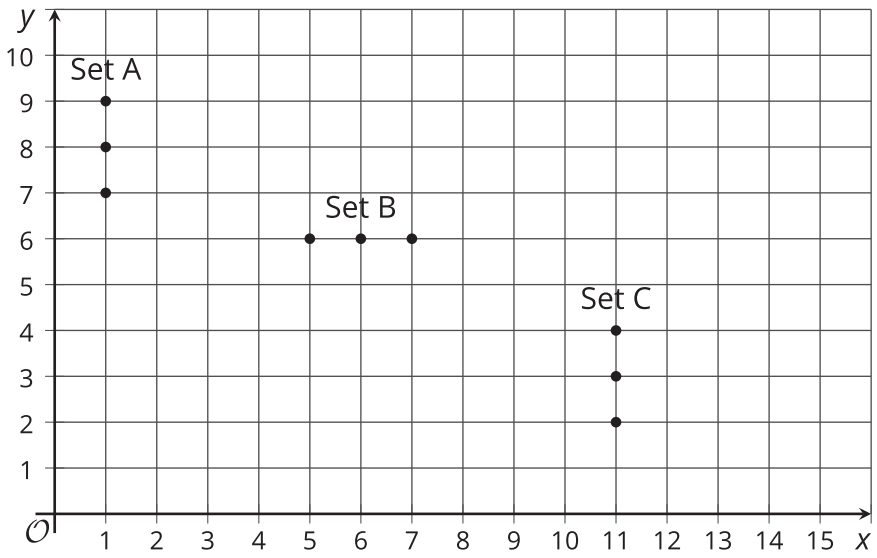
Constructing the Coordinate Plane

Let's explore the coordinate plane.

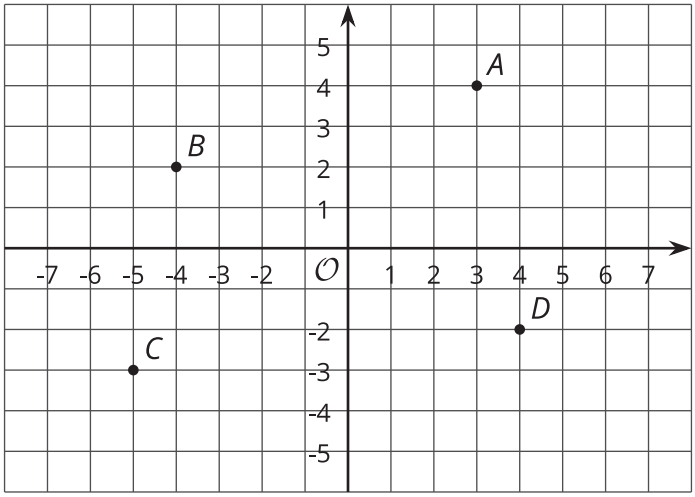
11.1 Guess My Line

Choose 1 set of points, and write the coordinates of each of the 3 points in the set. What do you notice about the coordinates?



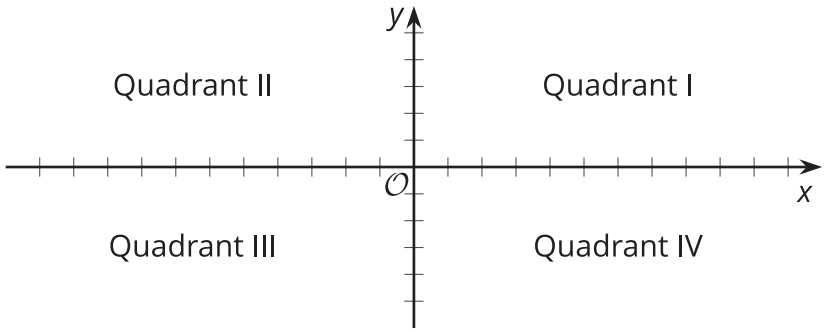
11.2 The Coordinate Plane

1. Write the coordinates of each labeled point.



2. Plot a point at $(-2, 5)$. Label it E.
3. Plot another point at $(3, -4.5)$. Label it F.
4. The **coordinate plane** is divided into four **quadrants**: I, II, III, and IV, as shown here.

