GROWING RECTANGLES

- **Multiplication**
- **Rectangles**
- **Growth patterns**
- **Predicting**

Getting Ready

What You'll Need

Color Tiles, 100 of each of 2 different colors per group

Color Tile grid paper, page 90 (optional)

Overhead Color Tiles and/or Color Tile grid paper transparency (optional)

Overview

Children use Color Tiles to build rectangles that "grow" in a predictable way. Then they predict the number of tiles needed to produce the rectangle that represents ten more stages of growth. In this activity, children have the opportunity to:

◆ search for patterns

◆ use patterns to make predictions

◆ use a rectangular array as a model for multiplication

The Activity

If children announce that the 2-by-2 rectangle looks like a square, you may want to point out that a square is, in fact, a rectangle with four equal sides.

Introducing

◆ Show children a 2-by-1 rectangle made from two Color Tiles of one color and have children copy it. Point out that this rectangle is 2 tiles long and 1 tile wide. Record its dimensions on the chalkboard as "2 x 1."

◆ Tell children to make their rectangle "grow" wider by adding tiles of a different color to change it into a 2-by-2 rectangle. Have a volunteer record the dimensions of this rectangle (2 x 2) below the dimensions of the first one.

◆ Direct children to add more tiles of the first color to make their rectangle grow wider again until it becomes a 2-by-3 rectangle. Ask a volunteer to record the dimensions of this rectangle (2 x 3).

◆ Have volunteers predict the dimensions of the next two larger rectangles and record them on the chalkboard. Then have children check their predictions of the growth patterns by building the two rectangles with these dimensions.

On Their Own

How can you use Color Tiles to make a rectangle "grow" longer and wider?

- Work with a group. Use 2 Color Tiles of the same color to make a rectangle that is 2 tiles long and 1 tile wide.

- Use tiles of a different color to make your rectangle grow so that it is 1 tile longer and 1 tile wider than the starting rectangle.

- Use the first color of tile to make the rectangle grow again so that it is 1 tile longer and 1 tile wider.

- Record the first 3 stages of the rectangle's growth on grid paper.

- Now make your rectangle grow 2 more times! Record these stages of growth.

- Look for patterns in the number of Color Tiles used in each of the 5 stages of the rectangle's growth.

- Suppose your rectangle grew 10 more times. Without building it, predict what it would look like and how many tiles it would have.

- Be ready to tell how you were able to make your prediction.

The Bigger Picture

Thinking and Sharing

Ask children to suggest the best way to organize their data in order to see patterns emerge. You may wish to set up a table like this one and call on groups to contribute their data.

Size of Rectangle	Tiles in Rectangle	Tiles Added
2 x 1	2	—
3 x 2	6	4
4 x 3	12	6
5 x 4		

Some children may point out that by multiplying the dimensions of a rectangle, (l x w), they are applying the formula for finding the area of a rectangle. If children know how to apply the formula, allow them to do so instead of counting to find the number of "Tiles in Rectangle."

Use prompts such as these to promote class discussion:

- What did you notice as you built your rectangles?

- What patterns do you notice in the data?

- What is the same about the patterns? What is different?

- What did you do to predict the size of the rectangle if it grew ten more times?

- How could you find the data for the 100th row in the table?

Writing

Ask children to explain how the dimensions of a rectangle change as it grows. Have them include drawings of several stages of growth to illustrate their explanation.

Teacher Talk

Where's the Mathematics?

This activity gives children experience in exploring shapes to discover patterns and in predicting results based on those patterns. Children gain practice in organizing their data, thinking inductively, and using measurement vocabulary

By using contrasting colors to make their rectangles grow, children can see the pattern of tiles added.

2 x 1   3 x 2   4 x 3
               (4 tiles added)   (6 tiles added)
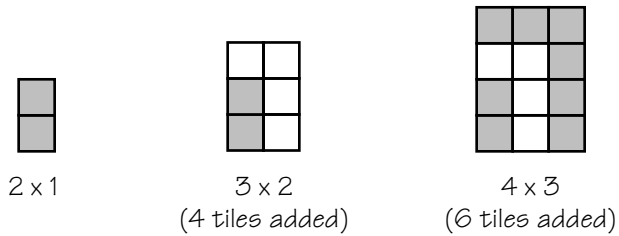
The completed table should look like this.

Size of Rectangle	Tiles in Rectangle	Tiles Added
2 x 1	2	–
3 x 2	6	4
4 x 3	12	6
5 x 4	20	8
6 x 5	30	10
7 x 6	42	12
8 x 7	56	14
9 x 8	72	16
10 x 9	90	18
11 x 10	110	20
12 x 11	132	22
13 x 12	156	24
14 x 13	182	26
15 x 14	210	28
16 x 15	240	30

Extending the Activity

1. Challenge children to find the distance around, or perimeter of, each of the rectangles they built. Then ask them to tell what patterns they discovered by doing this.

2. Have children find the area of each of the rectangles they built in order, from smallest to largest. Then have them discuss how their solutions relate to the data in their tables.

By examining the data, some children may realize that by adding to both the length and the width of their rectangles with each new stage of growth, the following patterns emerge:

1. The numbers in the *Tiles in Rectangle* column are the products of the numbers in the *Size of Rectangle* column.

2. The numbers in the *Tiles in Rectangle* column are a sequence formed by adding successive even numbers beginning with 4.

$$2 \searrow \quad \nearrow 6 \searrow \quad \nearrow 12 \searrow \quad \nearrow 20 \dots$$
$$\qquad +4 \qquad\qquad +6 \qquad\qquad +8$$

3. The numbers in the *Tiles Added* column form a sequence of even numbers beginning with 4. These numbers are also equal to two times the second dimensions (widths) of the rectangles.

Once children have an understanding of the patterns in their recordings and the table, they may be able to determine that the 100th rectangle will have the dimensions 101 x 100; will have 10,100 tiles; and will have 200 more tiles than the 99th rectangle.

Children should be encouraged to share their thinking and "shortcuts" with the class. If children complete one pattern of growing rectangles and record their data quickly, suggest that they begin again, this time with a rectangle of a different size, such as 2 by 4, then compare their data. Having a variety of results on the chalkboard may be of help to those children who have difficulty in seeing relationships within and across columns in a table.