

Represent Problems in the Coordinate Plane



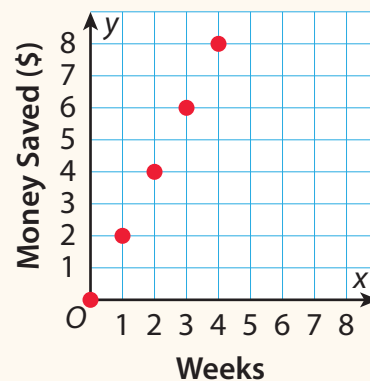
Dear Family,

This week your child is learning to solve problems by graphing points in the coordinate plane.

Your child has already learned to use ordered pairs to locate and identify points in the coordinate plane. Now your child is learning how to solve problems involving points and figures in the coordinate plane.

Carla is saving money to buy a gift for her brother. The points in the coordinate plane below show Carla's savings. How many weeks does it take Carla to save \$6?

You can solve the problem by using the axis titles to interpret the points. The x-axis represents the number of weeks that Carla has been saving money. The y-axis represents the amount of money that Carla has saved. To find the number of weeks it takes Carla to save \$6, find the point with a y-coordinate of 6. The point is (3, 6), so it takes Carla 3 weeks to save \$6.

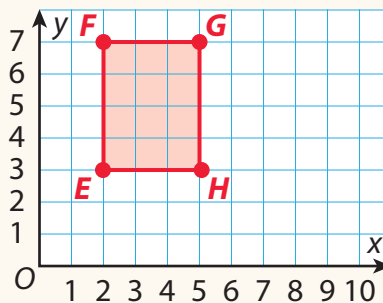


Your child is also learning to solve problems with plane figures graphed in the coordinate plane. For example, you can find the perimeter of the rectangle $EFGH$ in the coordinate plane at the right by counting the number of units on each side to find the side lengths of the rectangle. Then add the lengths to find the perimeter.

$$4 + 3 + 4 + 3 = 14$$

The perimeter of the rectangle is 14 units.

Invite your child to share what he or she knows about graphing points in the coordinate plane by doing the following activity together.



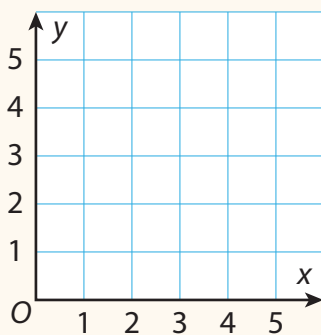
ACTIVITY GRAPHING A GEOMETRIC FIGURE

Do this activity with your child to graph a geometric figure in the coordinate plane.

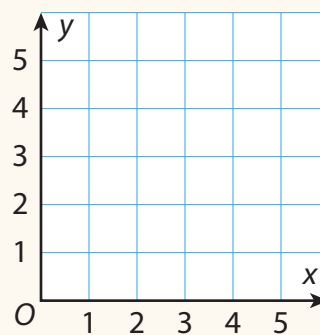
Play a game to graph points and draw matching figures in coordinate planes with your child.

- Cut out the coordinate planes below or use separate paper, so each player can draw without the other player seeing.
- Player 1 chooses 4 points, marks them, and labels them *A*, *B*, *C*, and *D*. He or she should make sure that the other player does not see the marked points.
- Player 1 connects the points with lines to draw a figure with 4 sides, making sure that the other player does not see the 4-sided figure.
- Player 1 lists the *x*- and *y*-coordinates for each point in the table.
- Player 2 uses the table to graph the points in his or her own coordinate plane. He or she connects the points to form a 4-sided figure.
- Now players compare the figures in their coordinate planes. Are they the same?

Point	<i>x</i>	<i>y</i>
<i>A</i>		
<i>B</i>		
<i>C</i>		
<i>D</i>		



Player 1



Player 2

Explore Representing Problems in the Coordinate Plane



Previously, you learned how to locate points in the coordinate plane. Use what you know to try to solve the problem below.

