# By the end of the lesson, you should be able to:

~ Tell if a RELATION is a function.

*Remember that a relation is a

- Mapping
- Set of Coordinate Pairs
- Equation
- Graph

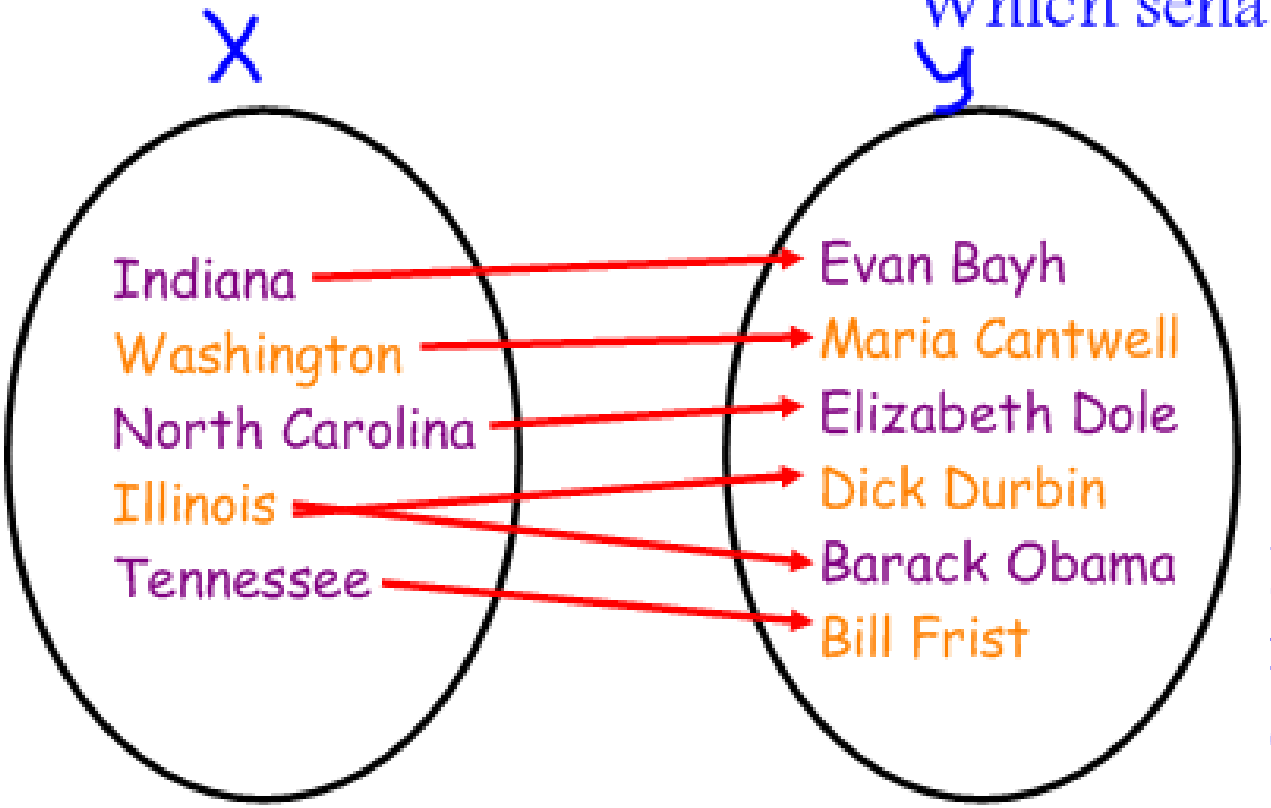
~ Find the value of a function

~ Graph a function

