8

Mathematics

Quarter 1- Module 8:
Solving Problems Involving System of Linear Equations in Two Variables by (a) Graphing; (b) Substitution; (c) Elimination

AIRs - LM

Mathematics 8
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(a) Graphing, (b)Substitution, (c) Elimination

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.

Target

This module was designed and written with you in mind. It is here to help you master on how to solve problems involving system of linear equations in two variables using graphical and algebraic (substitution and elimination) methods. The scope of this module permits it to be used in many different learning situations. The language and numeric used recognizes the diverse vocabulary and numeracy level of students. 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: Solves Problems Involving System of Linear Equations in Two Variables by (a) Graphing; (b)Substitution;(c) Elimination.

After going through this module, you are expected to:

1. translate word problems into linear equations;
2. solve problems involving system of linear equations in two variables by graphing, substitution and elimination; and
3. Apply the concepts of solving problems involving system of linear equations in dealing with real-life problems.

Pre-test

Direction: Read each item very carefully. Choose the letter of the correct answer. Write your answers on a separate sheet of paper.

1. What do you call the graph of a system of linear equations in two variables which shows only one solution?
   A. intersecting B. coinciding
   C. parallel D. perpendicular
2. What do you call the process of adding the equations to eliminate either x or y from the system of linear equations?
   A. cancellation B. elimination
   C. graphing D. substitution
3. What is the first step in graphing system of linear equations in two variables using slope and y-intercept?
   A. Determine the slope and y-intercept of each equation.
   B. Plot the point containing the y-intercepts of each equation.
   C. Use the slopes to locate the other points of each equation.
   D. Write each equation into the slope-intercept form $y = mx + b$.

4. What is the equivalent slope-intercept form of each equation in the system

$$\begin{cases} 2x + y = -5 \\ 3x - y = -10 \end{cases}$$

A. $\begin{cases} y = 2x + 5 \\ y = 3x + 10 \end{cases}$
B. $\begin{cases} y = -2x + 5 \\ y = 3x - 10 \end{cases}$
C. $\begin{cases} y = -2x - 5 \\ y = 3x + 10 \end{cases}$
D. $\begin{cases} y = 2x - 5 \\ y = 3x - 10 \end{cases}$

5. Jane was asked by her Mathematics teacher to graph a system of linear equations in two variables. After following al l the steps in solving linear equations in by graphing, she was able to draw lines that are parallel to each other. Which of the following can Jane conclude about the solutions of the system?
A. It has no solution.
B. It has one solution.
C. It has two solutions.
D. It has infinitely many solutions.

6. What do you call the process of solving one of the equations for one variable and replacing the resulting expression to the other equation to solve for the other variable without changing the value of the original expression?
A. elimination
B. graphing
C. substitution
D. transformation

For items 7-10. Juana has 2 apples and 3 oranges with a total cost of ₱105.00 while his friend has 1 apple and 4 oranges cost ₱90.00.

7. Which of the following systems of linear equations best represent the situation above?
A. $\begin{cases} 2x + 3y = 105 \\ x + 4y = 90 \end{cases}$
B. $\begin{cases} 2x + 3y = 105 \\ x - 4y = 90 \end{cases}$
C. $\begin{cases} 2x - 3y = 105 \\ x + 4y = 90 \end{cases}$
D. $\begin{cases} 2x + 3y = 90 \\ x + 4y = 105 \end{cases}$

8. Which of the following steps would be the best way to begin with in finding the cost of an apple and the cost of an orange?
A. Multiply equation 2 by −2.
B. Multiply equation 1 by 4 and 2.
C. Add equation 1 and 2.
D. Multiply equation 2 by 2 and add.

9. What is the solution to the system of equations above?
A. (10, 20)
B. (15, 15)
C. (20, 15)
D. (30, 15)

10. How much does Juana pay for her oranges?
A. ₱15.00
B. ₱25.oo
C. ₱45.00
D. ₱90.00

11. Below are the steps in solving problems involving systems of linear equations in two variables. Which of the following is arranged in a chronological order?
I. Read and understand the problem.
II. Check to see if all information is used correctly and that the answer makes sense
III. Translate the facts into a system of linear equations.
IV. Solve the system of equations using one of the methods in solving system of linear equations.
A. I, II, III, and IV
B. I, II, IV and III
C. II, I, III and IV
D. I, III, IV and II

For items 12-14. The sum of two numbers is 100 and their difference is 28.

