MODULE 14
Unpacking the Standards

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.

6.NS.8
Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

What It Means to You
You will find the distance between two points on a coordinate plane.

UNPACKING EXAMPLE 6.NS.8
Find the distance between points A and B.

Add the absolute values of the y-coordinates.

\[ |3| + |−4| = 3 + 4 = 7 \]

The distance between points A and B is 7 units.

6.G.3
Draw polygons in the coordinate plane given coordinates for the vertices; …Apply these techniques in the context of solving real-world and mathematical problems.

What It Means to You
You can draw polygons on a coordinate plane by plotting the vertices and connecting them.

UNPACKING EXAMPLE 6.G.3
What type of polygon can you make by plotting these points?

Point A (−4, 2)
Point B (2, 2)
Point C (−4, −2)
Point D (2, −2)

Connect each point.
The points make a rectangle.
EXPLORE ACTIVITY 1 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.

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.

<table>
<thead>
<tr>
<th>Point</th>
<th>Reflected across y-axis</th>
<th>Reflected across x-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3, -2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?

__________________________________________________________________________
__________________________________________________________________________
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**

**Find each distance.**

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

1. **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.

2. **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.

3. **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?

1. **STEP 1** Find the distance between point D and the y-axis.
   - Point D is |−5| = 5 units from the y-axis.

2. **STEP 2** Find the distance between point C and the y-axis.
   - Point C is |−1| = 1 unit from the y-axis.

3. **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

**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)
1. The point \((5, -2)\) is reflected across the \(x\)-axis. What are the coordinates of the reflection? \(\text{(Explore Activity)}\)

2. The point \((-6, 8)\) is reflected across the \(y\)-axis. What are the coordinates of the reflection? \(\text{(Explore Activity)}\)

Use the coordinate plane. \(\text{(Example 1)}\)

3. The distance between point \(A\) and point \(B\) is \(\square + \square = \square + \square = \square\) units.

4. The distance between point \(A\) and point \(C\) is \(\square - \square = \square - \square = \square\) 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. \(\text{(Example 2)}\)

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

6.NS.6b, 6.NS.8

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 $A$.

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.