Maple 2018.2 Integration Test Results
on the problems in "8 Special functions"

Test results for the 82 problems in "8.1 Error functions.txt"

Problem 10: Unable to integrate problem.

$$\int x^3 \operatorname{erf}(b x)^2 \, dx$$

Optimal(type 4, 112 leaves, 8 steps):

$$\frac{1}{2 b^4 e^{2 b^2 x^2} \pi} + \frac{x^2}{4 b^2 e^{2 b^2 x^2} \pi} - \frac{3 \operatorname{erf}(b x)^2}{16 b^4} + \frac{x^4 \operatorname{erf}(b x)^2}{4} + \frac{3 x \operatorname{erf}(b x)}{4 b^3 e^{b^2 x^2} \sqrt{\pi}} + \frac{x^3 \operatorname{erf}(b x)}{2 b e^{b^2 x^2} \sqrt{\pi}}$$

Result(type 8, 12 leaves):

$$\int x^3 \operatorname{erf}(b x)^2 \, dx$$

Problem 12: Unable to integrate problem.

$$\int (d x + c)^2 \operatorname{erf}(b x + a)^2 \, dx$$

Optimal(type 4, 345 leaves, 16 steps):

$$\frac{d(-a d + b c)}{b^3 e^{2 (b x + a)^2} \pi} + \frac{d^2 (b x + a)}{3 b^3 e^{2 (b x + a)^2} \pi} - \frac{d(-a d + b c) \operatorname{erf}(b x + a)^2}{2 b^3} + \frac{(-a d + b c)^2 (b x + a) \operatorname{erf}(b x + a)^2}{b^3} + \frac{d(-a d + b c) (b x + a)^2 \operatorname{erf}(b x + a)^2}{b^3}$$

$$+ \frac{d^2 (b x + a)^3 \operatorname{erf}(b x + a)^2}{3 b^3} - \frac{(-a d + b c)^2 \operatorname{erf}\left((b x + a) \sqrt{2}\right) \sqrt{2}}{\sqrt{\pi}\, b^3} + \frac{2 d^2 \operatorname{erf}(b x + a)}{3 b^3 e^{(b x + a)^2} \sqrt{\pi}} + \frac{2 (-a d + b c)^2 \operatorname{erf}(b x + a)}{b^3 e^{(b x + a)^2} \sqrt{\pi}}$$

$$+ \frac{2 d (-a d + b c) (b x + a) \operatorname{erf}(b x + a)}{b^3 e^{(b x + a)^2} \sqrt{\pi}} + \frac{2 d^2 (b x + a)^2 \operatorname{erf}(b x + a)}{3 b^3 e^{(b x + a)^2} \sqrt{\pi}} - \frac{5 d^2 \operatorname{erf}\left((b x + a) \sqrt{2}\right) \sqrt{2}}{12 b^3 \sqrt{\pi}}$$

Result(type 8, 18 leaves):

$$\int (d x + c)^2 \operatorname{erf}(b x + a)^2 \, dx$$

Problem 14: Unable to integrate problem.

$$\int x \operatorname{erf}\left(d \left(a + b \ln(c x^n)\right)\right) dx$$

Optimal(type 4, 91 leaves, 5 steps):

$$\frac{x^2 \operatorname{erf}\left(d \left(a + b \ln\left(c x^n\right)\right)\right)}{2} - \frac{e^{\frac{-2 a b d^2 n + 1}{b^2 d^2 n^2}} x^2 \operatorname{erf}\left(\frac{a b d^2 - \frac{1}{n} + b^2 d^2 \ln\left(c x^n\right)}{b d}\right)}{2 \left(c x^n\right)^{\frac{2}{n}}}$$

Result(type 8, 17 leaves):

$$\int x \operatorname{erf}\left(d \left(a + b \ln\left(c x^n\right)\right)\right) \, dx$$

Problem 15: Unable to integrate problem.

$$\int \frac{\operatorname{erf}\left(d \left(a + b \ln\left(c x^n\right)\right)\right)}{x^3} \, dx$$

Optimal(type 4, 90 leaves, 5 steps):

$$-\frac{\operatorname{erf}\left(d \left(a + b \ln\left(c x^n\right)\right)\right)}{2 x^2} + \frac{e^{\frac{2 a b d^2 n + 1}{b^2 d^2 n^2}} \left(c x^n\right)^{\frac{2}{n}} \operatorname{erf}\left(\frac{1 + a b d^2 n + b^2 d^2 n \ln\left(c x^n\right)}{b d n}\right)}{2 x^2}$$

Result(type 8, 19 leaves):

$$\int \frac{\operatorname{erf}\left(d \left(a + b \ln\left(c x^n\right)\right)\right)}{x^3} \, dx$$

Problem 17: Unable to integrate problem.

$$\int \frac{e^{-b^2 x^2 + c}}{\operatorname{erf}(b x)} \, dx$$

Optimal(type 4, 15 leaves, 2 steps):

$$\frac{e^c \ln(\operatorname{erf}(b x)) \sqrt{\pi}}{2 b}$$

Result(type 8, 20 leaves):

$$\int \frac{e^{-b^2 x^2 + c}}{\operatorname{erf}(b x)} \, dx$$

Problem 23: Unable to integrate problem.

$$\int e^{b^2 x^2 + c} x^4 \operatorname{erf}(b x) \, dx$$

Optimal(type 5, 96 leaves, 7 steps):

$$-\frac{3\,e^{b^2x^2+c}\,x\,\mathrm{erf}(bx)}{4\,b^4}+\frac{e^{b^2x^2+c}\,x^3\,\mathrm{erf}(bx)}{2\,b^2}+\frac{3\,e^c\,x^2}{4\,b^3\sqrt{\pi}}-\frac{e^c\,x^4}{4\,b\sqrt{\pi}}+\frac{3\,e^c\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],b^2x^2\right)}{4\,b^3\sqrt{\pi}}$$

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Result(type 8, 20 leaves):
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$$\int e^{b^2x^2+c}\,x^4\,\mathrm{erf}(bx)\,dx$$

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Problem 25: Unable to integrate problem.
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$$\int \frac{x^4\,\mathrm{erf}(bx)}{e^{b^2x^2}}\,dx$$

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Optimal(type 4, 98 leaves, 7 steps):
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$$-\frac{3\,x\,\mathrm{erf}(bx)}{4\,b^4\,e^{b^2x^2}}-\frac{x^3\,\mathrm{erf}(bx)}{2\,b^2\,e^{b^2x^2}}-\frac{1}{2\,b^5\,e^{2\,b^2x^2}\sqrt{\pi}}-\frac{x^2}{4\,b^3\,e^{2\,b^2x^2}\sqrt{\pi}}+\frac{3\,\mathrm{erf}(bx)^2\sqrt{\pi}}{16\,b^5}$$

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Result(type 8, 20 leaves):
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$$\int \frac{x^4\,\mathrm{erf}(bx)}{e^{b^2x^2}}\,dx$$

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Problem 28: Unable to integrate problem.
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$$\int \mathrm{erf}(bx)\,\sinh\left(b^2x^2+c\right)dx$$

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Optimal(type 5, 44 leaves, 4 steps):
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$$\frac{b\,e^c\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],b^2x^2\right)}{2\sqrt{\pi}}-\frac{\mathrm{erf}(bx)^2\sqrt{\pi}}{8\,b\,e^c}$$

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Result(type 8, 17 leaves):
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$$\int \mathrm{erf}(bx)\,\sinh\left(b^2x^2+c\right)dx$$

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Problem 29: Unable to integrate problem.
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$$\int -\mathrm{erf}(bx)\,\sinh\left(b^2x^2-c\right)dx$$

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Optimal(type 5, 44 leaves, 4 steps):
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$$-\frac{b\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],b^2x^2\right)}{2\,e^c\sqrt{\pi}}+\frac{e^c\,\mathrm{erf}(bx)^2\sqrt{\pi}}{8\,b}$$

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Result(type 8, 20 leaves):
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$$\int \text{-erf}(b\,x)\,\sinh\left(b^2 x^2 - c\right)\,dx$$

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Problem 30: Unable to integrate problem.
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$$\int \cosh\left(b^2 x^2 + c\right)\,\text{erf}(b\,x)\,dx$$

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Optimal(type 5, 44 leaves, 4 steps):
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$$\frac{b\,e^c x^2\, \mathit{HypergeometricPFQ}\left([1,1], \left[\frac{3}{2}, 2\right], b^2 x^2\right)}{2\sqrt{\pi}} + \frac{\text{erf}(b\,x)^2 \sqrt{\pi}}{8\,b\,e^c}$$

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Result(type 8, 17 leaves):
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$$\int \cosh\left(b^2 x^2 + c\right)\,\text{erf}(b\,x)\,dx$$

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Problem 33: Result more than twice size of optimal antiderivative.
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$$\int (d\,x + c)^3\,\text{erfc}(b\,x + a)\,dx$$

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Optimal(type 4, 260 leaves, 12 steps):
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$$\frac{3\,d^3\,\text{erf}(b\,x+a)}{16\,b^4} + \frac{3\,d\,(-a\,d+b\,c)^2\,\text{erf}(b\,x+a)}{4\,b^4} + \frac{(-a\,d+b\,c)^4\,\text{erf}(b\,x+a)}{4\,b^4\,d} + \frac{(d\,x+c)^4\,\text{erfc}(b\,x+a)}{4\,d} - \frac{d^2\,(-a\,d+b\,c)}{b^4\,e^{(b\,x+a)^2}\sqrt{\pi}} - \frac{(-a\,d+b\,c)^3}{b^4\,e^{(b\,x+a)^2}\sqrt{\pi}}$$
$$- \frac{3\,d^3\,(b\,x+a)}{8\,b^4\,e^{(b\,x+a)^2}\sqrt{\pi}} - \frac{3\,d\,(-a\,d+b\,c)^2\,(b\,x+a)}{2\,b^4\,e^{(b\,x+a)^2}\sqrt{\pi}} - \frac{d^2\,(-a\,d+b\,c)\,(b\,x+a)^2}{b^4\,e^{(b\,x+a)^2}\sqrt{\pi}} - \frac{d^3\,(b\,x+a)^3}{4\,b^4\,e^{(b\,x+a)^2}\sqrt{\pi}}$$

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Result(type 4, 728 leaves):
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$$\frac{1}{b}\left(\frac{d^3\,\text{erfc}(b\,x+a)\,(b\,x+a)^4}{4\,b^3} - \frac{d^3\,\text{erfc}(b\,x+a)\,(b\,x+a)^3\,a}{b^3} + \frac{d^2\,\text{erfc}(b\,x+a)\,(b\,x+a)^3\,c}{b^2} + \frac{3\,d^3\,\text{erfc}(b\,x+a)\,(b\,x+a)^2\,a^2}{2\,b^3}\right.$$
$$- \frac{3\,d^2\,\text{erfc}(b\,x+a)\,(b\,x+a)^2\,a\,c}{b^2} + \frac{3\,d\,\text{erfc}(b\,x+a)\,(b\,x+a)^2\,c^2}{2\,b} - \frac{d^3\,\text{erfc}(b\,x+a)\,(b\,x+a)\,a^3}{b^3} + \frac{3\,d^2\,\text{erfc}(b\,x+a)\,(b\,x+a)\,a^2\,c}{b^2}$$
$$- \frac{3\,d\,\text{erfc}(b\,x+a)\,(b\,x+a)\,a\,c^2}{b} + \text{erfc}(b\,x+a)\,(b\,x+a)\,c^3 + \frac{d^3\,\text{erfc}(b\,x+a)\,a^4}{4\,b^3} - \frac{d^2\,\text{erfc}(b\,x+a)\,a^3\,c}{b^2} + \frac{3\,d\,\text{erfc}(b\,x+a)\,a^2\,c^2}{2\,b} - \text{erfc}(b\,x$$
$$+ a)\,a\,c^3 + \frac{b\,\text{erfc}(b\,x+a)\,c^4}{4\,d} + \frac{1}{2\sqrt{\pi}\,b^3\,d}\left(d^4\left(-\frac{(b\,x+a)^3}{2\,e^{(b\,x+a)^2}} - \frac{3\,(b\,x+a)}{4\,e^{(b\,x+a)^2}} + \frac{3\sqrt{\pi}\,\text{erf}(b\,x+a)}{8}\right) + \frac{a^4\,d^4\sqrt{\pi}\,\text{erf}(b\,x+a)}{2}\right.$$

$$+\frac{b^4 c^4 \sqrt{\pi}\,\mathrm{erf}(b x+a)}{2}+\frac{2 a^3 d^4}{e^{(b x+a)^2}}+6 a^2 d^4\left(-\frac{b x+a}{2\,e^{(b x+a)^2}}+\frac{\sqrt{\pi}\,\mathrm{erf}(b x+a)}{4}\right)-4 a d^4\left(-\frac{(b x+a)^2}{2\,e^{(b x+a)^2}}-\frac{1}{2\,e^{(b x+a)^2}}\right)-\frac{2 b^3 c^3 d}{e^{(b x+a)^2}}+6 b^2 c^2 d^2\left(\right.$$

$$\left.-\frac{b x+a}{2\,e^{(b x+a)^2}}+\frac{\sqrt{\pi}\,\mathrm{erf}(b x+a)}{4}\right)+4 b c d^3\left(-\frac{(b x+a)^2}{2\,e^{(b x+a)^2}}-\frac{1}{2\,e^{(b x+a)^2}}\right)-2 a b^3 c^3 d\sqrt{\pi}\,\mathrm{erf}(b x+a)+3 a^2 b^2 c^2 d^2\sqrt{\pi}\,\mathrm{erf}(b x+a)$$

$$-2 a^3 b c d^3\sqrt{\pi}\,\mathrm{erf}(b x+a)+\frac{6 a b^2 c^2 d^2}{e^{(b x+a)^2}}-\frac{6 a^2 b c d^3}{e^{(b x+a)^2}}-12 a b c d^3\left(-\frac{b x+a}{2\,e^{(b x+a)^2}}+\frac{\sqrt{\pi}\,\mathrm{erf}(b x+a)}{4}\right)\Bigg)\Bigg)$$

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Problem 34: Result more than twice size of optimal antiderivative.
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$$\int (d x+c)^2\,\mathrm{erfc}(b x+a)\,dx$$

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Optimal(type 4, 172 leaves, 9 steps):
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$$\frac{d(-a d+b c)\,\mathrm{erf}(b x+a)}{2 b^3}+\frac{(-a d+b c)^3\,\mathrm{erf}(b x+a)}{3 b^3 d}+\frac{(d x+c)^3\,\mathrm{erfc}(b x+a)}{3 d}-\frac{d^2}{3 b^3 e^{(b x+a)^2}\sqrt{\pi}}-\frac{(-a d+b c)^2}{b^3 e^{(b x+a)^2}\sqrt{\pi}}-\frac{d(-a d+b c)(b x+a)}{b^3 e^{(b x+a)^2}\sqrt{\pi}}$$

$$-\frac{d^2 (b x+a)^2}{3 b^3 e^{(b x+a)^2}\sqrt{\pi}}$$

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Result(type 4, 427 leaves):
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$$\frac{1}{b}\left(\frac{d^2\,\mathrm{erfc}(b x+a)(b x+a)^3}{3 b^2}-\frac{d^2\,\mathrm{erfc}(b x+a)(b x+a)^2 a}{b^2}+\frac{d\,\mathrm{erfc}(b x+a)(b x+a)^2 c}{b}+\frac{d^2\,\mathrm{erfc}(b x+a)(b x+a) a^2}{b^2}\right.$$

$$-\frac{2 d\,\mathrm{erfc}(b x+a)(b x+a) a c}{b}+\mathrm{erfc}(b x+a)(b x+a) c^2-\frac{d^2\,\mathrm{erfc}(b x+a) a^3}{3 b^2}+\frac{d\,\mathrm{erfc}(b x+a) a^2 c}{b}-\mathrm{erfc}(b x+a) a c^2$$

$$+\frac{b\,\mathrm{erfc}(b x+a) c^3}{3 d}+\frac{1}{3\sqrt{\pi}\,b^2 d}\left(2\left(d^3\left(-\frac{(b x+a)^2}{2\,e^{(b x+a)^2}}-\frac{1}{2\,e^{(b x+a)^2}}\right)+\frac{b^3 c^3\sqrt{\pi}\,\mathrm{erf}(b x+a)}{2}-\frac{a^3 d^3\sqrt{\pi}\,\mathrm{erf}(b x+a)}{2}-\frac{3 a^2 d^3}{2\,e^{(b x+a)^2}}-3 a d^3\left(\right.\right.\right.$$

$$\left.-\frac{b x+a}{2\,e^{(b x+a)^2}}+\frac{\sqrt{\pi}\,\mathrm{erf}(b x+a)}{4}\right)-\frac{3 b^2 c^2 d}{2\,e^{(b x+a)^2}}+3 b c d^2\left(-\frac{b x+a}{2\,e^{(b x+a)^2}}+\frac{\sqrt{\pi}\,\mathrm{erf}(b x+a)}{4}\right)-\frac{3 a b^2 c^2 d\sqrt{\pi}\,\mathrm{erf}(b x+a)}{2}$$

$$\left.\left.\left.+\frac{3 a^2 b c d^2\sqrt{\pi}\,\mathrm{erf}(b x+a)}{2}+\frac{3 a b c d^2}{e^{(b x+a)^2}}\right)\right)\right)$$

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Problem 38: Unable to integrate problem.
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$$\int x^3\,\mathrm{erfc}(b x)^2\,dx$$

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Optimal(type 4, 112 leaves, 8 steps):
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$$\frac{1}{2 b^4 e^{2 b^2 x^2} \pi} + \frac{x^2}{4 b^2 e^{2 b^2 x^2} \pi} - \frac{3 \operatorname{erfc}(b x)^2}{16 b^4} + \frac{x^4 \operatorname{erfc}(b x)^2}{4} - \frac{3 x \operatorname{erfc}(b x)}{4 b^3 e^{b^2 x^2} \sqrt{\pi}} - \frac{x^3 \operatorname{erfc}(b x)}{2 b e^{b^2 x^2} \sqrt{\pi}}$$

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Result(type 8, 12 leaves):
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$$\int x^3 \operatorname{erfc}(b x)^2 \, dx$$

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Problem 39: Unable to integrate problem.
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$$\int \frac{\operatorname{erfc}(b x)^2}{x^7} \, dx$$

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Optimal(type 4, 157 leaves, 12 steps):
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$$-\frac{b^2}{15 e^{2 b^2 x^2} \pi x^4} + \frac{2 b^4}{9 e^{2 b^2 x^2} \pi x^2} + \frac{28 b^6 \operatorname{Ei}(-2 b^2 x^2)}{45 \pi} - \frac{4 b^6 \operatorname{erfc}(b x)^2}{45} - \frac{\operatorname{erfc}(b x)^2}{6 x^6} + \frac{2 b \operatorname{erfc}(b x)}{15 e^{b^2 x^2} x^5 \sqrt{\pi}} - \frac{4 b^3 \operatorname{erfc}(b x)}{45 e^{b^2 x^2} x^3 \sqrt{\pi}} + \frac{8 b^5 \operatorname{erfc}(b x)}{45 e^{b^2 x^2} x \sqrt{\pi}}$$

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Result(type 8, 12 leaves):
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$$\int \frac{\operatorname{erfc}(b x)^2}{x^7} \, dx$$

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Problem 42: Unable to integrate problem.
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$$\int \frac{\operatorname{erfc}(d (a + b \ln(c x^n)))}{x^2} \, dx$$

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Optimal(type 4, 88 leaves, 5 steps):
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$$-\frac{e^{\frac{1}{4 b^2 d^2 n^2} + \frac{a}{b n}} (c x^n)^{\frac{1}{n}} \operatorname{erf}\left(\frac{2 a b d^2 + \frac{1}{n} + 2 b^2 d^2 \ln(c x^n)}{2 b d}\right)}{x} - \frac{\operatorname{erfc}(d (a + b \ln(c x^n)))}{x}$$

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Result(type 8, 19 leaves):
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$$\int \frac{\operatorname{erfc}(d (a + b \ln(c x^n)))}{x^2} \, dx$$

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Problem 43: Unable to integrate problem.
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$$\int \frac{\operatorname{erfc}(d (a + b \ln(c x^n)))}{x^3} \, dx$$

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Optimal(type 4, 90 leaves, 5 steps):
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$$-\frac{e^{\frac{2 a b d^2 n + 1}{b^2 d^2 n^2}} (c x^n)^{\frac{2}{n}} \operatorname{erf}\left(\frac{1 + a b d^2 n + b^2 d^2 n \ln(c x^n)}{b d n}\right)}{2 x^2} - \frac{\operatorname{erfc}(d (a + b \ln(c x^n)))}{2 x^2}$$

Result(type 8, 19 leaves):

$$\int \frac{\operatorname{erfc}\left(d\left(a+b\ln\left(c\,x^n\right)\right)\right)}{x^3}\,dx$$

Problem 44: Unable to integrate problem.

$$\int \frac{e^{-b^2 x^2+c}}{\operatorname{erfc}(b\,x)}\,dx$$

Optimal(type 4, 15 leaves, 2 steps):

$$-\frac{e^c\ln(\operatorname{erfc}(b\,x))\sqrt{\pi}}{2\,b}$$

Result(type 8, 20 leaves):

$$\int \frac{e^{-b^2 x^2+c}}{\operatorname{erfc}(b\,x)}\,dx$$

Problem 45: Unable to integrate problem.

$$\int e^{-b^2 x^2+c}\operatorname{erfc}(b\,x)^n\,dx$$

Optimal(type 4, 23 leaves, 2 steps):

$$-\frac{e^c\operatorname{erfc}(b\,x)^{1+n}\sqrt{\pi}}{2\,b\,(1+n)}$$

Result(type 8, 20 leaves):

$$\int e^{-b^2 x^2+c}\operatorname{erfc}(b\,x)^n\,dx$$

Problem 49: Unable to integrate problem.

$$\int \frac{\operatorname{erfc}(b\,x)}{e^{b^2 x^2}\,x^4}\,dx$$

Optimal(type 4, 93 leaves, 7 steps):

$$-\frac{\operatorname{erfc}(b\,x)}{3\,e^{b^2 x^2}\,x^3}+\frac{2\,b^2\operatorname{erfc}(b\,x)}{3\,e^{b^2 x^2}\,x}+\frac{b}{3\,e^{2\,b^2 x^2}\,x^2\sqrt{\pi}}+\frac{4\,b^3\operatorname{Ei}\left(-2\,b^2 x^2\right)}{3\sqrt{\pi}}-\frac{b^3\operatorname{erfc}(b\,x)^2\sqrt{\pi}}{3}$$

Result(type 8, 20 leaves):

$$\int \frac{\operatorname{erfc}(b\,x)}{e^{b^2 x^2}\,x^4}\,dx$$

Problem 50: Result more than twice size of optimal antiderivative.

$$\int e^{d x^2+c} x \operatorname{erfc}(b x+a)\, dx$$

Optimal(type 4, 76 leaves, 3 steps):

$$\frac{e^{d x^2+c} \operatorname{erfc}(b x+a)}{2 d}+\frac{b\, e^{c+\frac{a^2 d}{b^2-d}} \operatorname{erf}\left(\frac{a b+\left(b^2-d\right) x}{\sqrt{b^2-d}}\right)}{2 d \sqrt{b^2-d}}$$

Result(type 4, 174 leaves):

$$\frac{1}{b}\left(\frac{b\, e^{\frac{(b x+a)^2 d}{b^2}-\frac{2 a d (b x+a)}{b^2}+\frac{a^2 d}{b^2}+c}}{2 d}-\frac{\operatorname{erf}(b x+a)\, b\, e^{\frac{(b x+a)^2 d}{b^2}-\frac{2 a d (b x+a)}{b^2}+\frac{a^2 d}{b^2}+c}}{2 d}\right.$$
$$\left.+\frac{b\, e^{\frac{a^2 d}{b^2}+c-\frac{a^2 d^2}{b^4\left(-1+\frac{d}{b^2}\right)}} \operatorname{erf}\left(\sqrt{1-\frac{d}{b^2}}\,(b x+a)+\frac{a d}{b^2 \sqrt{1-\frac{d}{b^2}}}\right)}{2 d \sqrt{1-\frac{d}{b^2}}}\right)$$

Problem 52: Unable to integrate problem.

$$\int -\operatorname{erfc}(b x) \sin\left(-c+I b^2 x^2\right) dx$$

Optimal(type 5, 70 leaves, 6 steps):

$$\frac{I b\, e^{I c} x^2 \, HypergeometricPFQ\left([1,1],\left[\frac{3}{2},2\right], b^2 x^2\right)}{2 \sqrt{\pi}}-\frac{I \operatorname{erfc}(b x)^2 \sqrt{\pi}}{8 b\, e^{I c}}-\frac{I e^{I c} \operatorname{erfi}(b x) \sqrt{\pi}}{4 b}$$

Result(type 8, 22 leaves):

$$\int -\operatorname{erfc}(b x) \sin\left(-c+I b^2 x^2\right) dx$$

Problem 53: Unable to integrate problem.

$$\int \cosh\left(b^2 x^2+c\right) \operatorname{erfc}(b x)\, dx$$

Optimal(type 5, 58 leaves, 6 steps):

$$-\frac{b\,e^{c}x^{2}\,HypergeometricPFQ\left([1,1],\left[\frac{3}{2},2\right],b^{2}x^{2}\right)}{2\sqrt{\pi}}-\frac{\operatorname{erfc}(b\,x)^{2}\sqrt{\pi}}{8\,b\,e^{c}}+\frac{e^{c}\operatorname{erfi}(b\,x)\sqrt{\pi}}{4\,b}$$

Result(type 8, 17 leaves):

$$\int \cosh\left(b^{2}x^{2}+c\right)\operatorname{erfc}(b\,x)\;dx$$

Problem 58: Result more than twice size of optimal antiderivative.

$$\int (d\,x+c)^{3}\operatorname{erfi}(b\,x+a)\;dx$$

Optimal(type 4, 247 leaves, 12 steps):

$$-\frac{3\,d^{3}\operatorname{erfi}(b\,x+a)}{16\,b^{4}}+\frac{3\,d\,(-a\,d+b\,c)^{2}\operatorname{erfi}(b\,x+a)}{4\,b^{4}}-\frac{(-a\,d+b\,c)^{4}\operatorname{erfi}(b\,x+a)}{4\,b^{4}\,d}+\frac{(d\,x+c)^{4}\operatorname{erfi}(b\,x+a)}{4\,d}+\frac{d^{2}\,(-a\,d+b\,c)\,e^{(b\,x+a)^{2}}}{b^{4}\sqrt{\pi}}$$
$$-\frac{(-a\,d+b\,c)^{3}\,e^{(b\,x+a)^{2}}}{b^{4}\sqrt{\pi}}+\frac{3\,d^{3}\,e^{(b\,x+a)^{2}}\,(b\,x+a)}{8\,b^{4}\sqrt{\pi}}-\frac{3\,d\,(-a\,d+b\,c)^{2}\,e^{(b\,x+a)^{2}}\,(b\,x+a)}{2\,b^{4}\sqrt{\pi}}-\frac{d^{2}\,(-a\,d+b\,c)\,e^{(b\,x+a)^{2}}\,(b\,x+a)^{2}}{b^{4}\sqrt{\pi}}$$
$$-\frac{d^{3}\,e^{(b\,x+a)^{2}}\,(b\,x+a)^{3}}{4\,b^{4}\sqrt{\pi}}$$

Result(type 4, 702 leaves):

$$\frac{1}{b}\left(\frac{d^{3}\operatorname{erfi}(b\,x+a)\,(b\,x+a)^{4}}{4\,b^{3}}-\frac{d^{3}\operatorname{erfi}(b\,x+a)\,(b\,x+a)^{3}\,a}{b^{3}}+\frac{d^{2}\operatorname{erfi}(b\,x+a)\,(b\,x+a)^{3}\,c}{b^{2}}+\frac{3\,d^{3}\operatorname{erfi}(b\,x+a)\,(b\,x+a)^{2}\,a^{2}}{2\,b^{3}}\right.$$
$$-\frac{3\,d^{2}\operatorname{erfi}(b\,x+a)\,(b\,x+a)^{2}\,a\,c}{b^{2}}+\frac{3\,d\operatorname{erfi}(b\,x+a)\,(b\,x+a)^{2}\,c^{2}}{2\,b}-\frac{d^{3}\operatorname{erfi}(b\,x+a)\,(b\,x+a)\,a^{3}}{b^{3}}+\frac{3\,d^{2}\operatorname{erfi}(b\,x+a)\,(b\,x+a)\,a^{2}\,c}{b^{2}}$$
$$-\frac{3\,d\operatorname{erfi}(b\,x+a)\,(b\,x+a)\,a\,c^{2}}{b}+\operatorname{erfi}(b\,x+a)\,(b\,x+a)\,c^{3}+\frac{d^{3}\operatorname{erfi}(b\,x+a)\,a^{4}}{4\,b^{3}}-\frac{d^{2}\operatorname{erfi}(b\,x+a)\,a^{3}\,c}{b^{2}}+\frac{3\,d\operatorname{erfi}(b\,x+a)\,a^{2}\,c^{2}}{2\,b}-\operatorname{erfi}(b\,x+a)\,a\,c^{3}$$
$$+\frac{b\operatorname{erfi}(b\,x+a)\,c^{4}}{4\,d}-\frac{1}{2\,b^{3}\,d\sqrt{\pi}}\left(d^{4}\left(\frac{e^{(b\,x+a)^{2}}\,(b\,x+a)^{3}}{2}-\frac{3\,(b\,x+a)\,e^{(b\,x+a)^{2}}}{4}+\frac{3\sqrt{\pi}\operatorname{erfi}(b\,x+a)}{8}\right)+\frac{a^{4}\,d^{4}\sqrt{\pi}\operatorname{erfi}(b\,x+a)}{2}\right.$$
$$+\frac{b^{4}\,c^{4}\sqrt{\pi}\operatorname{erfi}(b\,x+a)}{2}-2\,a^{3}\,d^{4}\,e^{(b\,x+a)^{2}}+6\,a^{2}\,d^{4}\left(\frac{(b\,x+a)\,e^{(b\,x+a)^{2}}}{2}-\frac{\sqrt{\pi}\operatorname{erfi}(b\,x+a)}{4}\right)-4\,a\,d^{4}\left(\frac{(b\,x+a)^{2}\,e^{(b\,x+a)^{2}}}{2}-\frac{e^{(b\,x+a)^{2}}}{2}\right)$$

$$+2 b^3 c^3 d\, e^{(b x+a)^2}+6 b^2 c^2 d^2 \left(\frac{(b x+a)\, e^{(b x+a)^2}}{2}-\frac{\sqrt{\pi}\, \mathrm{erfi}(b x+a)}{4}\right)+4 b c d^3 \left(\frac{(b x+a)^2 e^{(b x+a)^2}}{2}-\frac{e^{(b x+a)^2}}{2}\right)-2 a b^3 c^3 d \sqrt{\pi}\, \mathrm{erfi}(b x+a)$$

$$+3 a^2 b^2 c^2 d^2 \sqrt{\pi}\, \mathrm{erfi}(b x+a)-2 a^3 b c d^3 \sqrt{\pi}\, \mathrm{erfi}(b x+a)-6 a b^2 c^2 d^2 e^{(b x+a)^2}+6 a^2 b c d^3 e^{(b x+a)^2}-12 a b c d^3 \left(\frac{(b x+a)\, e^{(b x+a)^2}}{2}\right.$$

$$\left.\left.\left.-\frac{\sqrt{\pi}\, \mathrm{erfi}(b x+a)}{4}\right)\right)\right)$$

