

Lesson 14 Introduction

The Coordinate Plane

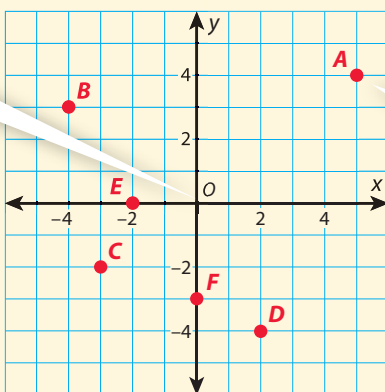
6.NS.C.6b
6.NS.C.6c
6.NS.C.8

Use What You Know

You learned how to graph points on a coordinate plane when the coordinates were positive. You know how to locate negative numbers on a number line. Now we'll put these skills together. Take a look at this problem.

Describe the location of points A, B, C, and D on the graph below.

The point where the number lines intersect is the **origin**. The ordered pair for the origin is $(0, 0)$.



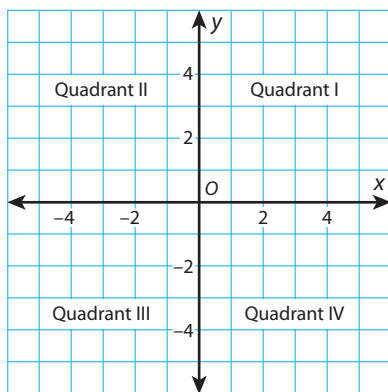
An ordered pair (x, y) describes the location of a point.

Use the math you already know to solve this problem.

- Place your finger on the origin. Move 5 units to the right and 4 units up. The ordered pair for point A is $(\underline{\hspace{1cm}}, 4)$.
- Place your finger on the origin. Move left and up to point B. Describe how far left and up point B is from $(0, 0)$. $\underline{\hspace{2cm}}$
The ordered pair for point B is $(-4, \underline{\hspace{1cm}})$.
- Start at $(0, 0)$. Describe how to get to point C. What is the ordered pair for point C?
 $\underline{\hspace{2cm}}$
The ordered pair for point C is $\underline{\hspace{2cm}}$.
- What is the ordered pair for point D? $\underline{\hspace{2cm}}$
- Explain how to locate points on the coordinate plane. $\underline{\hspace{2cm}}$
 $\underline{\hspace{2cm}}$

Find Out More

On the previous page, you wrote ordered pairs to describe points on a coordinate plane. The x -axis and y -axis intersect at the origin and divide the coordinate plane into four **quadrants**.



Points A , B , C , and D from the previous page are in different quadrants.

Point	Coordinates (x, y)	Quadrant
A	$(5, 4)$	I
B	$(-4, 3)$	II
C	$(-3, -2)$	III
D	$(2, -4)$	IV

Points E and F are not in a quadrant.

Point E at $(-2, 0)$ is on the x -axis. Every point on the x -axis has a y -coordinate that is 0.

Point F at $(0, -3)$ is on the y -axis. Every point on the y -axis has an x -coordinate that is 0.

Reflect

- Describe the location of a point that has a negative x -coordinate and a negative y -coordinate.

Learn About**Graphing on the Coordinate Plane**

Read the problem below. Then explore how to graph points on the coordinate plane.

Allyn is a college student. She started her day in her room. Then she attended classes in the Science, Education, and Art buildings. She ate lunch at the dining hall before meeting a friend at the Music building.

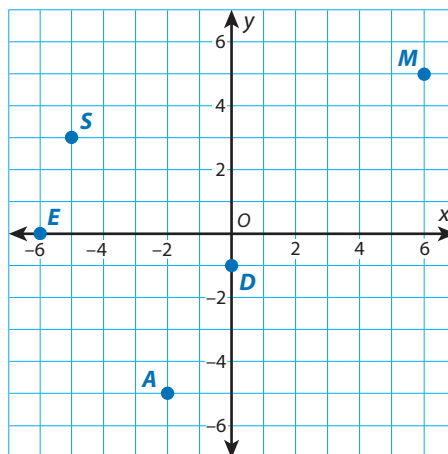
The coordinate plane represents a map of Allyn's college campus. Graph each building as a point on a coordinate plane labeled with the first letter of the building.

