Unit 1 – Part 2
Linear Functions

Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Jan. 18th	Jan. 19th	Jan. 20th	Jan. 21st	Jan. 22nd
No School	*Unit 1 Part 1 Test*	*Unit 1 Part 1 Test*	Graphing Linear Functions	Characteristics of Linear Functions
Jan. 25th	Jan. 26th	Jan. 27th	Jan. 28th	Jan. 29th
Function Notation	PSAT Day – No Class	Arithmetic Sequences	Review **Quiz due at midnight**	Solving Systems by Graphing
Feb. 1st	Feb. 2nd	Feb. 3rd	Feb. 4th	Feb. 5th
Solving Systems by Substitution	Solving Systems by Elimination Quiz	**Quiz due at midnight**	Systems of Equations Word Problems	Graphing Systems of Inequalities
Feb. 8th	Feb. 9th	Feb. 10th	Feb. 11th	Feb. 12th
Graphing Systems of Inequalities	Review Test	**Test due at midnight**	*Factoring by GCF*	*Factoring*

Graphing Linear Functions

In order to graph a linear function, you must know two things: the ____________________ and the _____________.

Y-Intercept

The y-intercept is the point on the graph where the ___________ crosses the __________.
The y-intercept is represented by the variable _______ and can be found at the point ____________.

Slope

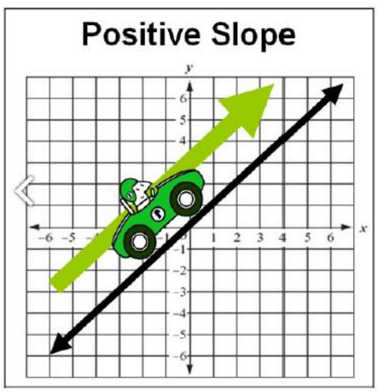
The slope is the constant rate of change of the rise to the run.
The slope is represented by the variable ________. If the slope is given to you as a whole number, you can make it a fraction by putting the number over ______.

4 Types of Slope

Positive Slope

Examples:
$\frac{3}{2}$ or 4

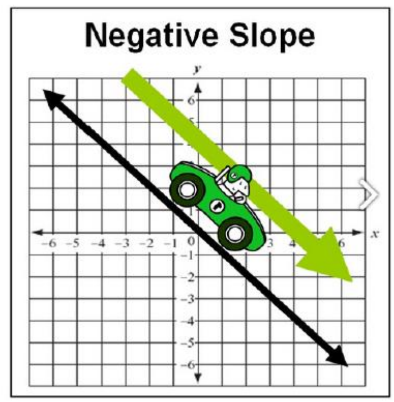
Going up a hill



Negative Slope

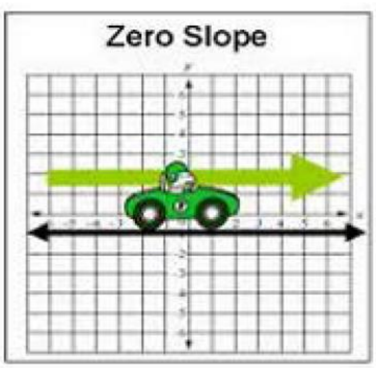
Examples:
$-\frac{1}{2}$ or -4

Going down a hill



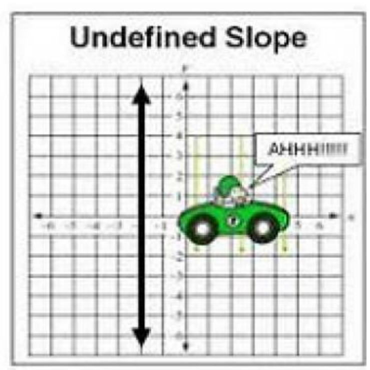
Zero Slope

Y-values are the same
Going in a straight line (No Vertical Change)



Undefined Slope

X-values are the same
Falling off a cliff (No Horizontal Change)



Slope of a Line

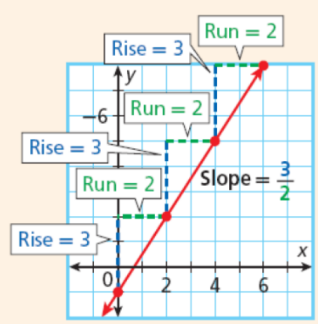
The **rise** is the difference in the ***y*-values** of two points on a line.

The **run** is the difference in the ***x*-values** of two points on a line.

The **slope** of a line is the ratio of rise to run for any two points on the line.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$$

(Remember that *y* is the **dependent variable** and *x* is the **independent variable**.)



Slope-Intercept Form: $y = mx + b$

Step 1: Identify the y-intercept (b) and plot the point $(0, b)$.

Step 2: Use the slope (m) to find a second point: $m = \frac{rise}{run}$. (Remember to make whole numbers into fractions). You can do this several times.

Step 3: Connect the points.

