

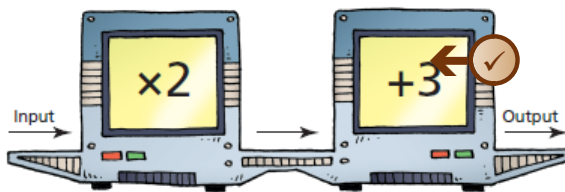
## 5.2 Properties of Functions



### LESSON FOCUS

Develop the concept of a function.

### Make Connections



x	y
Input	Output
1	5
3	
5	11

$$y = 2x + 3$$

What is the rule for the Input/Output machine above?

Which numbers would complete this table for the machine?

# Independent / Dependent

## Dependent

generally  $y$

- a variable whose value is determined by the value of another (independent) variable.

## Independent

$x$

- a variable whose value is not determined by the value of another variable, and whose value determines the value of another (dependent) variable

**Independent Variable**

- Hours do not depend on the person's pay.

**Dependent Variable**

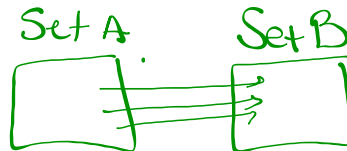
- A person's pay often depends on the number of hours worked.

Hours Worked, $h$	Gross Pay, $P$ (\$)
1	12
2	24
3	36
4	48
5	60

**Domain & Range**

**Domain**

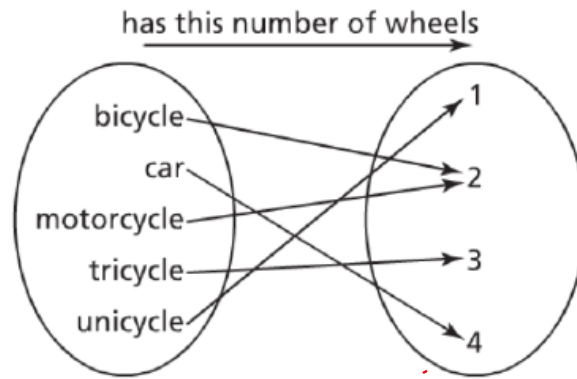
- the set of first elements in a relation



**Range**

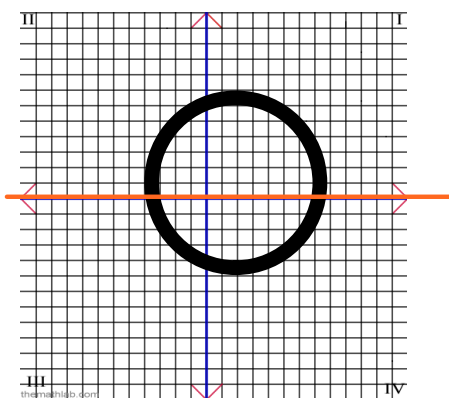
- the set of second elements in a relation

Input	Output
1	5
2	7
	9
4	
	13



<b>Domain</b>	The first set of elements: {bicycle, car, motorcycle, tricycle, unicycle}
<b>Range</b>	The second set of elements: {1, 2, 3, 4}

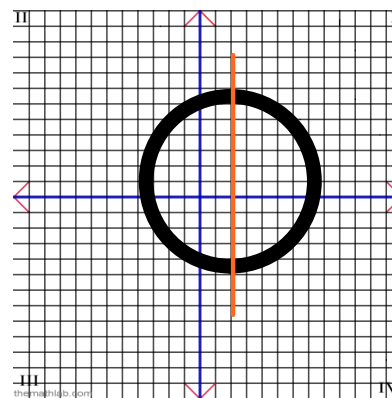
Domain



The **domain** represents all the values of x.

X is the independent Variable

Range

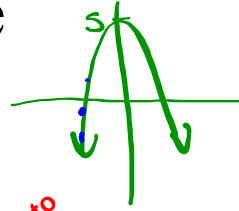


The **range** represents all the values of y.

Y is the dependent Variable



How do you state the range?