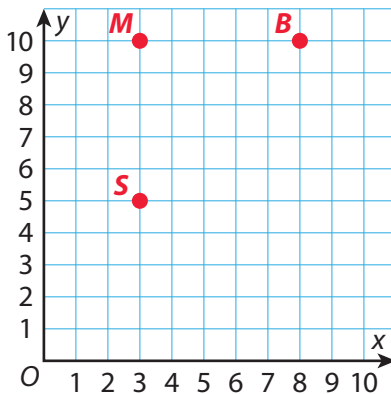
On the graph below, points *S*, *M*, and *B* are three vertices of a square. Plot and label the fourth vertex, *G*, of the square. What are the *x*- and *y*-coordinates of *G*? How do you know?

Learning Target

- Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

SMP 1, 2, 3, 4, 5, 6, 7, 8

TRY IT



Math Toolkit

- geoboards
- rulers
- coordinate plane grid paper



DISCUSS IT

Ask your partner: Do you agree with me? Why or why not?

Tell your partner:
I knew ... so I ...

CONNECT IT

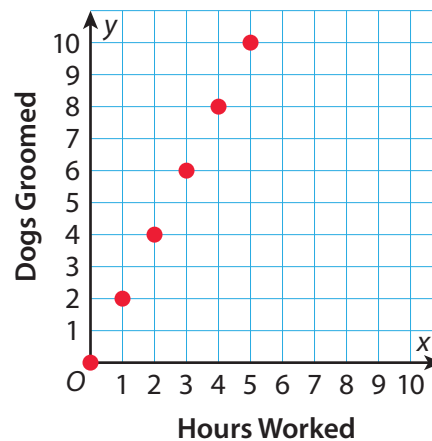
1 LOOK BACK

Explain how you determined the ordered pair for the fourth vertex, G , of the square.

2 LOOK AHEAD

On the previous page, you solved a problem about a geometric figure graphed in the coordinate plane. A coordinate plane graph can also be used to show relationships between two real-world quantities.

Mia works as a dog groomer at a pet store. The coordinate plane shows the relationship between the number of dogs Mia grooms and the number of hours she works.



- Use the titles on the axes to explain how to interpret a point on the graph.
- How many dogs did Mia groom in 4 hours? How do you know?
- What do the coordinates of the point located at $(3, 6)$ represent in this situation?

3 REFLECT

What are some differences between the graphs in **Try It** and problem 2?


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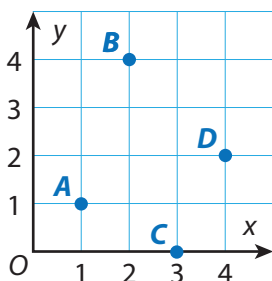
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Prepare for Representing Problems in the Coordinate Plane

- 1 Think about what you know about the coordinate plane. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

<p>What Is It?</p>	<p>What I Know About It</p>	
 <p>coordinates</p>		
<p>Examples</p>	<p>Examples</p>	<p>Examples</p>

- 2 Write the ordered pair that gives the coordinates of each point.



Point A:

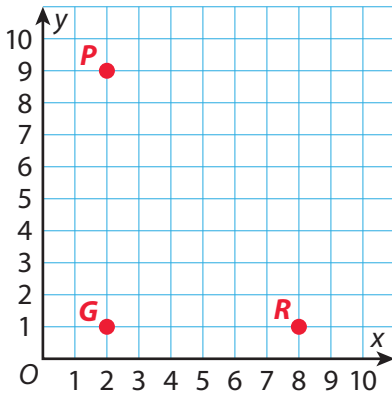
Point B:

Point C:

Point D:

3 Solve the problem. Show your work.

Points P , G , and R are three vertices of a rectangle. Plot and label the fourth vertex, A , of the rectangle. What are the x - and y -coordinates of A ? How do you know?



