

# LESSON 9

## Objective

Use patterns and function tables to solve problems.

## Common Core State Standards

- **6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation  $d = 65t$  to represent the relationship between distance and time.*

## Expressions and Equations

# Patterns and Function Tables

The ability to recognize and use patterns to solve problems forms the basis of algebraic thinking. Representing patterns in function tables allows students to discover patterns more easily and to see how  $x$ -values relate to  $y$ -values. These relationships can then be used to make predictions. Function tables will help students to graph relationships between  $x$  and  $y$ .

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

## Talk About It

Discuss the Try It! activity.

- **Ask:** What does the variable  $x$  in the function table represent? What does the variable  $y$  represent?
- **Ask:** What words can you use to describe the pattern in the function table? How does the function table help you see the pattern?
- **Ask:** Why should you test the function rule for all of the values in the table?

## Solve It

Reread the problem with students. After they build a model for 4 square stones, students can use the pattern in the table to predict the number of triangle stones for 6 square stones. Have students complete the function table to check their predictions.

## More Ideas

For other ways to teach about using patterns and function tables—

- Have students use triangle Pattern Blocks to find the perimeter of one triangle, then two, three, and four triangles placed side-to-side. They record the number of triangles as  $x$  in the function table and the perimeter as  $y$ . Have them predict perimeters for 6, 7, and 8 triangles placed side-to-side.
- Have students use Centimeter Cubes to build other patterns, such as triangular numbers. Guide them to use 1, 3, 6, and 10 Centimeter Cubes to build triangles. Have them use the pattern in the function table to predict the number of cubes used in the fifth figure.

## Formative Assessment

Have students try the following problem.

Raul is using blue and gold tiles to create a mosaic pattern. If  $x$  represents blue tiles and  $y$  represents gold tiles, how many gold tiles does Raul use if he uses 8 blue tiles?

$x$	$y$
3	9
4	12
5	15

- A. 11
- B. 18
- C. 21
- D. 24

# Try It!

20 minutes | Pairs

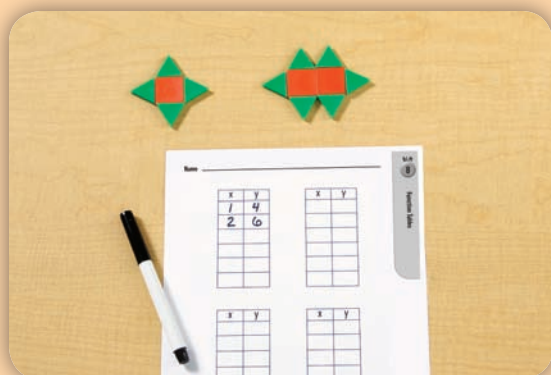
Here is a problem about patterns and function tables.

Lee Ann will use square and triangular stones to make a path in her garden. Each side of a triangular stone is the same length as each side of a square stone. The triangles will be used as a border around a row of squares. For example, she would use four triangles for a border around one square and six triangles for a border around two squares. How many triangles will she need for a border around six squares?

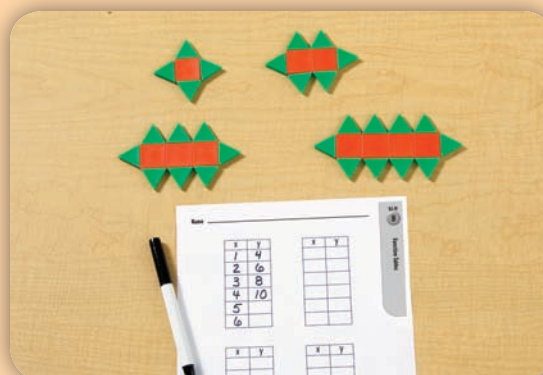
Introduce the problem. Then have students do the activity to solve the problem. Distribute Pattern Blocks, function tables, and pencils to students.

## Materials

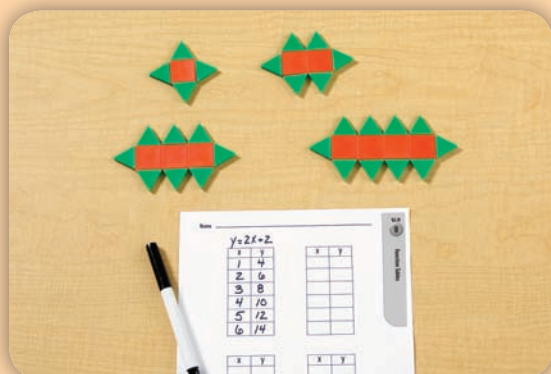
- Pattern Blocks (25 per pair)
- Function Tables (BLM 8; 1 per pair)
- pencils (1 per pair)



**1. Say:** Use a square Pattern Block to represent each square stone. Use a triangle to represent each triangular stone. Have students create models for paths with one and two squares. Then for each path have them record the number of squares in the x column and the number of triangles in the y column.



