[6.41] Integration error in AMS 2.05

AMS 2.05 on TI89/92+ calculators can return incorrect results for indefinite and definite integrals which include, in the integrand, the expression

$$\sqrt{(ax+b)^n}$$

where *x* is the integration variable and *a*, *b* and *n* are constants. This bug has been reported by Damien Cassou and others.

One solution is to use the exponential form for the integrand, instead of the square root operator.

For example, in Auto mode,

$$\int \sqrt{(7x+4)^3}\,dx \quad \text{returns} \quad \frac{2(7x+4)\sqrt{(7x+4)^3}}{5} \qquad [1]$$

while the correct result should be $\dfrac{2(7x+4)\sqrt{(7x+4)^3}}{35}$

Another example of an incorrect result is

$$\int \sqrt{(2x-3)^7}\,dx \quad \text{which returns} \quad \frac{2(2x-3)\sqrt{(2x-3)^7}}{7} \qquad [2]$$

but the correct result is $\dfrac{(2x-3)\sqrt{(2x-3)^7}}{9}$

However, if symbolic values are used for the constants, the correct result is returned, that is

$$\int \sqrt{(ax+b)^n}\,dx \quad \text{returns} \quad \frac{2(ax+b)^{\frac{n}{2}+1}}{a(n+2)} \qquad [3]$$

If Approx mode is used instead of Auto mode, examples [1] to [3] return correct results.

The problem also exists with definite integrals. This is shown with a definite integral of example [1] above:

$$\int_2^9 \sqrt{(7x+4)^3}\,dx \quad \text{returns} \quad \frac{8978\sqrt{67}}{5} - \frac{1944\sqrt{2}}{5} \qquad [4]$$

but the correct result is $\dfrac{8978\sqrt{67}}{35} - \dfrac{1944\sqrt{2}}{35}$

In Approx mode the correct result of about 2021.11 is returned.

Correct results can be obtained in Auto mode by writing the integrand in exponential form, instead of using the square root operator. Applying this to example [1]:

$$\int (7x+4)^{\frac{3}{2}} \quad \text{correctly returns} \quad \frac{2(7x+4)^{\frac{5}{2}}}{35} \qquad [5]$$

and for the definite integral of example [4]:

$$\int_{2}^{9} \sqrt{(7x+4)^3}\, dx \qquad \text{correctly returns} \qquad \frac{8978\sqrt{67}}{35} - \frac{1944\sqrt{2}}{35} \qquad [6]$$

Incorrect results will be obtained if you use substitution (the "with" operator |) for *n*, for example

$$\int \sqrt{(7x+4)^n}\, dx \mid n=3$$ returns the incorrect result of [1]

but if you evaluate the expression without the constraint *n=3*, and then apply the constraint to that result, the correct integral is returned.

A similar problem also occurs with integrands of the form

$$\frac{1}{\sqrt{(ax+b)^n}} \qquad [7]$$

For integrals of this form, the correct result is returned if $n \geq 10$ or $n \leq -10$.

The built-in differential equation solver can fail with arguments of this type, too.

(Credit to Gary Wardall, Damien Cassou, Kevin Kofler, and ES)