Problem 60: Unable to integrate problem.

$$\int x^5 \mathrm{erfi}(b x)^2 \, dx$$

Optimal(type 4, 147 leaves, 12 steps):

$$\frac{11 e^{2 b^2 x^2}}{12 b^6 \pi}-\frac{7 e^{2 b^2 x^2} x^2}{12 b^4 \pi}+\frac{e^{2 b^2 x^2} x^4}{6 b^2 \pi}+\frac{5 \mathrm{erfi}(b x)^2}{16 b^6}+\frac{x^6 \mathrm{erfi}(b x)^2}{6}-\frac{5 e^{b^2 x^2} x \,\mathrm{erfi}(b x)}{4 b^5 \sqrt{\pi}}+\frac{5 e^{b^2 x^2} x^3 \mathrm{erfi}(b x)}{6 b^3 \sqrt{\pi}}-\frac{e^{b^2 x^2} x^5 \mathrm{erfi}(b x)}{3 b \sqrt{\pi}}$$

Result(type 8, 12 leaves):

$$\int x^5 \mathrm{erfi}(b x)^2 \, dx$$

Problem 61: Unable to integrate problem.

$$\int x\, \mathrm{erfi}(b x)^2 \, dx$$

Optimal(type 4, 61 leaves, 5 steps):

$$\frac{e^{2 b^2 x^2}}{2 b^2 \pi}+\frac{\mathrm{erfi}(b x)^2}{4 b^2}+\frac{x^2 \mathrm{erfi}(b x)^2}{2}-\frac{e^{b^2 x^2} x \,\mathrm{erfi}(b x)}{b \sqrt{\pi}}$$

Result(type 8, 10 leaves):

$$\int x\, \mathrm{erfi}(b x)^2 \, dx$$

Problem 63: Unable to integrate problem.

$$\int \frac{\mathrm{erfi}(b x)^2}{x^5} \, dx$$

Optimal(type 4, 104 leaves, 8 steps):

$$-\frac{b^2 e^{2 b^2 x^2}}{3 \pi x^2}+\frac{4 b^4 \mathrm{Ei}\left(2 b^2 x^2\right)}{3 \pi}+\frac{b^4 \mathrm{erfi}(b x)^2}{3}-\frac{\mathrm{erfi}(b x)^2}{4 x^4}-\frac{b\, e^{b^2 x^2} \mathrm{erfi}(b x)}{3 x^3 \sqrt{\pi}}-\frac{2 b^3 e^{b^2 x^2} \mathrm{erfi}(b x)}{3 x \sqrt{\pi}}$$

Result(type 8, 12 leaves):

$$\int \frac{\operatorname{erfi}(b x)^2}{x^5}\, dx$$

Problem 66: Unable to integrate problem.

$$\int (d x+c) \operatorname{erfi}(b x+a)^2\, dx$$

Optimal(type 4, 166 leaves, 10 steps):

$$\frac{d\, e^{2 (b x+a)^2}}{2 b^2 \pi}+\frac{d \operatorname{erfi}(b x+a)^2}{4 b^2}+\frac{(-a d+b c)\, (b x+a) \operatorname{erfi}(b x+a)^2}{b^2}+\frac{d\, (b x+a)^2 \operatorname{erfi}(b x+a)^2}{2 b^2}+\frac{(-a d+b c) \operatorname{erfi}\left((b x+a) \sqrt{2}\right) \sqrt{2}}{\sqrt{\pi}\, b^2}$$
$$-\frac{2\, (-a d+b c)\, e^{(b x+a)^2} \operatorname{erfi}(b x+a)}{b^2 \sqrt{\pi}}-\frac{d\, e^{(b x+a)^2}\, (b x+a) \operatorname{erfi}(b x+a)}{b^2 \sqrt{\pi}}$$

Result(type 8, 16 leaves):

$$\int (d x+c) \operatorname{erfi}(b x+a)^2\, dx$$

Problem 67: Unable to integrate problem.

$$\int \operatorname{erfi}(b x+a)^2\, dx$$

Optimal(type 4, 60 leaves, 4 steps):

$$\frac{(b x+a) \operatorname{erfi}(b x+a)^2}{b}+\frac{\operatorname{erfi}\left((b x+a) \sqrt{2}\right) \sqrt{2}}{\sqrt{\pi}\, b}-\frac{2\, e^{(b x+a)^2} \operatorname{erfi}(b x+a)}{b \sqrt{\pi}}$$

Result(type 8, 10 leaves):

$$\int \operatorname{erfi}(b x+a)^2\, dx$$

Problem 68: Unable to integrate problem.

$$\int x \operatorname{erfi}\left(d\, (a+b \ln(c x^n))\right) dx$$

Optimal(type 4, 91 leaves, 5 steps):

$$\frac{x^2 \operatorname{erfi}\left(d\, (a+b \ln(c x^n))\right)}{2}-\frac{x^2 \operatorname{erfi}\left(\frac{a b d^2+\frac{1}{n}+b^2 d^2 \ln(c x^n)}{b d}\right)}{2\, e^{\frac{2 a b d^2 n+1}{b^2 d^2 n^2}}\, (c x^n)^{\frac{2}{n}}}$$

Result(type 8, 17 leaves):

$$\int x \operatorname{erfi}\left(d\, (a+b \ln(c x^n))\right) dx$$

Problem 69: Unable to integrate problem.

$$\int \frac{\operatorname{erfi}\left(d\left(a+b\ln\left(c x^{n}\right)\right)\right)}{x^{2}}\, dx$$

Optimal(type 4, 89 leaves, 5 steps):

$$-\frac{\operatorname{erfi}\left(d\left(a+b\ln\left(c x^{n}\right)\right)\right)}{x}+\frac{e^{-\frac{1}{4 b^{2} d^{2} n^{2}}+\frac{a}{b n}}\left(c x^{n}\right)^{\frac{1}{n}} \operatorname{erfi}\left(\frac{2 a b d^{2}-\frac{1}{n}+2 b^{2} d^{2}\ln\left(c x^{n}\right)}{2 b d}\right)}{x}$$

Result(type 8, 19 leaves):

$$\int \frac{\operatorname{erfi}\left(d\left(a+b\ln\left(c x^{n}\right)\right)\right)}{x^{2}}\, dx$$

Problem 70: Unable to integrate problem.

$$\int e^{b^{2} x^{2}+c} \operatorname{erfi}(b x)^{n}\, dx$$

Optimal(type 4, 23 leaves, 2 steps):

$$\frac{e^{c} \operatorname{erfi}(b x)^{1+n} \sqrt{\pi}}{2 b (1+n)}$$

Result(type 8, 19 leaves):

$$\int e^{b^{2} x^{2}+c} \operatorname{erfi}(b x)^{n}\, dx$$

Problem 71: Unable to integrate problem.

$$\int e^{d x^{2}+c} x^{5} \operatorname{erfi}(b x)\, dx$$

Optimal(type 4, 220 leaves, 9 steps):

$$\frac{e^{d x^{2}+c} \operatorname{erfi}(b x)}{d^{3}}-\frac{e^{d x^{2}+c} x^{2} \operatorname{erfi}(b x)}{d^{2}}+\frac{e^{d x^{2}+c} x^{4} \operatorname{erfi}(b x)}{2 d}-\frac{3 b e^{c} \operatorname{erfi}\left(x\sqrt{b^{2}+d}\right)}{8 d\left(b^{2}+d\right)^{5/2}}-\frac{b e^{c} \operatorname{erfi}\left(x\sqrt{b^{2}+d}\right)}{2 d^{2}\left(b^{2}+d\right)^{3/2}}-\frac{b e^{c} \operatorname{erfi}\left(x\sqrt{b^{2}+d}\right)}{d^{3}\sqrt{b^{2}+d}}$$
$$+\frac{3 b e^{c+\left(b^{2}+d\right) x^{2}} x}{4 d\left(b^{2}+d\right)^{2}\sqrt{\pi}}+\frac{b e^{c+\left(b^{2}+d\right) x^{2}} x}{d^{2}\left(b^{2}+d\right)\sqrt{\pi}}-\frac{b e^{c+\left(b^{2}+d\right) x^{2}} x^{3}}{2 d\left(b^{2}+d\right)\sqrt{\pi}}$$

Result(type 8, 18 leaves):

$$\int e^{d x^{2}+c} x^{5} \operatorname{erfi}(b x)\, dx$$

Problem 74: Unable to integrate problem.

$$\int \frac{x^2 \operatorname{erfi}(b\,x)}{e^{b^2 x^2}}\,dx$$

Optimal(type 5, 58 leaves, 3 steps):

$$-\frac{x \operatorname{erfi}(b\,x)}{2\,b^2\,e^{b^2 x^2}}+\frac{x^2}{2\,b\,\sqrt{\pi}}+\frac{x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-b^2 x^2\right)}{2\,b\,\sqrt{\pi}}$$

Result(type 8, 20 leaves):

$$\int \frac{x^2 \operatorname{erfi}(b\,x)}{e^{b^2 x^2}}\,dx$$

Problem 75: Unable to integrate problem.

$$\int \frac{\operatorname{erfi}(b\,x)}{e^{b^2 x^2}\,x^4}\,dx$$

Optimal(type 5, 87 leaves, 5 steps):

$$-\frac{\operatorname{erfi}(b\,x)}{3\,e^{b^2 x^2}\,x^3}+\frac{2\,b^2 \operatorname{erfi}(b\,x)}{3\,e^{b^2 x^2}\,x}-\frac{b}{3\,x^2\,\sqrt{\pi}}+\frac{4\,b^5\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-b^2 x^2\right)}{3\,\sqrt{\pi}}-\frac{4\,b^3 \ln(x)}{3\,\sqrt{\pi}}$$

Result(type 8, 20 leaves):

$$\int \frac{\operatorname{erfi}(b\,x)}{e^{b^2 x^2}\,x^4}\,dx$$

Problem 76: Unable to integrate problem.

$$\int \frac{\operatorname{erfi}(b\,x)}{e^{b^2 x^2}\,x^6}\,dx$$

Optimal(type 5, 120 leaves, 7 steps):

$$-\frac{\operatorname{erfi}(b\,x)}{5\,e^{b^2 x^2}\,x^5}+\frac{2\,b^2 \operatorname{erfi}(b\,x)}{15\,e^{b^2 x^2}\,x^3}-\frac{4\,b^4 \operatorname{erfi}(b\,x)}{15\,e^{b^2 x^2}\,x}-\frac{b}{10\,x^4\,\sqrt{\pi}}+\frac{2\,b^3}{15\,x^2\,\sqrt{\pi}}-\frac{8\,b^7\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-b^2 x^2\right)}{15\,\sqrt{\pi}}+\frac{8\,b^5 \ln(x)}{15\,\sqrt{\pi}}$$

Result(type 8, 20 leaves):

$$\int \frac{\operatorname{erfi}(b\,x)}{e^{b^2 x^2}\,x^6}\,dx$$

Problem 77: Unable to integrate problem.

$$\int e^{b^2 x^2 + c} x^3 \operatorname{erfi}(b x) \, dx$$

Optimal(type 4, 79 leaves, 5 steps):

$$-\frac{e^{b^2 x^2 + c} \operatorname{erfi}(b x)}{2 b^4} + \frac{e^{b^2 x^2 + c} x^2 \operatorname{erfi}(b x)}{2 b^2} + \frac{5 e^c \operatorname{erfi}\left(b x \sqrt{2}\right) \sqrt{2}}{16 b^4} - \frac{e^{2 b^2 x^2 + c} x}{4 b^3 \sqrt{\pi}}$$

Result(type 8, 20 leaves):

$$\int e^{b^2 x^2 + c} x^3 \operatorname{erfi}(b x) \, dx$$

Problem 78: Unable to integrate problem.

$$\int e^{b^2 x^2 + c} x^4 \operatorname{erfi}(b x) \, dx$$

Optimal(type 4, 100 leaves, 7 steps):

$$-\frac{3 e^{b^2 x^2 + c} x \operatorname{erfi}(b x)}{4 b^4} + \frac{e^{b^2 x^2 + c} x^3 \operatorname{erfi}(b x)}{2 b^2} + \frac{e^{2 b^2 x^2 + c}}{2 b^5 \sqrt{\pi}} - \frac{e^{2 b^2 x^2 + c} x^2}{4 b^3 \sqrt{\pi}} + \frac{3 e^c \operatorname{erfi}(b x)^2 \sqrt{\pi}}{16 b^5}$$

Result(type 8, 20 leaves):

$$\int e^{b^2 x^2 + c} x^4 \operatorname{erfi}(b x) \, dx$$

Problem 79: Unable to integrate problem.

$$\int e^{d x^2 + c} x \operatorname{erfi}(b x + a) \, dx$$

Optimal(type 4, 68 leaves, 3 steps):

$$\frac{e^{d x^2 + c} \operatorname{erfi}(b x + a)}{2 d} - \frac{b e^{c + \frac{a^2 d}{b^2 + d}} \operatorname{erfi}\left(\frac{a b + \left(b^2 + d\right) x}{\sqrt{b^2 + d}}\right)}{2 d \sqrt{b^2 + d}}$$

Result(type 8, 18 leaves):

$$\int e^{d x^2 + c} x \operatorname{erfi}(b x + a) \, dx$$

Problem 82: Unable to integrate problem.

$$\int -\operatorname{erfi}(b x) \sinh\left(b^2 x^2 - c\right) \, dx$$

Optimal(type 5, 45 leaves, 4 steps):

$$\frac{b\, e^{c} x^{2}\, HypergeometricPFQ\left(\,[1,1],\left[\frac{3}{2},2\right],-b^{2}x^{2}\right)}{2\sqrt{\pi}}-\frac{\operatorname{erfi}(b\,x)^{2}\sqrt{\pi}}{8\,b\,e^{c}}$$

Result(type 8, 20 leaves):

$$\int -\operatorname{erfi}(b\,x)\,\sinh\left(b^{2}x^{2}-c\right)\,dx$$

Test results for the 27 problems in "8.10 Formal derivatives.txt"

Problem 11: Result more than twice size of optimal antiderivative.

$$\int \frac{-g(x)\; Derivative(1)\,(f)\,(x)\;-f(x)\; Derivative(1)\,(g)\,(x)}{1+f(x)^{2}\,g(x)^{2}}\,dx$$

Optimal(type 9, 8 leaves, 2 steps):

$$-\arctan(f(x)\;g(x))$$

Result(type 9, 29 leaves):

$$\int \frac{-g(x)\; Derivative(1)\,(f)\,(x)\;-f(x)\; Derivative(1)\,(g)\,(x)}{1+f(x)^{2}\,g(x)^{2}}\,dx$$

Problem 23: Result more than twice size of optimal antiderivative.

$$\int \cos(Derivative(-1+m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x))\;(Derivative(m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x)\;+Derivative(-1+m)\,(f)\,(x)\; Derivative(n)\,(g)\,(x))\,dx$$

Optimal(type 9, 6 leaves, 2 steps):

$$\sin(Derivative(-1+m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x))$$

Result(type 9, 20 leaves):

$$\int \cos(Derivative(-1+m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x))\;(Derivative(m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x)\;+Derivative(-1+m)\,(f)\,(x)\; Derivative(n)\,(g)\,(x))\,dx$$

Problem 24: Result more than twice size of optimal antiderivative.

$$\int \cos\left(Derivative(-1+m)\,(f)\,(x)^{2}\, Derivative(-1+n)\,(g)\,(x)\right) Derivative(-1+m)\,(f)\,(x)\;(2\, Derivative(m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x)\;+Derivative(-1+m)\,(f)\,(x)\; Derivative(n)\,(g)\,(x))\,dx$$

Optimal(type 9, 8 leaves, 2 steps):

$$\sin\left(Derivative(-1+m)\,(f)\,(x)^{2}\, Derivative(-1+n)\,(g)\,(x)\right)$$

Result(type 9, 25 leaves):

$$\int \cos\left(Derivative(-1+m)\,(f)\,(x)^{2}\, Derivative(-1+n)\,(g)\,(x)\right) Derivative(-1+m)\,(f)\,(x)\;(2\, Derivative(m)\,(f)\,(x)\; Derivative(-1+n)\,(g)\,(x)\;+Derivative($$

$-1+m)(f)(x)\,Derivative(n)(g)(x))\,dx$

Problem 26: Result more than twice size of optimal antiderivative.

$$\int \cos\left(Derivative(m)(f)(x)^2\,Derivative(n)(g)(x)^3\right)Derivative(m)(f)(x)\,Derivative(n)(g)(x)^2\,(2\,Derivative(1+m)(f)(x)\,Derivative(n)(g)(x) + 3\,Derivative(m)(f)(x)\,Derivative(1+n)(g)(x))\,dx$$

Optimal(type 9, 10 leaves, 2 steps):

$$\sin\left(Derivative(m)(f)(x)^2\,Derivative(n)(g)(x)^3\right)$$

Result(type 9, 32 leaves):

$$\int \cos\left(Derivative(m)(f)(x)^2\,Derivative(n)(g)(x)^3\right)Derivative(m)(f)(x)\,Derivative(n)(g)(x)^2\,(2\,Derivative(1+m)(f)(x)\,Derivative(n)(g)(x) + 3\,Derivative(m)(f)(x)\,Derivative(1+n)(g)(x))\,dx$$

Test results for the 56 problems in "8.2 Fresnel integral functions.txt"

Problem 12: Unable to integrate problem.

$$\int x^3\,\mathrm{FresnelS}(b\,x)^2\,dx$$

Optimal(type 4, 122 leaves, 10 steps):

$$\frac{3\,x^2}{8\,b^2\,\pi^2}+\frac{x^2\cos(b^2\,\pi\,x^2)}{8\,b^2\,\pi^2}+\frac{x^3\cos\left(\frac{b^2\,\pi\,x^2}{2}\right)\mathrm{FresnelS}(b\,x)}{2\,b\,\pi}+\frac{3\,\mathrm{FresnelS}(b\,x)^2}{4\,b^4\,\pi^2}+\frac{x^4\,\mathrm{FresnelS}(b\,x)^2}{4}-\frac{3\,x\,\mathrm{FresnelS}(b\,x)\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)}{2\,b^3\,\pi^2}-\frac{\sin(b^2\,\pi\,x^2)}{2\,b^4\,\pi^3}$$

Result(type 8, 12 leaves):

$$\int x^3\,\mathrm{FresnelS}(b\,x)^2\,dx$$

Problem 16: Unable to integrate problem.

$$\int \frac{\mathrm{FresnelS}(b\,x)^2}{x^9}\,dx$$

Optimal(type 4, 210 leaves, 20 steps):

$$-\frac{b^2}{336\,x^6}+\frac{b^6\,\pi^2}{1680\,x^2}+\frac{b^2\cos(b^2\,\pi\,x^2)}{336\,x^6}-\frac{b^6\,\pi^2\cos(b^2\,\pi\,x^2)}{336\,x^2}-\frac{b^3\,\pi\cos\left(\frac{b^2\,\pi\,x^2}{2}\right)\mathrm{FresnelS}(b\,x)}{140\,x^5}+\frac{b^7\,\pi^3\cos\left(\frac{b^2\,\pi\,x^2}{2}\right)\mathrm{FresnelS}(b\,x)}{420\,x}+\frac{b^8\,\pi^4\,\mathrm{FresnelS}(b\,x)^2}{840}$$
$$-\frac{\mathrm{FresnelS}(b\,x)^2}{8\,x^8}-\frac{b^8\,\pi^3\,\mathrm{Si}(b^2\,\pi\,x^2)}{280}-\frac{b\,\mathrm{FresnelS}(b\,x)\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)}{28\,x^7}+\frac{b^5\,\pi^2\,\mathrm{FresnelS}(b\,x)\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)}{420\,x^3}-\frac{b^4\,\pi\sin(b^2\,\pi\,x^2)}{420\,x^4}$$

Result(type 8, 12 leaves):

$$\int \frac{\mathrm{FresnelS}(b x)^2}{x^9}\, dx$$

Problem 17: Unable to integrate problem.

$$\int (d x + c)^2\, \mathrm{FresnelS}(b x + a)^2\, dx$$

Optimal(type 5, 451 leaves, 18 steps):

$$\frac{2 d^2 x}{3 b^2 \pi^2} + \frac{d(-a d + b c) \cos\left(\pi (b x + a)^2\right)}{2 b^3 \pi^2} + \frac{d^2 (b x + a) \cos\left(\pi (b x + a)^2\right)}{6 b^3 \pi^2} + \frac{2(-a d + b c)^2 \cos\left(\frac{\pi (b x + a)^2}{2}\right) \mathrm{FresnelS}(b x + a)}{b^3 \pi}$$
$$+ \frac{2 d(-a d + b c)(b x + a) \cos\left(\frac{\pi (b x + a)^2}{2}\right) \mathrm{FresnelS}(b x + a)}{b^3 \pi} + \frac{2 d^2 (b x + a)^2 \cos\left(\frac{\pi (b x + a)^2}{2}\right) \mathrm{FresnelS}(b x + a)}{3 b^3 \pi}$$
$$- \frac{d(-a d + b c) \mathrm{FresnelC}(b x + a) \mathrm{FresnelS}(b x + a)}{b^3 \pi} + \frac{(-a d + b c)^2 (b x + a) \mathrm{FresnelS}(b x + a)^2}{b^3} + \frac{d(-a d + b c)(b x + a)^2 \mathrm{FresnelS}(b x + a)^2}{b^3}$$
$$+ \frac{d^2 (b x + a)^3 \mathrm{FresnelS}(b x + a)^2}{3 b^3} + \frac{I d(-a d + b c)(b x + a)^2 \mathit{HypergeometricPFQ}\left([1, 1], \left[\frac{3}{2}, 2\right], -\frac{I}{2} \pi (b x + a)^2\right)}{4 b^3 \pi}$$
$$- \frac{I d(-a d + b c)(b x + a)^2 \mathit{HypergeometricPFQ}\left([1, 1], \left[\frac{3}{2}, 2\right], \frac{I}{2} \pi (b x + a)^2\right)}{4 b^3 \pi} - \frac{4 d^2 \mathrm{FresnelS}(b x + a) \sin\left(\frac{\pi (b x + a)^2}{2}\right)}{3 b^3 \pi^2}$$
$$- \frac{5 d^2 \mathrm{FresnelC}\left((b x + a)\sqrt{2}\right)\sqrt{2}}{12 b^3 \pi^2} - \frac{(-a d + b c)^2 \mathrm{FresnelS}\left((b x + a)\sqrt{2}\right)\sqrt{2}}{2 b^3 \pi}$$

Result(type 8, 18 leaves):

$$\int (d x + c)^2\, \mathrm{FresnelS}(b x + a)^2\, dx$$

Problem 18: Unable to integrate problem.

$$\int \mathrm{FresnelS}\left(d\left(a + b \ln\left(c x^n\right)\right)\right) dx$$

Optimal(type 4, 186 leaves, 10 steps):

$$\frac{\left(\frac{1}{4} - \frac{I}{4}\right) x \,\mathrm{erf}\left(\frac{\left(\frac{1}{2} + \frac{I}{2}\right)\left(\frac{1}{n} + I a b d^2 \pi + I b^2 d^2 \pi \ln\left(c x^n\right)\right)}{b d \sqrt{\pi}}\right)}{e^{\frac{2 a b n - \frac{I}{\pi d^2}}{2 b^2 n^2}} \left(c x^n\right)^{\frac{1}{n}}} + \frac{\left(\frac{1}{4} - \frac{I}{4}\right) x \,\mathrm{erfi}\left(\frac{\left(\frac{1}{2} + \frac{I}{2}\right)\left(\frac{1}{n} - I a b d^2 \pi - I b^2 d^2 \pi \ln\left(c x^n\right)\right)}{b d \sqrt{\pi}}\right)}{e^{\frac{2 a b n + \frac{I}{\pi d^2}}{2 b^2 n^2}} \left(c x^n\right)^{\frac{1}{n}}}$$

$$+x\,\mathrm{FresnelS}\left(d\left(a+b\ln\left(c\,x^{n}\right)\right)\right)$$

Result(type 8, 15 leaves):

$$\int \mathrm{FresnelS}\left(d\left(a+b\ln\left(c\,x^{n}\right)\right)\right)\,\mathrm{d}x$$

Problem 19: Unable to integrate problem.

$$\int \frac{\mathrm{FresnelS}\left(d\left(a+b\ln\left(c\,x^{n}\right)\right)\right)}{x^{3}}\,\mathrm{d}x$$

Optimal(type 4, 200 leaves, 10 steps):

$$\frac{\left(\frac{1}{8}-\frac{\mathrm{I}}{8}\right)\mathrm{e}^{\frac{2\,\mathrm{I}+2\,a\,b\,d^{2}\,n\,\pi}{b^{2}\,d^{2}\,n^{2}\,\pi}}\left(c\,x^{n}\right)^{\frac{2}{n}}\mathrm{erf}\left(\frac{\left(\frac{1}{2}+\frac{\mathrm{I}}{2}\right)\left(\frac{2}{n}-\mathrm{I}\,a\,b\,d^{2}\,\pi-\mathrm{I}\,b^{2}\,d^{2}\,\pi\ln\left(c\,x^{n}\right)\right)}{b\,d\sqrt{\pi}}\right)}{x^{2}}$$

$$+\frac{\left(\frac{1}{8}-\frac{\mathrm{I}}{8}\right)\left(c\,x^{n}\right)^{\frac{2}{n}}\mathrm{erfi}\left(\frac{\left(\frac{1}{2}+\frac{\mathrm{I}}{2}\right)\left(\frac{2}{n}+\mathrm{I}\,a\,b\,d^{2}\,\pi+\mathrm{I}\,b^{2}\,d^{2}\,\pi\ln\left(c\,x^{n}\right)\right)}{b\,d\sqrt{\pi}}\right)}{\mathrm{e}^{\frac{2\,(\mathrm{I}-a\,b\,d^{2}\,n\,\pi)}{b^{2}\,d^{2}\,n^{2}\,\pi}}\,x^{2}}-\frac{\mathrm{FresnelS}\left(d\left(a+b\ln\left(c\,x^{n}\right)\right)\right)}{2\,x^{2}}$$

Result(type 8, 19 leaves):

$$\int \frac{\mathrm{FresnelS}\left(d\left(a+b\ln\left(c\,x^{n}\right)\right)\right)}{x^{3}}\,\mathrm{d}x$$

Problem 20: Unable to integrate problem.

$$\int \cos\left(c+\frac{b^{2}\,\pi\,x^{2}}{2}\right)\mathrm{FresnelS}\left(b\,x\right)\,\mathrm{d}x$$

Optimal(type 5, 81 leaves, 4 steps):

$$\frac{\cos(c)\,\mathrm{FresnelC}(b\,x)\,\mathrm{FresnelS}(b\,x)}{2\,b}-\frac{\mathrm{I}\,b\,x^{2}\cos(c)\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-\frac{\mathrm{I}}{2}\,b^{2}\,\pi\,x^{2}\right)}{8}$$

$$+\frac{\mathrm{I}\,b\,x^{2}\cos(c)\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],\frac{\mathrm{I}}{2}\,b^{2}\,\pi\,x^{2}\right)}{8}-\frac{\mathrm{FresnelS}(b\,x)^{2}\sin(c)}{2\,b}$$

Result(type 8, 19 leaves):

$$\int \cos\left(c+\frac{b^{2}\,\pi\,x^{2}}{2}\right)\mathrm{FresnelS}\left(b\,x\right)\,\mathrm{d}x$$

Problem 26: Unable to integrate problem.

$$\int x^8 \cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)\, dx$$

Optimal(type 5, 271 leaves, 23 steps):

$$\frac{35 x^4}{8 b^5 \pi^3} - \frac{x^8}{16 b \pi} - \frac{40 \cos(b^2 \pi x^2)}{b^9 \pi^5} + \frac{5 x^4 \cos(b^2 \pi x^2)}{2 b^5 \pi^3} - \frac{105 x \cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)}{b^8 \pi^4} + \frac{7 x^5 \cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)}{b^4 \pi^2}$$
$$+ \frac{105 \,\text{FresnelC}(b x)\, \text{FresnelS}(b x)}{2 b^9 \pi^4} - \frac{105\, \mathrm{I}\, x^2\, \mathit{HypergeometricPFQ}\left([1, 1], \left[\frac{3}{2}, 2\right], -\frac{\mathrm{I}}{2} b^2 \pi x^2\right)}{8 b^7 \pi^4}$$
$$+ \frac{105\, \mathrm{I}\, x^2\, \mathit{HypergeometricPFQ}\left([1, 1], \left[\frac{3}{2}, 2\right], \frac{\mathrm{I}}{2} b^2 \pi x^2\right)}{8 b^7 \pi^4} - \frac{35 x^3 \,\text{FresnelS}(b x) \sin\left(\frac{b^2 \pi x^2}{2}\right)}{b^6 \pi^3} + \frac{x^7 \,\text{FresnelS}(b x) \sin\left(\frac{b^2 \pi x^2}{2}\right)}{b^2 \pi} - \frac{55 x^2 \sin(b^2 \pi x^2)}{4 b^7 \pi^4}$$
$$+ \frac{x^6 \sin(b^2 \pi x^2)}{4 b^3 \pi^2}$$