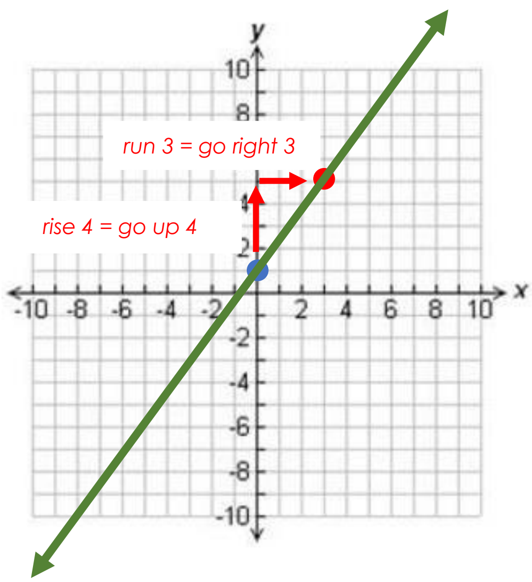
Example: $y = \frac{4}{3}x + 1$

$b = 1$

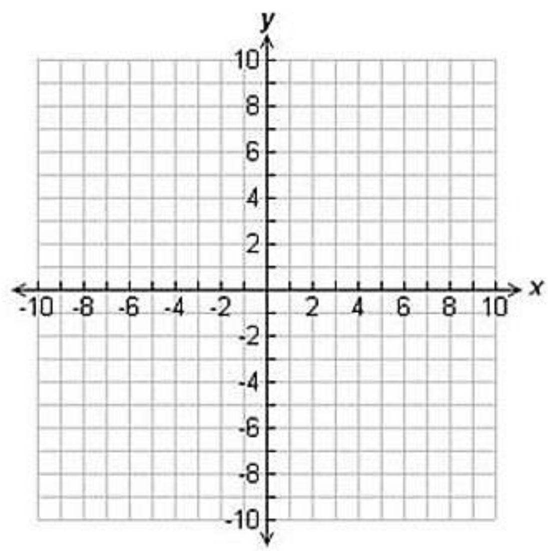
$y - int: (0, 1)$

$m = \frac{4}{3}$

$slope = \frac{rise\ 4}{run\ 3}$

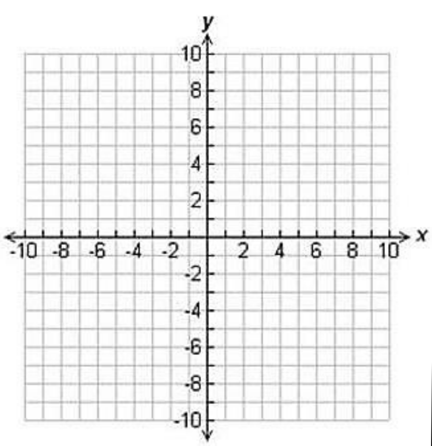


You Try: $y = 3x - 5$

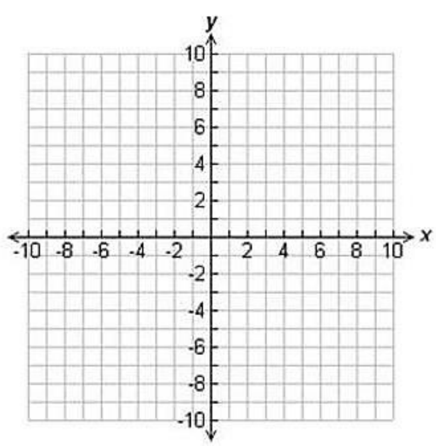


More Practice

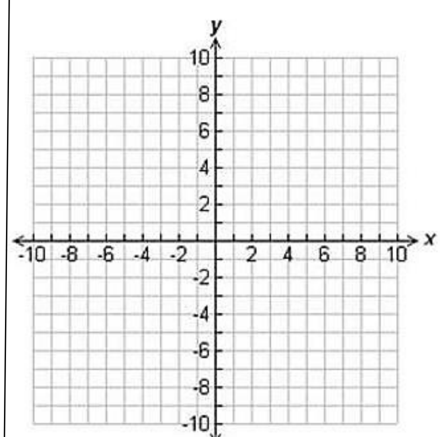
$y = -\frac{2}{3}x + 4$



$y = 4x - 2$

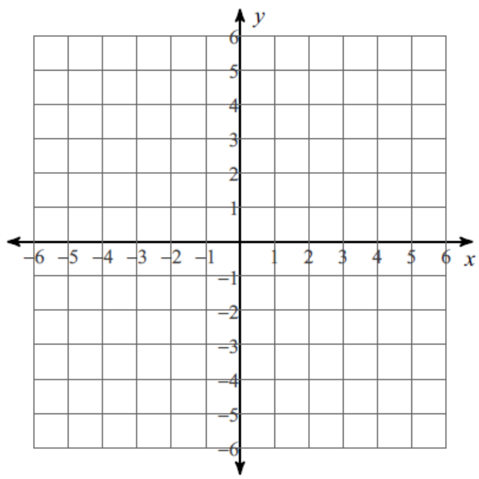


$y = -\frac{1}{4}x - 6$

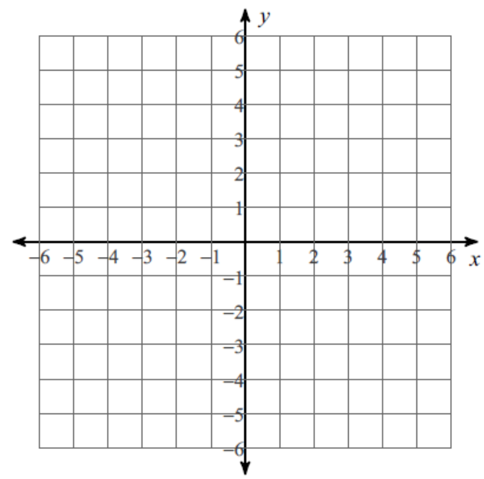


Graphing in Slope-Intercept Form Practice

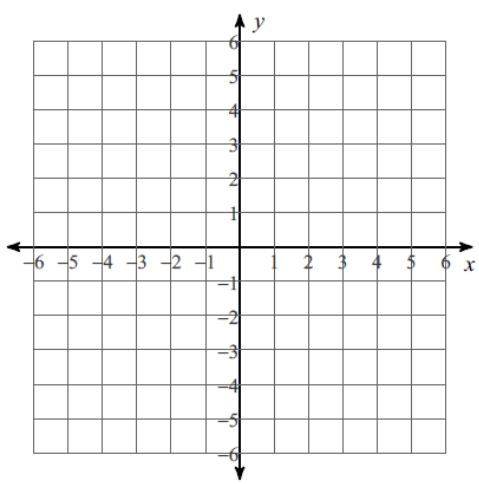
1) $y = -6x + 5$



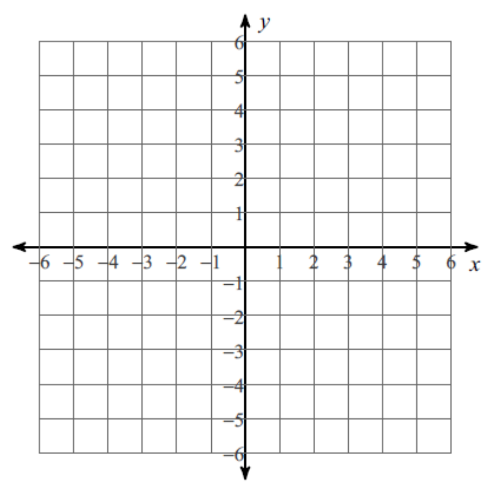
2) $y = \frac{6}{5}x + 4$



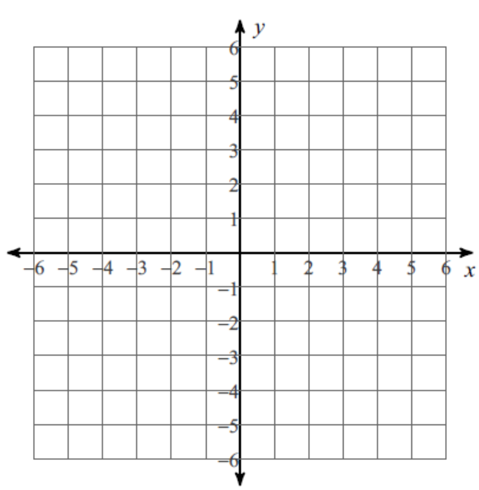
3) $y = x - 2$



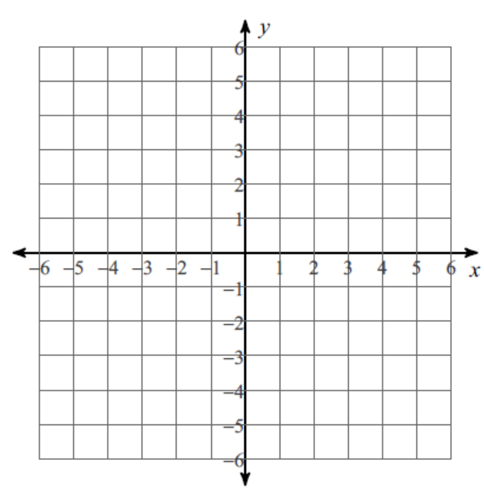
4) $y = -\frac{3}{2}x - 4$



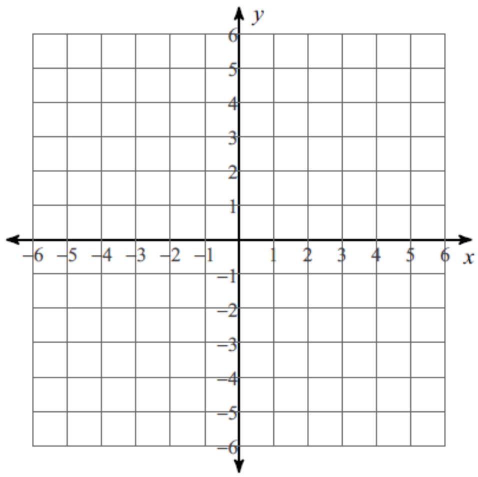
5) $y = \frac{3}{5}x$



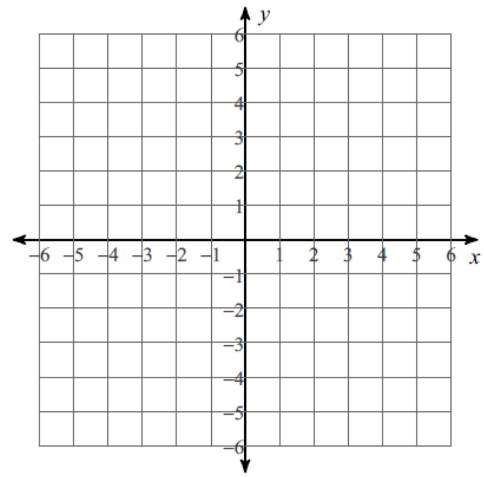
6) $y = -x - 2$



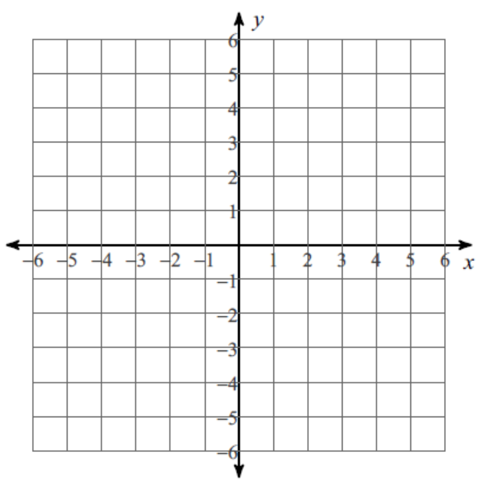
7) $x = -2$



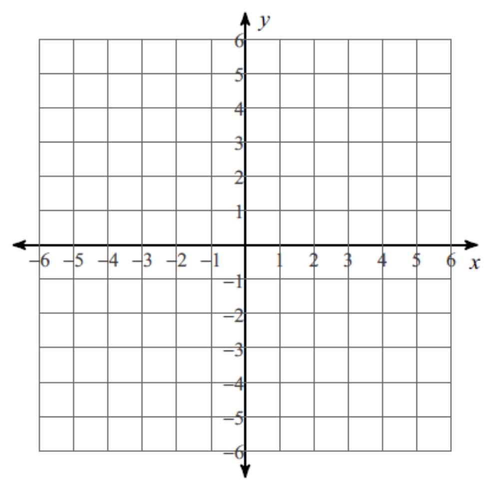
8) $y = -\frac{1}{5}x - 4$



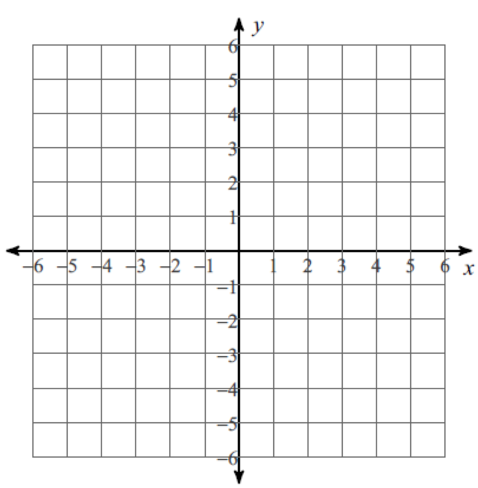
9) $y = 2$



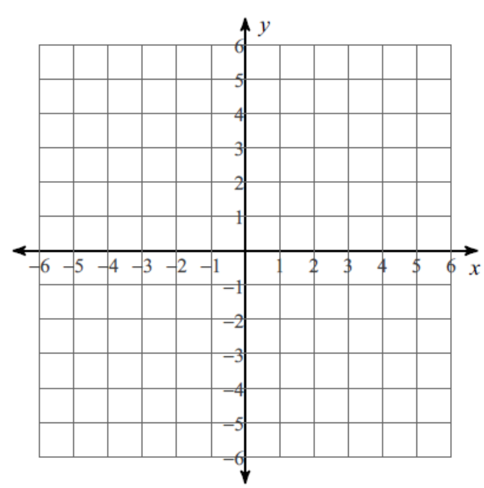
10) $y = 5x$



11) $y = \frac{2}{5}x - 3$



12) $x = 3$



Graphing in Standard Form

Standard Form: $\boldsymbol{Ax + By = C}$

Step 1: Convert from standard form to slope-intercept form (solve for y)

Step 2: Follow the same steps from graphing in slope-intercept form (pg. 3)

