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Mathematics

Quarter 1 – Module 9: Writing the Linear Equation $Ax + By = C$ in the Form $y = mx + b$ and Vice versa

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Mathematics

Quarter 1 – Module 9

"Writing the Linear Equation $Ax + By = C$ in the Form $y = mx + b$ and Vice versa"

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What I Need to Know

In this module, you will learn writing linear equations in two variables in different forms. The scope of this module enables you to use it in many different learning situations. The lesson is 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: Writing the Linear Equation $Ax + By = C$ in the Form $y = mx + b$ and Vice versa

After going through this module, you are expected to:

1. distinguish standard form of linear equations from slope-intercept form;
2. write the linear equation $Ax + By = C$ in the form $y = mx + b$ and vice versa;
3. identify the slope and the y-intercept given linear equation in two variables; and
4. relate the forms of linear equation in two variables in real life situations.

What I Know

Choose the letter of the correct answer. Write your answer on a separate sheet of paper.

1. In the equation $y = -\frac{3}{5}x - 7$, what is the slope?
   A. -7 C. $-\frac{3}{5}$
   B. -3 D. $\frac{3}{5}$

2. In the equation $y = 2x - 5$, determine the y-intercept.
   A. -5 C. 2
   B. -2 D. 5

3. The standard form of the equation of a line is $Ax + By = C$. Which of the following equations is written in standard form?
   A. $3y = 2x + 8$ C. $-2y = x + 2$
   B. $x + 5y = 6$ D. $2 + y = 5$

4. Which of the following equations below is written in slope-intercept form?
   A. $4x - 3y = 10$ C. $x + y = 2$
   B. $y = -\frac{2}{3}x + 5$ D. $x = 2y - 6$

5. Determine the slope and y-intercept of the line $2x = y + 4$.
   A. $m = 2; b = -4$ C. $m = -2; b = 4$
   B. $m = 2; b = 4$ D. $m = -2; b = -4$

6. Which of the following is the standard form of the equation $y = -3x + 4$?
   A. $3x - y = 4$ C. $3x + y = 4$
   B. $3x + y = -4$ D. $3x - y = -4$

7. In the equation $6x + y = 2$, what is the slope?
   A. 6 C. -2
   B. 2 D. -6

8. If the equation has a slope of 3/5 and y-intercept of −5, then what is the equation in slope-intercept form?
   A. $y = \frac{3}{5}x + 5$ C. $y = 5x + \frac{3}{5}$
   B. $y = \frac{3}{5}x - 5$ D. $y = 5x - \frac{3}{5}$

9. Rewrite $2x - y = 12$ in slope-intercept form.
   A. $y = 2x + 12$ C. $y = 2x - 12$
   B. $y = 2x + 6$ D. $y = -2x + 6$

10. Determine the slope and y-intercept of the line $7x + 2y = 14$.
   A. $m = -\frac{7}{2}; b = 14$ C. $m = \frac{7}{2}; b = 7$
   B. $m = -\frac{7}{2}; b = 7$ D. $m = 7; b = 14$

11. Rewrite the equation $2x + y = 3$ in slope-intercept form.
   A. $y = 2x + 3$ C. $2x = -y + 3$
   B. $y = -2x + 3$ D. $y = -2x - 3$

12. In her Math class, Joan, was asked by her teacher to rewrite $6x + 2y = 8$ in slope-intercept form. She answered, $2y = -6x + 8$. Was Joan correct?
   A. Yes, because $6x$ and 8 is on the other side of the equation.
   B. Yes, because Joan is the smartest and never got wrong in the class.
   C. No, because the term $-6x$ must be positive.
   D. No, because the simplified answer must be $y = -3x + 4$.

13. Reggie is starting his "rent-a-bicycle" business. He is planning to charge Php 50 to rent a bicycle plus Php 10 per hour of rental. If you will use a linear equation to model the situation, what is the slope and what does it represent?
   A. slope=10, it represents the initial cost
   B. slope=10, it represents the charge per hour
   C. slope=50, it represents the initial cost
   D. slope=50, it represents the charge per hour

14. Your sister decided to join a Zumba session. The initial fee is Php 120, and a Php 25 fee for each session. Which of the following equations model the amount your sister will pay in x number of sessions?
   A. $y = 120x + 25$
   B. $y = 25x + 120$
   C. $x - 120y = 25$
   D. $x - 25y = 120$

15. Which of the following statements is correct about the two given linear equations?

Equation 1: $3x - 6y = 15$
Equation 2: $8x - 4y = 12$

A. The slope of the two equations are negative.
B. The slope of the two linear equations are equal.
C. The slope of equation 1 is less that the slope of equation 2.
D. The slope of equation 1 is greater than the slope of equation 2.

