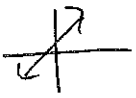
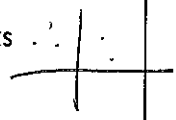
Characteristics of Functions

Types of Functions

- ***Continuous*** has NO breaks



- ***Discrete*** has gaps or breaks



Domain & Range

- The **domain** of a relation is the set of all **inputs** or **x-coordinates**.
- The **range** of a relation is the set of all **outputs** or **y-coordinates**.

Notation

Set Notation

- If the graph is discrete, list all of the inputs or outputs inside the squiggly brackets.
- Example: D= {1,2,4,5,7}

Notation

Interval Notation (Low, High)

For each **continuous** section of the graph, write the starting and ending point separated by a comma.

Start End

Parenthesis: point **is not** included in Domain/ Range (#, #)

Brackets: point **is** included in Domain/ Range [#, #]

(#, #]

[#, #)

Notation

Algebraic Notation

- Use equality and inequality symbols and variables to describe the domain and range.
- Examples:

$y > 5$ $-2 \leq x \leq x$

$x \geq 7$ $-x \leq y \leq x$

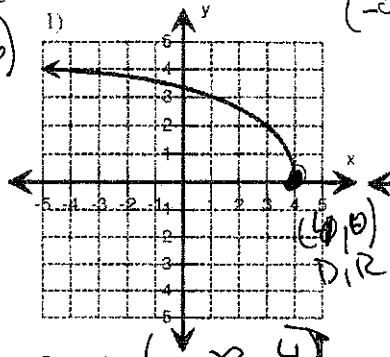
Steps: (1) Write endpoints as ordered pairs
(2) Label order pairs, D for domain, R for range
(3) Decide ( ) or [ ] or ( ] or [ )

Name: _____ Score: _____

Domain and Range

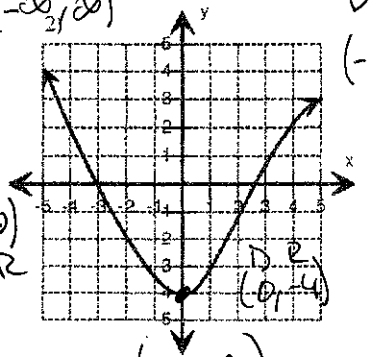
Find the Domain and Range for each graph.

1) D, R $(-\infty, \infty)$



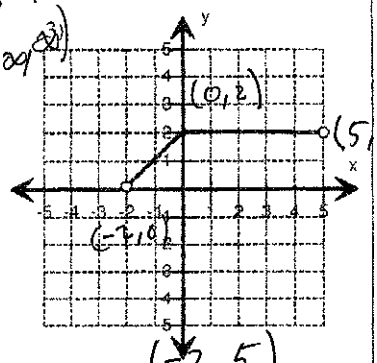
Domain : $(-\infty, 4]$
Range : $[0, \infty)$

$(-\infty, \infty)$ D, R



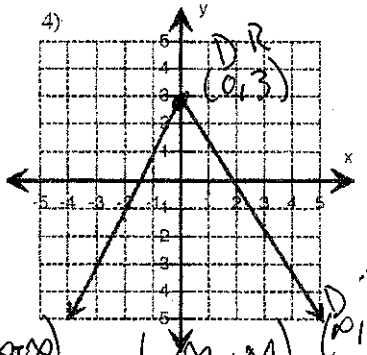
Domain : $(-\infty, \infty)$
Range : $(0, \infty)$

D R $(-\infty, 2]$



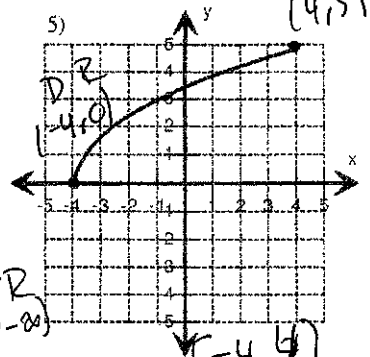
Domain : $(-2, 5]$
Range : $(0, 2]$

4) D R $(0,3)$



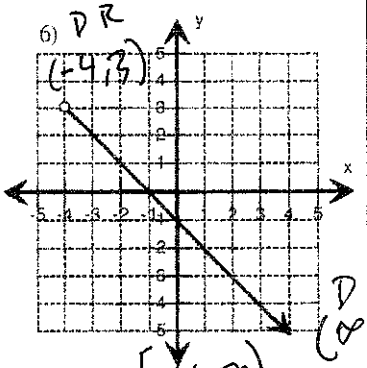
Domain : $(-\infty, \infty)$
Range : $(-\infty, 3]$

