Basic MAPLE Reference

Basic syntax and symbols

:=	Assigns a name to a string of symbols	a:=3*x;
;	Indicates that a line of input has ended	b:=5*y;
+−*/	The usual mathematical symbols. Can be used with strings.	c:=a/b;
^	Power	d:=3*x^2;
f(x)	f is a function of *x*, used as a string name	f(x):=4*x^2; e:=3*f(x)+5;
=	Equal sign in an expression	g:=f(x)=3*x; g is the name of the string f(x)=3*x
:	At the end of a line is the same as ";" but the output line is not printed	h:=3*x:
%	The result of the previous line	i:=3*x; j:=3*%; gives j:= 9x
%%	The result of two lines back	
infinity	Infininity, usually used in limits	
Pi	The numerical value of π	
I	i, $\sqrt{-1}$	

Notes:
- MAPLE is case sensitive. That is, "A" and "a" are two different things.
- The order in which operators are evaluated if there are no parentheses: ^ before */ before +−.
  Operators have the same level are evaluated left to right. 3/x/y is the same as 3/(x*y).

Simple algebraic manipulations

simplify(a)	Simplifies the string named "a"	a:=3*x+6*x; b:=simplify(a); gives b:=9x;
factor(a)	Factors a polynomial expression "a"	a:=x^2+6*x+9; b:=factor(a); gives b:=$(x+3)^2$
expand(b)	Expands an expression "b" – the inverse of factor	b:=(x+3)^2; a:=expand(b); gives a:=x^2+6x+9;
solve(a,x)	Finds the root of an algebraic expression "a" for x	a:=a*x^2+b*x+c; b:=solve(a,x);
evalf(a)	Gives a numerical evaluation to powers, roots, etc. in an expression "a"	a:=solve(3*x^3+5*x^2+7); b:=evalf(a);

Session handling

restart;

Clears variable names and starts over. It is good practice to use this regularly, as names can quickly get confused.

Saving sessions or graphs

Click on the save icon.

Editing tips

Highlight by dragging with the mouse or by SHIFT + arrow keys.
You may copy and paste from input strings, or from output.
Copying may be done by deleting and inserting highlighted lines.
You may re-execute any line by moving to it with the arrows.
Lines may be edited before re-execution.
You may click into an equation where you wish to edit it.

Common error messages for beginners

Warning, premature end of input

You probably forgot the final " ;"?

';' unexpected

Syntax error, such as unbalanced parenthesis. MAPLE was expecting more input.

Help

Click on **Help**.

Try the **New User's Tour**.

Topic Search is good. You can cut and paste examples from the topic search into a MAPLE session.This can be quite helpful in seeing how statements function.

Solving more complicated equations

fsolve(a,x)	Gives a numerical solution to the roots of an expression for *x*, very useful for transcendental equations	a:=x=tan(x); fslove(a,x); or fsolve(x=tanx,x);
fsolve(a,x=0..1)	Like fsolve(a,x), but looks for a root in the range 0 to 1.	a:=x=tan(x); fslove(a,x=0..1);

Warning: fsolve finds **real** roots, and it may not find all the roots in the range given.

solve({e1,e2},{x,y})	Solves two equations for two unknowns	e1:=3*x+4*y=0;
		e2:=5*x+12*y=7;
		g:=solve({e1,e2},{x,y});

assign(g)	"solve" only finds the solutions, but does not associate *x* and *y* with anything. Follow solve with assign, so *x* and *y* becomes the names of the solutions.	After the lines above: assign(g);

Common functions

sin(x), cos(x) tan(x), csc(x), etc.	Trigonometric functions
sinh(x), csch(x), etc.	Hyperbolic funcions
arcsin(x), etc.	Inverse trigonometric functions
arcsinh(x), etc.	Inverse hyperbolic functions
abs(x)	Absolute value
factorial(x)	Factorial
ln(x), log(x)	Natural logarithm
exp(x)	e^x
log10(x)	Logarithm, base 10
signum(x)	sign (+ or –), yields ±1
sqrt(x)	$\sqrt{x}$

Note:

- You may need to use "evalf" to get a numerical answer rather than just something like "cos(1)"
  a:=cos(1); b=evalf(a); or b:=evalf(cos(1));

Elementary calculus

diff(a,x)	Differentiates the expression "a" with respect to *x*	a:=3*x^2+s*x; b:=diff(a,x);
diff(a,x$2)	Finds the second derivative of the expression "a" with respect to *x*	a(x):=3*x^2+s*x; c(x):=diff(a(x),x$2);
int(a,x)	The integral of "a" with respect to *x*	a:=3*x*sin(x); b:=int(a,x);

int(a,x=0..1)	The definite integral of "a" with respect to *x* from *x* = 0 to 1.	a:=3*x*sin(x);
		b:=int(a,x);
		b:=evalf(b); – to give a number

taylor(a,x);	Truncated Taylor series of "a" with respect to *x*	b:=taylor(sin(x),x);
Order	Sets the order for calculating series solutions	Order:=10;
implicitdiff(a,s,t)	Implicit differentiation: "a" is a function of *s* and *t*. The result is *ds /dt*	a:=3*y^2:=4*x^2+7*y; implicitdiff(a,y,x);
maximize(a) minimize(a)	Returns the maximum or minimum value of "a"	a:=6-x^2-3*x; b:=maximize(a);

Ordinary differential equations

diff(f(x),x)	*df /dx*. The functional notation is needed here.	a:=diff(f(x),x)=-f(x);
diff(f(x),x$2)	df^2 /dx^2	a:=diff(f(x),x$2)=-f(x);

dsolve(a,f(x))	Solves the differential equation "a" for *f(x)*	a:=diff(f(x),x)=-f(x);
		dsolve(a,f(x));
		assign(%);

f(0)=0	Boundary or initial conditions on a function	a:=diff(f(x),x$2)=-f(x); b:=f(0)=0,f(Pi/4)=1;
D(f)(0)=0	Boundary or initial conditions on a derivative	a:=diff(f(x),x$2)=-f(x); b:=f(0)=0,D(f)(0)=1;
dsolve(a,f(x),type=numeric)	Provides a numeric solution rather than an algebraic one. Useful for difficult equations.	dsolve({D(y)(x) = y(x), y(0)=1}, y(x),type=numeric);

Graphing functions

You may want to click on **Options:Plot Display:Window** before beginning, so that your plots will be in a separate window.

plot(f(x),x=0..2*Pi)

Plots *f(x)* over the range given.
Various options for axes, etc., appear on a toolbar when the plat is finished. "Plotting error empty plot" is the typical error message for something going wrong.

plot({a,b},x=0..1)

Plot two curves in the same graph.

```
f(x,t):=sin(3*x-4*t+Pi/12);
with(plots);
animate(f(x,t),x=0..10,t=0..2);
```

This defines a function of two variables. Here, the functional notation is optional. "with(plots)" opens some routines that are not normally opened with MAPLE. "animate" then makes a series of *f(x,t)* plots for different values of *t*. To run the animation, click on the graph if it is not in a separate window, then click on the forward arrow to run. Note the color is automatically chosen by cycling through the available colors. For some strange reason, white is sometimes chosen and you will see nothing until you execute the line again.

animate(f(x,t),x=0..10,t=0..2,frames=12);

Frames controls the number of graphs produced in the animation

To specify the number of *x* points and the color, you may use:
animate(f(x,t),x=0..10,t=0..2,numpoints=150,frames=100,color=blue);