TAKE THE CAKE

GEOMETRY • PATTERNS/FUNCTIONS • NUMBER

- Surface area
- Perimeter
- Estimation
- Pattern recognition

Getting Ready

What You'll Need

Snap Cubes, 40-50 in 3 different colors per pair

Overview

Children use Snap Cubes to build models of one-layer sheet cakes. Then they determine the numbers of pieces with three sides of icing, two sides of icing, and one side of icing. In this activity, children have the opportunity to:

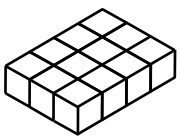
- link multiplication with the concept of area
- search for patterns
- use patterns to make predictions

The Activity

If children have difficulty seeing different kinds of pieces, suggest that they rebuild the cake using one color to represent the pieces that have three sides of icing, a second color to represent the pieces with two sides of icing, and a third color to represent the pieces with one side of icing.

Introducing

- Show children a 3 x 4 Snap Cube "cake." Explain that each cube represents one serving of cake. Ask them to imagine that the cake is covered with icing and to figure out how many pieces have three sides of icing, how many have two sides of icing, and how many have one side of icing.



- Once children have reached agreement on the number of each kind of serving, ask a volunteer to post the data on the board.

Size of Cake	Number of Servings	Icing on		
		3 sides	2 sides	1 side
3 x 4	12	4	6	2

On Their Own

Can you describe a square sheet cake built with Snap Cubes by how many of each kind of serving the cake has?

- Work with a partner.
- Use Snap Cubes to build larger and larger square sheet cakes that are all 1 layer tall. Start with a 2-by-2 cake. Imagine that each cake is covered with icing and that each Snap Cube is 1 serving.
- For each cake, find the number of servings with icing on 3 sides, the number of servings with icing on 2 sides, and the number of servings with icing on 1 side.
- Keep track of your data in a chart like this:

Size of Cake	Number of Servings	Icing on		
		1 side	2 sides	3 sides
2 x 2	4			

- Look for patterns so that you could describe the number and kinds of servings for any square cake.

The Bigger Picture

Thinking and Sharing

Collect children's data in a class chart. Then discuss the data.

Use prompts such as these to promote class discussion:

- What patterns do you see?
- How many people could you serve if 25 pieces of the cake have icing only on one side?
- If you wanted a cake with at least 28 servings with icing on two sides, what size cake would you order?
- If you made a cake that measured 25 x 25, how many of each kind of serving would there be?
- How much do you think you should charge for each kind of serving? Using those prices, how much would a 6 x 6 cake cost?
- If you made a 1 x 1 cake, how much should you charge for that cake? Explain.

Drawing and Writing

Ask children to explain how to find the number of each kind of servings in a 6 x 6 cake. Have them draw a "bird's eye" view of the cake to illustrate their explanation.

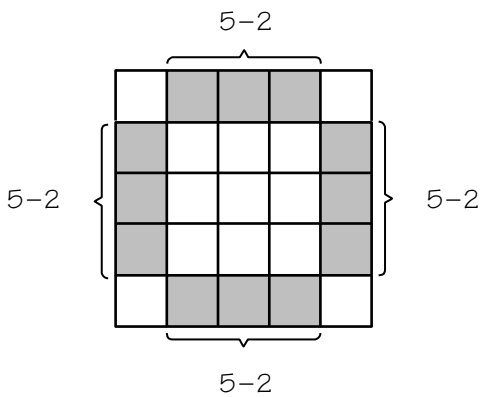
Teacher Talk

Where's the Mathematics?

This activity helps children organize data and look for patterns in a real-world setting. Finding the number of servings in each case reinforces the multiplication facts in a meaningful way.

Size of Cake	Number of Servings	Icing on		
		3 sides	2 sides	1 side
2 x 2	4	4	0	0
3 x 3	9	4	4	1
4 x 4	16	4	8	4
5 x 5	25	4	12	9
6 x 6	36	4	16	16
7 x 7	49	4	20	25

As children explore the square cakes, they may be surprised at first that there are always four servings of cake with three sides of icing no matter how large the cake gets. Some children will recognize that the number of servings with two sides of icing is described by the multiples of four. They may be able to generalize that they can find the number of servings with icing on two sides by multiplying four times two less than the number of pieces on a side. For example, for a 5 x 5 cake, there are 4(5–2) or 12 servings with icing on two sides:



Extending the Activity

1. Have children set a price for each kind of serving and compute the total price for different-sized cakes.
2. Ask children to find the number of each kind of serving in cakes with these dimensions: 4 x 5, 4 x 6, 4 x 7, 4 x 8, and 4 x 9.

The dimensions of a square cake indicate the number of pieces of cake along each edge. All pieces along an edge—except the two corner pieces—have two iced sides. Four times this number gives the total number of pieces with two iced sides. Restating this algebraically, a cake of n x n dimensions would have $4(n-2)$ servings with two sides of icing.

Some children may recognize the pattern of square numbers occurring in the column labeled "Icing on 1 side." If the children have built the color-coded cakes (as suggested in *Introducing*), it will be easier to see that the square numbers occur because subtracting all the servings around the perimeter of the cake still leaves a square. Some children may be able to generalize that they can find the number of servings with icing on one side by subtracting two from the side and then multiplying the number by itself. Or, a cake of n x n dimensions would have $(n-2)^2$ servings of cake with icing on one side.

Using whatever method they derived from studying the patterns in the data, children can figure out that a 25 x 25 cake will have four servings with three sides of icing, 92 servings with two sides of icing, and 529 servings with icing on the top only. This cake can serve 25^2 or 625 guests.

To guarantee that they get a cake with 28 servings with icing on two sides, children would need to order a 9 x 9 cake. A cake with 25 servings with icing only on the top would come from a cake that measures 7 x 7 and therefore, serves 49 people.

For a 1 x 1 cake, there would be five sides of cake with icing. Children will have to use some proportional thinking to arrive at a fair price for the cake. Some will multiply the price of "icing only on the top" times five. Others may argue that this cake will only serve one person and charging five times as much is unrealistic. Accept whatever prices the children can justify with a line of reasoning.

The generalizations children make when studying the patterns generated in this activity set the stage for deriving and using formulas.
