LESSON 5

Objective

Dilate a plane figure.

Common Core State Standards

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

Geometry

Dilations

A *dilation* is a transformation that produces an image that is the same shape as the original but of a different size. Dilations with a scale factor greater than 1 produce a larger image, while scale factors between 0 and 1 produce a smaller image. Students at this level start their investigation of transformational geometry with reflections, translations, and rotations. A key point in understanding these transformations is that they result in figures that are congruent to the original. A dilation produces a figure that is similar to, but not congruent to, the original.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** *What points did you have to plot on the pegboard to model Lauren's pool? Lauren's patio? Lauren's yard?*
- **Ask:** *What is the scale factor of the pool to the pool and patio together?*
- **Ask:** *What is the scale factor of the pool to the yard?*
- **Ask:** *Is the area of the pool and patio together larger than one-half the area of the yard? Will the city allow Lauren to build the patio?*

Solve It

Reread the problem with students. Have students explain whether the city will allow Lauren to build the patio. They should use the terms *scale factor* and *dilation* in their explanations.

More Ideas

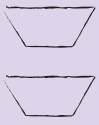
For another way to teach about dilations—

- Use Color Tiles or Centimeter Cubes to create growing (dilating) squares or rectangles with a scale factor of 2, 3, and 4.

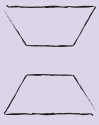
Formative Assessment

Have students try the following problem.

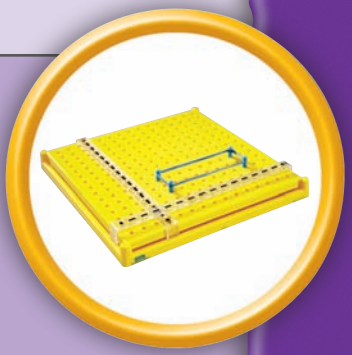
Which of the following diagrams shows a dilation?

A. 

B. 

C. 

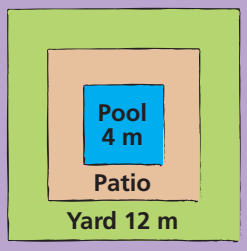
D. 



Try It! 35 minutes | Pairs

Here is a problem about dilations.

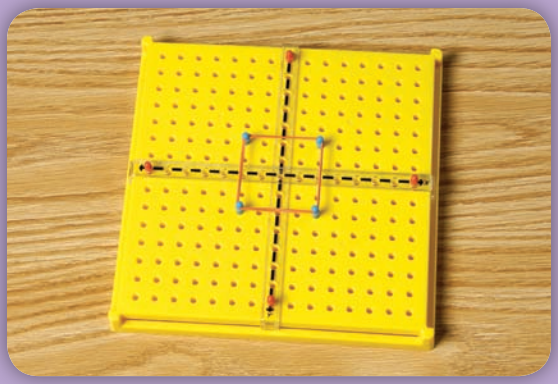
Lauren has a square pool in her backyard that is 4 meters on a side. She wants to surround it with a square patio whose sides are double the length of the pool. However, a city ordinance says that a pool and its surrounding patio cannot cover more than half the area of the yard. Her yard is a square 12 meters on a side. Will the city allow her to build the patio?



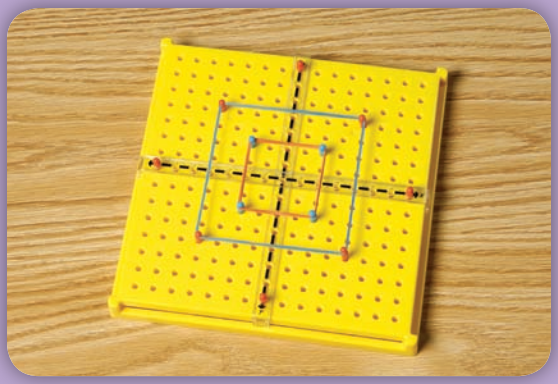
Introduce the problem. Then have students do the activity to solve the problem. Sketch the diagram on the board. Review scale factor, if necessary. Distribute the materials. Have students set up the XY Coordinate Pegboard for four-quadrant plotting.