Result(type 8, 20 leaves):

$$\int x^8 \cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)\, dx$$

Problem 29: Unable to integrate problem.

$$\int \frac{\cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)}{x^2}\, dx$$

Optimal(type 4, 42 leaves, 4 steps):

$$-\frac{\cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)}{x} - \frac{b \pi \,\text{FresnelS}(b x)^2}{2} + \frac{b \,\text{Si}(b^2 \pi x^2)}{4}$$

Result(type 8, 20 leaves):

$$\int \frac{\cos\left(\frac{b^2 \pi x^2}{2}\right) \text{FresnelS}(b x)}{x^2}\, dx$$

Problem 41: Unable to integrate problem.

$$\int x^5 \,\text{FresnelC}(b x)^2\, dx$$

Optimal(type 5, 227 leaves, 16 steps):

$$\frac{5x^4}{24b^2\pi^2}+\frac{11\cos(b^2\pi x^2)}{6b^6\pi^4}-\frac{x^4\cos(b^2\pi x^2)}{12b^2\pi^2}-\frac{5x^3\cos\left(\frac{b^2\pi x^2}{2}\right)\operatorname{FresnelC}(bx)}{3b^3\pi^2}+\frac{x^6\operatorname{FresnelC}(bx)^2}{6}-\frac{5\operatorname{FresnelC}(bx)\operatorname{FresnelS}(bx)}{2b^6\pi^3}$$
$$-\frac{5\,\mathrm{I}\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-\frac{\mathrm{I}}{2}b^2\pi x^2\right)}{8b^4\pi^3}+\frac{5\,\mathrm{I}\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],\frac{\mathrm{I}}{2}b^2\pi x^2\right)}{8b^4\pi^3}+\frac{5x\operatorname{FresnelC}(bx)\sin\left(\frac{b^2\pi x^2}{2}\right)}{b^5\pi^3}$$
$$-\frac{x^5\operatorname{FresnelC}(bx)\sin\left(\frac{b^2\pi x^2}{2}\right)}{3b\pi}+\frac{7x^2\sin(b^2\pi x^2)}{12b^4\pi^3}$$

Result(type 8, 12 leaves):

$$\int x^5\operatorname{FresnelC}(bx)^2\,dx$$

Problem 44: Unable to integrate problem.

$$\int\frac{\operatorname{FresnelC}(bx)^2}{x^5}\,dx$$

Optimal(type 4, 109 leaves, 9 steps):

$$-\frac{b^2}{24x^2}-\frac{b^2\cos(b^2\pi x^2)}{24x^2}-\frac{b\cos\left(\frac{b^2\pi x^2}{2}\right)\operatorname{FresnelC}(bx)}{6x^3}-\frac{b^4\pi^2\operatorname{FresnelC}(bx)^2}{12}-\frac{\operatorname{FresnelC}(bx)^2}{4x^4}-\frac{b^4\pi\operatorname{Si}(b^2\pi x^2)}{12}$$
$$+\frac{b^3\pi\operatorname{FresnelC}(bx)\sin\left(\frac{b^2\pi x^2}{2}\right)}{6x}$$

Result(type 8, 12 leaves):

$$\int\frac{\operatorname{FresnelC}(bx)^2}{x^5}\,dx$$

Problem 46: Unable to integrate problem.

$$\int\frac{\operatorname{FresnelC}(bx)^2}{x^9}\,dx$$

Optimal(type 4, 210 leaves, 20 steps):

$$-\frac{b^2}{336x^6}+\frac{b^6\pi^2}{1680x^2}-\frac{b^2\cos(b^2\pi x^2)}{336x^6}+\frac{b^6\pi^2\cos(b^2\pi x^2)}{336x^2}-\frac{b\cos\left(\frac{b^2\pi x^2}{2}\right)\operatorname{FresnelC}(bx)}{28x^7}+\frac{b^5\pi^2\cos\left(\frac{b^2\pi x^2}{2}\right)\operatorname{FresnelC}(bx)}{420x^3}+\frac{b^8\pi^4\operatorname{FresnelC}(bx)^2}{840}$$

$$-\frac{\text{FresnelC}(b x)^2}{8 x^8}+\frac{b^8 \pi^3 \text{Si}(b^2 \pi x^2)}{280}+\frac{b^3 \pi \text{FresnelC}(b x) \sin\left(\frac{b^2 \pi x^2}{2}\right)}{140 x^5}-\frac{b^7 \pi^3 \text{FresnelC}(b x) \sin\left(\frac{b^2 \pi x^2}{2}\right)}{420 x}+\frac{b^4 \pi \sin(b^2 \pi x^2)}{420 x^4}$$

Result(type 8, 12 leaves):

$$\int \frac{\text{FresnelC}(b x)^2}{x^9}\, dx$$

Problem 47: Unable to integrate problem.

$$\int \text{FresnelC}(d (a+b \ln(c x^n)))\, dx$$

Optimal(type 4, 186 leaves, 10 steps):

$$\frac{\left(\frac{1}{4}+\frac{I}{4}\right) x \,\text{erf}\left(\frac{\left(\frac{1}{2}+\frac{I}{2}\right)\left(\frac{1}{n}+I a b d^2 \pi+I b^2 d^2 \pi \ln(c x^n)\right)}{b d \sqrt{\pi}}\right)}{e^{\frac{2 a b n-\frac{I}{\pi d^2}}{2 b^2 n^2}} (c x^n)^{\frac{1}{n}}}-\frac{\left(\frac{1}{4}+\frac{I}{4}\right) x \,\text{erfi}\left(\frac{\left(\frac{1}{2}+\frac{I}{2}\right)\left(\frac{1}{n}-I a b d^2 \pi-I b^2 d^2 \pi \ln(c x^n)\right)}{b d \sqrt{\pi}}\right)}{e^{\frac{2 a b n+\frac{I}{\pi d^2}}{2 b^2 n^2}} (c x^n)^{\frac{1}{n}}}$$
$$+x \,\text{FresnelC}(d (a+b \ln(c x^n)))$$

Result(type 8, 15 leaves):

$$\int \text{FresnelC}(d (a+b \ln(c x^n)))\, dx$$

Problem 48: Unable to integrate problem.

$$\int \frac{\text{FresnelC}(d (a+b \ln(c x^n)))}{x^2}\, dx$$

Optimal(type 4, 185 leaves, 10 steps):

$$\frac{\left(\frac{1}{4}+\frac{I}{4}\right) e^{\frac{2 a b n+\frac{I}{\pi d^2}}{2 b^2 n^2}} (c x^n)^{\frac{1}{n}} \,\text{erf}\left(\frac{\left(\frac{1}{2}+\frac{I}{2}\right)\left(\frac{1}{n}-I a b d^2 \pi-I b^2 d^2 \pi \ln(c x^n)\right)}{b d \sqrt{\pi}}\right)}{x}$$
$$-\frac{\left(\frac{1}{4}+\frac{I}{4}\right) e^{\frac{2 a b n-\frac{I}{\pi d^2}}{2 b^2 n^2}} (c x^n)^{\frac{1}{n}} \,\text{erfi}\left(\frac{\left(\frac{1}{2}+\frac{I}{2}\right)\left(\frac{1}{n}+I a b d^2 \pi+I b^2 d^2 \pi \ln(c x^n)\right)}{b d \sqrt{\pi}}\right)}{x}-\frac{\text{FresnelC}(d (a+b \ln(c x^n)))}{x}$$

Result(type 8, 19 leaves):

$$\int \frac{\mathrm{FresnelC}\left(d\left(a+b\ln\left(c\,x^n\right)\right)\right)}{x^2}\,dx$$

Problem 52: Unable to integrate problem.

$$\int x^8\,\mathrm{FresnelC}(b\,x)\,\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)dx$$

Optimal(type 5, 272 leaves, 23 steps):

$$-\frac{35\,x^4}{8\,b^5\,\pi^3}+\frac{x^8}{16\,b\,\pi}-\frac{40\cos\left(b^2\,\pi\,x^2\right)}{b^9\,\pi^5}+\frac{5\,x^4\cos\left(b^2\,\pi\,x^2\right)}{2\,b^5\,\pi^3}+\frac{35\,x^3\cos\left(\frac{b^2\,\pi\,x^2}{2}\right)\mathrm{FresnelC}(b\,x)}{b^6\,\pi^3}-\frac{x^7\cos\left(\frac{b^2\,\pi\,x^2}{2}\right)\mathrm{FresnelC}(b\,x)}{b^2\,\pi}$$
$$+\frac{105\,\mathrm{FresnelC}(b\,x)\,\mathrm{FresnelS}(b\,x)}{2\,b^9\,\pi^4}+\frac{105\,\mathrm{I}\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-\frac{\mathrm{I}}{2}\,b^2\,\pi\,x^2\right)}{8\,b^7\,\pi^4}$$
$$-\frac{105\,\mathrm{I}\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],\frac{\mathrm{I}}{2}\,b^2\,\pi\,x^2\right)}{8\,b^7\,\pi^4}-\frac{105\,x\,\mathrm{FresnelC}(b\,x)\,\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)}{b^8\,\pi^4}+\frac{7\,x^5\,\mathrm{FresnelC}(b\,x)\,\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)}{b^4\,\pi^2}$$
$$-\frac{55\,x^2\sin\left(b^2\,\pi\,x^2\right)}{4\,b^7\,\pi^4}+\frac{x^6\sin\left(b^2\,\pi\,x^2\right)}{4\,b^3\,\pi^2}$$

Result(type 8, 20 leaves):

$$\int x^8\,\mathrm{FresnelC}(b\,x)\,\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)dx$$

Problem 55: Unable to integrate problem.

$$\int \mathrm{FresnelC}(b\,x)\,\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)dx$$

Optimal(type 5, 62 leaves, 1 step):

$$\frac{\mathrm{FresnelC}(b\,x)\,\mathrm{FresnelS}(b\,x)}{2\,b}+\frac{\mathrm{I}\,b\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],-\frac{\mathrm{I}}{2}\,b^2\,\pi\,x^2\right)}{8}-\frac{\mathrm{I}\,b\,x^2\,\mathit{HypergeometricPFQ}\left([1,1],\left[\frac{3}{2},2\right],\frac{\mathrm{I}}{2}\,b^2\,\pi\,x^2\right)}{8}$$

Result(type 8, 17 leaves):

$$\int \mathrm{FresnelC}(b\,x)\,\sin\left(\frac{b^2\,\pi\,x^2}{2}\right)dx$$

Test results for the 55 problems in "8.3 Exponential integral functions.txt"

Problem 1: Result more than twice size of optimal antiderivative.

$$\int x^2 \operatorname{Ei}_1(b x)\, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{x^3 \operatorname{Ei}_{-2}(b x)}{3}+\frac{x^3 \operatorname{Ei}_1(b x)}{3}$$

Result(type 4, 47 leaves):

$$\frac{\frac{b^3 x^3 \operatorname{Ei}_1(b x)}{3}-\frac{b^2 x^2 e^{-b x}}{3}-\frac{2 b x e^{-b x}}{3}-\frac{2 e^{-b x}}{3}}{b^3}$$

Problem 3: Result more than twice size of optimal antiderivative.

$$\int \frac{\operatorname{Ei}_1(b x)}{x^4}\, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{\operatorname{Ei}_1(b x)}{3 x^3}+\frac{\operatorname{Ei}_4(b x)}{3 x^3}$$

Result(type 4, 64 leaves):

$$b^3\left(-\frac{\operatorname{Ei}_1(b x)}{3 b^3 x^3}+\frac{e^{-b x}}{9 b^3 x^3}-\frac{e^{-b x}}{18 b^2 x^2}+\frac{e^{-b x}}{18 b x}-\frac{\operatorname{Ei}_1(b x)}{18}\right)$$

Problem 4: Result more than twice size of optimal antiderivative.

$$\int \operatorname{Ei}_2(b x)\, dx$$

Optimal(type 4, 10 leaves, 1 step):

$$-\frac{\operatorname{Ei}_3(b x)}{b}$$

Result(type 4, 67 leaves):

$$\frac{\frac{\left(\gamma-\frac{3}{2}+\ln(x)+\ln(b)\right) x^2 b^2}{2}+\frac{3 b^2 x^2}{4}+\frac{1}{2}-\frac{(-3 b x+3) e^{-b x}}{6}+\frac{b^2 x^2\left(-\gamma-\ln(b x)-\operatorname{Ei}_1(b x)\right)}{2}}{b}$$

Problem 5: Result more than twice size of optimal antiderivative.

$$\int \frac{\operatorname{Ei}_2(b x)}{x^5}\, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{\mathrm{Ei}_2(b x)}{3 x^4}+\frac{\mathrm{Ei}_5(b x)}{3 x^4}$$

Result(type 4, 164 leaves):

$$b^4\left(-\frac{1}{4 b^4 x^4}-\frac{-\frac{2}{3}+\gamma+\ln(x)+\ln(b)}{3 x^3 b^3}+\frac{1}{4 b^2 x^2}-\frac{1}{12 b x}+\frac{29}{864}-\frac{\gamma}{72}-\frac{\ln(x)}{72}-\frac{\ln(b)}{72}+\frac{-145 b^4 x^4+360 b^3 x^3-1080 b^2 x^2-960 b x+1080}{4320 b^4 x^4}\right.$$
$$\left.-\frac{\left(20 b^3 x^3-20 b^2 x^2+40 b x+360\right) \mathrm{e}^{-b x}}{1440 b^4 x^4}-\frac{\left(20 b^3 x^3+480\right)\left(-\gamma-\ln(b x)-\mathrm{Ei}_1(b x)\right)}{1440 b^3 x^3}\right)$$

Problem 6: Result more than twice size of optimal antiderivative.

$$\int x^2 \mathrm{Ei}_3(b x)\, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{x^3 \mathrm{Ei}_{-2}(b x)}{5}+\frac{x^3 \mathrm{Ei}_3(b x)}{5}$$

Result(type 4, 91 leaves):

$$\frac{-\frac{\left(-\frac{17}{10}+\gamma+\ln(x)+\ln(b)\right) x^5 b^5}{10}-\frac{17 b^5 x^5}{100}+\frac{2}{5}-\frac{\left(18 b^4 x^4-18 b^3 x^3+36 b^2 x^2+72 b x+72\right) \mathrm{e}^{-b x}}{180}-\frac{b^5 x^5\left(-\gamma-\ln(b x)-\mathrm{Ei}_1(b x)\right)}{10}}{b^3}$$

Problem 7: Result more than twice size of optimal antiderivative.

$$\int x \mathrm{Ei}_3(b x)\, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{x^2 \mathrm{Ei}_{-1}(b x)}{4}+\frac{x^2 \mathrm{Ei}_3(b x)}{4}$$

Result(type 4, 83 leaves):

$$\frac{-\frac{\left(-\frac{7}{4}+\gamma+\ln(x)+\ln(b)\right) x^4 b^4}{8}-\frac{7 b^4 x^4}{32}+\frac{1}{4}-\frac{\left(15 b^3 x^3-15 b^2 x^2+30 b x+30\right) \mathrm{e}^{-b x}}{120}-\frac{b^4 x^4\left(-\gamma-\ln(b x)-\mathrm{Ei}_1(b x)\right)}{8}}{b^2}$$

Problem 8: Result more than twice size of optimal antiderivative.

$$\int \mathrm{Ei}_3(b x)\, dx$$

Optimal(type 4, 10 leaves, 1 step):

$$-\frac{\mathrm{Ei}_4(b x)}{b}$$

Result(type 4, 75 leaves):

$$\frac{-\frac{\left(\gamma-\frac{11}{6}+\ln(x)+\ln(b)\right) x^3 b^3}{6}-\frac{11 b^3 x^3}{36}+\frac{1}{3}-\frac{\left(4 b^2 x^2-4 b x+8\right) \mathrm{e}^{-b x}}{24}-\frac{b^3 x^3\left(-\gamma-\ln(b x)-\mathrm{Ei}_1(b x)\right)}{6}}{b}$$

Problem 9: Result more than twice size of optimal antiderivative.

$$\int \frac{\mathrm{Ei}_3(b x)}{x} \, dx$$

Optimal(type 4, 15 leaves, 1 step):

$$-\frac{\mathrm{Ei}_1(b x)}{2}+\frac{\mathrm{Ei}_3(b x)}{2}$$

Result(type 4, 77 leaves):

$$\frac{\gamma}{2}+\frac{\ln(x)}{2}+\frac{\ln(b)}{2}-\frac{\left(-2+\gamma+\ln(x)+\ln(b)\right) x^2 b^2}{4}-\frac{b^2 x^2}{2}+\frac{\left(-9 b x+9\right) \mathrm{e}^{-b x}}{36}+\frac{\left(-9 b^2 x^2+18\right)\left(-\gamma-\ln(b x)-\mathrm{Ei}_1(b x)\right)}{36}$$

Problem 10: Result more than twice size of optimal antiderivative.

$$\int \frac{\mathrm{Ei}_3(b x)}{x^5} \, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{\mathrm{Ei}_3(b x)}{2 x^4}+\frac{\mathrm{Ei}_5(b x)}{2 x^4}$$

Result(type 4, 164 leaves):

$$b^4\left(-\frac{1}{8 b^4 x^4}+\frac{1}{3 x^3 b^3}+\frac{-1+\gamma+\ln(x)+\ln(b)}{4 x^2 b^2}-\frac{1}{6 b x}+\frac{31}{576}-\frac{\gamma}{48}-\frac{\ln(x)}{48}-\frac{\ln(b)}{48}+\frac{-155 b^4 x^4+480 b^3 x^3+720 b^2 x^2-960 b x+360}{2880 b^4 x^4}\right.$$
$$\left.-\frac{\left(15 b^3 x^3-15 b^2 x^2-150 b x+90\right) \mathrm{e}^{-b x}}{720 b^4 x^4}+\frac{\left(-15 b^2 x^2+180\right)\left(-\gamma-\ln(b x)-\mathrm{Ei}_1(b x)\right)}{720 b^2 x^2}\right)$$

Problem 11: Result more than twice size of optimal antiderivative.

$$\int \frac{\mathrm{Ei}_{-1}(b x)}{x} \, dx$$

Optimal(type 4, 15 leaves, 1 step):

$$-\frac{\mathrm{Ei}_{-1}(b x)}{2}+\frac{\mathrm{Ei}_1(b x)}{2}$$

Result(type 4, 68 leaves):

$$-\frac{1}{2 b^2 x^2}+\frac{1}{4}-\frac{\ln(x)}{2}-\frac{\ln(b)}{2}+\frac{-3 b^2 x^2+6}{12 b^2 x^2}-\frac{(3 b x+3) \mathrm{e}^{-b x}}{6 b^2 x^2}+\frac{\ln(b x)}{2}+\frac{\mathrm{Ei}_1(b x)}{2}$$

Problem 13: Result more than twice size of optimal antiderivative.

$$\int \frac{\mathrm{Ei}_{-2}(b x)}{x^3}\, \mathrm{d}x$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{\mathrm{Ei}_{-2}(b x)}{5 x^2}+\frac{\mathrm{Ei}_3(b x)}{5 x^2}$$

Result(type 4, 128 leaves):

$$b^2\left(-\frac{2}{5 x^5 b^5}+\frac{1}{6 b^2 x^2}-\frac{1}{4 b x}+\frac{17}{100}-\frac{\ln(x)}{10}-\frac{\ln(b)}{10}+\frac{-153 b^5 x^5+225 b^4 x^4-150 b^3 x^3+360}{900 b^5 x^5}-\frac{\left(18 b^4 x^4-18 b^3 x^3+36 b^2 x^2+72 b x+72\right) \mathrm{e}^{-b x}}{180 b^5 x^5}\right.$$
$$\left.+\frac{\ln(b x)}{10}+\frac{\mathrm{Ei}_1(b x)}{10}\right)$$

Problem 15: Result more than twice size of optimal antiderivative.

$$\int \mathrm{Ei}_{-1}(b x)\, \mathrm{d}x$$

Optimal(type 3, 14 leaves, 1 step):

$$-\frac{1}{b^2 \mathrm{e}^{b x} x}$$

Result(type 3, 41 leaves):

$$\frac{-\frac{1}{b x}+1+\frac{-2 b x+2}{2 b x}-\frac{\mathrm{e}^{-b x}}{b x}}{b}$$

Problem 16: Result more than twice size of optimal antiderivative.

$$\int \frac{\mathrm{Ei}_{-3}(b x)}{x^2}\, \mathrm{d}x$$

Optimal(type 4, 21 leaves, 1 step):

$$-\frac{\mathrm{Ei}_{-3}(b x)}{5 x}+\frac{\mathrm{Ei}_2(b x)}{5 x}$$

Result(type 4, 110 leaves):

$$b\left(-\frac{6}{5x^5b^5}+\frac{1}{4bx}-\frac{6}{25}+\frac{\ln(x)}{5}+\frac{\ln(b)}{5}+\frac{72b^5x^5-75b^4x^4+360}{300b^5x^5}-\frac{\left(-12b^4x^4+12b^3x^3+36b^2x^2+72bx+72\right)e^{-bx}}{60b^5x^5}-\frac{\ln(bx)}{5}-\frac{\mathrm{Ei}_1(bx)}{5}\right)$$

Problem 20: Result unnecessarily involves higher level functions.

$$\int (dx)^m \mathrm{Ei}_n(bx)\, dx$$

Optimal(type 4, 46 leaves, 1 step):

$$-\frac{(dx)^{1+m}\mathrm{Ei}_{-m}(bx)}{d(m+n)}+\frac{(dx)^{1+m}\mathrm{Ei}_n(bx)}{d(m+n)}$$

Result(type 5, 88 leaves):

$$(dx)^m x^{-m} b^{-1-m}\left(\frac{x^{1+m}b^{1+m}\mathrm{hypergeom}([1+m,1-n],[2+m,2-n],-bx)}{(-1+n)(1+m)}+\frac{\pi x^{m+n}b^{m+n}\csc(\pi n)}{(m+n)\Gamma(n)}\right)$$

Problem 23: Result unnecessarily involves higher level functions and more than twice size of optimal antiderivative.

$$\int x\,\mathrm{Ei}_n(bx)\, dx$$

Optimal(type 4, 30 leaves, 1 step):

$$-\frac{x^2\mathrm{Ei}_{-1}(bx)}{1+n}+\frac{x^2\mathrm{Ei}_n(bx)}{1+n}$$

Result(type 5, 62 leaves):

$$\frac{\frac{b^2x^2\mathrm{hypergeom}([2,1-n],[3,2-n],-bx)}{2(-1+n)}+\frac{\pi x^{1+n}b^{1+n}\csc(\pi n)}{(1+n)\Gamma(n)}}{b^2}$$

Problem 26: Unable to integrate problem.

$$\int (dx+c)^3\mathrm{Ei}_3(bx+a)\, dx$$

Optimal(type 4, 75 leaves, 4 steps):

$$-\frac{(dx+c)^3\mathrm{Ei}_4(bx+a)}{b}-\frac{3d(dx+c)^2\mathrm{Ei}_5(bx+a)}{b^2}-\frac{6d^2(dx+c)\mathrm{Ei}_6(bx+a)}{b^3}-\frac{6d^3\mathrm{Ei}_7(bx+a)}{b^4}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^3\mathrm{Ei}_3(bx+a)\, dx$$

Problem 27: Unable to integrate problem.

$$\int (dx+c)^2 \operatorname{Ei}_3(bx+a)\, dx$$

Optimal(type 4, 53 leaves, 3 steps):

$$-\frac{(dx+c)^2 \operatorname{Ei}_4(bx+a)}{b} - \frac{2d(dx+c)\operatorname{Ei}_5(bx+a)}{b^2} - \frac{2d^2 \operatorname{Ei}_6(bx+a)}{b^3}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^2 \operatorname{Ei}_3(bx+a)\, dx$$

Problem 28: Unable to integrate problem.

$$\int (dx+c)^3 \operatorname{Ei}_{-1}(bx+a)\, dx$$

Optimal(type 4, 118 leaves, 7 steps):

$$-\frac{3d^3 e^{-bx-a}}{b^4} - \frac{3d^2(-ad+bc)e^{-bx-a}}{b^4} - \frac{3d^2 e^{-bx-a}(dx+c)}{b^3} - \frac{e^{-bx-a}(dx+c)^3}{b(bx+a)} + \frac{3d(-ad+bc)^2 \operatorname{Ei}(-bx-a)}{b^4}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^3 \operatorname{Ei}_{-1}(bx+a)\, dx$$

Problem 29: Unable to integrate problem.

$$\int (dx+c)^2 \operatorname{Ei}_{-1}(bx+a)\, dx$$

Optimal(type 4, 69 leaves, 5 steps):

$$-\frac{2d^2 e^{-bx-a}}{b^3} - \frac{e^{-bx-a}(dx+c)^2}{b(bx+a)} + \frac{2d(-ad+bc)\operatorname{Ei}(-bx-a)}{b^3}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^2 \operatorname{Ei}_{-1}(bx+a)\, dx$$

Problem 30: Unable to integrate problem.

$$\int (dx+c) \operatorname{Ei}_{-1}(bx+a)\, dx$$

Optimal(type 4, 41 leaves, 2 steps):

$$-\frac{e^{-bx-a}(dx+c)}{b(bx+a)} + \frac{d\operatorname{Ei}(-bx-a)}{b^2}$$

Result(type 8, 15 leaves):

$$\int (dx+c) \operatorname{Ei}_{-1}(bx+a)\, dx$$

Problem 31: Unable to integrate problem.

$$\int \frac{\mathrm{Ei}_{-2}(bx+a)}{(dx+c)^2}\, dx$$

Optimal(type 4, 411 leaves, 15 steps):

$$\frac{2 d^2 e^{-bx-a}}{b^2 (-ad+bc)(dx+c)^3} + \frac{2 d e^{-bx-a}}{b^2 (bx+a)(dx+c)^3} + \frac{3 d^2 e^{-bx-a}}{b(-ad+bc)^2 (dx+c)^2} - \frac{d e^{-bx-a}}{b(-ad+bc)(dx+c)^2} + \frac{6 d^2 e^{-bx-a}}{(-ad+bc)^3 (dx+c)} - \frac{3 d e^{-bx-a}}{(-ad+bc)^2 (dx+c)} + \frac{e^{-bx-a}}{(-ad+bc)(dx+c)} + \frac{6 b d^2 \mathrm{Ei}(-bx-a)}{(-ad+bc)^4} - \frac{6 b d^2 e^{-a+\frac{bc}{d}} \mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{(-ad+bc)^4} + \frac{6 b d e^{-a+\frac{bc}{d}} \mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{(-ad+bc)^3} - \frac{3 b e^{-a+\frac{bc}{d}} \mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{(-ad+bc)^2} + \frac{b e^{-a+\frac{bc}{d}} \mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{d(-ad+bc)} - \frac{\mathrm{Ei}_{-1}(bx+a)}{b(dx+c)^2}$$

Result(type 8, 17 leaves):

$$\int \frac{\mathrm{Ei}_{-2}(bx+a)}{(dx+c)^2}\, dx$$

Problem 32: Unable to integrate problem.

$$\int (dx+c)^2 \mathrm{Ei}_{-3}(bx+a)\, dx$$

Optimal(type 4, 62 leaves, 3 steps):

$$-\frac{2 d^2 e^{-bx-a}}{b^3 (bx+a)} - \frac{(dx+c)^2 \mathrm{Ei}_{-2}(bx+a)}{b} - \frac{2 d (dx+c) \mathrm{Ei}_{-1}(bx+a)}{b^2}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^2 \mathrm{Ei}_{-3}(bx+a)\, dx$$

Problem 33: Unable to integrate problem.

$$\int (dx+c) \mathrm{Ei}_{-3}(bx+a)\, dx$$

Optimal(type 4, 31 leaves, 2 steps):

$$-\frac{(dx+c) \mathrm{Ei}_{-2}(bx+a)}{b} - \frac{d \mathrm{Ei}_{-1}(bx+a)}{b^2}$$

Result(type 8, 15 leaves):

$$\int (dx+c) \mathrm{Ei}_{-3}(bx+a)\, dx$$

Problem 34: Unable to integrate problem.

$$\int \mathrm{Ei}_{-3}(bx+a)\,dx$$

Optimal(type 4, 12 leaves, 1 step):

$$-\frac{\mathrm{Ei}_{-2}(bx+a)}{b}$$

Result(type 8, 9 leaves):

$$\int \mathrm{Ei}_{-3}(bx+a)\,dx$$

Problem 35: Unable to integrate problem.

$$\int \frac{\mathrm{Ei}_{-3}(bx+a)}{dx+c}\,dx$$

Optimal(type 4, 442 leaves, 16 steps):

$$-\frac{2d^3 e^{-bx-a}}{b^3(-ad+bc)(dx+c)^3}-\frac{2d^2 e^{-bx-a}}{b^3(bx+a)(dx+c)^3}-\frac{3d^3 e^{-bx-a}}{b^2(-ad+bc)^2(dx+c)^2}+\frac{d^2 e^{-bx-a}}{b^2(-ad+bc)(dx+c)^2}-\frac{6d^3 e^{-bx-a}}{b(-ad+bc)^3(dx+c)}$$
$$+\frac{3d^2 e^{-bx-a}}{b(-ad+bc)^2(dx+c)}-\frac{d e^{-bx-a}}{b(-ad+bc)(dx+c)}-\frac{6d^3\,\mathrm{Ei}(-bx-a)}{(-ad+bc)^4}+\frac{6d^3 e^{-a+\frac{bc}{d}}\,\mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{(-ad+bc)^4}-\frac{6d^2 e^{-a+\frac{bc}{d}}\,\mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{(-ad+bc)^3}$$
$$+\frac{3d\,e^{-a+\frac{bc}{d}}\,\mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{(-ad+bc)^2}-\frac{e^{-a+\frac{bc}{d}}\,\mathrm{Ei}\left(-\frac{b(dx+c)}{d}\right)}{-ad+bc}-\frac{\mathrm{Ei}_{-2}(bx+a)}{b(dx+c)}+\frac{d\,\mathrm{Ei}_{-1}(bx+a)}{b^2(dx+c)^2}$$