5) D R $(4,5)$ D R $(-4,0)$



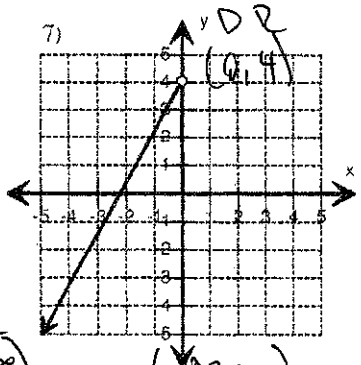
Domain : $[-4, 4]$
Range : $[0, 5]$

6) D R $(-4,3)$



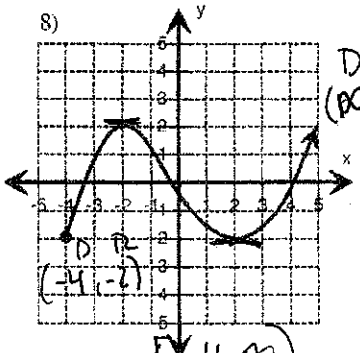
Domain : $[-4, \infty)$
Range : $(-\infty, 3]$

7) D R $(0,4)$



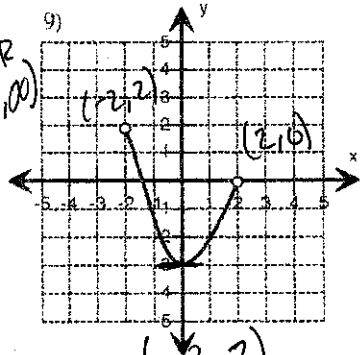
Domain : $(-\infty, 0]$
Range : $(-\infty, 4]$

8) D R $(-4,-2)$ D R (∞, ∞)



Domain : $[-4, \infty)$
Range : $[-2, \infty)$

9) D R $(-2,2)$ $(2,0)$



Domain : $(-2, 2)$
Range : $[-3, 2]$

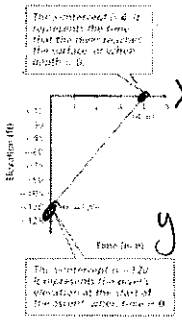
Vocabulary

y-intercept
x-intercept

Using Intercepts

The ***y*-intercept** is the *y*-coordinate of the point where the graph intersects the *y*-axis. The *x*-coordinate of this point is always 0.

The ***x*-intercept** is the *x*-coordinate of the point where the graph intersects the *x*-axis. The *y*-coordinate of this point is always 0.



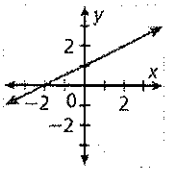
x-int (#, 0)

y-int (0, #)

Using Intercepts

Example 1A: Finding Intercepts

Find the *x*- and *y*-intercepts.



The graph intersects the y-axis at (0, 1).

The *y*-intercept is 1.

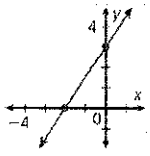
The graph intersects the x-axis at (–2, 0).

The *x*-intercept is –2.

Using Intercepts

Check It Out! Example 1a

Find the *x*- and *y*-intercepts.



The graph intersects the y-axis at (0, 3).

The *y*-intercept is 3.

The graph intersects the x-axis at (–2, 0).

The *x*-intercept is –2.

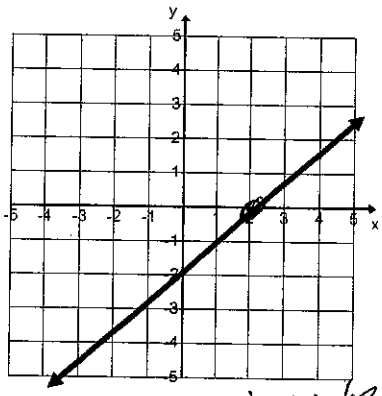
#_____

Name: _____
Date: _____ Period: _____

X and Y Intercepts Worksheet

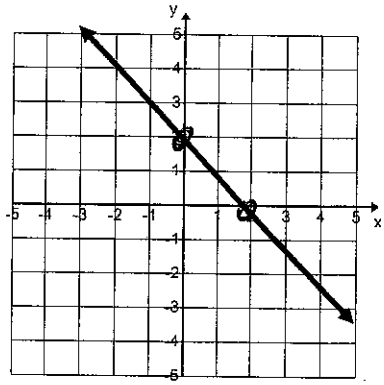
Identify the x and y intercepts and write as an ordered pair

1.



