Mathematica 11.3 Integration Test Results

Test results for the 22 problems in "4.2.1.3 (g tan)^p (a+b cos)^m.m"

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

$$\int \frac{\text{Tan}[x]^4}{a + a\,\text{Cos}[x]}\,dx$$

Optimal (type 3, 33 leaves, 5 steps):

$$\frac{\text{ArcTanh}[\text{Sin}[x]]}{2\,a} - \frac{\text{Sec}[x]\,\text{Tan}[x]}{2\,a} + \frac{\text{Tan}[x]^3}{3\,a}$$

Result (type 3, 105 leaves):

$$-\frac{1}{24\,a}\text{Sec}[x]^3 \left(9\,\text{Cos}[x]\left(\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right] - \text{Sin}\left[\frac{x}{2}\right]\right] - \text{Log}\left[\text{Cos}\left[\frac{x}{2}\right] + \text{Sin}\left[\frac{x}{2}\right]\right]\right) + 3\,\text{Cos}[3\,x] \left(\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right] - \text{Sin}\left[\frac{x}{2}\right]\right] - \text{Log}\left[\text{Cos}\left[\frac{x}{2}\right] + \text{Sin}\left[\frac{x}{2}\right]\right]\right) + 2\left(-3\,\text{Sin}[x] + 3\,\text{Sin}[2\,x] + \text{Sin}[3\,x]\right)\right)$$

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

$$\int \frac{\text{Tan}[x]^2}{a + a\,\text{Cos}[x]}\,dx$$

Optimal (type 3, 15 leaves, 4 steps):

$$-\frac{\text{ArcTanh}[\text{Sin}[x]]}{a} + \frac{\text{Tan}[x]}{a}$$

Result (type 3, 39 leaves):

$$\frac{\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right] - \text{Sin}\left[\frac{x}{2}\right]\right] - \text{Log}\left[\text{Cos}\left[\frac{x}{2}\right] + \text{Sin}\left[\frac{x}{2}\right]\right] + \text{Tan}[x]}{a}$$

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

$$\int \sqrt{a + b\,\text{Cos}[x]}\;\text{Tan}[x]\,dx$$

Optimal (type 3, 37 leaves, 4 steps):

$$2\sqrt{a}\;\text{ArcTanh}\left[\frac{\sqrt{a + b\,\text{Cos}[x]}}{\sqrt{a}}\right] - 2\sqrt{a + b\,\text{Cos}[x]}$$

Result (type 3, 75 leaves):

$$-\frac{1}{2\sqrt{a+b\,\text{Cos}[x]}}\frac{1}{b+a\,\text{Sec}[x]}\left(b+a\,\text{Sec}[x]-\sqrt{a}\,\sqrt{b}\,\text{ArcSinh}\left[\frac{\sqrt{a}\,\sqrt{\text{Sec}[x]}}{\sqrt{b}}\right]\sqrt{\text{Sec}[x]}\,\sqrt{1+\frac{a\,\text{Sec}[x]}{b}}\right)$$

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

$$\int\frac{\text{Tan}[x]}{\sqrt{a+b\,\text{Cos}[x]}}\,dx$$

Optimal (type 3, 24 leaves, 3 steps):

$$\frac{2\,\text{ArcTanh}\left[\frac{\sqrt{a+b\,\text{Cos}[x]}}{\sqrt{a}}\right]}{\sqrt{a}}$$

Result (type 3, 60 leaves):

$$\frac{2\sqrt{b}\,\text{ArcSinh}\left[\frac{\sqrt{a}\,\sqrt{\text{Sec}[x]}}{\sqrt{b}}\right]\sqrt{\frac{b+a\,\text{Sec}[x]}{b}}}{\sqrt{a}\,\sqrt{a+b\,\text{Cos}[x]}\,\sqrt{\text{Sec}[x]}}$$

Problem 21: Result unnecessarily involves higher level functions and more than twice size of optimal antiderivative.

$$\int\frac{\sqrt{e\,\text{Tan}[c+d\,x]}}{a+b\,\text{Cos}[c+d\,x]}\,dx$$

Optimal (type 4, 204 leaves, 9 steps):

$$-\left(\left(2\sqrt{2}\,\sqrt{\text{Cos}[c+d\,x]}\,\text{EllipticPi}\left[-\frac{\sqrt{-a+b}}{\sqrt{a+b}},\text{ArcSin}\left[\frac{\sqrt{\text{Sin}[c+d\,x]}}{\sqrt{1+\text{Cos}[c+d\,x]}}\right],-1\right]\sqrt{e\,\text{Tan}[c+d\,x]}\right)\Big/\left(\sqrt{-a+b}\,\sqrt{a+b}\,d\,\sqrt{\text{Sin}[c+d\,x]}\right)\right)+\left(2\sqrt{2}\,\sqrt{\text{Cos}[c+d\,x]}\,\text{EllipticPi}\left[\frac{\sqrt{-a+b}}{\sqrt{a+b}},\text{ArcSin}\left[\frac{\sqrt{\text{Sin}[c+d\,x]}}{\sqrt{1+\text{Cos}[c+d\,x]}}\right],-1\right]\sqrt{e\,\text{Tan}[c+d\,x]}\right)\Big/\left(\sqrt{-a+b}\,\sqrt{a+b}\,d\,\sqrt{\text{Sin}[c+d\,x]}\right)$$