# Determine whether a Mapping is a function.

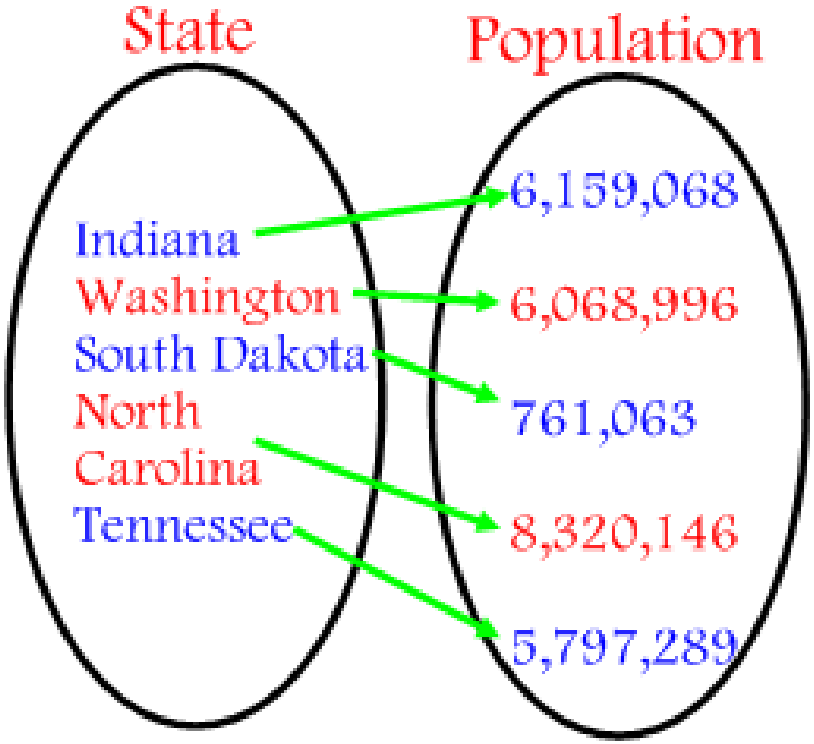
The Mapping shows the relationship between states and randomly selected Senators from 2005. We could say the relation (or relationship) is "is represented by".

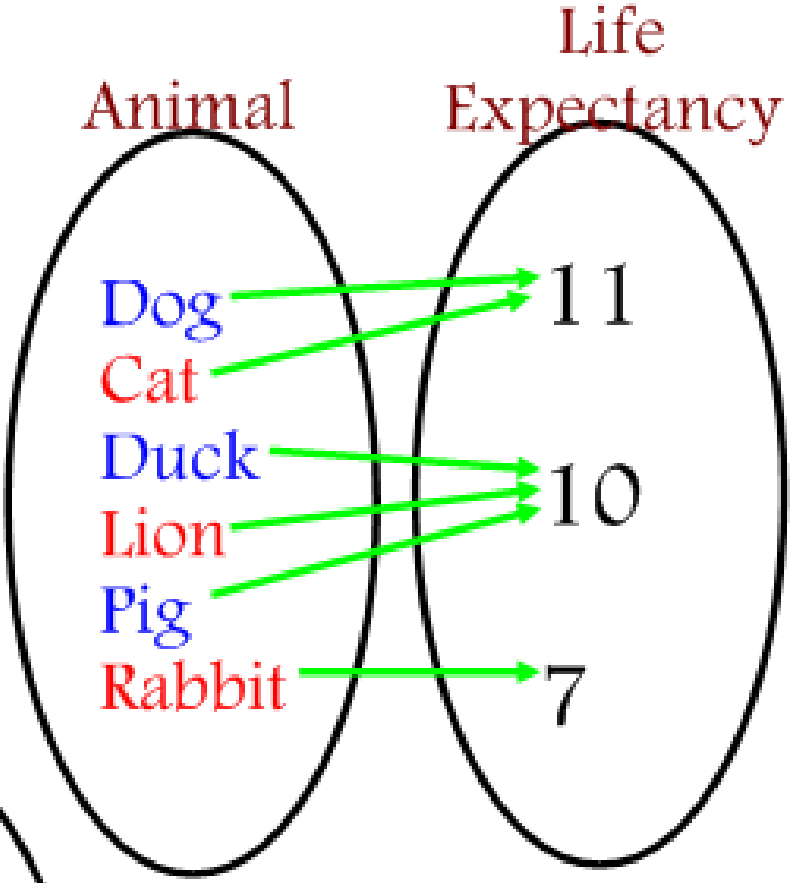
Which senator represents Illinois?

