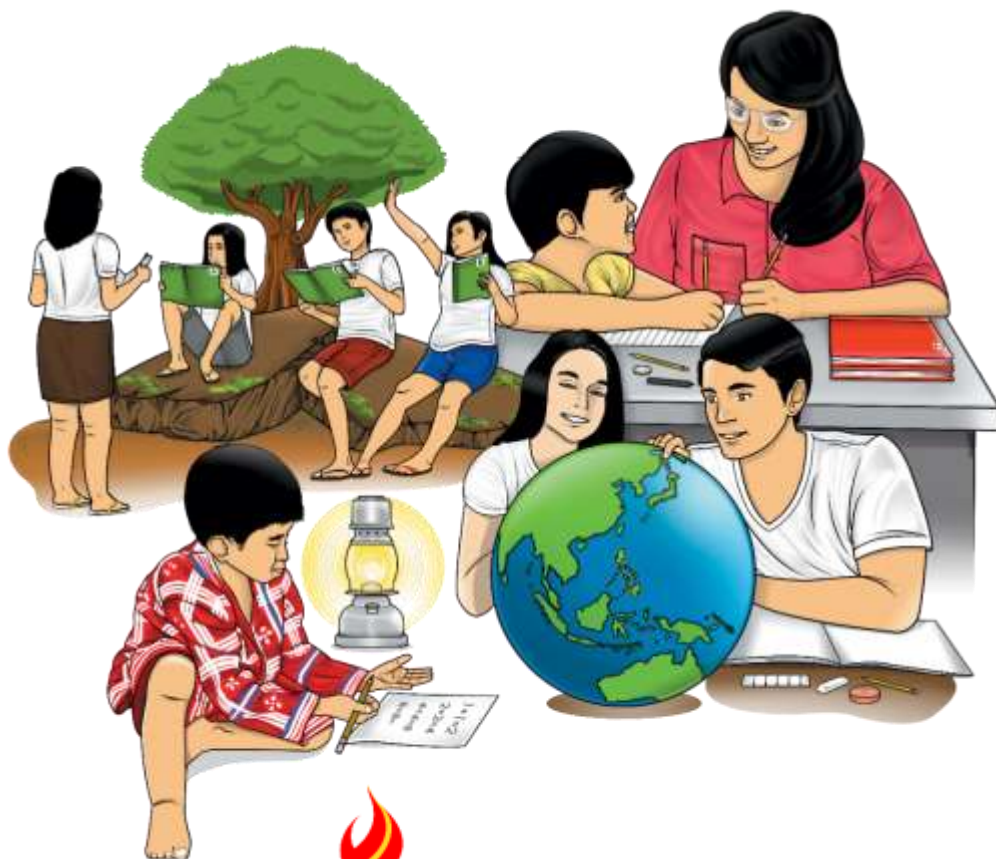


8

Mathematics

Quarter 1 – Module 12

Finding the Equation of a Line



Mathematics – Grade 8
Alternative Delivery Mode
Quarter 1 – Module 12 Finding the Equation of a Line
First Edition, 2020

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Secretary: Leonor Magtolis Briones
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Development Team of the Module

Writers: Wilmar N. Espinosa

Language Editor: Merjorie G. Dalagan

Content Evaluator: Michelle R. Alipao

Layout Evaluator: Jake D. Fraga

Reviewers: Rhea J. Yparraguirre, Lewellyn V. Mejias, Severiano D. Casil, Villaflor D. Edillor,
Florangel S. Arcadio, Alma R. Velasco, Crisante D. Cresino, Mercedita G. Gonzaga,
Juliet P. Utlang

Illustrator: Wilmar N. Espinosa

Layout Artist: Jake D. Fraga

Management Team: Francis Cesar B. Bringas
Isidro M. Biol, Jr.
Maripaz F. Magno
Josephine Chonie M. Obseñares
Josita B. Carmen
Celsa A. Casa
Regina Euann A. Puerto
Bryan L. Arreo
Elnie Anthony P. Barcena
Leopardo P. Cortes

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Department of Education – Caraga Region

Office Address: Learning Resource Management Section (LRMS)

J.P. Rosales Avenue, Butuan City, Philippines 8600

Tel. No./Telefax No.: (085) 342-8207 / (085) 342-5969

E-mail Address: caraga@deped.gov.ph

Mathematics

Quarter 1 – Module 12

Finding the Equation of a Line

Introductory Message

For the facilitator:

Welcome to the Mathematics 8 Alternative Delivery Mode (ADM) Module on Finding the Equation of a Line!

