Grade 6 First Quadrant Coordinate system

6.SS.8	
Identify and plot points in the first quadrant of a Cartesian plane using whole-number ordered pairs.	1. Label the axes of the first quadrant of a Cartesian plane and identify the origin. 2. Plot a point in the first quadrant of a Cartesian plane given its ordered pair. 3. Match points in the first quadrant of a Cartesian plane with their corresponding ordered pair. 4. Plot points in the first quadrant of a Cartesian plane with intervals of 1, 2, 5, or 10 on its axes, given whole-number ordered pairs. 5. Draw shapes or designs, given ordered pairs in the first quadrant of a Cartesian plane. 6. Determine the distance between points along horizontal and vertical lines in the first quadrant of a Cartesian plane. 7. Draw shapes or designs in the first quadrant of a Cartesian plane and identify the points used to produce them.

Clarification of the outcome:

- This outcome concerns a basic way of identifying position on a flat surface by means of two positive numbers, the x and y coordinates. The outcome should not be conceptually difficult for students, especially for those students who have played 'Battleship'.

Required close-to-at-hand prior knowledge:

- Have number recognition skills.
- Understand horizontal and vertical directions.
- Understand a number line.

SET SCENE stage

The problem task to present to students:

Organize students into pairs.

Hand each student a different map with a location marker somewhere on it (see sample map).

Hand each student the other student's map as well but that map does not have the marker on it (see sample map).

Each student privately determines a method for telling his/her partner where the location of the marker is on the marked map.

Each student takes a turn in telling the other student the location of the marker, using his/her method. The other student uses that information to place the marker on the unmarked map.

The location of the placed marker is compared to the actual location of the marker.

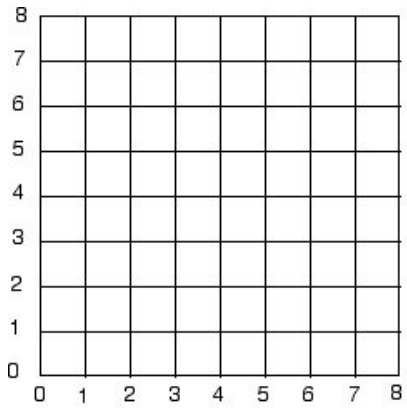
Comments

The task focusses directly on the heart of the matter - how can you identify where you are on a map (a flat surface that is an abstraction of reality)?

DEVELOP stage

Activity 1: Revisits SET SCENE and addresses indicator 1.

- Ask selected students to describe the method used to indicate where the dot is.
- Brainstorm methods for locating the position of something like a house on a map (e.g. north/south/east/west, longitude/latitude, street names, etc.).
- Ask students if a vertical and horizontal line having numbers attached to them could be used to locate a position [This approach may have occurred in the SET SCENE activity - if so, great, make use of it.]. Conclude the discussion by showing (or having students show) a coordinate system consisting of an intersecting grid of vertical and horizontal lines where whole numbers are marked on the leftmost vertical line and the bottom horizontal line (see example). [Note: The numbers are attached to the lines, not the gap between the lines.]



- Have students overlay a grid network (see above) on the map that had the location marker on it. Ask students how they could use the numbers that are at the left and bottom of the grid to identify the location of the marker. [Fraction issues may arise. Ask students to use the closest whole number value instead.] Lead students to understand that the coordinate system order we use (horizontal number, vertical number) is arbitrary. The order could have been (vertical number, horizontal number). A long time ago, someone decided to write the horizontal number first and then the vertical number for the location of a point.
- Introduce the terminology of x-coordinate and y-coordinate and ordered pair (x, y). Discuss where the origin is and why the term 'origin' is a good name for that location.

Activity 2: Addresses achievement indicators 2 and 3.

- Provide students with a coordinate grid with about five dots marked on them and with a letter (A, B, C, . . .) attached to each dot. Have students identify the location of each dot, using an ordered pair.
- Reverse the direction by providing students with a blank coordinate grid and a list of about five ordered pairs. Ask students to draw and label the point on the grid that corresponds to each ordered pair.

