Mathematica 11.3 Integration Test Results

Test results for the 62 problems in "4.2.1.1 (a+b cos)^n.m"

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

$$\int \frac{1}{(3+5\,\mathrm{Cos}[c+d\,x])^4}\,dx$$

Optimal (type 3, 140 leaves, 6 steps):

$$\frac{279\,\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]-\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]}{32768\,d}-\frac{279\,\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]+\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]}{32768\,d}+\frac{5\,\mathrm{Sin}[c+d\,x]}{48\,d\,(3+5\,\mathrm{Cos}[c+d\,x])^3}-\frac{25\,\mathrm{Sin}[c+d\,x]}{512\,d\,(3+5\,\mathrm{Cos}[c+d\,x])^2}+\frac{995\,\mathrm{Sin}[c+d\,x]}{24576\,d\,(3+5\,\mathrm{Cos}[c+d\,x])}$$

Result (type 3, 296 leaves):

$$\frac{1}{393216\,d\,(3+5\,\mathrm{Cos}[c+d\,x])^3}\Bigg(467046\,\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]-\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]+104625\,\mathrm{Cos}[3\,(c+d\,x)]\,\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]-\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]+765855\,\mathrm{Cos}[c+d\,x]\left(\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]-\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]-\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]+\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]\right)+376650\,\mathrm{Cos}[2\,(c+d\,x)]\left(\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]-\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]-\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]+\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]\right)-467046\,\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]+\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]-104625\,\mathrm{Cos}[3\,(c+d\,x)]\,\mathrm{Log}\left[2\,\mathrm{Cos}\left[\frac{1}{2}(c+d\,x)\right]+\mathrm{Sin}\left[\frac{1}{2}(c+d\,x)\right]\right]+226140\,\mathrm{Sin}[c+d\,x]+190800\,\mathrm{Sin}[2\,(c+d\,x)]+99500\,\mathrm{Sin}[3\,(c+d\,x)]\Bigg)$$

Problem 41: Result more than twice size of optimal antiderivative.

$$\int \frac{1}{(3-5\,\mathrm{Cos}[c+d\,x])^4}\,dx$$

Optimal (type 3, 138 leaves, 6 steps):

$$-\frac{279\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]-2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]}{32768\,d}+\frac{279\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]+2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]}{32768\,d}-\frac{5\,\text{Sin}[c+d x]}{48\,d\,(3-5\,\text{Cos}[c+d x])^3}+\frac{25\,\text{Sin}[c+d x]}{512\,d\,(3-5\,\text{Cos}[c+d x])^2}-\frac{995\,\text{Sin}[c+d x]}{24576\,d\,(3-5\,\text{Cos}[c+d x])}$$

Result (type 3, 288 leaves):

$$\frac{1}{393216\,d\,(-3+5\,\text{Cos}[c+d x])^3}\Bigg(467046\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]-2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]-104625\,\text{Cos}[3(c+d x)]\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]-2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]-765855\,\text{Cos}[c+d x]\left(\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]-2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]-\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]+2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]\right)+376650\,\text{Cos}[2(c+d x)]\left(\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]-2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]-\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]+2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]\right)-467046\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]+2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]+104625\,\text{Cos}[3(c+d x)]\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]+2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]+226140\,\text{Sin}[c+d x]-190800\,\text{Sin}[2(c+d x)]+99500\,\text{Sin}[3(c+d x)]\Bigg)$$

Problem 45: Result more than twice size of optimal antiderivative.

$$\int\frac{1}{(-3+5\,\text{Cos}[c+d x])^4}\,dx$$

Optimal (type 3, 138 leaves, 6 steps):

$$-\frac{279\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]-2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]}{32768\,d}+\frac{279\,\text{Log}\left[\text{Cos}\left[\frac{1}{2}(c+d x)\right]+2\,\text{Sin}\left[\frac{1}{2}(c+d x)\right]\right]}{32768\,d}-\frac{5\,\text{Sin}[c+d x]}{48\,d\,(3-5\,\text{Cos}[c+d x])^3}+\frac{25\,\text{Sin}[c+d x]}{512\,d\,(3-5\,\text{Cos}[c+d x])^2}-\frac{995\,\text{Sin}[c+d x]}{24576\,d\,(3-5\,\text{Cos}[c+d x])}$$