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:



Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator, you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the Mathematics 8 Alternative Delivery Mode (ADM) Module on Finding the Equation of a Line!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:



What I Need to Know

This will give you an idea of the skills or competencies you are expected to learn in the module.



What I Know

This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.



What's In

This is a brief drill or review to help you link the current lesson with the previous one.



What's New

In this portion, the new lesson will be introduced to you in various ways; a story, a song, a poem, a problem opener, an activity or a situation.



What is It

This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.



What's More

This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.



What I Have Learned

This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson.



What I Can Do

This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.



Assessment

This is a task which aims to evaluate your level of mastery in achieving the learning competency.



Additional Activities

In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned.



Answer Key

This contains answers to all activities in the module.

At the end of this module you will also find:

References

This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!



What I Need to Know

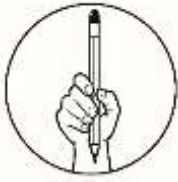
In this module, you will learn how to find the equation of a line given; two points; the slope and a point; and the slope and its y-intercept. These knowledge and skills will help you formulate patterns and relationship involving linear equation. The scope of this module permits it to be used in many different learning situations. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

This module contains:

Lesson 1 – Finding the equation of a line given: two points, the slope and a point, and the slope and y-intercept.

After going through this module, you are expected to:

1. find the equation of a line given: (a) two points; (b) the slope and a point; (c) the slope and its intercept;
2. solve problem using the three forms of linear equation; and
3. appreciate the importance of linear equation in solving real-life problems.

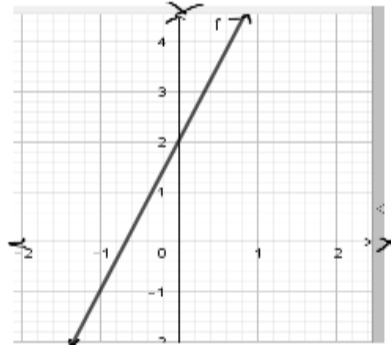


What I Know

Read the questions carefully and choose the letter of the correct answer. Write your answer on a separate sheet of paper.

- In the equation $Ax + By = C$ where A and B are not equal to zero is a linear equation in what form?
 - point- slope form
 - slope-intercept form
 - standard form
 - two-point form
- Given two points (x_1, y_1) and (x_2, y_2) where $x_1 \neq x_2$, which of the following shall be used to determine the equation of the line?
 - $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$
 - $\frac{x}{a} + \frac{y}{b} = 1$
 - $y - y_1 = m(x - x_1)$
 - $y = mx + b$
- What is the slope of the line $x + y = 3$?
 - 3
 - 1
 - 1
 - 3
- In the equation $-3x + y = 1$, what is the y - *intercept*?
 - 3
 - 1
 - 1
 - 3
- What is the y - *intercept* of the line $2x + 3y = -15$?
 - 5
 - 2
 - $-2/3$
 - 3
- Which of the following pair of points have a slope of -2 ?
 - $(2, 4)$ and $(5, -2)$
 - $(4, 2)$ and $(-2, 5)$
 - $(2, 5)$ and $(4, -2)$
 - $(-2, 2)$ and $(4, 5)$
- The line $y - 8 = \frac{3}{4}(x - 4)$ passes through which point?
 - $(-4, -8)$
 - $(-4, 2)$
 - $(-4, 8)$
 - $(3, 4)$

8. Which of the following equations is represented by the given graph on the right?



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

9. What are the slope and y -intercept of the equation $y = 2x - 4$?

- A. $m = 2$ and $b = 4$ C. $m = 2$ and $b = -4$
 B. $m = 4$ and $b = 2$ D. $m = -4$ and $b = 2$

10. What is the slope of a line if it contains the points $(-2, 3)$ and $(2, -3)$?

- A. $-3/2$ B. $-2/3$ C. $2/3$ D. $3/2$

11. What is the equation of a line that passes through the points $(0, 5)$ and $(2, 2)$?

- A. $y = -3/2x + 5$ C. $y = 2/3x + 5$
 B. $y = -2/3x + 5$ D. $y = 3/2x + 5$

12. The line passes through the point $(0, 3)$ and has a slope of 2. What is the equation of a line in slope-intercept form?