12. Which of the following systems of linear equation best represent the problem above?

A. $\begin{cases} x + y = 100 \\ x + y = 28 \end{cases}$

B. $\begin{cases} x + y = 100 \\ x - y = 28 \end{cases}$

C. $\begin{cases} x - y = 100 \\ x + y = 28 \end{cases}$

D. $\begin{cases} x + y = 28 \\ x + y = 100 \end{cases}$

13. What method best suited to solve the problem involving system of linear equations?

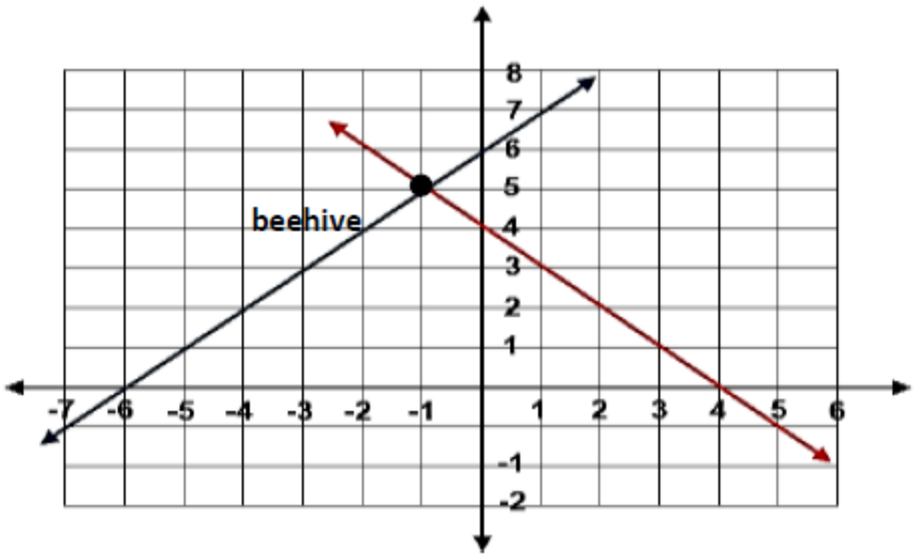
A. cancellation
B. elimination
C. graphing
D. substitution

14. What are the numbers (solution) in the problem?

A. (30, 20)
B. (44, 16)
C. (54, 26)
D. (64, 36))

15. A farmer is tracking two wild honey bees in his field. He maps the first bee's path to the hive on the line x + y = 4. The second bee's path follows the line –x + y = 6. Their paths cross at the hive. At what coordinates will the farmer find the hive?

A. (5, -1)
B. (1, 5)
C. (-1, 5)
D. (1, 5)



Lesson 1	Solving Problems Involving System of Linear equations in Two Variables by (a) Graphing; (b) Substitution; (c) Elimination

Start this module by reactivating your knowledge in solving linear equations for a given variable. These knowledge and skills may help you in solving problems involving systems of linear equations graphically and algebraically (substitution and elimination) to achieve the targets for this module.

Jumpstart

Activity 1: **Transform Me in Terms of the Other**
Directions: Express each equation in terms of the indicated variable then answer the questions that follow. The first item is done for you.

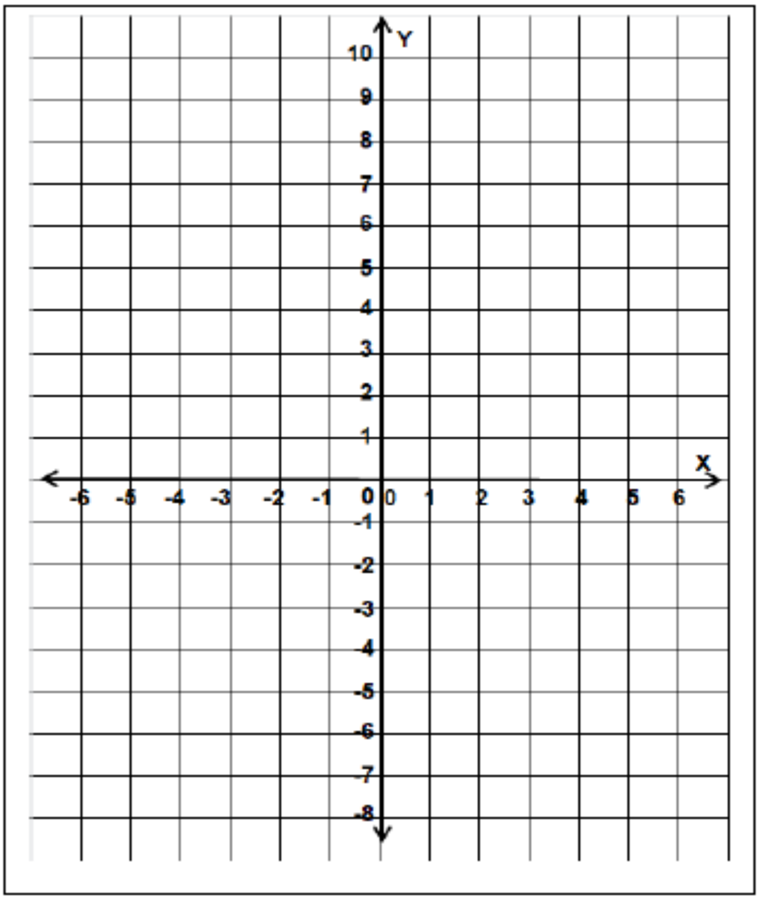
Original Equation	Transformed Equation
1. $x + y = 2$	$x = -y + 2$
2. $x - y = \frac{2}{3}$	x = ___________________
3. $3x + 2y = 6$	x = ___________________
4. $\frac{1}{4}x + y = 2$	y = ___________________
5. $4x - 3y = -33$	y = ___________________

Guide Questions:
1. Was it easy to solve for one variable in terms of the other?
2. In item number 4, was it easy to solve for y in terms of x? How would it be different if you were asked to solve for x in terms of y?
3. Did you find any difficulty in the conduct of the activity? What did you do to overcome this difficulty?

