

## Basic Maple Skills

### Some concepts

It is assumed you will be working in *worksheets* mode. To default to *worksheets* mode, under menu option Tools, select Options, then select tab Interface and set the Default format to *Worksheet*. To work with Document mode, see the training videos listed at the website printed at the end of this document.

You enter a command and Maple responds to the command.

#### Key symbols

$:=$   $\rightarrow$  "assign". Ex:  $y := x$  means when Maple sees 'y' it substitutes 'x'.  
 $=$   $\rightarrow$  "equal". Ex:  $y = x$  means when Maple knows y is equivalent to x  
 $\{ \}$   $\rightarrow$  a group. Ex:  $\{z = a, b = y + 3\}$   
 $[ ]$   $\rightarrow$  a set. Ex:  $[item1, item2, x]$

### 0. Enter

- initialize: `restart;`
- comments: `# comments exist beyond the number sign`
- expression: `g := x2 + 3; eq1 := x2 +  $\sqrt{y}$  = z;`
- function: `f := x  $\rightarrow$  A . sin(k . x);`  
`f(10), f(x), f(g + y)`  
 (key strokes ">" creates  $\rightarrow$ )

### 1. Solving equations (algebraic)

- single: `solve(x . ex = 3, x);`
- multiple: `solve({x + y = 3, x - y = 4}, {x, y});`
- floating point: `fsolve(x . sin(x) = 0, x = 3) #starting at x=3.`

### 2. Substitute value into equations

- simple: `subs(x = 3, x . exp(-x));`
- multiple: `subs({x = 3, y = 2}, {x + y, x . y});`

### 3. Evaluation / Simplification

- floating point: `evalf( $\frac{23}{13}$  .  $\sqrt{15}$ )`
- extract result: `eval(x, {x = 3, y = 12})`
- simplify results: `simplify(results1, trig);`
- simplify with assume: `simplify(results1, assume = [n :: integer, g > 0]);`

### 4. Integration

- indefinite: `int(x . sin(x), x)`  
 $\int x \cdot \sin(x) \, dx$
- definite: `int(A . exp(-x), 0 ..  $\infty$ )`

graphic version  $\int_0^{\infty} A \cdot e^{-x} \, dx$

### 5. Derivative

- single variable:  $\frac{d}{dx} \left( \frac{x}{\ln(x)}, x \right);$
- graphics version  $\frac{d}{dx} \left( \frac{x}{\ln(x)} \right)$
- multiple derivative  $\frac{diff}{diff} \left( \frac{x}{\ln(x)}, x, x \right)$
- graphics version  $\frac{d^2}{dx^2} \left( \frac{x}{\ln(x)} \right)$
- multiple variable:  $\frac{diff}{diff} (f(x) \cdot g(y), x, y);$
- graphic version  $\frac{\partial x}{\partial y} (f(x), g(y))$

### 6. Plot

- 2D: `plot(x . exp(-x), x = 0 .. 2);`
- 3D: `plot3d(sin(x . y), x = 0 ..  $\pi$ , y = 0 ..  $\pi$ );`
- multiple 2D: `plot([x, x2], x = 0 .. 5, color = [blue, green]);`
- Data: `m := [[1, 2], [2, 4]]; plot(m);`
- animation `plots[animate](sin(k . x), x = 0 .. 6, k = 0 .. 10);`  
`plots[animate3d](sin(k . x . y), x = 0 .. 6, y = 0 .. 6, k = 0 .. 10)`

### 7. Vectors / Matrix

- define: `with(LinearAlgebra);`  
 vector `v := < 1, 2, 4 >; v1 := Vector([2, 4, 5]);`  
 matrix `m := << 1, 2, f >> | < t, 5, 3, 7 >>;`
- dot product `DotProduct(v1, v2);`
- cross product `CrossProduct(v1, v2);`

### 8. Differential Equations

- entering equations `diff(y(x), x$2) + 2 . diff(y(x), x) - y(x) = sin(x)`  
 assume f(x) only `y'' - 2y' - y = sin(x)`
- algebraic `dsolve(diff(y(x), x$2) - y(x) = sin(x), y(x));`
- numeric `r := dsolve({diff(v(t), t$2) = v(t), v(0) = 1, D(v)(0) = 0}, v(t), numeric);`  
 get values: `r(0); r(1);`

### 9. Plotting Differential Equations

- algebraic `r := dsolve({diff(v(t), t$2) = 1, v(0) = 1, D(v)(0) = 0}, v(t));`  
`assign(r);`  
`plot(v(t), t = 0 .. 10);`  
`r := dsolve({diff(v(t), t, t) - cos(10 . t) = exp(-t), v(0) = 1, D(v)(0) = 0},`  
 $v(t)$ , type = numeric);  
`plots[odeplot](r, [t, v(t)], 0 .. 3);`  
`plots[odeplot](r, [t, D(v)(t)], 0 .. 3);`
- numeric

## ▼ 10. Fitting a curve

- a. linear fit  

```
xdata := Vector([1, 2, 3, 4, 5]);  
ydata := Vector([1, 3, 4, 6, 9]);  
Statistics[Fit](a · t + b, xdata, ydata, t);
```
- b. polynomial fit  

```
Statistics[Fit](a · t2 + b · t + c, xdata, ydata, t);
```
- c. non linear fit  

```
Statistics[Fit](a · sin(b · t) · exp(c · t), xdata, ydata, t);
```

## ▼ 11. Miscellaneous commands

- a. infinity  

```
infinity → ∞
```
- b. sequence of numbers  

```
seq(r2, n = 1..5);
```
- c. getting all results of calculates  

```
allvalues(results);
```
- d. assign results to function  

```
assign(results);
```
- e. change number of sig. figs.  

```
digits(20);
```

## ▼ 12. Useful Websites

- a. main website: [www.maplesoft.com](http://www.maplesoft.com)
- b. training: [www.maplesoft.com/support/training/](http://www.maplesoft.com/support/training/)
- c. Lessons for students [www.maplesoft.com/applications/app\\_center\\_view.aspx?AID=1569](http://www.maplesoft.com/applications/app_center_view.aspx?AID=1569)