Solution

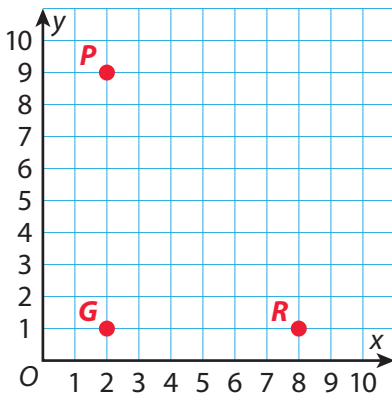
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4 Check your answer. Show your work.



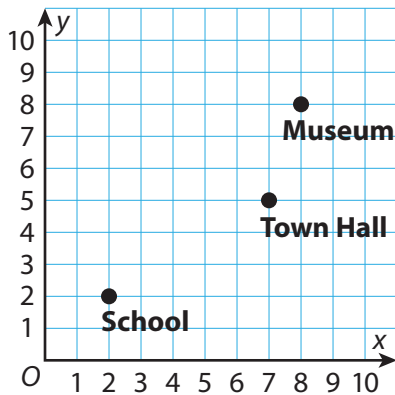
Develop Graphing Points and Finding Distances

Read and try to solve the problem below.

The coordinate plane shows the locations of buildings in Max's town. From the school, Max walks 3 units to the right and 5 units up to a park. Then he walks to the library, which is located at the point $(1, 7)$.

- Graph and label points to show the locations of the park and the library. Write the ordered pair for the park.
- How many units does Max walk in all? Assume Max takes the shortest path along grid lines from the park to the library.

TRY IT



Math Toolkit

- geoboards
- rulers
- coordinate plane grid paper



DISCUSS IT

Ask your partner: How did you get started?

Tell your partner: I also thought about ...

Explore different ways to understand graphing points and finding distances in the coordinate plane.

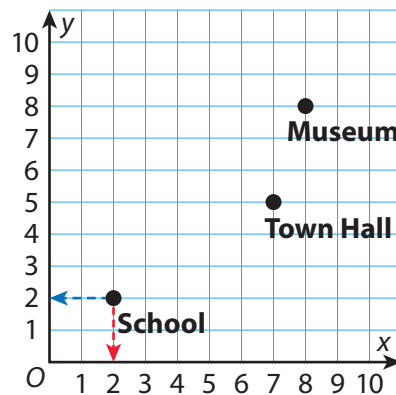
The coordinate plane shows the locations of buildings in Max’s town. From the school, Max walks 3 units to the right and 5 units up to a park. Then he walks to the library, which is located at the point (1, 7).

- Graph and label points to show the locations of the park and the library. Write the ordered pair for the park.
- How many units does Max walk in all? Assume Max takes the shortest path along grid lines from the park to the library.

MODEL IT

You can use the graph to find the coordinates of Max’s starting point.

Max starts walking from the school. The red and blue arrows on the graph show how to determine the coordinates for the school.

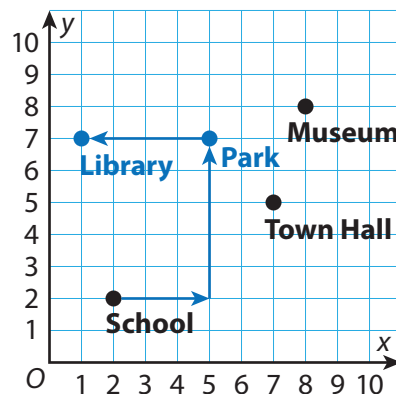


PICTURE IT

Plot points and show Max’s path in the coordinate plane.

The blue arrows on the graph show the path Max takes from the school to the park, and then to the library.

Count the total number of units indicated by the arrows to find the number of units Max walks in all.



CONNECT IT

Now you will use the problem from the previous page to help you understand graphing points and finding distances in the coordinate plane.

- 1 Look at the coordinate plane in the first **Picture It**. Where does Max start walking? What is the ordered pair for this location?