Activity 2: **Perfect Location**

Directions: Graph the given system of linear equations in the Cartesian Coordinate Plane using the slope-intercept form $y = mx + b$, label the graph and answer the guide questions that follow.

$$\begin{cases} 2x + y = 7 \\ x - 2y = 6 \end{cases}$$



Guide Questions:

1. What do the graphs of the system of linear equations look like?
2. What have you noticed with the slopes and y-intercepts of the system of linear equations in two variables?
3. Can there be other ways to solve the system of equations to identify the accurate point of intersection of the graph or the solution?

Discover

Methods in Solving Systems of Linear Equations in Two Variables

A.THE GRAPHING METHOD

Recall that in previous Module, several methods in graphing linear equations in two variables such as the use of any two points, the x – and y – intercepts, the slope and y-intercept, and the slope and a point were introduced. Here, the focus is on the use of the slope and y-intercept to graph the systems of linear equations in two variables.

To help you understand better, try to explore the following examples:

Illustrative Example 1:

Solve the system of linear equation by graphing: $\begin{cases} 3x - y = 3 \\ 2x + y = 2 \end{cases}$

Step 1. Transform each equation into the slope-intercept form y= mx + b and identify the slope and y-intercept.

Equation 1: $\mathbf{3x - y = 3}$

$3x - y = 3$	Given
$3x - y + (\mathbf{-3x}) = 3 + (\mathbf{-3x})$	Add (-3x) to both sides Addition Property of Equality
$-y = -3x + 3$	Inverse Property for Addition
$(-1)(-y = -3x + 3)$	Multiply each term with (-1) Multiplication Prop. of Equality
$\mathbf{y = 3x - 3}$	**Slope-intercept form**

$\boldsymbol{Slope\ (m) = 3;\ y - intercept(b) = -3}$

Equation 2: $\mathbf{2x + y = 2}$

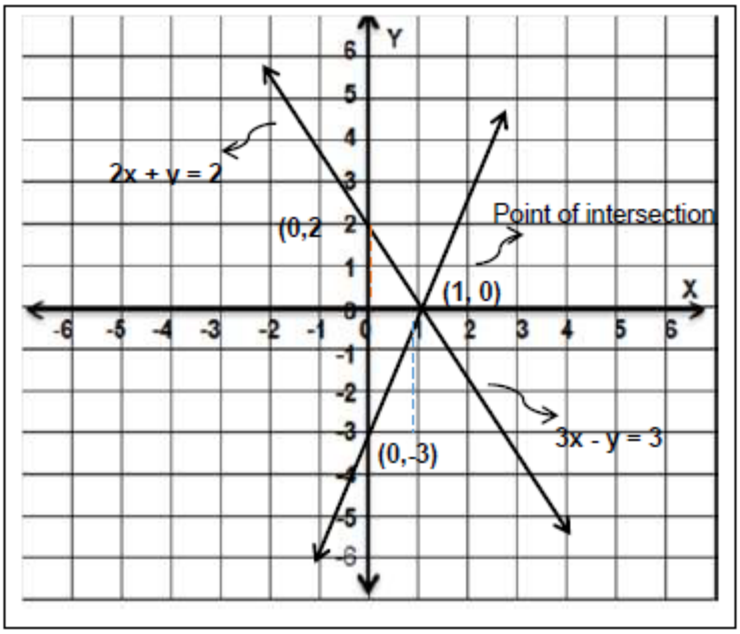
$2x + y = 2$	Given
$(\mathbf{-2x}) + 2x + y = 2 + (\mathbf{-2x})$	Addition Property of Equality
$y = (-2x) + 2$	Inverse Property for Addition
$y = -2x + 2$	**Slope-intercept form**

$\boldsymbol{Slope\ (m) = -2;\ y - intercept(b) = 2}$

Step 2. Graph each equation in one Cartesian Plane and label the graph. Use the slopes and y-intercepts of both equations:

Equation 1: $3x - y = 3$ ➡ $y = 3x - 3$; $m = 3$; $b = -3$

Equation 2: $2x + y = 2$ ➡ $y = -2x + 2$; $m = -2$; $b = 2$



Step 3. Identify the point of intersection and test whether it satisfies both the equations.

The graphs intersect at (1, 0). To determine whether point (1,0) satisfies both the original equations, we simply substitute x = 1, and y = 0 in both equations.

Equation 1: $3x - y = 3$	**Equation 2:** $2x + y = 2$
$3(1) - 2(0) = 3$ $3 - 0 = 3$ $3 = 3$ √	$2(1) + 0 = 2$ $2 + 0 = 2$ $2 = 2$ √

Since substituting (1,0) to both equations give a true statement, then (1, 0) is a solution to the system.

B.THE SUBSTITUTION METHOD

In the above section, we saw that one way to solve a system of linear equations is to graph each equation on the same xy-plane. If the graph is not accurate, then it can be difficult to see the solution. In this section we will look at another method in solving a system of linear equations: the substitution method. When using the substitution method, we use the fact that if two expressions y and x are of equal value $x = y$, then x may replace y or vice versa in another expression without changing the value of the expression. (Mathplanet.com)

Below are the illustrative examples to help you solve systems of linear equations in two variables using substitution method.