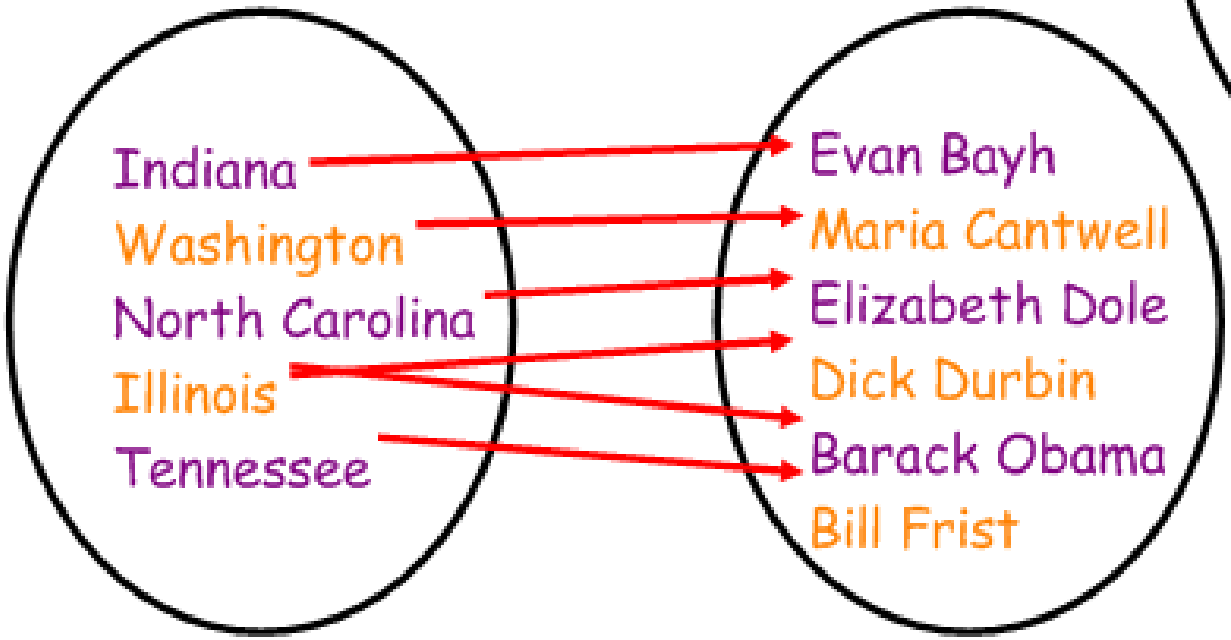



Each input "state" does not correspond to a single output "senator".

Determine whether a Mapping is a function.



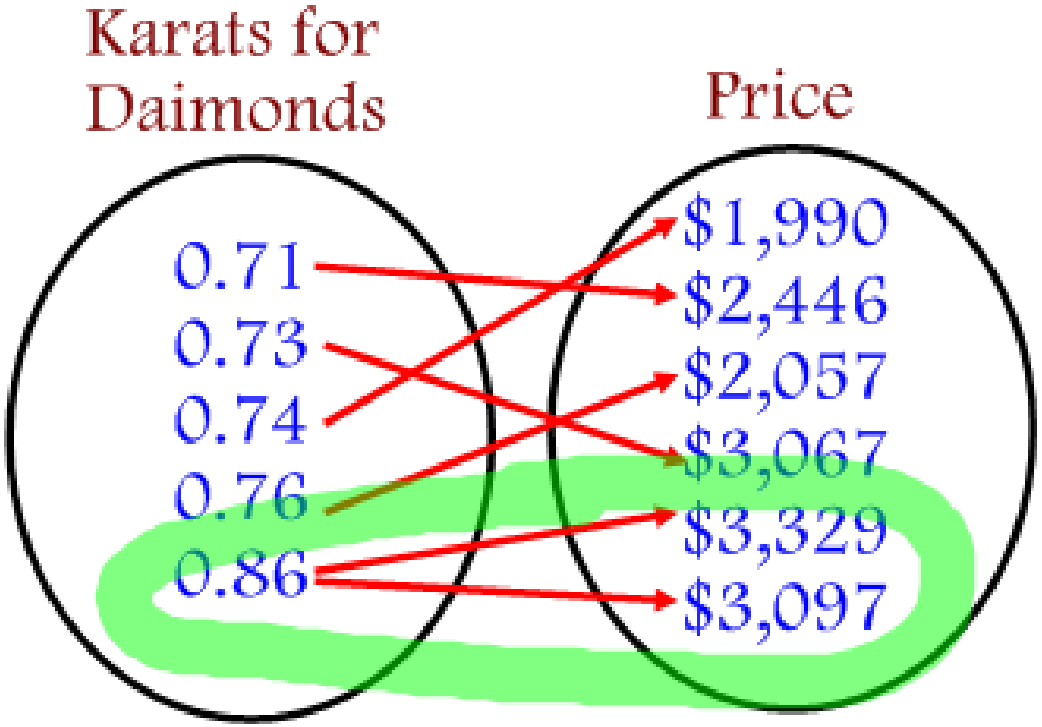

What do they have in common? What is different?