- A. $y = 1/2x$ C. $y = 2x + 3$
 B. $y = 3$ D. $y = 3x + 2$

13. What is the equation of a line that passes through the point $(-6, 1)$ with slope $2/3$?

- A. $y = \frac{2}{3}x - 5$ C. $y = \frac{2}{3}x + \frac{20}{3}$
 B. $y = \frac{2}{3}x - \frac{20}{3}$ D. $y = \frac{2}{3}x + 5$

14. What is the equation of a line that passes through the points $(1, 3)$ and $(-2, 5)$?

- A. $-2x + 3y = 11$ C. $2x - 3y = 11$
 B. $2x + 3y = 11$ D. $3x + 2y = 11$

15. Jojo was able to collect 5 kg of aluminum cans of soft drinks and sold them to the junkshop and received Php175. On the next day, he sold again another 3 kg of recycled cans and earned Php 105. He wanted to know how much

would he earn from the recycled materials if he can collect 22 kg. What equation would he have used to determine his earning?

A. $y = 5x$

C. $y = 35x$

B. $y = 5x + 35$

D. $y = 35x + 5$

Lesson

1

Finding the Equation of a Line

A first degree polynomial equation in two variables whose graph is a line is called **linear equation**. In the previous module, you learned that the standard form of a linear equation is,

$$Ax + By = C.$$

The equation of a line can be determined using two points, the slope and a point, and the slope and y-intercept.



What's In

Let's start this lesson by reviewing on writing linear equation $Ax + By = C$ in the form $y = mx + b$ and vice versa, in order for you to recall the properties used in writing the equation into another form.

Rewrite Me!

Directions: Write the given linear equation into $Ax + By = C$ or $y = mx + b$. Supply the missing terms in each item below as well as the properties used. Use a separate sheet of paper to write your answer.

1. Write the equation $2x + 3y = 12$ into $y = mx + b$.

Solution:

$$2x + 3y = 12$$

Given

$$2x + (\underline{\quad}) + 3y = 12 + (-2x)$$

$$(\underline{\quad})3y = (-2x + 12)(\underline{\quad})$$

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

Simplified as $y = mx + b$

2. Write the linear equation $y = -2x - 1$ into $Ax + By = C$.

Solution:

$$y = -2x - 1$$

Given

$$y + (\underline{\quad}) = -2x + (\underline{\quad}) - 1$$

$$2x + y = -1$$

Questions:

1. How did you write the linear equation $y = mx + b$ to the form $Ax + By = C$?
2. How did you write $Ax + By = C$ to the form $y = mx + b$?
3. What mathematical concepts or principles did you apply to write each linear equation to standard form? to $y = mx + b$ form?
4. What is the standard form of the linear equation?

Additive Inverse Property. The **additive inverse** (or the opposite sign or the negative) of a number a is the number that, when added to a , yields zero. In symbol, $a + (-a) = 0$.

Additive Identity Property states that the sum of any number and 0 is the given number. Zero, "0" is the **additive identity**. In symbol, $a + 0 = a$

Multiplicative Inverse Property The **multiplicative inverse** (or the reciprocal) of a number a is $\frac{1}{a}$ that, when multiplied to a , the product is one. In symbol,

Multiplicative Identity Property states that the product of any number and 1 is the given number, $a \cdot 1 = a$. One, "1" is the **multiplicative identity**.

Commutative Property of Addition. The order of the addends does not affect the sum. In symbol, $a + b = b + a$.

Directions: Classify each given linear equation by writing it under the column corresponding to the form it belongs. Use a separate sheet to write your answers.

