

## Elementary Maple Tutorial

**Using Maple:** It is presumed that you have already obtained your keyserved copy of Maple. Double click on the application Maple(PPC). After the application opens, you will see a window with a prompt: `>`. That means Maple is waiting for instructions.

Every Maple instruction (except help requests) must end with a semicolon (and a Return). So let's start with something which is not too taxing. Type `2+2;` and see what happens. Are you surprised? Now try `100!;` Your pocket calculator isn't up to this. It is apparent that Maple is designed to give exact answers. If you want approximate answers you will have to ask for them. The Maple way of expressing  $\sqrt{2}$  is `sqrt(2)`. Type `sqrt(2);` The answer isn't very enlightening. The reason is that any decimal Maple could print would only be an approximation to  $\sqrt{2}$  and therefore inexact. To get an approximation type `evalf(sqrt(2));` The `evalf` stands for "evaluate in floating-point" form. You will get ten-digit accuracy unless you ask for more. For thirty-digit accuracy type

`Digits := 30;`

and then evaluate as before. The rest of your approximations will be to thirty digits until you change the value of `Digits` again. You can type  $\pi$  as `Pi`. Try `evalf(Pi);` For the adventurous, try `evalf(Pi,1000);` Not too shabby!

Before proceeding, you should acquaint yourself with the **Help** menu. Try **Contents** first. From here, you could try **Introduction** for an introduction to Maple, which has some examples in it. Scrolling to the bottom, click on **index**, and then on **function** for a list of the functions and procedures that Maple knows about.

Many of the functions in the list will be familiar to you. We will be especially interested in differentiation and integration, `diff` and `int`. To use these functions it is necessary to type in the function to be differentiated or integrated. For example,  $x^4 + 3x^3 - 4x^2 + 2$  would be typed as `x^4 + 3*x^3 - 4*x^2 + 2`. Note that `^` indicates exponentiation and multiplication must always be indicated explicitly with `*`. The way of typing  $x^2 \sin x$  is `x^2*sin(x)`. Parentheses must always be used with the sine function. Now, to differentiate  $x^2 \sin x$  type

`diff(x^2*sin(x), x);`

The `x` after the comma means that we are differentiating with respect to  $x$ . If your function involves  $t$ 's, you put a `t` after the comma. Integration works similarly. Try

`int(a*x^2 + b*x + c, x);`

What would happen if you replaced the `x` after the comma by `a`? Why?

You can find out more by typing `?diff` and `?int`. Help for other functions and procedures is available similarly. You can find the third derivative of  $x^4$  with

`diff(x^4,x,x,x);`

or with **diff(x^4,x\$3)**; Also, definite integrals can be found. To compute  $\int_3^4 x^2 dx$  type **int(x^2,x=3..4)**; The two dots indicate the range between the first number and the second.

Maple can draw graphs of functions. To get a graph of that old chestnut  $\sin x/x$ , type **plot(sin(x)/x,x)**; If you don't specify a range of  $x$ -values for the graph, it will be plotted from  $x = -10$  to  $x = 10$ . If you want it to go from  $x = -10$  to  $x = 30$  instead, type

**plot(sin(x)/x,x=-10..30);**

Try **plot(tan(x),x)**; Not too illuminating. You can override the automatic scaling of the  $y$ -coordinates. If you want to see only from  $y = -5$  to  $y = 5$  (and  $x \in [-\pi, \pi]$ ), type

**plot(tan(x),x=-Pi..Pi,y=-5..5);**

More information can be obtained from **?plot**.

You may have noticed your graphs can be selected. Click once in the middle of your graph, and a perimeter appears around it. Drag one of the corners to enlarge (or shrink) the graph. Graphs can be copied and pasted like any other object.

When you give Maple a hard problem and it has to work on it for a while it will occasionally print a mysterious line about words used, alloc, and time. That just means the program is still alive and well and working hard, but does not yet have anything useful to report.

When you are done with Maple. you can save your document in the usual way, then quit the application in the usual way.

You may be entertained by fooling around with the rest of Maple. It is very powerful, and the help facility is really quite good. For those seeking further information about Maple, several written manuals for Maple can be obtained through the Dartmouth Bookstore. However, most of you should find more than enough guidance by consulting the online help, and the periodic postings we will make available to you.