Section 1.5 - Relations and Functions

Objectives:

- To identify independent and dependent variables in a relation.
- To understand and use the definition of a function.
- To differentiate between function and non-function relationships when using a table of values, a graph and a word description.
- To identify and state the domain and range of a function.
- To identify a function as increasing, decreasing, or constant.

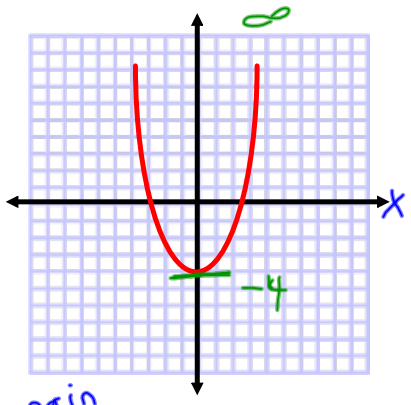
Vocabulary

- **Relation:**
  A rule that relates one set of numbers to another.
- **Function:**
  A relation where each input is assigned exactly one output.
- **Independent Variable:**
  Variable (usually "x") used to represent input values.
- **Dependent Variable:**
  Variable (usually "y") used to represent output values.
- **Domain:**
  The set of all input values.
  {list} or interval
- **Range:**
  The set of all output values.
  {list} or interval

Input
Independent Variable
Domain
Horizontal Axis

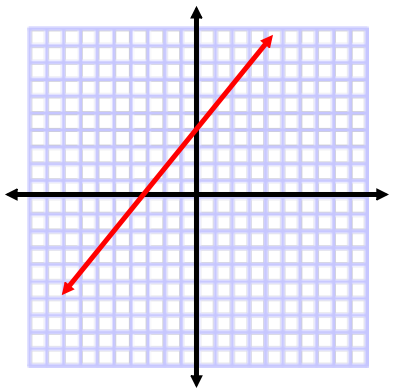
Output
Dependent Variable
Range
Vertical Axis

Example: - Determine what values are in the domain and range.

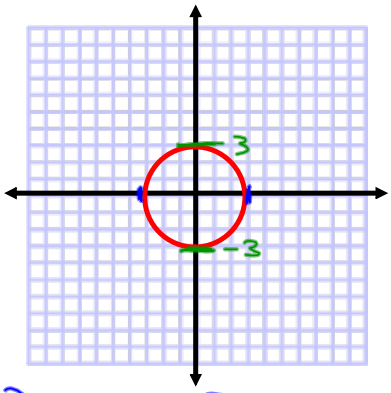


Domain
x- values
Left → Right
Domain $(-\infty, \infty)$

Range : y- values
Lowest → Highest
Range $[-4, \infty)$



Domain $(-\infty, \infty)$
Range $(-\infty, \infty)$



Domain $[-3, 3]$
Range $[-3, 3]$

Example 2 - Identify the independent and dependent variables. Determine the domain and the range. Does the table represent a function?

x (input)	2	4	6	8
y (output)	1	2	3	4

ind. var. is x Domain {2,4,6,8} yes, function

dep var. is y Range {1,2,3,4}

guys

x (input)	7	2	9	0
y (output)	-3	1	4	-3

ind var

dep. var

girls

Domain: {0,2,7,9} input (x) has no repeated values,

Range {-3,1,4} yes, a function

x (input)	0	1	-1	1
y (output)	4	5	3	6

ind.

dep

Domain {-1,0,1} Not a Function

Range {3,4,5,6}

Example: On Monday, Laura ran 3 miles in 25 minutes. On Tuesday, she ran 2 miles in 17 minutes. On Thursday, she ran 3 miles in 28 minutes. Is time a function of the distance run? (Hint: use a table to organize your information).

ind. var distance d

dep. var time t

miles	3	2	3
min	25	17	28

Not a function
$X = 3$ has 2 different output values.

Is the distance run a function of the time?

ind.