Illustrative Example 2:
Solve the system by substitution:

$$\begin{cases} 6x - 3y = -9 \text{ (a)} \\ 2x + 2y = -6 \text{ (b)} \end{cases}$$

To the right of each equation is a label. This will make keeping track of our work much easier. The idea behind the substitution method is to solve one equation for one variable, then substitute this value into the second equation. Once this substitution is made, the second equation becomes a one variable equation. Let us walk through the example above.

Step 1: Solving for a variable (any variable you want)
Looking at the first equation (a), let us solve for y.

$6x - 3y = -9$
$-3y = -6x - 9$ Subtraction Property of Equality
$y = 2x + 3$ Division Property of Equality

Step 2: Substitution
Now let us take a look at the second equation (b). Since we solved for y in the first equation, we know what y is equal to. We will use this value and plug it into the second equation (the variable we are plugging into the equation is in red).

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

Step 3: Simplify and solve
Notice how the second equation changes with the substitution we performed above! Our two variable equation $2x + 2y = -6$ just became the one variable equation $2x + 2(2x + 3) = -6$. And we know how to solve one variable equations.

$2x + 2(2x + 3) = -6$
$2x + 4x + 6 = -6$ Distributive Property
$6x + 6 = -6$ Combine like terms
$6x = -12$
$x = -2$

Step 4: Finding the second value
We are almost done. We have what x is equal to and now we just need what y is equal to. Looking back at Step 1 we actually have an idea of what y is. Now that we have a value for x, let us plug this value (shown in blue) into the Step 1 equation and simplify.

$y = 2x + 3$
$y = 2(-2) + 3$ Plug in the value of x which is -2
$y = -4 + 3$ Simplify
$y = -1$

Therefore, our solution to this system is $x = -2$ and $y = -1$. Since the solution represents the point of intersection, let us write our solution as a point: $(-2, -1)$.
If there exists at least one solution to the system, then the system is called a consistent system. A consistent system with one unique solution (as shown above) is said to have an independent solution. A consistent system with more than one solution is said to have a dependent solution. If no solution exists to the system, then the system is called an inconsistent system.

C.THE ELIMINATION METHOD

The third method in solving a system of linear equations is the elimination method (also called the addition method). Let us look at an example to see how the elimination method is carried out.

Illustrative Example 3:

Given the system below, solve it by the elimination method.

$$3x - 4y = 8$$
$$5x + 4y = -24$$

Step 1: Lining up the variables

To begin the process of the addition method we want to start by lining up the variables. Notice in the system above how the first term in each linear equation has the same variable: x. Likewise, how the second term in each linear equation has the same variable: y. Finally, on the right side of the equal sign, we have the numbers with no variables.

Step 2: Adding both equations

Now that the linear equations are lined up nicely, let us add them together

$$\begin{array}{r} 3x - 4y = 8 \\ + 5x + 4y = -24 \\ \hline 8x + \quad = -16 \\ x = -2 \end{array}$$

Notice that adding both equations together allows us to eliminate one variable and solve for the other simultaneously. So $x = -2$.

Step 3: Finding the second value

Now that we have one value let us solve for the other. To get the second value all we need to do is plug the value we found into one of the initial linear equations. It doesn't matter which one we choose, so let us pick the first one.

$3x - 4y = 8$	
$3(-2) - 4y = 8$	Plug in the value of x which is -2
$-6 - 4y = 8$	Simplify
$-4y = 14$	(Add 6 both sides) Addition Prop. of Equality
$y = -\frac{14}{4}$	Division Property of Equality
$y = -\frac{7}{2}$	Simplify

Our solution is therefore $x = -2$ and $y = -\frac{7}{2}$. Since our solution represents a point of intersection, let us write our solution as an ordered pair: $(-2, -\frac{7}{2})$

Solving Problems Involving Systems of Linear Equations in Two Variables

You have learned that systems of linear equations in two variables can be solved by graphing, substitution and elimination methods. This time, let us apply these methods in solving problems involving real-life scenarios. We can solve these problems by translating them to systems of equations and by using the problem-solving procedures as enumerated below.

Steps in problem-solving: (Polya's Approach)

1.Understand the problem. Read the problem carefully and decide which quantities are unknown.
2. **Develop a plan (Translate).** Study the stated facts until you understand their
meaning. Then translate the related facts into equations in two variables.
3. **Carry out the plan (Solve).** Use one of the methods for solving systems of equations. State the conclusions clearly. Include unit of measure if applicable.

To help you understand better, try to explore the following illustrative examples below on solving problems involving systems of linear equations in two variables by graphing, substitution and elimination:

Illustrative Example 4. **(Age Problem)**
The sum of Janna age and Jelo's age is 40. Two years ago, Janna was twice as old as Jelo. Find Janna's age now.
Step 1: Understand the problem.
Make sure that you read the question carefully several times. Since we are looking for Janna's age, we will let

$\boldsymbol{x}$ = Janna's age,
$\boldsymbol{y}$ = Jelo's age

Step 2: Devise a plan (translate).
Since we have 2 unknowns, we need to form a system with two equations.
For equation 1: The sum of Janna and Jelo's age is 40. ➡ $\boldsymbol{x + y = 40}$
For equation 2: Two years ago, Janna was twice as old as Jelo.
Janna (two years ago) = 2 times Jelo's age (two years ago)
$x - 2 = 2(y - 2)$ *Simplify. Use distributive Property*
$x - 2 = 2y - 4$ *Combine like terms*
$\boldsymbol{x - 2y = -2}$

Putting the two equations together in a system we get:
Equation 1 $x + y = 40$
Equation 2 $x - 2y = -2$

Step 3: Carry out the plan (solve).
Use one of the methods for solving systems of equations. For this example, we Use elimination method. Since the numerical coefficients of x are equal, we can use elimination by subtraction.

