LESSON 4

Objective

Rotate a plane figure a given number of degrees around a fixed point.

Common Core State Standards

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

Geometry

Rotations (Turns)

A *rotation* is a transformation that moves every point of a figure around a fixed point (usually a vertex or the origin of the coordinate plane). A rotation creates a figure that is congruent to the original figure. A rotation preserves distance from and orientation to the fixed point.

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

Talk About It

Discuss the Try It! activity.

- **Ask:** *Does the rotated (turned) figure look the same as the original figure (pre-image)? How is it like the original? How is it different?*
- **Ask:** *What does it mean for a figure to maintain its orientation as it turns?*
- **Ask:** *How many degrees did you rotate the trapezoid in order to bring it back to the starting point?*
- **Ask:** *What would happen if you rotated the trapezoid 60° each time? How many trapezoids would there be in the circle you generated?*

Solve It

Reread the problem with students. Have them write a brief description (with simple sketches) of how a rotation does not affect an object's distance from and orientation to a fixed point.

More Ideas

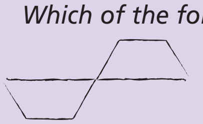
For other ways to teach about rotations—

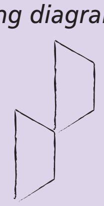
- Have the students rotate other Pattern Blocks on graph paper and notice how the figures maintain their orientation and distance regarding a center point.
- Have students practice rotations of multiples of 90° using the XY Coordinate Pegboard. Have students plot a shape and then re-peg it using clockwise and counterclockwise rotations.
- A Geoboard can be used similarly to the XY Coordinate Pegboard.

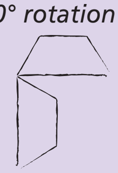
Formative Assessment

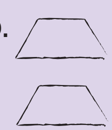
Have students try the following problem.

Which of the following diagrams shows a 90° rotation?

A. 

B. 

C. 

D. 

Try It!

30 minutes | Pairs

Here is a problem about rotations (turns).

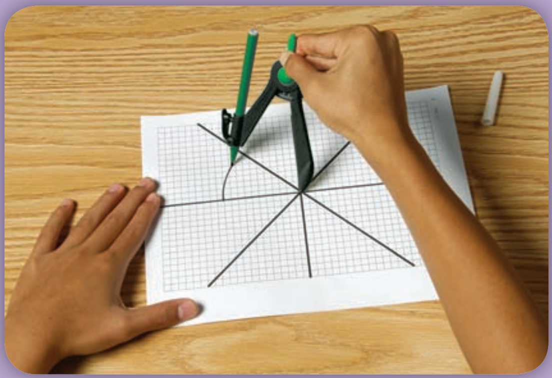
Jared is setting up stations for a relay game. The eight stations are to be evenly spaced from each other and set 10 feet from a center peg. The stations are trapezoids. Their smaller bases should face the peg. He has been asked to make a diagram showing where each station should be. What will his diagram look like?

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

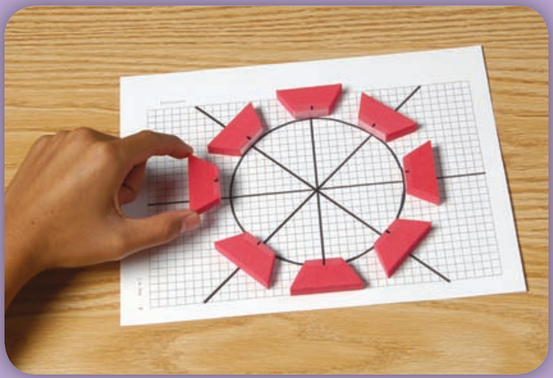
Materials

- Pattern Blocks (8 trapezoids)
- $\frac{1}{4}$-Inch Grid Paper (BLM 6; 1 per pair)
- marker
- tape
- drawing compass
- ruler
- protractor

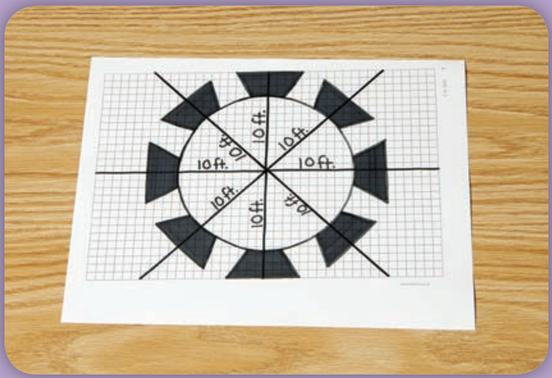
1. Have students put a piece of tape over the small base of each trapezoid. Then have them find and mark the middle of the small base.



2. Have students draw the *x*- and *y*-axes centered on the graph paper. **Ask:** *How many degrees must Jared rotate each station so that he can place them all evenly around the peg?* Next, have them draw lines that are at a 45° angle to the axes. Then have them draw a circle with a radius of 10 units from the origin.



3. Have students center a trapezoid over the point (10, 0) on the *x*-axis. **Ask:** *What is the distance from the middle of the circle to the marked point on the trapezoid?* (10 units) Have them put the remaining blocks in place where the lines intersect the circle.