Lesson 1 Writing the Linear Equation $Ax + By = C$ in the Form $y = mx + b$ and Vice versa

You have learned in the previous lesson that the standard form of a linear equation in two variables is written as $Ax + By = C$, where $A, B, and\ C$ are real numbers, A and B are not both zero. Also, the slope-intercept form of the equation of a line is written in the form $y = mx + b$, where m is the slope and b is the y-intercept, m and b are real numbers.

What's In

Activity: Classify My Form

Classify each linear equation as an equation written in standard form or in slope-intercept form. Write your answer in the appropriate box.

$3x - y = 7$	$4x - y = -8$
$y = 5x - 2$	$y = -x + 9$
$2x + y = -4$	$3x + 6y = 12$
$y = -\frac{3}{4}x + 1$	$y = \frac{2}{3}x + 5$

Standard Form	Slope-Intercept Form

Questions

1. How did you classify each of the given linear equations?
2. Differentiate standard form of linear equations from slope-intercept form.

What's New

Activity: Let's Begin...

Rewrite the following linear equations in specified form. Supply the missing terms in each of the items below. Write your answer on a separate sheet of paper.

In rewriting standard form of a linear equation to slope-intercept form, let us isolate the variable y in the left side of the equation. To do this, observe the steps and fill in the blanks with the correct term/s based on the property/ies written on the right.

1. Rewrite the equation $-4x + y = 12$ in slope-intercept form.

Solution:	$-4x + y = 12$	*Given*
	$-4x + y + \_\_ = 12 + \_\_$	*Addition Property of Equality*
	$y + (-4x + \_\_) = 12 + \_\_$	*Associative Property for Addition*
	$y + 0 = 12 + \_\_$	*Additive Inverse*
	$\_\_ = 12 + \_\_$	*Identity Property for Addition*
	$\boldsymbol{y = 4x + 12}$	*Commutative Property of Equality/Slope-Intercept Form*

2. Rewrite the equation $y = -3x + 9$ in standard form.

Solution:	$y = -3x + 9$	*Given*
	$y + \_\_ = -3x + \_\_ + 9$	*Addition Property of Equality*
	$y + \_\_ = (-3x + 3x) + 9$	*Associative Property for Addition*
	$y + \_\_ = \_\_ + 9$	*Additive Inverse*
	$y + \_\_ = 9$	*Identity Property for Addition*
	$\boldsymbol{3x + y = 9}$	*Commutative Property for Addition/Standard Form*

What is It

The equation of the form $Ax + By = C$ can be rewritten in the form $y = mx + b$ and vice versa.

Remember

Standard Form: $Ax + By = C$, where A, B and $C \in \Re, A \neq 0$ and $B \neq 0$; and

Slope-Intercept Form: $y = mx + b$, where m is the slope and b is the y-intercept, m and $b \in \Re$.

Example 1

Rewrite the following equations in the form $y = mx + b$. Determine the slope and y-intercept.

a. $-3x + y = 7$
b. $20x - 10y = 30$

In rewriting standard form of a linear equation to slope-intercept form, let us isolate the variable y in the left side of the equation. To do this, observe the steps below.

Solution

a.

$-3x + y = 7$	*Given*
$-3x + y + 3x = 12 + 3x$	*Addition Property of Equality*
$y + (-3x + 3x) = 12 + 3x$	*Associative Property for Addition*
$y + 0 = 12 + 3x$	*Additive Inverse*
$y = 12 + 3x$	*Identity Property for Addition*
$\boldsymbol{y = 3x + 12}$	*Commutative Property for Addition*

The slope is 3 and the y-intercept is 12.

b.

$20x - 10y = 30$	*Given*
$20x - 10y - 20x = 30 - 20x$	*Addition Property of Equality*
$-10y = 30 - 20x$	*Additive Inverse*
$-\frac{1}{10}(-10y) = -\frac{1}{10}(30 - 20x)$	*Multiplication Property of Equality*
$y = -3 + 2x$	*Multiplicative Inverse*
$\boldsymbol{y = 2x - 3}$	*Commutative Property for Addition*

The slope is 2 and the y-intercept is -3.

