Mathematics 8
Module 6 – Linear Equations

Introduction: This module was designed and written with you in mind. It is specially made for you to gain a thorough understanding on several concepts on linear equations. Specifically, you will be able to write the linear equation $Ax + By = C$ in the form $y = mx + b$ and vice versa, graph a linear equation given (a) any two points; (b) the x- and y- intercepts; (c) the slope and the y-intercept; and (d) the slope and a point on the line, and describe the graph of a linear equation in terms of its intercepts and slope.

Lesson 1 Forms of Linear Equation

What To Know

This module is designed for grade 8 students like you, so that you will have a better understanding on the concepts of linear equations. Specifically, you are expected to:

1. write the linear equation $Ax + By = C$ in the form $y = mx + b$ and determine the values of m and b;
2. write the linear equation $y = mx + b$ in the form $Ax + By = C$ and determine the values of A, B, and C.

Pre-Assessment

Answer the following questions. Choose the letter of the correct answer.

1. The linear equation $y = -x + 4$ can also be written as:

   A. $x + y = -4$ B. $-x + y = 4$ C. $x + y = 4$ D. $x - y = 4$

2. The linear equation $4x + 2y = 8$ can also be written as:

A. $y = 2x + 4$ B. $y = -2x - 4$ C. $y = 2x - 4$ D. $y = -2x + 4$

3. Identify the values of m and b in the equation $x + 2y = 4$.

A. $m = -\frac{1}{2}$ and $b = 2$
B. $m = \frac{1}{2}$ and $b = 2$
C. $m = -\frac{1}{2}$ and $b = -2$
D. $m = \frac{1}{2}$ and $b = -2$

4. Identify the values of m and b in the equation $y = 4x - 1$.

A. $m = 4$ and $b = 1$
B. $m = 4$ and $b = -1$
C. $m = -4$ and $b = -1$
D. $m = -4$ and $b = 1$

5. What is the value of B in the equation $y = 3x - 8$?

A. -3 B. 1 C. -8 D. 3

What To Processs

A linear equation is an equation in two variables which can be written in two forms:

- Standard Form: $Ax + By = C$, where A, B, and $C \in \Re$, A is positive, and A and B not both 0
- Slope-Intercept Form: $y = mx + b$, where m is the slope and b is the y-intercept, m and $b \in \Re$

Illustrative Example #1

Solution:

What To Remember

A linear equation is an equation in two variables which can be written in two forms:

- Standard Form: $Ax + By = C$, where A, B, and $C \in \Re$, A is positive, and A and B not both 0
- Slope-Intercept Form: $y = mx + b$, where m is the slope and b is the y-intercept, m and $b \in \Re$

Self-Test

Answer the following questions. Choose the letter of the correct answer.

1. The linear equation $y = x - 5$ can also be written as:

   A. $x + y = -5$ B. $-x - y = -5$ C. $x - y = -5$ D. $-x + y = -5$

2. The linear equation $6x + 2y = -4$ can also be written as:

   A. $y = -3x + 2$ B. $y = -3x - 2$ C. $y = 3x - 2$ D. $y = 3x + 2$

3. Identify the values of m and b in the equation $2x - 3y = 9$.

   A. $m = \frac{2}{3}$ and $b = -3$
   B. $m = \frac{2}{3}$ and $b = 3$
   C. $m = -\frac{2}{3}$ and $b = -3$
   D. $m = -\frac{2}{3}$ and $b = 3$

4. Identify the values of m and b in the equation $y = -3x + 2$.

   A. $m = 3$ and $b = -2$
   B. $m = 3$ and $b = 2$
   C. $m = -3$ and $b = -2$
   D. $m = -3$ and $b = 2$

5. What is the value of A in the equation $y = -4x + 3$?

   A. -4 B. 4 C. 1 D. 3

Lesson 2 Graphs of Linear Equations

What To Know

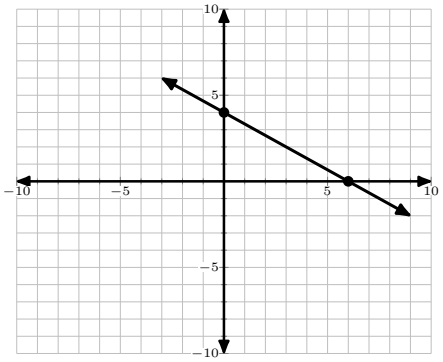
This module is designed for grade 8 students like you, so that you will have a better understanding on the concepts of linear equations. Specifically, you are expected to:

1. graph a linear equation given any two points;
2. graph a linear equation given the x- and y- intercepts;
3. graph a linear equation given the slope and the y-intercept;
4. graph a linear equation given the slope and a point on the line.

Pre-Assessment

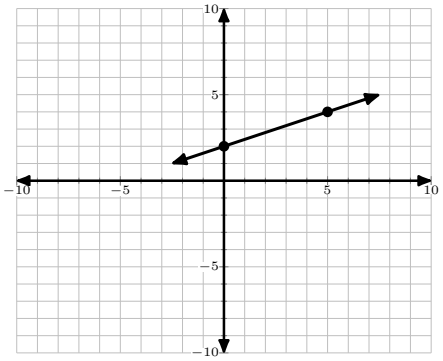
Answer the following questions. Choose the letter that corresponds to the correct answer.