Result (type 3, 288 leaves):

$$\frac{1}{393216\, d\, (-3+5\, \text{Cos}[c+d\, x])^3}\Big(467046\, \text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-$$
$$104625\, \text{Cos}[3(c+d\, x)]\, \text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-$$
$$765855\, \text{Cos}[c+d\, x]\,\Big(\text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-$$
$$\text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]\Big)+376650\, \text{Cos}[2(c+d\, x)]$$
$$\Big(\text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-\text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]\Big)-$$
$$467046\, \text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]+$$
$$104625\, \text{Cos}[3(c+d\, x)]\, \text{Log}\big[\text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+2\, \text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]+$$
$$226140\, \text{Sin}[c+d\, x]-190800\, \text{Sin}[2(c+d\, x)]+99500\, \text{Sin}[3(c+d\, x)]\Big)$$

Problem 49: Result more than twice size of optimal antiderivative.

$$\int \frac{1}{(-3-5\, \text{Cos}[c+d\, x])^4}\, dx$$

Optimal (type 3, 140 leaves, 6 steps):

$$\frac{279\, \text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]}{32768\, d}-\frac{279\, \text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]}{32768\, d}+$$
$$\frac{5\, \text{Sin}[c+d\, x]}{48\, d\, (3+5\, \text{Cos}[c+d\, x])^3}-\frac{25\, \text{Sin}[c+d\, x]}{512\, d\, (3+5\, \text{Cos}[c+d\, x])^2}+\frac{995\, \text{Sin}[c+d\, x]}{24576\, d\, (3+5\, \text{Cos}[c+d\, x])}$$

Result (type 3, 296 leaves):

$$\frac{1}{393216\, d\, (3+5\, \text{Cos}[c+d\, x])^3}\Big(467046\, \text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]+$$
$$104625\, \text{Cos}[3(c+d\, x)]\, \text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]+$$
$$765855\, \text{Cos}[c+d\, x]\,\Big(\text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-$$
$$\text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]\Big)+376650\, \text{Cos}[2(c+d\, x)]$$
$$\Big(\text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]-\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-\text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]\Big)-$$
$$467046\, \text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]-$$
$$104625\, \text{Cos}[3(c+d\, x)]\, \text{Log}\big[2\, \text{Cos}\big[\tfrac{1}{2}(c+d\, x)\big]+\text{Sin}\big[\tfrac{1}{2}(c+d\, x)\big]\big]+$$
$$226140\, \text{Sin}[c+d\, x]+190800\, \text{Sin}[2(c+d\, x)]+99500\, \text{Sin}[3(c+d\, x)]\Big)$$

Problem 56: Result more than twice size of optimal antiderivative.

$$\int (a + b \operatorname{Cos}[c + d x])^{4/3} \, dx$$

Optimal (type 6, 108 leaves, 3 steps):

$$\left(\sqrt{2}\ (a+b)\ \text{AppellF1}\left[\frac{1}{2}, \frac{1}{2}, -\frac{4}{3}, \frac{3}{2}, \frac{1}{2}\ (1-\operatorname{Cos}[c+d x]), \frac{b\ (1-\operatorname{Cos}[c+d x])}{a+b}\right] (a+b \operatorname{Cos}[c+d x])^{1/3} \operatorname{Sin}[c+d x]\right) \Big/ \left(d \sqrt{1+\operatorname{Cos}[c+d x]}\ \left(\frac{a+b \operatorname{Cos}[c+d x]}{a+b}\right)^{1/3}\right)$$

Result (type 6, 246 leaves):

$$-\frac{1}{16 b d} 3\ (a+b \operatorname{Cos}[c+d x])^{1/3} \operatorname{Csc}[c+d x] \left(4\ (-a^2+b^2)\ \text{AppellF1}\left[\frac{1}{3}, \frac{1}{2}, \frac{1}{2}, \frac{4}{3}, \frac{a+b \operatorname{Cos}[c+d x]}{a-b}, \frac{a+b \operatorname{Cos}[c+d x]}{a+b}\right] \sqrt{-\frac{b\ (-1+\operatorname{Cos}[c+d x])}{a+b}} \sqrt{-\frac{b\ (1+\operatorname{Cos}[c+d x])}{a-b}} + 5 a\ \text{AppellF1}\left[\frac{4}{3}, \frac{1}{2}, \frac{1}{2}, \frac{7}{3}, \frac{a+b \operatorname{Cos}[c+d x]}{a-b}, \frac{a+b \operatorname{Cos}[c+d x]}{a+b}\right] \sqrt{-\frac{b\ (-1+\operatorname{Cos}[c+d x])}{a+b}} \sqrt{-\frac{b\ (1+\operatorname{Cos}[c+d x])}{a-b}}\ (a+b \operatorname{Cos}[c+d x]) - 4 b^2 \operatorname{Sin}[c+d x]^2\right)$$