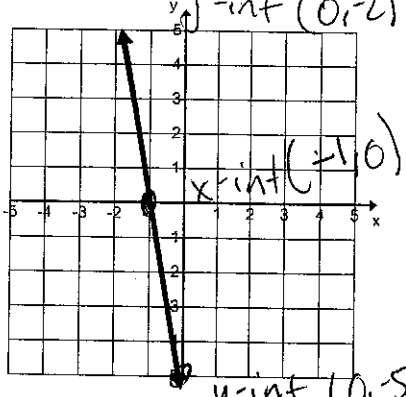
x int: (2,0)

2.



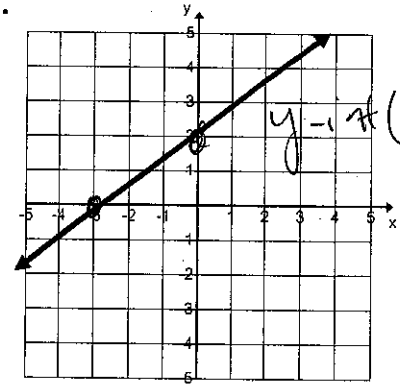
x-int (2,0)
y-int (0,2)

3.



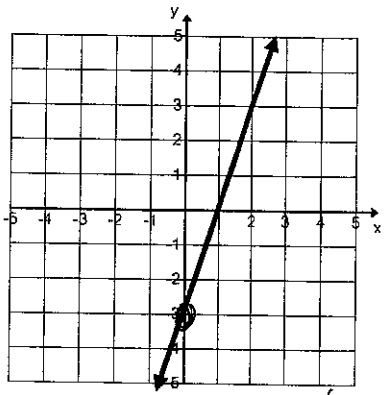
y-int (0,-2)
x-int (-1,0)
y-int (0,-5)

4.



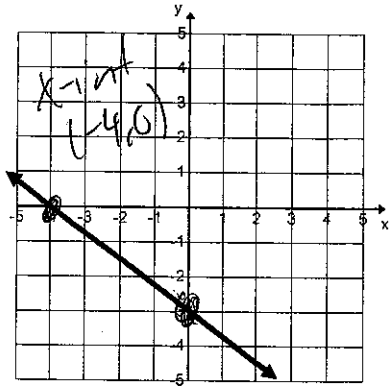
y-int (0,2)
x-int (-3,0)

5.



y-int (0,-3)
x-int (1,0)

6.



x-int (-4,0)
y-int (0,-3)

4

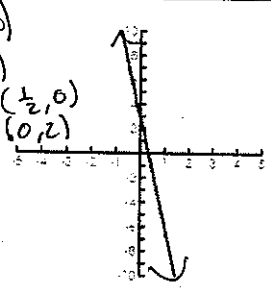
Increasing, Decreasing, or Constant

- Sweep from left to right and notice what happens to the y-values
- Finger Test- as you move your finger from left to right is it going up or down?

- ***Increasing*** goes up (L to R) positive slope, uphill
- ***Decreasing*** falls down (L to R) neg slope, downhill
- ***Constant*** is a horizontal graph 0 slope

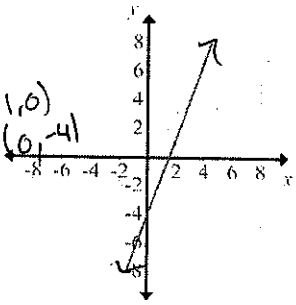
Characteristics

1. Domain: $(-\infty, \infty)$
2. Range: $(-\infty, \infty)$
3. Intercepts: x-int $(\frac{1}{2}, 0)$ y-int $(0, 2)$
4. Increasing or Decreasing?



Characteristics

1. Domain: $(-\infty, \infty)$
2. Range: $(-\infty, \infty)$
3. Intercepts: x-int $(1, 0)$ y-int $(0, -4)$
4. Increasing or Decreasing?



$(-\infty, \infty) \rightarrow \mathbb{R}$

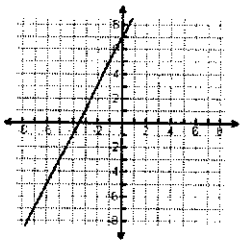
(all real numbers)

End Behavior

Figuring out what y-value the graph is going to as x gets bigger and as x gets smaller.