## Defintion

**Function:** A function is a relation in which each element in the domain (the inputs) of the relation corresponds to exactly one element in the range (the outputs) of the relation.

- Each x goes to exactly one y.

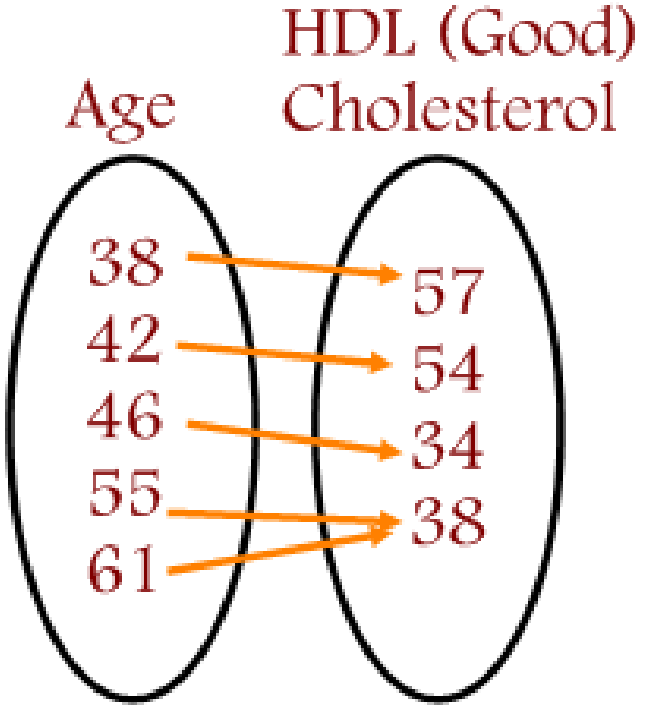
# Determine whether a Mapping is a function.




Function or not?

NO

# Determine whether a Mapping is a function.




Function or not?

yes

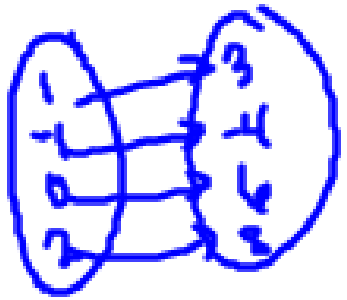
# Note:

Functions are always relations,
but
not all relations are functions!

# Function or not?

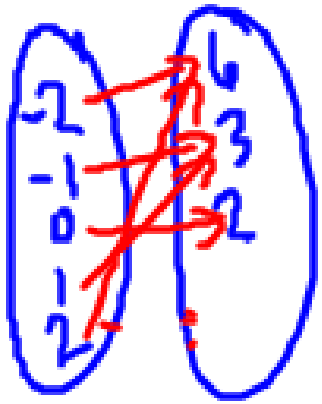
a.) {(1,3), (-1,4), (0,6), (2, 8)}

yes



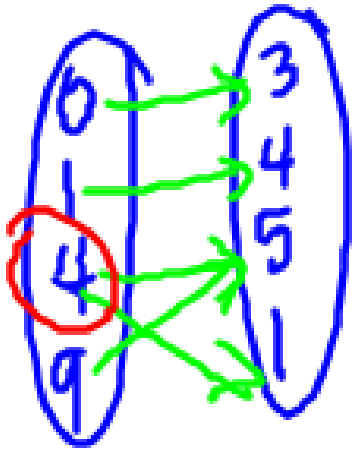

b.) {(-2, 6), (-1,3), (0,2), (1,3), (2, 6)}

yes




c.) {(0,3), (1,4), (4, 5), (9,5), (4, 1)}

No



# Function or not?

a.) {(1,3), (-1,4), (0,6), (2, 8)}

Function

b.) {(-2, 6), (-1,3), (0,2), (1,3), (2, 6)}

Function

c.) {(0,3), (1,4), (4, 5), (9,5), (4, 1)}

Not a Function - 4 goes to too many outputs.

# Note:

In a function, two different inputs cannot correspond to the same output, but two different ouputs can be the result of a single input.

