Name:_____ Date:_____

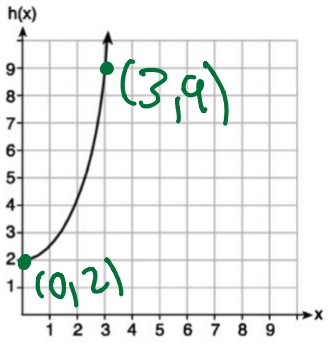
Notes: Functions

Do Now:

Given the functions g(x), f(x), and h(x) shown below:

$g(x) = x^2 - 2x$

x	f(x)
0	1
1	2
2	5
3	7



The correct list of functions ordered from greatest to least by average rate of change over the interval $0 \le x \le 3$ is

(1) f(x), g(x), h(x)
(2) h(x), g(x), f(x)
(3) g(x), f(x), h(x)
(4) h(x), f(x), g(x)

g(x)
$0^2 - 2(0) = 0$
(0,0)
$3^2 - 2(3)$
$9 - 6$
3
(3,3)
$\frac{3-0}{3-0} = 1$

f(x)
$\frac{7-1}{3-0}$
$\frac{6}{3}$
2

h(x)
$\frac{9-2}{3-0}$
$\frac{7}{3}$
$2.\overline{3}$

What Should I Be Able to Do?

- I can define relation, input, output, domain, range, and function.
- I can explain why a relation is a function or not a function.
- I can explain the similarities and differences between function notation and x-y notation.
- I can explain the advantages of using function notation.

Vocab Breakdown

$y = 3x + 5$

Relation: Any set of ordered pairs.

Input: A value of the independent variable.

Output: A value of the dependent variable

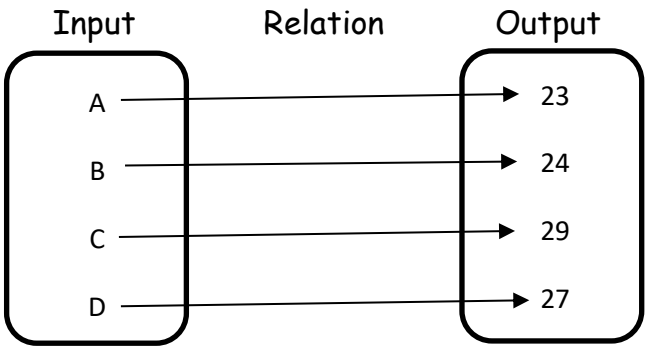
Domain: All possible inputs.

Range: All possible outputs.

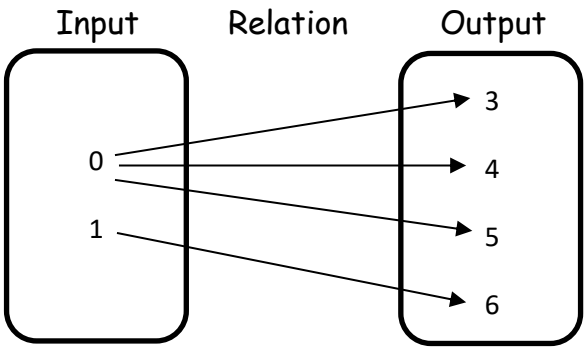
Vocab Breakdown

Function: A relation in which each input only has one output.

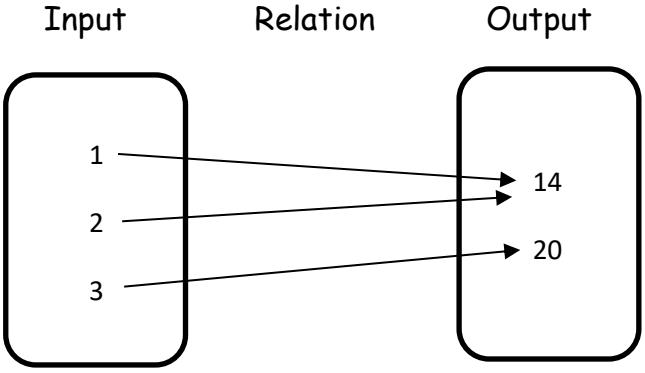
Tell whether each of the relations is a function. If not, tell which input makes the relation not a function.



