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DEPARTMENT OF EDUCATION

Mathematics

Quarter 1 – Module 15: “Graphing Systems of Linear Equations in Two Variables”

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Mathematics

Quarter 1 – Module 15:

“Graphing Systems of Linear Equations in Two Variables’’

DEPARTMENT OF EDUCATION

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.

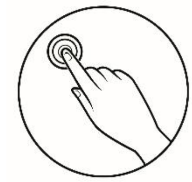
Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer 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

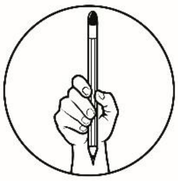
This module was designed and written with you in mind. It is here to help you master the skills of graphing systems of linear equations in two variables. You are provided with varied activities to process the knowledge and skills learned and to deepen and transfer your understanding of the lesson. The scope of this module enables you to use it 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- Graphing Systems of Linear Equations in Two Variables

After going through this module, you are expected to:

1. describe the graph of the systems of linear equations in two variables as parallel, intersecting, or coinciding;
2. determine through graphs whether the system is consistent and independent, consistent and dependent, or inconsistent;
3. appreciate the use of graphs of the systems of linear equations as basis for making decisions; and
4. graph systems of linear equations in two variables.



What I Know

Pre- Assessment:

Directions: Choose the letter of the correct answer. Write your answer on a separate sheet of paper. Take note, you may skip this module if you get 100% correct answers.

1. What do you call the graph of a system of linear equations in two variables which shows only one solution?
   A. coinciding
   B. intersecting
   C. parallel
   D. none of these

2. How do you describe the graphs of the system of linear equations in two variables which has no solution?
   A. coinciding
   B. intersecting
   C. parallel
   D. none of these

3. How many solutions does a system of linear equations in two variables have if the graphs are intersecting?
   A. one
   B. two
   C. no solution
   D. infinitely many

4. How many solutions does a system of linear equations in two variables have if the slopes of the lines are equal and the y-intercepts are also equal?
   A. one
   B. two
   C. no solution
   D. infinitely many

5. What do you call a system of linear equations in two variables having infinitely many solutions?
   A. inconsistent
   B. inconsistent and dependent
   C. consistent and dependent
   D. consistent and independent

1. 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 $y = mx + b$.

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

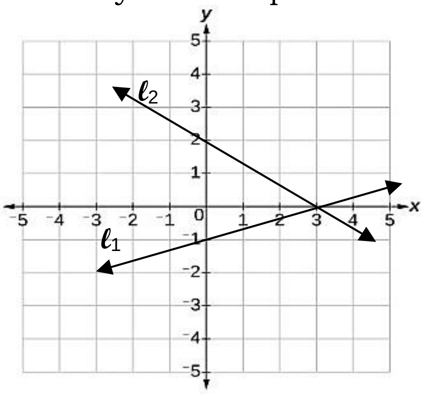
D. $\begin{cases} y = 2x - 5 \\ y = 3x - 10 \end{cases}$

8. If you will graph the system $\begin{cases} y = 3x - 2 \\ 2x + y = 8 \end{cases}$, then what is the point of intersection of the two graphs?

A. $(2,4)$
B. $(4,2)$
C. $(3,-2)$
D. $(-6,-20)$

9. What is the solution to the system of equations shown in the graph?

A. $(0,-1)$
B. $(0,2)$
C. $(0,3)$
D. $(3,0)$



10. Which system of linear equations is represented by the graph in item no. 9?

A. $\begin{cases} x + 3y = -3 \\ 2x + 3y = 6 \end{cases}$

B. $\begin{cases} x + 3y = 3 \\ 3x + 2y = 6 \end{cases}$

C. $\begin{cases} x - 3y = 3 \\ 3 + 2y = 6 \end{cases}$

D. $\begin{cases} x - 3y = 3 \\ 2x + 3y = 6 \end{cases}$

11. Which of the following systems of linear equations has intersecting graphs?

A. $\begin{cases} x + y = 3 \\ x + y = 2 \end{cases}$

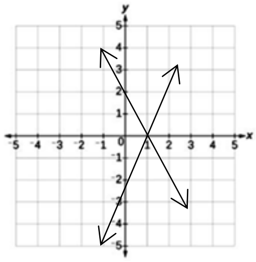
B. $\begin{cases} 3x - 2y = 5 \\ 6x - 4y = 10 \end{cases}$

C. $\begin{cases} 2x - y = 2 \\ 3x + y = 2 \end{cases}$

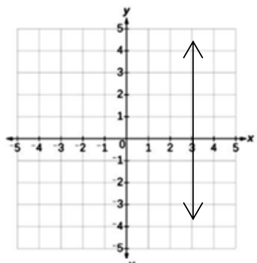
D. $\begin{cases} 3x + y = 2 \\ 3x + y = -2 \end{cases}$

12. Which of the following is the graph of the system $\begin{cases} 3x - y = 3 \\ 2x + y = 2 \end{cases}$?

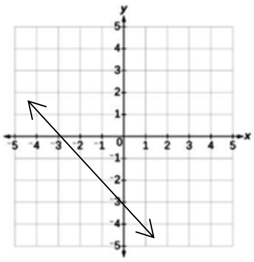
A.



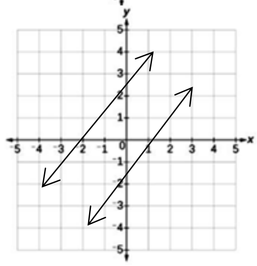
C.



B.



D.



13. Which system of linear equations has coinciding graphs?

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

C. $\begin{cases} x + y = -2 \\ 3x + 3y = -6 \end{cases}$

B. $\begin{cases} 2x - 3y = 5 \\ x + 3y = 1 \end{cases}$

D. $\begin{cases} 5x - 2y = 7 \\ 3x + 2y = 9 \end{cases}$

14. What value of k will make the graph of the system $\begin{cases} 2x + y = 3 \\ 4x + ky = 6 \end{cases}$ coinciding?

A. 4
C. 0
B. 2
D. -2

15. Jane was asked by her Mathematics teacher to graph a system of linear equations in two variables. After following all the steps in solving linear equations 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.

Lesson 1 Graphing Systems of Linear Equations in Two Variables

Start this module by assessing your knowledge and skills in graphing linear equations in two variables as discussed in Module 10. These knowledge and skills may help you in solving systems of linear equations graphically and achieve the targets for this module.

What's In

Activity 1: Remember Me

Directions: Graph each linear equation using the given condition and the method indicated. Use graph paper to plot accurately the points. Label each graph.

1. $3x + 4y = 12$, using the $x-$ $and\ y - intercept$

2. $2x - y = 3$, using the $slope\ (m)$ and $y - intercept\ (b)$

Guide Questions:

1. What did you do to find the x-and y-intercept of $3x + 4y = 12$?
2. What is the x-intercept of $3x + 4y = 12$? What is its y-intercept?
3. What did you do to determine the slope and y-intercept of $2x - y = 3$?
4. What is the slope of $2x - y = 3$? What is its y-intercept?
5. Were you able to graph the linear equations correctly?
6. Did you find any difficulty in the conduct of the activity? What did you do to overcome this difficulty?

What's New

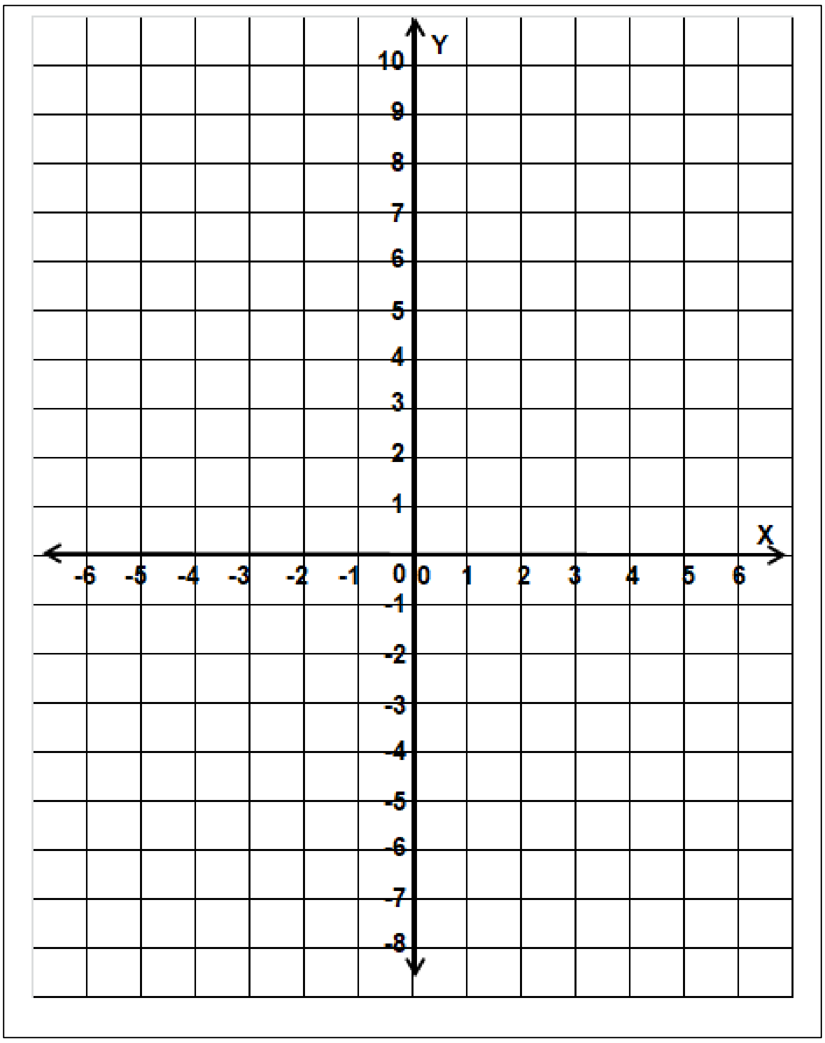
Activity 2: Perfect Location

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

1. $\begin{cases} -5x + y = 10 \\ 10x - 2y = -8 \end{cases}$

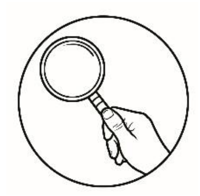
2. $\begin{cases} 3x + 2y = -12 \\ -4x + y = 5 \end{cases}$

3. $\begin{cases} 5x - 5y = -15 \\ x - y = -3 \end{cases}$



Guide Questions

1. What do the graphs of each pair of linear equations look like?
2. What have you noticed with the slopes and y-intercepts of a pair of linear equations in two variables when the graphs intersect at only one point? when the lines do not intersect? when all the points are the same?



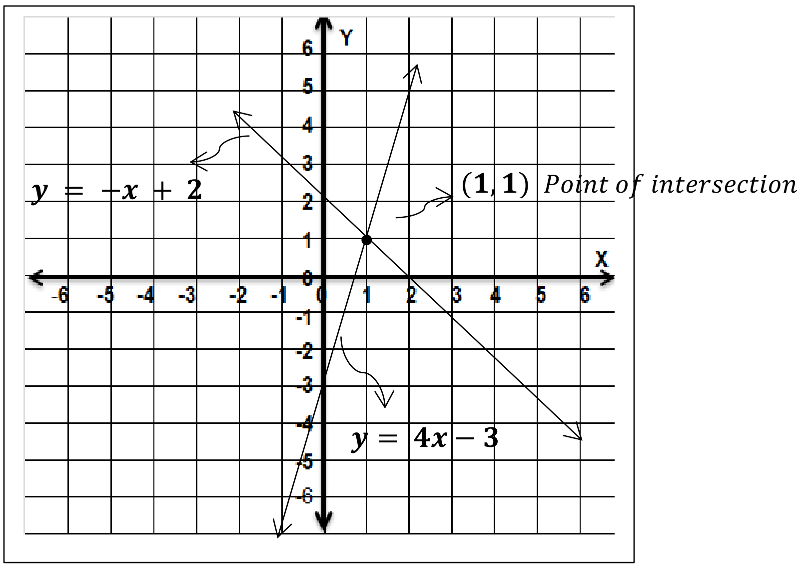
What is It

Recall that in Module 14: Illustrating Systems of Linear Equations in Two Variables, a **system of linear equations** is defined as a set of two or more linear equations with the same variables.

Recall further that every point on the graph of an equation is a solution. However, a **solution** to a system of linear equations in two variables is a set of numbers that, when we substitute them for specified variables in the system, makes each equation in the system a true statement.

The lines of each equation in the systems of equations in two variables do not always intersect at exactly one point, hence, it does not always have a unique solution. In fact, there are three possibilities as shown in the figures below:

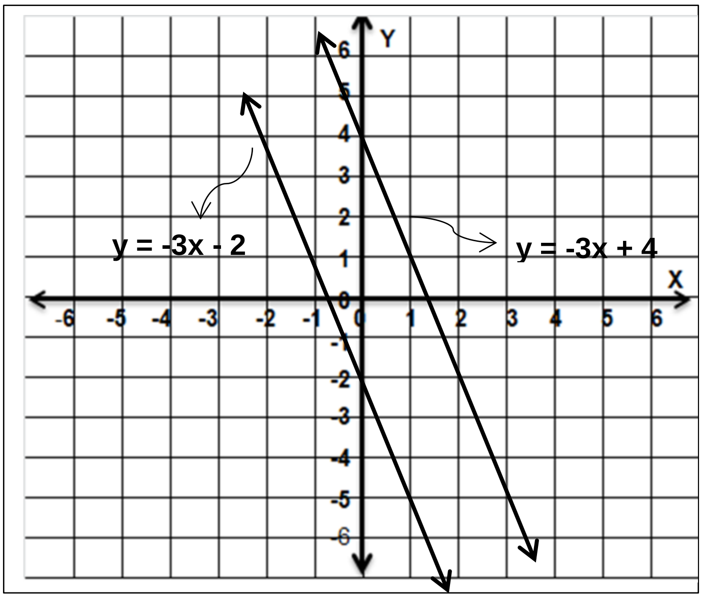
Figure 1. A system of linear equations whose graphs are intersecting lines



Notice that:

- The lines $y = -x + 2$ and $y = 4x - 3$ have different slopes
- The graphs intersect at only one point, hence, the system has only **one solution**
- The graphs intersect at (1, 1) so the solution of the system is (1, 1)

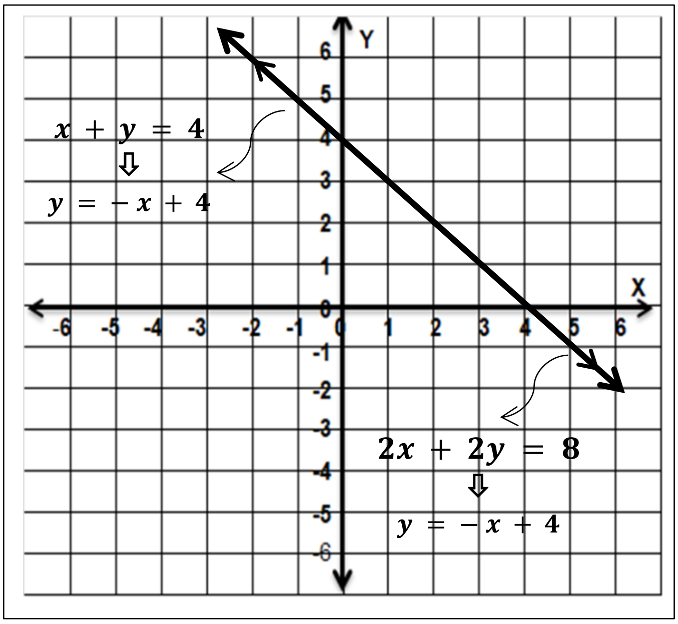
Figure 2. A system of linear equations whose graphs are parallel lines



Notice that:

- $y = -3x - 2$ and $y = -3x + 4$ have the same slopes but different y-intercepts
- The graphs do not intersect, so the system **has no solution.**

Figure 3. A system of linear equations whose graphs are coinciding



Notice that:

- $x + y = 4$ and $2x + 2y = 8$ can both be written as $y = -x + 4$
- the lines have the same slopes and the same y-intercepts
- the graphs are coinciding or are the same lines, hence, the system **has infinitely many solutions**

Based on the illustrations above, when can you say that a system **has one solution**? **no solution**? **or infinitely many solutions**?

To easily determine the number of solutions to a system of linear equations in two variables, transform each equation into the slope-intercept form $y = mx + b$ where m is the slope and b is the y-intercept. Based on the figures 1, 2, and 3 shown in the previous pages, we can conclude that the system of linear equations in two variables has:

1. only **one solution** if the **slopes of the equations are not equal**, that is, $m_1 \neq m_2$;
2. **no solution** if the **slopes of the equations are equal but the y-intercepts are not equal**; that is, $m_1 = m_2, b_1 \neq b_2$; and
3. **infinitely many solutions** if the **slopes are equal and the y-intercepts are equal**, that is, $m_1 = m_2$and $b_1 = b_2$.

Recall that in Module 10: Graphing Linear Equations, 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:

Example 1: Find the solution of the system of linear equations 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: $\boldsymbol{3x - y = 3}$

$3x - y = 3$	Given
$3x - y + (-\boldsymbol{3x}) = 3 + (-\boldsymbol{3x})$	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 Property of Equality
$\boldsymbol{y = 3x - 3}$	**Slope-intercept form**

Slope (m) = 3; y − intercept(b) = −3

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

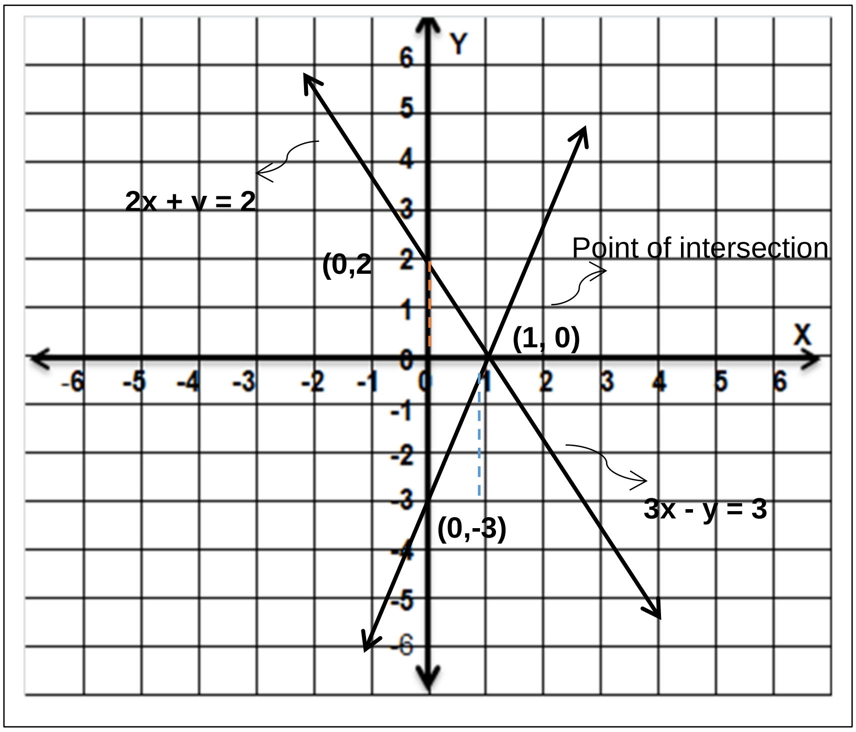
$2x + y = 2$	Given
$(-\boldsymbol{2x}) + 2x + y = 2 + (-\boldsymbol{2x})$	Addition Property of Equality
$y = (-2x) + 2$	Inverse Property for Addition
$y = -2x + 2$	**Slope-intercept form**

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: $3x - y = 3 \Rightarrow y = 3x - 3;\ m = 3;\ b = -3$

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



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.

The system of equations with at least one solution is called a **consistent system**. A consistent system can be classified as **independent or dependent**. A system is **consistent and independent** when it has exactly one solution and the graphs intersect at exactly one point.

Example 2. Determine the solution set of the system of linear equations by graphing.

$$\begin{cases} 2x + 3y = 6 \\ 4x + 6y = 12 \end{cases}$$

Step 1.

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

Equation 1: $\mathbf{2x + 3y = 6}$

$2x + 3y = 6$	Given
$2x + 3y + (\mathbf{-2x}) = 6 + (\mathbf{-2x})$	Add $(-2x)$ to both sides
	Addition Property of Equality
$3y = -2x + 6$	Inverse Property for Addition
$\left(\frac{1}{3}\right)(3y = -2x + 6)$	Multiply each term with $\frac{1}{3}$
	Multiplication Property of Equality
$\frac{3y}{3} = \frac{(-2x)}{3} + \frac{(6)}{3}$	Distributive Property
$y = -\frac{2}{3}x + 2$	**Slope-intercept form**

Slope($\boldsymbol{m}$) $= -\frac{\mathbf{2}}{\mathbf{3}}; \boldsymbol{y - intercept}(\boldsymbol{b}) = \mathbf{2}$

Equation 2: $\mathbf{4x + 6y = 12}$

$4x + 6y = 12$	Given
$4x + 6y + (\mathbf{-4x}) = 12 + (\mathbf{-4x})$	Add $(-2x)$ to both sides
	Addition Property of Equality
$6y = -4x + 12$	Inverse Property for Addition
$\left(\frac{1}{6}\right)(6y = -4x + 12)$	Multiply each term with $\frac{1}{6}$
	Multiplication Property of Equality
$\frac{6y}{6} = \frac{(-4x)}{6} + \frac{(12)}{6}$	Distributive Property
$y = -\frac{2}{3}x + 2$	**Slope-intercept form**

Slope($\boldsymbol{m}$) $= -\frac{\mathbf{2}}{\mathbf{3}}; \boldsymbol{y - intercept}(\boldsymbol{b}) = \mathbf{2}$

Step 2.

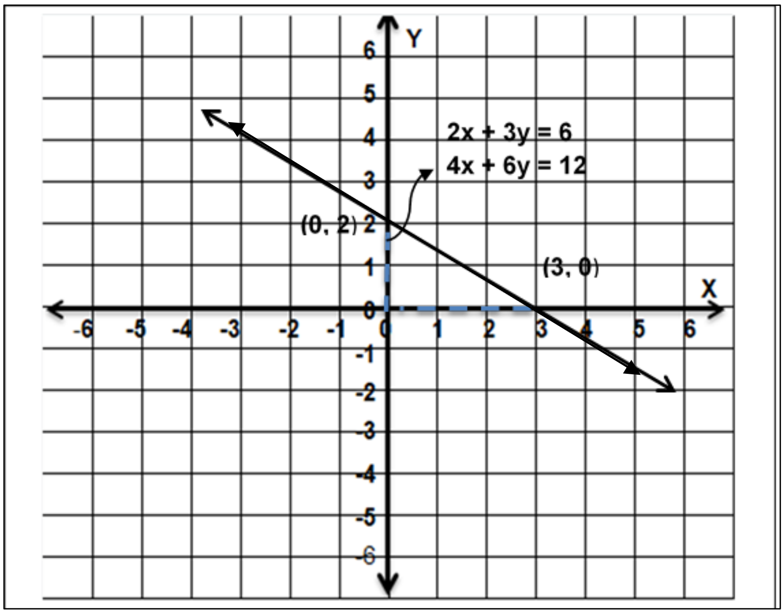
Graph each equation in one Cartesian Plane and label the graph. Use the slopes and y-intercepts of both equations:

Equation 1:

$$2x + 3y = 6 \Rightarrow y = -\frac{2}{3}x + 2\,;\ m = -\frac{2}{3};\ b = 2$$

Equation 2:

$$4x + 6y = 12 \Rightarrow y = -\frac{2}{3}x + 2\,;\; m = -\frac{2}{3};\; b = 2$$



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

Observe that the two linear equations have the same graph, hence, the lines are **coinciding**. This means that **every point** in the line represents a solution to the system of equations. Hence, the system **has infinitely many solutions.**

A system is **consistent and dependent** when it **has infinitely many solutions**. This occurs when the graphs of a system of linear equations are the same or are **coinciding**. This means further that all the points in the graph represents a solution to the system of equations.

Example 3. Find the solution of the system of linear equations by graphing $\begin{cases} 3x - 2y = 6 \\ 3x - 2y = -4 \end{cases}$.

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

Equation 1: $\mathbf{3x - 2y = 6}$

$3x - 2y = 6$	Given
$3x - 2y + (-\mathbf{3x}) = 6 + (-\mathbf{3x})$	Add $(-3x)$ to both sides
	Addition Property of Equality
$-2y = -3x + 6$	Inverse Property for Addition
$(-\frac{1}{2})(-2y = -3x + 6)$	Multiply each term with $-\frac{1}{2}$
	Multiplication Property of Equality
$\frac{-2y}{-2} = \frac{(-3x)}{-2} + \frac{(6)}{-2}$	Distributive Property
$\mathrm{y} = \frac{3}{2}x - 3$	**Slope-intercept form**

Slope ($\boldsymbol{m}$ ***)*** $= \frac{\mathbf{3}}{\mathbf{2}}; \boldsymbol{y - intercept(b) = -3}$

Equation 2: $\mathbf{3x - 2y = -4}$

$3x - 2y = -4$	Given
$3x - 2y + (-\mathbf{3x}) = -4 + (-\mathbf{3x})$	Add (-3x) to both sides
	Addition Property of Equality
$-2y = -3x - 4$	Inverse Property for Addition
$(-\frac{1}{2})(-2y = -3x - 4)$	Multiply each term with $-\frac{1}{2}$
	Multiplication Property of Equality
$\frac{-2y}{-2} = \frac{(-3x)}{-2} + \frac{(-4)}{-2}$	Distributive Property
$\mathrm{y} = \frac{3}{2}x + 2$	**Slope-intercept form**

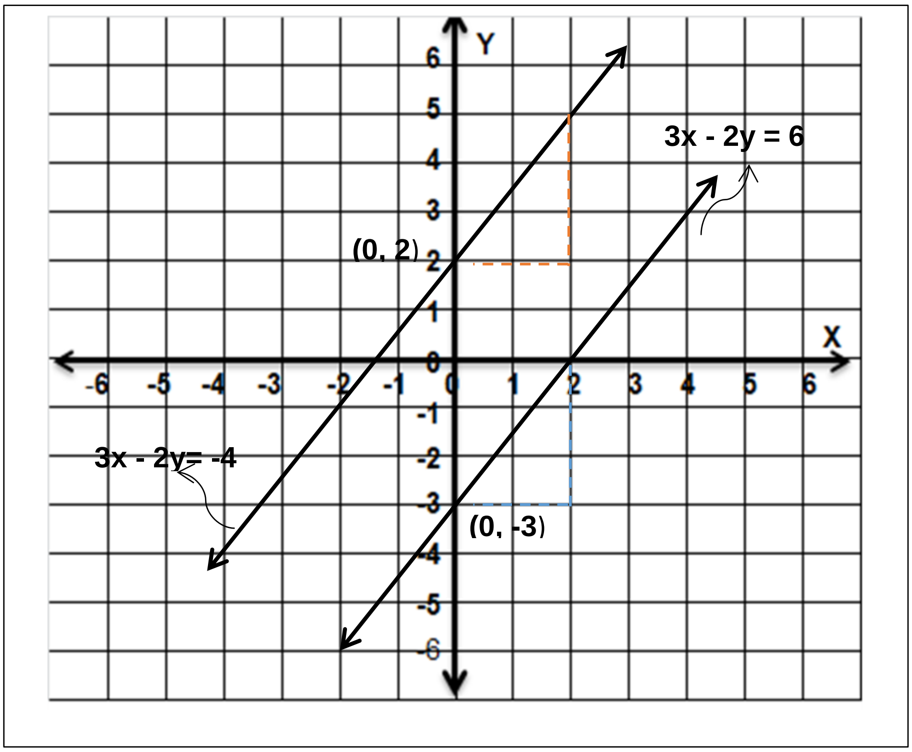
Slope ($\boldsymbol{m}$ ***)*** $= \frac{\mathbf{3}}{\mathbf{2}}; \boldsymbol{y - intercept(b) = 2}$

Step 2.

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

Equation 1: $3x - 2y = 6$ ⇨ $\mathrm{y} = \frac{3}{2}x - 3$; $m = \frac{3}{2}$; $b = -3$

Equation 2: $3x - 2y = -4$ ⇨ $\mathrm{y} = \frac{3}{2}x + 2$; $m = \frac{3}{2}$; $b = 2$



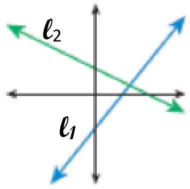
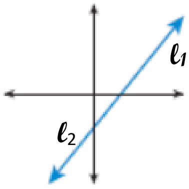
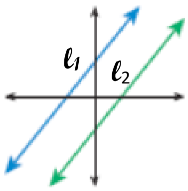
Step 3.

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

The graph shows that the two lines are parallel, hence, they do not intersect. This means that the system has no solution.

When the two lines in a system do not intersect, they are **parallel lines**. This means that there are no ordered pairs that satisfy both equations, so the system has no solution. A system that **has no solution** is called an

The table below shows how the graphs of the system of linear equation can be categorized:

Lines	**Intersecting**	**Coinciding**	**Parallel**
Description	Different slopes	same slopes, same y-intercepts	same slopes, different y-intercept
Classification	consistent and independent	consistent and dependent	Inconsistent
Number of Solutions	exactly one	infinitely many	None
Graph			

The graphs of systems of linear equations in two variables can also be a useful aid in making decisions. To illustrate, let us consider the problem below.

A mobile network provider offers a postpaid sim-only plan that costs Php999 per month plus Php2.50 per text message sent to other networks. Another mobile network sim-only plan costs Php1299 per month but offers Php1 only for every text message sent to other networks.

a. How many text messages would you have sent to other networks for the plan to cost the same for each month?
b. If a family member sends 500 or more text messages to other networks each month, which plan would you recommend? Why?

Solution:

Ley x be the total number of text messages sent to other networks

y be the total monthly cost of x text messages sent to other networks

The first mobile network provider charges Php2.50 per text message sent to other networks and the monthly cost of the plan is Php999, so it can be represented as:

$$y = 2.5x + 999$$

The other network charges only Php1 per text message sent to other networks but the monthly cost of the plan is Php1299, so it can be represented by the equation

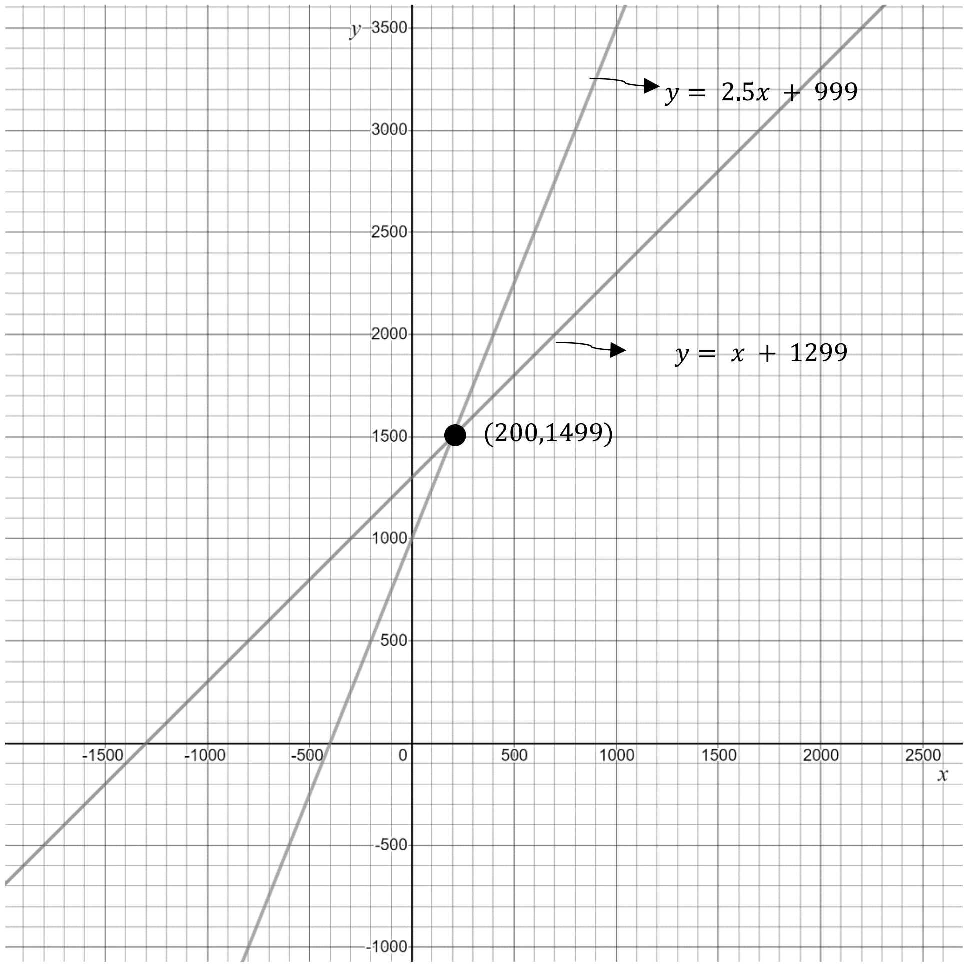
$$y = x + 1299$$

Using the slopes and y-intercepts of the equation obtained, we have

$$y = 2.5x + 999,\ m_{1=}\ 2.5;\ b_{1=}\ 999$$

$$y = x + 1299,\ \ m_{2=}\ 1;\ \ b_{2=}\ 1299$$

Plotting the points using the slopes and y-intercepts of the two equations we have:



To answer the questions in (a), note that the graph intersects at the point (200,1499), hence you need to send 200 text messages to other networks for the plans offered by the two mobile networks to cost the same.

To answer the question in (b), observe the value of y when $x = 500$. As shown in the graph, the value of y when $x = 500$ in the equation $y = x + 1299$ is lower compared to the value of y when $x = 500$ in the equation $y = 2.5x + 999$. This means that, the other mobile network is recommended if the number of text messages sent to other networks reaches 500 or more.

What's More

Activity 3: Equal or Not

Directions: Identify the $slope\ (m)$ and $y - intercept(b)$ of each system of linear equations. Write the symbol = if they have the same value of slopes and y-intercepts and the symbol ≠ if they don't have same value of slopes and y-intercepts.

1. $\begin{cases} x + 2y = 7 \\ x - y \ \ = 4 \end{cases}$ m_1 ______ m_2 b_1 ______ b_2

2. $\begin{cases} x - y \ \ = 4 \\ 3x - y = 2 \end{cases}$ m_1 ______ m_2 b_1 ______ b_2

3. $\begin{cases} x + y = 2 \\ x + y = 4 \end{cases}$ m_1 ______ m_2 b_1 ______ b_2

4. $\begin{cases} 4x + 2y = 8 \\ 6x + 3y \ \ = 12 \end{cases}$ m_1 ______ m_2 b_1 ______ b_2

5. $\begin{cases} 4x - \ 6y = 8 \\ 2x \ \ - \ 3y \ = -2 \end{cases}$ m_1 ______ m_2 b_1 ______ b_2

Guide questions:

1. How did you get the values of m and b?
2. What is the relationship between the slope and the y-intercept to the systems of linear equations?
3. How will you compare the $slope\ (m)$ and $y - intercept\ (b)$ of each system?
4. Have you encountered any difficulty in finding the slope and y-intercept of each equation in the given system of linear equations?

Activity 4: I can do it!

Directions: Examine each system and tell whether the graphs are intersecting, parallel, and coinciding. Write your answer on a separate sheet of paper.

Equations		Graphs
1. $\begin{cases} 3x - 2y = 6 \\ 3x - 2y = 4 \end{cases}$	⇒	
2. $\begin{cases} 3x - 6y = 12 \\ 4x - 8y = 16 \end{cases}$	⇒	
3. $\begin{cases} x + y \ = 6 \\ 2x + y = 4 \end{cases}$	⇒	
4. $\begin{cases} y = \frac{2}{5}x - 2 \\ 2x - 5y = 10 \end{cases}$	⇒	
5. $\begin{cases} 5x + 2y = 4 \\ 2x - 3y = 4 \end{cases}$	⇒	

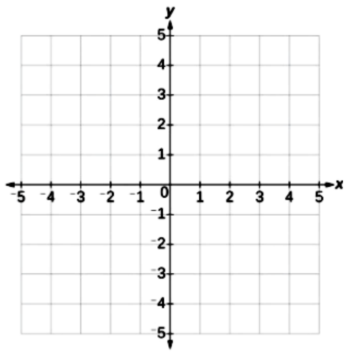
Guide questions:

1. How will you know if the graphs of a system of linear equation intersect at a single point?
2. When do you say that the lines of the system of linear equations are intersecting, parallel, and coinciding? Explain your answer.

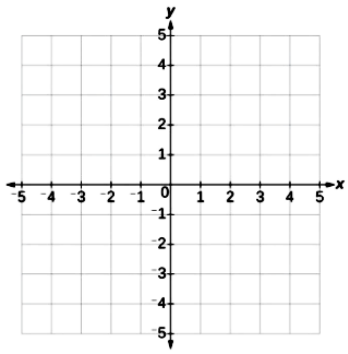
Activity 5: Let’s Examine!

Directions: Graph each system of equations and state whether the system is consistent and dependent, consistent, and independent, or inconsistent using slope-intercept method. Use graph paper.

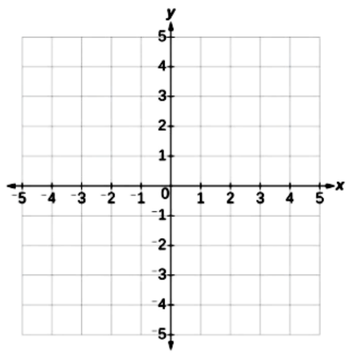
1. $\begin{cases} 3x + y = 1 \\ 2x \; - \; y = -6 \end{cases}$



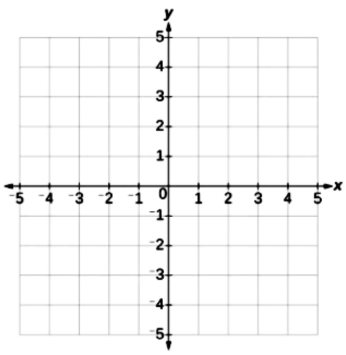
2. $\begin{cases} x + 3y = 4 \\ x + 2y = 3 \end{cases}$



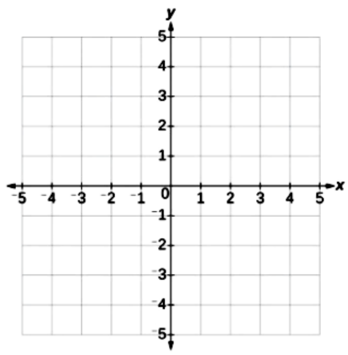
3. $\begin{cases} 3x + y = 1 \\ 2x \; - \; y = -6 \end{cases}$



4. $\begin{cases} -x + 2y = 12 \\ x - 2y = 4 \end{cases}$



5. $\begin{cases} 3x - 9y = 12 \\ x - 3y = 4 \end{cases}$



Guide Questions:

1. How do you identify systems of equations that are consistent and dependent? consistent and independent? inconsistent?
2. Which system of linear equations has only one solution? no solution? infinite number of solutions?

What I Have Learned

Activity No. 6: Complete Me!

Directions: Complete the graphic organizer below to summarize what you learned on how to graph systems of linear equations in two variables.

How do you solve systems of linear equations in two variables by graphing?

STEP 1: Examine each equation.

$$\begin{cases} x - y = -5 \\ x + y = 1 \end{cases}$$

Are both equations written in slope-intercept form?

YES

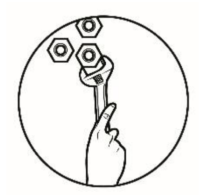
NO

STEP 2:

STEP 3:

STEP 4:

STEP 5:

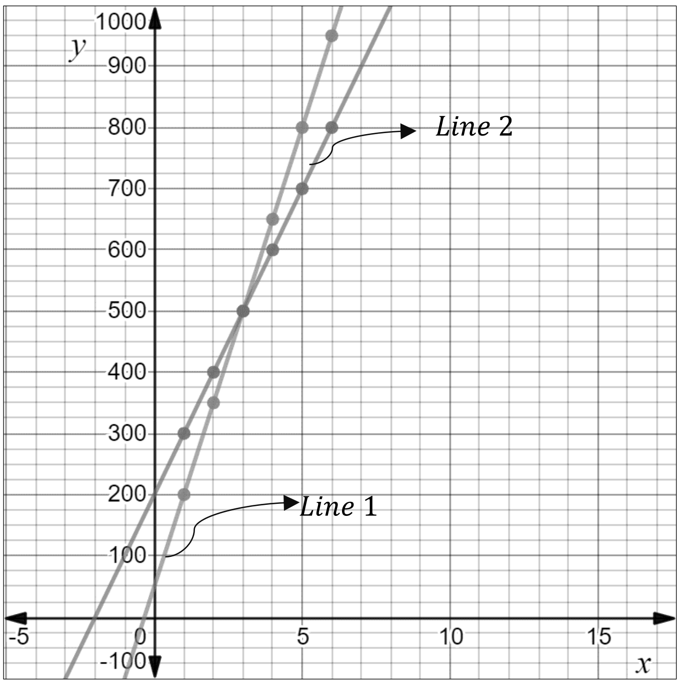


What I Can Do

Activity 7: Let us Tour Around the City

Directions: Read the problem below and answer the questions that follow.

To visit all the scenic places of Butuan City, a group of local tourists had to choose between two taxi services. Taxi A asked for Php300.00 for the first hour and Php100.00 for each additional hour, while taxi B asked for Php200.00 for the first hour and Php150.00 for each additional hour as shown in the graph below:



Questions:

1. What system of linear equations can be used to represent the situation?
2. Which line represents line A? line B?
3. Which taxi services would you recommend being hired if the travel is
    a. less than 3 hours?
    b. exactly 3 hours?
    c. more than 3 hours?
4. What is your basis for your recommendations in Item No. 3?

Assessment

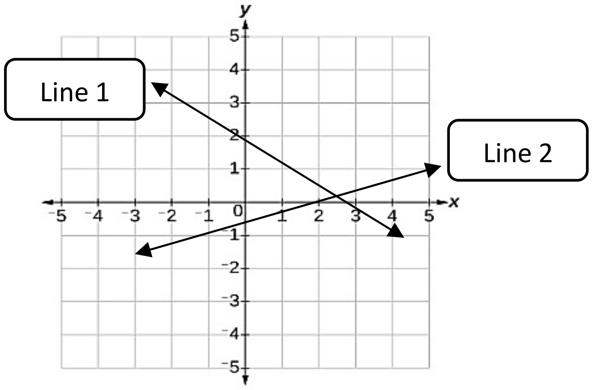
Post- Assessment

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

1. All are graphs of the system of linear equations in two variables EXCEPT:

   A. coinciding
   B. intersecting
   C. parabola
   D. parallel

For items 2-4, consider the graph below.



2. What are the slopes of the graph?

   A. $\frac{2}{3}$ and - $\frac{1}{3}$
   B. 3 and $-\frac{2}{3}$
   C. $-\frac{2}{3}$ and $\frac{1}{3}$
   D. $-\frac{2}{3}$ and -3

3. What are the y-intercepts of the graph?

   A. $(0, 2)$ *and* $(0, -1)$
   B. $(-2,0)$ *and* $(0,1)$
   C. $(3, 0)$ *and* $(1,0)$
   D. $(-3,0)$ *and* $(1, 0)$

4. Which system of linear equations represents the graph?

   A. $\begin{Bmatrix} 2x - 3y = 6 \\ x + 3y = 3 \end{Bmatrix}$
   B. $\begin{Bmatrix} 2x + 3y = 6 \\ x - 3y = 3 \end{Bmatrix}$
   C. $\begin{Bmatrix} 2x - 3y = -6 \\ -x + 3y = 3 \end{Bmatrix}$
   D. $\begin{Bmatrix} 2x + 3y = 6 \\ x - 3y = -3 \end{Bmatrix}$

For items 5-7: Use the system $\begin{cases} x + y = 2 \\ x - y = 4 \end{cases}$ to answer the questions that follow.

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

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

A. $\begin{cases} m_1 = 1;\ b_1 = -2, \\ m_2 = 1;\ b_2 = 4, \end{cases}$

B. $\begin{cases} m_1 = -1;\ b_1 = 2, \\ m_2 = 1;\ b_2 = -4, \end{cases}$

C. $\begin{cases} m_1 = -1;\ b_1 = 2, \\ m_2 = 1;\ b_2 = 4, \end{cases}$

D. $\begin{cases} m_1 = -1;\ b_1 = 2, \\ m_2 = -1;\ b_2 = 4, \end{cases}$

7. What is the point of intersection of the graph?

A. $(3,-1)$
B. $(3,1)$
C. $(3,-1)$
D. $(-3,1)$

8. Which system of linear equations has the same slopes and y-intercepts?

A. $\begin{cases} 7x - 14y = 28 \\ x - 2y = 4 \end{cases}$

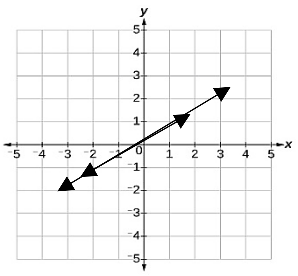
B. $\begin{cases} 8x - 2y = 4 \\ 4x + 2y = 8 \end{cases}$

C. $\begin{cases} \frac{2}{3}x - y = 4 \\ 3x + y = -5 \end{cases}$

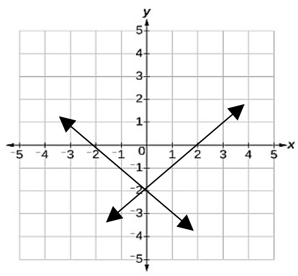
D. $\begin{cases} 5x - y = -9 \\ 3x + 4y = 12 \end{cases}$

9. Which of the following shows a graph of an inconsistent system of linear equations in two variables?

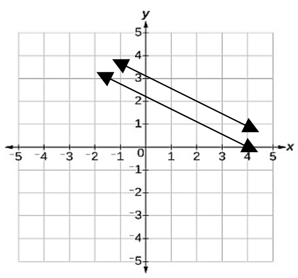
A.



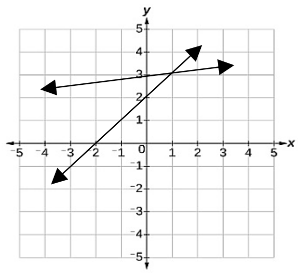
C.



B.

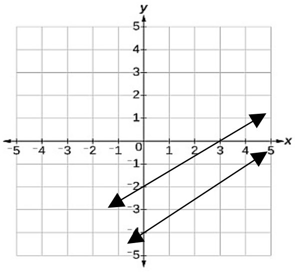


D.

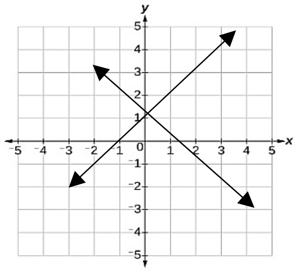


10. Which of the following shows the graph of the system $\begin{cases} 2x - 3y = 6 \\ 6x - 9y = 36 \end{cases}$?

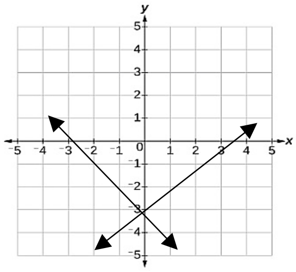
A.



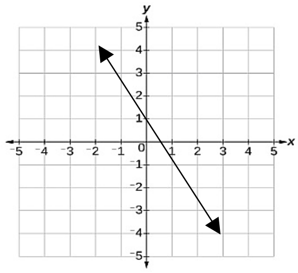
C.



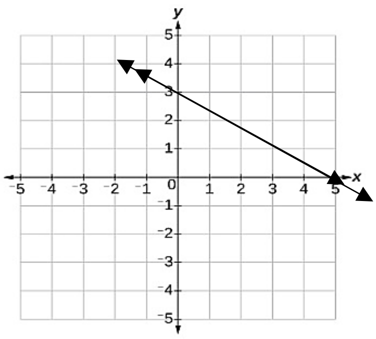
B.



D.



11. Which system of linear equations in two variables is represented by the graph below?



A. $\begin{cases} 3x - 5y = 15 \\ 6x + 5y = -30 \end{cases}$

B. $\begin{cases} 3x + 5y = 15 \\ 6x + 10y = 30 \end{cases}$

C. $\begin{cases} -3x - 5y = 15 \\ 6x - 10y = 30 \end{cases}$

D. $\begin{cases} 3x + 5y = -15 \\ 6x - 10y = 30 \end{cases}$

12. What do you call a system of linear equations in two variables having only one solution?

A. inconsistent

C. consistent and dependent

B. inconsistent and dependent

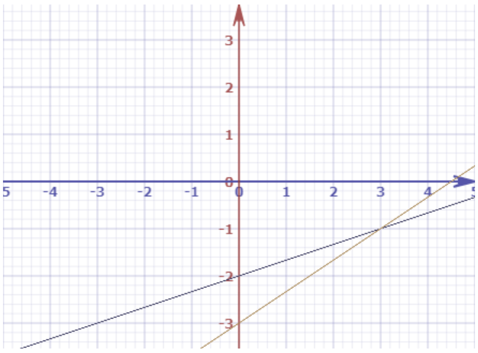
D. consistent and independent

13. 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.
IIV. The graph of the system shows parallel lines.

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

14. In a Grade 8 Mathematics class, the teacher asked the students to solve the system $\begin{cases} x - 3y = 6 \\ 2x - 3y = 3 \end{cases}$ using graphical method. Sheena enthusiastically volunteered and show her solutions on the board.



The system $\begin{cases} x - 3y = 6 \\ 2x - 3y = 3 \end{cases}$ intersects at exactly one point, hence the solution is $(3, -1)$.

Which of the following is an error committed by Sheena?
A. The slope of equation 1.
B. The slope of equation 2.
C. The y-intercept of equation 1.
D. The y-intercept of equation 2.

15. 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 this 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

Additional Activities

Answer the following questions below.

1. What value of $\boldsymbol{k}$ will make the system $\begin{cases} 3x - y = 7 \\ y = 3x + \boldsymbol{k} \end{cases}$ consistent and dependent?

2. What value of $\boldsymbol{k}$ will make the system $\begin{cases} 3x - 4y = 8 \\ y = \boldsymbol{k}x + 1 \end{cases}$ inconsistent?

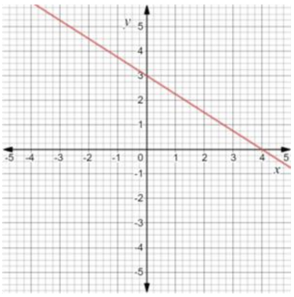
3. If the system $\begin{cases} \boldsymbol{k}x + y = 5 \\ 2x + 3y = 3 \end{cases}$ is consistent and independent, find the value of k?

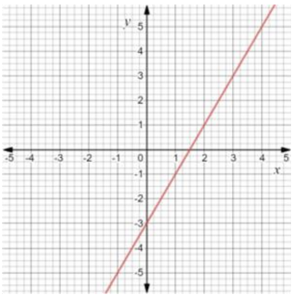
Answer Key

What I Know

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

What's In



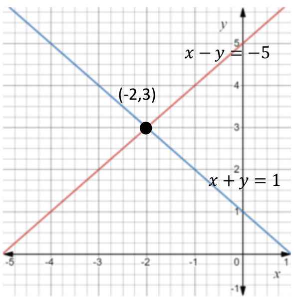


What I Can Do

Step 2. Write the equation in slope-intercept form.

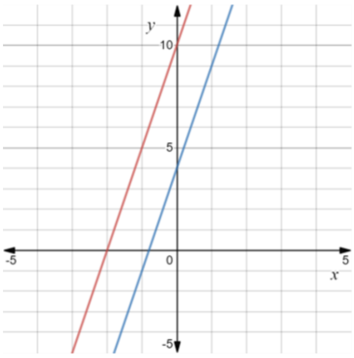
$$\begin{cases} y = x + 5 \\ y = -x + 1 \end{cases}$$

Step 3. Graph each system of equations.

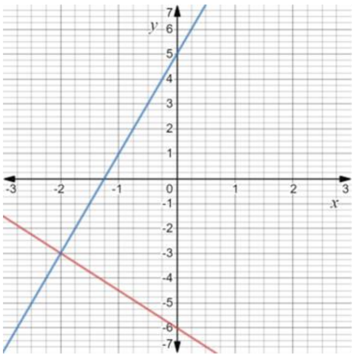


What's New

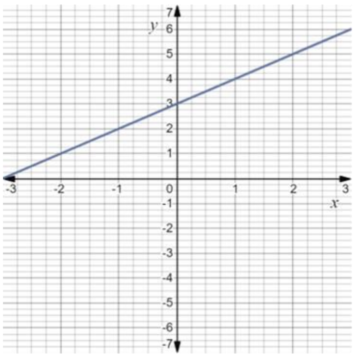
1.



2.



3.



Step 4. Determine the point of intersection and check.

when $x = -2, y = 3$	
$x - y = -5$ $-2 - 3 = -5$ $-5 = -5$✓	$x + y = 1$ $-2 + 3 = 1$ $1 = 1$✓

Step 5. Classify the system.

Since the graph intersects at exactly one point and ordered pair (-2,3) satisfies both of the equations in the system, then the system has exactly one solution. It is consistent and independent.

What's More

Activity 3: "Equal or not"

1. $m_1 \neq m_2;\ b_1 \neq b_2$
2. $m_1 \neq m_2;\ b_1 \neq b_2$
3. $m_1 = m_2;\ b_1 \neq b_2$
4. $m_1 = m_2;\ b_1 = b_2$
5. $m_1 = m_2;\ b_1 \neq b_2$

Questions:

1. The graphs are intersecting if the slopes are not equal, coinciding when the slopes are equal and the y-intercepts are also equal, parallel when the slopes are equal but the y-intercepts are not equal.
2. Intersecting – items 1 & 2; coinciding- item 4; parallel – items 3 & 5
3. The system is consistent and independent of the graphs are intersecting; the system is consistent and dependent if the graphs are coinciding; the system is inconsistent if the graphs are parallel.
4. consistent and independent - – items 1 & 2; consistent and dependent- item 4; inconsistent – items 3 & 5

Activity 4: "I can do it!"

1. Parallel
2. Coinciding
3. Intersecting
4. Coinciding
5. Intersecting

Activity 5: "Let's Examine"

1. Consistent and Independent
2. Inconsistent
3. Consistent and Independent
4. Inconsistent
5. Consistent and dependent

Post-Assessment

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

Additional Activities

1. -7

2. $\frac{3}{4}$

3. $k \neq \frac{2}{3}$

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