

# Functions

A **relation** is a connection between two quantities called variables.

Many relations involve a **dependency** between the variables. This is when the values of one variable (**dependent variable**) are determined by the values of the other variable (**independent variable**).

Recall: there are four ways to describe a relation.

Table of Values

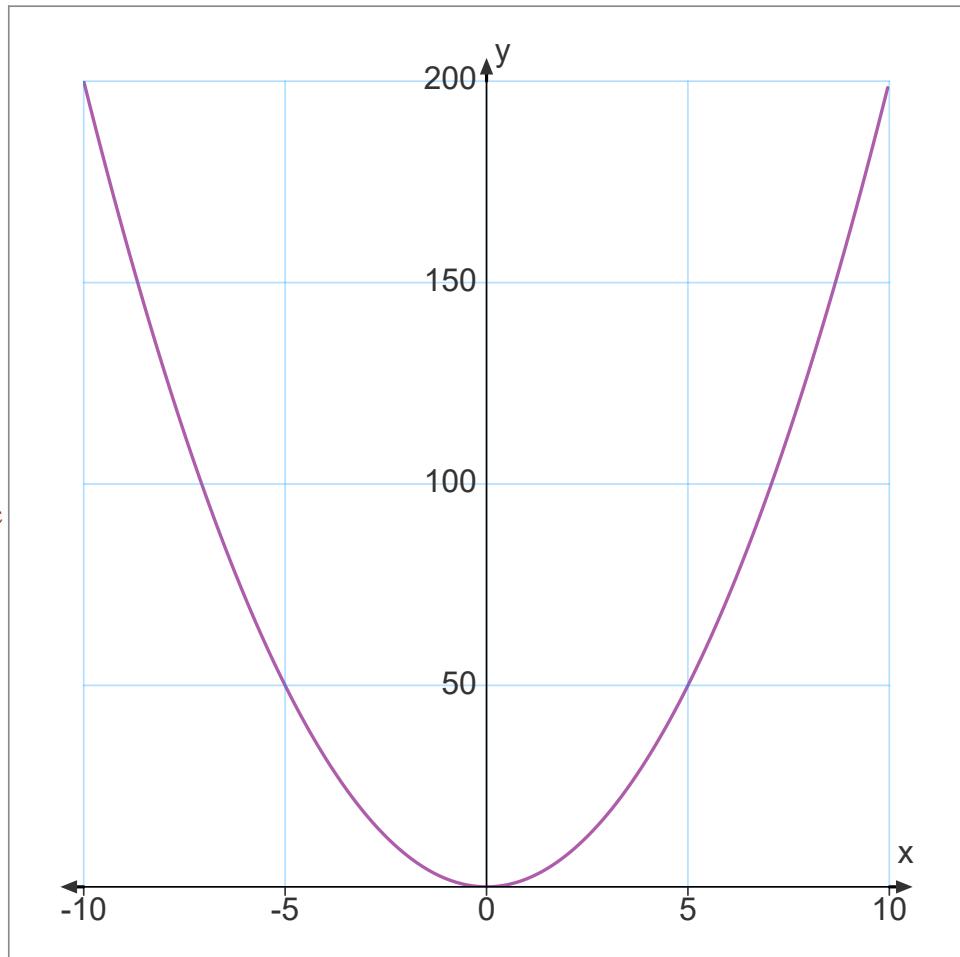
X	Y
4	10
5	7
6	4
7	1
