

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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Published by the Department of Education

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Printed in the Philippines by _____

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Mathematics
Quarter 1 - Module 12:
“Finding the Equation
of a Line”



Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



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:

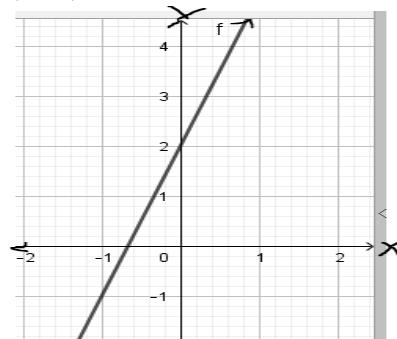
1. find the equation of a line given: (a) two points; (b) the slope and a point; (c) the slope and its intercept;
2. solve problem using the three forms of linear equation; and
3. appreciate the importance of linear equation in solving real-life problems.



What I Know

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

1. In the equation $Ax + By = C$ where A and B are not equal to zero is a linear equation in what form?
A. point-slope form C. standard form
B. slope-intercept form D. two-point form
2. 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?
A. $y = mx + b$ C. $\frac{x}{a} + \frac{y}{b} = 1$
B. $y - y_1 = m(x - x_1)$ D. $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$
3. What is the slope of the line $x + y = 3$?
A. -3 C. 1
B. -1 D. 3
4. In the equation $-3x + y = 1$, what is the y -intercept?
A. -3 C. 1
B. -1 D. 3
5. What is the y -intercept of the line $2x + 3y = -15$?
A. -5 C. $-2/3$
B. -2 D. 3
6. Which of the following pair of points have a slope of -2?
A. $(2, 4)$ and $(5, -2)$ C. $(2, 5)$ and $(4, -2)$
B. $(4, 2)$ and $(-2, 5)$ D. $(-2, 2)$ and $(4, 5)$
7. The line $y - 8 = \frac{3}{4}(x - 4)$ passes through which point?
A. $(-4, -8)$ C. $(-4, 8)$
B. $(-4, 2)$ D. $(3, 4)$
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 is the slope (m) and y -intercept (b) 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 P175. On the next day, he sold again another 3 kg of recycled cans and earned P105. 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. $y = 5x + 35$
B. $y = 35x$ 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, $Ax + By = C$, where A and B should not be both equal to zero.

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 $Ax + By = C$, where A and B should not be both equal to 0, 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.

Activity 1: 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:

$$2x + 3y = 12 \quad Given$$

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

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

$$y = -\frac{2}{3}x + 4 \quad \text{Simplified as } y = mx + b$$

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

Solution:

$$y = -2x - 1 \quad Given$$

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

$$2x + y = -1 \quad \underline{\hspace{2cm}}$$

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, $a + b = b + a$.



What's New

Activity 2: Where Do I Belong?

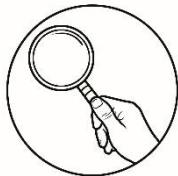
Directions: Classify each given linear equation by writing it under the column corresponding to the form it belongs. Use a separate sheet to write your answers.

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. $y - 3 = \frac{1}{2}(x + 2)$			
2. $y + 1 = \frac{3-2}{-1-3}(x - 2)$			
3. $y = 3x + 1$			
4. $y + 2 = -4(x - 1)$			
5. $y = x + 1$			
6. $y - 5 = \frac{4-(-2)}{1-3}(x + 2)$			

Questions:

1. What have you observed in the equations under **Slope-intercept Form**?
2. What do you need to have in order to form this equation?

3. What do the equations under **Point-slope Form** consist?
4. Do the equations in the Two-point Form column differ from those in the other two columns?
5. 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:

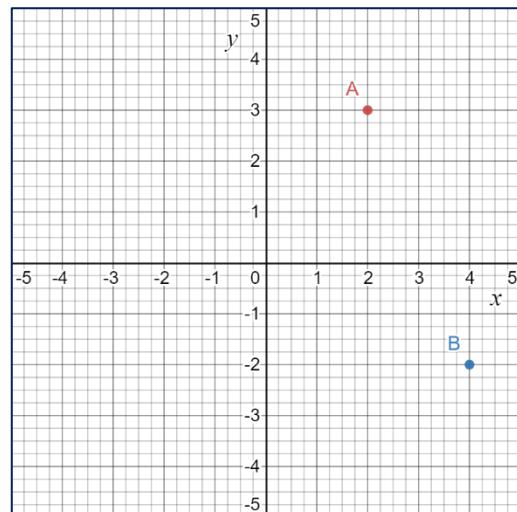
1. **Two points:** (x_1, y_1) and (x_2, y_2)

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 $(4, -2)$.

