Teacher Notes

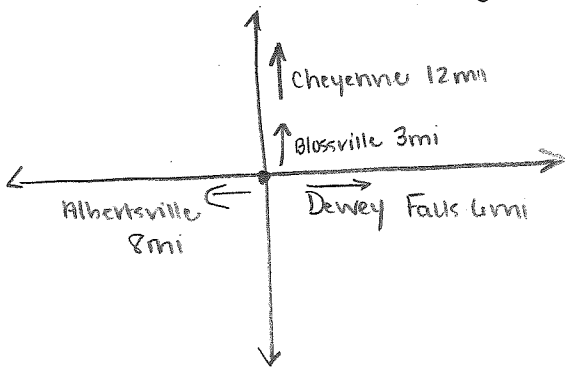
Lesson 18: Distance on the Coordinate Plane

Classwork

Opening Exercise

Four friends are touring on motorcycles. They come to an intersection of two roads; the road they are on continues straight, and the other is perpendicular to it. The sign at the intersection shows the distances to several towns. Draw a map/diagram of the roads and use it and the information on the sign to answer the following questions:

Albertsville ← 8 mi.
Blossville ↑ 3 mi.
Cheyenne ↑ 12 mi.
Dewey Falls → 6 mi.



What is the distance between Albertsville and Dewey Falls?

*. Since their distances are opposite we combine them.

$8+6=14$.

The distance is 14 miles.

What is the distance between Blossville and Cheyenne?

*. Since they are on the same side of intersection, Blossville is on the way to Cheyenne so the distance to Cheyenne is included in the distance to Blossville.

$12-3=9$

The distance is 9 miles

On the coordinate plane, what represents the intersection of the two roads?

The intersection is represented by the origin.

Example 1: The Distance Between Points on an Axis

Consider the points $(-4, 0)$ and $(5, 0)$.

What do the ordered pairs have in common and what does that mean about their location in the coordinate plane?

Both of their y-coordinates are zero, so each point lies on the x-axis, the horizontal number line.

How did we find the distance between two numbers on the number line?

We calculate the absolute values of the numbers, which told us how far the numbers were from zero. If the numbers were located on the opposite side of zero, then we add their absolute values together. If the numbers were located on the same side of zero, then we subtract the absolute values.

Use the same method to find the distance between $(-4, 0)$ and $(5, 0)$.

$|-4| = 4 \quad |5| = 5$

$4 + 5 = 9$

The distance is 9 units.

Example 2: The Length of a Line Segment on an Axis

Consider the line segment with endpoints $(0, -6)$ and $(0, -11)$.

What do the ordered pairs of the endpoints have in common, and what does that mean about the line segment's location in the coordinate plane?

The x-coordinates are both zero, so the points lie on the y-axis, (the vertical number line). If the end points lie on a vertical # line, then the line segment itself must also lie on the vertical line.

Find the length of the line segment described by finding the distance between its endpoints $(0, -6)$ and $(0, -11)$.

$|-6| = 6 \quad |-11| = 11$

$11 - 6 = 5$

The length of the end points is 5 units.

Example 3: Length of a Horizontal or Vertical Line Segment that does Not Lie on an Axis

Consider the line segment with endpoints $(-3, 3)$ and $(-3, -5)$.

What do the endpoints, which are represented by the ordered pairs, have in common? What does that tell us about the location of the line segment on the coordinate plane?

Both end points have x-coordinates of -3, so the points lie on the vertical line that intersects the x-axis at -3. This means that the end points of the line segment, lie on a vertical line.

Find the length of the line segment by finding the distance between its endpoints.

$|3| = 3 \quad |-5| = 5$

$3 + 5 = 8$

The distance is 8 units.

Exercise

Find the lengths of the line segments whose endpoints are given below. Explain how you determined that the line segments are horizontal or vertical.

a. $(-3, 4)$ and $(-3, 9)$

$|4| = 4 \quad |9| = 9$

$9 - 4 = 5$ units

b. $(2, -2)$ and $(-8, -2)$

$|2| = 2 \quad |-8| = 8$

$8 + 2 = 10$ units

c. $(-6, -6)$ and $(-6, 1)$

$|-6| = 6 \quad |1| = 1$

$6 + 1 = 7$ units

Look at * d. $(-9, 4)$ and $(-4, 4)$

$|-9| = 9 \quad |-4| = 4$

$9 - 4 = 5$ units.

e. $(0, -11)$ and $(0, 8)$

$|-11| = 11 \quad |8| = 8$

$11 + 8 = 19$ units.