- 2 Explain how to use the coordinates of the school to find the coordinates of the park. Then find the distance Max walks between these two locations.

- 3 How does the location of the park relate to the location of the library? Explain how to use the coordinate plane to find the distance Max walks between the park and the library.

- 4 The total distance Max walks is
- 5 Explain how you can use movements along grid lines to locate points and find distances in the coordinate plane.

6 REFLECT

Look back at your **Try It**, strategies by classmates, **Model It** and **Picture It**. Which models or strategies do you like best for solving problems about distance in the coordinate plane? Explain.

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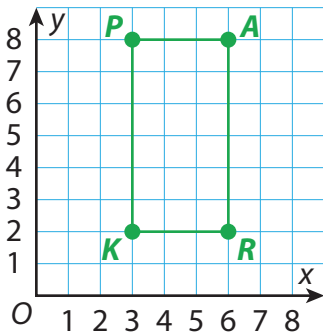
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APPLY IT

Use what you just learned to solve these problems.

- 7 Julia plans a rectangular park using the coordinate plane below. To get from one corner of the park to another, Julia travels 3 units left and 6 units up. Draw arrows on the coordinate plane to show Julia's path. Write the coordinates for her start and end points.



START:

END:

- 8 Use the coordinate plane in problem 7. What is the perimeter of rectangle *PARK*? Show your work.

Solution

- 9 Use the coordinate plane in problem 7. What is the length of Julia's path from point *R* to point *P* in the park?
- (A) 3 units
 - (B) 6 units
 - (C) 9 units
 - (D) 18 units

Practice Graphing Points and Finding Distances

Study the Example that shows how to solve a measurement problem on a coordinate grid. Then solve problems 1–5.

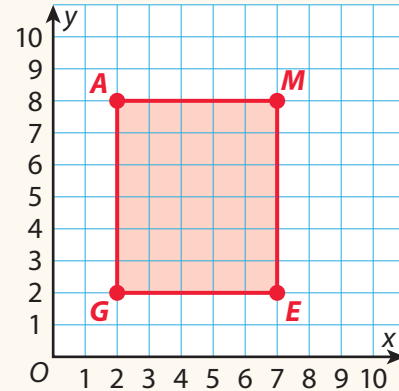
EXAMPLE

The owner of an arcade plans to add a new game room. He draws a rectangle in the coordinate plane to represent the room. What is the area of the rectangle?

From point G to point A , go up 6 units.
From point A to point M , go right 5 units.
Length of \overline{GA} is 6 units and length of \overline{AM} is 5 units.

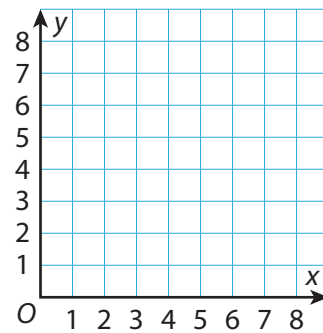
Area of a rectangle = length \times width
Multiply the lengths of the sides to find the area of the rectangle: $6 \times 5 = 30$.

Area of rectangle $GAME = 30$ square units

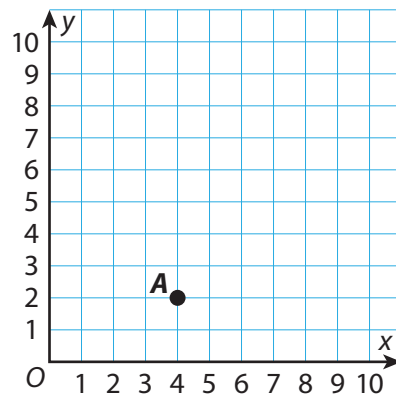


- Write ordered pairs for each vertex of rectangle $GAME$ in the Example.
 G (.....,) A (.....,)
 M (.....,) E (.....,)
- Find the lengths of \overline{ME} and \overline{EG} . Explain how you can count to find the distance between points M and E and between points E and G .
- What is the perimeter of rectangle $GAME$? Tell how you found your answer.