~ 2 x's or "domains" go to 1 y (range) is ~~BAD~~ OK.

~ 1 x "domain" go to 2 y's "range" is ~~OK~~ Bad.

# Determine if an equation is a function.

To determine if an equation is a function, we need to:

1. Solve for y
2. Check to see if one input (x) results in ONLY one y (output).

## Problem

$$y = \pm x$$

$$y^2$$

## Examples:

a.) $y = -2x + 5$

yes
function

b.) $y = \pm 3x$

NO

c.) $y = x^2 + 5x$

yes

d.) $x + y^2 = 9$

NO

$\sqrt{y^2} = \sqrt{9 - x}$

$y = \pm\sqrt{9 - x}$

## Examples:

a.) $y = -2x + 5$

Yes

b.) $y = \pm 3x$

No

c.) $y = x^2 + 5x$

Yes

d.) $x + y^2 = 9$

No

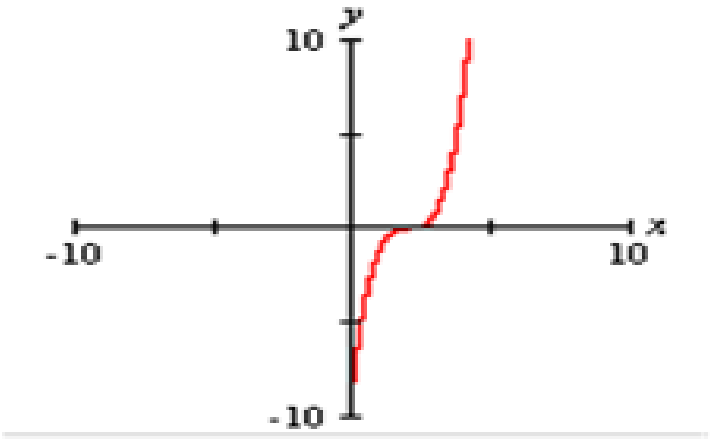
## Determine if a graph is a function.

To determine if an equation is a function, we need to us the Vertical Line Test.

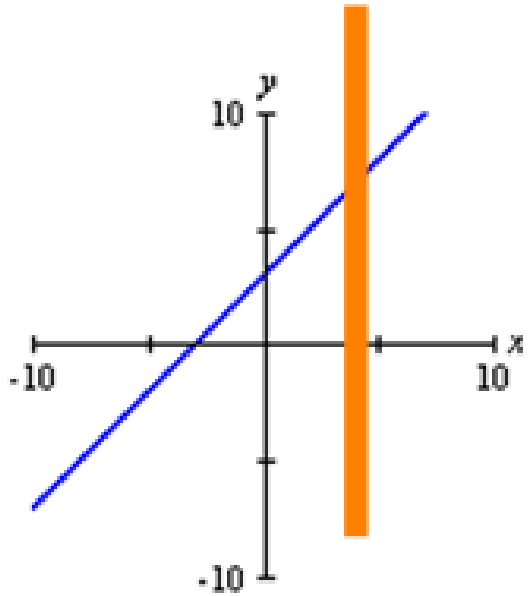
The Vertical Line Test states:

> A set of points in the xy-plane is the graph of a function if and only if every vertical line intersects the graph in at MOST one point.

