REASONING 1.4

DEVELOPING CONCEPTS
Finding Patterns

For use with Lesson 1.4

GOAL

Use algebraic expressions to describe patterns.

MATERIALS

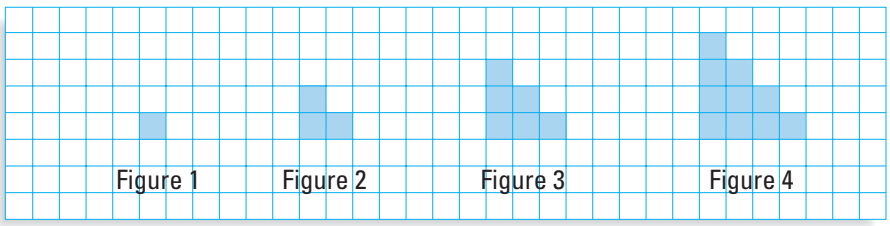
- graph paper
- toothpicks

Question

How can you use algebra to describe a pattern?

Explore

1 Copy the first four figures on graph paper. Then draw the fifth and sixth figures of the sequence.



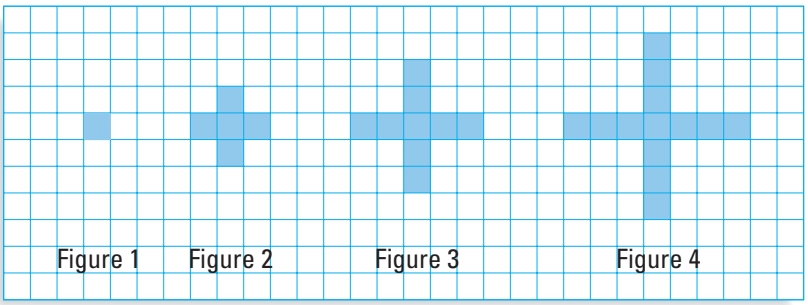
2 The table shows the mathematical pattern for the perimeters of the first four figures. Copy and complete the table.

Figure	1	2	3	4	5	6
Perimeter	4	8	12	16	?	?
Pattern	4 • 1	4 • 2	4 • 3	4 • 4	4 • ?	4 • ?

3 Observe that $4(1) = 4$, $4(2)$, $= 8$, $4(3) = 12$, and so on. This suggests that the perimeter of the nth figure is $4n$, where $n = 1, 2, 3, 4, \ldots$. Find the perimeter of the 10th figure.

Think About It

1. Copy the four figures below. Then draw the fifth and sixth figures.



2. Calculate the perimeters of all six figures. Organize your results in a table.

3. What is the perimeter of the 10th figure? Can you guess a formula for the nth figure?

Explore

1. Use toothpicks to model the perimeter of all six figures in Explore on page 22. Notice that the perimeter of each figure is equal to the number of toothpicks used to form the figure.

2. Change the shape of Figures 2–6 by moving toothpicks until the figures consist of n unit squares. Figures 2 and 3 in the sequence are shown below. Complete Figures 4, 5, and 6 on a separate sheet of paper.

Figure 2

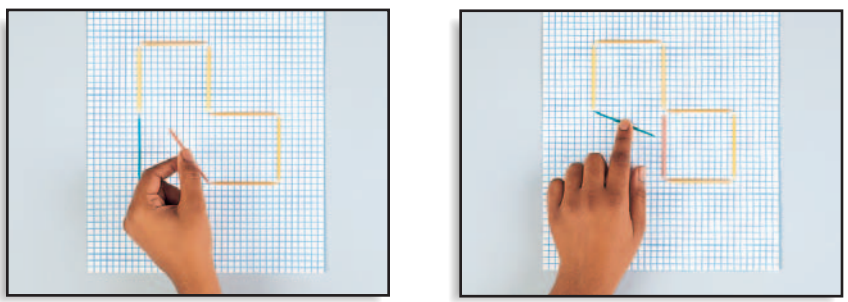
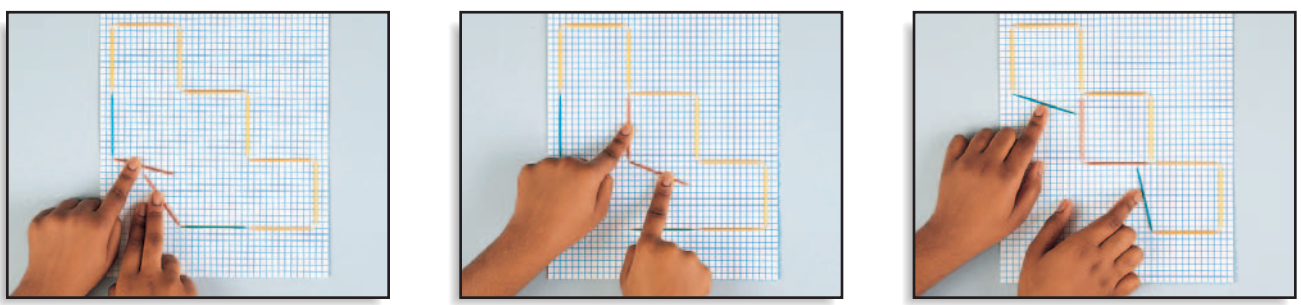


Figure 3



3. You should be able to conclude that if one square unit has a perimeter of $4 \cdot 1$, then n squares must have a perimeter of $4n$. This conclusion verifies the pattern you found on page 22.

Think About It

1. Use toothpicks to model the perimeter of all six figures in Exercise 1 on page 22.

2. Change the shape of the figures modeled above in Exercise 1 until they consist of n unit squares.

3. Do the number of unit squares verify the pattern found in Exercise 3 on page 22? Explain your reasoning.