Mathematica 11.3 Integration Test Results

Test results for the 27 problems in "6.6.7 (d hyper)^m (a+b (c csch)^n)^p.m"

Problem 2: Result more than twice size of optimal antiderivative.

$$\int \left(a+b\,\mathrm{Csch}[c+d\,x]^2\right)^3 \,dx$$

Optimal (type 3, 74 leaves, 4 steps):

$$a^3 x-\frac{b\left(3a^2-3ab+b^2\right)\mathrm{Coth}[c+d\,x]}{d}-\frac{(3a-2b)\,b^2\,\mathrm{Coth}[c+d\,x]^3}{3d}-\frac{b^3\,\mathrm{Coth}[c+d\,x]^5}{5d}$$

Result (type 3, 266 leaves):

$$-\frac{8b^3\,\mathrm{Cosh}[c+d\,x]\left(a+b\,\mathrm{Csch}[c+d\,x]^2\right)^3\mathrm{Sinh}[c+d\,x]}{5d\left(-a+2b+a\,\mathrm{Cosh}[2(c+d\,x)]\right)^3}-$$
$$\left(8\left(15ab^2\,\mathrm{Cosh}[c+d\,x]-4b^3\,\mathrm{Cosh}[c+d\,x]\right)\left(a+b\,\mathrm{Csch}[c+d\,x]^2\right)^3\mathrm{Sinh}[c+d\,x]^3\right)\Big/$$
$$\left(15d\left(-a+2b+a\,\mathrm{Cosh}[2(c+d\,x)]\right)^3\right)-$$
$$\left(8\left(45a^2b\,\mathrm{Cosh}[c+d\,x]-30ab^2\,\mathrm{Cosh}[c+d\,x]+8b^3\,\mathrm{Cosh}[c+d\,x]\right)\right.$$
$$\left.\left(a+b\,\mathrm{Csch}[c+d\,x]^2\right)^3\mathrm{Sinh}[c+d\,x]^5\right)\Big/\left(15d\left(-a+2b+a\,\mathrm{Cosh}[2(c+d\,x)]\right)^3\right)+$$
$$\frac{8a^3(c+d\,x)\left(a+b\,\mathrm{Csch}[c+d\,x]^2\right)^3\mathrm{Sinh}[c+d\,x]^6}{d\left(-a+2b+a\,\mathrm{Cosh}[2(c+d\,x)]\right)^3}$$

Problem 9: Result unnecessarily involves complex numbers and more than twice size of optimal antiderivative.

$$\int \left(a+b\,\mathrm{Csch}[c+d\,x]^2\right)^{5/2} dx$$

Optimal (type 3, 174 leaves, 8 steps):

$$\frac{a^{5/2}\,\mathrm{ArcTanh}\left[\frac{\sqrt{a}\,\mathrm{Coth}[c+d\,x]}{\sqrt{a-b+b\,\mathrm{Coth}[c+d\,x]^2}}\right]}{d}-\frac{\sqrt{b}\left(15a^2-10ab+3b^2\right)\mathrm{ArcTanh}\left[\frac{\sqrt{b}\,\mathrm{Coth}[c+d\,x]}{\sqrt{a-b+b\,\mathrm{Coth}[c+d\,x]^2}}\right]}{8d}-$$
$$\frac{(7a-3b)\,b\,\mathrm{Coth}[c+d\,x]\sqrt{a-b+b\,\mathrm{Coth}[c+d\,x]^2}}{8d}-\frac{b\,\mathrm{Coth}[c+d\,x]\left(a-b+b\,\mathrm{Coth}[c+d\,x]^2\right)^{3/2}}{4d}$$

