Welcome to Maple, eh! The very first thing we want to do before we start working is to type:

restart

This clears the memory buffer of any existing variable or function definitions.

Functions:
To define a function f(x) = sin(x), say, type

$f := x \rightarrow \sin(x)$

$$x \rightarrow \sin(x) \quad (1)$$

You can then call this function using a variable as input,

$f(x)$

$$\sin(x) \quad (2)$$

or you can evaluate it as an actual number as input:

$f\left(\frac{\text{Pi}}{4}\right)$

$$\frac{1}{2}\sqrt{2} \quad (3)$$

Maple likes to give us results symbolically, not numerically, so in order to see what that number is, type

$evalf(\%)$

$$0.7071067810 \quad (4)$$

Here, $evalf(\ )$ means "evaluate function", and the $\%$ means "last line calculated". We can alternatively combine the two steps:

$evalf\left(f\left(\frac{\text{Pi}}{4}\right)\right)$

$$0.7071067810 \quad (5)$$

Note that we can choose (almost) any name we want for our functions, as long as they don't conflict with pre-defined variable or function names. So, instead of the lame $f(x)$, we could instead have called it *myfirstfunction*:

$myfirstfunction := x \rightarrow \sin(x)$

$$x \rightarrow \sin(x) \quad (6)$$

which we can invoke accordingly:

$myfirstfunction(x)$

$$\sin(x) \quad (7)$$

Functions can be multivariate, and we'll frequently need to define these. For example,

$f2 := (x, a) \rightarrow a \cdot \sin(x)$

$$(x, a) \rightarrow a \sin(x) \quad \textbf{(8)}$$

is now a sine function whose amplitude we can vary as input:

$f2(x, a)$

$$a \sin(x) \quad \textbf{(9)}$$

$f2\left(\frac{\mathrm{Pi}}{4}, 1\right)$

$$\frac{1}{2}\sqrt{2} \quad \textbf{(10)}$$

$f2\left(\frac{\mathrm{Pi}}{4}, 2\right)$

$$\sqrt{2} \quad \textbf{(11)}$$

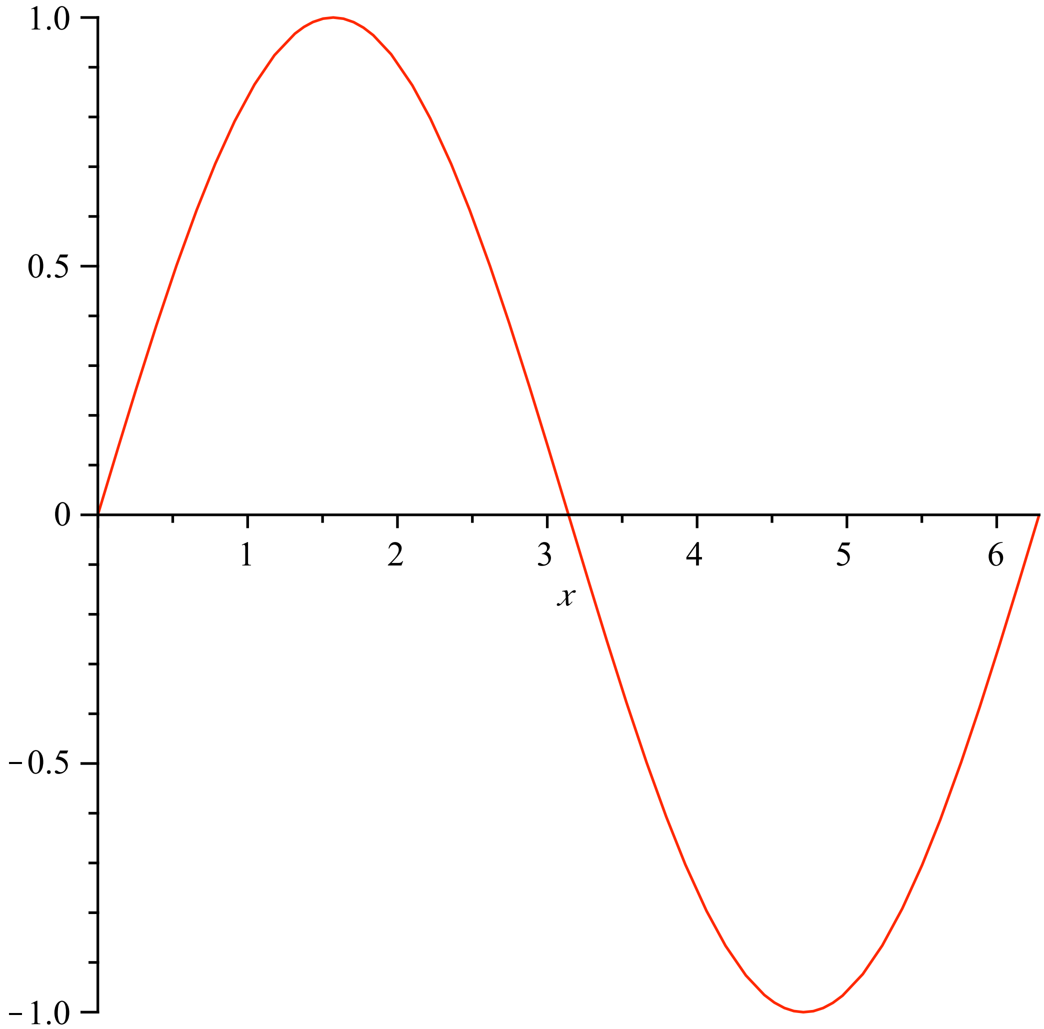
and so on. There's no limit to how many input variables you want to define.