Result(type 8, 17 leaves):

$$\int \frac{\mathrm{Ei}_{-3}(bx+a)}{dx+c}\,dx$$

Problem 39: Unable to integrate problem.

$$\int (dx+c)\,\mathrm{Ei}_{n}(bx+a)\,dx$$

Optimal(type 4, 35 leaves, 2 steps):

$$-\frac{(dx+c)\,\mathrm{Ei}_{1+n}(bx+a)}{b}-\frac{d\,\mathrm{Ei}_{2+n}(bx+a)}{b^2}$$

Result(type 8, 15 leaves):

$$\int (dx+c)\,\mathrm{Ei}_{n}(bx+a)\,dx$$

Problem 50: Result more than twice size of optimal antiderivative.

$$\int e^{b x+a} x^2 \operatorname{Ei}(d x+c)\, dx$$

Optimal(type 4, 228 leaves, 14 steps):

$$\frac{e^{a+c+(b+d) x}}{b (b+d)^2}+\frac{2 e^{a+c+(b+d) x}}{b^2 (b+d)}+\frac{c e^{a+c+(b+d) x}}{b d (b+d)}-\frac{e^{a+c+(b+d) x} x}{b (b+d)}+\frac{2 e^{b x+a} \operatorname{Ei}(d x+c)}{b^3}-\frac{2 e^{b x+a} x \operatorname{Ei}(d x+c)}{b^2}+\frac{e^{b x+a} x^2 \operatorname{Ei}(d x+c)}{b}$$
$$-\frac{2 e^{a-\frac{b c}{d}} \operatorname{Ei}\left(\frac{(b+d) (d x+c)}{d}\right)}{b^3}-\frac{c^2 e^{a-\frac{b c}{d}} \operatorname{Ei}\left(\frac{(b+d) (d x+c)}{d}\right)}{b d^2}-\frac{2 c e^{a-\frac{b c}{d}} \operatorname{Ei}\left(\frac{(b+d) (d x+c)}{d}\right)}{b^2 d}$$

Result(type 4, 693 leaves):

$$\frac{1}{d}\left(\frac{1}{d b}\left(\operatorname{Ei}(d x+c)\left(\frac{d^2\left(\left(\frac{b (d x+c)}{d}+\frac{a d-b c}{d}\right)^2 e^{\frac{b (d x+c)}{d}+\frac{a d-b c}{d}}-2\left(\frac{b (d x+c)}{d}+\frac{a d-b c}{d}\right) e^{\frac{b (d x+c)}{d}+\frac{a d-b c}{d}}+2 e^{\frac{b (d x+c)}{d}+\frac{a d-b c}{d}}\right)}{b^2}\right.\right.\right.$$
$$\left.\left.+\frac{e^{\frac{b (d x+c)}{d}+\frac{a d-b c}{d}} d^2 a^2}{b^2}-\frac{2 d^2 a\left(\left(\frac{b (d x+c)}{d}+\frac{a d-b c}{d}\right) e^{\frac{b (d x+c)}{d}+\frac{a d-b c}{d}}-e^{\frac{b (d x+c)}{d}+\frac{a d-b c}{d}}\right)}{b^2}\right)\right)$$
$$-\frac{1}{d b}\left(\frac{1}{(b+d)^2}\left(d^2\left(\left(\frac{(b+d) (d x+c)}{d}+\frac{a d-b c}{d}\right) e^{\frac{(b+d) (d x+c)}{d}+\frac{a d-b c}{d}}-e^{\frac{(b+d) (d x+c)}{d}+\frac{a d-b c}{d}}+\frac{e^{\frac{(b+d) (d x+c)}{d}+\frac{a d-b c}{d}} b c}{d}\right.\right.\right.$$
$$\left.\left.\left.-e^{\frac{(b+d) (d x+c)}{d}+\frac{a d-b c}{d}} a\right)\right)-c^2 e^{-\frac{-a d+b c}{d}} \operatorname{Ei}_1\left(-\frac{(b+d) (d x+c)}{d}-\frac{a d-b c}{d}-\frac{-a d+b c}{d}\right)-\frac{2 c e^{d x+c+\frac{b (d x+c)}{d}+a-\frac{b c}{d}}}{1+\frac{b}{d}}$$
$$\left.\left.-\frac{2 d e^{d x+c+\frac{b (d x+c)}{d}+a-\frac{b c}{d}}}{b\left(1+\frac{b}{d}\right)}-\frac{2 d^2 e^{-\frac{-a d+b c}{d}} \operatorname{Ei}_1\left(-\frac{(b+d) (d x+c)}{d}-\frac{a d-b c}{d}-\frac{-a d+b c}{d}\right)}{b^2}\right)\right)$$

$$-\frac{2\,d\,c\,\mathrm{e}^{-\frac{-a\,d+b\,c}{d}}\,\mathrm{Ei}_1\left(-\frac{(b+d)\,(d\,x+c)}{d}-\frac{a\,d-b\,c}{d}-\frac{-a\,d+b\,c}{d}\right)}{b}\Bigg)\Bigg)$$

Test results for the 40 problems in "8.4 Trig integral functions.txt"

Problem 1: Result unnecessarily involves higher level functions.

$$\int x^m\,\mathrm{Si}(b\,x)\,\mathrm{d}x$$

Optimal(type 4, 78 leaves, 5 steps):

$$\frac{x^m\,\Gamma(1+m,-\mathrm{I}\,b\,x)}{2\,b\,(1+m)\,(-\mathrm{I}\,b\,x)^m}+\frac{x^m\,\Gamma(1+m,\mathrm{I}\,b\,x)}{2\,b\,(1+m)\,(\mathrm{I}\,b\,x)^m}+\frac{x^{1+m}\,\mathrm{Si}(b\,x)}{1+m}$$

Result(type 5, 36 leaves):

$$\frac{b\,x^{2+m}\,\mathrm{hypergeom}\left(\left[\frac{1}{2},1+\frac{m}{2}\right],\left[\frac{3}{2},\frac{3}{2},2+\frac{m}{2}\right],-\frac{b^2\,x^2}{4}\right)}{2+m}$$

Problem 13: Unable to integrate problem.

$$\int\frac{\mathrm{Si}(b\,x)\,\sin(b\,x)}{x^3}\,\mathrm{d}x$$

Optimal(type 4, 84 leaves, 14 steps):

$$b^2\,\mathrm{Ci}(2\,b\,x)-\frac{b\cos(b\,x)\,\mathrm{Si}(b\,x)}{2\,x}-\frac{b^2\,\mathrm{Si}(b\,x)^2}{4}-\frac{b\cos(b\,x)\,\sin(b\,x)}{2\,x}-\frac{\mathrm{Si}(b\,x)\,\sin(b\,x)}{2\,x^2}-\frac{\sin(b\,x)^2}{4\,x^2}-\frac{b\sin(2\,b\,x)}{4\,x}$$

Result(type 8, 14 leaves):

$$\int\frac{\mathrm{Si}(b\,x)\,\sin(b\,x)}{x^3}\,\mathrm{d}x$$

Problem 16: Unable to integrate problem.

$$\int\frac{\cos(b\,x)\,\mathrm{Si}(b\,x)}{x^2}\,\mathrm{d}x$$

Optimal(type 4, 40 leaves, 7 steps):

$$b\,\mathrm{Ci}(2\,b\,x)-\frac{\cos(b\,x)\,\mathrm{Si}(b\,x)}{x}-\frac{b\,\mathrm{Si}(b\,x)^2}{2}-\frac{\sin(2\,b\,x)}{2\,x}$$

Result(type 8, 14 leaves):

$$\int \frac{\cos(b x)\,\mathrm{Si}(b x)}{x^2}\,dx$$

`Problem 22: Result more than twice size of optimal antiderivative.`

$$\int x \cos(b x + a)\,\mathrm{Si}(d x + c)\,dx$$

`Optimal(type 4, 350 leaves, 24 steps):`

$$\frac{c\,\mathrm{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)\cos\left(a - \frac{b c}{d}\right)}{2 b d} - \frac{c\,\mathrm{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)\cos\left(a - \frac{b c}{d}\right)}{2 b d} + \frac{\cos\left(a - \frac{b c}{d}\right)\mathrm{Si}\left(\frac{c(b-d)}{d} + (b-d)x\right)}{2 b^2}$$
$$+ \frac{\cos(b x + a)\,\mathrm{Si}(d x + c)}{b^2} - \frac{\cos\left(a - \frac{b c}{d}\right)\mathrm{Si}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2 b^2} + \frac{\mathrm{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)\sin\left(a - \frac{b c}{d}\right)}{2 b^2}$$
$$- \frac{\mathrm{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)\sin\left(a - \frac{b c}{d}\right)}{2 b^2} - \frac{c\,\mathrm{Si}\left(\frac{c(b-d)}{d} + (b-d)x\right)\sin\left(a - \frac{b c}{d}\right)}{2 b d} + \frac{c\,\mathrm{Si}\left(\frac{c(b+d)}{d} + (b+d)x\right)\sin\left(a - \frac{b c}{d}\right)}{2 b d}$$
$$+ \frac{x\,\mathrm{Si}(d x + c)\sin(b x + a)}{b} - \frac{\sin(a - c + (b-d)x)}{2 b (b-d)} + \frac{\sin(a + c + (b+d)x)}{2 b (b+d)}$$

`Result(type 4, 1207 leaves):`

$$\frac{1}{d}\left(\frac{1}{b}\left(\mathrm{Si}(d x + c)\left(\frac{d\left(\cos\left(\frac{b(d x + c)}{d} + \frac{a d - b c}{d}\right) + \left(\frac{b(d x + c)}{d} + \frac{a d - b c}{d}\right)\sin\left(\frac{b(d x + c)}{d} + \frac{a d - b c}{d}\right)\right)}{b}\right.\right.\right.$$
$$\left.\left.- \frac{d\,a \sin\left(\frac{b(d x + c)}{d} + \frac{a d - b c}{d}\right)}{b}\right)\right) - \frac{1}{b}\left(\frac{d \sin\left(\frac{(b-d)(d x + c)}{d} + \frac{a d - b c}{d}\right)}{2(b-d)} + \frac{1}{2(b-d)}\left((a d\right.\right.$$
$$\left.- b c)\,d\left(\frac{\mathrm{Si}\left(\frac{(b-d)(d x + c)}{d} + \frac{a d - b c}{d} + \frac{-a d + b c}{d}\right)\sin\left(\frac{-a d + b c}{d}\right)}{d}\right.\right.$$
$$\left.\left.+ \frac{\mathrm{Ci}\left(\frac{(b-d)(d x + c)}{d} + \frac{a d - b c}{d} + \frac{-a d + b c}{d}\right)\cos\left(\frac{-a d + b c}{d}\right)}{d}\right)\right)$$
$$- \frac{1}{2(b-d)}\left(a d^2\left(\frac{\mathrm{Si}\left(\frac{(b-d)(d x + c)}{d} + \frac{a d - b c}{d} + \frac{-a d + b c}{d}\right)\sin\left(\frac{-a d + b c}{d}\right)}{d}\right.\right.$$

$$+\frac{\mathrm{Ci}\left(\frac{(b-d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2\,(b-d)}\Bigg(d^2\,c\,\Bigg(\frac{\mathrm{Si}\left(\frac{(b-d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\sin\left(\frac{-a\,d+b\,c}{d}\right)}{d}$$

$$+\frac{\mathrm{Ci}\left(\frac{(b-d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)-\frac{d\sin\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}\right)}{2\,(b+d)}-\frac{1}{2\,(b+d)}\Bigg((a\,d$$

$$-b\,c)\,d\,\Bigg(\frac{\mathrm{Si}\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\sin\left(\frac{-a\,d+b\,c}{d}\right)}{d}$$

$$+\frac{\mathrm{Ci}\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2\,(b+d)}\Bigg(a\,d^2\,\Bigg(\frac{\mathrm{Si}\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\sin\left(\frac{-a\,d+b\,c}{d}\right)}{d}$$

$$+\frac{\mathrm{Ci}\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2\,(b+d)}\Bigg(d^2\,c\,\Bigg(\frac{\mathrm{Si}\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\sin\left(\frac{-a\,d+b\,c}{d}\right)}{d}$$

$$+\frac{\mathrm{Ci}\left(\frac{(b+d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)$$

$$-\frac{1}{2\,b}\Bigg(d^2\,\Bigg(\frac{\mathrm{Si}\left(\frac{(b-d)\,(d\,x+c)}{d}+\frac{a\,d-b\,c}{d}+\frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}$$

$$- \frac{\mathrm{Ci}\left(\frac{(b-d)\,(d\,x+c)}{d} + \frac{a\,d-b\,c}{d} + \frac{-a\,d+b\,c}{d}\right)\sin\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+ \frac{1}{2\,b}\Bigg(d^2\Bigg(\frac{\mathrm{Si}\left(\frac{(b+d)\,(d\,x+c)}{d} + \frac{a\,d-b\,c}{d} + \frac{-a\,d+b\,c}{d}\right)\cos\left(\frac{-a\,d+b\,c}{d}\right)}{d}$$

$$- \frac{\mathrm{Ci}\left(\frac{(b+d)\,(d\,x+c)}{d} + \frac{a\,d-b\,c}{d} + \frac{-a\,d+b\,c}{d}\right)\sin\left(\frac{-a\,d+b\,c}{d}\right)}{d}\Bigg)\Bigg)\Bigg)\Bigg)$$

Problem 28: Unable to integrate problem.

$$\int x^2\,\mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)\,\mathrm{d}x$$

Optimal(type 4, 131 leaves, 7 steps):

$$\frac{x^3\,\mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)}{3} - \frac{x^3\,\mathrm{Ei}\left(\frac{(3-\mathrm{I}\,b\,d\,n)\,(a+b\ln(c\,x^n))}{b\,n}\right)}{6\,\mathrm{e}^{\frac{3\,a}{b\,n}}\,(c\,x^n)^{\frac{3}{n}}} - \frac{x^3\,\mathrm{Ei}\left(\frac{(3+\mathrm{I}\,b\,d\,n)\,(a+b\ln(c\,x^n))}{b\,n}\right)}{6\,\mathrm{e}^{\frac{3\,a}{b\,n}}\,(c\,x^n)^{\frac{3}{n}}}$$

Result(type 8, 19 leaves):

$$\int x^2\,\mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)\,\mathrm{d}x$$

Problem 29: Unable to integrate problem.

$$\int x\,\mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)\,\mathrm{d}x$$

Optimal(type 4, 131 leaves, 7 steps):

$$\frac{x^2\,\mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)}{2} - \frac{x^2\,\mathrm{Ei}\left(\frac{(2-\mathrm{I}\,b\,d\,n)\,(a+b\ln(c\,x^n))}{b\,n}\right)}{4\,\mathrm{e}^{\frac{2\,a}{b\,n}}\,(c\,x^n)^{\frac{2}{n}}} - \frac{x^2\,\mathrm{Ei}\left(\frac{(2+\mathrm{I}\,b\,d\,n)\,(a+b\ln(c\,x^n))}{b\,n}\right)}{4\,\mathrm{e}^{\frac{2\,a}{b\,n}}\,(c\,x^n)^{\frac{2}{n}}}$$

Result(type 8, 17 leaves):

$$\int x\,\mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)\,\mathrm{d}x$$

Problem 30: Unable to integrate problem.

$$\int \mathrm{Ci}\left(d\,(a+b\ln(c\,x^n))\right)\,\mathrm{d}x$$

Optimal(type 4, 118 leaves, 7 steps):

$$x\,\mathrm{Ci}\left(d\left(a+b\ln\left(c x^n\right)\right)\right)-\frac{x\,\mathrm{Ei}\left(\frac{(1-\mathrm{I}\,b\,d\,n)\left(a+b\ln\left(c x^n\right)\right)}{b\,n}\right)}{2\,\mathrm{e}^{\frac{a}{b\,n}}\left(c x^n\right)^{\frac{1}{n}}}-\frac{x\,\mathrm{Ei}\left(\frac{(1+\mathrm{I}\,b\,d\,n)\left(a+b\ln\left(c x^n\right)\right)}{b\,n}\right)}{2\,\mathrm{e}^{\frac{a}{b\,n}}\left(c x^n\right)^{\frac{1}{n}}}$$

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Result(type 8, 15 leaves):
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$$\int \mathrm{Ci}\left(d\left(a+b\ln\left(c x^n\right)\right)\right)\,\mathrm{d}x$$

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Problem 39: Result more than twice size of optimal antiderivative.
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$$\int x\,\mathrm{Ci}(d x+c)\sin(b x+a)\,\mathrm{d}x$$

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Optimal(type 4, 351 leaves, 24 steps):
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$$-\frac{c\,\mathrm{Ci}\left(\frac{c(b-d)}{d}+(b-d)x\right)\cos\left(a-\frac{b c}{d}\right)}{2 b d}-\frac{c\,\mathrm{Ci}\left(\frac{c(b+d)}{d}+(b+d)x\right)\cos\left(a-\frac{b c}{d}\right)}{2 b d}-\frac{x\,\mathrm{Ci}(d x+c)\cos(b x+a)}{b}$$
$$-\frac{\cos\left(a-\frac{b c}{d}\right)\mathrm{Si}\left(\frac{c(b-d)}{d}+(b-d)x\right)}{2 b^2}-\frac{\cos\left(a-\frac{b c}{d}\right)\mathrm{Si}\left(\frac{c(b+d)}{d}+(b+d)x\right)}{2 b^2}-\frac{\mathrm{Ci}\left(\frac{c(b-d)}{d}+(b-d)x\right)\sin\left(a-\frac{b c}{d}\right)}{2 b^2}$$
$$-\frac{\mathrm{Ci}\left(\frac{c(b+d)}{d}+(b+d)x\right)\sin\left(a-\frac{b c}{d}\right)}{2 b^2}+\frac{c\,\mathrm{Si}\left(\frac{c(b-d)}{d}+(b-d)x\right)\sin\left(a-\frac{b c}{d}\right)}{2 b d}+\frac{c\,\mathrm{Si}\left(\frac{c(b+d)}{d}+(b+d)x\right)\sin\left(a-\frac{b c}{d}\right)}{2 b d}$$
$$+\frac{\mathrm{Ci}(d x+c)\sin(b x+a)}{b^2}+\frac{\sin(a-c+(b-d)x)}{2 b(b-d)}+\frac{\sin(a+c+(b+d)x)}{2 b(b+d)}$$

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Result(type 4, 1207 leaves):
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$$\frac{1}{d}\left(\frac{1}{b}\left(\mathrm{Ci}(d x+c)\left(\frac{d\left(\sin\left(\frac{b(d x+c)}{d}+\frac{a d-b c}{d}\right)-\left(\frac{b(d x+c)}{d}+\frac{a d-b c}{d}\right)\cos\left(\frac{b(d x+c)}{d}+\frac{a d-b c}{d}\right)\right)}{b}\right.\right.\right.$$
$$\left.\left.+\frac{d\cos\left(\frac{b(d x+c)}{d}+\frac{a d-b c}{d}\right)a}{b}\right)\right)-\frac{1}{b}\left(-\frac{d\sin\left(\frac{(b-d)(d x+c)}{d}+\frac{a d-b c}{d}\right)}{2(b-d)}-\frac{1}{2(b-d)}\left((a d\right.\right.$$
$$-b c)\,d\left(\frac{\mathrm{Si}\left(\frac{(b-d)(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}\right.$$

$$+\frac{\operatorname{Ci}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2\,(b-d)}\Bigg(a\,d^2\Bigg(\frac{\operatorname{Si}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}$$

$$+\frac{\operatorname{Ci}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\Bigg)\Bigg)$$

$$-\frac{1}{2\,(b-d)}\Bigg(d^2\,c\Bigg(\frac{\operatorname{Si}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}$$

$$+\frac{\operatorname{Ci}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\Bigg)\Bigg)-\frac{d\sin\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}\right)}{2\,(b+d)}-\frac{1}{2\,(b+d)}\Bigg((a\,d$$

$$-b\,c)\,d\Bigg(\frac{\operatorname{Si}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}$$

$$+\frac{\operatorname{Ci}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2\,(b+d)}\Bigg(a\,d^2\Bigg(\frac{\operatorname{Si}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}$$

$$+\frac{\operatorname{Ci}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2\,(b+d)}\Bigg(d^2\,c\Bigg(\frac{\operatorname{Si}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}$$

$$+\frac{\operatorname{Ci}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\Bigg)\Bigg)$$

$$+\frac{1}{2 b}\left(d^2\left(\frac{\operatorname{Si}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\right.\right.$$

$$\left.\left.-\frac{\operatorname{Ci}\left(\frac{(b-d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}\right)\right)$$

$$+\frac{1}{2 b}\left(d^2\left(\frac{\operatorname{Si}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\cos\left(\frac{-a d+b c}{d}\right)}{d}\right.\right.$$

$$\left.\left.-\frac{\operatorname{Ci}\left(\frac{(b+d)\,(d x+c)}{d}+\frac{a d-b c}{d}+\frac{-a d+b c}{d}\right)\sin\left(\frac{-a d+b c}{d}\right)}{d}\right)\right)\Bigg)\Bigg)$$

Test results for the 40 problems in "8.5 Hyperbolic integral functions.txt"

Problem 1: Result unnecessarily involves higher level functions.

$$\int x^m \operatorname{Shi}(b x)\,dx$$

Optimal(type 4, 72 leaves, 5 steps):

$$-\frac{x^m \Gamma(1+m,-b x)}{2 b\,(1+m)\,(-b x)^m}-\frac{x^m \Gamma(1+m,b x)}{2 b\,(1+m)\,(b x)^m}+\frac{x^{1+m}\operatorname{Shi}(b x)}{1+m}$$

Result(type 5, 36 leaves):

$$\frac{b\,x^{2+m}\operatorname{hypergeom}\left(\left[\frac{1}{2},1+\frac{m}{2}\right],\left[\frac{3}{2},\frac{3}{2},2+\frac{m}{2}\right],\frac{b^2 x^2}{4}\right)}{2+m}$$

Problem 10: Unable to integrate problem.

$$\int\frac{\operatorname{Shi}(b x+a)}{x^2}\,dx$$

Optimal(type 4, 46 leaves, 7 steps):

$$\frac{b\cosh(a)\operatorname{Shi}(b x)}{a}-\frac{b\operatorname{Shi}(b x+a)}{a}-\frac{\operatorname{Shi}(b x+a)}{x}+\frac{b\operatorname{Chi}(b x)\sinh(a)}{a}$$

Result(type 8, 12 leaves):

$$\int \frac{\mathrm{Shi}(b x + a)}{x^2}\, dx$$

```
Problem 13: Unable to integrate problem.
```

$$\int \frac{\mathrm{Shi}(b x) \sinh(b x)}{x^3}\, dx$$

```
Optimal(type 4, 84 leaves, 14 steps):
```

$$b^2 \mathrm{Chi}(2 b x) - \frac{b \cosh(b x) \mathrm{Shi}(b x)}{2 x} + \frac{b^2 \mathrm{Shi}(b x)^2}{4} - \frac{b \cosh(b x) \sinh(b x)}{2 x} - \frac{\mathrm{Shi}(b x) \sinh(b x)}{2 x^2} - \frac{\sinh(b x)^2}{4 x^2} - \frac{b \sinh(2 b x)}{4 x}$$

```
Result(type 8, 14 leaves):
```

$$\int \frac{\mathrm{Shi}(b x) \sinh(b x)}{x^3}\, dx$$

```
Problem 16: Unable to integrate problem.
```

$$\int \frac{\cosh(b x) \mathrm{Shi}(b x)}{x^2}\, dx$$

```
Optimal(type 4, 40 leaves, 7 steps):
```

$$b \mathrm{Chi}(2 b x) - \frac{\cosh(b x) \mathrm{Shi}(b x)}{x} + \frac{b \mathrm{Shi}(b x)^2}{2} - \frac{\sinh(2 b x)}{2 x}$$

```
Result(type 8, 14 leaves):
```

$$\int \frac{\cosh(b x) \mathrm{Shi}(b x)}{x^2}\, dx$$

```
Problem 20: Unable to integrate problem.
```

$$\int \mathrm{Shi}(d x + c) \sinh(b x + a)\, dx$$

```
Optimal(type 4, 145 leaves, 9 steps):
```

$$\frac{\cosh\left(a - \frac{b c}{d}\right) \mathrm{Shi}\left(\frac{c (b - d)}{d} + (b - d) x\right)}{2 b} + \frac{\cosh(b x + a) \mathrm{Shi}(d x + c)}{b} - \frac{\cosh\left(a - \frac{b c}{d}\right) \mathrm{Shi}\left(\frac{c (b + d)}{d} + (b + d) x\right)}{2 b}$$
$$+ \frac{\mathrm{Chi}\left(\frac{c (b - d)}{d} + (b - d) x\right) \sinh\left(a - \frac{b c}{d}\right)}{2 b} - \frac{\mathrm{Chi}\left(\frac{c (b + d)}{d} + (b + d) x\right) \sinh\left(a - \frac{b c}{d}\right)}{2 b}$$

```
Result(type 8, 15 leaves):
```

$$\int \mathrm{Shi}(d x + c) \sinh(b x + a)\, dx$$

Problem 22: Unable to integrate problem.

$$\int x \cosh(b x + a) \operatorname{Shi}(d x + c) \, dx$$

Optimal(type 4, 351 leaves, 24 steps):

$$-\frac{c \operatorname{Chi}\left(\frac{c (b-d)}{d} + (b-d) x\right) \cosh\left(a - \frac{b c}{d}\right)}{2 b d} + \frac{c \operatorname{Chi}\left(\frac{c (b+d)}{d} + (b+d) x\right) \cosh\left(a - \frac{b c}{d}\right)}{2 b d} - \frac{\cosh\left(a - \frac{b c}{d}\right) \operatorname{Shi}\left(\frac{c (b-d)}{d} + (b-d) x\right)}{2 b^2}$$
$$- \frac{\cosh(b x + a) \operatorname{Shi}(d x + c)}{b^2} + \frac{\cosh\left(a - \frac{b c}{d}\right) \operatorname{Shi}\left(\frac{c (b+d)}{d} + (b+d) x\right)}{2 b^2} - \frac{\operatorname{Chi}\left(\frac{c (b-d)}{d} + (b-d) x\right) \sinh\left(a - \frac{b c}{d}\right)}{2 b^2}$$
$$+ \frac{\operatorname{Chi}\left(\frac{c (b+d)}{d} + (b+d) x\right) \sinh\left(a - \frac{b c}{d}\right)}{2 b^2} - \frac{c \operatorname{Shi}\left(\frac{c (b-d)}{d} + (b-d) x\right) \sinh\left(a - \frac{b c}{d}\right)}{2 b d} + \frac{c \operatorname{Shi}\left(\frac{c (b+d)}{d} + (b+d) x\right) \sinh\left(a - \frac{b c}{d}\right)}{2 b d}$$
$$+ \frac{x \operatorname{Shi}(d x + c) \sinh(b x + a)}{b} + \frac{\sinh(a - c + (b-d) x)}{2 b (b-d)} - \frac{\sinh(a + c + (b+d) x)}{2 b (b+d)}$$

Result(type 8, 16 leaves):

$$\int x \cosh(b x + a) \operatorname{Shi}(d x + c) \, dx$$

Problem 26: Unable to integrate problem.

$$\int \frac{\operatorname{Chi}(b x + a)}{x^2} \, dx$$

Optimal(type 4, 46 leaves, 7 steps):

$$-\frac{b \operatorname{Chi}(b x + a)}{a} - \frac{\operatorname{Chi}(b x + a)}{x} + \frac{b \operatorname{Chi}(b x) \cosh(a)}{a} + \frac{b \operatorname{Shi}(b x) \sinh(a)}{a}$$

Result(type 8, 12 leaves):

$$\int \frac{\operatorname{Chi}(b x + a)}{x^2} \, dx$$

Problem 27: Unable to integrate problem.

$$\int \frac{\operatorname{Chi}(b x + a)}{x^3} \, dx$$

Optimal(type 4, 97 leaves, 11 steps):

$$\frac{b^2 \operatorname{Chi}(b x + a)}{2 a^2} - \frac{\operatorname{Chi}(b x + a)}{2 x^2} - \frac{b^2 \operatorname{Chi}(b x) \cosh(a)}{2 a^2} - \frac{b \cosh(b x + a)}{2 a x} + \frac{b^2 \cosh(a) \operatorname{Shi}(b x)}{2 a} + \frac{b^2 \operatorname{Chi}(b x) \sinh(a)}{2 a} - \frac{b^2 \operatorname{Shi}(b x) \sinh(a)}{2 a^2}$$

Result(type 8, 12 leaves):

$$\int \frac{\operatorname{Chi}(b x + a)}{x^3} \, dx$$

Problem 28: Unable to integrate problem.

$$\int x^2 \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right) dx$$

Optimal(type 4, 128 leaves, 7 steps):

$$\frac{x^3 \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right)}{3}-\frac{x^3 \operatorname{Ei}\left(\frac{(-b d n+3) \left(a+b \ln\left(c x^n\right)\right)}{b n}\right)}{6 e^{\frac{3 a}{b n}} \left(c x^n\right)^{\frac{3}{n}}}-\frac{x^3 \operatorname{Ei}\left(\frac{(b d n+3) \left(a+b \ln\left(c x^n\right)\right)}{b n}\right)}{6 e^{\frac{3 a}{b n}} \left(c x^n\right)^{\frac{3}{n}}}$$