- 4
- Plot and label the points $K(2, 2)$, $G(6, 2)$, and $S(6, 5)$. Connect the points to form a triangle.
 - Which two sides of the triangle form a right angle?
- c. What are the lengths of the two sides that form the right angle?



- 5
- The coordinate plane at the right models the streets of a city. Each grid line represents 1 city block. Jared's house is at point A. Jared walks 6 blocks up to his friend Kenji's house. Then Jared and Kenji walk to their school, which is located at $(6, 9)$.



- Graph point B to show the location of Kenji's house and point C to show the location of the school.
- Write the ordered pair for each boy's house.
 point A point B
- How many blocks does Jared walk in all from his house to school? Assume the boys take the shortest path from Kenji's house to school while staying on the city streets. Explain how you found your answer.

Develop Representing Relationships Between Quantities

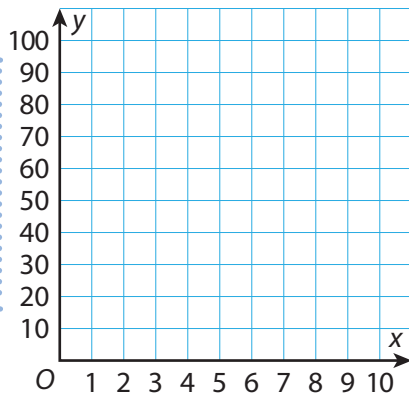
Read and try to solve the problem below.

Jenny has \$20 saved in the bank. She earns \$10 an hour washing cars and saves all her money. Graph points in the coordinate plane to show the relationship between the number of hours Jenny works and the total amount of money she has saved. Include the following in your graph:

- titles for the x - and y -axes to show which quantity each axis represents.
- points for 0, 1, 2, 3, 4, and 5 hours of work.



TRY IT



Math Toolkit

- counters
- geoboards
- rulers
- coordinate plane grid paper



DISCUSS IT

Ask your partner: Why did you choose that strategy?

Tell your partner: The strategy I used to find the answer was . . .

Explore different ways to understand how to use the coordinate plane to show relationships between quantities in the coordinate plane.

Jenny has \$20 saved in the bank. She earns \$10 an hour washing cars and saves all her money. Graph points in the coordinate plane to show the relationship between the number of hours Jenny works and the total amount of money she has saved. Include the following in your graph:

- titles for the x - and y -axes to show which quantity each axis represents.
- points for 0, 1, 2, 3, 4, and 5 hours of work.

MODEL IT

You can use a table to model the relationship between the quantities.

The table shows the number hours Jenny works and the total amount of money she has saved.

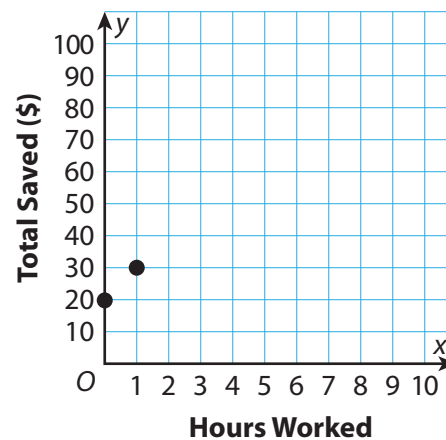
Hours Worked	0	1	2	3	4	5
Total Saved (\$)	20	30	40	50	60	70

PICTURE IT

You can graph points in the coordinate plane to model the relationship.

Use the data in the table to form ordered pairs to graph. The coordinate plane at the right shows points plotted for the first two columns of the table.

The ordered pair $(1, 30)$ is the ordered pair that represents the total the amount of money, \$30, that Jenny will have saved after working 1 hour.



CONNECT IT

Now you will use the problem from the previous page to help you understand how to use the coordinate plane to show relationships between two quantities.