Ex1

such that

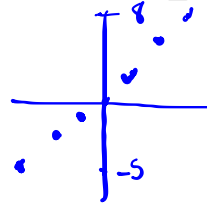
$$\{y \mid y \leq 5, y \in \mathbb{R}\}$$

Belongs to real

|

Ex2

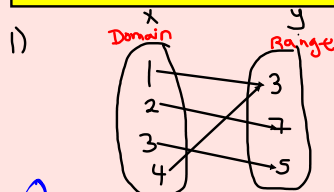
$$\{y \mid -5 \leq y \leq 8, y \in \mathbb{I}\}$$



Relations VS Functions

- a relation is where a pattern/relationship exists between the independent variable (x) and the dependent variable (y).

- a function is a special relationship where... "each x has one and only one y value".



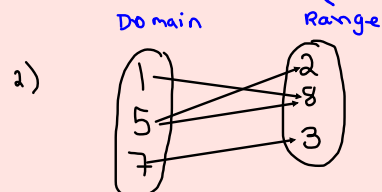
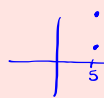
Ordered pairs (x,y)

- (4,3)
- (2,7)
- (3,5)
- (1,3)

Function

↓  
x values are not repeated

function.



- (1, 8)
  - (5, 2)
  - (5, 8)
  - (7, 3)
- Non function

# Function or Nonfunction

## Function:

A relation where each element in the first set is associated with one and only one element in the second set.

F  
u  
n  
c  
t  
i  
o  
n

## Functions

- How can I tell from a set of points/table?

"an x value has more than one y value"

- a function is a relation in which no two ordered pairs have the same first coordinate.

x	y
3	5
7	11
8	15
9	22

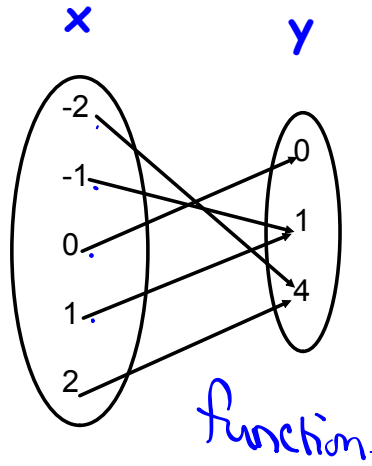
Function or Not a function  
that is the question?



## Arrow Diagrams

Function:

For every first element there is one and only one second element. (Only one arrow starts from each element of the domain.)



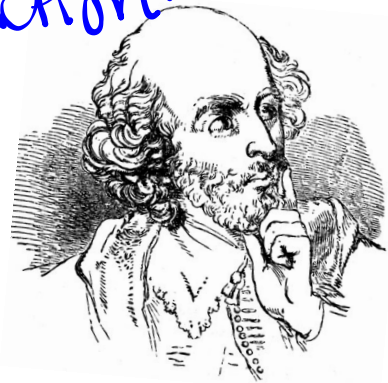
Function or Not a function  
that is the question?

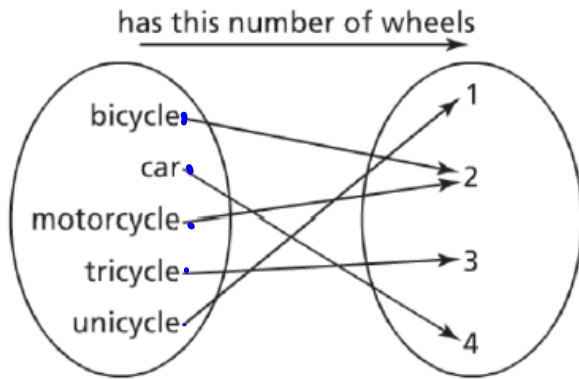


Sport	Equipment
badminton	shuttlecock
badminton	racquet
hockey	puck
hockey	stick
tennis	ball
tennis	racquet
soccer	ball

Function or Not a function  
that is the question?

non function.





Function or Not a function  
that is the question?

function.

