

What's the Point?

Strand:	Geometry
Topic:	Identifying coordinates of a point and graphing ordered pairs
Primary SOL:	6.8 The student will a) identify the components of the coordinate plane; and b) identify the coordinates of a point and graph ordered pairs in a coordinate plane.

Materials

- Chart paper
- Markers
- Centimeter graph paper
- Rulers
- Geoboards

Vocabulary

geoboards, horizontal, line segment, regular polygon, vertical (earlier grades)
axis, coordinate, quadrants, ordered pairs, origin, plot (6.8)

Student/Teacher Actions: What should students be doing? What should teachers be doing?

Before the lesson, create on chart paper a large coordinate plane for display.

1. Display the coordinate plane, and ask students what it is called. Ask where they have seen a coordinate plane before; they may mention the game “Battleship.” Ask students whether they have ever played “Flappy Bird.” Explain to them that that game uses the coordinate plane. Teachers can let them watch this [video](#) to see how the coordinate plane is used to create two-dimensional video games. If there is extra time, teachers can let them go to this [link](#) from code.org to see how the coordinate plane can be used on video games. (Teachers will need to create an account and use the course “CS in Algebra,” Lesson 1, Progress 1.) Tell students that coordinate planes are used throughout mathematics to help us understand geometry and algebra. Show students the four quadrants, and discuss the differences among them. Ask students to share with partners what they notice.
2. Display the following ordered pairs: $(0, 0)$, $(3, 7)$, $(7, 0)$, $(0, 3)$, $(-3, 0)$, $(-3, 7)$, $(0, -7)$, $(-3, -7)$, $(3, -7)$. Have students talk with their partners about what they notice about the sets of ordered pairs, discussing where each pair might be located on the coordinate plane. Have students share their ideas.
3. Model how to graph each of these ordered pairs on the displayed coordinate plane, making sure to label them clearly. Ask students whether the points are located where they thought they would be, and why or why not. Talk about coordinates and how they determine where a point is located on a coordinate plane.
4. Tell students that they will be working with their own coordinate planes in three activities.

Activity 1

1. Give each student several sheets of centimeter graph paper. Have each student draw a coordinate plane and label the x - and y -axes, label the lines, label the origin, and identify the quadrants.
2. Have students work with partners to graph several ordered pairs in their coordinate planes, recording each ordered pair, the quadrant in which the point is placed, and the distance from the x - and y -axes.
3. Have students draw a horizontal and vertical line segment anywhere on the graph starting and ending at x - and y -axis intersections where they are using only integers. Have them record the distance between the two points on the graph paper.
4. Without plotting, based solely on the coordinates, have students find the pattern of determining the quadrant in which a point should be placed. Have them record their thinking about this pattern in their math journals.
5. Bring all students together to discuss the patterns they discovered.

Activity 2

1. Have each student draw a coordinate plane and label the x - and y -axes, label the lines, label the origin, and identify the quadrants.
2. Distribute rulers and instruct each student to draw a regular polygon on their coordinate plane, using only straight lines. Have them place a dot at each point where two lines come together. (*Note: Teachers might require that they use all four quadrants and/or have a certain number of points in their pictures.*) Have students label the dots as ordered pairs. Then, direct them to list the ordered pairs on a separate piece of paper, placing them in a sequential order that will make it possible for another student to graph them and connect the dots to re-create the picture. Emphasize that for this to work, the ordered pairs must be listed in sequential order around the outline of the picture, either clockwise or counterclockwise.
3. Have students exchange their lists of ordered pairs with their partners. Instruct each student to use this list to re-create the drawing on a blank coordinate plane, connecting the ordered pairs as they plot the points in sequential order. As they are doing this, have the student label the distance between each line segment to prove that it is a regular polygon, having all the same length sides.
4. Have students check their drawings against the original ones created by their partners and discuss any discrepancies.

Activity 3

1. Distribute Geoboards, and have students create the x - and y -axes on them. Then, have students mark a given number of points on their geoboards with small, round stickers.
2. Have students play a “Guess the Point” game. Players take turns trying to locate their opponents’ points by asking yes/no questions and guessing ordered pairs, based on the answers. Players should keep a written record of their questions, the answers, and their guesses. Play proceeds as follows:
 - Player A asks a yes/no question of Player B (e.g., Is there a point at 7 on the y -axis?). If the answer is “Yes,” Player A may ask another question (e.g., Is there a point at -3 on the

x-axis?). Some questions they may ask can include questions about distance from the axes or other points as well.

- When the answer to a question is “No,” Player A must guess an ordered pair. If the guess is correct, Player A marks the point on his/her geoboard and continues asking questions. If the guess is incorrect, Player B takes a turn.
- The first player who locates all his/her partner’s points is the winner.

Assessment

- **Questions**

- How can you determine the quadrant in which an ordered pair should be placed without plotting the point?
- What is the same about the four quadrants? How are the four quadrants different from each other?
- How do you graph a particular point in a coordinate plane?
- How do you identify the ordered pair of a particular point in a coordinate plane? How do you know you are correct?
- What can you say about the ordered pairs found in a specific quadrant?
- Where is the origin located on a coordinate plane?
- How can you find the distance between points on the same horizontal or vertical line?
- Can any given point be represented by more than one ordered pair?
- In naming a point in the coordinate plane, does the order of the two coordinates matter?
- How can you determine whether a polygon on a coordinate plane is a regular polygon using the ordered pairs?

- **Journal/Writing Prompts**

- Describe the steps to follow to graph an ordered pair. Explain whether these steps are the same for every quadrant and why.
- Describe and create the whole coordinate plane. Specifically explain axes, grid lines, origin, and quadrants and their relationships with each other.
- Explain how coordinates on the same vertical line are similar/different and how coordinates on the same horizontal line are similar/different.

- **Other Assessments**

- Use the coordinate planes and students’ writings about the patterns they notice in Activity 1 as an assessment.
- Use students’ drawings, lists of ordered pairs, and completed pictures from Activity 2 as an assessment.
- Create a life-size coordinate plane. Give students cards with ordered pairs and the important labels and have them move on the plane beginning at the origin to their card’s location.

Extensions and Connections

- Have students make a list of real-life uses of coordinate planes.

- Invite an air traffic controller to the class to discuss how to read and determine the position of an aircraft.
- Have students create a game on code.org that requires them to use the x- and y-axis position for the players.

Strategies for Differentiation

- Provide students with inch graph paper instead of centimeter graph paper.
- Provide students with coordinate planes with the axes and lines already labeled.
- Have students write down the steps to follow to graph an ordered pair, or provide this information to them.
- Preteach essential vocabulary to some students as necessary before the introduction of the lesson.