What is a Function?

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function/mapping: a mapping (also called a function) is a rule that assigns to every element x of a set X a single element of a set Y. It is written as:

$$f : X \to Y$$

where the arrow indicates mapping, and the letter f symbolically specifies a rule of mapping. When we write:

$$y = f(x)$$

we are mapping from argument x in domain X to value y in co-domain Y.

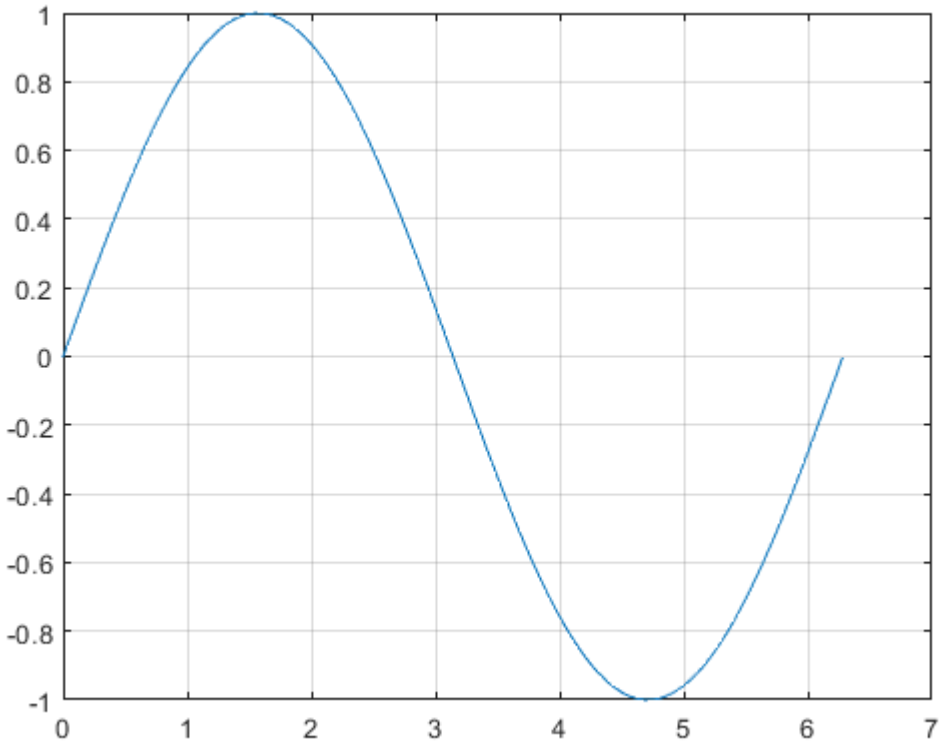
Definitions:

- **domain**: big X is the domain of f
- **argument**: little x is an element in big X, an argument of the function f.
- **co-domain**: big Y is the co-domain of f.
- **image/value**: when $y = f(x)$, we refer to y as the image or value of x under f.
- **range**: $f(X) = \{y \in Y : y = f(x) \text{ for some } x \in X\}$
- **graph:** "The graph of a function of one variables consists of all points in the Cartesian plane whose coordinates (x,y) satisfy the equation y = f(x)" (SB)

In some textbooks, x is called independent or exogenous variables, and y is called dependent or endogenous variables. We will avoid using those words to avoid confusion.

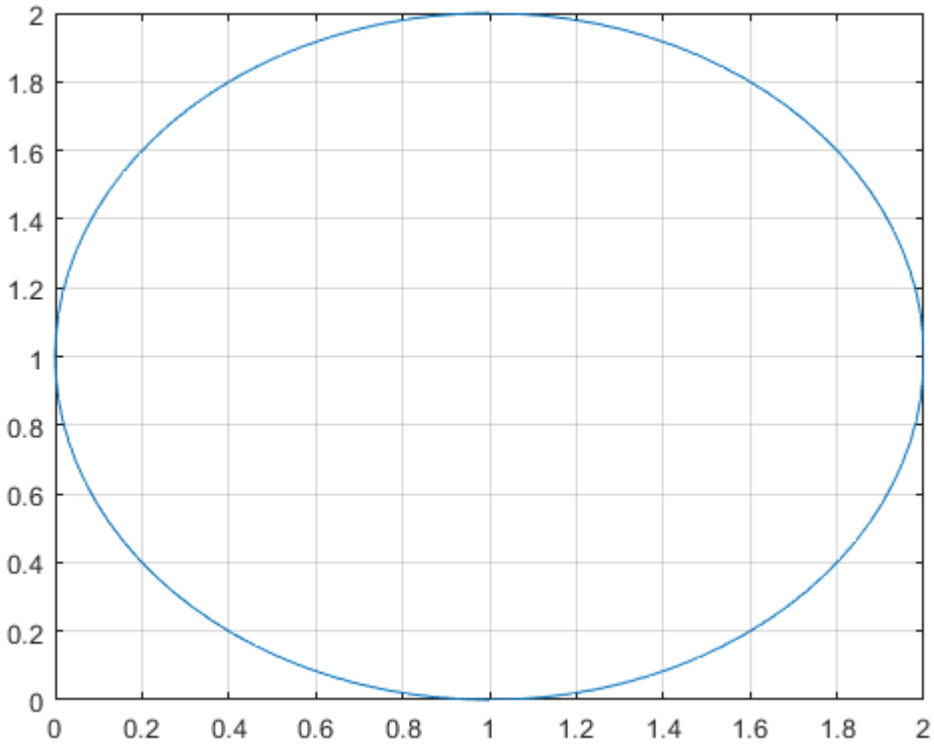
This is a function:

```
figure();
x = 0:pi/100:2*pi;
y = sin(x);
plot(x,y);
grid on;
```