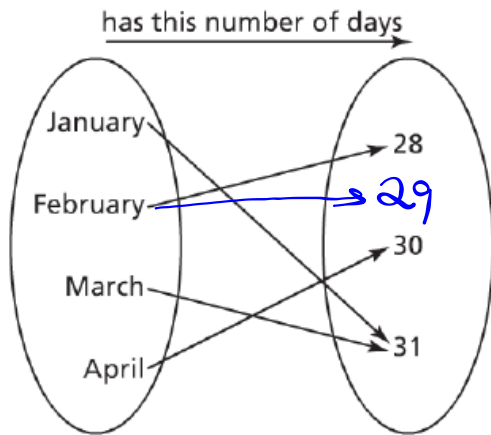


{ (2, 5), (3,7), (4, 2), (2, 6), (8,0) }

Function or Not a function  
that is the question?

Non-function.





Function or Not a function that is the question?



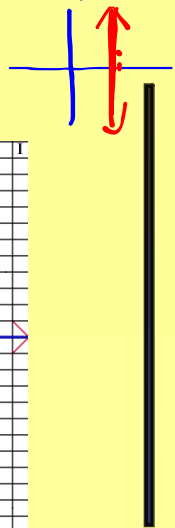
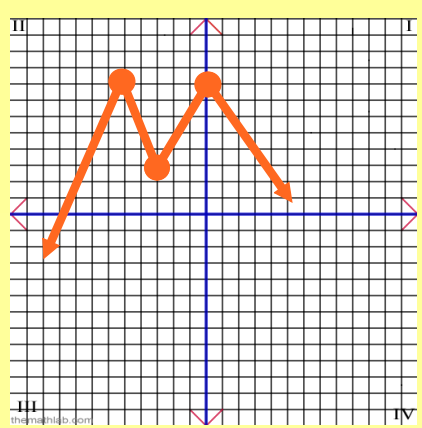
# Function or Nonfunction



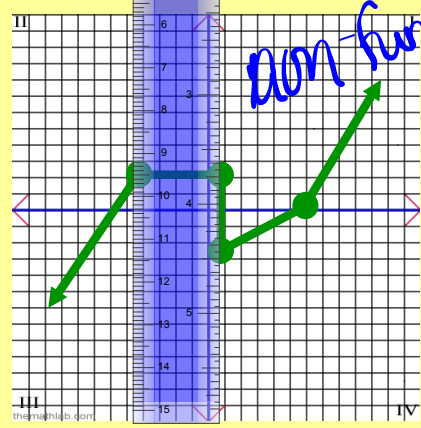
\*\* To determine whether or not a graph is a function or nonfunction, we use what is called the vertical line test!!

\*\* If the line crosses the graph more than once at any particular location, then it is not a function.

Function

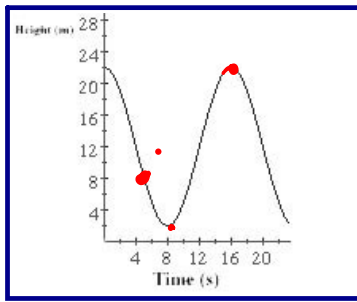


Vertical lines → non function  
Nonfunction

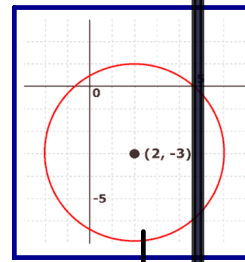




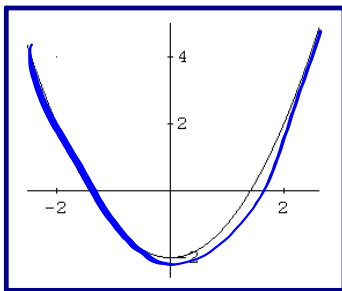
Use the Vertical Line Test to see if the graph is a function



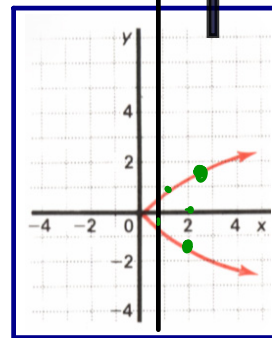
*function!*



*non-function*



*function*



*non-function!*

# Terminology

A set is a collection of distinct objects.

*The set of x values is the domain*

Set of Fruit

*The set of y values is the range*

Set of Colours

Fruit
apple
blueberry
cherry
huckleberry

Colour
red
green
blue

*{red, green, blue}*

An element of a set is one object in the set.



