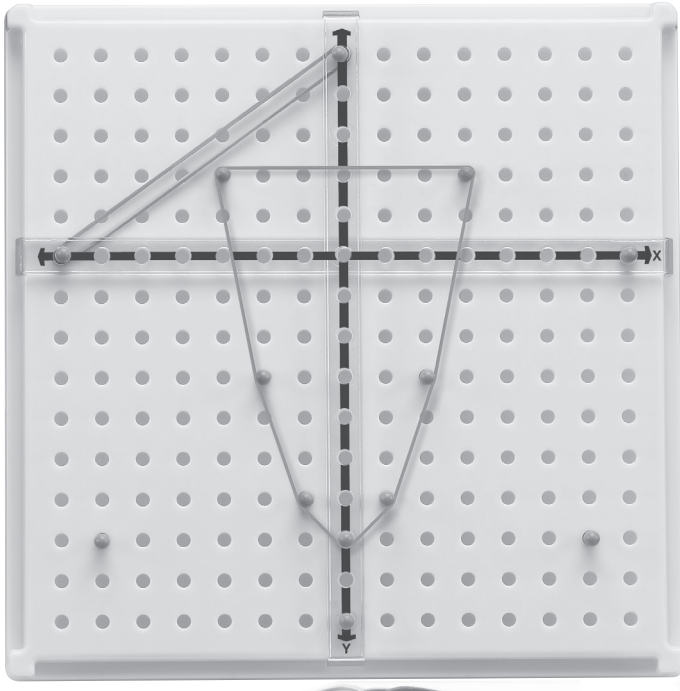
Learning About...®

XY Coordinate Pegboard

A Guide to Teaching Strategies, Activities, and Ideas



hand2mind

INTRODUCTION

Learning About...® XY Coordinate Pegboard Activity Guide is a resource providing hands-on activities and ideas that allow you, the teacher, to lead students in an active exploration of the world of graphing. The activities presented involve students in the investigation of abstract concepts through the use of manipulatives. Students are encouraged to think critically, plan strategies, record their answers, and share their results.

The Learning About...® XY Coordinate Pegboard emphasizes:

- communication
- problem solving
- exploration
- analysis

Each **XY Coordinate Pegboard** comes with 50 pegs and rubber bands.

The XY Coordinate Pegboard can be used to—

- graph coordinates in 1, 2, or 4 quadrants
- show translations of geometric figures
- display bar graphs and surveys
- graph lines

Exploring with the XY Coordinate Pegboard

Students should be allowed free time to investigate and experiment with their XY Coordinate Pegboard before the guided activities begin. You may have to assist students in placing the moveable axes on the pegboard. Have them snap the *y*-axis in place first and then place the *x*-axis over the *y*-axis.

INTRODUCTION TO FIRST QUADRANT GRAPHING

Group Size: Pairs or small groups

Procedure: Provide each student or group of students with a XY Coordinate Pegboard and pegs. Have them slide the vertical axis all the way to the left and the horizontal axis all the way to the bottom.

- Which axis does the 1st coordinate correspond to? [horizontal axis]
- Which axis does the 2nd coordinate correspond to? [vertical axis]

Tell students that because the order of the coordinates does matter, the name of each pair of coordinates is referred to as an ordered pair. Instruct students to place pegs in for the following ordered pairs on their XY Coordinate Pegboard: (0, 5), (5, 10), (10, 5). Have them connect the ordered pairs with rubber bands.

- Which axis does the first ordered pair lie on? [vertical axis]
- What geometric shape do the ordered pairs form? [triangle]

Have one student in each group plot random ordered pairs on their XY Coordinate Pegboard. Have their partners determine the coordinates of each ordered pair.

Observe students carefully as they plot their ordered pairs. Be mindful of students who might plot the coordinates in the incorrect order.

LOCATE AND NAME ORDERED PAIRS

Group Size: Pairs or small groups

Warm-Up: Before distributing the XY Coordinate Pegboard to students, remind students that the first coordinate represents the horizontal axis and the second coordinate represents the vertical axis. Have students adjust the moveable *x*- and *y*- axes for either 1, 2, or 4 quadrants.

Procedure: Have one student secretly place 10 pegs on the pegboard. Have the other student name each of the coordinate locations and write down the direction to each peg starting from (0, 0).