Example: $\boldsymbol{2x + 6y = 12}$

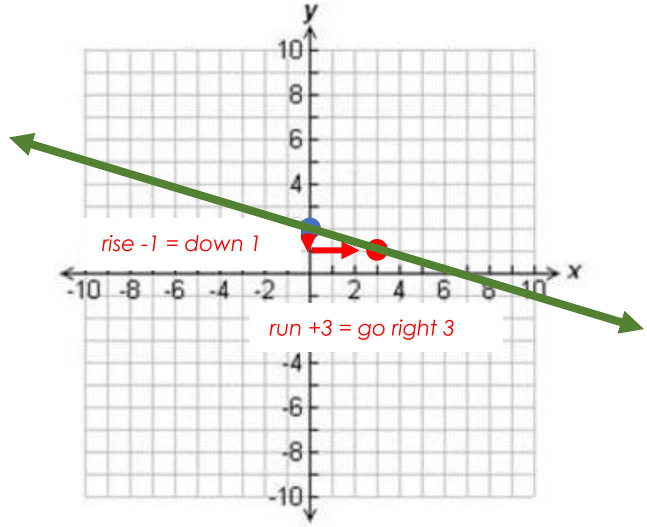
$$\begin{aligned} 2x + 6y &= 12 \\ \underline{-2x \qquad\quad} & \underline{\;-\,2x\;} \\ 6y &= -2x + 12 \\ \frac{6y}{6} &= \frac{-2x + 12}{6} \\ y &= -\frac{2}{6}x + \frac{12}{6} \\ y &= -\frac{1}{3}x + 2 \end{aligned}$$

$b = 2$

$y - int: (0,2)$

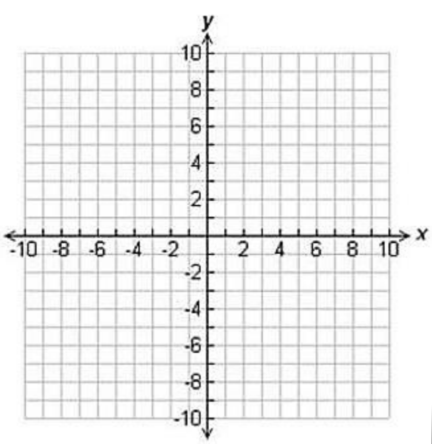
$m = -\frac{1}{3}$

$m = \frac{rise -1}{run +3} = \frac{down\ 1}{right\ 3}$

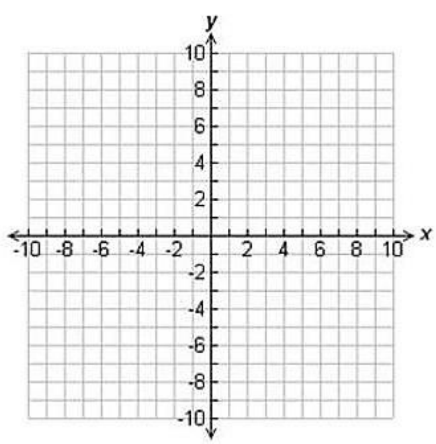


Practice

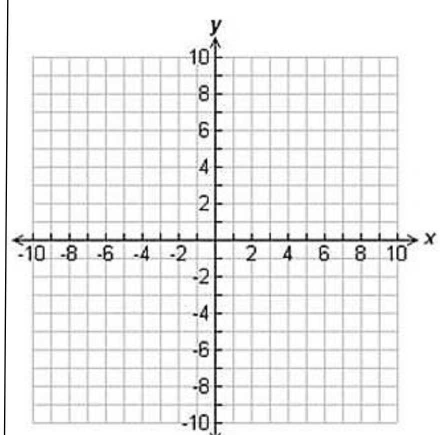
$2x + 8y = -24$



$3x - 2y = -12$

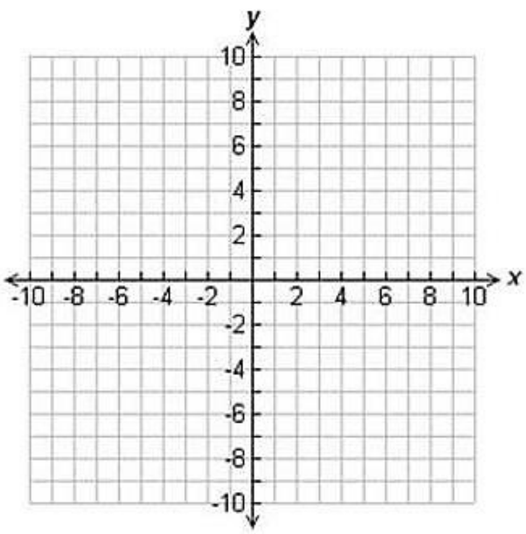


$4x - y = 1$

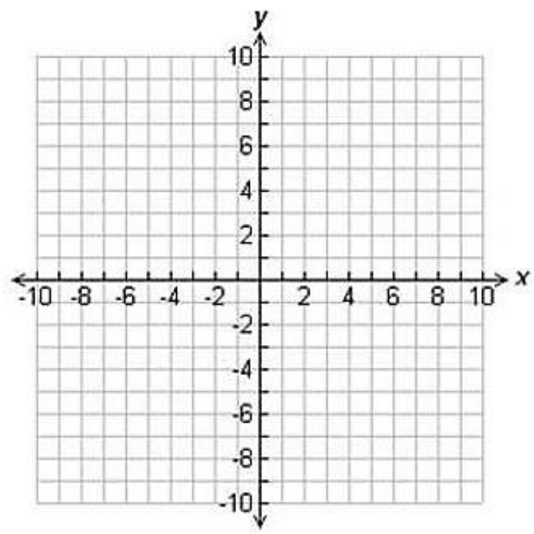


Graphing in Standard Form Practice

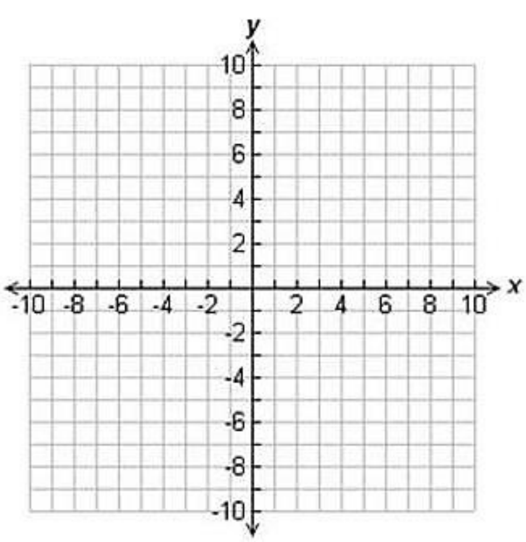
1) $y = 2x + 5$



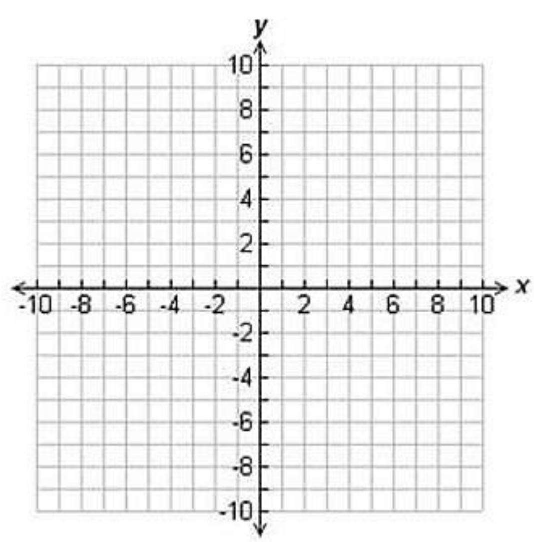
2) $2y - x = 6$



3) $2x + 3y = 15$



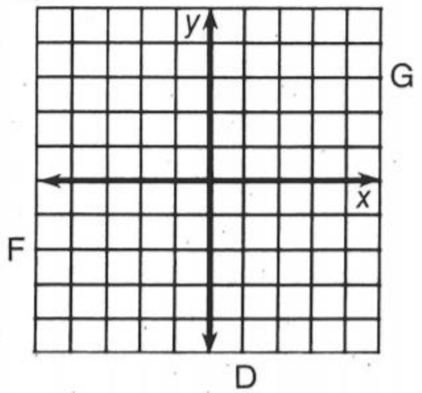
4) $3(x + 2) - y + 2 = 14$



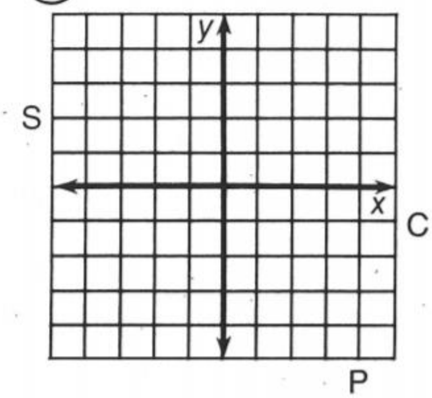
Why Did the Cow Want a Divorce?

Graph each equation below. The graph, if extended, ill cross a letter. Look for this letter in the string of letters near the bottom of the page and CROSS IT OUT each time it appears. When you finish, write the remaining letters in the rectangle at the bottom of the page.