1. Which of the following information may be used to plot the graph at the right?



   A. $a = 4$ and $b = 6$
   B. $m = 4$ and $b = 6$
   C. $a = 6$ and $b = 4$
   D. $m = 6$ and $b = 4$

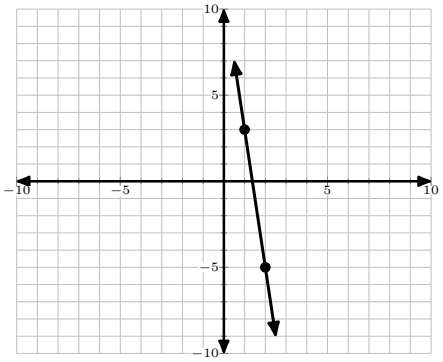
2. The graph at the right can be described by which of the following information?



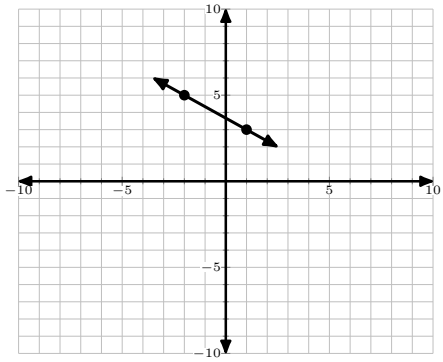
   A. $a = 2$ and $m = \frac{2}{5}$
   B. $b = 2$ and $m = \frac{2}{5}$
   C. $a = 2$ and $b = \frac{2}{5}$
   D. $b = 2$ and $a = \frac{2}{5}$

3. Which of the following lines can be graphed given the points $(1, 3)$ and $(-2, 5)$?

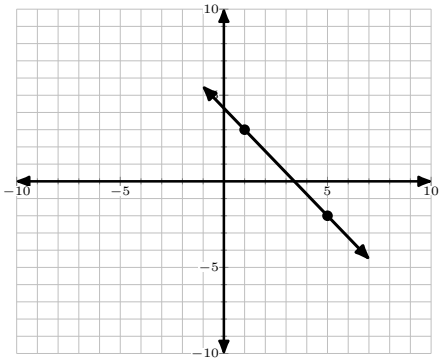
A.



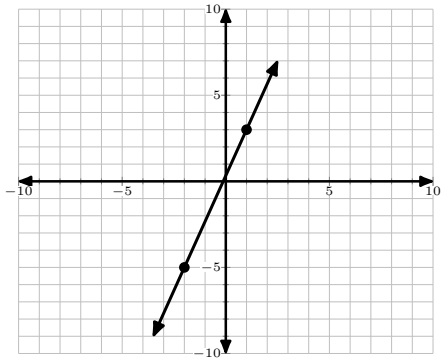
C.



B.

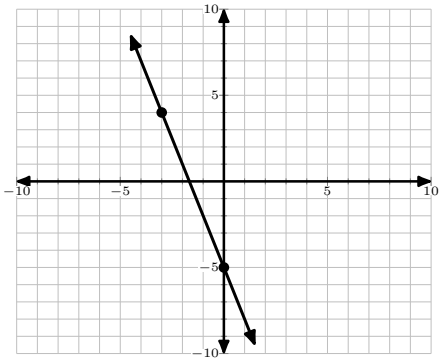


D.

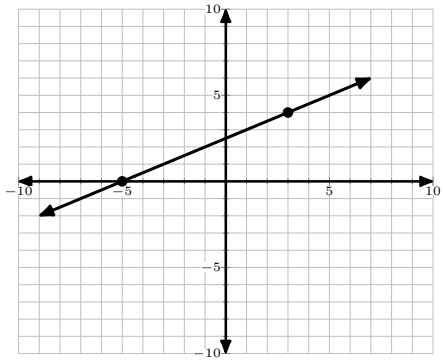


4. Which of the following lines can be graphed given the slope $m = \frac{3}{4}$ and y-intercept $b = -5$?

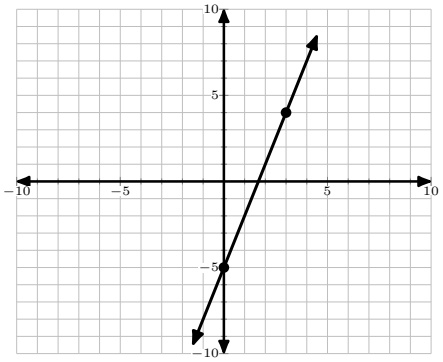
A.



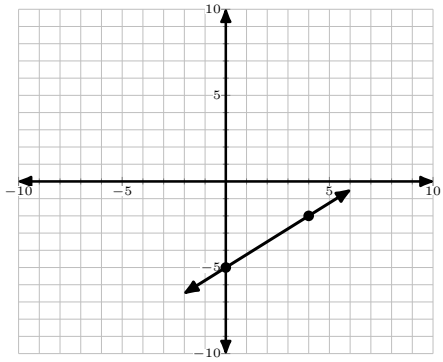
C.