✓ $x_1 = 2$ and $y_1 = 3$; $x_2 = 4$ and $y_2 = -2$

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

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

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

✓ $y - 3 = \frac{-5}{2} (x - 2)$

Step 4. Apply Distributive property.

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

Step 5. Apply Addition Property of Equality.

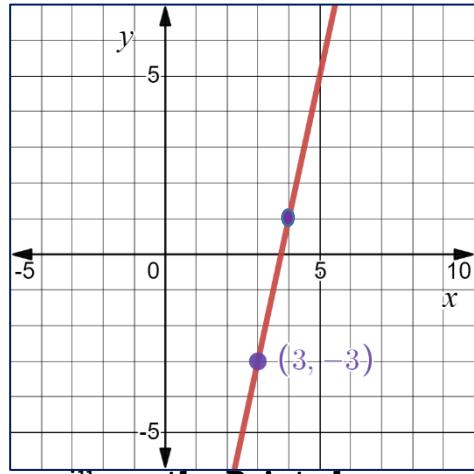
- ✓ $y - 3 + 3 = \frac{-5}{2}x + 5 + 3$
- ✓ $y = \frac{-5}{2}x + 8.$

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

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) .

- ✓ $m = 4$; and $x_1 = 3$ and $y_1 = -3$

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

- ✓ $y - (-3) = (4)(x - (3))$

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

- ✓ $y + 3 = 4(x - 3)$

Step 4. Apply Distributive property.

- ✓ $y + 3 = 4(x) - 4(3)$
- ✓ $y + 3 = 4x - 12$

Step 5. Apply Addition Property of Equality.

- ✓ $y + 3 - 3 = 4x - 12 - 3$
- ✓ $y = 4x - 15$.

Thus, the equation of a line whose graph has a slope of 4 and a point $(3, -3)$ is

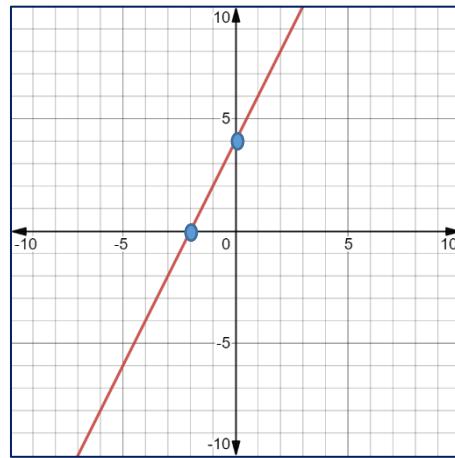
$y = 4x - 15$ or $-4x + y = -15$ in standard form ($Ax + By = C$). Since, we are translating the slope-intercept form into standard form, “A” should be positive. Multiply both sides by -1 to make the equation positive. Thus, we have the standard form of $4x - y = 15$.

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 .

- ✓ $m = 2$ and $b = 4$

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

- ✓ $y = (2)x + (4)$
- ✓ $y = 2x + 4$

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.

In addition, this idea of finding the equation of a line could be used in solving real life problems.

Example: A motorcycle driver charged you P8.00 per kilometer and an additional of P5.00 per succeeding kilometer as fare.

- a. What equation will represent the situation?
- b. What is the cost of 20-km ride?

Solution:

Let C be the cost of the fare and k be the additional no. of kilometers. Then,

a. $C = P5.00k + P8.00$

b. $C = P5.00k + P8.00$

$$C = P100 + P8.00$$

$$C = P108$$

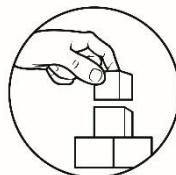
$$C = P5.00(20) + P8.00$$

Thus, you will be cost a total of P108.00 in a 20 km ride.

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 3: 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 4: 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 5: Writing 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.

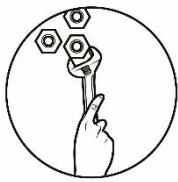


What I Have Learned

Activity 6: Complete Me!

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

Activity 7: Buy Me a Birthday Cake

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. (*Hint: Use the Slope-intercept form $y = mx + b$*)
 - b. How much money did Aiza save in 10 school days?



