Mathematica 11.3 Integration Test Results

Test results for the 9 problems in "4.7.4 x^m (a+b trig^n)^p.m"

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

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

Optimal (type 4, 203 leaves, 9 steps):

$$-\frac{i\,x\,\text{Log}\left[1-\frac{b\,e^{2\,i\,x}}{2\,a+b-2\,\sqrt{a}\,\sqrt{a+b}}\right]}{2\,\sqrt{a}\,\sqrt{a+b}}+\frac{i\,x\,\text{Log}\left[1-\frac{b\,e^{2\,i\,x}}{2\,a+b+2\,\sqrt{a}\,\sqrt{a+b}}\right]}{2\,\sqrt{a}\,\sqrt{a+b}}-\frac{\text{PolyLog}\left[2,\frac{b\,e^{2\,i\,x}}{2\,a+b-2\,\sqrt{a}\,\sqrt{a+b}}\right]}{4\,\sqrt{a}\,\sqrt{a+b}}+\frac{\text{PolyLog}\left[2,\frac{b\,e^{2\,i\,x}}{2\,a+b+2\,\sqrt{a}\,\sqrt{a+b}}\right]}{4\,\sqrt{a}\,\sqrt{a+b}}$$

Result (type 4, 545 leaves):

$$\frac{1}{4\sqrt{-a\,(a+b)}}\left(4\,x\,\mathrm{ArcTanh}\left[\frac{a\,\mathrm{Cot}[x]}{\sqrt{-a\,(a+b)}}\right]-2\,\mathrm{ArcCos}\left[1+\frac{2\,a}{b}\right]\,\mathrm{ArcTanh}\left[\frac{\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]}{a}\right]+\right.$$

$$\left(\mathrm{ArcCos}\left[1+\frac{2\,a}{b}\right]-2\,i\,\mathrm{ArcTanh}\left[\frac{a\,\mathrm{Cot}[x]}{\sqrt{-a\,(a+b)}}\right]+2\,i\,\mathrm{ArcTanh}\left[\frac{\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]}{a}\right]\right)$$

$$\mathrm{Log}\left[\frac{\sqrt{2}\,\sqrt{-a\,(a+b)}\,e^{-i\,x}}{\sqrt{-b}\,\sqrt{2\,a+b-b\,\mathrm{Cos}[2\,x]}}\right]+$$

$$\left(\mathrm{ArcCos}\left[1+\frac{2\,a}{b}\right]+2\,i\,\left(\mathrm{ArcTanh}\left[\frac{a\,\mathrm{Cot}[x]}{\sqrt{-a\,(a+b)}}\right]-\mathrm{ArcTanh}\left[\frac{\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]}{a}\right]\right)\right)$$

$$\mathrm{Log}\left[\frac{\sqrt{2}\,\sqrt{-a\,(a+b)}\,e^{i\,x}}{\sqrt{-b}\,\sqrt{2\,a+b-b\,\mathrm{Cos}[2\,x]}}\right]-\left(\mathrm{ArcCos}\left[1+\frac{2\,a}{b}\right]+2\,i\,\mathrm{ArcTanh}\left[\frac{\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]}{a}\right]\right)$$

$$\mathrm{Log}\left[\frac{2\,a\,\left(a+b-i\,\sqrt{-a\,(a+b)}\right)\,(1-i\,\mathrm{Tan}[x])}{b\,\left(a+\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]\right)}\right]-$$

$$\left(\mathrm{ArcCos}\left[1+\frac{2\,a}{b}\right]-2\,i\,\mathrm{ArcTanh}\left[\frac{\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]}{a}\right]\right)$$

$$\mathrm{Log}\left[\frac{2\,a\,\left(a+b+i\,\sqrt{-a\,(a+b)}\right)\,(1+i\,\mathrm{Tan}[x])}{b\,\left(a+\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]\right)}\right]+$$

$$i\,\left(\mathrm{PolyLog}\left[2,\frac{\left(2\,a+b-2\,i\,\sqrt{-a\,(a+b)}\right)\,\left(-a+\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]\right)}{b\,\left(a+\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]\right)}\right]-\right.$$

$$\left.\left.\mathrm{PolyLog}\left[2,\frac{\left(2\,a+b+2\,i\,\sqrt{-a\,(a+b)}\right)\,\left(-a+\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]\right)}{b\,\left(a+\sqrt{-a\,(a+b)}\,\mathrm{Tan}[x]\right)}\right]\right)\right)$$

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

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

Optimal (type 4, 203 leaves, 9 steps):

$$-\frac{i\, x\, \text{Log}\left[1+\frac{b\, e^{2 i x}}{2 a+b-2 \sqrt{a} \sqrt{a+b}}\right]}{2 \sqrt{a} \sqrt{a+b}}+\frac{i\, x\, \text{Log}\left[1+\frac{b\, e^{2 i x}}{2 a+b+2 \sqrt{a} \sqrt{a+b}}\right]}{2 \sqrt{a} \sqrt{a+b}}-\frac{\text{PolyLog}\left[2,-\frac{b\, e^{2 i x}}{2 a+b-2 \sqrt{a} \sqrt{a+b}}\right]}{4 \sqrt{a} \sqrt{a+b}}+\frac{\text{PolyLog}\left[2,-\frac{b\, e^{2 i x}}{2 a+b+2 \sqrt{a} \sqrt{a+b}}\right]}{4 \sqrt{a} \sqrt{a+b}}$$

