## Maple Reference

## Mathematical Operators and Constants

The symbols in the table below are used to create Maple expressions.

| Symbol | Description | Example |
| :--- | :--- | :--- |
| $+,-, *, /,^{\wedge}$ | arithmetic operators | $2+54 / 3 * 5^{\wedge} 3 ;$ |
| $()$, | expression delimiters | $(2+12 / 25) * 3^{\wedge}(7 / 3) ;$ |
| Pi | $\pi$ | $5 *$ Pi; |
| I | imaginary unit, $\sqrt{ }-1$ | $2+5 * I ;$ |
| infinity | positive infinity, $\infty$ |  |
| alpha, beta, gamma | other constants |  |

## Special Maple Delimiters and Command Terminators

The symbols in the table below are used in Maple to terminate commands, assign results to named labels, and to delimit sets and lists.

| Symbol | Description | Example |
| :---: | :---: | :---: |
| ; | terminate command, get output | $2 * 31 \wedge 12 * \mathrm{Pi}$; |
| : | terminate command, suppress output | $2 * 31 \wedge 12 * \mathrm{Pi}$ : |
| $=$ | equality, for setting up equation | $2 * x+3=5$ |
| := | assignment of a label to an expression | $\begin{aligned} & \mathrm{f}:=23 * \mathrm{x}+5 * \mathrm{y} \\ & 2 * \mathrm{f} ; \end{aligned}$ |
| -> | function definition | $\begin{aligned} & \mathrm{g}:=\mathrm{x}->\mathrm{x}^{\wedge} 2+2 * \mathrm{x} ; \\ & \mathrm{g}(\mathrm{x}) ; \end{aligned}$ |
|  | numerical range, mostly used in plot | $\begin{aligned} & -2.2 \\ & \operatorname{plot}\left(x^{\wedge} 2, x=0 \ldots 5\right) \end{aligned}$ |
| [,] | delimit a list in Maple | [1,2,3,4] |
| \{,\} | delimit a set in Maple | \{2,5, $\mathrm{x}, \mathrm{r}\}$ |
| , , | delay evaluation, often used to clear out a variable given a previous value | $\begin{aligned} & \mathrm{x}:=2 ; \\ & \mathrm{x}:=\text { ' } \mathrm{x} \text {; } \\ & \mathrm{x} ; \end{aligned}$ |
| ', ' | used to delimit a character string, for example a plot title | plot $\left(x^{\wedge} 2, x=-2 \ldots 2\right.$, title $=$ <br> My First Plot); |

## Standard Mathematical Functions

| Command | function | Example |
| :--- | :--- | :--- |
| abs | absolute value | $\operatorname{abs}(-12 / 31) ;$ |
| sqrt | square root function | $\operatorname{sqrt}(35) ;$ <br> sqrt $(\mathrm{x}+1) ;$ |
| $\exp$ | e to the $: e^{2 x}$ | $\exp (2 * x) ;$ |
| $\ln$ | natural logarithm | $\ln (200.4) ;$ |
| sin $, \cos , \tan$ <br> $\cot , \sec , \csc$ | trig functions | $\cos (\mathrm{Pi}) ;$ <br> $\tan (\mathrm{x}) ;$ |
| $\arccos , \arcsin$ <br> $\arctan , \operatorname{arccot}$ <br> $\operatorname{arcsec}, \operatorname{arccsc}$ | inverse trig <br> functions | $\arcsin (1 / 2) ;$ <br> $\arctan (\mathrm{x}) ;$ <br> $\operatorname{arccsc}(1) ;$ |

## Essential Maple Commands

The following commands are those used most often in Calculus. Note that each example ends with a semi-colon, which is the signal to Maple to process the command and print its result.

| Command | Description | Example |
| :---: | :---: | :---: |
| with | load a Maple package | with (CalcP7) ; |
| subs | substitute a value substitute into a function | $\begin{aligned} & \text { subs }(x=2, x * \exp (x)) ; \\ & f(2) ; \end{aligned}$ |
| evalf | evaluate to a decimal (floating-point) approximation | evalf(Pi) ; |
| expand | expand an expression | expand ( $\left.(\mathrm{x}+1)^{\wedge} 8\right)$; |
| factor | factor an expression | factor ( $\mathrm{x}^{\wedge} 2+\mathrm{x}$ ) ; |
| simplify | simplify and expression | simplify $\left(\left(x^{\wedge} 2+x\right) /(\mathrm{x}+1)\right)$; |
| solve | solve an equation analytically | solve( $2 * x+3=5, \mathrm{x})$; |
| fsolve | solve an equation numerically | fsolve( $\mathrm{x}=\tan (\mathrm{x}), \mathrm{x}=\mathrm{Pi} / 2 . .3 * \mathrm{Pi} / 2$ ) ; |
| D | differentiation operator (works only on a function) | $\begin{aligned} & \mathrm{D}(\mathrm{~g})(\mathrm{x}) ; \\ & \mathrm{D}(\mathrm{~g})(2) ; \end{aligned}$ |
| diff | differentiation of an expression or a function | $\begin{aligned} & \operatorname{diff}\left(x^{\wedge} 2, x\right) ; \\ & \operatorname{diff}(g(x), x, x) ; \end{aligned}$ |
| int | indefinite or definite integral | $\begin{aligned} & \operatorname{int}\left(x^{\wedge} 2, x\right) ; \\ & \operatorname{int}\left(x^{\wedge} 2, x=0 \ldots 1\right) ; \end{aligned}$ |
| limit | limit of an expression or a function | $\begin{aligned} & \operatorname{limit}(\sin (x) / x, x=0) ; \\ & \operatorname{limit}(f(x), x=0) ; \end{aligned}$ |
| plot | two-dimensional plot more than one function | ```plot(x^2,x=-2..2); plot([x^3,2*x],x=-2..2);``` |
| plot3d | three dimensional plot | plot3d (x^2+y^2, $\mathrm{x}=-1 . .1, \mathrm{y}=-1 . .1$ ) ; |
| map | apply a function to a list | $\operatorname{map}(\mathrm{t} \rightarrow>1 / \mathrm{t},[1,2,3,4])$; |
| seq | define a sequence | seq(i^3,i=1..5); |

