Mathematica 11.3 Integration Test Results

Test results for the 68 problems in "6.2.3 (e x)^m (a+b cosh(c+d x^n))^p.m"

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

$$\int x \operatorname{Cosh}\left[a+b x^2\right] \, dx$$

Optimal (type 3, 15 leaves, 2 steps):

$$\frac{\operatorname{Sinh}\left[a+b x^2\right]}{2 b}$$

Result (type 3, 31 leaves):

$$\frac{\operatorname{Cosh}\left[b x^2\right] \operatorname{Sinh}[a]}{2 b}+\frac{\operatorname{Cosh}[a] \operatorname{Sinh}\left[b x^2\right]}{2 b}$$

Problem 67: Result is not expressed in closed-form.

$$\int \frac{\operatorname{Cosh}\left[a+b (c+d x)^{1/3}\right]}{x} \, dx$$

Optimal (type 4, 232 leaves, 13 steps):

$$\operatorname{Cosh}\left[a+b c^{1/3}\right] \operatorname{CoshIntegral}\left[b \left(c^{1/3}-(c+d x)^{1/3}\right)\right]+$$
$$\operatorname{Cosh}\left[a+(-1)^{2/3} b c^{1/3}\right] \operatorname{CoshIntegral}\left[-b \left((-1)^{2/3} c^{1/3}-(c+d x)^{1/3}\right)\right]+$$
$$\operatorname{Cosh}\left[a-(-1)^{1/3} b c^{1/3}\right] \operatorname{CoshIntegral}\left[b \left((-1)^{1/3} c^{1/3}+(c+d x)^{1/3}\right)\right]-$$
$$\operatorname{Sinh}\left[a+b c^{1/3}\right] \operatorname{SinhIntegral}\left[b \left(c^{1/3}-(c+d x)^{1/3}\right)\right]-$$
$$\operatorname{Sinh}\left[a+(-1)^{2/3} b c^{1/3}\right] \operatorname{SinhIntegral}\left[b \left((-1)^{2/3} c^{1/3}-(c+d x)^{1/3}\right)\right]+$$
$$\operatorname{Sinh}\left[a-(-1)^{1/3} b c^{1/3}\right] \operatorname{SinhIntegral}\left[b \left((-1)^{1/3} c^{1/3}+(c+d x)^{1/3}\right)\right]$$

Result (type 7, 231 leaves):

$$\frac{1}{2}\left(\text{RootSum}\left[c-\#1^3\,\&,\ \text{Cosh}[a+b\,\#1]\,\text{CoshIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]-\text{CoshIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]\text{Sinh}[a+b\,\#1]-\text{Cosh}[a+b\,\#1]\,\text{SinhIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]+\text{Sinh}[a+b\,\#1]\,\text{SinhIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]\,\&\right]+\text{RootSum}\left[c-\#1^3\,\&,\ \text{Cosh}[a+b\,\#1]\,\text{CoshIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]+\text{CoshIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]\text{Sinh}[a+b\,\#1]+\text{Cosh}[a+b\,\#1]\,\text{SinhIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]+\text{Sinh}[a+b\,\#1]\,\text{SinhIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]\,\&\right]\right)$$

Problem 68: Result is not expressed in closed-form.

$$\int\frac{\text{Cosh}\left[a+b\,(c+d\,x)^{1/3}\right]}{x^2}\,dx$$

Optimal (type 4, 329 leaves, 14 steps):

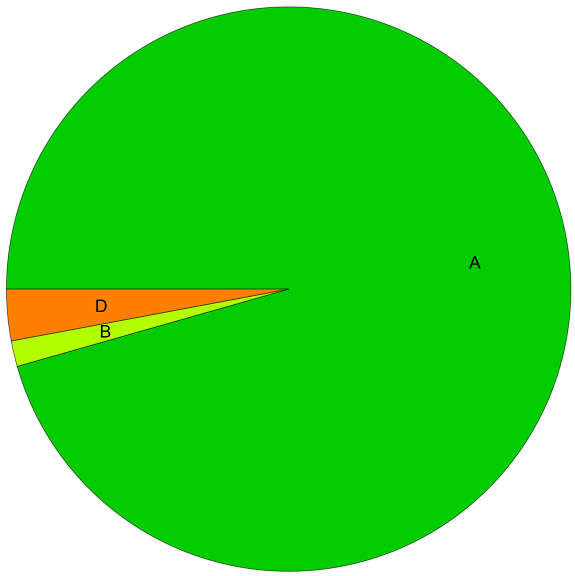
$$-\frac{\text{Cosh}\left[a+b\,(c+d\,x)^{1/3}\right]}{x}+\frac{b\,d\,\text{CoshIntegral}\left[b\left(c^{1/3}-(c+d\,x)^{1/3}\right)\right]\text{Sinh}\left[a+b\,c^{1/3}\right]}{3\,c^{2/3}}-\frac{1}{3\,c^{2/3}}(-1)^{1/3}\,b\,d\,\text{CoshIntegral}\left[b\left((-1)^{1/3}c^{1/3}+(c+d\,x)^{1/3}\right)\right]\text{Sinh}\left[a-(-1)^{1/3}b\,c^{1/3}\right]+\frac{1}{3\,c^{2/3}}(-1)^{2/3}\,b\,d\,\text{CoshIntegral}\left[-b\left((-1)^{2/3}c^{1/3}-(c+d\,x)^{1/3}\right)\right]\text{Sinh}\left[a+(-1)^{2/3}b\,c^{1/3}\right]-\frac{b\,d\,\text{Cosh}\left[a+b\,c^{1/3}\right]\text{SinhIntegral}\left[b\left(c^{1/3}-(c+d\,x)^{1/3}\right)\right]}{3\,c^{2/3}}-\frac{1}{3\,c^{2/3}}(-1)^{2/3}\,b\,d\,\text{Cosh}\left[a+(-1)^{2/3}b\,c^{1/3}\right]\text{SinhIntegral}\left[b\left((-1)^{2/3}c^{1/3}-(c+d\,x)^{1/3}\right)\right]-\frac{1}{3\,c^{2/3}}(-1)^{1/3}\,b\,d\,\text{Cosh}\left[a-(-1)^{1/3}b\,c^{1/3}\right]\text{SinhIntegral}\left[b\left((-1)^{1/3}c^{1/3}+(c+d\,x)^{1/3}\right)\right]$$

Result (type 7, 211 leaves):

$$\frac{1}{6\,x}\left(b\,d\,x\,\text{RootSum}\left[c-\#1^3\,\&,\ \frac{e^{a+b\,\#1}\,\text{ExpIntegralEi}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]}{\#1^2}\,\&\right]+e^{-a}\left(-3\,e^{-b\,(c+d\,x)^{1/3}}\left(1+e^{2\left(a+b\,(c+d\,x)^{1/3}\right)}\right)-b\,d\,x\,\text{RootSum}\left[c-\#1^3\,\&,\ \frac{1}{\#1^2}\left(\text{Cosh}[b\,\#1]\,\text{CoshIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]-\text{CoshIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]\text{Sinh}[b\,\#1]-\text{Cosh}[b\,\#1]\,\text{SinhIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]+\text{Sinh}[b\,\#1]\,\text{SinhIntegral}\left[b\left((c+d\,x)^{1/3}-\#1\right)\right]\right)\&\right]\right)\right)$$

Summary of Integration Test Results

68 integration problems



A - 65 optimal antiderivatives

B - 1 more than twice size of optimal antiderivatives

C - 0 unnecessarily complex antiderivatives

D - 2 unable to integrate problems

E - 0 integration timeouts