8

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Mathematics

Quarter 1 – Module 7: "Illustrating Linear Equations in Two Variables"

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8

Mathematics

Quarter 1 – Module 7: "Illustrating Linear Equations in Two Variables"

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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 be acquainted with linear equations in two variables which will help you know how the value of a quantity be predicted given the rate of change. 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- Linear Equations in Two Variables

After going through this module, you are expected to:

1. define linear equations in two variables;
2. determine the value of A, B, and C in $Ax + By = C$;
3. evaluate linear equations in two variables; and
4. model real life situations using linear equations in two variables.

What I Know

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

1. If A, B, and C are real numbers and if A and B are both not equal to 0 then $Ax + By = C$ is called a _____.
   A. linear equation in one variable
   B. linear equation in two variables
   C. system of linear equations
   D. system of linear inequalities

2. Which of the following is the standard form of a linear equation in two variables?
   A. $y = mx + b$
   B. $y = mx - b$
   C. $Ax + By = C$
   D. $Ax - By = C$

3. What is C in the equation $Ax + By = C$?
   A. coefficient
   B. constant
   C. slope
   D. variable

4. If written in standard form, what is the value of B in the equation $4y - 5 = x$?
   A. -5
   B. -4
   C. 0
   D. 1

5. On his notes on linear equation in two variables, Joshua found an equation $2x + 3y = 10$. If you were Joshua, how would you describe the equation according to its form?
   A. It has constant
   B. It has variables
   C. It is in standard form
   D. It is in slope-intercept form

6. Which statement below DOES NOT satisfy the definition of linear equation in two variables?
   A. It has no variable inside a radical sign.
   B. The equation has variable in the denominator.
   C. The standard form of the equation is $Ax + By = C$.
   D. The highest exponent of the variable in each term is 1.

7. In the equation $Ax + By = 5$, what happens when A and B are both zero?
   A. The equation remains true
   B. The equation is not defined
   C. The graph of the equation is vertical
   D. The graph of the equation is horizontal

8. What value of x would make $y = 1$ in the equation $3x + y = 4$?
   A. -1
   B. 0
   C. 1
   D. 2

9. The following are situations which can be modelled by linear equations in two variables **EXCEPT** ONE. Which is it?
   A. calculating the perimeter of a rectangle
   B. calculating the wage of an employee based on hourly rate
   C. finding the total number of bacteria that doubles every hour
   D. cost of hiring a car when a deposit is paid and there is a daily charge

10. What is $10\left(\frac{x}{2} - \frac{1}{5} = y\right)$ in standard form?
   A. $5x - 10y = 2$
   B. $5x + 10y = -2$
   C. $5x + y = \frac{1}{5}$
   D. $\frac{10}{2}x + y = -\frac{1}{5}$

11. If written in standard form, what are the values of A, B, and C in the equation $-21 - 5x = 9 - 3y$?
   A. $A = -5,\ B = -30,\ C = -3$
   B. $A = 5,\ B = -3,\ C = -30$
   C. $A = -3,\ B = -5,\ C = -30$
   D. $A = 3,\ B = 5,\ C = -30$

12. Which ordered pair satisfies the linear equation $2x - 3y = 12$?
   A. $(-5, 2)$
   B. $(-3, 2)$
   C. $(2, -5)$
   D. $(3, -2)$

13. What makes $-3y^2 = -2x - 11$ NOT a linear equation in two variables?
   A. Its degree is not one.
   B. It is not written in standard form.
   C. It does not start with a positive term.
   D. Each of its terms has negative sign.

14. Suppose a survey on household having internet connection in your barangay was conducted. From year 2014 to 2019, the number of households that have internet connection was tallied and observed to increase at a constant rate as shown in the table below.

Year	2014	2015	2016	2017	2018	2019
Number of households that have internet connection	25	31	37	43	49	55

If the pattern continues, can you predict the number of households that would have internet connection by year 2025?

A. Yes, the number of households that have internet connection in 2025 is 85.
B. Yes, the number of households that have internet connection in 2025 is 91.
C. No, because there are information that are not stipulated in the problem.
D. No, because there are many people that cannot afford to subscribe internet connection.