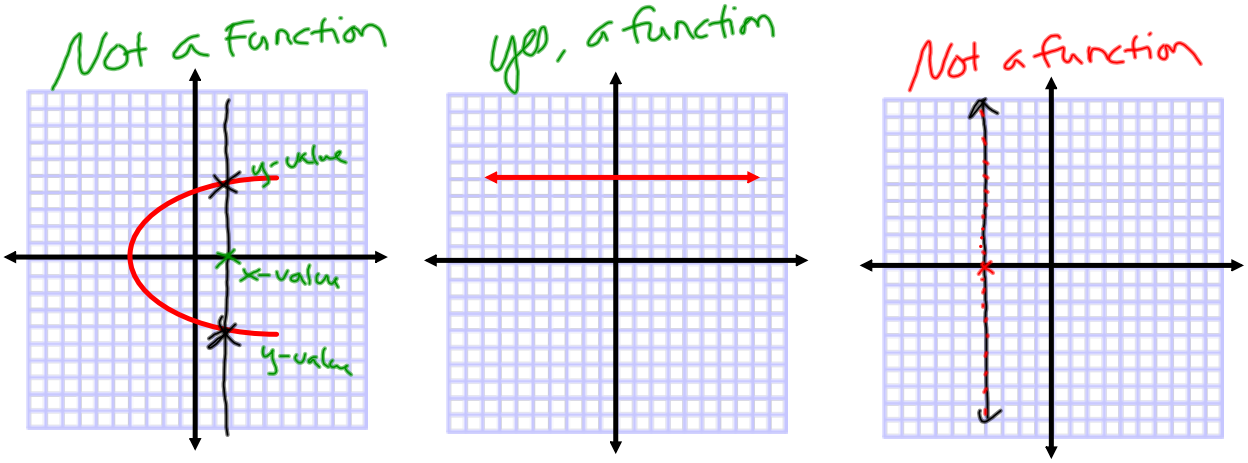
dep

t min	25	17	28
d miles	3	2	3

Yes, this is a function because no input values are repeated.

Vertical Line Test - a **relation is not a function** if a vertical line could be drawn that intersects the graph in more than one point. Otherwise the relation is a function.

(Use previous examples and those below.)



Example: A Verbal Description:

Jamie buys apples at a price of $1.29 per pound. The total cost he pays is related to the number of pounds of apples he buys.

dependent

independent

Is this a relation? yes

What is the independent variable?

n = # pounds of apples

What is the dependent variable?

C = total cost of apples

Is this a function? yes

Hint: These phrases indicate relations, and the DEPENDENT variable is always the first one mentioned:
"is dependent on"
"is a function of"
"is related to"

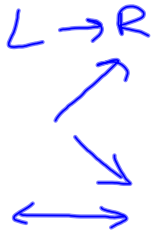
$C = 1.29n$

n lbs	1	2	3	
C	1.29	2.58		

Increasing, Decreasing, and Constant Functions -

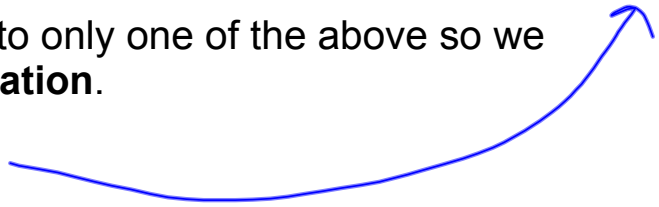
As the value of the independent variable increases, if the value of the dependent variable:

ALWAYS increases, the function is **Increasing**.
ALWAYS decreases, the function is **Decreasing**.
remains the same, the function is **Constant**.

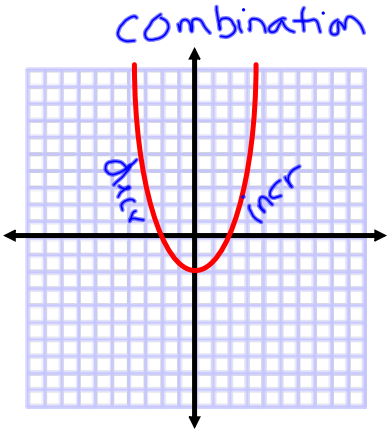


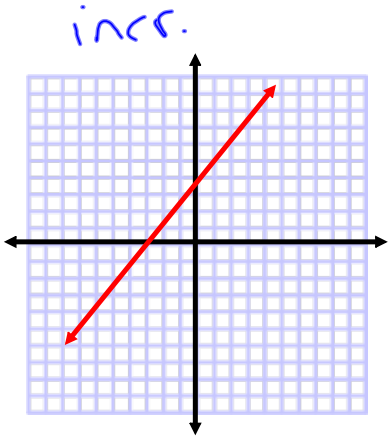
Some functions do not fit into only one of the above so we describe them as a **combination**.

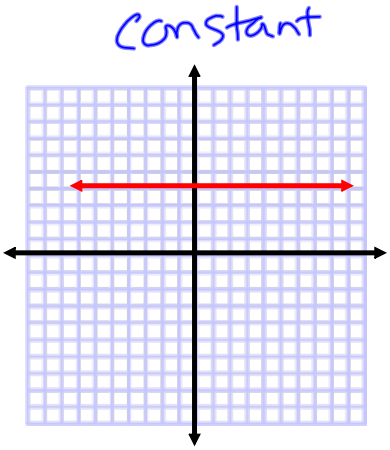
Graphically this means:



Example: Identify whether each function is increasing, decreasing, constant or a combination of these.







0	1	2	3	up
-5	-2	1	4	up

→ incr.