Result(type 8, 19 leaves):

$$\int x^2 \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right) dx$$

Problem 29: Unable to integrate problem.

$$\int x \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right) dx$$

Optimal(type 4, 128 leaves, 7 steps):

$$\frac{x^2 \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right)}{2}-\frac{x^2 \operatorname{Ei}\left(\frac{(-b d n+2) \left(a+b \ln\left(c x^n\right)\right)}{b n}\right)}{4 e^{\frac{2 a}{b n}} \left(c x^n\right)^{\frac{2}{n}}}-\frac{x^2 \operatorname{Ei}\left(\frac{(b d n+2) \left(a+b \ln\left(c x^n\right)\right)}{b n}\right)}{4 e^{\frac{2 a}{b n}} \left(c x^n\right)^{\frac{2}{n}}}$$

Result(type 8, 17 leaves):

$$\int x \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right) dx$$

Problem 30: Unable to integrate problem.

$$\int \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right) dx$$

Optimal(type 4, 115 leaves, 7 steps):

$$x \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right)-\frac{x \operatorname{Ei}\left(\frac{(-b d n+1) \left(a+b \ln\left(c x^n\right)\right)}{b n}\right)}{2 e^{\frac{a}{b n}} \left(c x^n\right)^{\frac{1}{n}}}-\frac{x \operatorname{Ei}\left(\frac{(b d n+1) \left(a+b \ln\left(c x^n\right)\right)}{b n}\right)}{2 e^{\frac{a}{b n}} \left(c x^n\right)^{\frac{1}{n}}}$$

Result(type 8, 15 leaves):

$$\int \operatorname{Chi}\left(d \left(a+b \ln\left(c x^n\right)\right)\right) dx$$

Problem 39: Unable to integrate problem.

$$\int x \operatorname{Chi}(d x+c) \sinh(b x+a)\, dx$$

Optimal(type 4, 351 leaves, 24 steps):

$$\frac{c\,\mathrm{Chi}\left(\frac{c\,(b-d)}{d}+(b-d)\,x\right)\cosh\left(a-\frac{b\,c}{d}\right)}{2\,b\,d}+\frac{c\,\mathrm{Chi}\left(\frac{c\,(b+d)}{d}+(b+d)\,x\right)\cosh\left(a-\frac{b\,c}{d}\right)}{2\,b\,d}+\frac{x\,\mathrm{Chi}(d\,x+c)\cosh(b\,x+a)}{b}+\frac{\cosh\left(a-\frac{b\,c}{d}\right)\mathrm{Shi}\left(\frac{c\,(b-d)}{d}+(b-d)\,x\right)}{2\,b^2}+\frac{\cosh\left(a-\frac{b\,c}{d}\right)\mathrm{Shi}\left(\frac{c\,(b+d)}{d}+(b+d)\,x\right)}{2\,b^2}+\frac{\mathrm{Chi}\left(\frac{c\,(b-d)}{d}+(b-d)\,x\right)\sinh\left(a-\frac{b\,c}{d}\right)}{2\,b^2}+\frac{\mathrm{Chi}\left(\frac{c\,(b+d)}{d}+(b+d)\,x\right)\sinh\left(a-\frac{b\,c}{d}\right)}{2\,b^2}+\frac{c\,\mathrm{Shi}\left(\frac{c\,(b-d)}{d}+(b-d)\,x\right)\sinh\left(a-\frac{b\,c}{d}\right)}{2\,b\,d}+\frac{c\,\mathrm{Shi}\left(\frac{c\,(b+d)}{d}+(b+d)\,x\right)\sinh\left(a-\frac{b\,c}{d}\right)}{2\,b\,d}-\frac{\mathrm{Chi}(d\,x+c)\sinh(b\,x+a)}{b^2}-\frac{\sinh(a-c+(b-d)\,x)}{2\,b\,(b-d)}-\frac{\sinh(a+c+(b+d)\,x)}{2\,b\,(b+d)}$$

Result(type 8, 16 leaves):

$$\int x\,\mathrm{Chi}(d\,x+c)\sinh(b\,x+a)\,\mathrm{d}x$$

Test results for the 63 problems in "8.6 Gamma functions.txt"

Problem 1: Result more than twice size of optimal antiderivative.

$$\int x^{100}\,\mathrm{Ei}_1(a\,x)\,\mathrm{d}x$$

Optimal(type 4, 21 leaves, 1 step):

$$\frac{x^{101}\,\mathrm{Ei}_1(a\,x)}{101}-\frac{\Gamma(101,a\,x)}{101\,a^{101}}$$

Result(type 4, 1321 leaves):

$$\frac{1}{a^{101}}\Bigg($$

$$-1\Big/$$

$$101\,\Big($$

$$93326215443944152681699238856266700490715968264381621468592963895217599993229915608941463976156518286253697920827223758251185210916 8\backslash$$

$$64000000000000000000000000\,\mathrm{e}^{-a\,x}\Big)$$

$$-1\Big/$$

101 (

150417367799215597054291509769577641937162306114776993008430981080550850952184245627205614387649525152389280458342400000000000000000\

000 $a^{24} x^{24} e^{-a x}$)

$- 1 /$

101 (

83030387025167009573968913392806858349313592975356900140653901556464069725605703586217499141982537884118882813005004800000000000000000\

00000 $a^{22} x^{22} e^{-a x}$)

$- 1 /$

101 (

383600388056271584231736379874767685573828799546148878649821025190864002132298350568324846035959325024629238596083122176000000000000000\

00000000 $a^{20} x^{20} e^{-a x}$)

$- 1 /$

101 (

145768147461383202008059824352411720518054943827536573886931989572528320810273373215963441493664543509359110666511586426880000000000\

00000000000 $a^{18} x^{18} e^{-a x}$)

$- 1 /$

101 (

4460505312318325981446630625183798647852481281122619160940118880919366616794365220408481309706135031386388786395254544662528000000000\

$0000000000000\, a^{16} x^{16} e^{-a x})$

$$- \frac{1544745660480658589417716947971599850793795457612196415341375333993504621840071171686531072000000000000000\, a^{43} x^{43} e^{-a x}}{101}$$

$$- \frac{2789810662828069412488396808036709330533594596447626726106523853192269347043168536065875116032000000000000000\, a^{41} x^{41} e^{-a x}}{101}$$

$$- \frac{4575289487038033836480970765180203302075095138174107830814699119235321729150796399148035190292480000000000000000\, a^{39} x^{39} e^{-a x}}{101}$$

$$- \frac{6780579019790366145664798673997061293675290994774027805267384094706746802601480263537388152013455360000000000000000\, a^{37} x^{37} e^{-a x}}{101}$$

$$- \frac{9031731254360767706025511833764085643175487605039005036616155614149386741065171711031801018481922539520000000000000000\, a^{35} x^{35} e^{-a x}}{101}$$

$$- \frac{100\, a^{99} x^{99} e^{-a x}}{101} - \frac{970200\, a^{97} x^{97} e^{-a x}}{101} - \frac{9034502400\, a^{95} x^{95} e^{-a x}}{101} - \frac{9900\, a^{98} x^{98} e^{-a x}}{101} - \frac{94109400\, a^{96} x^{96} e^{-a x}}{101}$$

$- 1 /$

$101\, ($

1070521274956398235547191350044111675484595507469428598625628531420647988030647652898035514329472407532733308734861090719006720000000\

$000000000000000\, a^{14} x^{14} e^{-a x})$

$- 1 /$

$101\, ($

1948348720420644788695888257080283249381963823594360049498643927185579338215778728274424636079639781709574621897447185108592230400000\

$00000000000000000\, a^{12} x^{12} e^{-a x})$

$- 1 /$

101 (

257182031095525112107857249934597388918419224714455526533820998388496472644482792132224051962512451185663850090463028434334174412800\

0000000000000000000 $a^{10} x^{10} \mathrm{e}^{-a x}$)

$-$ 1 /

101 (

231463827985972600897071524941137650026577302243009973880438898549646825380034512919001646766261206067097465081416725590900756971520\

000000000000000000000 $a^{8} x^{8} \mathrm{e}^{-a x}$)

$-$ 1 /

101 (

129619743672144656502360053967037084014883289256085585373045783187802222212819327234640922189106275397574580445593366330904423904051\

2000000000000000000000 $a^{6} x^{6} \mathrm{e}^{-a x}$)

$-$ 1 /

101 (

388859231016433969507080161901111252044649867768256756119137349563406666638457981703922766567318826192723741336780098992713271712153\

6000000000000000000000000 $a^{4} x^{4} \mathrm{e}^{-a x}$) $- \frac{858277728000\, a^{94} x^{94} \mathrm{e}^{-a x}}{101} - \frac{7503063898176000\, a^{92} x^{92} \mathrm{e}^{-a x}}{101} - \frac{6281565095552947200 0\, a^{90} x^{90} \mathrm{e}^{-a x}}{101}$

$- \frac{503153364153791070720000\, a^{88} x^{88} \mathrm{e}^{-a x}}{101} - \frac{385214215596142443743232 0000\, a^{86} x^{86} \mathrm{e}^{-a x}}{101} - \frac{2815915916007801263763025920 0000\, a^{84} x^{84} \mathrm{e}^{-a x}}{101}$

$- \frac{196325657664063904109558167142400000\, a^{82} x^{82} \mathrm{e}^{-a x}}{101} - \frac{13039950182047124510956853461598208 00000\, a^{80} x^{80} \mathrm{e}^{-a x}}{101}$

$$- \frac{82412485150537826909247313877300674560000000\, a^{78} x^{78} \mathrm{e}^{-a x}}{101} - \frac{494969385814130188416939367147067851407360000000\, a^{76} x^{76} \mathrm{e}^{-a x}}{101}$$

$- 1\,/$

101 (

4666310772197207634084961942813335024535798413219081073429648194760879999661495780447073198807825914312684896041361187912559260545 84\

32000000000000000000000000 $a^{2} x^{2} \mathrm{e}^{-a x}$)

$- 1\,/$

101 (

9332621544394415268169923885626670049071596826438162146859296389521759999322991560894146397615651828625369792082722375825118521091 68\

64000000000000000000000000 $a\, x\, \mathrm{e}^{-a x}$)

$- 1\,/$

101 (

6016694711968623882171660390783105677486492244591079720337239243222034038087369825088224575505981006095571218333696000000000000000 00\

0 $a^{25} x^{25} \mathrm{e}^{-a x}$)

$- 1\,/$

101 (

3610016827181174329302996234469863406491895346754647832202343545933220422852421895052934745303588603657342731000217600000000000000 00\

0000 $a^{23} x^{23} \mathrm{e}^{-a x}$)

$-1/$

$101\,($

$1826668514553674210627316094641750883684899045457851803094385834242209533963325478896784981123615833450615421886110105600000000000000\backslash$

$0000000\,a^{21}\,x^{21}\,e^{-a\,x})$

$-1/$

$101\,($

$7672007761125431684634727597495353711476575990922977572996420503817280042645967011366496920719186500492584771921662443520000000000000\backslash$

$000000000\,a^{19}\,x^{19}\,e^{-a\,x})$

$-1/$

$101\,($

$2623826654304897636145076838343410969324988988895658329964775812305509774584920717887341946885961783168463991997208555683840000000000\backslash$

$000000000000\,a^{17}\,x^{17}\,e^{-a\,x})$

$-1/$

$101\,($

$1555436924065735878028320647604445008178599471073027024476549398253626666553831926815691066269275304770894965347120395970853086848 61\backslash$

$4400000000000000000000000\,a^{3}\,x^{3}\,e^{-a\,x})$

$-1/$

$101\,(107477601926893135701703590821792619153788302499964159935732251808377702218675543361278432119934878220288000000000000000000\,a^{33}\,x^{33}$

$e^{-a\,x})$

$-1/$

$101\,(113496347634799151300998991907813005826400447439962152892133257909646853542921373789510024318651231400624128000000000000000000$

$a^{31}\,x^{31}\,e^{-a\,x})$

$-1/$

$101\,($

$1055516033003632107099290624742660954185524161191648021896839298559715737949168776242443226163456452025804390400000000000000000\,a^{29}$

$x^{29}\,e^{-a\,x})$

$-1/$

$101\,($

$857079018798949270964623987291040694798645618887618193780233510430489179214725046308863899644726639044953165004800000000000000000$

$$a^{27}\,x^{27}\,e^{-a\,x}) + \frac{a^{101}\,x^{101}\,\mathrm{Ei}_1(a\,x)}{101} - \frac{a^{100}\,x^{100}\,e^{-a\,x}}{101}$$

$$- \frac{2508814237322435473895975509378912678659857668066390287948932115041496316962547697508833616244978483200000000000000000\,a^{36}\,x^{36}\,e^{-a\,x}}{101}$$

$-1/$

$101\,(31611059390262686971089291418174299751114206617636517628156544649522853593728100988611303564686728888320000000000000000\,a^{34}\,x^{34}$

$$e^{-a\,x}) - \frac{15240800346357208283621346829572225039824584704000000000\,a^{72}\,x^{72}\,e^{-a\,x}}{101}$$

$$- \frac{779109713705780487458723249927732144035832770068480000000000\, a^{70}\, x^{70}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{37630999171989197544256332971509462556930722794307584000000000\, a^{68}\, x^{68}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{1714468322275827840116318530181971114093763730508653527040000000000\, a^{66}\, x^{66}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{73550691025633014340990064944806560794622464038821236310016000000000\, a^{64}\, x^{64}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{2965563862153523138228719418574600531239177750045272248019845120000000000\, a^{62}\, x^{62}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{112157625266646245087810168410491392091465702506712196420110542438400000000000\, a^{60}\, x^{60}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{39703799344392770761084799617313952800378858687376117532719132023193600000000000\, a^{58}\, x^{58}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{1312607606325625001361463475348399279580525068204654445631694504686780416000000000000\, a^{56}\, x^{56}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{40428314274829250041933075040730697811080172100703356925456190744352836812800000000000\, a^{54}\, x^{54}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{1157058354545613136200124607665712571353114525552213007520655617910337818958233600000000000000\, a^{52}\, x^{52}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{30685187562549660372027304595294697392284597216846889594477869869821589587723550720000000000000\, a^{50}\, x^{50}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{751787095282466679114668962584720086110972631812748795064707811810628944899226992640000000000000000\, a^{48}\, x^{48}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{16960316869572448280826931795911285142663542573695612816659808234447788996926560953958400000000000000\, a^{46}\, x^{46}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{351078559200149679413117488175363602453135331275499185304858030453069232236379811746938880000000000000000\, a^{44}\, x^{44}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{6642406340066831934496182876277879358413320467732444585967913936172069873912306038252083609600000000000000000\, a^{42}\, x^{42}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{114382237175950845912024269129505082551877378454352695770367477980883043228769909978700879757312000000000000000\, a^{40}\, x^{40}\, \mathrm{e}^{-a\, x}}{101}$$

$$- \frac{1784362899944833196227578598420279287809287103887902054017732656501775474368810595667733724214067200000000000000000\, a^{38}\, x^{38}\, \mathrm{e}^{-a\, x}}{101}$$

$$- 1 \Big/$$

$$101\, \big($$

7136808499709321570314609000294077836563970049796190657504190209470986586870984352653570095529816050218222058232407271460044800000000\
00000000000000 $a^{15}\,x^{15}\,\mathrm{e}^{-a\,x}$)

$-1/$

101 (

1498729784938957529766067890061756345678433710457200038075879943988907183242906714057249720061261370545826632228805527006609408000000\
00000000000000000 $a^{13}\,x^{13}\,\mathrm{e}^{-a\,x}$)

$-1/$

101 (

2338018464504773746435065908496339899258356588313232059398372712622695205858934473929309563295567738051489546276936622130310676480000\
0000000000000000000 $a^{11}\,x^{11}\,\mathrm{e}^{-a\,x}$)

$-1/$

101 (

2571820310955251121078572499345973889184192247144555265338209983884964726444827921322240519625124511856638500904630284343341744128000\
000000000000000000000 $a^{9}\,x^{9}\,\mathrm{e}^{-a\,x}$)

$-1/$

101 (

1851710623887780807176572199529101200212618417944079791043511188397174603040276103352013174130089648536779720651333804727206055772160\
00000000000000000000000 $a^{7}\,x^{7}\,\mathrm{e}^{-a\,x}$)

$-1/$

$101\,($

$777718462032867939014160323802222504089299735536513512238274699126813333276915963407845533134637652385447482673560197985426543424307\backslash$

$200000000000000000000000\, a^{5}\, x^{5}\, e^{-a\, x}) - \frac{80678106432000\, a^{93}\, x^{93}\, e^{-a\, x}}{101} - \frac{690281878632192000\, a^{91}\, x^{91}\, e^{-a\, x}}{101} - \frac{565340858599765248000\, a^{89}\, x^{89}\, e^{-a\, x}}{101}$

$- \frac{442774960455336142233600000\, a^{87}\, x^{87}\, e^{-a\, x}}{101} - \frac{33128422541268250161917952000\, a^{85}\, x^{85}\, e^{-a\, x}}{101} - \frac{2365369369446553061560941772800000\, a^{83}\, x^{83}\, e^{-a\, x}}{101}$

$- \frac{160987039284532401369837697056768000000\, a^{81}\, x^{81}\, e^{-a\, x}}{101} - \frac{10431960145637699608765482769278566400000\, a^{79}\, x^{79}\, e^{-a\, x}}{101}$

$- \frac{642817384174195049892129048242945261568000000\, a^{77}\, x^{77}\, e^{-a\, x}}{101} - \frac{37617673321873894319687391903177156706959360000000\, a^{75}\, x^{75}\, e^{-a\, x}}{101}$

$- \frac{2087780869364001134742650250626332197236244480000000\, a^{73}\, x^{73}\, e^{-a\, x}}{101}$

$- \frac{109733762493771899642073697172920020286737009868800000000\, a^{71}\, x^{71}\, e^{-a\, x}}{101}$

$- \frac{5453767995940463412211062749494125008250829390479360000000000\, a^{69}\, x^{69}\, e^{-a\, x}}{101}$

$- \frac{255890794369526543300943064206264345387128915001291571200000000000\, a^{67}\, x^{67}\, e^{-a\, x}}{101}$

$- \frac{11315490927020463744767702299201009353018840621357113278464000000000\, a^{65}\, x^{65}\, e^{-a\, x}}{101}$

$- \frac{470724422564051291782336415646761989085583769848455912384102400000000000\, a^{63}\, x^{63}\, e^{-a\, x}}{101}$

$- \frac{18386495945351843457018060395162523293682902050280687937723039744000000000000\, a^{61}\, x^{61}\, e^{-a\, x}}{101}$

$- \frac{672945751599877470526861010462948352548794215040273178520663254630400000000000000\, a^{59}\, x^{59}\, e^{-a\, x}}{101}$

$- \frac{23028203619747807041429183778042092624219738038678148168977096573452288000000000000\, a^{57}\, x^{57}\, e^{-a\, x}}{101}$

$- \frac{735060259542350000762419546195103596565094038194606489553748922624597032960000000000000\, a^{55}\, x^{55}\, e^{-a\, x}}{101}$

$- \frac{21831289708407795022643860521994576817983292934379812739746343001950531878912000000000000000\, a^{53}\, x^{53}\, e^{-a\, x}}{101}$

$- \frac{601670344363718830824064795986170537103619553271507639107409213133756658582814720000000000000000\, a^{51}\, x^{51}\, e^{-a\, x}}{101}$

$- \frac{15342593781274830186013652297647348696142298608423444797238934934910794793861775360000000000000000000\, a^{49}\, x^{49}\, e^{-a\, x}}{101}$

$$- \frac{36085780573558400597504110204066564133326686327011942163105974966910189355162895646720000000000000\, a^{47} x^{47} e^{-a x}}{101}$$

$$- \frac{780174576000332620918038862611919116562522958389998189566351178784598293858621803882086400000000000000\, a^{45} x^{45} e^{-a x}}{101}$$

$$- 1 \Big/$$

$$101 \left(35467608635874734781562184971191564320750139824988172778791643096764641732162929309221882599578509812695040000000000000000000\, a^{32}\right.$$

$$\left. x^{32} e^{-a x}\right)$$

$$- 1 \Big/$$

$$101 \left(351838677667877369033096874914220318061841387063882673965613099519905245983056258747481075387818817341934796800000000000000000\right.$$

$$\left. a^{30} x^{30} e^{-a x}\right)$$

$$- 1 \Big/$$

$$101 \left(\right.$$

$$306099649571053311058794281175371676713802006745577926350083396582317564005258945110308535587402371087483273216000000000000000000\, a^{28}$$

$$\left. x^{28} e^{-a x}\right)$$

$$- 1 \Big/$$

$$101 \left(\right.$$

$$231411335075716303160448476568580987595634317099656912320663047816232078387975762503393252904076192542137354551296000000000000000000$$

$$\left. a^{26} x^{26} e^{-a x}\right) - \frac{282132549914054207397655439273828675302195200000000\, a^{74} x^{74} e^{-a x}}{101} \Big)$$

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Problem 3: Result more than twice size of optimal antiderivative.
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$$\int \frac{\mathrm{Ei}_1(a x)}{x^3}\, dx$$

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Optimal(type 4, 21 leaves, 1 step):
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$$\frac{\mathrm{Ei}_3(a x)}{2 x^2} - \frac{\mathrm{Ei}_1(a x)}{2 x^2}$$

Result(type 4, 51 leaves):

$$a^2 \left(-\frac{\mathrm{Ei}_1(a x)}{2 a^2 x^2} + \frac{\mathrm{e}^{-a x}}{4 a^2 x^2} - \frac{\mathrm{e}^{-a x}}{4 a x} + \frac{\mathrm{Ei}_1(a x)}{4} \right)$$

Problem 7: Maple result simpler than optimal antiderivative, IF it can be verified!

$$\int x^{100} \mathrm{e}^{-a x} (a x + 1) \, \mathrm{d}x$$

Optimal(type 4, 26 leaves, 1 step):

$$\frac{x^{101} \mathrm{e}^{-a x} (a x + 1)}{101} - \frac{\Gamma(103, a x)}{101 a^{101}}$$

Result(type 3, 815 leaves):

$$-\frac{1}{a^{101}} \Big(\big(x^{101} a^{101} + 102 x^{100} a^{100} + 10200 x^{99} a^{99} + 1009800 x^{98} a^{98} + 98960400 x^{97} a^{97} + 9599158800 x^{96} a^{96} + 921519244800 x^{95} a^{95} + 87544328256000 x^{94} a^{94}$$
$$+ 8229166856064000 x^{93} a^{93} + 765312517613952000 x^{92} a^{92} + 70408751620483584000 x^{91} a^{91} + 6407196397464006144000 x^{90} a^{90}$$
$$+ 576647675771760552960000 x^{89} a^{89} + 51321643143686689213440000 x^{88} a^{88} + 4516304596644428650782720000 x^{87} a^{87}$$
$$+ 392918499908065292618096640000 x^{86} a^{86} + 33790990992093615165156311040000 x^{85} a^{85} + 2872234234327957289038286438400000 x^{84} a^{84}$$
$$+ 241267675683548412279216060825600000 x^{83} a^{83} + 20025217081734518219174933048524800000 x^{82} a^{82}$$
$$+ 1642067800702230493972344509979033600000 x^{81} a^{81} + 133007491856880670011759905308301721600000 x^{80} a^{80}$$
$$+ 10640599348550453600940792424664137728000000 x^{79} a^{79} + 840607348535485834474322601548466880512000000 x^{78} a^{78}$$
$$+ 65567373185767895088997162920780416679936000000 x^{77} a^{77} + 5048687735304127921852781544900092084355072000000 x^{76} a^{76}$$
$$+ 383700267883113722060811397412406998410985472000000 x^{75} a^{75} + 28777520091233529154560854805930524880823910400000000 x^{74} a^{74}$$
$$+ 2129536486751281157437503255638858841180969369600000000 x^{73} a^{73} + 155456163532843524492937737661636695406210763980800000000 x^{72} a^{72}$$
$$+ 11192843774364733763491517111637842069247175006617600000000 x^{71} a^{71}$$
$$+ 794691907979896097207897714926286786916549425469849600000000 x^{70} a^{70}$$
$$+ 55628433558592726804552840044840075084158459782889472000000000 x^{69} a^{69}$$
$$+ 3838361915542898149514145963093965180806933725019373568000000000 x^{68} a^{68}$$
$$+ 261008610256917074166961925490389632294871493301317402624000000000 x^{67} a^{67}$$
$$+ 17487576887213443969186449007856105363756390051188265975808000000000 x^{66} a^{66}$$
$$+ 1154180074556087301966305634518502954007921743378425554403328000000000 x^{65} a^{65}$$
$$+ 75021704846145674627809866243702692010514913319597661036216320000000000 x^{64} a^{64}$$
$$+ 4801389110153323176179831439596972288672954452454250306317844480000000000 x^{63} a^{63}$$
$$+ 302487513939659360099329380694609254186396130504617769298024202240000000000 x^{62} a^{62}$$
$$+ 18754225864258880326158421603065773759556560091286301696477500538880000000000 x^{61} a^{61}$$

$+ 1144007777719791699895663717787012199332950165568464403485127532871680000000000\, x^{60}\, a^{60}$

$+ 6864046666318750199373982306722073195997700993410786420910765197230080000000000\, x^{59}\, a^{59}$

$+ 40497875331280626176306495609660231856386435861123639883373514663657472000000000\, x^{58}\, a^{58}$

$+ 234887676921427631822577674536029344767041327994517111323566385049213337600000000000\, x^{57}\, a^{57}$

$+ 1338859758452137501388692744855367265172135569568747534544328394780516024320000000000\, x^{56}\, a^{56}$

$+ 7497614647331970007776679371190056684963959189584986193448239010770889736192000000000\, x^{55}\, a^{55}$

$+ 41236880560325835042771736541545311767301775542717424063965314559239893549056000000000000\, x^{54}\, a^{54}$

$+ 222679155025759509230967377324344683543429587930674089945412698619895425164902400000000000\, x^{53}\, a^{53}$

$+ 1180199521636525398924127099819026822780176816032572676710687302685445753373982720000000000000\, x^{52}\, a^{52}$

$+ 6137037512509932074405460919058939478456919443369377918895573973964317917544710144000000000000\, x^{51}\, a^{51}$

$+ 31298891313800653579467850687200591340130289161183827386367427267218021379478021734400000000000000\, x^{50}\, a^{50}$

$+ 156494456569003267897339253436002956700651445805919136931837136336090106897390108672000000000000000\, x^{49}\, a^{49}$

$+ 766822837188116012696962341836414487833192084449003770966001968046841523797211532492800000000000000\, x^{48}\, a^{48}$

$+ 3680749618502956860945419240814789541599322005355218100636809446624839314226615355965440000000000000000\, x^{47}\, a^{47}$

$+ 17299523206963897246443470431829510845516813425169525072993004399136744776865092173037568000000000000000\, x^{46}\, a^{46}$

$+ 79577806752033927333639963986415749889377341755779815335767820236029025973579423995972812800000000000000\, x^{45}\, a^{45}$

$+ 358100130384152673001379837938870874502198037901009169010955191062130616881107407981877657600000000000000000\, x^{44}\, a^{44}$

$+ 1575640573690271761206071286931031847809671366764440343648202840673374714276872595120261693440000000000000000\, x^{43}\, a^{43}$

$+ 6775254466868168573186106533803436945581586877087093477687272214895511271390552159017125281792000000000000000\, x^{42}\, a^{42}$

$+ 284560687608463080073816474419744351714426648837657926062865433025611473398403190678719261835264000000000000000\, x^{41}\, a^{41}$

$+ 1166698819194698628302647545120951842029149260234397496857748275405007040933453081782748973524582400000000000000000\, x^{40}\, a^{40}$

$+ 4666795276778794513210590180483807368116597040937589987430993101620028163733812327130995894098329600000000000000000\, x^{39}\, a^{39}$

$+ 18200501579437298601521301703886848735654728459656600950980873096318109838561868075810883986983485440000000000000000\, x^{38}\, a^{38}$

$+ 69161906001861734685780946474770025195487968146695083613727317766008817386535098688081359150537244672000000000000000\, x^{37}\, a^{37}$

$+ 255899052206888418337389501956649093223305482142771809370791075734232624330179865145901028856987805286400000000000000000\, x^{36}\, a^{36}$

$+ 921236587944798306014602207043936735603899735713978513734847872643237447588647514525243703885156099031040000000000000000\, x^{35}\, a^{35}$

$+ 3224328057806794071051107724653778574613649074998924798071967554251331066560266300838352963598046346608640000000000000000\, x^{34}\, a^{34}$

$+ 10962715396543099841573766263822847153686406854996344313444689684454525626304905422850400076233357578469376000000000000000000\, x^{33}\, a^{33}$

$+ 36176960808592229477193428670615395607165142621487936234367475958699934566806187895406320251570080008948940800000000000000000\, x^{32}\, a^{32}$

$+ 115766274587495134327018971745969265942928456388761395949975923067839790613779801265300224805024256028636610560000000000000000\, x^{31}\, a^{31}$

$+ 358875451221234916413758812412504724423078214805160327444925361510303350902717383922430696895575193688773492736000000000000000000\, x^{30}\, a^{30}$

$+ 107662635366370474924127643723751417326923464441548098233477608453091005270815215176729209068672558106632047820800000000000000000000\backslash$
$x^{29}\, a^{29}$

$+ 312221642562474377279970166798879110248078046880489484877085064513963915285364124012514706299150418509232938680320000000000000000\backslash$
$0\, x^{28}\, a^{28}$

$+ 874220599174928256383916467036861508694618531265370557655838180639098962799019547235041177637621171825852228304896000000000000000\backslash$
$00\, x^{27}\, a^{27}$

$+ 236039561777230629223657446099952607347547003441650050567076308772556719955735277753461117962157716392980101642321920000000000000\backslash$
$0000\, x^{26}\, a^{26}$

$+ 613702860620799635981509359859876779103622208948290131474398402808647471884911722158998906701610062621748264270036992000000000000\backslash$
$00000\, x^{25}\, a^{25}$