<u>Set of Fruit</u>
Fruit
apple
blueberry
cherry
huckleberry

*Apple* is an element of the set of Fruit

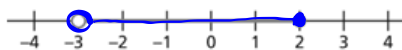
## Activate Prior Learning: Writing Inequalities



x is greater than -3 and less than or equal to 2:

$$-3 < x \leq 2$$

Since -3 is not part of the solution, we draw an open circle at -3.



- ○ → does not include  
- ● → does include

Use symbols to write inequalities that correspond to each statement.

- s is less than 4
- f is greater than 0 and less than 12

$$s < 4$$

$$0 < f < 12$$



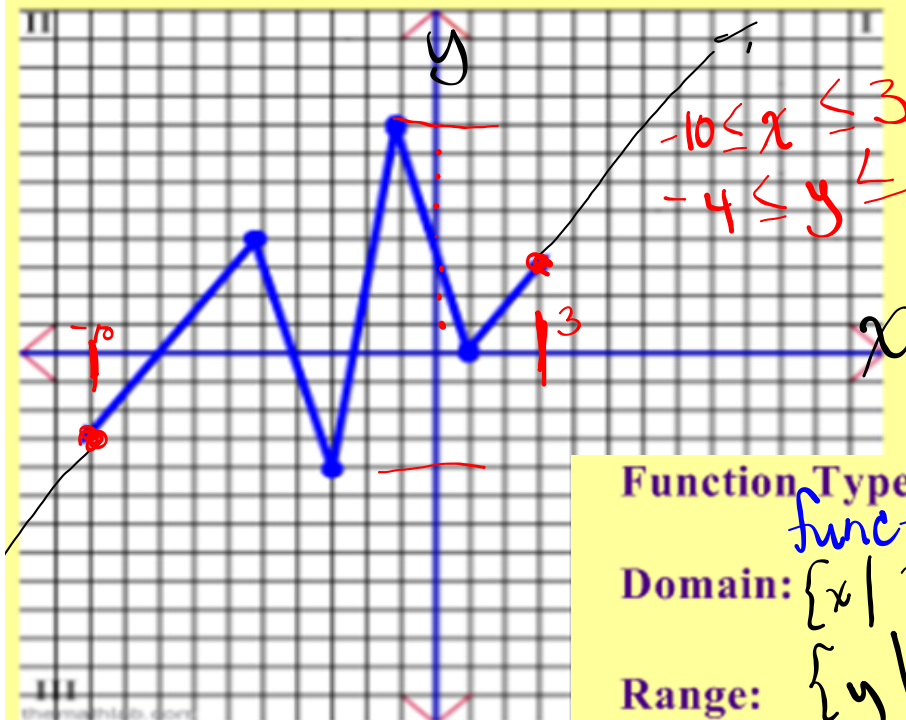
$<$  less than

$>$  greater than

$\leq$  less than or = to

$\geq$  greater than or = to.