Materials

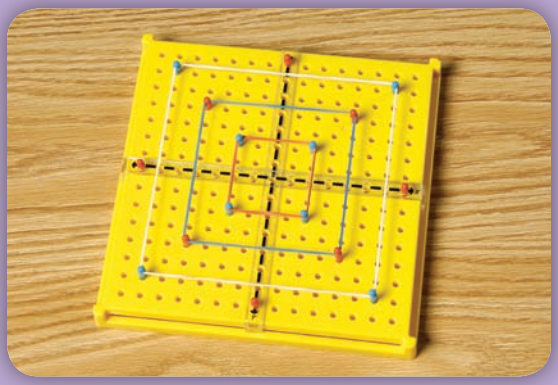
- XY Coordinate Pegboard
- paper (1 sheet per pair)
- pencils (1 per pair)



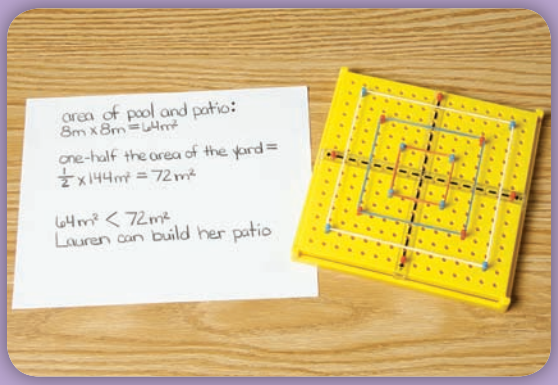
1. Have students plot the following points: (–2, 2), (2, 2), (2, –2), (–2, –2). Then have them connect the points with a rubber band to represent Lauren's pool.



2. Next have students determine the scale factor for the patio and then plot the patio on the pegboard. **Say:** *The scale factor is the number by which you multiply the original dimensions to get the new dimensions.* The scale factor is 2.



3. Now have students plot the sides of the yard on the pegboard. Students may need to use a separate rubber band for each side of this square.



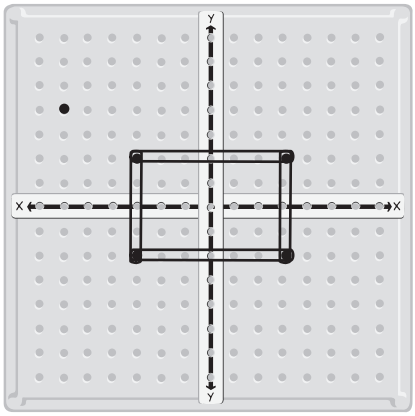
4. Have students calculate the area of the pool and patio together and compare it to the area of the yard. **Ask:** *Will the city allow Lauren to build the patio?*

Answer Key

Use an XY Coordinate Pegboard to model each rectangle. One vertex of a dilation is shown. Find the other vertices. Write the coordinates of the vertices after the dilation. What is the scale factor?

(Check students' work.)

1.



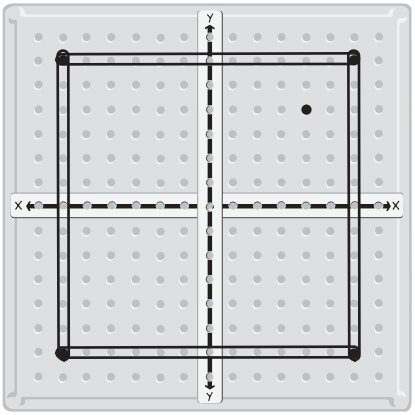
vertices of dilated image

(–6, 4); (–6, –4); (6, 4); (6, –4)

scale factor

2

2.



vertices of dilated image

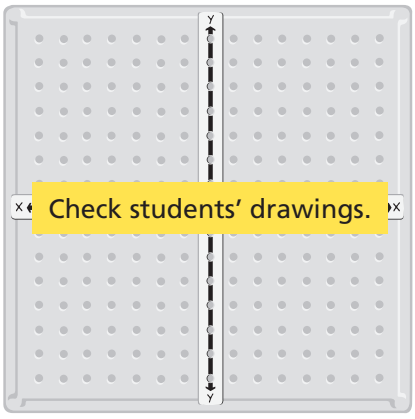
(–4, 4); (–4, –4); (4, –4); (4, 4)

scale factor

$\frac{2}{3}$

Using an XY Coordinate Pegboard, model a rectangle. Draw the figure and the dilated images on the grid below. Name the coordinates of the original rectangle and the dilated rectangle.

