Ha1

FUNctions

A **Function** is a relationship between inputs and outputs in which each input has exactly one output

-all functions are relations

<u>How to determine a function from the four representations of relations:</u>

- Ordered Pairs

  -each x value is listed only once

  ex: $\{(1,2),(3,4),(1,5)\}$ → Not a function

- Table

  -no x-values are repeated

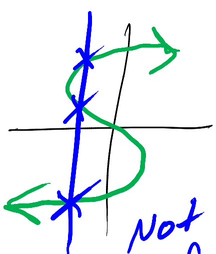
  ex:

x	0	4	0
y	2	-1	6

  Not a function

- Graph
  - Vertical Line Test

    -If any vertical line can cross the graph in more than one spot, then it is not a function

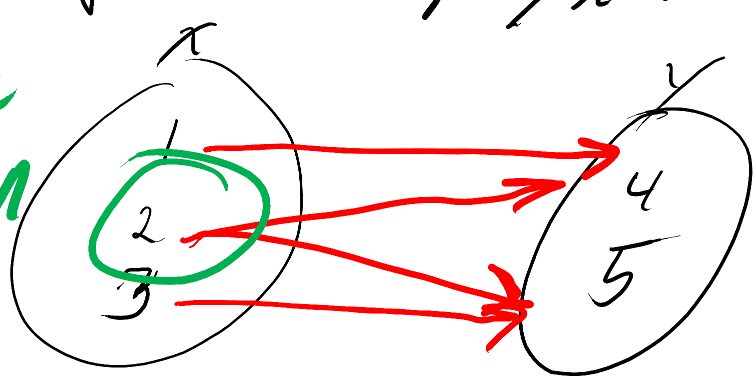


Not a function

- Mapping

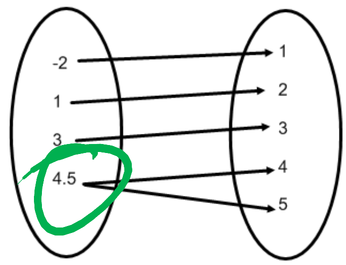
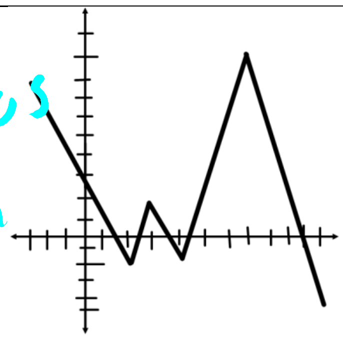
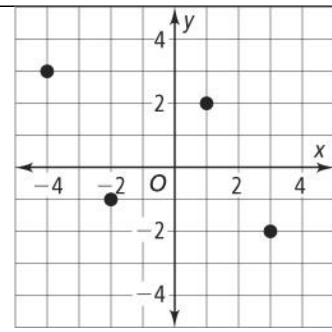
  -only one arrow can come out of each input/x-value/domain.

Not a function



Practice: Determine if each relation is a function or not. Explain.

<table>
<tr>
<td>{(3, 2), (1, -1), (2, -4), (3, -9), (4, -16)}

No!</td>
<td>
No....</td>
</tr>
<tr>
<td>continuous Graph

YES</td>
<td>
Discrete Graph
YES</td>
</tr>
<tr>
<td>{(-2, 0), (3, 2), (4, 5)}

YES</td>
<td>
<table>
<tr><th>x</th><th>y</th></tr>
<tr><td>-2</td><td>-12</td></tr>
<tr><td>0</td><td>-6</td></tr>
<tr><td>1</td><td>-3</td></tr>
<tr><td>4</td><td>6</td></tr>
</table>
YES</td>
</tr>
</table>

Function Notation:

Function Notation is the way a function is written. It is meant to be a precise way of giving information about the function without a lengthy written explanation.

The most popular function notation is $f(x)$ which is read f of x

**This does NOT represent the multiplication of f time x

For example:

function name

$$f(\underset{\text{input value}}{x}) = \underbrace{3x + 1}_{\text{output value}}$$

**The input value should always be the same variable used throughout the function.

Usually, functions are referred to by single letter names, such as f, g, h, k, etc. Any letter(s) may be used to name a function. Examples:

$f(x) = 4$ | $g(t) = 3t^2$ | $max(t) = -16t^2$

The $f(x)$ notation is another way of representing the y-value in a function, $y = f(x)$. The y-axis is sometimes even labeled as the $f(x)$ axis, when graphing. And ordered pairs may be written as $(x, f(x))$, instead of the typical (x, y).

$y = 5x + 2$ is EQUIVALENT to $f(x) = 5x + 2$

Advantages of function notation:

1. Allows for individual function names to avoid confusion
2. Quickly identifies the independent variable
3. It quickly states which element of the function is to be examined.

Evaluating Functions

To evaluate a function, substitute the input (the given number or expression) for the function's variable.

a) Replace all the x-values with the number or expression
b) Simplify.

Examples:

Evaluate $f(x) = x^2 - 2x + 3$, when $x = -3$ and $x = 4$.

$f(-3) = (-3)^2 - 2(-3) + 3$

$\boxed{f(-3) = 18}$

$f(4) = 4^2 - 2(4) + 3$

$\boxed{f(4) = 11}$

Practice:

1. Given the function $f(x) = 3x - 5$, find $f(4)$.

$f(4) = 7$

2. Find the value of $h(b) = 3b^2 - 2b + 1 \ when \ b = -3$

$h(-3) = 34$

3. Find $j(-11)$ if $j(x) = 3x - 6$

$j(-11) = -39$

$3 \cdot (-11) - 6$

$-33 - 6$

$\boxed{-39}$

4. Find $g(3w)$ when $g(x) = 2x + 1$

$\boxed{g(3w) = 6w + 1}$

5. Find $f(5)$ when $f(x) = -4x + 3y$

$f(5) = -20 + 3y$

6. Given $f(x) = x - 4$. If $\underbrace{f(k)}_{\text{output}} = 8$, what is the value of $\underbrace{k}_{\text{input}}$?

$f(k) = k - 4 = 8$

$k = 12$

$\boxed{f(12) = 8}$