Observe students to ensure that they are placing the pegs and writing down their directions correctly.

Repeat this exercise using multiple quadrants for students who have mastered the activity. Have the students describe what types of ordered pairs are in each of the quadrants and those that lie on each of the axes. [ordered pairs in the upper right quadrant: (positive number, positive number); in the lower right quadrant: (positive number, negative number); in the upper left quadrant (negative number, positive number); in the lower left quadrant: (negative number, negative number); ordered pairs that lie on the *x*-axis: (number, 0), on the *y*-axis: (0, number).]

FOLLOWING DIRECTIONS

Group Size: Pairs or small groups

Warm-Up: Distribute the XY Coordinate Pegboard to each student or group of students, along with several rubber bands. Make sure they can name random coordinates on their pegboards before they begin this activity. Have students adjust the moveable *x*- and *y*- axes for 1, 2, or 4 quadrants.

Procedure: Have students take turns secretly creating a basic shape on the pegboard with pegs. Have them connect each of the pegs with a rubber band. Next, have the student share the location of each peg with their partner using directions beginning at (0, 0). For example, "The first peg is located 2 spaces to the right and 4 spaces up." describes the ordered pair for (2, 4). After all pegs are placed, have the partner use rubber bands to connect the ordered pairs on his or her pegboard and guess the shape.

Listen to students as they give one another directions for how to move from one coordinate to another to ensure they are accurately describing movements on the pegboard.

Invite students to talk about the pattern of the coordinates that form each shape. For example, a rectangle will have two ordered pairs with the same first coordinate and two ordered pairs with the same second coordinate.

Once your students have mastered plotting basic shapes, have them try plotting rhombi, parallelograms, or trapezoids.

DETERMINING DISTANCE BETWEEN ORDERED PAIRS

Group Size: Individuals

Procedure: Give each student a XY Coordinate Pegboard. Have them plot two points, with the same first or second coordinate, on their pegboard and find the distance between the two points.

Observe students as they find the distance between the two points to ensure they understand that they are to count each space between the points accurately.

Once students have mastered finding the distance between two ordered pairs, have them plot squares and rectangles. They should connect the figures with rubber bands. Have them determine the distance between each set of points for the sides of each of the figures.

PLOT POINTS, GIVEN DISTANCE

Group Size: Pairs or small groups

Warm-Up: Plot the points (5, 0) and (5, 7) and have students determine the distance. Next, plot (0, 4) and (3, 4) and have them determine the distance. Make sure students have mastered finding the distance between two points on a vertical or horizontal line, before they begin this activity.

Procedure: Provide a XY Coordinate Pegboard and several pegs for each group of students. The student with the pegboard will ask a partner to pick a number between 1–7 to be used as a distance between two numbers. The student will then plot any two points which are the given distance apart.

Encourage students to determine whether there are several possible solutions. Challenge them to find as many different solutions as they can.

Instruct students to explain how to determine the distance between two points. [To find the distance between two ordered pairs on a horizontal line, find the difference between the 2nd coordinates. To find the distance between two ordered pairs on a vertical line, find the difference between the 1st coordinates.]

Once students have mastered determining the distance between two points on a vertical or horizontal line, have them repeat the exercise, using the given distance as the side of a square. Have them plot several squares on their pegboard as different possibilities.

POSITIVE AND NEGATIVE COORDINATES

Group Size: Pairs or small groups

Procedure: Draw the following table on the chalk board:
(Note: All answers are in brackets and should not initially be filled in.)

1st Ordered Pair	2nd Ordered Pair	Distance
(0, 5)	(0, -3)	[8]
(2, 0)	(2, -5)	[5]
(1, 5)	(-1, 5)	[2]
(-4, 3)	([-9 or 1], 3)	5
(-2, -1)	(-2, -3)	[2]
(-1, 1),	(-5, 1)	[4]
(-5, -4)	(-5, -7)	[3]
(-2, -5)	(-2, [-7 or -3])	2
(-5, 3)	(-5, -3)	[6]
(-2, 1)	([-5 or 1], 1)	3

Ask students to help you fill in the table.

- Why do some rows have two answers? [Distance away from a given ordered pair can be measured in any direction.]
- Explain the strategy you used to find the distance between two ordered pairs.

