TI-89: Important Functions

d() — [2nd] [*d*] key or MATH/Calculus menu

d(*expression1*, *var* [,*order*]) ⇒ *expression*
d(*list1*,*var* [,*order*]) ⇒ *list*
d(*matrix1*,*var* [,*order*]) ⇒ *matrix*

Returns the first derivative of *expression1* with respect to variable *var*. *expression1* can be a list or a matrix.

order, if included, must be an integer. If the order is less than zero, the result will be an anti-derivative.

d() does not follow the normal evaluation mechanism of fully simplifying its arguments and then applying the function definition to these fully simplified arguments. Instead, ***d***() performs the following steps:

1. Simplify the second argument only to the extent that it does not lead to a non-variable.
2. Simplify the first argument only to the extent that it does recall any stored value for the variable determined by step 1.
3. Determine the symbolic derivative of the result of step 2 with respect to the variable from step 1.
4. If the variable from step 1 has a stored value or a value specified by a "with" (|) operator, substitute that value into the result from step 3.

```
d(3x^3-x+7,x) [ENTER]                         9x²-1
d(3x^3-x+7,x,2) [ENTER]                       18·x
d(f(x)*g(x),x) [ENTER]
      d/dx(f(x))·g(x) + d/dx(g(x))·f(x)
d(sin(f(x)),x) [ENTER]
                         cos(f(x)) d/dx(f(x))
d(x^3,x)|x=5 [ENTER]                          75
d(d(x^2*y^3,x),y) [ENTER]                6·y²·x
d(x^2,x,⁻1) [ENTER]                           x³/3
d({x^2,x^3,x^4},x) [ENTER]
                         {2·x   3·x²   4·x³}
```

nDeriv() — MATH/Calculus menu

nDeriv(*expression1*, *var*[, *h*]) ⇒ *expression*
nDeriv(*expression1*, *var*, *list*) ⇒ *list*
nDeriv(*list*, *var*[, *h*]) ⇒ *list*
nDeriv(*matrix*, *var*[, *h*]) ⇒ *matrix*

Returns the numerical derivative as an expression. Uses the central difference quotient formula.

h is the step value. If *h* is omitted, it defaults to 0.001.

When using *list* or *matrix*, the operation gets mapped across the values in the list or across the matrix elements.

Note: See also avgRC() and ***d***().

```
nDeriv(cos(x),x,h) [ENTER]
                  ⁻(cos(x-h)-cos(x+h)) / (2·h)
limit(nDeriv(cos(x),x,h),h,0)
[ENTER]
                                       ⁻sin(x)
nDeriv(x^3,x,0.01) [ENTER]
                             3.·(x²+.000033)
nDeriv(cos(x),x)|x=π/2 [ENTER]
                                           ⁻1.
nDeriv(x^2,x,{.01,.1}) [ENTER]
                                 {2.·x   2.·x}
```

nInt() — MATH/Calculus menu

nInt(*expression1*, *var*, *lower*, *upper*) ⇒ *expression*

If the integrand *expression1* contains no variable other than *var*, and if *lower* and *upper* are constants, positive ∞, or negative ∞, then **nInt**() returns an approximation of ∫(*expression1*, *var*, *lower*, *upper*). This approximation is a weighted average of some sample values of the integrand in the interval *lower*<*var*<*upper*.

```
nInt(e^(⁻x^2),x,⁻1,1) [ENTER]
                                      1.493...
```

∫() (integrate) [2nd] [∫] key

∫(*expression1*, *var*[, *lower*] [,*upper*]) ⇒ *expression*
∫(*list1*,*var* [,*order*]) ⇒ *list*
∫(*matrix1*,*var* [,*order*]) ⇒ *matrix*

Returns the integral of *expression1* with respect to the variable *var* from *lower* to *upper*.

∫(x^2,x,a,b) [ENTER] $\frac{b^3}{3}-\frac{a^3}{3}$

Returns an anti-derivative if *lower* and *upper* are omitted. A symbolic constant of integration such as C is omitted.

∫(x^2,x) [ENTER] $\frac{x^3}{3}$

However, *lower* is added as a constant of integration if only *upper* is omitted.

∫(a*x^2,x,c) [ENTER] $\frac{a\cdot x^3}{3}+c$

∫() returns itself for pieces of *expression1* that it cannot determine as an explicit finite combination of its built-in functions and operators.

∫(b*e^(⁻x^2)+a/(x^2+a^2),x) [ENTER]

$$\blacksquare \int\left(b\cdot e^{-x^2}+\frac{a}{x^2+a^2}\right)dx$$
$$b\cdot\int\left(e^{-x^2}\right)dx+\tan^{-1}\left(\frac{x}{a}\right)$$

When *lower* and *upper* are both present, an attempt is made to locate any discontinuities or discontinuous derivatives in the interval *lower* < *var* < *upper* and to subdivide the interval at those places.

For the AUTO setting of the Exact/Approx mode, numerical integration is used where applicable when an anti-derivative or a limit cannot be determined.

For the APPROX setting, numerical integration is tried first, if applicable. Anti-derivatives are sought only where such numerical integration is inapplicable or fails.

∫(e^(⁻x^2),x,⁻1,1)[◆] [ENTER] 1.493...