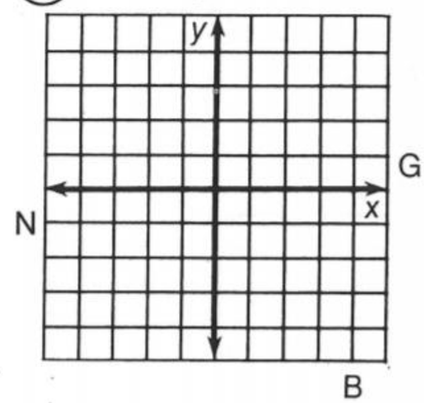
(1) $y = -2$



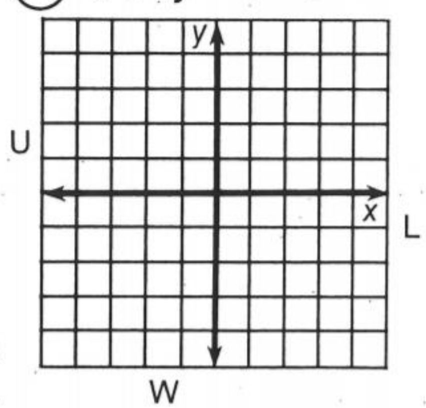
(2) $x = 4$



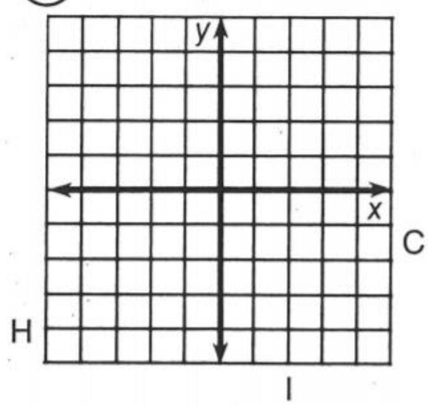
(3) $2x - 3y = 9$



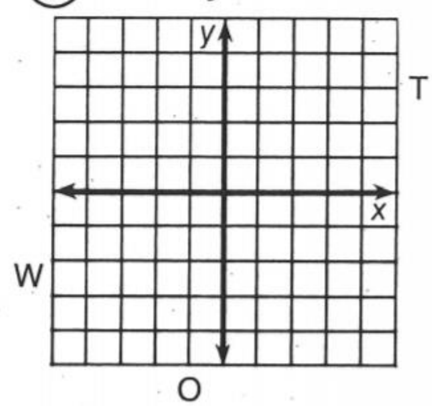
(4) $x + 2y - 4 = 0$



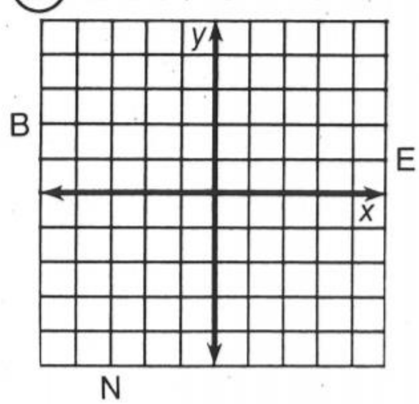
(5) $3x + 4y = 12$



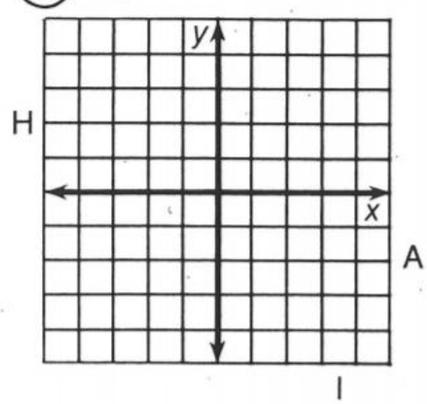
(6) $6x - 5y + 20 = 0$



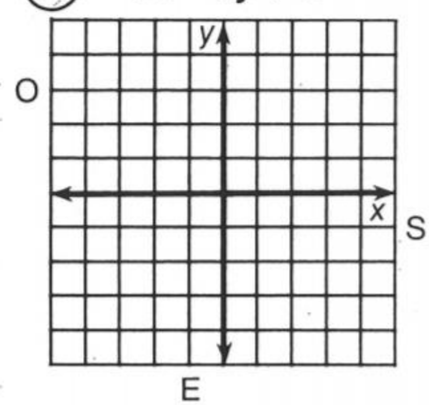
(7) $x + 3 = 0$



(8) $2x - 7 = 0$



(9) $-2x = 2y + 5$



C S I H O W E H O F A N D A P L B O I U L F G M S I P T O W E I E R N

Answer: ____

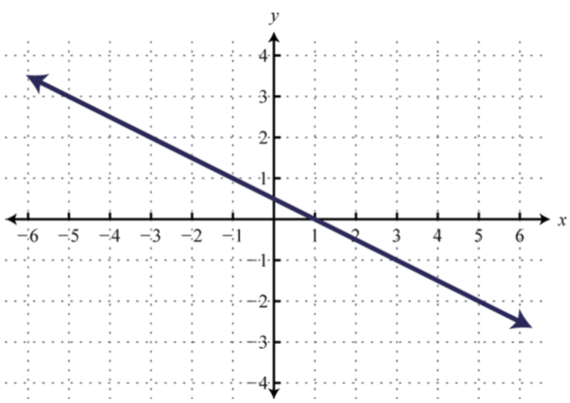
Work for Why Did the Cow Want a Divorce?

1)	2)	3)
4)	5)	6)
7)	8)	9)

Characteristics of Linear Functions

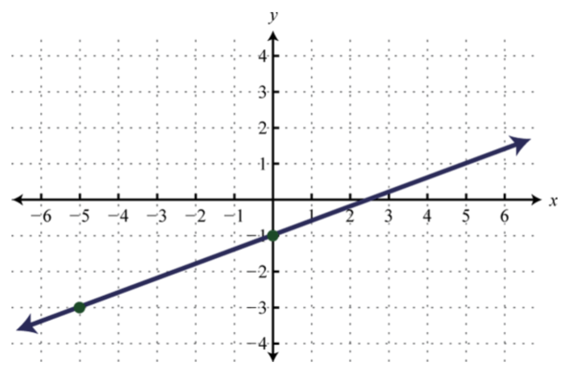
Domain and Range

Domain		
Define: All possible values of x	**Think:** How far left to right does the graph go?	**Write:**
Range		
Define: All possible values of y	**Think:** How far down to how far up does the graph go?	**Write:**



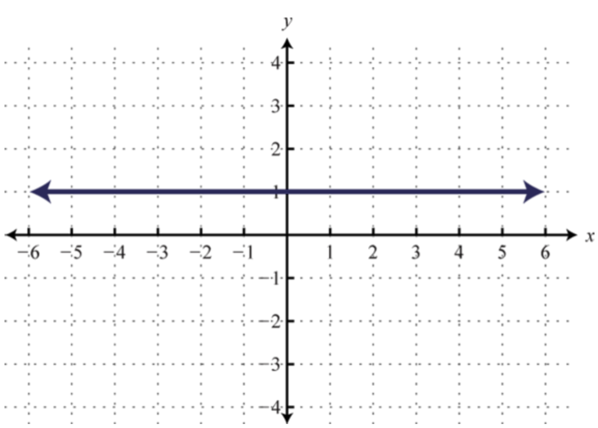
Domain:

Range:



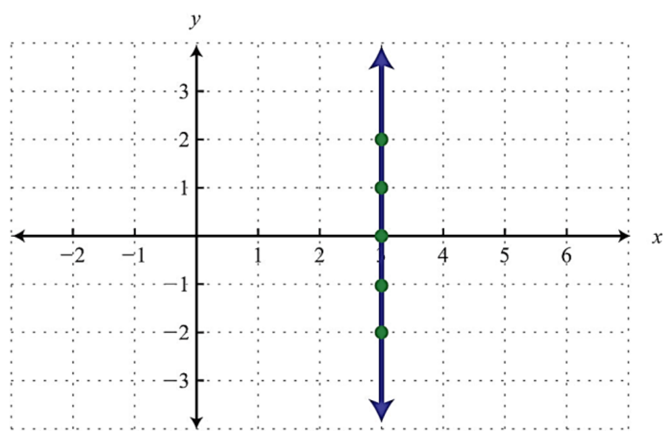
Domain:

Range:



Domain:

Range:

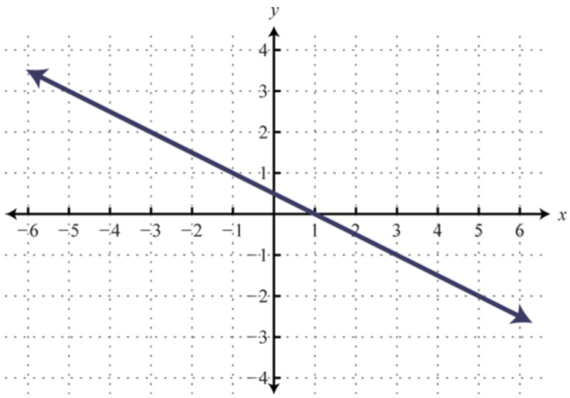


Domain:

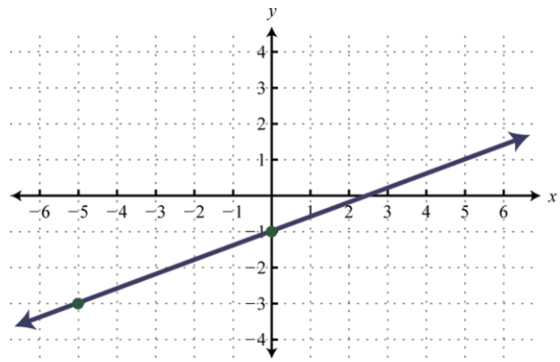
Range:

Zeros and Intercepts

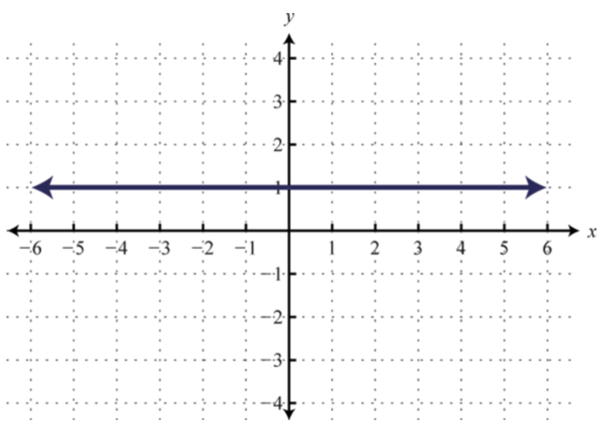
Y-Intercept		
Define: Point where the graph crosses the y-axis	**Think:** At what coordinate point does the graph cross the y-axis?	**Write:**
X-Intercept		
Define: Point where the graph crosses the x-axis	**Think:** At what coordinate point does the graph cross the x-axis?	**Write:**