15. During weekends, Marco cleans the basketball court in his barangay and gets paid Php35 per hour and a cash allowance. If you want to compute Mario's total pay given the number of hours x and a cash allowance y, which of the following model is appropriate?

A. $x + y = total\ pay$
B. $x + 35y = total\ pay$
C. $35x + y = total\ pay$
D. $35x + 35y = total\ pay$

Lesson 1 Linear Equations in Two Variables

Anna and Peter's combined score in an exam is 19. Can we write this algebraically? Is it possible to find their individual score?

Problems like the one above can be solved and modelled using linear equations in two variables. Finding their individual score can be confusing but as long as one score is given you can find the other score.

Let us start this lesson by reviewing some properties of real numbers you have learned in your Mathematics 7.

Enjoy learning!

What's In

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 • 1 = a. One, "1" is the **multiplicative identity**.

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

Addition Property of Equality (APE) states that if the same number is added to both sides of an equation, then the equality is still true. In symbol, if $a = b$, then $a + c = b + c$.

Multiplication Property of Equality (MPE) states that when we multiply both sides of an equation by the same number, then the two sides remain equal. That is if $a, b,$ and c are real numbers such that $a = b$, then $a \cdot c = b \cdot c$.

Activity 1: Let's Get Real!

Directions: Fill in the blank with an appropriate term to make the equation correct, then determine the property of real numbers illustrated in each item. Number one is done as your guide.

	EQUATION	MISSING TERM	PROPERTY OF REAL NUMBERS
1.	$4 + \_\_\_\_\_ = 0$	-4	Additive Inverse Property
2.	$\_\_\_\_\_ + 3x = 3x$		
3.	$2x + 3y = 3y + \_\_\_\_\_$		
4.	$(\_\_\_)(5) = 5$		
5.	$(\_\_\_)(7x) = x$		

Bear these properties of real numbers in mind for you will be using these in the succeeding discussion.

What's New

Activity 2: Let's Calculate!

Directions: Consider the situation about Anna and Peter's combined score. Complete the table below by finding the score of one student given the score of the other student, then answer the questions that follow.

ANNA'S SCORE	PETER'S SCORE	ANNA + PETER'S SCORE
1		19
	8	19
5		19
	7	19
17		19

Questions:

1. How did you find the activity? Is it difficult to find the score of one student given the score of the other student?
2. What will be Peter's score if Anna's score is 17?
3. What will you suggest to Peter to get a better score? Would you do the same as to your suggestion?
4. If Anna's score is represented by a variable x and Peter's score by a variable y, how would you write the problem algebraically?
5. The equation you formed in number 4 is an example of linear equation in two variables. What is a linear equation in two variables?

What is It!

In your previous activity, the combined scores of Anna and Peter can be written as follow:

$$Anna's\ Score + Peter's\ Score = 19$$

Replacing Anna's score by a variable x and Peter's score by a variable y, respectively, the equation becomes:

$$x + y = 19$$

This is an example of a linear equation in two variables.

If , , and are real numbers, and if and are not both equal to 0, then is called a ***linear equation in two variables***. The numbers and are the

The equation $x + y = 19$ is written in standard form where $A = 1$, $B = 1$, and $C = 19$. So, when can we say that a linear equation is in its standard form?

The standard form of a linear equation in two variables is written in the order.

Consider the equation below and answer the questions that follow.

$$4y = 6 - 5x$$

Questions:

1. How many variables are used in the equation?
2. How many variable/s in each term?
3. What is the exponent of each variable in each term?
4. Did you see any variable in the denominator?
5. Did you see any variable inside the radical sign?
6. Is the given equation a linear equation in two variables? If so, what are the values of A, B, and C?
7. Is the equation written in standard form? If not, how can we rewrite this in standard form?

The equation $4y = 6 - 5x$ is a **linear equation in two variables** because:

1. it has two variables, x and y;
2. it has only 1 variable in each term;
3. the exponent of the variable in each term is 1 which means the degree of the equation is 1;
4. there is no variable in the denominator; and
5. there is no variable inside a radical sign.