Plotting

After we define our functions, we will also want to plot them. Plotting is a fairly simple procedure, but you have to watch your syntax.

Suppose we want to plot $f(x)$ as defined above. The only variable is x, so we would type

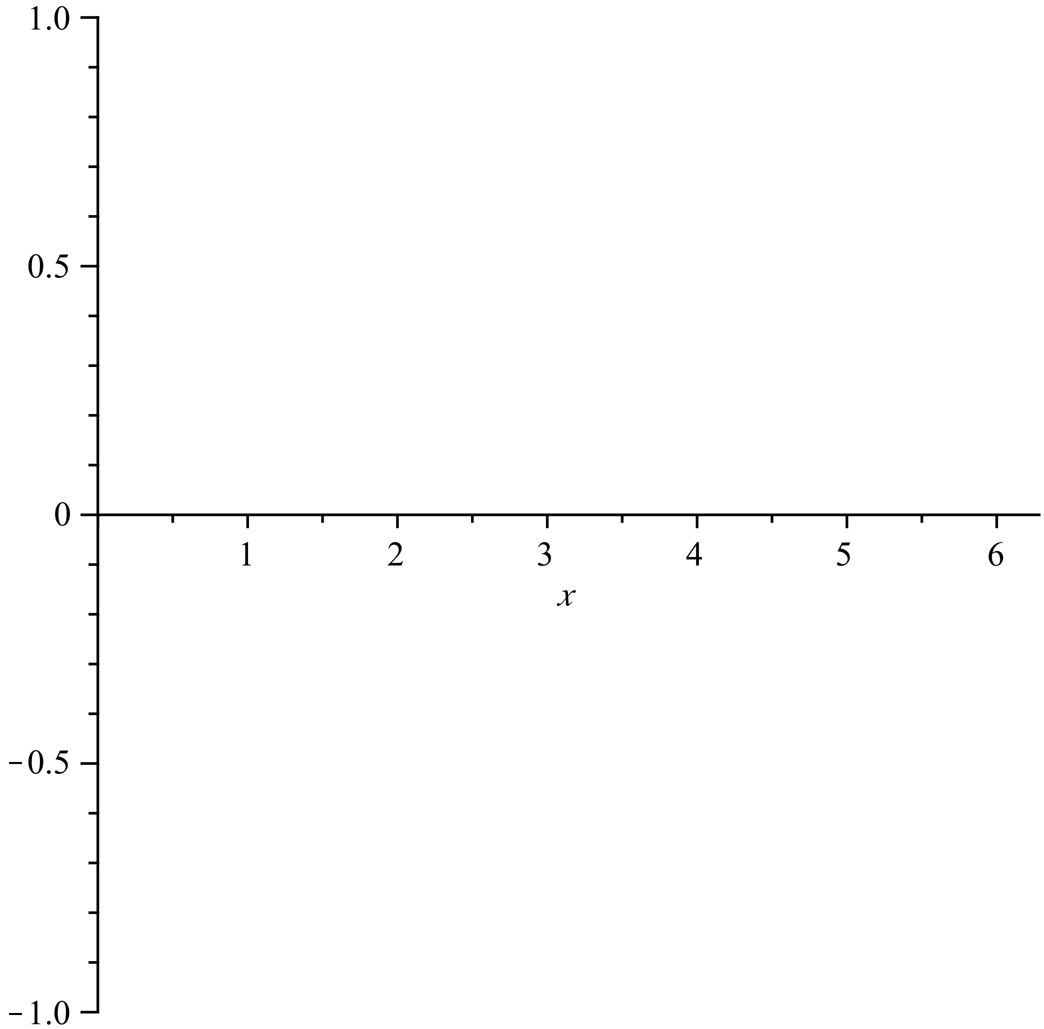
$plot(f(x), x = 0 .. 2 \cdot \mathrm{Pi})$



That is, of course, what we expect to see! We can vary the range to whatever we want.