- 1 Look at the coordinate plane in **Picture It**.
 What does the x-axis represent?
 What does the y-axis represent?
- 2 Complete these ordered pairs, (x, y) , where x is the number of hours Jenny works, and y is the total amount of money Jenny will have saved.
 $(0, \dots)$ $(1, \dots)$ $(2, \dots)$
 $(3, \dots)$ $(4, \dots)$ $(5, \dots)$
 Plot the missing ordered pairs in the coordinate plane in **Picture It**.
- 3 How much money will Jenny have saved if she works for 5 hours?
 Which point on the graph shows this?
- 4 How many hours does Jenny need to work to have saved \$40?
 Which point on the graph shows this?
- 5 How can you use the coordinate plane to represent relationships between two real-world quantities?

6 REFLECT

Look back at your **Try It**, strategies by classmates, **Model It**, and **Picture It**. Which models or strategies do you like best for graphing points to show relationships between quantities in the coordinate plane? Explain.

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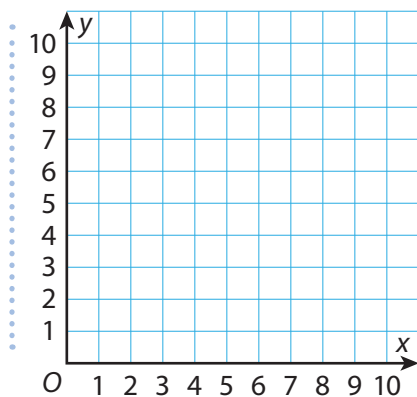
APPLY IT

Use what you just learned to solve these problems.

7 Ferran works in an ice cream store. He uses two scoops of ice cream for each ice cream cone he sells. Make a table of values and then graph the points on the coordinate plane to show the relationship between the number of ice cream cones Ferran sells and the number of scoops of ice cream he uses. Include the following in both the table and graph:

- titles to show which quantity is represented by x - and y -values
- data for 0, 1, 2, 3, and 4 ice cream cones.

Number of Ice Cream Cones, x					
....., y					



8 Use the table and graph in problem 7. Where would you put a point on the graph to show how many scoops of ice cream would be used for 5 cones? Explain your answer.

9 What does the point (2, 4) represent in the graph above?

- Ⓐ 2 scoops of ice cream are used for 4 ice cream cones.
- Ⓑ 6 scoops of ice cream are used in all.
- Ⓒ 2 ice cream cones use 4 scoops of ice cream.
- Ⓓ 8 scoops of ice cream are used in all.



Practice Representing Relationships Between Quantities

Study the Example showing how to use the coordinate plane to represent relationships between quantities. Then solve problems 1–6.

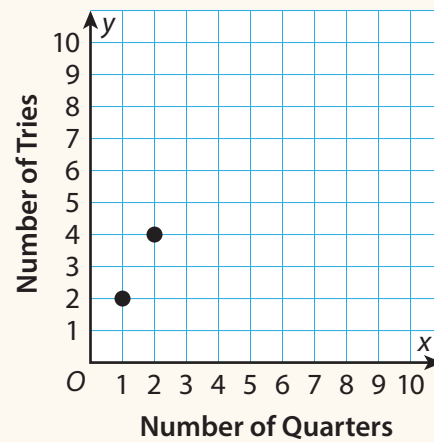
EXAMPLE

Holly is playing a crane game at the arcade. With each quarter, she gets 2 tries to grab a stuffed animal with the crane. Holly wants to show the relationship between the number of quarters and numbers of tries in a graph.

Make a table of x - and y -coordinates.