10	-8

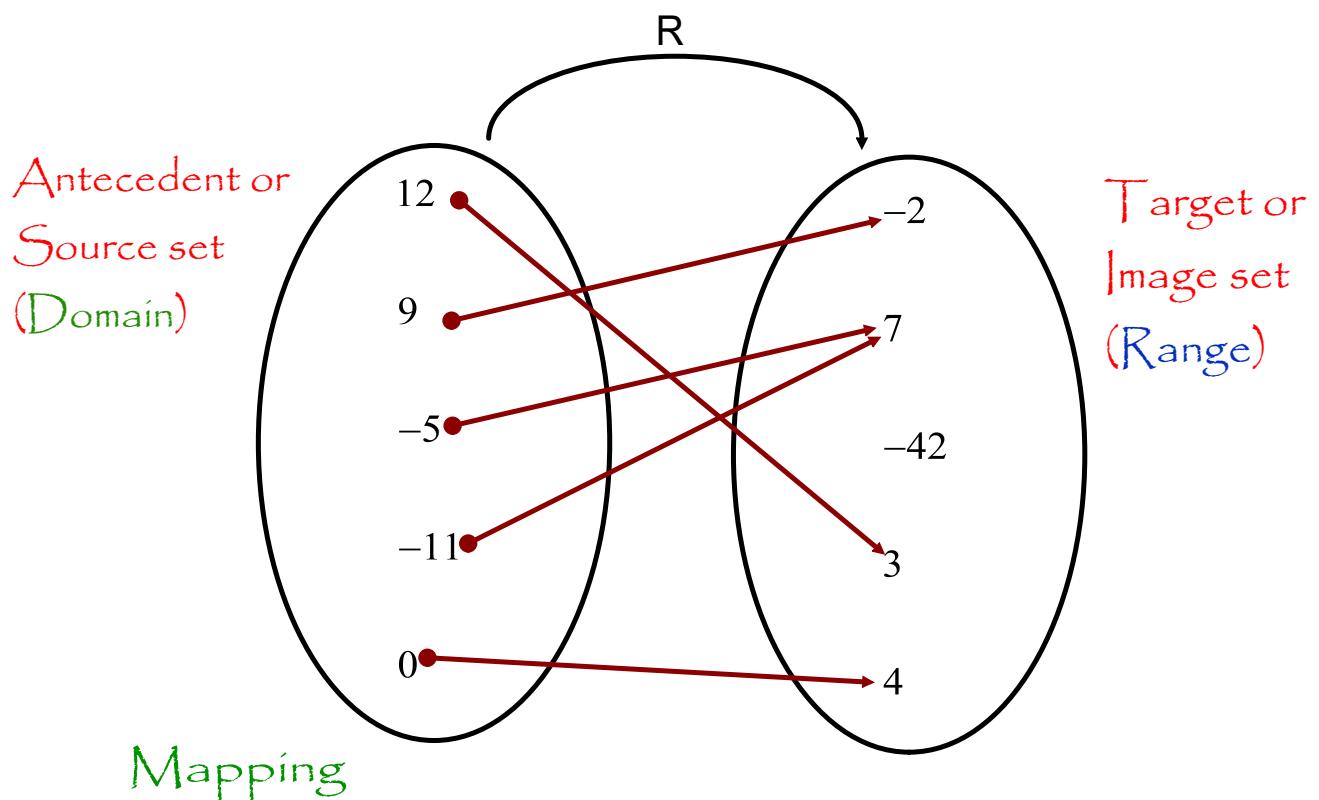
Rule or Equation

$$y = -3x + 22$$

Graph

Cartesian Plane





## Verbal Description

The cost of parking is \$2 for the first hour, or part thereof, and \$1 for each consecutive hour, or part thereof.

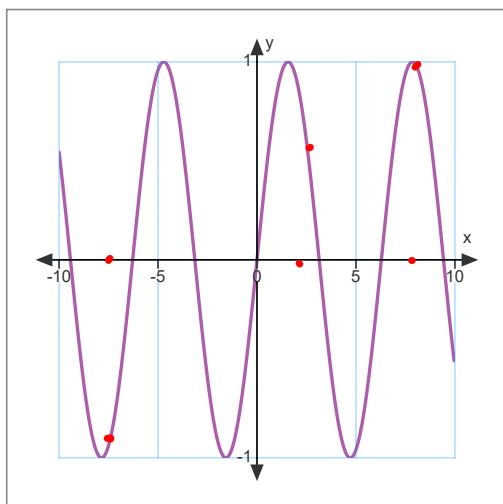
Function A relation in which each value of the independent variable is associated with one and only one value of the dependent variable.