Result (type 4, 532 leaves):

$$\frac{1}{4 \sqrt{-a (a+b)}}\left(4 x\, \text{ArcTanh}\left[\frac{(a+b) \text{Cot}[x]}{\sqrt{-a (a+b)}}\right]+2\, \text{ArcCos}\left[-1-\frac{2 a}{b}\right] \text{ArcTanh}\left[\frac{a \text{Tan}[x]}{\sqrt{-a (a+b)}}\right]+\right.$$

$$\left(\text{ArcCos}\left[-1-\frac{2 a}{b}\right]-2 i \left(\text{ArcTanh}\left[\frac{(a+b) \text{Cot}[x]}{\sqrt{-a (a+b)}}\right]+\text{ArcTanh}\left[\frac{a \text{Tan}[x]}{\sqrt{-a (a+b)}}\right]\right)\right)$$

$$\text{Log}\left[\frac{\sqrt{2} \sqrt{-a (a+b)}\, e^{-i x}}{\sqrt{b} \sqrt{2 a+b+b \text{Cos}[2 x]}}\right]+$$

$$\left(\text{ArcCos}\left[-1-\frac{2 a}{b}\right]+2 i \left(\text{ArcTanh}\left[\frac{(a+b) \text{Cot}[x]}{\sqrt{-a (a+b)}}\right]+\text{ArcTanh}\left[\frac{a \text{Tan}[x]}{\sqrt{-a (a+b)}}\right]\right)\right)$$

$$\text{Log}\left[\frac{\sqrt{2} \sqrt{-a (a+b)}\, e^{i x}}{\sqrt{b} \sqrt{2 a+b+b \text{Cos}[2 x]}}\right]-\left(\text{ArcCos}\left[-1-\frac{2 a}{b}\right]+2 i\, \text{ArcTanh}\left[\frac{a \text{Tan}[x]}{\sqrt{-a (a+b)}}\right]\right)$$

$$\text{Log}\left[\frac{2 (a+b) \left(-i a+\sqrt{-a (a+b)}\right) (-i+\text{Tan}[x])}{b \left(a+b+\sqrt{-a (a+b)} \text{Tan}[x]\right)}\right]-$$

$$\left(\text{ArcCos}\left[-1-\frac{2 a}{b}\right]-2 i\, \text{ArcTanh}\left[\frac{a \text{Tan}[x]}{\sqrt{-a (a+b)}}\right]\right)$$

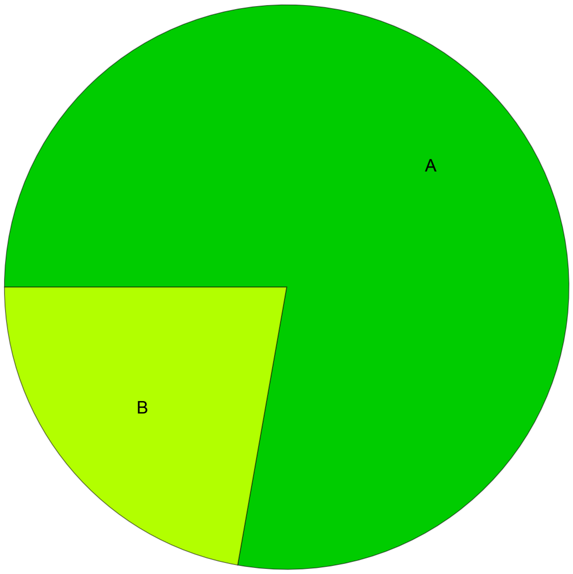
$$\text{Log}\left[\frac{2 (a+b) \left(i a+\sqrt{-a (a+b)}\right) (i+\text{Tan}[x])}{b \left(a+b+\sqrt{-a (a+b)} \text{Tan}[x]\right)}\right]+$$

$$i \left(\text{PolyLog}\left[2,\frac{\left(2 a+b-2 i \sqrt{-a (a+b)}\right) \left(a+b-\sqrt{-a (a+b)} \text{Tan}[x]\right)}{b \left(a+b+\sqrt{-a (a+b)} \text{Tan}[x]\right)}\right]-\right.$$

$$\left.\left.\text{PolyLog}\left[2,\frac{\left(2 a+b+2 i \sqrt{-a (a+b)}\right) \left(a+b-\sqrt{-a (a+b)} \text{Tan}[x]\right)}{b \left(a+b+\sqrt{-a (a+b)} \text{Tan}[x]\right)}\right]\right)\right)$$

Summary of Integration Test Results

9 integration problems



A - 7 optimal antiderivatives

B - 2 more than twice size of optimal antiderivatives

C - 0 unnecessarily complex antiderivatives

D - 0 unable to integrate problems

E - 0 integration timeouts