# These graphs pass the Vertical Line Test so they are FUNCTIONS.

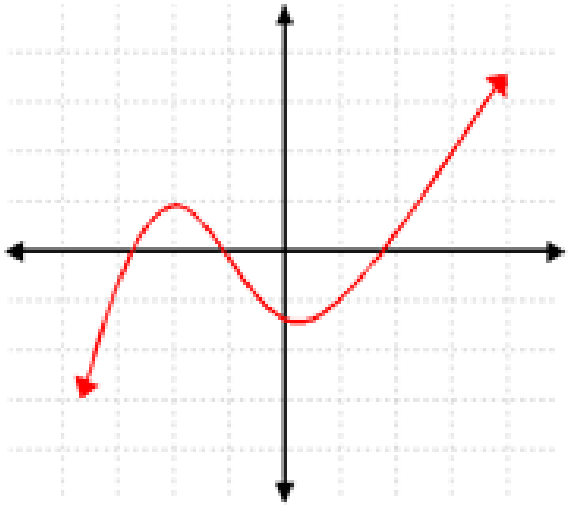



yes

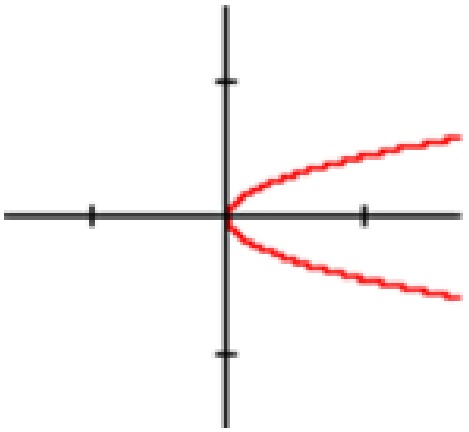



yes

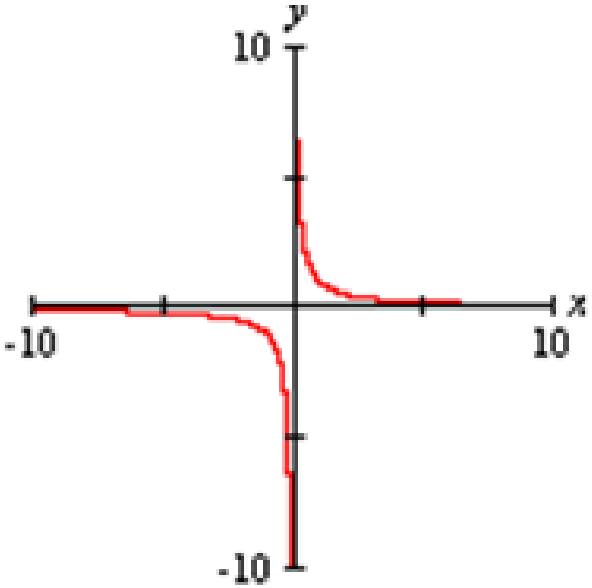
# Function or not?



yes

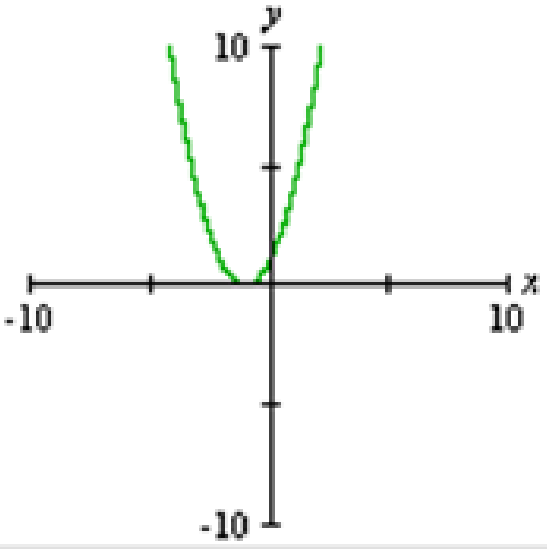


NO

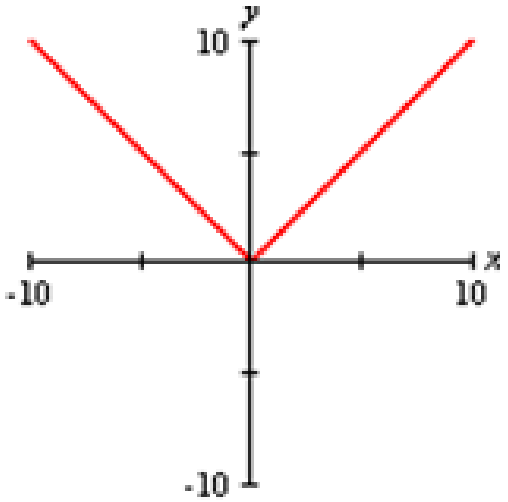



yes

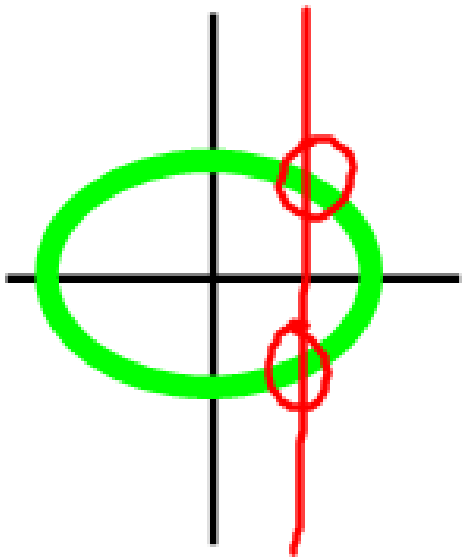
# Function or not?