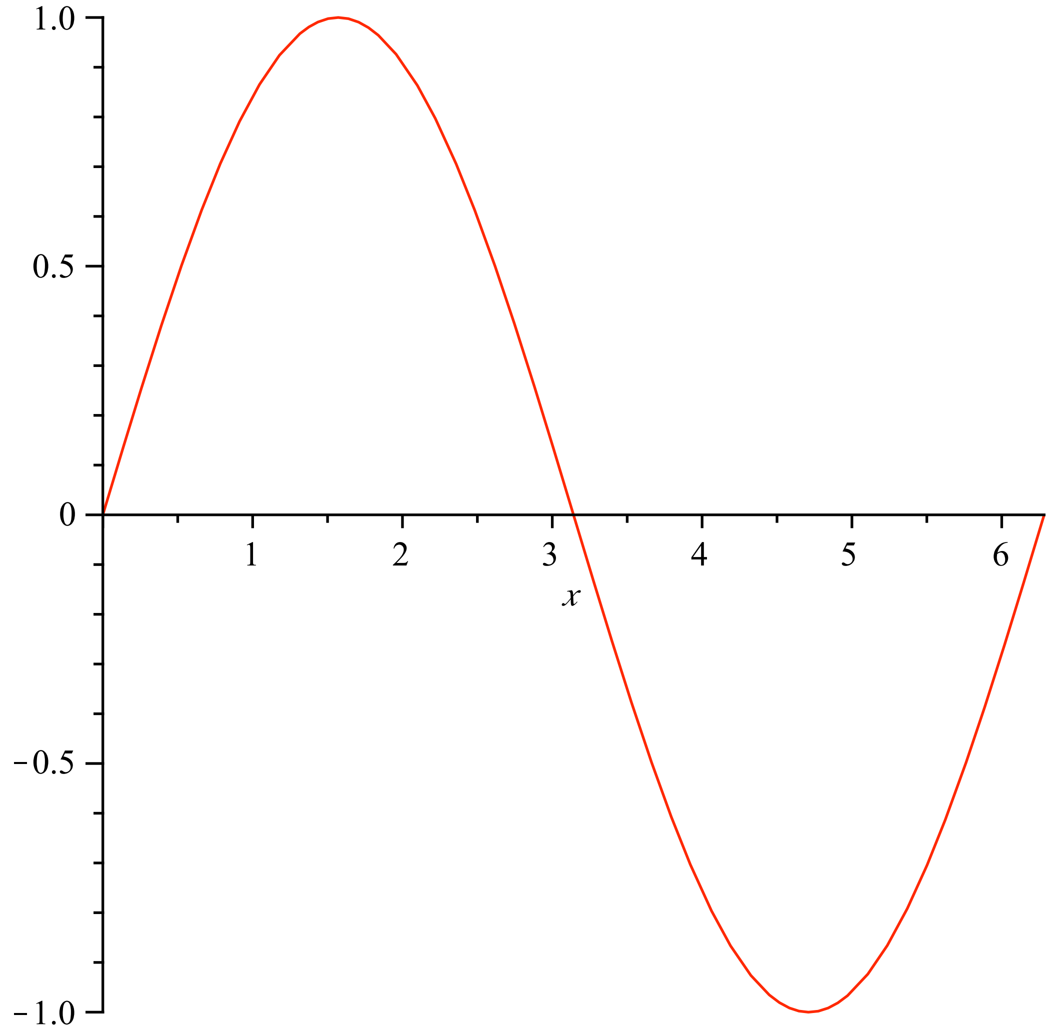
To plot our second function of two variables, let's type:

$plot(f2(x, a), x = 0 ..2 \text{ Pi})$

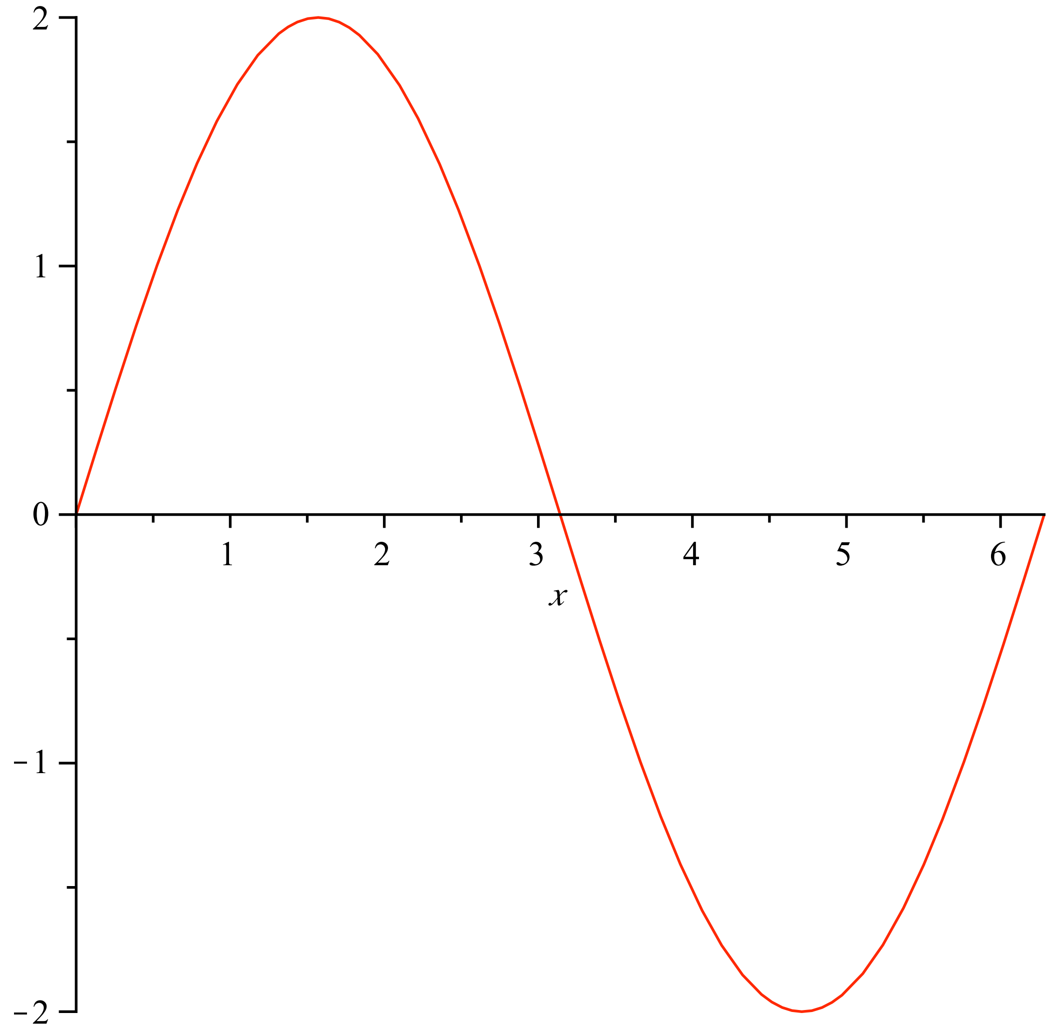


Uh oh! Why didn't it show anything? Duh! We forgot to set a value for *a*. Let's try again:

plot(*f2*(*x*, 1), *x* = 0 ..2 Pi)



plot(*f2*(*x*, 2), *x* = 0 ..2 Pi)



Much better!

Integrating and Differentiating

The other important thing we'll need to do is calculus. To differentiate a function, type

$diff(f(x), x)$

$$\cos(x) \tag{12}$$

To perform an indefinite integrate, type

$int(f(x), x)$

$$-\cos(x) \tag{13}$$

and for a definite integral, we need to specify bounds (but they need not be numerical):

$int(f(x), x = 0 .. \mathrm{Pi})$

$$2 \tag{14}$$

$int\left(f(x), x = 0 .. \frac{b}{2}\right)$

$$1-\cos\left(\frac{1}{2}\,b\right) \quad \textbf{(15)}$$

This works with multivariate functions as well, and this time you don't need to define the value of any other variable (but you can if you want):

$diff\,(\,f2(x,a),x)$

$$a\cos(x) \quad \textbf{(16)}$$

$diff\,(\,f2(x,2),x)$

$$2\cos(x) \quad \textbf{(17)}$$

$int(\,f2(x,a),x)$

$$-a\cos(x) \quad \textbf{(18)}$$

and so on.

We can perform higher-order derivatives. Here's the second derivative:

$diff\,(\,f\,(x),x\$2)$

$$-\sin(x) \quad \textbf{(19)}$$

$diff\,(\,f2(x,a),x\$2)$

$$-a\sin(x) \quad \textbf{(20)}$$

and we can also perform multidimensional integration:

$int(int(\,f2(x,a),x=0..b),a=-1..c)$

$$\frac{1}{2}\,(1-\cos(b))\,\left(c^2-1\right) \quad \textbf{(21)}$$

The possibilities are endless, but that's enough to start you out on the road.