Function



Not a Function, 0

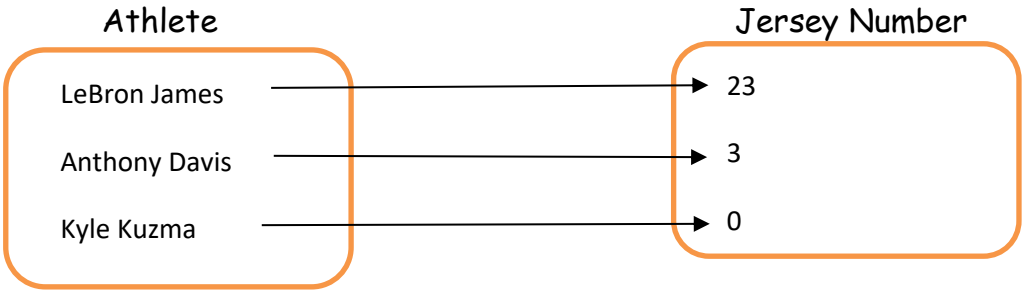


Function

$\{(1,1), (2,1), (3,2), (4,3), (5,5), (6,8), (7,13)\}$

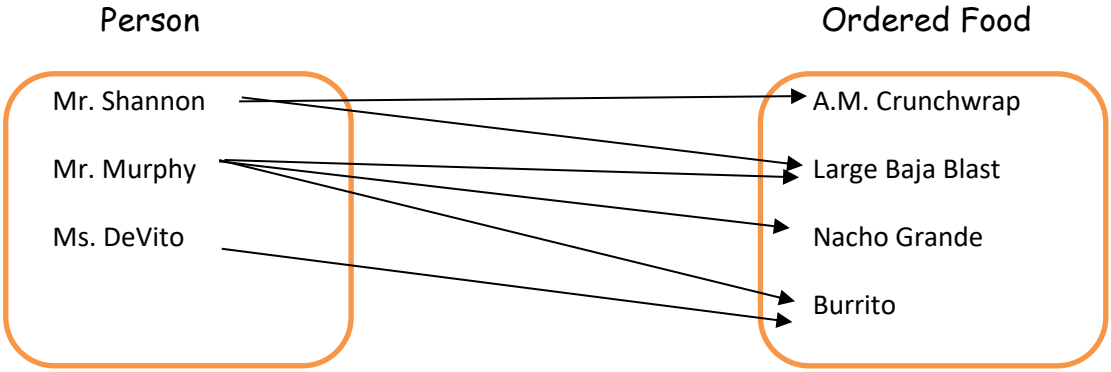
Function

Real World Examples of Functions



1) Is the relation of player to jersey number on the 2019-2020 Los Angeles Lakers a function? Explain your reasoning.

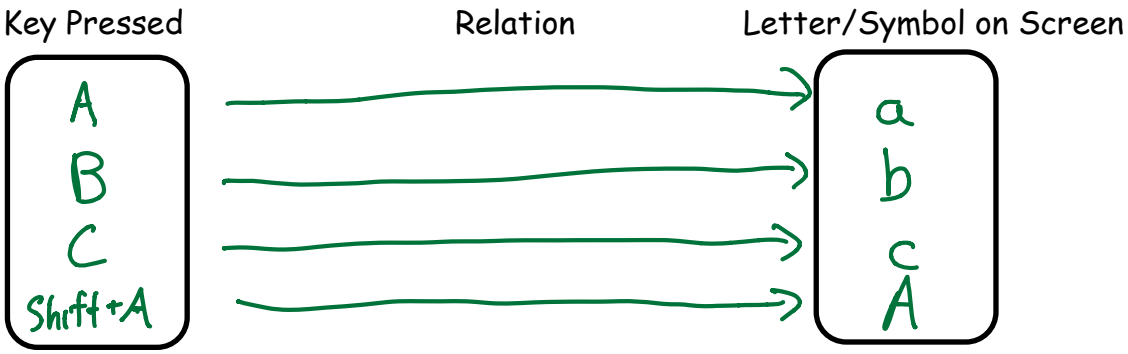
Yes because each input only has one output.



2) Is the relation of person to ordered food from a most recent visit to Taco Bell a function? Explain your reasoning.

No because the inputs of Mr. Shannon and Mr. Murphy have more than one output.

3) Think about typing on the computer, is the key you press and the letter/symbol that shows up on the screen a function?