yes

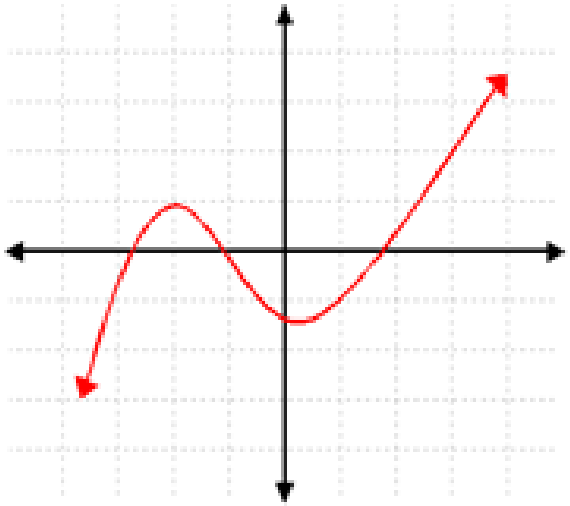



yes

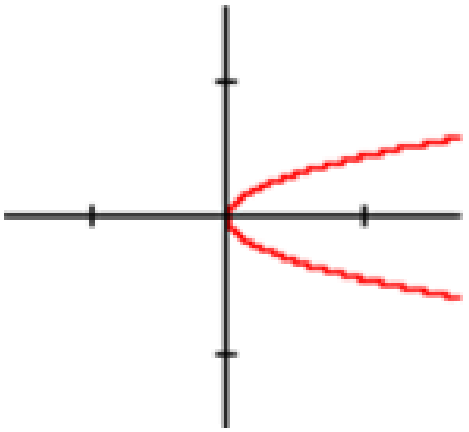


NO

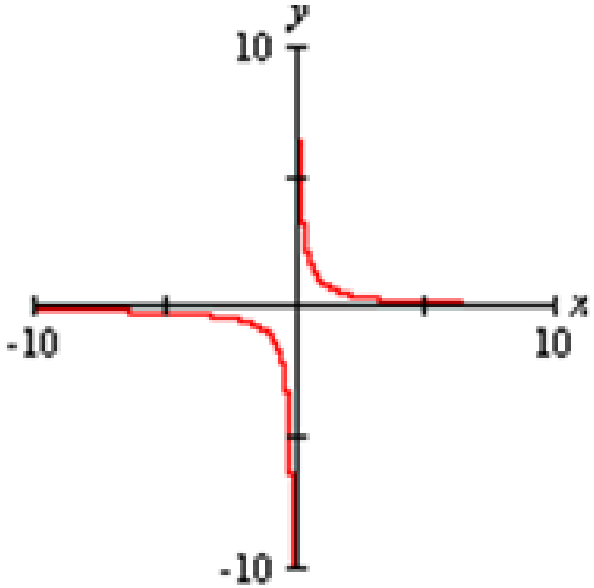
# Function or not?