$+ 153425715155199908995377339964969194775905552237072532868599600702161867971227930539749726675402515655437066067509248000000000000\backslash$
$0000000\, x^{24}\, a^{24}$

$+ 368221716372479781588905615915926067462173325368974078884639041685188483130947033295399344020966037573048958562022195200000000000\backslash$
$00000000\, x^{23}\, a^{23}$

$+ 846909947656703497654482916606629955162998648348640381434669795875933511201178176579418491248221886418012604692651048960000000000\backslash$
$000000000\, x^{22}\, a^{22}$

$+ 186320188484474769483986241653458590135859702636700883915627355092705372464259198847472068074608815011962773032383230771200000000\backslash$
$00000000000\, x^{21}\, a^{21}$

$+ 391272395817397015916371107472263039285305375537071856222817445694681282174944317579691342956678511525121823368004784619520000000\backslash$
$000000000000\, x^{20}\, a^{20}$

$+ 782544791634794031832742214944526078570610751074143712445634891389362564349888635159382685913357023050243646736009569239040000000\backslash$
$0000000000000\, x^{19}\, a^{19}$

$+ 148683510410610866048221020839459954928416042704087305364670629363978887226478840680282710323537834379546292879841818155417600000\backslash$
$000000000000000\, x^{18}\, a^{18}$

$+ 267630318739099558886797837511027918871148876867357149656407132855161997007661913224508878582368101883183327183715272679751680000\backslash$
$0000000000000000\, x^{17}\, a^{17}$

$+ 454971541856469250107556323768747462080953090674507154415892125853775394913025252481665093590025773201411656212315963555577856000\backslash$
$00000000000000000\, x^{16}\, a^{16}$

$+ 727954466970350800172090118029995939329524945079211447065427401366040631860840403970664149744041237122258649939705541688924569600\backslash$
$000000000000000000\, x^{15}\, a^{15}$

$+ 109193170045552620025813517704499390899428741761881717059814110204906094779126060595599622461606185568338797490955831253338685440\backslash$
$00000000000000000000\, x^{14}\, a^{14}$

$+ 152870438063773668036138924786299147259200238466634403883739754286868532690776484833839471446248659795674316487338163754674159616\backslash$
$0000000000000000000000\, x^{13}\, a^{13}$

$+\ 19873156948290576844698060222218889143696031000662472504886168057292909249800943028399131288012325773437661143353961288107640750 08\backslash$
$000000000000000000000\, x^{12}\, a^{12}$
$+\ 238477883379486922136376722666626669724352372007949670058634016687514910997611316340789575456147909281251933720247535457291689000 9\backslash$
$6000000000000000000000\, x^{11}\, a^{11}$
$+\ 262325671717435614350014394933289336696787609208744637064497418356266402097372447974868533001762700209377127092272289003020857901 0\backslash$
$56000000000000000000000\, x^{10}\, a^{10}$
$+\ 262325671717435614350014394933289336696787609208744637064497418356266402097372447974868533001762700209377127092272289003020857901 0\backslash$
$560000000000000000000000\, x^{9}\, a^{9}$
$+\ 236093104545692052915012955439960403027108848287870173358047676520639761887635203177381679701586430188439414383045060102718772110 9\backslash$
$50400000000000000000000000\, x^{8}\, a^{8}$
$+\ 188874483636553642332010364351968322421687078630296138686438141216511809510108162541905343761269144150751531506436048082175017688 7\backslash$
$603200000000000000000000000\, x^{7}\, a^{7}$
$+\ 132212138545587549632407255046377825695180955041207297080506698851558266657075713779333740632888400905526072054505233657522512382 1\backslash$
$3222400000000000000000000000\, x^{6}\, a^{6}$
$+\ 793272831273525297794443530278266954171085730247243782483040193109349599942454282676002443797330405433156432327031401945135074292 7\backslash$
$9334400000000000000000000000\, x^{5}\, a^{5}$
$+\ 396636415636762648897221765139133477085542865123621891241520096554674799971227141338001221898665202716578216163515700972567537146 3\backslash$
$96672000000000000000000000000\, a^{4}\, x^{4}$
$+\ 158654566254705059558888706055653390834217146049448756496608038621869919988490856535200488759466081086631286465406280389027014858 5\backslash$
$586688000000000000000000000000\, a^{3}\, x^{3}$
$+\ 475963698764115178676666118166960172502651438148346269489824115865609759965472569605601466278398243259893859396218841167081044575 6\backslash$
$7600640000000000000000000000000\, a^{2}\, x^{2}$
$+\ 951927397528230357353332236333920345005302876296692538979648231731219519930945139211202932556796486519787718792437682334162089151 3\backslash$
$5201280000000000000000000000000\, a\, x$
$+\ 951927397528230357353332236333920345005302876296692538979648231731219519930945139211202932556796486519787718792437682334162089151 3\backslash$
$5201280000000000000000000000000\,)\ e^{-a x})$

Problem 12: Result more than twice size of optimal antiderivative.

$$\int \frac{x\,\mathrm{Ei}_2(a x)}{a}\, dx$$

Optimal(type 4, 29 leaves, 1 step):

$$\frac{x^2\,\mathrm{Ei}_2(a x)}{3 a} - \frac{e^{-a x}\,(a x + 1)}{3 a^3}$$

Result(type 4, 75 leaves):

$$\frac{\frac{\left(-\frac{4}{3}+\gamma+\ln(x)+\ln(a)\right)x^3a^3}{3}+\frac{4a^3x^3}{9}+\frac{1}{3}-\frac{\left(-8a^2x^2+8ax+8\right)e^{-ax}}{24}+\frac{a^3x^3\left(-\gamma-\ln(ax)-\mathrm{Ei}_1(ax)\right)}{3}}{a^3}$$

Problem 13: Result more than twice size of optimal antiderivative.

$$\int\frac{\mathrm{Ei}_2(ax)}{ax^3}\,dx$$

Optimal(type 4, 26 leaves, 1 step):

$$\frac{\mathrm{Ei}_3(ax)}{ax^2}-\frac{\mathrm{Ei}_2(ax)}{ax^2}$$

Result(type 4, 105 leaves):

$$a\left(-\frac{1}{2a^2x^2}-\frac{\gamma+\ln(x)+\ln(a)}{xa}-\frac{\gamma}{2}+\frac{5}{4}-\frac{\ln(x)}{2}-\frac{\ln(a)}{2}+\frac{-15a^2x^2+6}{12a^2x^2}-\frac{(6ax+6)e^{-ax}}{12a^2x^2}-\frac{(6ax+12)\left(-\gamma-\ln(ax)-\mathrm{Ei}_1(ax)\right)}{12ax}\right)$$

Problem 14: Result more than twice size of optimal antiderivative.

$$\int\frac{\mathrm{Ei}_2(ax)}{ax^5}\,dx$$

Optimal(type 4, 27 leaves, 1 step):

$$\frac{\mathrm{Ei}_5(ax)}{3ax^4}-\frac{\mathrm{Ei}_2(ax)}{3ax^4}$$

Result(type 4, 164 leaves):

$$a^3\left(-\frac{1}{4a^4x^4}-\frac{-\frac{2}{3}+\gamma+\ln(x)+\ln(a)}{3x^3a^3}+\frac{1}{4a^2x^2}-\frac{1}{12ax}+\frac{29}{864}-\frac{\gamma}{72}-\frac{\ln(x)}{72}-\frac{\ln(a)}{72}+\frac{-145a^4x^4+360a^3x^3-1080a^2x^2-960ax+1080}{4320a^4x^4}\right.$$
$$\left.-\frac{\left(20a^3x^3-20a^2x^2+40ax+360\right)e^{-ax}}{1440a^4x^4}-\frac{\left(20a^3x^3+480\right)\left(-\gamma-\ln(ax)-\mathrm{Ei}_1(ax)\right)}{1440a^3x^3}\right)$$

Problem 15: Result more than twice size of optimal antiderivative.

$$\int\frac{\mathrm{Ei}_3(ax)}{xa^2}\,dx$$

Optimal(type 4, 21 leaves, 1 step):

$$\frac{\mathrm{Ei}_3(ax)}{2a^2}-\frac{\mathrm{Ei}_1(ax)}{2a^2}$$

Result(type 4, 81 leaves):

$$\frac{\frac{\gamma}{2}+\frac{\ln(x)}{2}+\frac{\ln(a)}{2}-\frac{(-2+\gamma+\ln(x)+\ln(a))x^2a^2}{4}-\frac{a^2x^2}{2}+\frac{(-9ax+9)e^{-ax}}{36}+\frac{(-9a^2x^2+18)(-\gamma-\ln(ax)-\mathrm{Ei}_1(ax))}{36}}{a^2}$$

Problem 17: Result more than twice size of optimal antiderivative.

$$\int\frac{\mathrm{Ei}_3(ax)}{a^2x^5}\,dx$$

Optimal(type 4, 27 leaves, 1 step):

$$\frac{\mathrm{Ei}_5(ax)}{2a^2x^4}-\frac{\mathrm{Ei}_3(ax)}{2a^2x^4}$$

Result(type 4, 164 leaves):

$$a^2\left(-\frac{1}{8a^4x^4}+\frac{1}{3a^3x^3}+\frac{-1+\gamma+\ln(x)+\ln(a)}{4x^2a^2}-\frac{1}{6ax}+\frac{31}{576}-\frac{\gamma}{48}-\frac{\ln(x)}{48}-\frac{\ln(a)}{48}+\frac{-155a^4x^4+480a^3x^3+720a^2x^2-960ax+360}{2880a^4x^4}\right.$$
$$\left.-\frac{(15a^3x^3-15a^2x^2-150ax+90)e^{-ax}}{720a^4x^4}+\frac{(-15a^2x^2+180)(-\gamma-\ln(ax)-\mathrm{Ei}_1(ax))}{720a^2x^2}\right)$$

Problem 19: Result more than twice size of optimal antiderivative.

$$\int\frac{\mathrm{Ei}_4(ax)}{a^3x^7}\,dx$$

Optimal(type 4, 27 leaves, 1 step):

$$\frac{\mathrm{Ei}_7(ax)}{3a^3x^6}-\frac{\mathrm{Ei}_4(ax)}{3a^3x^6}$$

Result(type 4, 212 leaves):

$$a^3\left(-\frac{1}{18a^6x^6}+\frac{1}{10x^5a^5}-\frac{1}{8a^4x^4}-\frac{-\frac{3}{2}+\gamma+\ln(x)+\ln(a)}{18x^3a^3}+\frac{1}{48a^2x^2}-\frac{1}{240ax}+\frac{167}{129600}-\frac{\gamma}{2160}-\frac{\ln(x)}{2160}-\frac{\ln(a)}{2160}\right.$$
$$+\frac{-1169x^6a^6+3780x^5a^5-18900a^4x^4-75600a^3x^3+113400a^2x^2-90720ax+50400}{907200a^6x^6}$$
$$\left.-\frac{(28x^5a^5-28a^4x^4+56a^3x^3+3192a^2x^2-2688ax+3360)e^{-ax}}{60480a^6x^6}-\frac{(28a^3x^3+3360)(-\gamma-\ln(ax)-\mathrm{Ei}_1(ax))}{60480a^3x^3}\right)$$

Problem 20: Unable to integrate problem.

$$\int \frac{\sqrt{\pi}\,\mathrm{erfc}\left(\sqrt{a\,x}\right)}{x}\,dx$$

Optimal(type 5, 25 leaves, 1 step):

$$\ln(x)\sqrt{\pi}-4\,HypergeometricPFQ\left(\left[\frac{1}{2},\frac{1}{2}\right],\left[\frac{3}{2},\frac{3}{2}\right],-a\,x\right)\sqrt{a\,x}$$

Result(type 8, 15 leaves):

$$\int \frac{\sqrt{\pi}\,\mathrm{erfc}\left(\sqrt{a\,x}\right)}{x}\,dx$$

Problem 24: Result unnecessarily involves higher level functions.

$$\int \frac{(d\,x)^m\,\mathrm{Ei}_2(b\,x)}{b\,x}\,dx$$

Optimal(type 4, 55 leaves, 1 step):

$$\frac{(d\,x)^{1+m}\,\mathrm{Ei}_2(b\,x)}{b\,x\,d\,(1+m)}-\frac{(d\,x)^m\,\Gamma(m,b\,x)}{b\,(1+m)\,(b\,x)^m}$$

Result(type 5, 96 leaves):

$$b^{-1-m}\,(d\,x)^m\,x^{-m}\left(\frac{x^m\,b^m}{m}+\frac{\left(\Psi(1+m)+\gamma-1-\Psi(2+m)+\ln(x)+\ln(b)\right)x^{1+m}\,b^{1+m}}{1+m}-\frac{x^{2+m}\,b^{2+m}\,\mathrm{hypergeom}([1,1,2+m],[2,3,3+m],-b\,x)}{2\,(2+m)}\right)$$

Problem 25: Result unnecessarily involves higher level functions and more than twice size of optimal antiderivative.

$$\int \frac{(d\,x)^m\,\mathrm{Ei}_3(b\,x)}{b^2\,x^2}\,dx$$

Optimal(type 4, 57 leaves, 1 step):

$$\frac{(d\,x)^{1+m}\,\mathrm{Ei}_3(b\,x)}{b^2\,x^2\,d\,(1+m)}-\frac{(d\,x)^m\,\Gamma(-1+m,b\,x)}{b\,(1+m)\,(b\,x)^m}$$

Result(type 5, 115 leaves):

$$b^{-1-m}\,(d\,x)^m\,x^{-m}\left(\frac{x^{-1+m}\,b^{-1+m}}{2\,(-1+m)}-\frac{x^m\,b^m}{m}-\frac{\left(\Psi(1+m)+\gamma-\frac{3}{2}-\Psi(2+m)+\ln(x)+\ln(b)\right)x^{1+m}\,b^{1+m}}{2\,(1+m)}\right.$$
$$\left.+\frac{x^{2+m}\,b^{2+m}\,\mathrm{hypergeom}([1,1,2+m],[2,4,3+m],-b\,x)}{6\,(2+m)}\right)$$

Problem 26: Unable to integrate problem.

$$\int \frac{\Gamma(n, a x)}{x^2}\, dx$$

Optimal(type 4, 20 leaves, 1 step):

$$a\Gamma(-1+n, a x) - \frac{\Gamma(n, a x)}{x}$$

Result(type 9, 147 leaves):

$$a\left(-\frac{\pi \csc(\pi n)}{\Gamma(1-n)\, x a} - \frac{\pi \csc(\pi n)}{\Gamma(2-n)} - \frac{x^{-1+n} a^{-1+n} (a x - n + 1)\, (a x)^{-\frac{n}{2}}\, e^{-\frac{a x}{2}} \operatorname{WhittakerM}\left(\frac{n}{2}, \frac{n}{2} + \frac{1}{2}, a x\right)}{n\, (-1+n)\, (1+n)} - \frac{x^{-2+n} a^{-2+n} (a x + 1)\, (a x)^{-\frac{n}{2}}\, e^{-\frac{a x}{2}} \operatorname{WhittakerM}\left(\frac{n}{2} + 1, \frac{n}{2} + \frac{1}{2}, a x\right)}{n\, (-1+n)}\right)$$

Problem 27: Result unnecessarily involves higher level functions and more than twice size of optimal antiderivative.

$$\int \frac{\Gamma(n, a x)}{x^3}\, dx$$

Optimal(type 4, 23 leaves, 1 step):

$$\frac{a^2 \Gamma(-2+n, a x)}{2} - \frac{\Gamma(n, a x)}{2 x^2}$$

Result(type 5, 78 leaves):

$$a^2\left(-\frac{\pi \csc(\pi n)}{2\Gamma(1-n)\, x^2 a^2} + \frac{\pi \csc(\pi n)}{2\Gamma(3-n)} - \frac{x^{-2+n} a^{-2+n} \operatorname{hypergeom}([n, -2+n], [1+n, -1+n], -a x)}{n\, (-2+n)}\right)$$

Problem 28: Result unnecessarily involves higher level functions and more than twice size of optimal antiderivative.

$$\int \frac{\Gamma(n, 2 x)}{x^3}\, dx$$

Optimal(type 4, 20 leaves, 1 step):

$$2\Gamma(-2+n, 2 x) - \frac{\Gamma(n, 2 x)}{2 x^2}$$

Result(type 5, 68 leaves):

$$-\frac{\pi \csc(\pi n)}{2\Gamma(1-n)\, x^2} + \frac{2\pi \csc(\pi n)}{\Gamma(3-n)} - \frac{x^{-2+n} 2^n \operatorname{hypergeom}([n, -2+n], [1+n, -1+n], -2 x)}{n\, (-2+n)}$$

Problem 29: Result unnecessarily involves higher level functions and more than twice size of optimal antiderivative.

$$\int \frac{\Gamma(n, 2x)}{x^4}\, dx$$

Optimal(type 4, 20 leaves, 1 step):

$$\frac{8\,\Gamma(-3+n, 2x)}{3} - \frac{\Gamma(n, 2x)}{3x^3}$$

Result(type 5, 68 leaves):

$$-\frac{\pi \csc(\pi n)}{3\,\Gamma(1-n)\,x^3} - \frac{8\,\pi \csc(\pi n)}{3\,\Gamma(4-n)} - \frac{x^{-3+n}\,2^n\,\mathrm{hypergeom}([n, -3+n], [1+n, -2+n], -2x)}{n\,(-3+n)}$$

Problem 30: Result more than twice size of optimal antiderivative.

$$\int (dx+c)^3\,\mathrm{Ei}_1(bx+a)\, dx$$

Optimal(type 4, 259 leaves, 8 steps):

$$-\frac{(-ad+bc)^3\,e^{-bx-a}}{4b^4} - \frac{(-ad+bc)^4\,\mathrm{Ei}_1(bx+a)}{4b^4 d} + \frac{(dx+c)^4\,\mathrm{Ei}_1(bx+a)}{4d} - \frac{d\,(-ad+bc)^2\,e^{-a+\frac{bc}{d}}\,e^{-\frac{b(dx+c)}{d}}\left(1+\frac{b\,(dx+c)}{d}\right)}{4b^4}$$
$$-\frac{d^2\,(-ad+bc)\,e^{-a+\frac{bc}{d}}\,e^{-\frac{b(dx+c)}{d}}\left(1+\frac{b\,(dx+c)}{d}+\frac{b^2\,(dx+c)^2}{2d^2}\right)}{2b^4}$$
$$-\frac{3d^3\,e^{-a+\frac{bc}{d}}\,e^{-\frac{b(dx+c)}{d}}\left(1+\frac{b\,(dx+c)}{d}+\frac{b^2\,(dx+c)^2}{2d^2}+\frac{b^3\,(dx+c)^3}{6d^3}\right)}{2b^4}$$

Result(type 4, 765 leaves):

$$\frac{1}{b}\Bigg(\frac{d^3\,\mathrm{Ei}_1(bx+a)\,(bx+a)^4}{4b^3} - \frac{d^3\,\mathrm{Ei}_1(bx+a)\,(bx+a)^3\,a}{b^3} + \frac{d^2\,\mathrm{Ei}_1(bx+a)\,(bx+a)^3\,c}{b^2} + \frac{3d^3\,\mathrm{Ei}_1(bx+a)\,(bx+a)^2\,a^2}{2b^3}$$
$$-\frac{3d^2\,\mathrm{Ei}_1(bx+a)\,(bx+a)^2\,a\,c}{b^2} + \frac{3d\,\mathrm{Ei}_1(bx+a)\,(bx+a)^2\,c^2}{2b} - \frac{d^3\,\mathrm{Ei}_1(bx+a)\,(bx+a)\,a^3}{b^3} + \frac{3d^2\,\mathrm{Ei}_1(bx+a)\,(bx+a)\,a^2\,c}{b^2}$$
$$-\frac{3d\,\mathrm{Ei}_1(bx+a)\,(bx+a)\,a\,c^2}{b} + \mathrm{Ei}_1(bx+a)\,(bx+a)\,c^3 + \frac{d^3\,\mathrm{Ei}_1(bx+a)\,a^4}{4b^3} - \frac{d^2\,\mathrm{Ei}_1(bx+a)\,a^3\,c}{b^2} + \frac{3d\,\mathrm{Ei}_1(bx+a)\,a^2\,c^2}{2b} - \mathrm{Ei}_1(bx+a)\,a\,c^3$$
$$+\frac{b\,\mathrm{Ei}_1(bx+a)\,c^4}{4d} + \frac{1}{4b^3 d}\Big(d^4\left(-(bx+a)^3\,e^{-bx-a} - 3\,(bx+a)^2\,e^{-bx-a} - 6\,(bx+a)\,e^{-bx-a} - 6\,e^{-bx-a}\right) - a^4 d^4\,\mathrm{Ei}_1(bx+a) - b^4 c^4\,\mathrm{Ei}_1(bx$$
$$+a) + 4\,e^{-bx-a}\,a^3 d^4 + 6\,a^2 d^4\left(-(bx+a)\,e^{-bx-a} - e^{-bx-a}\right) + 4\,a\,d^4\left((bx+a)^2\,e^{-bx-a} + 2\,(bx+a)\,e^{-bx-a} + 2\,e^{-bx-a}\right) - 4\,e^{-bx-a}\,b^3 c^3 d$$

$$+6b^2c^2d^2\left(-(bx+a)\,e^{-bx-a}-e^{-bx-a}\right)-4bcd^3\left((bx+a)^2e^{-bx-a}+2(bx+a)\,e^{-bx-a}+2e^{-bx-a}\right)+12e^{-bx-a}ab^2c^2d^2-12e^{-bx-a}a^2bcd^3$$
$$+4ab^3c^3d\,\mathrm{Ei}_1(bx+a)-6a^2b^2c^2d^2\,\mathrm{Ei}_1(bx+a)+4a^3bcd^3\,\mathrm{Ei}_1(bx+a)-12abcd^3\left(-(bx+a)\,e^{-bx-a}-e^{-bx-a}\right)\Big)\Big)$$

Problem 37: Result more than twice size of optimal antiderivative.

$$\int \frac{e^{-bx-a}(bx+a+1)}{(dx+c)^2}\,dx$$

Optimal(type 4, 79 leaves, 5 steps):

$$\frac{b\,e^{-bx-a}}{d^2}-\frac{b(-ad+bc)\,e^{-a+\frac{bc}{d}}\,\mathrm{Ei}_1\left(\frac{b(dx+c)}{d}\right)}{d^3}-\frac{e^{-bx-a}(bx+a+1)}{d(dx+c)}$$

Result(type 4, 209 leaves):

$$-\frac{1}{b}\left(\frac{b^2\left(-\frac{e^{-bx-a}}{-bx-a+\frac{ad-bc}{d}}-e^{-\frac{ad-bc}{d}}\,\mathrm{Ei}_1\left(bx+a-\frac{ad-bc}{d}\right)\right)}{d^2}+\frac{(ad-bc)\,b^2\left(-\frac{e^{-bx-a}}{-bx-a+\frac{ad-bc}{d}}-e^{-\frac{ad-bc}{d}}\,\mathrm{Ei}_1\left(bx+a-\frac{ad-bc}{d}\right)\right)}{d^3}+\frac{b^2e^{-\frac{ad-bc}{d}}\,\mathrm{Ei}_1\left(bx+a-\frac{ad-bc}{d}\right)}{d^2}\right)$$

Problem 38: Result more than twice size of optimal antiderivative.

$$\int \frac{e^{-bx-a}(bx+a+1)}{(dx+c)^4}\,dx$$

Optimal(type 4, 110 leaves, 5 steps):

$$-\frac{b(-ad+bc)\,e^{-a+\frac{bc}{d}}\,\mathrm{Ei}_3\left(\frac{b(dx+c)}{d}\right)}{3(dx+c)^2d^3}+\frac{b^2e^{-a+\frac{bc}{d}}\,\mathrm{Ei}_2\left(\frac{b(dx+c)}{d}\right)}{3(dx+c)\,d^3}-\frac{e^{-bx-a}(bx+a+1)}{3d(dx+c)^3}$$

Result(type 4, 411 leaves):

$$-\frac{1}{b}\left(\frac{b^4\left(-\frac{e^{-bx-a}}{3\left(-bx-a+\frac{ad-bc}{d}\right)^3}-\frac{e^{-bx-a}}{6\left(-bx-a+\frac{ad-bc}{d}\right)^2}-\frac{e^{-bx-a}}{6\left(-bx-a+\frac{ad-bc}{d}\right)}-\frac{e^{-\frac{ad-bc}{d}}\,\mathrm{Ei}_1\left(bx+a-\frac{ad-bc}{d}\right)}{6}\right)}{d^4}\right.$$

$$+\frac{1}{d^5}\left(b^4\,(a d-b c)\left(-\frac{e^{-b x-a}}{3\left(-b x-a+\frac{a d-b c}{d}\right)^3}-\frac{e^{-b x-a}}{6\left(-b x-a+\frac{a d-b c}{d}\right)^2}-\frac{e^{-b x-a}}{6\left(-b x-a+\frac{a d-b c}{d}\right)}\right.\right.$$

$$\left.\left.-\frac{e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)}{6}\right)\right)$$

$$\left.-\frac{b^4\left(-\frac{e^{-b x-a}}{2\left(-b x-a+\frac{a d-b c}{d}\right)^2}-\frac{e^{-b x-a}}{2\left(-b x-a+\frac{a d-b c}{d}\right)}-\frac{e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)}{2}\right)}{d^4}\right)$$

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Problem 40: Result more than twice size of optimal antiderivative.
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$$\int \frac{2\,e^{-b x-a}\left(1+b x+a+\frac{(b x+a)^2}{2}\right)}{(d x+c)^2}\,dx$$

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Optimal(type 4, 118 leaves, 6 steps):
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$$-\frac{b\,(-a d+b c)\,e^{-b x-a}}{d^3}+\frac{b\,(-a d+b c)^2\,e^{-a+\frac{b c}{d}}\,\mathrm{Ei}_1\left(\frac{b\,(d x+c)}{d}\right)}{d^4}+\frac{b\,e^{-b x-a}\,(b x+a+1)}{d^2}-\frac{2\,e^{-b x-a}\left(1+b x+a+\frac{(b x+a)^2}{2}\right)}{d\,(d x+c)}$$

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Result(type 4, 376 leaves):
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$$-\frac{1}{b}\left(\frac{b^2\,e^{-b x-a}}{d^2}+\frac{(a^2 d^2-2 a b c d+c^2 b^2)\,b^2\left(-\frac{e^{-b x-a}}{-b x-a+\frac{a d-b c}{d}}-e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)\right)}{d^4}\right.$$

$$+\frac{2\,(a d-b c)\,b^2\,e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)}{d^3}+\frac{2\,b^2\left(-\frac{e^{-b x-a}}{-b x-a+\frac{a d-b c}{d}}-e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)\right)}{d^2}$$

$$+\frac{2\,(a d-b c)\,b^2\left(-\frac{e^{-b x-a}}{-b x-a+\frac{a d-b c}{d}}-e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)\right)}{d^3}+\frac{2\,b^2\,e^{-\frac{a d-b c}{d}}\,\mathrm{Ei}_1\left(b x+a-\frac{a d-b c}{d}\right)}{d^2}\Bigg)$$

Problem 41: Unable to integrate problem.

$$\int \frac{\mathrm{Ei}_2(b x+a)}{(b x+a)\,(d x+c)^2}\,dx$$

Optimal(type 4, 111 leaves, 6 steps):

$$\frac{b\,\mathrm{Ei}_2(b x+a)}{(b x+a)\,d\,(-a d+b c)}-\frac{\mathrm{Ei}_2(b x+a)}{(b x+a)\,d\,(d x+c)}-\frac{b\,\mathrm{Ei}_1(b x+a)}{(-a d+b c)^2}+\frac{b\,e^{-a+\frac{b c}{d}}\,\mathrm{Ei}_1\left(\frac{b\,(d x+c)}{d}\right)}{(-a d+b c)^2}$$

Result(type 8, 24 leaves):

$$\int \frac{\mathrm{Ei}_2(b x+a)}{(b x+a)\,(d x+c)^2}\,dx$$

Problem 42: Unable to integrate problem.

$$\int \frac{(d x+c)\,\mathrm{Ei}_3(b x+a)}{(b x+a)^2}\,dx$$

Optimal(type 4, 99 leaves, 6 steps):

$$-\frac{(-a d+b c)^2\,\mathrm{Ei}_3(b x+a)}{2\,(b x+a)^2\,b^2\,d}+\frac{(d x+c)^2\,\mathrm{Ei}_3(b x+a)}{2\,(b x+a)^2\,d}-\frac{(-a d+b c)\,\mathrm{Ei}_2(b x+a)}{(b x+a)\,b^2}-\frac{d\,\mathrm{Ei}_1(b x+a)}{2\,b^2}$$

Result(type 8, 22 leaves):

$$\int \frac{(d x+c)\,\mathrm{Ei}_3(b x+a)}{(b x+a)^2}\,dx$$

Problem 43: Unable to integrate problem.

$$\int \frac{\mathrm{Ei}_3(b x+a)}{(b x+a)^2}\,dx$$

Optimal(type 4, 38 leaves, 1 step):

$$\frac{\mathrm{Ei}_3(bx+a)}{(bx+a)\,b}-\frac{\mathrm{Ei}_2(bx+a)}{(bx+a)\,b}$$

Result(type 8, 17 leaves):

$$\int \frac{\mathrm{Ei}_3(bx+a)}{(bx+a)^2}\,dx$$

Problem 44: Unable to integrate problem.

