Mathematica 11.3 Integration Test Results

Test results for the 23 problems in "4.4.1.2 (d csc)^m (a+b cot)^n.m"

Problem 7: Result more than twice size of optimal antiderivative.

$$\int \frac{\text{Csc}[x]^3}{i + \text{Cot}[x]}\, dx$$

Optimal (type 3, 12 leaves, 2 steps):

$$i\ \text{ArcTanh}[\text{Cos}[x]] - \text{Csc}[x]$$

Result (type 3, 26 leaves):

$$-\text{Csc}[x] + i\left(\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right]\right] - \text{Log}\left[\text{Sin}\left[\frac{x}{2}\right]\right]\right)$$

Problem 9: Result more than twice size of optimal antiderivative.

$$\int \frac{\text{Csc}[x]^5}{i + \text{Cot}[x]}\, dx$$

Optimal (type 3, 28 leaves, 3 steps):

$$\frac{1}{2}\, i\ \text{ArcTanh}[\text{Cos}[x]] + \frac{1}{2}\, i\ \text{Cot}[x]\ \text{Csc}[x] - \frac{\text{Csc}[x]^3}{3}$$

Result (type 3, 67 leaves):

$$\frac{1}{24}\, i\ \text{Csc}[x]^3\left(8\, i + 9\left(\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right]\right] - \text{Log}\left[\text{Sin}\left[\frac{x}{2}\right]\right]\right)\text{Sin}[x] + 6\,\text{Sin}[2x] - 3\,\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right]\right]\text{Sin}[3x] + 3\,\text{Log}\left[\text{Sin}\left[\frac{x}{2}\right]\right]\text{Sin}[3x]\right)$$

Problem 11: Result more than twice size of optimal antiderivative.

$$\int \frac{\text{Csc}[x]^7}{i + \text{Cot}[x]}\, dx$$

Optimal (type 3, 40 leaves, 4 steps):

$$\frac{3}{8}\, i\ \text{ArcTanh}[\text{Cos}[x]] + \frac{3}{8}\, i\ \text{Cot}[x]\ \text{Csc}[x] + \frac{1}{4}\, i\ \text{Cot}[x]\ \text{Csc}[x]^3 - \frac{\text{Csc}[x]^5}{5}$$

Result (type 3, 99 leaves):

$$\frac{1}{640}\,i\,\text{Csc}[x]^5\left(128\,i+150\left(\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right]\right]-\text{Log}\left[\text{Sin}\left[\frac{x}{2}\right]\right]\right)\text{Sin}[x]+140\,\text{Sin}[2\,x]-75\,\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right]\right]\text{Sin}[3\,x]+75\,\text{Log}\left[\text{Sin}\left[\frac{x}{2}\right]\right]\text{Sin}[3\,x]-30\,\text{Sin}[4\,x]+15\,\text{Log}\left[\text{Cos}\left[\frac{x}{2}\right]\right]\text{Sin}[5\,x]-15\,\text{Log}\left[\text{Sin}\left[\frac{x}{2}\right]\right]\text{Sin}[5\,x]\right)$$

Problem 15: Result unnecessarily involves imaginary or complex numbers.

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

Optimal (type 3, 72 leaves, 7 steps):

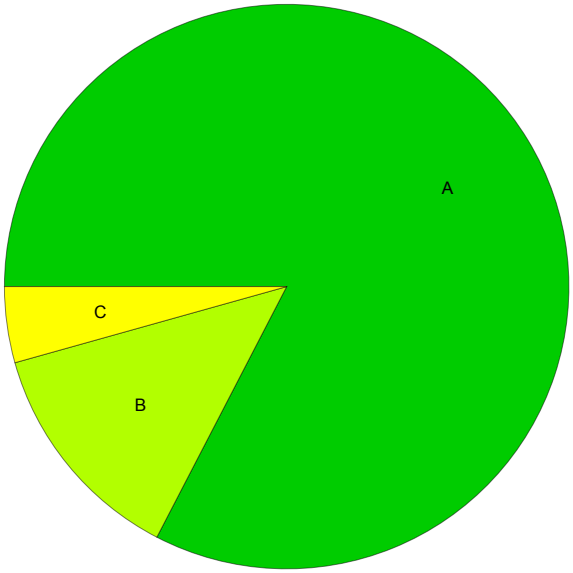
$$\frac{a\left(a^2+3\,b^2\right)x}{2\left(a^2+b^2\right)^2}-\frac{b^3\,\text{Log}[b\,\text{Cos}[x]+a\,\text{Sin}[x]]}{\left(a^2+b^2\right)^2}-\frac{\left(b+a\,\text{Cot}[x]\right)\text{Sin}[x]^2}{2\left(a^2+b^2\right)}$$

Result (type 3, 94 leaves):

$$\frac{1}{4\left(a^2+b^2\right)^2}\left(2\,a^3\,x+6\,a\,b^2\,x-4\,i\,b^3\,x+4\,i\,b^3\,\text{ArcTan}[\text{Tan}[x]]+b\left(a^2+b^2\right)\text{Cos}[2\,x]-2\,b^3\,\text{Log}\left[\left(b\,\text{Cos}[x]+a\,\text{Sin}[x]\right)^2\right]-a^3\,\text{Sin}[2\,x]-a\,b^2\,\text{Sin}[2\,x]\right)$$

Summary of Integration Test Results

23 integration problems



A - 19 optimal antiderivatives

B - 3 more than twice size of optimal antiderivatives

C - 1 unnecessarily complex antiderivatives

D - 0 unable to integrate problems

E - 0 integration timeouts