Assessment

Directions: Read each item carefully. Then write on your answer sheet the letter that corresponds to the correct answer.

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 $\frac{2}{3}x + 4y = 8$?

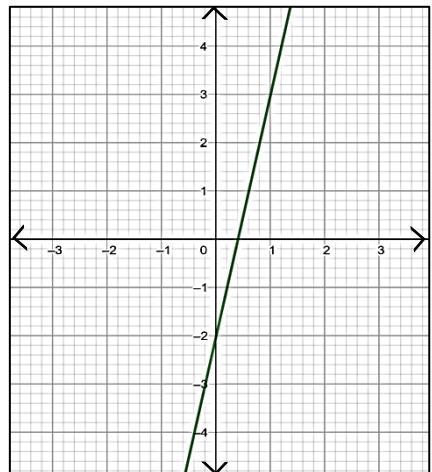
A. $-\frac{1}{6}$	C. 4
B. $\frac{2}{3}$	D. 8
3. If the graph of a linear equation passes through a point $(1, -2)$ and a slope of 3, what form is being illustrated?

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. $-\frac{3}{2}$ B. $-\frac{2}{3}$ 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. $y = 5x - 2$ C. $y = 2x - 5$
 B. $y = 5x + 2$ 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. $y = 90 + 100$
B. $y = 100x$ D. $y = 100x + 90$



Additional Activities

Direction: Solve the problem and show your solution:

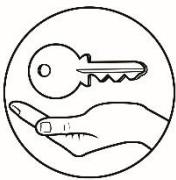
- Find the equation of a line in standard form with x -intercept 3 and y -intercept 6.
- Find the equation of a line in *slope-intercept form* with x -intercept 8 and y -intercept 4.

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

$$2. y = -\frac{2}{1}x + 4$$

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

Additional Activities

$$\begin{array}{ll} \checkmark y - 5 = \frac{1-3}{4-(2)}(x+2) & \text{Slope: } m = \frac{x_2 - x_1}{y_2 - y_1} \\ \checkmark y + 1 = \frac{-1-3}{3-2}(x-2) & \text{Points: } (x_1, y_1) \text{ and } (x_2, y_2) \end{array}$$

Two-point Form

$$\begin{array}{ll} \checkmark y + 2 = -4(x-1) & \\ \checkmark y - 3 = \frac{2}{1}(x+2) & \text{It has slope } m \text{ and a point } (x_1, y_1). \end{array}$$

Point-slope Form

$$\begin{array}{ll} \checkmark y = x + 1 & \\ \checkmark y = 3x + 1 & \text{It has slope } m \text{ and } y\text{-intercept } b. \end{array}$$

What's New

$$\begin{array}{ll} 2x + y = -1 & \\ y + (2x) = -2x + (2x) - 1 & \\ y = -2x - 1 & \text{Given} \\ y = -\frac{3}{2}x + 4 & \text{Simplified as } y = mx + b \\ \frac{3}{1}(3y) = (-2x + 12)\frac{1}{3} & \text{Multiplication Property} \\ 2x + (-2x) + 3y = 12 + (-2x) & \text{Addition Property} \\ 2x + 3y = 12 & \text{Given} \\ 1. & \end{array}$$

What's In

What I Know		What's More		Assessment	
1. C	2. D	1. C	2. A	1. C	2. A
3. B	4. C	3. A	4. B	5. A	5. C
5. A	6. A	6. A	7. C	8. C	9. C
7. B	8. A	8. A	9. A	10. A	11. A
9. C	10. B	10. B	11. B	12. C	13. D
11. B	12. B	12. B	13. C	14. C	15. A
13. C	14. B	14. B	15. B		
15. A					
Act. 1:		Act. 2:		Act 3.	
1. $m = 5; b = 4$	2. $3x - 6y = 7$	1. $y = \frac{9}{7}x - \frac{8}{7}$	2. $y = 3x - 13$	1. $3x - y = -1$	2. $4x + y = 2$
2. C	3. A	3. $y = 2x + \frac{3}{2}$	4. $y = -x + 2$	5. $y = -3x + 7$	2. $p700$
3. B	4. B	4. $y = -x + 2$	5. $2x - 7y = -6$	1. $y = 20x + 500$	
5. A	6. A	5. $2x - 7y = -6$			
7. C	8. C				
9. C	10. A				
11. A	12. C				
12. B	13. C				
13. C	14. B				
14. C	15. A				

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