Although the equation $4y = 6 - 5x$ is not in standard form because it is not written in the form $Ax + By = C$**,** but this can be transformed into standard form as follows:

$4y = 6 - 5x$	*Given*
$4y + 5x = 6 - 5x + 5x$	*Additive Inverse Property/ Addition Property of Equality*
$4y + 5x = 6 - 0$	*Additive Inverse Property*
$4y + 5x = 6$	*Additive Identity Property*
$5x + 4y = 6$	*Commutative Property of Addition/ Standard Form*

Therefore, $5x + 4y = 6$ is now written in standard form where $A = 5, B = 4$, and $C = 6$.

A linear equation in two variables have many sets of ordered pair that satisfies the equation.

This time, we will find possible values of x and y that will satisfy the equation $5x + 4y = 6$. What do you think are the values of x and y?

Illustrative Examples

1. Find 2 ordered pairs that satisfy the equation $5x + 4y = 6$.

   Solution:

   To do this, we will assign any value of x, substitute it to the equation to solve for the value of y.

   If $x = 0$, then

$5x + 4y = 6$	*Given*
$5(0) + 4y = 6$	*Substitution*
$0 + 4y = 6$	*Simplified*
$4y = 6$	*Additive Identity Property*
$\left[\frac{1}{4}\right][4y] = 6\left[\frac{1}{4}\right]$	*Multiplicative Inverse Property/ Multiplication Property of Equality*
$y = \frac{6}{4}$	*Multiplicative Identity Property*
$y = \frac{3}{2}$	*Simplified*

   The ordered pair $\left(0, \frac{3}{2}\right)$ satisfies the equation $5x + 4y = 6$.

   If $x = -1$, then

$5x + 4y = 6$	*Given*
$5(-1) + 4y = 6$	*Substitution*
$-5 + 4y = 6$	*Simplified*
$-5 + 5 + 4y = 6 + 5$	*Additive Inverse Property Addition Property of Equality*
$0 + 4y = 11$	*Simplified*
$4y = 11$	*Additive Identity Property*
$\left[\frac{1}{4}\right][4y] = 11\left[\frac{1}{4}\right]$	*Multiplicative Inverse Property Multiplication Property of Equality*
$y = \frac{11}{4}$	*Multiplicative Identity Property / Simplified*

   The ordered pair $\left(-1, \frac{11}{4}\right)$ satisfies the equation $5x + 4y = 6$.

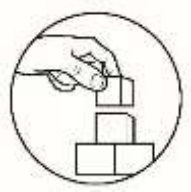
2. Determine if the ordered pair $(2, -3)$ satisfies the equation $2x - y = 7$.

Solution:

In the given ordered pair, $x = 2$ and $y = -3$. Substituting each value, we have

$$\begin{aligned} 2x - y &= 7 \\ 2(2) - (-3) &= 7 \\ 4 + 3 &= 7 \\ 7 &\overset{\checkmark}{=} 7 \end{aligned}$$

Hence, the ordered pair $(2, -3)$ satisfies the given equation.



What's More

Activity 3: Yes or No!

Directions: Write **YES** if each equation below is a linear equation in two variables, otherwise, **NO**. Write your answer on a separate sheet of paper.

1. $3x - 11y = 7$
2. $5x^2 + 4y = 6$
3. $x - \frac{1}{9}y = -9$
4. $\frac{1}{x} + 8\sqrt{y} = 10$
5. $y - 2x - 15 = 0$

Things to remember in identifying linear equation in two variables:

It has two variables.
There is NO more than one variable in each term.
The exponent of the variable in each term is 1 (or the degree of the equation is 1).
There is NO variable in the denominator.
There is NO variable inside radical sign.
Generally, it is written in the form.

Activity 4: Put me into your standard!

Directions: Write each of the following linear equations in two variables in standard form. Do this on a separate sheet of paper.

1. $4y - 12 = 3x$
2. $3 + x = \frac{1}{2}y$
3. $7x + 5y + 25 = 0$
4. $13 = x - y$
5. $3y = 20 - \sqrt{2}x$

Activity 5: Find my pair!

Directions: Match each linear equation in Column A to its corresponding ordered pair in Column B. Write your answer on a separate sheet of paper.