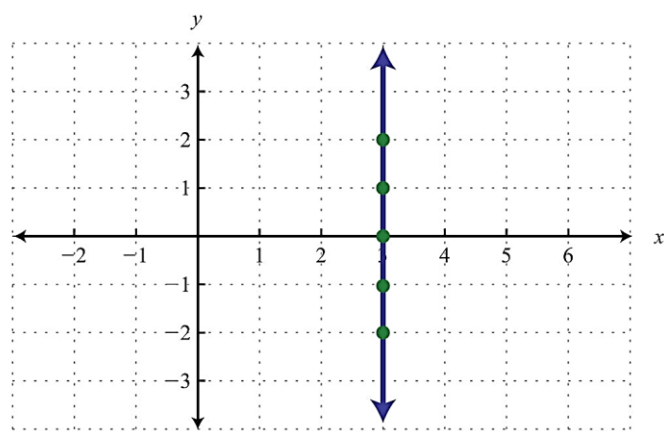
X-intercepts: Y-intercept:



X-intercepts: Y-intercept:



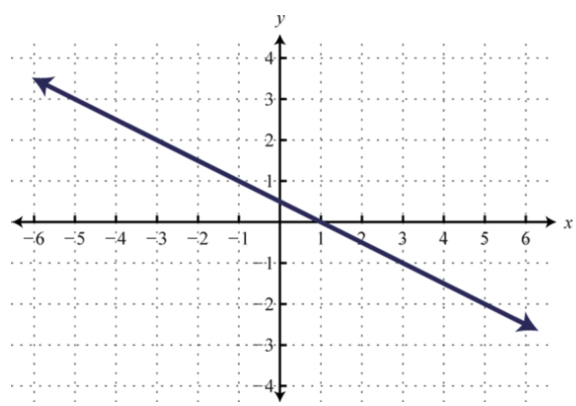
X-intercepts: Y-intercept:



X-intercepts: Y-intercept:

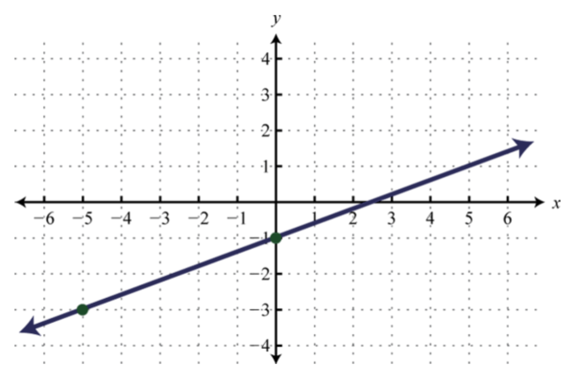
End Behavior

End Behavior	
Define: Behavior of the ends of the function (what happens to the y-values or f(x)) as x approaches positive or negative infinity. The arrows indicate the function goes on forever so we want to know where those ends go.	
Think: As x goes to the left (negative infinity), what direction does the left arrow go?	**Write:**
Think: As x goes to the right (positive infinity), what direction does the right arrow go?	**Write:**



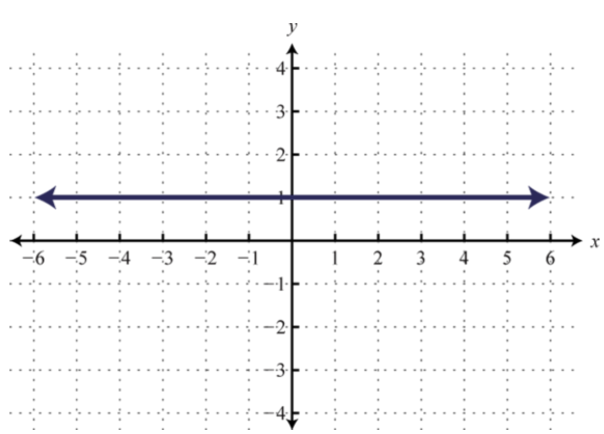
$As\ x \rightarrow -\infty, f(x) \rightarrow$______.

$As\ x \rightarrow \infty, f(x) \rightarrow$______.



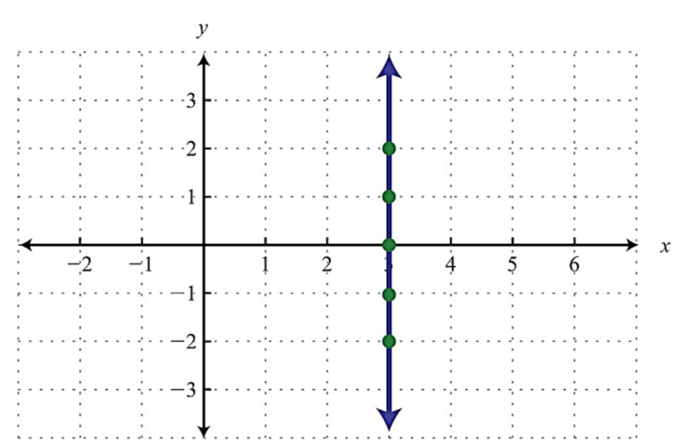
$As\ x \rightarrow -\infty, f(x) \rightarrow$______.

$As\ x \rightarrow \infty, f(x) \rightarrow$______.



$As\ x \rightarrow -\infty, f(x) \rightarrow$______.

$As\ x \rightarrow \infty, f(x) \rightarrow$______.

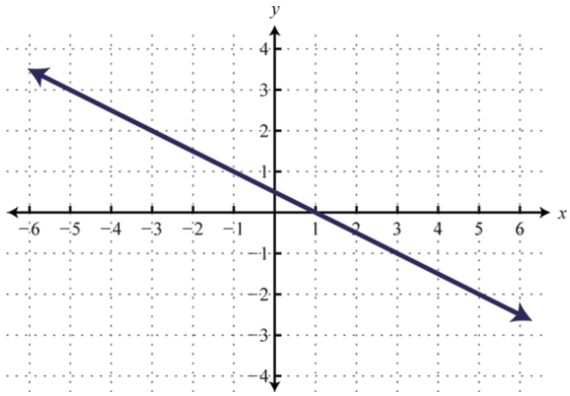


$As\ x \rightarrow -\infty, f(x) \rightarrow$______.

$As\ x \rightarrow \infty, f(x) \rightarrow$______.

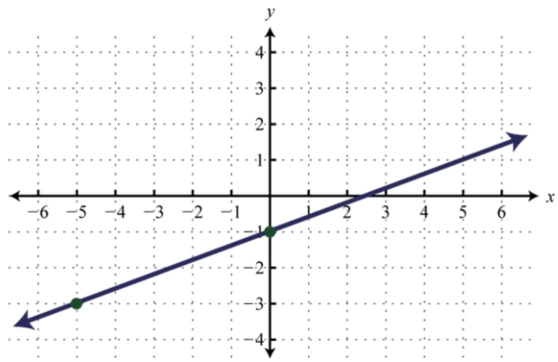
Average Rate of Change

Average Rate of Change		
Define: Rate of change or slope for a given interval on a graph	**Think:** How is the graph changing over the given interval?	**Write:**



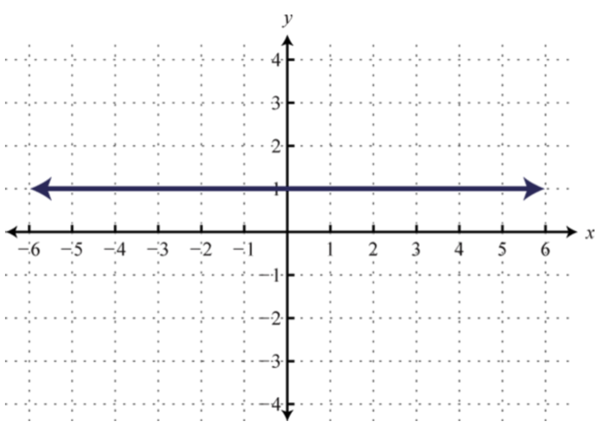
Calculate the average rate of change

for the interval $-3 \leq x \leq 3$.

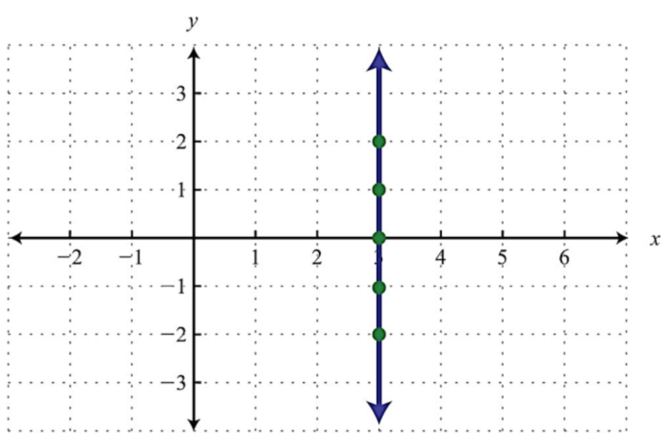


Calculate the average rate of change

for the interval $-5 \leq x \leq -1$.



A horizontal line has a slope of _____.



A vertical line has a slope of ___________.

Calculate the average rate of change for the function $f(x) = 3x$ for the interval $1 \leq x \leq 3$.