Result (type 3, 391 leaves):

$$-\left(\left(\left(-4 a^3+15 a^2 b-10 a b^2+3 b^3\right) \text{ArcTanh}\left[\frac{\sqrt{2}\,\sqrt{b}\,\text{Cosh}[c+d x]}{\sqrt{-a+2 b-a \text{Cos}\left[2\left(\frac{\pi}{2}-\mathrm{i}\,(c+d x)\right)\right]}}\right]\right.\right.$$

$$\left.\left.\left(a+b\,\text{Csch}[c+d x]^2\right)^{5/2} \text{Sinh}[c+d x]^5\right) \Big/ \left(\sqrt{2}\,\sqrt{b}\,d\left(-a+2 b+a \text{Cosh}[2 (c+d x)]\right)^{5/2}\right)\right)+$$

$$\left(\left(a+b\,\text{Csch}[c+d x]^2\right)^{5/2}\left(-\frac{3}{2}\left(3 a b \text{Cosh}[c+d x]-b^2 \text{Cosh}[c+d x]\right) \text{Csch}[c+d x]^2-\right.\right.$$

$$\left.\left. b^2 \text{Coth}[c+d x] \text{Csch}[c+d x]^3\right) \text{Sinh}[c+d x]^5\right) \Big/ \left(d\left(-a+2 b+a \text{Cosh}[2 (c+d x)]\right)^2\right)+$$

$$\left(4 a^3\left(a+b\,\text{Csch}[c+d x]^2\right)^{5/2}\left(-\frac{\text{ArcTanh}\left[\frac{\sqrt{2}\,\sqrt{b}\,\text{Cosh}[c+d x]}{\sqrt{-a+2 b+a \text{Cosh}[2 (c+d x)]}}\right]}{\sqrt{2}\,\sqrt{b}}+\frac{1}{\sqrt{a}}\right.\right.$$

$$\left.\sqrt{2}\,\text{Log}\left[\sqrt{2}\,\sqrt{a}\,\text{Cosh}[c+d x]+\sqrt{-a+2 b+a \text{Cosh}[2 (c+d x)]}\right]\right)$$

$$\left.\text{Sinh}[c+d x]^5\right) \Big/ \left(d\left(-a+2 b+a \text{Cosh}[2 (c+d x)]\right)^{5/2}\right)$$

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

$$\int \frac{1}{\sqrt{a+b\,\text{Csch}[c+d x]^2}}\,dx$$

Optimal (type 3, 38 leaves, 3 steps):

$$\frac{\text{ArcTanh}\left[\frac{\sqrt{a}\,\text{Coth}[c+d x]}{\sqrt{a+b\,\text{Csch}[c+d x]^2}}\right]}{\sqrt{a}\,d}$$

Result (type 3, 97 leaves):

$$\left(\sqrt{-a+2 b+a \text{Cosh}[2 (c+d x)]}\,\text{Csch}[c+d x]\right.$$

$$\left.\text{Log}\left[\sqrt{2}\,\sqrt{a}\,\text{Cosh}[c+d x]+\sqrt{-a+2 b+a \text{Cosh}[2 (c+d x)]}\right]\right) \Big/$$

$$\left(\sqrt{2}\,\sqrt{a}\,d\,\sqrt{a+b\,\text{Csch}[c+d x]^2}\right)$$

Problem 20: Result more than twice size of optimal antiderivative.

$$\int \sqrt{1-\text{Csch}[x]^2}\, dx$$

Optimal (type 3, 26 leaves, 5 steps):

$$\text{ArcSin}\left[\frac{\text{Coth}[x]}{\sqrt{2}}\right]+\text{ArcTanh}\left[\frac{\text{Coth}[x]}{\sqrt{2-\text{Coth}[x]^2}}\right]$$

Result (type 3, 65 leaves):

$$\frac{1}{\sqrt{-3+\text{Cosh}[2x]}}\sqrt{2-2\,\text{Csch}[x]^2}\left(\text{ArcTan}\left[\frac{\sqrt{2}\,\text{Cosh}[x]}{\sqrt{-3+\text{Cosh}[2x]}}\right]+\text{Log}\left[\sqrt{2}\,\text{Cosh}[x]+\sqrt{-3+\text{Cosh}[2x]}\right]\right)\text{Sinh}[x]$$