SLIDES ON A GRAPH

Group Size: Pairs

Warm-Up: Go over several congruent polygons with students. Have them name the shape and point out their vertices. Also, review the meaning of "a translation" with students.

Procedure: Each student takes a turn secretly making polygons on their pegboard. They tell their partner the location of each of the vertices. Their partner puts pegs in each of the vertex holes and uses a rubber band to connect each point. Then they name the shape that has been formed. The student then makes a second congruent shape on the grid and gives their partner the new vertices. The partner then guesses the translation that takes place, describing what changes were made to both the *x*- and *y*-coordinates. Students switch roles and repeat the activity.

- How did you determine the translation? [Count how many places the pegs have moved from their original location.]

Encourage students to use multiple shape selections and translations.

FLIPS ON A GRAPH

Group Size: Pairs

Warm-Up: Review the meaning of "a reflection" with students.

Procedure: Students take turns making polygons on their pegboard and giving their partner the ordered pairs for each of the vertices. The partner graphs the shape. The student then tells his or her partner to flip the shape over the *x*- or *y*-axis. The partner will graph the reflected shape. Check students' pegboards to ensure they understand how to "flip" their shapes over the given axis.

- Describe what happens to a shape when it is reflected. [When you reflect a shape over an axis, the axis acts like a mirror. The new shape is a reflection or mirror image of the original shape. The vertices of the new shape are not in the same position as in the original shape, so the orientation of the reflected shape is different than the orientation of the original shape. However, the two shapes are congruent. Each coordinate should be the same distance from the *x*- or *y*- axis.]

TURNS ON A GRAPH

Group Size: Pairs

Warm-Up: Review the meaning of "a rotation" with students. Also, review how to rotate a polygon 45°, 90°, 180°, and 270°. Distinguish between clockwise and counterclockwise rotations.

Procedure: One student makes a polygon on his or her pegboard and tells their partner the vertices. The student rotates their shape based on their partner's direction of 45°, 90°, 180°, or 270° either clockwise or counterclockwise. After the shape has been rotated, the student states the new vertices. Have students switch roles and repeat the procedure for several different shapes.

- Describe what happens to a shape when it is rotated. [Rotating a shape about a point is similar to spinning it around the point. The point of rotation stays fixed, but the other points move the given number of degrees around the rotation point.]

PERIMETER

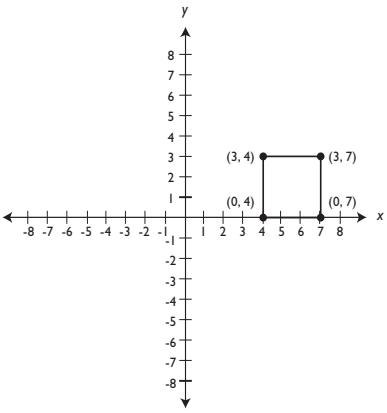
Group Size: Individuals

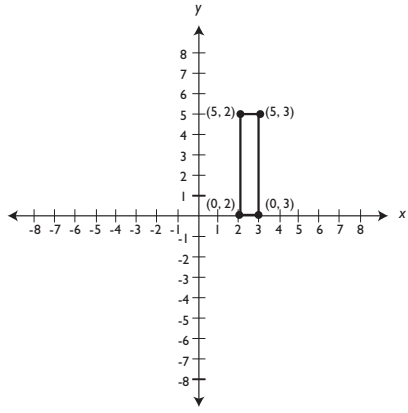
Procedure: Put the following table on the chalkboard:
(Note: All answers are in brackets and should not initially be filled in.)

Vertices	Perimeter
(0, 4); (0, 6); (1, 4), (1, 6)	[8]
(2, 4); (2, 8); (3, 4); (3, 8)	[10]
(-1, 3); (-1, 7); (-5, 3), (-5, 7)	[16]
(-2, 4); (-2, -1); (3, 4); (3, -1)	[20]
(-5, -2); (-5, 6); (3, -2); (3, 6)	[32]

Have students determine the perimeter of each of the given rectangles, using their pegboard and rubber bands to connect each of the vertices.

Have students explore ways to create different rectangles with the same perimeter.





Example:

Square with perimeter of 12

Rectangle with perimeter of 12

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