Checkpoint:

A function is shown in the table below

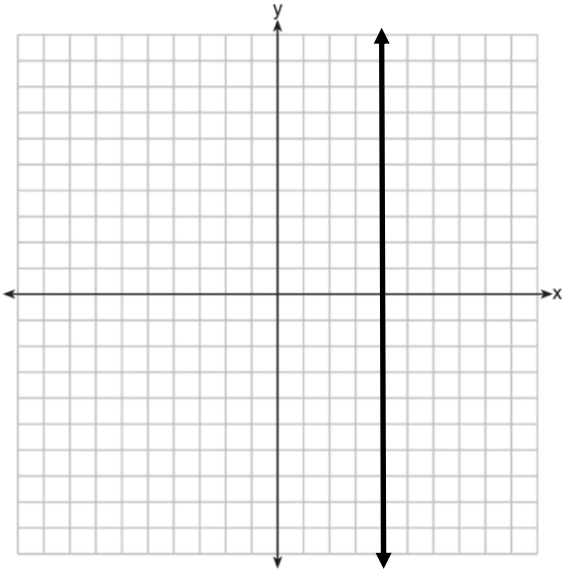
x	y
-5	-3
-3	15
0	1
4	-4
2	15
0	7

If included in the table, which ordered pair, (2,15) or (0,7), would result in a relation that is no longer a function? Explain your answer.

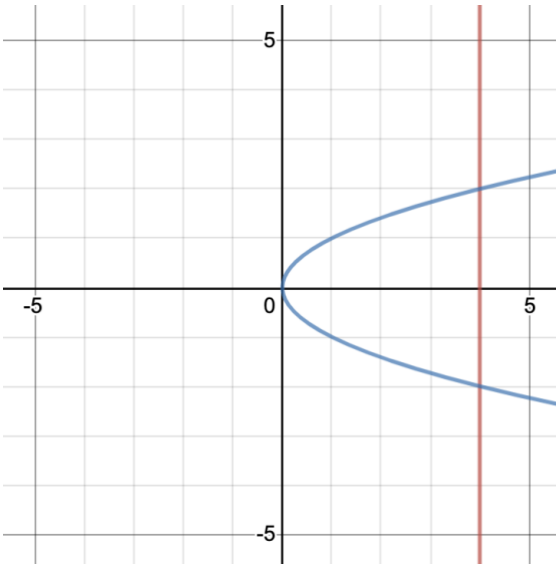
(0,7) because now 0 has more than one output, 7 and 1.

What is the equation of the following line?

$x = 4$



What can you say about the input of 4 in the relation below?



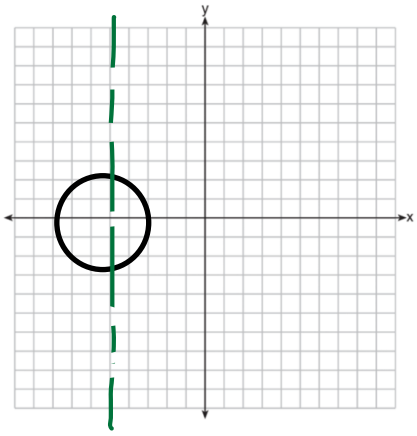
4 has two outputs of 2 and -2

Vocab Breakdown

Vertical Line Test: If any vertical line intersects a relation in more than one point, the relation is not a function.

Are the following relations functions? Explain your reasoning.

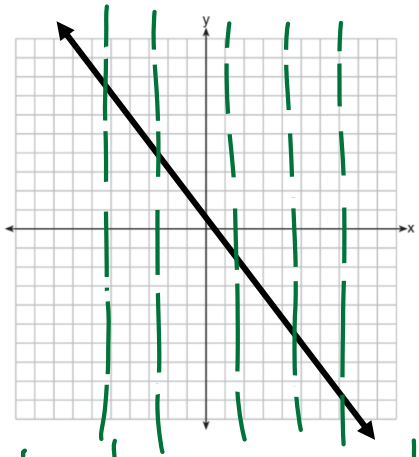
1)



No because the input of -5 has two ouputs.

No because the relation DOES NOT PASS the vertical line test.

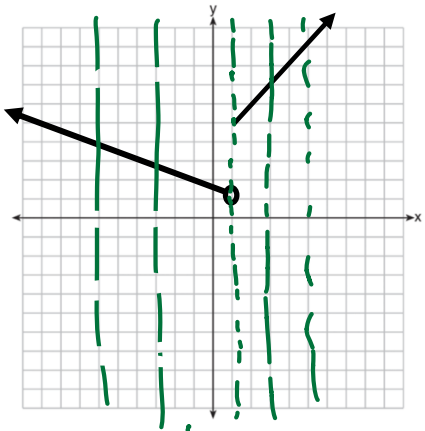
2)



Yes because each input only has one output.

Yes because the relation PASSES the vertical line test.