Example 2

Rewrite the following equations in the form $Ax + By = C$.

a. $y = -x + 4$

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

> To write slope intercept form $y = mx + b$ to standard form $Ax + By + C = 0$, let m = A/B, collect all terms on the left side of the equation and multiply by the denominator B to get rid of the fraction.

Solution

a.

$y = -x + 4$	*Given*
$y + x = -x + x + 9$	*Addition Property of Equality*
$y + x = (-x + x) + 9$	*Associative Property for Addition*
$y + x = 0 + 9$	*Additive Inverse*
$y + x = 9$	*Identity Property for Addition*
$x + y = 9$	*Commutative Property for Addition*
$\boldsymbol{x + y = 9}$	*Standard Form*

b.

$y = \frac{2}{3}x + 5$	*Given*
$(3)(y) = (3)\left(\frac{2}{3}x + 5\right)$	*Multiplication Property of Equality*
$3y = \frac{6}{3}x + 15$	*Distributive Property*
$3y = 2x + 15$	*Simplified* $\left(\frac{6}{3} = 2\right)$
$3y + (-2x) = 2x + 15 + (-2x)$	*Addition Property of Equality*
$3y + (-2x) = (2x - 2x) + 15$	*Associative Property for Addition*
$3y + (-2x) = 0 + 15$	*Additive Inverse*
$3y - 2x = 0 + 15$	*Distributive Property*
$3y - 2x = 15$	*Identity Property for Addition*
$-2x + 3y = 15$	*Commutative Property*
$(-1)\ (-2x + 3y) = (-1)(15)$	*Multiplication Property of Equality*
$\boldsymbol{2x - 3y = -15}$	*Standard Form*

Example 3

Situation

Eli's mother asked her to buy apple and orange in the market. Each apple costs ₱20 and each orange costs ₱10. She was told by her mother to spend exactly ₱50.
Let x represents the number of apples and y represents the number of oranges she bought.

1. Write an equation in standard form modeling the situation.
2. Using your answer in number 1, rewrite the equation of the line in slope-intercept form.

Solution:

1. Since each apple costs ₱20, the coefficient for x should be 20. Since each orange costs ₱10, the coefficient for y should be 10. If the total cost is exactly ₱50, then we set the sum of these two costs to 50, so we have

$$\boxed{\mathbf{20x + 10y = 50}}$$

2. Rewriting the equation $20x + 10y = 50$ in slope-intercept form

$20x + 10y = 50$	*Given*
$20x + 10y - 20x = 50 - 20x$	*Addition Property of Equality*
$10y = 50 - 20x$	*Additive Inverse*
$\frac{1}{10}(10y) = \frac{1}{10}(50 - 20x)$	*Multiplication Property of Equality*
$y = 5 - 2x$	*Multiplicative Inverse*
$\boxed{\mathbf{y = -2x + 5}}$	*Commutative Property*

What's More

Activity 1: Re-Match! (Rewrite and Match)

Rewrite the following equations in Column A in the form $y = mx + b$, and find its corresponding slope-intercept form in Column B. Write your answer on a separate sheet of paper.

COLUMN A	COLUMN B
1. $x + y = 3$	A. $y = 5x - 10$
2. $x - 3y = 9$	B. $y = \frac{1}{2}x + 2$
3. $10x - 2y = 20$	C. $y = 2x + 2$
4. $6x = 12 + 2y$	D. $y = 3x - 6$
5. $4x + 16 - 8y = 0$	E. $y = \frac{1}{3}x - 3$
	F. $y = -x + 3$

Questions

1. How did you find the activity? Is finding the slope-intercept form of a linear equation difficult?
2. How did you rewrite the above equations in the form $y = mx + b$?
3. Give the slope and the y-intercept of each of the given equations.

Activity 2: Set Me to My Standard!

Give the equivalent standard form of each linear equation written in slope-intercept form. Answers can be found inside the box. Use a separate sheet of paper.

1. $y = 3x + 6$
2. $y = -2x + 4$
3. $y = \frac{1}{2}x - 6$
4. $y = \frac{2}{3}x$
5. $y = -4x + \frac{1}{8}$

$3x - y = -6$	$2x + y = 4$
$x - 2y = 12$	$2x - 3y = 0$
$32x + 8y = 1$	$x - 3y = 6$
$2x + y = -12$	$8x + y = 32$

Questions

1. What are your thoughts and feelings as you performed the activity?
2. Is finding the standard form of a linear equation easy? Explain your answer.
3. What mathematical principles/concepts did you apply in finding the standard form of a linear equation?

Activity 3: Vice Versa!