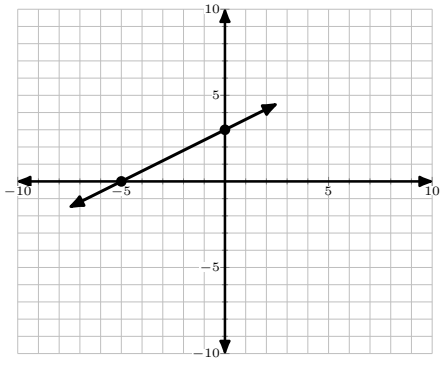
B.



D.



5. What are the intercepts of the graph in the right?



   A. $a = 5$ and $b = 3$
   B. $a = -5$ and $b = 3$
   C. $a = 3$ and $b = 5$
   D. $a = 3$ and $b = -5$

What To Processs

Consider the figures below. Each of them is composed of triangles.

Graphing linear equations can be done using any of the four methods:

1. Using two points
2. Using the x- and y-intercepts
3. Using the slope and the y-intercept
4. Using the slope and a point

The **x-intercept** is the abscissa of the coordinates of the point in which the graph intersects the x-axis. The **y-intercept** is the ordinate of the coordinates of the point in which the graph intersects the y-axis.

What To Remember

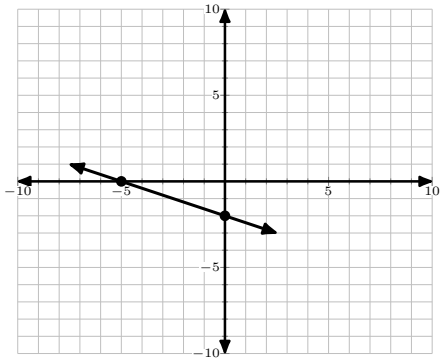
Graphing linear equations can be done using any of the four methods:

1. Using two points
2. Using the x- and y-intercepts
3. Using the slope and the y-intercept
4. Using the slope and a point

Self-Test

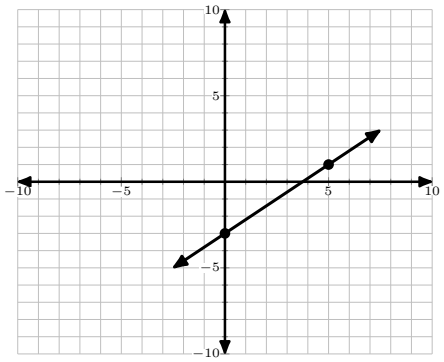
Answer the following questions. Choose the letter that corresponds to the correct answer.

1. Which of the following information may be used to plot the graph at the right?



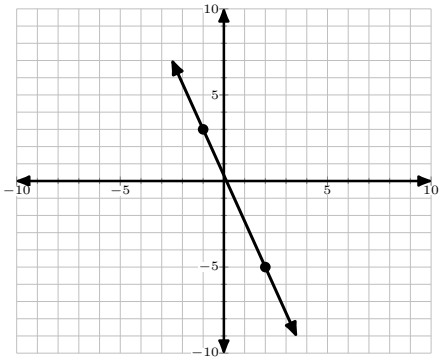
   A. $a = -5$ and $b = -2$
   B. $m = -5$ and $b = -2$
   C. $a = -2$ and $b = -5$
   D. $m = -2$ and $b = -5$

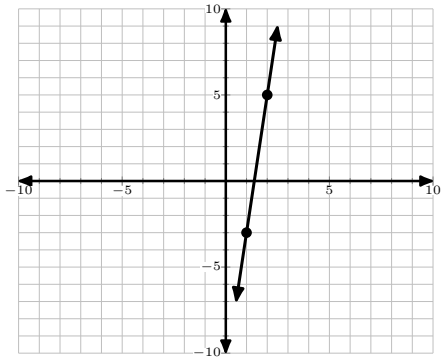
2. The graph at the right can be described by which of the following information?

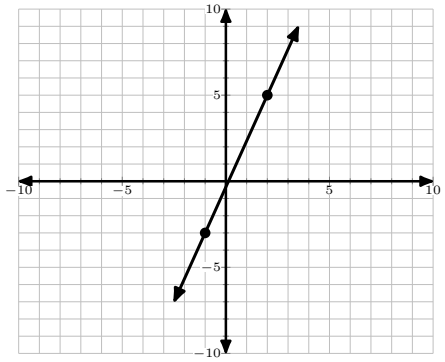


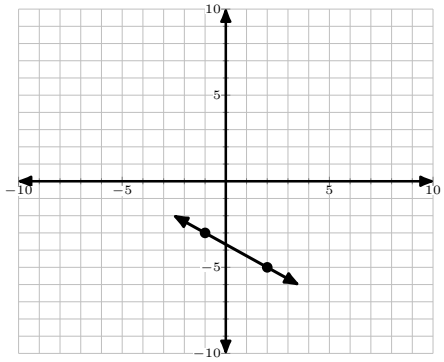
   A. $a = -3$ and $m = \frac{4}{5}$
   B. $b = -3$ and $m = \frac{4}{5}$
   C. $a = -3$ and $b = \frac{4}{5}$
   D. $b = -3$ and $a = \frac{4}{5}$