**\*\* State whether the graph is a function or nonfunction, as well as stating the domain & range!!**



**Function Type:**

function

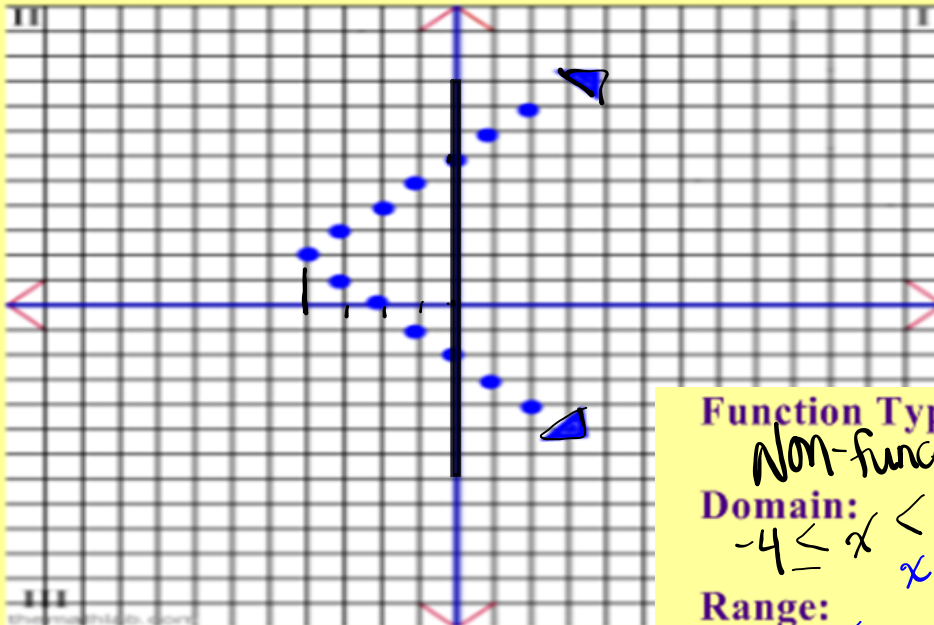
**Domain:**

$\{x \mid x \in \mathbb{R}\}$

**Range:**

$\{y \mid y \in \mathbb{R}\}$

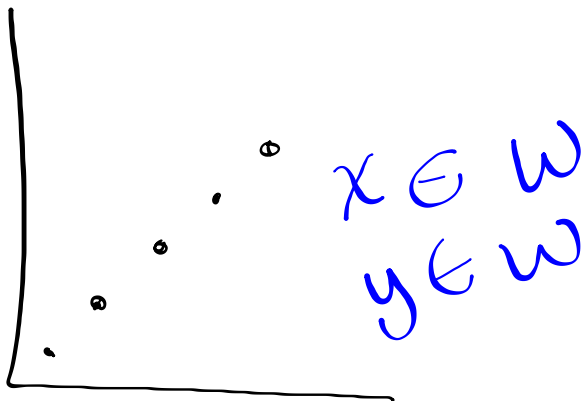
\* State whether the graph is a function or nonfunction, as well as stating the domain & range!!

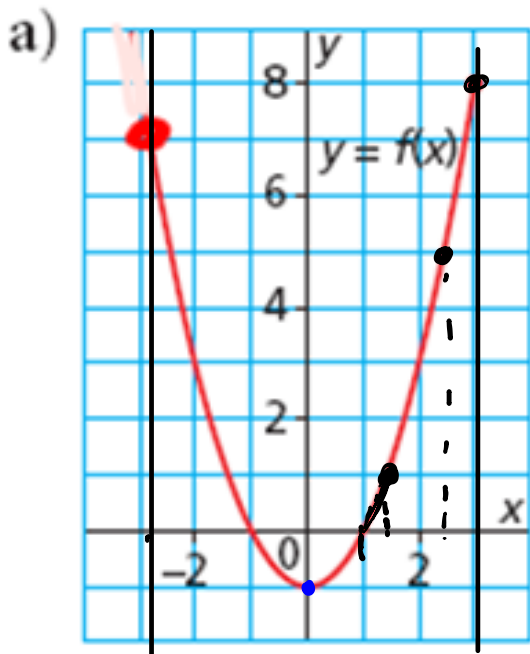


Function Type:  
Non-function.

Domain:  
 $-4 \leq x < \infty$   
 $x \in \mathbb{R}$

Range:  
 $y \in \mathbb{R}$   
 $-\infty < y < \infty$





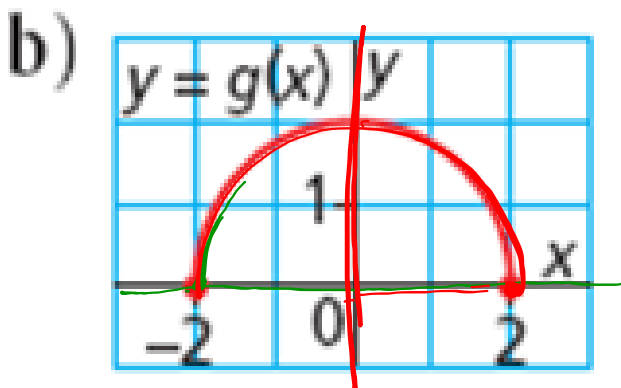
Function

$$D: -3 \leq x \leq 3$$

$x \in \mathbb{R}$ .