$x + y = 40$ Equation 1
$x - 2y = -2$ Equation 2

To find Jelo's age,

$x + y = 40$ *Eliminate x by subtraction & solve for y*
$-\ \underline{x - 2y = -2}$

$3y = 42$

$\frac{1}{3}(3y) = \frac{1}{3}(42)$ *Multiply both sides by* $\frac{1}{3}$ *by Multiplication Property of Equality*

$\boldsymbol{y = 14}$ *By simplification*

To find Janna's age

$x + y = 40$ *Use equation 1 to find Janna's age*

$x + 14 = 40$ *Substitute the value of y obtained*

$x + 14 - 14 = 40 - 14$ *Add both sides by −14 by Addition Property of Equality*

$\boldsymbol{x = 26}$ *By simplification*

Step 4: Look back (check and interpret).

Check answers directly against the facts of the problems. Substitute the value of x and y to both equations

Sum of Janna's and Jello's age
$$x + y = 40$$
$$26 + 14 = 40$$
$$40 = 40$$

Two years ago, Janna was twice as old as Jelo
$$-x + 2y = 2$$
$$-26 + 2(14) = 2$$
$$-26 + 28 = 2$$
$$2 = 2$$

Therefore: Janna's age is 26

Illustrative Example 5: (Number Problem)

The sum of two numbers is 14 and their difference is 2. Find the numbers.

Step 1: Understand the problem.

Make sure that you read the question carefully several times. Since we are looking for the two numbers, we will let

$\boldsymbol{x}$ = first number,

$\boldsymbol{y}$ = second number

Step 2: Devise a plan (translate).

Since we have 2 unknowns, we need to form a system with two equations

For equation 1: The sum of two numbers is 14 ➡ $x + y = 14$

For equation 2: Their difference is 2. ➡ $x - y = 2$

Putting the two equations together in a system we get:
equations together in a system we get:

$$\begin{cases} x + y = 14 & \text{Equation 1} \\ x - y = 2 & \text{Equation 2} \end{cases}$$

Step 3: Carry out the plan (solve).

Use one of the methods for solving systems of equations. For this example, we use elimination method since the coefficients of variable y are already the same and with opposite signs.

To find the first number:

$x + y = 14$ *Eliminate y by addition to find the value of x*

$x - y = 2$

$2x = 16$

$\frac{1}{2}(2x) = \frac{1}{2}(16)$ *Multiply both sides by ½ by Multiplication Property of Equality*

$\boldsymbol{x = 8}$ *By simplification.*

To find the second number.

$x + y = 14$ *Use equation 1 to find the second number*

$8 + y = 14$ *Substitute the value of x*

$8 + y - 8 = 14 - 8$ *Add* (-8) *to both sides by Addition Property of Equality*

$\boldsymbol{y = 6}$ *By simplification*

Step 4: Look back (check and interpret).

Check answers directly against the facts of the problems. Substitute the value of x and y to both equations.

$x + y = 14$	$x - y = 2$
$8 + 6 = 14$	$8 - 6 = 2$
$14 = 14$ √	$2 = 2$ √

Therefore, the first number is 8, and the second number is 6

Illustrative Example 6: (Break-even Point Problem)

Mrs. Perez is trying to decide between two hotels to be the venue of her daughter's 18th birthday celebration. Both venues are spacious and elegant and can provide LED screen. Hotel ***A*** charges Php12,000.00 for the venue rental, plus an additional Php500.00 per hour for the extended hours used. Hotel ***B*** charges Php10,500.00 for the venue rental, plus Php1,000.00 per hour for the extended hour used. At how many hours will the two hotels charge the same amount of money? If you are to recommend to Mrs. Perez as to which of the two venues shall be the venue of her daughter's 18th birthday celebration, which hotel will you recommend? Why?

Step 1: Understand the problem.

Make sure that you read the question carefully several times. Since we are looking for an ordered pair, we will let

x = number of hours of extended use
y = total cost (rental cost plus the additional charge per hour)

Step 2: Devise a plan (translate).