COLUMN A	**COLUMN B**
1. $3x - y = 9$	A. $(-2, -2)$
2. $x - 5y = 2$	B. $(-2, 4)$
3. $x - y = 16$	C. $(1, -3)$
4. $2x - y = 5$	D. $(3, 0)$
5. $x - 3y = 4$	E. $(12, 2)$
	F. $(20, 4)$

What I Have Learned

Activity 6: Fill Me In!

Directions: Complete the paragraph below by filling in the blanks with correct word/s or figure/s which you can choose from the box below. Each word or figure may be used repeatedly. Write your answer on a separate sheet.

A	one	some	standard form	inside radical
B	two	few		outside radical
C	three	many	assigning	substituting
D	four	degree 1	not a linear equation	
E	five	denominator	a linear equation	

Many real-life situations such as budgeting, finding the rate, making predictions, finding the cost, and the like, can be modelled using linear equations. A linear equation in two variables is an equation that has _____ variables. You can use any variable other than x and y provide that no more than _____ variable in each term. The exponent of the variable in each term is _____, hence, it is an equation of _____. If you can see a variable in the _____ or _____ sign, then it is _____ in two variables. This can be written in the form _____ which is the _____. The coefficients of the variables x and y are _____ and _____, respectively, and the constant is _____. You can find an ordered pair that satisfies a linear equation in two variables by _____ values of x or y and then by _____ it to the equation to find the value of the other variable. There are _____ possible set of ordered pairs that satisfy a linear equation in two variables.

What I Can Do

Activity 7: Let's Be Healthy!

Directions: Read the problem below and answer the questions that follow. Do this on a separate sheet of paper.

In year 2020, an emerging disease called Corona Virus Disease 2019 (COVID-19) put the world into a pandemic. Governments encouraged the public to observe safety protocols such as physical distancing, proper hygiene, and to maintain healthy lifestyle. Because of this, Jose's mother wanted to boost her children's immune system to fight the disease. She allotted in her weekly budget an exact amount of Php300 to buy fruits that would help boost the immune system. In the market, the cost of papaya per kilogram is Php40 while kalamansi is Php70 per kilograms.

a. Let x represent the papaya, y the kalamansi, model a linear equation in two variables and write it in standard form.
b. What are the values of A, B, and C in the modelled equation?
c. If she buys 2 kilograms of kalamansi, how many kilograms of papaya can she buy to cost her a total of $Php300$?
d. If due to scarcity of supply, papaya and kalamansi are unavailable in the market, what other alternative fruits that can boost the immune system would you suggest to Jose's mother?

Assessment

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

1. Which of the following is a linear equation in two variables?

A. $x - \frac{1}{y} = 5$
C. $x + 6y^3 = 9$
B. $\sqrt{x} - 2y = 7$
D. $3x + \sqrt{5}y = 2$

2. Which of the following linear equations in two variables is written in standard form?
   A. $2y = 3x - 4$
   B. $5x = 7 - 4y$
   C. $x - y = 11$
   D. $6x - 8y + 7 = 0$

3. Given the equation $13 - 7y = 4x$, what is the value of the coefficient A?
   A. -7
   B. -4
   C. 4
   D. 13

4. What makes $\frac{5}{2} = xy$ NOT a linear equation in two variables?
   A. The equation contains fraction.
   B. The degree of the equation is two.
   C. The left side of the equation has only one term.
   D. The constant should be written on the right side.

5. The following statements below are true about linear equation in two variables *except* one.
   A. The coefficients A and B can be any real number.
   B. It can be written in standard form $Ax + By = C$.
   C. It has no variable in the denominator.
   D. The degree of the equation is one.

6. What will be the value of B in the equation $3x - By = 15$ if $x = 4$ and $y = 3$?
   A. -9
   B. -1
   C. 1
   D. 9

7. In the equation $2x + 3y = 7$, when $y = 1$, which would be the corresponding value of x?
   A. -2
   B. 0
   C. 2
   D. 4

8. What is the value of y in the equation $x - 2y = 4$ given that $x = 8$?
   A. -4
   B. -2
   C. 2
   D. 4

9. If written in standard form, what are the values of A, B, and C in the equation $2x = 4(-y + 5)$?
   A. $A = 2,\ B = -4,\ C = 5$
   B. $A = 2,\ B = -4,\ C = 20$
   C. $A = 2,\ B = 4,\ C = 5$
   D. $A = 2,\ B = 4,\ C = 20$