Problem 61: Result more than twice size of optimal antiderivative.

$$\int \frac{1}{(a + b \operatorname{Cos}[c + d x])^{4/3}} \, dx$$

Optimal (type 6, 110 leaves, 3 steps):

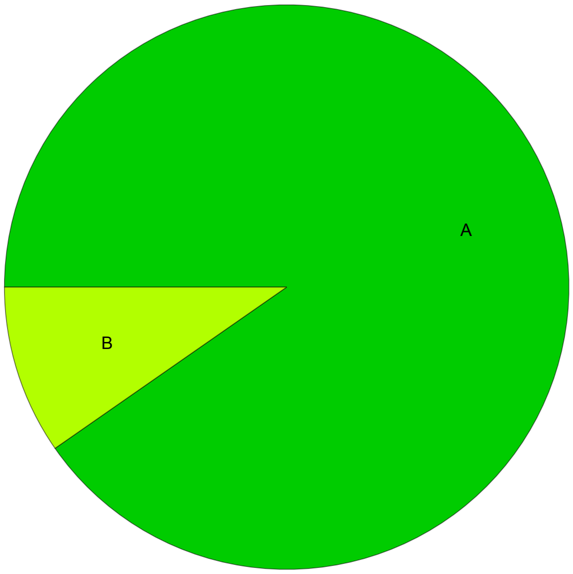
$$\frac{\sqrt{2}\ \text{AppellF1}\left[\frac{1}{2}, \frac{1}{2}, \frac{4}{3}, \frac{3}{2}, \frac{1}{2}\ (1-\operatorname{Cos}[c+d x]), \frac{b\ (1-\operatorname{Cos}[c+d x])}{a+b}\right] \left(\frac{a+b \operatorname{Cos}[c+d x]}{a+b}\right)^{1/3} \operatorname{Sin}[c+d x]}{(a+b)\ d \sqrt{1+\operatorname{Cos}[c+d x]}\ (a+b \operatorname{Cos}[c+d x])^{1/3}}$$

Result (type 6, 268 leaves):

$$\left(15\, a\, \text{AppellF1}\left[\frac{2}{3},\frac{1}{2},\frac{1}{2},\frac{5}{3},\frac{a+b\,\text{Cos}[c+d\,x]}{a-b},\frac{a+b\,\text{Cos}[c+d\,x]}{a+b}\right] \sqrt{-\frac{b\,(-1+\text{Cos}[c+d\,x])}{a+b}}\,\sqrt{-\frac{b\,(1+\text{Cos}[c+d\,x])}{a-b}}\,(a+b\,\text{Cos}[c+d\,x])\,\text{Csc}[c+d\,x]-6\left(5\,b^2+2\,\text{AppellF1}\left[\frac{5}{3},\frac{1}{2},\frac{1}{2},\frac{8}{3},\frac{a+b\,\text{Cos}[c+d\,x]}{a-b},\frac{a+b\,\text{Cos}[c+d\,x]}{a+b}\right]\sqrt{-\frac{b\,(-1+\text{Cos}[c+d\,x])}{a+b}}\,\sqrt{\frac{b\,(1+\text{Cos}[c+d\,x])}{-a+b}}\,(a+b\,\text{Cos}[c+d\,x])^2\,\text{Csc}[c+d\,x]^2\right)\text{Sin}[c+d\,x]\right)\Big/\left(10\,b\,(a^2-b^2)\,d\,(a+b\,\text{Cos}[c+d\,x])^{1/3}\right)$$

Summary of Integration Test Results

62 integration problems



A - 56 optimal antiderivatives

B - 6 more than twice size of optimal antiderivatives

C - 0 unnecessarily complex antiderivatives

D - 0 unable to integrate problems

E - 0 integration timeouts