revised 6/16/99

Maple Tutorial

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Basic arithmetical stuff

Maple uses the four basic arithmetic operations: +, -, * and /, and it can raise to powers (including fractional powers) using the ^. For example

```
STUDENT > x+y;
          x-y;
          x*y;
          x/y;
          x^y;
```

$$x + y$$
$$x - y$$
$$x\,y$$
$$\frac{x}{y}$$
$$x^{y}$$

I am not going to worry about precedence rules. I will be careful about what I do, and the output is usually very clear.

The input (what I type) is in red and the output in blue. Comments are in black. The STUDENT > is a prompt, which can be removed from the output, as can the left hand square brackets. I will probably never bother to remove these.

The assigment symbol := replaces the equals sign in writing equations

```
STUDENT > y:=x*z;
```

$$y := x\,z$$

and it appears in the output as well. The equals sign is used within plotting and integrating routines, which I will demonstrate in a moment.

Maple admits array variables. These may be of any dimension, but, in the student version, no more than three indices may be specified. For example, I can construct an array named z that represents a three by three matrix. I will do this from time to time to represent stress and strain tensors.

```
STUDENT > z:=array(1..3,1..3);
```

$$z := \mathrm{array}(1 .. 3, 1 .. 3, [\ ])$$

```
STUDENT > print(z);
```

$$\begin{bmatrix} z_{1,1} & z_{1,2} & z_{1,3} \\ z_{2,1} & z_{2,2} & z_{2,3} \\ z_{3,1} & z_{3,2} & z_{3,3} \end{bmatrix}$$

Maple also has a linear algebra package, but I do not intend to make use of it.

Notice that I have been using a semicolon (;) to terminate statements. I can use a colon (:) instead if I

wish to suppress printing.

Maple can do loops and if then statements. The basic forms are

for i from n1 by increment to n2 do . . . . od:

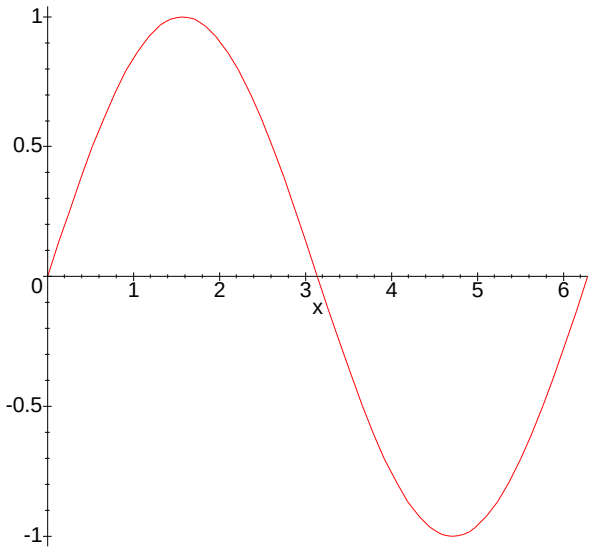
if statement1 then . . . . fi:

Plotting procedures

Maple can plot results in two and three dimensions. (It has other plotting properties as well, but I won't be using them.)

```
STUDENT > y:=sin(x);
          plot(y,x=0..2*Pi);
```

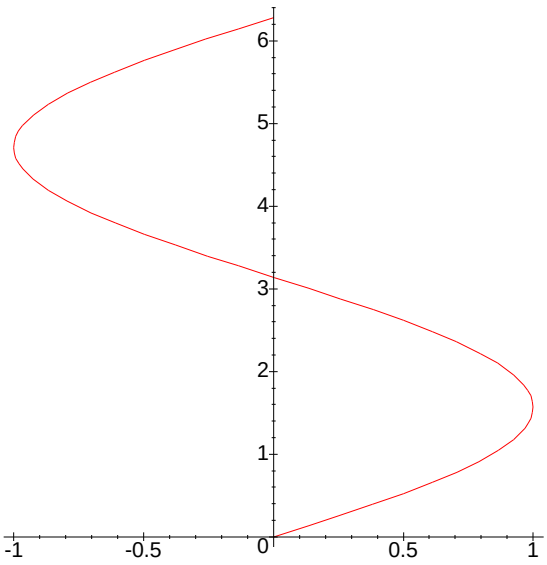
$$y := \sin(x)$$



Note the use of the equals sign in the plotting routine, and the fact that Pi is a reserved word for π.