10. Which equation below satisfies the ordered pair $(-2, -7)$?
    A. $2y = x + 17$
    B. $5x = 12 - y$
    C. $11x - y = -15$
    D. $10x + 2y = 34$

11. Jake was tasked by his teacher to find the value of x in the linear equation $5x + 3y = 21$ given that $y = 2$. His solution is shown below.

$$5x + 3y = 21$$
$$5x + 3(2) = 21$$
$$5x + 6 = 21$$
$$5x + 6 - 6 = 21 + 6$$
$$x = 3$$

Is his solution correct?
    A. Yes, because he substituted the variable y by 2.
    B. Yes, because he followed the process of evaluating linear equation.
    C. No, because twenty-one plus six is twenty-seven.
    D. No, because he is supposed to add of negative six to twenty-one.

For items 12 to 15, refer to the situation below.

Mrs. Flores followed a new weight loss program introduced by her friend. With the hope that the program works for her, she monitored her progress and recorded her weight weekly as follows:

Week	0	1	2	3	4	5
Weight (in kg)	78	76.5	75	73.5	72	71.5

12. If the pattern continues, can you predict her weight on the 10^{th} week of the program?
    A. Yes, her weight by the 10^{th} week is 60.
    B. Yes, her weight by the 10^{th} week is 63.
    C. No, because she might be tempted to cheat.
    D. No, because there is no enough information.

13. If y represents Mrs. Flores' weight and x represents the number of weeks she stays in the program, which equation is appropriate for the situation?
    A. $x + y = 78$
    B. $x - y = 78$
    C. $1.5x + y = 78$
    D. $1.5x - y = 78$

14. How many weeks will she have to stay in the program for her to weigh 60 kilograms?
    A. 13
    B. 12
    C. 11
    D. 10

15. If you are Mrs. Flores what piece of advice could you give to those who are on diet to successfully lose weight?
    A. Eat as much foods and exercise more.
    B. Eat nutritious foods and exercise regularly.
    C. Eat any food once a day and exercise less.
    D. Eat three times a day and sleep very late at night.

Additional Activities

Activity 8: I Can Do It Independently!

Directions: Solve each of the following problems. Show all your solutions on a separate sheet of paper.

1. The difference of two variables x and y is 7. Find two ordered pairs that satisfy this equation if the values of y are 1 and 3.

2. The linear equation $3x + y = 9$ has x values equal to 0 and 2. Find two ordered pairs that satisfy the equation using those values.

Answer Key

What I Know

B

C

B

B

C

B

B

C

What's In

Activity 1:

; Additive Inverse Property

; Additive Identity Property

; Commutative Property of Addition

; Multiplicative Identity Property

: Multiplicative Inverse

What's New

Activity 2

Questions:

Answer vary

Answer vary

A linear equation in two variables is an equation of the form , where , , and are real numbers, and are not both equal to 0.

What's More

Activity 3:

YES

NO

YES

NO

YES

Activity 4:

or

- or

Note: *You are encouraged to write the first term (the term) with positive sign. Multiply the whole equation by whenever term in is negative and simplify.*

What I Have Learned

Activity 6

Many real-life situations such as budgeting, finding the rate, making predictions, finding the cost, and the like, can be modelled using linear equations. A linear equation in two variables is an equation that has **two** variables. You can use any variable other than and provide that no more than **one** variable in each term. The exponent of the variable in each term is **one**, hence, it is an equation of degree 1. If you can see a variable in the **denominator** or **inside the radical** sign, then it is **not** **a linear equation** in two variables. This can be written in the form which is the **standard form**. The coefficients of the variables and are **A** and **B**, respectively, and the constant is **C**. You can find an ordered pair that satisfies a linear equations in two variables by **assigning** values of or and then by **substituting** it to the equation to find the value of the other variable. There are **many** possible set of ordered pairs that satisfy a linear equation in two variables.

What I Can Do

Activity 7

Additional Activities

Activity 8

Answer varies.

1. (8,1) and (10,3)
2. (0,9) and (2,3)

Assessment

D

C

C

B

A

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