

[2.3] Use *when()* for absolute value in integrals

AMS 2.03 and later support the *when()* function in integration, so it can be used for numeric solutions of integrals. This is especially useful when the integrand includes expressions using the absolute value. For example, if you try to evaluate this integral

$$\int_{-2}^3 |x^2 - 1| dx$$

with this command

```
f(abs(x^2-1), x, -2, 3)
```

the calculator is busy for several seconds, then returns the original expression. The integral can be evaluated, though, using *when()* to implement the absolute value function:

```
x^2-1→f(x)  
f(when(f(x)≥0, f(x), -f(x)), x, -2, 3)
```

which eventually returns the approximate answer of 9.3333 3370 4891 4. The exact answer of 28/3 can be found by integrating $x^2 - 1$ over the three intervals $[-2,-1]$, $[-1,1]$ and $[1,3]$, and summing the absolute values of the results. So, the approximate answer is good to about seven significant digits.

This method works only in Approx mode. In Exact mode, the method still returns the original integrand.

A more accurate Approx mode result can be obtained without using this method, by integrating over the three intervals listed above. In this case, the result is correct to all 14 significant digits.

(Credit to TM)