^2 m^3 x^5 + 23 (ex)^m B d^2 m x^7 + 22 (ex)^m A c^2 m^3 x^5 + 11 (ex)^m A d^2 m^2 x^5 + 15 (ex)^m B d^2 m x^7 + (ex)^m B c^2 m^3 x^3 + 2 (ex)^m A c d m^3 x^3 + 62 (ex)^m B c d m x^5 + 31 (ex)^m A d^2 m x^5 + 13 (ex)^m B c^2 m^2 x^3 + 26 (ex)^m A c d m^2 x^3 + 42 (ex)^m B c d x^5 + 21 (ex)^m A d^2 x^5 + (ex)^m A c^2 m^3 x + 47 (ex)^m B c^2 m x^3 + 94 (ex)^m A c d m x^3 + 15 (ex)^m A c^2 m^2 x + 35 (ex)^m B c^2 x^3 + 70 (ex)^m A c d x^3 + 71 (ex)^m A c^2 m x + 105 (ex)^m A c^2 x}{m^4 + 16 m^3 + 86 m^2 + 176 m + 105}$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="giac")`

output $((e x)^m B d^2 m^3 x^7 + 9 (e x)^m B d^2 m^2 x^7 + 2 (e x)^m B c d m^3 x^5 + (e x)^m A d^2 m^3 x^5 + 23 (e x)^m B d^2 m x^7 + 22 (e x)^m B c d m^2 x^5 + 11 (e x)^m A d^2 m^2 x^5 + 15 (e x)^m B d^2 m x^7 + (e x)^m B c^2 m^3 x^3 + 2 (e x)^m A c d m^3 x^3 + 62 (e x)^m B c d m x^5 + 31 (e x)^m A d^2 m x^5 + 13 (e x)^m B c^2 m^2 x^3 + 26 (e x)^m A c d m^2 x^3 + 42 (e x)^m B c d x^5 + 21 (e x)^m A d^2 x^5 + (e x)^m A c^2 m^3 x + 47 (e x)^m B c^2 m x^3 + 94 (e x)^m A c d m x^3 + 15 (e x)^m A c^2 m^2 x + 35 (e x)^m B c^2 x^3 + 70 (e x)^m A c d x^3 + 71 (e x)^m A c^2 m x + 105 (e x)^m A c^2 x) / (m^4 + 16 m^3 + 86 m^2 + 176 m + 105)$

3.11.9 Mupad [B] (verification not implemented)

Time = 5.48 (sec) , antiderivative size = 179, normalized size of antiderivative = 1.97

$$\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx = (ex)^m \left(\frac{B d^2 x^7 (m^3 + 9 m^2 + 23 m + 15)}{m^4 + 16 m^3 + 86 m^2 + 176 m + 105} + \frac{A c^2 x (m^3 + 15 m^2 + 71 m + 105)}{m^4 + 16 m^3 + 86 m^2 + 176 m + 105} + \frac{c x^3 (2 A d + B c) (m^3 + 13 m^2 + 47 m + 35)}{m^4 + 16 m^3 + 86 m^2 + 176 m + 105} + \frac{d x^5 (A d + 2 B c) (m^3 + 11 m^2 + 31 m + 21)}{m^4 + 16 m^3 + 86 m^2 + 176 m + 105} \right)$$

3.11. $\int (ex)^m (A + Bx^2) (c + dx^2)^2 dx$

input `int((A + B*x^2)*(e*x)^m*(c + d*x^2)^2,x)`

output `(e*x)^m*((B*d^2*x^7*(23*m + 9*m^2 + m^3 + 15))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105) + (A*c^2*x*(71*m + 15*m^2 + m^3 + 105))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105) + (c*x^3*(2*A*d + B*c)*(47*m + 13*m^2 + m^3 + 35))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105) + (d*x^5*(A*d + 2*B*c)*(31*m + 11*m^2 + m^3 + 21))/(176*m + 86*m^2 + 16*m^3 + m^4 + 105))`

3.12
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{a+bx^2} dx$$

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3.12.1 Optimal result

Integrand size = 31, antiderivative size = 178

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{a + bx^2} dx = \frac{(a^2 B d^2 - a b d(2 B c + A d) + b^2 c(B c + 2 A d))(ex)^{1+m}}{b^3 e(1+m)} + \frac{d(2 b B c + A b d - a B d)(ex)^{3+m}}{b^2 e^3(3+m)} + \frac{B d^2 (ex)^{5+m}}{b e^5(5+m)} + \frac{(A b - a B)(b c - a d)^2 (ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{b x^2}{a}\right)}{a b^3 e(1+m)}$$

output `(a^2*B*d^2-a*b*d*(A*d+2*B*c)+b^2*c*(2*A*d+B*c))*(e*x)^(1+m)/b^3/e/(1+m)+d*(A*b*d-B*a*d+2*B*b*c)*(e*x)^(3+m)/b^2/e^3/(3+m)+B*d^2*(e*x)^(5+m)/b/e^5/(5+m)+(A*b-B*a)*(-a*d+b*c)^2*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a/b^3/e/(1+m)`

3.12.2 Mathematica [A] (verified)

Time = 0.24 (sec) , antiderivative size = 146, normalized size of antiderivative = 0.82

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{a + bx^2} dx = \frac{x(ex)^m \left(\frac{a^2 B d^2 - a b d(2 B c + A d) + b^2 c(B c + 2 A d)}{1+m} + \frac{b d(2 b B c + A b d - a B d)x^2}{3+m} + \frac{b^2 B d^2 x^4}{5+m} + \frac{(A b - a B)(b c - a d)^2 \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{b x^2}{a}\right)}{a(1+m)} \right)}{b^3}$$

3.12.
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{a+bx^2} dx$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2)^2)/(a + b*x^2),x]`

output `(x*(e*x)^m*((a^2*B*d^2 - a*b*d*(2*B*c + A*d) + b^2*c*(B*c + 2*A*d))/(1 + m) + (b*d*(2*b*B*c + A*b*d - a*B*d)*x^2)/(3 + m) + (b^2*B*d^2*x^4)/(5 + m) + ((A*b - a*B)*(b*c - a*d)^2*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(a*(1 + m)))/b^3`

3.12.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 178, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 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.

$$\int \frac{(A + Bx^2)(c + dx^2)^2 (ex)^m}{a + bx^2} dx$$

↓ 437

$$\int \left(\frac{(ex)^m (a^2 Bd^2 - abd(Ad + 2Bc) + b^2 c(2Ad + Bc))}{b^3} + \frac{(ex)^m (a^3(-B)d^2 + a^2 Abd^2 + 2a^2 bBcd - 2aAb^2 cd - a^3 b^2 d^2)}{b^3 (a + bx^2)} \right) dx$$

↓ 2009

$$\frac{(ex)^{m+1} (a^2 Bd^2 - abd(Ad + 2Bc) + b^2 c(2Ad + Bc))}{b^3 e(m+1)} + \frac{(ex)^{m+1} (Ab - aB)(bc - ad)^2 \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{ab^3 e(m+1)} + \frac{d(ex)^{m+3}(-aBd + Abd + 2bBc)}{b^2 e^3(m+3)} + \frac{Bd^2 (ex)^{m+5}}{be^5(m+5)}$$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2)^2)/(a + b*x^2),x]`

output `((a^2*B*d^2 - a*b*d*(2*B*c + A*d) + b^2*c*(B*c + 2*A*d))*(e*x)^(1 + m))/(b^3*e*(1 + m)) + (d*(2*b*B*c + A*b*d - a*B*d)*(e*x)^(3 + m))/(b^2*e^3*(3 + m)) + (B*d^2*(e*x)^(5 + m))/(b*e^5*(5 + m)) + ((A*b - a*B)*(b*c - a*d)^2*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(a*b^3*e*(1 + m))`

3.12. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{a+bx^2} dx$

3.12.3.1 Defintions of rubi rules used

```
rule 437 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q
_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(
a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f
, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]
```

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

3.12.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)^2}{bx^2 + a} dx$$

```
input int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a),x)
```

```
output int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a),x)
```

3.12.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{bx^2 + a} dx$$

```
input integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a),x, algorithm="fricas")
```

```
output integral((B*d^2*x^6 + (2*B*c*d + A*d^2)*x^4 + A*c^2 + (B*c^2 + 2*A*c*d)*x^
2)*(e*x)^m/(b*x^2 + a), x)
```


3.12.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 5.86 (sec) , antiderivative size = 649, normalized size of antiderivative = 3.65

$$\begin{aligned}
 \int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{a + bx^2} dx = & \frac{Ac^2e^m mx^{m+1} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} \\
 & + \frac{Ac^2e^m x^{m+1} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} \\
 & + \frac{Acde^m mx^{m+3} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{2a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} \\
 & + \frac{3Acde^m x^{m+3} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{2a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} \\
 & + \frac{Ad^2e^m mx^{m+5} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} \\
 & + \frac{5Ad^2e^m x^{m+5} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} \\
 & + \frac{Bc^2e^m mx^{m+3} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} \\
 & + \frac{3Bc^2e^m x^{m+3} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} \\
 & + \frac{Bcde^m mx^{m+5} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{2a\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} \\
 & + \frac{5Bcde^m x^{m+5} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{2a\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} \\
 & + \frac{Bd^2e^m mx^{m+7} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{7}{2}\right) \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{9}{2}\right)} \\
 & + \frac{7Bd^2e^m x^{m+7} \Phi\left(\frac{bx^2e^{i\pi}}{a}, 1, \frac{m}{2} + \frac{7}{2}\right) \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)}{4a\Gamma\left(\frac{m}{2} + \frac{9}{2}\right)}
 \end{aligned}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**2/(b*x**2+a), x)`

3.12. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{a+bx^2} dx$

output `A*c**2*e**m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*a*gamma(m/2 + 3/2)) + A*c**2*e**m*x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*a*gamma(m/2 + 3/2)) + A*c*d*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(2*a*gamma(m/2 + 5/2)) + 3*A*c*d*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(2*a*gamma(m/2 + 5/2)) + A*d**2*e**m*x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2)) + 5*A*d**2*e**m*x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2)) + B*c**2*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + 3*B*c**2*e**m*x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + B*c*d*e**m*x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(2*a*gamma(m/2 + 7/2)) + 5*B*c*d*e**m*x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(2*a*gamma(m/2 + 7/2)) + B*d**2*e**m*x**(m + 7)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 7/2)*gamma(m/2 + 7/2)/(4*a*gamma(m/2 + 9/2)) + 7*B*d**2*e**m*x**(m + 7)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 7/2)*gamma(m/2 + 7/2)/(4*a*gamma(m/2 + 9/2))`

3.12.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(e*x)^m/(b*x^2 + a), x)`

3.12.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(e*x)^m/(b*x^2 + a), x)`

3.12. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{a+bx^2} dx$

3.12.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{a + bx^2} dx = \int \frac{(Bx^2 + A) (ex)^m (dx^2 + c)^2}{bx^2 + a} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^2)/(a + b*x^2), x)`output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^2)/(a + b*x^2), x)`

3.13
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{(a+bx^2)^2} dx$$

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3.13.1 Optimal result

Integrand size = 31, antiderivative size = 247

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{(a + bx^2)^2} dx$$

$$= -\frac{d(Ab(2bc(1+m) - ad(3+m)) - aB(2bc(3+m) - ad(5+m)))(ex)^{1+m}}{2ab^3e(1+m)}$$

$$- \frac{d^2(Ab(3+m) - aB(5+m))(ex)^{3+m}}{2ab^2e^3(3+m)} + \frac{(Ab - aB)(ex)^{1+m}(c + dx^2)^2}{2abe(a + bx^2)}$$

$$+ \frac{(bc - ad)(aB(bc(1+m) - ad(5+m)) + Ab(ad(3+m) + b(c - cm)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \right.}{2a^2b^3e(1+m)}$$

output

```
-1/2*d*(A*b*(2*b*c*(1+m)-a*d*(3+m))-a*B*(2*b*c*(3+m)-a*d*(5+m))*(e*x)^(1+m)/a/b^3/e/(1+m)-1/2*d^2*(A*b*(3+m)-a*B*(5+m))*(e*x)^(3+m)/a/b^2/e^3/(3+m)+1/2*(A*b-B*a)*(e*x)^(1+m)*(d*x^2+c)^2/a/b/e/(b*x^2+a)+1/2*(-a*d+b*c)*(a*B*(b*c*(1+m)-a*d*(5+m))+A*b*(a*d*(3+m)+b*(-c*m+c)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^2/b^3/e/(1+m)
```

3.13.2 Mathematica [A] (verified)

Time = 0.58 (sec) , antiderivative size = 156, normalized size of antiderivative = 0.63

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^2} dx$$

$$= \frac{x(ex)^m \left(\frac{d(2bBc + Abd - 2aBd)}{1+m} + \frac{bBd^2x^2}{3+m} + \frac{(bc-ad)(bBc + 2Abd - 3aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a(1+m)} + \frac{(Ab-aB)(bc-ad)}{b^3} \right)}{b^3}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2)^2)/(a + b*x^2)^2,x]`

output `(x*(e*x)^m*((d*(2*b*B*c + A*b*d - 2*a*B*d))/(1 + m) + (b*B*d^2*x^2)/(3 + m) + ((b*c - a*d)*(b*B*c + 2*A*b*d - 3*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(1 + m)) + ((A*b - a*B)*(b*c - a*d)^2*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a^2*(1 + m))))/b^3`

3.13.3 Rubi [A] (verified)

Time = 0.52 (sec) , antiderivative size = 245, normalized size of antiderivative = 0.99, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.129$, Rules used = {439, 25, 437, 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.

$$\int \frac{(A + Bx^2) (c + dx^2)^2 (ex)^m}{(a + bx^2)^2} dx$$

$$\downarrow 439$$

$$\frac{(c + dx^2)^2 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)} - \int \frac{(ex)^m (dx^2 + c) (c(aB(m+1) + A(b-bm)) - d(Ab(m+3) - aB(m+5))x^2)}{bx^2 + a} dx}{2ab}$$

$$\downarrow 25$$

$$\int \frac{(ex)^m (dx^2 + c) (c(aB(m+1) + A(b-bm)) - d(Ab(m+3) - aB(m+5))x^2)}{bx^2 + a} dx}{2ab} + \frac{(c + dx^2)^2 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)}$$

$$\downarrow 437$$

3.13. $\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^2} dx$

$$\int \left(-\frac{d(Ab(2bc(m+1)-ad(m+3))-aB(2bc(m+3)-ad(m+5)))(ex)^m}{b^2} + \frac{(5Bd^2a^3+Bd^2ma^3-3Abd^2a^2-6bBcda^2-Abd^2ma^2-2bBcdma^2+b^2Bcdma^2)(ex)^m}{b^2(bx^2+a)} \right) dx$$

$$\frac{(c + dx^2)^2 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)}$$

↓ 2009

$$\frac{(ex)^{m+1}(bc-ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right) (Ab(ad(m+3)+bc(1-m))+aB(bc(m+1)-ad(m+5)))}{ab^2e^{m+1}} - \frac{d(ex)^{m+1}(Ab(2bc(m+1)-ad(m+3))-aB(2bc(m+3)-ad(m+5)))}{b^2}$$

$$\frac{(c + dx^2)^2 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)}$$

```
input Int[((ex)^m*(A + B*x^2)*(c + d*x^2)^2)/(a + b*x^2)^2,x]
```

```
output ((A*b - a*B)*(e*x)^(1 + m)*(c + d*x^2)^2)/(2*a*b*e*(a + b*x^2)) + (-((d*(A*b*(2*b*c*(1 + m) - a*d*(3 + m)) - a*B*(2*b*c*(3 + m) - a*d*(5 + m)))*(e*x)^(1 + m))/(b^2*e*(1 + m))) - (d^2*(A*b*(3 + m) - a*B*(5 + m))*(e*x)^(3 + m))/(b*e^3*(3 + m)) + ((b*c - a*d)*(A*b*(b*c*(1 - m) + a*d*(3 + m)) + a*B*(b*c*(1 + m) - a*d*(5 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*b^2*e*(1 + m)))/(2*a*b)
```

3.13.3.1 Defintions of rubi rules used

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

```
rule 437 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^(m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]
```

3.13. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{(a+bx^2)^2} dx$

```
rule 439 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)
.*(e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-b*e - a*f)*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*(c + d*x^2)^q/(2*a*b*g*(p + 1)), x] + Simp[1/(2*a*b*(p
+ 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(
p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1
))*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && G
tQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])
```

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

3.13.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)^2}{(bx^2 + a)^2} dx$$

```
input int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^2,x)
```

```
output int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^2,x)
```

3.13.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{(bx^2 + a)^2} dx$$

```
input integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^2,x, algorithm="fricas")
```

```
output integral((B*d^2*x^6 + (2*B*c*d + A*d^2)*x^4 + A*c^2 + (B*c^2 + 2*A*c*d)*x^
2)*(e*x)^m/(b^2*x^4 + 2*a*b*x^2 + a^2), x)
```

3.13.6 Sympy [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{(a + bx^2)^2} dx = \int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{(a + bx^2)^2} dx$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**2/(b*x**2+a)**2,x)`

output `Integral((e*x)**m*(A + B*x**2)*(c + d*x**2)**2/(a + b*x**2)**2, x)`

3.13.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2(ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(e*x)^m/(b*x^2 + a)^2, x)`

3.13.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2(ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(e*x)^m/(b*x^2 + a)^2, x)`

3.13.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m (dx^2 + c)^2}{(bx^2 + a)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^2)/(a + b*x^2)^2,x)`output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^2)/(a + b*x^2)^2, x)`

3.14
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{(a+bx^2)^3} dx$$

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3.14.1 Optimal result

Integrand size = 31, antiderivative size = 292

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^2}{(a + bx^2)^3} dx$$

$$= \frac{d(bc(1 + m) - ad(3 + m))(Ab(1 + m) - aB(5 + m))(ex)^{1+m}}{8a^2b^3e(1 + m)}$$

$$+ \frac{(Ab - aB)(ex)^{1+m} (c + dx^2)^2}{4abe(a + bx^2)^2}$$

$$+ \frac{(bc - ad)(ex)^{1+m} (c(Ab(3 - m) + aB(1 + m)) - d(Ab(1 + m) - aB(5 + m))x^2)}{8a^2b^2e(a + bx^2)}$$

$$- \frac{(ad(bc(1 + m) - ad(3 + m))(Ab(1 + m) - aB(5 + m)) - bc(Ab(3 - m) + aB(1 + m))(ad(1 + m) + b^2c))}{8a^3b^3e(1 + m)}$$

output

```
1/8*d*(b*c*(1+m)-a*d*(3+m))*(A*b*(1+m)-a*B*(5+m))*(e*x)^(1+m)/a^2/b^3/e/(1+m)+1/4*(A*b-B*a)*(e*x)^(1+m)*(d*x^2+c)^2/a/b/e/(b*x^2+a)^2+1/8*(-a*d+b*c)*(e*x)^(1+m)*(c*(A*b*(3-m)+a*B*(1+m))-d*(A*b*(1+m)-a*B*(5+m))*x^2)/a^2/b^2/e/(b*x^2+a)-1/8*(a*d*(b*c*(1+m)-a*d*(3+m))*(A*b*(1+m)-a*B*(5+m))-b*c*(A*b*(3-m)+a*B*(1+m))*(a*d*(1+m)+b*(-c*m+c))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^3/b^3/e/(1+m)
```

3.14.
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^2}{(a+bx^2)^3} dx$$

3.14.2 Mathematica [A] (verified)

Time = 0.74 (sec) , antiderivative size = 165, normalized size of antiderivative = 0.57

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx$$

$$= \frac{x(ex)^m \left(Bd^2 + \frac{d(2bBc + Abd - 3aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a} + \frac{(bc-ad)(bBc + 2Abd - 3aBd) \operatorname{Hypergeometric2F1}\left(2, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a^2} \right)}{b^3(1+m)}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2)^2)/(a + b*x^2)^3,x]`

output `(x*(e*x)^m*(B*d^2 + (d*(2*b*B*c + A*b*d - 3*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/a + ((b*c - a*d)*(b*B*c + 2*A*b*d - 3*a*B*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/a^2 + ((A*b - a*B)*(b*c - a*d)^2*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/a^3))/(b^3*(1 + m))`

3.14.3 Rubi [A] (verified)

Time = 0.51 (sec) , antiderivative size = 305, normalized size of antiderivative = 1.04, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.194$, Rules used = {439, 25, 439, 25, 363, 278}

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.

$$\int \frac{(A + Bx^2) (c + dx^2)^2 (ex)^m}{(a + bx^2)^3} dx$$

$$\downarrow 439$$

$$\frac{(c + dx^2)^2 (ex)^{m+1} (Ab - aB)}{4abe (a + bx^2)^2} - \frac{\int -\frac{(ex)^m (dx^2 + c) (c(Ab(3-m) + aB(m+1)) - d(Ab(m+1) - aB(m+5))x^2)}{(bx^2 + a)^2} dx}{4ab}$$

$$\downarrow 25$$

$$\frac{\int \frac{(ex)^m (dx^2 + c) (c(Ab(3-m) + aB(m+1)) - d(Ab(m+1) - aB(m+5))x^2)}{(bx^2 + a)^2} dx}{4ab} + \frac{(c + dx^2)^2 (ex)^{m+1} (Ab - aB)}{4abe (a + bx^2)^2}$$

$$\downarrow 439$$

3.14. $\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx$

$$\frac{(ex)^{m+1}(bc-ad)(c(aB(m+1)+Ab(3-m))-dx^2(Ab(m+1)-aB(m+5)))}{2abe(a+bx^2)} - \int -\frac{(ex)^m(d(bc(m+1)-ad(m+3))(Ab(m+1)-aB(m+5))x^2+c(Ab(3-m)+aB(m+1)))}{bx^2+a} \frac{4ab}{2ab}$$

$$\frac{(c+dx^2)^2(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \quad 4ab$$

↓ 25

$$\int \frac{(ex)^m(d(bc(m+1)-ad(m+3))(Ab(m+1)-aB(m+5))x^2+c(Ab(3-m)+aB(m+1))(ad(m+1)+b(c-cm)))}{bx^2+a} dx + \frac{(ex)^{m+1}(bc-ad)(c(aB(m+1)+Ab(3-m))-dx^2(Ab(m+1)-aB(m+5)))}{2abe(a+bx^2)}$$

$$\frac{(c+dx^2)^2(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \quad 4ab$$

↓ 363

$$\frac{d(ex)^{m+1}(Ab(m+1)-aB(m+5))(bc(m+1)-ad(m+3))}{be(m+1)} - \frac{(ad(Ab(m+1)-aB(m+5))(bc(m+1)-ad(m+3)) - c(aB(m+1)+Ab(3-m))(ad(m+1)+b(c-cm)))}{2ab}$$

$$\frac{(c+dx^2)^2(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \quad 4ab$$

↓ 278

$$\frac{d(ex)^{m+1}(Ab(m+1)-aB(m+5))(bc(m+1)-ad(m+3))}{be(m+1)} - \frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right) \left(\frac{ad(Ab(m+1)-aB(m+5))(bc(m+1)-ad(m+3))}{b} - c(aB(m+1)+Ab(3-m))(ad(m+1)+b(c-cm))\right)}{ae(m+1)}$$

$$\frac{(c+dx^2)^2(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \quad 4ab$$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2)^2)/(a + b*x^2)^3,x]`

output `((A*b - a*B)*(e*x)^(1 + m)*(c + d*x^2)^2)/(4*a*b*e*(a + b*x^2)^2) + (((b*c - a*d)*(e*x)^(1 + m)*(c*(A*b*(3 - m) + a*B*(1 + m)) - d*(A*b*(1 + m) - a*B*(5 + m))*x^2))/(2*a*b*e*(a + b*x^2)) + ((d*(b*c*(1 + m) - a*d*(3 + m))*(A*b*(1 + m) - a*B*(5 + m))*(e*x)^(1 + m))/(b*e*(1 + m)) - (((a*d*(b*c*(1 + m) - a*d*(3 + m))*(A*b*(1 + m) - a*B*(5 + m)))/b - c*(A*b*(3 - m) + a*B*(1 + m))*(a*d*(1 + m) + b*(c - c*m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*e*(1 + m)))/(2*a*b)/(4*a*b)`

$$3.14. \int \frac{(ex)^m(A+Bx^2)(c+dx^2)^2}{(a+bx^2)^3} dx$$

3.14.3.1 Defintions of rubi rules used

- rule 25 `Int[-(Fx_), x_Symbol] := Simp[Identity[-1] Int[Fx, x], x]`
- rule 278 `Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`
- rule 363 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^(m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d, 0] && NeQ[m + 2*p + 3, 0]`
- rule 439 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(- (b*e - a*f)) * (g*x)^(m + 1) * (a + b*x^2)^(p + 1) * ((c + d*x^2)^q / (2*a*b*g*(p + 1))), x] + Simp[1 / (2*a*b*(p + 1)) Int[(g*x)^m * (a + b*x^2)^(p + 1) * (c + d*x^2)^(q - 1) * Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1)) * x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

3.14.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)^2}{(bx^2 + a)^3} dx$$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^3,x)`

output `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^3,x)`

3.14.5 Fracas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^3,x, algorithm="fricas")`

output `integral((B*d^2*x^6 + (2*B*c*d + A*d^2)*x^4 + A*c^2 + (B*c^2 + 2*A*c*d)*x^2)*(e*x)^m/(b^3*x^6 + 3*a*b^2*x^4 + 3*a^2*b*x^2 + a^3), x)`

3.14.6 Sympy [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx = \int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**2/(b*x**2+a)**3,x)`

output `Integral((e*x)**m*(A + B*x**2)*(c + d*x**2)**2/(a + b*x**2)**3, x)`

3.14.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(e*x)^m/(b*x^2 + a)^3, x)`

3.14.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^2 (ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^2/(b*x^2+a)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(e*x)^m/(b*x^2 + a)^3, x)`

3.14.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^2}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m (dx^2 + c)^2}{(bx^2 + a)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^2)/(a + b*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^2)/(a + b*x^2)^3, x)`

3.15 $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx$

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3.15.1 Optimal result

Integrand size = 31, antiderivative size = 379

$$\begin{aligned} & \int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx \\ &= \frac{a^3 Ac^3 (ex)^{1+m}}{e(1+m)} + \frac{a^2 c^2 (aBc + 3A(bc + ad))(ex)^{3+m}}{e^3(3+m)} \\ &+ \frac{3ac(aBc(bc + ad) + A(b^2c^2 + 3abcd + a^2d^2))(ex)^{5+m}}{e^5(5+m)} \\ &+ \frac{(3aBc(b^2c^2 + 3abcd + a^2d^2) + A(b^3c^3 + 9ab^2c^2d + 9a^2bcd^2 + a^3d^3))(ex)^{7+m}}{e^7(7+m)} \\ &+ \frac{(a^3Bd^3 + 9ab^2cd(Bc + Ad) + 3a^2bd^2(3Bc + Ad) + b^3c^2(Bc + 3Ad))(ex)^{9+m}}{e^9(9+m)} \\ &+ \frac{3bd(a^2Bd^2 + b^2c(Bc + Ad) + abd(3Bc + Ad))(ex)^{11+m}}{e^{11}(11+m)} \\ &+ \frac{b^2d^2(3bBc + Abd + 3aBd)(ex)^{13+m}}{e^{13}(13+m)} + \frac{b^3Bd^3(ex)^{15+m}}{e^{15}(15+m)} \end{aligned}$$

output

```
a^3*A*c^3*(e*x)^(1+m)/e/(1+m)+a^2*c^2*(B*a*c+3*A*(a*d+b*c))*(e*x)^(3+m)/e^3/(3+m)+3*a*c*(a*B*c*(a*d+b*c)+A*(a^2*d^2+3*a*b*c*d+b^2*c^2))*(e*x)^(5+m)/e^5/(5+m)+(3*a*B*c*(a^2*d^2+3*a*b*c*d+b^2*c^2)+A*(a^3*d^3+9*a^2*b*c*d^2+9*a*b^2*c^2*d+b^3*c^3))*(e*x)^(7+m)/e^7/(7+m)+(a^3*B*d^3+9*a*b^2*c*d*(A*d+B*c)+3*a^2*b*d^2*(A*d+3*B*c)+b^3*c^2*(3*A*d+B*c))*(e*x)^(9+m)/e^9/(9+m)+3*b*d*(a^2*B*d^2+b^2*c*(A*d+B*c)+a*b*d*(A*d+3*B*c))*(e*x)^(11+m)/e^11/(11+m)+b^2*d^2*(A*b*d+3*B*a*d+3*B*b*c)*(e*x)^(13+m)/e^13/(13+m)+b^3*B*d^3*(e*x)^(15+m)/e^15/(15+m)
```


3.15.2 Mathematica [A] (verified)

Time = 0.96 (sec) , antiderivative size = 327, normalized size of antiderivative = 0.86

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx$$

$$= x(ex)^m \left(\frac{a^3 Ac^3}{1+m} + \frac{a^2 c^2 (aBc + 3A(bc + ad))x^2}{3+m} \right.$$

$$+ \frac{3ac(aBc(bc + ad) + A(b^2 c^2 + 3abcd + a^2 d^2))x^4}{5+m}$$

$$+ \frac{(3aBc(b^2 c^2 + 3abcd + a^2 d^2) + A(b^3 c^3 + 9ab^2 c^2 d + 9a^2 bcd^2 + a^3 d^3))x^6}{7+m}$$

$$+ \frac{(a^3 Bd^3 + 9ab^2 cd(Bc + Ad) + 3a^2 bd^2(3Bc + Ad) + b^3 c^2(Bc + 3Ad))x^8}{9+m}$$

$$+ \frac{3bd(a^2 Bd^2 + b^2 c(Bc + Ad) + abd(3Bc + Ad))x^{10}}{11+m} + \frac{b^2 d^2(3bBc + Abd + 3aBd)x^{12}}{13+m}$$

$$\left. + \frac{b^3 Bd^3 x^{14}}{15+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^3*(A + B*x^2)*(c + d*x^2)^3,x]`

output `x*(e*x)^m*((a^3*A*c^3)/(1+m) + (a^2*c^2*(a*B*c + 3*A*(b*c + a*d))*x^2)/(3+m) + (3*a*c*(a*B*c*(b*c + a*d) + A*(b^2*c^2 + 3*a*b*c*d + a^2*d^2))*x^4)/(5+m) + ((3*a*B*c*(b^2*c^2 + 3*a*b*c*d + a^2*d^2) + A*(b^3*c^3 + 9*a*b^2*c^2*d + 9*a^2*b*c*d^2 + a^3*d^3))*x^6)/(7+m) + ((a^3*B*d^3 + 9*a*b^2*c*d*(B*c + A*d) + 3*a^2*b*d^2*(3*B*c + A*d) + b^3*c^2*(B*c + 3*A*d))*x^8)/(9+m) + (3*b*d*(a^2*B*d^2 + b^2*c*(B*c + A*d) + a*b*d*(3*B*c + A*d))*x^10)/(11+m) + (b^2*d^2*(3*b*B*c + A*b*d + 3*a*B*d))*x^12)/(13+m) + (b^3*B*d^3*x^14)/(15+m))`

3.15.3 Rubi [A] (verified)

Time = 0.65 (sec) , antiderivative size = 379, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 2009}

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

$$\int (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 (ex)^m dx$$

3.15. $\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx$

$$\int \left(a^3 A c^3 (ex)^m + \frac{3ac(ex)^{m+4} (A(a^2 d^2 + 3abcd + b^2 c^2) + aBc(ad + bc))}{e^4} + \frac{3bd(ex)^{m+10} (a^2 B d^2 + abd(Ad + 3Bc))}{e^{10}} \right)$$

$$\begin{aligned} & \frac{a^3 A c^3 (ex)^{m+1}}{e(m+1)} + \frac{3ac(ex)^{m+5} (A(a^2 d^2 + 3abcd + b^2 c^2) + aBc(ad + bc))}{e^5(m+5)} + \\ & \frac{3bd(ex)^{m+11} (a^2 B d^2 + abd(Ad + 3Bc) + b^2 c(Ad + Bc))}{e^{11}(m+11)} + \frac{a^2 c^2 (ex)^{m+3} (3A(ad + bc) + aBc)}{e^3(m+3)} + \\ & \frac{(ex)^{m+9} (a^3 B d^3 + 3a^2 b d^2 (Ad + 3Bc) + 9ab^2 c d (Ad + Bc) + b^3 c^2 (3Ad + Bc))}{e^9(m+9)} + \\ & \frac{(ex)^{m+7} (3aBc(a^2 d^2 + 3abcd + b^2 c^2) + A(a^3 d^3 + 9a^2 b c d^2 + 9ab^2 c^2 d + b^3 c^3))}{e^7(m+7)} + \\ & \frac{b^2 d^2 (ex)^{m+13} (3aBd + Abd + 3bBc)}{e^{13}(m+13)} + \frac{b^3 B d^3 (ex)^{m+15}}{e^{15}(m+15)} \end{aligned}$$

input `Int[(e*x)^m*(a + b*x^2)^3*(A + B*x^2)*(c + d*x^2)^3,x]`

output `(a^3*A*c^3*(e*x)^(1+m))/(e*(1+m)) + (a^2*c^2*(a*B*c + 3*A*(b*c + a*d)) * (e*x)^(3+m))/(e^3*(3+m)) + (3*a*c*(a*B*c*(b*c + a*d) + A*(b^2*c^2 + 3*a*b*c*d + a^2*d^2))*(e*x)^(5+m))/(e^5*(5+m)) + ((3*a*B*c*(b^2*c^2 + 3*a*b*c*d + a^2*d^2) + A*(b^3*c^3 + 9*a*b^2*c^2*d + 9*a^2*b*c*d^2 + a^3*d^3)) * (e*x)^(7+m))/(e^7*(7+m)) + ((a^3*B*d^3 + 9*a*b^2*c*d*(B*c + A*d) + 3*a^2*b*d^2*(3*B*c + A*d) + b^3*c^2*(B*c + 3*A*d)) * (e*x)^(9+m))/(e^9*(9+m)) + (3*b*d*(a^2*B*d^2 + b^2*c*(B*c + A*d) + a*b*d*(3*B*c + A*d)) * (e*x)^(11+m))/(e^11*(11+m)) + (b^2*d^2*(3*b*B*c + A*b*d + 3*a*B*d) * (e*x)^(13+m))/(e^13*(13+m)) + (b^3*B*d^3 * (e*x)^(15+m))/(e^15*(15+m))`

3.15.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_.)^(m_.))*((a_.) + (b_.)*(x_.)^2)^(p_.)*((c_.) + (d_.)*(x_.)^2)^(q_.)*((e_.) + (f_.)*(x_.)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^(m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

$$3.15. \quad \int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx$$

3.15.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 3952 vs. $2(379) = 758$.

Time = 3.96 (sec) , antiderivative size = 3953, normalized size of antiderivative = 10.43

method	result	size
gosper	Expression too large to display	3953
risch	Expression too large to display	3953
parallelrisch	Expression too large to display	5235

```
input int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^3,x,method=_RETURNVERBOSE)
```

```
output x*(B*b^3*d^3*m^7*x^14+49*B*b^3*d^3*m^6*x^14+A*b^3*d^3*m^7*x^12+3*B*a*b^2*d^3*m^7*x^12+3*B*b^3*c*d^2*m^7*x^12+973*B*b^3*d^3*m^5*x^14+51*A*b^3*d^3*m^6*x^12+153*B*a*b^2*d^3*m^6*x^12+153*B*b^3*c*d^2*m^6*x^12+10045*B*b^3*d^3*m^4*x^14+3*A*a*b^2*d^3*m^7*x^10+3*A*b^3*c*d^2*m^7*x^10+1045*A*b^3*d^3*m^5*x^12+3*B*a^2*b*d^3*m^7*x^10+9*B*a*b^2*c*d^2*m^7*x^10+3135*B*a*b^2*d^3*m^5*x^12+3*B*b^3*c^2*d*m^7*x^10+3135*B*b^3*c*d^2*m^5*x^12+57379*B*b^3*d^3*m^3*x^14+159*A*a*b^2*d^3*m^6*x^10+159*A*b^3*c*d^2*m^6*x^10+11055*A*b^3*d^3*m^4*x^12+159*B*a^2*b*d^3*m^6*x^10+477*B*a*b^2*c*d^2*m^6*x^10+33165*B*a*b^2*d^3*m^4*x^12+159*B*b^3*c^2*d*m^6*x^10+33165*B*b^3*c*d^2*m^4*x^12+177331*B*b^3*d^3*m^2*x^14+3*A*a^2*b*d^3*m^7*x^8+9*A*a*b^2*c*d^2*m^7*x^8+3375*A*a*b^2*d^3*m^5*x^10+3*A*b^3*c^2*d*m^7*x^8+3375*A*b^3*c*d^2*m^5*x^10+64339*A*b^3*d^3*m^3*x^12+B*a^3*d^3*m^7*x^8+9*B*a^2*b*c*d^2*m^7*x^8+3375*B*a^2*b*d^3*m^5*x^10+9*B*a*b^2*c^2*d*m^7*x^8+10125*B*a*b^2*c*d^2*m^5*x^10+193017*B*a*b^2*d^3*m^3*x^12+B*b^3*c^3*m^7*x^8+3375*B*b^3*c^2*d*m^5*x^10+193017*B*b^3*c*d^2*m^3*x^12+264207*B*b^3*d^3*m*x^14+165*A*a^2*b*d^3*m^6*x^8+495*A*a*b^2*c*d^2*m^6*x^8+36795*A*a*b^2*d^3*m^4*x^10+165*A*b^3*c^2*d*m^6*x^8+36795*A*b^3*c*d^2*m^4*x^10+201609*A*b^3*d^3*m^2*x^12+55*B*a^3*d^3*m^6*x^8+495*B*a^2*b*c*d^2*m^6*x^8+36795*B*a^2*b*d^3*m^4*x^10+495*B*a*b^2*c^2*d*m^6*x^8+110385*B*a*b^2*c*d^2*m^4*x^10+604827*B*a*b^2*d^3*m^2*x^12+55*B*b^3*c^3*m^6*x^8+36795*B*b^3*c^2*d*m^4*x^10+604827*B*b^3*c*d^2*m^2*x^12+135135*B*b^3*d^3*x^1...
```

3.15. $\int (ex)^m (a + bx^2)^3 (A + Bx^2)(c + dx^2)^3 dx$

3.15.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2657 vs. $2(379) = 758$.

Time = 0.32 (sec) , antiderivative size = 2657, normalized size of antiderivative = 7.01

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="fracas")`

output `((B*b^3*d^3*m^7 + 49*B*b^3*d^3*m^6 + 973*B*b^3*d^3*m^5 + 10045*B*b^3*d^3*m^4 + 57379*B*b^3*d^3*m^3 + 177331*B*b^3*d^3*m^2 + 264207*B*b^3*d^3*m + 135135*B*b^3*d^3)*x^15 + ((3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m^7 + 467775*B*b^3*c*d^2 + 51*(3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m^6 + 1045*(3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m^5 + 11055*(3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m^4 + 155925*(3*B*a*b^2 + A*b^3)*d^3 + 64339*(3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m^3 + 201609*(3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m^2 + 303255*(3*B*b^3*c*d^2 + (3*B*a*b^2 + A*b^3)*d^3)*m*x^13 + 3*((B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m^7 + 184275*B*b^3*c^2*d + 53*(B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m^6 + 1125*(B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m^5 + 12265*(B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m^4 + 184275*(3*B*a*b^2 + A*b^3)*c*d^2 + 184275*(B*a^2*b + A*a*b^2)*d^3 + 73139*(B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m^3 + 233487*(B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m^2 + 355815*(B*b^3*c^2*d + (3*B*a*b^2 + A*b^3)*c*d^2 + (B*a^2*b + A*a*b^2)*d^3)*m*x^11 + ((B*b^3*c^3 + 3*(3*B*a*b^2 + A*b^3)*c^2*d + 9*(B*a^2*b + A*a*b^2)*c*d^2 + (B*a^3 + 3*A*a^2*b)*d^3)*m^7 + 225225*B*b^3*c^3 + 55*(B*b^3*c^3 + 3*(3*B*a*b^2 + A*b^3)*c^2*d + 9*(B*a^2*b + A*a*b^2)*c*d^2 + (B*a^3 + 3*A*a^2*b)*d^3)*m^6 + ...`

3.15.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 20086 vs. $2(377) = 754$.

Time = 1.93 (sec) , antiderivative size = 20086, normalized size of antiderivative = 53.00

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**3*(B*x**2+A)*(d*x**2+c)**3,x)`

output `Piecewise(((-A**3*c**3/(14*x**14) - A**3*c**2*d/(4*x**12) - 3*A**3*c*d**2/(10*x**10) - A**3*d**3/(8*x**8) - A**2*b*c**3/(4*x**12) - 9*A**2*b*c**2*d/(10*x**10) - 9*A**2*b*c*d**2/(8*x**8) - A**2*b*d**3/(2*x**6) - 3*A*a*b**2*c**3/(10*x**10) - 9*A*a*b**2*c**2*d/(8*x**8) - 3*A*a*b**2*c*d**2/(2*x**6) - 3*A*a*b**2*d**3/(4*x**4) - A*b**3*c**3/(8*x**8) - A*b**3*c**2*d/(2*x**6) - 3*A*b**3*c*d**2/(4*x**4) - A*b**3*d**3/(2*x**2) - B*a**3*c**3/(12*x**12) - 3*B*a**3*c**2*d/(10*x**10) - 3*B*a**3*c*d**2/(8*x**8) - B*a**3*d**3/(6*x**6) - 3*B*a**2*b*c**3/(10*x**10) - 9*B*a**2*b*c**2*d/(8*x**8) - 3*B*a**2*b*c*d**2/(2*x**6) - 3*B*a**2*b*d**3/(4*x**4) - 3*B*a*b**2*c**3/(8*x**8) - 3*B*a*b**2*c**2*d/(2*x**6) - 9*B*a*b**2*c*d**2/(4*x**4) - 3*B*a*b**2*d**3/(2*x**2) - B*b**3*c**3/(6*x**6) - 3*B*b**3*c**2*d/(4*x**4) - 3*B*b**3*c*d**2/(2*x**2) + B*b**3*d**3*log(x))/e**15, Eq(m, -15)), ((-A**3*c**3/(12*x**12) - 3*A**3*c**2*d/(10*x**10) - 3*A**3*c*d**2/(8*x**8) - A**3*d**3/(6*x**6) - 3*A**2*b*c**3/(10*x**10) - 9*A**2*b*c**2*d/(8*x**8) - 3*A**2*b*c*d**2/(2*x**6) - 3*A**2*b*d**3/(4*x**4) - 3*A*a*b**2*c**3/(8*x**8) - 3*A*a*b**2*c**2*d/(2*x**6) - 9*A*a*b**2*c*d**2/(4*x**4) - 3*A*a*b**2*d**3/(2*x**2) - A*b**3*c**3/(6*x**6) - 3*A*b**3*c**2*d/(4*x**4) - 3*A*b**3*c*d**2/(2*x**2) + A*b**3*d**3*log(x) - B*a**3*c**3/(10*x**10) - 3*B*a**3*c**2*d/(8*x**8) - B*a**3*c*d**2/(2*x**6) - B*a**3*d**3/(4*x**4) - 3*B*a**2*b*c**3/(8*x**8) - 3*B*a**2*b*c**2*d/(2*x**6) - 9*B...`

3.15.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 762 vs. $2(379) = 758$.

3.15. $\int (ex)^m (a + bx^2)^3 (A + Bx^2)(c + dx^2)^3 dx$

Time = 0.29 (sec) , antiderivative size = 762, normalized size of antiderivative = 2.01

$$\begin{aligned}
 \int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx = & \frac{Bb^3d^3e^m x^{15}x^m}{m+15} + \frac{3Bb^3cd^2e^m x^{13}x^m}{m+13} \\
 & + \frac{3Bab^2d^3e^m x^{13}x^m}{m+13} + \frac{Ab^3d^3e^m x^{13}x^m}{m+13} \\
 & + \frac{3Bb^3c^2de^m x^{11}x^m}{m+11} + \frac{9Bab^2cd^2e^m x^{11}x^m}{m+11} \\
 & + \frac{3Ab^3cd^2e^m x^{11}x^m}{m+11} + \frac{3Ba^2bd^3e^m x^{11}x^m}{m+11} \\
 & + \frac{3Aab^2d^3e^m x^{11}x^m}{m+11} + \frac{Bb^3c^3e^m x^9x^m}{m+9} \\
 & + \frac{9Bab^2c^2de^m x^9x^m}{m+9} + \frac{3Ab^3c^2de^m x^9x^m}{m+9} \\
 & + \frac{9Ba^2bcd^2e^m x^9x^m}{m+9} + \frac{9Aab^2cd^2e^m x^9x^m}{m+9} \\
 & + \frac{Ba^3d^3e^m x^9x^m}{m+9} + \frac{3Aa^2bd^3e^m x^9x^m}{m+9} \\
 & + \frac{3Bab^2c^3e^m x^7x^m}{m+7} + \frac{Ab^3c^3e^m x^7x^m}{m+7} \\
 & + \frac{9Ba^2bc^2de^m x^7x^m}{m+7} + \frac{9Aab^2c^2de^m x^7x^m}{m+7} \\
 & + \frac{3Ba^3cd^2e^m x^7x^m}{m+7} + \frac{9Aa^2bcd^2e^m x^7x^m}{m+7} \\
 & + \frac{Aa^3d^3e^m x^7x^m}{m+7} + \frac{3Ba^2bc^3e^m x^5x^m}{m+5} \\
 & + \frac{3Aab^2c^3e^m x^5x^m}{m+5} + \frac{3Ba^3c^2de^m x^5x^m}{m+5} \\
 & + \frac{9Aa^2bc^2de^m x^5x^m}{m+5} + \frac{3Aa^3cd^2e^m x^5x^m}{m+5} \\
 & + \frac{Ba^3c^3e^m x^3x^m}{m+3} + \frac{3Aa^2bc^3e^m x^3x^m}{m+3} \\
 & + \frac{3Aa^3c^2de^m x^3x^m}{m+3} + \frac{(ex)^{m+1} Aa^3c^3}{e(m+1)}
 \end{aligned}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="maxima")`

output

```

B*b^3*d^3*e^m*x^15*x^m/(m + 15) + 3*B*b^3*c*d^2*e^m*x^13*x^m/(m + 13) + 3*
B*a*b^2*d^3*e^m*x^13*x^m/(m + 13) + A*b^3*d^3*e^m*x^13*x^m/(m + 13) + 3*B*
b^3*c^2*d*e^m*x^11*x^m/(m + 11) + 9*B*a*b^2*c*d^2*e^m*x^11*x^m/(m + 11) +
3*A*b^3*c*d^2*e^m*x^11*x^m/(m + 11) + 3*B*a^2*b*d^3*e^m*x^11*x^m/(m + 11)
+ 3*A*a*b^2*d^3*e^m*x^11*x^m/(m + 11) + B*b^3*c^3*e^m*x^9*x^m/(m + 9) + 9*
B*a*b^2*c^2*d*e^m*x^9*x^m/(m + 9) + 3*A*b^3*c^2*d*e^m*x^9*x^m/(m + 9) + 9*
B*a^2*b*c*d^2*e^m*x^9*x^m/(m + 9) + 9*A*a*b^2*c*d^2*e^m*x^9*x^m/(m + 9) +
B*a^3*d^3*e^m*x^9*x^m/(m + 9) + 3*A*a^2*b*d^3*e^m*x^9*x^m/(m + 9) + 3*B*a*
b^2*c^3*e^m*x^7*x^m/(m + 7) + A*b^3*c^3*e^m*x^7*x^m/(m + 7) + 9*B*a^2*b*c^
2*d*e^m*x^7*x^m/(m + 7) + 9*A*a*b^2*c^2*d*e^m*x^7*x^m/(m + 7) + 3*B*a^3*c*
d^2*e^m*x^7*x^m/(m + 7) + 9*A*a^2*b*c*d^2*e^m*x^7*x^m/(m + 7) + A*a^3*d^3*
e^m*x^7*x^m/(m + 7) + 3*B*a^2*b*c^3*e^m*x^5*x^m/(m + 5) + 3*A*a*b^2*c^3*e^
m*x^5*x^m/(m + 5) + 3*B*a^3*c^2*d*e^m*x^5*x^m/(m + 5) + 9*A*a^2*b*c^2*d*e^
m*x^5*x^m/(m + 5) + 3*A*a^3*c*d^2*e^m*x^5*x^m/(m + 5) + B*a^3*c^3*e^m*x^3*
x^m/(m + 3) + 3*A*a^2*b*c^3*e^m*x^3*x^m/(m + 3) + 3*A*a^3*c^2*d*e^m*x^3*x^
m/(m + 3) + (e*x)^(m + 1)*A*a^3*c^3/(e*(m + 1))

```

3.15.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 5234 vs. $2(379) = 758$.

Time = 0.41 (sec) , antiderivative size = 5234, normalized size of antiderivative = 13.81

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="giac")`

output

```

((e*x)^m*B*b^3*d^3*m^7*x^15 + 49*(e*x)^m*B*b^3*d^3*m^6*x^15 + 3*(e*x)^m*B*
b^3*c*d^2*m^7*x^13 + 3*(e*x)^m*B*a*b^2*d^3*m^7*x^13 + (e*x)^m*A*b^3*d^3*m^
7*x^13 + 973*(e*x)^m*B*b^3*d^3*m^5*x^15 + 153*(e*x)^m*B*b^3*c*d^2*m^6*x^13
+ 153*(e*x)^m*B*a*b^2*d^3*m^6*x^13 + 51*(e*x)^m*A*b^3*d^3*m^6*x^13 + 1004
5*(e*x)^m*B*b^3*d^3*m^4*x^15 + 3*(e*x)^m*B*b^3*c^2*d*m^7*x^11 + 9*(e*x)^m*
B*a*b^2*c*d^2*m^7*x^11 + 3*(e*x)^m*A*b^3*c*d^2*m^7*x^11 + 3*(e*x)^m*B*a^2*
b*d^3*m^7*x^11 + 3*(e*x)^m*A*a*b^2*d^3*m^7*x^11 + 3135*(e*x)^m*B*b^3*c*d^2
*m^5*x^13 + 3135*(e*x)^m*B*a*b^2*d^3*m^5*x^13 + 1045*(e*x)^m*A*b^3*d^3*m^5
*x^13 + 57379*(e*x)^m*B*b^3*d^3*m^3*x^15 + 159*(e*x)^m*B*b^3*c^2*d*m^6*x^1
1 + 477*(e*x)^m*B*a*b^2*c*d^2*m^6*x^11 + 159*(e*x)^m*A*b^3*c*d^2*m^6*x^11
+ 159*(e*x)^m*B*a^2*b*d^3*m^6*x^11 + 159*(e*x)^m*A*a*b^2*d^3*m^6*x^11 + 33
165*(e*x)^m*B*b^3*c*d^2*m^4*x^13 + 33165*(e*x)^m*B*a*b^2*d^3*m^4*x^13 + 11
055*(e*x)^m*A*b^3*d^3*m^4*x^13 + 177331*(e*x)^m*B*b^3*d^3*m^2*x^15 + (e*x)
^m*B*b^3*c^3*m^7*x^9 + 9*(e*x)^m*B*a*b^2*c^2*d*m^7*x^9 + 3*(e*x)^m*A*b^3*c
^2*d*m^7*x^9 + 9*(e*x)^m*B*a^2*b*c*d^2*m^7*x^9 + 9*(e*x)^m*A*a*b^2*c*d^2*m
^7*x^9 + (e*x)^m*B*a^3*d^3*m^7*x^9 + 3*(e*x)^m*A*a^2*b*d^3*m^7*x^9 + 3375*
(e*x)^m*B*b^3*c^2*d*m^5*x^11 + 10125*(e*x)^m*B*a*b^2*c*d^2*m^5*x^11 + 3375
*(e*x)^m*A*b^3*c*d^2*m^5*x^11 + 3375*(e*x)^m*B*a^2*b*d^3*m^5*x^11 + 3375*(
e*x)^m*A*a*b^2*d^3*m^5*x^11 + 193017*(e*x)^m*B*b^3*c*d^2*m^3*x^13 + 193017
*(e*x)^m*B*a*b^2*d^3*m^3*x^13 + 64339*(e*x)^m*A*b^3*d^3*m^3*x^13 + 2642...

