Functions (review)

A function is a relationship between two variables (an input variable and an output variable) where each input is associated with exactly one output. If we call out input variable x and our output variable y, then we can say that for every (valid) x value, there is exactly one y value. There are three common ways to specify functions:

- **i.** In-Out Tables
- **ii.** Graphs
- **iii.** Equations

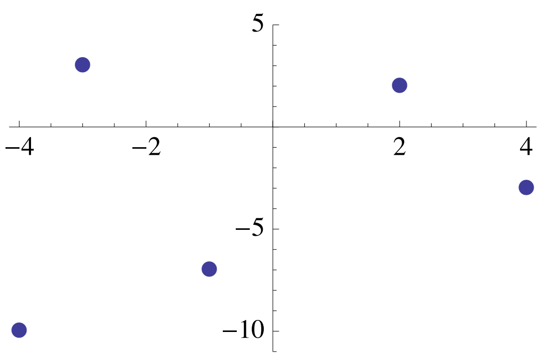
In-Out Tables

One way of showing functional relationships is the "In-Out Table" (also called an "X-Y Table"). Here is an example function that is defined using an In-Out table:

In (x)	**Out (y)**
−4	−10
−1	−7
0	3
4	−1
2	2

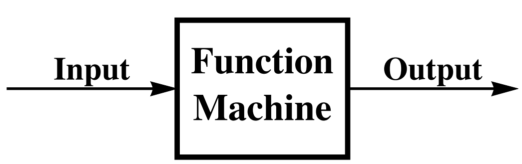
Graphs

In mathematical language, a function "maps" an input value to a unique output value. We can also show this mapping on a graph by plotting the input and output values as x- and y-coordinates:

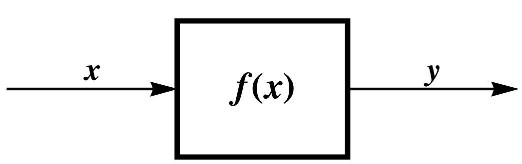


Equations

Pictorially, we have talked about functions as "machines" that take an input and produce an output:



Mathematically, we can also think of this using function notation:



A function is often denoted by the letter "f", though many other letters are also often used, such as g and h. The notation $f(x)$ means that the function f operates on an input x to produce an output (which is often denoted by y). Because $f(x)$ produces y, you will often see the equality: $y = f(x)$.

Specifically note that the notation $f(x)$ does not mean f multiplied by x. To avoid confusion, when we have two variables that are multiplied together, we either use a dot or space. The following table gives some clarifying examples:

Multiplying	**Function Notation**
$g \cdot x$	$g(x)$
$g\ x$	$g(x)$
$h\ a$	$h(a)$
$r\ s$	$r(s)$

Using function notation, we can specify a function using an equation. For example, here is a linear function written as the equation of a line:

$$y = f(x) = 3\,x + 6$$

Functions do not have to be linear. Here is the equation of a non-linear function:

$$f(x) = 2\,x^2$$