Maple in a Nutshell

Maple is a powerful and sophisticated mathematics program that is simple to use. Here is a brief introduction into using Maple.

Expressions

To enter a Maple expression, just type it in at the prompt. Maple knows most special functions by name, such as *sin(x)* and *cos(x)*; use a space or * for multiplication, the caret ^ for powers; to enter π, type Pi.

As you type, Maple arranges your expression in mathematically meaningful typesetting. Use the arrow keys to navigate your expression. You can also highlight parts of your expression before pressing, say, the "division" symbols / to put the highlighted part of your expression in the numerator.

When you are done typing your expression, press ENTER. Maple will check your input for errors and display its answer in blue. Maple also numbers your expression automatically (on the right side). To practice, enter the following expressions, each in a line by itself:

$$2^3 + 3$$

$$x^2 - \cos(3\,x) + \sin(\pi)$$

$$1/2 + 3/4$$

$$\frac{2x+1}{3-x}$$

Functions

To define a function in Maple, use the assignment operator := (colon-equal). To define, for example, the function *f(x) = 4 x + 2* you type

```
f(x) := 4 x + 2 [ENTER]
```

Note the assignment operator := … Maple will check whether you want to define a function or a *table expression*. Choose "*define function*". After you have defined a function, you can evaluate it. Try, for example:

f(2), f(4 t), and $\frac{f(x+h)-f(x)}{h}$

Note that Maple often simplifies its answer (especially for the last expression).

Commands

Maple knows hundreds of commands you can use to manipulate expressions and functions. You can either type them in (if you know the name and syntax) or select them by right-clicking a blue expression and selecting the command from the pop-up context menu.

Using the right-click context menu is easier, typing a command is more flexible. Note that the right-click context menu items depend on the expression you right-click.

Most of the time right-clicking works best. If you do need to type commands, here are the most useful ones (note that Maple is case-sensitive):

simplify	Simplifies expression `simplify(2 x + 3 x)`
factor	Factors an expression `factor(x^2 - 1)`
expand	Expands an expression (foil) `expand((x+1) (x-1))`
evalf	Approx. expression as decimal number `evalf(2 Pi)`
subs	Substitutes a term into an expression `subs(x=1, x^2 + 2)`
numer	Extracts numerator of a quotient `numer(6/7)`
denom	Extracts denominator of a quotient `denom(6/7)`
solve	Solves an equation `solve(x^2 + x = 10, x)`
fsolve	Solves an equation numerically `fsolve(cos(x)*sin(2 x) = 0.5, x = 5)`

limit	Finds a limit
	`limit(sin(x)/x,x=0)`
	`limit(abs(x)/x,x=0,left)`
	`limit(abs(x)/x,x=0,left)`

diff	Finds a derivative `diff(sin(x^2), x)` or `f'(x)` if f is a function `diff(sin(x^2, x$2)` of `f''(x)` if f is a function

int	Finds definite or indefinite integral
	`int(x^2,x)`
	`int(x^2,x=0..1)`

plot	Plots one or more expressions in one variable
	`plot(x^2, x=-2..2)`
	`plot(1/x, x=-3..3, y=-8..8)`
	`plot({x^2,x^3},x=-2..2)`

Plot3d	Plots one or more expressions in two variables `plot3d(sin(x)*cos(y),x=-4..4,y=-4..4))`

Re-Using expressions

Often you want to refer to an expression that already exists. You can:

- Retype the expression (of course)
- Refer to the expression by its number (press CTRL-L and enter the expression number)
- Use the mouse to drag a copy of a blue expression to its new location

For example, you can enter an expression such as sin(x^2), then hit ENTER.

- on the next line, type "diff(", then select the blue expression above and drag it to your differentiation command, or
- on the next line, type "diff(" and press CTRL-L, then type the number of the previous expression and click OK

Then complete the command by typing ",x)" – your command should say "diff(sin(x^2), x)".

Sample Questions

1. Define the following functions:

f(x) = x^3 - x^2 + 2x - 1 and *g(x) = sqrt(x) + 3*

Then use Maple to find (and simplify)

f(x^2) as well as *g(x^2)*
(f + h)(x) and *(f / h)(x)*
f(g(x)) and *g(f(x))*
(f(x + h) - f(x)) / h and *(g(x + h) - g(x)) / h*

2. Define the functions

f(x) = x^2 and *g(x) = sqrt(x)*

Use Maple to find *f(g(x))* and *g(f(x))* and simplify the result. Interpret the answer. Is Maple correct ? Can you simplify the answer more, making certain assumptions on *x* ?

3. Define the function *f(x) = (x^2-4)*x* and plot the function for *x* between -3 and 3. Then plot each of the following functions and interpret the result.

f(x - 2), f(x - 1), f(x), f(x + 1), f(x + 2)

5. A ball is thrown straight into the air, and the distance function depending on time is given as:

*s(t) = 1.7 + 24.5*t - 4.9* t^2*

1. At what time does the ball hit the ground ?
2. If your friend is standing on the balcony of a house, 5.6 meters above ground, how many chances does he have of catching the ball, and when do they occur ?
3. How long does the ball stay 3 meters above the ground ?

5. Find the derivatives of $g(x) = \tan(\sin(x))$ and $f(x) = \frac{x \cos(x^2)}{(2-x^5)^2}$

6. Find the critical points and possible inflection points for $f(x) = \frac{x^2-1}{(2-x^2)^2}$

7. Find the following integrals:

$\int \sin(x)\,dx$ and $\int_0^1 \cos(x)\,dx$

$\int x\sin(x)dx$ and $\int_{-\pi}^{\pi} x\cos(x^2)\,dx$

$\int_{-\infty}^{1} \sin(x^2)\,dx$