

LESSON 14.1 Distance in the Coordinate Plane

COMMON CORE 6.NS.8

Solve...problems by graphing points....Include use of coordinates and absolute value to find distances between points... Also 6.NS.6b



ESSENTIAL QUESTION

How can you use absolute value to find the distance between two points with the same x - or y -coordinates?

EXPLORE ACTIVITY 1

COMMON CORE 6.NS.6b

Reflecting in the Coordinate Plane

A point on a coordinate plane can be *reflected* across an axis. The **reflection** is located on the opposite side of the axis, at the same distance from the axis.

Hold your paper up to the light if necessary to see the reflection.

Draw a coordinate plane on graph paper. Label both axes from -10 to 10 .

- A** Graph $(3, -2)$. Then fold your coordinate plane along the y -axis and find the reflection of $(3, -2)$. Record the coordinates of the new point in the table.
- B** Unfold your coordinate plane. Then fold it along the x -axis and find the reflection of $(3, -2)$. Record the coordinates of the new point in the table.
- C** Choose three additional points and repeat **A** and **B**.

Point	Reflected across y -axis	Reflected across x -axis
$(3, -2)$		

Reflect

1. What is the relationship between the coordinates of a point and the coordinates of its reflection across each axis?

2. **Conjecture** A point is reflected across the y -axis. Then the reflected point is reflected across the x -axis. How will the coordinates of the final point be related to the coordinates of the original point?



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Finding Distances in the Coordinate Plane

You can also use absolute values to find distances between two points that have the same x -coordinates or the same y -coordinates on a coordinate plane.

EXAMPLE 1

COMMON CORE 6.NS.6b

Find each distance.

- A** What is the distance between point A and point B ?

STEP 1 Find the distance between point A and the x -axis.

The y -coordinate is 3, so point A is $|3|$ units from the x -axis.

STEP 2 Find the distance between point B and the x -axis.

The y -coordinate of B is -2 , so point B is $|-2| = 2$ units from the x -axis.

STEP 3 Find the sum of the distances.

- Distance from A to $B = |3| + |-2| = 3 + 2 = 5$ units.

- B** What is the distance between point D and point C ?

STEP 1 Find the distance between point D and the y -axis.

Point D is $|-5| = 5$ units from the y -axis.

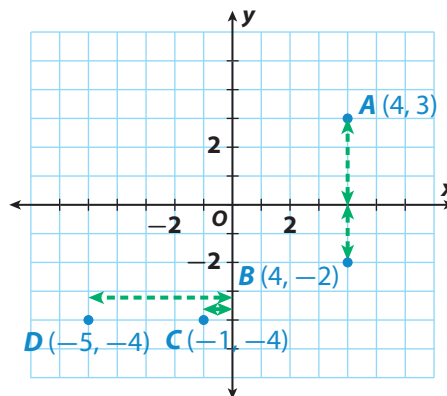
STEP 2 Find the distance between point C and the y -axis.

Point C is $|-1| = 1$ unit from the y -axis.

STEP 3 Find the distance between C and D by finding this difference:

Distance of D from the y -axis – distance of C from the y -axis

- $|-5| - |-1| = 4$ units



Math Talk

Mathematical Practices

How is the distance between a point and its reflection across an axis related to the distance between the point and the axis? Explain.



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YOUR TURN

Find the distance between each pair of points.

3. $E(-4, 7)$ and $F(5, 7)$ _____ 4. $G(0, -5)$ and $H(0, -10)$ _____

Solving Distance Problems

You can solve problems using the distance between points on a grid.



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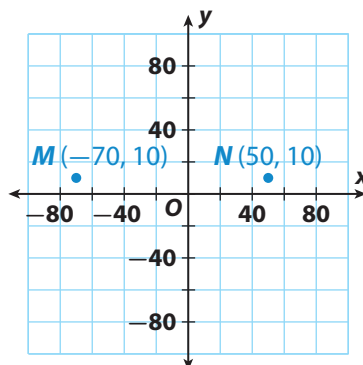
EXAMPLE 2

Problem Solving

COMMON CORE

6.NS.8

The coordinate plane represents a map. Each grid unit represents 20 miles. A retail company has warehouses at $M(-70, 10)$ and $N(50, 10)$. How long does it take a truck that drives 40 miles per hour to travel from warehouse M to warehouse N ?



Analyze Information

Identify the important information.

- One warehouse is located at $M(-70, 10)$. The other is at $N(50, 10)$.
- A truck drives from M to N at a speed of 40 miles per hour.



Formulate a Plan

- Find the distance between M and N by adding the absolute values of the x -coordinates of the points.
- Find the time it takes the truck to drive this distance by using the relationship, distance = rate \cdot time.



Solve

Add the absolute values of the x -coordinates to find the distance between point M and point N on the grid.

$$|-70| + |50| = 70 + 50 = 120$$

The warehouses are 120 miles apart.

The truck drives 120 miles at 40 mi/h. Because $120 = 40(3)$, it takes the truck 3 hours to travel from M to N .



Justify and Evaluate

You found the sum of the absolute values of the x -coordinates to find the horizontal distance on the grid. Then you used distance = rate \cdot time to find the time it takes to drive that distance.