Describe the End Behavior

End Behavior as $x \to, \infty$ $y \to \infty$



End Behavior as $x \to -\infty$, $y \to -\infty$

End Behavior

as $x \to -\infty$, $y \to$ ___

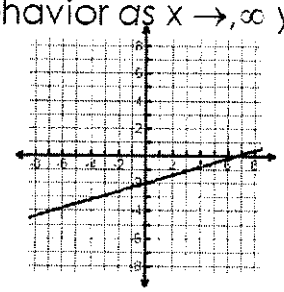
(like your left arm)

as $x \to \infty$, $y \to$ ___

(like your right arm)

Describe the End Behavior

End Behavior as $x \to, \infty$ $y \to \infty$

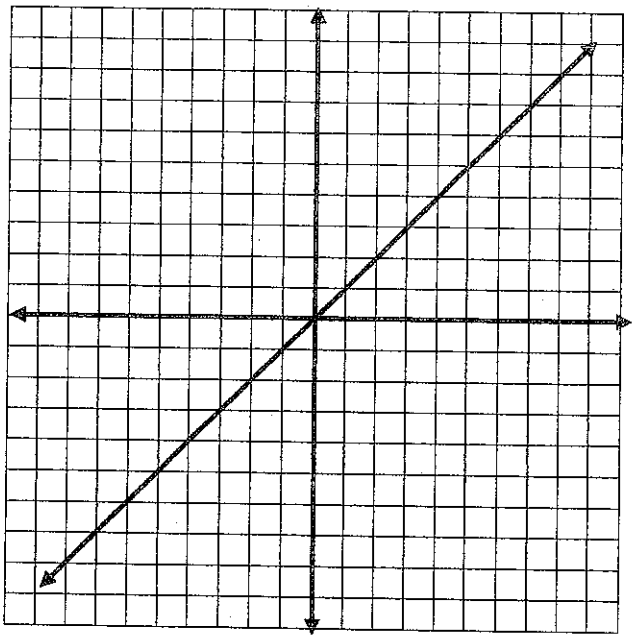


End Behavior as $x \to -\infty$, $y \to -\infty$

End Behavior (for linear functions)

- If the graph is going **UP**, the y-value is approaching $+\infty$.
- If the graph is going **down**, the y-value is approaching $-\infty$.

The Linear Function Family



The parent of the family is **f(x) = x**

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

Domain $(-\infty,\infty)$ or $\mathbb{R}$
Range $(-\infty,\infty)$ or $\mathbb{R}$

x and y intercept = (0,0)

Increasing or Decreasing? Inc

END BEHVIOR:
As $x \to -\infty$, $y \to -\infty$
As $x \to \infty$, $y \to \infty$

Graph each of the following members of the linear family and explain the relation to the parent. Use the graph grid below each column.

f(x) = 2x + 3

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

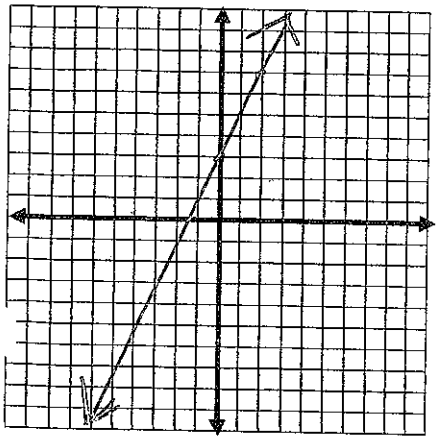
X- intercept: $(-\frac{3}{2}, 0)$

Y- intercept: $(0, 3)$

Increasing or Decreasing?

END BEHVIOR:
As $x \to -\infty$, $y \to -\infty$

As $x \to \infty$, $y \to \infty$



f(x) = - ½ x - 5

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

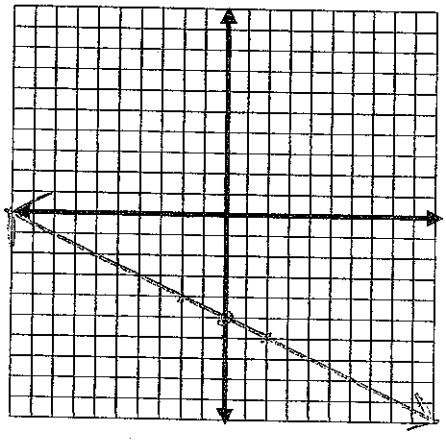
X- intercept: $(-10, 0)$

Y- intercept: : $(0, -5)$

Increasing or Decreasing?