3)



Yes because each input only has one output.

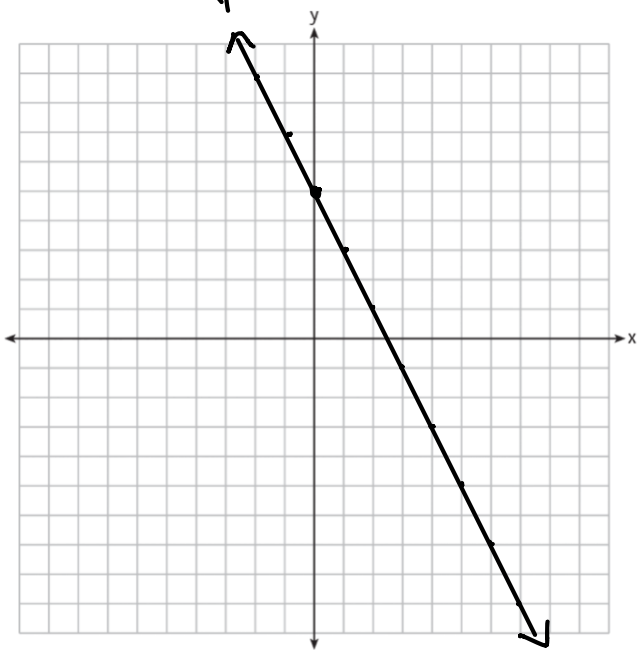
Yes because the relation PASSES the vertical line test.

Explain why the vertical line test works for distinguishing whether the graph of a relation is a function or not.

A vertical line hax the general equation of $x=a$ for some real number a. Therefore if a line crosses the line $x=a$ at more than one point, the input of a has more than output and is therefore not a function.

Do Now: Graph the relation, $y = -2x + 5$.

$y = -2x + 5$



a) Find the value of y when $x = 10$.

$y = -2(10) + 5$ $\quad y = -20 + 5$ $\quad \boxed{y = -15}$

b) Find the value of x when $y = 2$.

$2 = -2x + 5$
$-5 \quad -5$

$\frac{-2x}{-2} = \frac{-3}{-2}$ $\quad \boxed{x = 1.5}$

Vocab Breakdown

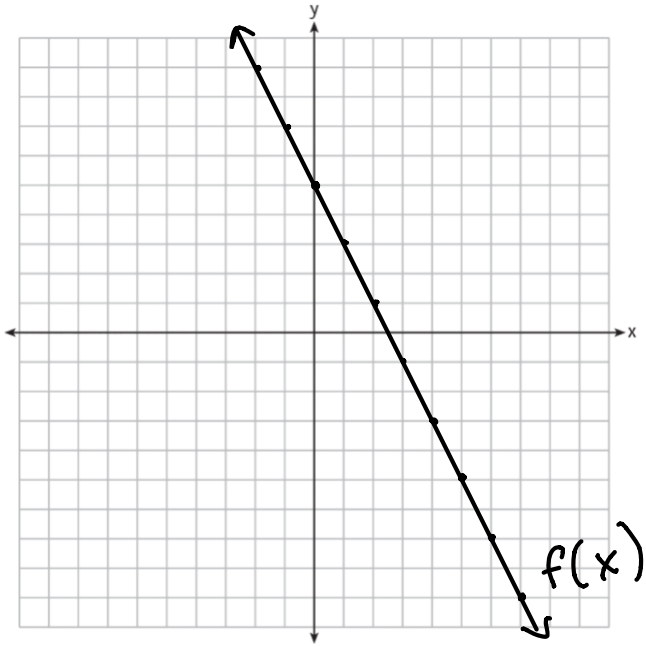
Function Notation: To write a rule in function notation, you use the symbol $f(x)$ in place of y.

Write $y = -2x + 5$ in function notation.

$f(x) = -2x + 5$

	Point	Relation	Solving	Solving
Equation Notation	(x, y)	$y = 2x - 3$	Find y when $x = 4$ $y = 2(4) - 3$ $\boxed{y = 5}$	Find x when $y = 7$. $7 = 2x - 3$ $10 = 2x$ $\boxed{x = 5}$
Function Notation	$(x, f(x))$	$f(x) = 2x - 3$	Find $f(4)$ $f(4) = 2(4) - 3$ $\boxed{f(4) = 5}$	Find x when $f(x) = 7$. $7 = 2x - 3$ $10 = 2x$ $\boxed{x = 5}$

Graph the relation, $f(x) = -2x + 5$.