YOUR TURN

5. A store is located at $P(50, -30)$. How long will it take a truck driving at 50 miles per hour to drive from warehouse N to this store?
- _____



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Guided Practice

1. The point $(5, -2)$ is reflected across the x -axis. What are the coordinates of the reflection? [\(Explore Activity\)](#)

2. The point $(-6, 8)$ is reflected across the y -axis. What are the coordinates of the reflection? [\(Explore Activity\)](#)

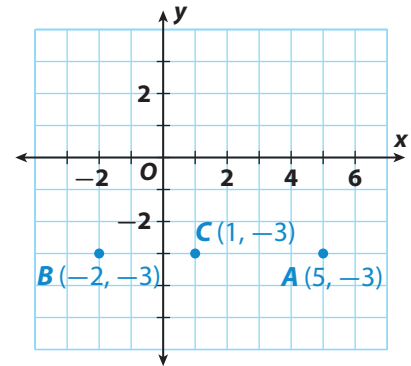
Use the coordinate plane. [\(Example 1\)](#)

3. The distance between point A and point B is

$$|\square| + |\square| = \square + \square = \square \text{ units.}$$

4. The distance between point A and point C is

$$|\square| - |\square| = \square - \square = \square \text{ units.}$$



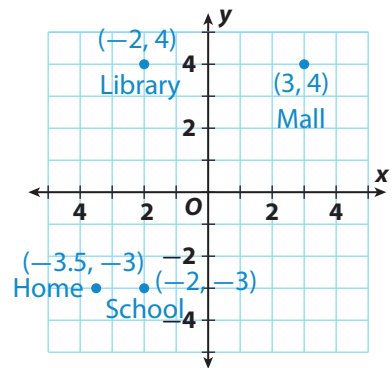
5. Plot the reflection of point C across the y -axis.
What is the distance between point C and its reflection? _____

6. Plot the reflection of point A across the x -axis.
What is the distance of the reflection from the x -axis? _____

Use the map shown. Each grid on the map represents 1 city block. [\(Example 2\)](#)

7. Yoko walks from the library to the mall.
How many city blocks does she walk? _____

8. If Yoko walks 1 block in 3 minutes, how long does it take her to walk from the school to the library? How long does it take her to walk from home to school?




ESSENTIAL QUESTION CHECK-IN

9. How do you use absolute value to find the distance between two points that have the same x -coordinates but different y -coordinates?

14.1 Independent Practice

COMMON CORE 6.NS.6b, 6.NS.8



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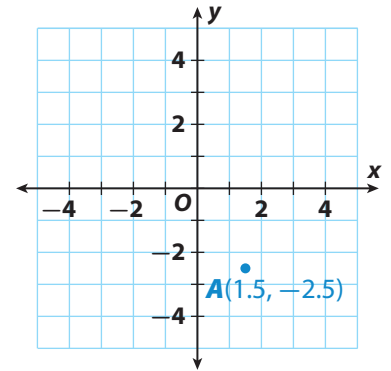
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Use the coordinate plane.

- 10.** Plot the reflection of point A across the x-axis. What are the coordinates of the reflection of point A across the x-axis? What is the distance between point A and its reflection?

- 11.** How can you plot the reflection of point A across the y-axis? Give the coordinates of the reflection across the y-axis, and tell how many units the reflection is from point A.

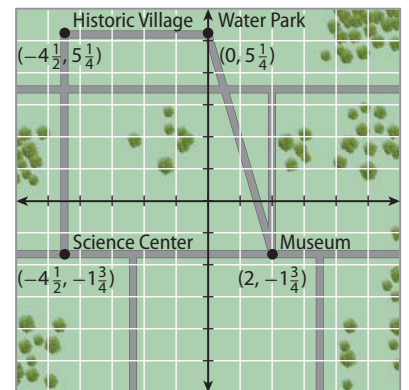


Find the coordinates of each point after the described reflection. Give the distance between each point and its reflection.

- 12.** $R(-5, 8)$ is reflected across the x-axis. _____
- 13.** $S(-7, -3)$ is reflected across the y-axis. _____
- 14.** $T(8, 2)$ is reflected across the x-axis. _____
- 15.** $U(2.4, -1)$ is reflected across the y-axis _____

Pedro uses a coordinate system to map the locations of some tourist locations in a large city. Each grid unit represents one mile.

- 16.** The planetarium, which is not marked on the map, is halfway between the historic village and the science center. What are its coordinates?
- _____
- 17.** Pedro wants to walk from the historic village to the science center. Then he will walk from the science center to the museum. If he walks at a speed of $4\frac{1}{2}$ miles per hour, how long will it take him?
- _____



- 18.** Pedro is staying at a hotel whose location is a reflection across the x-axis of the museum's location. What are the coordinates of the location of Pedro's hotel?
- _____



19. **Communicate Mathematical Ideas** Deirdre plotted a point D in Quadrant IV. After she reflected the point across an axis, the reflection was in Quadrant III. Give possible coordinates for point D and its reflection, and tell why you chose these coordinates.

20. **Explain the Error** Jason plotted the points $(4, 4)$ and $(-4, -4)$ on a coordinate plane. He says that the distance between the two points is 8 units because $|4| + |-4| = 8$. What mistake is Jason making?

21. **Look for a Pattern** A point is reflected over the x -axis and then reflected again over the y -axis. Will the coordinates after these two reflections be the same or different if the point is first reflected over the y -axis and then over the x -axis? Use an example to support your answer.

22. **Explain the Error** Bentley states that the distance between $R(-8, -3.5)$ and $S(-8, -12)$ is $|-12| + |-3.5| = 15.5$ units. Is Bentley correct? Explain your answer. If Bentley is not correct, explain how to find the correct distance between the points.