Activity 3: Addresses achievement indicators 2, 3, and 4.

- Provide students with a coordinate grid marked off in 2s, a grid marked off in 5s, and a grid marked in 10s. Have students draw 3 points on each grid and describe the location of each point, using an ordered pair.

Activity 4: Addresses achievement indicators 2, 3, 5, and 6.

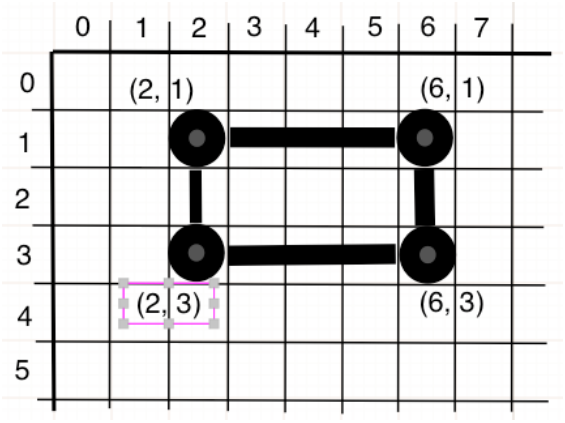
- Provide students with a list of ordered pairs IN ORDER OF JOINING that correspond to the vertices of a composite 2-D shape, for which at least one or more horizontal and vertical lines form the shape [e.g. (6, 0), (8, 0), (10, 4), (8, 4),(8, 10), (6, 10), (4, 4)]. Ask students to predict what the shape might be. Ask students to draw the shape by marking and joining vertices.
- Ask students to determine the distance along the horizontal and vertical lines found in the shape (e.g. the distance from (6, 0) to (8, 0) is 2).
- Repeat the above with a different 2-D shape.

Activity 5: Addresses achievement indicators 2, 3, 5, 7, and practice.

- Organize students into pairs. One student of the pair draws a 2-D shape on the first quadrant grid. He/she provides his/her partner with the coordinates of the vertices of the shape. The partner draws the shape, based on the given coordinates.
- The two students switch roles.

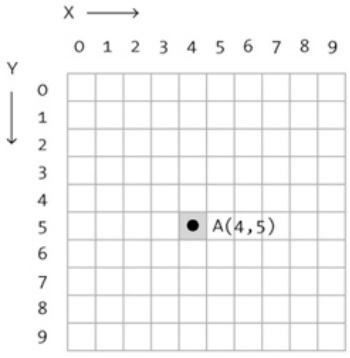
Activity 6: Addresses practice and another way to identify location.

- Ask students to research the coordinate system used on a computer screen (see diagram). Discuss their findings. Discuss why the computer screen coordinate system attaches numbers to the intersection of a row and column of squares (the gap), not to the intersection of lines.
- Ask students to create a pixel shape (see simple example) by identifying and drawing points in the way it is done on a computer screen. Discuss the results. [Notice that the coordinates of a pixel refer to an area (a square) and not to an intersection of lines.]



Comments

The origin is at the top left corner of a computer screen and the y-axis runs down the screen. The coordinates of a pixel (a point on the screen) are defined by the intersection of a row and column of squares. Why? Because a pixel has an area and a square has area. The intersection of two lines, a point, does not have an area. A point in mathematics has no area, When we draw a mathematical point, we draw it as a blob so that we can see what we are talking about.



Activity 7: Addresses achievement indicators 2, 3, 6, and practice.

- Ask students to create a first quadrant map of their neighborhood, placing important sites on it (e.g. the house where they live). Ask students to place the four main compass directions on the map (N/S/E/W). Ask students to indicate the coordinates of every important site they put on the map. Discuss results.
- Ask students to determine the distance between the site that is furthest west and the site that is furthest east. Ask students to determine the distance between the site that is furthest north and the site that is furthest south. Discuss results.

Activity 8: Assessment of teaching.

- Provide students with a coordinate grid. Ask them to draw a path consisting of four points on the grid and to provide the coordinates of each point. [Note: Ensure students realize that we are no longer referring to computer screen coordinate system.]