   In which quadrant is point G located? Point H? Point I?



$G\ (5, 2)$

$H\ (-1, -5)$

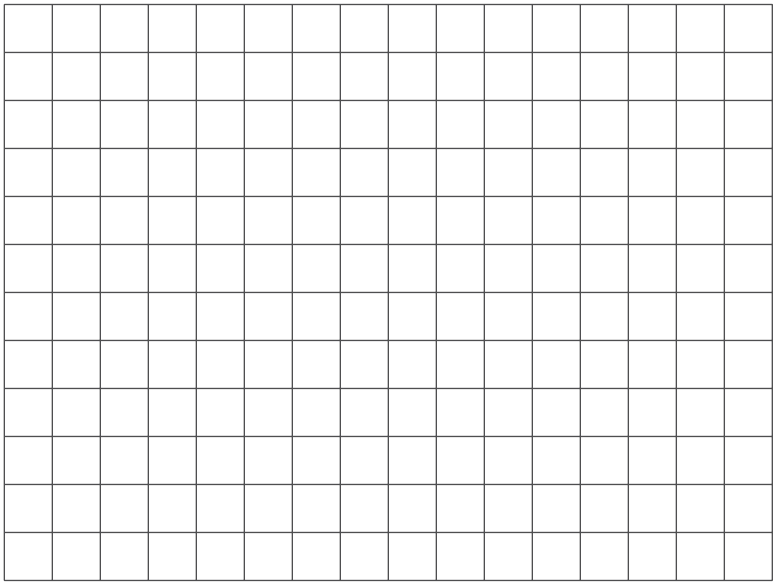
$I\ (7, -4)$

5. If a point has a positive y-coordinate, in which quadrants could it be?

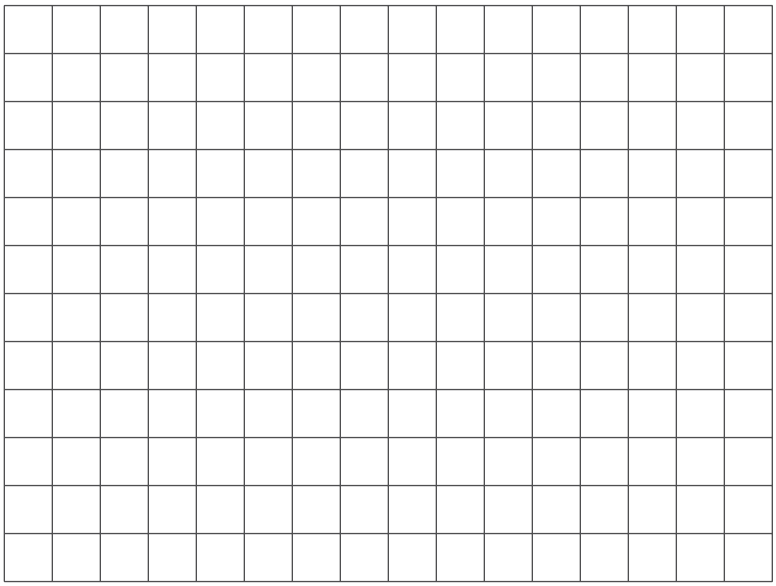
11.3 Axes Drawing Decisions

1. For each set of coordinates, draw and label an appropriate pair of axes, and plot the points.

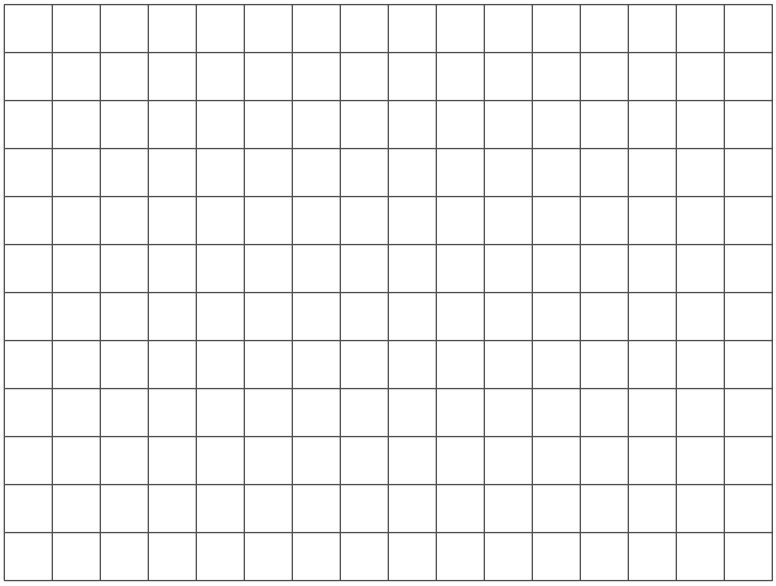
   a. $(1, 2), (3, -4), (-5, -2), (0, 2.5)$



   b. $(50, 50), (0, 0), (-10, -30), (-35, 40)$



