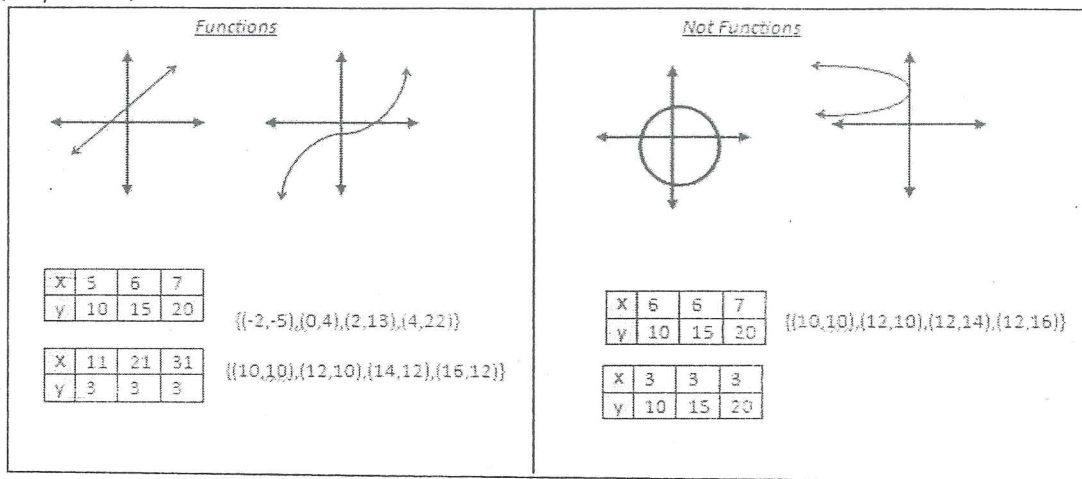


## 6.4a Functions

A relation is a connection between two quantities. In this lesson, we will study a special type of relation called a function.

### FUNCTIONS

A function is a special type of relation in which each element of the domain is related to **exactly one element of the range**. In other words, each input (or x-value) should only result in one output (or y-value).



**How to determine whether a relation is a function?**

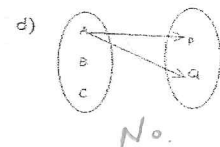
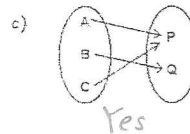
1. **Table of values and ordered pairs:** For each pair, check to see which relation has a domain value associated with more than one range value. These are not functions.

Which of the following are functions?

- a)  $(5, 8), (6, 7), (-5, 3), (2, 3), (6, 8)$       b)  $(3, 3), (2, 3), (4, 5), (-3, 2)$

No

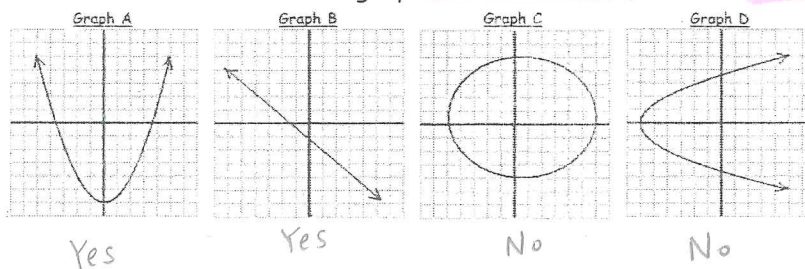
Yes



**If one x-value produces two different y-values, then it is not a function**

2. **Graph:** The **vertical line test** can be used on a graph of a relation to determine whether the relation is a function or not.

- If every vertical line, drawn on the domain of the relation, intersects the graph exactly once, then the relation is a function
- If any vertical line intersects the graph **more than once**, then it is not a function.



Which relations are functions?

## Function Notation

Functions can be written using function notation.

$y = 3x - 2$  can be written as  $f(x) = 3x - 2$ . 'f' is the name of the function and x is the name of the input variable (other letters can be used).

$f(x)$  replaces y in the function and is read "f of x" or "f at x"

If we chose 3 as the input, the ordered pair associated with this function would be...

Example: Determine the following if the function g is defined as  $g(x) = 5 - 3x$ .

a)  $g(4)$

$$\begin{aligned} g(4) &= 5 - 3(4) \\ &= 5 - 12 \\ &= \boxed{-7} \end{aligned}$$

b)  $g(-2)$

$$\begin{aligned} g(-2) &= 5 - 3(-2) \\ &= 5 + 6 \\ &= \boxed{11} \end{aligned}$$

c)  $g\left(\frac{2}{3}\right)$

$$\begin{aligned} g\left(\frac{2}{3}\right) &= 5 - 3\left(\frac{2}{3}\right) \\ &= 5 - 2 \\ &= \boxed{3} \end{aligned}$$

Example: For this example, the function f is defined as  $f(x) = 2x - 3$ .

a) Find the value of x for which  $f(x) = -1$

$$f(x) = 2x - 3 = -1$$

$$2x = 2$$

$$\boxed{x = 1}$$

b) Find the value of x for which  $f(x) = 7$

$$f(x) = 2x - 3 = 7$$

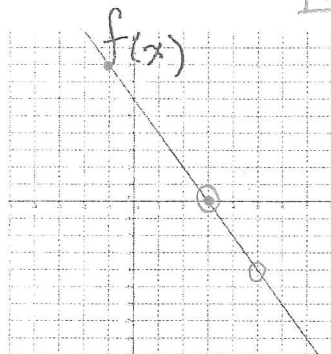
$$2x = 10$$

$$\boxed{x = 5}$$

Example: Given  $f(x)$

Find  $f(3) = 0$

$f(-1) = 8$



Find x if  $f(x) = 0$

$$x = 3$$

Find x if  $f(x) = -4$

$$x = 5$$

Example: Circumference is calculated by multiplying pi by the diameter.

Write this formula using function notation.

$$c(d) = \pi d$$