```

3.15. $\int (ex)^m (a + bx^2)^3 (A + Bx^2)(c + dx^2)^3 dx$

3.15.9 Mupad [B] (verification not implemented)

Time = 6.61 (sec) , antiderivative size = 933, normalized size of antiderivative = 2.46

$$\int (ex)^m (a + bx^2)^3 (A + Bx^2) (c + dx^2)^3 dx$$

$$= \frac{x^7 (ex)^m (3Ba^3cd^2 + Aa^3d^3 + 9Ba^2bc^2d + 9Aa^2bcd^2 + 3Bab^2c^3 + 9Aab^2c^2d + Ab^3c^3) (m^7 + 5m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{x^9 (ex)^m (Ba^3d^3 + 9Ba^2bcd^2 + 3Aa^2bd^3 + 9Bab^2c^2d + 9Aab^2cd^2 + Bb^3c^3 + 3Ab^3c^2d) (m^7 + 5m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{Bb^3d^3x^{15} (ex)^m (m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{3acx^5 (ex)^m (Ba^2cd + Aa^2d^2 + Bab^2c^2 + 3Aabcd + Ab^2c^2) (m^7 + 59m^6 + 1413m^5 + 17575m^4 + 12265m^3 + 3513m^2 + 264m + 15)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{3bdx^{11} (ex)^m (Ba^2d^2 + 3Babcd + Aabd^2 + Bb^2c^2 + Ab^2cd) (m^7 + 53m^6 + 1125m^5 + 12265m^4 + 12265m^3 + 3513m^2 + 264m + 15)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{a^2c^2x^3 (ex)^m (3Aad + 3Abc + Bac) (m^7 + 61m^6 + 1525m^5 + 20065m^4 + 147859m^3 + 594439m^2 + 12265m + 15)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{b^2d^2x^{13} (ex)^m (Abd + 3Bad + 3Bbc) (m^7 + 51m^6 + 1045m^5 + 11055m^4 + 64339m^3 + 201609m^2 + 12265m + 15)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

$$+ \frac{Aa^3c^3x (ex)^m (m^7 + 63m^6 + 1645m^5 + 22995m^4 + 185059m^3 + 852957m^2 + 2071215m + 2027025)}{m^8 + 64m^7 + 1708m^6 + 24640m^5 + 208054m^4 + 1038016m^3 + 2924172m^2 + 4098240m + 2027025}$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^3*(c + d*x^2)^3,x)`

output

```
(x^7*(e*x)^m*(A*a^3*d^3 + A*b^3*c^3 + 3*B*a*b^2*c^3 + 3*B*a^3*c*d^2 + 9*A*
a*b^2*c^2*d + 9*A*a^2*b*c*d^2 + 9*B*a^2*b*c^2*d)*(544095*m + 340011*m^2 +
99715*m^3 + 15477*m^4 + 1309*m^5 + 57*m^6 + m^7 + 289575))/(4098240*m + 29
24172*m^2 + 1038016*m^3 + 208054*m^4 + 24640*m^5 + 1708*m^6 + 64*m^7 + m^8
+ 2027025) + (x^9*(e*x)^m*(B*a^3*d^3 + B*b^3*c^3 + 3*A*a^2*b*d^3 + 3*A*b^
3*c^2*d + 9*A*a*b^2*c*d^2 + 9*B*a*b^2*c^2*d + 9*B*a^2*b*c*d^2)*(430335*m +
277093*m^2 + 84547*m^3 + 13723*m^4 + 1213*m^5 + 55*m^6 + m^7 + 225225))/(
4098240*m + 2924172*m^2 + 1038016*m^3 + 208054*m^4 + 24640*m^5 + 1708*m^6
+ 64*m^7 + m^8 + 2027025) + (B*b^3*d^3*x^15*(e*x)^m*(264207*m + 177331*m^2
+ 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135))/(4098240*m +
2924172*m^2 + 1038016*m^3 + 208054*m^4 + 24640*m^5 + 1708*m^6 + 64*m^7 + m
^8 + 2027025) + (3*a*c*x^5*(e*x)^m*(A*a^2*d^2 + A*b^2*c^2 + B*a*b*c^2 + B*
a^2*c*d + 3*A*a*b*c*d)*(738567*m + 437121*m^2 + 120179*m^3 + 17575*m^4 + 1
413*m^5 + 59*m^6 + m^7 + 405405))/(4098240*m + 2924172*m^2 + 1038016*m^3 +
208054*m^4 + 24640*m^5 + 1708*m^6 + 64*m^7 + m^8 + 2027025) + (3*b*d*x^11
*(e*x)^m*(B*a^2*d^2 + B*b^2*c^2 + A*a*b*d^2 + A*b^2*c*d + 3*B*a*b*c*d)*(35
5815*m + 233487*m^2 + 73139*m^3 + 12265*m^4 + 1125*m^5 + 53*m^6 + m^7 + 18
4275))/(4098240*m + 2924172*m^2 + 1038016*m^3 + 208054*m^4 + 24640*m^5 + 1
708*m^6 + 64*m^7 + m^8 + 2027025) + (a^2*c^2*x^3*(e*x)^m*(3*A*a*d + 3*A*b*
c + B*a*c)*(1140855*m + 594439*m^2 + 147859*m^3 + 20065*m^4 + 1525*m^5 ...
```

3.16 $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx$

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3.16.1 Optimal result

Integrand size = 31, antiderivative size = 284

$$\begin{aligned} & \int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx \\ &= \frac{a^2 Ac^3 (ex)^{1+m}}{e(1+m)} + \frac{ac^2(2Abc + aBc + 3aAd)(ex)^{3+m}}{e^3(3+m)} \\ &+ \frac{c(aBc(2bc + 3ad) + A(b^2c^2 + 6abcd + 3a^2d^2))(ex)^{5+m}}{e^5(5+m)} \\ &+ \frac{(6abcd(Bc + Ad) + a^2d^2(3Bc + Ad) + b^2c^2(Bc + 3Ad))(ex)^{7+m}}{e^7(7+m)} \\ &+ \frac{d(a^2Bd^2 + 3b^2c(Bc + Ad) + 2abd(3Bc + Ad))(ex)^{9+m}}{e^9(9+m)} \\ &+ \frac{bd^2(3bBc + Abd + 2aBd)(ex)^{11+m}}{e^{11}(11+m)} + \frac{b^2Bd^3(ex)^{13+m}}{e^{13}(13+m)} \end{aligned}$$

```
output a^2*A*c^3*(e*x)^(1+m)/e/(1+m)+a*c^2*(3*A*a*d+2*A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)+c*(a*B*c*(3*a*d+2*b*c)+A*(3*a^2*d^2+6*a*b*c*d+b^2*c^2))*(e*x)^(5+m)/e^5/(5+m)+(6*a*b*c*d*(A*d+B*c)+a^2*d^2*(A*d+3*B*c)+b^2*c^2*(3*A*d+B*c))*(e*x)^(7+m)/e^7/(7+m)+d*(a^2*B*d^2+3*b^2*c*(A*d+B*c)+2*a*b*d*(A*d+3*B*c))*(e*x)^(9+m)/e^9/(9+m)+b*d^2*(A*b*d+2*B*a*d+3*B*b*c)*(e*x)^(11+m)/e^11/(11+m)+b^2*B*d^3*(e*x)^(13+m)/e^13/(13+m)
```

3.16.2 Mathematica [A] (verified)

Time = 0.61 (sec) , antiderivative size = 239, normalized size of antiderivative = 0.84

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx$$

$$= x(ex)^m \left(\frac{a^2 Ac^3}{1+m} + \frac{ac^2(2Abc + aBc + 3aAd)x^2}{3+m} \right. \\ \left. + \frac{c(aBc(2bc + 3ad) + A(b^2c^2 + 6abcd + 3a^2d^2))x^4}{5+m} \right. \\ \left. + \frac{(6abcd(Bc + Ad) + a^2d^2(3Bc + Ad) + b^2c^2(Bc + 3Ad))x^6}{7+m} \right. \\ \left. + \frac{d(a^2Bd^2 + 3b^2c(Bc + Ad) + 2abd(3Bc + Ad))x^8}{9+m} + \frac{bd^2(3bBc + Abd + 2aBd)x^{10}}{11+m} \right. \\ \left. + \frac{b^2Bd^3x^{12}}{13+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^2*(A + B*x^2)*(c + d*x^2)^3,x]`

output `x*(e*x)^m*((a^2*A*c^3)/(1 + m) + (a*c^2*(2*A*b*c + a*B*c + 3*a*A*d)*x^2)/(3 + m) + (c*(a*B*c*(2*b*c + 3*a*d) + A*(b^2*c^2 + 6*a*b*c*d + 3*a^2*d^2))*x^4)/(5 + m) + ((6*a*b*c*d*(B*c + A*d) + a^2*d^2*(3*B*c + A*d) + b^2*c^2*(B*c + 3*A*d))*x^6)/(7 + m) + (d*(a^2*B*d^2 + 3*b^2*c*(B*c + A*d) + 2*a*b*d*(3*B*c + A*d))*x^8)/(9 + m) + (b*d^2*(3*b*B*c + A*b*d + 2*a*B*d))*x^10)/(11 + m) + (b^2*B*d^3*x^12)/(13 + m))`

3.16.3 Rubi [A] (verified)

Time = 0.52 (sec) , antiderivative size = 284, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 2009}

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

$$\int (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 (ex)^m dx$$

$$\downarrow 437$$

$$\int \left(\frac{(ex)^{m+6} (a^2 d^2 (Ad + 3Bc) + 6abcd(Ad + Bc) + b^2 c^2 (3Ad + Bc))}{e^6} + \frac{c(ex)^{m+4} (A(3a^2 d^2 + 6abcd + b^2 c^2) + a}{e^4} \right.$$

↓ 2009

$$\begin{aligned} & \frac{(ex)^{m+7} (a^2 d^2 (Ad + 3Bc) + 6abcd(Ad + Bc) + b^2 c^2 (3Ad + Bc))}{e^7(m+7)} + \\ & \frac{c(ex)^{m+5} (A(3a^2 d^2 + 6abcd + b^2 c^2) + aBc(3ad + 2bc))}{e^5(m+5)} + \\ & \frac{d(ex)^{m+9} (a^2 B d^2 + 2abd(Ad + 3Bc) + 3b^2 c(Ad + Bc))}{e^9(m+9)} + \frac{a^2 A c^3 (ex)^{m+1}}{e(m+1)} + \\ & \frac{ac^2 (ex)^{m+3} (3aAd + aBc + 2Abc)}{e^3(m+3)} + \frac{bd^2 (ex)^{m+11} (2aBd + Abd + 3bBc)}{e^{11}(m+11)} + \frac{b^2 B d^3 (ex)^{m+13}}{e^{13}(m+13)} \end{aligned}$$

input `Int[(e*x)^m*(a + b*x^2)^2*(A + B*x^2)*(c + d*x^2)^3,x]`

output `(a^2*A*c^3*(e*x)^(1+m))/(e*(1+m)) + (a*c^2*(2*A*b*c + a*B*c + 3*a*A*d)*(e*x)^(3+m))/(e^3*(3+m)) + (c*(a*B*c*(2*b*c + 3*a*d) + A*(b^2*c^2 + 6*a*b*c*d + 3*a^2*d^2))*(e*x)^(5+m))/(e^5*(5+m)) + ((6*a*b*c*d*(B*c + A*d) + a^2*d^2*(3*B*c + A*d) + b^2*c^2*(B*c + 3*A*d))*(e*x)^(7+m))/(e^7*(7+m)) + (d*(a^2*B*d^2 + 3*b^2*c*(B*c + A*d) + 2*a*b*d*(3*B*c + A*d))*(e*x)^(9+m))/(e^9*(9+m)) + (b*d^2*(3*b*B*c + A*b*d + 2*a*B*d)*(e*x)^(11+m))/(e^11*(11+m)) + (b^2*B*d^3*(e*x)^(13+m))/(e^13*(13+m))`

3.16.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_)^(m_.))*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.16. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx$

3.16.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 2442 vs. $2(284) = 568$.

Time = 3.63 (sec) , antiderivative size = 2443, normalized size of antiderivative = 8.60

method	result	size
gospers	Expression too large to display	2443
risch	Expression too large to display	2443
parallelrisch	Expression too large to display	3284

```
input int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^3,x,method=_RETURNVERBOSE)
```

```
output x*(B*b^2*d^3*m^6*x^12+36*B*b^2*d^3*m^5*x^12+A*b^2*d^3*m^6*x^10+2*B*a*b*d^3
*m^6*x^10+3*B*b^2*c*d^2*m^6*x^10+505*B*b^2*d^3*m^4*x^12+38*A*b^2*d^3*m^5*x
^10+76*B*a*b*d^3*m^5*x^10+114*B*b^2*c*d^2*m^5*x^10+3480*B*b^2*d^3*m^3*x^12
+2*A*a*b*d^3*m^6*x^8+3*A*b^2*c*d^2*m^6*x^8+555*A*b^2*d^3*m^4*x^10+B*a^2*d^
3*m^6*x^8+6*B*a*b*c*d^2*m^6*x^8+1110*B*a*b*d^3*m^4*x^10+3*B*b^2*c^2*d*m^6*
x^8+1665*B*b^2*c*d^2*m^4*x^10+12139*B*b^2*d^3*m^2*x^12+80*A*a*b*d^3*m^5*x^
8+120*A*b^2*c*d^2*m^5*x^8+3940*A*b^2*d^3*m^3*x^10+40*B*a^2*d^3*m^5*x^8+240
*B*a*b*c*d^2*m^5*x^8+7880*B*a*b*d^3*m^3*x^10+120*B*b^2*c^2*d*m^5*x^8+11820
*B*b^2*c*d^2*m^3*x^10+19524*B*b^2*d^3*m*x^12+A*a^2*d^3*m^6*x^6+6*A*a*b*c*d
^2*m^6*x^6+1226*A*a*b*d^3*m^4*x^8+3*A*b^2*c^2*d*m^6*x^6+1839*A*b^2*c*d^2*m
^4*x^8+14039*A*b^2*d^3*m^2*x^10+3*B*a^2*c*d^2*m^6*x^6+613*B*a^2*d^3*m^4*x^
8+6*B*a*b*c^2*d*m^6*x^6+3678*B*a*b*c*d^2*m^4*x^8+28078*B*a*b*d^3*m^2*x^10+
B*b^2*c^3*m^6*x^6+1839*B*b^2*c^2*d*m^4*x^8+42117*B*b^2*c*d^2*m^2*x^10+1039
5*B*b^2*d^3*x^12+42*A*a^2*d^3*m^5*x^6+252*A*a*b*c*d^2*m^5*x^6+9056*A*a*b*d
^3*m^3*x^8+126*A*b^2*c^2*d*m^5*x^6+13584*A*b^2*c*d^2*m^3*x^8+22902*A*b^2*d
^3*m*x^10+126*B*a^2*c*d^2*m^5*x^6+4528*B*a^2*d^3*m^3*x^8+252*B*a*b*c^2*d*m
^5*x^6+27168*B*a*b*c*d^2*m^3*x^8+45804*B*a*b*d^3*m*x^10+42*B*b^2*c^3*m^5*x
^6+13584*B*b^2*c^2*d*m^3*x^8+68706*B*b^2*c*d^2*m*x^10+3*A*a^2*c*d^2*m^6*x^
4+679*A*a^2*d^3*m^4*x^6+6*A*a*b*c^2*d*m^6*x^4+4074*A*a*b*c*d^2*m^4*x^6+332
54*A*a*b*d^3*m^2*x^8+A*b^2*c^3*m^6*x^4+2037*A*b^2*c^2*d*m^4*x^6+49881*A...
```

3.16.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1690 vs. $2(284) = 568$.

Time = 0.28 (sec) , antiderivative size = 1690, normalized size of antiderivative = 5.95

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="fricas")`

output `((B*b^2*d^3*m^6 + 36*B*b^2*d^3*m^5 + 505*B*b^2*d^3*m^4 + 3480*B*b^2*d^3*m^3 + 12139*B*b^2*d^3*m^2 + 19524*B*b^2*d^3*m + 10395*B*b^2*d^3)*x^13 + ((3*B*b^2*c*d^2 + (2*B*a*b + A*b^2)*d^3)*m^6 + 36855*B*b^2*c*d^2 + 38*(3*B*b^2*c*d^2 + (2*B*a*b + A*b^2)*d^3)*m^5 + 555*(3*B*b^2*c*d^2 + (2*B*a*b + A*b^2)*d^3)*m^4 + 12285*(2*B*a*b + A*b^2)*d^3 + 3940*(3*B*b^2*c*d^2 + (2*B*a*b + A*b^2)*d^3)*m^3 + 14039*(3*B*b^2*c*d^2 + (2*B*a*b + A*b^2)*d^3)*m^2 + 22902*(3*B*b^2*c*d^2 + (2*B*a*b + A*b^2)*d^3)*m)*x^11 + ((3*B*b^2*c^2*d + 3*(2*B*a*b + A*b^2)*c*d^2 + (B*a^2 + 2*A*a*b)*d^3)*m^6 + 45045*B*b^2*c^2*d + 40*(3*B*b^2*c^2*d + 3*(2*B*a*b + A*b^2)*c*d^2 + (B*a^2 + 2*A*a*b)*d^3)*m^5 + 613*(3*B*b^2*c^2*d + 3*(2*B*a*b + A*b^2)*c*d^2 + (B*a^2 + 2*A*a*b)*d^3)*m^4 + 45045*(2*B*a*b + A*b^2)*c*d^2 + 15015*(B*a^2 + 2*A*a*b)*d^3 + 4528*(3*B*b^2*c^2*d + 3*(2*B*a*b + A*b^2)*c*d^2 + (B*a^2 + 2*A*a*b)*d^3)*m^3 + 16627*(3*B*b^2*c^2*d + 3*(2*B*a*b + A*b^2)*c*d^2 + (B*a^2 + 2*A*a*b)*d^3)*m^2 + 27688*(3*B*b^2*c^2*d + 3*(2*B*a*b + A*b^2)*c*d^2 + (B*a^2 + 2*A*a*b)*d^3)*m)*x^9 + ((B*b^2*c^3 + A*a^2*d^3 + 3*(2*B*a*b + A*b^2)*c^2*d + 3*(B*a^2 + 2*A*a*b)*c*d^2)*m^6 + 19305*B*b^2*c^3 + 19305*A*a^2*d^3 + 42*(B*b^2*c^3 + A*a^2*d^3 + 3*(2*B*a*b + A*b^2)*c^2*d + 3*(B*a^2 + 2*A*a*b)*c*d^2)*m^5 + 679*(B*b^2*c^3 + A*a^2*d^3 + 3*(2*B*a*b + A*b^2)*c^2*d + 3*(B*a^2 + 2*A*a*b)*c*d^2)*m^4 + 57915*(2*B*a*b + A*b^2)*c^2*d + 57915*(B*a^2 + 2*A*a*b)*c*d^2 + 5292*(B*b^2*c^3 + A*a^2*d^3 + 3*(2*B*a*b + A*b^2)*c^2*d + ...`

3.16.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 11914 vs. $2(284) = 568$.

Time = 1.33 (sec) , antiderivative size = 11914, normalized size of antiderivative = 41.95

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**2*(B*x**2+A)*(d*x**2+c)**3,x)`

output `Piecewise(((-A*a**2*c**3/(12*x**12) - 3*A*a**2*c**2*d/(10*x**10) - 3*A*a**2*c*d**2/(8*x**8) - A*a**2*d**3/(6*x**6) - A*a*b*c**3/(5*x**10) - 3*A*a*b*c**2*d/(4*x**8) - A*a*b*c*d**2/x**6 - A*a*b*d**3/(2*x**4) - A*b**2*c**3/(8*x**8) - A*b**2*c**2*d/(2*x**6) - 3*A*b**2*c*d**2/(4*x**4) - A*b**2*d**3/(2*x**2) - B*a**2*c**3/(10*x**10) - 3*B*a**2*c**2*d/(8*x**8) - B*a**2*c*d**2/(2*x**6) - B*a**2*d**3/(4*x**4) - B*a*b*c**3/(4*x**8) - B*a*b*c**2*d/x**6 - 3*B*a*b*c*d**2/(2*x**4) - B*a*b*d**3/x**2 - B*b**2*c**3/(6*x**6) - 3*B*b**2*c**2*d/(4*x**4) - 3*B*b**2*c*d**2/(2*x**2) + B*b**2*d**3*log(x))/e**13, Eq(m, -13)), ((-A*a**2*c**3/(10*x**10) - 3*A*a**2*c**2*d/(8*x**8) - A*a**2*c*d**2/(2*x**6) - A*a**2*d**3/(4*x**4) - A*a*b*c**3/(4*x**8) - A*a*b*c**2*d/x**6 - 3*A*a*b*c*d**2/(2*x**4) - A*a*b*d**3/x**2 - A*b**2*c**3/(6*x**6) - 3*A*b**2*c**2*d/(4*x**4) - 3*A*b**2*c*d**2/(2*x**2) + A*b**2*d**3*log(x) - B*a**2*c**3/(8*x**8) - B*a**2*c**2*d/(2*x**6) - 3*B*a**2*c*d**2/(4*x**4) - B*a**2*d**3/(2*x**2) - B*a*b*c**3/(3*x**6) - 3*B*a*b*c**2*d/(2*x**4) - 3*B*a*b*c*d**2/x**2 + 2*B*a*b*d**3*log(x) - B*b**2*c**3/(4*x**4) - 3*B*b**2*c**2*d/(2*x**2) + 3*B*b**2*c*d**2*log(x) + B*b**2*d**3*x**2/2)/e**11, Eq(m, -11)), ((-A*a**2*c**3/(8*x**8) - A*a**2*c**2*d/(2*x**6) - 3*A*a**2*c*d**2/(4*x**4) - A*a**2*d**3/(2*x**2) - A*a*b*c**3/(3*x**6) - 3*A*a*b*c**2*d/(2*x**4) - 3*A*a*b*c*d**2/x**2 + 2*A*a*b*d**3*log(x) - A*b**2*c**3/(4*x**4) - 3*A*b**2*c**2*d/(2*x**2) + 3*A*b**2*c*d**2*log(x) + A*b**2*d...`

3.16. $\int (ex)^m (a + bx^2)^2 (A + Bx^2)(c + dx^2)^3 dx$

3.16.7 Maxima [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 550, normalized size of antiderivative = 1.94

$$\begin{aligned}
\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx = & \frac{Bb^2d^3e^m x^{13}x^m}{m+13} + \frac{3Bb^2cd^2e^m x^{11}x^m}{m+11} \\
& + \frac{2Babd^3e^m x^{11}x^m}{m+11} + \frac{Ab^2d^3e^m x^{11}x^m}{m+11} \\
& + \frac{3Bb^2c^2de^m x^9x^m}{m+9} + \frac{6Babcd^2e^m x^9x^m}{m+9} \\
& + \frac{3Ab^2cd^2e^m x^9x^m}{m+9} + \frac{Ba^2d^3e^m x^9x^m}{m+9} \\
& + \frac{2Aabd^3e^m x^9x^m}{m+9} + \frac{Bb^2c^3e^m x^7x^m}{m+7} \\
& + \frac{6Babc^2de^m x^7x^m}{m+7} + \frac{3Ab^2c^2de^m x^7x^m}{m+7} \\
& + \frac{3Ba^2cd^2e^m x^7x^m}{m+7} + \frac{6Aabcd^2e^m x^7x^m}{m+7} \\
& + \frac{Aa^2d^3e^m x^7x^m}{m+7} + \frac{2Babc^3e^m x^5x^m}{m+5} \\
& + \frac{Ab^2c^3e^m x^5x^m}{m+5} + \frac{3Ba^2c^2de^m x^5x^m}{m+5} \\
& + \frac{6Aabc^2de^m x^5x^m}{m+5} + \frac{3Aa^2cd^2e^m x^5x^m}{m+5} \\
& + \frac{Ba^2c^3e^m x^3x^m}{m+3} + \frac{2Aabc^3e^m x^3x^m}{m+3} \\
& + \frac{3Aa^2c^2de^m x^3x^m}{m+3} + \frac{(ex)^{m+1} Aa^2c^3}{e(m+1)}
\end{aligned}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="maxima")`

output $B*b^2*d^3*e^m*x^{13}*x^m/(m + 13) + 3*B*b^2*c*d^2*e^m*x^{11}*x^m/(m + 11) + 2*B*a*b*d^3*e^m*x^{11}*x^m/(m + 11) + A*b^2*d^3*e^m*x^{11}*x^m/(m + 11) + 3*B*b^2*c^2*d*e^m*x^9*x^m/(m + 9) + 6*B*a*b*c*d^2*e^m*x^9*x^m/(m + 9) + 3*A*b^2*c*d^2*e^m*x^9*x^m/(m + 9) + B*a^2*d^3*e^m*x^9*x^m/(m + 9) + 2*A*a*b*d^3*e^m*x^9*x^m/(m + 9) + B*b^2*c^3*e^m*x^7*x^m/(m + 7) + 6*B*a*b*c^2*d*e^m*x^7*x^m/(m + 7) + 3*A*b^2*c^2*d*e^m*x^7*x^m/(m + 7) + 3*B*a^2*c*d^2*e^m*x^7*x^m/(m + 7) + 6*A*a*b*c*d^2*e^m*x^7*x^m/(m + 7) + A*a^2*d^3*e^m*x^7*x^m/(m + 7) + 2*B*a*b*c^3*e^m*x^5*x^m/(m + 5) + A*b^2*c^3*e^m*x^5*x^m/(m + 5) + 3*B*a^2*c^2*d*e^m*x^5*x^m/(m + 5) + 6*A*a*b*c^2*d*e^m*x^5*x^m/(m + 5) + 3*A*a^2*c*d^2*e^m*x^5*x^m/(m + 5) + B*a^2*c^3*e^m*x^3*x^m/(m + 3) + 2*A*a*b*c^3*e^m*x^3*x^m/(m + 3) + 3*A*a^2*c^2*d*e^m*x^3*x^m/(m + 3) + (e*x)^(m + 1)*A*a^2*c^3/(e*(m + 1))$

3.16.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 3283 vs. $2(284) = 568$.

Time = 0.37 (sec) , antiderivative size = 3283, normalized size of antiderivative = 11.56

$$\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="giac")`

output

```

((e*x)^m*B*b^2*d^3*m^6*x^13 + 36*(e*x)^m*B*b^2*d^3*m^5*x^13 + 3*(e*x)^m*B*
b^2*c*d^2*m^6*x^11 + 2*(e*x)^m*B*a*b*d^3*m^6*x^11 + (e*x)^m*A*b^2*d^3*m^6*
x^11 + 505*(e*x)^m*B*b^2*d^3*m^4*x^13 + 114*(e*x)^m*B*b^2*c*d^2*m^5*x^11 +
76*(e*x)^m*B*a*b*d^3*m^5*x^11 + 38*(e*x)^m*A*b^2*d^3*m^5*x^11 + 3480*(e*x
)^m*B*b^2*d^3*m^3*x^13 + 3*(e*x)^m*B*b^2*c^2*d*m^6*x^9 + 6*(e*x)^m*B*a*b*c
*d^2*m^6*x^9 + 3*(e*x)^m*A*b^2*c*d^2*m^6*x^9 + (e*x)^m*B*a^2*d^3*m^6*x^9 +
2*(e*x)^m*A*a*b*d^3*m^6*x^9 + 1665*(e*x)^m*B*b^2*c*d^2*m^4*x^11 + 1110*(e
*x)^m*B*a*b*d^3*m^4*x^11 + 555*(e*x)^m*A*b^2*d^3*m^4*x^11 + 12139*(e*x)^m*
B*b^2*d^3*m^2*x^13 + 120*(e*x)^m*B*b^2*c^2*d*m^5*x^9 + 240*(e*x)^m*B*a*b*c
*d^2*m^5*x^9 + 120*(e*x)^m*A*b^2*c*d^2*m^5*x^9 + 40*(e*x)^m*B*a^2*d^3*m^5*
x^9 + 80*(e*x)^m*A*a*b*d^3*m^5*x^9 + 11820*(e*x)^m*B*b^2*c*d^2*m^3*x^11 +
7880*(e*x)^m*B*a*b*d^3*m^3*x^11 + 3940*(e*x)^m*A*b^2*d^3*m^3*x^11 + 19524*
(e*x)^m*B*b^2*d^3*m*x^13 + (e*x)^m*B*b^2*c^3*m^6*x^7 + 6*(e*x)^m*B*a*b*c^2
*d*m^6*x^7 + 3*(e*x)^m*A*b^2*c^2*d*m^6*x^7 + 3*(e*x)^m*B*a^2*c*d^2*m^6*x^7
+ 6*(e*x)^m*A*a*b*c*d^2*m^6*x^7 + (e*x)^m*A*a^2*d^3*m^6*x^7 + 1839*(e*x)^
m*B*b^2*c^2*d*m^4*x^9 + 3678*(e*x)^m*B*a*b*c*d^2*m^4*x^9 + 1839*(e*x)^m*A*
b^2*c*d^2*m^4*x^9 + 613*(e*x)^m*B*a^2*d^3*m^4*x^9 + 1226*(e*x)^m*A*a*b*d^3
*m^4*x^9 + 42117*(e*x)^m*B*b^2*c*d^2*m^2*x^11 + 28078*(e*x)^m*B*a*b*d^3*m^
2*x^11 + 14039*(e*x)^m*A*b^2*d^3*m^2*x^11 + 10395*(e*x)^m*B*b^2*d^3*x^13 +
42*(e*x)^m*B*b^2*c^3*m^5*x^7 + 252*(e*x)^m*B*a*b*c^2*d*m^5*x^7 + 126*(...

```

3.16.9 Mupad [B] (verification not implemented)

Time = 6.26 (sec) , antiderivative size = 694, normalized size of antiderivative = 2.44

$$\begin{aligned}
& \int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx \\
&= \frac{x^7 (ex)^m (3Ba^2cd^2 + Aa^2d^3 + 6Babc^2d + 6Aabcd^2 + Bb^2c^3 + 3Ab^2c^2d) (m^6 + 42m^5 + 679m^4 + 13m^3 + 10395m^2 + 264207m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135} \\
&+ \frac{cx^5 (ex)^m (3Ba^2cd + 3Aa^2d^2 + 2Babc^2 + 6Aabcd + Ab^2c^2) (m^6 + 44m^5 + 753m^4 + 6280m^3 + 13m^2 + 10395m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135} \\
&+ \frac{dx^9 (ex)^m (Ba^2d^2 + 6Babcd + 2Aabd^2 + 3Bb^2c^2 + 3Ab^2cd) (m^6 + 40m^5 + 613m^4 + 4528m^3 + 13m^2 + 10395m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135} \\
&+ \frac{Aa^2c^3x (ex)^m (m^6 + 48m^5 + 925m^4 + 9120m^3 + 48259m^2 + 129072m + 135135)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135} \\
&+ \frac{ac^2x^3 (ex)^m (3Aad + 2Abc + Bac) (m^6 + 46m^5 + 835m^4 + 7540m^3 + 34759m^2 + 73054m + 45000)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135} \\
&+ \frac{bd^2x^{11} (ex)^m (Abd + 2Bad + 3Bbc) (m^6 + 38m^5 + 555m^4 + 3940m^3 + 14039m^2 + 22902m + 12000)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135} \\
&+ \frac{Bb^2d^3x^{13} (ex)^m (m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395)}{m^7 + 49m^6 + 973m^5 + 10045m^4 + 57379m^3 + 177331m^2 + 264207m + 135135}
\end{aligned}$$

3.16. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^2*(c + d*x^2)^3,x)`

output `(x^7*(e*x)^m*(A*a^2*d^3 + B*b^2*c^3 + 3*A*b^2*c^2*d + 3*B*a^2*c*d^2 + 6*A*a*b*c*d^2 + 6*B*a*b*c^2*d)*(34986*m + 20335*m^2 + 5292*m^3 + 679*m^4 + 42*m^5 + m^6 + 19305))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (c*x^5*(e*x)^m*(3*A*a^2*d^2 + A*b^2*c^2 + 2*B*a*b*c^2 + 3*B*a^2*c*d + 6*A*a*b*c*d)*(47436*m + 25979*m^2 + 6280*m^3 + 753*m^4 + 44*m^5 + m^6 + 27027))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (d*x^9*(e*x)^m*(B*a^2*d^2 + 3*B*b^2*c^2 + 2*A*a*b*d^2 + 3*A*b^2*c*d + 6*B*a*b*c*d)*(27688*m + 16627*m^2 + 4528*m^3 + 613*m^4 + 40*m^5 + m^6 + 15015))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (A*a^2*c^3*x*(e*x)^m*(129072*m + 48259*m^2 + 9120*m^3 + 925*m^4 + 48*m^5 + m^6 + 135135))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (a*c^2*x^3*(e*x)^m*(3*A*a*d + 2*A*b*c + B*a*c)*(73054*m + 34759*m^2 + 7540*m^3 + 835*m^4 + 46*m^5 + m^6 + 45045))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (b*d^2*x^11*(e*x)^m*(A*b*d + 2*B*a*d + 3*B*b*c)*(22902*m + 14039*m^2 + 3940*m^3 + 555*m^4 + 38*m^5 + m^6 + 12285))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135) + (B*b^2*d^3*x^13*(e*x)^m*(19524*m + 12139*m^2 + 3480*m^3 + 505*m^4 + 36*m^5 + m^6 + 10395))/(264207*m + 177331*m^2 + 57379*m^3 + 10045*m^4 + 973*m^5 + 49*m^6 + m^7 + 135135)`

3.16. $\int (ex)^m (a + bx^2)^2 (A + Bx^2) (c + dx^2)^3 dx$

3.17 $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx$

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3.17.1 Optimal result

Integrand size = 29, antiderivative size = 189

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx = \frac{aAc^3(ex)^{1+m}}{e(1+m)} + \frac{c^2(ABC + aBc + 3aAd)(ex)^{3+m}}{e^3(3+m)} + \frac{c(3ad(Bc + Ad) + bc(Bc + 3Ad))(ex)^{5+m}}{e^5(5+m)} + \frac{d(3bc(Bc + Ad) + ad(3Bc + Ad))(ex)^{7+m}}{e^7(7+m)} + \frac{d^2(3bBc + Abd + aBd)(ex)^{9+m}}{e^9(9+m)} + \frac{bBd^3(ex)^{11+m}}{e^{11}(11+m)}$$

```
output a*A*c^3*(e*x)^(1+m)/e/(1+m)+c^2*(3*A*a*d+A*b*c+B*a*c)*(e*x)^(3+m)/e^3/(3+m)
)+c*(3*a*d*(A*d+B*c)+b*c*(3*A*d+B*c))*(e*x)^(5+m)/e^5/(5+m)+d*(3*b*c*(A*d+
B*c)+a*d*(A*d+3*B*c))*(e*x)^(7+m)/e^7/(7+m)+d^2*(A*b*d+B*a*d+3*B*b*c)*(e*x)
)^(9+m)/e^9/(9+m)+b*B*d^3*(e*x)^(11+m)/e^11/(11+m)
```

3.17.2 Mathematica [A] (verified)

Time = 0.43 (sec) , antiderivative size = 151, normalized size of antiderivative = 0.80

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx = x(ex)^m \left(\frac{aAc^3}{1+m} + \frac{c^2(Abc + aBc + 3aAd)x^2}{3+m} + \frac{c(3ad(Bc + Ad) + bc(Bc + 3Ad))x^4}{5+m} + \frac{d(3bc(Bc + Ad) + ad(3Bc + Ad))x^6}{7+m} + \frac{d^2(3bBc + Abd + aBd)x^8}{9+m} + \frac{bBd^3x^{10}}{11+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)*(A + B*x^2)*(c + d*x^2)^3,x]`

output `x*(e*x)^m*((a*A*c^3)/(1 + m) + (c^2*(A*b*c + a*B*c + 3*a*A*d)*x^2)/(3 + m) + (c*(3*a*d*(B*c + A*d) + b*c*(B*c + 3*A*d))*x^4)/(5 + m) + (d*(3*b*c*(B*c + A*d) + a*d*(3*B*c + A*d))*x^6)/(7 + m) + (d^2*(3*b*B*c + A*b*d + a*B*d)*x^8)/(9 + m) + (b*B*d^3*x^10)/(11 + m))`

3.17.3 Rubi [A] (verified)

Time = 0.38 (sec) , antiderivative size = 189, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.069$, Rules used = {437, 2009}

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

$$\int (a + bx^2) (A + Bx^2) (c + dx^2)^3 (ex)^m dx$$

$$\downarrow 437$$

$$\int \left(\frac{c^2(ex)^{m+2}(3aAd + aBc + Abc)}{e^2} + \frac{d^2(ex)^{m+8}(aBd + Abd + 3bBc)}{e^8} + \frac{d(ex)^{m+6}(ad(Ad + 3Bc) + 3bc(Ad + Bc))}{e^6} \right) dx$$

$$\downarrow 2009$$

$$\frac{c^2(ex)^{m+3}(3aAd + aBc + Abc)}{e^3(m+3)} + \frac{d^2(ex)^{m+9}(aBd + Abd + 3bBc)}{e^9(m+9)} +$$

$$\frac{d(ex)^{m+7}(ad(Ad + 3Bc) + 3bc(Ad + Bc))}{e^7(m+7)} + \frac{c(ex)^{m+5}(3ad(Ad + Bc) + bc(3Ad + Bc))}{e^5(m+5)} +$$

$$\frac{aAc^3(ex)^{m+1}}{e(m+1)} + \frac{bBd^3(ex)^{m+11}}{e^{11}(m+11)}$$

input `Int[(e*x)^m*(a + b*x^2)*(A + B*x^2)*(c + d*x^2)^3,x]`

output `(a*A*c^3*(e*x)^(1 + m))/(e*(1 + m)) + (c^2*(A*b*c + a*B*c + 3*a*A*d)*(e*x)^(3 + m))/(e^3*(3 + m)) + (c*(3*a*d*(B*c + A*d) + b*c*(B*c + 3*A*d))*(e*x)^(5 + m))/(e^5*(5 + m)) + (d*(3*b*c*(B*c + A*d) + a*d*(3*B*c + A*d))*(e*x)^(7 + m))/(e^7*(7 + m)) + (d^2*(3*b*B*c + A*b*d + a*B*d)*(e*x)^(9 + m))/(e^9*(9 + m)) + (b*B*d^3*(e*x)^(11 + m))/(e^11*(11 + m))`

3.17.3.1 Defintions of rubi rules used

rule 437 `Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2)^(r_), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.17.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 1228 vs. $2(189) = 378$.

Time = 3.47 (sec) , antiderivative size = 1229, normalized size of antiderivative = 6.50

method	result	size
gospers	Expression too large to display	1229
risch	Expression too large to display	1229
paralelrisch	Expression too large to display	1709

input `int((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^3,x,method=_RETURNVERBOSE)`

```

output x*(B*b*d^3*m^5*x^10+25*B*b*d^3*m^4*x^10+A*b*d^3*m^5*x^8+B*a*d^3*m^5*x^8+3*
B*b*c*d^2*m^5*x^8+230*B*b*d^3*m^3*x^10+27*A*b*d^3*m^4*x^8+27*B*a*d^3*m^4*x
^8+81*B*b*c*d^2*m^4*x^8+950*B*b*d^3*m^2*x^10+A*a*d^3*m^5*x^6+3*A*b*c*d^2*m
^5*x^6+262*A*b*d^3*m^3*x^8+3*B*a*c*d^2*m^5*x^6+262*B*a*d^3*m^3*x^8+3*B*b*c
^2*d*m^5*x^6+786*B*b*c*d^2*m^3*x^8+1689*B*b*d^3*m*x^10+29*A*a*d^3*m^4*x^6+
87*A*b*c*d^2*m^4*x^6+1122*A*b*d^3*m^2*x^8+87*B*a*c*d^2*m^4*x^6+1122*B*a*d^
3*m^2*x^8+87*B*b*c^2*d*m^4*x^6+3366*B*b*c*d^2*m^2*x^8+945*B*b*d^3*x^10+3*A
*a*c*d^2*m^5*x^4+302*A*a*d^3*m^3*x^6+3*A*b*c^2*d*m^5*x^4+906*A*b*c*d^2*m^3
*x^6+2041*A*b*d^3*m*x^8+3*B*a*c^2*d*m^5*x^4+906*B*a*c*d^2*m^3*x^6+2041*B*a
*d^3*m*x^8+B*b*c^3*m^5*x^4+906*B*b*c^2*d*m^3*x^6+6123*B*b*c*d^2*m*x^8+93*A
*a*c*d^2*m^4*x^4+1366*A*a*d^3*m^2*x^6+93*A*b*c^2*d*m^4*x^4+4098*A*b*c*d^2*
m^2*x^6+1155*A*b*d^3*x^8+93*B*a*c^2*d*m^4*x^4+4098*B*a*c*d^2*m^2*x^6+1155*
B*a*d^3*x^8+31*B*b*c^3*m^4*x^4+4098*B*b*c^2*d*m^2*x^6+3465*B*b*c*d^2*x^8+3
*A*a*c^2*d*m^5*x^2+1050*A*a*c*d^2*m^3*x^4+2577*A*a*d^3*m*x^6+A*b*c^3*m^5*x
^2+1050*A*b*c^2*d*m^3*x^4+7731*A*b*c*d^2*m*x^6+B*a*c^3*m^5*x^2+1050*B*a*c^
2*d*m^3*x^4+7731*B*a*c*d^2*m*x^6+350*B*b*c^3*m^3*x^4+7731*B*b*c^2*d*m*x^6+
99*A*a*c^2*d*m^4*x^2+5190*A*a*c*d^2*m^2*x^4+1485*A*a*d^3*x^6+33*A*b*c^3*m^
4*x^2+5190*A*b*c^2*d*m^2*x^4+4455*A*b*c*d^2*x^6+33*B*a*c^3*m^4*x^2+5190*B*
a*c^2*d*m^2*x^4+4455*B*a*c*d^2*x^6+1730*B*b*c^3*m^2*x^4+4455*B*b*c^2*d*x^6
+A*a*c^3*m^5+1218*A*a*c^2*d*m^3*x^2+10467*A*a*c*d^2*m*x^4+406*A*b*c^3*m...

```

3.17.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 837 vs. $2(189) = 378$.

Time = 0.28 (sec) , antiderivative size = 837, normalized size of antiderivative = 4.43

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx \\
 = \frac{((Bbd^3m^5 + 25 Bbd^3m^4 + 230 Bbd^3m^3 + 950 Bbd^3m^2 + 1689 Bbd^3m + 945 Bbd^3)x^{11} + ((3 Bbcd^2 + (Ba$$

```

input integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="fricas")

```


output

```
((B*b*d^3*m^5 + 25*B*b*d^3*m^4 + 230*B*b*d^3*m^3 + 950*B*b*d^3*m^2 + 1689*
B*b*d^3*m + 945*B*b*d^3)*x^11 + ((3*B*b*c*d^2 + (B*a + A*b)*d^3)*m^5 + 346
5*B*b*c*d^2 + 27*(3*B*b*c*d^2 + (B*a + A*b)*d^3)*m^4 + 1155*(B*a + A*b)*d^
3 + 262*(3*B*b*c*d^2 + (B*a + A*b)*d^3)*m^3 + 1122*(3*B*b*c*d^2 + (B*a + A
*b)*d^3)*m^2 + 2041*(3*B*b*c*d^2 + (B*a + A*b)*d^3)*m*x^9 + ((3*B*b*c^2*d
+ A*a*d^3 + 3*(B*a + A*b)*c*d^2)*m^5 + 4455*B*b*c^2*d + 1485*A*a*d^3 + 29
*(3*B*b*c^2*d + A*a*d^3 + 3*(B*a + A*b)*c*d^2)*m^4 + 4455*(B*a + A*b)*c*d^
2 + 302*(3*B*b*c^2*d + A*a*d^3 + 3*(B*a + A*b)*c*d^2)*m^3 + 1366*(3*B*b*c^
2*d + A*a*d^3 + 3*(B*a + A*b)*c*d^2)*m^2 + 2577*(3*B*b*c^2*d + A*a*d^3 + 3
*(B*a + A*b)*c*d^2)*m*x^7 + ((B*b*c^3 + 3*A*a*c*d^2 + 3*(B*a + A*b)*c^2*d
)*m^5 + 2079*B*b*c^3 + 6237*A*a*c*d^2 + 31*(B*b*c^3 + 3*A*a*c*d^2 + 3*(B*a
+ A*b)*c^2*d)*m^4 + 6237*(B*a + A*b)*c^2*d + 350*(B*b*c^3 + 3*A*a*c*d^2 +
3*(B*a + A*b)*c^2*d)*m^3 + 1730*(B*b*c^3 + 3*A*a*c*d^2 + 3*(B*a + A*b)*c^
2*d)*m^2 + 3489*(B*b*c^3 + 3*A*a*c*d^2 + 3*(B*a + A*b)*c^2*d)*m*x^5 + ((3
*A*a*c^2*d + (B*a + A*b)*c^3)*m^5 + 10395*A*a*c^2*d + 33*(3*A*a*c^2*d + (B
*a + A*b)*c^3)*m^4 + 3465*(B*a + A*b)*c^3 + 406*(3*A*a*c^2*d + (B*a + A*b)
*c^3)*m^3 + 2262*(3*A*a*c^2*d + (B*a + A*b)*c^3)*m^2 + 5353*(3*A*a*c^2*d +
(B*a + A*b)*c^3)*m*x^3 + (A*a*c^3*m^5 + 35*A*a*c^3*m^4 + 470*A*a*c^3*m^3
+ 3010*A*a*c^3*m^2 + 9129*A*a*c^3*m + 10395*A*a*c^3)*x)*(e*x)^m/(m^6 + 36
m^5 + 505*m^4 + 3480*m^3 + 12139*m^2 + 19524*m + 10395)
```

3.17.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 5992 vs. $2(184) = 368$.

Time = 0.94 (sec) , antiderivative size = 5992, normalized size of antiderivative = 31.70

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)*(B*x**2+A)*(d*x**2+c)**3,x)`

output `Piecewise(((-A*a*c**3/(10*x**10) - 3*A*a*c**2*d/(8*x**8) - A*a*c*d**2/(2*x**6) - A*a*d**3/(4*x**4) - A*b*c**3/(8*x**8) - A*b*c**2*d/(2*x**6) - 3*A*b*c*d**2/(4*x**4) - A*b*d**3/(2*x**2) - B*a*c**3/(8*x**8) - B*a*c**2*d/(2*x**6) - 3*B*a*c*d**2/(4*x**4) - B*a*d**3/(2*x**2) - B*b*c**3/(6*x**6) - 3*B*b*c**2*d/(4*x**4) - 3*B*b*c*d**2/(2*x**2) + B*b*d**3*log(x))/e**11, Eq(m, -11)), ((-A*a*c**3/(8*x**8) - A*a*c**2*d/(2*x**6) - 3*A*a*c*d**2/(4*x**4) - A*a*d**3/(2*x**2) - A*b*c**3/(6*x**6) - 3*A*b*c**2*d/(4*x**4) - 3*A*b*c*d**2/(2*x**2) + A*b*d**3*log(x) - B*a*c**3/(6*x**6) - 3*B*a*c**2*d/(4*x**4) - 3*B*a*c*d**2/(2*x**2) + B*a*d**3*log(x) - B*b*c**3/(4*x**4) - 3*B*b*c**2*d/(2*x**2) + 3*B*b*c*d**2*log(x) + B*b*d**3*x**2/2)/e**9, Eq(m, -9)), ((-A*a*c**3/(6*x**6) - 3*A*a*c**2*d/(4*x**4) - 3*A*a*c*d**2/(2*x**2) + A*a*d**3*log(x) - A*b*c**3/(4*x**4) - 3*A*b*c**2*d/(2*x**2) + 3*A*b*c*d**2*log(x) + A*b*d**3*x**2/2 - B*a*c**3/(4*x**4) - 3*B*a*c**2*d/(2*x**2) + 3*B*a*c*d**2*log(x) + B*a*d**3*x**2/2 - B*b*c**3/(2*x**2) + 3*B*b*c**2*d*log(x) + 3*B*b*c*d**2*x**2/2 + B*b*d**3*x**4/4)/e**7, Eq(m, -7)), ((-A*a*c**3/(4*x**4) - 3*A*a*c**2*d/(2*x**2) + 3*A*a*c*d**2*log(x) + A*a*d**3*x**2/2 - A*b*c**3/(2*x**2) + 3*A*b*c**2*d*log(x) + 3*A*b*c*d**2*x**2/2 + A*b*d**3*x**4/4 - B*a*c**3/(2*x**2) + 3*B*a*c**2*d*log(x) + 3*B*a*c*d**2*x**2/2 + B*a*d**3*x**4/4 + B*b*c**3*log(x) + 3*B*b*c**2*d*x**2/2 + 3*B*b*c*d**2*x**4/4 + B*b*d**3*x**6/6)/e**5, Eq(m, -5)), ((-A*a*c**3/(2*x**2) + 3*A*a*c**2...`

3.17.7 Maxima [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 338, normalized size of antiderivative = 1.79

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx = \frac{Bbd^3 e^m x^{11} x^m}{m + 11} + \frac{3 Bbcd^2 e^m x^9 x^m}{m + 9} + \frac{Bad^3 e^m x^9 x^m}{m + 9} + \frac{Abd^3 e^m x^9 x^m}{m + 9} + \frac{3 Bbc^2 de^m x^7 x^m}{m + 7} + \frac{3 Bacd^2 e^m x^7 x^m}{m + 7} + \frac{3 Abcd^2 e^m x^7 x^m}{m + 7} + \frac{Aad^3 e^m x^7 x^m}{m + 7} + \frac{Bbc^3 e^m x^5 x^m}{m + 5} + \frac{3 Bac^2 de^m x^5 x^m}{m + 5} + \frac{3 Abc^2 de^m x^5 x^m}{m + 5} + \frac{3 Aacd^2 e^m x^5 x^m}{m + 5} + \frac{Bac^3 e^m x^3 x^m}{m + 3} + \frac{Abc^3 e^m x^3 x^m}{m + 3} + \frac{3 Aac^2 de^m x^3 x^m}{m + 3} + \frac{(ex)^{m+1} Aac^3}{e(m + 1)}$$

3.17. $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="maxima")`

output $B*b*d^3*e^m*x^{11}*x^m/(m + 11) + 3*B*b*c*d^2*e^m*x^9*x^m/(m + 9) + B*a*d^3*e^m*x^9*x^m/(m + 9) + A*b*d^3*e^m*x^9*x^m/(m + 9) + 3*B*b*c^2*d*e^m*x^7*x^m/(m + 7) + 3*B*a*c*d^2*e^m*x^7*x^m/(m + 7) + 3*A*b*c*d^2*e^m*x^7*x^m/(m + 7) + A*a*d^3*e^m*x^7*x^m/(m + 7) + B*b*c^3*e^m*x^5*x^m/(m + 5) + 3*B*a*c^2*d*e^m*x^5*x^m/(m + 5) + 3*A*b*c^2*d*e^m*x^5*x^m/(m + 5) + 3*A*a*c*d^2*e^m*x^5*x^m/(m + 5) + B*a*c^3*e^m*x^3*x^m/(m + 3) + A*b*c^3*e^m*x^3*x^m/(m + 3) + 3*A*a*c^2*d*e^m*x^3*x^m/(m + 3) + (e*x)^{(m + 1)}*A*a*c^3/(e*(m + 1))$

3.17.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1708 vs. $2(189) = 378$.