3. Which of the following lines can be graphed given the points $(-1, -3)$ and $(2, -5)$?

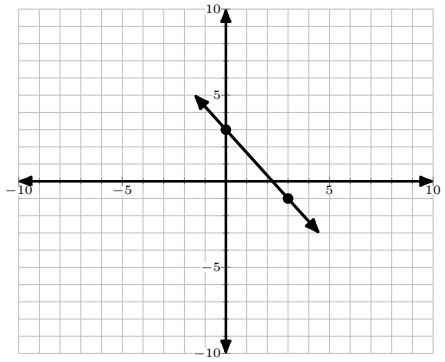
   A. 

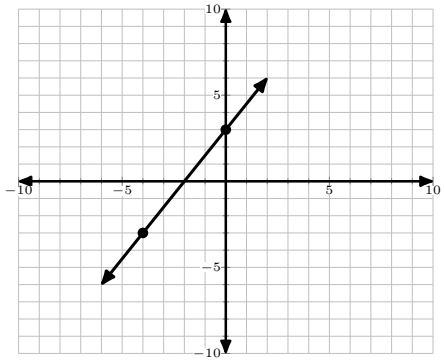
   B. 

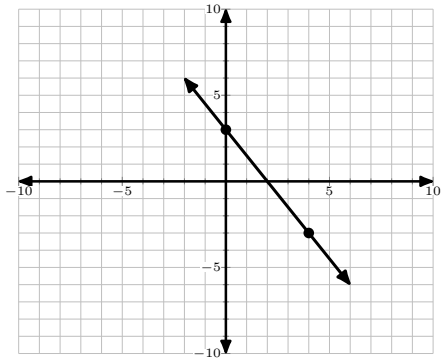
C. 

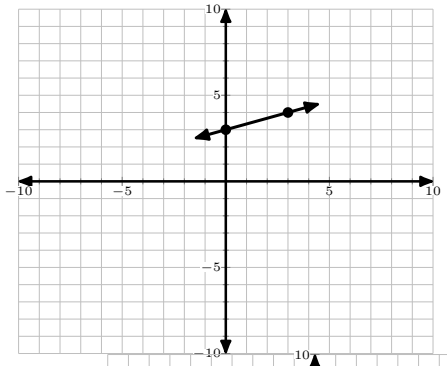
D. 

4. Which of the following lines can be graphed given the slope $m = -\frac{4}{3}$ and y-intercept $b = 3$?

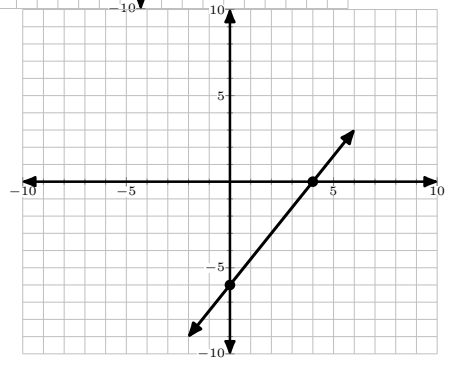
A. 

C. 

B. 

D. 

5. What are the intercepts of the graph at the right?



A. $a = 4$ and $b = -6$
B. $a = -6$ and $b = 4$
C. $a = 4$ and $b = 6$
D. $a = 6$ and $b = 4$

Lesson 3 Describing Graphs of Linear Equations

What To Know

This module is designed for grade 8 students like you, so that you will have a better understanding on the concepts of linear equations. Specifically, you are expected to:

1. describe the graph of a linear equation in terms of its x-intercept and y-intercept;
2. describe the graph of a linear equation in terms of its slope.

Pre-Assessment

Answer the following questions. Choose the letter of the correct answer.

1. What is the trend of the graph whose x-intercept is -3 and y-intercept is 5?

   A. The line rises from left to right.
   B. The line falls from left to right.
   C. The line is horizontal.
   D. The line is vertical.

2. What is the trend of the graph whose slope is -2?

   A. The line rises from left to right.
   B. The line falls from left to right.
   C. The line is horizontal.
   D. The line is vertical.

3. Which of the following best describes a line that falls from left to right?

   A. The x-intercept is positive and the y-intercept is negative.
   B. The x-intercept is negative and the y-intercept is negative.
   C. The slope is positive.
   D. The slope is zero.

4. Which of the following describes a horizontal line?

   A. $a = 3$ and $b = 0$
   B. m is undefined
   C. $m = 3$
   D. $m = 0$

5. What is the slope of a linear equation whose graph is a vertical line?

A. positive B. negative C. undefined D. zero

What To Processs

The values of the x-intercept a and y-intercept b determine the trend of the graph.

- If a and b have the same sign, then the graph falls from left to right.
- If a and b have different signs, then the graph rises from left to right.
- If a is zero and b is not zero, then the graph is a horizontal line.
- If b is zero and a is not zero, then the graph is a vertical line.

The value of the slope m also tells the trend of the graph.