Linear Equation	Slope-intercept Form ($y = mx + b$)	Point-slope Form $y - y_1 = m(x - x_1)$	Two-point Form $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$
1. $y = 3x + 1$			
2. $y - 3 = \frac{1}{2}(x + 2)$			
3. $y = x + 1$			
4. $y + 1 = \frac{3-2}{-1-3}(x - 2)$			
5. $y + 2 = -4(x - 1)$			
6. $y - 5 = \frac{4-(-2)}{1-3}(x + 2)$			

Questions:

1. What have you observed in the equations under **Slope-intercept Form**?
What do you need to have in order to form this equation?
2. What do the equations under **Point-slope Form** consist?
3. Do the equations in the Two-point Form column differ from those in the other two columns?
4. What information are required under each form of equations?



What is It!

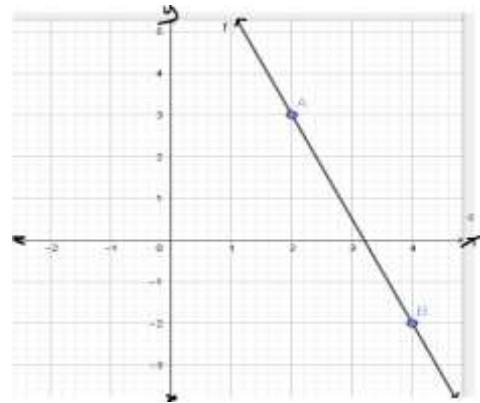
You have learned in the previous activity the different forms of the equation of the line. Let us use these equations in finding the equation of the line.

Equation of the line can be determined if the given are:

1. **Two points:** (x_1, y_1) and (x_2, y_2)

Example:

Find the equation of a line that passes through the points $(2,3)$ and $(4, -2)$ as shown on the graph.



Solution:

Since, two points are given $(2,3)$ and $(4, -2)$, then, we will use **the Two-point Form** defined as,

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

Step 1. Identify (x_1, y_1) and (x_2, y_2) using the given two points $(2,3)$ and $(4, -2)$.

$$\checkmark x_1 = 2 \text{ and } y_1 = 3 ; x_2 = 4 \text{ and } y_2 = -2$$

Step 2. Substitute these values on the formula: $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$.

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

Step 3. Simplify: $y - (3) = \frac{(-2) - (3)}{(4) - (2)}(x - (2))$

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

Step 4. Apply Distributive property.

$$\checkmark y - 3 = \left(\frac{-5}{2}\right)(x) - \left(\frac{-5}{2}\right)(2)$$

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

$$\checkmark y - 3 = \frac{-5}{2}x + 5.$$

Step 5. Apply Addition Property of Equality.

$$\checkmark y - 3 + 3 = \frac{-5}{2}x + 5 + 3$$

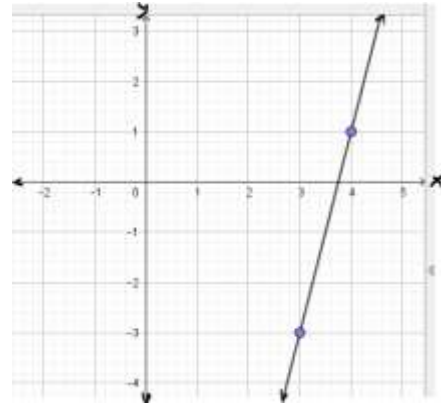
$$\checkmark y = \frac{-5}{2}x + 8.$$

Thus, the equation of a line that passes through the points (2,3) and (4, -2) is $y = \frac{-5}{2}x + 8$ or $\frac{5}{2}x + y = 8$ in standard form.

2. **Slope and a point:** m and (x_1, y_1)

Example:

Write the equation of a line whose graph has slope of 4 and a point (3, -3).



Solution:

If given a slope and a particular point, then we will use **the Point-slope Form** defined as,

$$y - y_1 = m(x - x_1)$$

Step 1. Identify the slope and a point (x_1, y_1) .

$$\checkmark m = 4 ; \text{ and } x_1 = 3 \text{ and } y_1 = -3$$

Step 2. Substitute the given values on the formula: $y - y_1 = m(x - x_1)$

$$\checkmark y - (-3) = (4)(x - (3))$$

Step 3. Simplify: $y - (-3) = (4)(x - (3))$

$$\checkmark y + 3 = 4(x - 3)$$

Step 4. Apply Distributive property.

$$\checkmark y + 3 = 4(x) - 4(3)$$

$$\checkmark y + 3 = 4x - 12$$

Step 5. Apply Addition Property of Equality.

$$\checkmark y + 3 - 3 = 4x - 12 - 3$$

$$\checkmark y = 4x - 15.$$

Thus, the equation of a line whose graph has a slope of 4 and a point (3, -3) is $y = 4x - 15$ or $-4x + y = -15$ in standard form. Since, we are translating the slope-intercept form into standard form, "A" should be positive. Multiply both sides by -1 to make the equation positive. Thus, we have the standard form of $4x - y = 15$.