Result (type 6, 584 leaves):

$$\frac{1}{d\,\left(a+b\,\mathrm{Cos}[c+d\,x]\right)\,\sqrt{\mathrm{Tan}[c+d\,x]}\,\left(1+\mathrm{Tan}[c+d\,x]^2\right)^{3/2}}$$

$$2\,\mathrm{Sec}[c+d\,x]^2\,\sqrt{e\,\mathrm{Tan}[c+d\,x]}\,\left(b+a\,\sqrt{1+\mathrm{Tan}[c+d\,x]^2}\right)$$

$$\left(\left(-2\,\mathrm{ArcTan}\left[1-\frac{\sqrt{2}\,\sqrt{a}\,\sqrt{\mathrm{Tan}[c+d\,x]}}{\left(a^2-b^2\right)^{1/4}}\right]+2\,\mathrm{ArcTan}\left[1+\frac{\sqrt{2}\,\sqrt{a}\,\sqrt{\mathrm{Tan}[c+d\,x]}}{\left(a^2-b^2\right)^{1/4}}\right]+\right.\right.$$

$$\mathrm{Log}\left[\sqrt{a^2-b^2}-\sqrt{2}\,\sqrt{a}\,\left(a^2-b^2\right)^{1/4}\sqrt{\mathrm{Tan}[c+d\,x]}+a\,\mathrm{Tan}[c+d\,x]\right]-\mathrm{Log}\left[\sqrt{a^2-b^2}+\right.$$

$$\left.\left.\sqrt{2}\,\sqrt{a}\,\left(a^2-b^2\right)^{1/4}\sqrt{\mathrm{Tan}[c+d\,x]}+a\,\mathrm{Tan}[c+d\,x]\right]\right)\Big/\left(4\,\sqrt{2}\,\sqrt{a}\,\left(a^2-b^2\right)^{1/4}\right)+$$

$$\left(7\,b\,\left(a^2-b^2\right)\,\mathrm{AppellF1}\left[\frac{3}{4},\,\frac{1}{2},\,1,\,\frac{7}{4},\,-\mathrm{Tan}[c+d\,x]^2,\,-\frac{a^2\,\mathrm{Tan}[c+d\,x]^2}{a^2-b^2}\right]\,\mathrm{Tan}[c+d\,x]^{3/2}\right)\Big/$$

$$\left(3\,\sqrt{1+\mathrm{Tan}[c+d\,x]^2}\right.$$

$$\left(-7\,\left(a^2-b^2\right)\,\mathrm{AppellF1}\left[\frac{3}{4},\,\frac{1}{2},\,1,\,\frac{7}{4},\,-\mathrm{Tan}[c+d\,x]^2,\,-\frac{a^2\,\mathrm{Tan}[c+d\,x]^2}{a^2-b^2}\right]+\right.$$

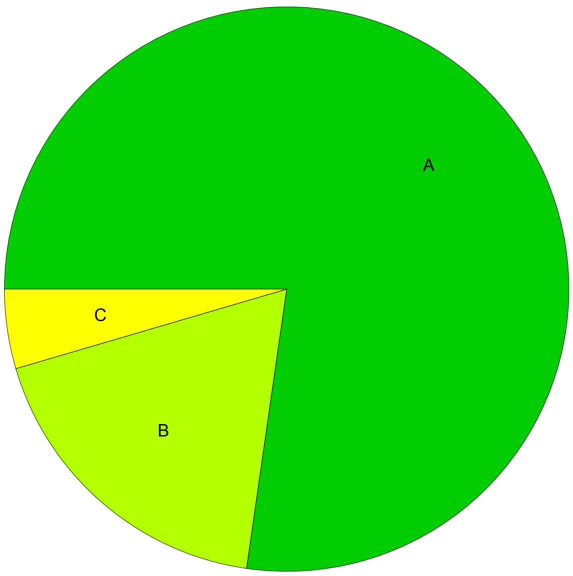
$$2\,\left(2\,a^2\,\mathrm{AppellF1}\left[\frac{7}{4},\,\frac{1}{2},\,2,\,\frac{11}{4},\,-\mathrm{Tan}[c+d\,x]^2,\,-\frac{a^2\,\mathrm{Tan}[c+d\,x]^2}{a^2-b^2}\right]+\right.$$

$$\left.\left(a^2-b^2\right)\,\mathrm{AppellF1}\left[\frac{7}{4},\,\frac{3}{2},\,1,\,\frac{11}{4},\,-\mathrm{Tan}[c+d\,x]^2,\,-\frac{a^2\,\mathrm{Tan}[c+d\,x]^2}{a^2-b^2}\right]\right)$$

$$\left.\left.\left.\mathrm{Tan}[c+d\,x]^2\right)\,\left(-b^2+a^2\,\left(1+\mathrm{Tan}[c+d\,x]^2\right)\right)\right)\right)$$

Summary of Integration Test Results

22 integration problems



A - 17 optimal antiderivatives

B - 4 more than twice size of optimal antiderivatives

C - 1 unnecessarily complex antiderivatives

D - 0 unable to integrate problems

E - 0 integration timeouts