$f(x) = -2x + 5$

a) Find $f(10)$. $f(x)$ 10 is taking the place of x!

$-2(10) + 5$

$\boxed{-15}$

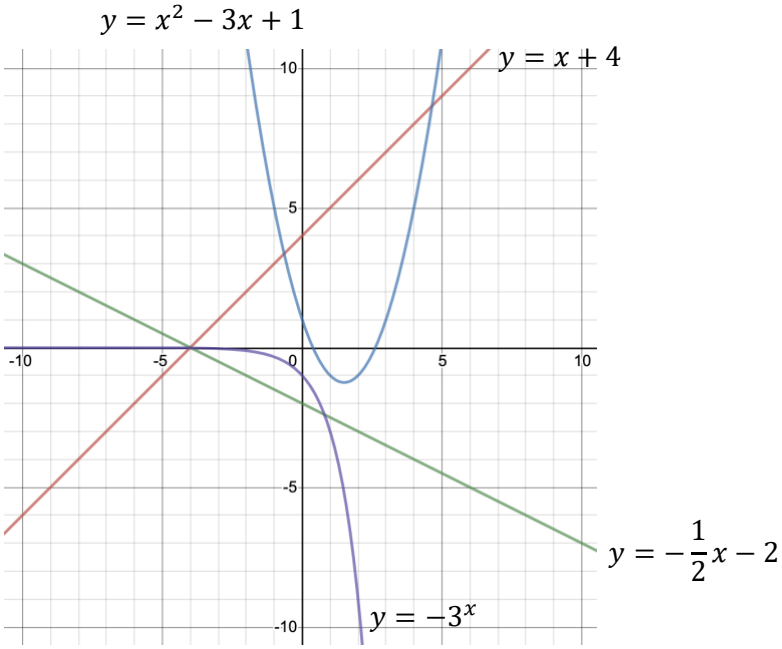
b) Find the value of x when $f(x) = 2$.

$y = 2$

$2 = -2x + 5$

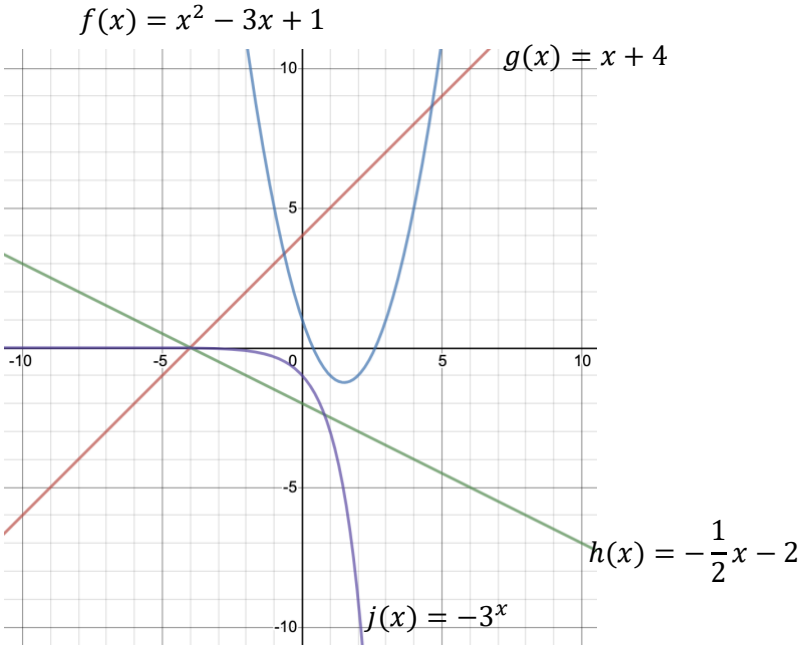
$-3 = -2x$

$\boxed{x = 1.5}$



Make an observation of the graph above, making sure to identify the equation(s) you are speaking about.

The graphs of $y=-3^x$ and $y=x^2-3x+1$ are curved.
The graphs of $y=x+4$ and $y=-\frac{1}{2}x-2$ are straight lines.



Make an observation of the graph above, making sure to identify the equation(s) you are speaking about.

The graphs of $j(x)$ and $f(x)$ are curved.
The graphs of $g(x)$ and $h(x)$ are straight lines.