3. Slope and *y*-intercept: *m* and *b*

Example:

Find the equation of a line whose graph has a slope of 2 and an intercept of 4.

Solution:

If the slope of a line and a *y*-intercept are known. Therefore, we will use **the Slope-intercept Form** defined as,

$$y = mx + b$$

Step 1. Identify the slope or *m* and *y* – intercept or *b*.

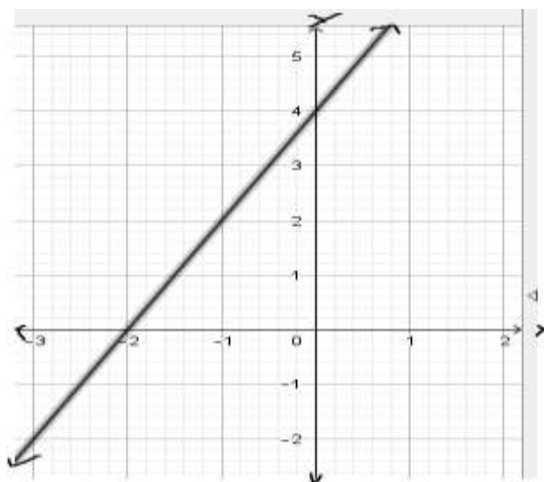
$$\checkmark m = 2 \text{ and } b = 4$$

Step 2. Substitute the given values on the formula: $y = mx + b$.

$$\checkmark y = (2)x + (4)$$

$$\checkmark y = 2x + 4$$

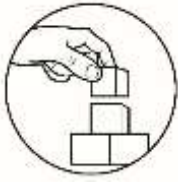
Thus, the equation of a line whose graph has a slope of 2 and an intercept of 4 is $y = 2x + 4$ or $2x - y = -4$ in standard form.



Quick Notes:

To determine the equation of the line:

- ❖ If the graph of a linear equation has a slope *m* and *y* – intercept *b*, then use the equation $y = mx + b$. This form is called the **slope-intercept form**.
- ❖ If the graph of a linear equation has a slope *m* and passes through the point (x_1, y_1) , then use the equation $y - y_1 = m(x - x_1)$. This form is called the **point-slope form**.
- ❖ If the graph of a linear equation passes through the points (x_1, y_1) and (x_2, y_2) , then use the equation $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$. This form is called the **two-point form**.
- ❖ Standard form of $Ax + By = C$, where A, B, and C are real numbers.



What's More

Activity 1: Fill in the box!

Directions: Fill in the boxes below where m is the slope and b is the y – *intercept*.

1. $-5x + y = 4$

$$m = \boxed{}$$

and

$$b = \boxed{}$$

2. $\boxed{}x - 6y = 7$

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

and

$$b = \frac{-\boxed{}}{6}$$

Activity 2: Let's Write an Equation!

Directions: Write an equation of the line in slope- intercept form given the following:

1. The line passes the points $(-6, 2)$ and $(3, -5)$.
2. The line passes the point $(3, -4)$ and a slope of 3.
3. A line that has a slope of 2 and a y – *intercept* of $\frac{3}{2}$.
4. The line passes through the points $(-1, 3)$ and $(2, 0)$.
5. The line has a slope -3 and passes through the point $(2, 1)$.

Activity 3: Transform into Standard Form!

Direction: Find the equation of each line in standard form with the given properties:

1. $Slope = 3, y$ – *intercept* = 1
2. Passing through $(0, 2), slope = -4$
3. passing through $(-1, 3)$ and $(1, 1)$
4. passing through $(1, 3), slope = \frac{1}{2}$
5. passing through $(\frac{1}{2}, 1)$ and $(4, 2)$

Study Tip: After writing an equation, check that the given points are solutions of the equations. Simply substitute the values of x and y to the equation.