Time = 0.35 (sec) , antiderivative size = 1708, normalized size of antiderivative = 9.04

$$\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="giac")`

```

output ((e*x)^m*B*b*d^3*m^5*x^11 + 25*(e*x)^m*B*b*d^3*m^4*x^11 + 3*(e*x)^m*B*b*c
d^2*m^5*x^9 + (e*x)^m*B*a*d^3*m^5*x^9 + (e*x)^m*A*b*d^3*m^5*x^9 + 230*(e*x
)^m*B*b*d^3*m^3*x^11 + 81*(e*x)^m*B*b*c*d^2*m^4*x^9 + 27*(e*x)^m*B*a*d^3*m
^4*x^9 + 27*(e*x)^m*A*b*d^3*m^4*x^9 + 950*(e*x)^m*B*b*d^3*m^2*x^11 + 3*(e
x)^m*B*b*c^2*d*m^5*x^7 + 3*(e*x)^m*B*a*c*d^2*m^5*x^7 + 3*(e*x)^m*A*b*c*d^2
*m^5*x^7 + (e*x)^m*A*a*d^3*m^5*x^7 + 786*(e*x)^m*B*b*c*d^2*m^3*x^9 + 262*(
e*x)^m*B*a*d^3*m^3*x^9 + 262*(e*x)^m*A*b*d^3*m^3*x^9 + 1689*(e*x)^m*B*b*d^
3*m*x^11 + 87*(e*x)^m*B*b*c^2*d*m^4*x^7 + 87*(e*x)^m*B*a*c*d^2*m^4*x^7 + 8
7*(e*x)^m*A*b*c*d^2*m^4*x^7 + 29*(e*x)^m*A*a*d^3*m^4*x^7 + 3366*(e*x)^m*B
b*c*d^2*m^2*x^9 + 1122*(e*x)^m*B*a*d^3*m^2*x^9 + 1122*(e*x)^m*A*b*d^3*m^2*
x^9 + 945*(e*x)^m*B*b*d^3*x^11 + (e*x)^m*B*b*c^3*m^5*x^5 + 3*(e*x)^m*B*a*c
^2*d*m^5*x^5 + 3*(e*x)^m*A*b*c^2*d*m^5*x^5 + 3*(e*x)^m*A*a*c*d^2*m^5*x^5 +
906*(e*x)^m*B*b*c^2*d*m^3*x^7 + 906*(e*x)^m*B*a*c*d^2*m^3*x^7 + 906*(e*x)
^m*A*b*c*d^2*m^3*x^7 + 302*(e*x)^m*A*a*d^3*m^3*x^7 + 6123*(e*x)^m*B*b*c*d^
2*m*x^9 + 2041*(e*x)^m*B*a*d^3*m*x^9 + 2041*(e*x)^m*A*b*d^3*m*x^9 + 31*(e
x)^m*B*b*c^3*m^4*x^5 + 93*(e*x)^m*B*a*c^2*d*m^4*x^5 + 93*(e*x)^m*A*b*c^2*d
*m^4*x^5 + 93*(e*x)^m*A*a*c*d^2*m^4*x^5 + 4098*(e*x)^m*B*b*c^2*d*m^2*x^7 +
4098*(e*x)^m*B*a*c*d^2*m^2*x^7 + 4098*(e*x)^m*A*b*c*d^2*m^2*x^7 + 1366*(e
*x)^m*A*a*d^3*m^2*x^7 + 3465*(e*x)^m*B*b*c*d^2*x^9 + 1155*(e*x)^m*B*a*d^3*
x^9 + 1155*(e*x)^m*A*b*d^3*x^9 + (e*x)^m*B*a*c^3*m^5*x^3 + (e*x)^m*A*b*...

```

3.17.9 Mupad [B] (verification not implemented)

Time = 5.91 (sec) , antiderivative size = 469, normalized size of antiderivative = 2.48

$$\begin{aligned}
 & \int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx \\
 &= \frac{c^2 x^3 (ex)^m (3Aad + Abc + Bac) (m^5 + 33m^4 + 406m^3 + 2262m^2 + 5353m + 3465)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395} \\
 &+ \frac{d^2 x^9 (ex)^m (Abd + Bad + 3Bbc) (m^5 + 27m^4 + 262m^3 + 1122m^2 + 2041m + 1155)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395} \\
 &+ \frac{cx^5 (ex)^m (3Aad^2 + Bbc^2 + 3Abcd + 3Bacd) (m^5 + 31m^4 + 350m^3 + 1730m^2 + 3489m + 2079)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395} \\
 &+ \frac{dx^7 (ex)^m (Aad^2 + 3Bbc^2 + 3Abcd + 3Bacd) (m^5 + 29m^4 + 302m^3 + 1366m^2 + 2577m + 1485)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395} \\
 &+ \frac{Bbd^3 x^{11} (ex)^m (m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395} \\
 &+ \frac{Aac^3 x (ex)^m (m^5 + 35m^4 + 470m^3 + 3010m^2 + 9129m + 10395)}{m^6 + 36m^5 + 505m^4 + 3480m^3 + 12139m^2 + 19524m + 10395}
 \end{aligned}$$

```

input int((A + B*x^2)*(e*x)^m*(a + b*x^2)*(c + d*x^2)^3,x)

```

3.17. $\int (ex)^m (a + bx^2) (A + Bx^2) (c + dx^2)^3 dx$

output $(c^2x^3(e^x)^m(3Aad + Abc + B*ac)*(5353m + 2262m^2 + 406m^3 + 33m^4 + m^5 + 3465))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (d^2x^9(e^x)^m(Abd + B*ad + 3B*b*c)*(2041m + 1122m^2 + 262m^3 + 27m^4 + m^5 + 1155))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (c*x^5(e^x)^m(3Aad^2 + B*b*c^2 + 3A*b*c*d + 3B*ac*d)*(3489m + 1730m^2 + 350m^3 + 31m^4 + m^5 + 2079))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (d*x^7(e^x)^m(Aad^2 + 3B*b*c^2 + 3A*b*c*d + 3B*ac*d)*(2577m + 1366m^2 + 302m^3 + 29m^4 + m^5 + 1485))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (B*b*d^3*x^11(e^x)^m(1689m + 950m^2 + 230m^3 + 25m^4 + m^5 + 945))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395) + (A*ac^3*x*(e^x)^m(9129m + 3010m^2 + 470m^3 + 35m^4 + m^5 + 10395))/(19524m + 12139m^2 + 3480m^3 + 505m^4 + 36m^5 + m^6 + 10395)$

3.18 $\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx$

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3.18.1 Optimal result

Integrand size = 22, antiderivative size = 121

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx = \frac{Ac^3(ex)^{1+m}}{e(1+m)} + \frac{c^2(Bc + 3Ad)(ex)^{3+m}}{e^3(3+m)} + \frac{3cd(Bc + Ad)(ex)^{5+m}}{e^5(5+m)} + \frac{d^2(3Bc + Ad)(ex)^{7+m}}{e^7(7+m)} + \frac{Bd^3(ex)^{9+m}}{e^9(9+m)}$$

output `A*c^3*(e*x)^(1+m)/e/(1+m)+c^2*(3*A*d+B*c)*(e*x)^(3+m)/e^3/(3+m)+3*c*d*(A*d+B*c)*(e*x)^(5+m)/e^5/(5+m)+d^2*(A*d+3*B*c)*(e*x)^(7+m)/e^7/(7+m)+B*d^3*(e*x)^(9+m)/e^9/(9+m)`

3.18.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 90, normalized size of antiderivative = 0.74

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx = x(ex)^m \left(\frac{Ac^3}{1+m} + \frac{c^2(Bc + 3Ad)x^2}{3+m} + \frac{3cd(Bc + Ad)x^4}{5+m} + \frac{d^2(3Bc + Ad)x^6}{7+m} + \frac{Bd^3x^8}{9+m} \right)$$

input `Integrate[(e*x)^m*(A + B*x^2)*(c + d*x^2)^3,x]`

```
output x*(e*x)^m*((A*c^3)/(1 + m) + (c^2*(B*c + 3*A*d)*x^2)/(3 + m) + (3*c*d*(B*c
+ A*d)*x^4)/(5 + m) + (d^2*(3*B*c + A*d)*x^6)/(7 + m) + (B*d^3*x^8)/(9 +
m))
```

3.18.3 Rubi [A] (verified)

Time = 0.27 (sec) , antiderivative size = 121, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.091$, Rules used = {355, 2009}

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

$$\int (A + Bx^2) (c + dx^2)^3 (ex)^m dx$$

$$\downarrow \text{355}$$

$$\int \left(\frac{c^2(ex)^{m+2}(3Ad + Bc)}{e^2} + \frac{d^2(ex)^{m+6}(Ad + 3Bc)}{e^6} + \frac{3cd(ex)^{m+4}(Ad + Bc)}{e^4} + Ac^3(ex)^m + \frac{Bd^3(ex)^{m+8}}{e^8} \right) dx$$

$$\downarrow \text{2009}$$

$$\frac{c^2(ex)^{m+3}(3Ad + Bc)}{e^3(m + 3)} + \frac{d^2(ex)^{m+7}(Ad + 3Bc)}{e^7(m + 7)} + \frac{3cd(ex)^{m+5}(Ad + Bc)}{e^5(m + 5)} + \frac{Ac^3(ex)^{m+1}}{e(m + 1)} + \frac{Bd^3(ex)^{m+9}}{e^9(m + 9)}$$

```
input Int[(e*x)^m*(A + B*x^2)*(c + d*x^2)^3,x]
```

```
output (A*c^3*(e*x)^(1 + m))/(e*(1 + m)) + (c^2*(B*c + 3*A*d)*(e*x)^(3 + m))/(e^3
*(3 + m)) + (3*c*d*(B*c + A*d)*(e*x)^(5 + m))/(e^5*(5 + m)) + (d^2*(3*B*c
+ A*d)*(e*x)^(7 + m))/(e^7*(7 + m)) + (B*d^3*(e*x)^(9 + m))/(e^9*(9 + m))
```

3.18.3.1 Defintions of rubi rules used

```
rule 355 Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q
_.), x_Symbol] := Int[ExpandIntegrand[(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^q,
x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && IGtQ[p, 0] &
& IGtQ[q, 0]
```

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

3.18.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 474 vs. $2(121) = 242$.

Time = 3.41 (sec) , antiderivative size = 475, normalized size of antiderivative = 3.93

method	result
gospers	$\frac{x(Bd^3m^4x^8+16Bd^3m^3x^8+Ad^3m^4x^6+3Bcd^2m^4x^6+86Bd^3m^2x^8+18Ad^3m^3x^6+54Bcd^2m^3x^6+176mx^8Bd^3+3Ac d^2m^4)}{x(Bd^3m^4x^8+16Bd^3m^3x^8+Ad^3m^4x^6+3Bcd^2m^4x^6+86Bd^3m^2x^8+18Ad^3m^3x^6+54Bcd^2m^3x^6+176mx^8Bd^3+3Ac d^2m^4)}$
risch	$\frac{x(Bd^3m^4x^8+16Bd^3m^3x^8+Ad^3m^4x^6+3Bcd^2m^4x^6+86Bd^3m^2x^8+18Ad^3m^3x^6+54Bcd^2m^3x^6+176mx^8Bd^3+3Ac d^2m^4)}{x(Bd^3m^4x^8+16Bd^3m^3x^8+Ad^3m^4x^6+3Bcd^2m^4x^6+86Bd^3m^2x^8+18Ad^3m^3x^6+54Bcd^2m^3x^6+176mx^8Bd^3+3Ac d^2m^4)}$
parallelrisch	$\frac{900Bx^5(ex)^m c^2 dm + 492Ax^3(ex)^m c^2 dm^2 + 1374Ax^3(ex)^m c^2 dm + 315Bx^3(ex)^m c^3 + 945Ax(ex)^m c^3 + 666Bx^7(ex)^m c d^2 m + \dots}{x(Bd^3m^4x^8+16Bd^3m^3x^8+Ad^3m^4x^6+3Bcd^2m^4x^6+86Bd^3m^2x^8+18Ad^3m^3x^6+54Bcd^2m^3x^6+176mx^8Bd^3+3Ac d^2m^4)}$

```
input int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3,x,method=_RETURNVERBOSE)
```

```
output x*(B*d^3*m^4*x^8+16*B*d^3*m^3*x^8+A*d^3*m^4*x^6+3*B*c*d^2*m^4*x^6+86*B*d^3
*m^2*x^8+18*A*d^3*m^3*x^6+54*B*c*d^2*m^3*x^6+176*B*d^3*m*x^8+3*A*c*d^2*m^4
*x^4+104*A*d^3*m^2*x^6+3*B*c^2*d*m^4*x^4+312*B*c*d^2*m^2*x^6+105*B*d^3*x^8
+60*A*c*d^2*m^3*x^4+222*A*d^3*m*x^6+60*B*c^2*d*m^3*x^4+666*B*c*d^2*m*x^6+3
*A*c^2*d*m^4*x^2+390*A*c*d^2*m^2*x^4+135*A*d^3*x^6+B*c^3*m^4*x^2+390*B*c^2
*d*m^2*x^4+405*B*c*d^2*x^6+66*A*c^2*d*m^3*x^2+900*A*c*d^2*m*x^4+22*B*c^3*m
^3*x^2+900*B*c^2*d*m*x^4+A*c^3*m^4+492*A*c^2*d*m^2*x^2+567*A*c*d^2*x^4+164
*B*c^3*m^2*x^2+567*B*c^2*d*x^4+24*A*c^3*m^3+1374*A*c^2*d*m*x^2+458*B*c^3*m
*x^2+206*A*c^3*m^2+945*A*c^2*d*x^2+315*B*c^3*x^2+744*A*c^3*m+945*A*c^3)*(e
*x)^m/(9+m)/(7+m)/(5+m)/(3+m)/(1+m)
```


3.18.5 Fracas [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 381 vs. $2(121) = 242$.

Time = 0.27 (sec) , antiderivative size = 381, normalized size of antiderivative = 3.15

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx$$

$$= \frac{((Bd^3m^4 + 16Bd^3m^3 + 86Bd^3m^2 + 176Bd^3m + 105Bd^3)x^9 + ((3Bcd^2 + Ad^3)m^4 + 405Bcd^2 + 135Ad^3)m^3 + (3B^2cd + 3Ad^2)m^2 + 300Bcd + 135Ad^2)x^7 + ((B^2c^2d + A^2cd^2)m^4 + 189B^2cd + 189A^2cd^2 + 20(B^2c^2d + A^2cd^2)m^3 + 130(B^2c^2d + A^2cd^2)m^2 + 300(B^2c^2d + A^2cd^2)m)x^5 + ((B^2c^3 + 3A^2cd)m^4 + 315B^2c^3 + 945A^2cd + 22(B^2c^3 + 3A^2cd)m^3 + 164(B^2c^3 + 3A^2cd)m^2 + 458(B^2c^3 + 3A^2cd)m)x^3 + (A^3m^4 + 24A^3m^3 + 206A^3m^2 + 744A^3m + 945A^3)x}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} (ex)^m$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="fracas")`

output `((B*d^3*m^4 + 16*B*d^3*m^3 + 86*B*d^3*m^2 + 176*B*d^3*m + 105*B*d^3)*x^9 + ((3*B*c*d^2 + A*d^3)*m^4 + 405*B*c*d^2 + 135*A*d^3 + 18*(3*B*c*d^2 + A*d^3)*m^3 + 104*(3*B*c*d^2 + A*d^3)*m^2 + 222*(3*B*c*d^2 + A*d^3)*m)*x^7 + 3*((B*c^2*d + A*c*d^2)*m^4 + 189*B*c^2*d + 189*A*c*d^2 + 20*(B*c^2*d + A*c*d^2)*m^3 + 130*(B*c^2*d + A*c*d^2)*m^2 + 300*(B*c^2*d + A*c*d^2)*m)*x^5 + ((B*c^3 + 3*A*c^2*d)*m^4 + 315*B*c^3 + 945*A*c^2*d + 22*(B*c^3 + 3*A*c^2*d)*m^3 + 164*(B*c^3 + 3*A*c^2*d)*m^2 + 458*(B*c^3 + 3*A*c^2*d)*m)*x^3 + (A*c^3*m^4 + 24*A*c^3*m^3 + 206*A*c^3*m^2 + 744*A*c^3*m + 945*A*c^3)*x*(e*x)^m/(m^5 + 25*m^4 + 230*m^3 + 950*m^2 + 1689*m + 945)`

3.18.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 2152 vs. $2(110) = 220$.

Time = 0.63 (sec) , antiderivative size = 2152, normalized size of antiderivative = 17.79

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx = \text{Too large to display}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**3,x)`

```
output Piecewise((( -A*c**3/(8*x**8) - A*c**2*d/(2*x**6) - 3*A*c*d**2/(4*x**4) - A
*d**3/(2*x**2) - B*c**3/(6*x**6) - 3*B*c**2*d/(4*x**4) - 3*B*c*d**2/(2*x**
2) + B*d**3*log(x))/e**9, Eq(m, -9)), (( -A*c**3/(6*x**6) - 3*A*c**2*d/(4*x
**4) - 3*A*c*d**2/(2*x**2) + A*d**3*log(x) - B*c**3/(4*x**4) - 3*B*c**2*d/
(2*x**2) + 3*B*c*d**2*log(x) + B*d**3*x**2/2)/e**7, Eq(m, -7)), (( -A*c**3/
(4*x**4) - 3*A*c**2*d/(2*x**2) + 3*A*c*d**2*log(x) + A*d**3*x**2/2 - B*c**
3/(2*x**2) + 3*B*c**2*d*log(x) + 3*B*c*d**2*x**2/2 + B*d**3*x**4/4)/e**5,
Eq(m, -5)), (( -A*c**3/(2*x**2) + 3*A*c**2*d*log(x) + 3*A*c*d**2*x**2/2 + A
*d**3*x**4/4 + B*c**3*log(x) + 3*B*c**2*d*x**2/2 + 3*B*c*d**2*x**4/4 + B*d
**3*x**6/6)/e**3, Eq(m, -3)), ((A*c**3*log(x) + 3*A*c**2*d*x**2/2 + 3*A*c*
d**2*x**4/4 + A*d**3*x**6/6 + B*c**3*x**2/2 + 3*B*c**2*d*x**4/4 + B*c*d**2
*x**6/2 + B*d**3*x**8/8)/e, Eq(m, -1)), (A*c**3*m**4*x*(e*x)**m/(m**5 + 25
*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 24*A*c**3*m**3*x*(e*x)**m/(m
**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 206*A*c**3*m**2*x*(e
*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 744*A*c**3*
m*x*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 945*A
*c**3*x*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*m + 945) + 3
*A*c**2*d*m**4*x**3*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950*m**2 + 1689*
m + 945) + 66*A*c**2*d*m**3*x**3*(e*x)**m/(m**5 + 25*m**4 + 230*m**3 + 950
*m**2 + 1689*m + 945) + 492*A*c**2*d*m**2*x**3*(e*x)**m/(m**5 + 25*m**4...
```

3.18.7 Maxima [A] (verification not implemented)

Time = 0.22 (sec) , antiderivative size = 162, normalized size of antiderivative = 1.34

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx = \frac{Bd^3 e^m x^9 x^m}{m+9} + \frac{3Bcd^2 e^m x^7 x^m}{m+7} + \frac{Ad^3 e^m x^7 x^m}{m+7} + \frac{3Bc^2 d e^m x^5 x^m}{m+5} + \frac{3Acd^2 e^m x^5 x^m}{m+5} + \frac{Bc^3 e^m x^3 x^m}{m+3} + \frac{3Ac^2 d e^m x^3 x^m}{m+3} + \frac{(ex)^{m+1} Ac^3}{e(m+1)}$$

```
input integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="maxima")
```

```
output B*d^3*e^m*x^9*x^m/(m + 9) + 3*B*c*d^2*e^m*x^7*x^m/(m + 7) + A*d^3*e^m*x^7*
x^m/(m + 7) + 3*B*c^2*d*e^m*x^5*x^m/(m + 5) + 3*A*c*d^2*e^m*x^5*x^m/(m + 5
) + B*c^3*e^m*x^3*x^m/(m + 3) + 3*A*c^2*d*e^m*x^3*x^m/(m + 3) + (e*x)^(m +
1)*A*c^3/(e*(m + 1))
```

3.18.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 673 vs. $2(121) = 242$.

Time = 0.32 (sec) , antiderivative size = 673, normalized size of antiderivative = 5.56

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx$$

$$= \underline{(ex)^m Bd^3m^4x^9 + 16(ex)^m Bd^3m^3x^9 + 3(ex)^m Bcd^2m^4x^7 + (ex)^m Ad^3m^4x^7 + 86(ex)^m Bd^3m^2x^9 + 54($$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="giac")`

output `((e*x)^m*B*d^3*m^4*x^9 + 16*(e*x)^m*B*d^3*m^3*x^9 + 3*(e*x)^m*B*c*d^2*m^4*x^7 + (e*x)^m*A*d^3*m^4*x^7 + 86*(e*x)^m*B*d^3*m^2*x^9 + 54*(e*x)^m*B*c*d^2*m^3*x^7 + 18*(e*x)^m*A*d^3*m^3*x^7 + 176*(e*x)^m*B*d^3*m*x^9 + 3*(e*x)^m*B*c^2*d*m^4*x^5 + 3*(e*x)^m*A*c*d^2*m^4*x^5 + 312*(e*x)^m*B*c*d^2*m^2*x^7 + 104*(e*x)^m*A*d^3*m^2*x^7 + 105*(e*x)^m*B*d^3*x^9 + 60*(e*x)^m*B*c^2*d*m^3*x^5 + 60*(e*x)^m*A*c*d^2*m^3*x^5 + 666*(e*x)^m*B*c*d^2*m*x^7 + 222*(e*x)^m*A*d^3*m*x^7 + (e*x)^m*B*c^3*m^4*x^3 + 3*(e*x)^m*A*c^2*d*m^4*x^3 + 390*(e*x)^m*B*c^2*d*m^2*x^5 + 390*(e*x)^m*A*c*d^2*m^2*x^5 + 405*(e*x)^m*B*c*d^2*x^7 + 135*(e*x)^m*A*d^3*x^7 + 22*(e*x)^m*B*c^3*m^3*x^3 + 66*(e*x)^m*A*c^2*d*m^3*x^3 + 900*(e*x)^m*B*c^2*d*m*x^5 + 900*(e*x)^m*A*c*d^2*m*x^5 + (e*x)^m*A*c^3*m^4*x + 164*(e*x)^m*B*c^3*m^2*x^3 + 492*(e*x)^m*A*c^2*d*m^2*x^3 + 567*(e*x)^m*B*c^2*d*x^5 + 567*(e*x)^m*A*c*d^2*x^5 + 24*(e*x)^m*A*c^3*m^3*x + 458*(e*x)^m*B*c^3*m*x^3 + 1374*(e*x)^m*A*c^2*d*m*x^3 + 206*(e*x)^m*A*c^3*m^2*x + 315*(e*x)^m*B*c^3*x^3 + 945*(e*x)^m*A*c^2*d*x^3 + 744*(e*x)^m*A*c^3*m*x + 945*(e*x)^m*A*c^3*x)/(m^5 + 25*m^4 + 230*m^3 + 950*m^2 + 1689*m + 945)`

3.18.9 Mupad [B] (verification not implemented)

Time = 5.60 (sec) , antiderivative size = 280, normalized size of antiderivative = 2.31

$$\int (ex)^m (A + Bx^2) (c + dx^2)^3 dx$$

$$= (ex)^m \left(\frac{Ac^3 x (m^4 + 24m^3 + 206m^2 + 744m + 945)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} \right.$$

$$+ \frac{Bd^3 x^9 (m^4 + 16m^3 + 86m^2 + 176m + 105)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$+ \frac{c^2 x^3 (3Ad + Bc) (m^4 + 22m^3 + 164m^2 + 458m + 315)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$+ \frac{d^2 x^7 (Ad + 3Bc) (m^4 + 18m^3 + 104m^2 + 222m + 135)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945}$$

$$\left. + \frac{3cdx^5 (Ad + Bc) (m^4 + 20m^3 + 130m^2 + 300m + 189)}{m^5 + 25m^4 + 230m^3 + 950m^2 + 1689m + 945} \right)$$

input `int((A + B*x^2)*(e*x)^m*(c + d*x^2)^3,x)`output `(e*x)^m*((A*c^3*x*(744*m + 206*m^2 + 24*m^3 + m^4 + 945))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (B*d^3*x^9*(176*m + 86*m^2 + 16*m^3 + m^4 + 105))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (c^2*x^3*(3*A*d + B*c)*(458*m + 164*m^2 + 22*m^3 + m^4 + 315))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (d^2*x^7*(A*d + 3*B*c)*(222*m + 104*m^2 + 18*m^3 + m^4 + 135))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945) + (3*c*d*x^5*(A*d + B*c)*(300*m + 130*m^2 + 20*m^3 + m^4 + 189))/(1689*m + 950*m^2 + 230*m^3 + 25*m^4 + m^5 + 945))`

3.19
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{a+bx^2} dx$$

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3.19.1 Optimal result

Integrand size = 31, antiderivative size = 258

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{a + bx^2} dx$$

$$= -\frac{(a^3 B d^3 + 3 a b^2 c d (B c + A d) - a^2 b d^2 (3 B c + A d) - b^3 c^2 (B c + 3 A d)) (ex)^{1+m}}{b^4 e (1 + m)}$$

$$+ \frac{d(a^2 B d^2 + 3 b^2 c (B c + A d) - a b d (3 B c + A d)) (ex)^{3+m}}{b^3 e^3 (3 + m)}$$

$$+ \frac{d^2(3 b B c + A b d - a B d)(ex)^{5+m}}{b^2 e^5 (5 + m)} + \frac{B d^3 (ex)^{7+m}}{b e^7 (7 + m)}$$

$$+ \frac{(A b - a B)(b c - a d)^3 (ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{b x^2}{a}\right)}{a b^4 e (1 + m)}$$

output

```
-(a^3*B*d^3+3*a*b^2*c*d*(A*d+B*c)-a^2*b*d^2*(A*d+3*B*c)-b^3*c^2*(3*A*d+B*c))
*(e*x)^(1+m)/b^4/e/(1+m)+d*(a^2*B*d^2+3*b^2*c*(A*d+B*c)-a*b*d*(A*d+3*B*c))
*(e*x)^(3+m)/b^3/e^3/(3+m)+d^2*(A*b*d-B*a*d+3*B*b*c)*(e*x)^(5+m)/b^2/e^5/(5+m)
+B*d^3*(e*x)^(7+m)/b/e^7/(7+m)+(A*b-B*a)*(-a*d+b*c)^3*(e*x)^(1+m)*hy
pergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a/b^4/e/(1+m)
```

3.19.2 Mathematica [A] (verified)

Time = 0.59 (sec) , antiderivative size = 217, normalized size of antiderivative = 0.84

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{a + bx^2} dx$$

$$= \frac{x(ex)^m \left(\frac{-a^3 Bd^3 - 3ab^2 cd(Bc + Ad) + a^2 bd^2(3Bc + Ad) + b^3 c^2(Bc + 3Ad)}{1+m} + \frac{bd(a^2 Bd^2 + 3b^2 c(Bc + Ad) - abd(3Bc + Ad))x^2}{3+m} + \frac{b^2 d^2(3bBc + Ab)}{5+m} \right)}{b^4}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2)^3)/(a + b*x^2), x]`

output $(x*(e*x)^m*((-a^3*B*d^3) - 3*a*b^2*c*d*(B*c + A*d) + a^2*b*d^2*(3*B*c + A*d) + b^3*c^2*(B*c + 3*A*d))/(1 + m) + (b*d*(a^2*B*d^2 + 3*b^2*c*(B*c + A*d) - a*b*d*(3*B*c + A*d))*x^2)/(3 + m) + (b^2*d^2*(3*b*B*c + A*b*d - a*B*d)*x^4)/(5 + m) + (b^3*B*d^3*x^6)/(7 + m) + ((-(A*b) + a*B)*(-(b*c) + a*d)^3*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(1 + m)))/b^4$

3.19.3 Rubi [A] (verified)

Time = 0.51 (sec) , antiderivative size = 258, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 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.

$$\int \frac{(A + Bx^2)(c + dx^2)^3 (ex)^m}{a + bx^2} dx$$

↓ 437

$$\int \left(\frac{d(ex)^{m+2} (a^2 Bd^2 - abd(Ad + 3Bc) + 3b^2 c(Ad + Bc))}{b^3 e^2} - \frac{(ex)^m (a^3 Bd^3 - a^2 bd^2(Ad + 3Bc) + 3ab^2 cd(Ad + Bc))}{b^4} \right) dx$$

↓ 2009

$$\frac{d(ex)^{m+3} (a^2 B d^2 - abd(Ad + 3Bc) + 3b^2 c(Ad + Bc))}{b^3 e^3 (m+3)} - \frac{(ex)^{m+1} (a^3 B d^3 - a^2 b d^2 (Ad + 3Bc) + 3ab^2 cd(Ad + Bc) + b^3 (-c^2) (3Ad + Bc))}{b^4 e (m+1)} + \frac{(ex)^{m+1} (Ab - aB)(bc - ad)^3 \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{ab^4 e (m+1)} + \frac{d^2 (ex)^{m+5} (-aBd + Abd + 3bBc)}{b^2 e^5 (m+5)} + \frac{Bd^3 (ex)^{m+7}}{be^7 (m+7)}$$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2)^3)/(a + b*x^2),x]`

output `-(((a^3*B*d^3 + 3*a*b^2*c*d*(B*c + A*d) - a^2*b*d^2*(3*B*c + A*d) - b^3*c^2*(B*c + 3*A*d))*(e*x)^(1 + m))/(b^4*e*(1 + m))) + (d*(a^2*B*d^2 + 3*b^2*c*(B*c + A*d) - a*b*d*(3*B*c + A*d))*(e*x)^(3 + m))/(b^3*e^3*(3 + m)) + (d^2*(3*b*B*c + A*b*d - a*B*d)*(e*x)^(5 + m))/(b^2*e^5*(5 + m)) + (B*d^3*(e*x)^(7 + m))/(b*e^7*(7 + m)) + ((A*b - a*B)*(b*c - a*d)^3*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(a*b^4*e*(1 + m))`

3.19.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^(m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.19.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)^3}{bx^2 + a} dx$$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a),x)`

output `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a),x)`

3.19.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a),x, algorithm="fricas")`

output `integral((B*d^3*x^8 + (3*B*c*d^2 + A*d^3)*x^6 + 3*(B*c^2*d + A*c*d^2)*x^4 + A*c^3 + (B*c^3 + 3*A*c^2*d)*x^2)*(e*x)^m/(b*x^2 + a), x)`

3.19.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 9.38 (sec) , antiderivative size = 887, normalized size of antiderivative = 3.44

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{a + bx^2} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**3/(b*x**2+a),x)`

output

```
A***3***e**m**x**(m + 1)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*
gamma(m/2 + 1/2)/(4*a*gamma(m/2 + 3/2)) + A*c***3***e**m**x**(m + 1)*lerchphi(
b*x**2*exp_polar(I*pi)/a, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*a*gamma(m/2 +
3/2)) + 3*A*c**2*d***e**m**x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1,
m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + 9*A*c**2*d***e**m**x**(
m + 3)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(
4*a*gamma(m/2 + 5/2)) + 3*A*c*d**2*e**m**x**(m + 5)*lerchphi(b*x**2*exp_p
olar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2)) + 15*A
*c*d**2*e**m**x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*g
amma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2)) + A*d***3***e**m**x**(m + 7)*lerchphi
(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 7/2)*gamma(m/2 + 7/2)/(4*a*gamma(m/2 +
9/2)) + 7*A*d**3*e**m**x**(m + 7)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/
2 + 7/2)*gamma(m/2 + 7/2)/(4*a*gamma(m/2 + 9/2)) + B*c***3***e**m**x**(m + 3
)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*g
amma(m/2 + 5/2)) + 3*B*c***3***e**m**x**(m + 3)*lerchphi(b*x**2*exp_polar(I*pi
)/a, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*a*gamma(m/2 + 5/2)) + 3*B*c**2*d*e
**m**x**(m + 5)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2
+ 5/2)/(4*a*gamma(m/2 + 7/2)) + 15*B*c**2*d***e**m**x**(m + 5)*lerchphi(b*x
**2*exp_polar(I*pi)/a, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*a*gamma(m/2 + 7/2)
) + 3*B*c*d**2*e**m**x**(m + 7)*lerchphi(b*x**2*exp_polar(I*pi)/a, 1, ...
```

3.19.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(e*x)^m/(b*x^2 + a), x)`

3.19.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{a + bx^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{bx^2 + a} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(e*x)^m/(b*x^2 + a), x)`

3.19.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{a + bx^2} dx = \int \frac{(Bx^2 + A) (ex)^m (dx^2 + c)^3}{bx^2 + a} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^3)/(a + b*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^3)/(a + b*x^2), x)`

3.20 $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^2} dx$

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3.20.1 Optimal result

Integrand size = 31, antiderivative size = 347

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^2} dx =$$

$$-\frac{d(Ab(3b^2c^2(1+m) - 3abcd(3+m) + a^2d^2(5+m)) - aB(3b^2c^2(3+m) - 3abcd(5+m) + a^2d^2(7+m))}{2ab^4e(1+m)}$$

$$-\frac{d^2(Ab(3bc(3+m) - ad(5+m)) - aB(3bc(5+m) - ad(7+m)))(ex)^{3+m}}{2ab^3e^3(3+m)}$$

$$-\frac{d^3(Ab(5+m) - aB(7+m))(ex)^{5+m}}{2ab^2e^5(5+m)} + \frac{(Ab - aB)(ex)^{1+m}(c + dx^2)^3}{2abe(a + bx^2)}$$

$$+ \frac{(bc - ad)^2(aB(bc(1+m) - ad(7+m)) + Ab(ad(5+m) + b(c - cm)))(ex)^{1+m} \text{Hypergeometric2F1}(1, 1/2+1/2*m, [3/2+1/2*m], -b*x^2/a)/a^2/b^4/e/(1+m)}$$

output

```
-1/2*d*(A*b*(3*b^2*c^2*(1+m)-3*a*b*c*d*(3+m)+a^2*d^2*(5+m))-a*B*(3*b^2*c^2*(3+m)-3*a*b*c*d*(5+m)+a^2*d^2*(7+m))*(e*x)^(1+m)/a/b^4/e/(1+m)-1/2*d^2*(A*b*(3*b*c*(3+m)-a*d*(5+m))-a*B*(3*b*c*(5+m)-a*d*(7+m))*(e*x)^(3+m)/a/b^3/e^3/(3+m)-1/2*d^3*(A*b*(5+m)-a*B*(7+m))*(e*x)^(5+m)/a/b^2/e^5/(5+m)+1/2*(A*b-B*a)*(e*x)^(1+m)*(d*x^2+c)^3/a/b/e/(b*x^2+a)+1/2*(-a*d+b*c)^2*(a*B*(b*c*(1+m)-a*d*(7+m))+A*b*(a*d*(5+m)+b*(-c*m+c)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^2/b^4/e/(1+m)
```

3.20. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^2} dx$

3.20.2 Mathematica [A] (verified)

Time = 0.78 (sec) , antiderivative size = 209, normalized size of antiderivative = 0.60

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^2} dx$$

$$= \frac{x(ex)^m \left(\frac{d(3a^2Bd^2 + 3b^2c(Bc + Ad) - 2abd(3Bc + Ad))}{1+m} + \frac{bd^2(3bBc + Abd - 2aBd)x^2}{3+m} + \frac{b^2Bd^3x^4}{5+m} + \frac{(bc-ad)^2(bBc + 3Abd - 4aBd) \text{Hypergeometric2F1}}{a(1+m)} \right)}{b^4}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2)^3)/(a + b*x^2)^2,x]`

output `(x*(e*x)^m*((d*(3*a^2*B*d^2 + 3*b^2*c*(B*c + A*d) - 2*a*b*d*(3*B*c + A*d))/(1 + m) + (b*d^2*(3*b*B*c + A*b*d - 2*a*B*d)*x^2)/(3 + m) + (b^2*B*d^3*x^4)/(5 + m) + ((b*c - a*d)^2*(b*B*c + 3*A*b*d - 4*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(1 + m)) + ((-(A*b) + a*B)*(-(b*c) + a*d)^3*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a^2*(1 + m))))/b^4`

3.20.3 Rubi [A] (verified)

Time = 0.71 (sec) , antiderivative size = 340, normalized size of antiderivative = 0.98, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.129$, Rules used = {439, 25, 437, 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.

$$\int \frac{(A + Bx^2) (c + dx^2)^3 (ex)^m}{(a + bx^2)^2} dx$$

$$\downarrow 439$$

$$\frac{(c + dx^2)^3 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)} - \int \frac{(ex)^m (dx^2 + c)^2 (c(aB(m+1) + A(b-bm)) - d(Ab(m+5) - aB(m+7))x^2)}{bx^2 + a} dx}{2ab}$$

$$\downarrow 25$$

$$\int \frac{(ex)^m (dx^2 + c)^2 (c(aB(m+1) + A(b-bm)) - d(Ab(m+5) - aB(m+7))x^2)}{2ab} dx + \frac{(c + dx^2)^3 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)}$$

$$\downarrow 437$$

3.20. $\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^2} dx$

$$\int \left(-\frac{d(Ab(3b^2(m+1)c^2-3abd(m+3)c+a^2d^2(m+5))-aB(3b^2(m+3)c^2-3abd(m+5)c+a^2d^2(m+7)))(ex)^m}{b^3} + \frac{(-7Bd^3a^4-Bd^3ma^4+5Abd^3a^3}{b^3} \right)$$

$$\frac{(c + dx^2)^3 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)}$$

↓ 2009

$$\frac{-\frac{d(ex)^{m+1} (Ab(a^2d^2(m+5)-3abcd(m+3)+3b^2c^2(m+1))-aB(a^2d^2(m+7)-3abcd(m+5)+3b^2c^2(m+3)))}{b^3e(m+1)} + \frac{(ex)^{m+1} (bc-ad)^2 \text{Hypergeometric}}{b^3e(m+1)}}{b^3e(m+1)}$$

$$\frac{(c + dx^2)^3 (ex)^{m+1} (Ab - aB)}{2abe (a + bx^2)}$$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2)^3)/(a + b*x^2)^2,x]`

output `((A*b - a*B)*(e*x)^(1 + m)*(c + d*x^2)^3)/(2*a*b*e*(a + b*x^2)) + (-((d*(A*b*(3*b^2*c^2*(1 + m) - 3*a*b*c*d*(3 + m) + a^2*d^2*(5 + m)) - a*B*(3*b^2*c^2*(3 + m) - 3*a*b*c*d*(5 + m) + a^2*d^2*(7 + m)))*(e*x)^(1 + m))/(b^3*e*(1 + m))) - (d^2*(A*b*(3*b*c*(3 + m) - a*d*(5 + m)) - a*B*(3*b*c*(5 + m) - a*d*(7 + m)))*(e*x)^(3 + m))/(b^2*e^3*(3 + m)) - (d^3*(A*b*(5 + m) - a*B*(7 + m))*(e*x)^(5 + m))/(b*e^5*(5 + m)) + ((b*c - a*d)^2*(A*b*(b*c*(1 - m) + a*d*(5 + m)) + a*B*(b*c*(1 + m) - a*d*(7 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(a*b^3*e*(1 + m)))/(2*a*b)`

3.20.3.1 Defintions of rubi rules used

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

rule 437 `Int[((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*(e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^(m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

$$3.20. \int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^2} dx$$

```
rule 439 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)
.)*(e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-b*e - a*f)*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p
+ 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(
p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1
))*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && G
tQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])
```

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

3.20.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)^3}{(bx^2 + a)^2} dx$$

```
input int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^2,x)
```

```
output int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^2,x)
```

3.20.5 Fracas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{(bx^2 + a)^2} dx$$

```
input integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^2,x, algorithm="fricas")
```

```
output integral((B*d^3*x^8 + (3*B*c*d^2 + A*d^3)*x^6 + 3*(B*c^2*d + A*c*d^2)*x^4
+ A*c^3 + (B*c^3 + 3*A*c^2*d)*x^2)*(e*x)^m/(b^2*x^4 + 2*a*b*x^2 + a^2), x)
```

3.20.6 Sympy [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^2} dx = \int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^2} dx$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**3/(b*x**2+a)**2,x)`

output `Integral((e*x)**m*(A + B*x**2)*(c + d*x**2)**3/(a + b*x**2)**2, x)`

3.20.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(e*x)^m/(b*x^2 + a)^2, x)`

3.20.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{(bx^2 + a)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(e*x)^m/(b*x^2 + a)^2, x)`

3.20.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m (dx^2 + c)^3}{(bx^2 + a)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^3)/(a + b*x^2)^2,x)`output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^3)/(a + b*x^2)^2, x)`

3.21
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^3} dx$$

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3.21.1 Optimal result

Integrand size = 31, antiderivative size = 480

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^3} dx =$$

$$\frac{d(Ab(2b^2c^2(3 + 2m - m^2) + 3abcd(3 + 4m + m^2) - a^2d^2(15 + 8m + m^2)) + aB(2b^2c^2(1 + m)^2 - 3abcd(1 + m))}{8a^2b^4e(1 + m)}$$

$$\frac{d^2(Ab(3 + m)(bc(3 - m) + ad(5 + m)) + aB(bc(3 + 4m + m^2) - ad(35 + 12m + m^2)))(ex)^{3+m}}{8a^2b^3e^3(3 + m)}$$

$$+ \frac{(Ab(bc(3 - m) + ad(3 + m)) + aB(bc(1 + m) - ad(7 + m)))(ex)^{1+m} (c + dx^2)^2}{8a^2b^2e(a + bx^2)}$$

$$+ \frac{(Ab - aB)(ex)^{1+m} (c + dx^2)^3}{4abe(a + bx^2)^2}$$

$$+ \frac{(bc - ad)(Ab(2abcd(3 - 2m - m^2) + b^2c^2(3 - 4m + m^2) + a^2d^2(15 + 8m + m^2)) + aB(b^2c^2(1 - m^2) - 3abcd(1 - m))}{8a^3b^4e(1 + m)}$$

3.21.
$$\int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^3} dx$$

output
$$\begin{aligned} & -1/8*d*(A*b*(2*b^2*c^2*(-m^2+2*m+3)+3*a*b*c*d*(m^2+4*m+3)-a^2*d^2*(m^2+8*m \\ & +15))+a*B*(2*b^2*c^2*(1+m)^2-3*a*b*c*d*(m^2+8*m+15)+a^2*d^2*(m^2+12*m+35)) \\ &)*(e*x)^(1+m)/a^2/b^4/e/(1+m)-1/8*d^2*(A*b*(3+m)*(b*c*(3-m)+a*d*(5+m))+a*B \\ & *(b*c*(m^2+4*m+3)-a*d*(m^2+12*m+35)))*(e*x)^(3+m)/a^2/b^3/e^3/(3+m)+1/8*(A \\ & *b*(b*c*(3-m)+a*d*(3+m))+a*B*(b*c*(1+m)-a*d*(7+m)))*(e*x)^(1+m)*(d*x^2+c)^ \\ & 2/a^2/b^2/e/(b*x^2+a)+1/4*(A*b-B*a)*(e*x)^(1+m)*(d*x^2+c)^3/a/b/e/(b*x^2+a \\ &)^2+1/8*(-a*d+b*c)*(A*b*(2*a*b*c*d*(-m^2-2*m+3)+b^2*c^2*(m^2-4*m+3)+a^2*d^ \\ & 2*(m^2+8*m+15))+a*B*(b^2*c^2*(-m^2+1)+2*a*b*c*d*(m^2+6*m+5)-a^2*d^2*(m^2+1 \\ & 2*m+35)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^3/b \\ & ^4/e/(1+m) \end{aligned}$$

3.21.2 Mathematica [A] (verified)

Time = 0.79 (sec) , antiderivative size = 218, normalized size of antiderivative = 0.45

$$\int \frac{(ex)^m (A + Bx^2)(c + dx^2)^3}{(a + bx^2)^3} dx$$

$$= \frac{x(ex)^m \left(\frac{d^2(3bBc+Abd-3aBd)}{1+m} + \frac{bBd^3x^2}{3+m} + \frac{3d(bc-ad)(bBc+Abd-2aBd)}{a(1+m)} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right) + \frac{(bc-ad)^2(bBc+Abd-3aBd)}{b^4} \right)}{b^4}$$

input `Integrate[((e*x)^m*(A + B*x^2)*(c + d*x^2)^3)/(a + b*x^2)^3,x]`

output
$$\begin{aligned} & (x*(e*x)^m*((d^2*(3*b*B*c + A*b*d - 3*a*B*d))/(1 + m) + (b*B*d^3*x^2)/(3 + \\ & m) + (3*d*(b*c - a*d)*(b*B*c + A*b*d - 2*a*B*d)*\operatorname{Hypergeometric2F1}[1, (1 + \\ & m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(1 + m)) + ((b*c - a*d)^2*(b*B*c + 3*A \\ & *b*d - 4*a*B*d)*\operatorname{Hypergeometric2F1}[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/ \\ & (a^2*(1 + m)) + ((-A*b) + a*B)*(-b*c) + a*d)^3*\operatorname{Hypergeometric2F1}[3, (1 + \\ & m)/2, (3 + m)/2, -((b*x^2)/a)]/(a^3*(1 + m)))/b^4 \end{aligned}$$

3.21.3 Rubi [A] (verified)

Time = 1.09 (sec) , antiderivative size = 489, normalized size of antiderivative = 1.02, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.194$, Rules used = {439, 25, 439, 25, 437, 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.

$$3.21. \int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^3} dx$$

$$\begin{aligned}
 & \int \frac{(A+Bx^2)(c+dx^2)^3(ex)^m}{(a+bx^2)^3} dx \\
 & \quad \downarrow 439 \\
 & \frac{(c+dx^2)^3(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} - \frac{\int -\frac{(ex)^m(dx^2+c)^2(c(Ab(3-m)+aB(m+1))-d(Ab(m+3)-aB(m+7))x^2)}{(bx^2+a)^2} dx}{4ab} \\
 & \quad \downarrow 25 \\
 & \frac{\int \frac{(ex)^m(dx^2+c)^2(c(Ab(3-m)+aB(m+1))-d(Ab(m+3)-aB(m+7))x^2)}{(bx^2+a)^2} dx}{4ab} + \frac{(c+dx^2)^3(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \\
 & \quad \downarrow 439 \\
 & \frac{(c+dx^2)^2(ex)^{m+1}(Ab(ad(m+3)+bc(3-m))+aB(bc(m+1)-ad(m+7)))}{2abe(a+bx^2)} - \frac{\int -\frac{(ex)^m(dx^2+c)(c(aB(m+1)(ad(m+7)+b(c-cm))+Ab(bc(m^2-4m+3)-ad(m^2+4m+3)))}{bx^2+a} dx}{2ab}}{4ab} \\
 & \quad \downarrow 25 \\
 & \frac{(c+dx^2)^3(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \\
 & \quad \downarrow 437 \\
 & \frac{\int \left(-\frac{d(Ab(2b^2(-m^2+2m+3)c^2+3abd(m^2+4m+3)c-a^2d^2(m^2+8m+15))+aB(a^2(m^2+12m+35)d^2-3abc(m^2+8m+15)d+2b^2c^2(m+1)^2))}{b^2} (ex)^m + \frac{(35Bd^3c^2-m^2d^2c^2)}{ab^2e(m+1)} \right) dx}{4abe(a+bx^2)^2} \\
 & \quad \downarrow 2009 \\
 & \frac{(c+dx^2)^3(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \\
 & \quad \downarrow 2009 \\
 & \frac{(c+dx^2)^3(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2} \\
 & \quad \downarrow 2009 \\
 & \frac{(c+dx^2)^3(ex)^{m+1}(Ab-aB)}{4abe(a+bx^2)^2}
 \end{aligned}$$

3.21. $\int \frac{(ex)^m(A+Bx^2)(c+dx^2)^3}{(a+bx^2)^3} dx$

input `Int[((e*x)^m*(A + B*x^2)*(c + d*x^2)^3)/(a + b*x^2)^3,x]`

output `((A*b - a*B)*(e*x)^(1 + m)*(c + d*x^2)^3)/(4*a*b*e*(a + b*x^2)^2) + (((A*b*(b*c*(3 - m) + a*d*(3 + m)) + a*B*(b*c*(1 + m) - a*d*(7 + m)))*(e*x)^(1 + m)*(c + d*x^2)^2)/(2*a*b*e*(a + b*x^2)) + (-((d*(A*b*(2*b^2*c^2*(3 + 2*m - m^2) + 3*a*b*c*d*(3 + 4*m + m^2) - a^2*d^2*(15 + 8*m + m^2)) + a*B*(2*b^2*c^2*(1 + m)^2 - 3*a*b*c*d*(15 + 8*m + m^2) + a^2*d^2*(35 + 12*m + m^2)))*(e*x)^(1 + m))/(b^2*e*(1 + m))) - (d^2*(A*b*(3 + m)*(b*c*(3 - m) + a*d*(5 + m)) + a*B*(b*c*(3 + 4*m + m^2) - a*d*(35 + 12*m + m^2)))*(e*x)^(3 + m))/(b*e^3*(3 + m)) + ((b*c - a*d)*(A*b*(2*a*b*c*d*(3 - 2*m - m^2) + b^2*c^2*(3 - 4*m + m^2) + a^2*d^2*(15 + 8*m + m^2)) + a*B*(b^2*c^2*(1 - m^2) + 2*a*b*c*d*(5 + 6*m + m^2) - a^2*d^2*(35 + 12*m + m^2)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*b^2*e*(1 + m)))/(2*a*b))/(4*a*b)`

3.21.3.1 Defintions of rubi rules used

rule 25 `Int[-(F*x_), x_Symbol] := Simp[Identity[-1] Int[Fx, x], x]`

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

rule 439 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && ! (EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

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

$$3.21. \int \frac{(ex)^m (A+Bx^2)(c+dx^2)^3}{(a+bx^2)^3} dx$$

3.21.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A) (dx^2 + c)^3}{(bx^2 + a)^3} dx$$

input `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^3,x)`

output `int((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^3,x)`

3.21.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^3,x, algorithm="fricas")`

output `integral((B*d^3*x^8 + (3*B*c*d^2 + A*d^3)*x^6 + 3*(B*c^2*d + A*c*d^2)*x^4 + A*c^3 + (B*c^3 + 3*A*c^2*d)*x^2)*(e*x)^m/(b^3*x^6 + 3*a*b^2*x^4 + 3*a^2*b*x^2 + a^3), x)`

3.21.6 Sympy [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^3} dx = \int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^3} dx$$

input `integrate((e*x)**m*(B*x**2+A)*(d*x**2+c)**3/(b*x**2+a)**3,x)`

output `Integral((e*x)**m*(A + B*x**2)*(c + d*x**2)**3/(a + b*x**2)**3, x)`

3.21.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(e*x)^m/(b*x^2 + a)^3, x)`

3.21.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A)(dx^2 + c)^3 (ex)^m}{(bx^2 + a)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)*(d*x^2+c)^3/(b*x^2+a)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(e*x)^m/(b*x^2 + a)^3, x)`

3.21.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2) (c + dx^2)^3}{(a + bx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m (dx^2 + c)^3}{(bx^2 + a)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^3)/(a + b*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m*(c + d*x^2)^3)/(a + b*x^2)^3, x)`

3.22
$$\int \frac{(ex)^m (a+bx^2)^4 (A+Bx^2)}{c+dx^2} dx$$

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3.22.1 Optimal result

Integrand size = 31, antiderivative size = 363

$$\int \frac{(ex)^m (a+bx^2)^4 (A+Bx^2)}{c+dx^2} dx$$

$$= \frac{(a^4 B d^4 + b^4 c^3 (Bc - Ad) - 4ab^3 c^2 d (Bc - Ad) + 6a^2 b^2 c d^2 (Bc - Ad) - 4a^3 b d^3 (Bc - Ad)) (ex)^{1+m}}{d^5 e (1+m)}$$

$$+ \frac{b(4a^3 B d^3 - b^3 c^2 (Bc - Ad) + 4ab^2 c d (Bc - Ad) - 6a^2 b d^2 (Bc - Ad)) (ex)^{3+m}}{d^4 e^3 (3+m)}$$

$$+ \frac{b^2 (6a^2 B d^2 + b^2 c (Bc - Ad) - 4abd (Bc - Ad)) (ex)^{5+m}}{d^3 e^5 (5+m)}$$

$$- \frac{b^3 (bBc - Abd - 4aBd) (ex)^{7+m}}{d^2 e^7 (7+m)} + \frac{b^4 B (ex)^{9+m}}{d e^9 (9+m)}$$

$$- \frac{(bc - ad)^4 (Bc - Ad) (ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{cd^5 e (1+m)}$$

output

```
(a^4*B*d^4+b^4*c^3*(-A*d+B*c)-4*a*b^3*c^2*d*(-A*d+B*c)+6*a^2*b^2*c*d^2*(-A
*d+B*c)-4*a^3*b*d^3*(-A*d+B*c))*(e*x)^(1+m)/d^5/e/(1+m)+b*(4*a^3*B*d^3-b^3
*c^2*(-A*d+B*c)+4*a*b^2*c*d*(-A*d+B*c)-6*a^2*b*d^2*(-A*d+B*c))*(e*x)^(3+m)
/d^4/e^3/(3+m)+b^2*(6*a^2*B*d^2+b^2*c*(-A*d+B*c)-4*a*b*d*(-A*d+B*c))*(e*x)
^(5+m)/d^3/e^5/(5+m)-b^3*(-A*b*d-4*B*a*d+B*b*c)*(e*x)^(7+m)/d^2/e^7/(7+m)+
b^4*B*(e*x)^(9+m)/d/e^9/(9+m)-(-a*d+b*c)^4*(-A*d+B*c)*(e*x)^(1+m)*hypergeo
m([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c/d^5/e/(1+m)
```

3.22.
$$\int \frac{(ex)^m (a+bx^2)^4 (A+Bx^2)}{c+dx^2} dx$$

3.22.2 Mathematica [A] (verified)

Time = 0.69 (sec) , antiderivative size = 315, normalized size of antiderivative = 0.87

$$\int \frac{(ex)^m (a + bx^2)^4 (A + Bx^2)}{c + dx^2} dx$$

$$= x(ex)^m \left(\frac{a^4 B d^4 + b^4 c^3 (Bc - Ad) + 6a^2 b^2 c d^2 (Bc - Ad) + 4ab^3 c^2 d (-Bc + Ad) + 4a^3 b d^3 (-Bc + Ad)}{1+m} + \frac{bd(4a^3 B d^3 + 4ab^2 cd(Bc - Ad) + b^3 c^2 (-Bc + Ad))}{3+m} \right)$$

input `Integrate[((e*x)^m*(a + b*x^2)^4*(A + B*x^2))/(c + d*x^2),x]`

output `(x*(e*x)^m*((a^4*B*d^4 + b^4*c^3*(B*c - A*d) + 6*a^2*b^2*c*d^2*(B*c - A*d) + 4*a*b^3*c^2*d*(-(B*c) + A*d) + 4*a^3*b*d^3*(-(B*c) + A*d))/(1 + m) + (b*d*(4*a^3*B*d^3 + 4*a*b^2*c*d*(B*c - A*d) + b^3*c^2*(-(B*c) + A*d) + 6*a^2*b*d^2*(-(B*c) + A*d))*x^2)/(3 + m) + (b^2*d^2*(6*a^2*B*d^2 + b^2*c*(B*c - A*d) + 4*a*b*d*(-(B*c) + A*d))*x^4)/(5 + m) + (b^3*d^3*(-(b*B*c) + A*b*d + 4*a*B*d)*x^6)/(7 + m) + (b^4*B*d^4*x^8)/(9 + m) - ((b*c - a*d)^4*(B*c - A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(d*x^2)/c])/(c*(1 + m)))/d^5`

3.22.3 Rubi [A] (verified)

Time = 0.65 (sec) , antiderivative size = 363, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 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.

$$\int \frac{(a + bx^2)^4 (A + Bx^2) (ex)^m}{c + dx^2} dx$$

↓ 437

$$\int \left(\frac{b^2 (ex)^{m+4} (6a^2 B d^2 - 4abd(Bc - Ad) + b^2 c(Bc - Ad))}{d^3 e^4} + \frac{b (ex)^{m+2} (4a^3 B d^3 - 6a^2 b d^2 (Bc - Ad) + 4ab^2 cd(Bc - Ad))}{d^4 e^2} \right) dx$$

↓ 2009

3.22. $\int \frac{(ex)^m (a+bx^2)^4 (A+Bx^2)}{c+dx^2} dx$

$$\frac{b^2(ex)^{m+5} (6a^2Bd^2 - 4abd(Bc - Ad) + b^2c(Bc - Ad))}{d^3e^5(m+5)} + \frac{b(ex)^{m+3} (4a^3Bd^3 - 6a^2bd^2(Bc - Ad) + 4ab^2cd(Bc - Ad) + b^3(-c^2)(Bc - Ad))}{d^4e^3(m+3)} + \frac{(ex)^{m+1} (a^4Bd^4 - 4a^3bd^3(Bc - Ad) + 6a^2b^2cd^2(Bc - Ad) - 4ab^3c^2d(Bc - Ad) + b^4c^3(Bc - Ad))}{d^5e(m+1)} - \frac{b^3(ex)^{m+7}(-4aBd - Abd + bBc)}{d^2e^7(m+7)} - \frac{(ex)^{m+1}(bc - ad)^4(Bc - Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{cd^5e(m+1)} + \frac{b^4B(ex)^{m+9}}{de^9(m+9)}$$

input `Int[((ex)^m*(a + b*x^2)^4*(A + B*x^2))/(c + d*x^2),x]`

output `((a^4*B*d^4 + b^4*c^3*(B*c - A*d) - 4*a*b^3*c^2*d*(B*c - A*d) + 6*a^2*b^2*c*d^2*(B*c - A*d) - 4*a^3*b*d^3*(B*c - A*d))*(ex)^(1 + m))/(d^5*e*(1 + m)) + (b*(4*a^3*B*d^3 - b^3*c^2*(B*c - A*d) + 4*a*b^2*c*d*(B*c - A*d) - 6*a^2*b*d^2*(B*c - A*d))*(ex)^(3 + m))/(d^4*e^3*(3 + m)) + (b^2*(6*a^2*B*d^2 + b^2*c*(B*c - A*d) - 4*a*b*d*(B*c - A*d))*(ex)^(5 + m))/(d^3*e^5*(5 + m)) - (b^3*(b*B*c - A*b*d - 4*a*B*d)*(ex)^(7 + m))/(d^2*e^7*(7 + m)) + (b^4*B*(ex)^(9 + m))/(d*e^9*(9 + m)) - ((b*c - a*d)^4*(B*c - A*d)*(ex)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d^5*e*(1 + m)))`

3.2.2.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.22.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^4 (x^2 B + A)}{dx^2 + c} dx$$

input `int((e*x)^m*(b*x^2+a)^4*(B*x^2+A)/(d*x^2+c),x)`

output `int((e*x)^m*(b*x^2+a)^4*(B*x^2+A)/(d*x^2+c),x)`

3.22.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^4 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^4 (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^4*(B*x^2+A)/(d*x^2+c),x, algorithm="fricas")`

output `integral((B*b^4*x^10 + (4*B*a*b^3 + A*b^4)*x^8 + 2*(3*B*a^2*b^2 + 2*A*a*b^3)*x^6 + A*a^4 + 2*(2*B*a^3*b + 3*A*a^2*b^2)*x^4 + (B*a^4 + 4*A*a^3*b)*x^2)*(e*x)^m/(d*x^2 + c), x)`

3.22.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 13.39 (sec) , antiderivative size = 1102, normalized size of antiderivative = 3.04

$$\int \frac{(ex)^m (a + bx^2)^4 (A + Bx^2)}{c + dx^2} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**4*(B*x**2+A)/(d*x**2+c),x)`

```

output A***4***m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*
gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + A***4***m*x**(m + 1)*lerchphi(
d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 +
3/2)) + A***3*b***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m
/2 + 3/2)*gamma(m/2 + 3/2)/(c*gamma(m/2 + 5/2)) + 3*A***3*b***m*x**(m +
3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(c*ga
mma(m/2 + 5/2)) + 3*A***2*b**2***m*x**(m + 5)*lerchphi(d*x**2*exp_pola
r(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(2*c*gamma(m/2 + 7/2)) + 15*A*a
*2*b**2***m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*g
amma(m/2 + 5/2)/(2*c*gamma(m/2 + 7/2)) + A*a*b**3***m*x**(m + 7)*lerchp
hi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 7/2)*gamma(m/2 + 7/2)/(c*gamma(m/2 +
9/2)) + 7*A*a*b**3***m*x**(m + 7)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1,
m/2 + 7/2)*gamma(m/2 + 7/2)/(c*gamma(m/2 + 9/2)) + A*b**4***m*x**(m + 9
)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 9/2)*gamma(m/2 + 9/2)/(4*c*g
amma(m/2 + 11/2)) + 9*A*b**4***m*x**(m + 9)*lerchphi(d*x**2*exp_polar(I*p
i)/c, 1, m/2 + 9/2)*gamma(m/2 + 9/2)/(4*c*gamma(m/2 + 11/2)) + B*a***4***m
*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 +
3/2)/(4*c*gamma(m/2 + 5/2)) + 3*B*a***4***m*x**(m + 3)*lerchphi(d*x**2*ex
p_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + B
*a***3*b***m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5...

```

3.22.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^4 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^4 (ex)^m}{dx^2 + c} dx$$

```

input integrate((e*x)^m*(b*x^2+a)^4*(B*x^2+A)/(d*x^2+c),x, algorithm="maxima")

```

```

output integrate((B*x^2 + A)*(b*x^2 + a)^4*(e*x)^m/(d*x^2 + c), x)

```

3.22.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^4 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^4 (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^4*(B*x^2+A)/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^4*(e*x)^m/(d*x^2 + c), x)`

3.22.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^4 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^4}{dx^2 + c} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^4)/(c + d*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^4)/(c + d*x^2), x)`

3.23
$$\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{c+dx^2} dx$$

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3.23.1 Optimal result

Integrand size = 31, antiderivative size = 260

$$\begin{aligned} & \int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx \\ &= \frac{(a^3 B d^3 - b^3 c^2 (Bc - Ad) + 3ab^2 cd (Bc - Ad) - 3a^2 b d^2 (Bc - Ad)) (ex)^{1+m}}{d^4 e (1 + m)} \\ &+ \frac{b(3a^2 B d^2 + b^2 c (Bc - Ad) - 3abd (Bc - Ad)) (ex)^{3+m}}{d^3 e^3 (3 + m)} \\ &- \frac{b^2 (b B c - Abd - 3a B d) (ex)^{5+m}}{d^2 e^5 (5 + m)} + \frac{b^3 B (ex)^{7+m}}{d e^7 (7 + m)} \\ &+ \frac{(bc - ad)^3 (Bc - Ad) (ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{cd^4 e (1 + m)} \end{aligned}$$

```
output (a^3*B*d^3-b^3*c^2*(-A*d+B*c)+3*a*b^2*c*d*(-A*d+B*c)-3*a^2*b*d^2*(-A*d+B*c))*(e*x)^(1+m)/d^4/e/(1+m)+b*(3*a^2*B*d^2+b^2*c*(-A*d+B*c)-3*a*b*d*(-A*d+B*c))*(e*x)^(3+m)/d^3/e^3/(3+m)-b^2*(-A*b*d-3*B*a*d+B*b*c)*(e*x)^(5+m)/d^2/e^5/(5+m)+b^3*B*(e*x)^(7+m)/d/e^7/(7+m)+(-a*d+b*c)^3*(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c/d^4/e/(1+m)
```

3.23.2 Mathematica [A] (verified)

Time = 0.56 (sec) , antiderivative size = 219, normalized size of antiderivative = 0.84

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx$$

$$= \frac{x(ex)^m \left(\frac{a^3 B d^3 + 3 a b^2 c d (B c - A d) + b^3 c^2 (-B c + A d) + 3 a^2 b d^2 (-B c + A d)}{1+m} + \frac{b d (3 a^2 B d^2 + b^2 c (B c - A d) + 3 a b d (-B c + A d)) x^2}{3+m} + \frac{b^2 d^2 (-b B c + 3 a^2 B d^2 + b^2 c (B c - A d) + 3 a b d (-B c + A d)) x^4}{5+m} + \frac{b^3 d^3 (-b^2 B c + 3 a^2 B d^2 + b^2 c (B c - A d) + 3 a b d (-B c + A d)) x^6}{7+m} + ((b^3 B d^3 - 3 a^2 b d^2 (B c - A d) + 3 a b^2 c d (B c - A d) + b^3 c^2 (-B c + A d)) \operatorname{Hypergeometric2F1}[1, (1+m)/2, (3+m)/2, -(d x^2/c)]) / (c (1+m)) \right)}{d^4}$$

input `Integrate[((e*x)^m*(a + b*x^2)^3*(A + B*x^2))/(c + d*x^2),x]`

output `(x*(e*x)^m*((a^3*B*d^3 + 3*a*b^2*c*d*(B*c - A*d) + b^3*c^2*(-(B*c) + A*d) + 3*a^2*b*d^2*(-(B*c) + A*d))/(1 + m) + (b*d*(3*a^2*B*d^2 + b^2*c*(B*c - A*d) + 3*a*b*d*(-(B*c) + A*d))*x^2)/(3 + m) + (b^2*d^2*(-(b*B*c) + A*b*d + 3*a*B*d)*x^4)/(5 + m) + (b^3*B*d^3*x^6)/(7 + m) + ((b*c - a*d)^3*(B*c - A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*(1 + m)))/d^4`

3.23.3 Rubi [A] (verified)

Time = 0.49 (sec) , antiderivative size = 260, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 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.

$$\int \frac{(a + bx^2)^3 (A + Bx^2) (ex)^m}{c + dx^2} dx$$

$$\downarrow 437$$

$$\int \left(\frac{b(ex)^{m+2} (3a^2 B d^2 - 3abd(Bc - Ad) + b^2 c (Bc - Ad))}{d^3 e^2} + \frac{(ex)^m (a^3 B d^3 - 3a^2 b d^2 (Bc - Ad) + 3ab^2 c d (Bc - Ad))}{d^4} \right) dx$$

$$\downarrow 2009$$

3.23. $\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx$

$$\frac{b(ex)^{m+3} (3a^2Bd^2 - 3abd(Bc - Ad) + b^2c(Bc - Ad))}{d^3e^3(m+3)} + \frac{(ex)^{m+1} (a^3Bd^3 - 3a^2bd^2(Bc - Ad) + 3ab^2cd(Bc - Ad) + b^3(-c^2)(Bc - Ad))}{d^4e(m+1)} - \frac{b^2(ex)^{m+5}(-3aBd - Abd + bBc)}{d^2e^5(m+5)} + \frac{(ex)^{m+1}(bc - ad)^3(Bc - Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{cd^4e(m+1)} + \frac{b^3B(ex)^{m+7}}{de^7(m+7)}$$

input `Int[((e*x)^m*(a + b*x^2)^3*(A + B*x^2))/(c + d*x^2), x]`

output `((a^3*B*d^3 - b^3*c^2*(B*c - A*d) + 3*a*b^2*c*d*(B*c - A*d) - 3*a^2*b*d^2*(B*c - A*d))*(e*x)^(1 + m))/(d^4*e*(1 + m)) + (b*(3*a^2*B*d^2 + b^2*c*(B*c - A*d) - 3*a*b*d*(B*c - A*d))*(e*x)^(3 + m))/(d^3*e^3*(3 + m)) - (b^2*(b*B*c - A*b*d - 3*a*B*d)*(e*x)^(5 + m))/(d^2*e^5*(5 + m)) + (b^3*B*(e*x)^(7 + m))/(d*e^7*(7 + m)) + ((b*c - a*d)^3*(B*c - A*d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*d^4*e*(1 + m))`

3.23.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.23.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^3 (x^2B + A)}{dx^2 + c} dx$$

input `int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c), x)`

output `int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c), x)`

3.23.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c),x, algorithm="fricas")`

output `integral((B*b^3*x^8 + (3*B*a*b^2 + A*b^3)*x^6 + 3*(B*a^2*b + A*a*b^2)*x^4 + A*a^3 + (B*a^3 + 3*A*a^2*b)*x^2)*(e*x)^m/(d*x^2 + c), x)`

3.23.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 9.12 (sec) , antiderivative size = 887, normalized size of antiderivative = 3.41

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)**3*(B*x**2+A)/(d*x**2+c),x)`

output

```

A***3***e***m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*
gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + A***3***e***m*x**(m + 1)*lerchphi(
d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 +
3/2)) + 3*A**2*b***e***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1,
m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + 9*A**2*b***e***m*x**(
m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(
4*c*gamma(m/2 + 5/2)) + 3*A*a*b**2*e***m*x**(m + 5)*lerchphi(d*x**2*exp_p
olar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*c*gamma(m/2 + 7/2)) + 15*A
*a*b**2*e***m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*g
amma(m/2 + 5/2)/(4*c*gamma(m/2 + 7/2)) + A*b**3***e***m*x**(m + 7)*lerchphi
(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 7/2)*gamma(m/2 + 7/2)/(4*c*gamma(m/2 +
9/2)) + 7*A*b**3***e***m*x**(m + 7)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/
2 + 7/2)*gamma(m/2 + 7/2)/(4*c*gamma(m/2 + 9/2)) + B*a**3***e***m*x**(m + 3
)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*g
amma(m/2 + 5/2)) + 3*B*a**3***e***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi
)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + 3*B*a**2*b*e
***m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2
+ 5/2)/(4*c*gamma(m/2 + 7/2)) + 15*B*a**2*b***e***m*x**(m + 5)*lerchphi(d*x
**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*c*gamma(m/2 + 7/2)
) + 3*B*a*b**2*e***m*x**(m + 7)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, ...

```

3.23.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^3*(e*x)^m/(d*x^2 + c), x)`

3.23.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^3*(e*x)^m/(d*x^2 + c), x)`

3.23.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^3}{dx^2 + c} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^3)/(c + d*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^3)/(c + d*x^2), x)`

3.24 $\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx$

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3.24.1 Optimal result

Integrand size = 31, antiderivative size = 180

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{c + dx^2} dx$$

$$= \frac{(a^2 B d^2 + b^2 c (Bc - Ad) - 2abd(Bc - Ad)) (ex)^{1+m}}{d^3 e (1+m)} - \frac{b(bBc - Abd - 2aBd)(ex)^{3+m}}{d^2 e^3 (3+m)}$$

$$+ \frac{b^2 B (ex)^{5+m}}{d e^5 (5+m)} - \frac{(bc - ad)^2 (Bc - Ad) (ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{cd^3 e (1+m)}$$

```
output (a^2*B*d^2+b^2*c*(-A*d+B*c)-2*a*b*d*(-A*d+B*c))*(e*x)^(1+m)/d^3/e/(1+m)-b*
(-A*b*d-2*B*a*d+B*b*c)*(e*x)^(3+m)/d^2/e^3/(3+m)+b^2*B*(e*x)^(5+m)/d/e^5/(
5+m)-(-a*d+b*c)^2*(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2
*m], -d*x^2/c)/c/d^3/e/(1+m)
```

3.24.2 Mathematica [A] (verified)

Time = 0.25 (sec) , antiderivative size = 147, normalized size of antiderivative = 0.82

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{c + dx^2} dx$$

$$= \frac{x(ex)^m \left(\frac{a^2 B d^2 + b^2 c (Bc - Ad) + 2abd(-Bc + Ad)}{1+m} + \frac{bd(-bBc + Abd + 2aBd)x^2}{3+m} + \frac{b^2 B d^2 x^4}{5+m} - \frac{(bc - ad)^2 (Bc - Ad) \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(1+m)} \right)}{d^3}$$

3.24. $\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx$

input `Integrate[((e*x)^m*(a + b*x^2)^2*(A + B*x^2))/(c + d*x^2),x]`

output `(x*(e*x)^m*((a^2*B*d^2 + b^2*c*(B*c - A*d) + 2*a*b*d*(-(B*c) + A*d))/(1 + m) + (b*d*(-(b*B*c) + A*b*d + 2*a*B*d)*x^2)/(3 + m) + (b^2*B*d^2*x^4)/(5 + m) - ((b*c - a*d)^2*(B*c - A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*(1 + m)))/d^3`

3.24.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 180, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {437, 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.

$$\int \frac{(a + bx^2)^2 (A + Bx^2) (ex)^m}{c + dx^2} dx$$

↓ 437

$$\int \left(\frac{(ex)^m (a^2 Ad^3 - a^2 Bcd^2 - 2aAbcd^2 + 2abBc^2d + Ab^2c^2d - b^2Bc^3)}{d^3 (c + dx^2)} + \frac{(ex)^m (a^2 Bd^2 - 2abd(Bc - Ad) + b^2c)}{d^3} \right) dx$$

↓ 2009

$$\frac{(ex)^{m+1} (a^2 Bd^2 - 2abd(Bc - Ad) + b^2c(Bc - Ad))}{d^3 e(m+1)} - \frac{(ex)^{m+1} (bc - ad)^2 (Bc - Ad) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{cd^3 e(m+1)} - \frac{b(ex)^{m+3} (-2aBd - Abd + bBc)}{d^2 e^3 (m+3)} + \frac{b^2 B (ex)^{m+5}}{de^5 (m+5)}$$

input `Int[((e*x)^m*(a + b*x^2)^2*(A + B*x^2))/(c + d*x^2),x]`

output `((a^2*B*d^2 + b^2*c*(B*c - A*d) - 2*a*b*d*(B*c - A*d))*(e*x)^(1 + m))/(d^3 *e*(1 + m)) - (b*(b*B*c - A*b*d - 2*a*B*d)*(e*x)^(3 + m))/(d^2*e^3*(3 + m)) + (b^2*B*(e*x)^(5 + m))/(d*e^5*(5 + m)) - ((b*c - a*d)^2*(B*c - A*d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d^3*e*(1 + m))`

3.24. $\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx$

3.24.3.1 Defintions of rubi rules used

```
rule 437 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q
_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(
a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f
, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]
```

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

3.24.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^2 (x^2B + A)}{dx^2 + c} dx$$

```
input int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c),x)
```

```
output int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c),x)
```

3.24.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{dx^2 + c} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c),x, algorithm="fricas")
```

```
output integral((B*b^2*x^6 + (2*B*a*b + A*b^2)*x^4 + A*a^2 + (B*a^2 + 2*A*a*b)*x^
2)*(e*x)^m/(d*x^2 + c), x)
```

3.24.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 5.84 (sec) , antiderivative size = 649, normalized size of antiderivative = 3.61

$$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx = \frac{Aa^2 e^m m x^{m+1} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} + \frac{Aa^2 e^m x^{m+1} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} + \frac{Aabe^m m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{2c \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{3Aabe^m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{2c \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{Ab^2 e^m m x^{m+5} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} + \frac{5Ab^2 e^m x^{m+5} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} + \frac{Ba^2 e^m m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{3Ba^2 e^m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{Babe^m m x^{m+5} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{2c \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} + \frac{5Babe^m x^{m+5} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{2c \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} + \frac{Bb^2 e^m m x^{m+7} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{7}{2}\right) \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{9}{2}\right)} + \frac{7Bb^2 e^m x^{m+7} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{7}{2}\right) \Gamma\left(\frac{m}{2} + \frac{7}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{9}{2}\right)}$$

input `integrate((e*x)**m*(b*x**2+a)**2*(B*x**2+A)/(d*x**2+c), x)`

$$3.24. \int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx$$

```
output A***2***m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*
gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + A***2***m*x**(m + 1)*lerchphi(
d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 +
3/2)) + A*a*b***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2
+ 3/2)*gamma(m/2 + 3/2)/(2*c*gamma(m/2 + 5/2)) + 3*A*a*b***m*x**(m + 3)*l
erchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(2*c*gamma
a(m/2 + 5/2)) + A*b**2***m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c
, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*c*gamma(m/2 + 7/2)) + 5*A*b**2***m*x
*(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)
/(4*c*gamma(m/2 + 7/2)) + B*a**2***m*x**(m + 3)*lerchphi(d*x**2*exp_pol
ar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + 3*B*a
**2***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(
m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + B*a*b***m*x**(m + 5)*lerchphi(d*x**
2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(2*c*gamma(m/2 + 7/2))
+ 5*B*a*b***m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2
)*gamma(m/2 + 5/2)/(2*c*gamma(m/2 + 7/2)) + B*b**2***m*x**(m + 7)*lerch
phi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 7/2)*gamma(m/2 + 7/2)/(4*c*gamma(m/
2 + 9/2)) + 7*B*b**2***m*x**(m + 7)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1,
m/2 + 7/2)*gamma(m/2 + 7/2)/(4*c*gamma(m/2 + 9/2))
```

3.24.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{dx^2 + c} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c),x, algorithm="maxima")
```

```
output integrate((B*x^2 + A)*(b*x^2 + a)^2*(e*x)^m/(d*x^2 + c), x)
```

3.24.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{dx^2 + c} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c),x, algorithm="giac")
```

```
output integrate((B*x^2 + A)*(b*x^2 + a)^2*(e*x)^m/(d*x^2 + c), x)
```

3.24. $\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{c+dx^2} dx$

3.24.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^2}{dx^2 + c} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^2)/(c + d*x^2), x)`output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^2)/(c + d*x^2), x)`

3.25 $\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{c+dx^2} dx$

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3.25.1 Optimal result

Integrand size = 29, antiderivative size = 120

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{c + dx^2} dx$$

$$= -\frac{(bBc - Abd - aBd)(ex)^{1+m}}{d^2e(1+m)} + \frac{bB(ex)^{3+m}}{de^3(3+m)}$$

$$+ \frac{(bc - ad)(Bc - Ad)(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{cd^2e(1+m)}$$

```
output -(-A*b*d-B*a*d+B*b*c)*(e*x)^(1+m)/d^2/e/(1+m)+b*B*(e*x)^(3+m)/d/e^3/(3+m)+
(-a*d+b*c)*(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*
x^2/c)/c/d^2/e/(1+m)
```

3.25.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 93, normalized size of antiderivative = 0.78

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{c + dx^2} dx$$

$$= \frac{x(ex)^m \left(\frac{-bBc+Abd+aBd}{1+m} + \frac{bBdx^2}{3+m} + \frac{(bc-ad)(Bc-Ad) \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(1+m)} \right)}{d^2}$$

input `Integrate[((e*x)^m*(a + b*x^2)*(A + B*x^2))/(c + d*x^2),x]`

output `(x*(e*x)^m*((-(b*B*c) + A*b*d + a*B*d)/(1 + m) + (b*B*d*x^2)/(3 + m) + ((b*c - a*d)*(B*c - A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*(1 + m)))/d^2`

3.25.3 Rubi [A] (verified)

Time = 0.27 (sec) , antiderivative size = 120, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.069$, Rules used = {437, 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.

$$\int \frac{(a + bx^2)(A + Bx^2)(ex)^m}{c + dx^2} dx$$

↓ 437

$$\int \left(\frac{(ex)^m (aAd^2 - aBcd - Abcd + bBc^2)}{d^2(c + dx^2)} - \frac{(ex)^m (-aBd - Abd + bBc)}{d^2} + \frac{bB(ex)^{m+2}}{de^2} \right) dx$$

↓ 2009

$$\frac{(ex)^{m+1}(bc - ad)(Bc - Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{cd^2e(m+1)} - \frac{(ex)^{m+1}(-aBd - Abd + bBc)}{d^2e(m+1)} + \frac{bB(ex)^{m+3}}{de^3(m+3)}$$

input `Int[((e*x)^m*(a + b*x^2)*(A + B*x^2))/(c + d*x^2),x]`

output `-(((b*B*c - A*b*d - a*B*d)*(e*x)^(1 + m))/(d^2*e*(1 + m))) + (b*B*(e*x)^(3 + m))/(d*e^3*(3 + m)) + ((b*c - a*d)*(B*c - A*d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*d^2*e*(1 + m))`

3.25.3.1 Defintions of rubi rules used

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

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

3.25.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)(x^2B + A)}{dx^2 + c} dx$$

input `int((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c),x)`

output `int((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c),x)`

3.25.5 Fracas [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c),x, algorithm="fracas")`

output `integral((B*b*x^4 + (B*a + A*b)*x^2 + A*a)*(e*x)^m/(d*x^2 + c), x)`

3.25.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 3.50 (sec) , antiderivative size = 418, normalized size of antiderivative = 3.48

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{c + dx^2} dx = \frac{Aae^m mx^{m+1} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} + \frac{Aae^m x^{m+1} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} + \frac{Abe^m mx^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{3Abe^m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{Bae^m mx^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{3Bae^m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} + \frac{Bbe^m mx^{m+5} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)} + \frac{5Bbe^m x^{m+5} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{5}{2}\right) \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)}{4c\Gamma\left(\frac{m}{2} + \frac{7}{2}\right)}$$

input `integrate((e*x)**m*(b*x**2+a)*(B*x**2+A)/(d*x**2+c),x)`

output `A*a*e**m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + A*a*e**m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + A*b*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + 3*A*b*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + B*a*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + 3*B*a*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + B*b*e**m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*c*gamma(m/2 + 7/2)) + 5*B*b*e**m*x**(m + 5)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 5/2)*gamma(m/2 + 5/2)/(4*c*gamma(m/2 + 7/2))`

3.25. $\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{c+dx^2} dx$

3.25.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)*(e*x)^m/(d*x^2 + c), x)`

3.25.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)*(e*x)^m/(d*x^2 + c), x)`

3.25.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(ex)^m (bx^2 + a)}{dx^2 + c} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2))/(c + d*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2))/(c + d*x^2), x)`

3.26 $\int \frac{(ex)^m (A+Bx^2)}{c+dx^2} dx$

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3.26.1 Optimal result

Integrand size = 22, antiderivative size = 77

$$\int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = \frac{B(ex)^{1+m}}{de(1+m)} - \frac{(Bc - Ad)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{cde(1+m)}$$

output `B*(e*x)^(1+m)/d/e/(1+m)-(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c/d/e/(1+m)`

3.26.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 56, normalized size of antiderivative = 0.73

$$\int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = \frac{x(ex)^m \left(Bc + (-Bc + Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) \right)}{cd(1+m)}$$

input `Integrate[((e*x)^m*(A + B*x^2))/(c + d*x^2),x]`

output `(x*(e*x)^m*(B*c + (-B*c) + A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*d*(1 + m))`

3.26.3 Rubi [A] (verified)

Time = 0.20 (sec) , antiderivative size = 77, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.091$, Rules used = {363, 278}

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.

$$\int \frac{(A + Bx^2)(ex)^m}{c + dx^2} dx$$

↓ 363

$$\frac{B(ex)^{m+1}}{de(m+1)} - \frac{(Bc - Ad) \int \frac{(ex)^m}{dx^2 + c} dx}{d}$$

↓ 278

$$\frac{B(ex)^{m+1}}{de(m+1)} - \frac{(ex)^{m+1}(Bc - Ad) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{cde(m+1)}$$

input `Int[((e*x)^m*(A + B*x^2))/(c + d*x^2),x]`

output `(B*(e*x)^(1 + m))/(d*e*(1 + m)) - ((B*c - A*d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d*e*(1 + m))`

3.26.3.1 Defintions of rubi rules used

rule 278 `Int[((c_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 363 `Int[((e_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^(m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d, 0] && NeQ[m + 2*p + 3, 0]`

3.26.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{dx^2 + c} dx$$

input `int((e*x)^m*(B*x^2+A)/(d*x^2+c),x)`

output `int((e*x)^m*(B*x^2+A)/(d*x^2+c),x)`

3.26.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c),x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(d*x^2 + c), x)`

3.26.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.79 (sec) , antiderivative size = 201, normalized size of antiderivative = 2.61

$$\begin{aligned} \int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = & \frac{Ae^m m x^{m+1} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} \\ & + \frac{Ae^m x^{m+1} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{1}{2}\right) \Gamma\left(\frac{m}{2} + \frac{1}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)} \\ & + \frac{Be^m m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} \\ & + \frac{3Be^m x^{m+3} \Phi\left(\frac{dx^2 e^{i\pi}}{c}, 1, \frac{m}{2} + \frac{3}{2}\right) \Gamma\left(\frac{m}{2} + \frac{3}{2}\right)}{4c \Gamma\left(\frac{m}{2} + \frac{5}{2}\right)} \end{aligned}$$

input `integrate((e*x)**m*(B*x**2+A)/(d*x**2+c),x)`

3.26. $\int \frac{(ex)^m (A+Bx^2)}{c+dx^2} dx$

output `A***m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + A***m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(4*c*gamma(m/2 + 3/2)) + B***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2)) + 3*B***m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(4*c*gamma(m/2 + 5/2))`

3.26.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/(d*x^2 + c), x)`

3.26.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/(d*x^2 + c), x)`

3.26.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{dx^2 + c} dx$$

input `int(((A + B*x^2)*(e*x)^m)/(c + d*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m)/(c + d*x^2), x)`

3.26. $\int \frac{(ex)^m (A+Bx^2)}{c+dx^2} dx$

3.27 $\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)} dx$

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3.27.1 Optimal result

Integrand size = 31, antiderivative size = 125

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \frac{(Ab - aB)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a(bc - ad)e(1 + m)} + \frac{(Bc - Ad)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(bc - ad)e(1 + m)}$$

output `(A*b-B*a)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a/(-a*d+b*c)/e/(1+m)+(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c/(-a*d+b*c)/e/(1+m)`

3.27.2 Mathematica [A] (verified)

Time = 0.16 (sec) , antiderivative size = 100, normalized size of antiderivative = 0.80

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \frac{x(ex)^m \left((-Abc + aBc) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right) + a(-Bc + Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) \right)}{ac(-bc + ad)(1 + m)}$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)*(c + d*x^2)), x]`

output $(x*(e*x)^m*((-(A*b*c) + a*B*c)*\text{Hypergeometric2F1}[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)] + a*(-(B*c) + A*d)*\text{Hypergeometric2F1}[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(a*c*(-(b*c) + a*d)*(1 + m))$

3.27.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 125, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {446, 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.

$$\int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)(c + dx^2)} dx$$

↓ 446

$$\int \left(\frac{(ex)^m(Ab - aB)}{(a + bx^2)(bc - ad)} + \frac{(ex)^m(Bc - Ad)}{(c + dx^2)(bc - ad)} \right) dx$$

↓ 2009

$$\frac{(ex)^{m+1}(Ab - aB) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{ae(m+1)(bc - ad)} + \frac{(ex)^{m+1}(Bc - Ad) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{ce(m+1)(bc - ad)}$$

input $\text{Int}[(e*x)^m*(A + B*x^2)/((a + b*x^2)*(c + d*x^2)),x]$

output $((A*b - a*B)*(e*x)^{(1 + m)*\text{Hypergeometric2F1}[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/(a*(b*c - a*d)*e*(1 + m)) + ((B*c - A*d)*(e*x)^{(1 + m)*\text{Hypergeometric2F1}[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*(b*c - a*d)*e*(1 + m))$

3.27.3.1 Defintions of rubi rules used

```
rule 446 Int[(((g_)*(x_)^(m_))*((a_) + (b_)*(x_)^2)^(p_))*((e_) + (f_)*(x_)^2))/((c_) + (d_)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x]
```

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

3.27.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)(dx^2 + c)} dx$$

```
input int((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c),x)
```

```
output int((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c),x)
```

3.27.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)} dx$$

```
input integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c),x, algorithm="fricas")
```

```
output integral((B*x^2 + A)*(e*x)^m/(b*d*x^4 + (b*c + a*d)*x^2 + a*c), x)
```

3.27.6 Sympy [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx$$

```
input integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)/(d*x**2+c),x)
```

```
output Integral((e*x)**m*(A + B*x**2)/((a + b*x**2)*(c + d*x**2)), x)
```

3.27. $\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)} dx$

3.27.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)*(d*x^2 + c)), x)`

3.27.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)*(d*x^2 + c)), x)`

3.27.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)*(c + d*x^2)),x)`

output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)*(c + d*x^2)), x)`

3.28
$$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2 (c+dx^2)} dx$$

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3.28.1 Optimal result

Integrand size = 31, antiderivative size = 206

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \frac{(Ab - aB)(ex)^{1+m}}{2a(bc - ad)e(a + bx^2)} + \frac{(Ab(bc(1 - m) - ad(3 - m)) + aB(ad(1 - m) + bc(1 + m)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}\right)}{2a^2(bc - ad)^2e(1 + m)} - \frac{d(Bc - Ad)(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(bc - ad)^2e(1 + m)}$$

```
output 1/2*(A*b-B*a)*(e*x)^(1+m)/a/(-a*d+b*c)/e/(b*x^2+a)+1/2*(A*b*(b*c*(1-m)-a*d*(3-m))+a*B*(a*d*(1-m)+b*c*(1+m))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-b*x^2/a)/a^2/(-a*d+b*c)^2/e/(1+m)-d*(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c/(-a*d+b*c)^2/e/(1+m)
```

3.28.2 Mathematica [A] (verified)

Time = 0.36 (sec) , antiderivative size = 149, normalized size of antiderivative = 0.72

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \frac{x(ex)^m \left(abc(-Bc + Ad) \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right) + a^2d(Bc - Ad) \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) \right)}{a^2c(bc - ad)^2(1 + m)}$$

3.28.
$$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2 (c+dx^2)} dx$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)^2*(c + d*x^2)),x]`

output `-((x*(e*x)^m*(a*b*c*(-(B*c) + A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)] + a^2*d*(B*c - A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] - (A*b - a*B)*c*(b*c - a*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/(a^2*c*(b*c - a*d)^2*(1 + m))`

3.28.3 Rubi [A] (verified)

Time = 0.48 (sec) , antiderivative size = 223, normalized size of antiderivative = 1.08, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.097$, Rules used = {441, 446, 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.

$$\int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)^2(c + dx^2)} dx$$

↓ 441

$$\frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(bc - ad)} - \int \frac{(ex)^m(-((Ab - aB)d(1 - m)x^2) + 2aAd - Abc(1 - m) - aBc(m + 1))}{(bx^2 + a)(dx^2 + c)} dx}{2a(bc - ad)}$$

↓ 446

$$\frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(bc - ad)} - \int \left(\frac{(-Ab(bc(1 - m) - ad(3 - m)) - aB(ad(1 - m) + bc(m + 1)))(ex)^m}{(bc - ad)(bx^2 + a)} + \frac{2ad(Ad - Bc)(ex)^m}{(ad - bc)(dx^2 + c)} \right) dx}{2a(bc - ad)}$$

↓ 2009

$$\frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(bc - ad)} - \frac{2ad(ex)^{m+1}(Bc - Ad) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{ce(m+1)(bc - ad)} - \frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)(Ab(bc(1 - m) - ad(3 - m)))}{ae(m+1)(bc - ad)}}{2a(bc - ad)}$$

input `Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)^2*(c + d*x^2)),x]`

3.28. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^2(c+dx^2)} dx$

```
output ((A*b - a*B)*(e*x)^(1 + m))/(2*a*(b*c - a*d)*e*(a + b*x^2)) - (-(((A*b*(b*c*(1 - m) - a*d*(3 - m)) + a*B*(a*d*(1 - m) + b*c*(1 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(b*c - a*d)*e*(1 + m))) + (2*a*d*(B*c - A*d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*(b*c - a*d)*e*(1 + m)))/(2*a*(b*c - a*d))
```

3.28.3.1 Defintions of rubi rules used

```
rule 441 Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*(e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a^2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e^2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]
```

```
rule 446 Int[(((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((e_) + (f_)*(x_)^2))/(c_) + (d_)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x]
```

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

3.28.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)^2 (dx^2 + c)} dx$$

```
input int((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c),x)
```

```
output int((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c),x)
```


3.28.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c),x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b^2*d*x^6 + (b^2*c + 2*a*b*d)*x^4 + a^2*c + (2*a*b*c + a^2*d)*x^2), x)`

3.28.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)**2/(d*x**2+c), x)`

output `Timed out`

3.28.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^2*(d*x^2 + c)), x)`

3.28.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^2*(d*x^2 + c)), x)`

3.28.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^2*(c + d*x^2)),x)`

output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^2*(c + d*x^2)), x)`

3.29
$$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3 (c+dx^2)} dx$$

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3.29.1 Optimal result

Integrand size = 31, antiderivative size = 342

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx = \frac{(Ab - aB)(ex)^{1+m}}{4a(bc - ad)e(a + bx^2)^2} + \frac{(Ab(bc(3 - m) - ad(7 - m)) + aB(ad(3 - m) + bc(1 + m)))(ex)^{1+m}}{8a^2(bc - ad)^2e(a + bx^2)} + \frac{(Ab(a^2d^2(15 - 8m + m^2) - 2abcd(5 - 6m + m^2) + b^2c^2(3 - 4m + m^2)) + aB(b^2c^2(1 - m^2) - 2abcd(3 - 4m + m^2)))(ex)^{1+m}}{8a^3(bc - ad)^3e(1 + m)} + \frac{d^2(Bc - Ad)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(bc - ad)^3e(1 + m)}$$

```
output 1/4*(A*b-B*a)*(e*x)^(1+m)/a/(-a*d+b*c)/e/(b*x^2+a)^2+1/8*(A*b*(b*c*(3-m)-a*d*(7-m))+a*B*(a*d*(3-m)+b*c*(1+m))*(e*x)^(1+m)/a^2/(-a*d+b*c)^2/e/(b*x^2+a)+1/8*(A*b*(a^2*d^2*(m^2-8*m+15)-2*a*b*c*d*(m^2-6*m+5)+b^2*c^2*(m^2-4*m+3))+a*B*(b^2*c^2*(-m^2+1)-2*a*b*c*d*(-m^2+2*m+3)-a^2*d^2*(m^2-4*m+3)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^3/(-a*d+b*c)^3/e/(1+m)+d^2*(-A*d+B*c)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c/(-a*d+b*c)^3/e/(1+m)
```

3.29.2 Mathematica [A] (verified)

Time = 0.89 (sec) , antiderivative size = 195, normalized size of antiderivative = 0.57

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx$$

$$= \frac{x(ex)^m \left(\frac{bd(-Bc+Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a} + \frac{d^2(Bc-Ad) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c} + \frac{b(bc-ad)(Bc-Ad)}{(bc-ad)^3(1+m)} \right)}{(bc-ad)^3(1+m)}$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)^3*(c + d*x^2)),x]`

output `(x*(e*x)^m*((b*d*(-(B*c) + A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/a + (d^2*(B*c - A*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c + (b*(b*c - a*d)*(B*c - A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/a^2 + ((A*b - a*B)*(b*c - a*d)^2*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/a^3))/((b*c - a*d)^3*(1 + m))`

3.29.3 Rubi [F]

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

$$\int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)^3(c + dx^2)} dx$$

$$\downarrow 441$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{\int \frac{(ex)^m(-((Ab - aB)d(3 - m)x^2) + 4aAd - Abc(3 - m) - aBc(m + 1))}{(bx^2 + a)^2(dx^2 + c)} dx}{4a(bc - ad)}$$

$$\downarrow 441$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{\int \frac{(ex)^m(-d(1 - m)(Ab(bc(3 - m) - ad(7 - m)) + aB(ad(3 - m) + bc(m + 1)))x^2 + aBc(m + 1)(ad(5 - m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2c^2))}{(bx^2 + a)(dx^2 + c)} dx}{2a(bc - ad)}$$

$$\downarrow 25$$

3.29. $\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx$

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

3.29. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)} dx$

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

3.29. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)} dx$

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

3.29. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)} dx$

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

$$\int - \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} - \frac{2a(bc - ad)}{2a(bc - ad)}$$

$$4a(bc - ad)$$

↓ 25

3.29. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)} dx$

$$\begin{array}{c}
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \\
 \int - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} \\
 \hline
 \frac{4a(bc - ad)}{2a(bc - ad)} \\
 \hline
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \\
 \int - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} \\
 \hline
 \frac{4a(bc - ad)}{2a(bc - ad)} \\
 \hline
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \\
 \int - \frac{(ex)^m(d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(5-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} \\
 \hline
 \frac{4a(bc - ad)}{2a(bc - ad)} \\
 \hline
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(bc - ad)} - \\
 \int - \frac{(ex)^m(-d(1-m)(Ab(bc(3-m) - ad(7-m)) + aB(ad(3-m) + bc(m+1)))x^2 + aBc(m+1)(ad(5-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 8m + 7)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)} \\
 \hline
 \frac{4a(bc - ad)}{2a(bc - ad)} \\
 \hline
 \end{array}$$

input `Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)^3*(c + d*x^2)),x]`

output `$Aborted`

3.29. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)} dx$

3.29.3.1 Defintions of rubi rules used

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

rule 441 `Int[((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g*2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a*2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]`

3.29.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)^3 (dx^2 + c)} dx$$

input `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c),x)`

output `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c),x)`

3.29.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c),x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b^3*d*x^8 + (b^3*c + 3*a*b^2*d)*x^6 + 3*(a*b^2*c + a^2*b*d)*x^4 + a^3*c + (3*a^2*b*c + a^3*d)*x^2), x)`

3.29.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)**3/(d*x**2+c),x)`output `Timed out`**3.29.7 Maxima [F]**

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c),x, algorithm="maxima")`output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^3*(d*x^2 + c)), x)`**3.29.8 Giac [F]**

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c),x, algorithm="giac")`output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^3*(d*x^2 + c)), x)`

3.29.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)} dx = \int \frac{(Bx^2 + A) (ex)^m}{(bx^2 + a)^3 (dx^2 + c)} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^3*(c + d*x^2)),x)`output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^3*(c + d*x^2)), x)`

3.30
$$\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^2} dx$$

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3.30.1 Optimal result

Integrand size = 31, antiderivative size = 340

$$\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^2} dx =$$

$$\frac{b(3a^2d^2(Ad(1+m) - Bc(3+m)) - 3abcd(Ad(3+m) - Bc(5+m)) + b^2c^2(Ad(5+m) - Bc(7+m)))}{2cd^4e(1+m)}$$

$$- \frac{b^2(3ad(Ad(3+m) - Bc(5+m)) - bc(Ad(5+m) - Bc(7+m)))(ex)^{3+m}}{2cd^3e^3(3+m)}$$

$$- \frac{b^3(Ad(5+m) - Bc(7+m))(ex)^{5+m}}{2cd^2e^5(5+m)} - \frac{(Bc - Ad)(ex)^{1+m} (a+bx^2)^3}{2cde(c+dx^2)}$$

$$+ \frac{(bc - ad)^2(ad(Ad(1-m) + Bc(1+m)) + bc(Ad(5+m) - Bc(7+m)))(ex)^{1+m} \text{Hypergeometric2F1}}{2c^2d^4e(1+m)}$$

output

```
-1/2*b*(3*a^2*d^2*(A*d*(1+m)-B*c*(3+m))-3*a*b*c*d*(A*d*(3+m)-B*c*(5+m))+b^2*c^2*(A*d*(5+m)-B*c*(7+m))*(e*x)^(1+m)/c/d^4/e/(1+m)-1/2*b^2*(3*a*d*(A*d*(3+m)-B*c*(5+m))-b*c*(A*d*(5+m)-B*c*(7+m))*(e*x)^(3+m)/c/d^3/e^3/(3+m)-1/2*b^3*(A*d*(5+m)-B*c*(7+m))*(e*x)^(5+m)/c/d^2/e^5/(5+m)-1/2*(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^3/c/d/e/(d*x^2+c)+1/2*(-a*d+b*c)^2*(a*d*(A*d*(1-m)+B*c*(1+m))+b*c*(A*d*(5+m)-B*c*(7+m))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c^2/d^4/e/(1+m)
```

3.30.
$$\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^2} dx$$

3.30.2 Mathematica [A] (verified)

Time = 0.80 (sec) , antiderivative size = 212, normalized size of antiderivative = 0.62

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(\frac{b(3a^2Bd^2 + b^2c(3Bc - 2Ad) + 3abd(-2Bc + Ad))}{1+m} + \frac{b^2d(-2bBc + Abd + 3aBd)x^2}{3+m} + \frac{b^3Bd^2x^4}{5+m} - \frac{(bc-ad)^2(4bBc - 3Abd - aBd)}{c} \right)}{d^4}$$