c. $\left(\frac{1}{4}, \frac{3}{4}\right), \left(\frac{-5}{4}, \frac{1}{2}\right), \left(-1\frac{1}{4}, \frac{-3}{4}\right), \left(\frac{1}{4}, \frac{-1}{2}\right)$

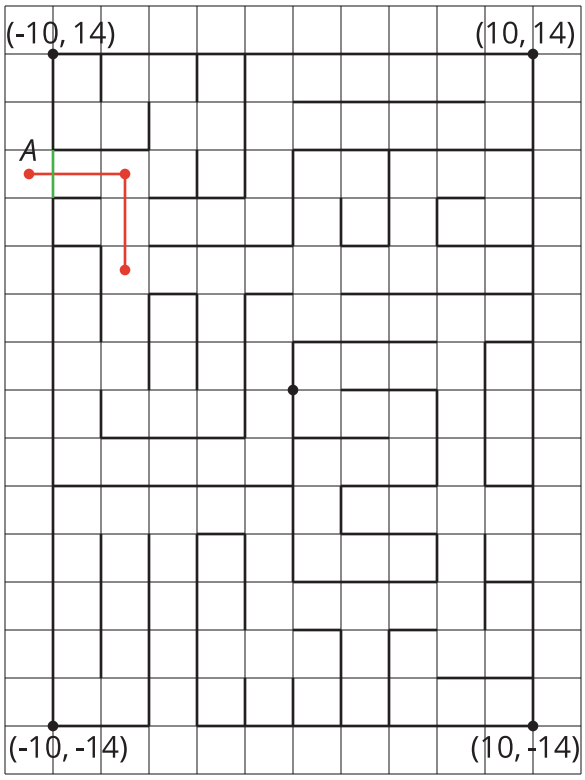


2. Discuss with a partner:
   - How are the axes and labels of your three drawings different?
   - How did the coordinates affect the way you drew the axes and label the numbers?

11.4 Positively "a-MAZE-ing"

Here is a maze in a coordinate plane. The black point in the center is (0, 0). The side of each grid square is 2 units long.

