

What is a function?

Three main parts of a function:

Input, Relationship, Output:

Example: $y = 3x$

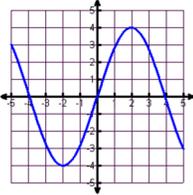
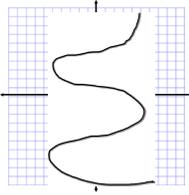
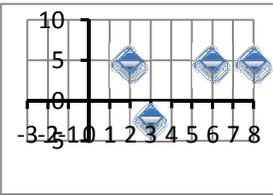
Input (x)	Relationship	Output (y)
1	times 3	3
4	times 3	12
10	times 3	30

Function Names: Functions can be named anything. In books, we most frequently see f or g as names. Examples:

- $f(x) = 3x$ means “a function f with input (x) ” and “you multiply the input by 3” for the output
- $g(x) = 2x + 1$ means “a function g with input (x) ” and “you multiply the input by 2 and add 1” for the output
- $h(x) = x^2$ means “a function h with input (x) ” and “you square the input” to get the output
- Sometimes there is no function name and you will see $y = 3x$, as in the table above. There is still input, output, and a relationship that assigns a unique output for each input. Remember x is just the variable-name for the input—it could be q or r or m etc.

Formal Definition of a Function: A function relates each element of an input set with exactly one element of an output set.

- “...each element...” means that every element in x (input) is related to a unique element in y (output)
- “...exactly one...” means that the function will not output more than 1 result for a given input. You can have ONLY ONE Y VALUE for each X VALUE

This is NOT a function (two points with y values for the same x value)	This is a function— (only one y value for each x value) USE VERTICAL LINE TEST*	This is NOT a function (two points with y values for the same x value) USE VERTICAL LINE TEST*	This is a function— (only one y value for each x value) (functions can also be discrete—not continuous)
$\{(7, 12), (6, 9), (7, 8), (4, 11)\}$ $\{(-2, 5), (-2, 6), (-2, 7)\}$			

*The vertical line test is only useful when graphing on a Cartesian plane. In other words graphing parametrically, in polar form etc. the vertical line test does not hold for determining function.

(Definition of Function: www.mathisfun.com/sets/function.html)

Function Representations: Stories, Tables, Graphs, Equations

NOTE: In the study of Functions, students must represent the functions using different representations (tables, graphs, equations) and be able to work interchangeably among those representations. They will need to...

- Describe increasing/decreasing patterns
- Compare rates of change from the same or different representations
- Write equations from real life situations, from data, from graphs
- Create functions from real life examples—use all forms of representations

The definitive assessment item for Functions in 8th grade math: “Describe a situation from real life which involves a mathematical function. Then create the table, graph, equation and prediction.”

1. Inform students from the beginning about this final assessment item.
2. Students should have extensive experience with real life problem situations (please refer to suggested lessons or assessment tasks on the wordpress site <http://middlemathccss.wordpress.com/8th-grade-math/>).

Other Instructional examples:

1. Write an equation describing the following situations:
 - Jane has \$20. She saves \$1.50 each week. How much money does she have in any given week?
 - Kris has edited 200 pages so far in his career. He can edit 8 pages per day. How many pages will he have edited in the future?
 - Leah is at her neighbor’s house 2 miles from her house. She runs toward her house at a rate of 1/10 of a mile each minute. How far is she from her house at any given time? When will she reach her house?
2. Describe the following situations as increasing or decreasing, and linear or nonlinear.
 - Mike has \$25. He saves \$11 each week.
 - Nettie has \$2. She doubles her money each week.
 - Paul has \$100. He spends \$5 each day.

A mathematical look at increasing and decreasing functions: http://apcentral.collegeboard.com/apc/members/repository/ap03_adaptation_calca_29895.pdf (Honors as written, adaptable for regular.)