$$R: -1 \leq y \leq 8$$

$y \in \mathbb{R}$



**F** or NF

$x$  values.

$$D: -2 \leq x \leq 2$$

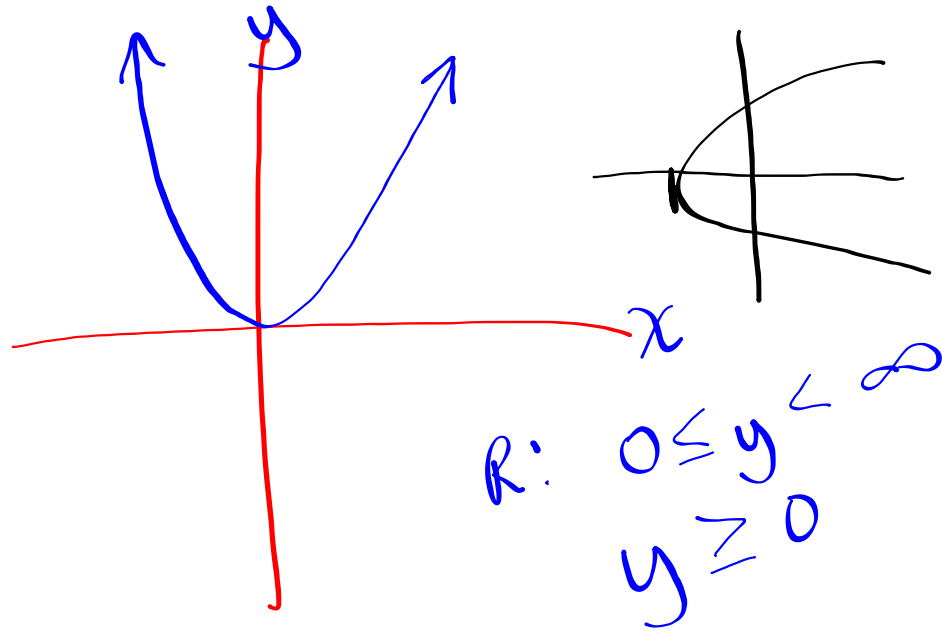
$x \in \mathbb{R}$ .

$y$  values.

$$R: 0 \leq y \leq 2$$

$y \in \mathbb{R}$





**Example 3**

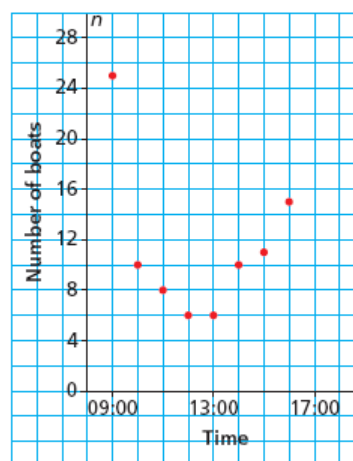
**Determining the Domain and Range of the Graph of a Situation**

This graph shows the number of fishing boats,  $n$ , anchored in an inlet in the Queen Charlotte Islands as a function of time,  $t$ .

- a) Identify the dependent variable and the independent variable. Justify the choices.
- b) Why are the points on the graph not connected? Explain.
- c) Determine the domain and range of the graph.

**SOLUTION**

Number of Fishing Boats Anchored in an Inlet



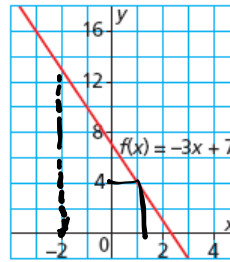
CHECK YOUR UNDERSTANDING

**Example 4**

**Determining Domain Values and Range Values from the Graph of a Function**

Here is a graph of the function  $f(x) = -3x + 7$ .

- a) Determine the range value when the domain value is  $-2$ .
- b) Determine the domain value when the range value is  $4$ .



**SOLUTION**



CHECK YOUR UNDERSTANDING

5.5 Graphs of Relations and Functions

**Homework**

Page 271: Questions: 5,8,9      **and**      Page 294: Questions: 4,5,6,7,8

Domain:  $\{1, 2, 3, 4\}$

Range:  $\{3, 6, 9, 12\}$