What I Have Learned

Directions: Complete the following statements:

1. The standard form $6x + 2y = -4$, when expressed to slope – intercept form is _____.
2. If the graph of a linear equation passes through two points, then the equation is _____.
3. If the graph passes through a point (x_1, y_1) and has a slope m , then the equation is _____.
4. If the graph of a linear equation has a slope m and a y intercept b then the equation is _____.



What I Can Do

Directions: Analyze and solve the problem. Show your solution. Use a separate sheet of paper for your answer.

1. Aiza wants to save her *baon* in order to buy a birthday cake for the upcoming 57th birthday of her mother that is 10 school days from now. She already had some initial savings from the gift she received from her *Ninong* during her 14th birthday. With a constant amount of daily savings, she had saved Php 540 in two school days and in five school days her total savings amounted to Php 600.
 - a. Write an equation that can be used to determine her total savings given a number of school days.
 - b. How much money did Aiza save in 10 school days?



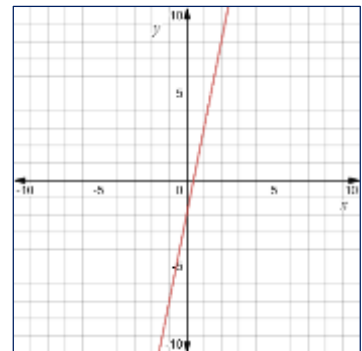
Assessment

Multiple Choice. Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

1. What is the standard form of the equation $y = -2x + 1$?
A. $2x - y = 1$ C. $2x + y = 1$
B. $-2x + y = 1$ D. $-2x - y = 1$
2. What is the slope of the equation of a line $\frac{2}{3}x + 4y = 8$?
A. $-\frac{1}{6}$ C. 4
B. $\frac{2}{3}$ D. 8
3. If the graph of a linear equation passes through a point $(1, -2)$ and a slope of 3, what form is being illustrated?
A. point-slope C. standard
B. slope-intercept D. two-point
4. In the equation $3x - y = 1$, what is the y-intercept?
A. -3 B. -1 C. 1 D. 3
5. What is the y-intercept of the line $3x + 2y = 6$?
A. $-\frac{2}{3}$ B. $-\frac{3}{2}$ C. 3 D. 6
6. Which of the following pair of points have a slope of -3 ?
A. $(3,4)$ and $(5, -2)$ C. $(2,5)$ and $(4, -2)$
B. $(4,2)$ and $(-2,5)$ D. $(-2,2)$ and $(4,5)$
7. The equation of the line $y = 2x + 5$ passes through which point?
A. $(-4, -8)$ B. $(-4, 3)$ C. $(1, 7)$ D. $(2, 7)$
8. Which of the following equations is represented by the given graph on the right?

- A. $y = 5x - 2$
B. $y = 5x + 2$

- C. $y = 2x - 5$
D. $y = 2x + 5$



9. Determine the slope and the y -intercept of the equation $y = 2x - \frac{1}{3}$?
- A. $m = 2$ and $b = -\frac{1}{3}$ C. $m = 2$ and $b = -3$
 B. $m = \frac{1}{3}$ and $b = 2$ D. $m = -1$ and $b = 2$
10. What is the slope of a line if it contains the points $(1, -2)$ and $(3, -4)$?
- A. -3 B. -1 C. 1 D. 3
11. Find the equation of a line passing through the points $(-2, 5)$ and $(4, -3)$.
- A. $y = -4x + \frac{7}{3}$ C. $y = -x + \frac{4}{7}$
 B. $y = -\frac{4}{3}x + \frac{7}{3}$ D. $y = \frac{4}{7}x + 1$
12. What is the equation of a line that passes through the points $(1, 3)$ and $(-2, 5)$?
- A. $-2x + 3y = 11$ C. $2x - 3y = 11$
 B. $2x + 3y = 11$ D. $3x + 2y = 11$
13. What is the equation of a line which contains the point $(3, 7)$ and has a slope $\frac{2}{3}$?
- A. $y = -\frac{3}{2}x + 5$ C. $y = \frac{2}{3}x + 5$
 B. $y = -\frac{2}{3}x + 5$ D. $y = \frac{3}{2}x + 5$
14. The line passes through the point $(0, 3)$ and has a slope of 2. What is the equation of a line in slope-intercept form?
- A. $y = \frac{1}{2}x$ C. $y = 2x + 3$
 B. $y = 3$ D. $y = 3x + 2$
15. Jojo's father was able to harvest 100 kilos of ripe mangoes. He sold the mangoes for Php 90 per kilo. He wanted to determine how much would he earn from his harvest. What equation represents the earnings of Jojo's father?
- A. $y = 90x$ C. $y = 100x$
 B. $y = 90x + 100$ D. $y = 100x + 90$



