Name: Date: Period:

1A: Identifying Functions

Relation vs. Function

Relation – Any set of _____ _____

Example 1: Average Gross Monthly Salaries=
{(Physician, $11,698),(Airline Pilot, $5,884), (Computer Programmer, $5,378),
(Salesperson, $2,260), (furniture finisher, $1,977)}

Domain ("input") – The set of all _____ components in a relation. (a.k.a. *x-values*)

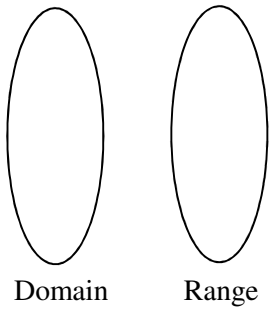
Range ("output")– The set of all _____ components in a relation. (a.k.a. *y-values*)

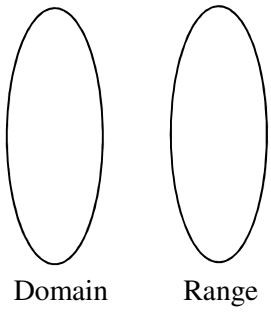
Example 2:
Salary Domain:
{physician, airline pilot, computer programmer, salesperson, furn. Finisher}
Salary Range : { $11,698 , $5,884, $5,378, $2,260, $1,977}

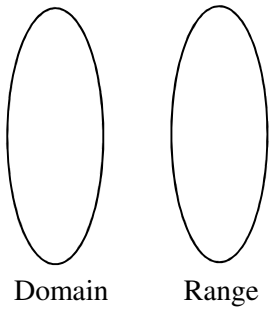
Mapping: A relation can be mapped to show how the domain is connected to the range.

Example 2: *Draw a map for these relations.*

a. {(2,0), (4,2),(5,1),(10,12)} b. {(3,4),(5,4),(6,-1),(7,5)} c. {(3,2),(3,9),(4,6),(5,9)}







Functions . Some relations are unique because they define *one specific outcome for every domain element.*

Example 3: Which of the following statements are *always* true?

a. A person's height is determined by their age.
b. An hourly worker's paycheck is determined by the hours they work.
c. A person's vision is determined by the amount of T.V. they watch.
d. The distance a car drives on the freeway (at the speed limit) is determined by the amount of time it drives.
e. The number of assigned problems and the time needed to complete them.

Which of these statements describe functions?

Definition: *A* ***function*** *is a relation such that*

for every _____(x) value, there is only one _____(y) value

A ***one-to-one*** *function is a function that has exactly one range value for each domain value.*

Example 2b: Which relations in Example 2 are functions?
Which relations in Example 2 are *one-to-one* functions?

We can also view the sets in Example 2 as tables:

Example 2c: {(2,0), (4,2),(5,1),(10,12)} →
Is it a function?
What is $f(5)$?

x	2	4	5	10
$f(x)$	0	2	1	12

Function as equations and graphs

Every function must have ***independent*** variable(s) which determine the value of the ***dependent*** variable.

You are familiar with functions with one dependent variable, like:

$$y = \frac{2}{3}x + 4, \qquad y = 3x^2 + 4 - 5, \qquad f(x) = 2\sin(x).$$

However, we can also have functions of more than one variable:

$$z = 2x + 3y + 4, \qquad f(x,y) = \sqrt{x^2 + y^2},$$
$$f(x,y) = -(\sin \pi x)(\cos \pi x) + \sin(4\pi x)\sin(4\pi y)$$

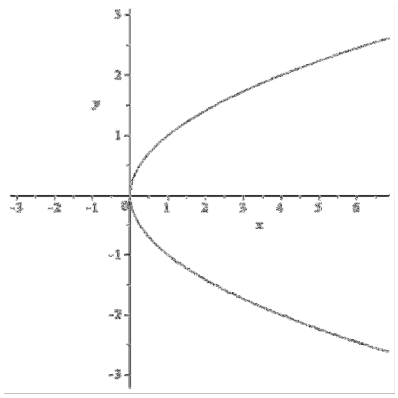
Example 4: Which of the equations below determine y as a function of x.
(Does every x have one and only one y-value pair?)

