

Rep Tiles

Lesson Topic _____ **Grade** _____

Creating similar shapes using a single shape 3

Lesson Length _____

60 minutes

NCTM Standards Addressed _____

- Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.
- Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes.
- Explore congruence and similarity.
- Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.
- Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.
- Build and draw geometric objects.
- Use geometric models to solve problems in other areas of mathematics, such as number and measurement.
- Understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute.
- Explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.

Sample State Standards Addressed _____

- Compare measurable characteristics of different objects on the same dimensions (e.g., time, temperature, area, length, weight, capacity, perimeter).
- Construct two- and three-dimensional shapes and figures using manipulatives, geoboards, and computer software.
- Determine the measurement of objects with non-standard and standard units (e.g., U.S. customary and metric).
- Use concrete objects to determine area and perimeter.
- Name and label geometric shapes in two and three dimensions (e.g., circle/sphere, square/cube, triangle/pyramid, rectangle/prism).
- Build geometric shapes using concrete objects (e.g., manipulatives). Predict how shapes can be changed by combining or dividing them.

Student Objectives

Students will:

- develop a deeper understanding of similarity
- review names of geometric figures
- make predictions about what happens to the perimeter of a shape when it is used to create a similar figure.

Grouping for Instruction

- Whole class for launch and closure
- Small groups of four to six for the investigation

Overview of Lesson

Students use pattern blocks of one shape at a time to try to create a similar shape. They then compare the perimeter of the new figure with the perimeter of the original shape and look for a pattern. The pattern is used to predict what will happen with other shapes.

Background Information

Students should have played with pattern blocks prior to starting this lesson. Students should be familiar with basic shapes and understand that the name of the shape remains the same even if the orientation changes. Students need to know how to find the perimeter of basic shapes. Familiarity with tilings of the plane would be beneficial. Students need some facility with a ruler.

Materials and Equipment

- Set of overhead pattern blocks
- A set of pattern blocks for each team
- A classroom set of rulers
- A classroom set of calculators

Procedure

A. Motivation and introduction

1. Use an overhead set of pattern blocks to show that four squares can be combined to create a new square that is similar to the original square. Explain: “Because the squares can be combined to create a similar square, we say the square is a ‘rep tile’ (for repeating tile). In fact, it is a rep-4 tile because it requires four squares to make a similar square.”

2. Remind students that for two shapes to be similar, corresponding angles must be congruent (the same measure) and corresponding sides must be proportional. Ask: “Is this true for the original square and the larger square just formed? Explain.”
3. Use six overhead squares to create a rectangle. Ask: “Is the larger shape similar to the original square? Why or why not?”
4. Ask: “Do you think other pattern blocks are rep tiles? How could you test your conjecture?”
5. Suggest that the students work on this problem in teams.

B. Development (including discussion points and feedback)

1. Place the students in heterogeneous cooperative groups.
2. Assign each student a task (leader, reporter, recorder, etc.).
3. Distribute the worksheet “Rep Tiles” (page 125).
4. Ask the teams to complete the investigation.
5. Circulate among the teams, guiding the students to complete the project.
6. Ask questions that will help students understand that they may have to rotate or flip the pattern blocks to make a similar shape.
7. Make sure each team compares the perimeters of the similar shapes.
8. Ask each team to report on one part of the investigation.
9. Ask questions to assess whether the students understand the concepts of perimeter and similarity, and the patterns discovered:
 - “If these shapes are similar, what must be true about the corresponding angles?”
 - “What does it mean for corresponding sides to be proportional?”
 - “How did you find the perimeter?”
 - “Justify your pattern. How do you know it always holds?”
10. Encourage the students to question whether each team has in fact found a rep tile, whether each team found a pattern that always holds.
11. Ask the students to predict the perimeter of a rep tile made from a rectangle that is one inch by three inches. Have a student show the rep tile on the overhead and measure the perimeter to determine if the conjecture is accurate.

C. Summary and closure

1. Ask students to write three mathematics concepts that they explored today (area, perimeter, similarity, rep tiles, etc.)
2. Have some students share what they wrote. Explore students’ understanding. (Did they learn what you wanted them to learn?)
3. Ask students why they think these concepts are important.

D. Assignment

Give examples of polygons that are not convex (as are all of the pattern blocks). Ask the students to find a non-convex polygon that is a rep tile for homework. Students should show a picture of their non-convex rep tile and how its similar shape was formed.

Assessment

- Observe the students during the investigation.
- Use anecdotal note cards to record your observations.
- Use prompting questions to help students find similar shapes and to understand what it means for shapes to be similar.
- Grade the group project, giving each team a group grade.
- Grade the homework, if you give them a rubric first.

4. Which of the other pattern blocks are rep-4 tiles? Complete the table below by recording the name of each pattern block that is a rep-4 tile, the perimeter of the pattern block, and the perimeter of the larger similar figure you created.

Pattern Block Name	Perimeter of Pattern Block	Perimeter of Rep Tile
Square	4	

5. Refer to the table above. Do you see a pattern between the perimeter of the original pattern block and the perimeter of the rep-4 tile formed using this pattern block? Describe the pattern using your own words.

6. Suppose the perimeter of a polygon is 12 centimeters. If four of these polygons form a similar polygon, what is the perimeter of the new, larger polygon?

Perimeter:

7. There is a triangle that is a rep-2 tile. Can you find it? Use what you have learned to sketch the triangle and the similar triangle formed using two of the original triangles. Find the perimeters of the two triangles.