Problem 21: Result more than twice size of optimal antiderivative.

$$\int \frac{1}{\sqrt{1-\text{Csch}[x]^2}}\, dx$$

Optimal (type 3, 16 leaves, 3 steps):

$$\text{ArcTanh}\left[\frac{\text{Coth}[x]}{\sqrt{2-\text{Coth}[x]^2}}\right]$$

Result (type 3, 45 leaves):

$$\frac{\sqrt{-3+\text{Cosh}[2x]}\,\text{Csch}[x]\,\text{Log}\left[\sqrt{2}\,\text{Cosh}[x]+\sqrt{-3+\text{Cosh}[2x]}\right]}{\sqrt{2-2\,\text{Csch}[x]^2}}$$

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

$$\int \sqrt{-1+\text{Csch}[x]^2}\, dx$$

Optimal (type 3, 33 leaves, 6 steps):

$$-\text{ArcTan}\left[\frac{\text{Coth}[x]}{\sqrt{-2+\text{Coth}[x]^2}}\right]-\text{ArcTanh}\left[\frac{\text{Coth}[x]}{\sqrt{-2+\text{Coth}[x]^2}}\right]$$

Result (type 3, 68 leaves):

$$\left(\sqrt{2}\,\sqrt{-1+\text{Csch}[x]^2}\left(\text{ArcTan}\left[\frac{\sqrt{2}\,\text{Cosh}[x]}{\sqrt{-3+\text{Cosh}[2x]}}\right]+\text{Log}\left[\sqrt{2}\,\text{Cosh}[x]+\sqrt{-3+\text{Cosh}[2x]}\right]\right)\text{Sinh}[x]\right)\Big/\left(\sqrt{-3+\text{Cosh}[2x]}\right)$$

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

$$\int \frac{1}{\sqrt{-1+\text{Csch}[x]^2}} \, dx$$

Optimal (type 3, 14 leaves, 3 steps):

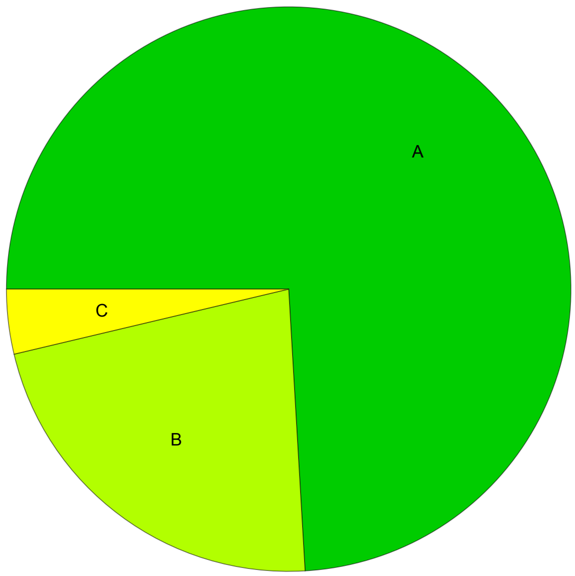
$$\text{ArcTan}\left[\frac{\text{Coth}[x]}{\sqrt{-2+\text{Coth}[x]^2}}\right]$$

Result (type 3, 48 leaves):

$$\frac{\sqrt{-3+\text{Cosh}[2x]}\ \text{Csch}[x]\ \text{Log}\left[\sqrt{2}\ \text{Cosh}[x]+\sqrt{-3+\text{Cosh}[2x]}\right]}{\sqrt{2}\ \sqrt{-1+\text{Csch}[x]^2}}$$

Summary of Integration Test Results

27 integration problems



A - 20 optimal antiderivatives

B - 6 more than twice size of optimal antiderivatives

C - 1 unnecessarily complex antiderivatives

D - 0 unable to integrate problems

E - 0 integration timeouts