Characteristics of Linear Functions Practice

1) Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

Decreasing: ________________

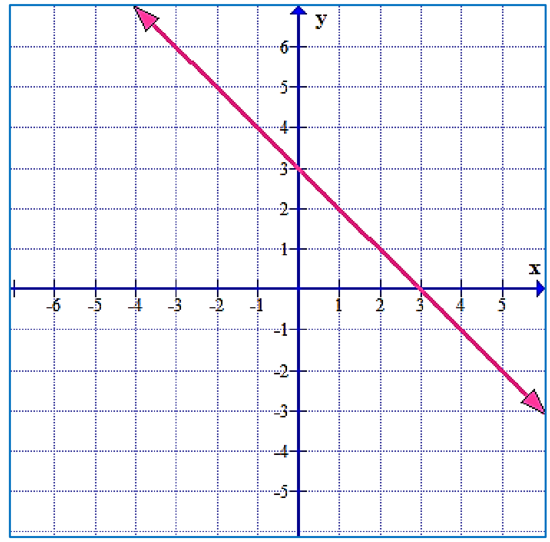
Constant: ________________

Slope: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$_____.

$As\ x \rightarrow \infty, f(x) \rightarrow$_____.

Equation: ___________________________



2) Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

Decreasing: ________________

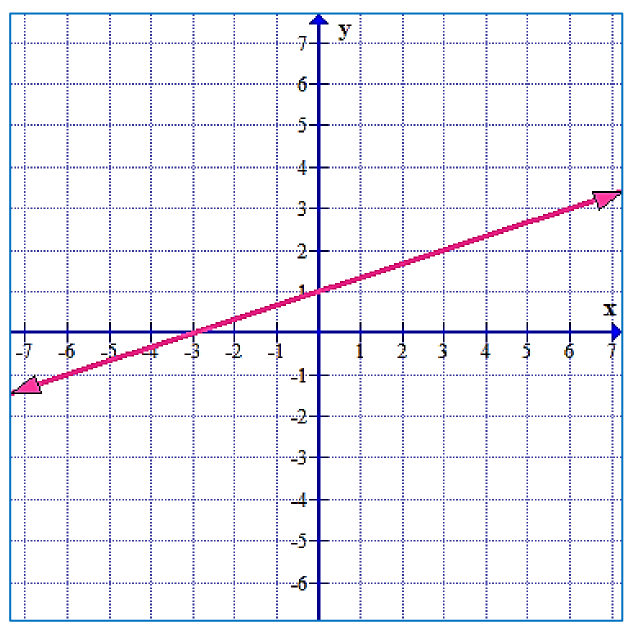
Constant: ________________

Slope: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$_____.

$As\ x \rightarrow \infty, f(x) \rightarrow$_____.

Equation: ___________________________



3) Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

Decreasing: ________________

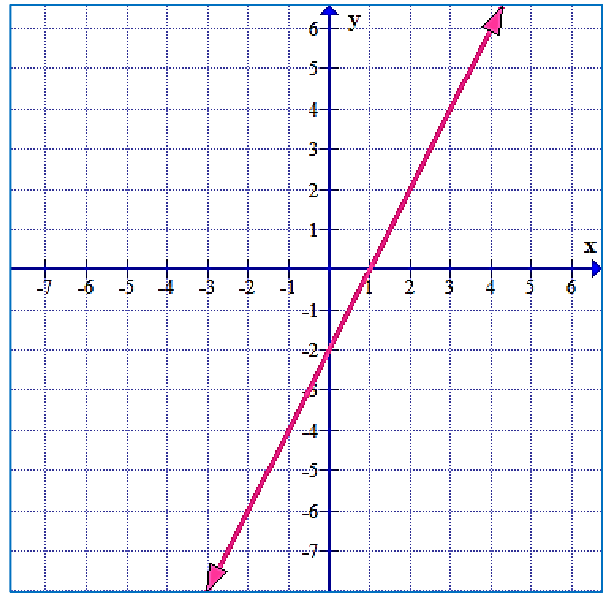
Constant: ________________

Slope: ________________

$As\ x \to -\infty, f(x) \to$ _____.

$As\ x \to \infty, f(x) \to$ _____.

Equation: ____________________________



4) Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

Decreasing: ________________

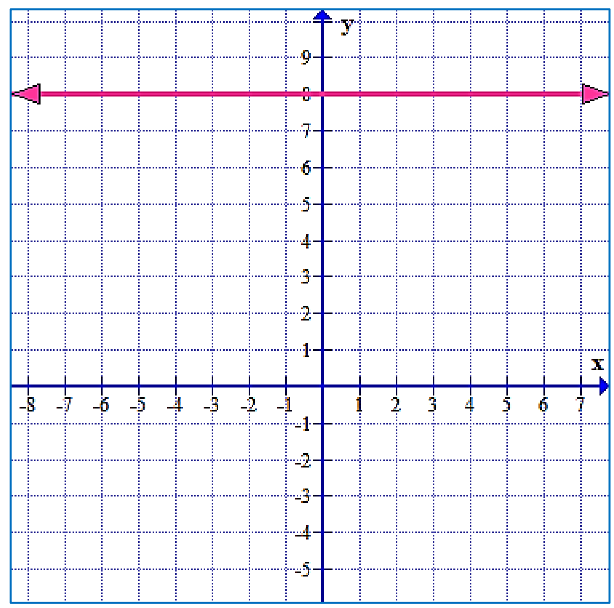
Constant: ________________

Slope: ________________

$As\ x \to -\infty, f(x) \to$ _____.

$As\ x \to \infty, f(x) \to$ _____.

Equation: ____________________________



5) Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

Decreasing: ________________

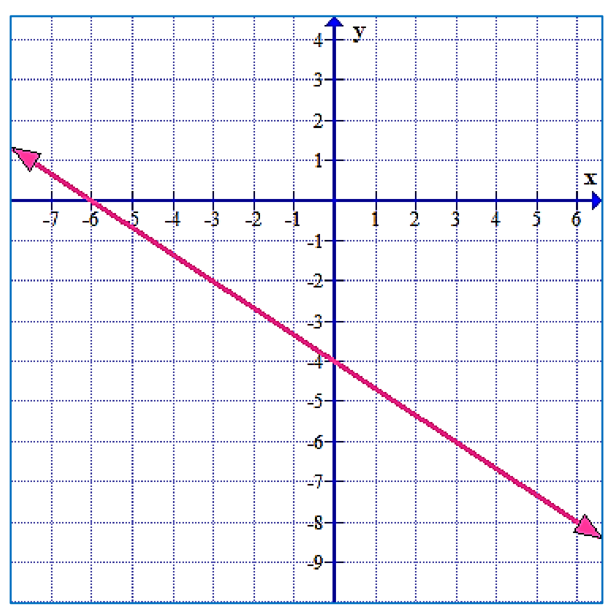
Constant: ________________

Slope: ________________

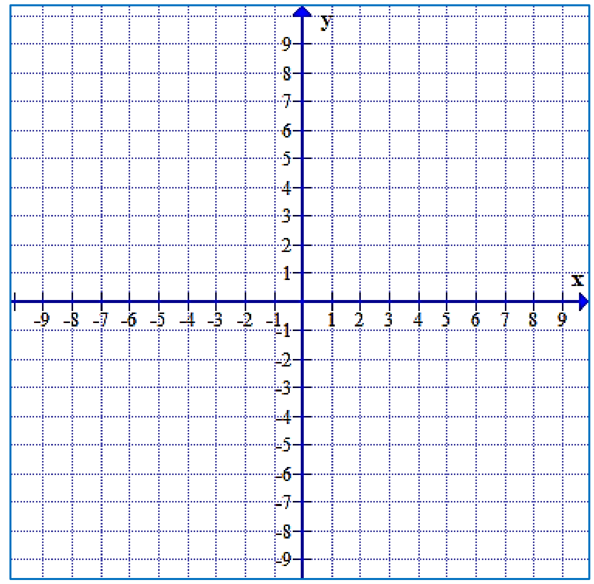
$As\ x \to -\infty, f(x) \to$ _____.

$As\ x \to \infty, f(x) \to$ _____.

Equation: ____________________________



6) Graph $y = 2x - 2$ and identify the characteristics.



Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

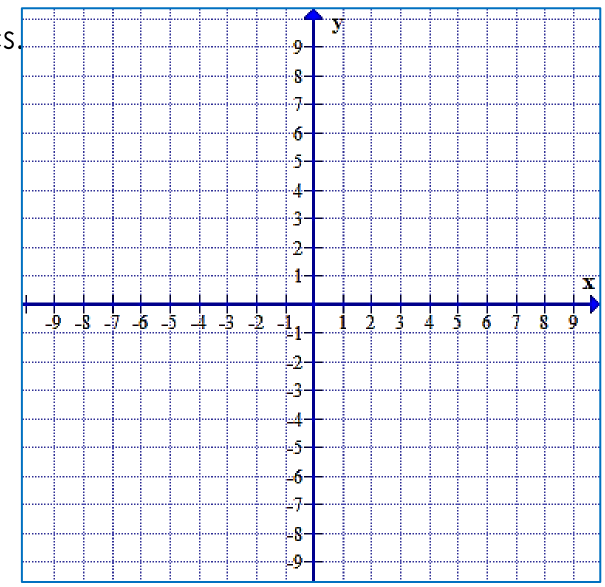
Decreasing: ________________

Constant: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$_____.

$As\ x \rightarrow \infty, f(x) \rightarrow$_____.

7) Graph $f(x) = 3x - 6$ and identify the characteristics.



Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

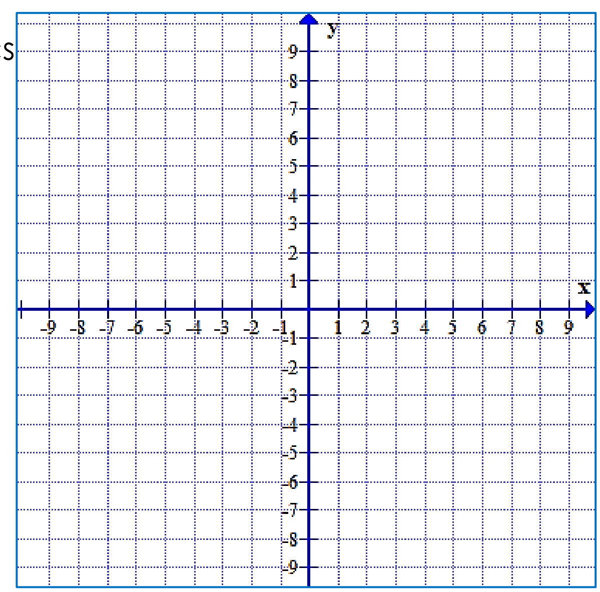
Decreasing: ________________

Constant: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$_____.

$As\ x \rightarrow \infty, f(x) \rightarrow$_____.

8) Graph $f(x) = -x + 2$ and identify the characteristics



Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

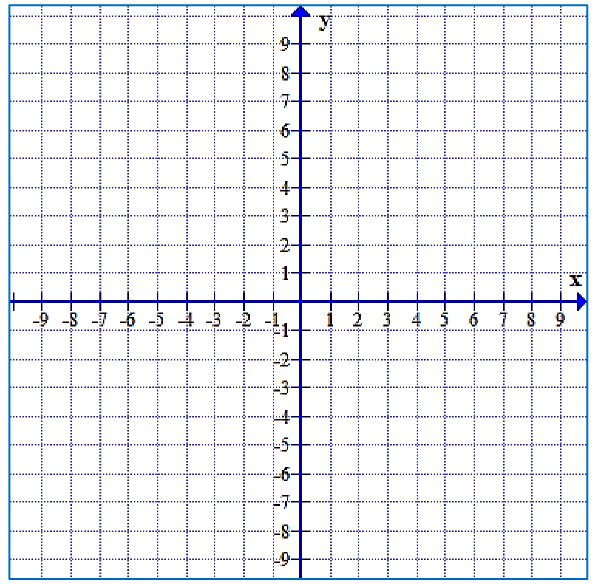
Decreasing: ________________

Constant: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$_____.

$As\ x \rightarrow \infty, f(x) \rightarrow$_____.

9) Graph $y = -\frac{3}{4}x$ and identify the characteristics.



Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

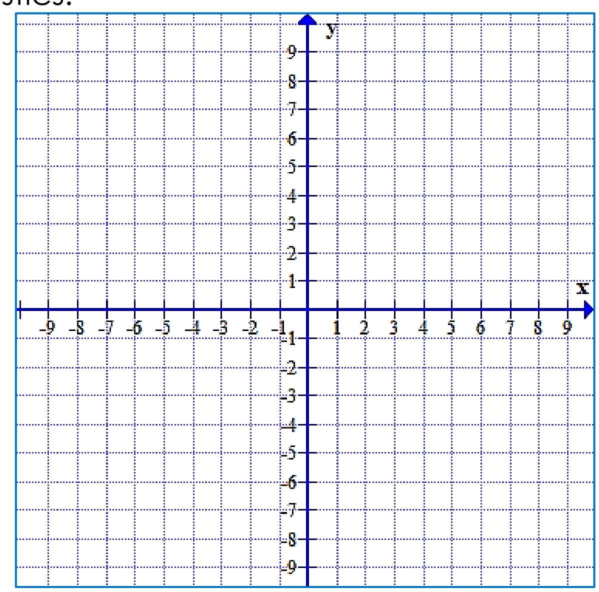
Decreasing: ________________

Constant: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$ ______.

$As\ x \rightarrow \infty, f(x) \rightarrow$ ______.

10) Graph $f(x) = -\frac{1}{2}x + 4$ and identify the characteristics.



Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

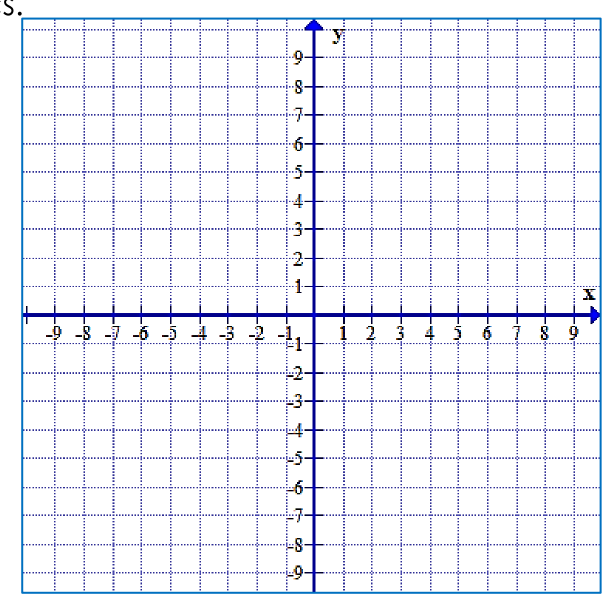
Decreasing: ________________

Constant: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$ ______.

$As\ x \rightarrow \infty, f(x) \rightarrow$ ______.

8) Graph $f(x) = \frac{3}{2}x - 5$ and identify the characteristics.



Domain: ________________

Range: ________________

X-Intercept: ________________

Y-Intercept: ________________

Increasing: ________________

Decreasing: ________________

Constant: ________________

$As\ x \rightarrow -\infty, f(x) \rightarrow$ ______.

$As\ x \rightarrow \infty, f(x) \rightarrow$ ______.

Functions and Relations Notes

Terms to Know

◇ **Relation:** a set of ________________ that has an ____________________

◇ **Function:** a _________________ such that every single _____________________ has exactly _________ output.

The notation of a function is important in higher mathematics such as calculus and in areas which use mathematics such as physics.

◇ **Domain:** ____

◇ **Range:** ____

How do I determine if a relation is function?

◇ Each input must have ____________________________ output.

◇ When given a graph – the vertical line test: **NO** vertical line can pass through ____ points on the graph.

Here are 2 examples of functions and the third is NOT a function.

1) Input the number of seconds after the starting gun in a race to get an output of the number of meters the runner has covered.

Race Chart				
number of seconds (input)	1	4	7	8
meters covered (output)	5	20	35	40

2) $y = x - 6$, where x is the place holder (also called a ______________________) for the input and y is the place holder for the output.

function $\boldsymbol{y = -x - 6}$				
x (input)	-3	0	7	8
y (output)	-9	-6	1	2

3) The rule about only <u>one output</u> each time is crucial and must not be violated.

not a function				
input	3	2	0	3
output	4	-1	2	-3

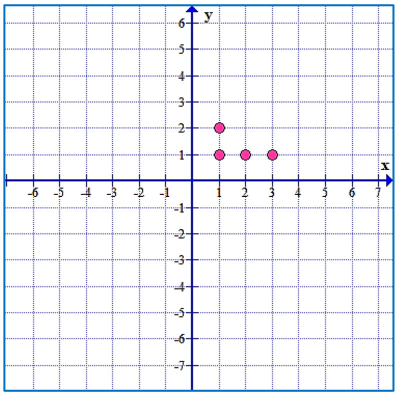
Why is this not a function? ____

____

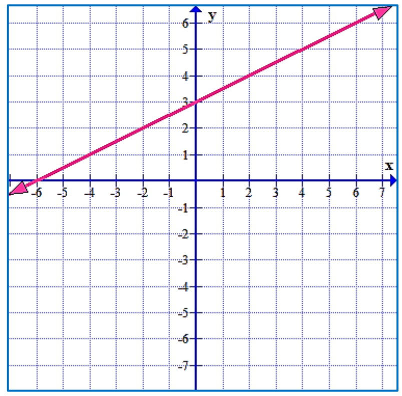
You Try: Determine whether each of the following is a function.

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

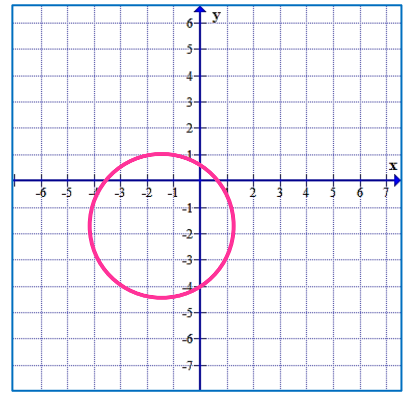
2)



3)



4)



Function Notation

◇ Function notation is ____. It is pronounced ______________________________.

◇ $f(x)$ is a fancy way of writing ________ in an _____________________.

Example: $f(x) = 2x + 4$ is the same as $y = 2x + 4$

Function Notation	x – y Notation
$f(x) = 5x + 2$	
	$y = -3x - 7$

Evaluating Functions

1) Given $f(x) = 2x + 3$, find $f(-2)$.

2) Given $f(x) = 32(2)^x$, find $f(3)$.

3) Given $f(x) = x^2 - 2x + 3$, find $f(-3)$.

4) Given $f(x) = 3^x + 1$, find $f(3)$.

Function Notation – Continued

When a function can be written as an equation, the symbol $f(x)$ replaces y and is read as "the value of function f at x" or simply "f of x".

This does NOT mean f times x.

Replacing y with $f(x)$ is called writing a function in function notation.

★ REMEMBER ★ $f(-3)$ means -3 if your input and you plug it in for x

★ $f(x) = -3$ means -3 is your output and your whole function is equal to -3 and you plug -3 into the y

Examples:

1) If $f(x) = 2x - 3$, find the following.

a) $f(-2)$ b) $f(7)$ c) $f(-4)$

2) If $k(x) = -7x + 1$, find the following.

a) $k(0)$ b) $k(-1)$ c) $k(5)$

Sometimes, there will be multiple x's in an equation. When this occurs, simply replace all of values of x.

