2017

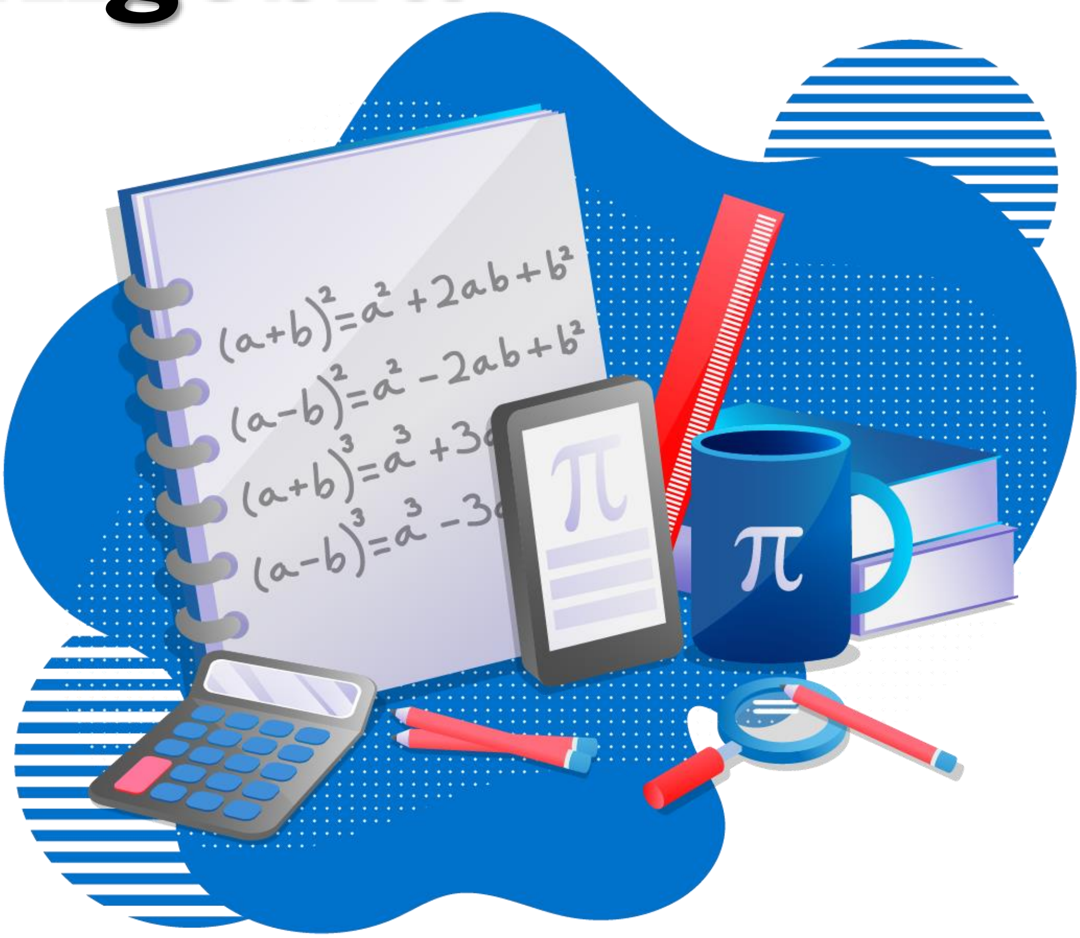
PEAC
PRIVATE EDUCATION ASSISTANCE COMMITTEE
Trustee of the Fund for Assistance to Private Education

DepED
DEPARTMENT OF EDUCATION

LEARNING MODULE

Mathematics G8 | Q2

Patterns and Algebra



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NOTICE TO THE SCHOOLS

This learning module (LM) was developed by the Private Education Assistance Committee under the GASTPE Program of the Department of Education. The learning modules were written by the PEAC Junior High School (JHS) Trainers and were used as exemplars either as a sample for presentation or for workshop purposes in the JHS In-Service Training (INSET) program for teachers in private schools.

The LM is designed for online learning and can also be used for blended learning and remote learning modalities. The year indicated on the cover of this LM refers to the year when the LM was used as an exemplar in the JHS INSET and the year it was written or revised. For instance, 2017 means the LM was written in SY 2016-2017 and was used in the 2017 Summer JHS INSET. The quarter indicated on the cover refers to the quarter of the current curriculum guide at the time the LM was written. The most recently revised LMs were in 2018 and 2019.

The LM is also designed such that it encourages independent and self-regulated learning among the students and develops their 21st century skills. It is written in such a way that the teacher is communicating directly to the learner. Participants in the JHS INSET are trained how to unpack the standards and competencies from the K-12 curriculum guides to identify desired results and design standards-based assessment and instruction. Hence, the teachers are trained how to write their own standards-based learning plan.

The parts or stages of this LM include Explore, Firm Up, Deepen and Transfer. It is possible that some links or online resources in some parts of this LM may no longer be available, thus, teachers are urged to provide alternative learning resources or reading materials they deem fit for their students which are aligned with the standards and competencies. Teachers are encouraged to write their own standards-based learning plan or learning module with respect to attainment of their school's vision and mission.

The learning modules developed by PEAC are aligned with the K to 12 Basic Education Curriculum of the Department of Education. Public school teachers may also download and use the learning modules.

MATHEMATICS 8

Module 3: Patterns And Algebra

Lesson 1: SYSTEM OF EQUATIONS AN INEQUALITIES

☑ MODULE INTRODUCTION AND FOCUS QUESTION(S):

Have you at a certain time asked yourself what would life have been like without numbers? If yes, how have you pictured it? Do you picture it as a progressive life? A life filled with technology? If so, why do you think that would be the case?

Read on and discover how vital numbers are in our life.

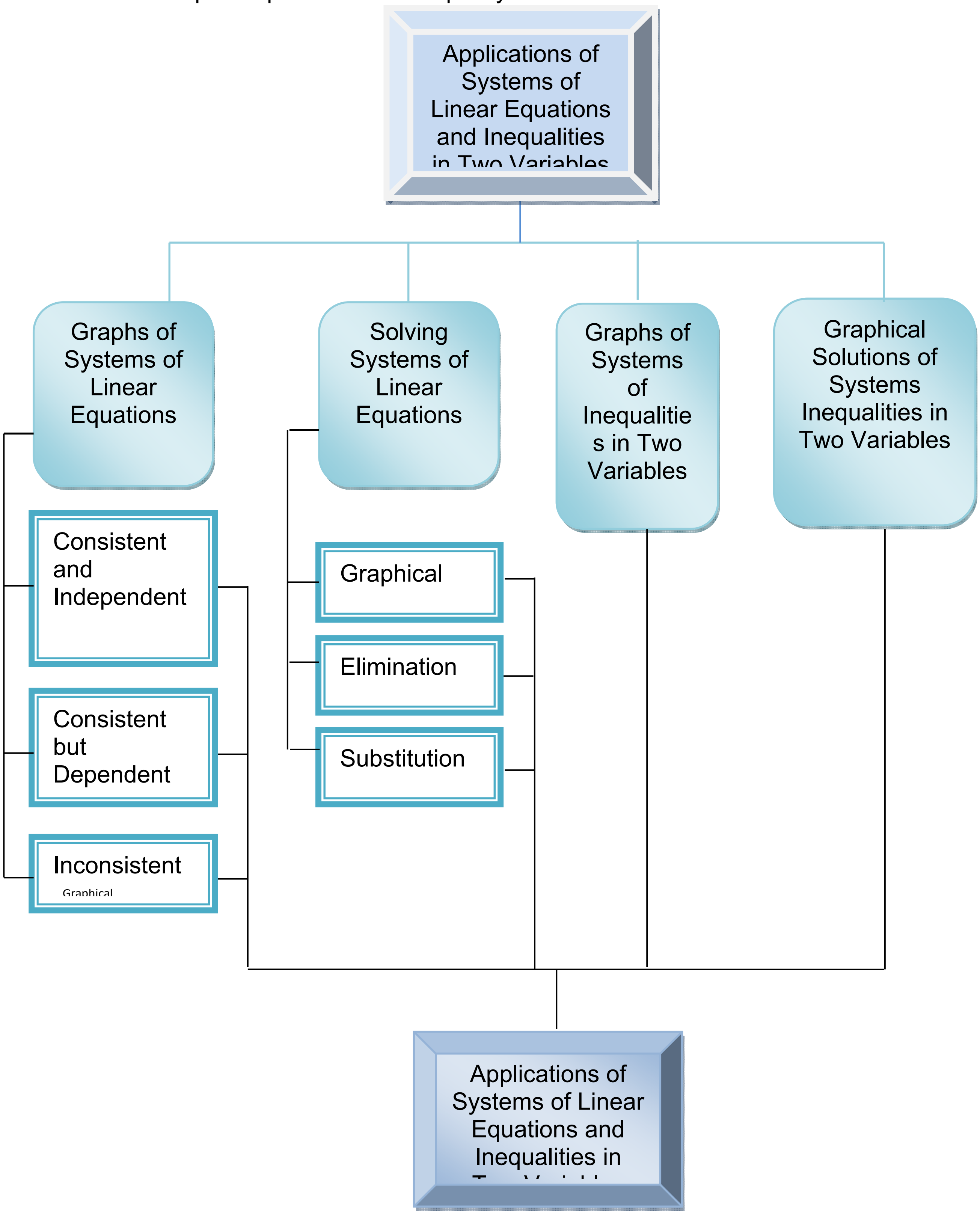
☑ LESSON COVERAGE:

In this lesson, you will examine this question when you take the following topics:

Title	You'll learn to…	Estimated Time
1.1 Graphs of System of Linear Equations	Describe system of Linear Equations and Inequalities using practical situations and Mathematical expressions. Identify systems of linear equations that have graphs that are parallel, intersecting lines and lines that coincide. Graph system of linear equation in two variables.	
1.2 Solving Systems of Linear Equations	Solve systems of linear equations by graphing, elimination and substitution.	
1.3 Graphs and Graphical Solutions of Systems of Linear Inequalities in Two Variables	Graph system of linear inequalities in two variables. Solve a system of linear inequalities in two variables by graphing. Solve problem involving systems of linear equations and inequalities in two variables. Identify applications of systems of linear equations and inequalities in real life.	

☑ **Concept Map of the Lesson**

Here is a simple map of the above topics you will cover:



☑ Expected Skills

To do well in this lesson, you need to remember and do the following:

1. Carefully read the lesson and do the activities neatly and accurately.
2. Break tasks into manageable parts.
3. Complete all activities even if you may not be asked to hand these in, but they will help you learn the material.
4. Keep copies of all accomplished activities. These are needed to assess your progress and for grading.
5. If you are having problems, do NOT wait to request help. The longer you wait the bigger the problem becomes!
6. Form study groups if possible.

PRE-ASSESSMENT

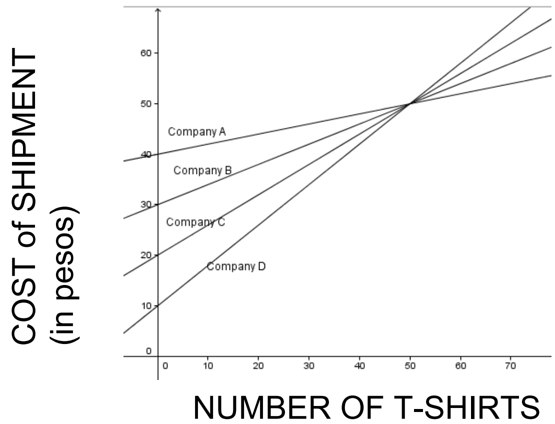
Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

1. What is the slope of the line $4x + 2y = 6$?
   A. -4 B. -2 C. 4 D. 3

2. Which one correctly describes how to graph linear equation in two variables?
   A. Mark the y-intercept and the slope then connect with a straight line.
   B. Mark any two points on the Cartesian plane and connect with a straight line.
   C. Connect the x-intercept and the y-intercept
   D. Connect the x-intercept and the slope with a straight line.

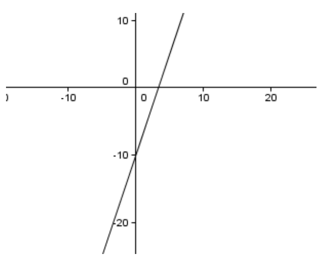
3. The graph below shows the cost of an order of t-shirts from four companies. Which company offers the cheapest price for an order of more than 60 t-shirts?

   A. Company A
   B. Company B
   C. Company C
   D. Company D.

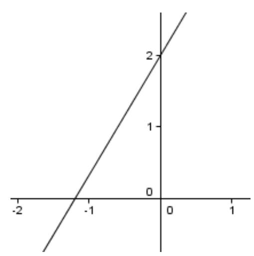


4. Which of the graphs below correctly represents the line 3x-5y-10 = 0?

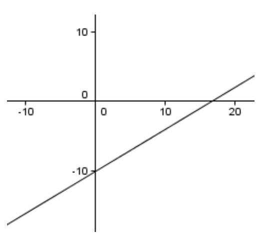
A.



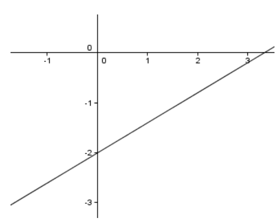
C.



B.



D.



5. The table below shows the weight in kilograms of newspapers collected from homes and the amount of money earned.

Weight	Income
30	12
40	24
50	36
60	48
70	60
80	72

Which of the linear equation below represents the income derived from the collected newspapers?

A. y=1.2x -24 C. y = 5x+3
B. y= 30x+12 D. y= 4x+5

6. Which of the following is a solution of the linear equation 4x – 2y= 12?

A. (2,-2) C. (4,2)
B. (3,1) D. (-2,-10)

7. Which of the following is described as the pair of numbers that satisfies a linear equation in two variables?

A. solution of linear equation C. ordered-pair
B. corresponding value D. coordinate

8. The equation 2x + y = 400 gives the total sale of x number of cell phone A and y number of cell phone B. What happens to y when x increases?

A. y increases
B. y decreases
C. y remains the same
D. y cannot be determined

9. The models below show the number of pages left after t minutes of printing. Which model will print the fastest?

A. p=-6.5t +20
B. p=-5t + 20
C. p= 20-7t
D. p=20-8t

10. Stephanie is tracking the progress of her plant's growth. Today the plant is 12 cm high. The plant grows 2 cm per day. What linear model best represents the height of the plant.

A. y = 12x - 2 C. y = 2x + 12
B. y = -12x + 2 D. y = 2x – 12

11. Based on item # 10, when will the height of the plant reach 50 cm?

A. 48 days C. 19 days
B. 4 days D. 38 days

12. A cat dresser charges P20 per night to board your cat. They also provide cat's accessories at P50 each. The equation $20x + 50y = 1000$ is the model of the cost of the combination of boarding the cat at cat dresser and cat accessories that you can buy for P1000. Which of the following explains the values of x and y in this model?

A. The variable x is the number of nights of boarding the cat and y is the number of nights.
B. The variable x is the number of nights of boarding the cat without any accessories and y is the number of nights.
C. The variable x is the number of nights boarding the cat without any accessories and y is the number of nights without boarding the cat.
D. The variable x is the number of nights of boarding the cat and y is the number of accessories purchased for the cat.

13. Laundry Jar charges P25 per kilo for wash-dry-fold. You can also ask for hand wash-dry-fold for sensitive materials clothes for P40. If you paid P 800, how many kilos will be washed if you paid for wash-dry-fold only or hand wash-dry-fold only?

A. 30 kilos for wash-dry-fold and 22 kilos for hand wash-dry-fold
B. 20 kilos for wash-dry-fold and 32 kilos for hand wash-dry-fold
C. 22 kilos for wash-dry-fold and 30 kilos for hand wash-dry-fold
D. 32 kilos for wash-dry-fold and 20 kilos for hand wash-dry-fold

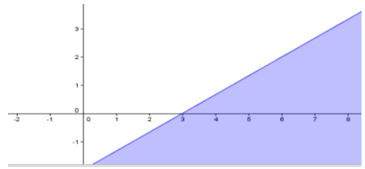
14. You are the purchasing agent of the Diamond Hotel .You have been tasked to submit a proposal for the acquisition of furniture for the newly constructed bedroom. You are given the budget of P120,000 for the combination of bed, a side table and chairs. Which of the following is an appropriate criteria for assessing your proposal?

A. Accuracy in the computation of the cost of furniture.
B. Authenticity of data used in the proposal.
C. Clarity of the presentation.
D. All of the above.

15. Which of the following points is a solution of $2x - 3y \geq 5$?

A. (2, 1) B. (-4, -1) C. (3, 1) D. (5/2, 0)

16.Which of the following points is a solution of an inequality whose graph is shown below?



A. (2, 1)
B. (-4, -1)
C. (-3, 1)
D. (3, 0)

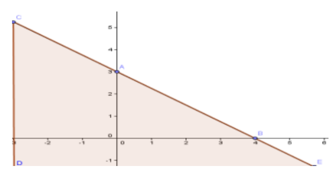
17.You are tasked by your mother to buy DVDs and CDs of the latest movies. You know that the price of a DVD is Php 150.00 and the price of the CD is Php 100.00. She gave you Php 1 500.00. Consider that you will not spend for the fare. If x refers to the number of DVD and y refers to the number CD, which of the following represents the situation above?

A. $150x + 100y \leq 1\,500$
B. $150x + 100y \geq 1\,500$
C. $150x + 100y < 1\,500$
D. $150x + 100y > 1\,500$

18. Use situation on item # 17. Consider you need to buy both CD and DVD and each contain one movie only, which strategy would give you the maximum number of movies?

A. Buy 12 DVDs and 2 CDs
B. Buy 7 DVDs and 5 CDs
C. Buy 5 DVDs and 7 CDs
D. Buy 2 DVDs and 12 CDs

19. Which inequality is shown in the graph?



A. $3x + 4y \leq 12$
B. $3x + 4y \geq 12$
C. $3x + 4y < 12$
D. $3x + 4y > 12$

20. You are making muffins and loaves of bread for a bake sale. You need 1/6 batch of batter per muffin and ½ batch of batter per loaf of bread. You have enough ingredients to make up to 12 batches of batter. If you make 4 loaves of bread, how many muffins can you make?

A. at least 60 muffins
B. at most 60 muffins
C. more than 60 muffins
D. less than 60 muffins

Lesson 1.1 Graphs of Systems of Linear Equations

In this lesson you will learn the following:

1. Describe system of Linear Equations using practical situations and Mathematical expressions.
2. Identify systems of linear equations that have graphs that are parallel, intersecting and graphs that coincide.
3. Graph system of linear equation in two variables.

EXPLORE

Let's begin our looking into a situation in real life that will require you to make an option. This will challenge what you know about modeling real life situation using equations in two variables and your skills in graphing linear equations in two variables. What you will be learning in this section will help you answer the question:

How do you determine the most favorable option?

ACTIVITY 1. Selecting the Best

Given some situations in life where you need to make a decision, how will you select the best option? Write your answers in the column for the "Decision Before".

HOW WILL YOU SELECT THE BEST OPTION?		
Decision Before		Decision After
	1. An investment plan from a number of plans with different incentive schemes.	
	2. An airline for a family trip outside the country.	
	3. A house loan plan.	
	4. An insurance plan.	
	5. Combination of products to sell given a fix capital.	
	6. A credit account in malls.	
	7. Job offer.	

Questions to Answer:

1. How do you determine the most favorable option?
2. How would you determine your options given certain constraints?

YOUR ANSWERS

You see in Activity 1, there are many situations in real life in which we need to make a decision. Some of these decisions may not be very significant, but other decisions may affect our lives and the lives of others for a long time. How do we make use of mathematics to guide us in selecting the most favorable options? How do we deal with constraints in making decisions?

In the next activity you will deal with a very concrete real life experience where you need to make a decision.

ACTIVITY 2. Your Decision, Please?

With a minimum purchase of P100, you can open a credit account with a food chain store. The store is offering either P25 or 20% off of your purchase if you open a credit account. You open a credit account . Should you choose P25 or 20% off of your purchase? Explain.

Questions to Answer:

QUESTIONS	YOUR ANSWERS
1. What mathematical knowledge and skills will help you solve the problem?	
2. What equations did you use to model the situations?	
3. Graph your equations on the same Cartesian coordinate plane. What do your graphs tell you about the offer of the store?	

4. Where in real life can you use these knowledge and skills?	
5. Where else in real life are you required to make an option?	
6. How do you determine the most favorable option?	
7. How would you determine your options given certain constraints?	

You have seen in Activity 2 that linear equations in two variables are useful in modeling situations in life. For you to decide on the best option, you came up with two equations in two variables. We call combinations like this systems linear equations. You saw from the activity that graphs are very helpful in determining our best option.

You have learned that graphs of linear equations are straight lines. How do graphs of systems of linear equations look like? What information can we get from these graphs? How do we graph systems of linear equations? Where in real life can we see these graphs?

In the next activity, you will use build up your knowledge and skills in graphing systems of linear equations in the Cartesian plane.

End of EXPLORE:

You just have tried to find out how mathematics can help you determine the most favorable option in life. Let us now strengthen that insight by doing the succeeding activities. What you will be learning in this section will help you perform well in your final performance task which will challenge you to use what you know to determine the best option.

FIRM-UP

Your goal in this section is to describe systems of linear equations using practical situations and mathematical expressions. Let's look into some situations in real life that can represented by systems of linear equations. Do the next activity to accomplish this goal.

Systems of Linear Equations in Real Life

Systems of linear equations are one of the useful mathematical tools to model situations in real life.

The succeeding activities will help you build up your knowledge and skill and deepen your understanding of the system of linear equations and help you answer the question: How do you determine the most favorable option?

ACTIVITY 3. Name that Situation! (System of Lines in Real Life)

Write linear equations to represent each of the following situations.

SITUATIONS	EQUATIONS
1. Sam prepared a snack food by mixing nuts and dried fruits and vegetables. A bag of nuts cost P40.00 and a bag of dried fruits cost P80.00. She would like to prepare 5 bags of the mixture that cost P60.00 per bag. How many bags of nuts and dried fruits should Sam purchase?	
2. Joseph chooses between two brands of milk. The price of brand A per box is P100.00 and the price of brand B is P120.00. He is to buy twice as many boxes of brand A than brand B. How many boxes of each brand will he purchase if his budget is only six hundred pesos?	
3. Ryan spends P200.00 per month on shampoo and facial wash. The price of shampoo is P6.00 per sachet while facial is P10.00. He consumes 5 as many sachets of shampoo as facial wash. Total sachets used in a month is 90. How many sachets of each kind did he buy in a month?	
4. You were recruited to become a member of a consumer club. You were told that if you are a member you can buy a capsule of vitamin for P5.00. For non-member, the cost per capsule is P8.00. The membership fee is P100.00. After how many capsules would it be beneficial for you to become a member? Which of the option would you consider?	

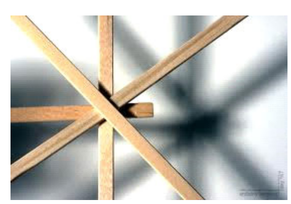
QUESTIONS	YOUR ANSWERS
1. What is the use of representing the situations described above using linear equations?	
2. Is it possible to answer the questions using one equation only?	
3. How can graphs of these systems help you solve the problems?	
4. How can systems of linear equations be graphed?	
5. In what way can your knowledge of system of linear equations be used to identify best options?	

You have learned that graphs of linear equations are straight lines. In a system of equations in two variables, the two equations will be represented by two lines. What will happen if these lines are drawn in one Cartesian plane? What information can we get from these graphs?

Before we learn how to graph systems of linear equations, let us try to find situations in real life where we see these set of lines.

ACTIVITY 4. Meet the Lines in Life.

Look at the pictures below. Identify whether lines are parallel, intersecting or coincident.



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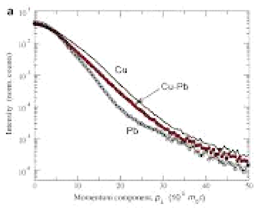


Questions to Answer:

1. How do we know that lines are parallel?
2. Are there common values between parallel lines?
3. How do we know that lines are intersecting?
4. Are there common values between intersecting lines?
5. How do we identify these common values?
6. How can we tell if lines coincide?
7. What quantitative relationships in real life can be represented by lines?
8. What information can we get from the graphs of systems of linear equations?
9. How useful are the graphs of systems of linear equations in making decisions?

MY INITIAL ANSWERS

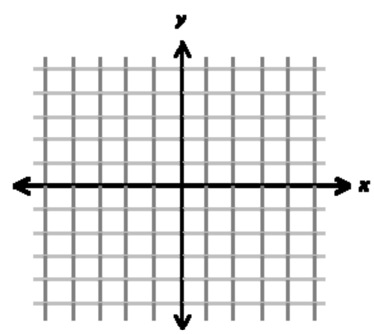
In the next activity check your initial answers by using technology. Access http://www.shodor.org/interactivate/activities/LinearFunctMachine/
Interactive site for finding the value of y when the value of x is given. This can help you graph linear equations by point-plotting method.

You may also download free mathematics software at www.**geogebra**.org. A geometry package providing for both graphical and algebraic input. Includes the program and worksheets for download.

ACTIVITY 5. How do I Look Like?

Graph each equation in the given system by point plotting in the same Cartesian plane and describe the graph as
   a. Parallel lines
   b. Intersecting lines
   c. Coincident/Identical lines

1. $\begin{cases} 2x - y = -1 \\ 4x - 2y = 6 \end{cases}$



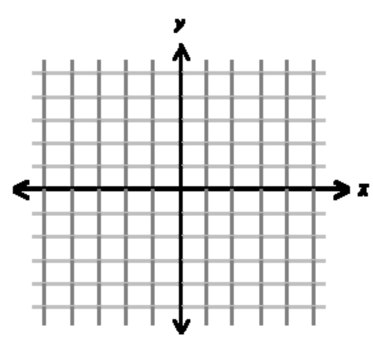
2x - y= -1

x			
y			

4x - 2y= 6

x			
y			

2. $\begin{cases} x - 2y = 4 \\ 2x + y = 1 \end{cases}$



x-2y = 4

x			
y			

2x+y = 1

x			
y			

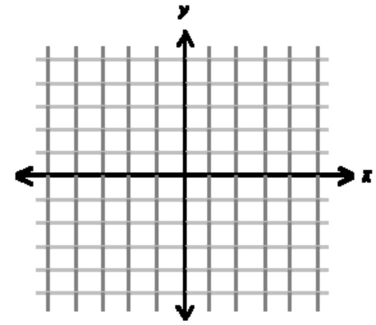
3. $\begin{cases} 2x + y = 3 \\ 4x + 2y = 6 \end{cases}$

2x +y = 3

x			
y			

4x +2y = 6

x			
y			

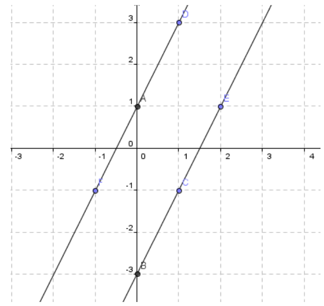


Questions to Answer:

1. How many points do you need to locate to draw the line?
2. Is there another way of graphing each equation? How will you do it?
3. Without graphing how will you know if the graph is a set of parallel lines? Intersecting lines? Lines that coincide?
4. What do graphs indicate about the values of the variables in the system?
5. In what way can your understanding of graphs of systems of linear equations help you in determining the most favorable options in life?

YOUR ANSWERS

1. $\begin{cases} 2x - y = -1 \\ 4x - 2y = 6 \end{cases}$



2x-y= -1

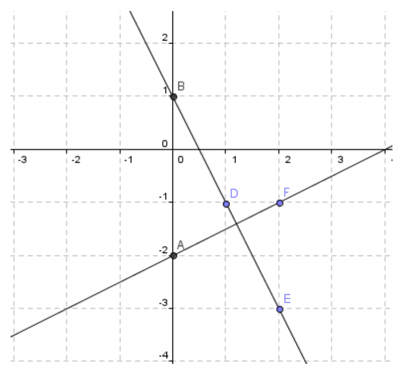
x	0	1	2
y	1	3	5

Parallel lines

4x-2y= 6

x	0	1	4
y	-3	-1	5

2. $\begin{cases} x - 2y = 4 \\ 2x + y = 1 \end{cases}$



x-2y = 4

x	0	2	4
y	-2	-1	0

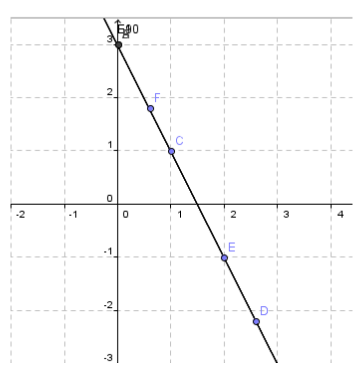
Intersecting lines

2x+y = 1

x	0	1	2
y	1	-1	-3

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

2x +y = 3



x	0	1	2
y	3	1	-1

4x +2y = 6

x	0	1	2
y	3	1	-1

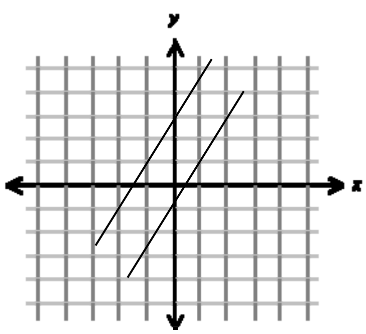
<u>Coincident/Identical lines</u>

Now rate your progress in understanding of the lesson based on your performance in activities 1 to 5..

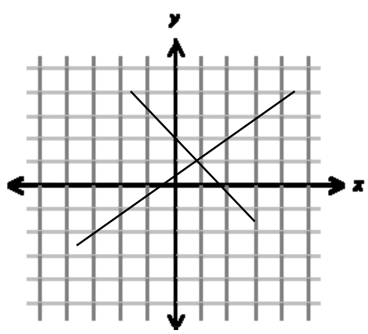
			
I need to shine my star!	Leveling up!	Good job!	Excellent!

We have learned in the previous module that equations of the form Ax + By = C are straight lines when graphed. Two equations of this form is called a system of linear equations or a linear system.

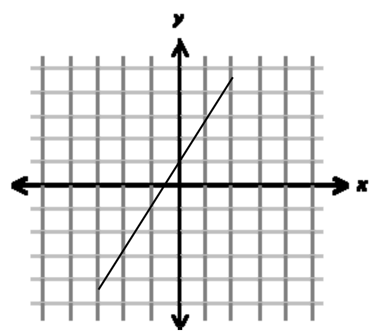
A system of linear equations in two variables represents a pair of lines. The lines intersect, are parallel or are coincident.



Parallel Lines



Intersecting Lines



Coincident Lines

Systems in which the lines intersect at precisely one point are called **independent systems.**

Systems in which the lines are coincident are called **dependent systems**.

Systems in which lines are parallel are **independent systems.**

Questions to Answer:

1. Are there common values for the variables when the system is independent?
2. What happens to the values of the variables when the system is dependent?
3. In what way can your knowledge and skills in graphing systems of linear equations help you find and understand solutions of systems of linear equations?
4. How can graphs of systems of linear equations help in identifying the most favorable options in life?

END OF FIRM - UP

We have seen in this section that graphs of linear systems indicates if equations in the system have common values or have no common values. You will use this information later to find and decide on the solutions of the linear systems. In the next section you will deepen your knowledge and enhance your skills in graphing systems of linear equations.

DEEPEN

Your goal in this section is to take a closer look at how we can graph systems of linear equations using another strategy.

In the previous module you learned how to graph linear equations by using slope and y-intercept. Now use this knowledge and skills in graphing systems of linear equations. How can the slope and y-intercept of the line be used to graph systems of linear equations. How can your knowledge on graphing system of linear equations help you answer the question: How do you determine the most favorable option?

You can access the following sites to use a free program for this activity.
http://www.mathwarehouse.com/algebra/linear_equation/systems-of-equation/index.php
Interactive site for finding solutions by graphing. Drag the point and drop to the desired location. Slope, equations of the lines and solutions will be given.

http://www.ltcconline.net/greenl/java/BasicAlgebra/Linegraph/LineGraph.htm

Interactive site for graphing linear equations using the slope and the y-intercept. It also provides process questions.

You may also use GeoGebra. Click on perspectives and select spreadsheets and graphics, then write the equation of the lines in slope-intercept form.

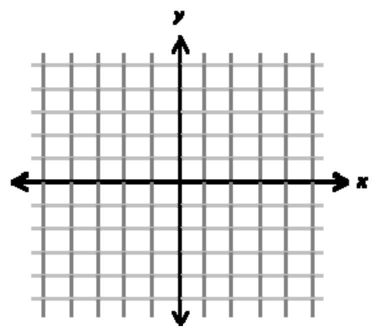
<u>Activity 6:</u> Know, Draw and Describe Me

Express each equation in the system in slope-intercept form and graph equation using the slopes and the y-intercepts. Use the graph to describe the system as:

a. dependent
b. Independent

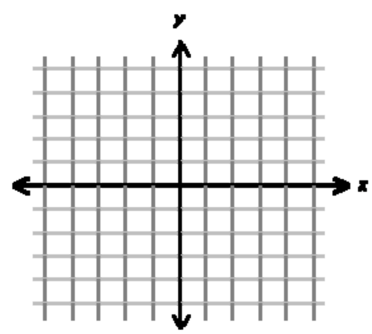
1. $\begin{cases} x + 2y = 4 \\ 2x - 4y = 0 \end{cases}$

Equations in y=mx + b form	m	b



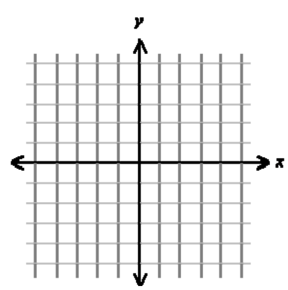
2. $\begin{cases} 2x - 3y = 6 \\ 4x - 6y = 0 \end{cases}$

Equations in y=mx + b form	m	b



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

Equations in y=mx + b form	m	b



Questions to Answer:

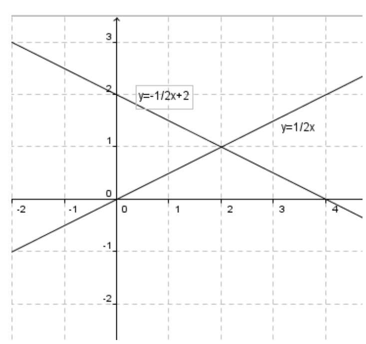
1. What are the steps in graphing a linear equation using its slope and y-intercept?
2. In what way is the process simpler than point-plotting?
3. In what way is the classification of system of linear equations useful?

YOUR ANSWERS

Answers to Activity 6.

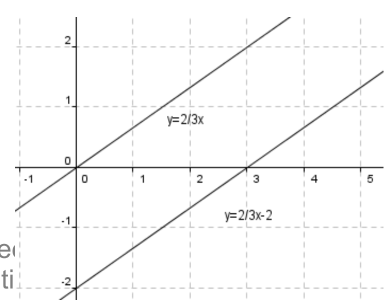
1. $\begin{cases} x + 2y = 4 \\ 2x - 4y = 0 \end{cases}$

Equations in y=mx + B form	m	b
$y = -\frac{1}{2}x + 2$	-1/2	2
$y = \frac{1}{2}x$	1/2	0



Intersecting lines

2. $\begin{cases} 2x - 3y = 6 \\ 4x - 6y = 0 \end{cases}$

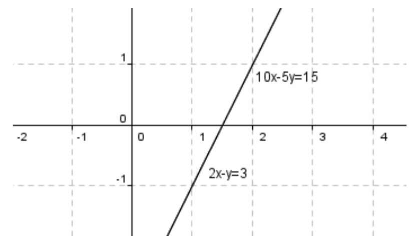


Equations in y=mx + B form	m	b
$y = \frac{2}{3}x - 2$	2/3	-2
$y = \frac{2}{3}x$	2/3	0

Parallel lines

3. $\begin{cases} 10x - 5y = 15 \\ 2x - y = 3 \end{cases}$

Equations in y=mx + B form	m	b
$y = 2x - 3$	2	-3
$y = 2x - 3$	2	-3

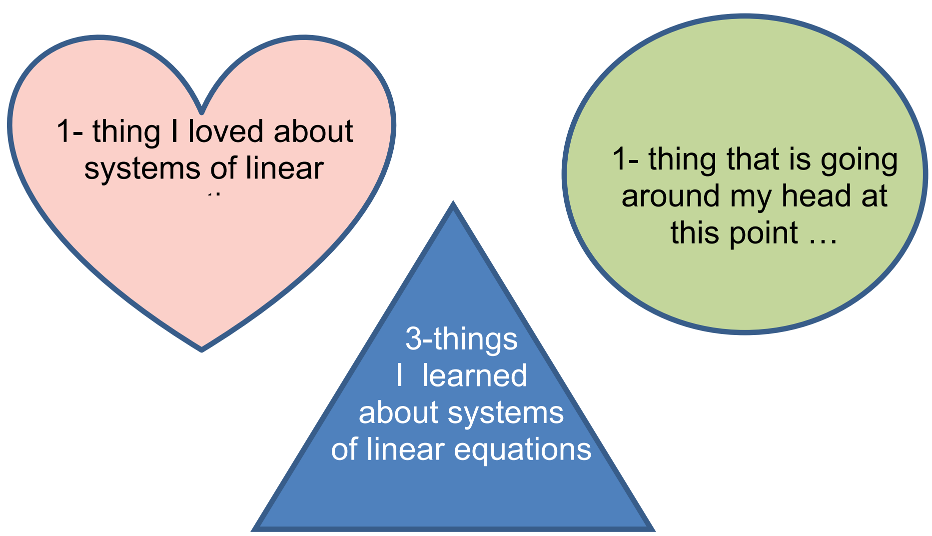


Coincident lines

Now, assess you skills in graphing systems of linear equation. If you need some more input you may access the website below.

http://www.wtamu.edu/academic/anns/mps/math/mathlab/int_algebra/int_alg_tut14_lineargr.htm#step4
Gives the process of graphing linear equation. A good site for review.

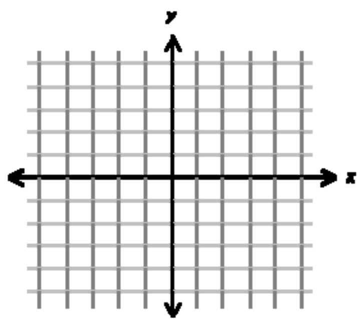
ACTIVITY 6. Shaping Up Review



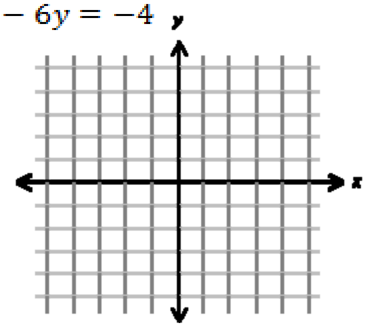
ACTIVITY 7. How Do I Graph You?

Use any of the method you have learned to graph each of the following systems of linear equations. Then classify each system based on their graphs.

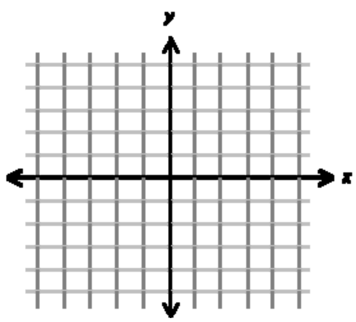
1. $\begin{cases} 3x - y = 2 \\ 2x + 3y = 5 \end{cases}$



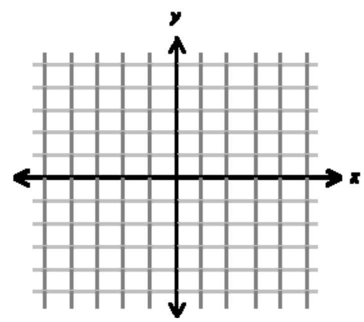
3. $\begin{cases} x - 3y = -2 \\ 2x - 6y = -4 \end{cases}$



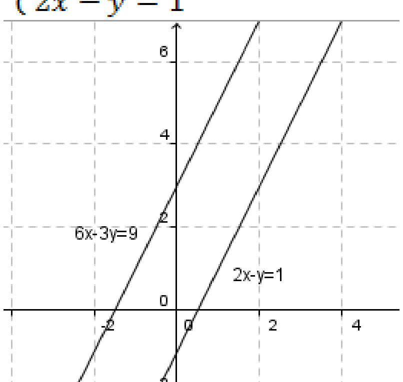
2. $\begin{cases} 6x - 3y = 9 \\ 3x - y = 6 \end{cases}$



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

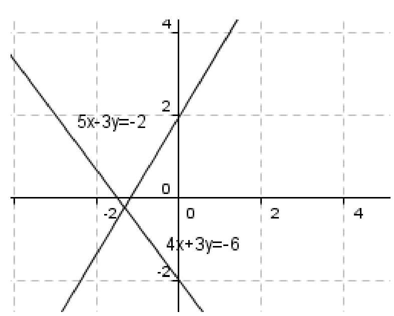


2. $\begin{cases} 6x - 3y = 9 \\ 2x - y = 1 \end{cases}$



Parallel lines

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



Intersecting lines

Now let's go back to situations given in Activity 2. Graph each system in one Cartesian plane. What do your graphs indicate about the solutions of each system? Do the systems have solutions? How did you know?

ACTIVITY 8. System of Lines in Real Life.

Write linear equations to represent each of the following situations in column 2 and draw the graphs in column 3.

PROBLEMS	SYSTEMS OF LINEAR EQUATIONS	GRAPHS
1. Sam prepared a snack food that is prepared by mixing nuts and dried fruits and vegetables. A bag of nuts cost P40.00 and a bag of dried fruits cost P80.00. She would like to prepare 5 bags of the mixture that will cost P60.00 per bag. How many bags of nuts and dried fruits should Sam purchase?		
2. Joseph was tasked to buy two brands of milk. The price of brand A per box is P100.00 and the price of brand B is P120.00. His budget is 600. He is to buy twice as many cans of brand A than brand B. How many boxes of each brand will he purchase?		
3. Ryan spends P200.00 per month on shampoo and facial wash. The price of shampoo is P6.00 per sachet while facial is P10.00. He consumes 5 times as many sachets of shampoo as facial wash. Total sachets used in a month is 90. How many sachets of each kind did he buy in a month?		

4. You were recruited to become a member of a consumer club. You were told that if you are a member you can buy a capsule of vitamin for P5.00.For non-member, the cost per capsule is P8.00. The membership fee is P100.00. After how many capsules would it be beneficial for you to become a member? Which of the option would you consider?		

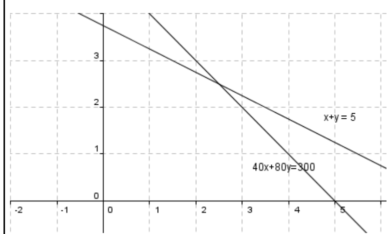
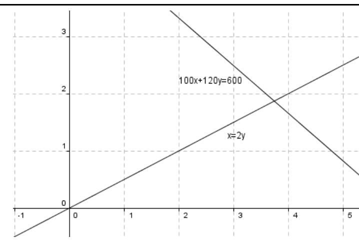
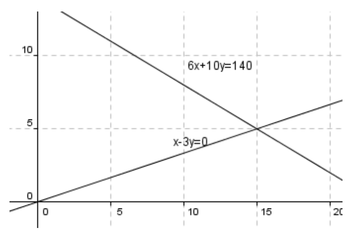
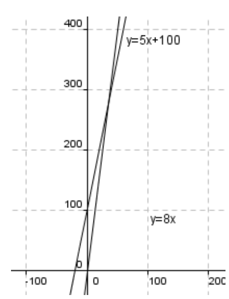
Questions to Answer:

1. How can graphs of these systems help you solve the problems related to systems of linear equations?

2. In what way can your knowledge of system of linear equations be used to identify best options in life?

YOUR ANSWERS

Answers to Activity 9.

PROBLEMS	SYSTEMS OF LINEAR EQUATIONS	GRAPHS
2. Sam prepared a snack food that is prepared by mixing nuts and dried fruits and vegetables. A bag of nuts cost P40.00 and a bag of dried fruits cost P80.00. She would like to prepare 5 bags of the mixture that cost P60.00 per bag. How many bags of nuts and dried fruits should Sam purchase?	Let x be the number of bags of nuts and y the number of bags of dried fruits. $40x + 80y = 300$ $x + y = 5$	
2. Joseph was tasked to buy two brands of milk. The price of brand A per box is P100.00 and the price of brand B is P120.00. His budget is 600. He is to buy twice as many cans of brand A than brand B. How many boxes of each brand will he purchase?	Let x be the number of boxes of brand A and y the number of boxes of brand B. $100x + 120y = 600$ $x - 2y = 0$	
3. Ryan spends P200.00 per month on shampoo and facial wash. The price of shampoo is P6.00 per sachet while facial is P10.00. He consumes 5 times as many sachets of shampoo as facial wash. Total sachets used in a month is 90. How many sachets of each kind did he buy in a month?	Let s = number of sachets of shampoo and f number od sachets of facial wash. $6x + 10y = 140$ $x - 3y = 0$	
4. You were recruited to become a member of a consumer club. You were told that if you are a member you can buy a capsule of vitamin for P5.00.For non-member, the cost per capsule is P8.00. The membership fee is P100.00. After how many capsules would it be beneficial for you to	Let y be the cost of playing in x capsules Members: $y = 100 + 5x$ Non-members: $y = 8x$	

become a member? Which of the option would you consider?		

END OF DEEPEN

In this section, you have gained knowledge and skills on graphing systems of linear equations using point-plotting and the slopes and y-intercept of each line in the system. You also have learned in the activity above that linear equations can represent situations in real life. Thus, linear equations can be a tool for problem solving and decision making. You also learned that graphs are effective tools for verifying if the equations in the given system have common point. These common points are the values of the variables that makes equations in the system true. These are common values are called the solutions of the system of linear equations.

TRANSFER

In this section, the discussion was about the types of systems of linear equations and how they can be identified by graphing.

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

We have stated at the start of this module that one of the main reasons why we study the system of linear equations is to use them to solve problems in real life and in making decision. How can we use our knowledge of systems of linear equations to to solve problems? Given situations . How do you determine the most favorable option?

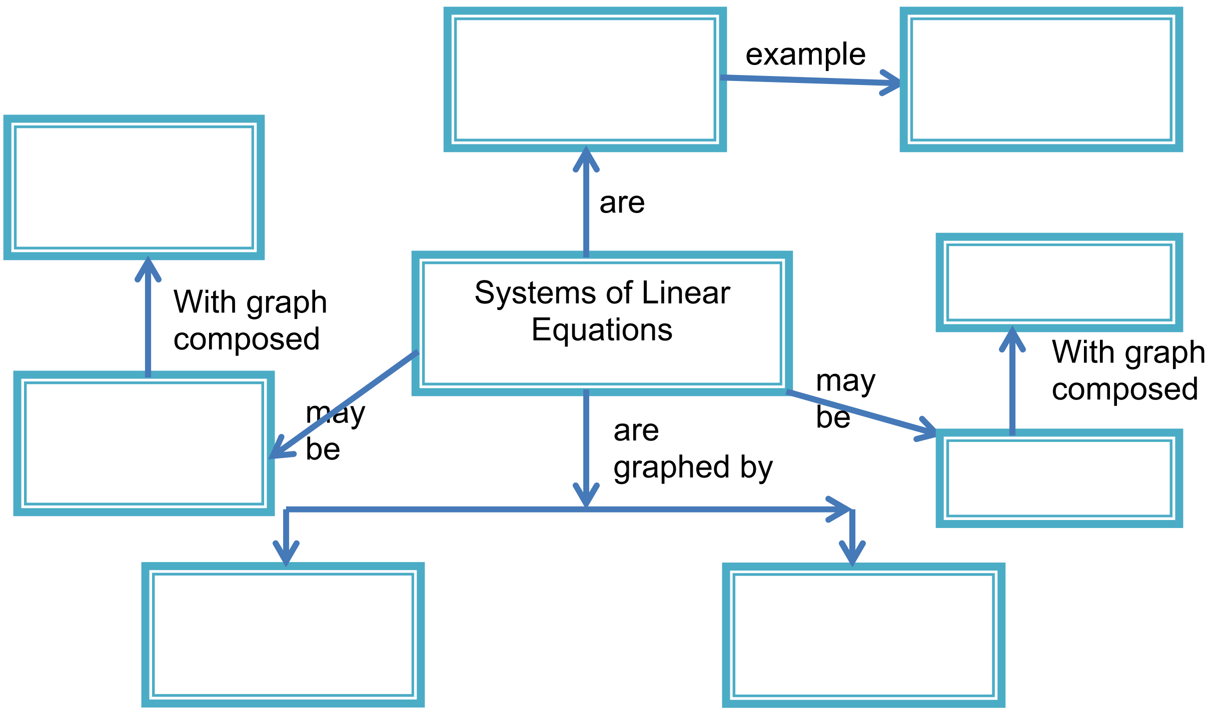
Try to answer these questions as you do the next activities. .

After learning how to graph and interpret graphs of systems of linear equations, you are ready to do the challenge activity for this lesson.

ACTIVITY 9. Let's Summarize

Do the following:

1. What is a system of linear equations?
2. How are systems of linear equations graphed?
3. How can the graph of systems of linear equations be described?
4. In what way are graphs of systems of linear equations useful?
5. How can systems of linear equations be used in real life?
6. In what way are graphs of systems of linear equations useful in real life?
7. Complete the concept map below:



YOUR ANSWERS

Now that you have done activities 1-9 successfully you are ready for a more challenging tasks. You are expected to demonstrate what you have learned in this lesson by doing the next activity.

ACTIVITY 10. Scaffolding (Level 1)

You are offered two jobs selling mobile phones. Company A offers a weekly salary of P1,000.00 plus a commission of 5% of sales. Company B offers a straight commission of 10% of sales.

a. Write a system of linear equations representing the given conditions?
b. Graph the equations in the same coordinate system.
c. How much would you have to sell to have the same salary in a week?
d. Which offer will you accept? Why?

YOUR ANSWERS

END OF TRANSFER:

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding. But you still need to learn many concepts to be able to do your performance task. So you better prepare now for lesson 2 – solving system of linear equations.

Lesson 1:2. Solving Systems of Linear Equations

In this lesson you will learn the following:

1. Graph system of linear equations by graphing.
2. Graph system of linear equations by elimination.
3. Graph system of linear equations by substitution.

EXPLORE

Let's begin by checking your understanding about the topics that you are about to encounter. Try to analyze each statement in the first activity.

ACTIVITY 11. A-R-G

Read and analyze each statement below. Put a check mark to indicate your response. At the end of the lesson, read and analyze the assigned text and then respond again.

Response before the lesson			Response after the lesson	
Agree	**Disagree**		**Agree**	**Disagree**
		The point of intersection is the solution of the system of linear equation.		
		If the graph of two linear equation did not intersect, then there is no solution to the system.		
		If the graph of two or more equations coincide, then there is no solution.		
		Substitution is replacing one variable to its equivalent value.		
		$x + 2y = 11$ is an equivalent equation of $x = 2y + 11$		
		Given $x = 2y – 6$ and $4x + 6y = -4$, you can solve for *y* by substituting the first equation to the second.		

		You can add or subtract unlike terms.		
		When you add opposite signed number, your answer is always equal to zero.		
		When you multiply a number on one side of the equation, you will get an equivalent equation.		

Questions to Answer:

1. After completing the response before the lesson, what questions are confusing?
2. Have you changed your beliefs?
3. Have you confirmed or changed your opinions? Explain.
4. How do you determine the most favorable option?

YOUR ANSWERS

End of EXPLORE:

You just tried finding out how to solve for solutions using graphs and without graphing. Let's find out if how and when to use such methods.

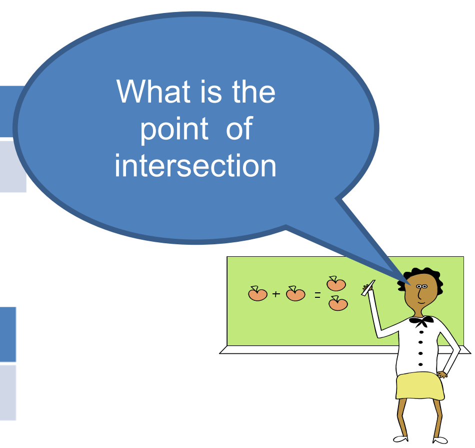
FIRM-UP

Your goal in this section is to learn and understand key concepts on solutions on linear system by graphing, substitution and elimination.

Solving for solution of linear equation using graph is a method of locating the solution. Let's see the relationship of the graph and the solution. Discover where in your graph can you find the solution for the system.

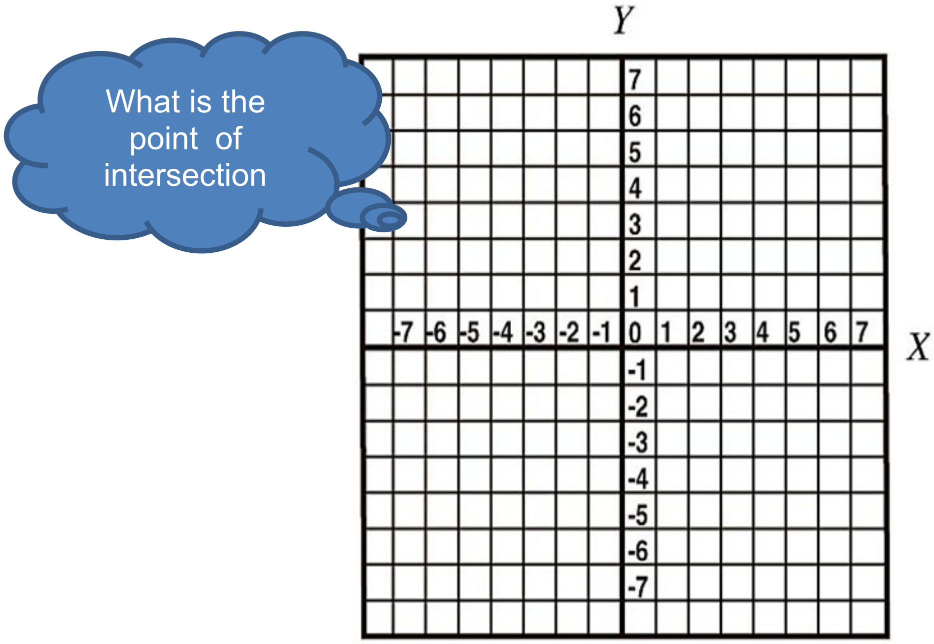
ACTIVITY 12. Plug it in!

x	0	1	2	3	4	5
y						



x	0	1	2	3	4	5
y						

:



Questions to Answer:

1. Which pair from the table satisfies both equations?
2. What is the point of intersection in your graph?
3. Compare the points from the tables and the graph?
4. What is the solution of the system? Describe it using the graph.
5. What solution is easier, the use of table or use of graph?
6. How do you determine the favorable option?

YOUR ANSWERS

Have you ever wondered if the point of intersection is not where the grid lines cross? In such an occasion, do you think it is possible that your estimation will be exactly the same as the others?

You can approximate the coordinates of the point, but there are other methods that can provide you with exact solution. In this learning session, we will explore how to solve for solutions using the most common algebraic method, Substitution and Elimination. Let us begin by the activity below:

ACTIVITY 13. Play with the graph!

In this activity, you will be given linear systems to work on. For each system, you need to fill in the table and click and use this interactive site (http://www.mathwarehouse.com/algebra/linear_equation/systems-of-equation/interactive-system-of-linear-equations.php) to graph the system. Using the graph they made, locate the solution for the system.

Given	Equations	Solution	Checking
1. Eq. 1: (1, 1)(6, -1) **Eq. 2: (0, -4) (2, -3)**	**2x + 5y = 7** **-x + 2y =-8**	**(6, -1)**	
2. Eq. 1: (0, -2)(8, -4) **Eq. 2: (0, -7) (5, -2)**	**-x + y = -7** **X + 4y = -8**	**(4, -3)**	
3. Eq. 1: (3, 1)(5, 3) **Eq. 2: (2, -2) (5, 4)**	**-x + y = -2** **2x – y = 6**	**(4, 2)**	
4. Eq. 1: (1, -2)(3, 2) **Eq. 2: (7, -2) (2, 3)**	**X + y = 5** **-2x + y = -4**	**(3, 2)**	
5. Eq. 1: (0, -1)(3, 1) **Eq. 2: (0, -2) (3, -1)**	**2x – 3y = 3** **X – 3y = 6**	**(-3, -3)**	
6. Eq. 1: (-1, -4)(0, 1) **Eq. 2: (1, 2) (2, 3)**	**7x – 21y = -49** **3x + y = 1**	**(-0.4, 2.2)**	

Questions to Answer:

1. How did you come up with the solution for each linear system?
2. How will you describe the solution to every equation?
3. What will happen if the coordinates are not in order?
4. How did you use graph and check method to solve a linear system on two
   equations in two variables?

5 Why is it important to check your solution?

6. In locating the solution, what part do you find it difficult?

7. What will happen if the point of intersection is not exactly on the grid lines?
   What will you do in such occasion?
8. What are the factors that affect your decision in choosing the point to be the solution in the system?
9. How do you determine the favorable option?

YOUR ANSWERS

ACTIVITY 14. Mixing Challenge!

You are a chemist in MFM Laboratory. You are tasked to make 11 liters of 70% alcohol solution for the company's Casino Project. In your laboratory, you only have the following available solutions; 50% alcohol solution and pure alcohol. How many liters of each solution should you mix to make 11 liters of 70% alcohol solution?

Questions:

1. What representations will you use and what will you represent?

Represent the number of liters for 50 % alcohol solution and for pure solution.

2. What equations will you use to solve the problems?

Write an equation for the total number of liters and an equation for the number of liters of alcohol solutions.

3. How can substitution be used in finding the unknowns?
4. What are the values for the unknowns how can you check your answer?
5. Which solution will have greater amount if you need to make 90%? Can you use the same solutions to make 30% alcohol solutions?
6. How much pure alcohol and 50% alcohol solution you need if you have to produce 16 liters of 70% solution?
7. What will happen if you miscalculated the amount of solution that you will use?
8. How did you determine the exact amount of solution you need?
9. How would you determine the most favorable option?

YOUR ANSWERS

The National Animal Kingdom

DESCRIPTION:

Practice solving for system of Linear Equations using substitution method. Solve for the value of the unknown quantities to reveal the national animal of the given countries.

1. Albania *a*

   $2x + 2y = -6$

   $x - y = -1$

2. Algeria *d*

   $x = 2 - y$

   $x - y = -4$

3. Angola *e*

   $x = -2y$

   $3x + 2y = -4$

4. Anguilla *b*

   $x = 2y + 1$

   $2x - 4y = 2$

5. Austria *c*

   $4x + 8y = 24$

   $x + 2y = 10$

a. Golden Eagle

$(-2, -1)$

b. Zenaida Dove

INFINITELY MANY SOLUTIONS

c. Black Eagle

NO SOLUTION

d. Fennec Fox 6

$(-1, 3)$

e. Magnificent Frigatebird

$(-2, 1)$

Questions to Answer:

1. Why does a consistent system with dependent equations result in a true equation when solved using the substitution method?
2. What is the solution for such condition?
3. Why does in inconsistent system result in a false equation when solved using the substitution method?

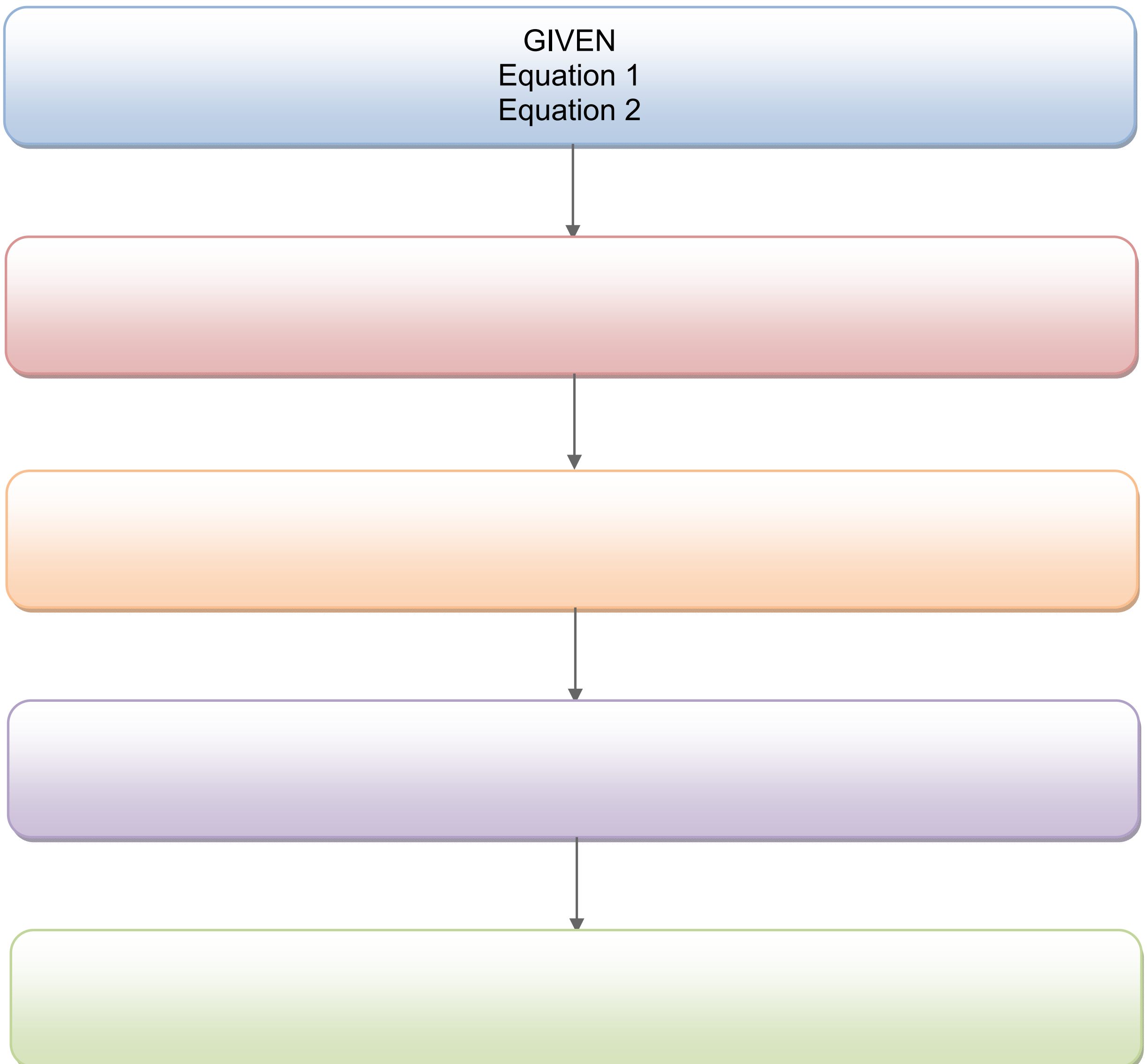
4. What is the solution for such condition?
5. How can you check your answer?
6. How do you choose which equation will you to solve for one variable in terms of the second variable?
7. How can finding solutions of the systems of linear equations help you determine the most favorable option?

YOUR ANSWERS

Solving for system of linear equations using substitution method requires you to follow certain steps and procedure. The next activity, will help you organize information and make meaning out of the knowledge and skills you encountered earlier.

ACTIVITY 15. SUBSTITUTION FLOWCHART

Direction: Complete the flow chart below to show how Substitution Method can be used to solve systems of linear equations . If you think you need to add more boxes, you may do so. After filling up your chart, discuss your work with a fellow learner then answer thee guide questions below.



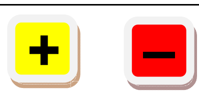
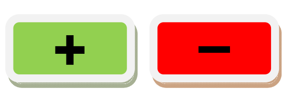
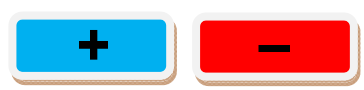
Questions to Answer:

1. How did you come up with such a chart?
2. What are the factors you considered in writing the procedure in sequence?
3. Given the chance to share your answer with a fellow learner, was there any difference to the procedure in its same sequence?
4. How much of your initial ideas are found in your partner's ideas? Which ideas are different and need revision?
5. How would you determine your options given certain constraints?

YOUR ANSWERS

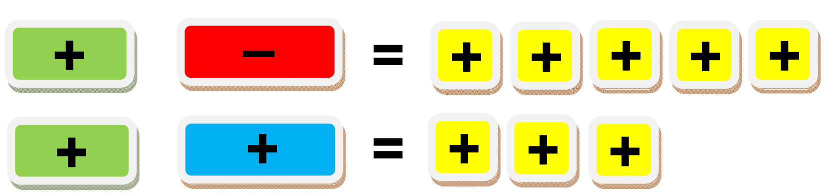
ACTIVITY 16. INVESTIGATE ALGEBRA TILES

Algebra tiles can help you in modeling algebraic concepts and skills, such as combining like terms. You can use the following tiles to model equations.

1-tiles	*x*-tiles	*y*-tiles
		

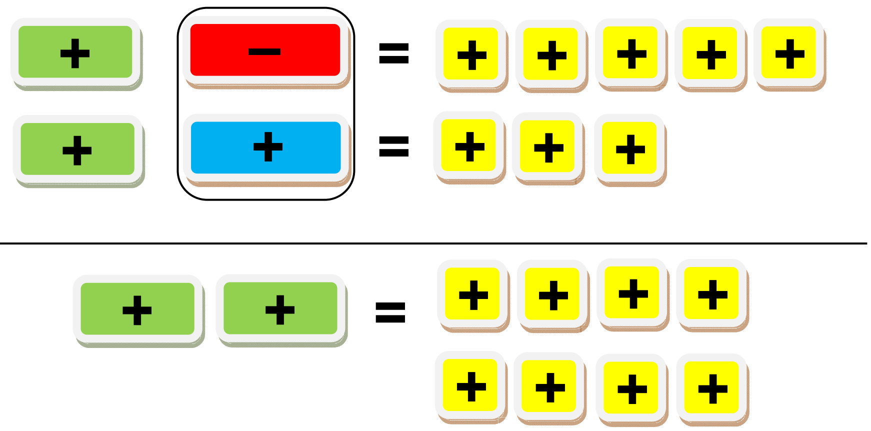
Equation 1: x – y = 5 *Equation 2:* x + y = 3

STEP 1: Model equations. Arrange algebra tiles so that one equation is directly below the other equation.



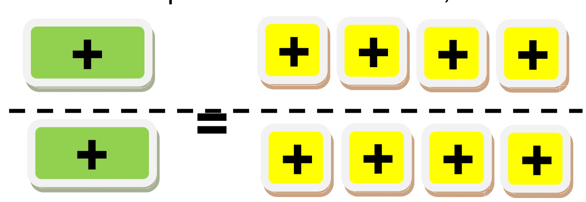
It's your turn! Do step 1
Equation 1: x + 2y = 3   *Equation 2:* x – 3y = 2

STEP 2: Add equations. Combine the two equations to form one equation. Notice that the new equation has one positive *y*-tile and one negative *y*-tile. The *y*-tiles can be removed.



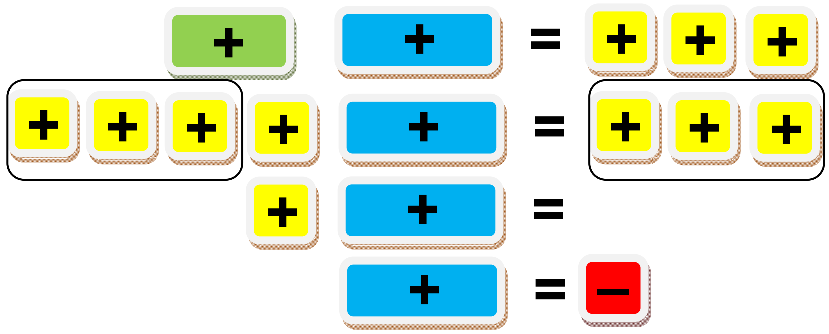
It's your turn! Do step 2

STEP 3: Solve for x. Each *x*-tile is equal to four 1-tiles. So, x = 4.



It's your turn! Do step 3

STEP 4: Model one of the equation. Solve for y.



So, y = -1. Therefore, the solution is (4, -1)

It's your turn! Do step 4

Questions to Answer:

1. How do the different tiles relate to each other?
2. What will happen if you transfer a tile on the other side of the equation?
3. What variable did you eliminate first? Why?
4. What variable has been solved?
5. How do you find the value of the other variable?
6. In what way are algebra tiles helpful in solving systems of linear equations?
7. Why do you think the process work?

YOUR ANSWERS

Now you can have a drill on solving systems of linear equations using the different method that you have learned with the help of technology.

ACTIVITY 17. Lets Go Techi!

Are you ready to take another challenge? Click on this link (http://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/e/systems_of_equations_with_elimination_0.5) and answer the interactive activity using elimination method by addition and subtraction. Then, click on this link (http://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/e/systems_of_equations_with_elimination) and answer the interactive activity using the same method by multiplying first. In this site, you will be encountering drills and by simply clicking on the CHECK ANSWER, the web site solution will be shown one step at a time. You can use it so that you will be well guided.

Questions to Answer:

1. What part of the solution do you find more challenging?
2. What will you do to overcome this challenge?
3. How did you choose the variable to be eliminated?
4. Do you think your fellow learners will choose the same? Explain.
5. How do you determine the most favorable option?

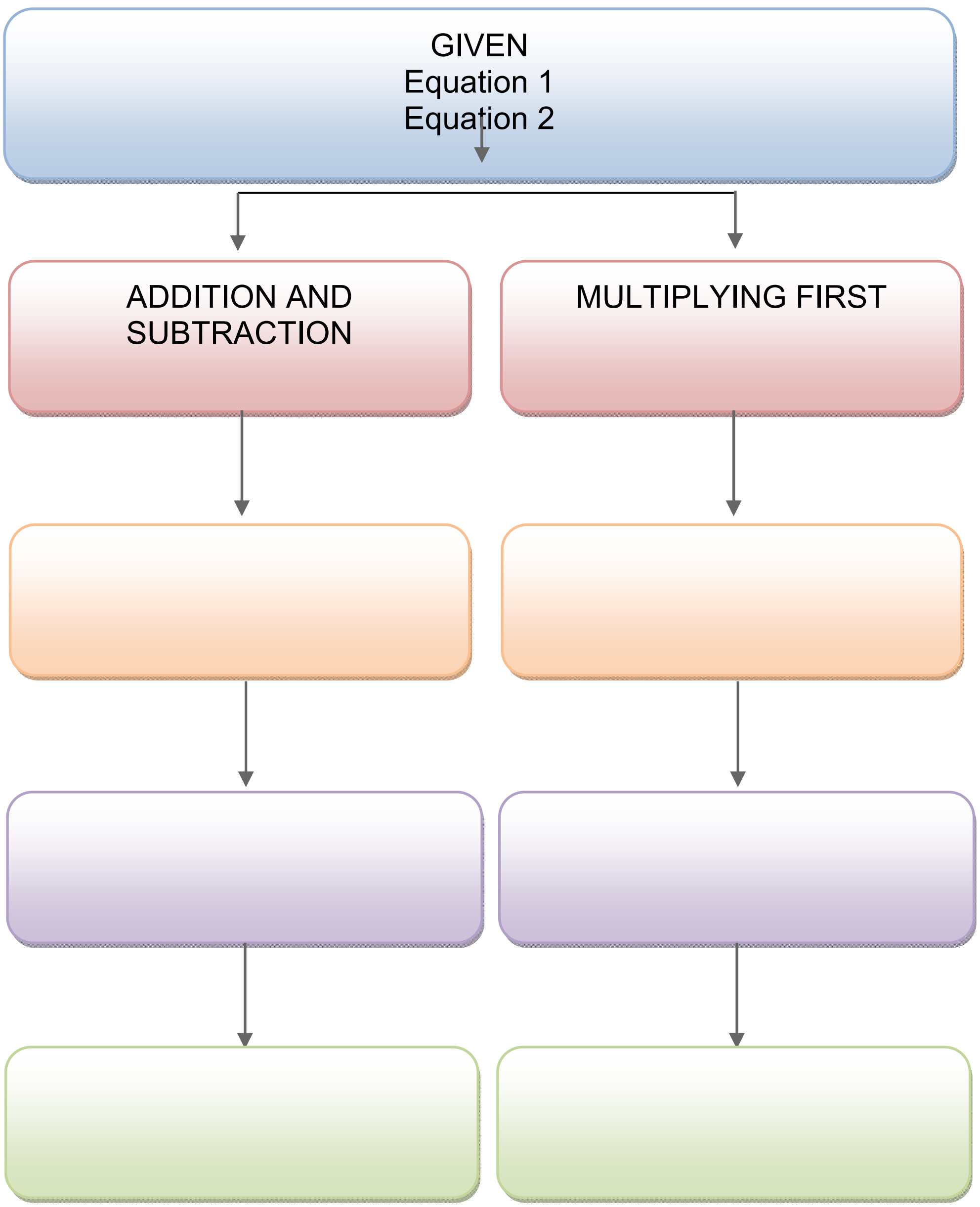
YOUR ANSWERS

Solving for system of linear equations using elimination method requires you to follow certain steps and procedure. The next activity will help you organize information and make meaning out of the knowledge and skills you encountered earlier.

ACTIVITY 18. ELIMINATION FLOWCHART

Direction:

Complete the flow chart below to show how to solve systems of linear equations using the elimination method. . If you think you need to add more boxes, you may do so. After filling up your chart, discuss your work with a fellow learner then answer the guide questions below.



Questions to Answer:

1. How did you come up with such a chart?
2. What are the factors you considered in writing the procedure in sequence?
3. Given the chance to share your answer with a fellow learner, was there any difference to the procedure in its same sequence?
4. How much of your initial ideas are found in your partner's ideas? Which ideas are different and need revision?
5. How would you determine your options given certain constraints?

YOUR ANSWERS

The next activity will help you master the skills in solving systems of linear equations using any of the methods that you have learned.

ACTIVITY 19. Digital Natives on the go!

The site below gives an interactive exercise for both the substitution and the elimination method. You are free to choose what method to use. It demonstrates the solution on both methods for systems of linear equations in two variables.

http://www.regentsprep.org/Regents/math/ALGEBRA/AE3/PracAlg.htm

Questions to Answer:

1. What method do you find more difficult? Why?

2. What are the factors you considered in deciding what method to use?
3. In which equation would you solve for which variable?

Solve for an equation where one of the variable have a numerical coefficient 1. So that only one step is needed to solve equation for one of the equations.

4. Suppose you solve a linear system using substitution/elimination. Explain how you can use the graph to check your solution.
5. Which of the three methods is easier for you? Justify your answer.
6. What is the most favorable method?

YOUR ANSWERS

Now you are ready to assess what you have learned so far. In the next activity, your ability to recall mathematical concepts and principles about solving linear system will be tested to completely answer each question.

ACTIVITY 20. Challenge Yourself!

Direction: Select the letter corresponding to the correct answer.

1. The solution set in the linear system y = x + 2 and y = 2x – 2.
   a. (6, 4)
   b. (4, 6)
   c. (1, 3)
   d. No solution
2. Which system of equation has no solution?
   a. x – y = 5 and 2x + y = 1
   b. x – y = 3 and x + y = 4
   c. 2x – y = 6 and x + y = 9
   d. x + y = 3 and x + y = 2
3. It is the solution in the system x + y = 10 and x – y = 6.
   a. (-2, 5)
   b. (6, 4)

c. (3, 7)
d. (8, 2)

4. It is the point of intersection of the linear system $y = -\frac{1}{2}x + 3$ and $y = 2x + 8$.
   a. (-2, 4)
   b. (4, 1)
   c. (0, 8)

(7, -2)

For numbers 5 and 6, use system of equation $y = 4x + 14$ and $7x - 3y = -17$.

5. It is the resulting equation after you substitute equation 1 to equation 2.
   a. $7(4x + 14) - 3y = -17$
   b. $7x - 3(4x + 14) = -17$
   c. $7(4x - 14) - 3y = -17$
   d. $7x - 3(4x - 14) = -17$
6. It is the solution in the given system.
   a. (5, 7)
   b. (-5, 7)
   c. (-5, -6)
   d. (-5, 6)

For numbers 7 and 8, use the system of equations $4x + y = 19$ and $y = 2x + 7$.

7. It is the resulting equation after you substitute equation 1 to equation 2.
   a. $4(2x + 7) + y = 19$
   b. $4x + (2x + 7) = 19$
   c. $4(2x - 7) - y = 19$
   d. $4x - (2x + 7) = 19$
8. It is the solution in the given system.
   a. (2, 11)
   b. (1, -3)
   c. (4, -3)
   d. (0, 5)

For numbers 9 and 10, the system (Eq. 1) $6x + 5y = 19$ and (Eq. 2) $2x + 3y = 5$ and use elimination by multiplying first.

9. It is the number to be multiplied to equation 2 and the new equation formed.
   a. 5 and $10x + 15y = 25$
   b. 3 and $6x + 9y = 15$

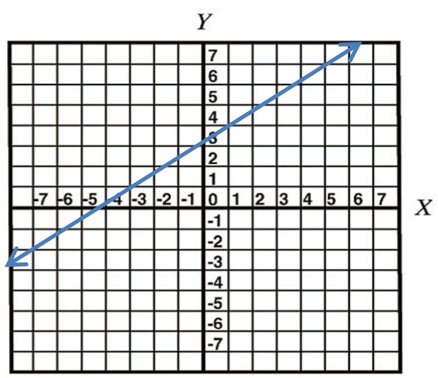
c. -3 and 6x – 9y = -15
d. -5 and 10x – 15y = - 25

10. It is the solution set in the given equation.
a. (4, -1)
b. (-1, 4)
c. (-4, 1)
d. (1, -4)

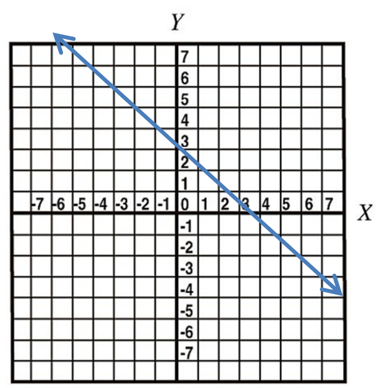
For numbers 11– 13, use the system of linear equation
(Eq. 1) y = – x + 3 and (Eq. 2) y = 4x - 2

11. It is the graph of equation 1: y = – x + 3.

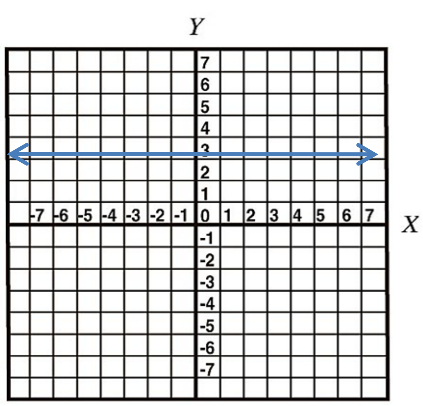
a.



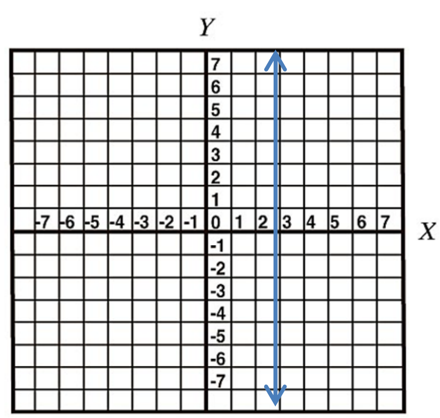
c



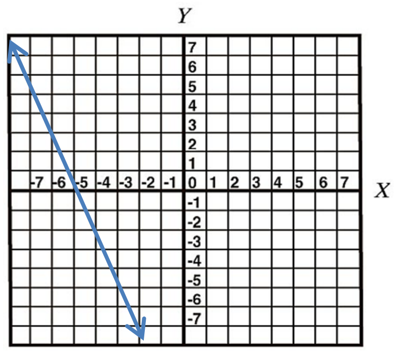
b.

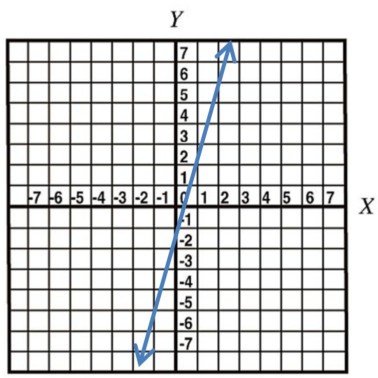


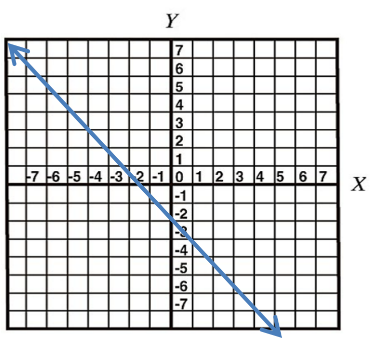
d.

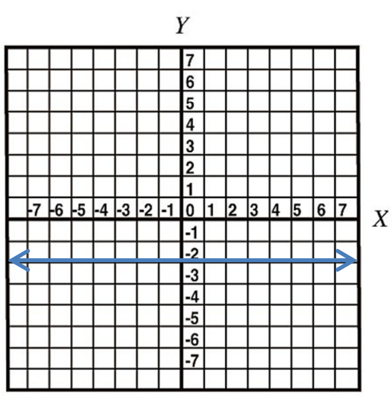


12. It is the graph of equation 2: $y = 4x - 2$.

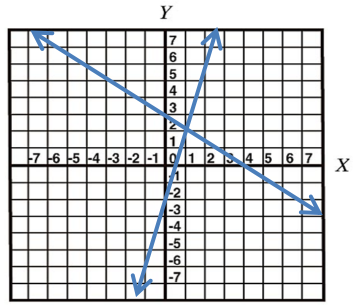
a. 

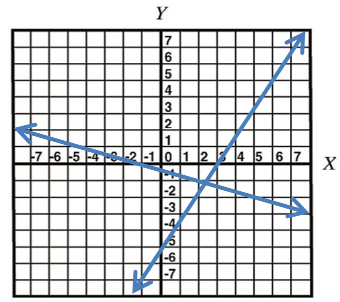
b. 

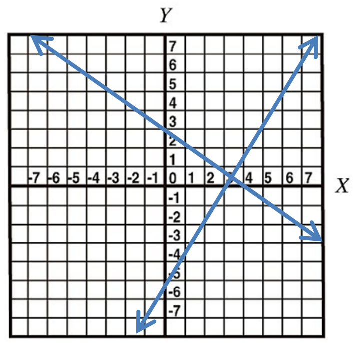
c. 

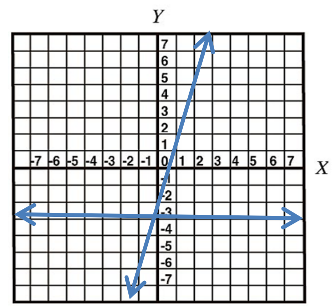
d. 

13. It is the graph of the given system of linear equation.

a. 



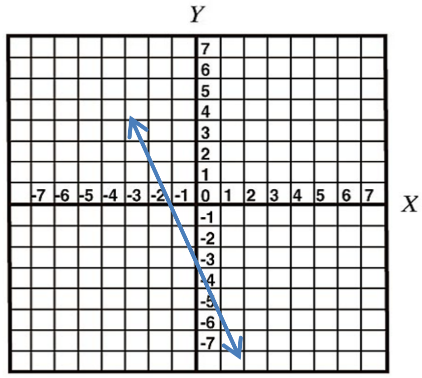
b. 

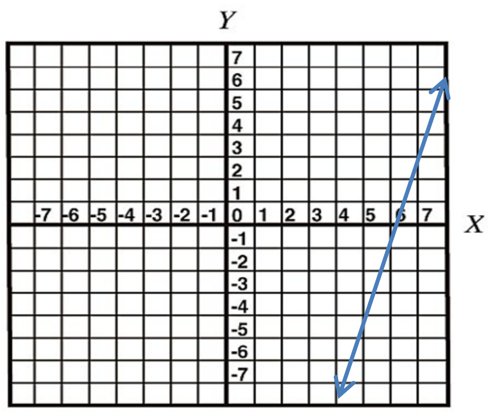
d. 

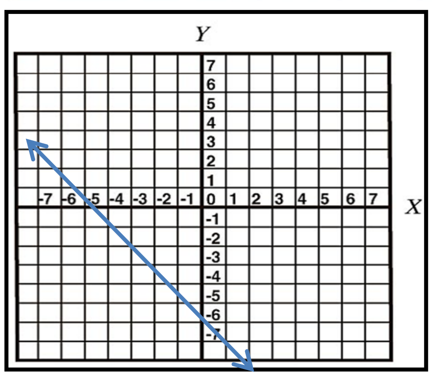
14. The system 2x + 3y = 7 (Eq. 1) and 3x + 2y = 8 (Eq. 2) can be solved by elimination method by eliminating x when _______.
    a. The first equation is multiplied by 3 and the second equation by 2.
    b. The first equation is multiplied by 2 and the second equation by 3.
    c. The first equation is multiplied by 6 and the second equation by 8.
    d. The first equation is multiplied by 8 and the second equation by 6.

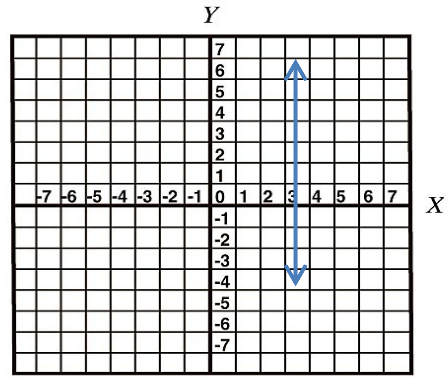
15. The equations in item number 14 after multiplying the numbers to eliminate x.
    a. 6x + 9y = 21 and 6x + 4y = 16
    b. 4x + 6y = 14 and 9x + 6y = 24
    c. 16x + 24y = 56 and 18x + 12y = 48
    d. 12x + 24y = 42 and 24x + 16y = 64

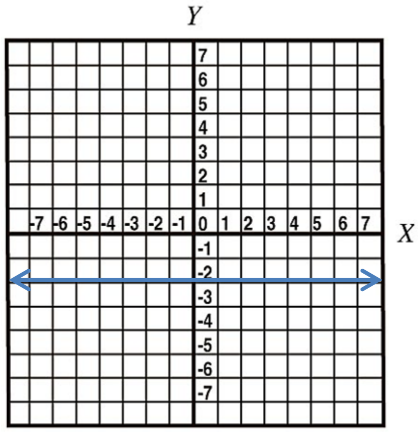
16. It is the graph of equation 1: y = – x + 3. It is the graph of equation 2: y = 4x – 2.

a. 

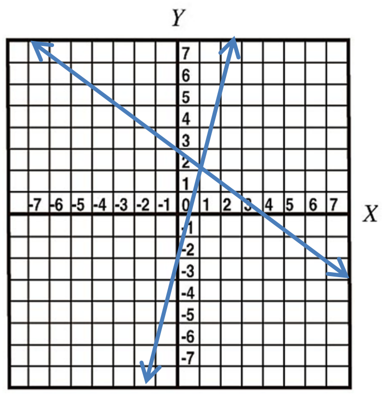
b. 

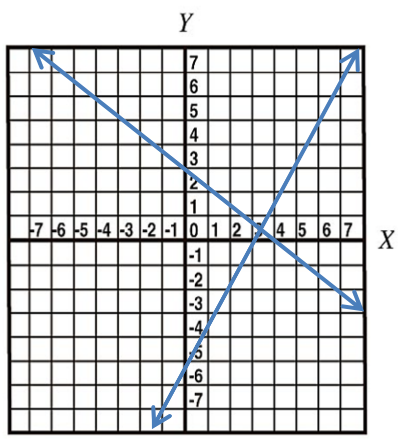
c. 

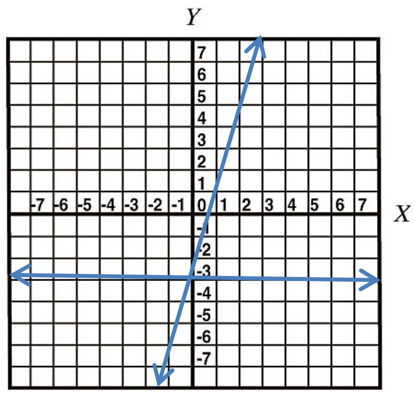


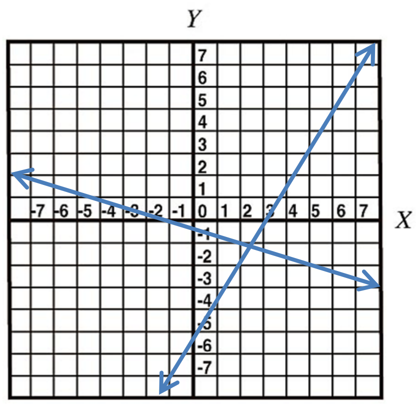
d. 

17. It is the graph of the given system of linear equation.

a. 

b. 

c. 

d. 

18. The system 2x + 3y = 7 (Eq. 1) and 3x + 2y = 8 (Eq. 2) can be solved by elimination method by eliminating x when _______.
    a. The first equation is multiplied by 3 and the second equation by 2.
    b. The first equation is multiplied by 2 and the second equation by 3.
    c. The first equation is multiplied by 6 and the second equation by 8.
    d. The first equation is multiplied by 8 and the second equation by 6.

19. The equations on item number 14 after multiplying the numbers to eliminate x.
    a. 6x + 9y = 21 and 6x + 4y = 16
    b. 4x + 6y = 14 and 9x + 6y = 24
    c. 16x + 24y = 56 and 18x + 12y = 48
    d. 12x + 24y = 42 and 24x + 16y = 64

20. The solution of the system in item number 15.
    a. (2, 1)
    b. (1, 2)
    c. (-2, -1)
    d. (-1, -2)

For numbers 17 - 18, refer to the following: A total of P170 coins consisting 10 peso coin and 5 peso coin are in a purse. If there are 25 pieces of coins, find the number of each denomination.

21. It is the system of equations that represents the given situation when *x* is the number of 10 peso coin and *y* is the number of 5 peso coin.
    a. Eq. 1: $5x + 10y = 170$
       Eq. 2: $x + y = 25$

    b. Eq. 1: $10x + 5y = 170$
       Eq. 2: $x + y = 170$
    c. Eq. 1: $5x + 10y = 25$
       Eq. 2: $x + y = 170$

    d. Eq. 1: $10x + 5y = 170$
       Eq. 2: $x + y = 25$

    a. It is the number of each denomination.There are 16 pieces of 10 peso coin and 9 pieces of 5 peso coin.
    b. There are 12 pieces of 10 peso coin and 13 pieces of 5 peso coin.
    c. There are 9 pieces of 10 peso coin and 16 pieces of 5 peso coin.
    d. There are 13 pieces of 10 peso coin and 12 pieces of 5 peso coin.

For numbers 19 - 20, refer to the following: Concert tickets for Nikki Minaj concert is now on sale. Glenda paid P2550 for 9 patron seats and 5 upper boxes. You paid for P2400 for 6 patron seats and 8 upper boxes. How much does each ticket cost?

22. It is the system of equations that represents the given situation when *x* is the cost of each patron ticket and *y* cost of upper box ticket.
    a. Eq. 1: $5x + 8y = 2550$
       Eq. 2: $9x + 6y = 2400$

    a. Eq. 1: $9x + 6y = 2550$
       Eq. 2: $5x + 8y = 2400$
    b. Eq. 1: $9x + 5y = 2550$
       Eq. 2: $6x + 8y = 2400$

    c. Eq. 1: $6x + 8y = 2550$
       Eq. 2: $9x + 5y = 2400$

23. It is the price of each ticket.
    a. Patron ticket cost P200 each and upper box cost P150 each.

b. Patron ticket cost P150 each and upper box cost P200 each.
c. Patron ticket cost 400 each and upper box cost P300 each.
d. Patron ticket cost P300 each and upper box cost P400 each.

END OF FIRM - UP

In this section, you have learned how to solve systems of linear equations using substitution and elimination method.

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

Your goal in this section is to take a closer look at some aspects of the topic. You will have a hands on experience on the usefulness of the systems of linear equations in solving problems.

Learning how to solve for system of linear equation using algebraic method will give you accurate solutions. Accuracy in real life is very important.

ACTIVITY 21. Make it Real!

Direction: Click on this link (http://www.regentsprep.org/Regents/math/ALGEBRA/AE3/PracWord.htm) and answer the interactive activity. When done, try the challenge below and answer the questions in the space provided.

I. It's your turn

Choose one problem in the site. Extend the problem by changing the conditions, adding more information or you may write your own real life problem and use your chosen problem as a guide. Do not forget to write the solution for your problem.

Questions to Answer:

1. What have you noticed about the solutions in the website?

2. How would compare your solutions to the solutions in the website?
3. Where else can we apply substitutions or eliminations in real-life?
4. What substitutions do you usually make in real-life? Explain.
5. What are the things that you usually eliminate and why?
6. Do you think eliminating these things will help you?
7. What are the things you did that you think helped you?
8. What are the things that you need to keep in mind?
9. How do you determine the most favorable option?

When done, copy your answers and e-mail to your teacher.

YOUR ANSWERS

END OF DEEPEN

In this section, the discussion was about analyzing real life applications of graphing, substitution and elimination methods. Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 22. Let's Get Physical!

You are a fitness adviser of ABC fitness gym and you are assigned in three different machines; a stair machine that can burn 5 calories l/min, an elliptical trainer that can burn 8 calories/.min and a stationary bike than can burn 6 calories/min. You need to show different choices of complete fitness programs for a client using two of your machines given the different number of minutes to exercise and the desired number of calories to be burned. Select 5 clients and determine the fitness program they want to attend to.

PROCESS QUESTIONS:

1. How did you find the performance task?
2. How did the task help you see the real world use of the topic?
3. What new realizations do you have about the topic?
4. What new connections have you made for yourself?
5. What part of the task do you find challenging?
6. What have you done to overcome these challenges?
7. What are the factors that will affect the decision of your client?
8. How do you determine the most favorable option?

YOUR ANSWERS

END OF TRANSFER:

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding but that task will be given to you after learning lesson 3 – system of inequalities.

Lesson 1.3 Graphs and Graphical Solutions of Systems of Linear Inequalities in Two Variables

In this lesson you will learn the following:

1. Graph system of linear inequalities in two variables.

2. Solve a system of linear inequalities in two variables by graphing.

3. Solve problem involving systems of linear equations and inequalities in two variables.

4. Identify applications of systems of linear equations and inequalities in real life. Graph system of linear equations by elimination.

EXPLORE

You learned from lesson 2 that the solution to the system of linear equations can be determined by looking at the intersection of the graphs of the system. In many cases, the graphs contain one intersection or one solution only. Aside from graphing, the solution of the system can also be determined through substitution or elimination method.

In this lesson, you will learn how to find the solutions of the system of linear inequalities by determining the region of solutions. You will also learn how to choose the best option given different situations.

Let's us start the lesson by answering and responding to the first situation which will test our critical thinking skills and problems solving strategy.

A. Graphical Method

How do you determine the most favorable option?
How would you determine your options given certain constraints?
How are systems of inequalities used to solve problems in real life?

Let's answer these questions in the by doing the activities below.

ACTIVITY 23. How Will You Deliver?

You are the manager of a hardware store which sells construction materials. One day you need to deliver a minimum of 500 bricks and 10 bags of sand to the construction site. Each brick weighs 2 pounds and each bag of sand weighs 50 pounds. You are aware that the maximum weight that a delivery truck can carry is 3000 pounds.

A. Modelling: Use x for bricks and y for sand.

Questions to Answer:

1. What inequality would model the minimum number of bricks?
2. What inequality would model the minimum number of bag of sands?
3. What inequality would model the number of bricks and sand for which the truck can carry?
4. Questions:
a. Can you deliver 600 bricks and 30 bags of sand in one trip?
b. How about 700 bricks and 35 bags of sand in one trip?
    c. If a bag of sand is needed for every 12 bricks, what is the ideal number of bricks and bag of sand should you deliver in one trip? Why?
    5. What will happen if you miscalculated the computation? If the truck got overload, what could be the possible result?
6. How did you use the concepts of math in your decisions?
    7. What are the difficulties that you encounter in answering the questions?
8. How do you determine the most favorable option?
    9. How would you determine your options given certain constraints?

To assess your work, your teacher will use the label below for you to know your performance in this problem solving activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

End of EXPLORE:

You just have tried to find out how mathematics can help you determine the most favorable option in life. Let us now strengthen that insight by doing the succeeding activities. What you will be learning in this section will help you perform well in your final performance task which will challenge you to use what you know to determine the best option.

Now move to activity 2 to learn the knowledge and skills you need to be a good problem solver and respond to different situations accurately.

FIRM-UP

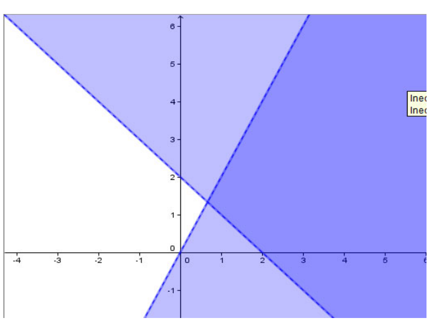
Your goal in this section is to learn and understand how to graph and analyze the solutions of system of inequalities.

ACTIVITY 24. Compare and Contrast!

In the previous situation, you encountered problems related to system of inequalities. In the next activity, you will develop the knowledge and skills in graphing systems of inequalities in two variables.
Directions: Observe the graphs of systems of inequalities below. Try to discover their similarities and differences. Answer the questions below.

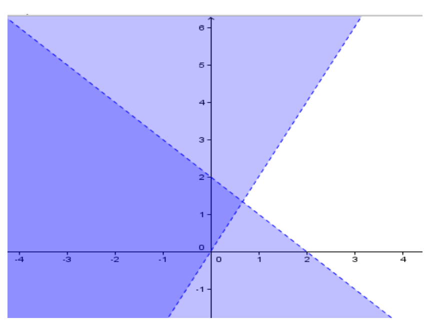
Graph 1

$x + y > 2$
$2x - y > 0$

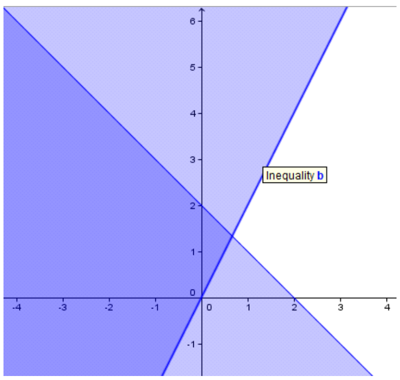


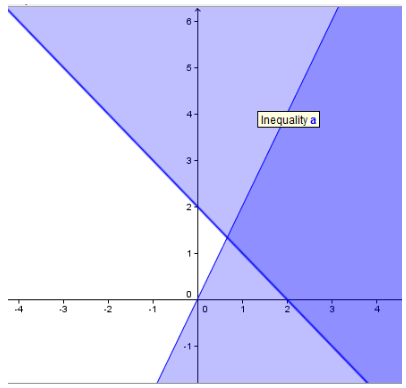
Graph 2

$x + y < 2$
$2x - y < 0$



Graph 3	Graph 4
$x + y \geq 2$	$x + y \leq 2$
$2x - y \geq 0$	$2x - y \leq 0$





Questions to Answer:

1. Compare graph 1 to graph 4 and graph 2 to graph 3, what did you notice? How do the symbols > and < differ from ≥ and ≤?
2. Compare graph 1 to graph 2 and graph 3 to graph 4, what did you notice? How do the symbols" >" and "≥" differ from "<"and "≤"?
3. How would you describe the region of intersection?
4. How would you compare the region of intersection to the solutions of the given system of inequalities? Justify your answer by giving 3 examples.
5. How can you use the concepts of inequalities in real life?
6. How would you determine your options given certain constraints?

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

In the previous activity you learned how to get the solution of systems of inequalities through graphing. Now, develop your skills in identifying whether a given point is a solution or not by working on the next activity.

ACTIVITY 25. PROVE IT!

Directions: Complete the table by filling up the 3rd and 4th columns. In the 3rd column, decide whether the given point is a solution to the system by writing the word "TRUE", and "FALSE" if otherwise. In the fourth column, justify your answer by substituting the given point to the given system.

System of Linear Inequality	Given Point	Decision	Justification
1. $2x + y > 5$ $3x - y < 6$	(2, 4)		
2. $5x - y \leq 5$ $3x - 2y > 6$	(-2, 1)		
3. $4x - 3y \leq 12$ $3x + 4y > 6$	(2, 2)		
4. $2x - 4y < 8$ $3x + 4y > 12$	(4, 0)		
5. $x - 4y \geq 8$ $2x - 6y < 12$	(0, -2)		

Questions to Answer:

1. How did you decide whether the given point is a solution to the system or not?
2. What is your decision if only one inequality is satisfied?
3. How would you describe the solutions of the system of inequalities?
4. Why should you know if the given point is a solution to the system or not?
5. What are the things you need to consider in solving problems related to the given situations?
6. How would you determine your options given certain constraints?

To assess your work, your teacher will use the label below for you to know your performance in this problem solving activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

In the previous activities, you learned how to verify whether the given point is a solution to the system or not. Now, we explore the use of technology to help us learn the lessons more thoroughly.

ACTIVITY 26. Meet the Digital Native

Directions: To help you solve the problems below, you need to open this interactive website below: In this site, you may move the points where each system of inequalities contains to satisfy the conditions below. Complete the table by writing the necessary information. An example is provided.

http://www.mathwarehouse.com/algebra/linear_equation/systems-of-equation/interactive-system-of-linear-inequality.php

This website contains interactive activities where graphs of system of inequalities can be manipulated by moving the points.

Conditions	Solution	system
1. The 1st inequality passes through (2, -2) and (-2, 4). The 2nd inequality passes through (-2, 0) and (0, 3).	One of the possible solutions is (0, 4).	$y \geq -1.5x + 1$ $y \geq 1.5x + 3$
2. The 1st inequality passes through (-2, -2) and (2, 2). The 2nd inequality passes through (-2, 2) and (2, -2).	One of the possible solutions is (0, 2).	

3. The 1st inequality passes through (2, 3) and (-2, -3). The 2nd inequality passes through (0, 0) and (3, 1).		$y \geq .33x$ $y \geq 1.5x$
4. The 1st inequality passes through (-3, 4) and (2, -1). The 2nd inequality passes through (-3, 1) and (2, 4).	One of the possible solutions is (-1, 5).	
5. The 1st inequality passes through (-1, 3) and (2, -3). The 2nd inequality passes through (-3, 2) and (2, -1).		$y \geq -.6x + .2$ $y \geq -2x + 1$

Questions to Answer:

1. What did you learn from the interactive website?
2. How did you choose the possible solutions?
3. How would you describe the solutions of system of inequalities?
4. Given so many points, how would determine the possible options?

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

ACTIVITY 27. Let's Trace It

Directions: To help you solve the problems below, you need to open these YouTube videos: In this video, you will learn some tips on how to graph system of inequalities in a very cool way. But if you prefer a more serious presentation, you may open the 2nd video.

http://www.youtube.com/watch?v=Eiwi3FvQumU&feature=rellist&playnext=1&list=PLTXF78ZN40CK2-BAY20GEBVFKJG8ARGJO

This video contains a cool presentation on how linear inequalities are graphed by focusing on the concept on how to shade the graphs of inequalities. This is entitled "SHADE IT".

http://www.youtube.com/watch?v=7sInE5tGJX4

This video contains a detailed and clear presentation on how to graph system of linear inequalities in two variables. This is also a good tool especially for the open high school students.

Graph each system of inequalities. From the graph, select the description of the proper solution to that set of inequalities, remembering that the top one is inequality 1 and the bottom one inequality 2.

1. c $\begin{cases} 5y-10x \ge 5 \\ 3y+3x \le 21 \end{cases}$ a. below inequality 1 and left of inequality 2 b. below inequality 1 and right of inequality 2 c. below inequality 2 and left of inequality 1	2. a $\begin{cases} 2y-6x \le 10 \\ 4y+8x \ge 12 \end{cases}$ a. above inequality 1 and right of inequality 2 b. below inequality 1 and right of inequality 2 c. above inequality 2 and right of inequality 1
3. c $\begin{cases} 3y-9x \ge 9 \\ 2y-6x \le -8 \end{cases}$ a. below inequality 1 and left of inequality 2 b. below inequality 1 and right of inequality 2 c. there are no solutions	4. b $\begin{cases} 3y-2x \ge 18 \\ 2y+3x \le -8 \end{cases}$ a. below inequality 1 and right of inequality 2 b. above inequality 1 and left of inequality 2 c. there are no solutions
5. b $\begin{cases} 4x+3y \le 10 \\ 4y-9x \le 4 \end{cases}$ a. below inequality 1 and left of inequality 2 b. below inequality 1 and right of inequality 2 c. below inequality 2 and right of inequality 1	

Questions to Answer:

1. What did you learn from the video presentations?
2. How did you use it in answering the questions in your quiz?
3. What did you consider in choosing the best answers?
4. How would you determine your options given certain constraints?

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

At this point you should have the red color, because you are about to encounter the deepen part. You are now expected to master how to graph systems of inequalities; let us see if you are able to graph system of inequalities independently. If you are still in the blue color at this point, find ways to meet your teacher for face to face instructions.

ACTIVITY 28. Map It Out!

Directions: Graph each of the following systems of inequalities and then identify 3 specific points which belong to the region of solutions.

Level 1	Level 2	Level 3
1. $y < 2x$ $2x + 3y > 6$	4. $2x - y > 2$ $x < 6$ $x > -2$	7. $y > 2$ $y < 6$ $x < 6$ $x > -2$
2. $3y > 2x-1$ $2x - 3y < 6$	5. $3x - 3y > 6$ $y > 2$ $y < 8$	8. $y \geq 2$ $y < 6$ $x \leq 6$ $x > -2$
3. $x + y \geq 3$ $3x - 4y \leq 12$	6. $3x - 5y < 15$ $x \leq 4$ $x \geq -3$	9. $y \geq -4$ $y \leq 0$ $x \leq 3$ $x \leq -5$

Questions to Answer:

1. What did you realize in graphing systems of linear inequalities?
2. How do graphs of the systems of level 1 differ from level 2? Level 3?
3. How did you know the solutions given these conditions?

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

Before we move to the deepen part, let's stop and write the things we learned from the previous activities.

ACTIVITY 29. Understanding Check!

CORNELL' S NOTE	
TOPICS	**THINGS I LEARNED**
Question I want to be answered:	

END OF FIRM - UP

In this section, you have learned how to solve systems of inequalities through graphing. Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

Your goal in this section is to take a closer look at some aspects of the topic. You will have a deeper experience about the importance of the lessons which will help you accomplish your performance task.

ACTIVITY 30. Watch My Model

Directions: Read each situation carefully, and then complete the table by writing the appropriate inequality to model the situation given.

Situation	Inequality
1. The no. of apples in the basket is no more 60 pieces while the no. of bananas is at most 35. Represent x for the no. of apples and y for the no. of bananas.	

2. To avail of the promo, you need to spend at least P1,000, but for you to get home, you need to save at least P35 for transportation. Represent x for the amount to avail the promo and y for your transportation.	
3. A person's maximum heart rate is given by 220 – x, where x is the person's age in years from 20 to 65. When exercising, a person should aim for a heart rate that is at least 70% of the maximum heart rate and at most 85% of the maximum heart rate. Represent the age of a person and use y to represent the heart rate when exercising.	
4. The shaded region of the system of inequalities is a rectangle with vertices at (2, 1), (2, 4), (6, 4), and (6, 1). Find the system of inequalities.	
5. The shaded region of the system of inequalities is a triangle with vertices at (-3, 0), (3, 2), and (0, -2). Find the system of inequalities.	

Questions to Answer:

1. What did you consider in representing situations to system of inequalities?
2. Why is it important to have a correct representation?
3. How did you model situations using systems of linear inequalities?

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

Now that you have already learned how to find the solutions of the system of linear inequalities, you know already how to graph, and you did good representations, let's see if you can apply what you learned in different situations.

ACTIVITY 31. AM I QUALIFIED?

Directions: Read the problem carefully and answer the questions below.

You own a shop that usually makes baseball bats for national players. You learned that the standard bats have a specific requirement. The length (in inches) of the bat minus its weight (in ounces) cannot exceed 3. The length should not be shorter than 26 inches but should not exceed to 34 inches.

Modelling: Use x to represent the length and y to represent the weight.

Questions to Answer:

A. Model the given situations.
1. The difference of the bat length and weight cannot be more than three.
2. The length of the bat shall be longer than 26 inches but should not exceed 34 inches.
3. The weight cannot be a negative number.

B. Graph the system of inequalities and shade the solution set.
C. If you make a bat which is 32 inches in length and 27 ounces in weight, will that qualify with the national standard? Explain.
D. Give three more measurements which will qualify with the national standard.
E. How did you use the concept of system of inequalities in your decision?
F. What happens if you make a substandard bat?
G. How would you decide given these constraints?

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

END OF DEEPEN

In this section, the discussion was about graphing system of linear inequalities. Now that you have finished answering the exercises, you are now ready to apply the concepts of system of inequalities in more realistic situations. To complete the preparation for your performance task you do the next activity.

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 32. (Scaffold 3) What's the Best Selling Strategy?

You are a group of bakers of a fast growing company. Your manager requires you to make a written proposal about selling two kinds of bread/cakes. You will present the proposal during the executive meeting. In your proposal, you must consider the expenses and the possible income.

You need to show a complete and detailed mathematical computation on how you are going to predict the possible profit. The proposal should include the following; price of your major ingredients like sugar and flour, price of the product, amount of ingredients needed for each bread/cake, number of pieces to produce to maximize the revenue. The proposal must have a graphical presentation and computation.

Your proposal will be assessed according to the following criteria: use of appropriate mathematical concepts, viability, organization, accuracy, and quality of presentation.

To assess your work, your teacher will use the label below for you to know your performance in this activity. The color of your performance will appear in each activity.

0 – 25% accurate	26% - 50% accurate	51% - 75% accurate	76% - 100% accurate

YOUR ANSWERS

If you got a red mark in the previous activity that means you are ready to take the challenge. You may now do the performance task of this module. To guide you about the standards you may consider the rubric below.

Now, you have done several activities that showed how you can use what you have learned in this unit in making the most favorable option in real life. Revisit Activity 1 and see if there is a significant change in your answers.

ACTIVITY 33. Selecting the Best

Given some situations in life where you need to make a decision, how will you select the best option? Write your answers in the column for the "Decision After".

HOW WILL YOU SELECT THE BEST OPTION?		
Decisions Before		Decisions After
	1. An investment plan from a number of plans with different incentive schemes.	
	2. An airline for a family trip outside the country.	
	3. A house loan plan.	
	4. An insurance plan.	
	5. Combination of products to sell given a fix capital.	
	6. A credit account in malls.	
	7. Job offer.	

Questions to Answer:

1. How do you determine the most favorable option?
2. How would you determine your options given certain constraints?

In Activity 1, you have seen that there are many situations in real life in which we need to make a decision. Some of these decisions may not be very significant, but other decisions may affect our lives and the lives of others for a long time. How do we make use of mathematics to guide us in selecting the most favorable options? How do we deal with constraints in making decisions?

Compare your answer now to your answer at the beginning of this unit. Are there significant changes in your answers?

ACTIVITY 34. Performance Task: What's the Best Investment Scheme?

(R) You are a business analyst of ADAMY Inc. (S) The company plans to invest in cell phone loading business as part of their expansion program. You are tasked to make a proposal which identifies the 2 leading networks of our country. Make a recommendation of the amount to be invested in each network that will give a maximum weekly profit. You are expected to orally present your written proposal to the board of directors of the company. Your proposal will be assessed according to the following criteria: use of appropriate mathematical concepts, viability, organization, accuracy, and quality of presentation.

Rubric of the Proposal

Components	1 Beginning	2 Developing	3 Satisfactory	4 Excellent
Use of appropriate Mathematical Concepts	Explanation shows serious gaps in understanding of the underlying concepts used to process data.	Explanation shows limited understanding of the underlying concepts used to process data	Explanation shows substantial understanding of the underlying concepts used to process data	Explanation shows mastery and in-depth understanding of the underlying concepts used to process data.
Accuracy of computation	Errors in computations are serious	Most of the computations are not correct. Number of operations done are limited	The computations are correct. Varied number of operations are done in the computation	All computations are correct and are logically presented. Insightful justifications are written regarding the computations.
Viability	The proposal shows very inefficient use of capital, projects negative returns, location not identified.	The proposal shows unnecessary use of capital, projects break even returns, and suggests viable location.	The proposal shows an efficient use of capital, projects sustainable income and good business location.	The proposal shows very efficient use of capital, projects highly profitable investment and a prime business location.
Organization of the report	Illogical and obscure. No logical connections of ideas. Difficult to determine the meaning.	Somewhat cluttered. Flow is not consistently smooth, appears disjointed.	The presentation is clear and logical.	The presentation is clear, logical and comprehensive.

Quality of presentation	Hesitant, not confident. Explanation is missing. No visual materials. Delivery is confusing.	Somewhat hesitant, less confident and failed to explain significant number of points. Some visual materials are appropriate but there are lapses.	Presentation is generally fluent, confident, and clearly explained the proposal. Uses appropriate visual materials.	Fluent, confident, and thoroughly explained each point by providing support that contains rich, vivid and powerful details. Uses appropriate and original visual materials

END OF TRANSFER:

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

1. What is the intercept of the line 3x - 2y = 8?

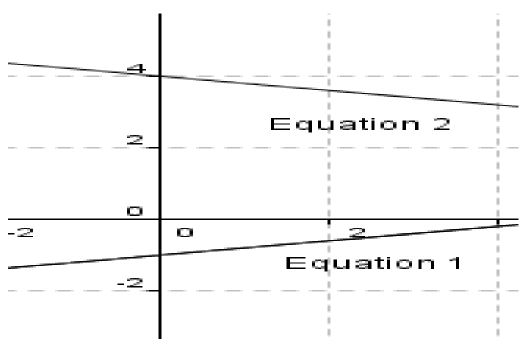
A. -4 B. -2 C. 8 D. 3

2. Which of the following correctly describe how to graph system of linear equations in two variables? Graph both equations on the same Cartesian plane by:

a. Locating the y-intercept, then, from that point, apply the slope to locate the second point where the line passes.
b. Locating the x-intercept, then, from that point, apply the slope to locate the second point where the line passes.
c. Locating the points along the x and y-axes.
d. plotting enough points and connecting all these points.

3. The graph accurately shows parts of the two lines in the system. What can be concluded about the system? The two equations have

A. a common point.
B. no common point.
C. infinitely many common points.
D. cannot be determined due to missing information.

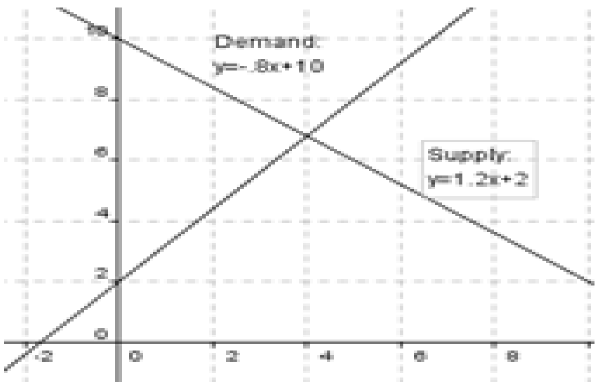


4. Which of the following is the solution of the system of linear equations below?

3x-y = 5
x + 2y = 18

A. (3, 4)
B. (10, 4)
C. (12, 3)
D. (4, 7)

5. The demand for cookies is modeled by y=-0.8+10 and has a supply by y=1.2x+2. In this model y is the number of boxes supplied or sold weekly and x is the price. The graph of these equations is shown below. Based on the graphs, at should price should cookies be sold so that the demand for cookies will be the same as the supply to avoid surplus?



6. Leo plans to commercially produce ube pastel. The fixed cost which includes space rental is P300.00 per month and the cost of producing a pastel is 4 pesos. Each pastel will be sold for P10.00. After selling how many pastels will Leo start to gain?

Which system of linear equations can be used to solve the problem?

A. $\begin{cases} y = 10x \\ y = 4x + 300 \end{cases}$ C. $\begin{cases} y = 300 - 10x \\ y = 10x + 300 \end{cases}$

B. $\begin{cases} y = 4x \\ y = 10x + 300 \end{cases}$ D. $\begin{cases} y = 10x - 300 \\ y = 4x + 300 \end{cases}$

7. It is the resulting equation after you substitute equation 1 to equation 2 using the system of equation y = 4x + 14 and 7x – 3y = -17.

a. 7(4x + 14) – 3y = -17
b. 7x – 3(4x + 14) = -17
c. 7(4x - 14) – 3y = -17
d. 7x – 3(4x – 14) = -17

8. It is the point of intersection of the linear system y = - ½ x + 3 and y = 2x + 8.

a. (-2, 4)
b. (4, -2)
c. (-2, 12)
d. (12, -2)

9. Which of the following procedure is best to solve the system of linear equation $3x + 6y = 21$ and $x = 4 - y$?

a. Elimination method by adding or subtracting
b. Elimination method by multiplying first
c. Substitution method
d. Divide the first equation by 3 then do substitution method

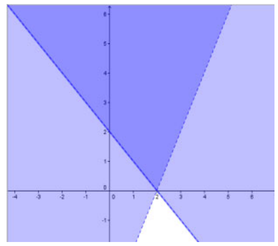
10. Which of the following situations may represent the system $3x + 3y = 51$ and $6x + 4y = 82$?
a. Claire bought 3 burgers and 3 fries for ₱51, Diane bought 4 same burgers and same 6 fries for ₱82.
b. Karen bought 6 pencils and 4 ball pens for ₱82, Gina bought 3 of both same items for ₱51.
c. Jam bought six candies and 4 lollipops for ₱82. The next day, she bought the 3 same candies and a lollipop for ₱51.
d. Jon bought 3 toy cars and 4 balls for ₱51. He bought 8 same toy cars and 3 balls for ₱81.

11. You are a caretaker of a farm. Mr. McDonald, the owner, asked you to determine the exact number of pigs and chickens in a pen with 20 animals. The total number of legs in the pen is 52.
a. There are 6 chickens and 14 pigs.
b. There are 4 pigs and 16 chickens.
c. There are 6 pigs and 14 chickens.
d. There are 16 chickens and 4 pigs.

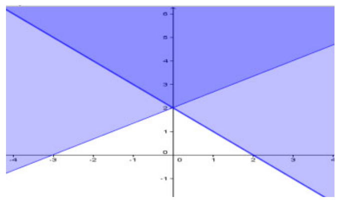
12. Marian bought 3 packs of crackers and 5 packs of peanuts and paid ₱23. Fatima bought 7 packs of the same crackers and 4 packs of the same peanuts and paid ₱46. How much does of each pack of crackers and peanuts cost?
a. ₱6 each pack of crackers
₱1 each pack of peanuts
b. ₱1 each pack of crackers
P6 each pack of peanuts
c. ₱3 each pack of crackers
P1 each pack of peanuts
d. ₱1 each pack of crackers
P3 each pack of peanuts

13. Which of the following points belongs to the region of the system $x + y > 2$ and $2x - y < 4$?

A. (2, 0) B. (0, 2)
C. (4, 0) D. (0, 4)



14. The graph of the system of inequalities which is shown below passed through (-3, 0), (0, 2) and (2, 0), which of the following models the situation?



A.	$x + y \leq 2$	B.	$x + y \geq 2$	$x + y \geq 2$	$x + y \leq 2$
C.	$3x - 2y \geq 6$	D.	$3x - 2y \leq 6$	$2x - 3y \leq -6$	$2x - 3y \geq -6$

15. To be a member of Principal's Scholar, a student must have a GPA of at least 90 in his academics(x) and average of more than 88 in conduct(y). Which of the following inequalities best represents the situation?

A. $x \leq 90$
$y \leq 88$

B. $x \geq 90$
$y \geq 88$

C. $x \geq 90$
$y > 88$

D. $x > 90$
$y \geq 88$

16. When is the point of intersection of the two boundary lines included in the solution set?

A. The point of intersection is in the solution set when both boundary lines are solid and when the symbol in both inequalities is either ≥ or ≤.
B. The point of intersection is in the solution set when both boundary lines are dashed and when the symbol in both inequalities is either ≥ or ≤.
C. The point of intersection is in the solution set when both boundary lines are solid and when the symbol in both inequalities is either > or <.
D. The point of intersection is in the solution set when both boundary lines are dashed and when the symbol in both inequalities is either > or <.

17. A wholesaler has ₱ 80,000.00 to spend on certain model of TV and DVD players. If the TV s may be obtained at Php 8, 000.00 each and the DVD players can be obtained at ₱ 4, 000.00 each, which of the following models restricts the purchase of TV and DVD players?

A. $8000x + 4000y \leq 80000$
B. $8000x + 4000y \geq 80000$
C. $8000x + 4000y < 80000$
D. $8000x + 4000y > 80000$

18. A system of two linear inequalities has either no points or infinitely many points in its solutions.

A. always
B. most of the time
C. sometimes
D. never

19. You are buying hot dogs and puto for a party. One hotdog costs ₱ 7.00 while puto costs ₱ 2.00 each. You must spend less than ₱ 500.00 and you want at least 40 pieces of hot dogs and at least 80 pieces of puto. Represent x for hot dogs and y for puto, which of the following best describes the situation?

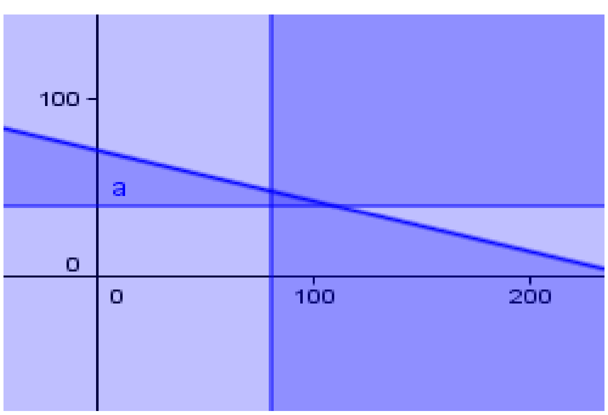
A. $2x + 7y \geq 500$
$y \geq 40$
$x \geq 80$

B. $2x + 7y \geq 500$
$y > 40$
$x > 80$

C. $2x + 7y \leq 500$
$y \geq 40$
$x \geq 80$

D. $2x + 7y \leq 500$
$y > 40$
$x > 80$

20. Using the situation of item #19, which of the following can be the possible combination? You may use the graph below.



A. 100 puto and 50 hotdogs
B. 90 puto and 50 hotdogs
C. 80 puto and 35 hotdogs
D. 80 puto and 38 hotdogs

GLOSSARY OF TERMS USED IN THIS MODULE:

Linear equation - An equation of the form y = ax + b, where a and b can be any real number.

System of linear equations is a collection of linear equations.

Solution of the system of linear equations in two variables is the ordered pair that makes both equations true at the same time.

The **graph of a line** is just the set of solution points of the linear equation.

A **linear inequality** in two variables is any expression that can be put in the form

$$ax + by < c$$

where *a*, *b*, and *c* are constants

A **system of linear inequalities in two variables** consists of at least two linear inequalities in the same variables.

Solution of a linear inequality is the ordered pair that is a solution to all inequalities in the system

Graph of the linear inequality is the graph of all solutions of the system.

WEBSITE RESOURCES AND LINKS IN THIS MODULE:
LESSON 1:

http://www.mathwarehouse.com/algebra/linear_equation/systems-of-equation/index.php

Interactive site for finding solutions by graphing. Drag the point and drop to the desired location. Slope, equations of the lines and solutions will be given.

http://www.ltcconline.net/greenl/java/BasicAlgebra/Linegraph/LineGraph.htm

Interactive site for graphing linear equations using the slope and the y-intercept. It also provides process questions.

To find the coordinates of the intersections, point your mouse to the intersection.

http://www.wtamu.edu/academic/anns/mps/math/mathlab/int_algebra/int_alg_tut14_lineargr.htm#step4

Gives the process of graphing linear equation.A good site for review.

Lesson 2:

(http://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/e/systems_of_equations_with_elimination_0.5)

Interactive activity using elimination method by addition and subtraction.

(http://www.khanacademy.org/math/algebra/systems-of-eq-and-ineq/e/systems_of_equations_with_elimination)

Interactive activity using the same method by multiplying first. In this site, you will be encountering drills and by simply clicking on the CHECK ANSWER, the web site solution will be shown one step at a time. You can use it so that you will be well guided.

http://www.regentsprep.org/Regents/math/ALGEBRA/AE3/PracAlg.htm

Interactive exercise for substitution and elimination method. You are free to choose what method to use. It demonstrates the solution on both methods for systems of linear equations in two variables.

(http://www.regentsprep.org/Regents/math/ALGEBRA/AE3/PracWord.htm)

Interactive site in solving for system of linear equation using algebraic method will give you accurate solutions.

Lesson 3:

http://www.mathwarehouse.com/algebra/linear_equation/systems-of-equation/interactive-system-of-linear-inequality.php

This website contains interactive activities where graphs of system of inequalities can be manipulated by moving the points.

http://www.youtube.com/watch?v=Eiwi3FvQumU&feature=rellist&playnext=1&list=PLTXF78ZN40CK2-BAY20GEBVFKJG8ARGJO

This video contains a cool presentation on how linear inequalities are graph which focused on the concept on how to shade the graphs of inequalities. This entitled “SHADE IT”.

http://www.youtube.com/watch?v=7sInE5tGJX4

This video contains a detailed and clear presentation on how to graph system of linear inequalities in two variables. This is also a good tool especially for the open high school students.

Lesson 2: Rectangular Coordinate, Relations and Functions

☑ **MODULE INTRODUCTION AND FOCUS QUESTION(S):**

Have you ever wondered how Meteorologists track storm and predict floods? How do emergency Response Teams locate stranded motorist or guide emergency vehicles? The ability to effectively identify and view the location of typhoon survivors, victims of violence , fire, individual vehicles or boats, and how their location relates to an entire network of transportation systems in a geographic area, has resulted in a whole new way of doing business. Location information coupled with automation has reduced delay in the dispatch of emergency services. What if we have this kind of facility in our country? In what way can it improve our ability to facilitate delivery of disaster relief, public safety services and faster recovery for victims of global tragedies?
How can you as students of mathematics contribute to the attainment of these goals? How can your knowledge of mathematics help you understand what it takes to attain these goals?
In this module you will you are expected to acquire deeper understanding of what relations and functions are and their many applications in real life. You will also learn how to use functions to model the relationship of quantitative variables and to use these models to solve problems accurately.

To be able to succeed in this module you need to ensure that you can do arithmetic operations, understand sets of real numbers and number lines.

This module contains three lessons. Each lesson includes applications of the rectangular coordinate system, relations and linear functions. . Before we start, find out where you are in terms of knowledge and skills and understanding of the concepts which are necessary for you to successfully learn relations and functions.

☑ **LESSON COVERAGE:**

In this lesson, you will examine this question when you take the following topics:

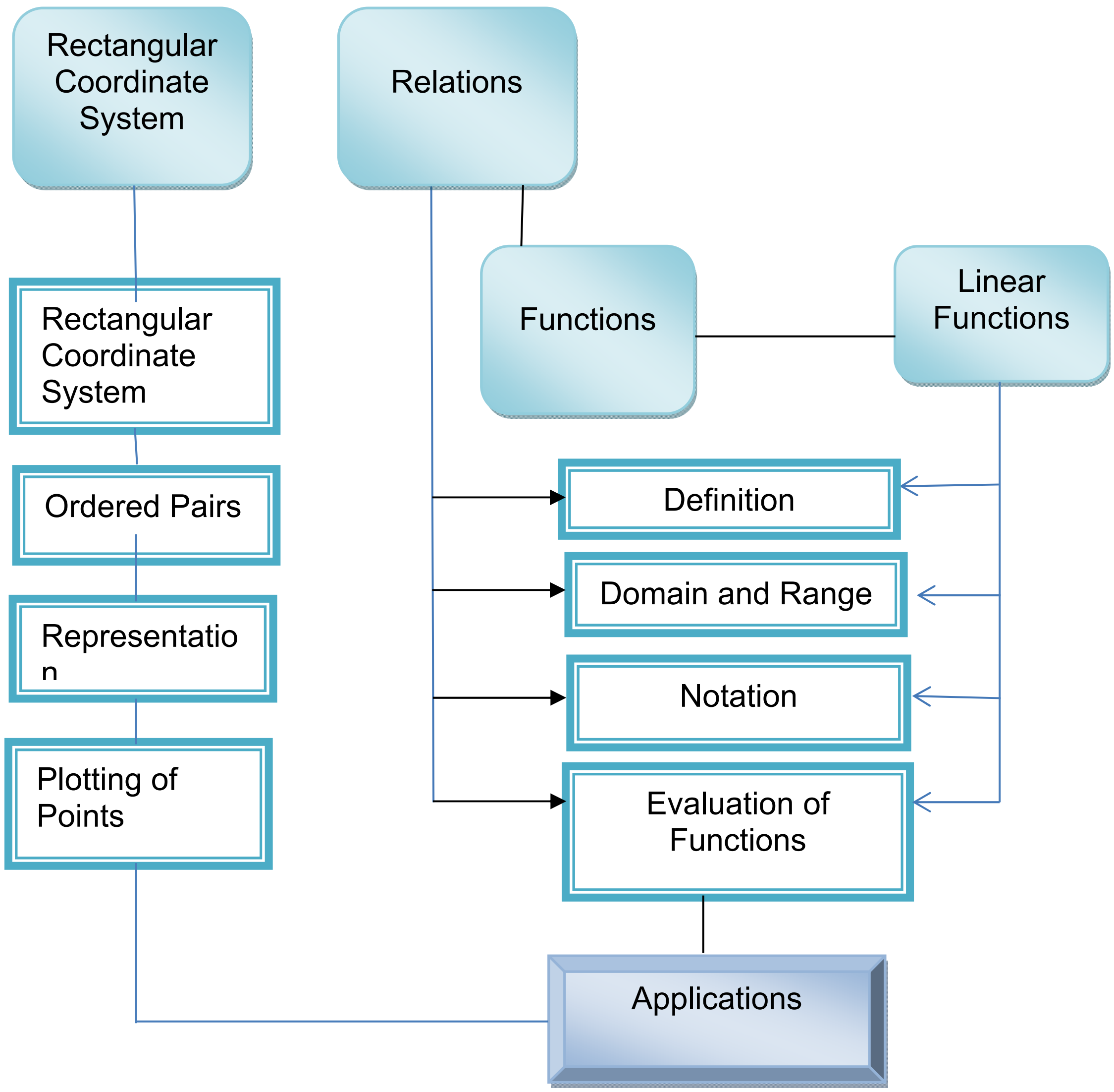
2.1 Rectangular Coordinate System
2.2 Relations
2.3 Functions

Each topic will incorporate its applications in real life.

In these topics, you will learn the following:

Rectangular Coordinate System	1. describe the rectangular coordinate system and its uses. 2. define and illustrates the coordinate axes, the origin and a point on the coordinate plane. 3. describe and plots positions on the coordinate plane using coordinate axes.
Relations	1. Define and illustrate a relation 2. Represent relations with graphs, tables, and sets of ordered pairs. 3. Determine the domain and range of relations 4. Use relations to model quantitative relationships and to use it to solve problems in real life.
Functons	1. Define and illustrate a function 2. Determine if a given relation is a function using a table of ordered pairs, graphs and equations. 3. Determines dependent and independent variables. 4. Finds the domain and range of a function. 5. Use linear functions to model and solve problems in real life.

☑ LESSON MAP

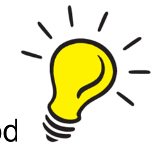


☑ Expected Skills

To do well in this lesson, you need to remember and do the following:

1. Carefully read the lesson and do the activities neatly and accurately.
2. Break tasks into manageable parts.
3. Complete all activities even if you may not be asked to hand these in, but they will help you learn the material.
4. Keep copies of all accomplished activities. These are needed to assess your progress and for grading.
5. If you are having problems, do NOT wait to request help. The longer you wait the bigger the problem becomes!
6. Form study groups if possible.

PRE-ASSESSMENT

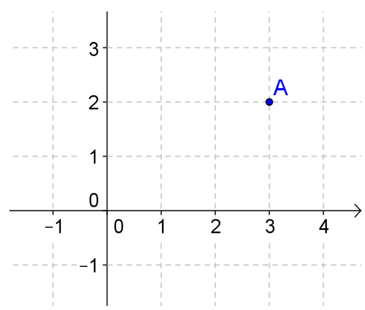


Let's find out how much you already know about this mod on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

(A) 1. Which one is described as the system of representing the position of a point in a rectangular coordinate plane?

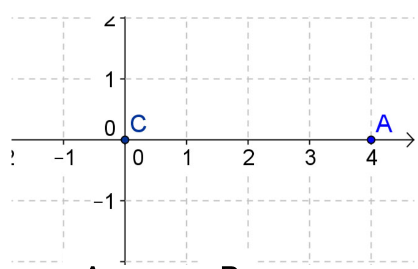
A. Rectangular coordinate system*
B. Polar coordinate system
C. Dimensional coordinate system
D. Point Plotting system

(A) 2. What are the coordinates of the plotted point?



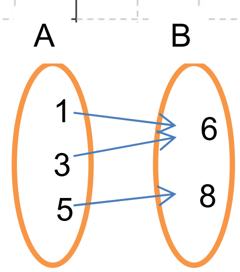
A. (2,3)
B. (3, 2)
C. (2,0)
D. (0,3)

(A) 3. In the rectangular coordinate system below, if point B (not shown) lies on the positive y-axis and the area of triangle ABC is 10, what is the y-coordinate of point B?



A. 2 B.3 C.4 D.5

(A) 4. Consider the relation represented by the mapping below. Which set of ordered pairs represent the relation?



A. {(1,6),(3,6), (5,8)}
B. {(6,1),(6,3), (8,5)}
C. {(1,3),(1,5), (6,8)}
D. {(1,6),(3,6), (5,8),(61), (8,5)}

(A) 5. The cost of printing (y) using a number (x) of short size bond papers is given by the equation y = 0.36x + 0.65. What the independent variable in this relation?

A. size of paper
B. number of papers
C. Cost of printing
D. 0.65

(M)6. The resale value R in pesos of a television set is given by R = 12,000 – 2000 T,
where T is time in years after the purchase of the TV set. What range of values for T
make sense?

A. T= 6 B. T > 6 C. 0<T<6 D. 0> T≤ 6

(M)7. The percent death caused by smoking is modeled by the function defined by
$f(x) = \frac{x-1}{x}$, where x is the number of times a smoker is likely to die of lung cancer
than a non-smoker. What is the restriction on the domain of this function?

A. x≠0
B. x≠ 1
C . x cannot be a fraction
D. none

(M)8. The table below shows the relation between the number of children and the cost
of feeding.

Number of Children (x)	2	3	7	12
Cost of Feeding (y)	22	33	77	132

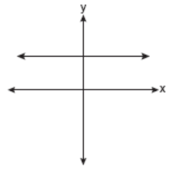
Which equation best represent the relation?

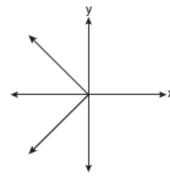
A. y = x +11
B. y = 10x + 2
C. y = 11x
D. y = 3x + 5x +3

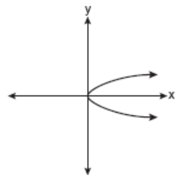
(A)9. Given the relation T = {(5,2), (7,4), (9,10), (*x*, 5)}. Which of the following values for
x will make relation T a function?

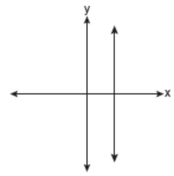
A. 2 B. 5 C. 7 D. 9

(A)10. Which graph represents a function?

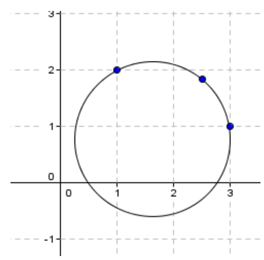
A. 

C. 

B. 

D. 

(M)11. Which statement is true about the relation shown at the right?



A. It is a function because there exists one *y*-coordinate for each *x*-coordinate.
B. It is a function because there exists one *x*-coordinate for each *y*-coordinate.
C. It is *not* a function because there are multiple *x*-values for a given *y*-value.
D. It is *not* a function because there are multiple *y*-values for a given *x*-value.*

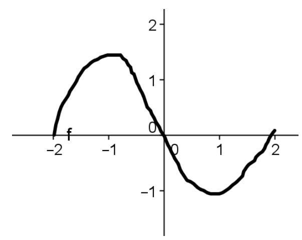
(A)12. Given $f(x) = 4x - 7$, what is $f(5)$?
A. -2 B. 2 C. 13 D. 27

(A)13. Blueberry Store sells phones online. When the order is received, they pack the phone on the box and ship via air freight. The cost of shipping x number of cell phones is given by the rule f(x)= = 23x +32. How much would it cost to ship an empty box ?
A. ₱23.00 B. ₱32.00 C. ₱9.00 D. None

(T) 14. A Grade 8 Class in planning to have a field trip. The survey showed that if the contribution is P200.00, 12 students will join and if the contribution will be reduced to P160.00, 20 students will join. Assuming that the relationship between the amount of contribution and the number of participants are linear, which function below can be used to predict the number of participants for any given contribution (x)?

A. f(x) = 5x + 60
B. f(x) = -5x + 260
C. f(x) = 0.2x + 260
D. f(x) = - 0.2x +52

(M) 15. The figure at the right is the graph of function f(x). According to this graph, which of the following statements is correct?



A. The domain of f is {x/-2≤ x ≥2}
B. The range of f is {x/-1≤ x ≥1}
C. When x = 0, f does not exist.
D. f(1) can not be determined.

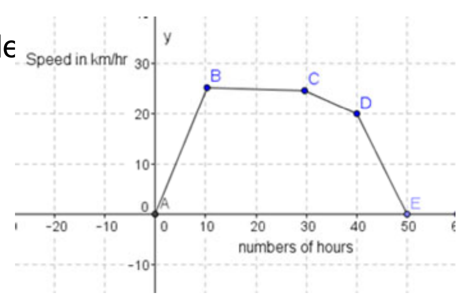
(T)16. The speed of sound in air is usually modelled as a linear function of the temperature.

The table below show the speed of sound, in meters per second, as a function of the temperature in degrees Celsius. What is the rate of change of speed per °C?

A. 0.6 B. 6 C. 10 D. 3.6

Temperature (°C)	10	16	20
Speed(m/sec)	337.4	341	343.4

(T)17. The graph shows the speed of a motor cycle as a function of time in hours. How long did the cyclist travel at 25km/h?



A. 10 h C. 30 h
B. 20h D. 50 h

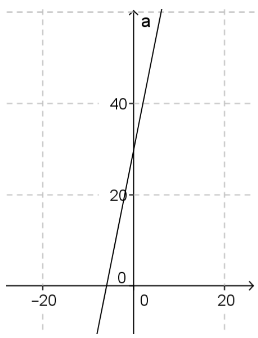
(T) 18. The entrance fee at the Herbal Plant Show is P20.00, and herbs in pots cost P30.00 each. Which of the following models represents the total cost (f(x)) of joining the show as a function of number of pots (x) purchased?

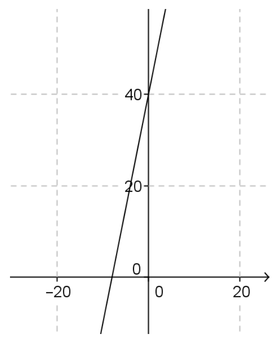
A. f(x) = 20x C. f(x) = 20x + 30
B. f(x) = 30 x D. f(x) = 30x + 20

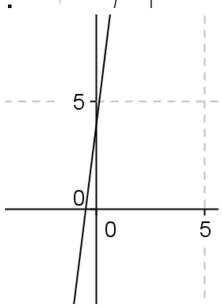
(T)19. Tina daily pay for selling cell phones cards is shown in the table below.

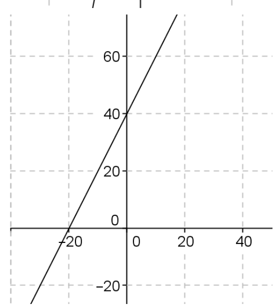
Number of cards sold	2	5	12	20
Pay (in pesos)	40	55	90	130

Which graph below correctly show the relationship?

A. .


C.


B.


D.


(T) 20. Jose invested P1,560.00 in making bags from recycled materials. He intends to sell the bags for P260.00 each. How many bags should he sell to make a profit of P1, 820.00?

A. 6 B. 7 C. 13 D . 42

x = 13

Lesson 2.1: Rectangular Coordinate System

In this topic, you will learn the following:

1. Describe the rectangular coordinate system and its uses.
2. Define and illustrates the coordinate axes, the origin and a point on the coordinate plane.
3. Describe and plots positions on the coordinate plane using coordinate axes.
4. Define and illustrate a relation
5. Represent relations with graphs, tables, and sets of ordered pairs.
6. Determine the domain and range of relations
7. Use relations to model quantitative relationships and to use it to solve problems in real life.
8. Define and illustrate a function
9. Determine if a given relation is a function using a table of ordered pairs, graphs and equations.
10. Determines dependent and independent variables.
11. Finds the domain and range of a function.
12. Use linear functions to model and solve problems in real life.

EXPLORE

Let's begin our study of this module by assessing what we know about it. Read each statement carefully and indicate whether you agree or disagree to these statements. This will help determine what you know and what else you need to know about the concepts discussed in this module.

ACTIVITY 1. Ready-Activate!

Read and react to each statement and by writing True or false in the first column before you start your study of this module.

Before	1. In rectangular coordinate system, two axes which are perpendicular to each other are used.	After
	2. A number line is a line marked with numbers in regular intervals as in a ruler.	
	3. A pair of numbers, written in the form (a, b), represents a point in the rectangular coordinate system.	
	4. The numbers in an ordered pair may be interchanged without changing the meaning.	
	5. A function is a rule that assigns to each input exactly one output.	
	6. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	
	7. The notation f(x) means f times x.	
	8. Functions model relationships between variables.	

How confident are you with your answers? Do you have now an idea of what you know about functions? In the next section try to gain deep understanding on the use of Cartesian coordinate system as a tool for visualizing functions. Discover the answers to the questions: What is it about functions that make it so useful? How can mathematical models be used to solve problems involving relations between two variables?

End of EXPLORE:

You just have shared you initial ideas about the statements presented in the table above. Let us strengthen that insight by doing the next succeeding activities. What you will learn from this section will help you do your performance task and will help you answer the question how can mathematical models be used to solve problems involving relations between two variables.

Let's now find out what the answer is by doing the next part.

FIRM-UP

Your goal in this section is to firm up your knowledge and skills in the Cartesian coordinate system. Discover the role of the rectangular coordinate system in visualizing relationships between variables and answer the question - “How can mathematical models be used to solve problems involving relations between two variables?”

Specifically, questions below will help you in your study of this module. Answer these questions as you start your study and continually revise your answer as you gain a better understanding of the lesson.

Questions	YOUR ANSWERS
1. What is a rectangular coordinate system?	
2. What are the applications of rectangular system in real life?	
3. In what way is rectangular coordinate system related to relations?	
4. What is the difference between functions and relations?	
5. How can relationships between variables be modelled using functions?	
6. How can mathematical models be used to solve problems involving relations between two variables?	

Post your answers to questions 5 and 6 in the discussion forum.

Based on your answers, draw a concept map to demonstrate the relationships among the key concepts: rectangular coordinate system, relations, functions and linear functions.

Rectangular Coordinate system

Relations

Functions

Linear Functions

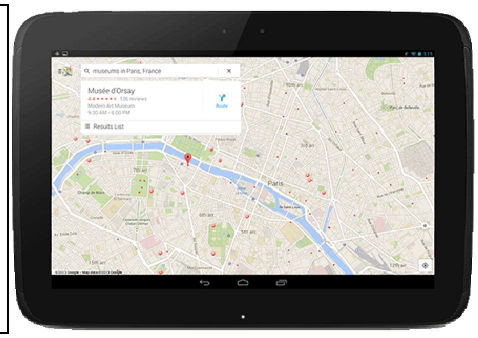
Your concept map here.

A critical component of any successful rescue operation is time. Knowing the precise location of landmarks, streets, buildings, emergency service resources, and disaster relief sites reduces that time -- and saves lives. This information is critical to disaster relief teams and public safety personnel in order to protect life and reduce property loss. How can mathematics help us describe a specific location? What knowledge and skills do we need to possess to be able to do it?

ACTIVITY 2. Tell Me Where?

Read and analyze and answer the questions.

Adelle was on her way to Isla de Oro and all of the sudden she saw a motorcycle crash on a wall about 10 meters from her position. No one was on the vicinity except her. On inspection she saw that the person needs help from Rescue Team. Adelle right away accessed the Google map of Cagayan de Oro City on her mobile phone. The map is shown below:



http://www.worldandcitymaps.com/asia/philippines/cagayan-de-oro-city/

Questions to Answer:

1. If you were Adelle, how would you describe the location of the accident to Rescue 117?
2. What is your basis in describing the location?
3. What are the other ways to locate the place?
4. What is a rectangular coordinate system?
5. How can mathematics be used to help locate and identify places?
6. How else can a coordinate system be of use in real life?

Write your answers here….

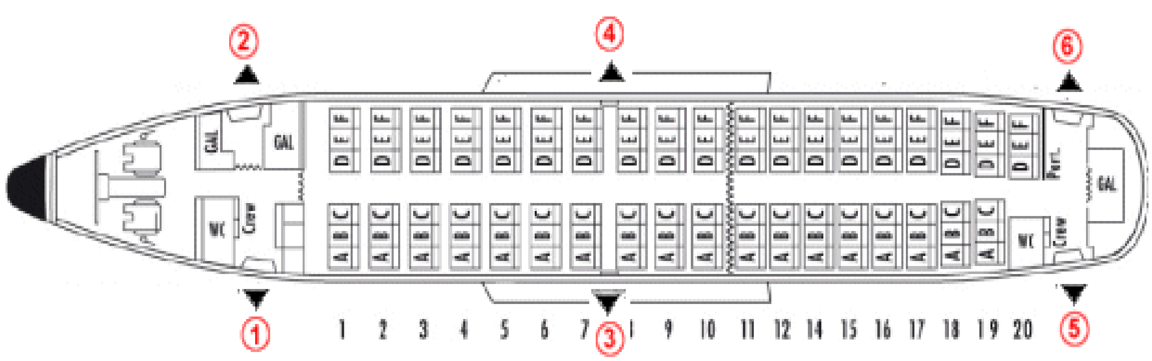
You see in Activity No.2 that locating a place or a point in many instances could be very critical. How can mathematics help us do this? What concepts do we need to understand? What skills do we need to develop?

In Mathematics rectangular coordinate system is an important tool in locating positions. How is this tool used in real life situations? How can rectangular coordinate system help in modeling relations involving two variables?".

In the next activity,you will deal with a concrete real life situation where rectangular coordinate system is used.

ACTIVITY 3. It's Travel Time!

Your school's Disaster Team was allowed to go to the disaster site to help in the rehabilitation work. Before the departure you were given the airplane seat number to facilitate fast boarding. The seat plan is shown below.



© aviation-safety.net

Source: http://www.gps.gov/applications/safety/

F	Lia Sio	Mila Ty	Cristy Roa	Ted Lara	Xy Chen
E	Megy Ui	Paul Uy	Ben	Fay Bora	Tim
D	Glen Abao	Rey Po	Lou Mier	Gio Tira	Josh
C	Noe Ebi	Luz Roxas	Nel Mata	Gab	Tom
B	Jigz Pit	Ed Pola	Fred	Tony Li	Axl Moo
A	May	Tess Vale	Nes Lai	Marie	Liz Baja
	1	2	3	4	5

Use the diagram to answer the questions below:

1. Who sits in row 1, column C?
2. Who sits in row 5, column F?
3. Who sits in row 3, column E?

If the location is designated as (Row letter, Column Number),

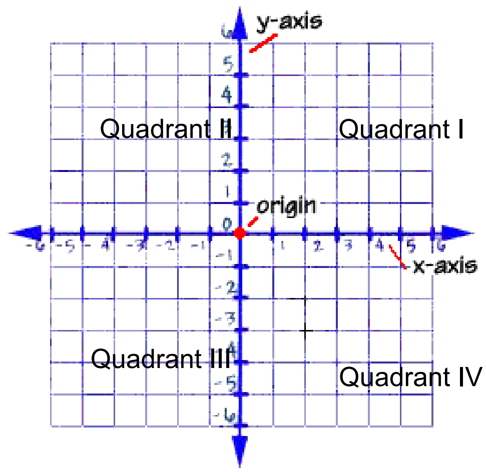
4. Where is Tom Oco located?
5. Where is Axl Moo located?
6. Where is Luz Roxas located?
7. How else can the location of a passenger be denoted?
8. In what way can your knowledge of mathematics help in denoting location of things, objects or persons in real life?

In Geometry, we describe points as a figure that denotes a location in space. Positions of points are represented using the rectangular coordinate system.

What is the rectangular Coordinate System? What makes it so useful?

The Rectangular Coordinate System

The rectangular coordinate system, also known as Cartesian coordinate system, can be used to plot points and graph lines. It is basically, a set of two number lines perpendicular to each other at their zero values. The horizontal line is called the x-axis and the vertical line is called the y-axis. The intersection of the x and the y-axis is called the origin.



Questions to Answer:

1. How many quadrants are there in the Cartesian plane?
2. How do you describe the coordinates of points in quadrant I? Quadrant II?, Quadrant III? , quadrant IV?
3. What is the contribution of rectangular coordinate system to the development of mathematics?

The invention of rectangular coordinates revolutionized mathematics by providing the first systematic link between geometry and algebra. Using the rectangular coordinate system, geometric shapes such as circles can be described by equations involving the coordinates of the points lying on the shape. For example, a circle of radius 3 may be described as the set of all points whose coordinates x and y satisfy the equation $x^2 + y^2 = 9$.

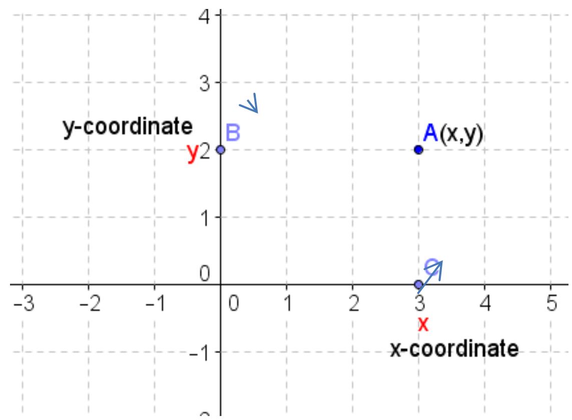
A point is represented by a pair of numbers (x, y). x stands for any value on the x-axis and y stands for any value on the y-axis. An example of a point is (1, 5) We call this pair of numbers as an ordered pair.

Ordered-Pair Numbers

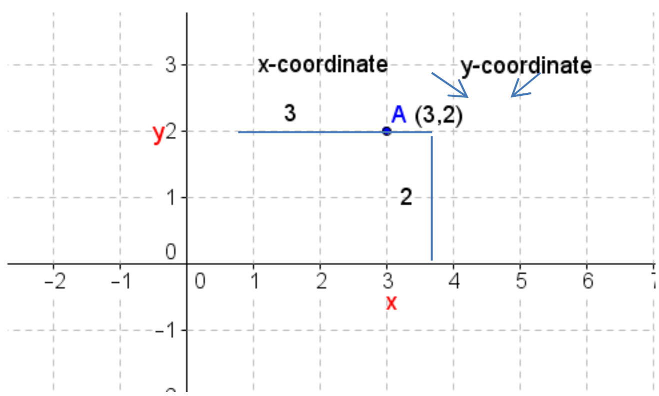
An ordered-pair number is a pair of numbers that go together. The numbers are written within a set of parentheses and separated by a comma.

How are ordered pairs plotted on the Cartesian plane?

Ordered pairs are plotted by locating the x-coordinate also known as abscissa of the point and the y-coordinate or ordinate of the point. In the figure below point A in x units away from the y-axis and y units away from the x-axis.



For example, (3,2) is an ordered-pair number; the order is designated by the first element 3 and the second element 2.



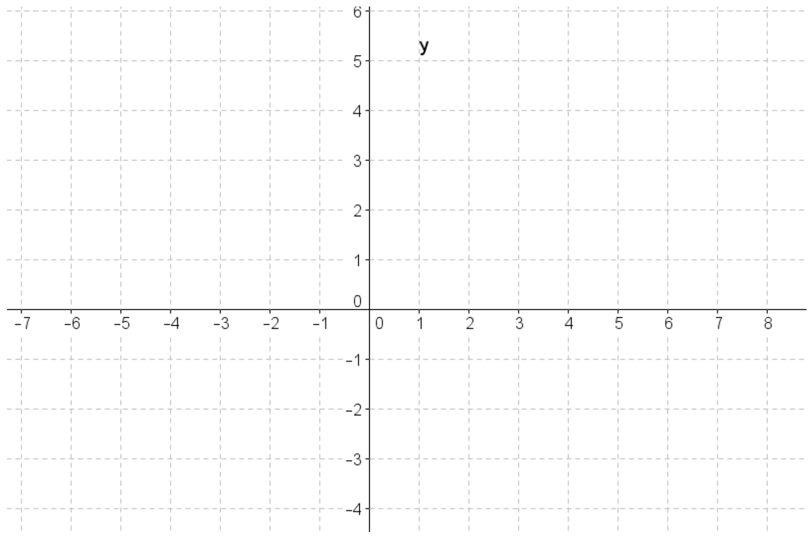
The pair (2, 3) is not the same as (3, 2) because of the different ordering.

Practice locating points on rectangular plane by doing the activity below.

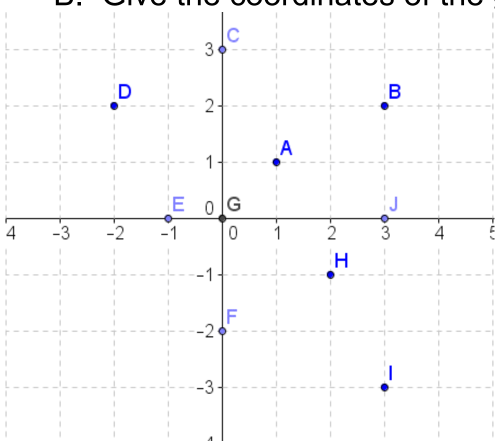
ACTIVITY 4. Can You Locate and Name?

A. Plot the following points on the Cartesian plane.

1. K(6,5)
2. L(3,4)
3. M(0,5)
4. N(-4,0)
5. O(-3,-1)
6. P(-3.5, 2)
7. Q(4,-1)
8. R(5,-3)
9. S(-6,-4)
10. T(4,0)



B. Give the coordinates of the given points.



A (__, __)
B (__, __)
C (__,__)
D (__, __)
E (__, __)
F (__, __)
G (__, __)
H (__, __)
I (__, __)
J (__, __)

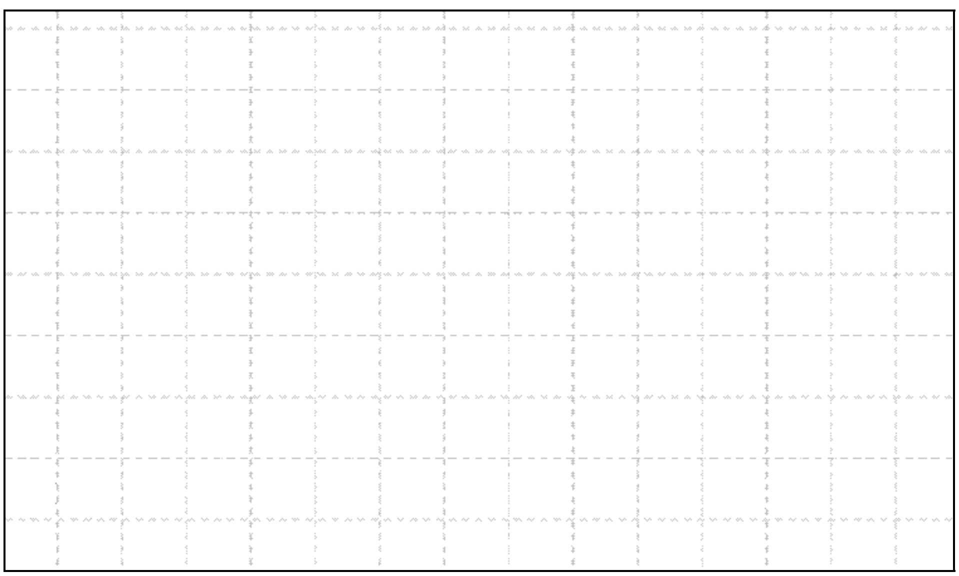
Questions to Answer:

1. How do you know that the point is located on the y-axis? x-axis? origin?
2. How are points whose coordinates are decimals or fractions located on the rectangular coordinate plane?

Now that you know what rectangular coordinate system is, denoting and plotting points on the rectangular plane, challenge yourself to do the next learning task.

ACTIVITY 5. Points and Patterns (Level 1 scaffold}

In the following diagram, draw the x-axis and y-axis.



1. Mark the points P, Q, R, S and T

   The coordinates of P are (2, 1)

   The coordinates of Q are (3, 3)

   R is 2 units below Q.

The coordinates of S are (2, -3)

T is the point where PS cut the x-axis.

2. Given: {(0, 0), (1, 4), (2, 8), (3, 12), (8, 32)}
   a. Plot the points on the coordinate plane.
   b. What pattern do you see in the pairing of x and y?
   c. If x = 6, what is y?
   d. If y = 40, what is x?
   e. What real life relation can be represented by the pattern?

ACTIVITY 6. Let's Sum it Up!

Questions to Answer:

1. How many numbers are used to represent a point?
2. Is the order of the numbers in an ordered pair important? Why?
3. How many number lines are used as reference lines?
4. How are the number lines positioned?
5. Describe the format for writing the ordered pairs.
6. Mark the points represented by (2, 5) , (-2, -3) an (3, -2) on the diagram.
7. How are points located on the x-axis named? On the y-axis?

Write your answers in your Math Journal.

Should you need more practice access the following sites:

1. http://www.mathsisfun.com/data/cartesian-coordinates-interactive.html

Choose Cartesian Coordinates for demonstration on naming points and "Hit the Coordinate Game for Practice on locating points on the plane.

2. http://www.shodor.org/interactivate/activities/SimpleCoordinates/

Practice on identifying coordinates of points and practice on naming coordinates of points.

3. http://teachers.henrico.k12.va.us/math/hcpsalgebra1/module5-1.html
Gives learning materials for review and for practice.

ACTIVITY 7. Quiz Yourself

Complete the following:

1. The system of representing the position of a point in a plane is called ______________

2. The horizontal number line is the __________________, labelled with an x.

3. The vertical number line is the ____________________, labelled with a y.

4. The intersecting point of the x-axis and y-axis is the __________________.

5. If a line perpendicular to the x-axis is drawn through a point, the number at the position where it cuts the x-axis is the_______________of the point.

6. If a line perpendicular to the y-axis is drawn through a point, the number at the position where it cuts the y-axis is the________________ of the point.

7. A pair of numbers whose order is important is called an _________________.

8. The ordered pair (____,____) are the ____________________ of the point.

WRITE YOUR ANSWERS HERE:

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________
5. ________________________________
6. ________________________________
7. ________________________________
8. ________________________________

Now that you have a very good understanding of what ordered pairs are and how they can be used to locate points in the rectangular or Cartesian plane , you can now explore how ordered pairs can be used to describe relationships between variables , find patterns, and represent this pattern mathematically, so that they can be used to predict future relationships and solve problems. Discover how this can be done as you continue to study this module.

Lesson 2.2: Relations

In many situations in real life, two variables may be linked by some type of relationship. Some of these relationships cannot be expressed numerically, but many can be. We will see this in the next activities.

ACTIVITY 8. Relations in Action

The table below shows five donors for the survivors of super typhoon Yolanda and the amount they have donated.

Donor (x)	1	2	3	4	5
Amount in Thousand of Pesos (y)	2	4	3	7	6

Questions to Answer:

QUESTIONS	YOUR ANSWERS
8. If x is donor's number and y his donation, how can you represent this data as a set of ordered pairs?	{(,), (,), (,) , (,) , (,)}
9. What is the advantage of expressing the data in this manner?	
10. What is the domain of set D?	
11. What is the range of set D?	

12. Are ther other ways of representing the the set of data? How?	

The pairing of the donor's number and his corresponding donation is a relation.

What is a relation?

A relation is any set of ordered-pair numbers. The first elements in the ordered pairs (the *x*-values), form the domain. The second elements in the ordered pairs (the *y*-values), form the range. Only the elements "used" by the relation constitute the range.

How can relations be used to model relationships between variables?

ACTIVITY 9. Try This!

Find the domain and the range of the following relations.

Relations	Domain	Range
1. Arm's length and height of a person		
2. Height of the object and its shadow		
3. Salary and withholding tax		
4. Circumference and the radius of cylindrical container.		
5. Perimeter of a square and the length of its side.		
6. Flowering plants and the color of their flowers.		
8. Animals and the food they eat.		
9. Length of Service in years of employees and their salary.		
10. Age of children and their heights.		

What factors or circumstances did you consider in defining the domain and the range of these relations? What are these?

How can relations be described?

Relations may be defined by several different methods: by listing ordered pair , by a correspondence or mapping , by graph or by equation

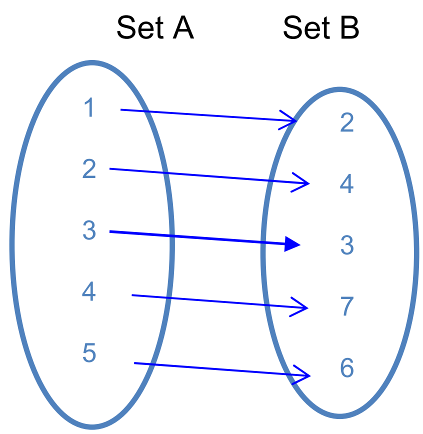
A. A relation may be defined as a set of ordered pairs.

   Examples:

   1. A = {(0,1), (2,3),4,6),(8,10)}
   2. B = {0,2), (3, 11), 4, 18)}

B. A relation may be defined as a correspondence .

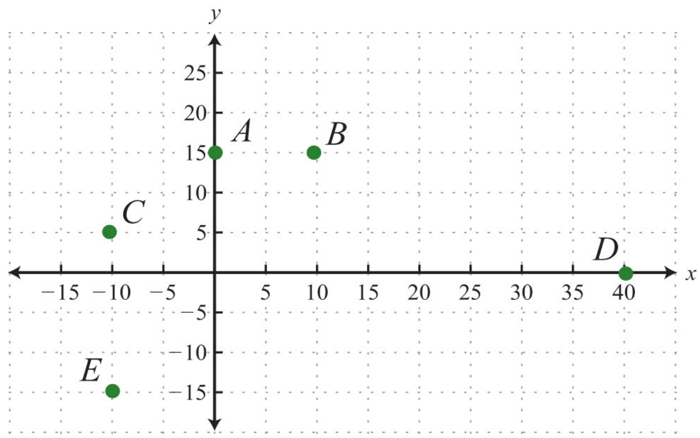
   For example, the relation can be represented as:



Mapping Diagram of Relation

A mapping diagram consists of two parallel columns. The first column represents the domain of a relation , and the other column for its range. Lines or arrows are drawn from domain to range, to represent the relation between any two elements.

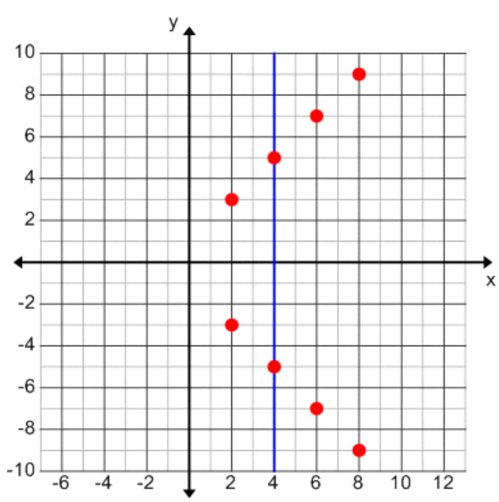
C. A relation may be defined by a graph.



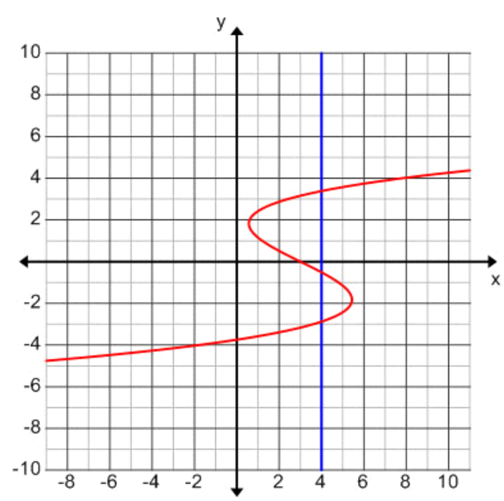
This relation is the set of ordered pairs : {(0,15), (10,15), (-10,5), (0,40), (-10,-15)}.

ACTIVITY 10. Naming Challenge!

Name some ordered pairs in each relation represented in the following graphs.

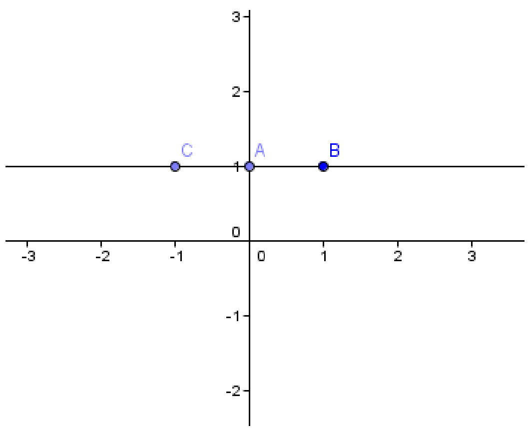


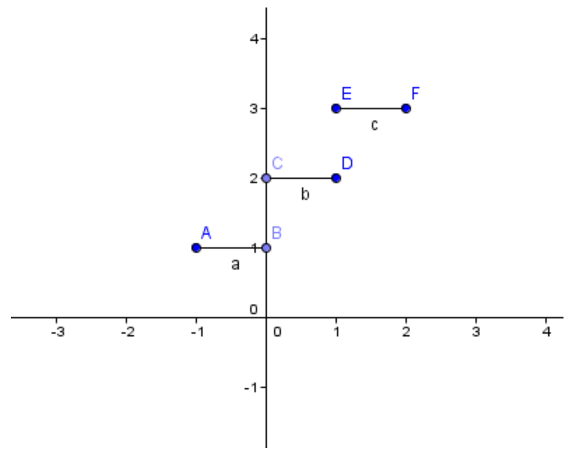
Relation 1

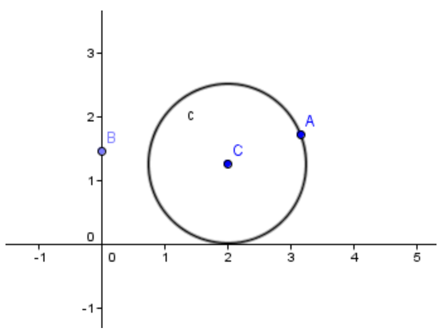


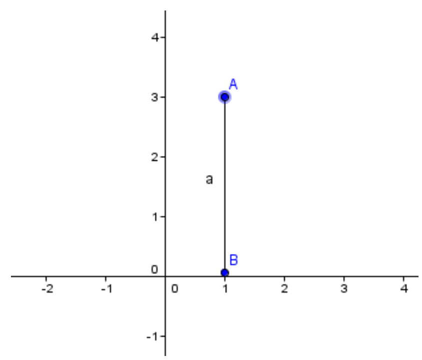
Relation 2

Set of oredered pairs:









D. A relation may be expressed by an equation such as y = 2x +3 where x is a real number. The solution to this equation define an infinite set of ordered pairs of the form {(x,y)/ y=2x+3}

{(x,y)} = {(-2, -1), (-1, 1), (0,3), (1, 5),…}

In the relations defined by the equation y = x^2 , where x={ -2, 3,4,5), the set of ordered pairs is { (-2,4), (-3,9), (4, 16), (5, 25)}. The range of this relations is a set of integers { 4,9,16,25}

The equations in the examples are known as mathematical models. How can mathematical models be used to solve problems involving relations between two variables?

ACTIVITY 11. Can You Follow?

Given the rule that defines the relations, find the range and list the ordered pairs for each relation.

Relations	Domain	Range	Set of ordered Pairs
1. y = 3x - 1	{0,4,6,8}		
2. y = 2/3x +4	{12,6,36,0}		
3. $y = x^2 - 4$	{-2,0,1,4}		
4. $y = \frac{2x+6}{3}$	{-1,0,2,4,10}		
5. X = |y|	{-4, -1, 0,1,4}		

ACTIVITY 12. Level 2 Scaffold

DISTANCE (meters)	FARE (Pesos)	DISTANCE (meters)	FARE (Pesos)
500		2500	
750		3200	
1000		25,000	
1200		300,000	
800		320,000	

The taxi rate in Metro Manila is computed using the equation y = 3.50x +40, where x is the number of 250 m-meter distance travelled over 500 meters. Use the equation to determine the fare for the following distance travelled:

Rewrite data as the set of ordered pairs.

a. What is the domain
b. What is the range?
c. Draw the graph to represent the relation.

d. Can you use the graph of the relation to predict the amount of fare for any distance travelled? Explain how.
e. How can mathematical models be used to solve problems involving relations between two variables?

ACTIVITY 13. Check your progress

Complete the concept map to summarize what you have learned about rectangular coordinate system and relations.

Rectangular Coordinate System

Relations

Using your revised concept map, can you now answer the questions **“**How can mathematical models be used to solve problems involving relations between two variables?” Are you confident with your answer? If not, What else do you need to know to answer this question? Post your answers to these questions in the discussion forum

In the next lesson you will learn more about relations. These are the type of relations that are very useful in real life situations.

Lesson 2.3: Functions

Let us now study a special type of relations called functions. We start by considering function machines that we used in real life before we focus on mathematical functions.

Example 1. Look at the machine below.

Can you tell the function of this machine? What can be the input ?

What is the output?

http://www.thegascompany.ie/iopen24/catering-toasters-burco-conveyor-belt-toaster-catering-bread-toaster-stainless-steel-p-968645.html#.Uqaz21Ix7ng

Example 2.

This is a multi-function fruit juice vending machine. Can you tell the operations done by this machine? What can be an input in this machine? What is the output?

There are many math functions that are very useful in real life. Like any machine, the output is highly dependent on the input. Math functions are special types of relations.

Functions are mathematical building blocks for designing machines, predicting natural disasters, curing diseases, understanding world economies and for keeping airplanes in the air. Functions can take input from many variables, but always give the same output, unique to that function. Functions are mathematical models. How these models be used to solve problems involving relations between two variables?

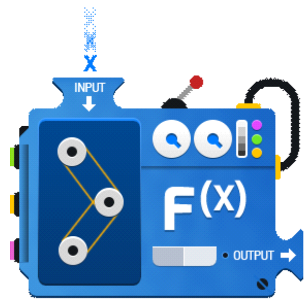
Try to answer this question as you deepen your knowledge about functions. What are examples of functions in real life?

Some examples of functions include:

1. A cost as a function of the number of items.
2. Revenue or gross proceeds as a function of number of items sold at a given price.
3. Profit as a function of revenue and cost of items.

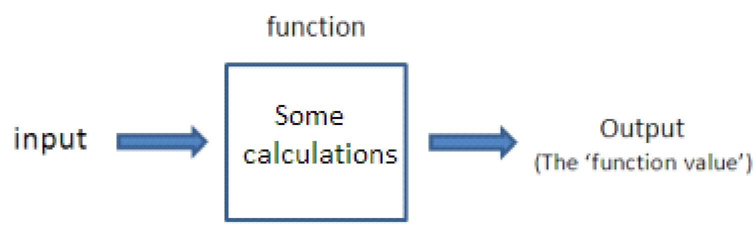
In function, the variable is known as the input or independent variable, because its value can be chosen freely. The calculated variable is known as the output or dependent variable, because its value depends on the chosen input value. We will see this in the next activity.

Function Machine



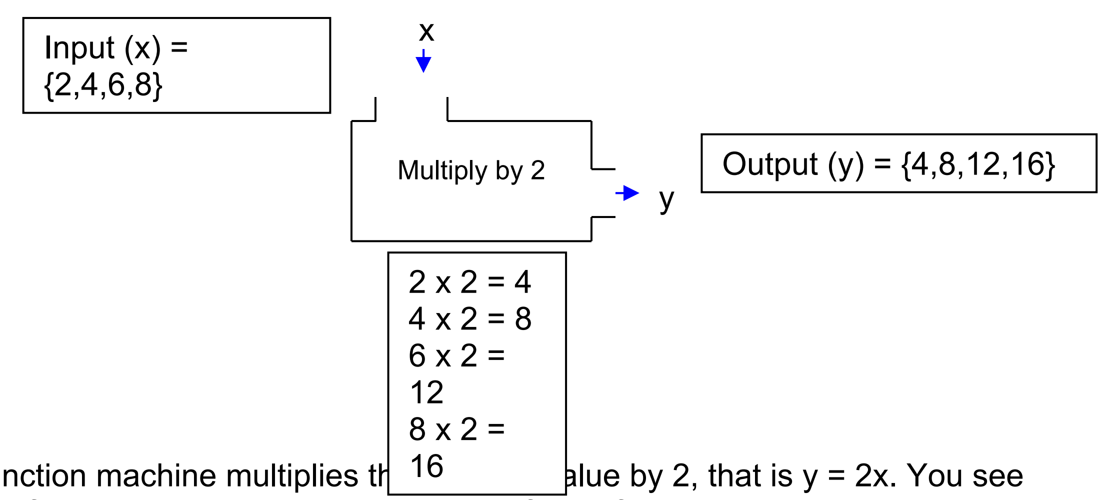
WWW.MATHWAREHOUSE.COM

A function can be thought of as a mathematical machine. You feed the machine an input, it does a calculations on it, and the gives you back another value which is the result of the calculations.



Let's have an example:

Input (x) = {2,4,6,8}



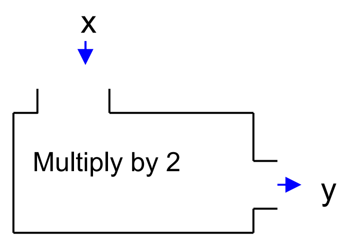
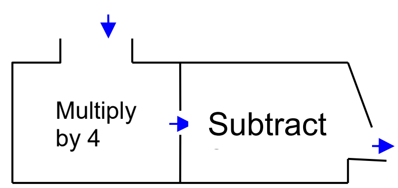
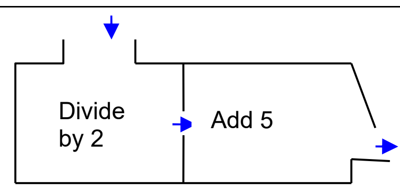
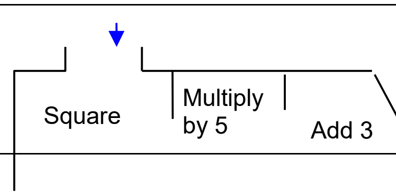
The function machine multiplies th alue by 2, that is y = 2x. You see that the function rule can be express in the form of an equation. This allows us to predict the value of the function for any other input.

Should you need more explanation access:

http://www.phschool.com/atschool/academy123/english/academy123_content/wl-book-demo/ph-187s.html
Gives an audio-visual presentation of the lesson on functions.
http://www.phschool.com/atschool/academy123/english/academy123_content/wl-book-demo/ph-187s.html
Gives an audio-visual presentation of the lesson on functions.

ACTIVITY 14. How Does It Work?

Write the function rule of each function machine and use it to calculate the output .

Input	Function	Output
{2, 4, 5, 9}	 y = ________________	
(1.5, 3, -10}	 y = ________________	
{6, 7, 8.5, 15}	 y = ________________	
{-2, 0, 4, 5}		

	y = ________________	

Questions to answer:

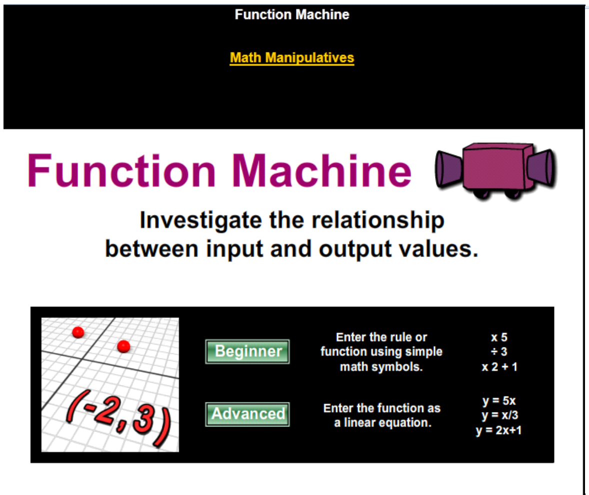
1. How did you find the rule?
2. How can functions be used in real life? Cite an example.

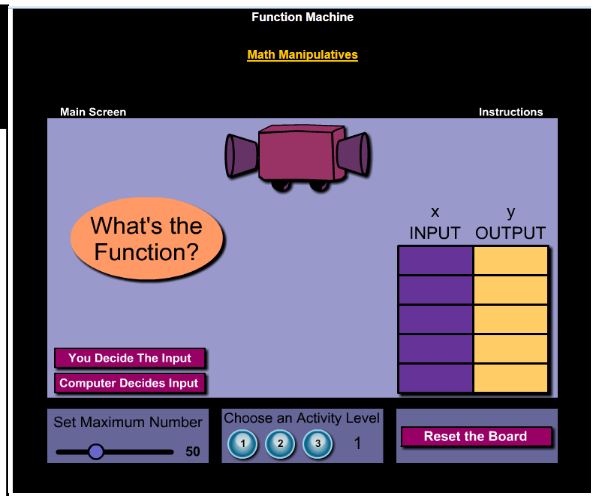
Your answers here.

You can use the next activity to assess your understanding of functions and for practice.

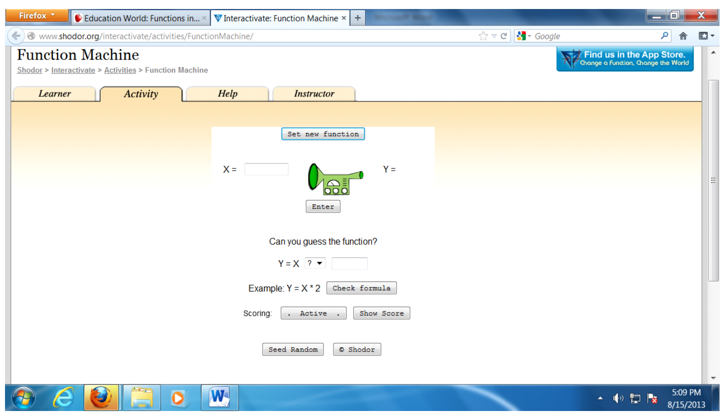
ACTIVITY 15. Practice and Assess Yourself

Access the website:
http://www.mathplayground.com/functionmachine.html
This ACTIVITY NO. will provide you with a very good way to practice finding the range given the domain and to describe the given function. To start click on beginner, then click instruction. Read the instruction and choose the level you are comfortable with 1,2,or 3. Challenge yourself to do the advance level.





For more practice you may also access :
http://www.shodor.org/interactivate/activities/FunctionMachine/



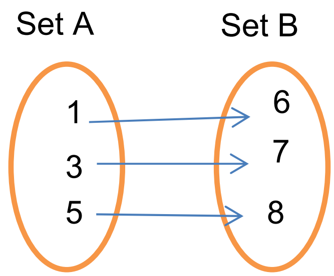
Functions can be expressed in many other different ways for different purposes.

1. Words

   Example: “The relationship between two variables is such that one is always 5 less than the other.”

2. Mapping Diagram

   Function may also be expressed as a correspondence or mapping from one set to another.

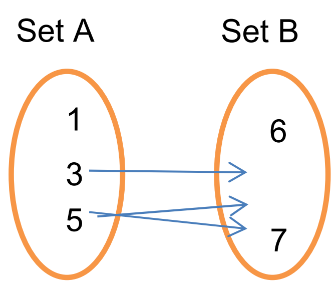


Definition of function

A function or a mapping from A to B , denoted by f:A → B is a relation from A to B in which every element from A appears exactly once as the first component of an ordered pair in the relation.

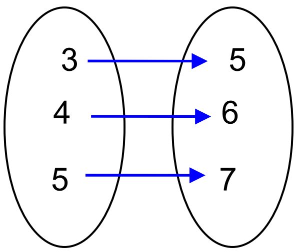
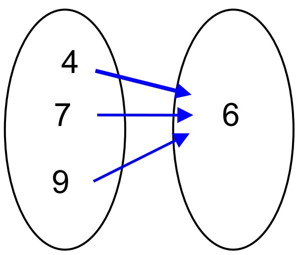
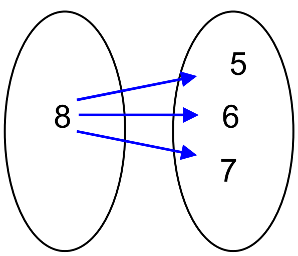
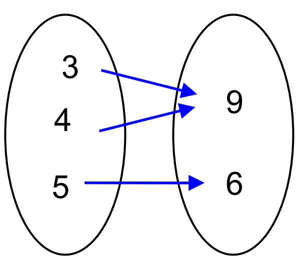
A function in which each element of the range is paired with exactly one element of the domain is called one-to-one mapping.

When the second element of the range associates with more than one element in the domain or the element(s) in range that have mapped more than one element in the domain is called many-to-one mapping. One-to-many relations is not a function.



ACTIVITY 16. Describe Me

Analyze the different relations below. Some of these relations are functions. Can you tell which are functions and which are relations?

Mapping Diagrams	Function or Relation?	What is the domain?	What is the range?	One-to-One Or One-to Many?
				
				
				
				

Question: Given the mapping diagram , how can you tell if the mapping is a function?

Your answer:

3. Since functions are relations, they can also be expressed as a set of ordered pairs using tables and graphs.

   Example: The set {(1,2), (3,4), (5,6)}

   Can you explain why this relation is a function?

   Definition:

   A function is a set of ordered pairs of numbers (x,y) , in which no two distinct ordered pairs have the same first number. The set of all admissible values of x is called the domain of the function , and the set of all resulting values of y is called the range of the function. Because values are assigned to x and because the value of y is dependent on the choice of x, x is the independent variable and y is the dependent variable.

4. Functions can also be expressed as a rule that tells how to determine the dependent variable for a specific value of the independent variable. The rule may be expressed in words such as : “y is three more than twice x”. However, usually the rule is an equation such as $y = 2x + 3$.

Can you tell which of the following equations represent a function for any real value of x? Why?

a. $\{(x,y)/\ y= 3x^2 -2)$
b. $\{(x,y)\ /\ x=y^2)$
c. $\{(x,y)/ = |x|$

http://www.phschool.com/atschool/academy123/english/academy123_content/wl-book-demo/ph-189s.html

Gives a video on making a table from function rule.

Functional Notation

We use functional notation to denote functions. The notation f(x) [read f of x] is used to name a second variable. So, the function defined by y = 3x + 2 is written as f(x) = 3x + 2 or g(x) = 3x + 2. Any letter may be used. This notation indicates that f or g is a function of the variable x, which means that it can be expressed in terms of x.

The Domain and the Range

Just like relations, the set of all values for the independent variable (x) is the domain, and the set of all values for the dependent variable is the range. Most of the functions are defined for all real numbers. This domain is denoted .

Example1. $f(x) = 2x + 5$

Domain is the set of real numbers , because $f(x)$ is defined for all real numbers x ; that is, we can find $f(x)$ for all real numbers x . The range is also the set of real numbers $\Re$ such that f(x) = 2x +5. Some of the elements of the set are given below.

Domain = $\{x/x\in\Re\}$ = {-2, -1.5, 0, 2, 2.3,…}

Range = $\{f(x)/f(x) = 2x+5, F(x) \in\Re\}$ = {-1, 2, 5, 7, 9, …}

Example 2. $f(x) = \frac{1}{2}x^2 - 6$

Domain = $\{ x/x\in\Re\}$

Range = $\{y=f(x)/f(x) = \frac{1}{2}x^2 - 6 \}$

Example 3. $f(x) = \sqrt{x}$

Domain = $\{x/ x/ x\geq 0\}$

This is because we cannot take the square root of a negative number. The range is the set of positive numbers and zero.

Example 4. $f(x) = \dfrac{x+2}{x}$

Domain = $\{x/x\neq 0, x\in\Re\}$

This is because we cannot divide by zero.

Study the examples above and answer the following questions.

1. How do we find the domain of functions?
2. How are the domain of functions involving square roots determined?
3. How are the domain of functions involving rational expressions determined?

ACTIVITY 17. Can You Tell?

Find the domain and the range of the following functions .

Function	Domain	Range
1. $f(x) = 4x - 7$		
2. $h(x) = x^2 + 3$		
3. $g(x) = \frac{x+8}{x-2}$		
4. $t(x) = \lvert 4x \rvert$		
5. $p(x) = [x]$		

http://www.phschool.com/atschool/academy123/english/academy123_content/wl-book-demo/ph-190s.html
Gives a video demonstrating finge domain and range of a function.

END OF FIRM - UP

You have seen in this section that functions describe situations where one quantity determines another. Because of this, functions are frequently used in modeling. How can mathematical models be used to solve problems involving relations between two variables?

In the next section you will learn how to use functions as models of quantitative relationships. These models will help you describe trends, predict values and solve problem accurately.

DEEPEN

Your goal in this section is to take a closer look at how functions can be used to find the rule or model to express quantitative relationships in real life. How can mathematical models be used to solve problems involving relations between two variables?

In to the question "How can mathematical models be used to solve problems involving relations between two variables? " will become clearer to you after finishing this section.

Evaluation of Functions

How are values of functions determined? To find the value of the function, replace each x with the given value and do the indicated operations.

Example:
Given f(x) = 5x + 2, what is the value of the function when x = 2 or f(2)?
Solution: Replace each x with the value 2. Thus, f(2) = 5(2) +3 = 10+ 2 = 12

ACTIVITY 18. What's My Value?

Complete the table by finding the value of each function for the given value of x.

Function	F(-3)	F(0)	F(2)	F(3/2)	F(0.6)	F(1.2)
1. F(x) = 7x -12						
2. F(x) = 1/2x + 6						
3. F(x) =x2 +1						
4. F(x) = 3x2 – 5x+2						

The value of x may be determined by replacing f(x) by the given value, then solve for x.

Example 1. f(x) = 3x -5, what is x when f(x) is 19?

By replacing the value of f(x), equation becomes

19 = 3x -5

Solving for x, $x = \frac{19+5}{3}$

X = 8.

Example 2. Given g(x) = -6x+13, What is x, when g(x) = 1?
Solution: 1 = -6x +13
Solving for x:
6x = 12
x = 2

ACTIVITY 19. . What is x?

Find x for the given value of the functions below.

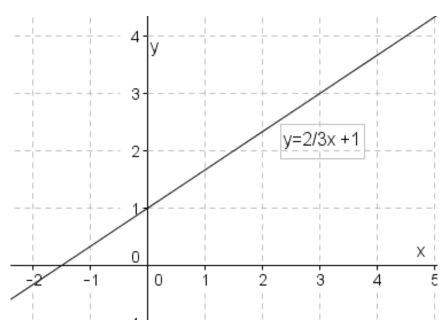
Given	If	What is x?
f(x) = 3x + 5	f(x) = 6	
g(x) = -3x+12	g(x) = 10	
h(x) = (4x-5)/2	h(x) = -2	
t(x) = x^2	t(x) = 1/2	
$p(x) = \sqrt{x-1}$	p(x) = 10	

SUBMIT

Graph of a Function

Functions also allow us to visualize relationships in terms of graphs, which are much easier to read and interpret than lists of numbers. This can be done by plotting the ordered pairs on the rectangular coordinate system.

The graph of a function f is the set of all points (x,y) in rectangular plane for which (x,y) is an ordered pair in f.

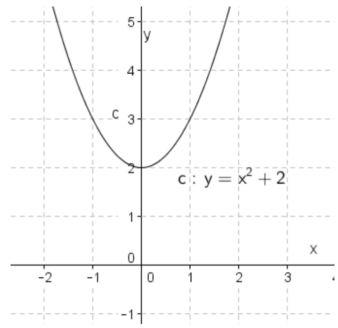


Example 1:

$$f(x) = \frac{2}{3}x + 1, \text{Domain}=\{x/x \in \Re\}$$

Compute for f(x) for some specific value of x.

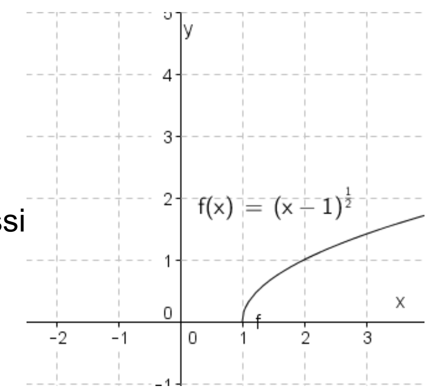
x	-1	0	1	2	3
y	1/3	1	1 2/3	2 1/3	3



3. $f(x) = x^2 + 2$, Domain ={x/x∈ℜ}

x	-2	-1	0	1	2
y	6	3	2	3	6

4. $f(x) = (x - 1)^{1/2}$, Domain ={x/x≥1,x∈ℜ}



Another way of writing this function is

$f(x) = \sqrt{x - 1}$. Note that only x≥1 can be a possi

value for x. Why?

x	1	2	3	4	5
y	0	1	$\sqrt{2}$	$\sqrt{3}$	2

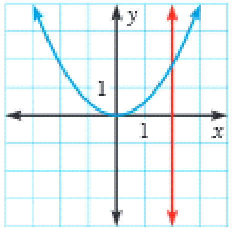
ACTIVITY 20. How do I Look Like?
Graph the following functions. Assume the domain is any real number.

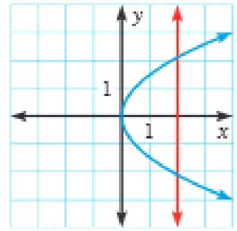
FUNCTIONS	GRAPHS
1. f(x) = 5x-1	

2. $g(x) = x^2 - 2$	
3. $h(x) = (x-3)/2$	
4. $j(x) = \sqrt{2x+3}$	
5. $k(x) = \begin{cases} 4x & if\ x \geq 3 \\ 2 & if\ x < 3 \end{cases}$	

The Vertical Line Tests for Graphs

To determine whether *y* is a function of *x* , given a graph of a relation, use the following criterion: if every *vertical line* you can draw goes through only 1 point, *y* is a function of *x* . If you can draw a vertical line that goes through 2 points, *y* is not a function of *x* . This is called the vertical line test.

Function


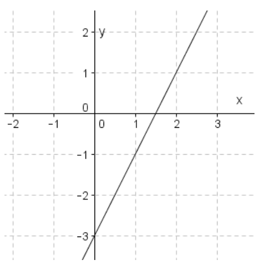
Not a function


http://www.phschool.com/atschool/academy123/english/academy123_content/wl-book-demo/ph-188s.html

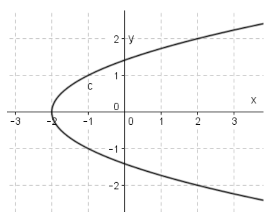
Gives video demonstrating the vertical line test.

ACTIVITY 21. Test and See

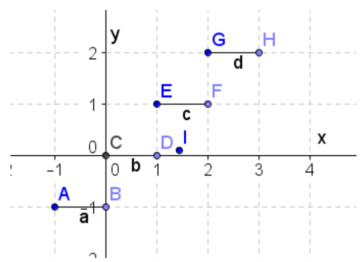
Use the vertical line test to tell if the graph represent a function.



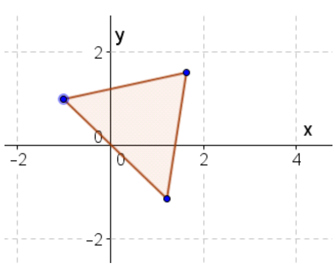
A



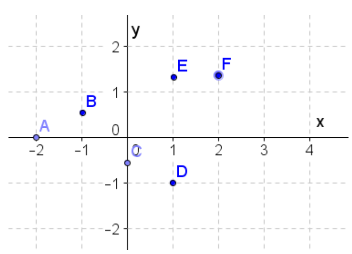
B



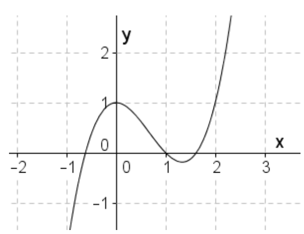
C



d



e



f

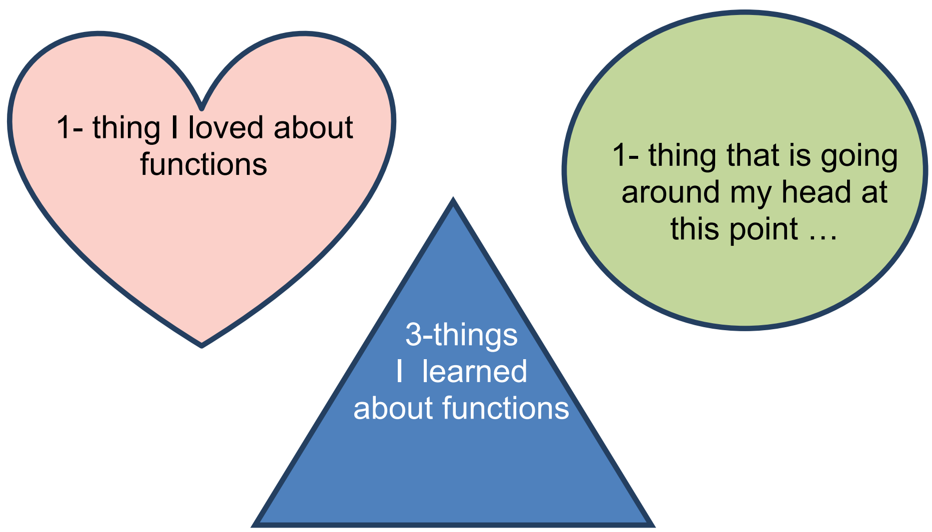
SUBMIT

ACTIVITY 22. Quiz Yourself

Access the following sites to quiz yourself.
http://teachers.henrico.k12.va.us/math/hcpsalgebra1/Documents/examviewweb/ev5-5.htm
Give a practice test on functions

http://www.regentsprep.org/Regents/math/algtrig/ATP5/FuncPrac.htm
Interactive Quiz

ACTIVITY 23. Shaping Up Review



Functions in Real Life

How can functions be used to model quantitative relations in real life? What would be the advantages of doing it? How can functions as models be used to solved problems?

There are many situations in real life that can be modeled by functions. In doing so, systemization and automation can easily be achieved. Some situations are given below.

Example 1.The function below shows the week day parking charges of a parking lot.

$$c(x)=\begin{cases}5x, x\leq 3\\ 20, x>3\end{cases}$$

Which scenario best represents the above equation?

a. The parking lot charges P5.00 for the initial 3 hours and a maximum of P20 per day.

a. The parking lot charges P5 per hour for the initial 3 hours and a maximum of P20 per day.
b. The parking lot charges P5 per hour for the initial 3 hours and P20 for 3 hours after this.
c. The parking lot charges P5 per hour for the initial 3 hours and P20 after this.

Example 2. Jose is a student assistant in the library. He receives an hourly wage of P20.00 per hour if he renders less than 25 hours per week. However, if he renders more than 25 hours, he receives 1.5 times the hourly rate plus P5.00.Which of the following best model the weekly earnings of Jose?

a. $f(x)\begin{cases}20x, x\leq 25\\ 1.5x+5, x>25\end{cases}$

c. $f(x)\begin{cases}20x, x\leq 25\\ 30x, x>25\end{cases}$

b. $f(x)\begin{cases}2x+4, x\leq 5\\ x-2, x>2\end{cases}$

d. $f(x)\begin{cases}4-2x, x\leq 0\\ 3x+5, x>0\end{cases}$

ACTIVITY 24. _Let's Model It!

1. Anthropologists can estimate a person's height from the from the length of certain bones. The height h (in inches) of an adult human female can be modeled by the function $h(l) = 1.95\ l + 28,$

where l is the length(in inches) of the femur, or thigh bone. The function is valid for femur lengths between 15 and 24 inches, inclusive.

a. Graph the function and determine a reasonable domain and range.
b. How tall is a female with a femur of 15 inches?
c. If an anthropologist estimates the female's height as 5.4 ft, how long is her femur?

2. Noemi sells home-made ice cream. The table below shows volume of the ice cream sold and the price.

Volume (in liters)	0.5	1	1.5	2	4
Price (in pesos)	18	36	54	72	144

a. Write a function that best model the situation.
b. Determine a reasonable domain and range
c. How much would you pay for 10 liters if ice cream?

3. The members of the Junior Cooperative pays fifty pesos for every share and a membership fee of fifty pesos.
a. Write a function that expresses Total collection as a function of the number of members.
b. Determine a reasonable domain and range.
c. What is the amount collected if there are 40 members?

4. The members of the Entrepreneurs Club conducted a rummage sale for the survivors of Typhoon Yolanda. If the cost of the items is five pesos or below, they sell it for P8.00. If the cost is greater than five, the mark up is 20% of the cost.
a. Write a function that expresses selling price as a function of cost.
b. Determine a reasonable domain and range
c. What is the selling price of an item costing P50 pesos?

LET'S REFLECT!

1. What concept/s did you use to solve the problems above?
2. How would you compare the concepts you used from this problem to the previous problems you encountered?
3. What can you say about functions?
4. How can mathematical models be used to solve problems involving relations between two variables?

ACTIVITY 25. Making Sure

Go back to Activity 1. Read and react to each statement and by writing True or false in the Second column before you start your study of this module.

Before	1. In rectangular coordinate system, two axes which are perpendicular to each other are used.	After
	2. A number line is a line marked with numbers in regular intervals as in a ruler.	
	3. A pair of numbers, written in the form (a, b), represents a point in the rectangular coordinate system.	
	4. The numbers in an ordered pair may be interchanged without changing the meaning.	
	5. A function is a rule that assigns to each input exactly one output.	
	6. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	
	7. The notation f(x) means f times x.	
	8. Functions model relationships between variables.	

Is there a change in your answers? Are you confident now with your answers? Do more self-assessment by answering the next set of questions.

Questions	My Revised answer
1. What is a rectangular coordinate system?	
2. What are the applications of rectangular system in real life?	
3. In what way is rectangular coordinate system related to relations?	

4. How can data be organized and represented to provide insight into the relationship between quantities?	
5. What is the difference between functions and relations?	
5. How can patterns be used to describe relationships in mathematical situations, solve problems and make predictions?	

ACTIVITY 26. Level 3 (Scaffold) What is the Model?

Take a piece of paper, and fold it in half as many times as you can. After each fold count the number of regions produced. How many folds are possible? Complete the table below.

Number of folds	0	1	2	3	4	20	n
Number of regions							

Questions to Answer

1. What pattern did you observe in the table?
2. How is the number of regions related to the number of folds?
3. What algebraic equation can best describe the relation?
4. Using this rule, how many regions will results from 20 folds? 30 folds? n folds
5. Your answers here.

B.

Maria is selling muffins in school. The table below show the profit, the gross proceeds and the cost.

a. Write a function rule that can predict the gross proceeds for any number of muffins sold.
b. Write an equation that can be used to predict the profit for any number of muffins sold.
c. Complete the table by indicating the gross proceeds, cost and profit for the given number of muffins sold

Number of Muffins Sold	Gross Proceeds in Pesos	Cost in Pesos	Profit in Pesos
5	60	40	20
12	144	96	48
24	288	192	96
30	360	240	120
40			
50			
70			
100			

How did you derive your models? How useful are these models in real life? Can you name other situations where you can use functions?

Now rate your progress in understanding of the lesson based on your performance in activities 1 to 5..

			
I need to shine my star!	Leveling up!	Good job!	Excellent!

Among the most common and important relationships between quantitative variables are those in which the dependent variable is a linear function of an independent variable.

How do we know the relationship between variables is linear? Is this characteristic true for all linear functions?

Now go back to Activity 20. How do I Look Like? Look at the graphs of the given functions. Which of the functions are represented by a line or a set of points that lies on the straight line?

These functions are called linear functions.

END OF DEEPEN

In this section, the discussion was about Relations and Functions and how they can be used to model mathematically quantitative relationships between variables.

What new realizations do you have about the topic? What new connections have you made for yourself? What helped you make these connections? Can you now answer the question: How can mathematical models be used to solve problems involving relations between two variables?

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding of linear functions.

To help you develop more the concepts you learned on how to use it in different situations, try to answer the quiz on problem solving.

ACTIVITY 27. QUIZ - PROBLEM SOLVING

Directions: You may answer this quiz using MS word. Send your answers to your teacher. To do that, go to the **student dashboard – message – attached file** then send it to your teacher.

1. Complete the table below. Consider *f* is a linear function. Values of x and f(x) are given in the table below.

x	***f(x)***
-3	***17***
0	***?***
?	***1***
4	***-18***
7	***?***
?	***-30***

2. A family of linear functions is given by

$$f(x) = mx + (3 - 2m)$$

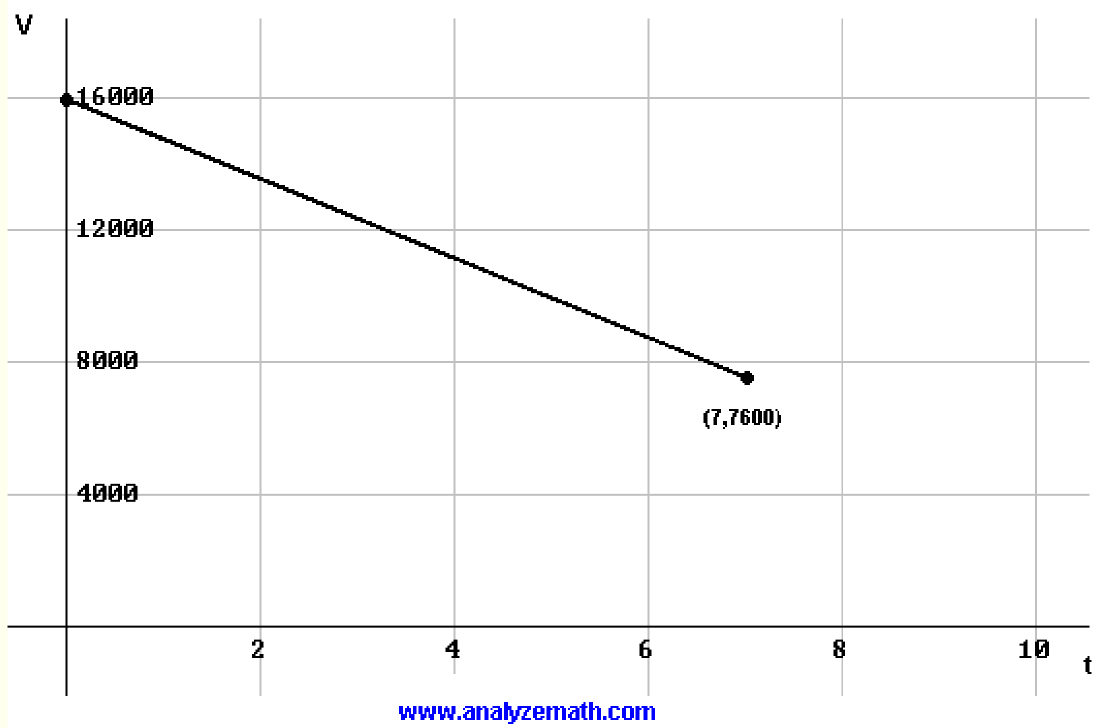
where x is the independent variable and m is a constant.

a) Graph f for $m = 0, 1, 2, -3$ and -5
b) What do all the graphs in part a) have in common?
c) Justify your answer to part b) analytically.
d) Write the equation of the family of functions whose graphs pass by the same point $(-2, -4)$.

Note: Use geogebra.com in graphing each function.

3. A high school had 1200 students enrolled in 2003 and 1500 students in 2006. If the student population P; grows as a linear function of time t, where t is the number of years after 2003.
   a) How many students will be enrolled in the school in 2010?
   b) Find a linear function that relates the student population to the time t.

4. The graph shown below is a linear function that relates the value V (in $) of a car to its age t, where t is the number of years after 2000.



   a) Find the slope and interpret it.

b) What will be the value of the car in the year 2010?

5. The cost of producing x tools by a company is given by

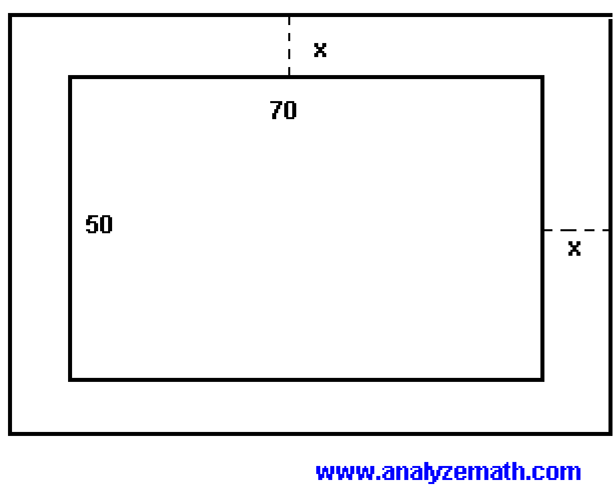
$$C(x) = 1200\,x + 5500 \quad \text{(in Php)}$$

a) What is the cost of 100 tools?
b) What is the cost of 101 tools?
c) Find the difference between the cost of 101 and 100 tools.
d) Find the slope of the graph of C?
e) Interpret the slope.

6. A 500-liter tank full of oil is being drained at the constant rate of 20 liters per minute.

a) Write a linear function V for the number of liters in the tank after t minutes (assuming that the drainage started at t = 0).
b) Find the V and the t intercepts and interpret them.
c) How many liters are in the tank after 11 minutes and 45 seconds?

7. A 50-meter by 70-meter rectangular garden is surrounded by a walkway of constant width x meters.



a) Write the outside perimeter P in terms of x.
b) Find the slope of the graph of P.
c) What is the meaning of the slope found in b)?

8. A driver starts a journey with 25 gallons in the tank of his car. The car burns 5 gallons for every 100 kilometer. Assuming that the amount of gasoline in the tank decreases linearly,

a) write a linear function that relates the number of gallons G left in the tank after a journey of x kilometer.
b) What is the value and meaning of the slope of the graph of G?
c) What is the value and meaning of the x intercept?

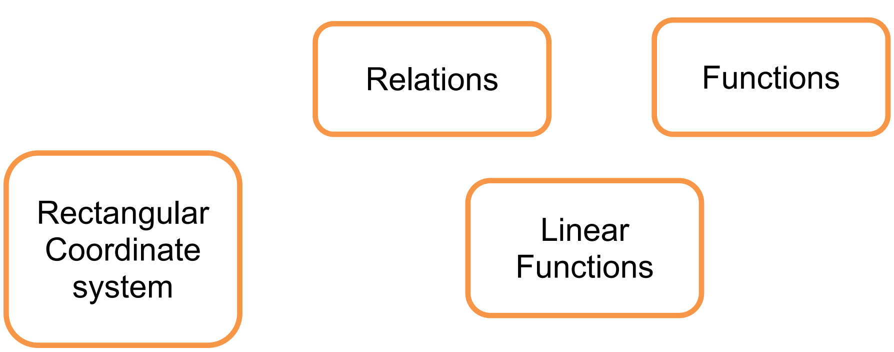
After taking the quiz let us go back to the first activity that you answered. Let see if you have improved your ideas about the following statements.

ACTIVITY 28.

In the last column write true if the statement is true and false if it is false.

Before	1. In rectangular coordinate system, two axes which are perpendicular to each other are used.	After
	2. A number line is a line marked with numbers in regular intervals as in a ruler.	
	3. A pair of numbers, written in the form (a, b), represents a point in the rectangular coordinate system.	
	4. The numbers in an ordered pair may be interchanged without changing the meaning.	
	9. A function is a rule that assigns to each input exactly one output.	
	10. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	
	11. The notation f(x) means f times x.	

Draw your final concept map to demonstrate the relationships among the key concepts: rectangular coordinate system, relations and functions.



Your final concept map here.

After answering again the first activity, you may have enough knowledge, skills and understanding to do your transfer task. To assess what you learned and understand you will apply the concepts of the lesson in an actual situation by doing the performance task.

ACTIVITY 29. PERFORMANCE TASK

You are a newly hired computer programmer of your company. Your company is presently encountering problems in terms of salary payment because the company has no computerized program to determine the salary of each employee for every pay period. Computation of deductions like taxes, SSS payment, PAG-IBIG, absences and leave as well as overtime pay and incentives are not regularly reflected in the record. You are hired by the company to fix this problem. You are expected to create a program considering the following factors: basic salary, tardiness, absences, overtime, incentives, etc. The program must be appropriate to the needs and present situation of the company, formulas must be correct and accurate, and easy to use. Prepare an audio recording to explain how the program works.

Rubric of the Performance Task

Components	1 Beginning	2 Developing	3 Satisfactory	4 Excellent
Use of Correct concepts	Explanation shows minimal understanding of the underlying concepts used to process data.	Explanation shows limited understanding of the underlying concepts used to process data.	Explanation shows substantial understanding of the underlying concepts used to process data.	Explanation shows extensive understanding of the underlying concepts used to process data.
Appropriateness	Three or more parts are not existing in the company.	One or two part is missing.	Details of the program are updated with the present needs of the company.	Details of the program are updated with the present needs of the company and ~~provision for~~ future possible

				deductions or incentives.
Accuracy	Most of the computations are wrong.	There are two or three values which are inconsistent.	All computations are correct.	All computations are correct. Icons appear if data is not appropriate.
Usability	Only experts and the person who created the program can operate.	Program is hard to operate. It requires long term orientation before using it.	Program can be operated by an ordinary employee.	Program can be operated by an ordinary employee. Formulae and cells are protected so that results can't be manipulated easily. May required basic knowledge on programming?

Note: Program may be submitted face to face or for initial submission you may go to student dash board – message – attached file. You may not need to submit this face to face if you could convince the teacher with your output or he/she has no clarification.

For your presentation and explanation, you may use **voki.com or present.me.** These web 2.0 applications will help you record your presentation in the most exciting way.

After doing your performance task it's time again to reflect on the learning process to check if there are ideas which you need to change, to revise or improve. You may now complete you IRF worksheet by writing your ideas on the F part.

CONCEPTUAL UNDERSTANDING CHECK

In the table below, write your answers on the final answer for the question what is the best way to solve problems involving triangle similarity?

INITIAL ANSWER
REVISED ANSWER
FINAL ANSWER

To complete the learning process, reflect again and complete the table below. This will also check if you have absorbed some misunderstandings which need to be corrected.

Let's Reflect!

CORNELL' S NOTES	
TOPICS	**THINGS I LEARNED**
Questions I want to be answered:	

To summarize what you learned, you may complete the synthesis journal below.

Synthesis Journal

The lesson was on ______________________________. One key idea was _____________________________. This is important because _______________________________________. Another key idea was ________________________________. This is also important because ____. In summary, the lesson ____

____

____.

End of TRANSFER

In this section, your task was to create a program which can solve problem related to salary of the employees and present it in a video presentation.

How did you find the performance task? How did the task help you see the real world use of the topic?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

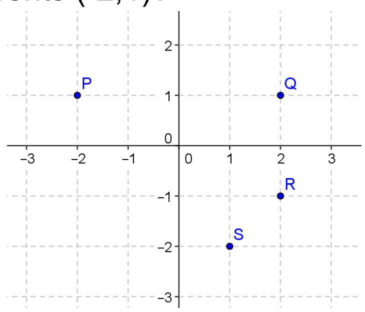
POST ASSESSMENT:

1. In what quadrant is C(3,-2) located?

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

2. Which one represents (-2,1)?

A. P
B. Q
C. R
D. S



3. What quadrants do the line y = 2x - 4 go through?

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

4. Angela's cable company charges her Php 650.00 per month (m), plus a basic connection charge of Php 1 300.00. What function models her expenses (E)?

A. E(m) = 650 m + 1 300
B. E(m) = 1300 m + 650
C. E(m) = 1950 m
D. E(m) = 650 m + 1 300 m

5. The profit earned(p) by a selling a number of roses (x) in the flower shop is the difference between the revenue minus the cost of roses expressed as y = 1.5x + 2. What is the dependent variable?

A. Profit earned
B. The cost of buying roses
C. The difference between revenue and cost
D. Number of roses sold

6. What is the domain of the relation {(1,3), (2, 4), (5,7), (3,5)(4,6)}?

A. { 1,2,3,4,5} C. {1,2,3,4,5,6,7)
B. {3, 4, 5, 6, 7) D. {Real numbers}

7. If $f(x) = 2(x-3)$, What is x when $f(x) = 20$?
a. 13 b. 20 C . 34 d. 40

8. The map of a city is drawn in a Cartesian co-ordinate system. On this map, the street on which the school and the arena are located is represented by the line whose equation is $y = 3x - 2$. The street where the church and the post office are located is represented by the equation $y = -3x - 2$. What is characteristic of the lines representing these two streets?

A. They are perpendicular.
B. They intersect and are not perpendicular.
C. They are distinct and parallel.
D. They are coincident.

9. Given $f(x) = 2x^2 - 3x + 6$, find $f(2.5)$.
A. 2.5 B. 4.75 C. 8.5 D. 11

10. It has been observed that a particular plant's growth is directly proportional to time. It measured 2 cm (H) when it arrived at the nursery and 2.5 cm exactly one week later (w). If the plant continues to grow at this rate, determine the function that represents the plant's growth and graph it.

A. $H(w) = 0.5w$
B. $H(w) = 2w + 0.5$
C. $W(h) = 0.5h$
D. $W(h) = 2h + 0.5$

11. A car rental charge is Php 1000 per day plus Php 20.00 per kilometer (k) travelled. Determine the equation of the line that represents the daily cost by the number of kilometer travelled. If a total of 300 kilometer was travelled in one day, how much is the rental company going to receive as a payment (P)?

A. Php 1 320.00

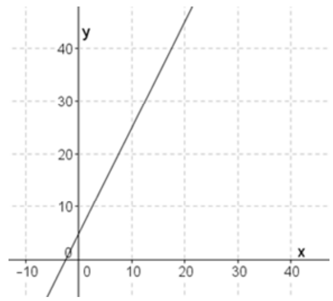
B. Php 6 500.00

C. Php 7 000.00

D. Php 20 300.00

12. The graph shows the cost of preparing banana cue for sale, wherein y represents pesos and x is the number of raw banana purchased. How many banana cues were cooked if the cost is P35.00?

a. 10 c. 20
b. 15 d. 25



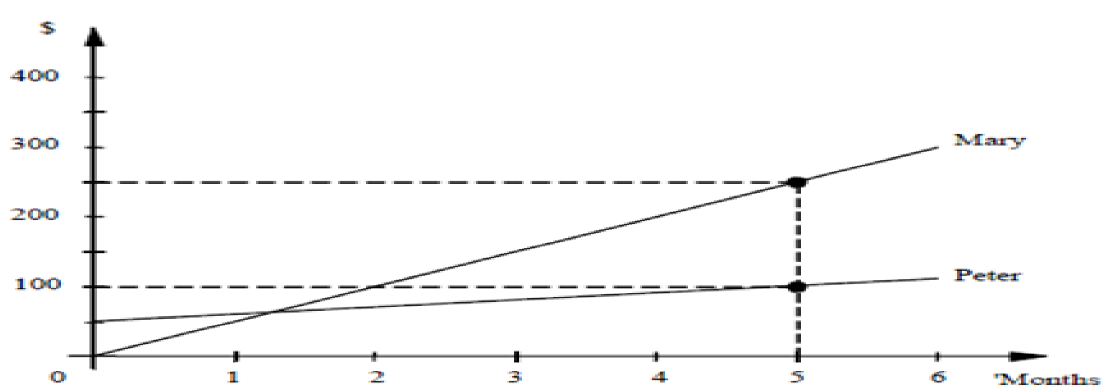
13. Half kilogram of squid can be purchased at the market for Php 60.00(P). Determine the equation and represent the function that defines the cost of squid based on weight (w).

A. P(w) = 120 w
B. P(w) = 60 w
C. P(w) = 30 w
D. P(w) = ½ w + 60

14. When digging into the earth, the temperature rises according to this linear equation: t = 15 + 0.01 h, t is the increase in temperature in degrees and h is the depth in meters. Calculate: Based on this equation, at what depth would there be a temperature of 100 ºC?

A. 850 meters
B. 8.5 kilometers
C. 85 000 meters
D. 850 kilometers

15. The following graphs show how Mary's and Peter's savings have increased over the last six months.



You are a friend of Mary and Peter. Six months ago you said “Peter and I had saved the same amount of money, but since then, my savings have increased at the same rate as Mary's." Which equation can be used to calculate your savings as a function of the number of months gone by?

A. y = 50x
B. y = 50 + 50x
C. y = 50 + 5x
D. y = 50 + (50 + 20x)

16. The function below can be used to find the normal blood pressure of a person according to his or her age.

$$P = 100 + \frac{a}{2}$$

where P is the blood pressure
and a is the person's age.

According to this function, how old should a person be to have a blood pressure of 130?

A. 15 years old
B. 30 years old
C. 60 years old
D. 65 years old

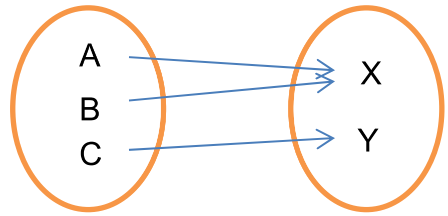
17. The number of subscribers to a scientific journal grows at a rate of 3350 per year. If the journal already had 4900 subscribers after its first year of operation, how many would it have five years after it began publication?

A. 16 750 subscribers
B. 21 650 subscribers
C. 18 300 subscribers
D. 24 500 subscribers

18. The fine for exceeding the speed limit of 100 km/h travelling at v km/h is F(v) = 20(v − 100). If a driver is caught travelling at 115 km/h in this 100 km/h zone, what fine will he have to pay?

A. Php 150.00
B. Php 300.00
C. Php 450.00
D. Php 600. 00

19. Consider the relation represented by the mapping below. Which set of ordered pairs represent the relation?
A. {(A,X),(B,X), (C,Y)}
B. {(X,A),(X,B), (Y,C)}
C. {(A,B),(A,C), (X,Y)}
D. {(A,X),(B,X), (C,Y),(X,Y), (Y,C)}



20. Given the relation T = {(5,2), (7,4), (9,10), (x, 5)}. Which of the following values for x will make relation T a function?
A. 2 B. 5 C. 7 D. 9

GLOSSARY OF TERMS USED IN THIS LESSON:

Relation – A set of ordered pairs.

Domain – The first coordinates of a relation.

Range – The second coordinates of a relation.

Function – When each member of the domain is paired with exactly one member of the range.

Vertical-line test – The test tha visually determines whether or not a relation is a function or not.

Solution – An ordered pair that makes an equation a true statement is a solution of the equation.

Linear Equation – Any equation whose graph is a line.

Y – intercept – The point where the line crosses the y – axis. Also, the constant in an equation that is in slope – intercept form (y = mx + b).

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

http://teachers.henrico.k12.va.us/math/hcpsalgebra1/Documents/examviewweb/ev5-5.htm
This site contains worksheet about graphing linear functions.

http://www.phschool.com/webcodes10/index.cfm?fuseaction=home.gotoWebCode&wcprefix=ata&wcsuffix=0502
This site conatins interactive quiz about graphing a linear function.

http://www.vitutor.com/calculus/functions/linear_graphs.html
This site contains worksheets on linear function.

http://www.youtube.com/watch?v=n7QeVeghB9A
This site contains video about the application of linear function in real life.

http://www.youtube.com/watch?v=AqIMrHOBM4g
This site contains video about linear function and its notation.

http://www.youtube.com/watch?v=xf8-BEdoSss
This site contains video about slope of a line.

http://dmc122011.delmar.edu/math/pjohnson/Webpage/businessmath/notes/3.3.pdf

This site contains worksheets about the application of linear functions in real life.

Lesson 3: Linear Inequalities in Two Variables

☑ INTRODUCTION AND FOCUS QUESTION(S):


Have you thought of why Algebra is difficult to understand and often perceived to have a confusing set of letters, numbers and symbols? Have you at a certain time asked yourself how Algebra can help you in choosing the best option if there is a variety of choices?

In this module, you will pay attention to linear inequalities in two variables where the knowledge and skills learned in the previous lessons can be applied. You will find out the different concepts involved in Linear Equations and Inequalities in Two Variables. As you go over the exercises, you will be able to answer the questions: How can we use equations and inequalities to solve real-life problems where certain quantities are unknown? What makes linear inequality

☑ LESSON COVERAGE:

In this lesson, you will examine this question when you take the following topics:

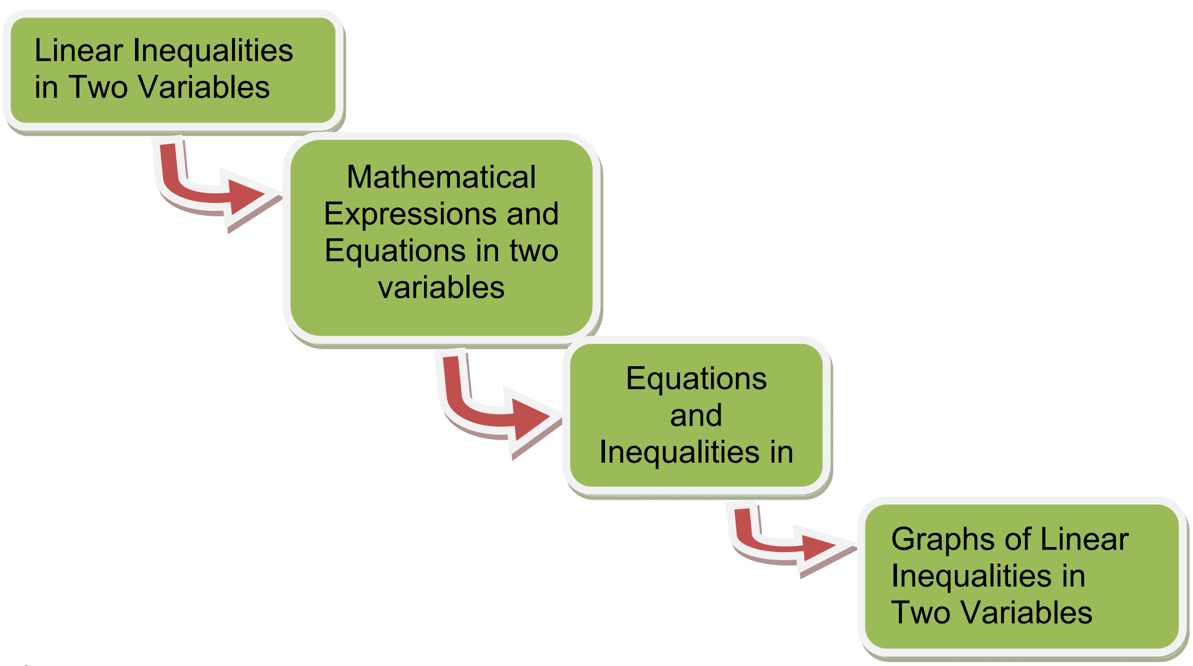
3.1. Mathematical Expressions and Equations in Two Variables Equations and Inequalities in Two Variables
3.2. Graphs of Linear Inequalities in Two Variables

In this lesson, you will learn the following:

3.1	• Differentiates between mathematical expressions and mathematical equations. • Differentiates between mathematical equations and inequalities. • Illustrate linear inequalities in two variables.
3.2	• Graphs linear inequalities in two variables on the coordinate plane.

☑ **LESSON MAP:**

Here is a simple map of the above lesson you will cover:



☑ **EXPECTED SKILLS:**

To do well in this lesson, you need to remember and do the following:

1. Look up the meaning of words you do not know.
2. Complete all activities and exercises.
3. Take note of the proper modeling of situations using oral, written, graphical and algebraic methods to solve problems.
4. Use the checklist and rubric provided to evaluate your work before submission.
5. Be mindful of the meaning of unfamiliar words you encounter in this module. A glossary of terms is provided in the last part of this module.

6. Maximize the use of online resources in each lesson. Online resources can be accessed multiple times. The summary of online resources is provided in the end of the module.

PRE-ASSESSMENT:

Let's find out how much you already know about this module. Click on the letter that you think best answers the question. Please answer all items. After taking this short test, you will see your score. Take note of the items that you were not able to correctly answer and look for the right answer as you go through this module.

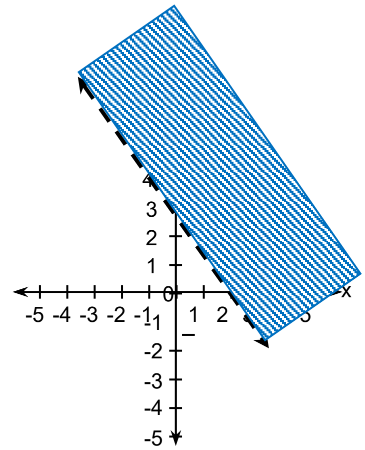
1. Which of the following is used to graph the inequality $x + y > 51$?
   A. a solid line
   B. a ray
   C. a dashed line
   D. a segment

2. Which of the following inequalities *does not* contain the test point (0,0) in its half-plane?
   A. $2x + y + 2 > -5$
   B. $x + 2y - 2 < 5$
   C. $2x - y + 2 \leq -5$
   D. $x - 3y - 2 \geq -5$

3. Which of the following is the boundary of $5x + 4y \geq 12$?
   A. $5x - 4y = 0$
   B. $4y - 5x = 12$
   C. $5x + 4y = 12$*
   D. $5x + 4y > 12$

4. What is a solution of the inequality $2x - 3y > 12$?

   A. (2, 3)
   B. (-3, 0)
   C. (5, -4)
   D. (-4, 0)

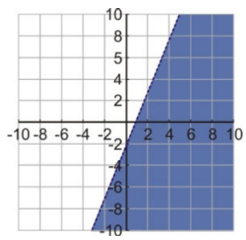


5. What linear inequality is represented by the graph at the right?

   A. $x + y > 0$
   B. $x - y < 0$
   C. $-x + y > 0$
   D. $-x + y < 0$

6. Which of the following is the graph of $-2y > -5x + 4$?

A.



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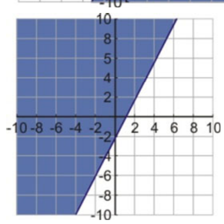
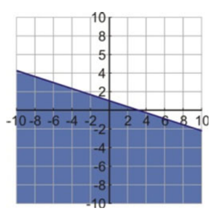


C.



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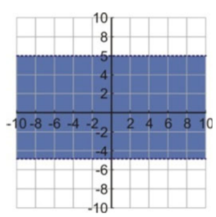


7. "It will take at least 20 points to make the playoff," the hockey team coach told the players. "We get 2 points for a win and 1 point for a tie." Write an inequality to describe the values of wins and ties that will enable the team to make the playoffs.

   A. $2w + t > 20$
   B. $2w + t < 20$
   C. $2w + t \leq 20$
   D. $2w + t \geq 20$

8. You are a car dealer. You have Php63 360 000 available to purchase compact cars and sport utility vehicles for your lot. The compact car costs Php495 000 and the sport utility vehicle costs Php990 000. If *x* represents the number of compact cars and *y* represents the number of sport utility vehicles you purchase,which inequality models the different numbers of compact cars and sport utility vehicles that you could purchase?

   A. $495\,000x + 990\,000y > 63\,360\,000$
   B. $495\,000x + 990\,000y \leq 65\,360\,000$
   C. $990\,000x + 495\,000y < 65\,360\,000$
   D. $990\,000x + 495\,000y \geq 65\,360\,000$

9. You have relatives living in both the United States and Mexico. You are given a prepaid phone card worth Php300. Calls within the United States cost Php2 perminute(x) and calls to Mexico cost Php5 per minute(y). What is the greatest number of minutes you can use for calls within the United States if you have already consumed 25 minutes of calls to Mexico?

   A. 97.5 minutes
   B. 97 minutes
   C. 87.5 minutes
   D. 87 minutes

10. You are on a treasure hunter, hunting for the lost silver and gold. Every hunter has placed whatever object is being collected in a wired basket. One of the hunters signaled you to reel in the basket, but it feels as if it contains no more than 75 pounds of materials. If each gold coin weighs about 0.75 ounce and each silver coins weighs at around 0.35 ounce. Which of the following models the situation?

    a. $0.75x + 0.35y \leq 120$
    b. $0.75x + 0.35y < 120$
    c. $0.75x + 0.35y < 75$
    d. $0.75x + 0.35y \leq 75$

11. Which of the following is an example of a mathematical equation?

    a. $3x + 2y < 11$
    b. $2x \geq 4$
    c. $5y$
    d. $x + y = 14$

12. The difference between Jessan's score and Cathy's score in the test is not more than 5 points. What mathematical statement represents the difference in Jessan's and Cathy's scores?

a. $x - y \leq 6$
b. $2x - y \leq 5$
c. $x - y \leq 5$
d. $x - 2y \leq 5$

13. Which of the following statements is not true about an expression?
    a. An expression does not have an answer.
    b. An expression is a combination of numbers, variables, and symbols to be calculated.
    c. An expression is separated by an equals sign.
    d. An expression has no solution.

14. Which of the following is an example of linear equation in two variables?
    a. $4x – 3y = 5$
    b. $5x – 2y \neq 4z$
    c. $2x + 3y \leq -8$
    d. $3x + 2y > 6$

15. A motorcycle has a fuel reserve of 0.5 L which can be used if its 2.5-liter fuel tank is about to be emptied. The motorcycle consumes at most 1 L of fuel for every 25 km of travel.
    a. $y \geq 3 - \frac{x}{25}$
    b. $y \geq 25 - \frac{x}{25}$
    c. $y \geq -\frac{x}{25}$
    d. $y \geq 3 - \frac{25x}{2}$

16. Suppose the motorcycle's tank is full and it travels a distance of 50 km About how much fuel would be left in its tank?
    a. About 4 L
    b. About 3 L
    c. About 2 L
    d. About 1 L

17. Which of the following is a mathematical equation?
    a. The cost of apple and pie is at most 200 pesos
    b. The cost of 1 kilo of pork and ½ kilo of beef is at least 400 pesos
    c. The cost of two apples and 5 oranges is 75 pesos
    d. Two apples costs less than 25 pesos

18. You are a businessman who calls for a business partner in order get enough money to get the store running. You are currently trying to decide how much of product A and product B you want to buy for the business. Product A takes

up less space than product B, but it also yields a smaller profit. To show your potential partner your business qualifications, you need to make a written proposal and a PowerPoint presentation containing different sets of products which will give you a higher profit, keeping in mind that you have 600ft^3 to store those products. Which of the following standards will be best to assess your work?

a. Accuracy, Justification, Use of Mathematical Terminology and Notations, Oral and Visual presentation.
b. Accuracy, Practicality, Grammar and Dependability
c. Justification, Coherence, Practicality, and Proper Use of Subject Verb Agreement
d. Accuracy, Justification, Use of Mathematical Representation, Neatness and Cooperation

19. Erin brought three apples and two oranges in the fruit stand. The total amount he paid is at most P120. 00. How will you represent the number of apples (x) and oranges (y) respectively?
a. $3x + 2y = 120$
b. $3x + 2y < 120$
c. $3x + 2y \leq 120$ *
d. $3x + 2y \neq 120$

20. You are an amateur coin collector; you want to collect at least 50.00 pesos worth of 25 cents and 50 cents old coins. You want to present this in the class to show a little history of Philippine coinage. Which of the following models the given stituation?
a. $0.25x + 0.5y = 50$
b. $0.25x + 0.5y \geq 50$
c. $0.25x + 0.5y \leq 50$
d. $0.25x +0.5y > 50$

3.1 Mathematical Expressions, Equations and Inequalities in Two Variables

EXPLORE

Let's begin by finding out the meaning of linear inequalities in two variables.

ACTIVITY 1. WHICH IS WHICH.

Directions: Compare the two cellphone plans below and choose which is a better option.

PLAN A	PLAN B
A Monthly bill of P350.00 consumable. In excess of the P350.00 costs P7.00 per minute calls and P1.00 SMS to other networks while P5.00 per call and P0.75 SMS to same network.	P650 monthly bill. In excess of P650 costs P4.00 call rate to other and same network. While P1.00 SMS rate to all networks.

Answer the following questions:

1. Which of the given choices is a better option?
2. How did you come up with this choice?
3. How can we use equations and inequalities to solve real-life problems where certain quantities are unknown?
4. What makes linear inequality different from linear equations?
5. How can linear inequality in two variables help us solve real life problems?

The difference between expressions and equations is what each represents. An expression shows a math relationship. One key to an expression is that there is no solution, and, therefore, it has no answer.

An expression, however, can be "evaluated." To evaluate an expression, substitute values for the variables. The evaluation changes if you substitute different numbers in for the variables. In this way, expressions can be simplified. This is how we get numbers from expressions.

Both use numbers and variables; however, it is all based on the arrangement. So, let's take look at both to determine their use and relationship. An expression is a combination of numbers, variables, and symbols to be calculated, while an equation contains expressions that are separated by an equals sign.

To further understand the difference of a mathematical expression and linear equations in two variables, you may visit the website http://www.youtube.com/watch?v=NP7wXbgHupQ.

Let's begin by finding out what you know about Linear Equations and Inequalities in Two Variables.

ACTIVITY 2. IRF WORKSHEET.

In this lesson, you will do varied activities which will help you answer the questions; How can we use equations and inequalities to solve real-life problems where certain quantities are unknown? What makes linear inequalities different from linear equations? How can linear inequalities in two variables help us solve real life problems?

Let's begin by answering the "I" portion of the IRF Worksheet that is given below. Fill up by writing your initial answer to the topical focus question:

IRF WORKSHEET		
Initial Answer	Revised Answer	Final Answer

For a number of days you will study linear inequalities in two variables and will verify what you initially know about this topic. We will explore its nature and its usefulness to our lives. There are relatively more inequalities in life thanequalities. This is evident in the different real-life situationsthat follow;;.

Now you are done differentiating an expression and an equation. By doing the next activity you will identify real-life situations related to inequalities.

End of EXPLORE:

FIRM-UP

Your goal in this section is to learn and understand key concepts of linear inequalities in two variables. In the next activities, you will be able to differentiate linear inequalities in two variables from an equation. You will also be able to model linear inequalities in two variables.

ACTIVITY 3.   CLASSIFY ME!!!

Classify the given equations as linear equations or linear inequalities in two variables by putting a check mark (√) in the appropriate column. Then, write your reason for classifying as such under the “Reason” column. As you do so, you are trying to answer the question: ***What makes linear equation different from linear inequalities in two variables?***

Given	Linear Equation in Two variables	Linear Inequalities in Two Variables	Reason
1. $y = -\frac{1}{2}x + 2$			
2. $3x \leq 2y - 5$			
3. $3x < 2y - 5$			
4. $3x + 2y = -5$			
5. $y \geq 3x + 2$			
6. $x - 2 = \frac{1}{3}y$			
7. $x - 2y = \frac{1}{3}$			

8. $3x \leq 2y - 7$			
9. $2y - 7 = -4x$			
10. $2y - 7 = -4x - 6$			

PROCESS QUESTIONS:

1. *Based on your answers above, what helped you classify linear equations and linear inequalities in two variables?*
2. *Do you have any basis to easily classify linear equations and linear inequalities in two variables?*
3. *What makes linear equations different from linear inequalities in two variables*

You just gave your answers in the activity. Let's now find out more about linear equations and inequalities in two variables by doing the next part. As you move on, think of the last question asked above: ***How can linear equations and inequalities in two variables help in your daily life?***

Let's find out how others would answer the question and compare their ideas to our own. As you compare you will also learn other concepts which will help you complete the required project. The project is about making a written proposal and a PowerPoint presentation as an application of linear equation and inequalities in two variables.

We will start by doing the next activity.

In the previous activity you were able to classify whether the given is a linear equation or inequalities in two variables. The next activity will test you on how you can represent the given statements to mathematical expressions involving linear equations and inequalities in two variables.

Example:

Kiara has two part-time jobs, one paying Php45 per hour and another paying Php70 per hour. She must earn at least Php1,295 per week to pay her expenses while attending high school night class. Write an equality that shows the various ways she can schedule her time to achieve her goal.

Solution:

Let x = the number of hours Kiara works on the first job
Let y = the number of hours she works on the second job

The hourly rate on the first Job	times	The hours worked on the first job	plus	The hourly rate on the second job	times	The hours worked on the second	is at least	1,295
45	$\cdot$	x	+	70	$\cdot$	y	$\geq$	1,295

Answer: the inequality obtained, $45x + 70y \geq 1295$, is an example of a linear inequality in two variables.

ACTIVITY 4. MODEL IT!!

Mathematical Sentence	Mathematical Model
1. If x represents the number of cows and y, the number of hens in a farm, what expression will give the total number of legs of the animals in the farm?	
2. Let x be the number of boys and y, the number of girls in a camp. The number of girls exceeds twice the number of boys by 12.	
3. The difference between two numbers x and y is no less than 15.	
4. The math club officers plan to hold a mini-concert as part of their fund raising project. Student tickets are sold at P25 each and non-student tickets are sold at P40 each. They should sell at least 120 tickets.	
5. The math club officers plan to hold a mini-concert as part of their fund raising project. Student tickets are sold at P25 each and non-student tickets are sold at P40 each. They should make at least P4000 from the total sales.	

6. The difference between two numbers is greater than 20.	

Questions:

1. How can we use equations and inequalities to solve real-life problems where certain quantities are unknown?
2. What makes linear inequality different from linear equations?
3. How can linear inequality in two variables help us solve real life problems?

ACTIVITY 5. WATCH AND LEARN.

Watch the video clip by clicking on the hyperlink below on how to model linear inequalities in two variables. http://www.youtube.com/watch?v=cCMpin3Te4s

An inequality is really just any mathematical statement relating two quantities using an inequality symbol such as $<$, $>$, $\leq$, or $\geq$. For inequalities that contain variable expressions, you may be asked to solve the inequality for that variable.

A linear inequality in two variables can also be written in one of the four forms:

This just means that you need to find the values of the variable that make the inequality true. Remember that when you solve a linear equation there is usually one value that makes the equation true. But when you solve an inequality, there can be many values that make the statement true!

Consider a linear equation for instance, $3x + 4y = 1$. If in this equation, the equality symbol $=$ is replaced by an inequality symbol such as $\leq$, $\geq$, $<$, or $>$, the resulting statement is called a linear inequality in two variables.

An ordered pair of numbers is called a solution of a linear inequality in two variables if the numbers satisfy the inequality.

Example 1

Determine if the ordered pair (1, 2) is a solution of the linear inequality $2x + 3y < 12$.

Solution:

Substitute 1 for x and 2 for y in the inequality $2x + 3y < 12$. Check if the resulting inequality is true.

$$2(1) + 3(2) < 12$$
$$2 + 6 < 12$$
$$8 < 12$$

Since the resulting inequality is true, the ordered pair is (1, 2) is a solution of 2x + 3y < 12 .

Example 2

Determine if the points (3,4), (0,0) and (2,0) are solutions of the inequality 2x + 3y < 12.

Solution:

To determine if a given point is a solution of an inequality or not, substitute the coordinates in the inequality. Then apply the Law of Trichotomy.

If 2x + 3y < 12, and x = 3 and y = 4

$2(3) + 3(4) < 6$
$6 + 12 < 6$
$18 < 6$ FALSE

Thus, (3,4) is not a solution of 2x + 3y < 12.

If 2x + 3y < 12 and x = 0 and y = 0

$2(0) + 3(0) < 6$
$0 + 0 < 6$
$0 < 6$ TRUE

Thus, (2,0) is a solution of 2x + 3y < 12.

If 2x + 3y < 12 and x = 2 and y = 0

$2(2) + 3(0) < 6$
$2 + 0 < 6$
$2 < 6$ FALSE

Thus, (2,0) is not a solution of 2x + 3y < 12.

Example 3
Determine whether the following are solutions of the linear inequality $4x - 5y > 20$.

Solution:

1. Replace x with 4 and y with 6 in the linear inequality.

$4x - 5y > 20$
$4(4) - 5(6) > 20$
$16 - 30 > 20$
$-14 > 20$

Conclusion: $-14 > 20$ is false. (4, 6) is not a solution.

2. Replace x with 2 and y with -4 in the linear inequality.

$4x - 5y > 20$
$4(2) - 5(-4) > 20$
$8 + 20 > 20$
$28 > 20$

Conclusion: $28 > 20$ is true. (2, -4) is a solution.

3. Replace x with 9 and y with 0 in the linear inequality.

$4x - 5y > 20$
$4(9) - 5(0) > 20$
$36 - 0 > 20$
$36 > 20$

Conclusion: $36 > 20$ is true. (9, 0) is a solution.

Watch the TenMarkInstructor by clicking on the hyperlink below. The video will give you additional information on how to determine whether the given is a solution of a linear inequality or not. http://www.youtube.com/watch?v=GOAP-2F1OaI

ACTIVITY 6. SHOW ME!!

Watch the Algebra II - Recipe by clicking on the hyperlink below. Answer the questions using your knowledge about linear inequalities.
http://www.algebralab.org/studyaids/studyaid.aspx?file=Algebra2_2-6.xml

Process Questions:
1. How did you find the activity?
2. Did you encounter any difficulty in answering the exercises? Why?
3. How did you overcome this difficulty?
4. How can we use equations and inequalities to solve real-life problems where certain quantities are unknown?
5. What makes linear inequality different from linear equations?

6. How can linear inequality in two variables help us solve real life problems?

ACTIVITY 7. ANALYZE ME

Determine whether the given points is a solution of the linear inequality.

1. $3x - 4y > 13$; (2, -3), (4, 2)

Solution:

2. $x < y$; (4, 7), (2, -3) and (5, 6)

Solution:

3. $2x - y \leq 7$; (2, -7) and (3, 2)

Solution:

4. $1.7x + 0.8y < 5.1$; (-2, 0.7) and (3, 1.2)

Solution:

5. $2x - y \geq 10$; (-2, 3), (1, 3) and (-2, -1)

Solution:

In this section, the discussion focused on modeling linear inequalities in two variables and how they are easily derived through the use of patterns. You may go back to the previous section to check and compare your ideas with the discussed topic.

In this section, the discussion was about linear inequalities in two variables.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision? For additional information on how to determine solutions of linear inequalities in two variables, you may visit http://www.youtube.com/watch?v=IMTudaflcik&playnext=1&list=PLD76A144881E89E96&feature=results_video .

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

Before you move on to the next section, let's do first the next activity.

ACTIVITY 8. IRF Worksheet.

Now that you have learned the difference between linear inequalities in two variables and equation in two variables, how they are modeled and how to determine whether the given is a solution or not. Using the "R" portion of the IRF Worksheet, answer the topical focus question: How can we use equations and inequalities to solve real-life problems where certain quantities are unknown? What makes linear inequality different from linear equations? How can linear inequality in two variables help us solve real life problems?

IRF WORKSHEET		
Initial Answer	Revised Answer	Final Answer

End of Firm up

In this section, the discussion was about the characteristics of linear inequalities in two variables. You also learned that real-life situations involve linear inequalities.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

In this section, you are going to look at some aspects of linear inequalities in two variables. The next activities will focus on modeling real life situations involving linear inequalities in two variables.

In the previous activities you were able to: classify whether the given is a linear equation or inequalities in two variables, illustrate linear inequalities in two variables, identify the solution set of a given linear inequality and graph linear inequalities in two variables. The next activity will test you on how you can represent or model the given real-life situations involving linear inequalities in two variables. As you move on, think of these questions asked in the previous activity: **How can you use inequalities to solve real-life problems where certain quantities are unknown? How can linear inequality help you solve real life problems?**

ACTIVITY 9. INVESTIGATE (Scaffold Level 1 – Directed Prompt)

You as a student will write to the School Publication about the TechNo Editorials. This month's column is going to be on the 32gig iPad 3. Someone wrote in to your column and attached a printout from a gadget magazine that claimed that the 32 GB iPad 3 has "32 GB capacity for 14,000 songs or 120 hours of video." This seemed interesting to you so you decided to investigate.

You found this information:

A. Downloading ***songs*** on iTunes: Each song costs 25.00
B. Downloading ***movies*** on iTunes: Each movie costs 75.00 and takes up approximately 1.75 GB

A. iPad 3

16 GB – 17, 800
32 GB – 24, 000

B. iPad 2

8 GB – 12, 200
16 GB - 16, 600

You also did some research and found that 1,024 MB = 1 GB.
You need to present a table showing the different sets of music and videos in the models of the iPad' s with their corresponding prices and totals.

For each of the following questions, be sure to define the variables you used in each question and show your work.

1. If the website's claim for the songs is accurate, how large (in MB) is the average song? How does this compare to the data you found?
2. It seems reasonable that the length (L) of a song is related to its size in MB (S). That is, the longer a song, the larger its size in MB should be. Use the website information from question #2, or another site you find, to develop a formula that relates L and S.
3. Assuming you can fit 14,000 songs on the 32 GB iPad3 how much would it cost to buy it **and** fill it with songs? Justify your answer.

Solution:
14,000 songs x P25.00 = P350, 000 worth of songs + P24, 000 amount of Ipad 3.

4. How long would it take you in days and hours to listen to all 14,000 songs? Round to the nearest hour if appropriate.

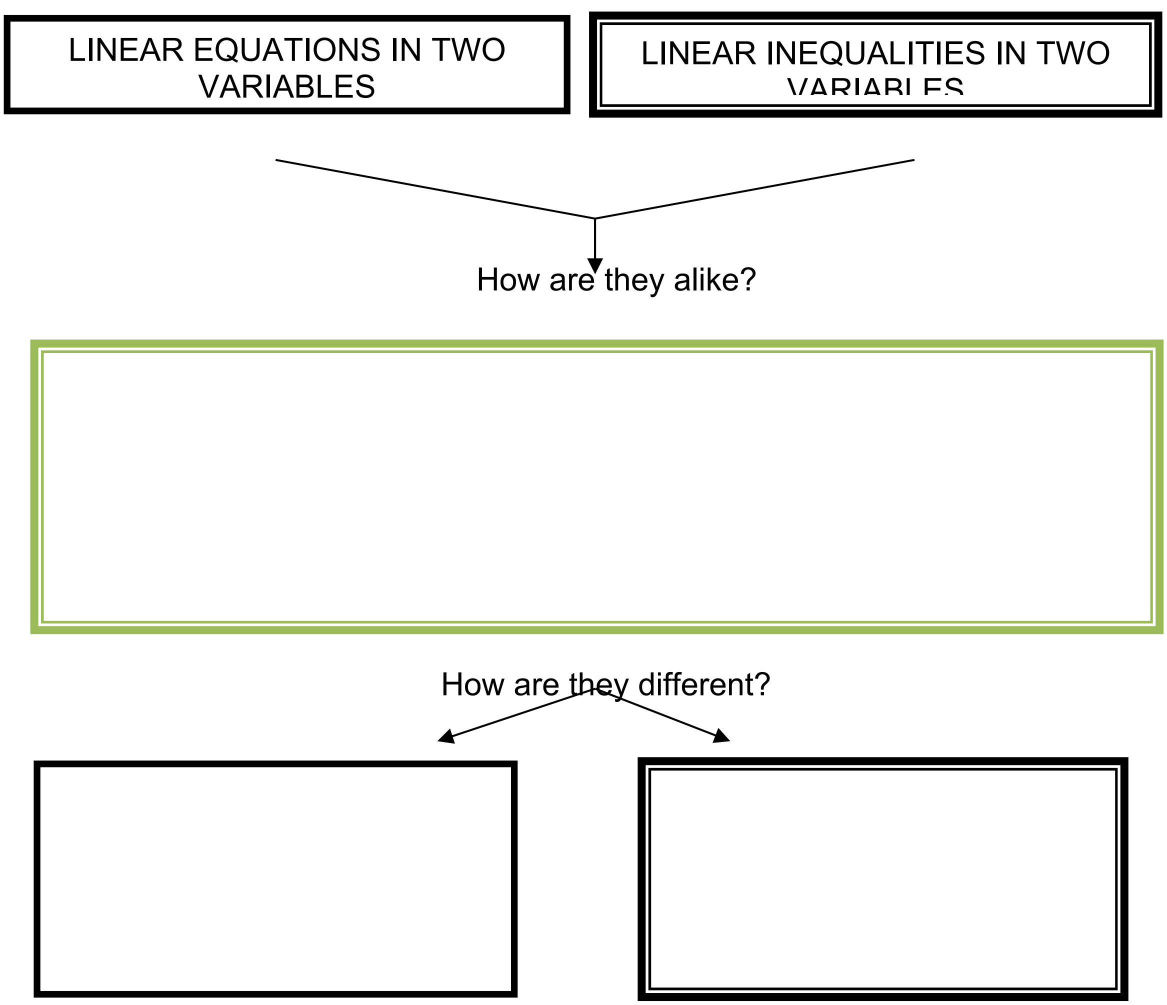
PROCESS QUESTIONS:

1. How did you find the activity?
2. Did you encounter any difficulty in answering the exercises? Why?
3. How did you overcome these difficulties?
4. How can linear inequality in two variables help us solve real life problems?

ACTIVITY 10. COMPARE AND CONTRAST CHART

To see how well you understand the process of determining the solution set of an inequality, accomplish Compare and Contrast Chart based on what you saw in the solution.

Compare and Contrast Chart Graphic Organizer



ACTIVITY 11. MTV I Like!!!

In groups, let the students conduct a survey on the memory size of their classmates' mobile phones memory cards. Suppose their favorite mp3 songs of same sizes will be saved to each memory card, how many files will fill each memory card? If they will also be saving their favorite video, what is the maximum number of files for each memory card? What factors will determine the number of files that can be saved on the memory cards?

Process Questions:

1. How did you find the activity?
2. Did you encounter difficulties during the activity?
3. How did you overcome these difficulties?
4. How can linear inequalities in two variables help us solve real life problems?

Students can make use of graphical and linear inequalities model in their oral and written presentation.

ACTIVITY 12. 3-2-1

Answer this formative assessment:

Three things I learned about linear inequalities in two variables	Two things I want to know more	One thing I don't understand

End of DEEPEN:

In this section, the discussion was about applying what you learned in real life. You will be given a practical task which will demonstrate your understanding of linear equations and linear inequalities in two variables.

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

All throughout the lesson, the question about how can linear Inequalities in two variables help in your daily life was asked repeatedly. The Transfer section of the lesson will guide you in determining the best answer to the question.

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 13. PERFORMANCE TASK: CBS FILES

Suppose you are the President of the Central Board of Students in your school that is planning to purchase t-shirts for the upcoming Sports fest. Your group received bids from two t-shirt manufacturers, Green Corner and Shanes T – Shirts. Green Corner is more expensive in price that costs P140 each, but the shirts are of good quality;however Shanes T – Shirts offers P105 per shirt lower than Green Corner but the shirts are of poorer quality than that of Green Corner.

Your group must present a Power Point Presentation to the School Principal, in which the preferred manufacturer should be stated. You as the president should be able to convince the Principal about the number of orders and justify it using mathematical models. Your product will be graded according to justification, clarity of graphics and representations, accuracy of data, fluency and organization.

PERFORMANCE TASK RUBRIC

	4 Excellent	3 Good	2 Developing	1 Beginning
Mathematical Concept / Justification	The proposal shows sophisticated understanding of the relevant ideas and processes. Main concepts are accurately presented in an in-depth	The proposal shows solid understanding of the relevant ideas and processes. All sub concepts are organized and consistently branch out	The proposal shows somewhat limited understanding of the relevant ideas and processes and sub-concepts don't consistently	The proposal shows little apparent understanding of the relevant ideas and issues and sub concepts don't consistently branch out from the main

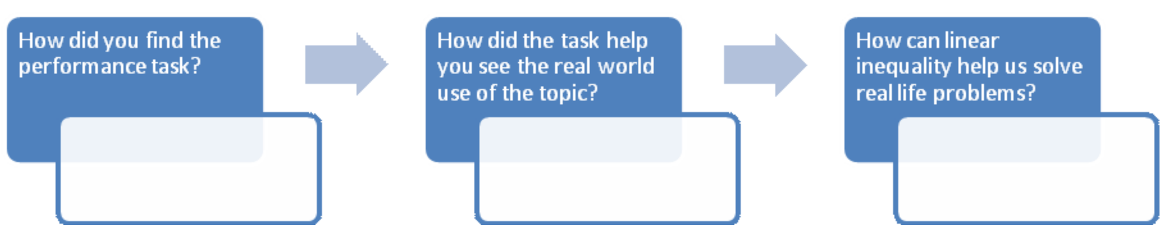
	way that makes connections between each information All sub concepts are logically organized which branch out appropriately from the main idea	from the main idea	branch out from the main idea. It shows some misunderstanding of key ideas.	idea. It shows major misunderstandings of the key ideas.
Clarity of the graphics and representations	All graphics and representations used are highly appropriate and attractive which enhanced the topic and aid in comprehension; very clear and well-situated.	All graphics and representations used are appropriate which enhanced the topic and aid in comprehension; clear and well-situated.	Few graphics and representations used are appropriate which enhanced the topic and give a little aid in comprehension; clear and properly placed.	Many graphics and representations used are inappropriate and poorly selected and don't enhance the topic; some graphics are ill-placed.
Accuracy of data	The data are credibly accurate and precise. Math concepts and procedures are detailed and applied appropriately. Use of efficient strategy that leads directly to a correct solution are highly evident.	The data are correct. Math concepts and procedures are applied correctly. Use of strategy that leads to a solution is evident.	The data contain minor errors. Some math concepts are used but not all of the necessary ones. Some strategies used are inappropriate	The data contain major errors. Inappropriate math concepts or procedures are used. No evidence of a strategy or the strategy shown is inappropriate

Fluency of presentation	Fluent, confident and thoroughly explained each point by providing support that contains rich, vivid and powerful detail .	Generally fluent, confident and clearly explained the proposal.	Somewhat hesitant, less confident and failed to explain significant number of points	Hesitant, not confident. Explanation is missing.
Organization of the presentation	Highly organized and done in an interesting way. Flows smoothly. Observes logical connections of points.	Satisfactorily organized. Sentence flow is generally smooth and logical.	Somewhat cluttered . Flow is not consistently smooth, appears disjointed.	Illogical and obscure. No logical connections of ideas. Difficult to determine the meaning.

Now that you have completed your project, you may now complete the KWHL Chart.

ACTIVITY 14. CONNECT me!!!

Answer the following by reflecting on the following questions.



ACTIVITY 15. IRF Worksheet.

Now that you have learned the difference between linear inequalities in two variables and equations in two variables, how they are modeled and how to determine whether the given is a solution or not. Using the “R” portion of the IRF Worksheet, answer the topical focus question: How can we use equations and inequalities to solve real-life problems where certain quantities are unknown? What makes linear inequalities different from linear equations? How can linear inequalities in two variables help us solve real life problems?

IRF WORKSHEET		
Initial Answer	Revised Answer	Final Answer

End of TRANSFER:

In this section, your task was to create a power point presentation and a written proposal.At this point it is expected that you should be able to answer the following questions: ***How can we use equations and inequalities to solve real-life problems where certain quantities are unknown? What makes linear inequalities different from linear equations? How can linear inequalities in two variables help us solve real life problems?***

3.2. Graphs and Models of Linear Inequalities in Two Variables

Let's begin by answering activity no.1

Let us begin by answering activity no. 1 to refresh what you already knew about linear inequalities in two variables and to prepare you to answer the following questions.
How can we use equations and inequalities to solve real-life problems where certain quantities are unknown?
How can linear inequalities help us solve real life problems?

A. Focus: Pre-Assessment

ACTIVITY 1. KWHL CHART

Instruction: Answer the question in the first and second columns.

What I *know* about linear inequalities in two variables?	**What I *want* to know about linear inequalities in two variables?**	**What I *learn* about linear inequalities in two variables?**

For a number of days we will study linear inequalities in two variables and you will verify what you initially know about this topic. We will explore its nature and its usefulness to our lives. There are relatively more inequalities in life than equalities. This is evident in the different real-life situations below. Now you will identify real- life situations related to inequalities by doing the next activity.

B. Focus: Eliciting Prior Knowledge

ACTIVITY 2. "WHAT AM I?"

Instructions: For each of the following situations/statements below write its mathematical model and illustrate its corresponding graph.

Real-Life Situations	Mathematical Model	Graph
1. The value of one Philippine peso is less than the value of one US dollar.		
2. According to the NSO, there are more female Filipinos than male Filipinos.		
3. The number of girls in the band is one more than twice the number of boys.		
4. The school bus has a maximum seating capacity of 80 persons.		
5. According to research, an average adult generates about 4 kg of waste daily.		
6. To get a passing mark in school, a student must have a grade of at least 75.		

PROCESS QUESTIONS:

Answer the following questions:

1. How do you describe the graph and model of situations 3 & 5? How about situations 1, 2, 4 & 6?
2. How does the graph and model of situation 3 differ from that of situation 1?
3. **How do you graph linear inequalities in two variables?**
4. **How can we use equations and inequalities to solve real-life problems where certain quantities are unknown?**
5. **How can linear inequalities help us solve real life problems?**

End of EXPLORE:

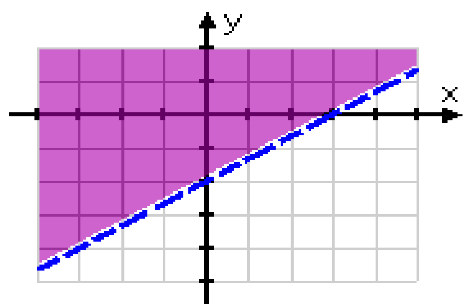
You just tried finding out what the answer is by the doing the next part. What you learn in the next sections will also enable you to do the final project which involves making a business proposal to convince a businessperson to be your business partner.

Let's now find out what the answer is by doing the next part.

FIRM-UP

Your goal in this section is to learn and understand key concepts about graphing linear inequalities in two variables. How do you graph linear inequalities in two variables? How do the graphs of linear inequalities in two variables present solutions to real-life problems?

C. Focus: Graphing Linear Inequalities in Two Variables



ACTIVITY 3.   ANALYZE ME!

You have written the model and identified the graph of linear inequalities in two variables, to verify your answers in activity 2 click the site below. To view the illustrations of the graph just click the right play icon of the first screen.
http://www.slideshare.net/guestd1dc2e/66-graphing-inequalities-in-two-variables-2751651
This contains illustrations on how to graph linear inequalities in two variables and how to model real-life situations.

PROCESS QUESTIONS:

1. What did you experience in accessing the site? Did you find any difficulty? Why?
2. How do you find the information found on each slide?
3. How are linear inequalities in two variables graphed?
4. How are linear inequalities used in modeling real-life situations?

ACTIVITY 4. KNOW ME MORE!

Enrich your understanding by answering the activities in the site below:
http://www.algebralab.org/studyaids/studyaid.aspx?file=Algebra2_2-6.xml.
This site contains examples and exercises on graphs of linear inequalities in two variables. To know the answer to the examples click the arrow symbol. Answer the practice problems by clicking the icon.

PROCESS QUESTIONS:

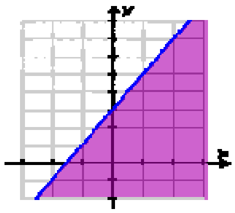
5. How did you find the activity?
6. Did you encounter any difficulty in answering the exercises? Why?
7. How do you graph linear inequalities in two variables?

ACTIVITY 5. 3-2-1!

Answer this formative assessment:

Three things I learned about the graphs of linear inequalities in two variables	**Two things I want to know more**	**One thing I don't understand**

End of FIRM UP:



In this section, the discussion was about the characteristics of the graphs of linear inequalities in two variables and how the graph is sketched. You also learned that real-life situations involve linear inequalities.

Go back to the previous section and compare your initial ideas with the discussion. How much of your initial ideas are found in the discussion? Which ideas are different and need revision?

Now that you know the important ideas about this topic, let's go deeper by moving on to the next section.

DEEPEN

Your goal in this section is to take a closer look at some aspects of linear inequalities in two variables. You will be performing activities related to its graphs and applications in real-life situations to enrich your understanding about linear inequalities in two variables. You will learn how to model real-life situations and solve problems involving linear inequalities in two variables. Hopefully you will be able to answer this question:

How useful are linear inequalities in two variables in solving real-life problems?

D. Focus: Modeling Real-Life Situations

ACTIVITY 6. MODEL IT!

You already understand about solutions of linear inequalities in two variables and their graphs now you will deepen your understanding by analyzing the examples on modeling and graphing with linear inequality below:

1. *A retailer sells two types of coffee beans. One type costs $9 per pound and the other type costs $7 per pound. Find all the possible amounts of the two different coffee beans that can be mixed together to get a quantity of coffee beans costing $8.50 or less.*

Solution

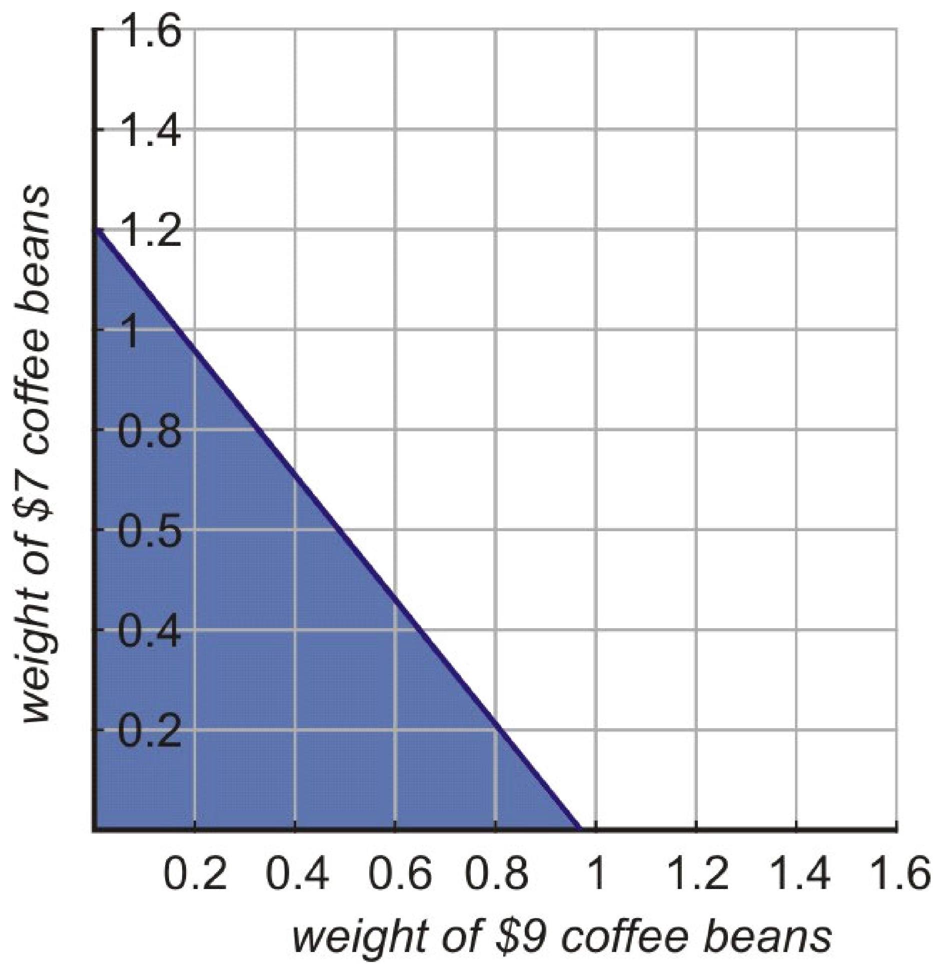
Let $x =$ weight of \$9 per pound coffee beans in pounds.

Let $y =$ weight of \$7 per pound coffee beans in pounds.

The cost of a pound of coffee blend is given by $9x + 7y$.

We are looking for the mixtures that cost \$8.50 or less. We write the inequality model $9x + 7y \leq 8.50$.

Since this inequality is in standard form, its easiest to graph it by finding the $x-$ and $y-$ intercepts. When $x = 0$, we have $7y = 8.50$ or $y = \frac{8.50}{7} \approx 1.21$. When $y = 0$, we have $9x = 8.50$ or $x = \frac{8.50}{9} \approx 0.94$. We can then graph the line that includes those two points.



Notice also that in this graph we show only the first quadrant of the coordinate plane. That's because weight values in the real world are always nonnegative, so points outside the first quadrant don't represent real-world solutions to this problem.

2. *Julius has a job as an appliance salesman. He earns a commission of $60 for each washing machine he sells and $130 for each refrigerator he sells. How many washing machines and refrigerators must Julius sell in order to make $1000 or more in commissions?*

Solution

Let $x =$ number of washing machines Julius sells.

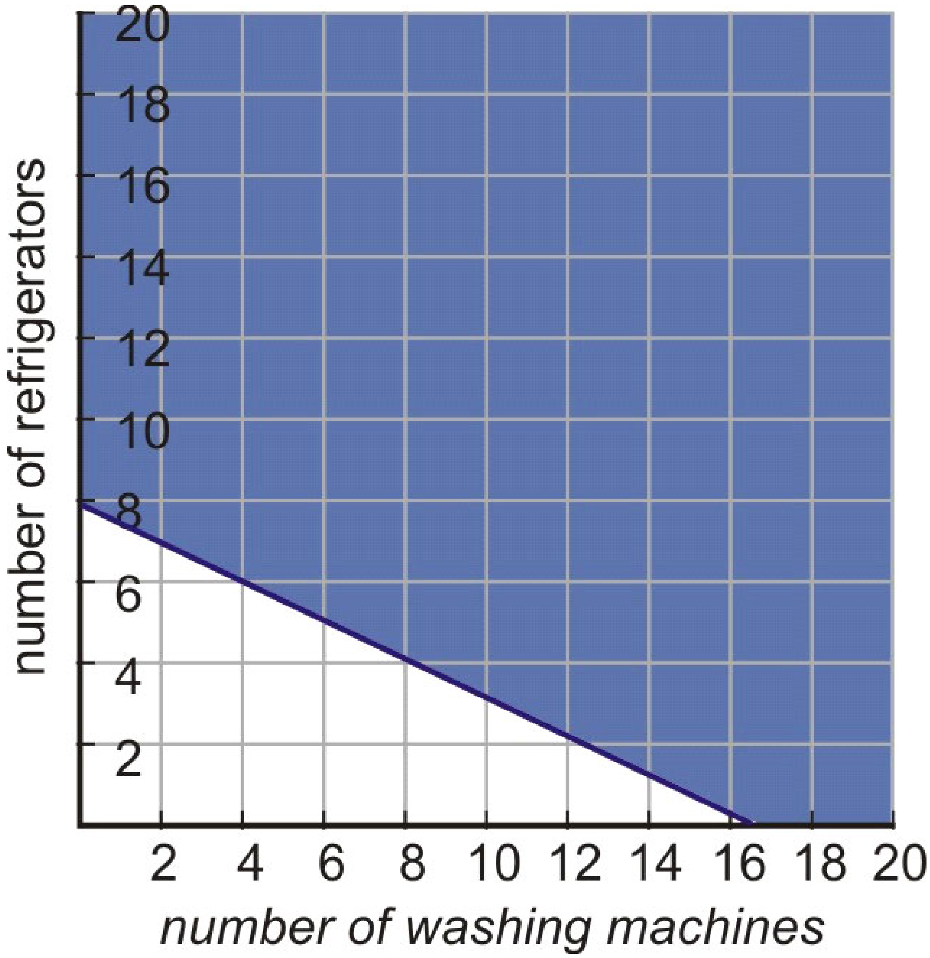
Let $y =$ number of refrigerators Julius sells.

The total commission is $60x + 130y$.

Were looking for a total commission of $1000 or more, so we write the inequality $60x + 130y \geq 1000$.

Once again, we can do this most easily by finding the $x-$and $y-$intercepts. When $x = 0$, we have $130y = 1000$, or $y = \frac{1000}{30} \approx 7.69$. When $y = 0$, we have $60x = 1000$, or $x = \frac{1000}{60} \approx 16.67$.

We draw a solid line connecting those points, and shade above the line because the inequality is greater than. We can check this by plugging in the point (0, 0): selling 0 washing machines and 0 refrigerators would give Julius a commission of $0, which is *not* greater than or equal to $1000, so the point (0, 0) is *not* part of the solution; instead, we want to shade the side of the line that does *not* include it.



Notice also that we show only the first quadrant of the coordinate plane, because Julius commission should be nonnegative.

The video at
http://www.youtube.com/watch?v=7629PsZLP1A&feature=related

http://www.youtube.com/watch?v=7629PsZLP1A&feature=related contains more examples of real-world problems using inequalities in two variables.

Answer the following:

1. How did you find the two illustrations above?
2. How do real-life situations involving linear inequalities in two variables modeled and solved?
3. **How can we use equations and inequalities to solve real-life problems where certain quantities are unknown?**
4. **How can linear inequality help us solve real life problems?**

ACTIVITY 7. JUSTIFY!

Instruction: Perform the guided transfer activity below by applying the different concepts that you've learned in the previous activities.

GUIDED TRANSFER

Suppose you are the President of the Central Board of Students in your school that is planning to purchase t-shirts for the upcoming Sports fest. Your group received bids from two t-shirt manufacturer, Green Corner and Shanes T – Shirts. Green Corner is much expensive in price but in good quality, however Shanes T – Shirts offers a lower price but not too much in quality. Your group must present a written report to the School Principal, containing which manufacturer will be chosen. You as the president should be able to convince the Principal the number of orders and justify it using mathematical models. Your product will be graded according to understanding, planning and execution, presentation and justification.

End of DEEPEN:

In this section, the discussion was about how real-life situations involving linear inequalities in two variables are modeled.

What new realizations do you have about the topic? What new connections have you made for yourself? Go back to your KWL Chart, then accomplish the third column.

ACTIVITY 8. KWHL CHART

Instruction: Answer the question in the first and second columns.

What I *know* about linear inequalities in two variables?	What I *want* to know about linear inequalities in two variables?	What I *learn* about linear inequalities in two variables?

Now that you have a deeper understanding of the topic, you are ready to do the tasks in the next section.

TRANSFER

Your goal in this section is apply your learning to real life situations. You will be given a practical task which will demonstrate your understanding.

ACTIVITY 9. : DO THE TASK!

PERFORMANCE TASK

You are a businessperson who calls for a business partner in order get enough money to get the store running. You are currently trying to decide how much of product A and product B you want to buy for the business. Product A takes up less space than product B, but it also yields a smaller profit. To show your potential partner your business qualifications, you need to make a written proposal and a PowerPoint presentation containing different sets of products which will give you a higher profit, keeping in mind that you have 600ft^3 to store those products. Your presentation will be graded according to the following standards: accuracy of data, justification and mathematical concepts, clarity of the graphics and representations, fluency of presentation and Organization of the presentation.

Use the rubric below as your guide in accomplishing the task and in rating your output. Your work should show the traits listed under Good or 3. If your work has these traits, you are ready to submit your work.

If you want to do more, your work should show the traits listed under Excellent or 4. If your work does not qualify to the traits under 3 or 4, revise your work before submitting it.

	4 Excellent	3 Good	2 Developing	1 Beginning
Mathematical Concept/ Justification	The proposal shows sophisticated understanding of the relevant ideas and processes.	The proposal shows solid understanding of the relevant ideas and processes. All sub concepts	The proposal shows somewhat limited understanding of the relevant ideas and	The proposal shows little apparent understanding of the relevant ideas and issues and sub

	Main concepts is accurately presented in an in-depth way that makes connections between each information All sub concepts are logically organized which branch out appropriately from the main idea	are organized and consistently branch out from the main idea	processes and sub-concepts don't consistently branch out from the main idea. It shows some misunderstan-ding of key ideas.	concepts don't consistently branch out from the main idea. It shows major misunderstan-dings of the key ideas.
Clarity of the graphics and represent-tations	All graphics and representations used are highly appropriate and attractive which enhanced the topic and aid in comprehension; very clear and well-situated.	All graphics and representations used are appropriate which enhanced the topic and aid in comprehension ; clear and well-situated.	Few graphics and representations used are appropriate which enhanced the topic and give a little aid in comprehension; clear and properly placed.	Many graphics and representations used are inappropriate and poorly selected and don't enhance the topic; some graphics are ill-placed.
Accuracy of data	The data are credibly accurate and precise. Math concepts and procedures are applied appropriately. Use of efficient strategy that leads directly to a correct solution are highly evident.	The data are correct. Math concepts and procedures are applied correctly. Use of strategy that leads to a solution is evident.	The data contain minor errors. Some math concepts are used but not all of the necessary ones. Some strategies used are inappropriate	The data contain major errors. Inappropriate math concepts or procedures are used. No evidence of a strategy or the strategy shown is inappropriate

Fluency of presentation	Fluent, confident and thoroughly explained each point by providing support that contains rich, vivid and powerful detail .	Generally fluent, confident and clearly explained the proposal.	Somewhat hesitant, less confident and failed to explain significant number of points	Hesitant, not confident. Explanation is missing.
Organization of the presentation	Highly organized. Flows smoothly. Observes logical connections of points.	Satisfactorily organized. Sentence flow is generally smooth and logical.	Somewhat cluttered . Flow is not consistently smooth, appears disjointed.	Illogical and obscure. No logical connections of ideas. Difficult to determine the meaning.

End of TRANSFER:

In this section, your task was to present your proposal according to the criteria or rubric given. You are also expected to answer the following questions:
How can we use equations and inequalities to solve real-life problems where certain quantities are unknown? What makes linear inequality different from linear equations? How can linear inequality help us solve real life problems?

ACTIVITY 10. SYNTHESIS JOURNAL

Write a synthesis journal by answering and reflecting on the following questions.

How did you find the performance task?

____
____
____

How did the task help you see the real world use of the topic?

____
____
____

How can linear inequalities help us solve real- life problems?

You have completed this lesson. Before you go to the next lesson, you have to answer the following post-assessment.

POST-ASSESSMENT:

It's now time to evaluate your learning. Click on the letter of the answer that you think best answers the question. Your score will only appear after you answer all items. If you do well, you may move on to the next module. If your score is not at the expected level, you have to go back and take the module again.

1. Which of the following is used to graph the inequality $3x + 2y \leq 11$?
A. a solid line
B. a ray
C. a dashed line
D. a segment

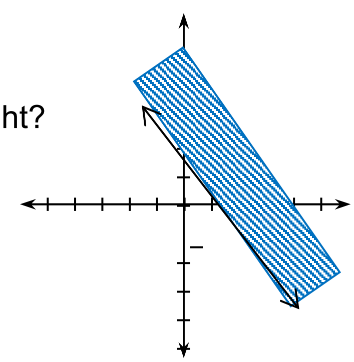
2. Which of the following inequalities contain the test point (0,0) in its half-plane?
A. $8x + y + 6 > 7$
B. $12x + 9y - 2 < -7$
C. $11x - 3y + 4 \leq -7$
D. $15x - 11y - 10 \geq -7$

3. Which of the following is the boundary of $2x + 5y \geq 2$?
A. $2x - 5y > 2$
B. $2x + 5y < 2$
C. $2x - 5y = 2$
D. $2x + 5y = 2$

4. Which is a solution to the inequality $x - 4y > 8$?

A. (3, 3)
B. (-2, 0)
C. (3, -2)
D. (-4, 0)

5. What linear inequality is represented by the graph at the right?



A. $x + y \geq 1$
B. $x - y \leq 1$
C. $-x + y \geq 1$
D. $-x + y \leq 1$

6. A phone company charges Php 8 for the daytime minutes(x) and P 4 for night minutes(y). How many day and night minutes would you have to use to be charged more than Php 430 in 24 hours?
Which of the following inequalities would you use to solve the problem?

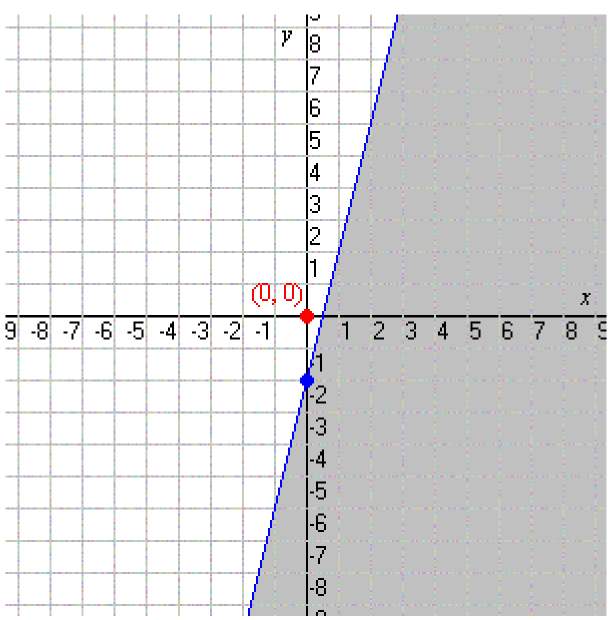
A. $8x + 4y \geq 430$
B. $8x + 4y > 430$
C. $8x + 4y \leq 430$
D. $8x + 4y < 430$

7. Your brother and sister are living in Japan and Australia respectively. You are given a prepaid phone card worth Php 1000. Calls within the Japan cost Php4 per minute(x) and calls to Australia cost Php5 per minute(y). What is the maximum number of minutes you can use to call your brother if you plan to talk to your sister for 30 minutes after calling your brother?

A. 211 minutes
B. 211.5 minutes
C. 212 minutes
D. 212.5 minutes

8. Which of the following inequalities represents the graph below?

A. $y \geq 4x + 2$
B. $y > 5x + 4$
C. $y \leq 8 + 6x$
D. $y \leq 4x - 2$



It is letter D because when graphed, the inequality will pass through the points (0,-2) & (1/2, 0). Also, when the inequality is tested at (0,0), it is false.

9. **Manufacturing tables**. The Ozark Furniture Company can obtain at most 8000 board feet of oak lumber for making two types of tables. It takes 50 board feet to make a round table and 80 board feet to make a rectangular table. Which inequality limits the possible number of tables of each type that can be made.

A. 50x + 80y≥ 8000
B. 80y + 50x > 8000
C. 50x+ 80y ≤ 8000
D. 80*y* + *50x* ≤8000

10. In problem number 9, what is the maximum number of round tables that can be made?

A. 100
B. 120
C. 140
D. 160

11.Which of the following is a mathematical equation?
a. $3x = 2y + 15$
b. $3x - 2y \geq 15$
c. $3x - y + 15 < 0$
d. $x - 3x - y \leq 10$

12. Which of the following inequality shows the difference of the ages of Jesu (J) and Brett (B) which is not more than 12 years?
a. $j - b > 12$
b. $j - b \leq 12$
c. $j - b < 12$
d. $j - b \leq 12$

13. Which of the following is an expression?
a. $4x^2$ *
b. $4x^2 + 8 = 16$
c. $4x^2 + 8y = 16$
d. $x^2 + 8y < 16$

14. Which of the following is an example of linear equation in two variables?
a. $4x - 3 = 24$
b. $4x - 3y \leq 16$
c. $4x - 3y = 16$
d. $4x + 3y \geq 16$

15. A car has a reserved fuel of 2.0 liters which can be used if its 16.0 – liter fuel tank is about to be emptied. The car consumes at most 3 liters of fuel for every 10 kilometers. Which of the following illustrates the situation?
   a. $y = 16 - \frac{x}{10}$
   b. $y = 18 - \frac{x}{10}$
   c. $y = 10 - \frac{x}{18}$
   d. $y = 18 - \frac{10}{x}$

16. Suppose the car's tank is full and it travels a distance of 50 kilometers, about how much fuel would be left in the tank?
   a. About 1 L
   b. About 2 L
   c. About 3 L
   d. About 4 L

17. Which of the following does not belong to the group?
   a. $x + 3y - 10 \leq 3y$
   b. $x - 2y > 15 - 5y$
   c. $x + 34y > 15$
   d. $12x - 5y \geq 60$

18. Jessan went to the supermarket and bought 5 kg of pork and 2 kg of fish. The total amount he paid is at most Php1, 300.00. Which among the following models the cost of the pork and the beef?
   a. $5x + 2y \leq 1300$
   b. $5x \leq 2y$
   c. $5x - 2y < 1300$
   d. $5x + 2y < 1300$

19. The sum between Jessan's score and Cathy's score in math quiz is at least 39 points. What mathematical statement represents the sum of Jessan and Cathy's scores?
   a. $x - y > 9$
   b. $x + y \leq 39$
   c. $x + y > 39$
   d. $x + y \geq 39$

20. A nutritionist advises an individual who is suffering from iron and vitamin B deficiency to take at least 2400 mg of iron, at least 2100 mg of vitamin B_1, and at least 1500 mg of vitamin B_2 over a period of time. Two vitamin pills are suitable, brand X and brand Y. Each brand X pill contains 40 mg of iron, 10 mg of vitamin B_1 and 5 mg of vitamin B_2, and cost 6 cents. Each

brand Y pill contains 10 mg of iron and 15 mg each of vitamins B_1 and B_2, and costs 8 cents. If you let x- be the number of pills of brand X and y - be the number of pills of brand Y, which of the following models the combination of pills should individual purchase in order to meet the minimum iron requirements at the lowest cost?

a. $40x + 10y \leq 2400$
b. $40x + 10y \geq 2400$
c. $10x + 15y \leq 2100$
d. $10x + 15y \geq 2100$

GLOSSARY OF TERMS USED IN THIS LESSON:

1. **A Linear Inequality in Two Variables** – is an inequality which involves a linear expression in two variables and any of the relational symbols such as <, >, ≤ or ≥.
2. **Half-planes** – are the regions on either side of a line in a plane.
3. **Boundary line** – is the edge of the half-plane.
4. Boundary line – is the edge of the half-plane.
5. Half-planes – are the regions on either side of a line in a plane.
6. Linear Inequality in Two Variables – is an inequality which involves a linear expression in two variables and any of the relational symbols such as <, >, ≤ or ≥.

REFERENCES AND WEBSITE LINKS USED IN THIS LESSON:

1. http://cphs.dadeschools.net/departments/mathematics/ebooks/alg1mcd/Source/LA10FAD.pdf
   This site contains examples on how to determine a given point a solution to the given linear inequalities in two variables. This also contains illustrations on how to graph linear inequalities in two variables.
2. http://www.algebralab.org/studyaids/studyaid.aspx?file=Algebra2_2-6.xml.
   This site contains examples and exercises on solutions graphs of linear inequalities in two variables.
3. http://www.icoachmath.com/math_dictionary/Linear_Inequality.html
   This contains example assessment on the graphs of linear inequality
4. http://www.classzone.com/eservices/home/pdf/teacher/LA202FAD.pdf
   This contains examples on modeling real-life problems involving linear inequality in two variables

5. http://www.mathwarehouse.com/algebra/linear_equation/interactive-linear-inequality.php
   This contains interactive graphs of linear inequalities in two variables

6. Intermediate Algebra by Zenaida E. Diaz and Maharlika P. Mojica on pp.83-88

7. Worktext in Intermediate Algebra II by Ferdinand C. Pascual, el.al. on pp.51-56.

8. http://cphs.dadeschools.net/departments/mathematics/ebooks/alg1mcd/Source/LA106FAD.pdf
   This site contains examples on how to determine a given point a solution to the given linear inequalities in two variables. This also contains illustrations on how to graph linear inequalities in two variables.

9. http://www.algebralab.org/studyaids/studyaid.aspx?file=Algebra2_2-6.xml.
   This site contains examples and exercises on solutions graphs of linear inequalities in two variables.

10. http://www.icoachmath.com/math_dictionary/Linear_Inequality.html
    This contains example assessment on the graphs of linear inequality

11. http://www.classzone.com/eservices/home/pdf/teacher/LA202FAD.pdf
    This contains examples on modeling real-life problems involving linear inequality in two variables

12. http://www.mathwarehouse.com/algebra/linear_equation/interactive-linear-inequality.php
    This contains interactive graphs of linear inequalities in two variables

13. http://learni.st/users/171/boards/1088-modeling-real-life-and-mathematical-problems-using-linear-equations-and-inequalities-common-core-standard-7-ee-4
    This is a powerpoint presentation that contains example of real-life problems that involve linear inequalities in to variables
14. Intermediate Algebra by Zenaida E. Diaz and Maharlika P. Mojica on pp.83-88
15. Worktext in Intermediate Algebra II by Ferdinand C. Pascual, el.al. on pp.51-56.