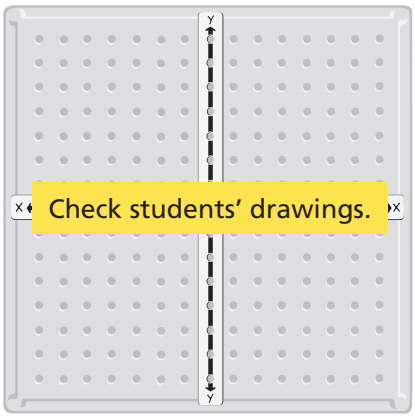
3. scale factor: 3



vertices of rectangle

vertices of dilated rectangle

4. scale factor: $\frac{1}{2}$



vertices of rectangle

vertices of dilated rectangle

Answer Key

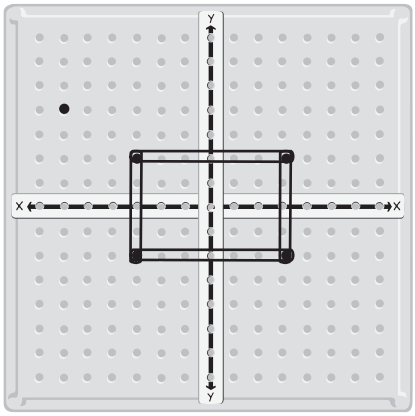
Challenge! Explain how you know from the scale factor if the dilated figure will be an enlargement or a reduction of the original figure.

Challenge: (Sample) If the scale factor is greater than 1, the dilated figure is a bigger size than the original figure. If the scale factor is a fraction less than 1, the dilated figure is a smaller size than the original figure.

Name _____

Use an XY Coordinate Pegboard to model each rectangle. One vertex of a dilation is shown. Find the other vertices. Write the coordinates of the vertices after the dilation. What is the scale factor?

1.



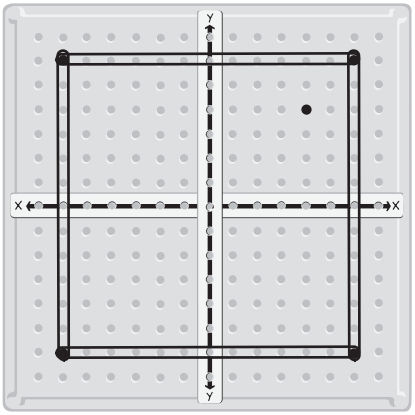
vertices of dilated image

_____

scale factor

_____

2.



vertices of dilated image

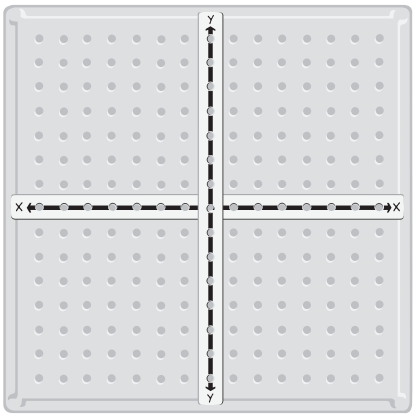
_____

scale factor

_____

Using an XY Coordinate Pegboard, model a rectangle. Draw the figure and the dilated images on the grid below. Name the coordinates of the original rectangle and the dilated rectangle.

3. scale factor: 3



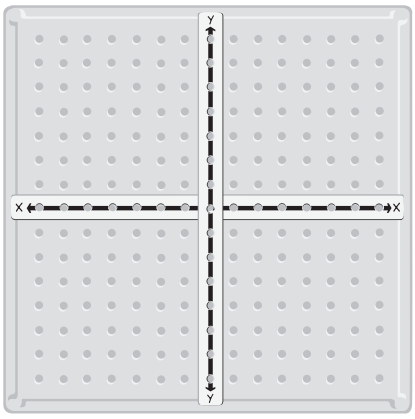
vertices of rectangle

_____

vertices of dilated rectangle

_____

4. scale factor: $\frac{1}{2}$



vertices of rectangle

_____

vertices of dilated rectangle

_____

Name _____

Challenge! Explain how you know from the scale factor if the dilated figure will be an enlargement or a reduction of the original figure.