3) If $h(x) = x^2 - 3x + 5$, find the following.

a) $h(-3)$ b) $h(5)$

4) If $p(x) = x^2 + 5x - 3$, find the following.

a) $p(-2)$ b) $p(1)$

5) If $f(x) = 5x - 3$, complete the following table of values. Then determine what type of function it is.

x	-2	-1	0	1	2	3
$f(x)$						

Function Notation Worksheet

1) Evaluate the following expressions given the functions below.

$g(x) = -3x + 1$ $f(x) = x^2 + 7$ $h(x) = \frac{12}{x}$ $j(x) = 2x + 9$

a) $g(10) =$

b) $f(3) =$

c) $h(-2) =$

d) $j(7) =$

e) $h(a) =$

f) Find x if $g(x) = 16$

g) Find x if $h(x) = -2$

h) Find x if $f(x) = 23$

2) Translate the following statements into coordinate points.

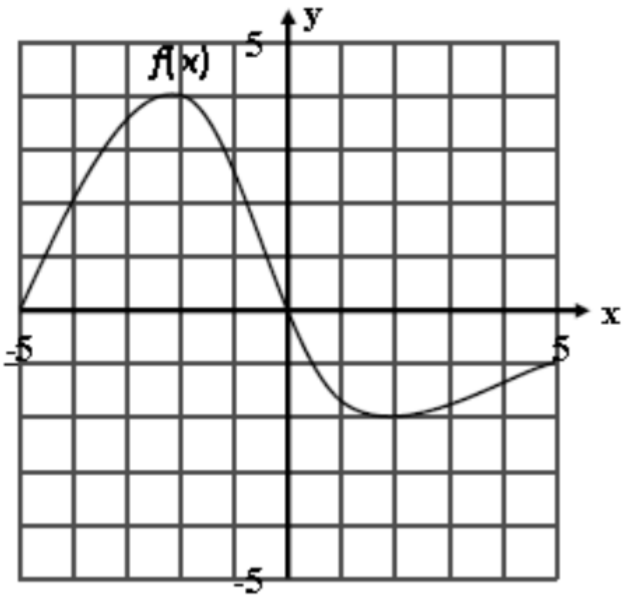
a) $f(-1) = 1$

b) $h(2) = 7$

c) $g(1) = -1$

d) $k(3) = 9$

3) Given this graph of function $f(x)$, find the following.



a) $f(-4) =$

b) $f(0) =$

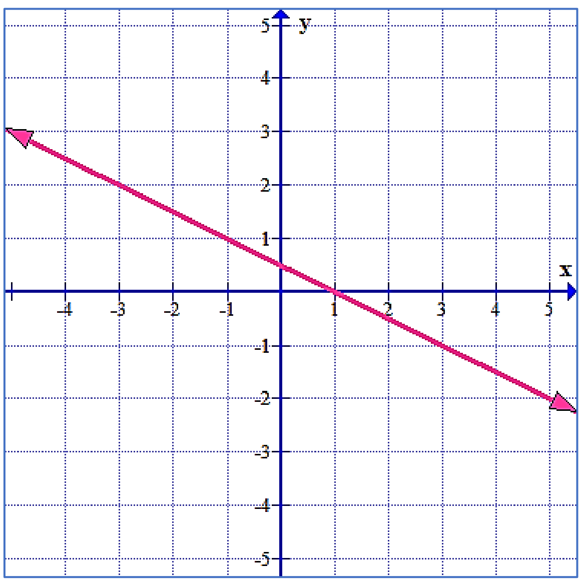
c) $f(3) =$

d) $f(-5) =$

e) x such that $f(x) = 2$

f) x such that $f(x) = 0$

4) Evaluate the function using the following graph.



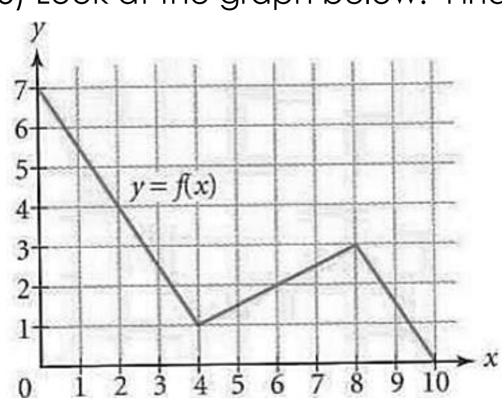
a) $f(-1) =$

b) $f(3) =$

c) $f(\_\_\_\_\_) = 0$

d) $f(\_\_\_\_\_) = 3$

5) Look at the graph below. Find the following values of the function.



a) $f(6) =$

b) $f(2) =$

c) $f(0) =$

d) $f(5) =$

e) For which value(s) of x is the following statement true? $f(x) = 1$

Function Notation – Quotable Puzzle

Directions: Solve the following problems. Match that answer to the correct letter of the alphabet. Enter that letter of the alphabet on the blank corresponding to the problem number. #15 is completed for you.

F																
15	12	4	2	9	8	14	4	10		3	1	10	10		9	11	7

V																
	7	6	9	8	2	1	13		13	8	4	7		9	7	10	9

A	B	C	D	E	F	G	H	I	J	K	L	M
9	0	-1	-16	18	16	-2	-4	3	2	-9	1	-3
N	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**
-7	4	5	7	8	23	-5	-8	15	-23	11	42	-18

Simplify.

1) $f(x) = 2x - 1$. Find $f(5)$.

2) $f(x) = x^2 - 3x - 1$. Find $f(3)$.

3) $f(x) = 2x + 5$. Find $f(0)$.

4) $f(x) = -2x^2 - 5$. Find $f(-1)$.

5) $f(x) = x + 5$. Find $f(-7)$.

6) $f(x) = 6x^2 + 2x$. Find $f(1)$.

7) $f(x) = \frac{1}{4}x + 2x$. Find $f(8)$.

8) $f(x) = 4x - 5$. Find $f(2)$.

9) $f(x) = x^3 - 2x - 1$. Find $f(-2)$.

10) $f(x) = x^4 + 2x^2 - 1$. Find $f(2)$.

11) $f(x) = -4x - 8$. Find $f(-1)$.

12) $f(x) = 2x - 10$. Find $f(1)$.

13) $f(x) = x^3 - 2x^2 + x + 5$. Find $f(-1)$.

14) $f(x) = x^2 - 21$. Find $f(5)$.

15) $f(x) = (x - 2)^2$. Find $f(-2)$.

$$f(-2) = ((-2) - 2)^2$$
$$f(-2) = (-2 - 2)^2$$
$$f(-2) = (-4)^2$$
$$f(-2) = 16$$

Arithmetic Sequences

An ___________________________ is one that has a ______________________________.

In other words, you _____ or ______________ the same number to get to the next ______.

Part A: How do identify an Arithmetic Sequence

A **common difference** is the number we add or subtract to get to the next term. The common difference must be **constant** throughout the sequence.

a) 35, 32, 29, 26, . . .

b) 9, 14, 19, 24, ...

There are ________ different ways you can write an arithmetic sequence

Part B: Writing a Recursive Formula for Arithmetic Sequences

A recursive formula finds the next term in the sequence by using the **previous term**.

Formula:

$a_1 =$___________	$a_n =$___________	$a_{n-1} =$__________	$n =$_____________	$d =$__________

a) 35, 32, 29, 26, . . .

b) 9, 14, 19, 24, . . .

Part C: Writing an Explicit Formula for Arithmetic Sequences

An explicit formula uses an **equation/function/formula** to that will **calculate/find** each term.

Formula:

$a_1 =$____________	$a_n =$____________	$a_{n-1} =$____________	$n =$____________	$d =$____________

a) 35, 32, 29, 26, . . .

b) 9, 14, 19, 24, ...

Part D: Using the Explicit Formula to find a specific term in our sequence.

a) 35, 32, 29, 26, . . .

Find a_{20}.

b) 9, 14, 19, 24, ...

Find a_{30}.

Arithmetic Sequences Practice Worksheet

Find the n[th] term for each arithmetic sequence.

1) $a_1 = -5,\ d = 4,\ n = 9$

2) $a_1 = 13, d = -\frac{5}{2}, n = 29$

3) $a_1 = 3, d = -4, n = 6$

4) $a_1 = -5,\ d = \frac{1}{2},\ n = 10$

Complete each statement.

5) 97 is the _______th term of $-3, 1, 5, 9$.

6) -10 is the _______th term of $14, 12.5, 11, 9.5$.

Find the indicated term(s) in each arithmetic sequence.

7) a_{15} for $-3, 3, 9, \ldots$

8) a_{19} for $17, 12, 7, \ldots$

9) The first term is -7 and the common difference is 3. Find the next 3 terms.

10) The first term is 6 and the common difference is -4. Find the next 3 terms.

11) The first term is 9 and the common difference is -4. Find the next 3 terms and the 100th term.

12) The first term is -6 and the common difference is 5. Find the next 3 terms and the 100th term.

13) Find the 43rd term of $-124. -122, -120, \ldots$

14) Find the 38th terms of $182, 176, 170,..$

15) Find the 51st term of $-67, -164, -161, \ldots$

16) Find the 29th term of $182, 176, 170, \ldots$

Write the recursive rule and explicit formula for each arithmetic sequence.

17) $5, 7, 9, 11, 13, \ldots$

18) $-4, -5, -6, -7, -8, \ldots$

19) $10, 15, 20, 25, \ldots$

20) $-9, -2, 5, 12, 19, \ldots$

21) $23, 20, 17, 14, \ldots$

22) $3, 7, 11, 15, 19, \ldots$

23) $8, 6.5, 5, 3.5, 2, \ldots$

24) $9, 11.5, 14, 16.5, \ldots$

25) $-8, -3, 2, 7, 12, \ldots$

26) $3, 10, 17, 24, 31, \ldots$