```
input Integrate[((e*x)^m*(a + b*x^2)^3*(A + B*x^2))/(c + d*x^2)^2,x]
```

```
output (x*(e*x)^m*((b*(3*a^2*B*d^2 + b^2*c*(3*B*c - 2*A*d) + 3*a*b*d*(-2*B*c + A*d)))/(1 + m) + (b^2*d*(-2*b*B*c + A*b*d + 3*a*B*d)*x^2)/(3 + m) + (b^3*B*d^2*x^4)/(5 + m) - ((b*c - a*d)^2*(4*b*B*c - 3*A*b*d - a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*(1 + m)) + ((b*c - a*d)^3*(B*c - A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c^2*(1 + m))))/d^4
```

3.30.3 Rubi [A] (verified)

Time = 0.73 (sec) , antiderivative size = 333, normalized size of antiderivative = 0.98, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.129$, Rules used = {439, 25, 437, 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.

$$\int \frac{(a + bx^2)^3 (A + Bx^2) (ex)^m}{(c + dx^2)^2} dx$$

$$\downarrow 439$$

$$- \frac{\int \frac{(ex)^m (bx^2+a)^2 (a(Ad(1-m)+Bc(m+1))-b(Ad(m+5)-Bc(m+7))x^2)}{dx^2+c} dx}{2cd} - \frac{(a + bx^2)^3 (ex)^{m+1} (Bc - Ad)}{2cde (c + dx^2)}$$

$$\downarrow 25$$

$$\int \frac{(ex)^m (bx^2+a)^2 (a(Ad(1-m)+Bc(m+1))-b(Ad(m+5)-Bc(m+7))x^2)}{dx^2+c} dx}{2cd} - \frac{(a + bx^2)^3 (ex)^{m+1} (Bc - Ad)}{2cde (c + dx^2)}$$

$$\downarrow 437$$

3.30. $\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^2} dx$

$$\int \left(-\frac{b(b^2(Ad(m+5)-Bc(m+7))c^2-3abd(Ad(m+3)-Bc(m+5))c+3a^2d^2(Ad(m+1)-Bc(m+3)))(ex)^m}{d^3} + \frac{(-7b^3Bc^4-b^3Bmc^4+5Ab^3dc^3+15a^2d^2c^2)(ex)^{m+1}}{d^3e^{m+1}} \right)$$

$$\frac{(a + bx^2)^3 (ex)^{m+1} (Bc - Ad)}{2cde (c + dx^2)}$$

↓ 2009

$$\frac{b(ex)^{m+1}(3a^2d^2(Ad(m+1)-Bc(m+3))-3abcd(Ad(m+3)-Bc(m+5))+b^2c^2(Ad(m+5)-Bc(m+7)))}{d^3e^{m+1}} - \frac{b^2(ex)^{m+3}(3ad(Ad(m+3)-Bc(m+5))+b^2c^2(Ad(m+5)-Bc(m+7)))}{d^2e^3(m+1)}$$

$$\frac{(a + bx^2)^3 (ex)^{m+1} (Bc - Ad)}{2cde (c + dx^2)}$$

input `Int[((ex)^m*(a + b*x^2)^3*(A + B*x^2))/(c + d*x^2)^2,x]`

output `-1/2*((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^3)/(c*d*e*(c + d*x^2)) + (-((b*(3*a^2*d^2*(A*d*(1 + m) - B*c*(3 + m)) - 3*a*b*c*d*(A*d*(3 + m) - B*c*(5 + m)) + b^2*c^2*(A*d*(5 + m) - B*c*(7 + m)))*(e*x)^(1 + m))/(d^3*e*(1 + m)) - (b^2*(3*a*d*(A*d*(3 + m) - B*c*(5 + m)) - b*c*(A*d*(5 + m) - B*c*(7 + m)))*(e*x)^(3 + m))/(d^2*e^3*(3 + m)) - (b^3*(A*d*(5 + m) - B*c*(7 + m))*(e*x)^(5 + m))/(d*e^5*(5 + m)) + ((b*c - a*d)^2*(a*d*(A*d*(1 - m) + B*c*(1 + m)) + b*c*(A*d*(5 + m) - B*c*(7 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d^3*e*(1 + m)))/(2*c*d)`

3.30.3.1 Defintions of rubi rules used

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

rule 437 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

3.30. $\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^2} dx$

```
rule 439 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.
.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p
+ 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(
p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1
))*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && G
tQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])
```

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

3.30.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^3 (x^2B + A)}{(dx^2 + c)^2} dx$$

```
input int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^2,x)
```

```
output int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^2,x)
```

3.30.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{(dx^2 + c)^2} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="fricas")
```

```
output integral((B*b^3*x^8 + (3*B*a*b^2 + A*b^3)*x^6 + 3*(B*a^2*b + A*a*b^2)*x^4
+ A*a^3 + (B*a^3 + 3*A*a^2*b)*x^2)*(e*x)^m/(d^2*x^4 + 2*c*d*x^2 + c^2), x)
```


3.30.6 Sympy [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(ex)^m (A + Bx^2) (a + bx^2)^3}{(c + dx^2)^2} dx$$

input `integrate((e*x)**m*(b*x**2+a)**3*(B*x**2+A)/(d*x**2+c)**2,x)`

output `Integral((e*x)**m*(A + B*x**2)*(a + b*x**2)**3/(c + d*x**2)**2, x)`

3.30.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^3*(e*x)^m/(d*x^2 + c)^2, x)`

3.30.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^3*(e*x)^m/(d*x^2 + c)^2, x)`

3.30.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^3}{(dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^3)/(c + d*x^2)^2,x)`output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^3)/(c + d*x^2)^2, x)`

3.31
$$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{(c+dx^2)^2} dx$$

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3.31.1 Optimal result

Integrand size = 31, antiderivative size = 246

$$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{(c+dx^2)^2} dx$$

$$= -\frac{b(2ad(Ad(1+m) - Bc(3+m)) - bc(Ad(3+m) - Bc(5+m)))(ex)^{1+m}}{2cd^3e(1+m)}$$

$$- \frac{b^2(Ad(3+m) - Bc(5+m))(ex)^{3+m}}{2cd^2e^3(3+m)} - \frac{(Bc - Ad)(ex)^{1+m} (a+bx^2)^2}{2cde(c+dx^2)}$$

$$- \frac{(bc - ad)(ad(Ad(1-m) + Bc(1+m)) + bc(Ad(3+m) - Bc(5+m)))(ex)^{1+m} \text{Hypergeometric2F1} \left(\right)}{2c^2d^3e(1+m)}$$

output

```
-1/2*b*(2*a*d*(A*d*(1+m)-B*c*(3+m))-b*c*(A*d*(3+m)-B*c*(5+m)))*(e*x)^(1+m)
/c/d^3/e/(1+m)-1/2*b^2*(A*d*(3+m)-B*c*(5+m))*(e*x)^(3+m)/c/d^2/e^3/(3+m)-1
/2*(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^2/c/d/e/(d*x^2+c)-1/2*(-a*d+b*c)*(a*d*
(A*d*(1-m)+B*c*(1+m))+b*c*(A*d*(3+m)-B*c*(5+m)))*(e*x)^(1+m)*hypergeom([1,
1/2+1/2*m],[3/2+1/2*m],[-d*x^2/c)/c^2/d^3/e/(1+m)
```

3.31.
$$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{(c+dx^2)^2} dx$$

3.31.2 Mathematica [A] (verified)

Time = 0.65 (sec) , antiderivative size = 158, normalized size of antiderivative = 0.64

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(\frac{b(-2bBc + Abd + 2aBd)}{1+m} + \frac{b^2 B dx^2}{3+m} + \frac{(bc-ad)(3bBc - 2Abd - aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(1+m)} - \frac{(bc-ad)^2 (Bc - Ad)}{c^2} \right)}{d^3}$$

input `Integrate[((e*x)^m*(a + b*x^2)^2*(A + B*x^2))/(c + d*x^2)^2,x]`

output `(x*(e*x)^m*((b*(-2*b*B*c + A*b*d + 2*a*B*d))/(1 + m) + (b^2*B*d*x^2)/(3 + m) + ((b*c - a*d)*(3*b*B*c - 2*A*b*d - a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*(1 + m)) - ((b*c - a*d)^2*(B*c - A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c^2*(1 + m)))/d^3`

3.31.3 Rubi [A] (verified)

Time = 0.52 (sec) , antiderivative size = 245, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.129$, Rules used = {439, 25, 437, 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.

$$\int \frac{(a + bx^2)^2 (A + Bx^2) (ex)^m}{(c + dx^2)^2} dx$$

$$\downarrow 439$$

$$- \int \frac{(ex)^m (bx^2 + a) (a(Ad(1-m) + Bc(m+1)) - b(Ad(m+3) - Bc(m+5))x^2)}{2cd} dx - \frac{(a + bx^2)^2 (ex)^{m+1} (Bc - Ad)}{2cde (c + dx^2)}$$

$$\downarrow 25$$

$$\int \frac{(ex)^m (bx^2 + a) (a(Ad(1-m) + Bc(m+1)) - b(Ad(m+3) - Bc(m+5))x^2)}{2cd} dx - \frac{(a + bx^2)^2 (ex)^{m+1} (Bc - Ad)}{2cde (c + dx^2)}$$

$$\downarrow 437$$

3.31. $\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx$

$$\int \left(-\frac{b(2ad(Ad(m+1)-Bc(m+3))-bc(Ad(m+3)-Bc(m+5)))(ex)^m}{d^2} + \frac{(5b^2Bc^3+b^2Bmc^3-3Ab^2dc^2-6abBdc^2-Ab^2dmc^2-2abBdmc^2+2aAbd)}{d^2(dx^2+c)} \right) dx$$

$$\frac{(a+bx^2)^2(ex)^{m+1}(Bc-Ad)}{2cde(c+dx^2)}$$

↓ 2009

$$\frac{(ex)^{m+1}(bc-ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)(ad(Ad(1-m)+Bc(m+1))+bc(Ad(m+3)-Bc(m+5)))}{cd^2e(m+1)} - \frac{b(ex)^{m+1}(2ad(Ad(m+1)-Bc(m+3))-bc(Ad(m+3)-Bc(m+5)))}{cd^2}$$

$$\frac{(a+bx^2)^2(ex)^{m+1}(Bc-Ad)}{2cde(c+dx^2)}$$

```
input Int[((ex)^m*(a + b*x^2)^2*(A + B*x^2))/(c + d*x^2)^2,x]
```

```
output -1/2*((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^2)/(c*d*e*(c + d*x^2)) + (-((b*(2*a*d*(A*d*(1 + m) - B*c*(3 + m)) - b*c*(A*d*(3 + m) - B*c*(5 + m)))*(e*x)^(1 + m))/(d^2*e*(1 + m))) - (b^2*(A*d*(3 + m) - B*c*(5 + m))*(e*x)^(3 + m))/(d*e^3*(3 + m)) - ((b*c - a*d)*(a*d*(A*d*(1 - m) + B*c*(1 + m)) + b*c*(A*d*(3 + m) - B*c*(5 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d^2*e*(1 + m)))/(2*c*d)
```

3.31.3.1 Defintions of rubi rules used

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

```
rule 437 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^(m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]
```

3.31. $\int \frac{(ex)^m(a+bx^2)^2(A+Bx^2)}{(c+dx^2)^2} dx$

```
rule 439 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.
.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-b*e - a*f)*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*(c + d*x^2)^q/(2*a*b*g*(p + 1)), x] + Simp[1/(2*a*b*(p
+ 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(
p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1
))*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && G
tQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])
```

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

3.31.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^2 (x^2B + A)}{(dx^2 + c)^2} dx$$

```
input int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^2,x)
```

```
output int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^2,x)
```

3.31.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{(dx^2 + c)^2} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="fricas")
```

```
output integral((B*b^2*x^6 + (2*B*a*b + A*b^2)*x^4 + A*a^2 + (B*a^2 + 2*A*a*b)*x^
2)*(e*x)^m/(d^2*x^4 + 2*c*d*x^2 + c^2), x)
```

3.31.6 Sympy [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(ex)^m (A + Bx^2) (a + bx^2)^2}{(c + dx^2)^2} dx$$

input `integrate((e*x)**m*(b*x**2+a)**2*(B*x**2+A)/(d*x**2+c)**2,x)`

output `Integral((e*x)**m*(A + B*x**2)*(a + b*x**2)**2/(c + d*x**2)**2, x)`

3.31.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^2*(e*x)^m/(d*x^2 + c)^2, x)`

3.31.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^2*(e*x)^m/(d*x^2 + c)^2, x)`

3.31.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^2}{(dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^2)/(c + d*x^2)^2,x)`output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^2)/(c + d*x^2)^2, x)`

3.32
$$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{(c+dx^2)^2} dx$$

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3.32.1 Optimal result

Integrand size = 29, antiderivative size = 171

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^2} dx$$

$$= -\frac{B(ad(1+m) - bc(3+m))(ex)^{1+m}}{2cd^2e(1+m)} - \frac{(bc - ad)(ex)^{1+m}(A + Bx^2)}{2cde(c + dx^2)}$$

$$+ \frac{(ad(Ad(1 - m) + Bc(1 + m)) + bc(Ad(1 + m) - Bc(3 + m)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}\right)}{2c^2d^2e(1+m)}$$

output

```
-1/2*B*(a*d*(1+m)-b*c*(3+m))*(e*x)^(1+m)/c/d^2/e/(1+m)-1/2*(-a*d+b*c)*(e*x)^(1+m)*(B*x^2+A)/c/d/e/(d*x^2+c)+1/2*(a*d*(A*d*(1-m)+B*c*(1+m))+b*c*(A*d*(1+m)-B*c*(3+m))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c^2/d^2/e/(1+m)
```

3.32.2 Mathematica [A] (verified)

Time = 0.21 (sec) , antiderivative size = 108, normalized size of antiderivative = 0.63

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(bBc^2 + c(-2bBc + Abd + aBd) \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) + (bc - ad)(Bc - Ad) \right)}{c^2d^2(1+m)}$$

3.32.
$$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{(c+dx^2)^2} dx$$

input `Integrate[((e*x)^m*(a + b*x^2)*(A + B*x^2))/(c + d*x^2)^2,x]`

output `(x*(e*x)^m*(b*B*c^2 + c*(-2*b*B*c + A*b*d + a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] + (b*c - a*d)*(B*c - A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c^2*d^2*(1 + m))`

3.32.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 174, normalized size of antiderivative = 1.02, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.138$, Rules used = {439, 25, 363, 278}

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.

$$\begin{aligned}
 & \int \frac{(a + bx^2)(A + Bx^2)(ex)^m}{(c + dx^2)^2} dx \\
 & \quad \downarrow 439 \\
 & - \frac{\int \frac{(ex)^m (A(ad(1-m) + bc(m+1)) - B(ad(m+1) - bc(m+3))x^2)}{dx^2 + c} dx}{2cd} - \frac{(A + Bx^2)(ex)^{m+1}(bc - ad)}{2cde(c + dx^2)} \\
 & \quad \downarrow 25 \\
 & \frac{\int \frac{(ex)^m (A(ad(1-m) + bc(m+1)) - B(ad(m+1) - bc(m+3))x^2)}{dx^2 + c} dx}{2cd} - \frac{(A + Bx^2)(ex)^{m+1}(bc - ad)}{2cde(c + dx^2)} \\
 & \quad \downarrow 363 \\
 & \frac{(ad(Ad(1-m) + Bc(m+1)) + bc(Ad(m+1) - Bc(m+3))) \int \frac{(ex)^m}{dx^2 + c} dx}{d} - \frac{B(ex)^{m+1}(ad(m+1) - bc(m+3))}{de(m+1)} \\
 & \quad \frac{2cd}{(A + Bx^2)(ex)^{m+1}(bc - ad)} \\
 & \quad \frac{2cde(c + dx^2)}{\quad} \\
 & \quad \downarrow 278 \\
 & \frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right) (ad(Ad(1-m) + Bc(m+1)) + bc(Ad(m+1) - Bc(m+3)))}{cde(m+1)} - \frac{B(ex)^{m+1}(ad(m+1) - bc(m+3))}{de(m+1)} \\
 & \quad \frac{2cd}{(A + Bx^2)(ex)^{m+1}(bc - ad)} \\
 & \quad \frac{2cde(c + dx^2)}{\quad}
 \end{aligned}$$

3.32. $\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^2} dx$

input `Int[((e*x)^m*(a + b*x^2)*(A + B*x^2))/(c + d*x^2)^2,x]`

output `-1/2*((b*c - a*d)*(e*x)^(1 + m)*(A + B*x^2))/(c*d*e*(c + d*x^2)) + (-((B*(a*d*(1 + m) - b*c*(3 + m))*(e*x)^(1 + m))/(d*e*(1 + m))) + ((a*d*(A*d*(1 - m) + B*c*(1 + m)) + b*c*(A*d*(1 + m) - B*c*(3 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d*e*(1 + m)))/(2*c*d)`

3.32.3.1 Defintions of rubi rules used

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

rule 278 `Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 363 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d, 0] && NeQ[m + 2*p + 3, 0]`

rule 439 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

3.32.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)(x^2B + A)}{(dx^2 + c)^2} dx$$

input `int((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^2,x)`

output `int((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^2,x)`

3.32.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="fricas")`

output `integral((B*b*x^4 + (B*a + A*b)*x^2 + A*a)*(e*x)^m/(d^2*x^4 + 2*c*d*x^2 + c^2), x)`

3.32.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 29.82 (sec) , antiderivative size = 2069, normalized size of antiderivative = 12.10

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^2} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)*(B*x**2+A)/(d*x**2+c)**2,x)`

output

```

A*a*(-c***m**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2)) + 2*c*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2)) + c*e**m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2)) + 2*c*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2)) - d*e**m**2*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2)) + d*e**m*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2)) + A*b*(-c*e**m**2*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2)) - 4*c*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2)) + 2*c*e**m*x**(m + 3)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2)) - 3*c*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2)) + 6*c*e**m*x**(m + 3)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2)) - d*e**m**2*x**2*x**(m...

```

3.32.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)*(e*x)^m/(d*x^2 + c)^2, x)`

3.32.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)*(e*x)^m/(d*x^2 + c)^2, x)`

3.32.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)}{(dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2))/(c + d*x^2)^2,x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2))/(c + d*x^2)^2, x)`

3.33
$$\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^2} dx$$

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3.33.1 Optimal result

Integrand size = 22, antiderivative size = 103

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx$$

$$= -\frac{(Bc - Ad)(ex)^{1+m}}{2cde(c + dx^2)}$$

$$+ \frac{(Ad(1 - m) + Bc(1 + m))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{2c^2de(1 + m)}$$

output `-1/2*(-A*d+B*c)*(e*x)^(1+m)/c/d/e/(d*x^2+c)+1/2*(A*d*(1-m)+B*c*(1+m))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c^2/d/e/(1+m)`

3.33.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 81, normalized size of antiderivative = 0.79

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(Bc \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) + (-Bc + Ad) \text{Hypergeometric2F1}\left(2, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) \right)}{c^2d(1 + m)}$$

input `Integrate[((e*x)^m*(A + B*x^2))/(c + d*x^2)^2,x]`

output `(x*(e*x)^m*(B*c*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] + (-B*c) + A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c^2*d*(1 + m))`

3.33.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 103, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.091$, Rules used = {362, 278}

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.

$$\int \frac{(A + Bx^2)(ex)^m}{(c + dx^2)^2} dx$$

$$\downarrow \text{362}$$

$$\frac{(Ad(1 - m) + Bc(m + 1)) \int \frac{(ex)^m}{dx^2 + c} dx}{2cd} - \frac{(ex)^{m+1}(Bc - Ad)}{2cde(c + dx^2)}$$

$$\downarrow \text{278}$$

$$\frac{(ex)^{m+1}(Ad(1 - m) + Bc(m + 1)) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{2c^2de(m + 1)} - \frac{(ex)^{m+1}(Bc - Ad)}{2cde(c + dx^2)}$$

input `Int[((e*x)^m*(A + B*x^2))/(c + d*x^2)^2,x]`

output `-1/2*((B*c - A*d)*(e*x)^(1 + m))/(c*d*e*(c + d*x^2)) + ((A*d*(1 - m) + B*c*(1 + m))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(2*c^2*d*e*(1 + m))`

3.33.3.1 Defintions of rubi rules used

rule 278 `Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 362 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[(-b*c - a*d)*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(2*a*b*e*(p + 1))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(2*a*b*(p + 1)) Int[(e*x)^m*(a + b*x^2)^(p + 1), x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && LtQ[p, -1] && ((!IntegerQ[p + 1/2] && NeQ[p, -5/4]) || !RationalQ[m] || (ILtQ[p + 1/2, 0] && LeQ[-1, m, -2*(p + 1)]))`

3.33.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(dx^2 + c)^2} dx$$

input `int((e*x)^m*(B*x^2+A)/(d*x^2+c)^2,x)`

output `int((e*x)^m*(B*x^2+A)/(d*x^2+c)^2,x)`

3.33.5 Fracas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="fracas")`

output `integral((B*x^2 + A)*(e*x)^m/(d^2*x^4 + 2*c*d*x^2 + c^2), x)`

3.33.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 15.02 (sec) , antiderivative size = 954, normalized size of antiderivative = 9.26

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx = \text{Too large to display}$$

```
input integrate((e*x)**m*(B*x**2+A)/(d*x**2+c)**2,x)
```

```
output A*(-c***m**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)
)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2))
+ 2*c*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2))
+ c*e**m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2))
+ 2*c*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2))
- d*e**m*m**2*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2))
+ d*e**m*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(8*c**3*gamma(m/2 + 3/2) + 8*c**2*d*x**2*gamma(m/2 + 3/2))
+ B*(-c***m**2*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2))
- 4*c*e**m*m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2))
+ 2*c*e**m*m*x**(m + 3)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2))
- 3*c*e**m*x**(m + 3)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 3/2)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2))
+ 6*c*e**m*x**(m + 3)*gamma(m/2 + 3/2)/(8*c**3*gamma(m/2 + 5/2) + 8*c**2*d*x**2*gamma(m/2 + 5/2))
- d*e**m*m**2*x**2*x**(m + 3...
```

3.33.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^2} dx$$

```
input integrate((e*x)^m*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="maxima")
```

```
output integrate((B*x^2 + A)*(e*x)^m/(d*x^2 + c)^2, x)
```

3.33. $\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^2} dx$

3.33.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/(d*x^2 + c)^2, x)`

3.33.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m)/(c + d*x^2)^2,x)`

output `int(((A + B*x^2)*(e*x)^m)/(c + d*x^2)^2, x)`

$$3.34 \quad \int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)^2} dx$$

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3.34.1 Optimal result

Integrand size = 31, antiderivative size = 205

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx$$

$$= \frac{(Bc - Ad)(ex)^{1+m}}{2c(bc - ad)e(c + dx^2)} + \frac{b(Ab - aB)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a(bc - ad)^2 e(1+m)}$$

$$+ \frac{(bc(Bc(1-m) - Ad(3-m)) + ad(Ad(1-m) + Bc(1+m)))(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}\right)}{2c^2(bc - ad)^2 e(1+m)}$$

```
output 1/2*(-A*d+B*c)*(e*x)^(1+m)/c/(-a*d+b*c)/e/(d*x^2+c)+b*(A*b-B*a)*(e*x)^(1+m)
)*hypergeom([1, 1/2+1/2*m],[3/2+1/2*m],-b*x^2/a)/a/(-a*d+b*c)^2/e/(1+m)+1/
2*(b*c*(B*c*(1-m)-A*d*(3-m))+a*d*(A*d*(1-m)+B*c*(1+m)))*(e*x)^(1+m)*hyperg
eom([1, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c^2/(-a*d+b*c)^2/e/(1+m)
```

3.34.2 Mathematica [A] (verified)

Time = 0.34 (sec) , antiderivative size = 147, normalized size of antiderivative = 0.72

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(b(Ab - aB)c^2 \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right) + a(-Ab + aB)cd \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right) \right)}{ac^2(bc - ad)^2(1+m)}$$

3.34. $\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)^2} dx$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)*(c + d*x^2)^2),x]`

output `(x*(e*x)^m*(b*(A*b - a*B)*c^2*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)] + a*(-(A*b) + a*B)*c*d*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] + a*(b*c - a*d)*(B*c - A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(a*c^2*(b*c - a*d)^2*(1 + m))`

3.34.3 Rubi [A] (verified)

Time = 0.49 (sec) , antiderivative size = 222, normalized size of antiderivative = 1.08, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.097$, Rules used = {441, 446, 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.

$$\int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)(c + dx^2)^2} dx$$

↓ 441

$$\frac{\int \frac{(ex)^m (b(Bc - Ad)(1 - m)x^2 + 2Abc - aAd(1 - m) - aBc(m + 1))}{(bx^2 + a)(dx^2 + c)} dx}{2c(bc - ad)} + \frac{(ex)^{m+1}(Bc - Ad)}{2ce(c + dx^2)(bc - ad)}$$

↓ 446

$$\frac{\int \left(\frac{2b(Ab - aB)c(ex)^m}{(bc - ad)(bx^2 + a)} + \frac{(ad(Ad(1 - m) + Bc(m + 1)) - bc(Ad(3 - m) - B(c - cm)))(ex)^m}{(bc - ad)(dx^2 + c)} \right) dx}{2c(bc - ad)} + \frac{(ex)^{m+1}(Bc - Ad)}{2ce(c + dx^2)(bc - ad)}$$

↓ 2009

$$\frac{2bc(ex)^{m+1}(Ab - aB) \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{ae(m+1)(bc - ad)} + \frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)(ad(Ad(1 - m) + Bc(m + 1)))}{ce(m+1)(bc - ad)}}{2c(bc - ad)}$$

$$\frac{(ex)^{m+1}(Bc - Ad)}{2ce(c + dx^2)(bc - ad)}$$

input `Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)*(c + d*x^2)^2),x]`

```
output ((B*c - A*d)*(e*x)^(1 + m))/(2*c*(b*c - a*d)*e*(c + d*x^2)) + ((2*b*(A*b -
a*B)*c*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)
/a]])/(a*(b*c - a*d)*e*(1 + m)) + ((b*c*(B*c*(1 - m) - A*d*(3 - m)) + a*d*
(A*d*(1 - m) + B*c*(1 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2,
(3 + m)/2, -((d*x^2)/c)]/(c*(b*c - a*d)*e*(1 + m))/(2*c*(b*c - a*d))
```

3.34.3.1 Defintions of rubi rules used

```
rule 441 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_
)*(e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Si
mp[1/(a^2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2
)^q*Simp[c*(b*e - a*f)*(m + 1) + e^2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m
+ 2*(p + q + 2) + 1)*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q},
x] && LtQ[p, -1]
```

```
rule 446 Int[(((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((e_) + (f_.)*(x_)^2))/
(c_) + (d_.)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^
p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x
]
```

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

3.34.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)(dx^2 + c)^2} dx$$

```
input int((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^2,x)
```

```
output int((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^2,x)
```

3.34.5 Fracas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^2,x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b*d^2*x^6 + (2*b*c*d + a*d^2)*x^4 + a*c^2 + (b*c^2 + 2*a*c*d)*x^2), x)`

3.34.6 Sympy [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx = \int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)/(d*x**2+c)**2,x)`

output `Integral((e*x)**m*(A + B*x**2)/((a + b*x**2)*(c + d*x**2)**2), x)`

3.34.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)*(d*x^2 + c)^2), x)`

3.34.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)*(d*x^2 + c)^2), x)`

3.34.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)*(c + d*x^2)^2), x)`

output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)*(c + d*x^2)^2), x)`

3.35
$$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2 (c+dx^2)^2} dx$$

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3.35.1 Optimal result

Integrand size = 31, antiderivative size = 304

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx$$

$$= \frac{d(ABC - 2aBc + aAd)(ex)^{1+m}}{2ac(bc - ad)^2 e (c + dx^2)} + \frac{(Ab - aB)(ex)^{1+m}}{2a(bc - ad)e (a + bx^2) (c + dx^2)}$$

$$+ \frac{b(Ab(bc(1 - m) - ad(5 - m)) + aB(ad(3 - m) + bc(1 + m)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, \frac{-bx^2}{a}\right)}{2a^2(bc - ad)^3 e(1 + m)}$$

$$- \frac{d(bc(Bc(3 - m) - Ad(5 - m)) + ad(Ad(1 - m) + Bc(1 + m)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, \frac{-dx^2}{c}\right)}{2c^2(bc - ad)^3 e(1 + m)}$$

```
output 1/2*d*(A*a*d+A*b*c-2*B*a*c)*(e*x)^(1+m)/a/c/(-a*d+b*c)^2/e/(d*x^2+c)+1/2*(
A*b-B*a)*(e*x)^(1+m)/a/(-a*d+b*c)/e/(b*x^2+a)/(d*x^2+c)+1/2*b*(A*b*(b*c*(1
-m)-a*d*(5-m))+a*B*(a*d*(3-m)+b*c*(1+m)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/
2*m], [3/2+1/2*m], -b*x^2/a)/a^2/(-a*d+b*c)^3/e/(1+m)-1/2*d*(b*c*(B*c*(3-m)-
A*d*(5-m))+a*d*(A*d*(1-m)+B*c*(1+m)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m]
, [3/2+1/2*m], -d*x^2/c)/c^2/(-a*d+b*c)^3/e/(1+m)
```

3.35.2 Mathematica [A] (verified)

Time = 0.94 (sec) , antiderivative size = 207, normalized size of antiderivative = 0.68

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(-abc^2(bBc - 2Abd + aBd) \operatorname{Hypergeometric2F1} \left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a} \right) + a^2cd(bBc - 2Abd + aBd) \right)}{(a + bx^2)^2 (c + dx^2)^2}$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)^2*(c + d*x^2)^2), x]`

output `(x*(e*x)^m*(-(a*b*c^2*(b*B*c - 2*A*b*d + a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]) + a^2*c*d*(b*B*c - 2*A*b*d + a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] - (b*c - a*d)*(b*(A*b - a*B)*c^2*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)] + a^2*d*(-(B*c) + A*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(a^2*c^2*(-(b*c) + a*d)^3*(1 + m))`

3.35.3 Rubi [A] (verified)

Time = 0.74 (sec) , antiderivative size = 329, normalized size of antiderivative = 1.08, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.161$, Rules used = {441, 441, 27, 446, 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.

$$\int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)^2 (c + dx^2)^2} dx$$

$$\downarrow 441$$

$$\frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(-((Ab - aB)d(3 - m)x^2) + 2aAd - Abc(1 - m) - aBc(m + 1))}{(bx^2 + a)(dx^2 + c)^2} dx}{2a(bc - ad)}$$

$$\downarrow 441$$

$$\frac{\int \frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)(bc - ad)} dx}{\frac{(bx^2+a)(dx^2+c)}{2c(bc-ad)}} = \frac{d(ex)^{m+1}(aAd - 2aBc + Abc)}{ce(c+dx^2)(bc-ad)}$$

↓ 27

$$\frac{\int \frac{(ex)^m(-bd(ABC-2aBc+aAd)(1-m)x^2 + A(-b^2(1-m)c^2 + 4abdc - a^2d^2(1-m)) - aBc(bc+ad)(m+1))}{(bx^2+a)(dx^2+c)} dx}{c(bc-ad)} = \frac{d(ex)^{m+1}(aAd - 2aBc + Abc)}{ce(c+dx^2)(bc-ad)}$$

↓ 446

$$\frac{\int \left(\frac{bc(-Ab(bc(1-m) - ad(5-m)) - aB(ad(3-m) + bc(m+1)))}{(bc-ad)(bx^2+a)} (ex)^m + \frac{ad(bc(Bc(3-m) - Ad(5-m)) + ad(Ad(1-m) + Bc(m+1)))}{(bc-ad)(dx^2+c)} (ex)^m \right) dx}{c(bc-ad)} = \frac{d(ex)^{m+1}(aAd - 2aBc + Abc)}{ce(c+dx^2)(bc-ad)}$$

↓ 2009

$$\frac{ad(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right) (ad(Ad(1-m) + Bc(m+1)) + bc(Bc(3-m) - Ad(5-m)))}{ce(m+1)(bc-ad)} - \frac{bc(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{ae(m+1)(bc-ad)}}{c(bc-ad)} = \frac{2a(bc - ad)}{2a(bc - ad)}$$

input `Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)^2*(c + d*x^2)^2),x]`

output `((A*b - a*B)*(e*x)^(1 + m))/(2*a*(b*c - a*d)*e*(a + b*x^2)*(c + d*x^2) - ((d*(A*b*c - 2*a*B*c + a*A*d)*(e*x)^(1 + m))/(c*(b*c - a*d)*e*(c + d*x^2))) + ((b*c*(A*b*(b*c*(1 - m) - a*d*(5 - m)) + a*B*(a*d*(3 - m) + b*c*(1 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(b*c - a*d)*e*(1 + m))) + (a*d*(b*c*(B*c*(3 - m) - A*d*(5 - m)) + a*d*(A*d*(1 - m) + B*c*(1 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*(b*c - a*d)*e*(1 + m)))/(c*(b*c - a*d))/(2*a*(b*c - a*d))`

3.35. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^2(c+dx^2)^2} dx$

3.35.3.1 Defintions of rubi rules used

rule 27 `Int[(a_)*(F_x_), x_Symbol] := Simp[a Int[Fx, x], x] /; FreeQ[a, x] && !MatchQ[Fx, (b_)*(Gx_)] /; FreeQ[b, x]`

rule 441 `Int[((g_)*(x_)^(m_))*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a^2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]`

rule 446 `Int[(((g_)*(x_)^(m_))*((a_) + (b_)*(x_)^2)^(p_)*((e_) + (f_)*(x_)^2))/(c_ + (d_)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x]`

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

3.35.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)^2 (dx^2 + c)^2} dx$$

input `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^2,x)`

output `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^2,x)`

3.35.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^2,x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b^2*d^2*x^8 + 2*(b^2*c*d + a*b*d^2)*x^6 + (b^2*c^2 + 4*a*b*c*d + a^2*d^2)*x^4 + a^2*c^2 + 2*(a*b*c^2 + a^2*c*d)*x^2), x)`

3.35.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)**2/(d*x**2+c)**2,x)`

output `Timed out`

3.35.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^2*(d*x^2 + c)^2), x)`

3.35.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^2*(d*x^2 + c)^2), x)`

3.35.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m}{(bx^2 + a)^2 (dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^2*(c + d*x^2)^2),x)`

output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^2*(c + d*x^2)^2), x)`

3.36 $\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3 (c+dx^2)^2} dx$

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3.36.1 Optimal result

Integrand size = 31, antiderivative size = 491

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx$$

$$= -\frac{d(A(4a^2d^2 - b^2c^2(3 - m) + abcd(11 - m)) - aBc(ad(11 - m) + bc(1 + m)))(ex)^{1+m}}{8a^2c(bc - ad)^3e(c + dx^2)}$$

$$+ \frac{(Ab - aB)(ex)^{1+m}}{4a(bc - ad)e(a + bx^2)^2(c + dx^2)}$$

$$+ \frac{(Ab(bc(3 - m) - ad(9 - m)) + aB(ad(5 - m) + bc(1 + m)))(ex)^{1+m}}{8a^2(bc - ad)^2e(a + bx^2)(c + dx^2)}$$

$$+ \frac{b(aB(b^2c^2(1 - m^2) - 2abcd(5 + 4m - m^2) - a^2d^2(15 - 8m + m^2)) + Ab(a^2d^2(35 - 12m + m^2) - 2abcd(11 - m) - a^2d^2(15 - 8m + m^2)) - 2abcd(11 - m) - a^2d^2(15 - 8m + m^2))}{8a^3(bc - ad)^4e(1 + m)}$$

$$+ \frac{d^2(bc(Bc(5 - m) - Ad(7 - m)) + ad(Ad(1 - m) + Bc(1 + m)))(ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, \frac{d(a+bx^2)}{c+dx^2}\right)}{2c^2(bc - ad)^4e(1 + m)}$$

3.36. $\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3 (c+dx^2)^2} dx$

output
$$\begin{aligned} & -1/8*d*(A*(4*a^2*d^2-b^2*c^2*(3-m)+a*b*c*d*(11-m))-a*B*c*(a*d*(11-m)+b*c*(\\ & 1+m)))*(e*x)^(1+m)/a^2/c/(-a*d+b*c)^3/e/(d*x^2+c)+1/4*(A*b-B*a)*(e*x)^(1+m) \\ &)/a/(-a*d+b*c)/e/(b*x^2+a)^2/(d*x^2+c)+1/8*(A*b*(b*c*(3-m)-a*d*(9-m))+a*B* \\ & (a*d*(5-m)+b*c*(1+m)))*(e*x)^(1+m)/a^2/(-a*d+b*c)^2/e/(b*x^2+a)/(d*x^2+c)+ \\ & 1/8*b*(a*B*(b^2*c^2*(-m^2+1)-2*a*b*c*d*(-m^2+4*m+5)-a^2*d^2*(m^2-8*m+15))+ \\ & A*b*(a^2*d^2*(m^2-12*m+35)-2*a*b*c*d*(m^2-8*m+7)+b^2*c^2*(m^2-4*m+3)))*(e* \\ & x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^3/(-a*d+b*c)^4/e \\ & /(1+m)+1/2*d^2*(b*c*(B*c*(5-m)-A*d*(7-m))+a*d*(A*d*(1-m)+B*c*(1+m)))*(e*x) \\ & ^{(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c^2/(-a*d+b*c)^4/e/(\\ & 1+m)} \end{aligned}$$

3.36.2 Mathematica [A] (verified)

Time = 1.20 (sec) , antiderivative size = 265, normalized size of antiderivative = 0.54

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx$$

$$= \frac{x(ex)^m \left(-\frac{bd(2bBc-3Abd+aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a} + \frac{d^2(2bBc-3Abd+aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c} \right)}{1}$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)^3*(c + d*x^2)^2), x]`

output
$$\begin{aligned} & (x*(e*x)^m*(-((b*d*(2*b*B*c - 3*A*b*d + a*B*d)*Hypergeometric2F1[1, (1 + m) \\ &)/2, (3 + m)/2, -((b*x^2)/a)]/a) + (d^2*(2*b*B*c - 3*A*b*d + a*B*d)*Hyper \\ & geometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c + (b*(b*c - a*d)*(b \\ & *B*c - 2*A*b*d + a*B*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^ \\ & 2)/a)]/a^2 + (d^2*(b*c - a*d)*(B*c - A*d)*Hypergeometric2F1[2, (1 + m)/2, \\ & (3 + m)/2, -((d*x^2)/c)]/c^2 + (b*(A*b - a*B)*(b*c - a*d)^2*Hypergeometr \\ & ic2F1[3, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/a^3))/((b*c - a*d)^4*(1 + m) \\ &) \end{aligned}$$

3.36.3 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.

$$\begin{aligned}
 & \int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)^3(c + dx^2)^2} dx \\
 & \quad \downarrow 441 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(-((Ab - aB)d(5 - m)x^2) + 4aAd - Abc(3 - m) - aBc(m + 1))}{(bx^2 + a)^2(dx^2 + c)^2} dx}{4a(bc - ad)} \\
 & \quad \downarrow 441 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(-d(3 - m)(Ab(bc(3 - m) - ad(9 - m)) + aB(ad(5 - m) + bc(m + 1)))x^2 + aBc(m + 1)(ad(7 - m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} dx}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(d(3 - m)(Ab(bc(3 - m) - ad(9 - m)) + aB(ad(5 - m) + bc(m + 1)))x^2 + aBc(bc(1 - m) - ad(7 - m))(m + 1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} dx}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(-d(3 - m)(Ab(bc(3 - m) - ad(9 - m)) + aB(ad(5 - m) + bc(m + 1)))x^2 + aBc(m + 1)(ad(7 - m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} dx}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(d(3 - m)(Ab(bc(3 - m) - ad(9 - m)) + aB(ad(5 - m) + bc(m + 1)))x^2 + aBc(bc(1 - m) - ad(7 - m))(m + 1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} dx}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{\int \frac{(ex)^m(d(3 - m)(Ab(bc(3 - m) - ad(9 - m)) + aB(ad(5 - m) + bc(m + 1)))x^2 + aBc(bc(1 - m) - ad(7 - m))(m + 1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} dx}{2a(bc - ad)}}{4a(bc - ad)}
 \end{aligned}$$

$$3.36. \quad \int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)^2} dx$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$4a(bc - ad)$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$4a(bc - ad)$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$4a(bc - ad)$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$4a(bc - ad)$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$4a(bc - ad)$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$4a(bc - ad)$$

3.36. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)^2} dx$

$$\begin{aligned} & \downarrow 25 \\ & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ & \int - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ & \frac{4a(bc - ad)}{2a(bc - ad)} \end{aligned}$$

$$\begin{aligned} & \downarrow 25 \\ & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ & \int - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ & \frac{4a(bc - ad)}{2a(bc - ad)} \end{aligned}$$

$$\begin{aligned} & \downarrow 25 \\ & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ & \int - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ & \frac{4a(bc - ad)}{2a(bc - ad)} \end{aligned}$$

$$\begin{aligned} & \downarrow 25 \\ & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ & \int - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ & \frac{4a(bc - ad)}{2a(bc - ad)} \end{aligned}$$

$$\begin{aligned} & \downarrow 25 \\ & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ & \int - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ & \frac{4a(bc - ad)}{2a(bc - ad)} \end{aligned}$$

3.36. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)^2} dx$

$$\int \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\int \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\int \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\int \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\int \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\int \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

3.36. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)^2} dx$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ \int - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ \int - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ \int - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ \int - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \\ \int - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2} \\ \hline \hline 4a(bc - ad) \end{array}$$

\downarrow 25

3.36. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)^2} dx$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(7-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)(bc - ad)} - \frac{(ex)^m(-d(3-m)(Ab(bc(3-m) - ad(9-m)) + aB(ad(5-m) + bc(m+1)))x^2 + aBc(m+1)(ad(7-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 10m + 5)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^2}$$

```
input Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)^3*(c + d*x^2)^2), x]
```

```
output $Aborted
```

3.36.3.1 Defintions of rubi rules used

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

```
rule 441 Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g*2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a*2*(b*c - a*d)*(p + 1) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]
```

3.36. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)^2} dx$

3.36.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)^3 (dx^2 + c)^2} dx$$

input `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^2,x)`

output `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^2,x)`

3.36.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^2,x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b^3*d^2*x^10 + (2*b^3*c*d + 3*a*b^2*d^2)*x^8 + (b^3*c^2 + 6*a*b^2*c*d + 3*a^2*b*d^2)*x^6 + a^3*c^2 + (3*a*b^2*c^2 + 6*a^2*b*c*d + a^3*d^2)*x^4 + (3*a^2*b*c^2 + 2*a^3*c*d)*x^2), x)`

3.36.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)**3/(d*x**2+c)**2,x)`

output `Timed out`

3.36.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^3*(d*x^2 + c)^2), x)`

3.36.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^3*(d*x^2 + c)^2), x)`

3.36.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^3*(c + d*x^2)^2),x)`

output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^3*(c + d*x^2)^2), x)`

$$3.37 \quad \int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^3} dx$$

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3.37.1 Optimal result

Integrand size = 31, antiderivative size = 433

$$\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^3} dx =$$

$$\frac{b(2a^2d^2(1+m)(Ad(3-m)+Bc(1+m))+3abcd(3+m)(Ad(1+m)-Bc(5+m))-b^2c^2(5+m)(A+Bx^2)}{8c^2d^4e(1+m)}$$

$$\frac{b^2(ad(3+m)(Ad(3-m)+Bc(1+m))+bc(5+m)(Ad(3+m)-Bc(7+m)))(ex)^{3+m}}{8c^2d^3e^3(3+m)}$$

$$\frac{(Bc-Ad)(ex)^{1+m}(a+bx^2)^3}{4cde(c+dx^2)^2}$$

$$+\frac{(ad(Ad(3-m)+Bc(1+m))+bc(Ad(3+m)-Bc(7+m)))(ex)^{1+m}(a+bx^2)^2}{8c^2d^2e(c+dx^2)}$$

$$\frac{(bc-ad)(a^2d^2(1-m)(Ad(3-m)+Bc(1+m))+b^2c^2(5+m)(Ad(3+m)-Bc(7+m))+2abcd(A+Bx^2))}{8c^3d^4e(1+m)}$$

$$3.37. \quad \int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^3} dx$$

output
$$\begin{aligned} & -1/8*b*(2*a^2*d^2*(1+m)*(A*d*(3-m)+B*c*(1+m))+3*a*b*c*d*(3+m)*(A*d*(1+m)-B*c*(5+m))-b^2*c^2*(5+m)*(A*d*(3+m)-B*c*(7+m)))*(e*x)^(1+m)/c^2/d^4/e/(1+m) \\ & -1/8*b^2*(a*d*(3+m)*(A*d*(3-m)+B*c*(1+m))+b*c*(5+m)*(A*d*(3+m)-B*c*(7+m))) \\ & *(e*x)^(3+m)/c^2/d^3/e^3/(3+m)-1/4*(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^3/c/d/ \\ & e/(d*x^2+c)^2+1/8*(a*d*(A*d*(3-m)+B*c*(1+m))+b*c*(A*d*(3+m)-B*c*(7+m)))*(e \\ & *x)^(1+m)*(b*x^2+a)^2/c^2/d^2/e/(d*x^2+c)-1/8*(-a*d+b*c)*(a^2*d^2*(1-m)*(A \\ & *d*(3-m)+B*c*(1+m))+b^2*c^2*(5+m)*(A*d*(3+m)-B*c*(7+m))+2*a*b*c*d*(A*d*(-m \\ & ^2-2*m+3)+B*c*(m^2+6*m+5)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2* \\ & m], -d*x^2/c)/c^3/d^4/e/(1+m) \end{aligned}$$

3.37.2 Mathematica [A] (verified)

Time = 0.83 (sec) , antiderivative size = 222, normalized size of antiderivative = 0.51

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^3} dx$$

$$= \frac{x(ex)^m \left(\frac{b^2(-3bBc+Abd+3aBd)}{1+m} + \frac{b^3Bdx^2}{3+m} + \frac{3b(bc-ad)(2bBc-Abd-aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c(1+m)} - \frac{(bc-ad)^2(4b^2A-3b^2B)}{d^4} \right)}{d^4}$$

input `Integrate[((e*x)^m*(a + b*x^2)^3*(A + B*x^2))/(c + d*x^2)^3,x]`

output
$$\begin{aligned} & (x*(e*x)^m*((b^2*(-3*b*B*c + A*b*d + 3*a*B*d))/(1 + m) + (b^3*B*d*x^2)/(3 \\ & + m) + (3*b*(b*c - a*d)*(2*b*B*c - A*b*d - a*B*d)*\operatorname{Hypergeometric2F1}[1, (1 \\ & + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c*(1 + m)) - ((b*c - a*d)^2*(4*b*B*c - \\ & 3*A*b*d - a*B*d)*\operatorname{Hypergeometric2F1}[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]) \\ & / (c^2*(1 + m)) + ((b*c - a*d)^3*(B*c - A*d)*\operatorname{Hypergeometric2F1}[3, (1 + m)/2 \\ & , (3 + m)/2, -((d*x^2)/c)]/(c^3*(1 + m)))/d^4 \end{aligned}$$

3.37.3 Rubi [A] (verified)

Time = 1.05 (sec) , antiderivative size = 443, normalized size of antiderivative = 1.02, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.194$, Rules used = {439, 25, 439, 25, 437, 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.

3.37. $\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^3} dx$

$$\begin{aligned}
 & \int \frac{(a+bx^2)^3 (A+Bx^2) (ex)^m}{(c+dx^2)^3} dx \\
 & \quad \downarrow \text{439} \\
 & - \frac{\int - \frac{(ex)^m (bx^2+a)^2 (a(Ad(3-m)+Bc(m+1))-b(Ad(m+3)-Bc(m+7))x^2)}{(dx^2+c)^2} dx}{4cd} - \frac{(a+bx^2)^3 (ex)^{m+1} (Bc-Ad)}{4cde (c+dx^2)^2} \\
 & \quad \downarrow \text{25} \\
 & \frac{\int \frac{(ex)^m (bx^2+a)^2 (a(Ad(3-m)+Bc(m+1))-b(Ad(m+3)-Bc(m+7))x^2)}{(dx^2+c)^2} dx}{4cd} - \frac{(a+bx^2)^3 (ex)^{m+1} (Bc-Ad)}{4cde (c+dx^2)^2} \\
 & \quad \downarrow \text{439} \\
 & \frac{(a+bx^2)^2 (ex)^{m+1} (ad(Ad(3-m)+Bc(m+1))+bc(Ad(m+3)-Bc(m+7)))}{2cde(c+dx^2)} - \frac{\int - \frac{(ex)^m (bx^2+a) (a(ad(1-m)(Ad(3-m)+Bc(m+1))-bc(m+1)(Ad(m+3)-Bc(m+7)))x^2)}{2cd} dx}{4cd} \\
 & \quad \downarrow \text{25} \\
 & \frac{(a+bx^2)^3 (ex)^{m+1} (Bc-Ad)}{4cde (c+dx^2)^2} \\
 & \quad \downarrow \text{437} \\
 & \frac{\int \left(- \frac{b(-b^2(m+5)(Ad(m+3)-Bc(m+7))c^2+3abd(m+3)(Ad(m+1)-Bc(m+5))c+2a^2d^2(m+1)(Ad(3-m)+Bc(m+1))) (ex)^m}{d^2} + \frac{(b^3 Bm^2 c^4+35b^3 Bc^4+12b^3 Bmc^4)}{cd^2 e(m+1)} \right) dx}{4cd} \\
 & \quad \downarrow \text{2009} \\
 & \frac{(ex)^{m+1} (bc-ad) \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right) (a^2 d^2 (1-m)(Ad(3-m)+Bc(m+1))+2abcd(Ad(-m^2-2m+3)+Bc(m^2+6m+5))+b^2 c^2 (m+5)(Ad(m+3)-Bc(m+7)))}{cd^2 e(m+1)}}{4cde (c+dx^2)^2} \\
 & \quad \downarrow \\
 & \frac{(a+bx^2)^3 (ex)^{m+1} (Bc-Ad)}{4cde (c+dx^2)^2}
 \end{aligned}$$

3.37. $\int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^3} dx$

input `Int[((e*x)^m*(a + b*x^2)^3*(A + B*x^2))/(c + d*x^2)^3,x]`

output `-1/4*((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^3)/(c*d*e*(c + d*x^2)^2) + (((a*d*(A*d*(3 - m) + B*c*(1 + m)) + b*c*(A*d*(3 + m) - B*c*(7 + m)))*(e*x)^(1 + m)*(a + b*x^2)^2)/(2*c*d*e*(c + d*x^2)) + (-((b*(2*a^2*d^2*(1 + m)*(A*d*(3 - m) + B*c*(1 + m)) + 3*a*b*c*d*(3 + m)*(A*d*(1 + m) - B*c*(5 + m)) - b^2*c^2*(5 + m)*(A*d*(3 + m) - B*c*(7 + m)))*(e*x)^(1 + m))/(d^2*e*(1 + m))) - (b^2*(a*d*(3 + m)*(A*d*(3 - m) + B*c*(1 + m)) + b*c*(5 + m)*(A*d*(3 + m) - B*c*(7 + m)))*(e*x)^(3 + m))/(d*e^3*(3 + m)) - ((b*c - a*d)*(a^2*d^2*(1 - m)*(A*d*(3 - m) + B*c*(1 + m)) + b^2*c^2*(5 + m)*(A*d*(3 + m) - B*c*(7 + m)) + 2*a*b*c*d*(A*d*(3 - 2*m - m^2) + B*c*(5 + 6*m + m^2)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*d^2*e*(1 + m)))/(2*c*d))/(4*c*d)`

3.37.3.1 Defintions of rubi rules used

rule 25 `Int[-(F*x_), x_Symbol] := Simp[Identity[-1] Int[F*x, x], x]`

rule 437 `Int[((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Int[ExpandIntegrand[(g*x)^(m*(a + b*x^2)^p*(c + d*x^2)^q*(e + f*x^2)^r, x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && IGtQ[p, -2] && IGtQ[q, 0] && IGtQ[r, 0]`

rule 439 `Int[((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p + 1)) Int[(g*x)^(m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

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

$$3.37. \int \frac{(ex)^m (a+bx^2)^3 (A+Bx^2)}{(c+dx^2)^3} dx$$

3.37.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^3 (x^2 B + A)}{(dx^2 + c)^3} dx$$

input `int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^3,x)`

output `int((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^3,x)`

3.37.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="fricas")`

output `integral((B*b^3*x^8 + (3*B*a*b^2 + A*b^3)*x^6 + 3*(B*a^2*b + A*a*b^2)*x^4 + A*a^3 + (B*a^3 + 3*A*a^2*b)*x^2)*(e*x)^m/(d^3*x^6 + 3*c*d^2*x^4 + 3*c^2*d*x^2 + c^3), x)`

3.37.6 Sympy [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(ex)^m (A + Bx^2) (a + bx^2)^3}{(c + dx^2)^3} dx$$

input `integrate((e*x)**m*(b*x**2+a)**3*(B*x**2+A)/(d*x**2+c)**3,x)`

output `Integral((e*x)**m*(A + B*x**2)*(a + b*x**2)**3/(c + d*x**2)**3, x)`

3.37.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^3*(e*x)^m/(d*x^2 + c)^3, x)`

3.37.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^3 (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^3*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^3*(e*x)^m/(d*x^2 + c)^3, x)`

3.37.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^3 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^3}{(dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^3)/(c + d*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^3)/(c + d*x^2)^3, x)`

3.38
$$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{(c+dx^2)^3} dx$$

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3.38.1 Optimal result

Integrand size = 31, antiderivative size = 292

$$\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{(c+dx^2)^3} dx$$

$$= \frac{b(ad(1+m) - bc(3+m))(Ad(1+m) - Bc(5+m))(ex)^{1+m}}{8c^2d^3e(1+m)}$$

$$- \frac{(Bc - Ad)(ex)^{1+m} (a+bx^2)^2}{4cde(c+dx^2)^2}$$

$$- \frac{(bc - ad)(ex)^{1+m} (a(Ad(3-m) + Bc(1+m)) - b(Ad(1+m) - Bc(5+m))x^2)}{8c^2d^2e(c+dx^2)}$$

$$+ \frac{(ad(ad(1-m) + bc(1+m))(Ad(3-m) + Bc(1+m)) - bc(ad(1+m) - bc(3+m))(Ad(1+m) - Bc(5+m)))(ex)^{1+m}}{8c^3d^3e(1+m)}$$

output

```
1/8*b*(a*d*(1+m)-b*c*(3+m))*(A*d*(1+m)-B*c*(5+m))*(e*x)^(1+m)/c^2/d^3/e/(1+m)-1/4*(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^2/c/d/e/(d*x^2+c)^2-1/8*(-a*d+b*c)*(e*x)^(1+m)*(a*(A*d*(3-m)+B*c*(1+m))-b*(A*d*(1+m)-B*c*(5+m))*x^2)/c^2/d^2/e/(d*x^2+c)+1/8*(a*d*(a*d*(1-m)+b*c*(1+m))*(A*d*(3-m)+B*c*(1+m))-b*c*(a*d*(1+m)-b*c*(3+m))*(A*d*(1+m)-B*c*(5+m))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c^3/d^3/e/(1+m)
```

3.38.2 Mathematica [A] (verified)

Time = 0.76 (sec) , antiderivative size = 169, normalized size of antiderivative = 0.58

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx$$

$$= \frac{x(ex)^m \left(b^2 B - \frac{b(3bBc - Abd - 2aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c} + \frac{(bc-ad)(3bBc - 2Abd - aBd) \operatorname{Hypergeometric2F1}\left(2, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c^2} \right)}{d^3(1+m)}$$

input `Integrate[((e*x)^m*(a + b*x^2)^2*(A + B*x^2))/(c + d*x^2)^3,x]`

output `(x*(e*x)^m*(b^2*B - (b*(3*b*B*c - A*b*d - 2*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c + ((b*c - a*d)*(3*b*B*c - 2*A*b*d - a*B*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c^2 - ((b*c - a*d)^2*(B*c - A*d)*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c^3))/(d^3*(1 + m))`

3.38.3 Rubi [A] (verified)

Time = 0.51 (sec) , antiderivative size = 304, normalized size of antiderivative = 1.04, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.194$, Rules used = {439, 25, 439, 25, 363, 278}

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.

$$\int \frac{(a + bx^2)^2 (A + Bx^2) (ex)^m}{(c + dx^2)^3} dx$$

$$\downarrow 439$$

$$\frac{\int -\frac{(ex)^m (bx^2 + a) (a(Ad(3-m) + Bc(m+1)) - b(Ad(m+1) - Bc(m+5))x^2)}{(dx^2 + c)^2} dx}{4cd} - \frac{(a + bx^2)^2 (ex)^{m+1} (Bc - Ad)}{4cde (c + dx^2)^2}$$

$$\downarrow 25$$

$$\frac{\int \frac{(ex)^m (bx^2 + a) (a(Ad(3-m) + Bc(m+1)) - b(Ad(m+1) - Bc(m+5))x^2)}{(dx^2 + c)^2} dx}{4cd} - \frac{(a + bx^2)^2 (ex)^{m+1} (Bc - Ad)}{4cde (c + dx^2)^2}$$

$$\downarrow 439$$

3.38. $\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx$

$$\frac{\int -\frac{(ex)^m (b(ad(m+1)-bc(m+3))(Ad(m+1)-Bc(m+5))x^2+a(ad(1-m)+bc(m+1))(Ad(3-m)+Bc(m+1)))}{dx^2+c} dx}{2cd} - \frac{(ex)^{m+1}(bc-ad)(a(Ad(3-m)+Bc(m+1))}{2cde(c+dx^2)}}{4cd}$$

$$\frac{(a+bx^2)^2 (ex)^{m+1}(Bc-Ad)}{4cde(c+dx^2)^2}$$

↓ 25

$$\frac{\int \frac{(ex)^m (b(ad(m+1)-bc(m+3))(Ad(m+1)-Bc(m+5))x^2+a(ad(1-m)+bc(m+1))(Ad(3-m)+Bc(m+1)))}{dx^2+c} dx}{2cd} - \frac{(ex)^{m+1}(bc-ad)(a(Ad(3-m)+Bc(m+1))}{2cde(c+dx^2)}}{4cd}$$

$$\frac{(a+bx^2)^2 (ex)^{m+1}(Bc-Ad)}{4cde(c+dx^2)^2}$$

↓ 363

$$\frac{(a(ad(1-m)+bc(m+1))(Ad(3-m)+Bc(m+1))- \frac{bc(ad(m+1)-bc(m+3))(Ad(m+1)-Bc(m+5))}{d}) \int \frac{(ex)^m}{dx^2+c} dx + \frac{b(ex)^{m+1}(ad(m+1)-bc(m+3))(Ad(m+1)-Bc(m+5))}{de(m+1)}}{2cd}}{4cd}$$

$$\frac{(a+bx^2)^2 (ex)^{m+1}(Bc-Ad)}{4cde(c+dx^2)^2}$$

↓ 278

$$\frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right) \left(a(ad(1-m)+bc(m+1))(Ad(3-m)+Bc(m+1)) - \frac{bc(ad(m+1)-bc(m+3))(Ad(m+1)-Bc(m+5))}{d}\right) + b(ex)^{m+1}}{ce(m+1)}}{2cd}}{4cd}$$

$$\frac{(a+bx^2)^2 (ex)^{m+1}(Bc-Ad)}{4cde(c+dx^2)^2}$$

input `Int[((ex)^m*(a + b*x^2)^2*(A + B*x^2))/(c + d*x^2)^3,x]`

output `-1/4*((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^2)/(c*d*e*(c + d*x^2)^2) + (-1/2*((b*c - a*d)*(e*x)^(1 + m)*(a*(A*d*(3 - m) + B*c*(1 + m)) - b*(A*d*(1 + m) - B*c*(5 + m))*x^2))/(c*d*e*(c + d*x^2)) + ((b*(a*d*(1 + m) - b*c*(3 + m))*(A*d*(1 + m) - B*c*(5 + m))*(e*x)^(1 + m))/(d*e*(1 + m)) + ((a*(a*d*(1 - m) + b*c*(1 + m))*(A*d*(3 - m) + B*c*(1 + m)) - (b*c*(a*d*(1 + m) - b*c*(3 + m))*(A*d*(1 + m) - B*c*(5 + m)))/d)*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*e*(1 + m))/(2*c*d)/(4*c*d)`

3.38. $\int \frac{(ex)^m (a+bx^2)^2 (A+Bx^2)}{(c+dx^2)^3} dx$

3.38.3.1 Defintions of rubi rules used

- rule 25 `Int[-(Fx_), x_Symbol] := Simp[Identity[-1] Int[Fx, x], x]`
- rule 278 `Int[((c_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`
- rule 363 `Int[((e_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2), x_Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^(m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d, 0] && NeQ[m + 2*p + 3, 0]`
- rule 439 `Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-b*e - a*f)*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

3.38.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^2 (x^2 B + A)}{(dx^2 + c)^3} dx$$

input `int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^3,x)`

output `int((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^3,x)`

3.38.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="fricas")`

output `integral((B*b^2*x^6 + (2*B*a*b + A*b^2)*x^4 + A*a^2 + (B*a^2 + 2*A*a*b)*x^2)*(e*x)^m/(d^3*x^6 + 3*c*d^2*x^4 + 3*c^2*d*x^2 + c^3), x)`

3.38.6 Sympy [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(ex)^m (A + Bx^2) (a + bx^2)^2}{(c + dx^2)^3} dx$$

input `integrate((e*x)**m*(b*x**2+a)**2*(B*x**2+A)/(d*x**2+c)**3,x)`

output `Integral((e*x)**m*(A + B*x**2)*(a + b*x**2)**2/(c + d*x**2)**3, x)`

3.38.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^2*(e*x)^m/(d*x^2 + c)^3, x)`

3.38.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^2 (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^2*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^2*(e*x)^m/(d*x^2 + c)^3, x)`

3.38.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^2 (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^2}{(dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^2)/(c + d*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^2)/(c + d*x^2)^3, x)`

3.39
$$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{(c+dx^2)^3} dx$$

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3.39.1 Optimal result

Integrand size = 29, antiderivative size = 208

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{(c + dx^2)^3} dx = -\frac{(bc - ad)(ex)^{1+m} (A + Bx^2)}{4cde (c + dx^2)^2} + \frac{(bc(Ad(1 + m) - Bc(3 + m)) + ad(Ad(3 - m) - B(c - cm)))(ex)^{1+m}}{8c^2d^2e (c + dx^2)} + \frac{(ad(1 - m)(Ad(3 - m) + Bc(1 + m)) + bc(1 + m)(Ad(1 - m) + Bc(3 + m)))(ex)^{1+m}}{8c^3d^2e(1 + m)} \text{Hypergeometric}$$

output

```
-1/4*(-a*d+b*c)*(e*x)^(1+m)*(B*x^2+A)/c/d/e/(d*x^2+c)^2+1/8*(b*c*(A*d*(1+m)-B*c*(3+m))+a*d*(A*d*(3-m)-B*(-c*m+c))*(e*x)^(1+m)/c^2/d^2/e/(d*x^2+c)+1/8*(a*d*(1-m)*(A*d*(3-m)+B*c*(1+m))+b*c*(1+m)*(A*d*(1-m)+B*c*(3+m))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c^3/d^2/e/(1+m)
```

3.39.2 Mathematica [A] (verified)

Time = 0.43 (sec) , antiderivative size = 133, normalized size of antiderivative = 0.64

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{(c + dx^2)^3} dx = \frac{x(ex)^m \left(bBc^2 \text{Hypergeometric2F1} \left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c} \right) + c(-2bBc + Abd + aBd) \text{Hypergeometric2F1} \left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c} \right) \right)}{c^3d^2(1 + m)}$$

3.39.
$$\int \frac{(ex)^m (a+bx^2)(A+Bx^2)}{(c+dx^2)^3} dx$$

input `Integrate[((e*x)^m*(a + b*x^2)*(A + B*x^2))/(c + d*x^2)^3,x]`

output `(x*(e*x)^m*(b*B*c^2*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]) + c*(-2*b*B*c + A*b*d + a*B*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] + (b*c - a*d)*(B*c - A*d)*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)))/(c^3*d^2*(1 + m))`

3.39.3 Rubi [A] (verified)

Time = 0.40 (sec) , antiderivative size = 219, normalized size of antiderivative = 1.05, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.138$, Rules used = {439, 25, 362, 278}

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.

$$\begin{aligned}
 & \int \frac{(a + bx^2)(A + Bx^2)(ex)^m}{(c + dx^2)^3} dx \\
 & \quad \downarrow 439 \\
 & -\frac{\int -\frac{(ex)^m(B(ad(1-m)+bc(m+3))x^2 + A(ad(3-m)+bc(m+1)))}{(dx^2+c)^2} dx}{4cd} - \frac{(A + Bx^2)(ex)^{m+1}(bc - ad)}{4cde(c + dx^2)^2} \\
 & \quad \downarrow 25 \\
 & \frac{\int \frac{(ex)^m(B(ad(1-m)+bc(m+3))x^2 + A(ad(3-m)+bc(m+1)))}{(dx^2+c)^2} dx}{4cd} - \frac{(A + Bx^2)(ex)^{m+1}(bc - ad)}{4cde(c + dx^2)^2} \\
 & \quad \downarrow 362 \\
 & \frac{(ad(1-m)(Ad(3-m)+Bc(m+1))+bc(m+1)(Ad(1-m)+Bc(m+3))) \int \frac{(ex)^m}{dx^2+c} dx}{2cd} + \frac{(ex)^{m+1}(ad(Ad(3-m)-B(c-cm))+bc(Ad(m+1)-Bc(m+3)))}{2cde(c+dx^2)} \\
 & \quad \downarrow 278 \\
 & \frac{(A + Bx^2)(ex)^{m+1}(bc - ad)}{4cde(c + dx^2)^2}
 \end{aligned}$$

3.39. $\int \frac{(ex)^m(a+bx^2)(A+Bx^2)}{(c+dx^2)^3} dx$

$$\frac{(ex)^{m+1} \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right) (ad(1-m)(Ad(3-m)+Bc(m+1))+bc(m+1)(Ad(1-m)+Bc(m+3)))}{2c^2de(m+1)} + \frac{(ex)^{m+1} (ad(Ad(3-m)+Bc(m+1)))}{4cd} \\ \frac{(A+Bx^2)(ex)^{m+1}(bc-ad)}{4cde(c+dx^2)^2}$$

input `Int[((e*x)^m*(a + b*x^2)*(A + B*x^2))/(c + d*x^2)^3,x]`

output `-1/4*((b*c - a*d)*(e*x)^(1 + m)*(A + B*x^2))/(c*d*e*(c + d*x^2)^2) + (((b*c*(A*d*(1 + m) - B*c*(3 + m)) + a*d*(A*d*(3 - m) - B*(c - c*m)))*(e*x)^(1 + m))/(2*c*d*e*(c + d*x^2)) + ((a*d*(1 - m)*(A*d*(3 - m) + B*c*(1 + m)) + b*c*(1 + m)*(A*d*(1 - m) + B*c*(3 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(2*c^2*d*e*(1 + m)))/(4*c*d)`

3.39.3.1 Defintions of rubi rules used

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

rule 278 `Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 362 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[(-(b*c - a*d))*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(2*a*b*e*(p + 1))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(2*a*b*(p + 1)) Int[(e*x)^m*(a + b*x^2)^(p + 1), x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && LtQ[p, -1] && ((!IntegerQ[p + 1/2] && NeQ[p, -5/4]) || !RationalQ[m] || (ILtQ[p + 1/2, 0] && LeQ[-1, m, -2*(p + 1)]))`

rule 439 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(2*a*b*g*(p + 1))), x] + Simp[1/(2*a*b*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^(q - 1)*Simp[c*(2*b*e*(p + 1) + (b*e - a*f)*(m + 1)) + d*(2*b*e*(p + 1) + (b*e - a*f)*(m + 2*q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m}, x] && LtQ[p, -1] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[b*c - a*d, b*e - a*f])`

3.39. $\int \frac{(ex)^m(a+bx^2)(A+Bx^2)}{(c+dx^2)^3} dx$

3.39.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)(x^2B + A)}{(dx^2 + c)^3} dx$$

input `int((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^3,x)`

output `int((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^3,x)`

3.39.5 Fracas [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="fricas")`

output `integral((B*b*x^4 + (B*a + A*b)*x^2 + A*a)*(e*x)^m/(d^3*x^6 + 3*c*d^2*x^4 + 3*c^2*d*x^2 + c^3), x)`

3.39.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 94.11 (sec) , antiderivative size = 6411, normalized size of antiderivative = 30.82

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^3} dx = \text{Too large to display}$$

input `integrate((e*x)**m*(b*x**2+a)*(B*x**2+A)/(d*x**2+c)**3,x)`

output

```

A*a*(c**2*e**m*m**3*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 +
1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/
2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) - 3*c**2*e**m*m**2*x**(m +
1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c
**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4
*gamma(m/2 + 3/2)) - 2*c**2*e**m*m**2*x**(m + 1)*gamma(m/2 + 1/2)/(32*c**5
*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*ga
mma(m/2 + 3/2)) - c**2*e**m*m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c
, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**
2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) + 8*c**2*e**m*m*x
**(m + 1)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma
a(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) + 3*c**2*e**m*x**(m + 1
)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c*
**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*
gamma(m/2 + 3/2)) + 10*c**2*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(32*c**5*gamma
a(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m
/2 + 3/2)) + 2*c*d*e**m*m**3*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*p
i)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d
*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) - 6*c*d*e**m*
m**2*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*g...

```

3.39.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)(A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)*(e*x)^m/(d*x^2 + c)^3, x)`

3.39.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)(ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)*(e*x)^m/(d*x^2 + c)^3, x)`

3.39.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2) (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)}{(dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2))/(c + d*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2))/(c + d*x^2)^3, x)`

3.40 $\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^3} dx$

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3.40.1 Optimal result

Integrand size = 22, antiderivative size = 103

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx$$

$$= -\frac{(Bc - Ad)(ex)^{1+m}}{4cde (c + dx^2)^2}$$

$$+ \frac{(Ad(3 - m) + Bc(1 + m))(ex)^{1+m} \text{Hypergeometric2F1}\left(2, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{4c^3de(1 + m)}$$

output `-1/4*(-A*d+B*c)*(e*x)^(1+m)/c/d/e/(d*x^2+c)^2+1/4*(A*d*(3-m)+B*c*(1+m))*(e*x)^(1+m)*hypergeom([2, 1/2+1/2*m],[3/2+1/2*m],-d*x^2/c)/c^3/d/e/(1+m)`

3.40.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 81, normalized size of antiderivative = 0.79

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx$$

$$= \frac{x(ex)^m \left(Bc \text{Hypergeometric2F1}\left(2, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) + (-Bc + Ad) \text{Hypergeometric2F1}\left(3, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right) \right)}{c^3d(1 + m)}$$

3.40. $\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^3} dx$

input `Integrate[((e*x)^m*(A + B*x^2))/(c + d*x^2)^3,x]`

output `(x*(e*x)^m*(B*c*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)] + (-B*c) + A*d)*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/(c^3*d*(1 + m))`

3.40.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 103, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.091$, Rules used = {362, 278}

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.

$$\int \frac{(A + Bx^2)(ex)^m}{(c + dx^2)^3} dx$$

$$\downarrow \text{362}$$

$$\frac{(Ad(3 - m) + Bc(m + 1)) \int \frac{(ex)^m}{(dx^2 + c)^2} dx}{4cd} - \frac{(ex)^{m+1}(Bc - Ad)}{4cde(c + dx^2)^2}$$

$$\downarrow \text{278}$$

$$\frac{(ex)^{m+1}(Ad(3 - m) + Bc(m + 1)) \text{Hypergeometric2F1}\left(2, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right)}{4c^3de(m + 1)} - \frac{(ex)^{m+1}(Bc - Ad)}{4cde(c + dx^2)^2}$$

input `Int[((e*x)^m*(A + B*x^2))/(c + d*x^2)^3,x]`

output `-1/4*((B*c - A*d)*(e*x)^(1 + m))/(c*d*e*(c + d*x^2)^2) + ((A*d*(3 - m) + B*c*(1 + m))*(e*x)^(1 + m)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(4*c^3*d*e*(1 + m))`

3.40.3.1 Defintions of rubi rules used

rule 278 `Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`

rule 362 `Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x_Symbol] := Simp[(-b*c - a*d)*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(2*a*b*e*(p + 1))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(2*a*b*(p + 1)) Int[(e*x)^m*(a + b*x^2)^(p + 1), x], x] /; FreeQ[{a, b, c, d, e, m}, x] && NeQ[b*c - a*d, 0] && LtQ[p, -1] && ((!IntegerQ[p + 1/2] && NeQ[p, -5/4]) || !RationalQ[m] || (ILtQ[p + 1/2, 0] && LeQ[-1, m, -2*(p + 1)]))`

3.40.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(dx^2 + c)^3} dx$$

input `int((e*x)^m*(B*x^2+A)/(d*x^2+c)^3,x)`

output `int((e*x)^m*(B*x^2+A)/(d*x^2+c)^3,x)`

3.40.5 Fracas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="fracas")`

output `integral((B*x^2 + A)*(e*x)^m/(d^3*x^6 + 3*c*d^2*x^4 + 3*c^2*d*x^2 + c^3), x)`

3.40.6 Sympy [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 52.50 (sec) , antiderivative size = 3199, normalized size of antiderivative = 31.06

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx = \text{Too large to display}$$

```
input integrate((e*x)**m*(B*x**2+A)/(d*x**2+c)**3,x)
```

```
output A*(c**2*e**m*m**3*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) - 3*c**2*e**m*m**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) - 2*c**2*e**m*m**2*x**(m + 1)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) - c**2*e**m*m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) + 8*c**2*e**m*m*x**(m + 1)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) + 3*c**2*e**m*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) + 10*c**2*e**m*x**(m + 1)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) + 2*c*d*e**m*m**3*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gamma(m/2 + 1/2)/(32*c**5*gamma(m/2 + 3/2) + 64*c**4*d*x**2*gamma(m/2 + 3/2) + 32*c**3*d**2*x**4*gamma(m/2 + 3/2)) - 6*c*d*e**m*m**2*x**2*x**(m + 1)*lerchphi(d*x**2*exp_polar(I*pi)/c, 1, m/2 + 1/2)*gam...
```

3.40.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^3} dx$$

```
input integrate((e*x)^m*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="maxima")
```

```
output integrate((B*x^2 + A)*(e*x)^m/(d*x^2 + c)^3, x)
```

3.40. $\int \frac{(ex)^m (A+Bx^2)}{(c+dx^2)^3} dx$

3.40.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/(d*x^2 + c)^3, x)`

3.40.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m)/(c + d*x^2)^3,x)`

output `int(((A + B*x^2)*(e*x)^m)/(c + d*x^2)^3, x)`

3.41 $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)(c+dx^2)^3} dx$

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3.41.1 Optimal result

Integrand size = 31, antiderivative size = 333

$$\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)(c+dx^2)^3} dx = \frac{(Bc-Ad)(ex)^{1+m}}{4c(bc-ad)e(c+dx^2)^2} + \frac{(bc(Bc(3-m)-Ad(7-m))+ad(Ad(3-m)+Bc(1+m)))(ex)^{1+m}}{8c^2(bc-ad)^2e(c+dx^2)} + \frac{b^2(Ab-aB)(ex)^{1+m} \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a(bc-ad)^3e(1+m)} + \frac{(b^2c^2(Bc(1-m)-Ad(5-m))(3-m)-a^2d^2(1-m)(Ad(3-m)+Bc(1+m))+2abcd(Bc(3+2m))}{8c^3(bc-ad)^3e(1+m)}$$

```
output 1/4*(-A*d+B*c)*(e*x)^(1+m)/c/(-a*d+b*c)/e/(d*x^2+c)^2+1/8*(b*c*(B*c*(3-m)-
A*d*(7-m))+a*d*(A*d*(3-m)+B*c*(1+m)))*(e*x)^(1+m)/c^2/(-a*d+b*c)^2/e/(d*x^
2+c)+b^2*(A*b-B*a)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2
/a)/a/(-a*d+b*c)^3/e/(1+m)+1/8*(b^2*c^2*(B*c*(1-m)-A*d*(5-m))*(3-m)-a^2*d^
2*(1-m)*(A*d*(3-m)+B*c*(1+m))+2*a*b*c*d*(B*c*(-m^2+2*m+3)+A*d*(m^2-6*m+5))
)*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c^3/(-a*d+b*c
)^3/e/(1+m)
```

3.41. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)(c+dx^2)^3} dx$

3.41.2 Mathematica [A] (verified)

Time = 0.87 (sec) , antiderivative size = 197, normalized size of antiderivative = 0.59

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx$$

$$= \frac{x(ex)^m \left(\frac{b^2(Ab - aB) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a} - \frac{b(Ab - aB)d \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c} - \frac{(Ab - aB)d(bc - ad)}{(bc - ad)^3(1+m)} \right)}{(bc - ad)^3(1+m)}$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)*(c + d*x^2)^3),x]`

output `(x*(e*x)^m*((b^2*(A*b - a*B)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/a - (b*(A*b - a*B)*d*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c - ((A*b - a*B)*d*(b*c - a*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c^2 + ((b*c - a*d)^2*(B*c - A*d)*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/c^3))/(b*c - a*d)^3*(1 + m))`

3.41.3 Rubi [A] (verified)

Time = 0.78 (sec) , antiderivative size = 370, normalized size of antiderivative = 1.11, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.129$, Rules used = {441, 441, 446, 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.

$$\int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)(c + dx^2)^3} dx$$

$$\downarrow 441$$

$$\int \frac{(ex)^m (b(Bc - Ad)(3 - m)x^2 + 4Abc - aAd(3 - m) - aBc(m + 1))}{4c(bc - ad)(bx^2 + a)(dx^2 + c)^2} dx + \frac{(ex)^{m+1}(Bc - Ad)}{4ce(c + dx^2)^2(bc - ad)}$$

$$\downarrow 441$$

3.41. $\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx$

$$\int \frac{(ex)^m (b(1-m)(bc(Bc(3-m) - Ad(7-m)) + ad(Ad(3-m) + Bc(m+1)))x^2 + aBc(ad(1-m) - bc(5-m))(m+1) + A(8b^2c^2 - abd(m^2 - 8m + 7)c + a^2d^2(m^2 - 4m + 3)))}{(bx^2 + a)(dx^2 + c)} dx$$

$$\frac{(ex)^{m+1}(Bc - Ad)}{4ce(c + dx^2)^2(bc - ad)} \quad 4c(bc - ad)$$

↓ 446

$$\int \left(\frac{8b^2(Ab - aB)c^2(ex)^m}{(bc - ad)(bx^2 + a)} + \frac{(b^2(Bc(1-m) - Ad(5-m))(3-m)c^2 + 2abd(Bc(-m^2 + 2m + 3) + Ad(m^2 - 6m + 5))c - a^2d^2(1-m)(Ad(3-m) + Bc(m+1)))(ex)^m}{(bc - ad)(dx^2 + c)} \right) dx$$

$$\frac{(ex)^{m+1}(Bc - Ad)}{4ce(c + dx^2)^2(bc - ad)} \quad 4c(bc - ad)$$

↓ 2009

$$\frac{(ex)^{m+1} \text{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{dx^2}{c}\right) (-a^2d^2(1-m)(Ad(3-m) + Bc(m+1)) + 2abcd(Ad(m^2 - 6m + 5) + Bc(-m^2 + 2m + 3)) + b^2c^2(3-m)(Bc(1-m) - Ad(5-m)))}{ce(m+1)(bc - ad)} dx$$

$$\frac{(ex)^{m+1}(Bc - Ad)}{4ce(c + dx^2)^2(bc - ad)} \quad 4c(bc - ad)$$

input `Int[((ex)^m*(A + B*x^2))/((a + b*x^2)*(c + d*x^2)^3),x]`

output `((B*c - A*d)*(e*x)^(1 + m))/(4*c*(b*c - a*d)*e*(c + d*x^2)^2 + (((b*c*(B*c*(3 - m) - A*d*(7 - m)) + a*d*(A*d*(3 - m) + B*c*(1 + m)))*(e*x)^(1 + m))/(2*c*(b*c - a*d)*e*(c + d*x^2)) + ((8*b^2*(A*b - a*B)*c^2*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)]/(a*(b*c - a*d)*e*(1 + m)) + ((b^2*c^2*(B*c*(1 - m) - A*d*(5 - m))*(3 - m) - a^2*d^2*(1 - m)*(A*d*(3 - m) + B*c*(1 + m)) + 2*a*b*c*d*(B*c*(3 + 2*m - m^2) + A*d*(5 - 6*m + m^2)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)]/(c*(b*c - a*d)*e*(1 + m)))/(2*c*(b*c - a*d))/(4*c*(b*c - a*d))`

3.41. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)(c+dx^2)^3} dx$

3.41.3.1 Defintions of rubi rules used

```
rule 441 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_
)*(e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Si
mp[1/(a^2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2
)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m
+ 2*(p + q + 2) + 1)*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q},
x] && LtQ[p, -1]
```

```
rule 446 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((e_) + (f_.)*(x_)^2))/
(c_) + (d_.)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^
p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x
]
```

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

3.41.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)(dx^2 + c)^3} dx$$

```
input int((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^3,x)
```

```
output int((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^3,x)
```

3.41.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^3} dx$$

```
input integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^3,x, algorithm="fricas")
```

```
output integral((B*x^2 + A)*(e*x)^m/(b*d^3*x^8 + (3*b*c*d^2 + a*d^3)*x^6 + 3*(b*c
^2*d + a*c*d^2)*x^4 + a*c^3 + (b*c^3 + 3*a*c^2*d)*x^2), x)
```

3.41. $\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)(c+dx^2)^3} dx$

3.41.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)/(d*x**2+c)**3,x)`output `Timed out`**3.41.7 Maxima [F]**

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^3,x, algorithm="maxima")`output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)*(d*x^2 + c)^3), x)`**3.41.8 Giac [F]**

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)/(d*x^2+c)^3,x, algorithm="giac")`output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)*(d*x^2 + c)^3), x)`

3.41.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)(dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)*(c + d*x^2)^3), x)`output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)*(c + d*x^2)^3), x)`

$$3.42 \quad \int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2 (c+dx^2)^3} dx$$

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3.42.8	Giac [F]	314
3.42.9	Mupad [F(-1)]	315

3.42.1 Optimal result

Integrand size = 31, antiderivative size = 452

$$\begin{aligned} & \int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx \\ &= \frac{d(2Abc - 3aBc + aAd)(ex)^{1+m}}{4ac(bc - ad)^2 e (c + dx^2)^2} + \frac{(Ab - aB)(ex)^{1+m}}{2a(bc - ad)e (a + bx^2) (c + dx^2)^2} \\ &+ \frac{d(A(4b^2c^2 - a^2d^2(3 - m) + abcd(11 - m)) - aBc(bc(11 - m) + ad(1 + m))) (ex)^{1+m}}{8ac^2(bc - ad)^3 e (c + dx^2)} \\ &+ \frac{b^2(Ab(bc(1 - m) - ad(7 - m)) + aB(ad(5 - m) + bc(1 + m))) (ex)^{1+m} \text{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, \frac{b^2c^2}{c^2}\right)}{2a^2(bc - ad)^4 e (1 + m)} \\ &- \frac{d(b^2c^2(Bc(3 - m) - Ad(7 - m))(5 - m) - a^2d^2(1 - m)(Ad(3 - m) + Bc(1 + m)) + 2abcd(Bc(5 + 4m) - Ad(5 + 4m))) (ex)^{1+m}}{8c^3(bc - ad)^4 e (1 + m)} \end{aligned}$$

```
output 1/4*d*(A*a*d+2*A*b*c-3*B*a*c)*(e*x)^(1+m)/a/c/(-a*d+b*c)^2/e/(d*x^2+c)^2+1/2*(A*b-B*a)*(e*x)^(1+m)/a/(-a*d+b*c)/e/(b*x^2+a)/(d*x^2+c)^2+1/8*d*(A*(4*b^2*c^2-a^2*d^2*(3-m)+a*b*c*d*(11-m))-a*B*c*(b*c*(11-m)+a*d*(1+m)))*(e*x)^(1+m)/a/c^2/(-a*d+b*c)^3/e/(d*x^2+c)+1/2*b^2*(A*b*(b*c*(1-m)-a*d*(7-m))+a*B*(a*d*(5-m)+b*c*(1+m)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^2/(-a*d+b*c)^4/e/(1+m)-1/8*d*(b^2*c^2*(B*c*(3-m)-A*d*(7-m))*(5-m)-a^2*d^2*(1-m)*(A*d*(3-m)+B*c*(1+m))+2*a*b*c*d*(B*c*(-m^2+4*m+5)+A*d*(m^2-8*m+7)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c^3/(-a*d+b*c)^4/e/(1+m)
```

$$3.42. \quad \int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^2 (c+dx^2)^3} dx$$

3.42.2 Mathematica [A] (verified)

Time = 1.24 (sec) , antiderivative size = 266, normalized size of antiderivative = 0.59

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx$$

$$= \frac{x(ex)^m \left(\frac{b^2(bBc - 3Abd + 2aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a} - \frac{bd(bBc - 3Abd + 2aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c} \right)}{1}$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)^2*(c + d*x^2)^3),x]`

output `(x*(e*x)^m*((b^2*(b*B*c - 3*A*b*d + 2*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/a - (b*d*(b*B*c - 3*A*b*d + 2*a*B*d)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c + (b^2*(-(A*b) + a*B)*(-(b*c) + a*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/a^2 - (d*(b*c - a*d)*(b*B*c - 2*A*b*d + a*B*d)*Hypergeometric2F1[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c^2 + (d*(b*c - a*d)^2*(-(B*c) + A*d)*Hypergeometric2F1[3, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c^3)/(b*c - a*d)^4*(1 + m))`

3.42.3 Rubi [A] (verified)

Time = 1.19 (sec) , antiderivative size = 500, normalized size of antiderivative = 1.11, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.226$, Rules used = {441, 441, 27, 441, 25, 446, 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.

$$\int \frac{(A + Bx^2) (ex)^m}{(a + bx^2)^2 (c + dx^2)^3} dx$$

$$\downarrow 441$$

$$\frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \frac{\int \frac{(ex)^m(-((Ab - aB)d(5 - m)x^2) + 2aAd - Abc(1 - m) - aBc(m + 1))}{(bx^2 + a)(dx^2 + c)^3} dx}{2a(bc - ad)}$$

$$\downarrow 441$$

3.42. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^2(c+dx^2)^3} dx$

$$\begin{aligned}
 & \frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \int \frac{2(ex)^m(-bd(2Abc - 3aBc + aAd)(3-m)x^2 + A(-2b^2(1-m)c^2 + 8abdc - a^2d^2(3-m)) - aBc(2bc + ad)(m+1))}{(bx^2 + a)(dx^2 + c)^2} dx \\
 & \frac{d(ex)^{m+1}(aAd - 3aBc + 2Abc)}{2ce(c + dx^2)^2(bc - ad)} \\
 & \frac{2a(bc - ad)}{4c(bc - ad)} \\
 & \quad \downarrow 27 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \int \frac{(ex)^m(-bd(2Abc - 3aBc + aAd)(3-m)x^2 + A(-2b^2(1-m)c^2 + 8abdc - a^2d^2(3-m)) - aBc(2bc + ad)(m+1))}{(bx^2 + a)(dx^2 + c)^2} dx \\
 & \frac{d(ex)^{m+1}(aAd - 3aBc + 2Abc)}{2ce(c + dx^2)^2(bc - ad)} \\
 & \frac{2a(bc - ad)}{2c(bc - ad)} \\
 & \quad \downarrow 441 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \int \frac{(ex)^m(bd(1-m)(A(4b^2c^2 + abd(11-m)c - a^2d^2(3-m)) - aBc(bc(11-m) + ad(m+1)))x^2 + aBc(4b^2c^2 + abd(9-m)c - a^2d^2(1-m))(m+1) - A(-4b^3(1-m)c^3 + 24abd^2(1-m)c^2 - 4b^2d^3(1-m)c + ad^4(1-m)))}{(bx^2 + a)(dx^2 + c)} dx \\
 & \frac{2c(bc - ad)}{2c(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \int \frac{(ex)^m(bd(1-m)(A(4b^2c^2 + abd(11-m)c - a^2d^2(3-m)) - aBc(bc(11-m) + ad(m+1)))x^2 + aBc(4b^2c^2 + abd(9-m)c - a^2d^2(1-m))(m+1) - A(-4b^3(1-m)c^3 + 24abd^2(1-m)c^2 - 4b^2d^3(1-m)c + ad^4(1-m)))}{(bx^2 + a)(dx^2 + c)} dx \\
 & \frac{2c(bc - ad)}{2c(bc - ad)} \\
 & \quad \downarrow 446 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \int \left(\frac{4b^2e^2(Ab(bc(1-m) - ad(7-m)) + aB(ad(5-m) + bc(m+1)))}{(bc - ad)(bx^2 + a)} + \frac{ad(-b^2(Bc(3-m) - Ad(7-m))(5-m)c^2 - 2abd(Bc(-m^2 + 4m + 5) + Ad(m^2 - 8m + 7))c + a^2d^2)}{(bc - ad)(dx^2 + c)} \right) dx \\
 & \frac{2c(bc - ad)}{2c(bc - ad)} \\
 & \quad \downarrow 2009
 \end{aligned}$$

3.42. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^2(c+dx^2)^3} dx$

$$\frac{(ex)^{m+1}(Ab - aB)}{2ae(a + bx^2)(c + dx^2)^2(bc - ad)} - \frac{4b^2c^2(ex)^{m+1} \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}, -\frac{bx^2}{a}\right)(Ab(bc(1-m) - ad(7-m)) + aB(ad(5-m) + bc(m+1)))}{ae(m+1)(bc - ad)} - \frac{ad(ex)^{m+1} \operatorname{Hypergeometric2F1}\left(1, \frac{m+1}{2}, \frac{m+3}{2}\right)}{2c(bc - ad)}$$

input `Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)^2*(c + d*x^2)^3),x]`

output `((A*b - a*B)*(e*x)^(1 + m))/(2*a*(b*c - a*d)*e*(a + b*x^2)*(c + d*x^2)^2 - (-1/2*(d*(2*A*b*c - 3*a*B*c + a*A*d)*(e*x)^(1 + m))/(c*(b*c - a*d)*e*(c + d*x^2)^2) + (-1/2*(d*(A*(4*b^2*c^2 - a^2*d^2*(3 - m) + a*b*c*d*(11 - m) - a*B*c*(b*c*(11 - m) + a*d*(1 + m)))*(e*x)^(1 + m))/(c*(b*c - a*d)*e*(c + d*x^2)) - ((4*b^2*c^2*(A*b*(b*c*(1 - m) - a*d*(7 - m)) + a*B*(a*d*(5 - m) + b*c*(1 + m)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(b*x^2)/a])/(a*(b*c - a*d)*e*(1 + m)) - (a*d*(b^2*c^2*(B*c*(3 - m) - A*d*(7 - m))*(5 - m) - a^2*d^2*(1 - m)*(A*d*(3 - m) + B*c*(1 + m)) + 2*a*b*c*d*(B*c*(5 + 4*m - m^2) + A*d*(7 - 8*m + m^2)))*(e*x)^(1 + m)*Hypergeometric2F1[1, (1 + m)/2, (3 + m)/2, -(d*x^2)/c])/(c*(b*c - a*d)*e*(1 + m)))/(2*c*(b*c - a*d))/(2*c*(b*c - a*d))/(2*a*(b*c - a*d))`

3.42.3.1 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] && !MatchQ[Fx, (b_)*(Gx_) /; FreeQ[b, x]]`

rule 441 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a^2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e^2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]`

$$3.42. \int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^2(c+dx^2)^3} dx$$

rule 446 `Int[(((g_.)*(x_)^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((e_) + (f_.)*(x_)^2))/(c_) + (d_.)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x]`

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

3.42.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)^2 (dx^2 + c)^3} dx$$

input `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^3,x)`

output `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^3,x)`

3.42.5 Fracas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^3,x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b^2*d^3*x^10 + (3*b^2*c*d^2 + 2*a*b*d^3)*x^8 + (3*b^2*c^2*d + 6*a*b*c*d^2 + a^2*d^3)*x^6 + a^2*c^3 + (b^2*c^3 + 6*a*b*c^2*d + 3*a^2*c*d^2)*x^4 + (2*a*b*c^3 + 3*a^2*c^2*d)*x^2), x)`

3.42.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)**2/(d*x**2+c)**3,x)`

output `Timed out`

3.42.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^2*(d*x^2 + c)^3), x)`

3.42.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^2 (dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^2/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^2*(d*x^2 + c)^3), x)`

3.42.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^2 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m}{(bx^2 + a)^2 (dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^2*(c + d*x^2)^3), x)`output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^2*(c + d*x^2)^3), x)`

3.43
$$\int \frac{(ex)^m (A+Bx^2)}{(a+bx^2)^3 (c+dx^2)^3} dx$$

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3.43.1 Optimal result

Integrand size = 31, antiderivative size = 665

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx$$

$$= -\frac{d(A(2a^2d^2 - b^2c^2(3 - m)) + abcd(13 - m)) - aBc(ad(11 - m) + bc(1 + m))}{8a^2c(bc - ad)^3e(c + dx^2)^2} (ex)^{1+m}$$

$$+ \frac{(Ab - aB)(ex)^{1+m}}{4a(bc - ad)e(a + bx^2)^2(c + dx^2)^2}$$

$$+ \frac{(Ab(bc(3 - m) - ad(11 - m)) + aB(ad(7 - m) + bc(1 + m)))}{8a^2(bc - ad)^2e(a + bx^2)(c + dx^2)^2} (ex)^{1+m}$$

$$+ \frac{d(A(bc + ad)(b^2c^2(3 - m) + a^2d^2(3 - m) - 2abcd(9 - m)) + aBc(2abcd(11 - m) + b^2c^2(1 + m) + a^2d^2(1 + m)))}{8a^2c^2(bc - ad)^4e(c + dx^2)^2} (ex)^{1+m}$$

$$+ \frac{b^2(aB(b^2c^2(1 - m^2) - 2abcd(7 + 6m - m^2) - a^2d^2(35 - 12m + m^2)) + Ab(a^2d^2(63 - 16m + m^2) - 2abcd(7 + 6m - m^2) - a^2d^2(1 - m^2)))}{8a^3(bc - ad)^5e(c + dx^2)^2} (ex)^{1+m}$$

$$+ \frac{d^2(b^2c^2(Bc(5 - m) - Ad(9 - m))(7 - m) - a^2d^2(1 - m)(Ad(3 - m) + Bc(1 + m)) + 2abcd(Bc(7 + 6m - m^2) - Ad(7 + 6m - m^2) - a^2d^2(1 - m)))}{8c^3(bc - ad)^5e(1 + m)} (ex)^{1+m}$$

output
$$\begin{aligned} & -1/8*d*(A*(2*a^2*d^2-b^2*c^2*(3-m)+a*b*c*d*(13-m))-a*B*c*(a*d*(11-m)+b*c*(1+m)))*(e*x)^(1+m)/a^2/c/(-a*d+b*c)^3/e/(d*x^2+c)^2+1/4*(A*b-B*a)*(e*x)^(1+m)/a/(-a*d+b*c)/e/(b*x^2+a)^2/(d*x^2+c)^2+1/8*(A*b*(b*c*(3-m)-a*d*(11-m))+a*B*(a*d*(7-m)+b*c*(1+m)))*(e*x)^(1+m)/a^2/(-a*d+b*c)^2/e/(b*x^2+a)/(d*x^2+c)^2+1/8*d*(A*(a*d+b*c)*(b^2*c^2*(3-m)+a^2*d^2*(3-m)-2*a*b*c*d*(9-m))+a*B*c*(2*a*b*c*d*(11-m)+b^2*c^2*(1+m)+a^2*d^2*(1+m)))*(e*x)^(1+m)/a^2/c^2/(-a*d+b*c)^4/e/(d*x^2+c)+1/8*b^2*(a*B*(b^2*c^2*(-m^2+1)-2*a*b*c*d*(-m^2+6*m+7)-a^2*d^2*(m^2-12*m+35))+A*b*(a^2*d^2*(m^2-16*m+63)-2*a*b*c*d*(m^2-10*m+9)+b^2*c^2*(m^2-4*m+3)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/a^3/(-a*d+b*c)^5/e/(1+m)+1/8*d^2*(b^2*c^2*(B*c*(5-m)-A*d*(9-m))*(7-m)-a^2*d^2*(1-m)*(A*d*(3-m)+B*c*(1+m))+2*a*b*c*d*(B*c*(-m^2+6*m+7)+A*d*(m^2-10*m+9)))*(e*x)^(1+m)*hypergeom([1, 1/2+1/2*m], [3/2+1/2*m], -d*x^2/c)/c^3/(-a*d+b*c)^5/e/(1+m) \end{aligned}$$

3.43.2 Mathematica [A] (verified)

Time = 1.51 (sec) , antiderivative size = 329, normalized size of antiderivative = 0.49

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx$$

$$= x(ex)^m \left(-\frac{3b^2d(bBc-2Abd+aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{a} + \frac{3bd^2(bBc-2Abd+aBd) \operatorname{Hypergeometric2F1}\left(1, \frac{1+m}{2}, \frac{3+m}{2}, -\frac{dx^2}{c}\right)}{c} \right)$$

input `Integrate[((e*x)^m*(A + B*x^2))/((a + b*x^2)^3*(c + d*x^2)^3),x]`

output
$$\begin{aligned} & (x*(e*x)^m*((-3*b^2*d*(b*B*c - 2*A*b*d + a*B*d)*\operatorname{Hypergeometric2F1}[1, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/a + (3*b*d^2*(b*B*c - 2*A*b*d + a*B*d)*\operatorname{Hypergeometric2F1}[1, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c + (b^2*(b*c - a*d)*(b*B*c - 3*A*b*d + 2*a*B*d)*\operatorname{Hypergeometric2F1}[2, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/a^2 + (d^2*(b*c - a*d)*(2*b*B*c - 3*A*b*d + a*B*d)*\operatorname{Hypergeometric2F1}[2, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c^2 + (b^2*(A*b - a*B)*(b*c - a*d)^2*\operatorname{Hypergeometric2F1}[3, (1 + m)/2, (3 + m)/2, -((b*x^2)/a)])/a^3 + (d^2*(b*c - a*d)^2*(B*c - A*d)*\operatorname{Hypergeometric2F1}[3, (1 + m)/2, (3 + m)/2, -((d*x^2)/c)])/c^3)/((b*c - a*d)^5*(1 + m)) \end{aligned}$$

3.43.3 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.

$$\begin{aligned}
 & \int \frac{(A + Bx^2)(ex)^m}{(a + bx^2)^3(c + dx^2)^3} dx \\
 & \quad \downarrow 441 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{\int \frac{(ex)^m(-((Ab - aB)d(7 - m)x^2) + 4aAd - Abc(3 - m) - aBc(m + 1))}{(bx^2 + a)^2(dx^2 + c)^3} dx}{4a(bc - ad)} \\
 & \quad \downarrow 441 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{\int - \frac{(ex)^m(-d(5 - m)(Ab(bc(3 - m) - ad(11 - m)) + aB(ad(7 - m) + bc(m + 1)))x^2 + aBc(m + 1)(ad(9 - m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3}}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{\int - \frac{(ex)^m(d(5 - m)(Ab(bc(3 - m) - ad(11 - m)) + aB(ad(7 - m) + bc(m + 1)))x^2 + aBc(bc(1 - m) - ad(9 - m))(m + 1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3}}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{\int - \frac{(ex)^m(-d(5 - m)(Ab(bc(3 - m) - ad(11 - m)) + aB(ad(7 - m) + bc(m + 1)))x^2 + aBc(m + 1)(ad(9 - m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3}}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{\int - \frac{(ex)^m(d(5 - m)(Ab(bc(3 - m) - ad(11 - m)) + aB(ad(7 - m) + bc(m + 1)))x^2 + aBc(bc(1 - m) - ad(9 - m))(m + 1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3}}{2a(bc - ad)}}{4a(bc - ad)} \\
 & \quad \downarrow 25 \\
 & \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{\int - \frac{(ex)^m(d(5 - m)(Ab(bc(3 - m) - ad(11 - m)) + aB(ad(7 - m) + bc(m + 1)))x^2 + aBc(bc(1 - m) - ad(9 - m))(m + 1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3}}{2a(bc - ad)}}{4a(bc - ad)}
 \end{aligned}$$

3.43. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)^3} dx$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2)}{(bx^2 + a)(dx^2 + c)^3}$$

3.43. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)^3} dx$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 4a(bc - ad) \end{array}$$

$$3.43. \quad \int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)^3} dx$$

$$\begin{array}{c}
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} \\
 \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\
 \hline
 2a(bc - ad) \\
 \hline
 4a(bc - ad) \\
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} \\
 \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\
 \hline
 2a(bc - ad) \\
 \hline
 4a(bc - ad) \\
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} \\
 \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\
 \hline
 2a(bc - ad) \\
 \hline
 4a(bc - ad) \\
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} \\
 \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\
 \hline
 2a(bc - ad) \\
 \hline
 4a(bc - ad) \\
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} \\
 \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\
 \hline
 2a(bc - ad) \\
 \hline
 4a(bc - ad) \\
 \downarrow 25 \\
 \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} \\
 \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\
 \hline
 2a(bc - ad) \\
 \hline
 4a(bc - ad)
 \end{array}$$

3.43. $\int \frac{(ex)^m(A + Bx^2)}{(a + bx^2)^3(c + dx^2)^3} dx$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 2a(bc - ad) \end{array}$$

$$4a(bc - ad)$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 2a(bc - ad) \end{array}$$

$$4a(bc - ad)$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 2a(bc - ad) \end{array}$$

$$4a(bc - ad)$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c - cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 2a(bc - ad) \end{array}$$

$$4a(bc - ad)$$

$$\begin{array}{c} \downarrow 25 \\ \frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \\ \int - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} \\ \hline \hline 2a(bc - ad) \end{array}$$

$$4a(bc - ad)$$

$$\downarrow 25$$

3.43. $\int \frac{(ex)^m(A+Bx^2)}{(a+bx^2)^3(c+dx^2)^3} dx$

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(bc(1-m) - ad(9-m))(m+1) + A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

↓ 25

$$\frac{(ex)^{m+1}(Ab - aB)}{4ae(a + bx^2)^2(c + dx^2)^2(bc - ad)} - \frac{(ex)^m(-d(5-m)(Ab(bc(3-m) - ad(11-m)) + aB(ad(7-m) + bc(m+1)))x^2 + aBc(m+1)(ad(9-m) - b(c-cm)) - A(b^2(m^2 - 4m + 3)c^2 - abd(m^2 - 12m + 3)c + 8a^2d^2))}{(bx^2 + a)(dx^2 + c)^3} - \frac{2a(bc - ad)}{4a(bc - ad)}$$

input `Int[((e*x)^m*(A + B*x^2))/((a + b*x^2)^3*(c + d*x^2)^3),x]`

output `$Aborted`

3.43.3.1 Defintions of rubi rules used

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

rule 441 `Int[((g_)*(x_)^(m_))*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g*2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a*2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]`

3.43.4 Maple [F]

$$\int \frac{(ex)^m (x^2 B + A)}{(bx^2 + a)^3 (dx^2 + c)^3} dx$$

input `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^3,x)`

output `int((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^3,x)`

3.43.5 Fricas [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^3,x, algorithm="fricas")`

output `integral((B*x^2 + A)*(e*x)^m/(b^3*d^3*x^12 + 3*(b^3*c*d^2 + a*b^2*d^3)*x^10 + 3*(b^3*c^2*d + 3*a*b^2*c*d^2 + a^2*b*d^3)*x^8 + (b^3*c^3 + 9*a*b^2*c^2*d + 9*a^2*b*c*d^2 + a^3*d^3)*x^6 + a^3*c^3 + 3*(a*b^2*c^3 + 3*a^2*b*c^2*d + a^3*c*d^2)*x^4 + 3*(a^2*b*c^3 + a^3*c^2*d)*x^2), x)`

3.43.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx = \text{Timed out}$$

input `integrate((e*x)**m*(B*x**2+A)/(b*x**2+a)**3/(d*x**2+c)**3,x)`

output `Timed out`

3.43.7 Maxima [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^3*(d*x^2 + c)^3), x)`

3.43.8 Giac [F]

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(B*x^2+A)/(b*x^2+a)^3/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(e*x)^m/((b*x^2 + a)^3*(d*x^2 + c)^3), x)`

3.43.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (A + Bx^2)}{(a + bx^2)^3 (c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(ex)^m}{(bx^2 + a)^3 (dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^3*(c + d*x^2)^3),x)`

output `int(((A + B*x^2)*(e*x)^m)/((a + b*x^2)^3*(c + d*x^2)^3), x)`

3.44 $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx$

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3.44.1 Optimal result

Integrand size = 31, antiderivative size = 1059

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx =$$

$$\frac{(a^3 B d^3 (105 + 71m + 15m^2 + m^3) - a^2 b d^2 (5 + m) (A d (3 + m) (9 + m + 2p) + 2 B c (30 + 13m + m^2 + 10p))) + (a^2 B d^2 (35 + 12m + m^2) + b^2 c (24 B c + A d (99 + m^2 + 40p + 4p^2 + 4m(5 + p))) - a b d (A d (5 + m) (9 + m + 2p) + b^3 e (5 + m + 2p) (7 + m + 2p) (9 + m + 2p)))}{b^2 e (7 + m + 2p) (9 + m + 2p)}$$

$$+ \frac{(a B d (7 + m) - b (6 B c + A d (9 + m + 2p))) (ex)^{1+m} (a + bx^2)^{1+p} (c + dx^2)^2}{b^2 e (7 + m + 2p) (9 + m + 2p)}$$

$$+ \frac{B (ex)^{1+m} (a + bx^2)^{1+p} (c + dx^2)^3}{b e (9 + m + 2p)}$$

$$+ \frac{(a(1 + m) (a^3 B d^3 (105 + 71m + 15m^2 + m^3) - a^2 b d^2 (5 + m) (A d (3 + m) (9 + m + 2p) + 2 B c (30 + 13m + m^2 + 10p)))}{b^2 e (7 + m + 2p) (9 + m + 2p)}$$

output

```

-(a^3*B*d^3*(m^3+15*m^2+71*m+105)-a^2*b*d^2*(5+m)*(A*d*(3+m)*(9+m+2*p)+2*B*c*(m^2+2*m*p+13*m+2*p+30))+a*b^2*c*d*(2*A*d*(216+m^3+84*p+8*p^2+4*m^2*(5+p)+m*(4*p^2+44*p+123))+B*c*(267+m^3+40*p+4*p^2+m^2*(21+4*p)+m*(4*p^2+44*p+143)))-b^3*c^2*(48*B*c+A*d*(513+m^3+366*p+92*p^2+8*p^3+m^2*(23+6*p)+m*(12*p^2+92*p+183))))*(e*x)^(1+m)*(b*x^2+a)^(p+1)/b^4/e/(3+m+2*p)/(5+m+2*p)/(7+m+2*p)/(9+m+2*p)+(a^2*B*d^2*(m^2+12*m+35)+b^2*c*(24*B*c+A*d*(99+m^2+40*p+4*p^2+4*m*(5+p)))-a*b*d*(A*d*(5+m)*(9+m+2*p)+B*c*(65+m^2+2*p+2*m*(9+p))))*(e*x)^(1+m)*(b*x^2+a)^(p+1)*(d*x^2+c)/b^3/e/(5+m+2*p)/(7+m+2*p)/(9+m+2*p)-(a*B*d*(7+m)-b*(6*B*c+A*d*(9+m+2*p)))*(e*x)^(1+m)*(b*x^2+a)^(p+1)*(d*x^2+c)^2/b^2/e/(7+m+2*p)/(9+m+2*p)+B*(e*x)^(1+m)*(b*x^2+a)^(p+1)*(d*x^2+c)^3/b/e/(9+m+2*p)+(a*(1+m)*(a^3*B*d^3*(m^3+15*m^2+71*m+105)-a^2*b*d^2*(5+m)*(A*d*(3+m)*(9+m+2*p)+2*B*c*(m^2+2*m*p+13*m+2*p+30))+a*b^2*c*d*(2*A*d*(216+m^3+84*p+8*p^2+4*m^2*(5+p)+m*(4*p^2+44*p+123))+B*c*(267+m^3+40*p+4*p^2+m^2*(21+4*p)+m*(4*p^2+44*p+143)))-b^3*c^2*(48*B*c+A*d*(513+m^3+366*p+92*p^2+8*p^3+m^2*(23+6*p)+m*(12*p^2+92*p+183))))-b*c*(3+m+2*p)*(2*b*c*(2+p)*(2*b*c*(3+p)*(a*B*(1+m)-A*b*(9+m+2*p)))+(-a*d+b*c)*(1+m)*(a*B*(7+m)-A*b*(9+m+2*p)))+(1+m)*(b*c*(2*b*c*(3+p)*(a*B*(1+m)-A*b*(9+m+2*p)))+(-a*d+b*c)*(1+m)*(a*B*(7+m)-A*b*(9+m+2*p)))-a*(2*b*c*d*(3+p)*(a*B*(1+m)-A*b*(9+m+2*p))+d*(-a*d+b*c)*(1+m)*(a*B*(7+m)-A*b*(9+m+2*p))+4*(-a*d+b*c)*(a*B*d*(7+m)-b*(6*B*c+A*d*(9+m+2*p)))))))*(e*x)^(1+m)*(b*x^2+a)^p*hypergeom([-p, 1/2+1/2*m], [3/2+1/2...

```

3.44.2 Mathematica [A] (verified)

Time = 0.33 (sec) , antiderivative size = 248, normalized size of antiderivative = 0.23

$$\begin{aligned}
 & \int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx \\
 &= x(ex)^m (a + bx^2)^p \left(1 + \frac{bx^2}{a} \right)^{-p} \left(\frac{Ac^3 \operatorname{Hypergeometric2F1} \left(\frac{1+m}{2}, -p, \frac{3+m}{2}, -\frac{bx^2}{a} \right)}{1+m} \right. \\
 & \quad + \frac{c^2(Bc + 3Ad)x^2 \operatorname{Hypergeometric2F1} \left(\frac{3+m}{2}, -p, \frac{5+m}{2}, -\frac{bx^2}{a} \right)}{3+m} \\
 & \quad + dx^4 \left(\frac{3c(Bc + Ad) \operatorname{Hypergeometric2F1} \left(\frac{5+m}{2}, -p, \frac{7+m}{2}, -\frac{bx^2}{a} \right)}{5+m} \right. \\
 & \quad \left. + dx^2 \left(\frac{(3Bc + Ad) \operatorname{Hypergeometric2F1} \left(\frac{7+m}{2}, -p, \frac{9+m}{2}, -\frac{bx^2}{a} \right)}{7+m} + \frac{Bdx^2 \operatorname{Hypergeometric2F1} \left(\frac{9+m}{2}, -p, \frac{11+m}{2}, -\frac{bx^2}{a} \right)}{9+m} \right) \right)
 \end{aligned}$$

input `Integrate[(e*x)^m*(a + b*x^2)^p*(A + B*x^2)*(c + d*x^2)^3,x]`

$$3.44. \quad \int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx$$


```
output (x*(e*x)^m*(a + b*x^2)^p*((A*c^3*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -((b*x^2)/a)]/(1 + m) + (c^2*(B*c + 3*A*d)*x^2*Hypergeometric2F1[(3 + m)/2, -p, (5 + m)/2, -((b*x^2)/a)]/(3 + m) + d*x^4*((3*c*(B*c + A*d)*Hypergeometric2F1[(5 + m)/2, -p, (7 + m)/2, -((b*x^2)/a)]/(5 + m) + d*x^2*((3*B*c + A*d)*Hypergeometric2F1[(7 + m)/2, -p, (9 + m)/2, -((b*x^2)/a)]/(7 + m) + (B*d*x^2*Hypergeometric2F1[(9 + m)/2, -p, (11 + m)/2, -((b*x^2)/a)]/(9 + m)))))/(1 + (b*x^2)/a)^p
```

3.44.3 Rubi [A] (verified)

Time = 1.73 (sec) , antiderivative size = 1020, normalized size of antiderivative = 0.96, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.226$, Rules used = {443, 25, 443, 443, 363, 279, 278}

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

$$\int (A + Bx^2) (c + dx^2)^3 (ex)^m (a + bx^2)^p dx$$

↓ 443

$$\frac{\int -(ex)^m (bx^2 + a)^p (dx^2 + c)^2 (c(aB(m + 1) - Ab(m + 2p + 9)) - (6bBc - aBd(m + 7) + Abd(m + 2p + 9))x^2) dx}{b(m + 2p + 9)}$$

$$\frac{B(c + dx^2)^3 (ex)^{m+1} (a + bx^2)^{p+1}}{be(m + 2p + 9)}$$

↓ 25

$$\frac{B(c + dx^2)^3 (ex)^{m+1} (a + bx^2)^{p+1}}{be(m + 2p + 9)} - \frac{\int (ex)^m (bx^2 + a)^p (dx^2 + c)^2 ((aBd(m + 7) - b(6Bc + Ad(m + 2p + 9)))x^2 + c(aB(m + 1) - Ab(m + 2p + 9))) dx}{b(m + 2p + 9)}$$

↓ 443

$$\frac{B(c + dx^2)^3 (ex)^{m+1} (a + bx^2)^{p+1}}{be(m + 2p + 9)} - \frac{\int (ex)^m (bx^2 + a)^p (dx^2 + c) ((2bcd(p+3)(aB(m+1) - Ab(m+2p+9)) + d(bc-ad)(m+1)(aB(m+7) - Ab(m+2p+9)) + 4(bc-ad)(aBd(m+7) - b(6Bc + Ad(m+2p+9)))) dx}{b(m+2p+7)}$$

↓ 443

3.44. $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx$

$$\frac{B(c + dx^2)^3 (ex)^{m+1} (a + bx^2)^{p+1}}{be(m + 2p + 9)} - \frac{\int (ex)^m (bx^2 + a)^p ((-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))}{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))} dx$$

↓ 363

$$\frac{B(ex)^{m+1} (bx^2 + a)^{p+1} (dx^2 + c)^3}{be(m + 2p + 9)} - \frac{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))}{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))} dx$$

↓ 279

$$\frac{B(ex)^{m+1} (bx^2 + a)^{p+1} (dx^2 + c)^3}{be(m + 2p + 9)} - \frac{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))}{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))} dx$$

↓ 278

$$\frac{B(ex)^{m+1} (bx^2 + a)^{p+1} (dx^2 + c)^3}{be(m + 2p + 9)} - \frac{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))}{(-c^2(48Bc + Ad(m^3 + (6p+23)m^2 + (12p^2 + 92p + 183)m + 8p^3 + 92p^2 + 366p + 513))b^3 + acd(2Ad(m^3 + 4(p+5)m^2 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216) + Bc(m^3 + (4p^2 + 44p + 123)m + 8p^2 + 84p + 216)))} dx$$

input `Int[(e*x)^m*(a + b*x^2)^p*(A + B*x^2)*(c + d*x^2)^3,x]`

```

output (B*(e*x)^(1 + m)*(a + b*x^2)^(1 + p)*(c + d*x^2)^3)/(b*e*(9 + m + 2*p)) -
(-(((6*b*B*c - a*B*d*(7 + m) + A*b*d*(9 + m + 2*p))*(e*x)^(1 + m)*(a + b*x
^2)^(1 + p)*(c + d*x^2)^2)/(b*e*(7 + m + 2*p))) + (-(((a^2*B*d^2*(35 + 12*
m + m^2) + b^2*c*(24*B*c + A*d*(99 + m^2 + 40*p + 4*p^2 + 4*m*(5 + p))) -
a*b*d*(A*d*(5 + m)*(9 + m + 2*p) + B*c*(65 + m^2 + 2*p + 2*m*(9 + p))))*(e
*x)^(1 + m)*(a + b*x^2)^(1 + p)*(c + d*x^2))/(b*e*(5 + m + 2*p))) + (((a^3
*B*d^3*(105 + 71*m + 15*m^2 + m^3) - a^2*b*d^2*(5 + m)*(A*d*(3 + m)*(9 + m
+ 2*p) + 2*B*c*(30 + 13*m + m^2 + 2*p + 2*m*p)) + a*b^2*c*d*(2*A*d*(216 +
m^3 + 84*p + 8*p^2 + 4*m^2*(5 + p) + m*(123 + 44*p + 4*p^2)) + B*c*(267 +
m^3 + 40*p + 4*p^2 + m^2*(21 + 4*p) + m*(143 + 44*p + 4*p^2))) - b^3*c^2*
(48*B*c + A*d*(513 + m^3 + 366*p + 92*p^2 + 8*p^3 + m^2*(23 + 6*p) + m*(18
3 + 92*p + 12*p^2))))*(e*x)^(1 + m)*(a + b*x^2)^(1 + p))/(b*e*(3 + m + 2*p
)) - (((a*(1 + m)*(a^3*B*d^3*(105 + 71*m + 15*m^2 + m^3) - a^2*b*d^2*(5 +
m)*(A*d*(3 + m)*(9 + m + 2*p) + 2*B*c*(30 + 13*m + m^2 + 2*p + 2*m*p)) + a
*b^2*c*d*(2*A*d*(216 + m^3 + 84*p + 8*p^2 + 4*m^2*(5 + p) + m*(123 + 44*p
+ 4*p^2)) + B*c*(267 + m^3 + 40*p + 4*p^2 + m^2*(21 + 4*p) + m*(143 + 44*p
+ 4*p^2))) - b^3*c^2*(48*B*c + A*d*(513 + m^3 + 366*p + 92*p^2 + 8*p^3 +
m^2*(23 + 6*p) + m*(183 + 92*p + 12*p^2)))))/(b*(3 + m + 2*p)) - c*(2*b*c*
(2 + p)*(2*b*c*(3 + p)*(a*B*(1 + m) - A*b*(9 + m + 2*p)) + (b*c - a*d)*(1
+ m)*(a*B*(7 + m) - A*b*(9 + m + 2*p))) + (1 + m)*(b*c*(2*b*c*(3 + p)*...

```

3.44.3.1 Defintions of rubi rules used

```

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

```

```

rule 278 Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((
c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (
-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0
] || GtQ[a, 0])

```

```

rule 279 Int[((c_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_), x_Symbol] := Simp[a^IntP
art[p]*((a + b*x^2)^FracPart[p]/(1 + b*(x^2/a))^FracPart[p]) Int[(c*x)^m*
(1 + b*(x^2/a))^p, x], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] &&
!(ILtQ[p, 0] || GtQ[a, 0])

```

```
rule 363 Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2), x
_Symbol] :> Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))),
x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^(
m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d
, 0] && NeQ[m + 2*p + 3, 0]
```

```
rule 443 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q
_.)*(e_) + (f_.)*(x_)^2), x_Symbol] :> Simp[f*(g*x)^(m + 1)*(a + b*x^2)^(p
+ 1)*((c + d*x^2)^q/(b*g*(m + 2*(p + q + 1) + 1))), x] + Simp[1/(b*(m + 2*
(p + q + 1) + 1)) Int[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^(q - 1)*Simp[c*((
b*e - a*f)*(m + 1) + b*e*2*(p + q + 1)) + (d*(b*e - a*f)*(m + 1) + f*2*q*(b
*c - a*d) + b*e*d*2*(p + q + 1))*x^2, x], x] /; FreeQ[{a, b, c, d, e, f
, g, m, p}, x] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[e + f*x^2, c + d*x^
2])
```

3.44.4 Maple [F]

$$\int (ex)^m (bx^2 + a)^p (x^2B + A) (dx^2 + c)^3 dx$$

```
input int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^3,x)
```

```
output int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^3,x)
```

3.44.5 Fricas [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx = \int (Bx^2 + A) (dx^2 + c)^3 (bx^2 + a)^p (ex)^m dx$$

```
input integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="fricas")
```

```
output integral((B*d^3*x^8 + (3*B*c*d^2 + A*d^3)*x^6 + 3*(B*c^2*d + A*c*d^2)*x^4
+ A*c^3 + (B*c^3 + 3*A*c^2*d)*x^2)*(b*x^2 + a)^p*(e*x)^m, x)
```

3.44.6 Sympy [F(-1)]

Timed out.

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx = \text{Timed out}$$

input `integrate((e*x)**m*(b*x**2+a)**p*(B*x**2+A)*(d*x**2+c)**3,x)`

output `Timed out`

3.44.7 Maxima [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx = \int (Bx^2 + A)(dx^2 + c)^3 (bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(b*x^2 + a)^p*(e*x)^m, x)`

3.44.8 Giac [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^3 dx = \int (Bx^2 + A)(dx^2 + c)^3 (bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^3*(b*x^2 + a)^p*(e*x)^m, x)`

3.44.9 Mupad [F(-1)]

Timed out.

$$\int (ex)^m (a+bx^2)^p (A+Bx^2) (c+dx^2)^3 dx = \int (Bx^2+A) (ex)^m (bx^2+a)^p (dx^2+c)^3 dx$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^3,x)`output `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^3, x)`

3.45 $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx$

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3.45.1 Optimal result

Integrand size = 31, antiderivative size = 495

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx$$

$$= \frac{(a^2 B d^2 (15 + 8m + m^2) + b^2 c (8 B c + A d (7 + m + 2p)^2) - a b d (A d (3 + m) (7 + m + 2p) + B c (27 + m^2 + 2p))) (ex)^{1+m} (a + bx^2)^{1+p} (c + dx^2)^2}{b^3 e (3 + m + 2p) (5 + m + 2p) (7 + m + 2p)}$$

$$- \frac{(a B d (5 + m) - b (4 B c + A d (7 + m + 2p))) (ex)^{1+m} (a + bx^2)^{1+p} (c + dx^2)^2}{b^2 e (5 + m + 2p) (7 + m + 2p)}$$

$$+ \frac{B (ex)^{1+m} (a + bx^2)^{1+p} (c + dx^2)^2}{b e (7 + m + 2p)}$$

$$- \frac{(b c (3 + m + 2p) (2 b c (2 + p) (a B (1 + m) - A b (7 + m + 2p)) + (b c - a d) (1 + m) (a B (5 + m) - A b (7 + m + 2p))) (ex)^{1+m} (a + bx^2)^{1+p} (c + dx^2)^2}{b^3 e (3 + m + 2p) (5 + m + 2p) (7 + m + 2p)}$$

output

```
(a^2*B*d^2*(m^2+8*m+15)+b^2*c*(8*B*c+A*d*(7+m+2*p)^2)-a*b*d*(A*d*(3+m)*(7+m+2*p)+B*c*(27+m^2+2*p+2*m*(6+p))))*(e*x)^(1+m)*(b*x^2+a)^(p+1)/b^3/e/(3+m+2*p)/(5+m+2*p)/(7+m+2*p)-(a*B*d*(5+m)-b*(4*B*c+A*d*(7+m+2*p)))*(e*x)^(1+m)*(b*x^2+a)^(p+1)*(d*x^2+c)/b^2/e/(5+m+2*p)/(7+m+2*p)+B*(e*x)^(1+m)*(b*x^2+a)^(p+1)*(d*x^2+c)^2/b/e/(7+m+2*p)-(b*c*(3+m+2*p)*(2*b*c*(2+p)*(a*B*(1+m)-A*b*(7+m+2*p)))+(-a*d+b*c)*(1+m)*(a*B*(5+m)-A*b*(7+m+2*p)))-a*(1+m)*(2*b*c*d*(2+p)*(a*B*(1+m)-A*b*(7+m+2*p))+d*(-a*d+b*c)*(1+m)*(a*B*(5+m)-A*b*(7+m+2*p))+2*(-a*d+b*c)*(a*B*d*(5+m)-b*(4*B*c+A*d*(7+m+2*p))))*(e*x)^(1+m)*(b*x^2+a)^p*hypergeom([-p, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/b^3/e/(1+m)/(3+m+2*p)/(5+m+2*p)/(7+m+2*p)/((1+b*x^2/a)^p)
```

3.45.2 Mathematica [A] (verified)

Time = 0.21 (sec) , antiderivative size = 198, normalized size of antiderivative = 0.40

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx$$

$$= x(ex)^m (a + bx^2)^p \left(1 + \frac{bx^2}{a} \right)^{-p} \left(\frac{Ac^2 \operatorname{Hypergeometric2F1} \left(\frac{1+m}{2}, -p, \frac{3+m}{2}, -\frac{bx^2}{a} \right)}{1+m} \right.$$

$$+ \frac{c(Bc + 2Ad)x^2 \operatorname{Hypergeometric2F1} \left(\frac{3+m}{2}, -p, \frac{5+m}{2}, -\frac{bx^2}{a} \right)}{3+m}$$

$$+ dx^4 \left(\frac{(2Bc + Ad) \operatorname{Hypergeometric2F1} \left(\frac{5+m}{2}, -p, \frac{7+m}{2}, -\frac{bx^2}{a} \right)}{5+m} \right.$$

$$\left. \left. + \frac{Bdx^2 \operatorname{Hypergeometric2F1} \left(\frac{7+m}{2}, -p, \frac{9+m}{2}, -\frac{bx^2}{a} \right)}{7+m} \right) \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^p*(A + B*x^2)*(c + d*x^2)^2,x]`

output `(x*(e*x)^m*(a + b*x^2)^p*((A*c^2*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -((b*x^2)/a)])/(1 + m) + (c*(B*c + 2*A*d)*x^2*Hypergeometric2F1[(3 + m)/2, -p, (5 + m)/2, -((b*x^2)/a)]/(3 + m) + d*x^4*((2*B*c + A*d)*Hypergeometric2F1[(5 + m)/2, -p, (7 + m)/2, -((b*x^2)/a)]/(5 + m) + (B*d*x^2*Hypergeometric2F1[(7 + m)/2, -p, (9 + m)/2, -((b*x^2)/a)]/(7 + m)))/(1 + (b*x^2)/a)^p`

3.45.3 Rubi [A] (verified)

Time = 0.86 (sec) , antiderivative size = 455, normalized size of antiderivative = 0.92, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}} = 0.194$, Rules used = {443, 25, 443, 363, 279, 278}

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

$$\int (A + Bx^2) (c + dx^2)^2 (ex)^m (a + bx^2)^p dx$$

↓ 443

$$\frac{\int -(ex)^m (bx^2 + a)^p (dx^2 + c) (c(aB(m+1) - Ab(m+2p+7)) - (4bBc - aBd(m+5) + Abd(m+2p+7))x^2) dx}{b(m+2p+7) \frac{B(c+dx^2)^2 (ex)^{m+1} (a+bx^2)^{p+1}}{be(m+2p+7)}} \quad \downarrow \text{25}$$

$$\frac{\int (ex)^m (bx^2 + a)^p (dx^2 + c) ((aBd(m+5) - b(4Bc + Ad(m+2p+7)))x^2 + c(aB(m+1) - Ab(m+2p+7))) dx}{b(m+2p+7) \frac{B(c+dx^2)^2 (ex)^{m+1} (a+bx^2)^{p+1}}{be(m+2p+7)}} \quad \downarrow \text{443}$$

$$\frac{\int (ex)^m (bx^2 + a)^p ((2bcd(p+2)(aB(m+1) - Ab(m+2p+7)) + d(bc - ad)(m+1)(aB(m+5) - Ab(m+2p+7)) + 2(bc - ad)(aBd(m+5) - b(4Bc + Ad(m+2p+7)))) dx}{b(m+2p+5) \frac{B(c+dx^2)^2 (ex)^{m+1} (a+bx^2)^{p+1}}{be(m+2p+7)}} \quad \downarrow \text{363}$$

$$\frac{\left(\frac{a(m+1)(a^2 Bd^2(m^2+8m+15) - abd(Ad(m+3)(m+2p+7) + Bc(m^2+2m(p+6)+2p+27)) + b^2 c(Ad(m+2p+7)^2 + 8Bc))}{b(m+2p+3)} + c((m+1)(bc - ad)(aB(m+5) - Ab(m+2p+7))) \right) dx}{b(m+2p+5) \frac{B(c+dx^2)^2 (ex)^{m+1} (a+bx^2)^{p+1}}{be(m+2p+7)}} \quad \downarrow \text{279}$$

$$\frac{(a+bx^2)^p \left(\frac{bx^2}{a} + 1 \right)^{-p} \left(\frac{a(m+1)(a^2 Bd^2(m^2+8m+15) - abd(Ad(m+3)(m+2p+7) + Bc(m^2+2m(p+6)+2p+27)) + b^2 c(Ad(m+2p+7)^2 + 8Bc))}{b(m+2p+3)} + c((m+1)(bc - ad)(aB(m+5) - Ab(m+2p+7))) \right) dx}{b(m+2p+5) \frac{B(c+dx^2)^2 (ex)^{m+1} (a+bx^2)^{p+1}}{be(m+2p+7)}} \quad \downarrow \text{278}$$

$$\frac{(ex)^{m+1} (a+bx^2)^p \left(\frac{bx^2}{a} + 1 \right)^{-p} \text{Hypergeometric2F1} \left(\frac{m+1}{2}, -p, \frac{m+3}{2}, -\frac{bx^2}{a} \right) \left(\frac{a(m+1)(a^2 Bd^2(m^2+8m+15) - abd(Ad(m+3)(m+2p+7) + Bc(m^2+2m(p+6)+2p+27)) + b^2 c(Ad(m+2p+7)^2 + 8Bc))}{b(m+2p+3)} + c((m+1)(bc - ad)(aB(m+5) - Ab(m+2p+7))) \right) dx}{e(m+1) \frac{B(c+dx^2)^2 (ex)^{m+1} (a+bx^2)^{p+1}}{be(m+2p+7)}}$$

3.45. $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx$

input `Int[(e*x)^m*(a + b*x^2)^p*(A + B*x^2)*(c + d*x^2)^2,x]`

output `(B*(e*x)^(1 + m)*(a + b*x^2)^(1 + p)*(c + d*x^2)^2)/(b*e*(7 + m + 2*p)) -
 (-(((4*b*B*c - a*B*d*(5 + m) + A*b*d*(7 + m + 2*p))*(e*x)^(1 + m)*(a + b*x
 ^2)^(1 + p)*(c + d*x^2))/(b*e*(5 + m + 2*p))) + (-(((a^2*B*d^2*(15 + 8*m +
 m^2) + b^2*c*(8*B*c + A*d*(7 + m + 2*p)^2) - a*b*d*(A*d*(3 + m)*(7 + m +
 2*p) + B*c*(27 + m^2 + 2*p + 2*m*(6 + p))))*(e*x)^(1 + m)*(a + b*x^2)^(1 +
 p))/(b*e*(3 + m + 2*p))) + ((c*(2*b*c*(2 + p)*(a*B*(1 + m) - A*b*(7 + m +
 2*p)) + (b*c - a*d)*(1 + m)*(a*B*(5 + m) - A*b*(7 + m + 2*p))) + (a*(1 +
 m)*(a^2*B*d^2*(15 + 8*m + m^2) + b^2*c*(8*B*c + A*d*(7 + m + 2*p)^2) - a*b
 d(A*d*(3 + m)*(7 + m + 2*p) + B*c*(27 + m^2 + 2*p + 2*m*(6 + p)))))/(b*(
 3 + m + 2*p)))*(e*x)^(1 + m)*(a + b*x^2)^p*Hypergeometric2F1[(1 + m)/2, -p
 , (3 + m)/2, -(b*x^2)/a])/(e*(1 + m)*(1 + (b*x^2)/a)^p)/(b*(5 + m + 2*p
)))/(b*(7 + m + 2*p))`

3.45.3.1 Defintions of rubi rules used

rule 25 `Int[-(F_x_), x_Symbol] := Simp[Identity[-1] Int[F_x, x], x]`

rule 278 `Int[((c_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((
 c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (
 -b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0
] || GtQ[a, 0])`

rule 279 `Int[((c_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_), x_Symbol] := Simp[a^IntP
 art[p]*((a + b*x^2)^FracPart[p]/(1 + b*(x^2/a))^FracPart[p]) Int[(c*x)^m*
 (1 + b*(x^2/a))^p, x], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] &&
 !(ILtQ[p, 0] || GtQ[a, 0])`

rule 363 `Int[((e_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2), x
 _Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))),
 x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^
 m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d
 , 0] && NeQ[m + 2*p + 3, 0]`

rule 443 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[f*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(b*g*(m + 2*(p + q + 1) + 1))), x] + Simp[1/(b*(m + 2*(p + q + 1) + 1)) Int[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^(q - 1)*Simp[c*((b*e - a*f)*(m + 1) + b*e*2*(p + q + 1)) + (d*(b*e - a*f)*(m + 1) + f*2*q*(b*c - a*d) + b*e*d*2*(p + q + 1))*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[e + f*x^2, c + d*x^2])`

3.45.4 Maple [F]

$$\int (ex)^m (bx^2 + a)^p (x^2B + A) (dx^2 + c)^2 dx$$

input `int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^2,x)`

output `int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^2,x)`

3.45.5 Fracas [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx = \int (Bx^2 + A) (dx^2 + c)^2 (bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="fracas")`

output `integral((B*d^2*x^6 + (2*B*c*d + A*d^2)*x^4 + A*c^2 + (B*c^2 + 2*A*c*d)*x^2)*(b*x^2 + a)^p*(e*x)^m, x)`

3.45.6 SymPy [F(-1)]

Timed out.

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx = \text{Timed out}$$

input `integrate((e*x)**m*(b*x**2+a)**p*(B*x**2+A)*(d*x**2+c)**2,x)`

output `Timed out`

3.45. $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx$

3.45.7 Maxima [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx = \int (Bx^2 + A)(dx^2 + c)^2 (bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(b*x^2 + a)^p*(e*x)^m, x)`

3.45.8 Giac [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx = \int (Bx^2 + A)(dx^2 + c)^2 (bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)^2*(b*x^2 + a)^p*(e*x)^m, x)`

3.45.9 Mupad [F(-1)]

Timed out.

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2)^2 dx = \int (Bx^2 + A) (ex)^m (bx^2 + a)^p (dx^2 + c)^2 dx$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^2,x)`

output `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^p*(c + d*x^2)^2, x)`

3.46 $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx$

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3.46.1 Optimal result

Integrand size = 29, antiderivative size = 253

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx$$

$$= -\frac{(aBd(3 + m) - b(2Ad + Bc(5 + m + 2p)))(ex)^{1+m} (a + bx^2)^{1+p}}{b^2e(3 + m + 2p)(5 + m + 2p)}$$

$$+ \frac{d(ex)^{1+m} (a + bx^2)^{1+p} (A + Bx^2)}{be(5 + m + 2p)}$$

$$- \frac{(Ab(3 + m + 2p)(ad(1 + m) - bc(5 + m + 2p)) - a(1 + m)(aBd(3 + m) - b(2Ad + Bc(5 + m + 2p))))}{b^2e(1 + m)(3 + m + 2p)(5 + m)}$$

output

```
-(a*B*d*(3+m)-b*(2*A*d+B*c*(5+m+2*p)))*(e*x)^(1+m)*(b*x^2+a)^(p+1)/b^2/e/(
3+m+2*p)/(5+m+2*p)+d*(e*x)^(1+m)*(b*x^2+a)^(p+1)*(B*x^2+A)/b/e/(5+m+2*p)-(
A*b*(3+m+2*p)*(a*d*(1+m)-b*c*(5+m+2*p))-a*(1+m)*(a*B*d*(3+m)-b*(2*A*d+B*c*
(5+m+2*p)))*(e*x)^(1+m)*(b*x^2+a)^p*hypergeom([-p, 1/2+1/2*m],[3/2+1/2*m]
,-b*x^2/a)/b^2/e/(1+m)/(3+m+2*p)/(5+m+2*p)/((1+b*x^2/a)^p)
```

3.46.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 147, normalized size of antiderivative = 0.58

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx$$

$$= x(ex)^m (a + bx^2)^p \left(1 + \frac{bx^2}{a} \right)^{-p} \left(\frac{Ac \operatorname{Hypergeometric2F1} \left(\frac{1+m}{2}, -p, \frac{3+m}{2}, -\frac{bx^2}{a} \right)}{1+m} \right.$$

$$+ \frac{(Bc + Ad)x^2 \operatorname{Hypergeometric2F1} \left(\frac{3+m}{2}, -p, \frac{5+m}{2}, -\frac{bx^2}{a} \right)}{3+m}$$

$$\left. + \frac{Bdx^4 \operatorname{Hypergeometric2F1} \left(\frac{5+m}{2}, -p, \frac{7+m}{2}, -\frac{bx^2}{a} \right)}{5+m} \right)$$

input `Integrate[(e*x)^m*(a + b*x^2)^p*(A + B*x^2)*(c + d*x^2),x]`

output `(x*(e*x)^m*(a + b*x^2)^p*((A*c*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -(b*x^2)/a])/(1 + m) + ((B*c + A*d)*x^2*Hypergeometric2F1[(3 + m)/2, -p, (5 + m)/2, -(b*x^2)/a])/(3 + m) + (B*d*x^4*Hypergeometric2F1[(5 + m)/2, -p, (7 + m)/2, -(b*x^2)/a])/(5 + m))/(1 + (b*x^2)/a)^p`

3.46.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 241, normalized size of antiderivative = 0.95, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.172$, Rules used = {443, 25, 363, 279, 278}

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

$$\int (A + Bx^2) (c + dx^2) (ex)^m (a + bx^2)^p dx$$

↓ 443

$$\frac{\int -(ex)^m (bx^2 + a)^p (A(ad(m+1) - bc(m+2p+5)) - (2Abd - aB(m+3)d + bBc(m+2p+5))x^2) dx}{b(m+2p+5)}$$

$$+ \frac{d(A + Bx^2) (ex)^{m+1} (a + bx^2)^{p+1}}{be(m+2p+5)}$$

3.46. $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx$

$$\begin{aligned}
& \downarrow 25 \\
& \frac{d(A+Bx^2)(ex)^{m+1}(a+bx^2)^{p+1}}{be(m+2p+5)} - \\
& \frac{\int (ex)^m (bx^2+a)^p ((aBd(m+3) - b(2Ad+Bc(m+2p+5)))x^2 + A(ad(m+1) - bc(m+2p+5))) dx}{b(m+2p+5)} \\
& \downarrow 363 \\
& \frac{d(A+Bx^2)(ex)^{m+1}(a+bx^2)^{p+1}}{be(m+2p+5)} - \\
& \frac{\left(-\frac{a(m+1)(aBd(m+3)-b(2Ad+Bc(m+2p+5)))}{b(m+2p+3)} + aAd(m+1) - Abc(m+2p+5)\right) \int (ex)^m (bx^2+a)^p dx + \frac{(ex)^{m+1}(a+bx^2)^{p+1}}{b(m+2p+5)}}{b(m+2p+5)} \\
& \downarrow 279 \\
& \frac{d(A+Bx^2)(ex)^{m+1}(a+bx^2)^{p+1}}{be(m+2p+5)} - \\
& \frac{(a+bx^2)^p \left(\frac{bx^2}{a} + 1\right)^{-p} \left(-\frac{a(m+1)(aBd(m+3)-b(2Ad+Bc(m+2p+5)))}{b(m+2p+3)} + aAd(m+1) - Abc(m+2p+5)\right) \int (ex)^m \left(\frac{bx^2}{a}\right)}{b(m+2p+5)} \\
& \downarrow 278 \\
& \frac{d(A+Bx^2)(ex)^{m+1}(a+bx^2)^{p+1}}{be(m+2p+5)} - \\
& \frac{(ex)^{m+1}(a+bx^2)^p \left(\frac{bx^2}{a} + 1\right)^{-p} \text{Hypergeometric2F1}\left(\frac{m+1}{2}, -p, \frac{m+3}{2}, -\frac{bx^2}{a}\right) \left(-\frac{a(m+1)(aBd(m+3)-b(2Ad+Bc(m+2p+5)))}{b(m+2p+3)} + aAd(m+1) - Abc(m+2p+5)\right)}{e(m+1)} \\
& \frac{\hspace{15em}}{b(m+2p+5)}
\end{aligned}$$

input `Int[(e*x)~m*(a + b*x^2)~p*(A + B*x^2)*(c + d*x^2),x]`

output `(d*(e*x)^(1+m)*(a + b*x^2)^(1+p)*(A + B*x^2))/(b*e*(5+m+2*p)) - ((a*B*d*(3+m) - b*(2*A*d + B*c*(5+m+2*p)))*(e*x)^(1+m)*(a + b*x^2)^(1+p))/(b*e*(3+m+2*p)) + ((a*A*d*(1+m) - A*b*c*(5+m+2*p) - (a*(1+m)*(a*B*d*(3+m) - b*(2*A*d + B*c*(5+m+2*p))))/(b*(3+m+2*p)))*(e*x)^(1+m)*(a + b*x^2)~p*Hypergeometric2F1[(1+m)/2, -p, (3+m)/2, -(b*x^2)/a)]/(e*(1+m)*(1 + (b*x^2)/a)~p))/(b*(5+m+2*p))`

3.46.3.1 Defintions of rubi rules used

- rule 25 `Int[-(Fx_), x_Symbol] := Simp[Identity[-1] Int[Fx, x], x]`
- rule 278 `Int[((c_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_), x_Symbol] := Simp[a^p*((c*x)^(m + 1)/(c*(m + 1)))*Hypergeometric2F1[-p, (m + 1)/2, (m + 1)/2 + 1, (-b)*(x^2/a)], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && (ILtQ[p, 0] || GtQ[a, 0])`
- rule 279 `Int[((c_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_), x_Symbol] := Simp[a^IntPart[p]*((a + b*x^2)^FracPart[p]/(1 + b*(x^2/a))^FracPart[p]) Int[(c*x)^m*(1 + b*(x^2/a))^p, x], x] /; FreeQ[{a, b, c, m, p}, x] && !IGtQ[p, 0] && !(ILtQ[p, 0] || GtQ[a, 0])`
- rule 363 `Int[((e_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2), x_Symbol] := Simp[d*(e*x)^(m + 1)*((a + b*x^2)^(p + 1)/(b*e*(m + 2*p + 3))), x] - Simp[(a*d*(m + 1) - b*c*(m + 2*p + 3))/(b*(m + 2*p + 3)) Int[(e*x)^m*(a + b*x^2)^p, x], x] /; FreeQ[{a, b, c, d, e, m, p}, x] && NeQ[b*c - a*d, 0] && NeQ[m + 2*p + 3, 0]`
- rule 443 `Int[((g_)*(x_))^(m_)*((a_) + (b_)*(x_)^2)^(p_)*((c_) + (d_)*(x_)^2)^(q_)*((e_) + (f_)*(x_)^2), x_Symbol] := Simp[f*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^q/(b*g*(m + 2*(p + q + 1) + 1))), x] + Simp[1/(b*(m + 2*(p + q + 1) + 1)) Int[(g*x)^m*(a + b*x^2)^p*(c + d*x^2)^(q - 1)*Simp[c*((b*e - a*f)*(m + 1) + b*e*2*(p + q + 1)) + (d*(b*e - a*f)*(m + 1) + f*2*q*(b*c - a*d) + b*e*d*2*(p + q + 1))*x^2, x], x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x] && GtQ[q, 0] && !(EqQ[q, 1] && SimplerQ[e + f*x^2, c + d*x^2])`

3.46.4 Maple [F]

$$\int (ex)^m (bx^2 + a)^p (x^2B + A) (dx^2 + c) dx$$

input `int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c),x)`

output `int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c),x)`

3.46. $\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx$

3.46.5 Fricas [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx = \int (Bx^2 + A)(dx^2 + c)(bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c),x, algorithm="fricas")`

output `integral((B*d*x^4 + (B*c + A*d)*x^2 + A*c)*(b*x^2 + a)^p*(e*x)^m, x)`

3.46.6 Sympy [F(-1)]

Timed out.

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx = \text{Timed out}$$

input `integrate((e*x)**m*(b*x**2+a)**p*(B*x**2+A)*(d*x**2+c),x)`

output `Timed out`

3.46.7 Maxima [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx = \int (Bx^2 + A)(dx^2 + c)(bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(b*x^2 + a)^p*(e*x)^m, x)`

3.46.8 Giac [F]

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx = \int (Bx^2 + A)(dx^2 + c)(bx^2 + a)^p (ex)^m dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)*(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(d*x^2 + c)*(b*x^2 + a)^p*(e*x)^m, x)`

3.46.9 Mupad [F(-1)]

Timed out.

$$\int (ex)^m (a + bx^2)^p (A + Bx^2) (c + dx^2) dx = \int (Bx^2 + A) (ex)^m (bx^2 + a)^p (dx^2 + c) dx$$

input `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^p*(c + d*x^2),x)`

output `int((A + B*x^2)*(e*x)^m*(a + b*x^2)^p*(c + d*x^2), x)`

$$3.47 \quad \int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{c+dx^2} dx$$

3.47.1	Optimal result	346
3.47.2	Mathematica [A] (verified)	346
3.47.3	Rubi [A] (verified)	347
3.47.4	Maple [F]	348
3.47.5	Fricas [F]	348
3.47.6	Sympy [F(-1)]	348
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3.47.9	Mupad [F(-1)]	349

3.47.1 Optimal result

Integrand size = 31, antiderivative size = 162

$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{c+dx^2} dx$$

$$= -\frac{(Bc - Ad)(ex)^{1+m} (a+bx^2)^p \left(1 + \frac{bx^2}{a}\right)^{-p} \text{AppellF1}\left(\frac{1+m}{2}, -p, 1, \frac{3+m}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c}\right)}{cde(1+m)}$$

$$+ \frac{B(ex)^{1+m} (a+bx^2)^p \left(1 + \frac{bx^2}{a}\right)^{-p} \text{Hypergeometric2F1}\left(\frac{1+m}{2}, -p, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{de(1+m)}$$

output `-(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^p*AppellF1(1/2+1/2*m, -p, 1, 3/2+1/2*m, -b*x^2/a, -d*x^2/c)/c/d/e/(1+m)/((1+b*x^2/a)^p)+B*(e*x)^(1+m)*(b*x^2+a)^p*hypergeom([-p, 1/2+1/2*m], [3/2+1/2*m], -b*x^2/a)/d/e/(1+m)/((1+b*x^2/a)^p)`

3.47.2 Mathematica [A] (verified)

Time = 0.35 (sec) , antiderivative size = 118, normalized size of antiderivative = 0.73

$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{c+dx^2} dx$$

$$= \frac{x(ex)^m (a+bx^2)^p \left(1 + \frac{bx^2}{a}\right)^{-p} \left((-Bc + Ad) \text{AppellF1}\left(\frac{1+m}{2}, -p, 1, \frac{3+m}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c}\right) + Bc \text{Hypergeome}\right)}{cd(1+m)}$$

3.47. $\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{c+dx^2} dx$

input `Integrate[((e*x)^m*(a + b*x^2)^p*(A + B*x^2))/(c + d*x^2),x]`

output `(x*(e*x)^m*(a + b*x^2)^p*((-(B*c) + A*d)*AppellF1[(1 + m)/2, -p, 1, (3 + m)/2, -(b*x^2)/a], -((d*x^2)/c)] + B*c*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -(b*x^2)/a]))/(c*d*(1 + m)*(1 + (b*x^2)/a)^p)`

3.47.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 162, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.065$, Rules used = {446, 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.

$$\int \frac{(A + Bx^2)(ex)^m(a + bx^2)^p}{c + dx^2} dx$$

↓ 446

$$\int \left(\frac{(ex)^m(a + bx^2)^p(Ad - Bc)}{d(c + dx^2)} + \frac{B(ex)^m(a + bx^2)^p}{d} \right) dx$$

↓ 2009

$$\frac{B(ex)^{m+1}(a + bx^2)^p \left(\frac{bx^2}{a} + 1\right)^{-p} \text{Hypergeometric2F1}\left(\frac{m+1}{2}, -p, \frac{m+3}{2}, -\frac{bx^2}{a}\right)}{de(m+1)} - \frac{(ex)^{m+1}(a + bx^2)^p \left(\frac{bx^2}{a} + 1\right)^{-p} (Bc - Ad) \text{AppellF1}\left(\frac{m+1}{2}, -p, 1, \frac{m+3}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c}\right)}{cde(m+1)}$$

input `Int[((e*x)^m*(a + b*x^2)^p*(A + B*x^2))/(c + d*x^2),x]`

output `-(((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^p*AppellF1[(1 + m)/2, -p, 1, (3 + m)/2, -(b*x^2)/a], -((d*x^2)/c)]/(c*d*e*(1 + m)*(1 + (b*x^2)/a)^p)) + (B*(e*x)^(1 + m)*(a + b*x^2)^p*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -(b*x^2)/a])/(d*e*(1 + m)*(1 + (b*x^2)/a)^p)`

3.47. $\int \frac{(ex)^m(a+bx^2)^p(A+Bx^2)}{c+dx^2} dx$

3.47.3.1 Defintions of rubi rules used

```
rule 446 Int[(((g_)*(x_)^(m_))*((a_) + (b_)*(x_)^2)^(p_))*((e_) + (f_)*(x_)^2))/((c_) + (d_)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x]
```

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

3.47.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^p (x^2B + A)}{dx^2 + c} dx$$

```
input int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c),x)
```

```
output int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c),x)
```

3.47.5 Fricas [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{dx^2 + c} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c),x, algorithm="fricas")
```

```
output integral((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c), x)
```

3.47.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{c + dx^2} dx = \text{Timed out}$$

```
input integrate((e*x)**m*(b*x**2+a)**p*(B*x**2+A)/(d*x**2+c),x)
```

```
output Timed out
```

3.47. $\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{c+dx^2} dx$

3.47.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c),x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c), x)`

3.47.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{dx^2 + c} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c),x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c), x)`

3.47.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{c + dx^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^p}{dx^2 + c} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^p)/(c + d*x^2),x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^p)/(c + d*x^2), x)`

3.48
$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^2} dx$$

3.48.1 Optimal result 350
 3.48.2 Mathematica [A] (verified) 351
 3.48.3 Rubi [A] (verified) 351
 3.48.4 Maple [F] 353
 3.48.5 Fracas [F] 353
 3.48.6 Sympy [F(-1)] 353
 3.48.7 Maxima [F] 354
 3.48.8 Giac [F] 354
 3.48.9 Mupad [F(-1)] 354

3.48.1 Optimal result

Integrand size = 31, antiderivative size = 295

$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^2} dx = \frac{(Bc-Ad)(ex)^{1+m} (a+bx^2)^{1+p}}{2c(bc-ad)e(c+dx^2)}$$

$$-\frac{(ad(Ad(1-m)+Bc(1+m))-bc(Ad(1-m-2p)+Bc(1+m+2p)))(ex)^{1+m} (a+bx^2)^p \left(1+\frac{bx^2}{a}\right)}{2c^2d(bc-ad)e(1+m)}$$

$$-\frac{b(Bc-Ad)(1+m+2p)(ex)^{1+m} (a+bx^2)^p \left(1+\frac{bx^2}{a}\right)^{-p} \text{Hypergeometric2F1}\left(\frac{1+m}{2}, -p, \frac{3+m}{2}, -\frac{bx^2}{a}\right)}{2cd(bc-ad)e(1+m)}$$

output

```
1/2*(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^(p+1)/c/(-a*d+b*c)/e/(d*x^2+c)-1/2*(a
*d*(A*d*(1-m)+B*c*(1+m))-b*c*(A*d*(1-m-2*p)+B*c*(1+m+2*p)))*(e*x)^(1+m)*(b
*x^2+a)^p*AppellF1(1/2+1/2*m,-p,1,3/2+1/2*m,-b*x^2/a,-d*x^2/c)/c^2/d/(-a*d
+b*c)/e/(1+m)/((1+b*x^2/a)^p)-1/2*b*(-A*d+B*c)*(1+m+2*p)*(e*x)^(1+m)*(b*x^
2+a)^p*hypergeom([-p, 1/2+1/2*m],[3/2+1/2*m],-b*x^2/a)/c/d/(-a*d+b*c)/e/(1
+m)/((1+b*x^2/a)^p)
```

3.48.
$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^2} dx$$

3.48.2 Mathematica [A] (verified)

Time = 0.38 (sec) , antiderivative size = 128, normalized size of antiderivative = 0.43

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx$$

$$= \frac{x(ex)^m (a + bx^2)^p \left(1 + \frac{bx^2}{a}\right)^{-p} \left(Bc \operatorname{AppellF1} \left(\frac{1+m}{2}, -p, 1, \frac{3+m}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c} \right) + (-Bc + Ad) \operatorname{AppellF1} \left(\frac{1+m}{2}, -p, 2, \frac{3+m}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c} \right) \right)}{c^2 d(1+m)}$$

input `Integrate[((e*x)^m*(a + b*x^2)^p*(A + B*x^2))/(c + d*x^2)^2,x]`

output `(x*(e*x)^m*(a + b*x^2)^p*(B*c*AppellF1[(1 + m)/2, -p, 1, (3 + m)/2, -(b*x^2)/a, -(d*x^2)/c] + (-B*c) + A*d)*AppellF1[(1 + m)/2, -p, 2, (3 + m)/2, -(b*x^2)/a, -(d*x^2)/c])/(c^2*d*(1 + m)*(1 + (b*x^2)/a)^p)`

3.48.3 Rubi [A] (verified)

Time = 0.52 (sec) , antiderivative size = 286, normalized size of antiderivative = 0.97, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.097$, Rules used = {441, 446, 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.

$$\int \frac{(A + Bx^2)(ex)^m (a + bx^2)^p}{(c + dx^2)^2} dx$$

$$\downarrow 441$$

$$\int \frac{(ex)^m (bx^2 + a)^p (-b(Bc - Ad)(m + 2p + 1)x^2 + 2Abc - aAd(1 - m) - aBc(m + 1))}{d(x^2 + c)^2} dx + \frac{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)}{2ce(c + dx^2)(bc - ad)}$$

$$\downarrow 446$$

$$\int \left(\frac{(d(2Abc - aB(m + 1)c - aAd(1 - m)) + bc(Bc - Ad)(m + 2p + 1))(ex)^m (bx^2 + a)^p}{d(dx^2 + c)} - \frac{b(Bc - Ad)(m + 2p + 1)(ex)^m (bx^2 + a)^p}{d} \right) dx + \frac{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)}{2ce(c + dx^2)(bc - ad)}$$

3.48. $\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx$

↓ 2009

$$\frac{(ex)^{m+1}(a+bx^2)^p\left(\frac{bx^2}{a}+1\right)^{-p}(ad(Ad(1-m)+Bc(m+1))-bc(Ad(-m-2p+1)+Bc(m+2p+1)))\operatorname{AppellF1}\left(\frac{m+1}{2},-p,1,\frac{m+3}{2},-\frac{bx^2}{a},-\frac{dx^2}{c}\right)}{cde(m+1)} = \frac{(ex)^{m+1}(a+bx^2)^{p+1}(Bc-Ad)}{2ce(c+dx^2)(bc-ad)}$$

input `Int[((e*x)^m*(a + b*x^2)^p*(A + B*x^2))/(c + d*x^2)^2,x]`

output `((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^(1 + p))/(2*c*(b*c - a*d)*e*(c + d*x^2) + (-(((a*d*(A*d*(1 - m) + B*c*(1 + m)) - b*c*(A*d*(1 - m - 2*p) + B*c*(1 + m + 2*p)))*(e*x)^(1 + m)*(a + b*x^2)^p*AppellF1[(1 + m)/2, -p, 1, (3 + m)/2, -(b*x^2)/a, -((d*x^2)/c)]/(c*d*e*(1 + m)*(1 + (b*x^2)/a)^p) - (b*(B*c - A*d)*(1 + m + 2*p)*(e*x)^(1 + m)*(a + b*x^2)^p*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -(b*x^2)/a]))/(d*e*(1 + m)*(1 + (b*x^2)/a)^p))/(2*c*(b*c - a*d))`