**2. Say:** Use more squares to model paths with three and four square stones. Add triangles and then fill in the next two rows of the table. Have students identify the pattern and use it to fill in the table for 5 and 6 square stones.



**3. Ask:** What operations can you perform on the x-values in the table to get the y-values? Guide students to see that they can multiply x by 2 and add 2 to get y. Have them write the equation as  $y = 2x + 2$  and then check that the equation works for all of the values in the table.

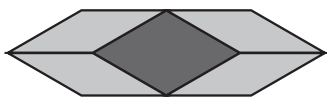
## Look Out!

Some students may have difficulty finding a rule to represent the pattern in the function table. Have them look at the model for two squares placed end-to-end. Point out that the number of triangles on each side of a square is twice the number of squares since there are two sides to each square and in addition there is a triangle at each end. Have them check that this pattern holds for each number of square stones.

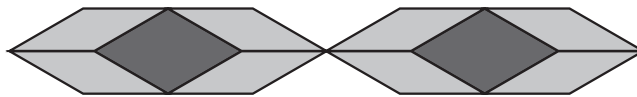
Use Pattern Blocks to model the pattern. Complete the table to show the relationship in the pattern. Write a rule for the pattern.


(Check students' work.)

1.



Let  $x$  = number of .



Let  $y$  = number of .

$x$	1	2	3	4	5	6
$y$	4	8				

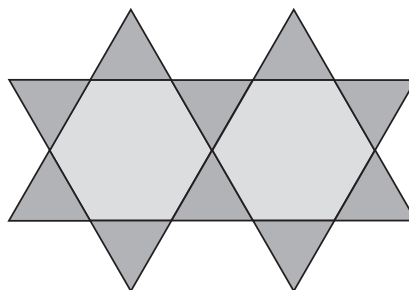
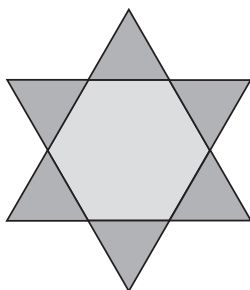
Rule: \_\_\_\_\_

3	4	5	6
12	16	20	24

$$y = 4x$$

Using Pattern Blocks, model the figure shown. Then create a pattern. Sketch the pattern. Make a table that shows the relationship in the pattern. Write the rule.

2.



$x$  = the number of hexagons;  
 $y$  = the number of triangles;

$x$	1	2	3	4	5
$y$	6	10	14	18	22

$$y = 4x + 2$$

Make a table for each function rule.

3.  $y = x + 5$

$x$	1	2	3	4	5
$y$	6	7	8	9	10

4.  $y = 4x$

$x$	1	2	3	4	5
$y$	4	8	12	16	20

5.  $y = 7 + x$

$x$	1	2	3	4	5
$y$	8	9	10	11	12

## Answer Key

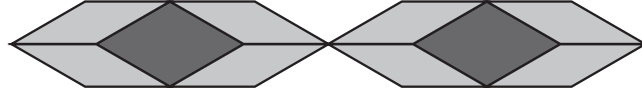
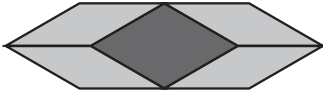
**Challenge!** Design your own pattern using Pattern Blocks. Then make a table to show the relationship of the numbers of each block as the pattern grows. Write the rule.

Challenge: Answers will vary.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Use Pattern Blocks to model the pattern. Complete the table to show the relationship in the pattern. Write a rule for the pattern.

1.



Let  $x$  = number of .

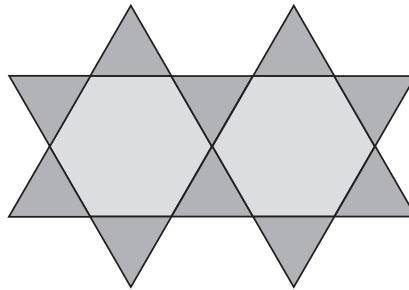
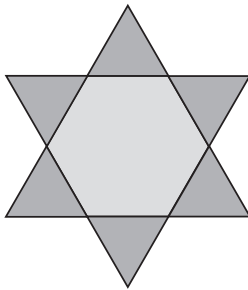
Let  $y$  = number of .

$x$	1	2	3	4	5	6
$y$	4	8				

Rule: \_\_\_\_\_

Using Pattern Blocks, model the figure shown. Then create a pattern. Sketch the pattern. Make a table that shows the relationship in the pattern. Write the rule.

2.



Make a table for each function rule.

3.  $y = x + 5$

4.  $y = 4x$

5.  $y = 7 + x$

Name \_\_\_\_\_

**Challenge!** Design your own pattern using Pattern Blocks. Then make a table to show the relationship of the numbers of each block as the pattern grows. Write the rule.

[illegible]

Name \_\_\_\_\_

x	y

x	y

x	y

x	y