Building	Science	Education	Art	Dining	Music
Coordinate	$(-5, 3)$	$(-6, 0)$	$(-2, -5)$	$(0, -1)$	$(6, 5)$

Model It You can use words to describe the locations.

Building	Location from the Origin
Science	5 units left, 3 units up
Education	6 units left
Art	2 units left, 5 units down
Dining	1 unit down
Music	6 units right, 5 units up

Graph It You can graph the ordered pairs to solve the problem.



► **Connect It** Now you will explain how to solve the problem from the previous page using your understanding of how to graph and locate points on a coordinate plane.

2 Why is the origin important when graphing points on the coordinate plane?

3 Look at the ordered pairs and *Model It*. What does the first coordinate tell you?

What does the second coordinate tell you? _____

4 Allyn's room is located at $(3, -3)$. Use words to describe the location on a coordinate plane. _____

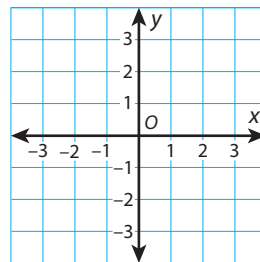
5 What does it mean when the x -coordinate or y -coordinate of a point is 0?

6 Explain how to graph a point on the coordinate plane. _____

► **Try It** Use what you just learned about graphing points on the coordinate plane to solve this problem.

7 Graph and label these locations on a coordinate plane. Explain how each point is related to the origin.

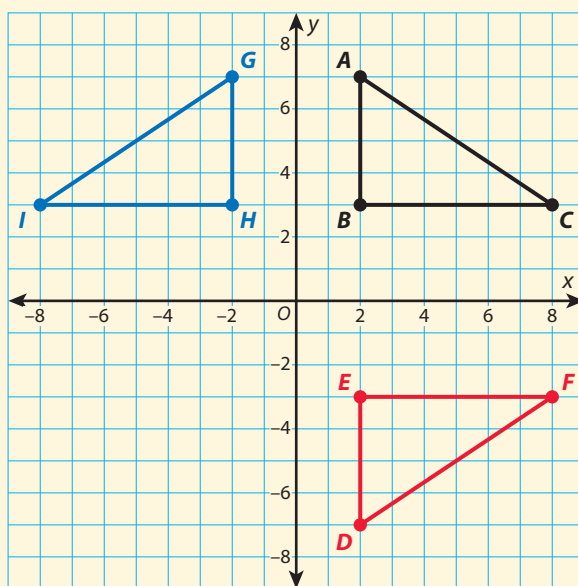
Location	Coordinate
Home	$(0, -3)$
School	$(-2, -3)$
Library	$(-1, 3)$
Park	$(2, -3)$



Learn About **Reflecting Points**

Read the problem below. Then explore how to reflect points across the x - and y -axis.

Sophia draws three triangles. What is the relationship between the coordinates of the vertices of triangle ABC and triangle DEF ? What is the relationship between the coordinates of the vertices of triangle ABC and triangle GHI ?



 **Picture It** You can list the coordinates of the vertices of each triangle to understand the problem.

$\triangle ABC$	$\triangle DEF$	$\triangle GHI$
A (2, 7)	D (2, -7)	G (-2, 7)
B (2, 3)	E (2, -3)	H (-2, 3)
C (8, 3)	F (8, -3)	I (-8, 3)

▶ Connect It Now you will solve the problem by analyzing the coordinates.