Checkpoint:

1)

If $f(x) = \frac{\sqrt{2x+3}}{6x-5}$, then $f\left(\frac{1}{2}\right) =$

(1) 1

(2) -2

(3) -1

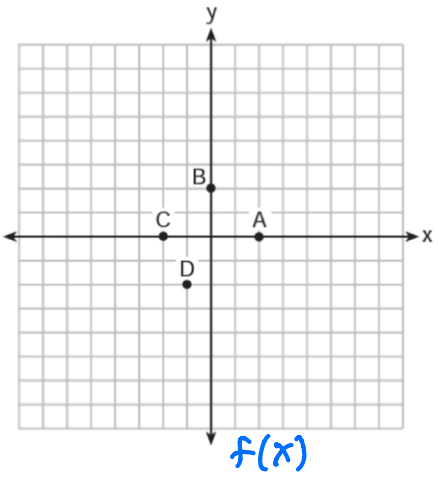
(4) $-\frac{13}{3}$

$$\frac{\sqrt{2\left(\frac{1}{2}\right)+3}}{6\left(\frac{1}{2}\right)-5}$$

$$\frac{\sqrt{1+3}}{3-5} = \frac{\sqrt{4}}{-2} = \frac{2}{-2} = -1$$

2)

The graph of $y = f(x)$ is shown below.



f(x)

Which point could be used to find $f(2)$?

(1) A

(2) B

(3) C ↑ when x is 2

(4) D

3)

Alex is selling tickets to a school play. An adult ticket costs \$6.50 and a student ticket costs \$4.00. Alex sells x adult tickets and 12 student tickets. Write a function, $f(x)$, to represent how much money Alex collected from selling tickets.

$6.50x + 4(12) = f(x)$

or

$6.50x + 48 = f(x)$

4)

The cost of belonging to a gym can be modeled by $C(m) = 50m + 79.50$, where $C(m)$ is the total cost for m months of membership.

State the meaning of the slope and y-intercept of this function with respect to the costs associated with the gym membership.

Slope: each month costs \$50

Y-intercept: the one-time start-up fee is \$79.50

Success Criteria

- I can define relation, input, output, domain, range, and function.

Define relation.

Any set of ordered pairs

Define input.

A value of the independent variable.

Define output.

A value of the dependent variable.

Define domain.

All possible inputs.

Define range.

All possible outputs.

Define function.

A relation in which every input only has one output.

- I can explain why a relation is a function or not a function.

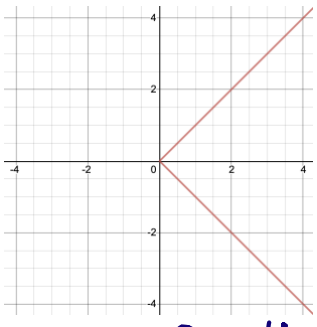
Do each of the following relations represent a function? Explain your reasoning.

1)

x	f(x)
−2	$\frac{1}{9}$
−1	$\frac{1}{3}$
0	1
1	3
2	9
3	27

Function because each input only has one output.

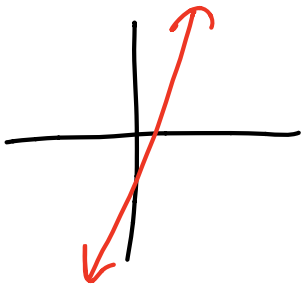
2)



Not a function because it does not pass the vertical line test.

3) $g(x) = 3x - 12$

Function because each input only has one output.



- I can explain the similarities and differences between function notation and x-y notation.

What are the similarities between using function notation and using x-y notation?

Graphing is the same between notations. Solving is very similar between notations, we just use slightly different symbols.

What are the difference between using function notation and x-y notation?

f(x) replaces y

f(4) is interpreted as "the output when the input is 4"

- I can explain the advantages of using function notation.

What are the advantages of using function notation?

Function notation makes it easier to communicate about math.

Name:_____ Date:_____

Homework: Functions

1) Evaluate the following expressions given the functions below:

$g(x) = -4x + 3$ $f(x) = x^2 + 10$ $h(x) = \frac{5}{x}$ $j(x) = \frac{1}{3}x + 1$