Rewrite the following linear equations in specified form, then answer the questions that follow. Use a separate sheet of paper.

A. Rewrite in the form $y = mx + b$. Then, identify the slope and the y-intercept.

1. $7x + 4y = 20$
2. $-4x + 2y = -20$

B. Rewrite in the form $Ax + By = C$.

1. $y - 5 = \frac{2}{3}(x - 3)$
2. $y + 8 = \frac{3}{4}(x + 4)$

Questions

1. Did you find any difficulty/ies in performing the task given to you? If yes, explain.
2. What properties of equality did you apply in rewriting the equations?

What I Have Learned

Direction: Read and answer the given problems.

Problem 1

Each pencil in a store costs Php 7, and each sharpener costs Php 5. If you want to spend exactly Php 43, write an equation in standard form modeling this situation.

Let p represents the number of pencils you buy, and s represents the number of sharpeners you buy.

Solution

Problem 2

Your family decides to rent a stall in your local market to sell school and office supplies. The initial payment is Php 3,000, and a Php1,500 monthly payment. Write an equation in slope-intercept form modeling the y amount the family will pay for renting in x number of months.

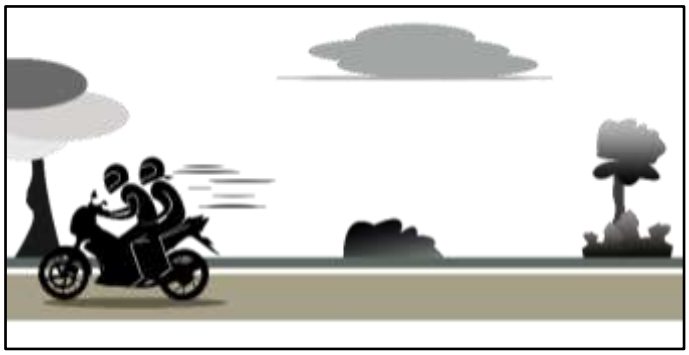
Solution

What I Can Do

Use the situation below to answer the questions that follow.

Situation

Seth is a driver providing a professional motorcycle ride to commuters. He has a base fare of Php 50 for the first 2 km travelled, plus Php 10 for every succeeding kilometer thereafter.



Questions

1. Write the linear equation expressing the fare paid (y) in relation to the distance (x) covered by a motorcycle.
2. How much will Seth receive if they travel 5 km?
3. About how many kilometers can a passenger travel if he/she has Php 120?
4. Using your answer in number 1, rewrite the equation of the line in the form

   $Ax + By = C$.

Assessment

Multiple Choice: Choose the letter of the correct answer for each item below and write them on your answer sheet.

1. In the equation $y = -2x + 6$, what is the slope?
   A. -2 C. $-\frac{1}{3}$
   B. -1 D. 6

2. In the equation $y = 3x - \frac{1}{2}$, determine the y-intercept.
   A. -3 C. $\frac{1}{2}$
   B. $-\frac{1}{2}$ D. 3

3. The slope-intercept form of the equation of a line is $y = mx + b$. Which of the following equations is in slope-intercept form?
   A. $y = 2x + 8$ C. $x + 5y = 6$
   B. $-2y = y + 2$ D. $2 + y = 5$

4. Which of the following linear equations is written in standard form?
   A. $4x - 3y = 10$ C. $y = 2$
   B. $y = -\frac{2}{3}x + 5$ D. $x = 2y - 6$

5. Determine the slope and y-intercept of the line $x = 3y + 3$.
   A. $m = 3; b = 3$ C. $m = \frac{1}{3}; b = -1$
   B. $m = -1; b = \frac{1}{3}$ D. $m = -2; b = -4$

6. In the equation $3x + y = 6$, what is the slope?
   A. -6 C. $3x$
   B. -3 D. $6x$

7. In the equation $2x = 2y + 10$, what is the value of $m + b$?
   A. -6 C. 4
   B. -4 D. 6

8. Rewrite $x + 5y = 7$ in slope-intercept form.
   A. $5y = x + 7$ C. $y = -\frac{x}{5} + \frac{7}{5}$
   B. $5y = -x + 7$ D. $y = \frac{x}{5} + 7$

9. Rewrite $8x - 4y = 12$ in slope-intercept form.
   A. $y = 2x - 3$ C. $y = 2x - 12$
   B. $y = 2x + 3$ D. $y = \frac{1}{2}x - 3$

10. Rewrite the equation $2x + y = 3$ into slope-intercept form.
    A. $y = 3x + 2$
    B. $y = 2x - 3$
    C. $y = -2x + 3$
    D. $y = -3x - 2$

11. Allan, whose favorite subject is Mathematics, is asked by his teacher to write the equation $15x + 5y = -35$ in slope-intercept form. He answered $5y = -15x - 7$. Is Allan correct?
    A. Yes, because he loves mathematics.
    B. Yes, because it is already the simplified answer.
    C. No, because the term $-15x$ must be positive.
    D. No, because the simplified answer must be $y = -3x - 7$.