8 Across which axis do you reflect $\triangle ABC$ to get $\triangle DEF$? _____

9 Look at the coordinates of points A and D on the graph. What is the same? What is different?

10 Compare the coordinates of points B and E and points C and F . How do the coordinates of a point change when it is reflected across the x -axis?

11 Across which axis do you reflect $\triangle ABC$ to get $\triangle GHI$? _____

12 Compare the coordinates of points G and A , points B and H , and points C and I . How do the coordinates of a point change when it is reflected across the y -axis?

▶ Try It Use what you just learned about reflecting points across the x - and y -axis to solve these problems. Write your answers on the lines below.

13 Brandon draws a reflection of the point $(-4, -6)$. He gets the point $(-4, 6)$. Across which axis did he reflect the point? Explain how you know.

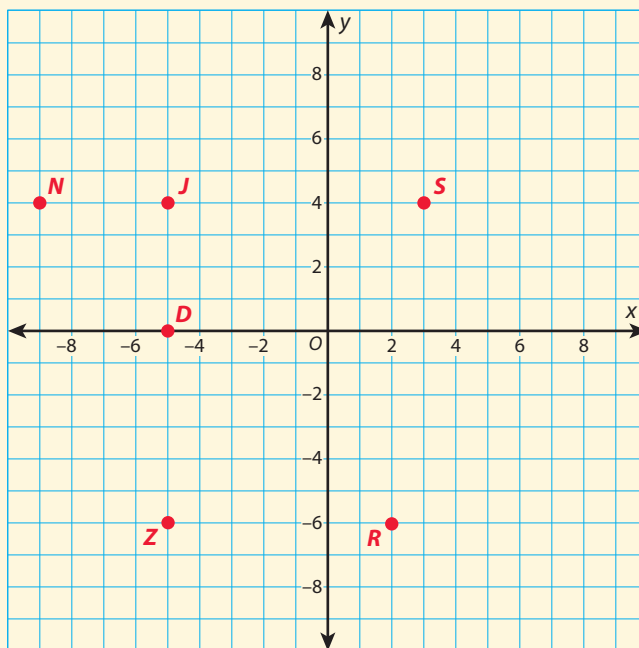
14 Flora reflects the point $(5, -10)$ across the y -axis. What are the coordinates of the reflected point? Explain how you know. _____

Learn About

The Distance Between Points

Read the problem below. Then explore how to find the distance between points with the same x - or y -coordinate that lie on opposite sides of an axis.

The coordinate plane below represents where Jenna's friends live. Jenna's apartment is at point J . Zac's house is at point Z . Each unit on this coordinate plane represents one block. How many blocks does Jenna need to walk to get to Zac's house?



Model It You can count the units between points to help you understand this problem.

The x -coordinates are the same, so you can count the units between the y -coordinates. Count from 4 to -6 .

Model It You can use absolute value to help you understand this problem.

You can find the distances of both points from the x -axis and add them.

The distance from $(-5, 4)$ to the x -axis is $|4|$.

The distance from $(-5, -6)$ to the x -axis is $|-6|$.

$$|4| + |-6| = 4 + 6$$

▶ Connect It Now you will solve the problem using the models.

- 15** Look at the first *Model It*. Count the units from $(-5, 4)$ to $(-5, -6)$. How many blocks are between Jenna's apartment and Zac's house? Explain how you know.

- 16** Jenna's friend Sam lives at point S. Explain how to count units to find the distance between Jenna's and Sam's apartments.

- 17** Look at the second *Model It*. What distances do the $|4|$ and $|-6|$ represent?

- 18** Explain how to find the distance between points J and Z using absolute value.

- 19** Explain how to use absolute value to find the distance between two points with the same x-coordinate that lie on opposite sides of the x-axis.

▶ Try It Use what you just learned about finding the distance between points to solve this problem. Write your answer on the lines below.

- 20** Explain how to find the distance between points J and S using absolute value.