a. $g(5) =$ $-4(5)+3$ -17

b. $f(-3) =$ $(-3)^2+10$ 19

c. $h(-2) =$ $\frac{5}{-2}$ $-\frac{5}{2}$

d. $j(10) =$ $\frac{1}{3}(10)+1$ $\frac{13}{3}$

e. $h(a)$ $\frac{5}{a}$

f. $g(7+4)$ $g(11)$ $-4(11)+3$ -41

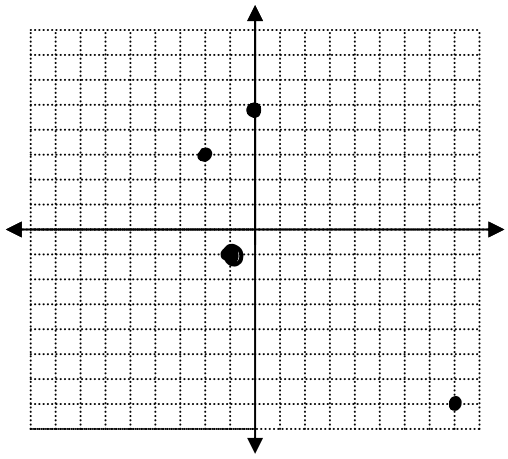
2) Convert each of the following into coordinate points and then plot each.

a. $f(-2) = 3$ $(-2,3)$

b. $f(0) = 5$ $(0,5)$

c. $f(-1) = -1$ $(-1,-1)$

d. $f(8) = -7$ $(8,-7)$



3)

Faith wants to use the formula $C(f) = \frac{5}{9}(f - 32)$ to convert degrees Fahrenheit, f, to degrees Celsius, $C(f)$. If Faith calculated $C(68)$, what would her result be?

(1) 20° Celsius
(2) 20° Fahrenheit
(3) 154° Celsius
(4) 154° Fahrenheit

$\frac{5}{9}(68-32)$

$\frac{5}{9}(36) = 20$

4)

If $f(n) = (n-1)^2 + 3n$, which statement is true?

(1) $f(3) = -2$
(2) $f(-2) = 3$
(3) $f(-2) = -15$
(4) $f(-15) = -2$

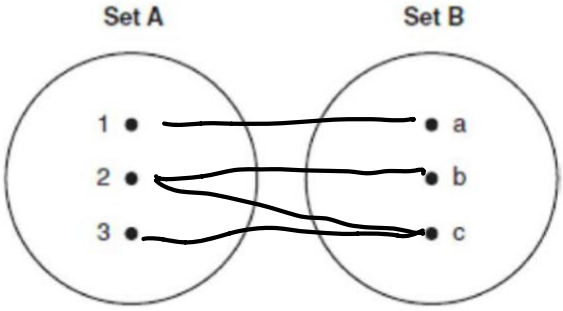
$f(-2) = (-2-1)^2 + 3(-2)$

$(-3)^2 + 3(-2)$

$9 - 6 = 3$

5)

On the accompanying diagram, draw a mapping of a relation from set *A* to set *B* that is not a function. Explain why the relationship you drew is not a function.



This relation is not a function because the input of 2 has two outputs.

6)

Which table represents a function?

x	2	4	2	4
f(x)	3	5	7	9

(1)

x	3	5	7	9
f(x)	2	4	2	4

(3)

x	0	−1	0	1
f(x)	0	1	−1	0

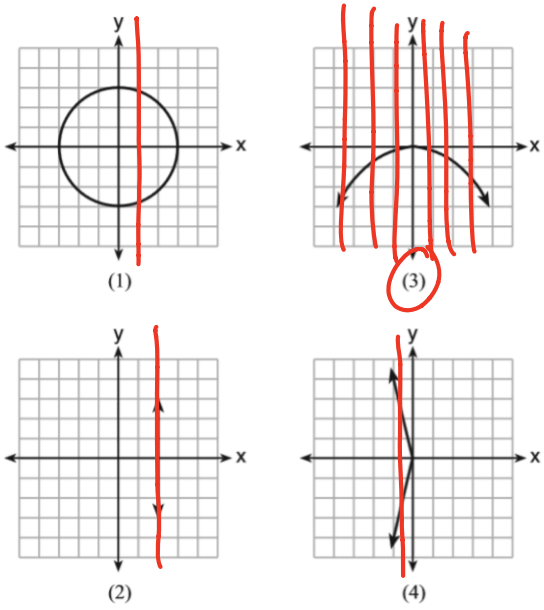
(2)

x	0	1	−1	0
f(x)	0	−1	0	1

(4)

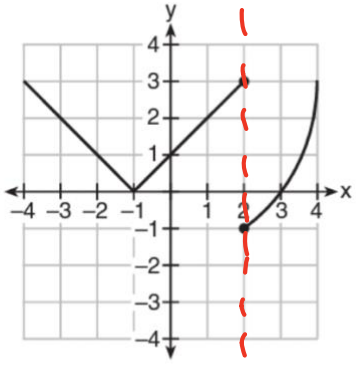
7)

Which graph represents a function?