3.48.3.1 Defintions of rubi rules used

rule 441 `Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_.)*((e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a + b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Simp[1/(a^2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m + 2*(p + q + 2) + 1)*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q}, x] && LtQ[p, -1]`

rule 446 `Int((((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((e_) + (f_.)*(x_)^2))/(c_) + (d_.)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x]`

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

3.48.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^p (x^2B + A)}{(dx^2 + c)^2} dx$$

input `int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^2,x)`

output `int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^2,x)`

3.48.5 Fracas [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="fracas")`

output `integral((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d^2*x^4 + 2*c*d*x^2 + c^2), x)`

3.48.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx = \text{Timed out}$$

input `integrate((e*x)**m*(b*x**2+a)**p*(B*x**2+A)/(d*x**2+c)**2,x)`

output `Timed out`

3.48.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c)^2, x)`

3.48.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{(dx^2 + c)^2} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^2,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c)^2, x)`

3.48.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^2} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^p}{(dx^2 + c)^2} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^p)/(c + d*x^2)^2,x)`

output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^p)/(c + d*x^2)^2, x)`

3.49
$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^3} dx$$

3.49.1	Optimal result	355
3.49.2	Mathematica [A] (verified)	356
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3.49.4	Maple [F]	358
3.49.5	Fricas [F]	358
3.49.6	Sympy [F(-1)]	359
3.49.7	Maxima [F]	359
3.49.8	Giac [F]	359
3.49.9	Mupad [F(-1)]	360

3.49.1 Optimal result

Integrand size = 31, antiderivative size = 483

$$\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^3} dx = \frac{(Bc-Ad)(ex)^{1+m} (a+bx^2)^{1+p}}{4c(bc-ad)e(c+dx^2)^2} + \frac{(ad(Ad(3-m)+Bc(1+m))+bc(Bc(1-m-2p)-Ad(5-m-2p)))(ex)^{1+m} (a+bx^2)^{1+p}}{8c^2(bc-ad)^2e(c+dx^2)} + \frac{(a^2d^2(1-m)(Ad(3-m)+Bc(1+m))-2abcd(Bc(1+m)(1-m-2p)+Ad(1-m)(3-m-2p))}{b(ad(Ad(3-m)+Bc(1+m))+bc(Bc(1-m-2p)-Ad(5-m-2p)))(1+m+2p)(ex)^{1+m} (a+bx^2)^{1+p}} - \frac{8c^2d(bc-ad)^2e(1+m)}{8c^2d(bc-ad)^2e(1+m)}$$

output

```
1/4*(-A*d+B*c)*(e*x)^(1+m)*(b*x^2+a)^(p+1)/c/(-a*d+b*c)/e/(d*x^2+c)^2+1/8*(a*d*(A*d*(3-m)+B*c*(1+m))+b*c*(B*c*(1-m-2*p)-A*d*(5-m-2*p)))*(e*x)^(1+m)*(b*x^2+a)^(p+1)/c^2/(-a*d+b*c)^2/e/(d*x^2+c)+1/8*(a^2*d^2*(1-m)*(A*d*(3-m)+B*c*(1+m))-2*a*b*c*d*(B*c*(1+m)*(1-m-2*p)+A*d*(1-m)*(3-m-2*p))+b^2*c^2*(1-m-2*p)*(A*d*(3-m-2*p)+B*c*(1+m+2*p)))*(e*x)^(1+m)*(b*x^2+a)^p*AppellF1(1/2+1/2*m,-p,1,3/2+1/2*m,-b*x^2/a,-d*x^2/c)/c^3/d/(-a*d+b*c)^2/e/(1+m)/((1+b*x^2/a)^p)-1/8*b*(a*d*(A*d*(3-m)+B*c*(1+m))+b*c*(B*c*(1-m-2*p)-A*d*(5-m-2*p)))*(1+m+2*p)*(e*x)^(1+m)*(b*x^2+a)^p*hypergeom([-p, 1/2+1/2*m],[3/2+1/2*m],-b*x^2/a)/c^2/d/(-a*d+b*c)^2/e/(1+m)/((1+b*x^2/a)^p)
```

3.49.2 Mathematica [A] (verified)

Time = 0.55 (sec) , antiderivative size = 128, normalized size of antiderivative = 0.27

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx$$

$$= \frac{x(ex)^m (a + bx^2)^p \left(1 + \frac{bx^2}{a}\right)^{-p} \left(Bc \operatorname{AppellF1} \left(\frac{1+m}{2}, -p, 2, \frac{3+m}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c} \right) + (-Bc + Ad) \operatorname{AppellF1} \left(\frac{1+m}{2}, -p, 3, \frac{3+m}{2}, -\frac{bx^2}{a}, -\frac{dx^2}{c} \right) \right)}{c^3 d(1+m)}$$

input `Integrate[((e*x)^m*(a + b*x^2)^p*(A + B*x^2))/(c + d*x^2)^3,x]`

output `(x*(e*x)^m*(a + b*x^2)^p*(B*c*AppellF1[(1 + m)/2, -p, 2, (3 + m)/2, -(b*x^2)/a], -(d*x^2)/c] + (-B*c) + A*d)*AppellF1[(1 + m)/2, -p, 3, (3 + m)/2, -(b*x^2)/a], -(d*x^2)/c)]/(c^3*d*(1 + m)*(1 + (b*x^2)/a)^p)`

3.49.3 Rubi [A] (verified)

Time = 0.95 (sec) , antiderivative size = 491, normalized size of antiderivative = 1.02, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}} = 0.129$, Rules used = {441, 441, 446, 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.

$$\int \frac{(A + Bx^2)(ex)^m (a + bx^2)^p}{(c + dx^2)^3} dx$$

$$\downarrow 441$$

$$\int \frac{(ex)^m (bx^2 + a)^p (b(Bc - Ad)(-m - 2p + 1)x^2 + 4Abc - aAd(3 - m) - aBc(m + 1))}{(dx^2 + c)^2} dx$$

$$\frac{4c(bc - ad)}{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)} +$$

$$\frac{4ce(c + dx^2)^2 (bc - ad)}{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)}$$

$$\downarrow 441$$

3.49. $\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx$

$$\int \frac{(ex)^m (bx^2+a)^P (b(d(4Abc-aB(m+1)c-aAd(3-m))-bc(Bc-Ad)(-m-2p+1))(m+2p+1)x^2+aBc(m+1)(ad(1-m)-bc(-m-2p+3))+A(8b^2c^2-abd(m^2-2(3-m)(m+1)c-aAd(3-m))-bc(Bc-Ad)(-m-2p+1)))}{\frac{dx^2+c}{2c(bc-ad)}} dx$$

$$\frac{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)}{4ce (c + dx^2)^2 (bc - ad)}$$

↓ 446

$$\int \left(\frac{b(d(4Abc-aB(m+1)c-aAd(3-m))-bc(Bc-Ad)(-m-2p+1))(m+2p+1)(bx^2+a)^P (ex)^m}{d} + \frac{(d(aBc(m+1)(ad(1-m)-bc(-m-2p+3))+A(8b^2c^2-abd(m^2-2(3-m)(m+1)c-aAd(3-m))-bc(Bc-Ad)(-m-2p+1)))}{2c(bc-ad)} \right) dx$$

$$\frac{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)}{4ce (c + dx^2)^2 (bc - ad)}$$

↓ 2009

$$\frac{(ex)^{m+1} (a+bx^2)^P \left(\frac{bx^2}{a}+1\right)^{-P} (a^2d^2(1-m)(Ad(3-m)+Bc(m+1))-2abcd(Ad(1-m)(-m-2p+3)+Bc(m+1)(-m-2p+1))+b^2c^2(-m-2p+1)(Ad(-m-2p+3)+Bc(m+1)(-m-2p+1)))}{cde(m+1)}$$

$$\frac{(ex)^{m+1} (a + bx^2)^{p+1} (Bc - Ad)}{4ce (c + dx^2)^2 (bc - ad)}$$

input `Int[((ex)^m*(a + b*x^2)^p*(A + B*x^2))/(c + d*x^2)^3,x]`

output `((B*c - A*d)*(e*x)^(1 + m)*(a + b*x^2)^(1 + p))/(4*c*(b*c - a*d)*e*(c + d*x^2)^2 + (((a*d*(A*d*(3 - m) + B*c*(1 + m)) + b*c*(B*c*(1 - m - 2*p) - A*d*(5 - m - 2*p)))*(e*x)^(1 + m)*(a + b*x^2)^(1 + p))/(2*c*(b*c - a*d)*e*(c + d*x^2)) + (((a^2*d^2*(1 - m)*(A*d*(3 - m) + B*c*(1 + m)) - 2*a*b*c*d*(B*c*(1 + m)*(1 - m - 2*p) + A*d*(1 - m)*(3 - m - 2*p)) + b^2*c^2*(1 - m - 2*p)*(A*d*(3 - m - 2*p) + B*c*(1 + m + 2*p)))*(e*x)^(1 + m)*(a + b*x^2)^p*AppellF1[(1 + m)/2, -p, 1, (3 + m)/2, -((b*x^2)/a), -((d*x^2)/c)]/(c*d*e*(1 + m)*(1 + (b*x^2)/a)^p) - (b*(a*d*(A*d*(3 - m) + B*c*(1 + m)) + b*c*(B*c*(1 - m - 2*p) - A*d*(5 - m - 2*p)))*(1 + m + 2*p)*(e*x)^(1 + m)*(a + b*x^2)^p*Hypergeometric2F1[(1 + m)/2, -p, (3 + m)/2, -((b*x^2)/a)]/(d*e*(1 + m)*(1 + (b*x^2)/a)^p))/(2*c*(b*c - a*d))/(4*c*(b*c - a*d))`

$$3.49. \int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^3} dx$$

3.49.3.1 Defintions of rubi rules used

```
rule 441 Int[((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((c_) + (d_.)*(x_)^2)^(q_)
)*(e_) + (f_.)*(x_)^2), x_Symbol] := Simp[(-(b*e - a*f))*(g*x)^(m + 1)*(a
+ b*x^2)^(p + 1)*((c + d*x^2)^(q + 1)/(a*g^2*(b*c - a*d)*(p + 1))), x] + Si
mp[1/(a*2*(b*c - a*d)*(p + 1)) Int[(g*x)^m*(a + b*x^2)^(p + 1)*(c + d*x^2
)^q*Simp[c*(b*e - a*f)*(m + 1) + e*2*(b*c - a*d)*(p + 1) + d*(b*e - a*f)*(m
+ 2*(p + q + 2) + 1)*x^2, x], x] /; FreeQ[{a, b, c, d, e, f, g, m, q},
x] && LtQ[p, -1]
```

```
rule 446 Int[(((g_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^2)^(p_.)*((e_) + (f_.)*(x_)^2))/
(c_) + (d_.)*(x_)^2), x_Symbol] := Int[ExpandIntegrand[(g*x)^m*(a + b*x^2)^
p*((e + f*x^2)/(c + d*x^2)), x], x] /; FreeQ[{a, b, c, d, e, f, g, m, p}, x
]
```

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

3.49.4 Maple [F]

$$\int \frac{(ex)^m (bx^2 + a)^p (x^2B + A)}{(dx^2 + c)^3} dx$$

```
input int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^3,x)
```

```
output int((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^3,x)
```

3.49.5 Fracas [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{(dx^2 + c)^3} dx$$

```
input integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="fricas")
```

```
output integral((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d^3*x^6 + 3*c*d^2*x^4 + 3*c^2*
d*x^2 + c^3), x)
```

3.49. $\int \frac{(ex)^m (a+bx^2)^p (A+Bx^2)}{(c+dx^2)^3} dx$

3.49.6 Sympy [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx = \text{Timed out}$$

input `integrate((e*x)**m*(b*x**2+a)**p*(B*x**2+A)/(d*x**2+c)**3,x)`

output `Timed out`

3.49.7 Maxima [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="maxima")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c)^3, x)`

3.49.8 Giac [F]

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A)(bx^2 + a)^p (ex)^m}{(dx^2 + c)^3} dx$$

input `integrate((e*x)^m*(b*x^2+a)^p*(B*x^2+A)/(d*x^2+c)^3,x, algorithm="giac")`

output `integrate((B*x^2 + A)*(b*x^2 + a)^p*(e*x)^m/(d*x^2 + c)^3, x)`

3.49.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(ex)^m (a + bx^2)^p (A + Bx^2)}{(c + dx^2)^3} dx = \int \frac{(Bx^2 + A) (ex)^m (bx^2 + a)^p}{(dx^2 + c)^3} dx$$

input `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^p)/(c + d*x^2)^3,x)`output `int(((A + B*x^2)*(e*x)^m*(a + b*x^2)^p)/(c + d*x^2)^3, x)`

3.50 $\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx$

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3.50.1 Optimal result

Integrand size = 29, antiderivative size = 84

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx = Ac\sqrt{a+bx^2} - \frac{(a+bx^2)^{3/2}(2aBd-5b(Bc+Ad)-3bBdx^2)}{15b^2} - \sqrt{a}A\operatorname{arctanh}\left(\frac{\sqrt{a+bx^2}}{\sqrt{a}}\right)$$

output `-1/15*(b*x^2+a)^(3/2)*(2*B*a*d-5*b*(A*d+B*c)-3*b*B*d*x^2)/b^2-A*c*arctanh((b*x^2+a)^(1/2)/a^(1/2))*a^(1/2)+A*c*(b*x^2+a)^(1/2)`

3.50.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.08

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx = \frac{\sqrt{a+bx^2}(-B(a+bx^2)(-5bc+2ad-3bdx^2)+5Ab(3bc+ad+bdx^2))}{15b^2} - \sqrt{a}A\operatorname{arctanh}\left(\frac{\sqrt{a+bx^2}}{\sqrt{a}}\right)$$

input `Integrate[(Sqrt[a + b*x^2]*(A + B*x^2)*(c + d*x^2))/x,x]`

output `(Sqrt[a + b*x^2]*(-(B*(a + b*x^2)*(-5*b*c + 2*a*d - 3*b*d*x^2)) + 5*A*b*(3*b*c + a*d + b*d*x^2)))/(15*b^2) - Sqrt[a]*A*c*ArcTanh[Sqrt[a + b*x^2]/Sqrt[a]]`

3.50.3 Rubi [A] (verified)

Time = 0.21 (sec) , antiderivative size = 89, normalized size of antiderivative = 1.06, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.172$, Rules used = {435, 164, 60, 73, 221}

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.

$$\begin{aligned}
 & \int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx \\
 & \quad \downarrow 435 \\
 & \frac{1}{2} \int \frac{\sqrt{bx^2+a}(Bx^2+A)(dx^2+c)}{x^2} dx^2 \\
 & \quad \downarrow 164 \\
 & \frac{1}{2} \left(Ac \int \frac{\sqrt{bx^2+a}}{x^2} dx^2 - \frac{2(a+bx^2)^{3/2} (2aBd - 5b(Ad+Bc) - 3bBdx^2)}{15b^2} \right) \\
 & \quad \downarrow 60 \\
 & \frac{1}{2} \left(Ac \left(a \int \frac{1}{x^2 \sqrt{bx^2+a}} dx^2 + 2\sqrt{a+bx^2} \right) - \frac{2(a+bx^2)^{3/2} (2aBd - 5b(Ad+Bc) - 3bBdx^2)}{15b^2} \right) \\
 & \quad \downarrow 73 \\
 & \frac{1}{2} \left(Ac \left(\frac{2a \int \frac{1}{\frac{x^4}{b} - \frac{a}{b}} d\sqrt{bx^2+a}}{b} + 2\sqrt{a+bx^2} \right) - \frac{2(a+bx^2)^{3/2} (2aBd - 5b(Ad+Bc) - 3bBdx^2)}{15b^2} \right) \\
 & \quad \downarrow 221 \\
 & \frac{1}{2} \left(Ac \left(2\sqrt{a+bx^2} - 2\sqrt{a} \operatorname{arctanh} \left(\frac{\sqrt{a+bx^2}}{\sqrt{a}} \right) \right) - \frac{2(a+bx^2)^{3/2} (2aBd - 5b(Ad+Bc) - 3bBdx^2)}{15b^2} \right)
 \end{aligned}$$

3.50. $\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx$

input `Int[(Sqrt[a + b*x^2]*(A + B*x^2)*(c + d*x^2))/x,x]`

output `((-2*(a + b*x^2)^(3/2)*(2*a*B*d - 5*b*(B*c + A*d) - 3*b*B*d*x^2))/(15*b^2 + A*c*(2*Sqrt[a + b*x^2] - 2*Sqrt[a]*ArcTanh[Sqrt[a + b*x^2]/Sqrt[a]]))/2`

3.50.3.1 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] && (!IntegerQ[n] || (GtQ[m, 0] && LtQ[m - n, 0]))) && !ILtQ[m + n + 2, 0] && IntLinearQ[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] && LtQ[-1, m, 0] && LeQ[-1, n, 0] && LeQ[Denominator[n], Denominator[m]] && IntLinearQ[a, b, c, d, m, n, x]`

rule 164 `Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.)*((e_.) + (f_.)*(x_))*((g_.) + (h_.)*(x_)), x_] := Simp[(-(a*d*f*h*(n + 2) + b*c*f*h*(m + 2) - b*d*(f*g + e*h)*(m + n + 3) - b*d*f*h*(m + n + 2)*x)*(a + b*x)^(m + 1)*((c + d*x)^(n + 1)/(b^2*d^2*(m + n + 2)*(m + n + 3))), x] + Simp[(a^2*d^2*f*h*(n + 1)*(n + 2) + a*b*d*(n + 1)*(2*c*f*h*(m + 1) - d*(f*g + e*h)*(m + n + 3)) + b^2*(c^2*f*h*(m + 1)*(m + 2) - c*d*(f*g + e*h)*(m + 1)*(m + n + 3) + d^2*e*g*(m + n + 2)*(m + n + 3)))/(b^2*d^2*(m + n + 2)*(m + n + 3)) Int[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, m, n}, x] && NeQ[m + n + 2, 0] && NeQ[m + n + 3, 0]`

rule 221 `Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] := Simp[(Rt[-a/b, 2]/a)*ArcTanh[x/Rt[-a/b, 2]], x] /; FreeQ[{a, b}, x] && NegQ[a/b]`

```
rule 435 Int[(x_)^(m_.)*((a_.) + (b_.)*(x_)^2)^(p_.)*((c_.) + (d_.)*(x_)^2)^(q_.)*((
e_.) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Simp[1/2 Subst[Int[x^((m - 1)/2)
*(a + b*x)^p*(c + d*x)^q*(e + f*x)^r, x], x, x^2], x] /; FreeQ[{a, b, c, d,
e, f, p, q, r}, x] && IntegerQ[(m - 1)/2]
```

3.50.4 Maple [A] (verified)

Time = 3.40 (sec) , antiderivative size = 95, normalized size of antiderivative = 1.13

method	result
pseudoelliptic	$\frac{-3A\sqrt{a}b^2c \operatorname{arctanh}\left(\frac{\sqrt{bx^2+a}}{\sqrt{a}}\right) + \left(\left(x^2\left(\frac{3d}{5}x^2+c\right)B+3\left(\frac{d}{3}x^2+c\right)A\right)b^2 + \left(\left(\frac{d}{5}x^2+c\right)B+Ad\right)ab - \frac{2B}{5}a^2d\right)\sqrt{bx^2+a}}{3b^2}$
default	$Bd\left(\frac{x^2(bx^2+a)^{\frac{3}{2}}}{5b} - \frac{2a(bx^2+a)^{\frac{3}{2}}}{15b^2}\right) + \frac{Ad(bx^2+a)^{\frac{3}{2}}}{3b} + \frac{Bc(bx^2+a)^{\frac{3}{2}}}{3b} + Ac\left(\sqrt{bx^2+a} - \sqrt{a} \ln\left(\frac{2a+2\sqrt{bx^2+a}}{\sqrt{a}}\right)\right)$

```
input int((B*x^2+A)*(d*x^2+c)*(b*x^2+a)^(1/2)/x,x,method=_RETURNVERBOSE)
```

```
output 1/3*(-3*A*a^(1/2)*b^2*c*arctanh((b*x^2+a)^(1/2)/a^(1/2))+((x^2*(3/5*d*x^2+
c)*B+3*(1/3*d*x^2+c)*A)*b^2+((1/5*d*x^2+c)*B+A*d)*a*b-2/5*B*a^2*d)*(b*x^2+
a)^(1/2))/b^2
```

3.50.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 231, normalized size of antiderivative = 2.75

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx = \left[\frac{15A\sqrt{ab^2}c \log\left(-\frac{bx^2-2\sqrt{bx^2+a}\sqrt{a+2a}}{x^2}\right) + 2(3Bb^2dx^4 + (5Bb^2c + (Bab + 5Ab^2)d)x^2 + 5(Bab + 3Ab^2)c)}{30b^2} \right]$$

```
input integrate((B*x^2+A)*(d*x^2+c)*(b*x^2+a)^(1/2)/x,x, algorithm="fricas")
```

```
output [1/30*(15*A*sqrt(a)*b^2*c*log(-(b*x^2 - 2*sqrt(b*x^2 + a))*sqrt(a) + 2*a)/x
^2) + 2*(3*B*b^2*d*x^4 + (5*B*b^2*c + (B*a*b + 5*A*b^2)*d)*x^2 + 5*(B*a*b
+ 3*A*b^2)*c - (2*B*a^2 - 5*A*a*b)*d)*sqrt(b*x^2 + a))/b^2, 1/15*(15*A*sqrt
(-a)*b^2*c*arctan(sqrt(-a)/sqrt(b*x^2 + a)) + (3*B*b^2*d*x^4 + (5*B*b^2*c
+ (B*a*b + 5*A*b^2)*d)*x^2 + 5*(B*a*b + 3*A*b^2)*c - (2*B*a^2 - 5*A*a*b)*
d)*sqrt(b*x^2 + a))/b^2]
```

3.50.6 Sympy [A] (verification not implemented)

Time = 9.66 (sec) , antiderivative size = 151, normalized size of antiderivative = 1.80

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx$$

$$= \begin{cases} \frac{2Aac \operatorname{atan}\left(\frac{\sqrt{a+bx^2}}{\sqrt{-a}}\right)}{\sqrt{-a}} + 2Ac\sqrt{a+bx^2} + \frac{2Bd(a+bx^2)^{\frac{5}{2}}}{5b^2} + \frac{2(a+bx^2)^{\frac{3}{2}}(Abd-Bad+Bbc)}{3b^2} & \text{for } b \neq 0 \\ A\sqrt{ac} \log(x^2) + A\sqrt{a}dx^2 + B\sqrt{ac}x^2 + \frac{B\sqrt{a}dx^4}{2} & \text{otherwise} \end{cases}$$

```
input integrate((B*x**2+A)*(d*x**2+c)*(b*x**2+a)**(1/2)/x,x)
```

```
output Piecewise((2*A*a*c*atan(sqrt(a + b*x**2)/sqrt(-a))/sqrt(-a) + 2*A*c*sqrt(a
+ b*x**2) + 2*B*d*(a + b*x**2)**(5/2)/(5*b**2) + 2*(a + b*x**2)**(3/2)*(A
*b*d - B*a*d + B*b*c)/(3*b**2), Ne(b, 0)), (A*sqrt(a)*c*log(x**2) + A*sqrt
(a)*d*x**2 + B*sqrt(a)*c*x**2 + B*sqrt(a)*d*x**4/2, True))/2
```

3.50.7 Maxima [A] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 100, normalized size of antiderivative = 1.19

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx = \frac{(bx^2+a)^{\frac{3}{2}}Bdx^2}{5b} - A\sqrt{ac} \operatorname{arsinh}\left(\frac{a}{\sqrt{ab}|x|}\right)$$

$$+ \sqrt{bx^2+a}Ac + \frac{(bx^2+a)^{\frac{3}{2}}Bc}{3b}$$

$$- \frac{2(bx^2+a)^{\frac{3}{2}}Bad}{15b^2} + \frac{(bx^2+a)^{\frac{3}{2}}Ad}{3b}$$

input `integrate((B*x^2+A)*(d*x^2+c)*(b*x^2+a)^(1/2)/x,x, algorithm="maxima")`

output $\frac{1}{5}(bx^2 + a)^{3/2}Bdx^2/b - A\sqrt{a}c\operatorname{arcsinh}(a/(\sqrt{a}b)|x|) + \sqrt{bx^2 + a}Ac + \frac{1}{3}(bx^2 + a)^{3/2}Bc/b - \frac{2}{15}(bx^2 + a)^{3/2}Bda/b^2 + \frac{1}{3}(bx^2 + a)^{3/2}Ad/b$

3.50.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 113, normalized size of antiderivative = 1.35

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx = \frac{Aac \arctan\left(\frac{\sqrt{bx^2+a}}{\sqrt{-a}}\right)}{\sqrt{-a}} + \frac{5(bx^2+a)^{3/2}Bb^9c + 15\sqrt{bx^2+a}Ab^{10}c + 3(bx^2+a)^{5/2}Bb^8d - 5(bx^2+a)^{3/2}Bab^8d + 5(bx^2+a)^{3/2}Ab^9d}{15b^{10}}$$

input `integrate((B*x^2+A)*(d*x^2+c)*(b*x^2+a)^(1/2)/x,x, algorithm="giac")`

output $Aac\arctan(\sqrt{bx^2+a}/\sqrt{-a})/\sqrt{-a} + \frac{1}{15}(5(bx^2+a)^{3/2})Bb^9c + 15\sqrt{bx^2+a}Ab^{10}c + 3(bx^2+a)^{5/2}Bb^8d - 5(bx^2+a)^{3/2}Bab^8d + 5(bx^2+a)^{3/2}Ab^9d/b^{10}$

3.50.9 Mupad [B] (verification not implemented)

Time = 5.99 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.20

$$\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx = \sqrt{bx^2+a} \left(\frac{Bdx^4}{5} - \frac{Ba(2ad-5bc)}{15b^2} + \frac{Bx^2(ad+5bc)}{15b} \right) + Ac\sqrt{bx^2+a} + \frac{Ad(bx^2+a)^{3/2}}{3b} - A\sqrt{a}c \operatorname{atanh}\left(\frac{\sqrt{bx^2+a}}{\sqrt{a}}\right)$$

input `int(((A + B*x^2)*(a + b*x^2)^(1/2)*(c + d*x^2))/x,x)`

output $(a + bx^2)^{1/2} * ((Bdx^4)/5 - (Ba*(2ad - 5bc))/(15*b^2) + (Bx^2*(a*d + 5*b*c))/(15*b)) + A*c*(a + b*x^2)^{1/2} + (A*d*(a + b*x^2)^{3/2})/(3*b) - A*a^{1/2}*c*atanh((a + b*x^2)^{1/2}/a^{1/2})$

3.50. $\int \frac{\sqrt{a+bx^2}(A+Bx^2)(c+dx^2)}{x} dx$

3.51 $\int \frac{(a+bx^2)(A+Bx^2)\sqrt{c+dx^2}}{x} dx$

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3.51.1 Optimal result

Integrand size = 29, antiderivative size = 84

$$\int \frac{(a+bx^2)(A+Bx^2)\sqrt{c+dx^2}}{x} dx = aA\sqrt{c+dx^2} - \frac{(c+dx^2)^{3/2}(2bBc-5(Ab+aB)d-3bBdx^2)}{15d^2} - aA\sqrt{c}\operatorname{arctanh}\left(\frac{\sqrt{c+dx^2}}{\sqrt{c}}\right)$$

```
output -1/15*(d*x^2+c)^(3/2)*(2*B*b*c-5*(A*b+B*a)*d-3*b*B*d*x^2)/d^2-a*A*arctanh(
(d*x^2+c)^(1/2)/c^(1/2))*c^(1/2)+a*A*(d*x^2+c)^(1/2)
```

3.51.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.08

$$\int \frac{(a+bx^2)(A+Bx^2)\sqrt{c+dx^2}}{x} dx = \frac{\sqrt{c+dx^2}(-b(c+dx^2)(2Bc-5Ad-3Bdx^2)+5ad(3Ad+B(c+dx^2)))}{15d^2} - aA\sqrt{c}\operatorname{arctanh}\left(\frac{\sqrt{c+dx^2}}{\sqrt{c}}\right)$$

input `Integrate[((a + b*x^2)*(A + B*x^2)*Sqrt[c + d*x^2])/x,x]`

output `(Sqrt[c + d*x^2]*(-(b*(c + d*x^2)*(2*B*c - 5*A*d - 3*B*d*x^2)) + 5*a*d*(3*A*d + B*(c + d*x^2))))/(15*d^2) - a*A*Sqrt[c]*ArcTanh[Sqrt[c + d*x^2]/Sqrt[c]]`

3.51.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 89, normalized size of antiderivative = 1.06, number of steps used = 6, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.172$, Rules used = {435, 164, 60, 73, 221}

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.

$$\begin{aligned}
 & \int \frac{(a + bx^2)(A + Bx^2)\sqrt{c + dx^2}}{x} dx \\
 & \quad \downarrow 435 \\
 & \frac{1}{2} \int \frac{(bx^2 + a)(Bx^2 + A)\sqrt{dx^2 + c}}{x^2} dx^2 \\
 & \quad \downarrow 164 \\
 & \frac{1}{2} \left(aA \int \frac{\sqrt{dx^2 + c}}{x^2} dx^2 - \frac{2(c + dx^2)^{3/2}(-5d(aB + Ab) + 2bBc - 3bBdx^2)}{15d^2} \right) \\
 & \quad \downarrow 60 \\
 & \frac{1}{2} \left(aA \left(c \int \frac{1}{x^2 \sqrt{dx^2 + c}} dx^2 + 2\sqrt{c + dx^2} \right) - \frac{2(c + dx^2)^{3/2}(-5d(aB + Ab) + 2bBc - 3bBdx^2)}{15d^2} \right) \\
 & \quad \downarrow 73 \\
 & \frac{1}{2} \left(aA \left(\frac{2c \int \frac{1}{\frac{x^4}{d} - \frac{c}{d}} d\sqrt{dx^2 + c}}{d} + 2\sqrt{c + dx^2} \right) - \frac{2(c + dx^2)^{3/2}(-5d(aB + Ab) + 2bBc - 3bBdx^2)}{15d^2} \right) \\
 & \quad \downarrow 221 \\
 & \frac{1}{2} \left(aA \left(2\sqrt{c + dx^2} - 2\sqrt{c} \operatorname{arctanh} \left(\frac{\sqrt{c + dx^2}}{\sqrt{c}} \right) \right) - \frac{2(c + dx^2)^{3/2}(-5d(aB + Ab) + 2bBc - 3bBdx^2)}{15d^2} \right)
 \end{aligned}$$

3.51. $\int \frac{(a+bx^2)(A+Bx^2)\sqrt{c+dx^2}}{x} dx$

input `Int[((a + b*x^2)*(A + B*x^2)*Sqrt[c + d*x^2])/x,x]`

output `((-2*(c + d*x^2)^(3/2)*(2*b*B*c - 5*(A*b + a*B)*d - 3*b*B*d*x^2))/(15*d^2 + a*A*(2*Sqrt[c + d*x^2] - 2*Sqrt[c]*ArcTanh[Sqrt[c + d*x^2]/Sqrt[c]]))/2`

3.51.3.1 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] && (!IntegerQ[n] || (GtQ[m, 0] && LtQ[m - n, 0]))) && !ILtQ[m + n + 2, 0] && IntLinearQ[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] && LtQ[-1, m, 0] && LeQ[-1, n, 0] && LeQ[Denominator[n], Denominator[m]] && IntLinearQ[a, b, c, d, m, n, x]`

rule 164 `Int[((a_.) + (b_.)*(x_))^(m_.)*((c_.) + (d_.)*(x_))^(n_.)*((e_.) + (f_.)*(x_))*((g_.) + (h_.)*(x_)), x_] := Simp[(-(a*d*f*h*(n + 2) + b*c*f*h*(m + 2) - b*d*(f*g + e*h)*(m + n + 3) - b*d*f*h*(m + n + 2)*x)*(a + b*x)^(m + 1)*((c + d*x)^(n + 1)/(b^2*d^2*(m + n + 2)*(m + n + 3))), x] + Simp[(a^2*d^2*f*h*(n + 1)*(n + 2) + a*b*d*(n + 1)*(2*c*f*h*(m + 1) - d*(f*g + e*h)*(m + n + 3)) + b^2*(c^2*f*h*(m + 1)*(m + 2) - c*d*(f*g + e*h)*(m + 1)*(m + n + 3) + d^2*e*g*(m + n + 2)*(m + n + 3)))/(b^2*d^2*(m + n + 2)*(m + n + 3)) Int[(a + b*x)^m*(c + d*x)^n, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, m, n}, x] && NeQ[m + n + 2, 0] && NeQ[m + n + 3, 0]`

rule 221 `Int[((a_) + (b_.)*(x_)^2)^(-1), x_Symbol] := Simp[(Rt[-a/b, 2]/a)*ArcTanh[x/Rt[-a/b, 2]], x] /; FreeQ[{a, b}, x] && NegQ[a/b]`

```
rule 435 Int[(x_)^(m_.)*((a_.) + (b_.)*(x_)^2)^(p_.)*((c_.) + (d_.)*(x_)^2)^(q_.)*((
e_.) + (f_.)*(x_)^2)^(r_.), x_Symbol] := Simp[1/2 Subst[Int[x^((m - 1)/2)
*(a + b*x)^p*(c + d*x)^q*(e + f*x)^r, x], x, x^2], x] /; FreeQ[{a, b, c, d,
e, f, p, q, r}, x] && IntegerQ[(m - 1)/2]
```

3.51.4 Maple [A] (verified)

Time = 3.41 (sec) , antiderivative size = 95, normalized size of antiderivative = 1.13

method	result
pseudoelliptic	$\frac{-Aa\sqrt{c}d^2 \operatorname{arctanh}\left(\frac{\sqrt{dx^2+c}}{\sqrt{c}}\right) + \sqrt{dx^2+c} \left(\left(\frac{\left(\frac{3b}{5}x^2+a\right)x^{2B}}{3} + A\left(\frac{bx^2}{3}+a\right) \right) d^2 + \frac{c\left(\left(\frac{b}{5}x^2+a\right)^{B+Ab}\right)d}{3} - \frac{2Bbc^2}{15} \right)}{d^2}$
default	$Bb\left(\frac{x^2(dx^2+c)^{\frac{3}{2}}}{5d} - \frac{2c(dx^2+c)^{\frac{3}{2}}}{15d^2}\right) + \frac{Ab(dx^2+c)^{\frac{3}{2}}}{3d} + \frac{Ba(dx^2+c)^{\frac{3}{2}}}{3d} + Aa\left(\sqrt{dx^2+c} - \sqrt{c} \ln\left(\frac{2c+2\sqrt{c}\sqrt{dx^2+c}}{c}\right)\right)$

```
input int((b*x^2+a)*(B*x^2+A)*(d*x^2+c)^(1/2)/x,x,method=_RETURNVERBOSE)
```

```
output (-A*a*c^(1/2)*d^2*arctanh((d*x^2+c)^(1/2)/c^(1/2))+(d*x^2+c)^(1/2)*((1/3*(
3/5*b*x^2+a)*x^2*B+A*(1/3*b*x^2+a))*d^2+1/3*c*((1/5*b*x^2+a)*B+A*b)*d-2/15
*B*b*c^2))/d^2
```

3.51.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 217, normalized size of antiderivative = 2.58

$$\int \frac{(a + bx^2)(A + Bx^2)\sqrt{c + dx^2}}{x} dx$$

$$= \left[\frac{15 Aa\sqrt{cd^2} \log\left(-\frac{dx^2-2\sqrt{dx^2+c}\sqrt{c}+2c}{x^2}\right) + 2(3 Bbd^2x^4 - 2 Bbc^2 + 15 Aad^2 + 5(Ba + Ab)cd + (Bbcd + 5(Aa + Ab)c^2))}{30 d^2} \right]$$

```
input integrate((b*x^2+a)*(B*x^2+A)*(d*x^2+c)^(1/2)/x,x, algorithm="fricas")
```

```
output [1/30*(15*A*a*sqrt(c)*d^2*log(-(d*x^2 - 2*sqrt(d*x^2 + c)*sqrt(c) + 2*c)/x
^2) + 2*(3*B*b*d^2*x^4 - 2*B*b*c^2 + 15*A*a*d^2 + 5*(B*a + A*b)*c*d + (B*b
*c*d + 5*(B*a + A*b)*d^2)*x^2)*sqrt(d*x^2 + c))/d^2, 1/15*(15*A*a*sqrt(-c)
*d^2*arctan(sqrt(-c)/sqrt(d*x^2 + c)) + (3*B*b*d^2*x^4 - 2*B*b*c^2 + 15*A*
a*d^2 + 5*(B*a + A*b)*c*d + (B*b*c*d + 5*(B*a + A*b)*d^2)*x^2)*sqrt(d*x^2
+ c))/d^2]
```

3.51.6 Sympy [A] (verification not implemented)

Time = 9.67 (sec) , antiderivative size = 151, normalized size of antiderivative = 1.80

$$\int \frac{(a + bx^2)(A + Bx^2)\sqrt{c + dx^2}}{x} dx$$

$$= \begin{cases} \frac{2Aa \operatorname{atan}\left(\frac{\sqrt{c+dx^2}}{\sqrt{-c}}\right)}{\sqrt{-c}} + 2Aa\sqrt{c + dx^2} + \frac{2Bb(c+dx^2)^{\frac{5}{2}}}{5d^2} + \frac{2(c+dx^2)^{\frac{3}{2}}(Abd+Bad-Bbc)}{3d^2} & \text{for } d \neq 0 \\ \frac{Aa\sqrt{c} \log(x^2) + Ab\sqrt{cx^2} + Ba\sqrt{cx^2} + \frac{Bb\sqrt{cx^4}}{2}}{2} & \text{otherwise} \end{cases}$$

```
input integrate((b*x**2+a)*(B*x**2+A)*(d*x**2+c)**(1/2)/x,x)
```

```
output Piecewise((2*A*a*c*atan(sqrt(c + d*x**2)/sqrt(-c))/sqrt(-c) + 2*A*a*sqrt(c
+ d*x**2) + 2*B*b*(c + d*x**2)**(5/2)/(5*d**2) + 2*(c + d*x**2)**(3/2)*(A
*b*d + B*a*d - B*b*c)/(3*d**2), Ne(d, 0)), (A*a*sqrt(c)*log(x**2) + A*b*sq
rt(c)*x**2 + B*a*sqrt(c)*x**2 + B*b*sqrt(c)*x**4/2, True))/2
```

3.51.7 Maxima [A] (verification not implemented)

Time = 0.22 (sec) , antiderivative size = 100, normalized size of antiderivative = 1.19

$$\int \frac{(a + bx^2)(A + Bx^2)\sqrt{c + dx^2}}{x} dx = \frac{(dx^2 + c)^{\frac{3}{2}}Bbx^2}{5d} - Aa\sqrt{c} \operatorname{arsinh}\left(\frac{c}{\sqrt{cd}|x|}\right)$$

$$+ \sqrt{dx^2 + c}Aa - \frac{2(dx^2 + c)^{\frac{3}{2}}Bbc}{15d^2}$$

$$+ \frac{(dx^2 + c)^{\frac{3}{2}}Ba}{3d} + \frac{(dx^2 + c)^{\frac{3}{2}}Ab}{3d}$$

input `integrate((b*x^2+a)*(B*x^2+A)*(d*x^2+c)^(1/2)/x,x, algorithm="maxima")`

output $\frac{1}{5}(dx^2 + c)^{3/2}Bbx^2/d - Aa\sqrt{c}\operatorname{arcsinh}(c/(\sqrt{c*d})*\operatorname{abs}(x)) + \sqrt{d*x^2 + c}*A*a - 2/15*(d*x^2 + c)^{3/2}*B*b*c/d^2 + 1/3*(d*x^2 + c)^{3/2}*B*a/d + 1/3*(d*x^2 + c)^{3/2}*A*b/d$

3.51.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 113, normalized size of antiderivative = 1.35

$$\int \frac{(a + bx^2)(A + Bx^2)\sqrt{c + dx^2}}{x} dx = \frac{Aac \arctan\left(\frac{\sqrt{dx^2+c}}{\sqrt{-c}}\right)}{\sqrt{-c}} + \frac{3(dx^2 + c)^{5/2}Bbd^8 - 5(dx^2 + c)^{3/2}Bbcd^8 + 5(dx^2 + c)^{3/2}Bad^9 + 5(dx^2 + c)^{3/2}Abd^9 + 15\sqrt{dx^2 + c}Aad^{10}}{15d^{10}}$$

input `integrate((b*x^2+a)*(B*x^2+A)*(d*x^2+c)^(1/2)/x,x, algorithm="giac")`

output $A*a*c*\arctan(\sqrt{d*x^2 + c}/\sqrt{-c})/\sqrt{-c} + 1/15*(3*(d*x^2 + c)^{5/2})*B*b*d^8 - 5*(d*x^2 + c)^{3/2}*B*b*c*d^8 + 5*(d*x^2 + c)^{3/2}*B*a*d^9 + 5*(d*x^2 + c)^{3/2}*A*b*d^9 + 15*\sqrt{d*x^2 + c}*A*a*d^{10}/d^{10}$

3.51.9 Mupad [B] (verification not implemented)

Time = 5.94 (sec) , antiderivative size = 101, normalized size of antiderivative = 1.20

$$\int \frac{(a + bx^2)(A + Bx^2)\sqrt{c + dx^2}}{x} dx = \sqrt{dx^2 + c} \left(\frac{Bbx^4}{5} + \frac{Bc(5ad - 2bc)}{15d^2} + \frac{Bx^2(5ad + bc)}{15d} \right) + Aa\sqrt{dx^2 + c} - Aa\sqrt{c}\operatorname{atanh}\left(\frac{\sqrt{dx^2 + c}}{\sqrt{c}}\right) + \frac{Ab(dx^2 + c)^{3/2}}{3d}$$

input `int(((A + B*x^2)*(a + b*x^2)*(c + d*x^2)^(1/2))/x,x)`

output $(c + d*x^2)^{1/2}*((B*b*x^4)/5 + (B*c*(5*a*d - 2*b*c))/(15*d^2) + (B*x^2*(5*a*d + b*c))/(15*d)) + A*a*(c + d*x^2)^{1/2} - A*a*c^{1/2}*atanh((c + d*x^2)^{1/2}/c^{1/2}) + (A*b*(c + d*x^2)^{3/2})/(3*d)$

3.51. $\int \frac{(a+bx^2)(A+Bx^2)\sqrt{c+dx^2}}{x} dx$

APPENDIX

4.1 Listing of Grading functions	373
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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;
    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
  end if
end proc:

```

```

elif type(expn, ``~`) then
  if type(op(2,expn), 'integer') then
    ExpnType(op(1,expn))
  elif type(op(2,expn), 'rational') then
    if type(op(1,expn), 'rational') then
      1
    else
      max(2, ExpnType(op(1,expn)))
    end if
  else
    max(3, ExpnType(op(1,expn)), ExpnType(op(2,expn)))
  end if
elif type(expn, ``+`) or type(expn, ``*`) then
  max(ExpnType(op(1,expn)), max(ExpnType(rest(expn))))
elif ElementaryFunctionQ(op(0,expn)) then
  max(3, ExpnType(op(1,expn)))
elif SpecialFunctionQ(op(0,expn)) then
  max(4, apply(max, map(ExpnType, [op(expn)])))
elif HypergeometricFunctionQ(op(0,expn)) then
  max(5, apply(max, map(ExpnType, [op(expn)])))
elif AppellFunctionQ(op(0,expn)) then
  max(6, apply(max, map(ExpnType, [op(expn)])))
elif op(0,expn)='int' then
  max(8, apply(max, map(ExpnType, [op(expn)]))) else
  9
end if
end proc:

```

```

ElementaryFunctionQ := proc(func)
  member(func, [
    exp, log, ln,
    sin, cos, tan, cot, sec, csc,
    arcsin, arccos, arctan, arccot, arcsec, arccsc,
    sinh, cosh, tanh, coth, sech, csch,
    arcsinh, arccosh, arctanh, arccoth, arcsech, arccsch])
end proc:

```

```

SpecialFunctionQ := proc(func)
  member(func, [
    erf, erfc, erfi,
    FresnelS, FresnelC,
    Ei, Ei, Li, Si, Ci, Shi, Chi,

```

```

        GAMMA,lnGAMMA,Psi,Zeta,polylog,dilog,LambertW,
        EllipticF,EllipticE,EllipticPi])
end proc:

HypergeometricFunctionQ := proc(func)
    member(func, [Hypergeometric1F1,hypergeom,HypergeometricPFQ])
end proc:

AppellFunctionQ := proc(func)
    member(func, [AppellF1])
end proc:

# u is a sum or product. rest(u) returns all but the
# first term or factor of u.
rest := proc(u) local v;
    if nops(u)=2 then
        op(2,u)
    else
        apply(op(0,u),op(2..nops(u),u))
    end if
end proc:

#leafcount(u) returns the number of nodes in u.
#Nasser 3/23/17 Replaced by build-in leafCount from package in Maple
leafcount := proc(u)
    MmaTranslator[Mma] [LeafCount] (u);
end proc:

```

4.1.3 Sympy grading function

```

#Dec 24, 2019. Nasser M. Abbasi:
#      Port of original Maple grading function by
#      Albert Rich to use with Sympy/Python
#Dec 27, 2019 Nasser. Added `RootSum`. See problem 177, Timofeev file
#      added 'exp_polar'
from sympy import *

def leaf_count(expr):
    #sympy do not have leaf count function. This is approximation
    return round(1.7*count_ops(expr))

def is_sqrt(expr):

```

```

if isinstance(expr,Pow):
    if expr.args[1] == Rational(1,2):
        return True
    else:
        return False
else:
    return False

def is_elementary_function(func):
    return func in [exp,log,ln,sin,cos,tan,cot,sec,csc,
        asin,acos,atan,acot,asec,acsc,sinh,cosh,tanh,coth,sech,csch,
        asinh,acosh,atanh,acoth,asech,acsch
    ]

def is_special_function(func):
    return func in [ erf,erfc,erfi,
        fresnels,fresnelc,Ei,Ei,Li,Si,Ci,Shi,Chi,
        gamma,loggamma,digamma,zeta,polylog,LambertW,
        elliptic_f,elliptic_e,elliptic_pi,exp_polar
    ]

def is_hypergeometric_function(func):
    return func in [hyper]

def is_appell_function(func):
    return func in [appellf1]

def is_atom(expn):
    try:
        if expn.isAtom or isinstance(expn,int) or isinstance(expn,float):
            return True
        else:
            return False

    except AttributeError as error:
        return False

def expnType(expn):
    debug=False
    if debug:
        print("expn=",expn,"type(expn)=",type(expn))

    if is_atom(expn):

```

```

return 1
elif isinstance(expn,list):
    return max(map(expnType, expn)) #apply(max,map(ExpnType,expn))
elif is_sqrt(expn):
    if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
        return 1
    else:
        return max(2,expnType(expn.args[0])) #max(2,ExpnType(op(1,expn)))
elif isinstance(expn,Pow): #type(expn,``^`)
    if isinstance(expn.args[1],Integer): #type(op(2,expn),'integer')
        return expnType(expn.args[0]) #ExpnType(op(1,expn))
    elif isinstance(expn.args[1],Rational): #type(op(2,expn),'rational')
        if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
            return 1
        else:
            return max(2,expnType(expn.args[0])) #max(2,ExpnType(op(1,expn)))
    else:
        return max(3,expnType(expn.args[0]),expnType(expn.args[1])) #max(3,ExpnType(op(1,expn)),ExpnT
elif isinstance(expn,Add) or isinstance(expn,Mul): #type(expn,``+`) or type(expn,``*`)
    m1 = expnType(expn.args[0])
    m2 = expnType(list(expn.args[1:]))
    return max(m1,m2) #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
elif is_elementary_function(expn.func): #ElementaryFunctionQ(op(0,expn))
    return max(3,expnType(expn.args[0])) #max(3,ExpnType(op(1,expn)))
elif is_special_function(expn.func): #SpecialFunctionQ(op(0,expn))
    m1 = max(map(expnType, list(expn.args)))
    return max(4,m1) #max(4,apply(max,map(ExpnType,[op(expn)])))
elif is_hypergeometric_function(expn.func): #HypergeometricFunctionQ(op(0,expn))
    m1 = max(map(expnType, list(expn.args)))
    return max(5,m1) #max(5,apply(max,map(ExpnType,[op(expn)])))
elif is_appell_function(expn.func):
    m1 = max(map(expnType, list(expn.args)))
    return max(6,m1) #max(5,apply(max,map(ExpnType,[op(expn)])))
elif isinstance(expn,RootSum):
    m1 = max(map(expnType, list(expn.args))) #Apply[Max,Append[Map[ExpnType,Apply[List,expn]],7]],
    return max(7,m1)
elif str(expn).find("Integral") != -1:
    m1 = max(map(expnType, list(expn.args)))
    return max(8,m1) #max(5,apply(max,map(ExpnType,[op(expn)])))
else:
    return 9

```

#main function


```

def grade_antiderivative(result,optimal):

    #print ("Enter grade_antiderivative for sagemath")
    #print("Enter grade_antiderivative, result=",result," optimal=",optimal)

    leaf_count_result = leaf_count(result)
    leaf_count_optimal = leaf_count(optimal)

    #print("leaf_count_result=",leaf_count_result)
    #print("leaf_count_optimal=",leaf_count_optimal)

    expnType_result = expnType(result)
    expnType_optimal = expnType(optimal)

    if str(result).find("Integral") != -1:
        grade = "F"
        grade_annotation = ""
    else:
        if expnType_result <= expnType_optimal:
            if result.has(I):
                if optimal.has(I): #both result and optimal complex
                    if leaf_count_result <= 2*leaf_count_optimal:
                        grade = "A"
                        grade_annotation = ""
                    else:
                        grade = "B"
                        grade_annotation = "Both result and optimal contain complex but leaf count of result is large"
                else: #result contains complex but optimal is not
                    grade = "C"
                    grade_annotation = "Result contains complex when optimal does not."
            else: # result do not contain complex, this assumes optimal do not as well
                if leaf_count_result <= 2*leaf_count_optimal:
                    grade = "A"
                    grade_annotation = ""
                else:
                    grade = "B"
                    grade_annotation = "Leaf count of result is larger than twice the leaf count of optimal. "+str(leaf_count_result)
        else:
            grade = "C"
            grade_annotation = "Result contains higher order function than in optimal. Order "+str(ExpnType_result)

    #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 Fracas, 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','arcoth','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:
    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 ("caught 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: #instance(expn,Pow)
    if type(expn.operands()[1])==Integer: #instance(expn.args[1],Integer)
        return expnType(expn.operands()[0]) #expnType(expn.args[0])
    elif type(expn.operands()[1])==Rational: #instance(expn.args[1],Rational)
        if type(expn.operands()[0])==Rational: #instance(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: #instance(expn,Add) or inst
    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
```