Since we have 2 unknowns, we need to form a system with two equations

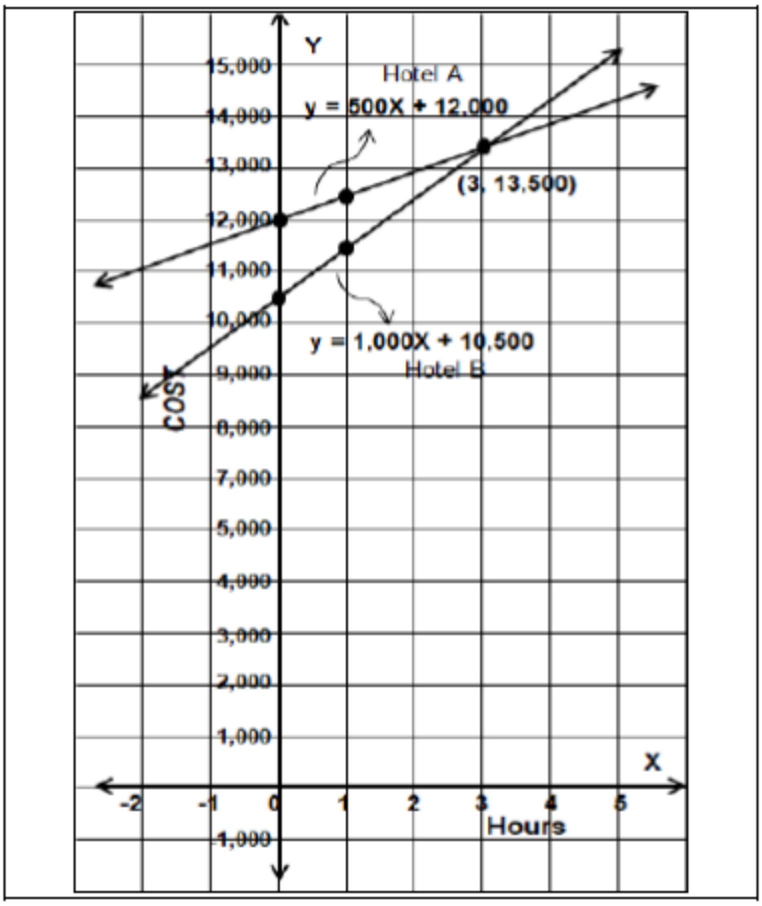
For equation 1 $y = 500x + 12{,}000$
For equation 2 $y = 1{,}000x + 10{,}500$

Step 3: Carry out the plan (solve).

Use one of the methods for solving systems of equations. Since the problem asks us to determine the number of hours where the two hotels charges the same amount of money, we can solve this graphically. To graph the equations obtained in step 2, simply determine the slopes and y-intercepts of the equations since the two equations obtained in step 2 are already in slope-intercept form.

For eq.1 $y = 500x + 12{,}000$; m = 500; b = 12,000
For eq.2 $y = 1{,}000x + 10{,}500$; m = 1,000; b = 10,500

The point of intersection of the graphs refers to a point where the two hotels charge the same amount of money.



Step 4: Look back (check and interpret).

Check answers directly against the facts of the problems. Substitute the value of x and y to both equations.

$y = 500x + 12,000$	$y = 1000x + 10,500$
$13,500 = 500(3) + 12,000$	$13,500 = 1000(3) + 10,500$
$13,500 = 1,500 + 12,000$	$13,500 = 3,000 + 10,500$
$13,500 = 13,500$	$13,500 = 13,500$

Therefore, the number of hours the two hotels charges the same amount is when the extended hours reach 3 hours at Php13,500.00

To answer Question No. 2, let us find the value of y when the extended number of hours is less than 3 hours and when the extended number of hours is more than 3 hours. Suppose we solve for y in both equations when x = 2 and when x = 4.

Equation 1: $y = 500x + 12{,}000$ (Hotel A)	Equation 2 : $y = 1000x + 10{,}500$ (Hotel B)
Solve for y, when $x = 2$	Solve for y, when $x = 2$
$y = 500x + 12{,}000$	$y = 1000x + 10{,}500$
$y = 500(2) + 12{,}000$	$y = 1000(2) + 10{,}500$

At x = 2, the cost of Hotel A is higher than the cost of Hotel B.

Equation 1: $y = 500x + 12{,}000$ (Hotel A)	Equation 2 : $y = 1000x + 10{,}500$ (Hotel B)
Solve for y, when $x = 4$	Solve for y, when $x = 4$
$y = 500x + 12{,}000$	$y = 1000x + 10{,}500$
$y = 500(4) + 12{,}000$	$y = 1000(4) + 10{,}500$

At x = 4, the cost of Hotel A is lower than the cost of Hotel B.

This means that Hotel B is recommended if the extended number of hours is less than3 hours, both hotels A & B can be recommended if the extended number of hours is exactly 3hours, and Hotel A is recommended if the extended number of hours is more than 3 hours.

Explore

Activity 1: Substitute!

Directions: Solve each system of equations by substitution. Check your solutions.

1. $\begin{cases} 3x - y = 4 \\ 2x - 3y = -9 \end{cases}$
2. $\begin{cases} y = 2x \\ x + y = 6 \end{cases}$
3. $\begin{cases} 5x + 2y = -17 \\ x = 3y \end{cases}$

Activity 2: Following Protocols

Directions: Solve the problem below by illustrating the process of finding solution. Write your answer on a separate sheet of paper.

Leo and Lea are selling fruit for a school fundraiser. Customers can buy small and large boxes of guavas. Leo sells 3 small boxes and 14 large boxes of guavas for a total of Php 203.00. Lea sells 11 small boxes of guavas and 11 large boxes of guavas for a total of Php 220.00. Find the cost of a small box and large box of guavas.

Step 1. Understand the problem	Let x Let y
Step 2. Devise a plan (translate)	Equation 1: Equation 2:
Step 3. Carry out the plan (solve).	Solution:
Step 4. Look back (Check and interpret)	Check:

Activity 3: Problems Solved!

Directions: Read each problem carefully and solve as required. Then answer the questions that follow. Use a separate sheet of paper.

A. The Number Game

The sum of two numbers is 90. The larger number is 14 more than 3 times the smaller number. Find the numbers.

Questions:

1. What equations can be formed to determine the two numbers?
2. What method of solving systems of linear equation in two variables can best be applied to solve this problem?
3. What are the two numbers?

B. Chocolate Desires

White chocolate costs *Php* 20.00 per bar, and dark chocolate costs *Php* 25.00 per bar. If Jana bought 15 bars of chocolate for *Php* 340, how many bars of dark chocolate did she buy?

Questions:

1. What two equations can be formed to represent the number of chocolate bars?
2. What method of solving systems of linear equations in two variables can best be applied to solve this problem? Why do you think the method you chose is appropriate to solve this type of problem?
3. How many bars of dark chocolate did Janine buy?

Deepen

With the illustrative examples you've encountered in this module that depict real-life applications of solving problems involving system of linear equations in two variables, let's turn the table around this time.

Activity: It's Your Turn

Do the following. Use a separate sheet of paper (graphing paper) for your output.

1. Formulate at least one real-life problems involving system of linear equations in two variables.
2. Solve the problems you formulated accurately using the three methods. Show complete solution and the graph.

Be guided with the following rubric:

Points	Indicators
10	The problem is clear, detailed and organized; No grammatical issues; Choose an efficient strategy that made sense; All of the steps in the solution are correct
8	The problem is clear and detailed; A few grammatical issues; Choose a strategy that made sense; A few of the steps in the solution are correct
6	The problem is not clear, not detailed and not organized; Lots of grammatical issues; The strategy doesn't make sense; All of the solutions are incorrect.

Gauge

Direction: Read each item very carefully. Choose the letter of the correct answer. Write your answers on a separate sheet of paper.

For items 1-3: Use the system $\begin{cases} x + y = 2 \\ x - y = 4 \end{cases}$ to answer the questions that follow.

1. What are the slope-intercept form of each equation?

A. $\begin{cases} y = -x + 2 \\ y = -x + 4 \end{cases}$ B. $\begin{cases} y = -x + 2 \\ y = x + 4 \end{cases}$

C. $\begin{cases} y = -x + 2 \\ y = x - 4 \end{cases}$ D. $\begin{cases} y = x - 2 \\ y = x + 4 \end{cases}$

2. What are the slopes and y-intercepts of each equation?

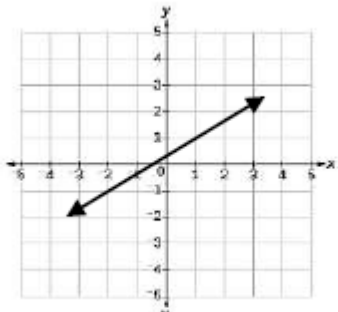
A. $\begin{cases} m1 = 1;\ b1 = -2 \\ m2 = 1;\ b2 = 4 \end{cases}$

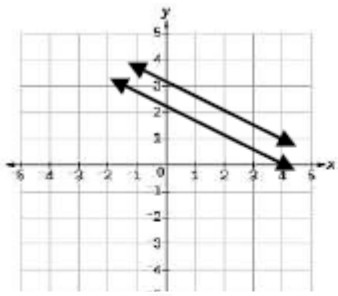
B. $\begin{cases} m1 = -1;\ b1 = 2, \\ m2 = 1;\ b2 = -4 \end{cases}$

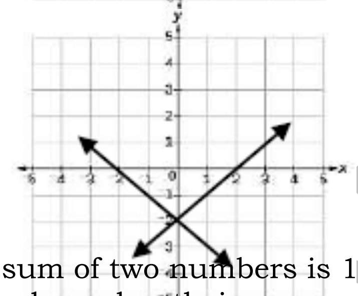
C. $\begin{cases} m1 = -1;\ b1 = 2, \\ m2 = 1;\ b2 = 4 \end{cases}$

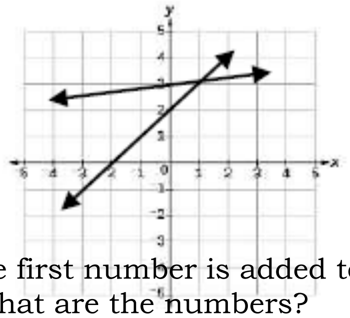
D. $\begin{cases} m1 = -1;\ b1 = 2, \\ m2 = -1;\ b2 = 4 \end{cases}$

3. What is the point of intersection of the graph?
   A. (-3, −1)
   B. (3,1)
   C. (3, −1)
   D. (−3,1)
4. Which method is best to use when the numerical coefficients of the variables are either 1 *or* -1?
   A. algebraic
   B. elimination
   C. graphical
   D. substitution
5. Which of the following shows the graph of a line whose slope is – ½ and whose y-intercepts are 2 and 3, respectively?

A.


B.


C.


D.


6. The sum of two numbers is 15. If twice the first number is added to thrice the second number their sum would be 35. What are the numbers?
   A. 7 and 8
   B. 9 and 6
   C. 10 and 5
   D. 12 and 3
7. A total of 315 Grade 8 students participated in a community outreach program organized by the local government. Some students rode in vans which hold 9 passengers each and some students rode in buses which hold 22 passengers each. How many of each type of vehicle did they use if there were 22 vehicles in total?
   A. 9 vans and 13 buses
   B. 13 vans and 9 buses
   C. 15 vans and 7 buses
   D. 7 vans and 15 buses

For item 8-9. 3 bags and 2 pairs of shoes cost Php1, 500.00 while 5 bags and 8 pairs of shoes cost Php4 950.00.

8. Which of the following systems of linear equations best represent the problem above?

A. $\begin{cases} 3x + 2y = 4950 \\ 5x + 8y = 1500 \end{cases}$

B. $\begin{cases} 3x + 8y = 1500 \\ 5x + 2y = 4950 \end{cases}$

C. $\begin{cases} 3x + 8y = 148 \\ 5x + 2y = 60 \end{cases}$

D. $\begin{cases} 3x + 2y = 1500 \\ 5x + 8y = 4950 \end{cases}$

9. What is the cost of each bag and a pair of shoes?
A. Each bag cost Php250.00 and each pair of shoes cost Php425.00.
B. Each bag cost Php275.00 and each pair of shoes cost Php400.00.
C. Each bag cost Php200.00 and each pair of shoes cost Php475.00.
D. Each bag cost Php150.00 and each pair of shoes cost Php525.00.

10. Ruel says that the system $\begin{cases} x + y = 10 \\ 3x - y = 2 \end{cases}$ has exactly one solution. Which of the Following reasons would support his statement?

I. The graph of the system intersects at (3,7).
II. The graph of the system shows intersecting lines.
III. The graph of the system shows coinciding lines.
IV. The graph of the system shows parallel lines.

A. I only
B. I and II
C. III
D. IV

For item 11-13. A farmyard has dogs and chickens. The owner said that his dogs and chickens had a total of 148 legs and 60 heads.

11. Which of the following systems of linear equations best represent the situation above?
A. $\begin{cases} 4x + 2y = 148 \\ x + y = 60 \end{cases}$
B. $\begin{cases} 4x + 4y = 148 \\ x - 4y = 60 \end{cases}$
C. $\begin{cases} 4x - 2y = 148 \\ x + 4y = 60 \end{cases}$
D. $\begin{cases} 4x + 2y = 60 \\ x + y = 148 \end{cases}$

12. What method best suited to solve the problem involving system of linear equations?
A. cancellation
B. elimination
C. graphing
D. substitution

13. How many dogs and chickens were in the farmyard?
A. 22 dogs and 38 chickens
B. 38 dogs and 22 chicken
C. 14 dogs and 46 chickens
D. 46 dogs and 14 chickens

14. A Grade 8 student asked his friend to help him transform the system
$$\begin{cases} x + 2y = 22 \\ 3x - 4y = 16 \end{cases}$$
into the slope-intercept form $y = mx + b$ since he will be needing this to graph the system. His friend gave him answer $\begin{cases} y = \frac{1}{2}x + 11 \\ y = \frac{4}{3}x - 4 \end{cases}$. Was his friend correct?

I. Yes, no errors were committed.
II. No, because the slope of equation 1 should be $-\frac{1}{2}$.
III. No, because the slope of equation 2 should be $\frac{3}{4}$

A. I
B. II only
C. III only
D. Both II and III

15. Trish was asked by her Math teacher to solve the system $\begin{cases} x = 2y + 3 \\ 2x + 3y = -3 \end{cases}$. She decided to use substitution method to solve the system. Which of the following statements justify her choice of method?

I. It is always the recommended method for systems with one solution.
II. It is recommended because one of the equations is not in standard form.
III. Substitution should be used since one of the equations is already solved in terms of one variable.

A. I
B. II
C. III
D. I and II

References

Books

- Mathematics 8 Learner's Module. Pasig City. Print Media Press, Inc., 2013
- Orlando A. Oronce, Marilyn O. Mendoza. Exploring Math 8- Textbook. Manila. Rex Book Store, Inc.,2018
- Orlando A. Oronce, Marilyn O. Mendoza. Exploring Math 8- Teacher's Manual. Manila. Rex Book Store, Inc.,2018
- Evelyn Zara. Pratical Mathematics 8, K – 12. Lipa City. United Eferza Academic Publications Co., 2013

Links

- https://opentextbc.ca/elementaryalgebraopenstax/chapter/solve-systems-of-equations-by-graphing/
- https://opentextbc.ca/elementaryalgebraopenstax/chapter/solve-systems-of-equations-by-substitution/
- https://opentextbc.ca/elementaryalgebraopenstax/chapter/solve-systems-of-equations-by-elimination/
- https://sccollege.edu/Faculty/epham/Documents/Introductory%20Algebra%20Jan%2018/Chapter%206%20-%20Systems%20of%20two%20linear%20equations%20in%20two%20variables.pdf

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