Not a Function

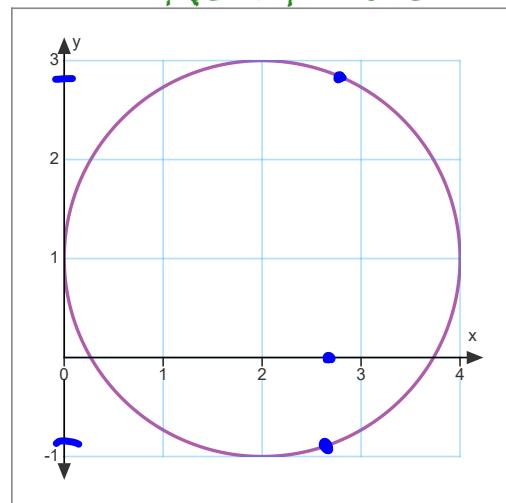
$x$	$y$
3	12
4	15
5	9
6	12

$x$	$y$
3	6
4	9
7	12
4	14
9	15

Function



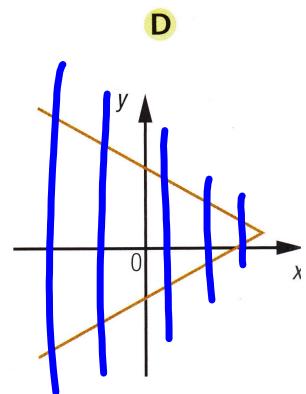
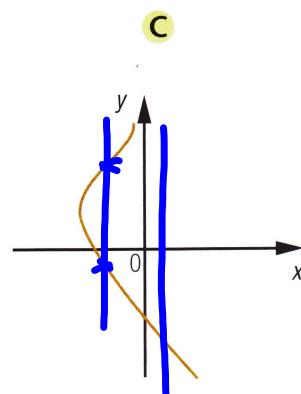
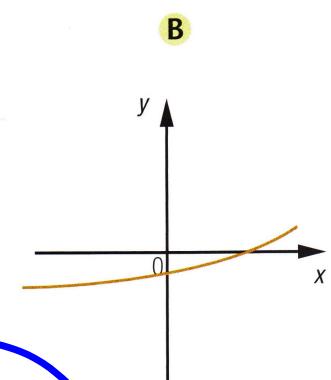
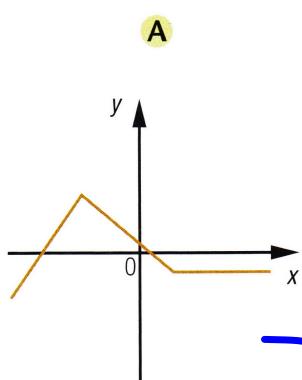
Not a Function



## Vertical Line Test for a Graph

If you draw a vertical line through the graph of a relation, and that line can only pass through the curve once (no matter where the line is drawn), then the relation is a function.

Identify which of the following graphs represents a function.



A, B

Function Notation - is a way of writing the rule of a

function. Instead of using  $y$ ,

we use  $f(x)$  (or  $g(x)$ , or  $h(x)$ , etc.)

e.g.,  $y = 2x + 2$  becomes  $f(x) = 2x + 2$

Why? 1: It lets us know that a relation is a function.

2: It can be used to show a point that is on the curve (graph).

e.g.  $f(4) = 40$  means that when  $x = 4$ ,  $y = 40$ ,  
or  $(4, 40)$ .

Example: If  $f(x) = 2x^3 - 6$  determine  $f(4)$ .

$$\begin{aligned}f(4) &= 2(4^3) - 6 \\f(4) &= 2 \cdot 64 - 6 = 128 - 6 = 122\end{aligned}$$

If  $f(x) = 48$ , determine  $x$ .

$$\begin{aligned}48 &= 2x^3 - 6 \\54 &= 2x^3 \\27 &= x^3 \\3 &= x\end{aligned}$$

Interval Notation : Used for Real Numbers ( $\mathbb{R}$ ) ; to show where something starts and something ends (an interval).

We use square brackets and/or parentheses.

Examples :  $[4, 22)$  or  $[4, 22[$  : 4 is included, but 22 is not.  
 $(-3, 10]$  or  $] -3, 10 ]$  : 10 is included but -3 is not.  
 $[2, 7]$  : both values are included.  
 $]0, 5[$  : both values are excluded.

## Properties of Functions

1) Domain and Range

2) Variation

3) Extrema

4) Sign

5) Intercepts

## 1) Domain and Range

Domain and range refer to the values that the variables are allowed to be.

Domain: these are the values of the independent variable ( $x$ -values)

Range: these are the values of the dependent variable ( $y$ -values)