As $x \to -\infty$, $y \to \infty$

As $x \to \infty$, $y \to -\infty$



f(x) = -3x – 7

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

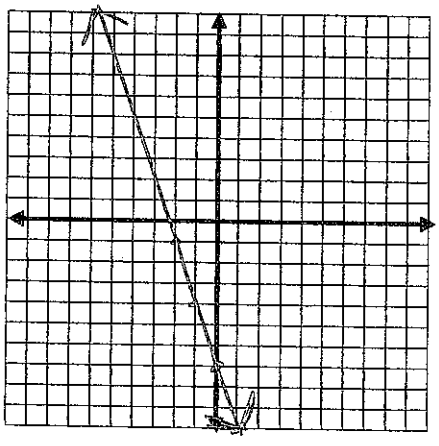
X- intercept: $(-2, 0)$

Y- intercept: $(0, -7)$

Increasing or Decreasing?

As $x \to -\infty$, $y \to \infty$

As $x \to \infty$, $y \to -\infty$



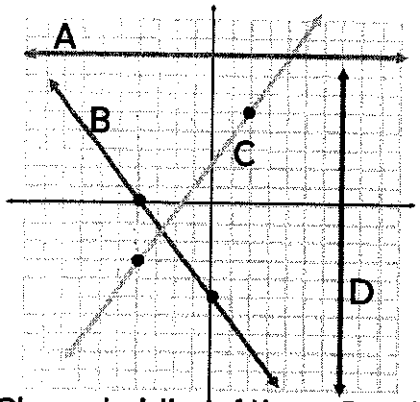
Algebra 1

Name_____

Characteristics of Linear Functions

Date_____

Warm-up: Find the rate of change.



1. Line A m = 0
2. Line B m = $-\frac{5}{4}$
3. Line C m = $\frac{8}{6} = \frac{4}{3}$
4. Line D m = undefined

What if you don't have a graph?

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$x_1\ y_1\ \ x_2\ y_2$

5. (1, 4) (6, 2)

$$m = \frac{2-4}{6-1} = \frac{-2}{5}$$

6. (2, –3) (4, 3)

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{3--3}{4-2} = \frac{6}{2} = 3$$

Characteristics of Linear Functions

Rate of Change - the slope of a function

Domain - the set of x-values for a function

Range - the set of y-values for a function

Increasing - the interval where the graph rises and the y-values increase

Decreasing - the interval where the graph falls and the y-values decrease

x-int - the point(s) where a graph crosses the x-axis

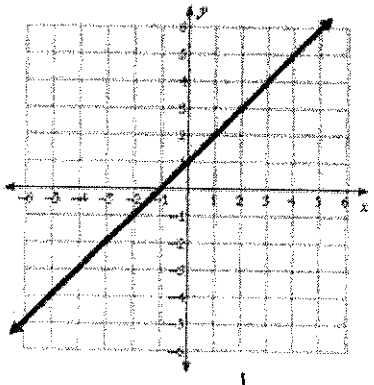
y-int - the point(s) where a graph crosses the y-axis

end behavior - the behavior at the end of the graph (up or down) as x approaches negative infinity (left) or positive infinity (right).

Note: A continuous linear function will always have a domain and range that include all real numbers.

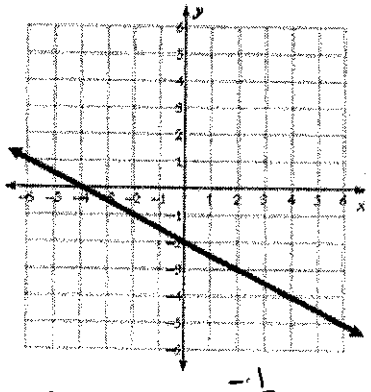
Rate of Change: the slope of a function. Find the rate of change for each function below.

1.



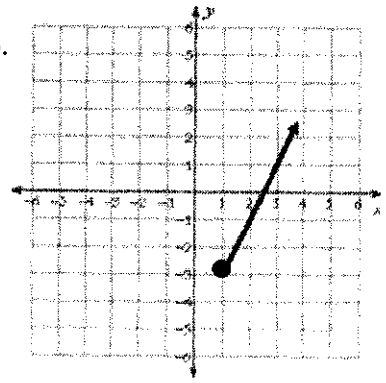
Rate of Change: 1

2.



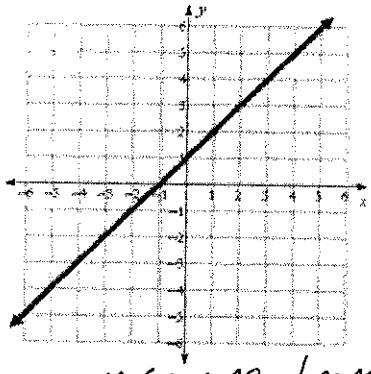
Rate of Change: $-\frac{1}{2}$

3.

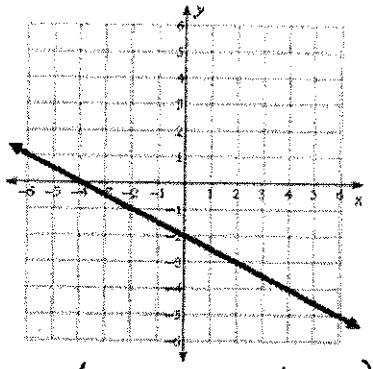


Rate of Change: 2

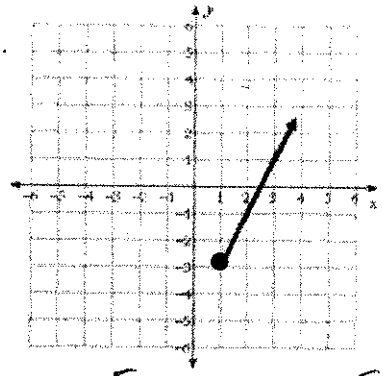
Domain: the set of x-values. **Range**: the set of y-values. Find the domain and range for each function below. Write the domain and range in inequality notation. + interval notation

1. 

Domain: $-\infty < x < \infty$, $(-\infty, \infty)$
Range: $-\infty < y < \infty$, $(-\infty, \infty)$

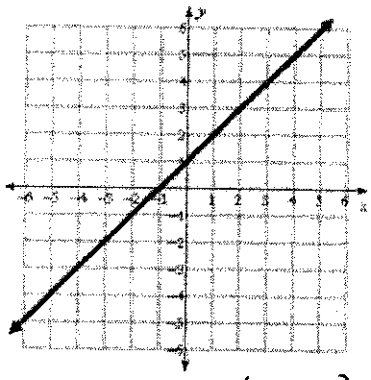
2. 

Domain: $-\infty < x < \infty$ $(-\infty, \infty)$
Range: $-\infty < x < \infty$ $(-\infty, \infty)$

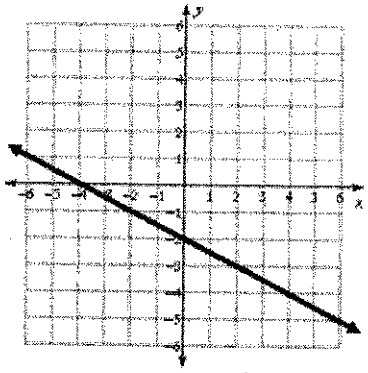
3. 

Domain: $1 \leq x < \infty$ $[1, \infty)$
Range: $-3 \leq x < \infty$ $[-3, \infty)$

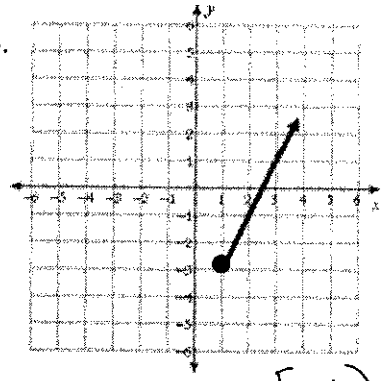
Increasing Interval: the interval where the graph rises and the y– values increase. **Decreasing Interval**: the interval where the graph falls and the y – values decrease. (The intervals should be written in inequality notation, and are written in terms of x). Find the intervals of increase and decrease for each function below. Always x-values... read left to → right

1. 

Increasing Interval: $(-\infty, \infty)$
Decreasing Interval: None

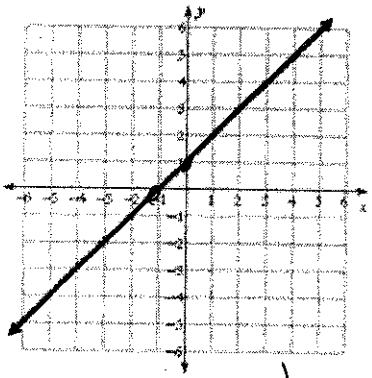
2. 

Increasing Interval: None
Decreasing Interval: $(-\infty, \infty)$

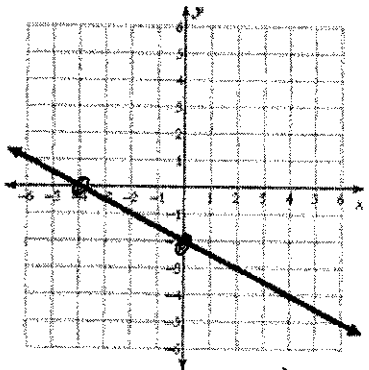
3. 

Increasing Interval: $[1, \infty)$
Decreasing Interval: None

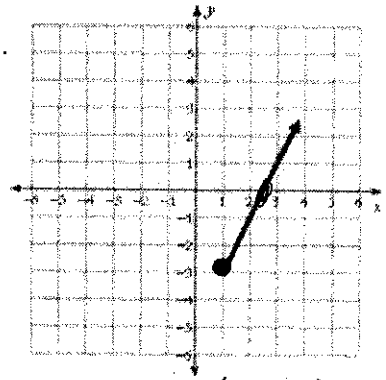
X-Intercept: the point(s) where a graph crosses the x-axis. **Y-Intercept**: the point where a graph crosses the y-axis. Find the x-intercept (s) and y-intercepts of each function below.

1. 

x – intercept(s): $(-1, 0)$
y – intercept: $(0, 1)$

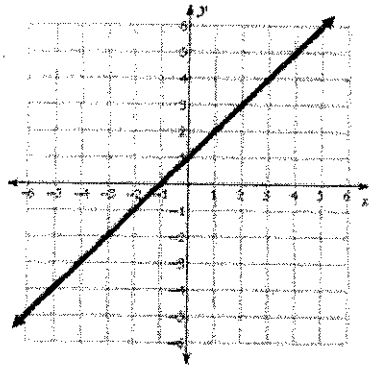
2. 

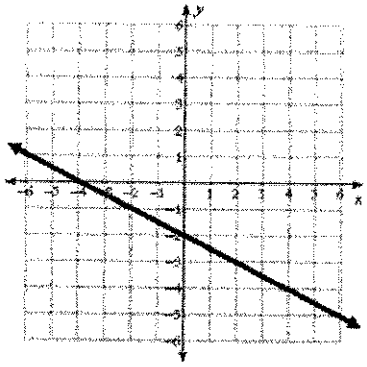
x – intercept(s): $(-4, 0)$
y – intercept: $(0, -2)$

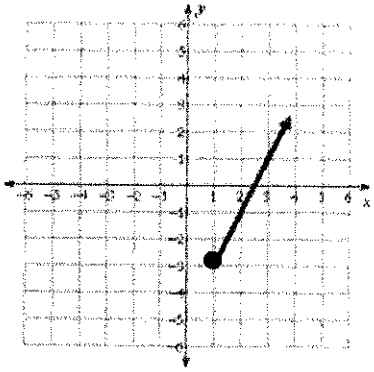
3. 

x – intercept(s): $(2\frac{1}{2}, 0)$
y – intercept: None

End Behavior: the behavior at the end of the graph (up or down) as x approaches negative infinity (left) or positive infinity (right). Find the left and right end behavior of each function below.

1. 

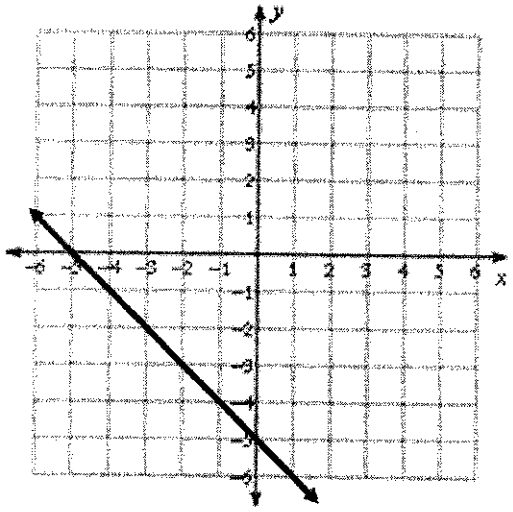
2. 

3. 

Left End Behavior: As $x \to -\infty$ $y \to -\infty$ Left End Behavior: As $x \to -\infty$ $y \to \infty$ Left End Behavior: ~~As $x \to -\infty$~~ N/A

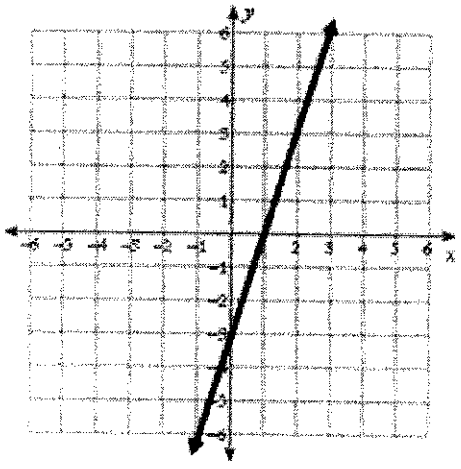
Right End Behavior: As $x \to \infty$, $y \to \infty$ Right End Behavior: As $x \to \infty$ $y \to$ Right End Behavior: As $x \to \infty$ $y \to \infty$

Put it all together!



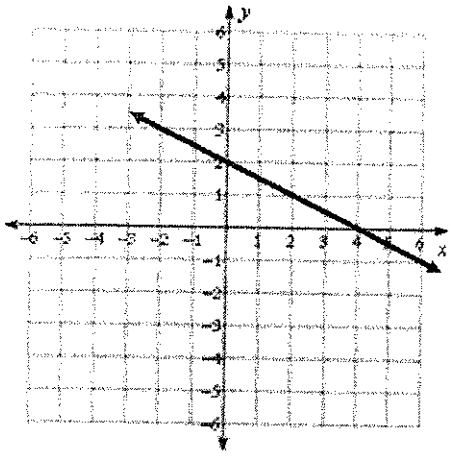
Characteristic	Answer
Rate of Change	-1
Domain	$(-\infty, \infty)$ $\mathbb{R}$
Range	$(-\infty, \infty)$ $\mathbb{R}$
Increasing Interval	$\emptyset$
Decreasing Interval	$(-\infty, \infty)$
x-intercept	$(-5, 0)$
y-intercept	$(0, -5)$
Left End Behavior	as $x \to -\infty$ $y \to \infty$
Right End Behavior	as $x \to \infty$ $y \to -\infty$

Classwork/Homework: Fill in the characteristics table for each function below.

1. 

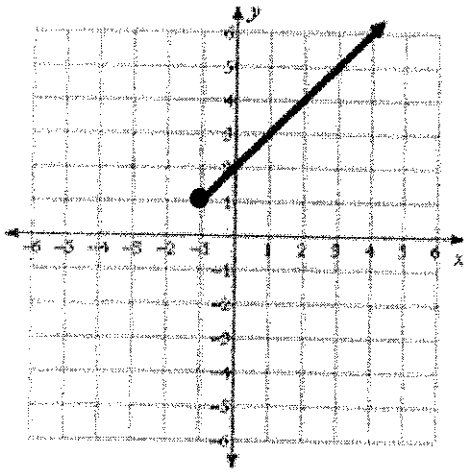
Characteristic	Answer
Rate of Change	3
Domain	$\mathbb{R}$
Range	$\mathbb{R}$
Increasing Interval	$(-\infty, \infty)$
Decreasing Interval	$\emptyset$
x-intercept	$(1, 0)$
y-intercept	$(0, -3)$
Left End Behavior	As $x \to -\infty$ $y \to -\infty$
Right End Behavior	As $x \to \infty$ $y \to \infty$

2.



Characteristic	Answer
Rate of Change	$-\frac{1}{2}$
Domain	$(-\infty, \infty)$ also $\mathbb{R}$
Range	$(-\infty, \infty)$ / $\mathbb{R}$
Increasing Interval	None
Decreasing Interval	$(-\infty, \infty)$
x-intercept	$(4, 0)$
y-intercept	$(0, 2)$
Left End Behavior	As $x \to -\infty$ $y \to \infty$
Right End Behavior	As $x \to \infty$ $y \to -\infty$

3.



Characteristic	Answer
Rate of Change	1
Domain	$[-1, \infty)$
Range	$[1, \infty)$
Increasing Interval	$[-1, \infty)$
Decreasing Interval	None
x-intercept	None
y-intercept	$(0, 2)$
Left End Behavior	As $x \to -\infty$ $y \to -1$
Right End Behavior	As $x \to \infty$ $y \to \infty$