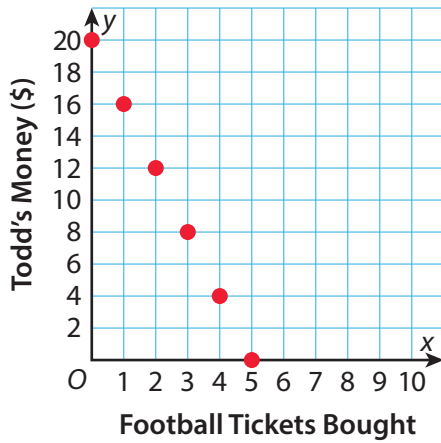
Number of Quarters, x	1	2	3	4	5
Number of Tries, y	2	4	6	8	10

Graph points (x, y) from the table.



- 1 Use the table in the Example above. Finish plotting the points (x, y) in the coordinate plane.
- 2 What is the meaning of the ordered pair $(3, 6)$ in this situation?
- 3 Use your graph in the Example. Describe moving from $(1, 2)$ to $(2, 4)$ and from $(2, 4)$ to $(3, 6)$ along grid lines. If you continue from point to point, what do you notice?

Use the coordinate plane to answer problems 4–6.



- 4 The graph above shows the relationship between the money Todd has and the number of football tickets he buys. How much does each football ticket cost? How do you know? Explain.

- 5 What do the coordinates of the point (3, 8) mean in this situation?

- 6 Which point on the graph shows that Todd has run out of money? Explain.

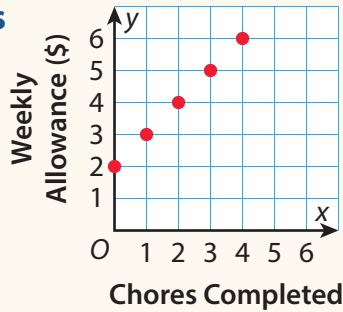
Refine Representing Problems in the Coordinate Plane

Complete the Example below. Then solve problems 1–8.

EXAMPLE

The graph shows how Jaina’s parents determine her weekly allowance. What does the point located at (3, 5) represent?

Look at how you can use the graph to solve this problem.



- The x-axis is labeled "Chores Completed."
- The x-coordinate in (3, 5) is 3.
- The y-axis is labeled "Weekly Allowance."
- The y-coordinate in (3, 5) is 5.

Solution

The titles on the axes tell me what the numbers mean.

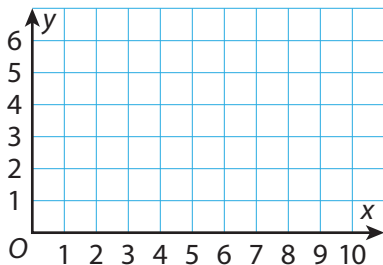


PAIR/SHARE

Explain how to use the graph to find how many chores Jaina must complete to earn \$4.

APPLY IT

- 1 Plot the points (4, 4), (8, 4), (3, 1), and (7, 1) in the coordinate plane. Use the points to draw two parallel, horizontal segments. Label the endpoints of one segment A and B. Label the endpoints of the other segment C and D. What is the distance between points A and B? What is the distance between points C and D?



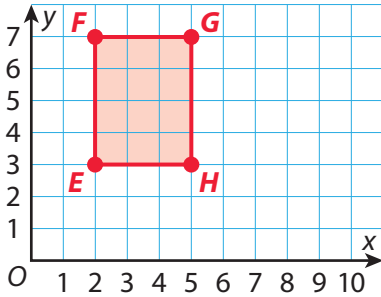
Solution

Are horizontal lines parallel to the x-axis or the y-axis?

PAIR/SHARE

What shape could have the four points as vertices?

- 2 What is the area of rectangle $EFGH$ shown in the coordinate plane? Show your work.



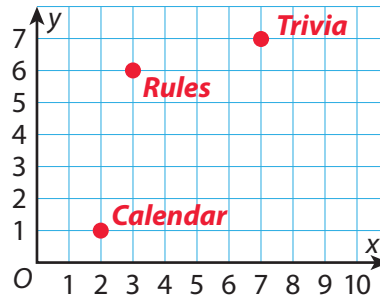
The formula for the area of a rectangle is $A = \ell \times w$.



