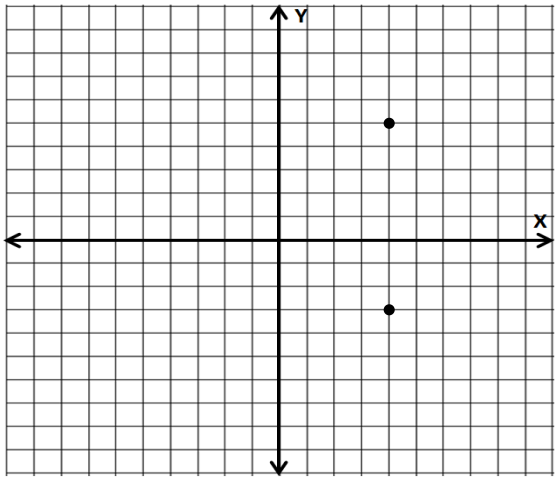
Lesson 19: Problem Solving and the Coordinate Plane

Classwork

Opening Exercise

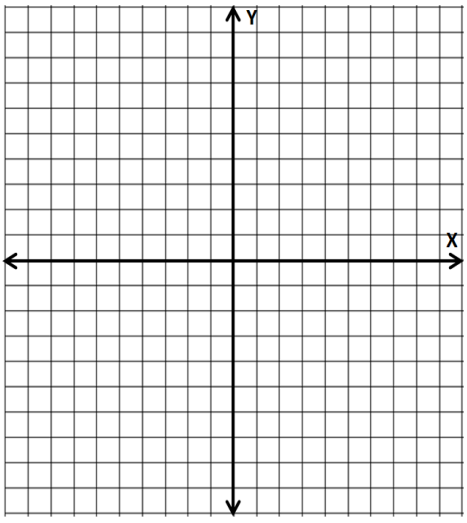
In the coordinate plane, find the distance between the points using absolute value.



Exploratory Challenge

Exercises 1–2: The Length of a Line Segment Is the Distance Between Its End Points

1. Locate and label $(4, 5)$ and $(4, -3)$. Draw the line segment between the end points given on the coordinate plane. How long is the line segment that you drew? Explain.



2. Draw a horizontal line segment starting at $(4, -3)$ that has a length of 9 units. What are the possible coordinates of the other end point of the line segment? (There is more than one answer.)

Which point did you choose to be the other end point of the horizontal line segment? Explain how and why you chose that point. Locate and label the point on the coordinate grid.

Exercise 3: Extending Lengths of Line Segments to Sides of Geometric Figures

3. The two line segments that you have just drawn could be seen as two sides of a rectangle. Given this, the end points of the two line segments would be three of the vertices of this rectangle.
   a. Find the coordinates of the fourth vertex of the rectangle. Explain how you find the coordinates of the fourth vertex using absolute value.

   b. How does the fourth vertex that you found relate to each of the consecutive vertices in either direction? Explain.

   c. Draw the remaining sides of the rectangle.

Exercises 4–6: Using Lengths of Sides of Geometric Figures to Solve Problems

4. Using the vertices that you have found and the lengths of the line segments between them, find the perimeter of the rectangle.

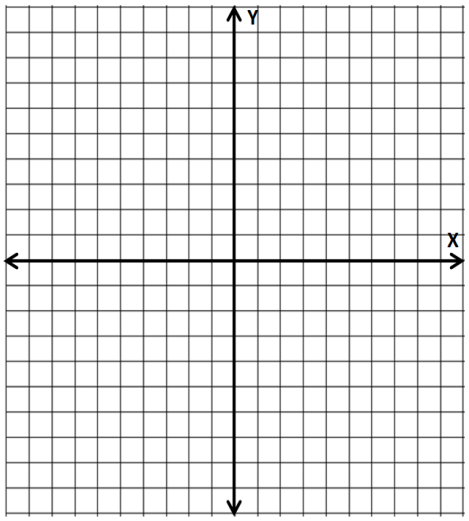
5. Find the area of the rectangle.

6. Draw a diagonal line segment through the rectangle with opposite vertices for end points. What geometric figures are formed by this line segment? What are the areas of each of these figures? Explain.

Extension (If time allows): Line the edge of a piece of paper up to the diagonal in the rectangle. Mark the length of the diagonal on the edge of the paper. Align your marks horizontally or vertically on the grid, and estimate the length of the diagonal to the nearest integer. Use that estimation to now estimate the perimeter of the triangles.

Exercise 7

7. Construct a rectangle on the coordinate plane that satisfies each of the criteria listed below. Identify the coordinate of each of its vertices.
   - Each of the vertices lies in a different quadrant.
   - Its sides are either vertical or horizontal.
   - The perimeter of the rectangle is 28 units.



Using absolute value, show how the lengths of the sides of your rectangle provide a perimeter of 28 units.

Lesson Summary

- The length of a line segment on the coordinate plane can be determined by finding the distance between its end points.
- You can find the perimeter and area of figures such as rectangles and right triangles by finding the lengths of the line segments that make up their sides and then using the appropriate formula.

Problem Set

1. One end point of a line segment is $(-3, -6)$. The length of the line segment is 7 units. Find four points that could serve as the other end point of the given line segment.

2. Two of the vertices of a rectangle are $(1, -6)$ and $(-8, -6)$. If the rectangle has a perimeter of 26 units, what are the coordinates of its other two vertices?

3. A rectangle has a perimeter of 28 units, an area of 48 square units, and sides that are either horizontal or vertical. If one vertex is the point $(-5, -7)$ and the origin is in the interior of the rectangle, find the vertex of the rectangle that is opposite $(-5, -7)$.