This is NOT a function:

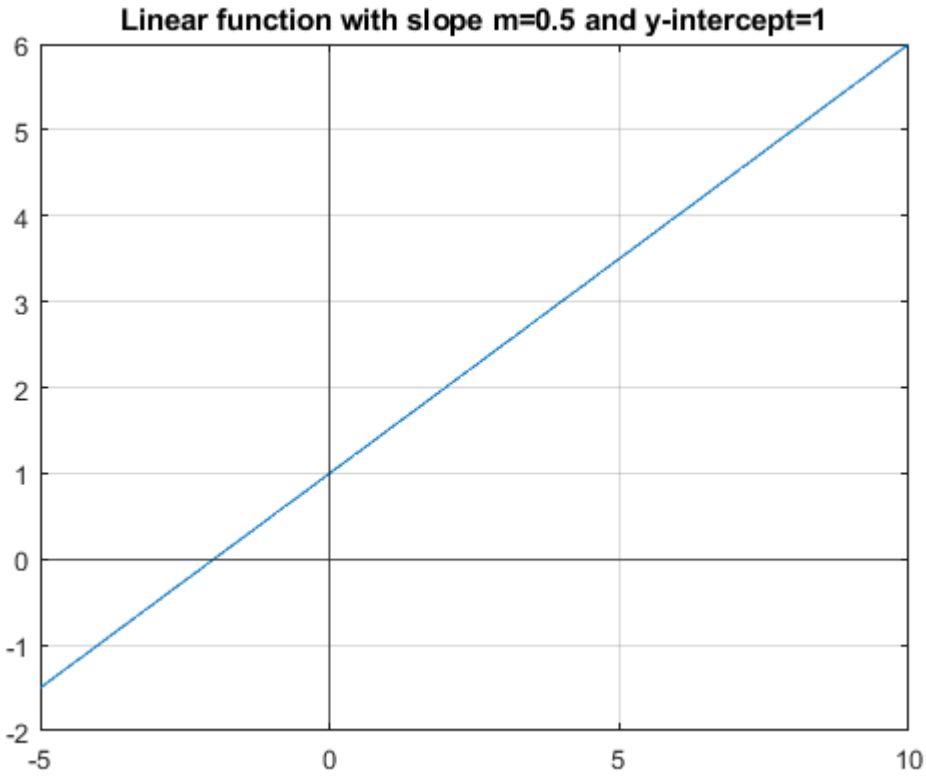
```
figure();
x = 1; y=1; r=1;
th = 0:pi/50:2*pi;
xunit = r * cos(th) + x;
yunit = r * sin(th) + y;
h = plot(xunit, yunit);
grid on;
```



A Linear Function

A linear function, polynomial of degreee 1, has slope m and intercept b. Linear functions have a constant slope.

```
figure();
m = 0.5;
b = 1;
ar_x = linspace(-5, 10, 100);
ar_y = ar_x*m + b;
h = plot(ar_x, ar_y);
% Title
title({['Linear function with slope m=' num2str(m) ' and y-intercept=' num2str(b)]});
% axis lines
xline0 = xline(0);
xline0.HandleVisibility = 'off';
yline0 = yline(0);
yline0.HandleVisibility = 'off';
grid on;
```


Linear function with slope m=0.5 and y-intercept=1
6
5
4
3
2
1
0
-1
-2
-5
0
5
10