a) $y = \sqrt{4x + 3}$
b) $y = 3x + 4z$
c) $0 = x - y^2$
d) $9 = 3xy$

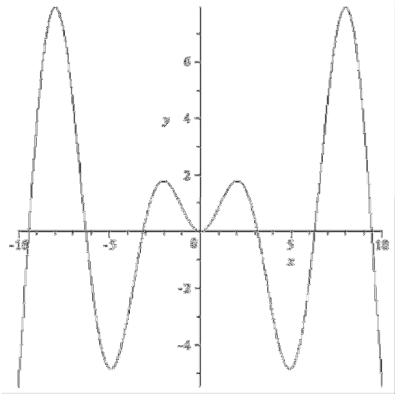
Vertical Line test – if a graph represents a function, then there are no vertical lines that can intersect the graph more than once.
Horizontal Line test – If a graph is a function and no *horizontal lines* pass intersect the graph more than once, then the function is a *one-to-one* function.

Example 5: Which ones of the following graphs represent functions?
Are any of them *one-to-one* functions?

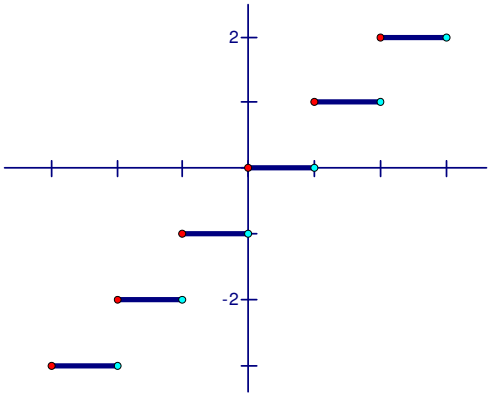
a.



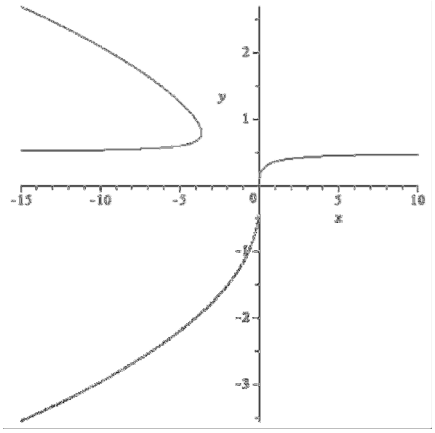
b.



c.



d.



Function Notation

A quick way to name a point is with function notation. If we want to say that "Your paycheck is a function of the hours you work", we can write this as $P = f(h)$ or more simply $P(h)$. Here h is the domain value of hours, and $P(h)$ represents the amount of pay you get for that number of hours.

Try It

a) If you work a job that you get \$25 each day plus \$10 per hour that you work, use function notation to write a function to represent you pay , $P(h)$, as a function of your hours worked in a day, h.

b) Find $P(3)$

c) What does $P(3)$ mean?

d) Find h so that $P(h) = 72$.

Tool Kit Functions

As we work with functions, you will need to recognize several basic functions. Use your graphing utility to draw a sample graph of each of the following functions.

Linear Constant: $f(x) = c$, where c is a constant

Quadratic: $f(x) = x^2$

Linear Identity: $f(x) = x$

Cubic: $f(x) = x^3$

Absolute value: $f(x) = |x|$

Reciprocal: $f(x) = \frac{1}{x}$

Reciprocal Squared: $f(x) = \frac{1}{x^2}$

Square Root: $f(x) = \sqrt{x}$

Cube Root: $f(x) = \sqrt[3]{x}$

Consider this:

Which functions are one-to-one functions?