Yes

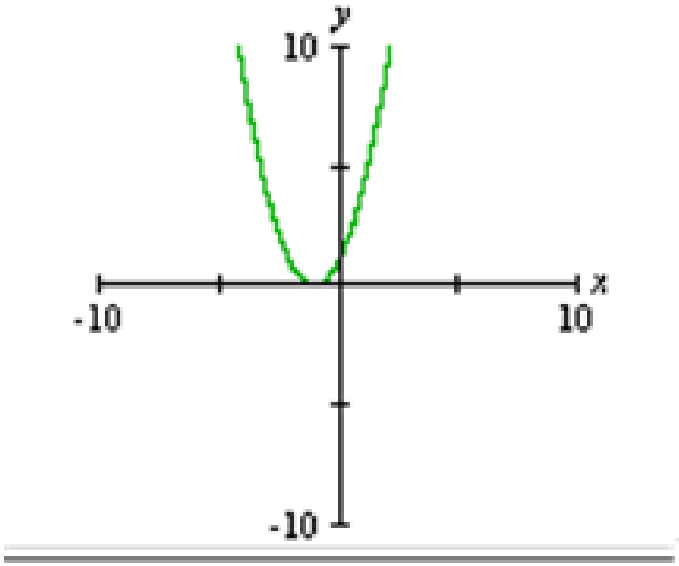


No

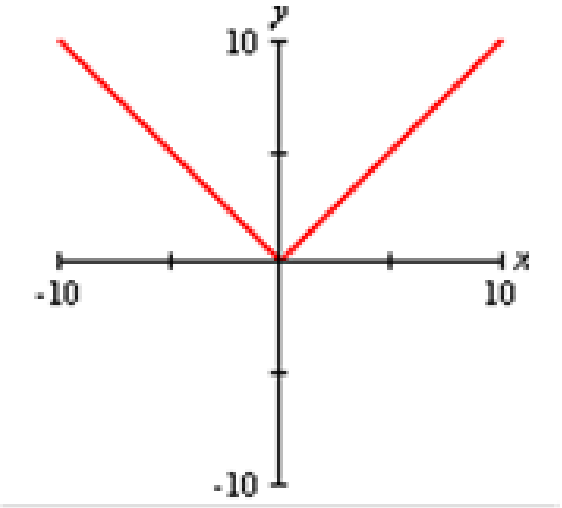



Yes

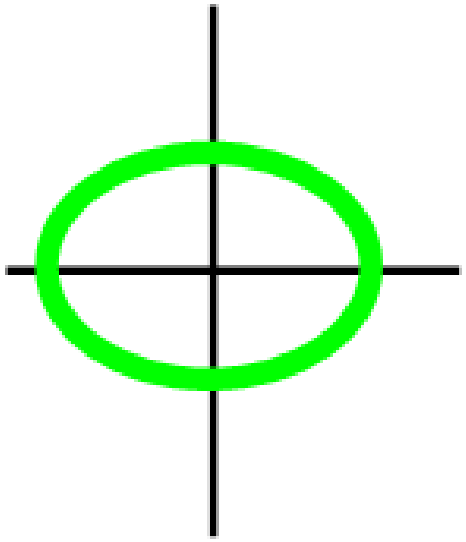
# Function or not?




Yes




Yes



No

We often denote functions as *f*, *F*, *g*, *G*, etc.

If *f* is a function, then for each number *x* in its domain, there is a corresponding value in the range - denoted as f(x). We call f(x) "the value of *f* at the number *x*". $f(x) = y$

For example:

We can rewrite y = 3x + 2 as f(x)= 3x + 2

For a function $y = f(x)$:

x is called the independent variable.

y is called the dependent variable.

↘ or $f$

y is called the dependent variable because its value depends on the value for x.

$W(c) = 30c + 50$

c = indep.

W = dep.

## Find the value for the function:

$$f(x) = x^2 + 5x$$

a.) $f(3) = (3)^2 + 5(3)$

$f(3) = 9 + 15$

$f(3) = 24$

b.) $f(-2) = -6$

$f(-2) = (-2)^2 + 5(-2)$

$= 4 - 10$

$f(-2) = -6$

## Find the value for the function:

$$f(x) = 4x + 7$$

$f(3) = 4(3)+7$
$= 12+7$
$= 19$

a.) $f(x+3) = 4(x+3)+7$

$= 4x+12+7$

$\boxed{f(x+3) = 4x+19}$

b.) $f(x) + f(3)$

$= 4x+7+19$

$= 4x+26$

$\boxed{f(x)+f(3) = 4x+26}$

## Summary

1. For each x in the domain there corresponds exaclty one y in the range.
2. *f* is a symbol that we use to denote the function. It represents the equation that we use to get from an x in the domain to f(x) in the range.
3. If y = f(x), then x is called the independent variable, and y is called the dependent variable or the value of *f* at x.

## Find the value for the function:

$$f(x) = 4x + 7$$

a.) f(x + 3)

b.) f(x) + f(3)

# By the end of the lesson, you should be able to:

~ Tell if a RELATION is a function.

*Remember that a relation is a

- ~ Mapping
- ~ Set of Coordinate Pairs
- ~ Equation
- ~ Graph

~ Find the value of a function

~ Graph a function

# Can you?

# Homework:

Pg. 165: 1, 2, 9, 11, 15-35 odds,
39, 43, 47, 51, 53, 67
(~~19~~ 20 prob)