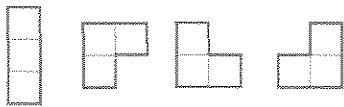# Polyominoes

You will need:

graph paper

Definition: *Polyominoes* are shapes that are made by joining squares edge-to-edge. The best known example is the *domino*.

Using three squares, you can find two different *trominoes*, the straight one and the bent one.

There are only two trominoes. The bent one is shown in different positions.

The following shapes are *not* polyominoes.

1. What part of the definition do they violate?

DISCOVERING POLYOMINOES

2. *Tetrominoes* are made up of four squares. There are five different tetrominoes. Find all of them.

3. Guess how many squares make up a *pentomino*. Find all twelve pentominoes. Make sure you do not "find" the same one more than once!

4. 💡 Find as many *hexominoes* as you can.

AREA AND PERIMETER

Large polyominoes may have holes in them, as in this 11-omino (i.e. polyomino of area 11).
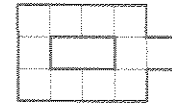
In this book, we will not discuss polyominoes with holes.

Definitions: The *area* of a two-dimensional figure is the number of unit squares it would take to cover it. The *perimeter* of a figure is the distance around it.

For example, the area of the domino is 2, and its perimeter is 6.

In this book, area and perimeter will provide you with many opportunities to discover and apply algebra concepts.

5. Here is a 10-omino. What is its area? What is its perimeter?
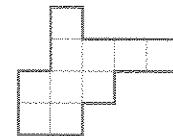
6. Draw some 10-ominoes, and find the perimeter of each one. It would take too long to find all of the 10-ominoes, but try to find every possible 10-omino perimeter.

7. Repeat problem 6 for 16-ominoes.

8. Draw as many polyominoes as you can having 10 units of perimeter, and find the area of each one.

9. Find some polyominoes having perimeter 16. It would take too long to find all of them, but try to find every possible area.

10. **Summary** Describe any patterns you noticed when working on this lesson.

11. ◆— Have you found any polyominoes having an odd-number perimeter? If you have, check your work. If you haven't, explain why.

Area and perimeter of polyominoes are related. It is not a simple relationship: for a given area, there may be more than one perimeter possible. For a given perimeter, there may be more than one area.

12. **Project** The words *polyomino, tetromino, pentomino, hexomino* all end the same way, but they start with different prefixes.
a. Find other words (not just from mathematics) that start with the prefixes *poly-, tetr-, pent-,* and *hex-*. Tell the meaning of each word.
b. What are the prefixes for 7, 8, 9, and 10? Find words that begin with those prefixes. Tell the meaning of each word.
c. Write a story using as many of the words you found as possible.

PREVIEW *DIMENSIONS*

- The following are one-dimensional: a line, the boundary of a soccer field.
- The following are two-dimensional: the surface of a lake, the paper wrapped around a present.
- The following are three-dimensional: an apple, a person.

An object like a sheet, while it does have some thickness and therefore is three-dimensional, can be thought of as a model of a two-dimensional surface with no thickness. Similarly, a wire or even a pencil can be thought of as a model of a one-dimensional line.

13. Divide the following into three groups: one-, two-, or three-dimensional.
a. a book
b. a lake
c. a map

d. a piece of paper
e. a piece of string
f. an algebra student
g. Mickey Mouse
h. the boundary of a county
i. the water in a glass
j. the paint on a house

14. Name three objects of each kind.
a. one-dimensional
b. two-dimensional
c. three-dimensional

Getting comfortable with the concept of dimension will help you with some of the algebra concepts that you will study later in this course.

15. Draw a picture that incorporates several of your objects of different dimensions.

16. Write a short paragraph explaining what 3-D glasses are used for.