An alternate method of plotting is

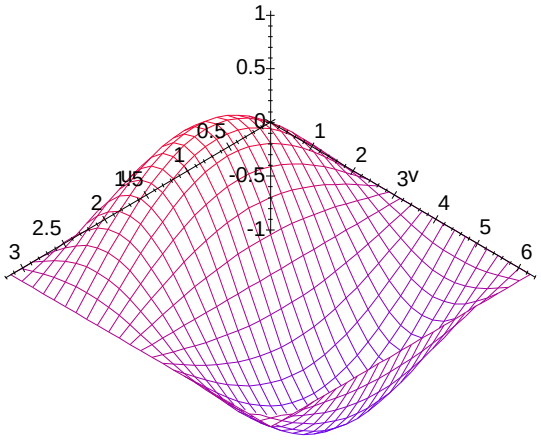
```
STUDENT > plot([y,x,x=0..2*Pi]);
```



Simple three d plots look like

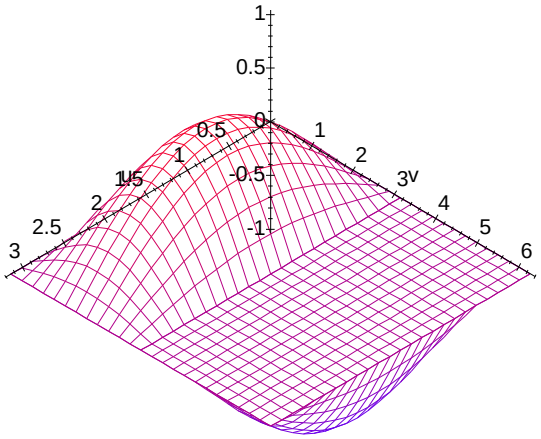
```
STUDENT > z:=sin(u)*sin(v);
          plot3d(z,u=0..Pi,v=0..2*Pi,axes = NORMAL,shading=Z);
```

$$z := \sin(u)\sin(v)$$



There are more options than it makes sense to set out in this little glossary. One worth noting is that more than one curve or surface can be plotted on the same plot.

```
STUDENT > plot3d({0,z},u=0..Pi,v=0..2*Pi,axes = NORMAL,shading=Z);
```



Calculus

Maple can differentiate and integrate symbolically. (It can also solve differential equations, but I won't be doing that.)

The first statement in the following set frees the variable y, which had previously been set equal to sin(x). I need to do this to reuse an independent variable.

```
STUDENT > y:='y':
          f:=tan(x)*y;
          diff(f,x);
          diff(f,y);
```

$$f := \tan(x)\, y$$

$$(1 + \tan(x)^2)\, y$$

$$\tan(x)$$

```
STUDENT > y:=f1(x);
          g:=f2(x,y);
          diff(g,x);
```

$$y := \mathrm{f1}(x)$$

$$g := \mathrm{f2}(x, \mathrm{f1}(x))$$

$$D_1(f2)(x, \mathrm{f1}(x)) + D_2(f2)(x, \mathrm{f1}(x)) \left(\frac{\partial}{\partial x} \mathrm{f1}(x)\right)$$

Here D1(f2) means the derivative of the function with respect to its first argument and D2(f2) means differentiation with respect to its second argument. Maple understands the chain rules.

Maple can also calculate series.

```
STUDENT > f:=tan(x):series(f,x);
```

$$x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \mathrm{O}(x^6)$$

Maple can do definite and indefinite integrals

```
STUDENT > int(f,x=0..Pi/4);int(f,x);
```

$$\frac{1}{2}\ln(2)$$

$$-\ln(\cos(x))$$

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