Funtions – Basics

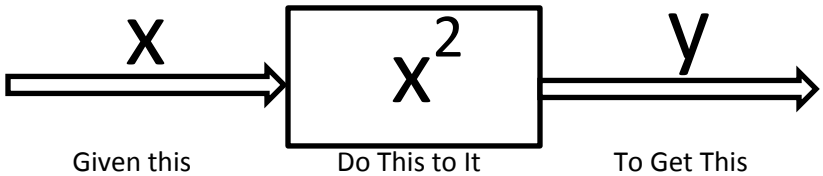
Imagine a machine. You put something into it….the machine does its thing…and something comes out.

This is what a function does.

Let's look at an equation like we've dealt with before: $y = x^2$

If you are given any value of x, you can easily find the corresponding value of y. How?

The equation tells you. It provides the instructions for getting y.

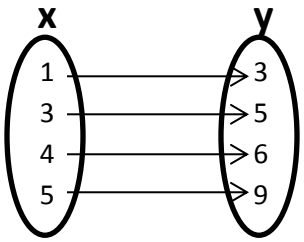


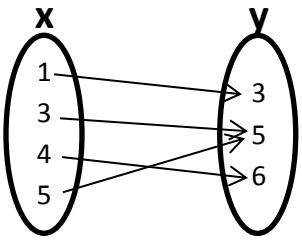
This is the essence of a function.

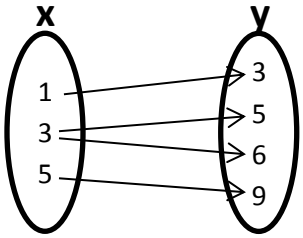
More specifically, a function is a relationship where every input related to only one output.

What does this mean? Consider these relations.

Ex. 1: $\{(1,3),(3,5),(4,6),(5,9)\}$ Ex. 2: $\{(1,3),(3,5),(4,6),(5,5)\}$ Ex. 3: $\{(1,3),(3,5),(3,6),(5,9)\}$







Every x goes to ONLY 1 y,

This IS a function

Every x goes to ONLY 1 y,

This IS a function

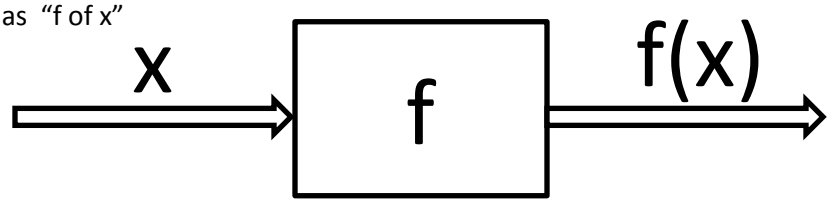
The 3 goes to MORE THAN 1 y,

This IS NOT a function

Function notation:

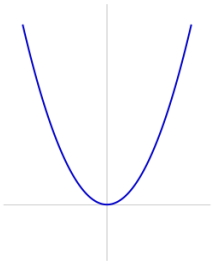
Instead of writing an equation such as $y = x^2$, we can show that this is a function by writing it as: $f(x) = x^2$

$f(x)$ is read as "f of x"



The input variable is called the Independent Variable, because you can pick whatever you like.
The output variable is called the Dependent Variable, because your answer depends on the function.

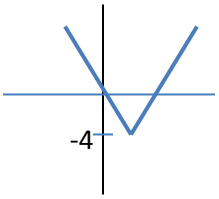
The set of ALL possible inputs for a function is called the DOMAIN of the function.
The set of ALL possible outputs for a function is called the RANGE of the function.



Look at the function, $f(x) = x^2$. If you graph it, it looks like:
Along the x-axis, the curve exists everywhere.
So the **domain** of this function is **all real numbers**.
Along the y-axis, the graph only exists with values greater than zero.
So the **range** of the function is $\boldsymbol{f(x) \geq 0}$.

Ex 2: For $\{(1,3),(3,5),(4,6),(5,5)\}$, Domain = {1, 3, 4, 5} & Range = {3, 5, 6}

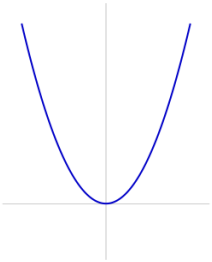
Ex 3: Looking at the function:
$y = 2|x - 2| - 4$



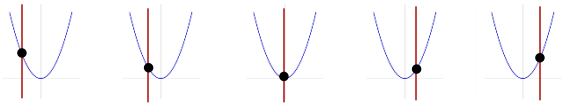
Domain = {all real numbers}
Range = $\{y \geq -4\}$

Vertical Line Test:
You can determine if a relation is a function by looking at its graph.
Suppose you draw a vertical (up and down) line anywhere through the graph, the Vertical Line Test says that if the line crosses the graph **NO MORE THAN ONCE**, then the relationship is a function.

Ex: $f(x) = x^2$ looks like

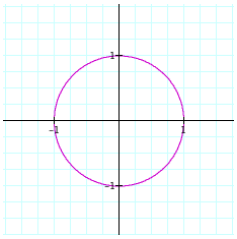


If you draw a vertical line anywhere through the graph:

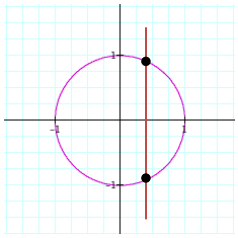


It will only cross once, so $f(x) = x^2$ IS a function.

Ex: What about this relation?



Drawing a vertical line through the graph:



The line crosses the curve MORE THAN ONCE, so it IS NOT a function.

Evaluating Functions:
Given the function $f(x) = x^2$, you can evaluate the function for any given x value.
Ex: Find $f(2)$.
This is a fancy way of saying "find y when x = 2". So plug 2 in for any x in your equation.
$f(2) = 2^2 = 4$ Note: You don't do anything with the 2 on the left. $f(2)$ is the NAME of value.
It is just telling you which x value you used.
Ex: $g(x) = x^2 - 3x + 5$, find $g(1)$. $g(1) = (1)^2 - 3(1) + 5 = 1 - 3 + 5 = 3$