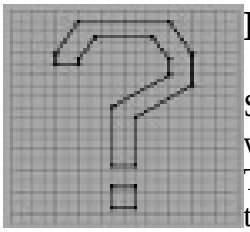

Do You See What I See? Graphing on the Coordinate Plane

Students will be given integer and decimal coordinates that will reveal a picture when graphed. Students will also create their own images to challenge classmates. This lesson can be extended to polygon attributes for 5th and 6th grade, and transformations and proportional reasoning for 7th and 8th grades.

Grade Level: 7th - 8th

Topics: Place Values
Proportional Reasoning
Geometry: graphing on the coordinate plane
two-dimensional figures on the coordinate plane
transformations on the coordinate plane

Math Standards: 7.2RP 8.1G
7.1G 8.2G
8.3G
8.4G

Goals:

- Students will be able to graph (x,y) coordinates in all 4 quadrants.
- Students will recognize the relationship between positive and negative numbers.
- Students will use place value to create decimal coordinates to the hundredths.
- Students will transform figures using reflection, translation and dilation.
- Students will be able to identify properties of two dimensional figures.

Prerequisite Knowledge: Student should be able to graph integer coordinates in the first quadrant of the coordinate plane.

Materials list:

- 8 ½ x 11 sheets of grid paper in 1 cm and ¼ inch sizes
- large sheets of 1 inch grid paper **or** grid for overhead/computer projector
- Mystery Pictures activity sheet
- rulers
- Cartesian Plane w/all 4 quadrants
- colored pencils

Activity time: 2 – 4 class periods

References: illuminations.nctm.org/Activities.aspx?grade=all&standard=all
Turtle Pond
Scale Factor
Shape Sorter, Shape Tool, Shape Cutter
www.nsa.gov/academia
select Middle School Geometry
“Exploring Transformations”
“What's Your Coordinate”

Directions for Graphing: Students will graph the given points and connect the points by following the arrows. Each row of coordinates begins a new line of the drawing. Students should connect the points as they go and not graph all coordinates first.

Lesson Plans

Day 1:

Tell students that when they graph the coordinates given to them, it will reveal a picture. Challenge students to try "Boo!" using centimeter grid paper labeled in increments of 1. Have Students work with a partner.

Discuss the idea of infinite points on the coordinate plane and that the numbering of the system can vary. Using ¼ inch grid paper, have students complete "Two Cats". Students may want to only draw quadrant one on the grid. Have students work with a partner to complete the picture. Each team should add features to the picture and write the coordinates. Have students write these on the board or on chart paper for classmates to try.

Students should work independently on "Autumn Night". As a helpful hint, students could think of numbering by nickels from 0 to $2.

Day 2:

Students will design their own pictures. Challenge them to include fractional or decimal coordinates. It is helpful to draw the picture first and then determine the directions. Students should exchange their coordinates so classmates can assess accuracy as they duplicate their drawings.

Day 3:

Students will need a copy of the Cartesian Plane already numbered. They should be given the directions for "Furry Friend". Have each student graph the points and create the picture.

Students should work with a partner to *reflect* the picture across the y-axis and then across the x-axis. Students should compare their results with other classmates. ***Solutions***: across the y-axis, all x-coordinates are opposite the original; (3,4) becomes (-3,4) and the figure is now in quadrant II. Across the x-axis, the x-coordinates remain the same, the y-coordinates are opposite; (-3,4) becomes (-3,-4).

Students should now do a slide *translation* of the picture. Write the directions on the board as (x+3, y-8). Discuss what this will do to the picture and the coordinates. Have students determine the new coordinates before graphing. Working with a partner, students should graph the new coordinates and then check to see that the figure has moved right 3 spaces and down 8. Discuss how students were able to determine that their figure was translated correctly. ***Solution***: the first row of coordinates would be (6,-4), (7,-4), (8,-5) and (7,-5).

Students will work independently to reflect "Lighting the Night" and should select a slide translation for the picture. Have students compare their work with classmates.

Day 4:

Students will need a colored pencil, regular pencil, ¼ inch grid paper, and a ruler. Students will create the four quadrants of the Cartesian plane on the grid paper and number the axes. Students will then graph "Computer" using pencil. Using the colored pencil, students will *dilate* the picture by a scale factor of 2. Students can work with a partner to compare ideas. Coordinates of the enlarged picture should be (2x, 2y). Have students determine the area of the smallest computer rectangle. ***Solution:*** the rectangle is 1.75 in by 1 in which is 1.75 sq in; the enlarged rectangle is 3.5 in by 2 in with an area of 7 sq in. Students should discuss why the area increased four times. Discuss the idea of proportion and similar figures with the class. Have students find as many equal ratios as possible in their two pictures. For example, (-3,-2) and (-6,-4). -3/-6 = -2/-4; -3/-6 = -2/-4. Students could also use lengths of the original picture and its enlargement to find ratios that are equal.

Have students graph "All Together" on another paper. Challenge them to *dilate* the picture by a scale factor of 2.5. It would help them to determine the new coordinates first. Ask students "How will you know the picture is correct?" Discuss how they could use ratios to check for proportion.

Students can work independently to draw "Lighting the Night" and dilate with a scale of 0.5.