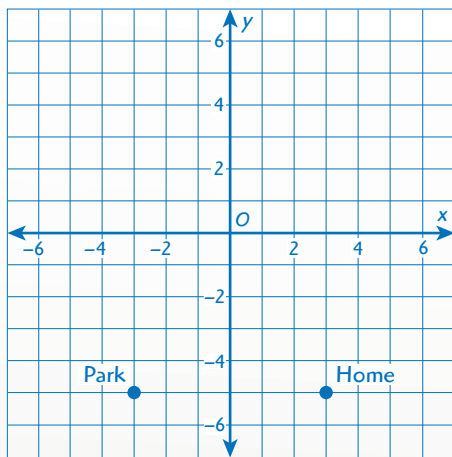
Practice Using the Coordinate Plane

Study the example below. Then solve problems 21–23.

Example

On a coordinate plane, Vera's home is at $(3, -5)$ and the park is at $(-3, -5)$. Graph each point on a coordinate plane and find the distance between Vera's home and the skate park. Each unit is 1 mile.

Look at how you can show your work using a model.



$$|3| + |-3| = 3 + 3$$

Solution 6 miles



The student located each point on the coordinate plane and found the distance to the y-axis.

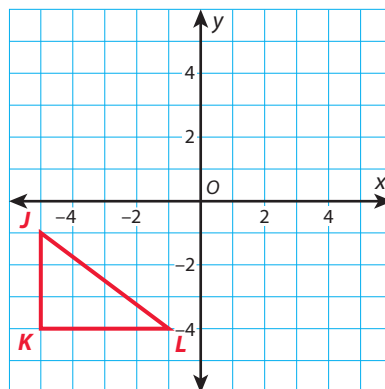


Pair/Share

What else do you notice about these points?

- 21** Draw $\triangle PQR$ by plotting the points $P(-5, 1)$, $Q(-5, 4)$, $R(-1, 4)$. What is the relationship between $\triangle PQR$ and $\triangle JKL$?

Show your work.



Are the points reflected across the x- or y-axis?

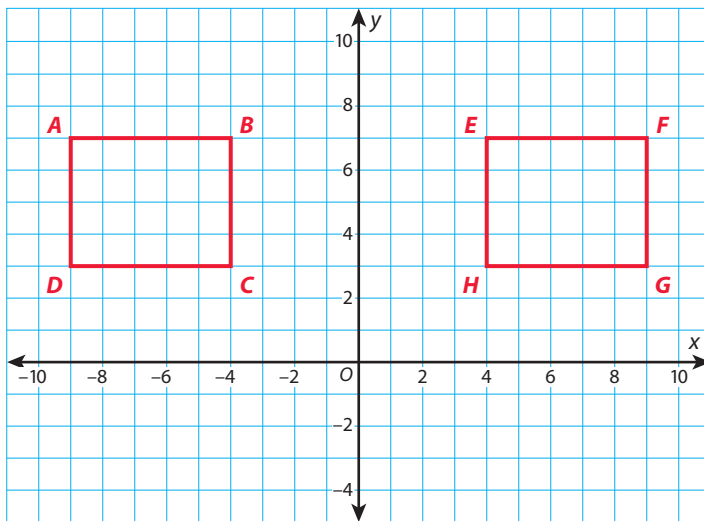


Pair/Share

How can you tell from the ordered pairs if a point is reflected across the x- or y-axis?

Solution _____

Use this coordinate plane for problems 22 and 23.



How many units from the y-axis are the two rectangles?

- 22** Use points C and H to calculate the distance between the two pools shown on the coordinate plane. Each unit is one meter.

Solution _____



Pair/Share

What other points could you use to check that the distance is correct?

- 23** Using the points on the coordinate plane above, which of the following statements is true?

- A** The distance from A to E is $|7| + |7|$.
- B** The distance from A to E is $|4| + |7|$.
- C** The distance from A to E is $|-9| + |7|$.
- D** The distance from A to E is $|-9| + |4|$.

