LESSON
2

Objective

Understand the terms *reflection* of a geometric figure and *line of reflection.*

Common Core State Standards

- **8.G.3** Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

Geometry

Reflections (Flips)

Students can expand their understanding of congruence by studying flips (reflections), turns (rotations), and slides (translations). A reflection "flips" a figure over a line called the *line of reflection*. A *reflection* over a line is a transformation in which each point of the original figure has a corresponding point that is the same distance from the line of reflection, but on the opposite side of the line.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *Does the figure you formed by reflecting it look the same as the original figure? How is it like the original? How is it different?*
- **Ask:** *How do the coordinates change when the pre-image (the original image) is reflected over the* y*-axis?* (The *x*-coordinate on the image is the opposite of the *x*-coordinate of the pre-image.) *How would the coordinates change if the pre-image were reflected over the* x*-axis?*
- **Ask:** *How far are the points on the pre-image from the* y*-axis (line of reflection)? How far are the points on the image from the* y*-axis (line of reflection)?*

Solve It

Reread the problem with the students. Have them draw a diagram of the two flower gardens in Mr. Lanka's yard, indicating the line of reflection. Ask them to explain what makes this transformation a reflection (flip) over a line of reflection.

More Ideas

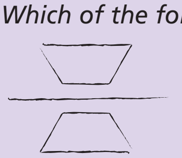
For another way to teach about reflections (flips)—

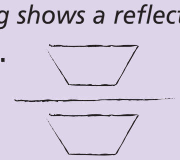
- Have students plot two geometric figures on the XY Coordinate Pegboard (Quadrants I and II as before) and tell whether or not the figures represent a reflection. If they do, have them indicate the line of reflection. The points are as follows: *A*(–7, 4), *B*(–6, 6), *C*(–4, 6), *D*(–3, 4); *A'*(3, 4), *B'*(4, 6), *C'*(6, 6), *D'*(7, 4).

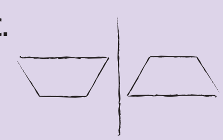
Formative Assessment

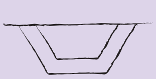
Have students try the following problem.

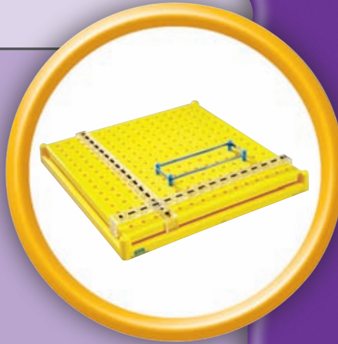
Which of the following shows a reflection and the line of reflection?

A. 

B. 

C. 

D. 



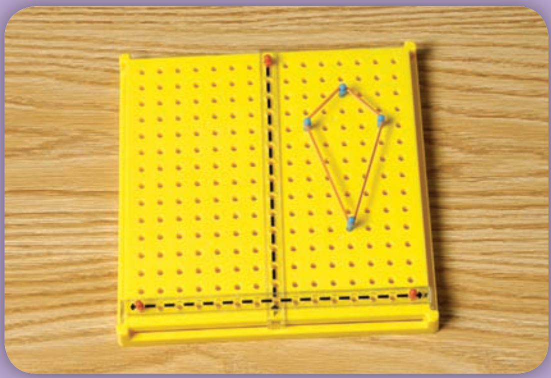
Try It! 30 minutes | Pairs

Here is a problem about reflections and lines of reflection.

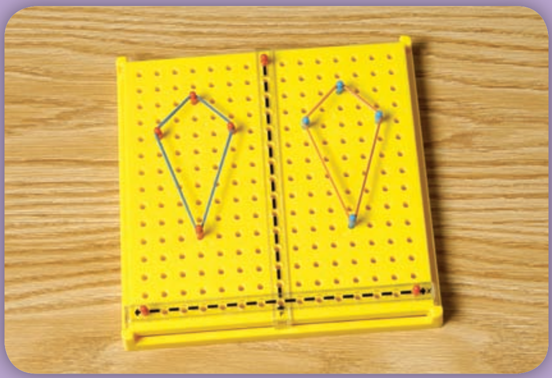
Mr. Lanka has a large flower garden shaped like a kite on one side of his yard. He wants to be able to stand in the middle of the yard and look to one side and then the other and see the same shape, just as if he were looking in a mirror. What will Mr. Lanka's landscape plan look like with both flower gardens?

Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

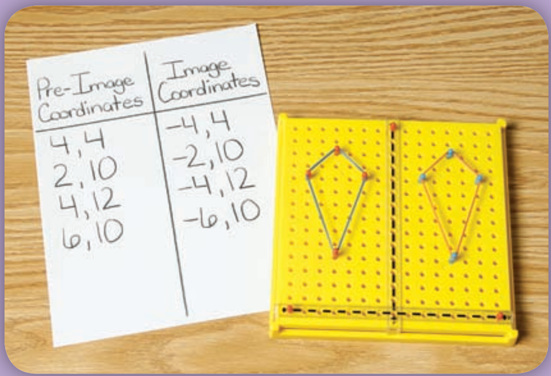
Materials
- XY Coordinate Pegboard
- paper (1 sheet per pair)
- pencils (1 per pair)



1. Have students set up the pegboard for graphing in Quadrants I and II. Have students use blue pegs to plot the following points: (4, 4), (2, 10), (4, 12), and (6, 10). Students should connect the points with a rubber band. These represent the location of Mr. Lanka's kite-shaped garden.



2. Have students reflect the image of the kite over the *y*-axis (the line of reflection) so that it is in the same position in Quadrant II as it is in Quadrant I. Have students use red pegs to plot this reflected image. Students should connect the points with a rubber band.



3. Have students compare the vertices of the pre-image to those of the image. Have students investigate the effect that reflecting a figure over the *y*-axis has on its coordinates.

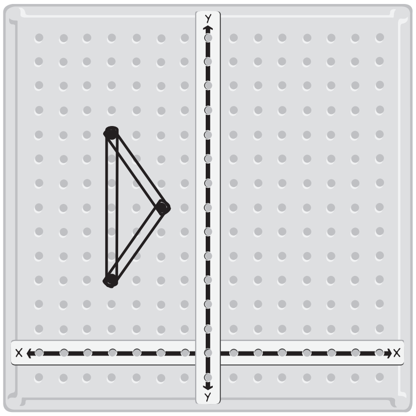
Look Out!

Watch for students who transpose coordinates and plot the *y*-coordinate first, rather than after the *x*-coordinate. Instruct students to start at the origin (0, 0). Remind them that the ordered pairs indicate how far to move horizontally and then vertically from the origin. Work through several examples that demonstrate the importance of order.

Answer Key

Use an XY Coordinate Pegboard to model each triangle. Write the coordinates of the vertices. Reflect over the axis shown. Name the coordinates of vertices for the new triangle. (Check students' work.)

1.



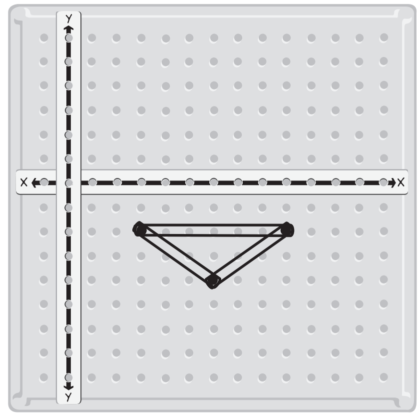
vertices of triangle

(–4, 3), (–2, 6), (–4, 9)

vertices of reflected triangle

y-axis; (4, 3), (2, 6), (4, 9)

2.



vertices of triangle

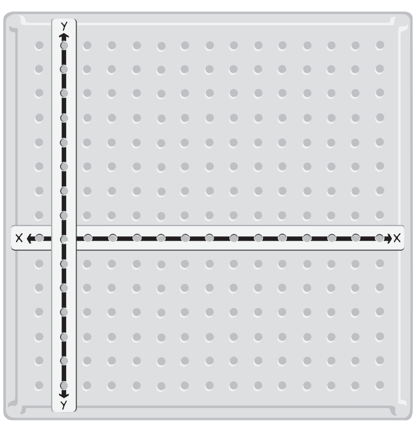
(3, –2), (9, –2), (6, –4)

vertices of reflected triangle

x-axis; (3, 2), (9, 2), (6, 4)

Using an XY Coordinate Pegboard, build each polygon. Then model each reflection. Draw the reflection on the grid below. Name the coordinates of the new polygon. How do the coordinates change? (Check students' models.)