Solution

- 3 Mr. Palmer uses the coordinate plane to design his bulletin board.

He moves *Rules* 2 units right and 3 units down. What ordered pair represents the new location of *Rules*?



- (A) (5, 3)
- (B) (1, 9)
- (C) (1, 3)
- (D) (5, 9)

Maya chose (C) as the correct answer. How did she get that answer?

PAIR/SHARE

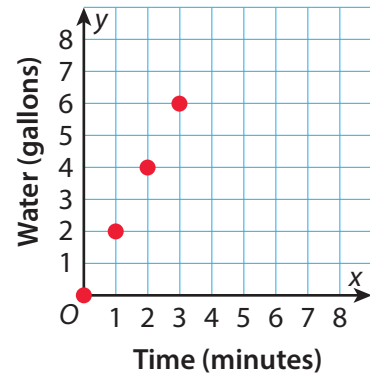
Suppose the x -coordinates for points G and H each increase by 1. What kind of shape would this be? What would be the area of this shape?

What is the ordered pair for the starting point?

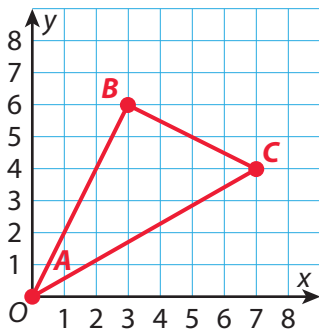
PAIR/SHARE

Does Maya's answer make sense?

- 4 The coordinate plane shows the relationship between the amount of water in the bathtub and the amount of time the faucet has been turned on. What do the coordinates of the point at (3, 6) represent in this situation?



- 5 Use the coordinate plane from problem 4. How many minutes must the faucet be turned on for there to be 8 gallons of water in the bathtub?
- Ⓐ 2 minutes
- Ⓑ 4 minutes
- Ⓒ 8 minutes
- Ⓓ 10 minutes
- 6 Look at triangle ABC .

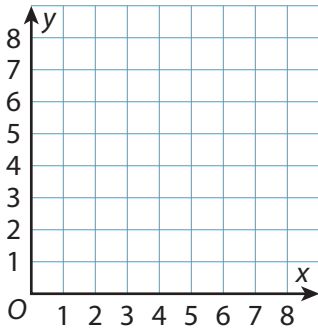


Which directions describe moving from point C to point B ?

- Ⓐ move 4 units right and 2 units down
- Ⓑ move 2 units up and 4 units right
- Ⓒ move 4 units left and 2 units down
- Ⓓ move 2 units up and 4 units left



- 7 **Part A** Draw a rectangle in the coordinate plane below with one vertex at the origin and an area 20 of square units. Label the vertices of your rectangle R, S, T, U .

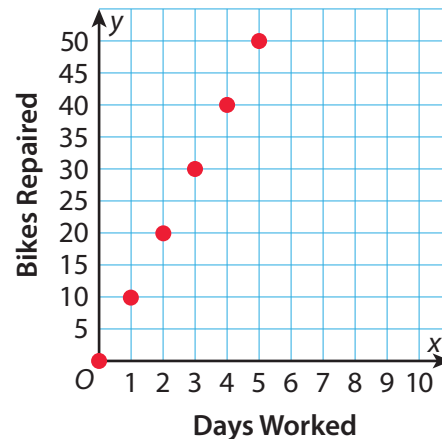


Part B Write the ordered pairs for the points $R, S, T,$ and U .

Part C How do you know that the area of rectangle $RSTU$ is 20 square units?

8 **MATH JOURNAL**

The coordinate plane shows the relationship between the number of bikes Harry repairs and the number of days he works at the bike shop. Describe two things you know from looking at points on the graph. Use coordinates in each of your descriptions.



 **SELF CHECK** Go back to the Unit 5 Opener and see what you can check off.