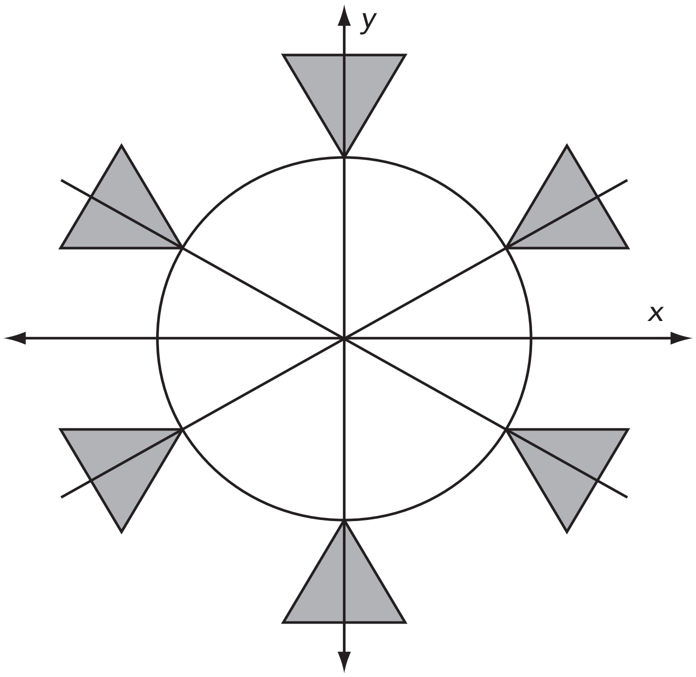


4. Finally, have students outline the trapezoids. They should convert the markings to feet using a scale of 2.5 inches:10 feet and label the length of each of the radii on the diagram.

Answer Key

Use Pattern Blocks and grid paper to model the rotations shown below. The triangle is rotated about the origin. Fill in the blanks. Find the degrees of rotation. (Check students' work.)

1.



One complete rotation is 360°.

The triangle is rotated 6 times.

The angle of rotation is 60°.

Using Pattern Blocks and grid paper, model the rotation of a square 4 times about the origin. Sketch the model.

2. (Check students' models.)

What is the angle of rotation when a square is rotated about the origin 4 times? 90°

Identify the angle of rotation about the origin for each number of rotations.

3. 5 rotations 72°

4. 12 rotations 30°

5. 3 rotations 120°

6. 10 rotations 36°

7. 9 rotations 40°

8. 15 rotations 24°

Answer Key

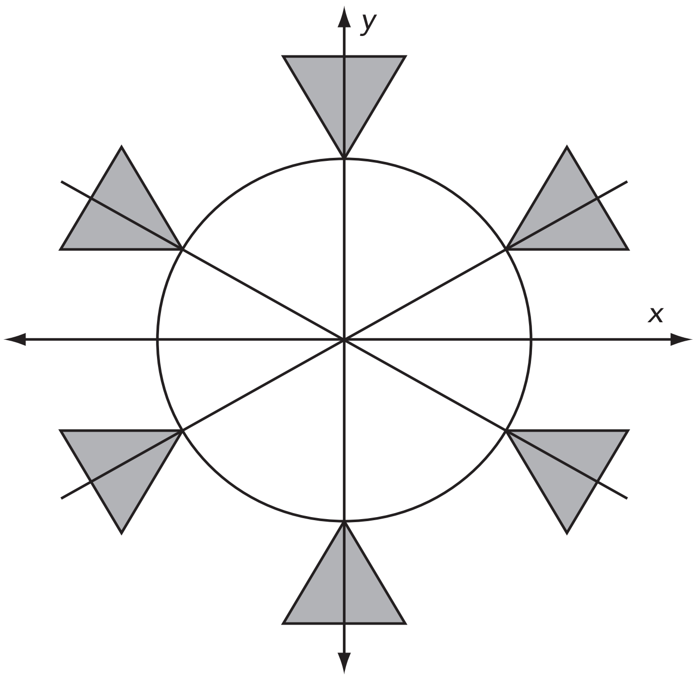
Challenge! Why do you use 360° as the dividend when you are finding an angle of rotation?

Challenge: (Sample) 360° is one complete rotation around a circle.

Name ________________________________

Use Pattern Blocks and grid paper to model the rotations shown below. The triangle is rotated about the origin. Fill in the blanks. Find the degrees of rotation.

1.



One complete rotation is ________.

The triangle is rotated _______ times.

The angle of rotation is _______.

Using Pattern Blocks and grid paper, model the rotation of a square 4 times about the origin. Sketch the model.

2.

What is the angle of rotation when a square is rotated about the origin 4 times? ___________

Identify the angle of rotation about the origin for each number of rotations.

3. 5 rotations ____________

4. 12 rotations ____________

5. 3 rotations ____________

6. 10 rotations ____________

7. 9 rotations ____________

8. 15 rotations ____________

Name ___________________________________

Challenge! Why do you use 360° as the dividend when you are finding an angle of rotation?

Name ____________________