3. rectangle with vertices at (2, 3), (2, 5), (4, 3), (4, 5) reflected over the *x*-axis

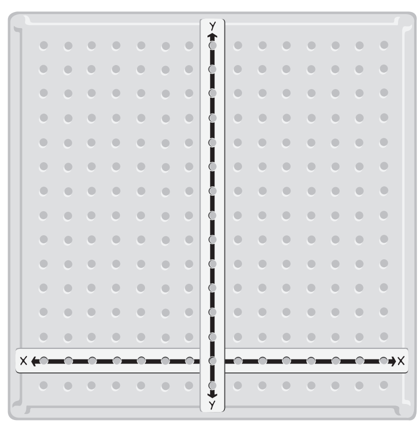


vertices of reflected triangle

(2, –3), (2, –5), (4, –3), (4, –5)

y coordinates are opposites

4. triangle with vertices at (3, 0), (4, 5), (1, 13) reflected over the *y*-axis



vertices of reflected triangle

(–3, 0), (–4, 5), (–1, 13)

x coordinates are opposites

Answer Key

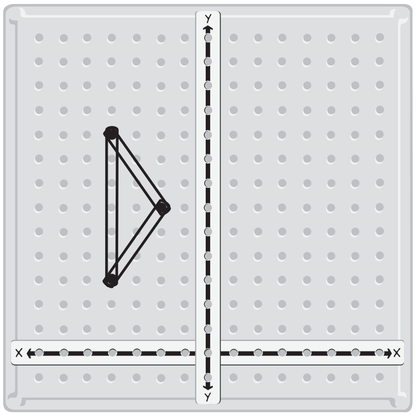
Challenge! How do you use the line of reflection to find the location of the reflected figure?

Challenge: (Sample) From the line of reflection, the original figure and the reflected figure have to be the same number of units away, but on opposite sides of the line.

Name ______________________________

Use an XY Coordinate Pegboard to model each triangle. Write the coordinates of the vertices. Reflect over the axis shown. Name the coordinates of vertices for the new triangle.

1.



vertices of triangle

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vertices of reflected triangle

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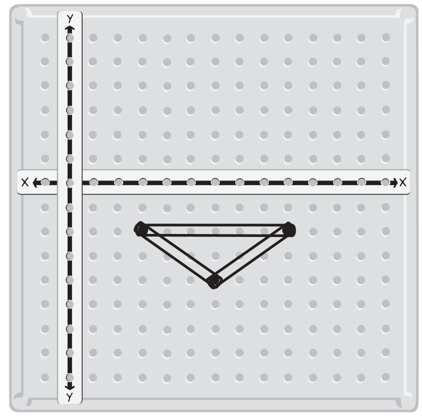
2.



vertices of triangle

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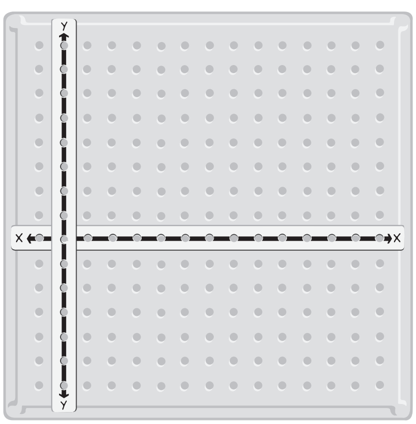
vertices of reflected triangle

____

Using an XY Coordinate Pegboard, build each polygon. Then model each reflection. Draw the reflection on the grid below. Name the coordinates of the new polygon. How do the coordinates change?

3. rectangle with vertices at (2, 3), (2, 5), (4, 3), (4, 5) reflected over the *x*-axis



vertices of reflected triangle

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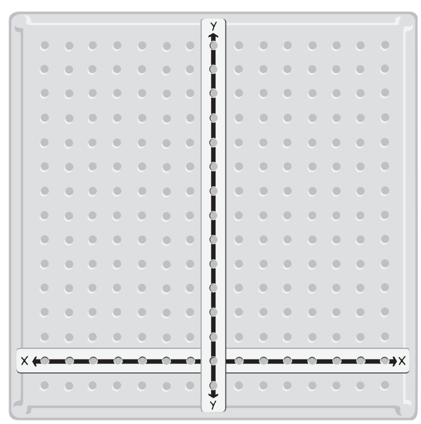
4. triangle with vertices at (3, 0), (4, 5), (1, 13) reflected over the *y*-axis



vertices of reflected triangle

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Name ___________________________________

Challenge! How do you use the line of reflection to find the location of the reflected figure?