8)

Marcel claims that the graph below represents a function.

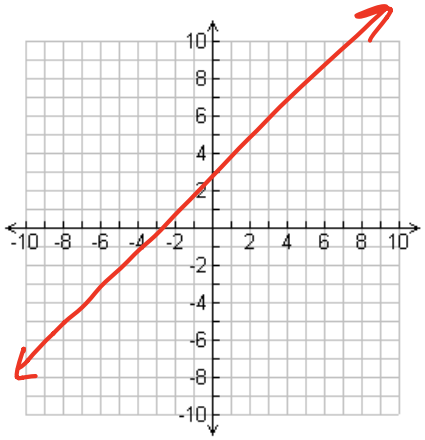


State whether Marcel is correct. Justify your answer.

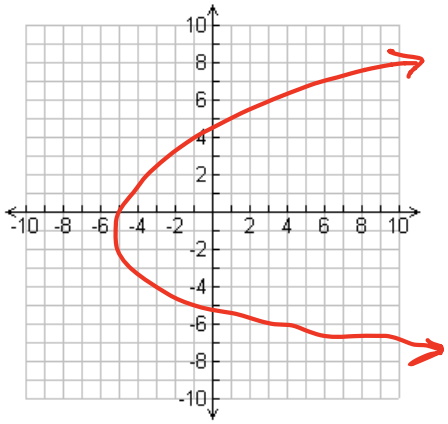
Marcel is incorrect because the input of 2 has two outputs. (Could also say it fails the vertical line test)

9) On the graphs below, sketch a relation that is a function and one that is not a function.

Function



Not a Function



Explain why your relation on the right graph is not a function.

Because it fails the vertical line test.

10)

Nora says that the graph of a circle is a function because she can trace the whole graph without picking up her pencil.

Mia says that a circle graph is *not* a function because multiple values of x map to the same y-value.

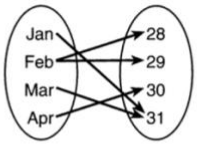
Determine if either one is correct, and justify your answer completely.

Nora is incorrect because the graph of a circle is not a function as it does not pass the vertical line test.

Mia is also incorrect in her reasoning because it should state multiple values of Y map to the same X-value

11)

A mapping is shown in the diagram below.



This mapping is

(1) a function, because Feb has two outputs, 28 and 29

(2) a function, because two inputs, Jan and Mar, result in the output 31

(3) not a function, because Feb has two outputs, 28 and 29

(4) not a function, because two inputs, Jan and Mar, result in the output 31

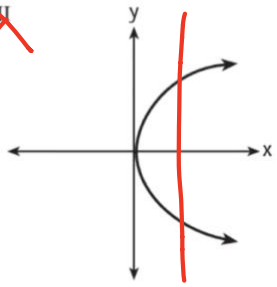
12)

Which representations are functions?

I

x	y
2	6
3	−12
4	7
5	5
2	−6

III



II $\{(1,1), (2,1), (3,2), (4,3), (5,5), (6,8), (7,13)\}$

IV $y = 2x + 1$

(1) I and II
(2) II and IV
(3) III, only
(4) IV, only

13)

The cost of airing a commercial on television is modeled by the function $C(n) = 110n + 900$, where n is the number of times the commercial is aired. Based on this model, which statement is true?

(1) The commercial costs \$0 to produce and \$110 per airing up to \$900.
(2) The commercial costs \$110 to produce and \$900 each time it is aired.
(3) The commercial costs \$900 to produce and \$110 each time it is aired.
(4) The commercial costs \$1010 to produce and can air an unlimited number of times.

14)

Sandy programmed a website's checkout process with an equation to calculate the amount customers will be charged when they download songs.

The website offers a discount. If one song is bought at the full price of \$1.29, then each additional song is \$.99.

State an equation that represents the cost, C, when s songs are downloaded.

$C = 0.99(s-1) + 1.29$

Sandy figured she would be charged \$52.77 for 52 songs. Is this the correct amount? Justify your answer.

$52.77 \neq 0.99(52-1) + 1.29$

$52.77 \neq 50.49 + 1.29$

$52.77 \neq 51.78$

NO

15) State whether the following statement is true or false. Explain your reasoning.

A relation has the students in class as the domain and the desks in the classroom as the range. This relation is a function.

This is a function because each student only sits in one desk.

BUT!

You could also think differently about this question and still be correct!

This is not a function because a student can change the desk they are sitting at during class.