12. April is buying a pizza. The pizza costs Php 350 plus Php 45 for each additional topping. Which function correctly models the amount April will pay in y pesos if she will have an additional x toppings?
    A. $y = 45x + 350$
    B. $y = -45x + 350$
    C. $y = 350x + 45$
    D. $y = -350x + 45$

13. Write the linear equation $y = \frac{1}{3}x - 3$ in standard form.
    A. $x - 3y = 9$
    B. $x + 2y = 3$
    C. $x + 2y = 9$
    D. $x - 2y = -6$

14. In a boutique, each shirt (s) costs Php 80, and each pair of pants (p) costs Php 150. If you are going to spend exactly ₱ 1,000. Write an equation in standard form modeling this situation.
    A. $150s + 80p = 1000$
    B. $80s + 150p = 1000$
    C. $s + p = 1000$
    D. $s - p = 1000$

15. You and your friends plan to go for a trip and decide to rent a car. The initial payment is about Php 3,000 and an extra Php 1,000 a day. Write an equation in slope-intercept form that models the amount your group will pay in y pesos if you will rent the car for x number of days.
    A. $y = 1000x + 3000$
    B. $y = 3000x + 1000$
    C. $x - 1000y = 3000$
    D. $-1000x + y = 3000$

Additional Activities

Read and analyze the situation, then answer the questions that follow. Use a separate sheet of paper.

Situation

Anna collected 2 kg of plastic bottles for their Christmas tree. She plans to collect an additional 3 ½ kg each week.

Questions:

a. Complete the table below.

No. of weeks (x)	1	2	3	4	5
No. of kilograms (y)					

b. Write a mathematical equation describing the situation.

c. How long will it take Anna to collect 26 ½ kg of plastic bottles?

d. Using your answer in letter a , rewrite the equation of the line in the form $Ax + By = C$.

Answer Key

What I Know

1. C
2. A
3. B
4. B
5. A
6. C
7. D
8. B
9. C
10. B
11. B
12. D
13. B
14. B
15. C

What's In

Standard Form

$3x - y = 7$

$2x + y = -4$

$4x - y = -8$

$3x + 6y = 12$

Slope-Intercept Form

$y = 5x - 2$

$y = -x + 9$

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

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

What's New

$-4x + y = 12$

$-4x + y + 4x = 12 + 4x$

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

$y + 0 = 12 + 4x$

$y = 12 + 4x$

$y = 4x + 12$

$\mathbf{y = 4x + 12}$

$y = -3x + 9$

$y + 3x = -3x + 3x + 9$

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

$y + 3x = 0 + 9$

$y + 3x = 9$

$3x + y = 9$

$\mathbf{3x + y = 9}$

What's More

Activity 1

1. F
2. E
3. A
4. D
5. B

Activity 2

1. $3x - y = -6$
2. $2x + y = 4$
3. $x - 2y = 12$
4. $2x - 3y = 0$
5. $32x + 8y = 1$

Activity 3

A.

1. $y = -\frac{7}{4}x + 5$
2. $y = 2x - 10$

B.

1. $2x - 3y = -9$
2. $3x - 4y = 20$

What Can I Do

1. $y = 50 + 10(x - 2)$
   $y = 10x + 30$
2. ₱ 80
3. 9 km
4. $10x - y = -30$

What I Have Learned

Problem 1:

$7p + 5s = 43$

Problem 2:

$\mathbf{y = 1500x + 3000}$

Assessment

1. A
2. B
3. A
4. A
5. C
6. B
7. B
8. C
9. A
10. C
11. D
12. A
13. A
14. B
15. A

Additional Activities

a. $y = 3\frac{1}{2}x + 2$

b. Week 1 – 5 ½ kg
   Week 2 – 9 kg
   Week 3 – 12 ½ kg
   Week 4 – 16 kg
   Week 5 – 19 ½ kg

c. 7 weeks

d. 7x-2y=-4

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https://sciencing.com/how-to-convert-slope-intercept-form-to-standard-form-13712257.html

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