- If m is positive, then the graph rises from left to right.
- If m is negative, then the graph falls from left to right.
- If m is zero, then the graph is a horizontal line.
- If m is undefined, then the graph is a vertical line.

What To Remember

The values of the x-intercept a and y-intercept b determine the trend of the graph.

- If a and b have the same sign, then the graph falls from left to right.
- If a and b have different signs, then the graph rises from left to right.
- If a is zero and b is not zero, then the graph is a horizontal line.
- If b is zero and a is not zero, then the graph is a vertical line.

The value of the slope m also tells the trend of the graph.

- If m is positive, then the graph rises from left to right.
- If m is negative, then the graph falls from left to right.
- If m is zero, then the graph is a horizontal line.
- If m is undefined, then the graph is a vertical line.

Self-Test

Answer the following questions. Choose the letter of the correct answer.

1. What is the trend of the graph whose x-intercept is 2 and y-intercept is 5?

   A. The line rises from left to right.
   B. The line falls from left to right.
   C. The line is horizontal.
   D. The line is vertical.

2. What is the trend of the graph whose slope is 3?

   A. The line rises from left to right.
   B. The line falls from left to right.
   C. The line is horizontal.
   D. The line is vertical.

3. Which of the following best describes a line that rises from left to right?

   A. The x-intercept is positive and the y-intercept is negative.
   B. The x-intercept is negative and the y-intercept is negative.
   C. The slope is negative.
   D. The slope is zero.

4. Which of the following describes a vertical line?

   A. $a = 0$ and $b = -2$
   B. m is undefined
   C. $m = -3$
   D. $m = 0$

5. What is the slope of a linear equation whose graph is a horizontal line?

   A. positive B. negative C. undefined D. zero

Worksheet 6.1 Forms of Linear Equation

Name:	Score:
Grade & Section:	Teacher:

Solve the following problems completely. Write your solutions and answers in the space provided as shown in the example problems.

A. Rewrite the following equations in the form $Ax + By = C$ and determine the values of A, B, and C. Take note that A is always positive.

Example: $y = -3x - 7$ Solution: $y = -3x - 7$ $3x + y = -7$ $A = 3$ $B = 1$ $C = -7$	1. $y = -2x + 6$ Solution:
2. $y = 3x - 8$ Solution:	3. $y = \frac{1}{2}x + 3$ Solution:
4. $y = 2x + \frac{1}{4}$ Solution:	5. $y = \frac{5}{4}x + \frac{3}{8}$ Solution:

B. Rewrite the following equations in the form $y = mx + b$ and identify the values of m and b.

Example: $3x - 2y = 6$
Solution:
$3x - 2y = 6$
$-2y = -3x + 6$
$\frac{-2y}{-2} = \frac{-3x}{-2} + \frac{6}{-2}$
$y = \frac{3}{2}x - 3$
$m = \frac{3}{2}$
$b = -3$

1. $x + 2y = 4$
Solution:

2. $5x + 2y = 7$
Solution:

3. $5x - 7y = 2$
Solution:

4. $\frac{2}{3}x - \frac{1}{3}y = 1$
Solution:

5. $\frac{2}{3}x - \frac{1}{5}y = \frac{3}{5}$
Solution:

Worksheet 6.2 Graphs of Linear Equations

Name:	Score:
Grade & Section:	Teacher:

Solve the following problems completely. Write your solutions and answers in the space provided.

A. Graph each linear equation using the x- and y-intercepts.

Example: $2x + 3y = 12$

Solution:

Set $y = 0$:

$2x + 3y = 12$

$2x + 3(0) = 12$

$2x = 12$

$\frac{2x}{2} = \frac{12}{2}$

$x = 6$

$\therefore a = 6$

Set $x = 0$:

$2x + 3y = 12$

$2(0) + 3y = 12$

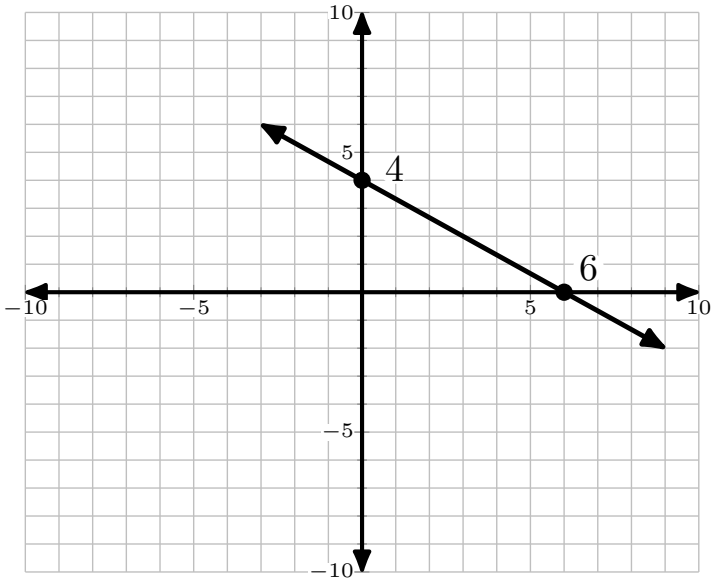
$3y = 12$

$\frac{3y}{3} = \frac{12}{3}$

$y = 4$

$\therefore b = 4$

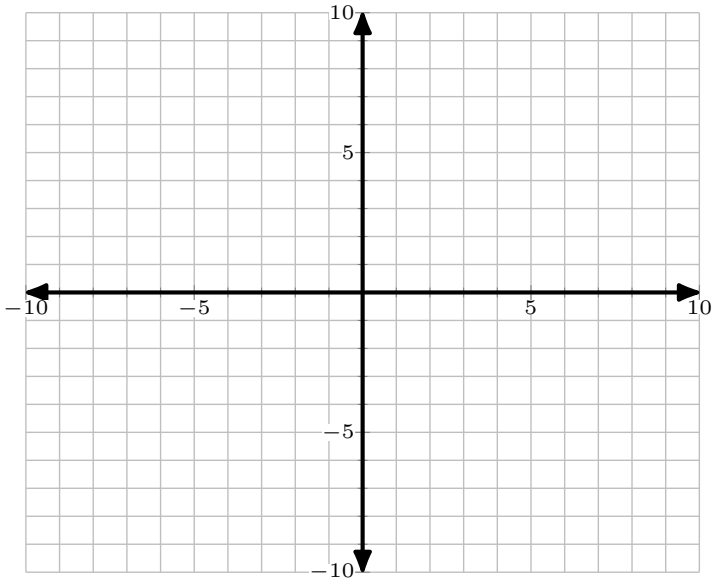
Graph:



1. $3x + 2y = -6$

Solution:

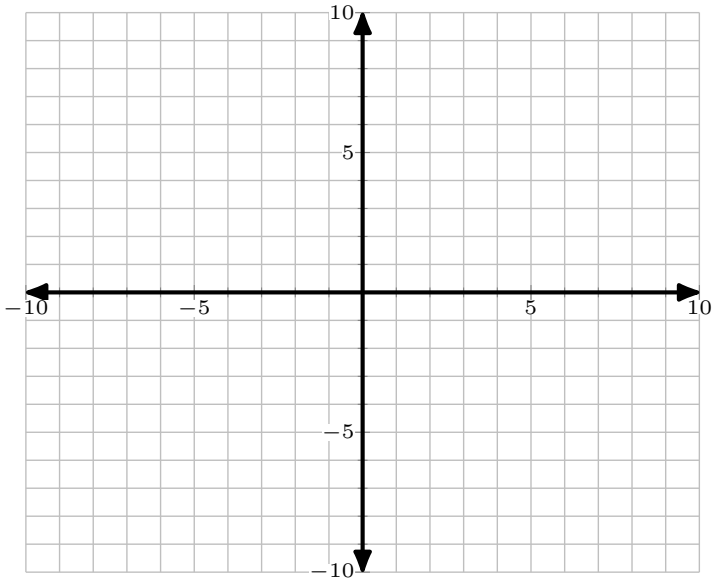
Graph:



2. $4x - 3y = 24$

Solution:

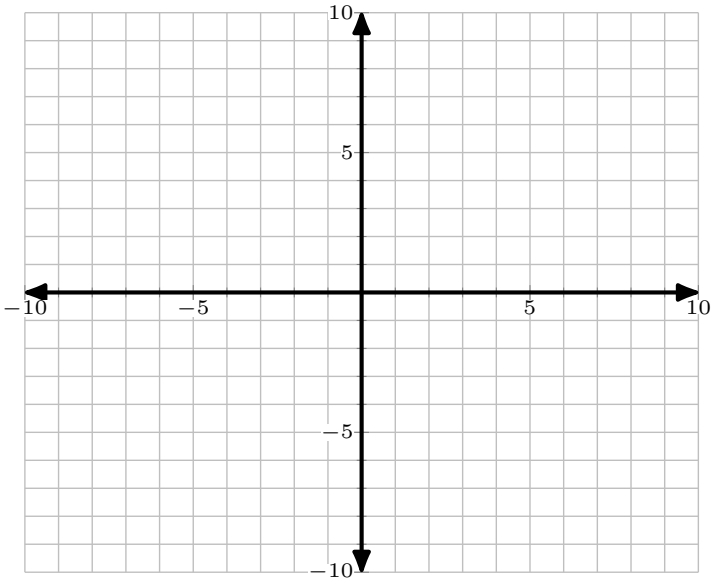
Graph:



3. $8y = 4x + 32$

Solution:

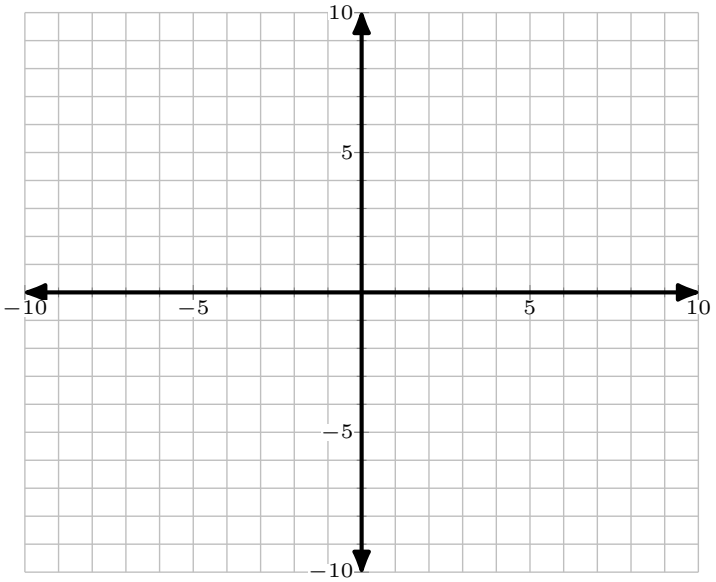
Graph:



4. $\frac{x}{-3} + \frac{y}{3} = 1$

Solution:

Graph:



B. Graph each linear equation using the slope and the y-intercept.

Example: $2x - 5y = -10$

Solution:

$2x - 5y = -10$

$-5y = -2x - 10$

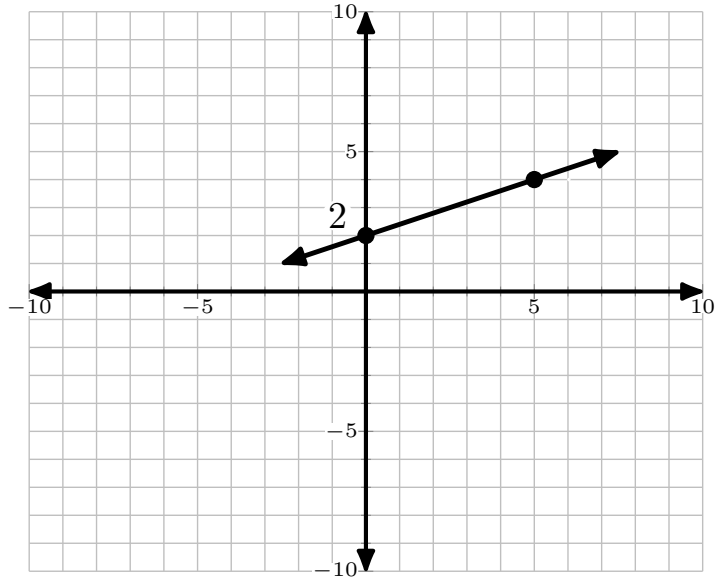
$\frac{-5y}{-5} = \frac{-2x}{-5} - \frac{10}{-5}$

$y = \frac{2}{5}x + 2$

$m = \frac{2}{5}$

$b = 2$

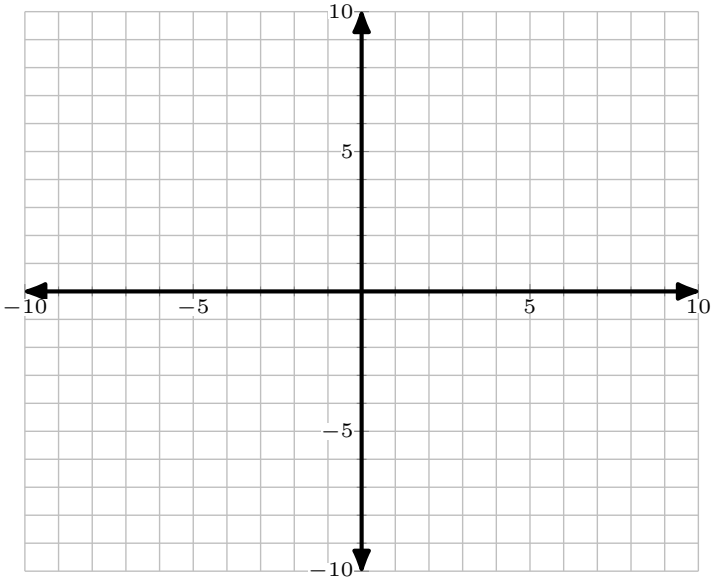
Graph:



1. $3x - 2y = 6$

Solution:

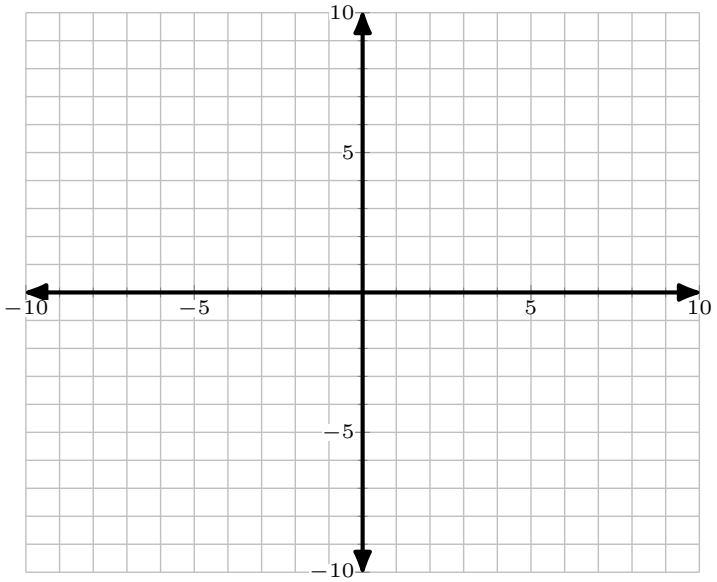
Graph:



2. $2(y - x) = 4$

Solution:

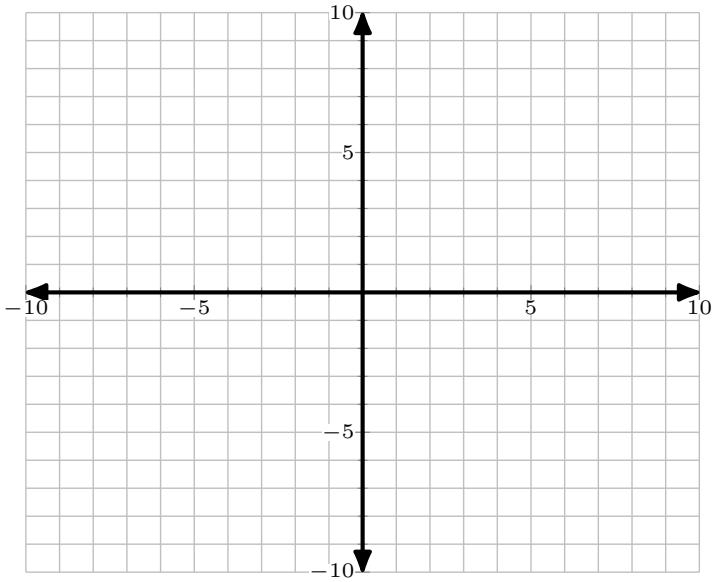
Graph:



3. $-2x = y + 5$

Solution:

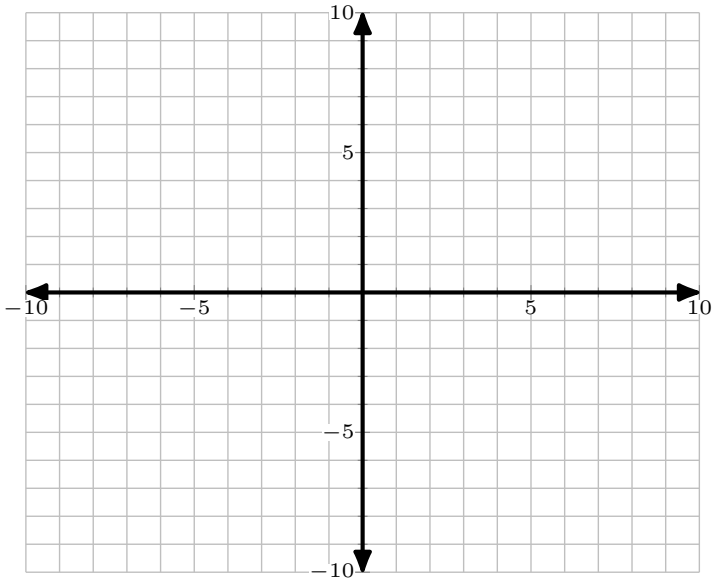
Graph:



4. $2x - 8 + 5y = 0$

Solution:

Graph:



Worksheet 6.3 Describing Graphs of Linear Equations

Name:	Score:
Grade & Section:	Teacher:

A. Classify under which trend the following characteristics of a line belong. Write the letters only.

a. Slope is 0.
b. a is positive and b is negative.
c. Slope is negative.
d. a is positive and b is positive.
e. a is negative and b is positive.
f. Slope is undefined.
g. a is negative and b is negative.
h. a is 0 and b is negative.
i. a is negative and b is 0.
j. Slope is positive.
k. a is 0 and b is positive.
l. a is positive and b is 0.

Rising	**Falling**	**Horizontal**	**Vertical**

B. Given the following characteristics of a line, determine if the graph is (A) rising from left to right, (B) falling from left to right, (C) a horizontal line, or (D) a vertical line. Write the letter only.

Characteristics	**Trend**
1. $m = -2$	
2. $m = 0$	
3. $a = 1$ and $b = -1$	
4. $m = 5$	
5. $a = 0$ and $b = -1$	
6. $m =$ undefined	
7. $a = 1$ and $b = 0$	
8. $m = -\frac{3}{2}$	
9. $a = 1$ and $b = 7$	
10. $m = \frac{5}{3}$	

Answer Key:

Forms of Linear Equation		**Graphs of Linear Equations**		**Describing Graphs of Linear Equations**	
Pre-Test	**Self-Test**	**Pre-Test**	**Self-Test**	**Pre-Test**	**Self-Test**
1. C	1. D	1. C	1. A	1. A	1. B
2. D	2. B	2. B	2. B	2. B	2. A
3. A	3. A	3. C	3. D	3. B	3. A
4. B	4. D	4. D	4. A	4. D	4. B
5. B	5. B	5. B	5. A	5. C	5. D

References:

E-MATH by Oronce, Orlando A. and Mendoza, Marilyn O., Rex Bookstore, Inc., 2016

Mathematics 3 2009 Edition, An Alternative Learning System (The Modular Approach), Division of City Schools, Quezon City, Metro Manila