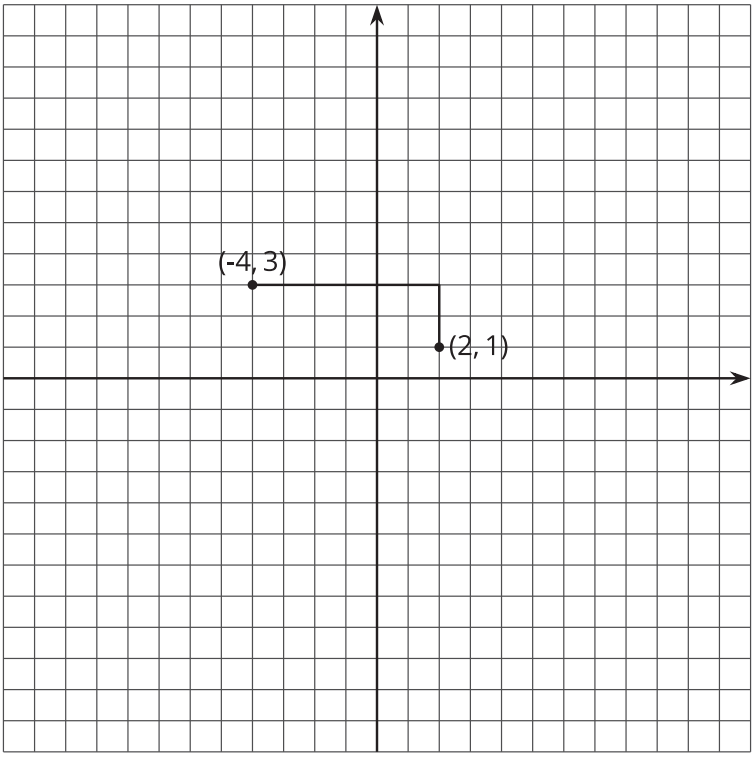
The starting point of the maze is located at the top left of the maze and labeled as point A. Draw line segments to show your way through and out of the maze. Label each turning point with a letter. Then list all the letters, and write their coordinates.



Are you ready for more?

To get from the point $(2, 1)$ to $(-4, 3)$ you can go two units up and six units to the left, for a total distance of eight units. This is called the "taxicab distance," because a taxi driver would have to drive eight blocks to get between those two points on a map.

Find as many points as you can that have a taxicab distance of eight units away from $(2, 1)$. What shape do these points make?



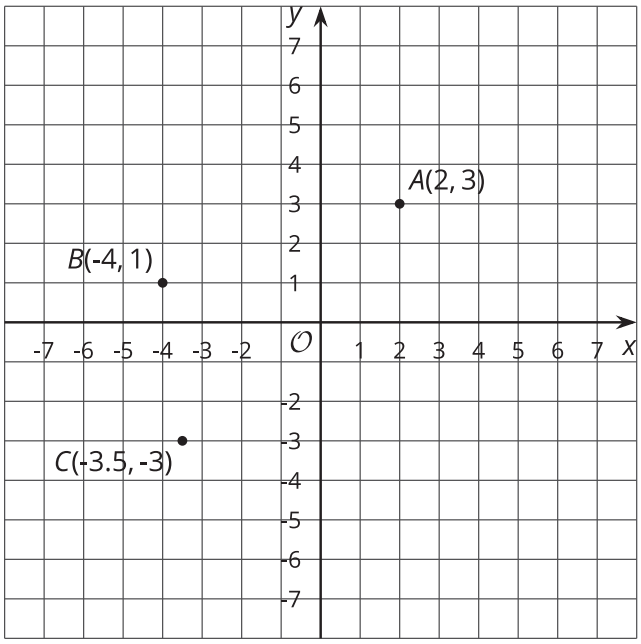
Lesson 11 Summary

Just as the number line can be extended to the left to include negative numbers, the x- and y-axes can also be extended to include negative values. This creates the **coordinate plane**, a system that can be used to describe the locations of points.

For example, point B can be described by the ordered pair $(-4, 1)$. The x-value of -4 tells us that the point is 4 units to the left of the y-axis. The y-value of 1 tells us that the point is 1 unit above the x-axis. Point B is located in Quadrant II.

The same reasoning applies to the points A and C. Point A is located in Quadrant I. Point C is located in Quadrant III.

Quadrant IV contains points whose x-coordinates are positive and whose y-coordinates are negative.



The coordinate plane can also be used to show information involving pairs of numbers. When using the coordinate plane, we should pay close attention to what each axis represents and what scale each axis uses.

Suppose we want to plot the following points: $(-4, 3)$, $(-1, -2)$, $(0, -4)$, and $(3, -8)$.

The data involve whole numbers, so it is appropriate that each square on the grid represents a whole number.

- To the left of the origin, the x-axis needs to go as far as -4 or lower. To the right, it needs to go to at least 3.
- Below the origin, the y-axis has to go as far as -8 or lower. Above the origin, it needs to go to at least 3.

Here is a possible graph of the data.