Angie chose **A** as the correct answer. Why is her answer incorrect?



Compare the x- and y-coordinates of A and E . Which coordinate is the same? Which is different?



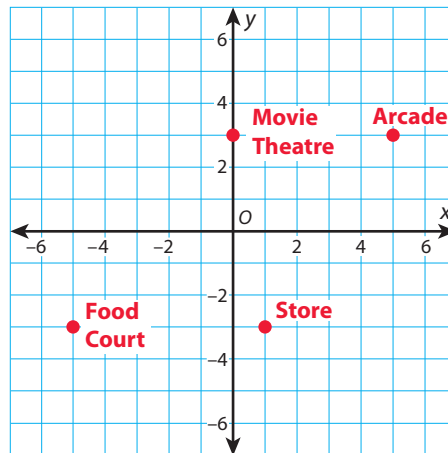
Pair/Share

What other points are the same distance apart as points A and E ?

Practice Using the Coordinate Plane

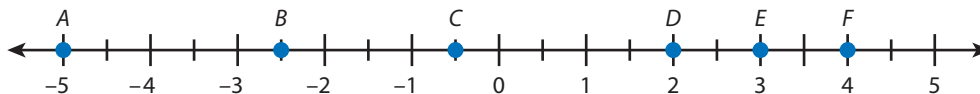
Solve the problems.

- 1 Which statement is true about the distance from the food court to the store?
- A It is equal to 4 units.
 - B It equals the distance from the movie theatre to the arcade.
 - C It is less than the distance from the movie theatre to the arcade.
 - D It is greater than the distance from the movie theatre to the arcade.



- 2 A new coffee shop is being built. Its location is the reflection of the arcade's coordinates across the y-axis. Which procedure will find the correct distance between the arcade and the new coffee shop? Circle all that apply.
- A Find the sum of $|3|$ and $|3|$.
 - B Simplify the expression $|-5| + |5|$.
 - C Find the distance between $(5, 3)$ and $(5, -3)$.
 - D Find the distance of each point from the y-axis and then add.

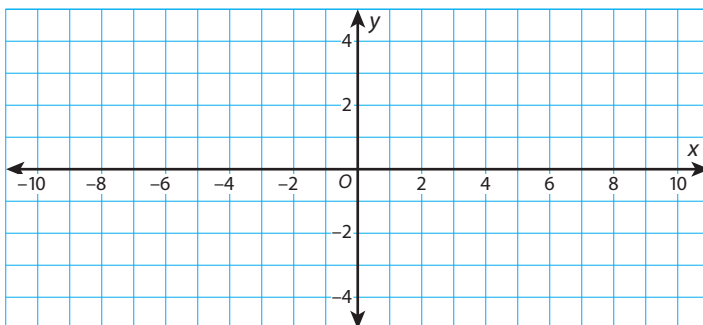
- 3 Each lettered point represents a location on the number line. Choose *True* or *False* for each statement.



- | | | |
|--|-------------------------------|--------------------------------|
| a. B is the location of $-3\frac{1}{2}$. | ☐ True | ☐ False |
| b. C is a positive number. | ☐ True | ☐ False |
| c. B and D are opposites. | ☐ True | ☐ False |
| d. The distance between A and B is negative. | ☐ True | ☐ False |
| e. The absolute value of A is greater than the value of F. | ☐ True | ☐ False |

- 4 Three points representing the corners of a rectangular garden are $A(-7, 3)$, $B(7, 3)$, and $C(7, -3)$.

Part A Graph the points representing the corners of the garden. Explain how to find the coordinates of the fourth corner, point D . Then graph and label that point.



Part B Name two points that are reflections of each other across the x -axis.

Name two points that are reflections of each other across the y -axis.

Part C Find the distance between two points that have the same y -coordinate.

Self Check Go back and see what you can check off on the Self Check on page 51.