$$\int \frac{\mathrm{Ei}_3(bx+a)}{(bx+a)^2\,(dx+c)^4}\,dx$$

Optimal(type 4, 240 leaves, 9 steps):

$$\frac{b^3\,\mathrm{Ei}_3(bx+a)}{3\,(bx+a)^2 d\,(-ad+bc)^3}-\frac{\mathrm{Ei}_3(bx+a)}{3\,(bx+a)^2 d\,(dx+c)^3}-\frac{b\,\mathrm{e}^{-a+\frac{bc}{d}}\,d\,\mathrm{Ei}_3\left(\frac{b\,(dx+c)}{d}\right)}{3\,(dx+c)^2\,(-ad+bc)^3}-\frac{b^3\,\mathrm{Ei}_2(bx+a)}{(bx+a)\,(-ad+bc)^4}-\frac{b^2\,\mathrm{e}^{-a+\frac{bc}{d}}\,d\,\mathrm{Ei}_2\left(\frac{b\,(dx+c)}{d}\right)}{(dx+c)\,(-ad+bc)^4}$$
$$+\frac{2\,b^3\,d\,\mathrm{Ei}_1(bx+a)}{(-ad+bc)^5}-\frac{2\,b^3\,d\,\mathrm{e}^{-a+\frac{bc}{d}}\,\mathrm{Ei}_1\left(\frac{b\,(dx+c)}{d}\right)}{(-ad+bc)^5}$$

Result(type 8, 24 leaves):

$$\int \frac{\mathrm{Ei}_3(bx+a)}{(bx+a)^2\,(dx+c)^4}\,dx$$

Problem 45: Unable to integrate problem.

$$\int \frac{(dx+c)\,\mathrm{Ei}_4(bx+a)}{(bx+a)^3}\,dx$$

Optimal(type 4, 106 leaves, 6 steps):

$$-\frac{(-ad+bc)^2\,\mathrm{Ei}_4(bx+a)}{2\,(bx+a)^3\,b^2\,d}+\frac{(dx+c)^2\,\mathrm{Ei}_4(bx+a)}{2\,(bx+a)^3\,d}-\frac{(-ad+bc)\,\mathrm{Ei}_3(bx+a)}{(bx+a)^2\,b^2}-\frac{d\,\mathrm{Ei}_2(bx+a)}{2\,(bx+a)\,b^2}$$

Result(type 8, 22 leaves):

$$\int \frac{(dx+c)\,\mathrm{Ei}_4(bx+a)}{(bx+a)^3}\,dx$$

Problem 46: Unable to integrate problem.

$$\int \frac{\mathrm{Ei}_4(bx+a)}{(bx+a)^3}\,dx$$

Optimal(type 4, 38 leaves, 1 step):

$$\frac{\mathrm{Ei}_4(bx+a)}{(bx+a)^2 b} - \frac{\mathrm{Ei}_3(bx+a)}{(bx+a)^2 b}$$

Result(type 8, 17 leaves):

$$\int \frac{\mathrm{Ei}_4(bx+a)}{(bx+a)^3}\,dx$$

Problem 49: Unable to integrate problem.

$$\int (dx+c)^4\,\Gamma(n, bx+a)\,dx$$

Optimal(type 4, 163 leaves, 9 steps):

$$-\frac{(-ad+bc)^5\,\Gamma(n, bx+a)}{5 b^5 d} + \frac{(dx+c)^5\,\Gamma(n, bx+a)}{5 d} - \frac{(-ad+bc)^4\,\Gamma(1+n, bx+a)}{b^5} - \frac{2 d\,(-ad+bc)^3\,\Gamma(2+n, bx+a)}{b^5} - \frac{2 d^2\,(-ad+bc)^2\,\Gamma(3+n, bx+a)}{b^5} - \frac{d^3\,(-ad+bc)\,\Gamma(4+n, bx+a)}{b^5} - \frac{d^4\,\Gamma(5+n, bx+a)}{5 b^5}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^4\,\Gamma(n, bx+a)\,dx$$

Problem 50: Unable to integrate problem.

$$\int (dx+c)^2\,\Gamma(n, bx+a)\,dx$$

Optimal(type 4, 109 leaves, 7 steps):

$$-\frac{(-ad+bc)^3\,\Gamma(n, bx+a)}{3 b^3 d} + \frac{(dx+c)^3\,\Gamma(n, bx+a)}{3 d} - \frac{(-ad+bc)^2\,\Gamma(1+n, bx+a)}{b^3} - \frac{d\,(-ad+bc)\,\Gamma(2+n, bx+a)}{b^3} - \frac{d^2\,\Gamma(3+n, bx+a)}{3 b^3}$$

Result(type 8, 17 leaves):

$$\int (dx+c)^2\,\Gamma(n, bx+a)\,dx$$

Problem 51: Unable to integrate problem.

$$\int x\,\Gamma\left(p, d\left(a+b\ln\left(c x^n\right)\right)\right)dx$$

Optimal(type 4, 120 leaves, 4 steps):

$$\frac{x^2\Gamma(p,d(a+b\ln(cx^n)))}{2}-\frac{x^2\Gamma\left(p,-\frac{(-bdn+2)(a+b\ln(cx^n))}{bn}\right)(d(a+b\ln(cx^n)))^p}{2\,\mathrm{e}^{\frac{2a}{bn}}(cx^n)^{\frac{2}{n}}\left(-\frac{(-bdn+2)(a+b\ln(cx^n))}{bn}\right)^p}$$

Result(type 8, 18 leaves):

$$\int x\,\Gamma(p,d(a+b\ln(cx^n)))\,\mathrm{d}x$$

Problem 52: Unable to integrate problem.

$$\int\frac{\Gamma(p,d(a+b\ln(cx^n)))}{x^2}\,\mathrm{d}x$$

Optimal(type 4, 108 leaves, 4 steps):

$$-\frac{\Gamma(p,d(a+b\ln(cx^n)))}{x}+\frac{\mathrm{e}^{\frac{a}{bn}}(cx^n)^{\frac{1}{n}}\,\Gamma\left(p,\frac{(bdn+1)(a+b\ln(cx^n))}{bn}\right)(d(a+b\ln(cx^n)))^p}{x\left(\frac{(bdn+1)(a+b\ln(cx^n))}{bn}\right)^p}$$

Result(type 8, 20 leaves):

$$\int\frac{\Gamma(p,d(a+b\ln(cx^n)))}{x^2}\,\mathrm{d}x$$

Problem 53: Unable to integrate problem.

$$\int(dx+c)\,\mathrm{lnGAMMA}(bx+a)\,\mathrm{d}x$$

Optimal(type 4, 30 leaves, 2 steps):

$$-\frac{d\,\Psi(-3,bx+a)}{b^2}+\frac{(dx+c)\,\Psi(-2,bx+a)}{b}$$

Result(type 8, 14 leaves):

$$\int(dx+c)\,\mathrm{lnGAMMA}(bx+a)\,\mathrm{d}x$$

Problem 61: Unable to integrate problem.

$$\int\left(\frac{\Psi(1,bx+a)}{x^2}-\frac{b\,\Psi(2,bx+a)}{x}\right)\mathrm{d}x$$

Optimal(type 4, 12 leaves, 2 steps):

$$-\frac{\Psi(1,bx+a)}{x}$$

Result(type 8, 27 leaves):

$$\int \left(\frac{\Psi(1, b x + a)}{x^2} - \frac{b \Psi(2, b x + a)}{x} \right) dx$$

Problem 62: Unable to integrate problem.

$$\int \left(\frac{\Psi(n, b x + a)}{x^2} - \frac{b \Psi(1 + n, b x + a)}{x} \right) dx$$

Optimal(type 4, 12 leaves, 2 steps):

$$-\frac{\Psi(n, b x + a)}{x}$$

Result(type 8, 29 leaves):

$$\int \left(\frac{\Psi(n, b x + a)}{x^2} - \frac{b \Psi(1 + n, b x + a)}{x} \right) dx$$

Test results for the 4 problems in "8.7 Zeta function.txt"

Problem 1: Unable to integrate problem.

$$\int x^2 \Psi(1, b x + a)\, dx$$

Optimal(type 4, 38 leaves, 4 steps):

$$-\frac{2 x \ln\mathrm{GAMMA}(b x + a)}{b^2} + \frac{2 \Psi(-2, b x + a)}{b^3} + \frac{x^2 \Psi(b x + a)}{b}$$

Result(type 8, 13 leaves):

$$\int x^2 \Psi(1, b x + a)\, dx$$

Problem 3: Unable to integrate problem.

$$\int \left(\frac{\Psi(1, b x + a)}{x^2} - \frac{b \Psi(2, b x + a)}{x} \right) dx$$

Optimal(type 4, 12 leaves, 3 steps):

$$-\frac{\Psi(1, b x + a)}{x}$$

Result(type 8, 27 leaves):

$$\int \left(\frac{\Psi(1, b x + a)}{x^2} - \frac{b \Psi(2, b x + a)}{x} \right) dx$$

Problem 4: Unable to integrate problem.

$$\int \zeta(0, s, b x + a)\, dx$$

Optimal(type 4, 21 leaves, 1 step):

$$\frac{\zeta(0, -1 + s, b x + a)}{b (1 - s)}$$

Result(type 8, 10 leaves):

$$\int \zeta(0, s, b x + a)\, dx$$

Test results for the 51 problems in "8.8 Polylogarithm function.txt"

Problem 13: Result more than twice size of optimal antiderivative.

$$\int x^4 \operatorname{polylog}(3, a x^2)\, dx$$

Optimal(type 4, 69 leaves, 6 steps):

$$\frac{8 x}{125 a^2} + \frac{8 x^3}{375 a} + \frac{8 x^5}{625} - \frac{8 \operatorname{arctanh}\left(x \sqrt{a}\right)}{125 a^{5/2}} - \frac{4 x^5 \ln(-a x^2 + 1)}{125} - \frac{2 x^5 \operatorname{polylog}(2, a x^2)}{25} + \frac{x^5 \operatorname{polylog}(3, a x^2)}{5}$$

Result(type 4, 143 leaves):

$$-\frac{1}{2 a^2 \sqrt{-a}} \left(\frac{2 x (-a)^{7/2} (168 a^2 x^4 + 280 a x^2 + 840)}{13125 a^3} + \frac{8 x (-a)^{7/2} \left(\ln\left(1 - \sqrt{a x^2}\right) - \ln\left(1 + \sqrt{a x^2}\right)\right)}{125 a^3 \sqrt{a x^2}} - \frac{8 x^5 (-a)^{7/2} \ln(-a x^2 + 1)}{125 a} - \frac{4 x^5 (-a)^{7/2} \operatorname{polylog}(2, a x^2)}{25 a} + \frac{2 x^5 (-a)^{7/2} \operatorname{polylog}(3, a x^2)}{5 a} \right)$$

Problem 14: Result more than twice size of optimal antiderivative.

$$\int \operatorname{polylog}(3, a x^2)\, dx$$

Optimal(type 4, 46 leaves, 5 steps):

$$8 x - 4 x \ln(-a x^2 + 1) - 2 x \operatorname{polylog}(2, a x^2) + x \operatorname{polylog}(3, a x^2) - \frac{8 \operatorname{arctanh}\left(x \sqrt{a}\right)}{\sqrt{a}}$$

Result(type 4, 118 leaves):

$$-\frac{1}{2 \sqrt{-a}} \left(\frac{16 x (-a)^{3/2}}{a} + \frac{8 x (-a)^{3/2} \left(\ln\left(1 - \sqrt{a x^2}\right) - \ln\left(1 + \sqrt{a x^2}\right)\right)}{a \sqrt{a x^2}} - \frac{8 x (-a)^{3/2} \ln(-a x^2 + 1)}{a} - \frac{4 x (-a)^{3/2} \operatorname{polylog}(2, a x^2)}{a} + \frac{2 x (-a)^{3/2} \operatorname{polylog}(3, a x^2)}{a} \right)$$

Problem 29: Unable to integrate problem.

$$\int \left(\operatorname{polylog}\left(-\frac{3}{2}, a x\right) + \operatorname{polylog}\left(-\frac{1}{2}, a x\right)\right) dx$$

Optimal(type 4, 7 leaves, 2 steps):

$$x \operatorname{polylog}\left(-\frac{1}{2}, a x\right)$$

Result(type 8, 13 leaves):

$$\int \left(\operatorname{polylog}\left(-\frac{3}{2}, a x\right) + \operatorname{polylog}\left(-\frac{1}{2}, a x\right)\right) dx$$

Problem 39: Unable to integrate problem.

$$\int x^2 \operatorname{polylog}(3, c (b x + a)) \, dx$$

Optimal(type 4, 313 leaves, 33 steps):

$$\frac{11 a^2 x}{18 b^2} - \frac{5 a (-c a + 1) x}{36 c b^2} + \frac{(-c a + 1)^2 x}{27 c^2 b^2} - \frac{5 a x^2}{72 b} + \frac{(-c a + 1) x^2}{54 b c} + \frac{x^3}{81} - \frac{5 a (-c a + 1)^2 \ln(-b c x - c a + 1)}{36 b^3 c^2} + \frac{(-c a + 1)^3 \ln(-b c x - c a + 1)}{27 b^3 c^3}$$
$$+ \frac{5 a x^2 \ln(-b c x - c a + 1)}{36 b} - \frac{x^3 \ln(-b c x - c a + 1)}{27} + \frac{11 a^2 (-b c x - c a + 1) \ln(-b c x - c a + 1)}{18 b^3 c} - \frac{11 a^3 \operatorname{polylog}(2, c (b x + a))}{18 b^3}$$
$$- \frac{a^2 x \operatorname{polylog}(2, c (b x + a))}{3 b^2} + \frac{a x^2 \operatorname{polylog}(2, c (b x + a))}{6 b} - \frac{x^3 \operatorname{polylog}(2, c (b x + a))}{9} + \frac{2 a^3 \operatorname{polylog}(3, c (b x + a))}{3 b^3}$$
$$- \frac{\left(-b^3 x^3 + a^3\right) \operatorname{polylog}(3, c (b x + a))}{3 b^3}$$

Result(type 8, 15 leaves):

$$\int x^2 \operatorname{polylog}(3, c (b x + a)) \, dx$$

Problem 40: Unable to integrate problem.

$$\int \operatorname{polylog}(3, c (b x + a)) \, dx$$

Optimal(type 4, 84 leaves, 9 steps):

$$x + \frac{(-b c x - c a + 1) \ln(-b c x - c a + 1)}{b c} - \frac{a \operatorname{polylog}(2, c (b x + a))}{b} - x \operatorname{polylog}(2, c (b x + a)) + \frac{a \operatorname{polylog}(3, c (b x + a))}{b} + x \operatorname{polylog}(3, c (b x + a))$$

Result(type 8, 11 leaves):

$$\int \operatorname{polylog}(3, c (b x + a)) \, dx$$

Problem 42: Unable to integrate problem.

$$\int \frac{\text{polylog}(2, x)}{(-1+x)\, x}\, dx$$

```
Optimal(type 4, 51 leaves, 8 steps):
```

$$\ln(1-x)^2 \ln(x) + 2\ln(1-x)\,\text{polylog}(2, 1-x) + \ln(1-x)\,\text{polylog}(2, x) - 2\,\text{polylog}(3, 1-x) - \text{polylog}(3, x)$$

```
Result(type 8, 14 leaves):
```

$$\int \frac{\text{polylog}(2, x)}{(-1+x)\, x}\, dx$$

```
Problem 43: Unable to integrate problem.
```

$$\int -\frac{\text{polylog}(2, x)}{(1-x)\, x}\, dx$$

```
Optimal(type 4, 51 leaves, 8 steps):
```

$$\ln(1-x)^2 \ln(x) + 2\ln(1-x)\,\text{polylog}(2, 1-x) + \ln(1-x)\,\text{polylog}(2, x) - 2\,\text{polylog}(3, 1-x) - \text{polylog}(3, x)$$

```
Result(type 8, 17 leaves):
```

$$\int -\frac{\text{polylog}(2, x)}{(1-x)\, x}\, dx$$

```
Problem 44: Unable to integrate problem.
```

$$\int -\frac{\ln\left(1 - e\left(\frac{b x + a}{d x + c}\right)^n\right)}{(b x + a)\,(d x + c)}\, dx$$

```
Optimal(type 4, 33 leaves, 1 step):
```

$$\frac{\text{polylog}\left(2, e\left(\frac{b x + a}{d x + c}\right)^n\right)}{(-a d + b c)\, n}$$

```
Result(type 8, 39 leaves):
```

$$\int -\frac{\ln\left(1 - e\left(\frac{b x + a}{d x + c}\right)^n\right)}{(b x + a)\,(d x + c)}\, dx$$

```
Problem 46: Unable to integrate problem.
```

$$\int x^3\, \text{polylog}\left(n, d\left(F^{c (b x + a)}\right)^p\right) dx$$

```
Optimal(type 4, 135 leaves, 5 steps):
```

$$\frac{x^3\, \text{polylog}\left(1+n, d\left(F^{c (b x + a)}\right)^p\right)}{b c p \ln(F)} - \frac{3 x^2\, \text{polylog}\left(2+n, d\left(F^{c (b x + a)}\right)^p\right)}{b^2 c^2 p^2 \ln(F)^2} + \frac{6 x\, \text{polylog}\left(3+n, d\left(F^{c (b x + a)}\right)^p\right)}{b^3 c^3 p^3 \ln(F)^3} - \frac{6\, \text{polylog}\left(4+n, d\left(F^{c (b x + a)}\right)^p\right)}{b^4 c^4 p^4 \ln(F)^4}$$

Result(type 8, 21 leaves):

$$\int x^3 \operatorname{polylog}\left(n, d\left(F^{c(bx+a)}\right)^p\right) dx$$

Problem 48: Unable to integrate problem.

$$\int \frac{\ln(-cx+1) \operatorname{polylog}(2, cx)}{x^3} dx$$

Optimal(type 4, 175 leaves, 23 steps):

$$-c^2 \ln(x) + c^2 \ln(-cx+1) - \frac{c \ln(-cx+1)}{x} - \frac{c^2 \ln(-cx+1)^2}{4} + \frac{\ln(-cx+1)^2}{4x^2} + \frac{c^2 \ln(cx) \ln(-cx+1)^2}{2} - \frac{c^2 \operatorname{polylog}(2, cx)}{2} + \frac{c \operatorname{polylog}(2, cx)}{2x}$$
$$+ \frac{c^2 \ln(-cx+1) \operatorname{polylog}(2, cx)}{2} - \frac{\ln(-cx+1) \operatorname{polylog}(2, cx)}{2x^2} + c^2 \ln(-cx+1) \operatorname{polylog}(2, -cx+1) - \frac{c^2 \operatorname{polylog}(3, cx)}{2} - c^2 \operatorname{polylog}(3, -cx+1)$$

Result(type 8, 18 leaves):

$$\int \frac{\ln(-cx+1) \operatorname{polylog}(2, cx)}{x^3} dx$$

Problem 49: Unable to integrate problem.

$$\int \frac{(bx+a) \ln(-cx+1) \operatorname{polylog}(2, cx)}{x^2} dx$$

Optimal(type 4, 129 leaves, 13 steps):

$$\frac{a(-cx+1) \ln(-cx+1)^2}{x} + a c \ln(cx) \ln(-cx+1)^2 - 2ac \operatorname{polylog}(2, cx) + a c \ln(-cx+1) \operatorname{polylog}(2, cx) - \frac{a \ln(-cx+1) \operatorname{polylog}(2, cx)}{x}$$
$$- \frac{b \operatorname{polylog}(2, cx)^2}{2} + 2 a c \ln(-cx+1) \operatorname{polylog}(2, -cx+1) - a c \operatorname{polylog}(3, cx) - 2ac \operatorname{polylog}(3, -cx+1)$$

Result(type 8, 23 leaves):

$$\int \frac{(bx+a) \ln(-cx+1) \operatorname{polylog}(2, cx)}{x^2} dx$$

Problem 50: Unable to integrate problem.

$$\int \frac{(bx+a) \ln(-cx+1) \operatorname{polylog}(2, cx)}{x^4} dx$$

Optimal(type 4, 410 leaves, 41 steps):

$$-\frac{7ac \ln(-cx+1)}{36x^2} - \frac{bc \ln(-cx+1)}{2x} - \frac{2ac^2 \ln(-cx+1)}{9x} - \frac{c(2ca+3b) \ln(-cx+1)}{6x} + \frac{c^2(2ca+3b) \ln(cx) \ln(-cx+1)^2}{6}$$
$$+ \frac{c^2(2ca+3b) \ln(-cx+1) \operatorname{polylog}(2, cx)}{6} + \frac{c^2(2ca+3b) \ln(-cx+1) \operatorname{polylog}(2, -cx+1)}{3} + \frac{7ac^2}{36x} - \frac{bc^2 \operatorname{polylog}(2, cx)}{2}$$

$$- \frac{2 a c^3 \operatorname{polylog}(2, c x)}{9} - \frac{c^2 (2 c a + 3 b) \operatorname{polylog}(3, c x)}{6} - \frac{c^2 (2 c a + 3 b) \operatorname{polylog}(3, -c x + 1)}{3} - \frac{c^2 (2 c a + 3 b) \ln(x)}{6} - \frac{b c^2 \ln(x)}{2} - \frac{5 a c^3 \ln(x)}{12}$$
$$+ \frac{b c^2 \ln(-c x + 1)}{2} + \frac{5 a c^3 \ln(-c x + 1)}{12} + \frac{c^2 (2 c a + 3 b) \ln(-c x + 1)}{6} - \frac{b c^2 \ln(-c x + 1)^2}{4} - \frac{a c^3 \ln(-c x + 1)^2}{9} + \frac{a \ln(-c x + 1)^2}{9 x^3}$$
$$+ \frac{b \ln(-c x + 1)^2}{4 x^2} - \frac{\left(\frac{2 a}{x^3} + \frac{3 b}{x^2}\right) \ln(-c x + 1) \operatorname{polylog}(2, c x)}{6} + \frac{a c \operatorname{polylog}(2, c x)}{6 x^2} + \frac{c (2 c a + 3 b) \operatorname{polylog}(2, c x)}{6 x}$$

Result(type 8, 23 leaves):

$$\int \frac{(b x + a) \ln(-c x + 1) \operatorname{polylog}(2, c x)}{x^4} \, dx$$

Problem 51: Unable to integrate problem.

$$\int \frac{\left(c x^2 + b x + a\right) \ln(-d x + 1) \operatorname{polylog}(2, d x)}{x^4} \, dx$$

Optimal(type 4, 465 leaves, 43 steps):

$$\frac{d (6 c + d (2 a d + 3 b)) \ln(-d x + 1) \operatorname{polylog}(2, d x)}{6} + \frac{d (6 c + d (2 a d + 3 b)) \ln(-d x + 1) \operatorname{polylog}(2, -d x + 1)}{3} + \frac{c (-d x + 1) \ln(-d x + 1)^2}{x}$$
$$- \frac{7 a d \ln(-d x + 1)}{36 x^2} - \frac{b d \ln(-d x + 1)}{2 x} + \frac{a d \operatorname{polylog}(2, d x)}{6 x^2} + \frac{d (2 a d + 3 b) \operatorname{polylog}(2, d x)}{6 x} - \frac{2 a d^2 \ln(-d x + 1)}{9 x} - \frac{d (2 a d + 3 b) \ln(-d x + 1)}{6 x}$$
$$+ \frac{d (6 c + d (2 a d + 3 b)) \ln(d x) \ln(-d x + 1)^2}{6} + \frac{7 a d^2}{36 x} - 2 c d \operatorname{polylog}(2, d x) - \frac{b d^2 \operatorname{polylog}(2, d x)}{2} - \frac{2 a d^3 \operatorname{polylog}(2, d x)}{9}$$
$$- \frac{d (6 c + d (2 a d + 3 b)) \operatorname{polylog}(3, d x)}{6} - \frac{d (6 c + d (2 a d + 3 b)) \operatorname{polylog}(3, -d x + 1)}{3} - \frac{b d^2 \ln(x)}{2} - \frac{5 a d^3 \ln(x)}{12} - \frac{d^2 (2 a d + 3 b) \ln(x)}{6}$$
$$+ \frac{b d^2 \ln(-d x + 1)}{2} + \frac{5 a d^3 \ln(-d x + 1)}{12} + \frac{d^2 (2 a d + 3 b) \ln(-d x + 1)}{6} - \frac{b d^2 \ln(-d x + 1)^2}{4} - \frac{a d^3 \ln(-d x + 1)^2}{9} + \frac{a \ln(-d x + 1)^2}{9 x^3}$$
$$+ \frac{b \ln(-d x + 1)^2}{4 x^2} - \frac{\left(\frac{2 a}{x^3} + \frac{3 b}{x^2} + \frac{6 c}{x}\right) \ln(-d x + 1) \operatorname{polylog}(2, d x)}{6}$$

Result(type 8, 28 leaves):

$$\int \frac{\left(c x^2 + b x + a\right) \ln(-d x + 1) \operatorname{polylog}(2, d x)}{x^4} \, dx$$

Test results for the 107 problems in "8.9 Product logarithm function.txt"

Problem 5: Result more than twice size of optimal antiderivative.

$$\int \frac{1}{\left(c\,\mathrm{LambertW}(b x+a)\right)^{5/2}}\,dx$$

Optimal(type 4, 70 leaves, 3 steps):

$$-\frac{2\,(b x+a)}{3\,b\,\left(c\,\mathrm{LambertW}(b x+a)\right)^{5/2}}-\frac{10\,(b x+a)}{3\,b\,c\,\left(c\,\mathrm{LambertW}(b x+a)\right)^{3/2}}+\frac{10\,\mathrm{erfi}\left(\frac{\sqrt{c\,\mathrm{LambertW}(b x+a)}}{\sqrt{c}}\right)\sqrt{\pi}}{3\,b\,c^{5/2}}$$

Result(type 4, 159 leaves):

$$\frac{1}{b\,c^2}\left(2\left(-\frac{b x+a}{\sqrt{c\,\mathrm{LambertW}(b x+a)}\;\mathrm{LambertW}(b x+a)}+\frac{\sqrt{\pi}\;\mathrm{erf}\left(\sqrt{-\frac{1}{c}}\;\sqrt{c\,\mathrm{LambertW}(b x+a)}\right)}{c\,\sqrt{-\frac{1}{c}}}+c\left(-\frac{b x+a}{3\,\left(c\,\mathrm{LambertW}(b x+a)\right)^{3/2}\,\mathrm{LambertW}(b x+a)}+\frac{2\left(-\frac{b x+a}{\sqrt{c\,\mathrm{LambertW}(b x+a)}\;\mathrm{LambertW}(b x+a)}+\frac{\sqrt{\pi}\;\mathrm{erf}\left(\sqrt{-\frac{1}{c}}\;\sqrt{c\,\mathrm{LambertW}(b x+a)}\right)}{c\,\sqrt{-\frac{1}{c}}}\right)}{3\,c}\right)\right)\right)$$

Problem 6: Result more than twice size of optimal antiderivative.

$$\int \frac{1}{\left(c\,\mathrm{LambertW}(b x+a)\right)^{7/2}}\,dx$$

Optimal(type 4, 93 leaves, 4 steps):

$$-\frac{2\,(b x+a)}{5\,b\,\left(c\,\mathrm{LambertW}(b x+a)\right)^{7/2}}-\frac{14\,(b x+a)}{15\,b\,c\,\left(c\,\mathrm{LambertW}(b x+a)\right)^{5/2}}-\frac{28\,(b x+a)}{15\,b\,c^2\,\left(c\,\mathrm{LambertW}(b x+a)\right)^{3/2}}+\frac{28\,\mathrm{erfi}\left(\frac{\sqrt{c\,\mathrm{LambertW}(b x+a)}}{\sqrt{c}}\right)\sqrt{\pi}}{15\,b\,c^{7/2}}$$

Result(type 4, 221 leaves):

$$\frac{1}{b\,c^2}\left(2\left(-\frac{b\,x+a}{3\,(c\,\mathrm{LambertW}(b\,x+a))^{3/2}\,\mathrm{LambertW}(b\,x+a)}\right.\right.$$

$$+\frac{2\left(-\frac{b\,x+a}{\sqrt{c\,\mathrm{LambertW}(b\,x+a)}\,\mathrm{LambertW}(b\,x+a)}+\frac{\sqrt{\pi}\,\mathrm{erf}\left(\sqrt{-\frac{1}{c}}\,\sqrt{c\,\mathrm{LambertW}(b\,x+a)}\right)}{c\,\sqrt{-\frac{1}{c}}}\right)}{3\,c}\Bigg)+c\Bigg($$

$$-\frac{b\,x+a}{5\,(c\,\mathrm{LambertW}(b\,x+a))^{5/2}\,\mathrm{LambertW}(b\,x+a)}+\frac{1}{5\,c}\left(2\left(-\frac{b\,x+a}{3\,(c\,\mathrm{LambertW}(b\,x+a))^{3/2}\,\mathrm{LambertW}(b\,x+a)}\right.\right.$$

$$\left.\left.\left.\left.+\frac{2\left(-\frac{b\,x+a}{\sqrt{c\,\mathrm{LambertW}(b\,x+a)}\,\mathrm{LambertW}(b\,x+a)}+\frac{\sqrt{\pi}\,\mathrm{erf}\left(\sqrt{-\frac{1}{c}}\,\sqrt{c\,\mathrm{LambertW}(b\,x+a)}\right)}{c\,\sqrt{-\frac{1}{c}}}\right)}{3\,c}\right)\right)\right)\right)$$

```
Problem 10: Result more than twice size of optimal antiderivative.
```

$$\int\frac{1}{(-c\,\mathrm{LambertW}(b\,x+a))^{7/2}}\,dx$$

```
Optimal(type 4, 97 leaves, 4 steps):
```

$$-\frac{2\,(b\,x+a)}{5\,b\,(-c\,\mathrm{LambertW}(b\,x+a))^{7/2}}+\frac{14\,(b\,x+a)}{15\,b\,c\,(-c\,\mathrm{LambertW}(b\,x+a))^{5/2}}-\frac{28\,(b\,x+a)}{15\,b\,c^2\,(-c\,\mathrm{LambertW}(b\,x+a))^{3/2}}+\frac{28\,\mathrm{erf}\left(\frac{\sqrt{-c\,\mathrm{LambertW}(b\,x+a)}}{\sqrt{c}}\right)\sqrt{\pi}}{15\,b\,c^{7/2}}$$

```
Result(type 4, 209 leaves):
```

$$\frac{1}{b\,c^2}\left(2\left(-\frac{b\,x+a}{3\,(-c\,\mathrm{LambertW}(b\,x+a))^{3/2}\,\mathrm{LambertW}(b\,x+a)}\right.\right.$$

$$\left.\left.-\frac{2\left(-\frac{b\,x+a}{\sqrt{-c\,\mathrm{LambertW}(b\,x+a)}\,\mathrm{LambertW}(b\,x+a)}-\frac{\sqrt{\pi}\,\mathrm{erf}\left(\frac{\sqrt{-c\,\mathrm{LambertW}(b\,x+a)}}{\sqrt{c}}\right)}{\sqrt{c}}\right)}{3\,c}\right)-c\left(\right.\right.$$

$$-\frac{b\,x+a}{5\,(-c\,\mathrm{LambertW}(b\,x+a))^{5/2}\,\mathrm{LambertW}(b\,x+a)}$$

$$-\frac{1}{5\,c}\left(2\left(-\frac{b\,x+a}{3\,(-c\,\mathrm{LambertW}(b\,x+a))^{3/2}\,\mathrm{LambertW}(b\,x+a)}\right.\right.$$

$$\left.\left.\left.\left.\left.-\frac{2\left(-\frac{b\,x+a}{\sqrt{-c\,\mathrm{LambertW}(b\,x+a)}\,\mathrm{LambertW}(b\,x+a)}-\frac{\sqrt{\pi}\,\mathrm{erf}\left(\frac{\sqrt{-c\,\mathrm{LambertW}(b\,x+a)}}{\sqrt{c}}\right)}{\sqrt{c}}\right)}{3\,c}\right)\right)\right)\right)\right)$$