If all is well with the assessment of teaching, engage students in PRACTICE (the conclusion to the lesson plan).

An example of a partial well-designed worksheet follows.

The worksheet contains a sampling of question types. More questions of each type are needed.

The MAINTAIN stage follows the sample worksheet.

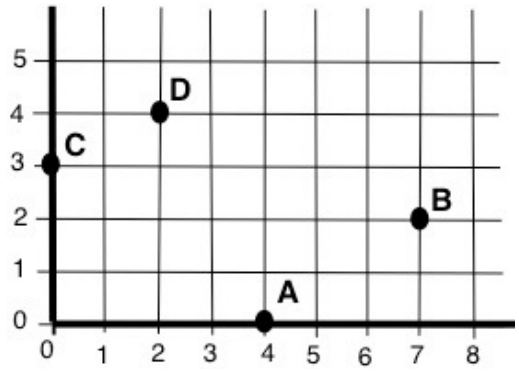
Question 1.

a) What are the coordinates of point A?
_____

b) What are the coordinates of point B?
_____

c) What are the coordinates of point C?
_____

d) What are the coordinates of point D?
_____



Question 2.

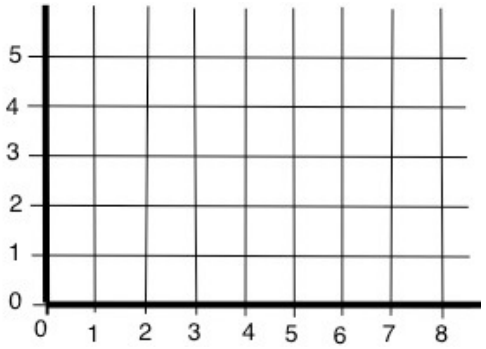
Place each point on the coordinate grid and label it (A, B, etc.).

Point A is at (2, 5)

Point B is at (0, 4)

Point C is at (0, 0)

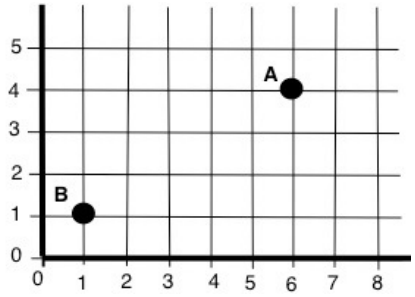
Point D is at (3, 0)



Question 3.

a) What is the horizontal distance between point A and point B? _____

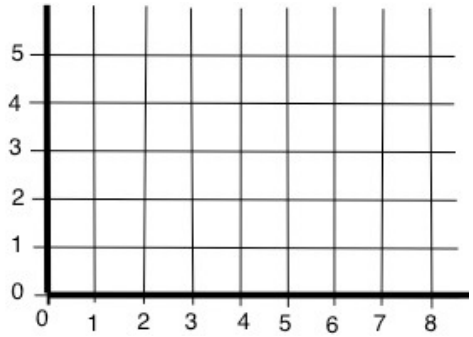
b) What is the vertical distance between point A and point B? _____



Question 4.

Place the following points in order on the grid:
A (2, 2); B (5, 0); C (5, 3); D (2, 5)

What is the name of the shape formed?
_____



MAINTAIN stage

Mini-task example

Every so often:

- Present students with a shape draw in the first quadrant. Ask them to attach coordinates to the labeled points. [E.G. Point A has coordinates (4, 7).]

Rich-task example #1

Provide students with four ordered pairs that are the vertices of a rectangle (situated parallel to the X and Y axes). Ask them to draw the shape formed by the vertices and to determine its area and perimeter.

Rich-task example #2

Provide students with three ordered pairs that are the vertices of an isosceles triangle. Ask students to draw the shape and name it. Ask students to shift (translate) the shape vertically up two grid lines and horizontally left 3 grid lines. Ask students to write the ordered pairs for the new locations of the vertices.

Comments

Each rich-task example involves integrating the coordinate system with other mathematical concepts.