

## Maple Command Summary: Basic Commands

### 1. GENERAL

If you begin to have a long worksheet, remember that you should watch what has already been assigned to a variable.

To do this:	Type This:
End a line	; or :
Help on command	?command
Assign expression $x^2 + 3x$ to A	A:=x^2+3x;
$f(x) = x^2$	f:=x->x^2;
	f(x) is an expression
$f(x, y) = x^2 + y^2$	f:=(x,y)->x^2+y^2
Assign Equation $x^2 + 3 = x$ to A	A:=x^2+3=x;

Common Functions	
$\sqrt{x}, \sqrt[n]{x}$	sqrt(x);, root(x,n);
$\times, \div$	* /
$e^x$	exp(x)
$ x $	abs(x)

### 2. ALGEBRA

- (1) You can simplify, expand, or factor algebraic expressions.
  - (a) Factor  $x^2 + 2x + 1$ : `factor(x^2+2*x+1);`
  - (b) Multiply  $(1 + x)^4$  out: `expand((1+x)^4);`
  - (c) Simplify  $x(x + 1)/(x^2 + 2x + 1)$ : `simplify((x*(x+1))/(x^2+2*x+1));`
- (2) Maple will do "Partial Fractions". For a reminder, see Section 7.4 in your Calculus book. For example, you may want to find  $A, B, C, D$  so that:

$$\frac{x^2 + 3}{x(x + 1)(x^2 + 3x + 3)} = \frac{A}{x} + \frac{B}{x + 1} + \frac{Cx + D}{x^2 + 3x + 3}$$

We would type:

```
g:=(x^2+3)/(x*(x+1)*(x^2+3*x+3));
convert(g,parfrac,x);
```

- (3) Maple will solve an equation for an unknown: Solve for  $x$  if  $x^3 - x - \frac{1}{5} = 0$ . The following attempts an exact answer:

```
A:=x^3-x-(1/5)=0;
solve(A,x);
```

To change it to get a numerical estimation, use `fsolve(A,x)`; You may need to give Maple a hint at which solution you want to find. For example, if you want the solution between 0 and 2, you can type: `fsolve(A,x,0..2)`;

### 3. LIMITS

Maple will compute limits at a point and limits at infinity. The symbol  $\infty$  in Maple is written out as `infinity`

- (1) Find the horizontal asymptotes of  $\frac{2x^2+3x-5}{3x^2-3x+1}$ 

```
A:=(2*x^2+3*x-5)/(3*x^2-3*x+1);
limit(A,x=infinity);
```
- (2) Find, if it exists:  $\lim_{x \rightarrow 2^+} \frac{|x-2|}{x-2}$ 

```
limit( abs(x-2)/(x-2), x=2, right );
```

## 4. DERIVATIVES

- (1) Differentiate a function, get a function back: Use the `D(f)` command, where  $f$  is itself a function. Example: Let  $f(x) = x^2 + 3 \sin(x)$ .

```
f:=x->x^2+3*sin(x);
df:=x->D(f);
```

- (2) Differentiate a function, get an expression back. Use the `diff(f(x),x)` command.

```
f:=x->x^2+3*sin(x);
df:=diff(f(x),x);
or
A:=x^2+3*sin(x);
dA:=diff(A,x);
```

## 5. INTEGRATION

The general command to write  $\int_a^b f(x) dx$  is `int(f(x), x=a..b)`; (where  $f$  has previously been defined as a function).

Examples:

- (1) Define  $g(t) = \int_2^t u^2 du$

```
g:=t->int(u^2,u=2..t);
```

- (2) Compute:  $\int_1^5 \frac{\sqrt{x+4}}{x} dx$

```
int(sqrt(x+4)/x,x=1..5);
```

NOTE: Maple will always attempt an exact (algebraic) solution. If it cannot find one, it will simply return the integral. For example:  $\int e^{\sin(x)} dx$  does not have an elementary antiderivative.

```
int(exp(sin(x)),x=1..4);
```

However, if you want a numerical approximation, Maple will give one:

```
evalf(int(exp(sin(x)),x=1..4));
```

## 6. GRAPHICS

- (1) To plot the function  $f(x)$  for  $a \leq x \leq b$ ,  $c \leq y \leq d$  the command is: `plot(f(x),x=a..b, y=c..d)`;  
 (2) To plot functions  $f, g$  on the same plot, you can either use:

```
f:=x->x^2;
g:=x->sin(x);
plot( {f(x), g(x)}, x=-3..10, y=-3..10 );
```

or you can overlay the graphs manually:

```
with(plots):
f:=x->x^2;
g:=x->sin(x);
P1:=plot(f(x), x=-3..10, y=-3..10):
P2:=plot(g(x), x=1..8):
display({P1,P2});
```

Note the use of `with(plots)`: This tells Maple that you're using some commands that it doesn't ordinarily load in at the start. If you run into problems with plotting, try typing that command in at the beginning of your worksheet.