Problem 38: Result more than twice size of optimal antiderivative.

$$\int\frac{\sqrt{c\,\mathrm{LambertW}(a\,x)}}{x^3}\,dx$$

Optimal (type 4, 60 leaves, 3 steps):

$$\frac{2\,(c\,\mathrm{LambertW}(a\,x))^{3/2}}{3\,c\,x^2}+\frac{2\,a^2\,\mathrm{erf}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a\,x)}}{\sqrt{c}}\right)\sqrt{c}\,\sqrt{2}\,\sqrt{\pi}}{3}-\frac{2\,\sqrt{c\,\mathrm{LambertW}(a\,x)}}{3\,x^2}$$

Result (type 4, 121 leaves):

$$2a^2 c\left(-\frac{e^{-2\,\mathrm{LambertW}(a x)}}{\sqrt{c\,\mathrm{LambertW}(a x)}}-\frac{\sqrt{\pi}\,\sqrt{2}\,\mathrm{erf}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a x)}}{\sqrt{c}}\right)}{\sqrt{c}}+c\left(-\frac{e^{-2\,\mathrm{LambertW}(a x)}}{3\,(c\,\mathrm{LambertW}(a x))^{3/2}}\right.\right.$$
$$\left.\left.-\frac{4\left(-\frac{e^{-2\,\mathrm{LambertW}(a x)}}{\sqrt{c\,\mathrm{LambertW}(a x)}}-\frac{\sqrt{\pi}\,\sqrt{2}\,\mathrm{erf}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a x)}}{\sqrt{c}}\right)}{\sqrt{c}}\right)}{3c}\right)\right)$$

Problem 42: Unable to integrate problem.

$$\int \frac{x^m}{\mathrm{LambertW}(a x)}\,dx$$

Optimal(type 4, 101 leaves, 3 steps):

$$\frac{x^m\,\Gamma(m,-(1+m)\,\mathrm{LambertW}(a x))\,(-(1+m)\,\mathrm{LambertW}(a x))^{1-m}}{a\,e^{m\,\mathrm{LambertW}(a x)}\,(1+m)\,\mathrm{LambertW}(a x)}+\frac{x^m\,\Gamma(1+m,-(1+m)\,\mathrm{LambertW}(a x))}{a\,e^{m\,\mathrm{LambertW}(a x)}\,(1+m)\,(-(1+m)\,\mathrm{LambertW}(a x))^m}$$

Result(type 8, 12 leaves):

$$\int \frac{x^m}{\mathrm{LambertW}(a x)}\,dx$$

Problem 43: Unable to integrate problem.

$$\int \frac{x^m}{\mathrm{LambertW}(a x)^2}\,dx$$

Optimal(type 4, 109 leaves, 3 steps):

$$\frac{x^m\,\Gamma(m,-(1+m)\,\mathrm{LambertW}(a x))\,(-(1+m)\,\mathrm{LambertW}(a x))^{1-m}}{a\,e^{m\,\mathrm{LambertW}(a x)}\,(1+m)\,\mathrm{LambertW}(a x)}+\frac{x^m\,\Gamma(-1+m,-(1+m)\,\mathrm{LambertW}(a x))\,(-(1+m)\,\mathrm{LambertW}(a x))^{2-m}}{a\,e^{m\,\mathrm{LambertW}(a x)}\,(1+m)\,\mathrm{LambertW}(a x)^2}$$

Result(type 8, 12 leaves):

$$\int \frac{x^m}{\mathrm{LambertW}(a x)^2}\,dx$$

Problem 49: Unable to integrate problem.

$$\int \frac{\mathrm{LambertW}(a x^2)^3}{x^9}\,dx$$

Optimal(type 4, 28 leaves, 2 steps):

$$-\frac{3 a^4 \operatorname{Ei}(-4 \operatorname{LambertW}(a x^2))}{2} - \frac{\operatorname{LambertW}(a x^2)^3}{2 x^8}$$

Result(type 8, 14 leaves):

$$\int \frac{\operatorname{LambertW}(a x^2)^3}{x^9} \, dx$$

Problem 51: Unable to integrate problem.

$$\int \frac{1}{x^3 \operatorname{LambertW}(a x^2)} \, dx$$

Optimal(type 4, 31 leaves, 4 steps):

$$-\frac{1}{4 x^2} - \frac{a \operatorname{Ei}(-\operatorname{LambertW}(a x^2))}{4} - \frac{1}{4 x^2 \operatorname{LambertW}(a x^2)}$$

Result(type 8, 14 leaves):

$$\int \frac{1}{x^3 \operatorname{LambertW}(a x^2)} \, dx$$

Problem 52: Unable to integrate problem.

$$\int \frac{x^7}{\operatorname{LambertW}(a x^2)^2} \, dx$$

Optimal(type 4, 40 leaves, 3 steps):

$$-\frac{x^8}{64 \operatorname{LambertW}(a x^2)^4} + \frac{x^8}{16 \operatorname{LambertW}(a x^2)^3} + \frac{x^8}{8 \operatorname{LambertW}(a x^2)^2}$$

Result(type 8, 14 leaves):

$$\int \frac{x^7}{\operatorname{LambertW}(a x^2)^2} \, dx$$

Problem 58: Unable to integrate problem.

$$\int \frac{\sqrt{c \operatorname{LambertW}(a x^2)}}{x^3} \, dx$$

Optimal(type 4, 40 leaves, 2 steps):

$$-\frac{a \operatorname{erf}\left(\frac{\sqrt{c \operatorname{LambertW}(a x^2)}}{\sqrt{c}}\right) \sqrt{c} \sqrt{\pi}}{2} - \frac{\sqrt{c \operatorname{LambertW}(a x^2)}}{x^2}$$

Result(type 8, 16 leaves):

$$\int \frac{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{x^3}\,\mathrm{d}x$$

Problem 59: Unable to integrate problem.

$$\int \frac{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{x^7}\,\mathrm{d}x$$

Optimal(type 4, 84 leaves, 4 steps):

$$\frac{\left(c\,\mathrm{LambertW}(a\,x^2)\right)^{3/2}}{15\,c\,x^6} - \frac{2\,\left(c\,\mathrm{LambertW}(a\,x^2)\right)^{5/2}}{5\,c^2\,x^6} - \frac{2\,a^3\,\mathrm{erf}\left(\frac{\sqrt{3}\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{\sqrt{c}}\right)\sqrt{c}\,\sqrt{3}\,\sqrt{\pi}}{5} - \frac{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{5\,x^6}$$

Result(type 8, 16 leaves):

$$\int \frac{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{x^7}\,\mathrm{d}x$$

Problem 60: Unable to integrate problem.

$$\int \frac{x^5}{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

Optimal(type 4, 82 leaves, 4 steps):

$$-\frac{c^2\,x^6}{72\,\left(c\,\mathrm{LambertW}(a\,x^2)\right)^{5/2}} + \frac{c\,x^6}{36\,\left(c\,\mathrm{LambertW}(a\,x^2)\right)^{3/2}} + \frac{\mathrm{erfi}\left(\frac{\sqrt{3}\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{\sqrt{c}}\right)\sqrt{3}\,\sqrt{\pi}}{432\,a^3\,\sqrt{c}} + \frac{x^6}{6\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}$$

Result(type 8, 16 leaves):

$$\int \frac{x^5}{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

Problem 61: Unable to integrate problem.

$$\int \frac{x^3}{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

Optimal(type 4, 64 leaves, 3 steps):

$$\frac{c\,x^4}{16\,(c\,\mathrm{LambertW}(a\,x^2))^{3/2}}-\frac{\mathrm{erfi}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{64\,a^2\,\sqrt{c}}+\frac{x^4}{4\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}$$

```
Result(type 8, 16 leaves):
```

$$\int\frac{x^3}{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

```
Problem 62: Unable to integrate problem.
```

$$\int\frac{x^2}{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

```
Optimal(type 4, 32 leaves, 2 steps):
```

$$\frac{c\,x^3}{9\,(c\,\mathrm{LambertW}(a\,x^2))^{3/2}}+\frac{x^3}{3\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}$$

```
Result(type 8, 16 leaves):
```

$$\int\frac{x^2}{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

```
Problem 64: Unable to integrate problem.
```

$$\int\frac{1}{x^5\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

```
Optimal(type 4, 84 leaves, 4 steps):
```

$$\frac{4\,(c\,\mathrm{LambertW}(a\,x^2))^{3/2}}{15\,c^2\,x^4}+\frac{4\,a^2\,\mathrm{erf}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{15\,\sqrt{c}}-\frac{1}{5\,x^4\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}-\frac{\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}{15\,c\,x^4}$$

```
Result(type 8, 16 leaves):
```

$$\int\frac{1}{x^5\,\sqrt{c\,\mathrm{LambertW}(a\,x^2)}}\,\mathrm{d}x$$

```
Problem 66: Result more than twice size of optimal antiderivative.
```

$$\int x\,(c\,\mathrm{LambertW}(a\,x^2))^p\,\mathrm{d}x$$

```
Optimal(type 4, 56 leaves, 3 steps):
```

$$\frac{x^2 (c \operatorname{LambertW}(a x^2))^p}{2} - \frac{p \Gamma(1+p, -\operatorname{LambertW}(a x^2)) (c \operatorname{LambertW}(a x^2))^p}{2 a (-\operatorname{LambertW}(a x^2))^p}$$

Result(type 4, 253 leaves):

$$\frac{1}{2a}\Bigg((-1)^{-p} (c \operatorname{LambertW}(a x^2))^p \operatorname{LambertW}(a x^2)^{-p} \Bigg(\operatorname{LambertW}(a x^2)^p (-1)^p (1+p) p \Gamma(p) (-\operatorname{LambertW}(a x^2))^{-p} + \frac{\operatorname{LambertW}(a x^2)^p (-1)^p (\operatorname{LambertW}(a x^2) - p - 1) a x^2}{\operatorname{LambertW}(a x^2)} - \operatorname{LambertW}(a x^2)^p (-1)^p (1+p) p (-\operatorname{LambertW}(a x^2))^{-p} \Gamma(p, -\operatorname{LambertW}(a x^2)) \Bigg) - (-1)^{-p} (c \operatorname{LambertW}(a x^2))^p \operatorname{LambertW}(a x^2)^{-p} \Bigg(\operatorname{LambertW}(a x^2)^p (-1)^p p \Gamma(p) (-\operatorname{LambertW}(a x^2))^{-p} - \frac{\operatorname{LambertW}(a x^2)^p (-1)^p a x^2}{\operatorname{LambertW}(a x^2)} - \operatorname{LambertW}(a x^2)^p (-1)^p p (-\operatorname{LambertW}(a x^2))^{-p} \Gamma(p, -\operatorname{LambertW}(a x^2)) \Bigg) \Bigg)$$

Problem 67: Unable to integrate problem.

$$\int \frac{(c \operatorname{LambertW}(a x^2))^p}{x} \, dx$$

Optimal(type 4, 38 leaves, 2 steps):

$$\frac{(c \operatorname{LambertW}(a x^2))^p}{2p} + \frac{(c \operatorname{LambertW}(a x^2))^{1+p}}{2c(1+p)}$$

Result(type 8, 16 leaves):

$$\int \frac{(c \operatorname{LambertW}(a x^2))^p}{x} \, dx$$

Problem 73: Unable to integrate problem.

$$\int x^2 \sqrt{\operatorname{LambertW}\left(\frac{a}{x}\right)} \, dx$$

Optimal(type 4, 64 leaves, 4 steps):

$$-\frac{2 x^3 \operatorname{LambertW}\left(\frac{a}{x}\right)^{3/2}}{15} + \frac{4 x^3 \operatorname{LambertW}\left(\frac{a}{x}\right)^{5/2}}{5} + \frac{4 a^3 \operatorname{erf}\left(\sqrt{3} \sqrt{\operatorname{LambertW}\left(\frac{a}{x}\right)}\right) \sqrt{3} \sqrt{\pi}}{5} + \frac{2 x^3 \sqrt{\operatorname{LambertW}\left(\frac{a}{x}\right)}}{5}$$

Result(type 8, 14 leaves):

$$\int x^2 \sqrt{\operatorname{LambertW}\left(\frac{a}{x}\right)} \, dx$$

Problem 75: Unable to integrate problem.

$$\int \frac{1}{x^4 \sqrt{\text{LambertW}\left(\frac{a}{x}\right)}}\, dx$$

Optimal(type 4, 64 leaves, 4 steps):

$$\frac{1}{36\, x^3 \,\text{LambertW}\left(\frac{a}{x}\right)^{5/2}} - \frac{1}{18\, x^3\, \text{LambertW}\left(\frac{a}{x}\right)^{3/2}} - \frac{\text{erfi}\left(\sqrt{3}\, \sqrt{\text{LambertW}\left(\frac{a}{x}\right)}\right) \sqrt{3}\, \sqrt{\pi}}{216\, a^3} - \frac{1}{3\, x^3 \sqrt{\text{LambertW}\left(\frac{a}{x}\right)}}$$

Result(type 8, 14 leaves):

$$\int \frac{1}{x^4 \sqrt{\text{LambertW}\left(\frac{a}{x}\right)}}\, dx$$

Problem 76: Unable to integrate problem.

$$\int x^2 \left(c\, \text{LambertW}\left(\frac{a}{x}\right)\right)^p dx$$

Optimal(type 4, 120 leaves, 4 steps):

$$\frac{3^{3-p}\, e^{4\, \text{LambertW}\left(\frac{a}{x}\right)}\, x^4\, \Gamma\left(-3+p, 3\, \text{LambertW}\left(\frac{a}{x}\right)\right) \text{LambertW}\left(\frac{a}{x}\right)^{4-p} \left(c\, \text{LambertW}\left(\frac{a}{x}\right)\right)^p}{a}$$
$$+ \frac{3^{2-p}\, e^{4\, \text{LambertW}\left(\frac{a}{x}\right)}\, x^4\, \Gamma\left(-2+p, 3\, \text{LambertW}\left(\frac{a}{x}\right)\right) \text{LambertW}\left(\frac{a}{x}\right)^{3-p} \left(c\, \text{LambertW}\left(\frac{a}{x}\right)\right)^{1+p}}{c\, a}$$

Result(type 8, 16 leaves):

$$\int x^2 \left(c\, \text{LambertW}\left(\frac{a}{x}\right)\right)^p dx$$

Problem 77: Unable to integrate problem.

$$\int \frac{\left(c\, \text{LambertW}\left(\frac{a}{x}\right)\right)^p}{x}\, dx$$

Optimal(type 4, 38 leaves, 2 steps):

$$-\frac{\left(c\,\mathrm{LambertW}\left(\frac{a}{x}\right)\right)^{p}}{p}-\frac{\left(c\,\mathrm{LambertW}\left(\frac{a}{x}\right)\right)^{1+p}}{c\,(1+p)}$$

```
Result(type 8, 16 leaves):
```

$$\int\frac{\left(c\,\mathrm{LambertW}\left(\frac{a}{x}\right)\right)^{p}}{x}\,\mathrm{d}x$$

```
Problem 81: Unable to integrate problem.
```

$$\int\mathrm{LambertW}(a\,x^{n})^{\frac{-1+n}{n}}\,\mathrm{d}x$$

```
Optimal(type 4, 40 leaves, 2 steps):
```

$$\frac{(1-n)\,x}{\mathrm{LambertW}(a\,x^{n})^{\frac{1}{n}}}+\frac{x}{\mathrm{LambertW}(a\,x^{n})^{\frac{1-n}{n}}}$$

```
Result(type 8, 16 leaves):
```

$$\int\mathrm{LambertW}(a\,x^{n})^{\frac{-1+n}{n}}\,\mathrm{d}x$$

```
Problem 82: Unable to integrate problem.
```

$$\int\frac{x^{-1-n}}{\sqrt{c\,\mathrm{LambertW}(a\,x^{n})}}\,\mathrm{d}x$$

```
Optimal(type 4, 71 leaves, 3 steps):
```

$$-\frac{2\,a\,\mathrm{erf}\left(\frac{\sqrt{c\,\mathrm{LambertW}(a\,x^{n})}}{\sqrt{c}}\right)\sqrt{\pi}}{3\,n\,\sqrt{c}}-\frac{2}{3\,n\,x^{n}\sqrt{c\,\mathrm{LambertW}(a\,x^{n})}}-\frac{2\sqrt{c\,\mathrm{LambertW}(a\,x^{n})}}{3\,c\,n\,x^{n}}$$

```
Result(type 8, 20 leaves):
```

$$\int\frac{x^{-1-n}}{\sqrt{c\,\mathrm{LambertW}(a\,x^{n})}}\,\mathrm{d}x$$

```
Problem 83: Unable to integrate problem.
```

$$\int x^{-1-2\,n}\,(c\,\mathrm{LambertW}(a\,x^{n}))^{11/2}\,\mathrm{d}x$$

Optimal(type 4, 131 leaves, 5 steps):

$$-\frac{165\,c^3\,(c\,\text{LambertW}(a\,x^n))^{5/2}}{128\,n\,x^{2\,n}}-\frac{55\,c^2\,(c\,\text{LambertW}(a\,x^n))^{7/2}}{32\,n\,x^{2\,n}}-\frac{11\,c\,(c\,\text{LambertW}(a\,x^n))^{9/2}}{8\,n\,x^{2\,n}}-\frac{(c\,\text{LambertW}(a\,x^n))^{11/2}}{2\,n\,x^{2\,n}}+\frac{165\,a^2\,c^{11/2}\,\text{erf}\left(\frac{\sqrt{2}\,\sqrt{c\,\text{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{512\,n}$$

Result(type 8, 20 leaves):

$$\int x^{-1-2\,n}\,(c\,\text{LambertW}(a\,x^n))^{11/2}\,dx$$

Problem 84: Unable to integrate problem.

$$\int x^{-1-2\,n}\,(c\,\text{LambertW}(a\,x^n))^{3/2}\,dx$$

Optimal(type 4, 58 leaves, 2 steps):

$$-\frac{2\,(c\,\text{LambertW}(a\,x^n))^{3/2}}{n\,x^{2\,n}}-\frac{3\,a^2\,c^{3/2}\,\text{erf}\left(\frac{\sqrt{2}\,\sqrt{c\,\text{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{2\,n}$$

Result(type 8, 20 leaves):

$$\int x^{-1-2\,n}\,(c\,\text{LambertW}(a\,x^n))^{3/2}\,dx$$

Problem 85: Unable to integrate problem.

$$\int \frac{x^{-1+n}}{(c\,\text{LambertW}(a\,x^n))^{9/2}}\,dx$$

Optimal(type 4, 111 leaves, 5 steps):

$$-\frac{2\,x^n}{7\,n\,(c\,\text{LambertW}(a\,x^n))^{9/2}}-\frac{18\,x^n}{35\,c\,n\,(c\,\text{LambertW}(a\,x^n))^{7/2}}-\frac{12\,x^n}{35\,c^2\,n\,(c\,\text{LambertW}(a\,x^n))^{5/2}}-\frac{24\,x^n}{35\,c^3\,n\,(c\,\text{LambertW}(a\,x^n))^{3/2}}+\frac{24\,\text{erfi}\left(\frac{\sqrt{c\,\text{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{\pi}}{35\,a\,c^{9/2}\,n}$$

Result(type 8, 18 leaves):

$$\int \frac{x^{-1+n}}{(c\,\text{LambertW}(a\,x^n))^{9/2}}\,dx$$

Problem 86: Unable to integrate problem.

$$\int \frac{x^{-1+2n}}{\sqrt{c\,\mathrm{LambertW}(a\,x^n)}}\,\mathrm{d}x$$

Optimal(type 4, 77 leaves, 3 steps):

$$\frac{c\,x^{2n}}{8\,n\,(c\,\mathrm{LambertW}(a\,x^n))^{3/2}}-\frac{\mathrm{erfi}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{32\,a^2\,n\,\sqrt{c}}+\frac{x^{2n}}{2\,n\,\sqrt{c\,\mathrm{LambertW}(a\,x^n)}}$$

Result(type 8, 20 leaves):

$$\int \frac{x^{-1+2n}}{\sqrt{c\,\mathrm{LambertW}(a\,x^n)}}\,\mathrm{d}x$$

Problem 87: Unable to integrate problem.

$$\int \frac{x^{-1+2n}}{(c\,\mathrm{LambertW}(a\,x^n))^{5/2}}\,\mathrm{d}x$$

Optimal(type 4, 56 leaves, 2 steps):

$$-\frac{2\,x^{2n}}{n\,(c\,\mathrm{LambertW}(a\,x^n))^{5/2}}+\frac{5\,\mathrm{erfi}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{2\,a^2\,c^{5/2}\,n}$$

Result(type 8, 20 leaves):

$$\int \frac{x^{-1+2n}}{(c\,\mathrm{LambertW}(a\,x^n))^{5/2}}\,\mathrm{d}x$$

Problem 88: Unable to integrate problem.

$$\int \frac{x^{-1+2n}}{(c\,\mathrm{LambertW}(a\,x^n))^{7/2}}\,\mathrm{d}x$$

Optimal(type 4, 79 leaves, 3 steps):

$$-\frac{2\,x^{2n}}{3\,n\,(c\,\mathrm{LambertW}(a\,x^n))^{7/2}}-\frac{14\,x^{2n}}{3\,c\,n\,(c\,\mathrm{LambertW}(a\,x^n))^{5/2}}+\frac{14\,\mathrm{erfi}\left(\frac{\sqrt{2}\,\sqrt{c\,\mathrm{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{3\,a^2\,c^{7/2}\,n}$$

Result(type 8, 20 leaves):

$$\int \frac{x^{-1+2n}}{(c\,\mathrm{LambertW}(a\,x^n))^{7/2}}\,\mathrm{d}x$$

Problem 89: Unable to integrate problem.

$$\int \frac{x^{-1+2n}}{\left(c\,\text{LambertW}(a\,x^n)\right)^{11/2}}\,dx$$

Optimal(type 4, 125 leaves, 5 steps):

$$-\frac{2\,x^{2n}}{7\,n\,\left(c\,\text{LambertW}(a\,x^n)\right)^{11/2}}-\frac{22\,x^{2n}}{35\,c\,n\,\left(c\,\text{LambertW}(a\,x^n)\right)^{9/2}}-\frac{88\,x^{2n}}{105\,c^2\,n\,\left(c\,\text{LambertW}(a\,x^n)\right)^{7/2}}-\frac{352\,x^{2n}}{105\,c^3\,n\,\left(c\,\text{LambertW}(a\,x^n)\right)^{5/2}}$$
$$+\frac{352\,\text{erfi}\left(\frac{\sqrt{2}\,\sqrt{c\,\text{LambertW}(a\,x^n)}}{\sqrt{c}}\right)\sqrt{2}\,\sqrt{\pi}}{105\,a^2\,c^{11/2}\,n}$$

Result(type 8, 20 leaves):

$$\int \frac{x^{-1+2n}}{\left(c\,\text{LambertW}(a\,x^n)\right)^{11/2}}\,dx$$

Problem 90: Unable to integrate problem.

$$\int x^{-1-2n}\,\text{LambertW}(a\,x^n)^3\,dx$$

Optimal(type 4, 41 leaves, 2 steps):

$$-\frac{3\,\text{LambertW}(a\,x^n)^2}{4\,n\,x^{2n}}-\frac{\text{LambertW}(a\,x^n)^3}{2\,n\,x^{2n}}$$

Result(type 8, 18 leaves):

$$\int x^{-1-2n}\,\text{LambertW}(a\,x^n)^3\,dx$$

Problem 91: Unable to integrate problem.

$$\int \frac{x^{-1+2n}}{\text{LambertW}(a\,x^n)}\,dx$$

Optimal(type 4, 37 leaves, 2 steps):

$$\frac{x^{2n}}{4\,n\,\text{LambertW}(a\,x^n)^2}+\frac{x^{2n}}{2\,n\,\text{LambertW}(a\,x^n)}$$

Result(type 8, 18 leaves):

$$\int \frac{x^{-1+2n}}{\text{LambertW}(a\,x^n)}\,dx$$

Problem 93: Unable to integrate problem.

$$\int x^{-1+n(2-p)} \left(c \operatorname{LambertW}\left(a x^{n}\right)\right)^{p} dx$$

Optimal(type 4, 102 leaves, 3 steps):

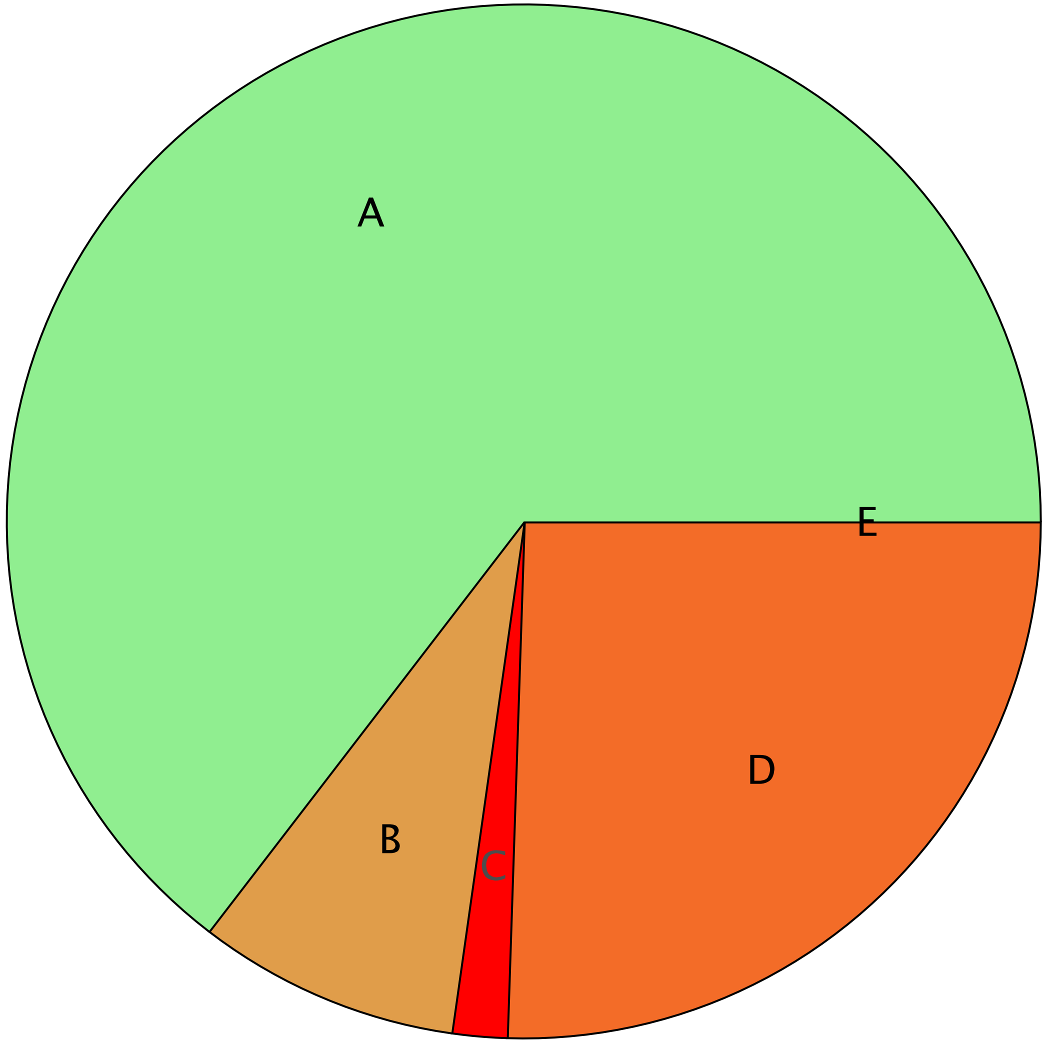
$$\frac{c^{2} p x^{n(2-p)} \left(c \operatorname{LambertW}\left(a x^{n}\right)\right)^{-2+p}}{n(2-p)^{3}}-\frac{c p x^{n(2-p)} \left(c \operatorname{LambertW}\left(a x^{n}\right)\right)^{p-1}}{n(2-p)^{2}}+\frac{x^{n(2-p)} \left(c \operatorname{LambertW}\left(a x^{n}\right)\right)^{p}}{n(2-p)}$$

Result(type 8, 24 leaves):

$$\int x^{-1+n(2-p)} \left(c \operatorname{LambertW}\left(a x^{n}\right)\right)^{p} dx$$

Summary of Integration Test Results

525 integration problems



A - 339 optimal antiderivatives
B - 43 more than twice size of optimal antiderivatives
C - 9 unnecessarily complex antiderivatives
D - 134 unable to integrate problems
E - 0 integration timeouts