Additional Activities

Direction: Solve the problem and show your solution:

1. Find the equation of a line in standard form with x – *intercept* 3 and y – *intercept* 6.
2. Find the equation of a line in *slope-intercept form* with x – *intercept* 8 and y – *intercept* 4.

The Intercepts Form

The intercepts form of the equation of a line is

$$\frac{x}{a} + \frac{y}{b} = 1,$$

Where a is the x – *intercept* and b is the y – *intercept*.



Answer Key

What's In	What's New
<p>1. $2x + 3y = 12$</p> <p><u>Addition Property</u></p> <p>Given</p> <p>$2x + (-2x) + 3y = 12 + (-2x)$</p> <p>$\frac{1}{3}(3y) = (-2x + 12)\frac{1}{3}$</p> <p>$y = -\frac{2}{3}x + 4$</p> <p>2. $y = -2x - 1$</p> <p>$y + (2x) = -2x + (2x) - 1$</p> <p>$2x + y = -1$</p>	<p>1. $2x + y = 6$</p> <p>2. $y = -\frac{1}{2}x + 4$</p>
<p><u>Multiplication Property</u></p> <p>Simplified as $y = mx + b$</p> <p>Given</p> <p><u>Addition Property</u></p> <p><u>Simplified as $Ax + By = C$</u></p>	<p>Slope-intercept Form</p> <p>✓ $y = 3x + 1$</p> <p>✓ $y = x + 1$</p> <p>Point-slope Form</p> <p>✓ $y - 3 = \frac{2}{1}(x + 2)$</p> <p>✓ $y + 2 = -4(x - 1)$</p> <p>Two-point Form</p> <p>✓ $y + 1 = \frac{-1-3}{3-2}(x - 2)$</p> <p>✓ $y - 5 = \frac{4-(-2)}{1-3}(x + 2)$</p> <p>Points: (x_1, y_1) and (x_2, y_2)</p> <p>Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$</p>
<p>Additional Activities</p> <p>1. $2x + y = 6$</p> <p>2. $y = -\frac{1}{2}x + 4$</p>	<p>Additional Activities</p> <p>1. $2x + y = 6$</p> <p>2. $y = -\frac{1}{2}x + 4$</p>

<p>What I Know</p> <ol style="list-style-type: none"> 1. C 2. A 3. B 4. C 5. A 6. A 7. B 8. C 9. C 10. A 11. A 12. C 13. D 14. B 15. C 	<p>What's More</p> <p>Act. 1:</p> <ol style="list-style-type: none"> 1. $m = 5; b = 4$ 2. $3x - 6y = 7$ <p>Act. 2:</p> <ol style="list-style-type: none"> 1. $y = \frac{9}{-7}x - \frac{3}{8}$ 2. $y = 3x - 13$ 3. $y = 2x + \frac{2}{3}$ 4. $y = -x + 2$ 5. $y = -3x + 7$ <p>Act. 3:</p> <ol style="list-style-type: none"> 1. $3x - y = -1$ 2. $4x + y = 2$ 3. $x + y = 2$ 4. $x - 2y = -5$ 5. $2x - 7y = -6$ <p>What I can Do</p> <ol style="list-style-type: none"> 1. $y = 20x + 500$ 2. P700 	<p>Assessment</p> <ol style="list-style-type: none"> 1. C 2. A 3. A 4. B 5. C 6. A 7. C 8. A 9. A 10. B 11. B 12. B 13. C 14. C 15. A
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For inquiries or feedback, please write or call:

Department of Education – Bureau of Learning Resource
Ground Floor, Bonifacio Building, DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax. Nos.: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph