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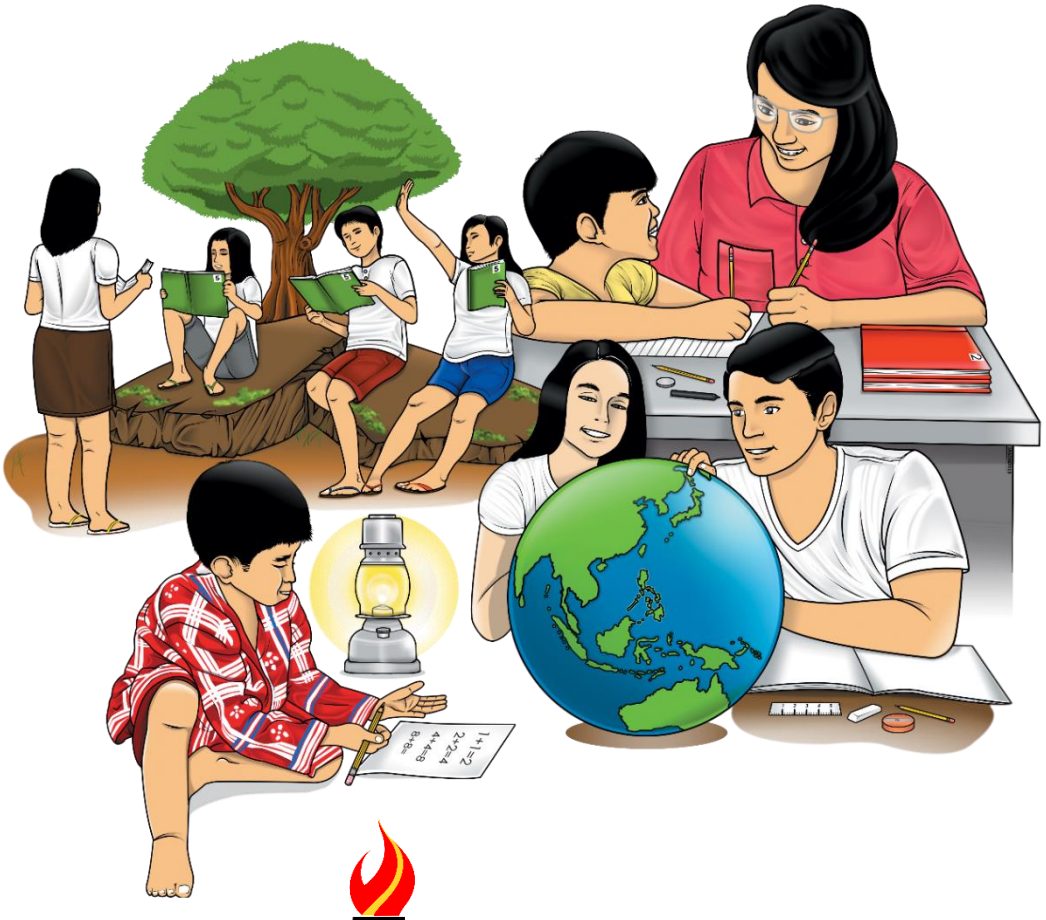
DEPARTMENT OF EDUCATION

Mathematics

Quarter 1 – Module 6
Illustrating a Rectangular Coordinate System



ALTERNATIVE DELIVERY MODE
ADM

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Mathematics – Grade 8
Alternative Delivery Mode
Quarter 1 – Module 6 Illustrating a Rectangular Coordinate System
First Edition, 2020

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8

Mathematics

Quarter 1 – Module 6
Illustrating a Rectangular Coordinate System

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Introductory Message

For the facilitator:

Welcome to the Mathematics 8 Alternative Delivery Mode (ADM) Module on Illustrating a Rectangular Coordinate System!

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

As a facilitator, you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the Mathematics 8 Alternative Delivery Mode (ADM) Module on Illustrating a Rectangular Coordinate System!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:

What I Need to Know	This will give you an idea of the skills or competencies you are expected to learn in the module.
What I Know	This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.
What's In	This is a brief drill or review to help you link the current lesson with the previous one.
What's New	In this portion, the new lesson will be introduced to you in various ways; a story, a song, a poem, a problem opener, an activity or a situation.
What is It	This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.
What's More	This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.
What I Have Learned	This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson.
What I Can Do	This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.
Assessment	This is a task which aims to evaluate your level of mastery in achieving the learning competency.
Additional Activities	In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned.
Answer Key	This contains answers to all activities in the module.

At the end of this module you will also find:

References	This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!

What I Need to Know

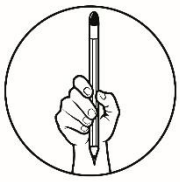
This module was designed and written for you to answer the activity you've missed while you are away from school. It is here to help you master rectangular coordinate system and its uses. The scope of this module permits it to be used in many different learning situations. The language used recognizes your diversity and diverse vocabulary level. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

This module contains:

Lesson 1- The Rectangular Coordinate System

After going through this module, you are expected to:

1. define the Rectangular Coordinate System and other related terms;
2. plot the point on a coordinate plane;
3. give the coordinates of a given point on a coordinate plane; and
4. use the coordinate plane to solve problems in daily life.



What I Know

PRE-ASSESSMENT

Choose the letter of the correct answer and write it on your answer sheet.

1. What is a Rectangular Coordinate System?

   A. It is a coordinate system that is used for naming points in a plane.
   B. It is a coordinate system that is used for graphing linear functions.
   C. It is a coordinate system that is used to determine the location of a point by using a single number.
   D. It is a coordinate system that is composed of two perpendicular number lines that meet at a point of origin.

2. How many quadrants does a Rectangular Coordinate System have?
   A. 2 C. 6
   B. 4 D. 8

3. Which among these mathematicians was the Cartesian Plane named after?
   A. Euclid C. Blaise Pascal
   B. Pythagoras D. Rene Descartes

4. What do you call the vertical number line in the Cartesian plane?
   A. y-axis C. origin
   B. x-axis D. quadrant

5. For the coordinates of the point in quadrant IV, the x value and y value are always _____ and _____, respectively.
   A. negative, positive C. positive, negative
   B. negative, negative D. positive, positive

6. The coordinates of the origin in the coordinate plane are_____.
   A. (0,1) C. (0,0)
   B. (1,0) D. (1,1)

7. Point (3, 4) is an example of _____.
   A. labels C. ordered pair
   B. fraction D. point of origin

8. Which of the following is true about the point (8, 1)?
   A. It lies in Quadrant I.
   B. It lies in Quadrant II.
   C. It lies in both Quadrant II and III.
   D. Both statements A and C are correct.

For numbers 9-12, use Figure 1 on the right.

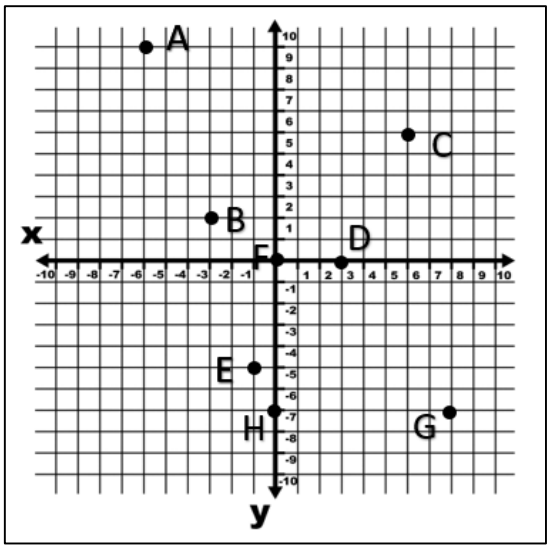


Figure 1

9. Which of the following is true about the points in *Figure 1*?
   A. Point D lies in the y-axis.
   B. Point C has all positive coordinates.
   C. Point G has all negative coordinates.
   D. Points A and B are located in Quadrant III.

10. Which point lies in the origin?
   A. D
   B. E
   C. F
   D. H

11. Which points lie in Quadrant II?
   A. A, B
   B. C, D
   C. D, G
   D. E, H

12. Which of the following illustrates the coordinates of point G?
   A. (-7,8)
   B. (-8,-7)
   C. (-8,7)
   D. (8,-7)

For items 13-15, refer to Figure 2.

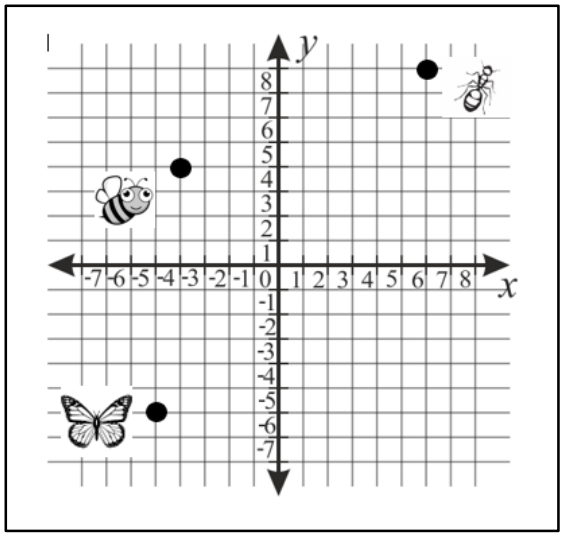


Figure 2

13. At what location is the butterfly located?
   A. (5,6)
   B. (-5,-6)
   C. (6,5)
   D. (-6,-5)

14. The ant is located at what quadrant?
   A. Quadrant I
   B. Quadrant II
   C. Quadrant III
   D. Quadrant IV

15. Which of the following illustrates the position of the bee?
   A. (4,4)
   B. (4,5)
   C. (-4,4)
   D. (-4,5)

Lesson 1 The Rectangular Coordinate System

Historically, maps played a vital role for travelers and explorers. This map contains vertical and horizontal lines called longitude and latitude, respectively. In this modern day, map applications and the Global Positioning System (GPS) in your mobile phone still utilize the use of horizontal and vertical lines to give you the exact location or coordinate of the place you are looking for.

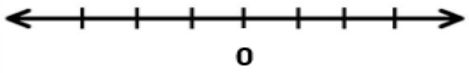
In this lesson, you will learn the concept of Rectangular Coordinate System, plotting points, and locating coordinates which may help you in understanding maps, distance, economics, research and other daily activity.

What's In

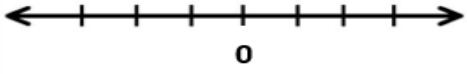
Activity: PLOT ME!

Plot the given point in the number line. Write your answer in a separate sheet of paper.

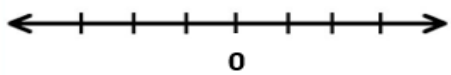
A. 0

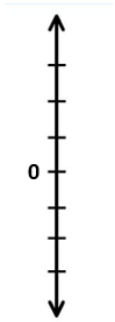


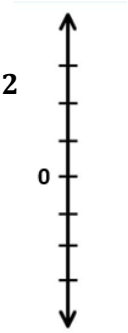
B. 3

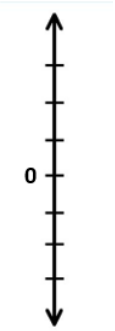


C. -1



D. 0 

E. -2 

F. 1 

Questions:

1. How were you able to locate a positive point and a negative point in the horizontal number line?
2. How were you able to locate a positive point and a negative point in the vertical number line?

Remember:

- The number associated with a point on the number line is called the **coordinate** of that point.
- The coordinate of the **origin** is zero.
- The coordinates of the points to the **right of the origin** on a horizontal number line and **above the origin** on a vertical number line form the set of positive integers.
- The coordinates of the points to the **left of the origin** on a horizontal number line and **below the origin** on a vertical number line form the set of negative integers.

What's New

Activity: Identify the Location

Suppose the books in the shelf are arranged in the following manner.

	Column 1	**Column 2**	**Column 3**
Row 1		Magazines	
Row 2		English Textbooks	
Row 3	Science Textbooks		
Row 4	Math Textbooks		Language Textbooks

Questions:

1. By writing (row number, column number) how will you describe the location of the following;
    a. Math Textbooks
    b. Magazines

2. Using ordered pairs in form (row number, column number), how will you locate the others books' position on the shelf?

What is It

The **Identify the Location** activity allows you to write the horizontal and vertical location of the objects in ordered pair. In similar manner, points in the Rectangular Coordinate System are also written in ordered pair.

A **Rectangular Coordinate System** or also known as a Cartesian plane is named after the French mathematician **René Descartes** (1596 – 1650), who is known as the "Father of Modern Mathematics". It is composed of two perpendicular number lines, typically called the $x-axis$ and the $y-axis$, respectively, that meet at a point of **origin** (0, 0) and divide the plane into four regions called **quadrants** which are numbered in sequence as Quadrant I, Quadrant II, Quadrant III, and Quadrant IV moving in a counter-clockwise direction starting from the upper right.

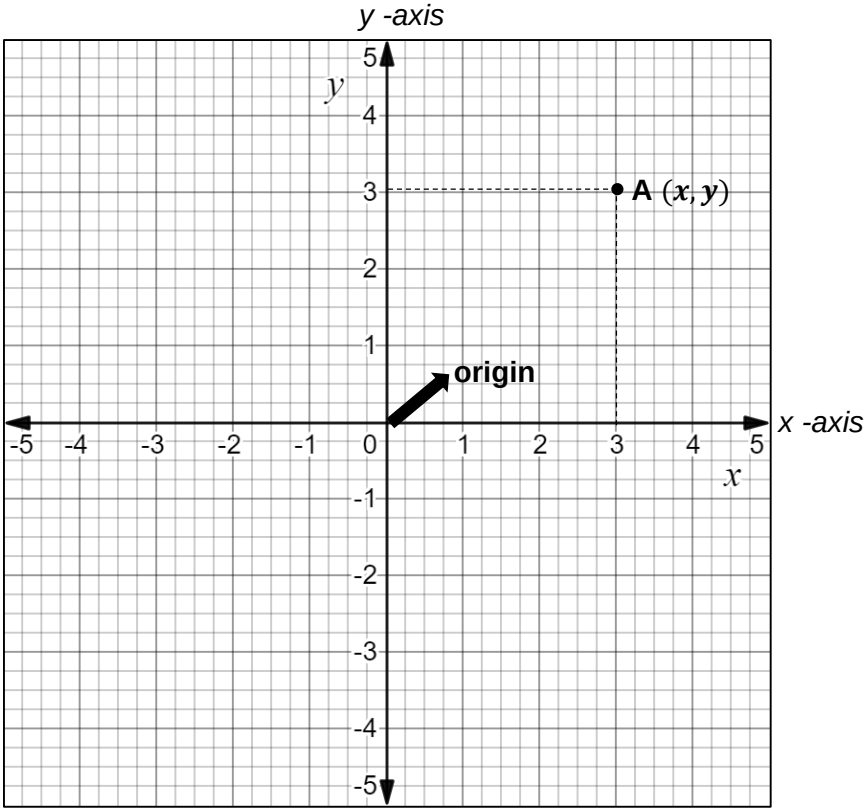


Figure 1

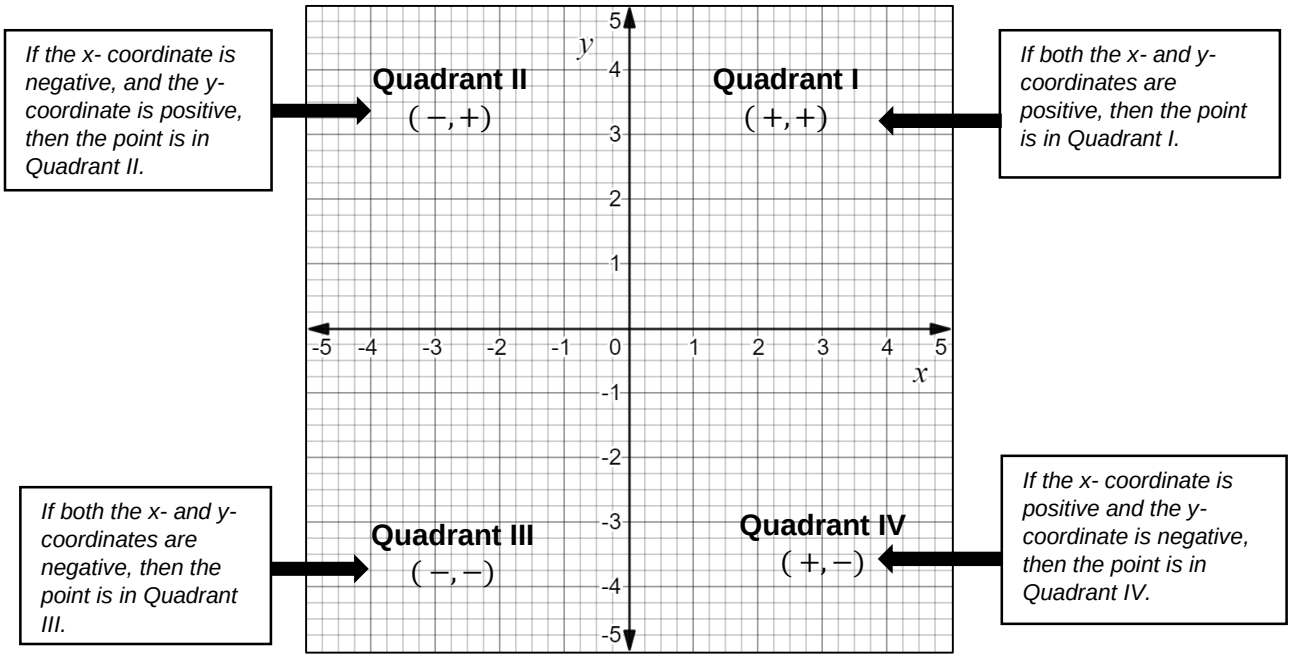
The **horizontal** number line is called the $\boldsymbol{x-axis}$.

The **vertical** number line is called the $\boldsymbol{y-axis}$.

The **point of intersection** of the horizontal and vertical number lines is called the **origin**.

Each point in the plane can be located using an ordered pair of numbers (x, y), where x is the **horizontal distance** and y is the **vertical distance** of the point from the **origin**. The numbers in the ordered pair are called **coordinates**. The $x-value$ of the coordinates (x, y) of a point is also known as the **abscissa**, while the $y-value$ is known as the **ordinate**.

The signs of the first and second coordinates of a point vary in the four quadrants as indicated below.



This means that you can easily tell which quadrant an ordered pair is located by just simply looking at the signs of the coordinates.

There are also points which lie in $the\ x-\ and\ y-axes$. The points which lie in the $x-axis$ have coordinates $(x, 0)$ and the points which lie in the $y-axis$ have coordinates $(0, y)$, where x and y are real numbers. Let us explore the following examples below.

Example 1:

The points A(0,1), B(2,1), C(0,3), D(-4,2), E(-2,-3), and F(4,-4) can be plotted in the Cartesian plane as shown in the illustration in Figure 2 where:

- point A is along the x-axis;
- point B is in Quadrant I;
- point C is along the y-axis;
- point D is in Quadrant II;
- point E is in Quadrant III; and
- point F is in Quadrant IV.

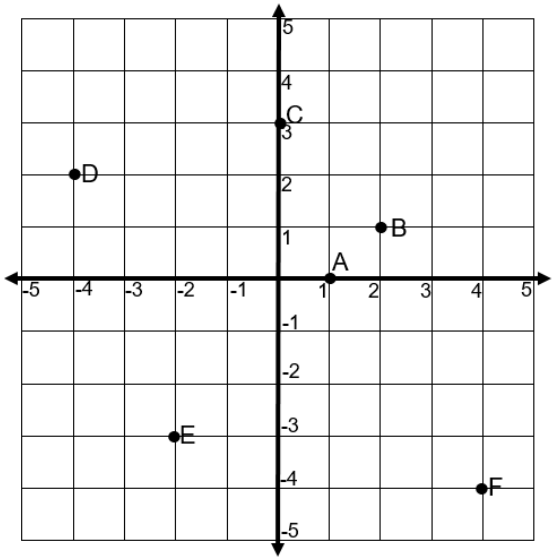


Figure 2

Remember: In naming the coordinates of a point, the first coordinate is the $x-coordinate$ and second is $y-coordinate$. *They can't be interchanged.*

Example 2. Use the Cartesian plane in Figure 3 to find the coordinates of the following points.

a) M b) A c) T d) H

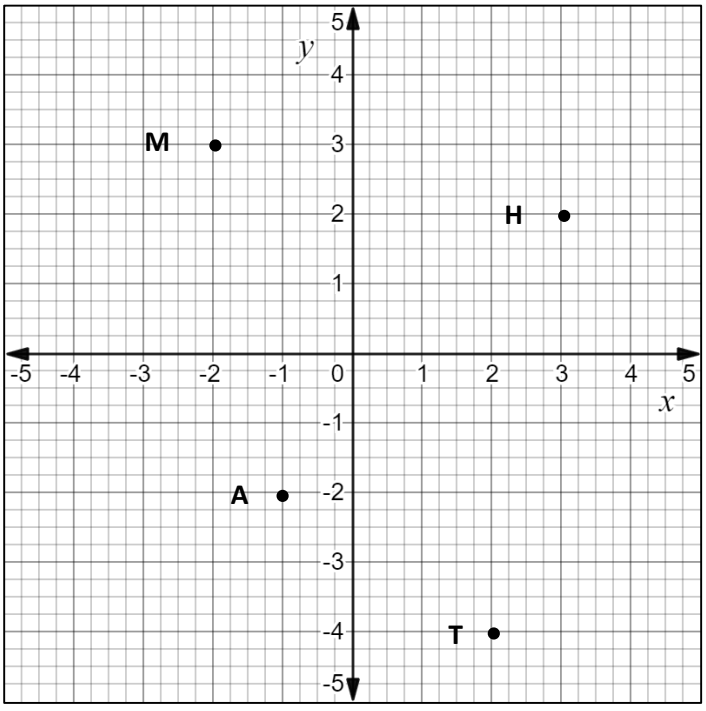


Figure 3

Answer:

- Point M is in Quadrant II. It is located **2 units to the left of the $y-axis$** and **3 units above the $x-axis$**. Hence, the coordinates of the point M is $(-2, 3)$.
- Point A is in Quadrant III. It is located **1 unit to the left of the $y-axis$** and **2 units below the $x-axis$**. Hence, the coordinates of the point A is $(-1, -2)$**.**
- Point T is in Quadrant IV. It is located **2 units to the right of the $y-axis$** and **4 units below the $x-axis$**. Hence, the coordinates of the point T is $(2, -4)$.
- Point H is in Quadrant I. The point is located **3 units to the right of the $y-axis$** and **2 units above the $x-axis$.** Hence, the coordinates of the point H is $(3, 2)$.

Example 3. Plot the points on the Cartesian plane and determine the quadrant. Connect each pair of consecutive points and find the perimeter of the resulting quadrilateral.

a) L $(3,4)$ b) O $(-3, 4)$ c) V $(-3, -4)$ d) E $(3, -4)$

Answers: Referring to the Cartesian plane in Figure 4 that follows,

- L $(3,4)$ means that the point is located **3 units to the right of the y-axis** and **4 units above the x –axis**. Since the signs of the coordinates are both positive, point L is in **Quadrant I**.
- O $(-3, 4)$ means that the point is located **3 units to the left of the y-axis** and **4 units above the x-axis**. Since the sign of the x-coordinate or the abscissa is negative and the sign of the y-coordinate or the ordinate is positive, then point O is in **Quadrant II**.
- V $(-3, -4)$ means that the point is located **3 units to the left of the y-axis** and **4 units below the x-axis.** Since the signs of both x-and y-coordinates are both negative, point V is in **Quadrant III.**
- E $(3, -4)$ means that the point is **located 3 units to the right of the y-axis** and **4 units below the x-axis.** Since the sign of the x-coordinate or abscissa is positive and the sign of the y-coordinate or ordinate is negative, point E is in **Quadrant IV**.

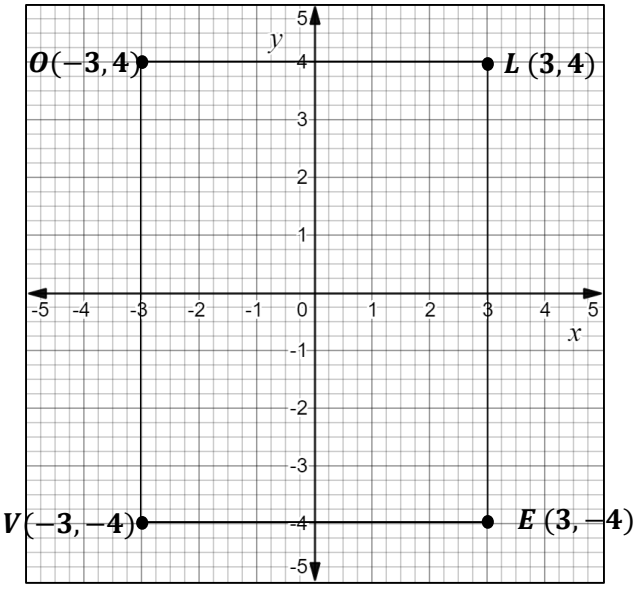


Figure 4

Connecting the adjacent vertices, we see that point L, O, V, and E forms a rectangle. To find the perimeter of the rectangle, we know that:

$$P = 2L + 2W$$

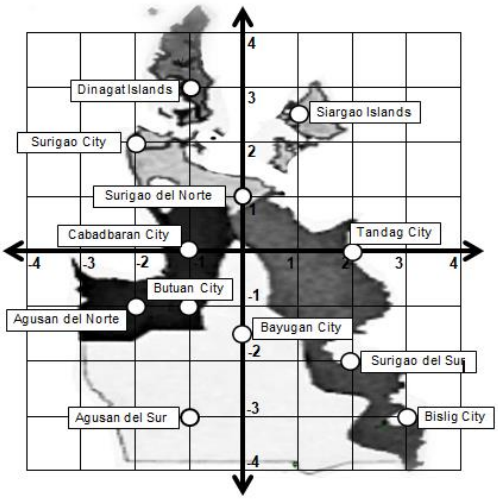
Note that each interval in the Cartesian plane represents one unit of measure. This means that quadrilateral formed by the points L, O, V, E has length of 8 units and width of 6 units. Hence, the perimeter of quadrilateral LOVE is:

$$P = 2L + 2W$$
$$P = 2(8) + 2(6)$$
$$P = 16 + 12$$
$$P = 28\,units$$

What's More

Activity 1: Wow Caraga!

Describe the location of each point that represents a place in Caraga Region by the completing the following table. An example is done for you. Write your answer in a separate sheet of paper.

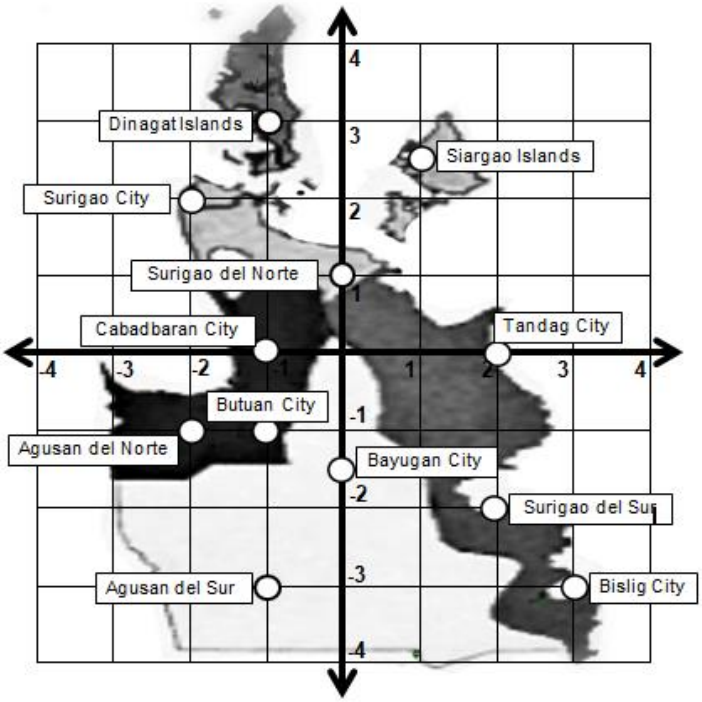


Place	COORDINATES	QUADRANT/AXIS
Example: Dinagat Islands	(-1,3)	QII
1. Agusan del Norte		
2. Cabadbaran City		
3. Surigao City		
4. Agusan del Sur		
5. Bislig City		
6. Surigao del Norte		
7. Tandag City		

Activity 2: Spotting Erroneous Coordinates

This activity will enable you to correct erroneous coordinates of the point.

Answer the questions asked. Write your answer in a separate sheet of paper.



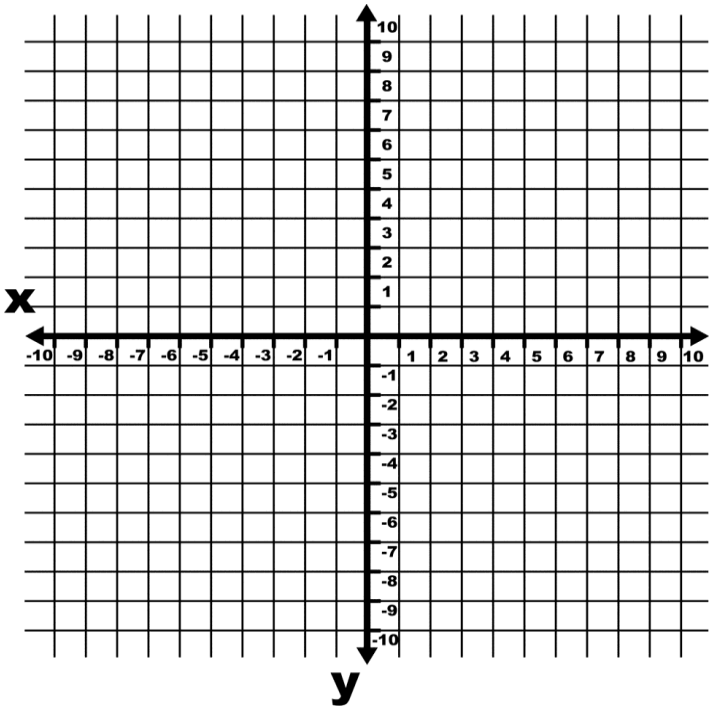
Questions:

1. Joey indicated that the Bayugan City can be found at coordinates (-$1\frac{1}{2}$,0). Do you agree with Joey? Why or why not?
2. Angelo insisted that the Butuan City can be found at coordinates $(-1,-1)$. Do you agree with Angelo? Why?
3. Karen insisted that the Siargao Islands can be found at Quadrant I. Is Karen correct? Why?

Activity 3: Plot the Points

This activity will enable you to plot the points in the Cartesian Plane given its coordinates.

Plot the following points in the Cartesian Plane then identify which quadrant or axis it belongs. Write your answer in a separate sheet of paper.



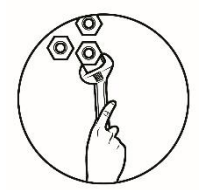
1. A$(-8,4)$
2. B$(-2,-6)$
3. C$(5,5)$
4. D$(0,-8)$
5. E$(10,-3)$
6. F$(6,0)$
7. G$(-4,-4)$
8. H$(0,0)$
9. I$(5,1)$
10. J$(9,-7)$

NOTE: When plotting a point in the Cartesian Plane, remember that the first number is for the horizontal axis and the second number is for the vertical axis. Therefore, make the first move either right or left in the x-axis then up or down in the y-axis.

What I Have Learned

Fill in the blanks of the appropriate element that would make the sentence correct. Write your answer in a separate sheet of paper.

1. The Rectangular Coordinate System is also termed as _____ in honor of the French mathematician _____ who is known as the “Father of Modern Mathematics.”
2. The Rectangular Coordinate Plane is composed of two perpendicular number lines that meet at the intersection called _____ and divide the plane into four regions called _____.
3. In an ordered pair, the first number is the x- coordinate which is also known as the _____ and the second number is the y – coordinate which is also known as _____.
4. The point falls in Quadrant I if it has signs (__,__), Quadrant II if (__,__), Quadrant III if (__,__) and Quadrant IV if (__,__).
5. For more ease in plotting the points in the Cartesian Plane, start making move from the origin either ____ or _____ in the x-axis then move _____ or _____ in the y-axis.



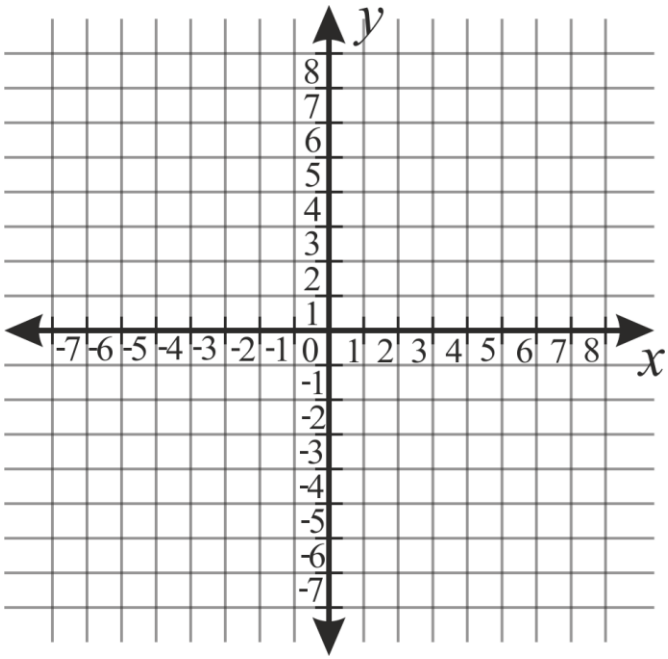
What I Can Do

Activity: Find the Hidden Shape

Plot the following ordered pairs in the Cartesian plane, connect the points, and identify the shape formed. Write your answer in a separate sheet of paper.

(Note: Connect the points in numerical order (order of the items). Don't forget to connect number 5 to number 1.)

1. $(-6, 4)$
2. $(4\frac{1}{2}, -5)$
3. $(1, 8)$
4. $(-4, -5)$
5. $(7, 2)$



Assessment

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. The point $(9,-1)$ is an example of_____.

   A. labels
   B. numbers
   C. fraction
   D. ordered pair

2. Point $(-7,-5)$ is located in which quadrant?

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

3. What do you call the horizontal number line in the Cartesian plane?

   A. x-axis
   B. y-axis
   C. origin
   D. quadrant

4. When plotting the point $(-8,1)$, which describes the movement along the x-axis and y-axis in the correct order?

   A. 8 units right then 1 unit up
   B. 8 units down then 1 unit left
   C. 8 units left then 1 unit up
   D. 8 units up then 1 unit right

5. In the quadrant I, the values of x, and y are always ____, and _____, respectively.

   A. positive, positive
   B. positive, negative
   C. Negative, negative
   D. Negative, positive

6. The coordinates for the origin in the coordinate plane are_____?

   A. $(0,1)$
   B. $(0,0)$
   C. $(1,1)$
   D. $(1,0)$

7. Which of the following is true about point (5, 5)?

   A. It lies in x-axis
   B. It lies in y-axis
   C. It lies in Quadrant I
   D. It lies in Quadrant II

8. Which of the following statements best describes the origin?

   A. The point contains positive and positive integers.
   B. The point contains negative and negative integers.
   C. The point contains positive and negative integers.
   D. The point contains neither positive nor negative integers.

For items 9-12, refer to figure 1 at the right.

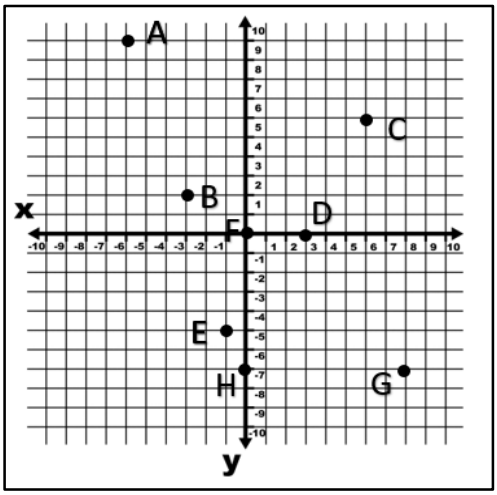


Figure 1

9. Which of the following is true about the points?
   A. Point H lies in the x-axis
   B. Point A has all positive coordinates.
   C. Point E has all negative coordinates.
   D. Point D and C are located in Quadrant II.

10. Which of the points lies in the x-axis?
   A. C C. G
   B. D D. H

11. Which points lie in quadrant III?
   A. A C. E
   B. C D. G

12. Point B has coordinates _____.
   A. (-3, 2) C. (3, 2)
   B. (-3,-2) D. (3,-2)

For items 13 and 14, refer to Figure 2 at the right.

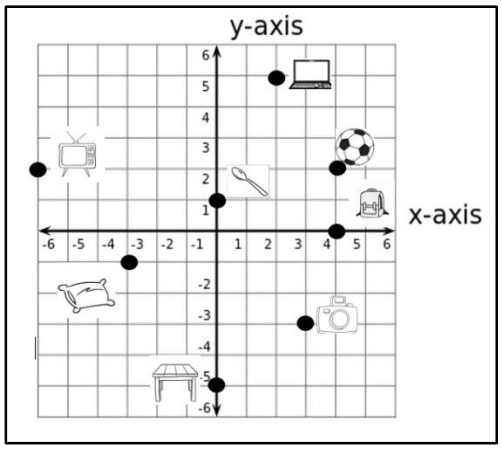


Figure 2

13. At what coordinate is the table located?
   A. (0,5) C. (5,0)
   B. (0,-5) D. (-5,0)

14. At what quadrant is the ball located?
   A. Quadrant I C. Quadrant III
   B. Quadrant II D. Quadrant IV

15. Which of the following statement is FALSE?
   A. Points that lie in Quadrant I has all positive signs.
   B. Points that lie in Quadrant III has all negative signs.
   C. Points that lie in Quadrant II has all positive signs.
   D. Points that lie in Quadrant IV has positive and negative signs.

Additional Activities

Activity: Our House

This activity will enable you to give the coordinates of the parts of your own houses.

Describe the location of each part of your house (e.g. areas in the house, etc.) by plotting them in a Cartesian Plane. Identify which point in the Cartesian Plane each part belongs. Assume that the center of your house is the origin. Draw and write your answer in a separate graphing paper.

Answer Key

What's In

Activity: Plot Me!

A. O

B. 3

C. -1

D. O

E. -2

F. 1

What's New

Activity: Identify the Location

1. a. (4,1)

   b. (1,2)

2. By using (row number, column number), we say that Science Textbooks are at 3, 1) English textbooks are at (2, 2), Language textbooks are at (4, 3)

What I Can Do

Activity: Find the Hidden Shape

Directions: Plot following ordered pairs in the Cartesian plane, connect the points, then identify the shape formed.

What's More

Activity 1: Wow Caraga!

Place	COORDINATES	QUADRANT/AXIS
Example: Dinagat Islands	(-1,3)	QII
1. Agusan del Norte	(-2,-1)	QIII
2. Cabadbaran City	(-1,0)	X-axis
3. Surigao City	(-2,2)	QII
4. Agusan del Sur	(-1,-3)	QIII
5. Bislig City	(3,-3)	QIV
6. Surigao del Norte	(0,1)	Y-axis
7. Tandag City	(2,0)	X-axis

Activity 2: Spotting Erroneous Coordinates

1. No, because Bayugan City is located at (0, -1½)
2. Yes
3. Yes

ACTIVITY 5: PLOT THE POINTS

Description: This activity will enable you to plot the points in the Cartesian Plane given its coordinates.

Direction: Plot the following points in the Cartesian Plane then identify which quadrant or axis it falls.

1. A(-8,4)
2. B(-2,-6)
3. C(5,5)
4. D(0,-8)
5. E(10,-3)
6. F(6,0)
7. G(-4,-4)
8. H(0,0)
9. I(5,1)
10. J(9,-7)

Pre-assessment

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

Assessment

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

References

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