

# SIDES AND ANGLES

GEOMETRY • NUMBER • PATTERNS/FUNCTIONS

- Counting
- Comparing
- Polygons
- Organizing data
- Interpreting data

## Getting Ready

### What You'll Need

Color Tiles, 50 per pair

Color Tile grid paper, several sheets per pair, page 90

Crayons

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

## Overview

Children try to build as many arrangements of eight Color Tiles as they can. Then they determine which arrangements have the fewest and the greatest numbers of sides and angles. In this activity, children have the opportunity to:

- ◆ record and interpret data
- ◆ explore the relationship between the number of sides and the number of angles of a polygon



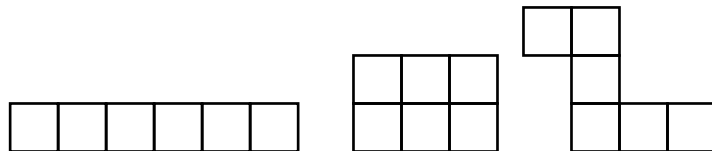
## The Activity

*You may wish to advise children who have difficulty counting the sides of the last shape to move a finger along its perimeter while keeping track of their starting point so as not to retrace it.*

*Recording a shape, then shading it, may keep children from making the mistake of counting the corners of individual tiles instead of the corners of the whole shape.*

## Introducing

- ◆ Make and display these three Color Tile arrangements.



- ◆ Ask volunteers to tell how these shapes are alike.
- ◆ After eliciting the likenesses, ask children to tell how the shapes differ. Elicit that the last shape has a different number of sides than the others.
- ◆ Now ask children to find the number of corners, or angles, in each shape.

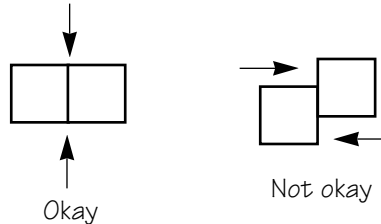


- ◆ Establish that shapes made up of the same number of tiles can have different numbers of sides and angles.

## On Their Own

*Can you make a shape with 8 Color Tiles that has the fewest number of sides and angles possible? Can you make an 8-tile shape with the greatest number of sides and angles possible?*

- With a partner, make a shape using 8 Color Tiles. Your shape must follow this rule:  
*Every tile must share at least 1 full side with another tile.*



- Use more tiles to make as many different 8-tile shapes as you can that follow the same rule.
- Record your shapes on grid paper. Then cut them out.
- Check your shapes to be sure they are all different. (Remember, if a shape can be covered exactly by a flip or turn of another shape, the 2 shapes are really the same!)
- Put your shapes facedown so that you can't see the grid marks.
- Now, looking at the back of each shape, find the number of sides and the number of angles. Write the numbers on the back.
- Decide on a way to sort your shapes. Be ready to talk about what you notice about their sides and angles.

## The Bigger Picture

### Thinking and Sharing

Invite a pair to post their shape with the least number of sides and angles. Call for other pairs to post shapes that look different but have the same number of sides and angles. Label the number of sides and angles for this group of postings. Now invite a pair to post their shape with the greatest number of sides and angles. Have others post shapes that look different but have the same number of sides and angles. Label the number of sides and angles for these postings.

Use prompts such as these to promote class discussion:

- ◆ How did you go about making your different shapes?
- ◆ What different numbers of sides and angles did you find for your shapes?
- ◆ What did you notice about the sides and angles in each of your shapes?
- ◆ Why do you think that four is the fewest number of sides and angles that can be made with eight Color Tiles? Why do you think that sixteen is the greatest number?

## Extending the Activity

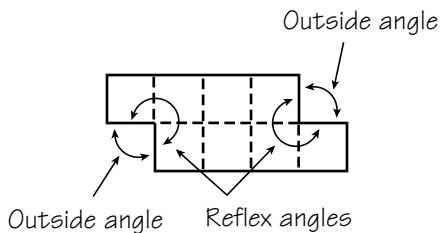
Have children work in groups to find the fewest and greatest numbers of sides and angles that can be made from shapes having from one to seven Color Tiles. Have them record their findings, then review them. Ask children

## Teacher Talk

### Where's the Mathematics?

Through their investigation, most children will begin to realize that each shape they build has an equal number of sides and angles. Children may be surprised to learn that this is true not only for the 8-tile shapes they work with in this activity but also for shapes made from other numbers of Color Tiles. If they have already done the activity *Ben's Garden Plot*, you may want to have them verify this fact by counting the numbers of sides and angles in each of the 10-tile designs they made for it.

In order to make their different arrangements of eight Color Tiles, children will take various approaches. Many may begin with a single row of eight, then go on to reposition one or more tiles in different ways to create more complex shapes. Others may begin by making the more complex shapes first, then work toward making the simpler ones. Still others will use a random approach. Whichever they choose, recording then sorting their shapes gives children an opportunity to analyze each to see how it fits into the scheme.



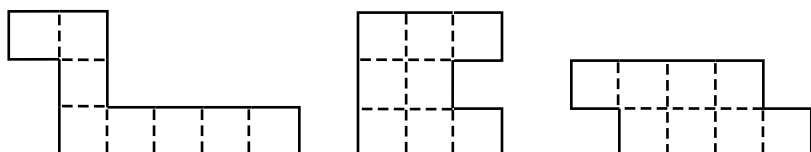
Most children will have no difficulty counting the interior right angles in each shape. However, the other kinds of interior angles that show up in these shapes are reflex angles that measure 270 degrees, and these may be hard for children to recognize as angles. In fact, when they count the angles in a shape and come to the reflex angles, they may instead count the right angles they see outside the shape that share vertices with the interior reflex angles. If children do this, they will still get the correct totals for the number of angles, but at some point you may wish to visit the concept of reflex angles.

Using eight tiles, it is possible to build shapes having these numbers of sides and angles: 4, 8, 10, 12, 14, and 16. Children's shapes will look like some of these:

4 Angles and 4 Sides

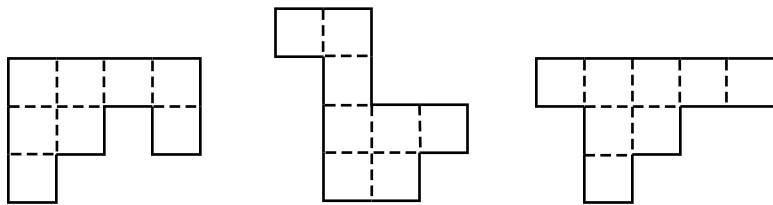


8 Angles and 8 Sides

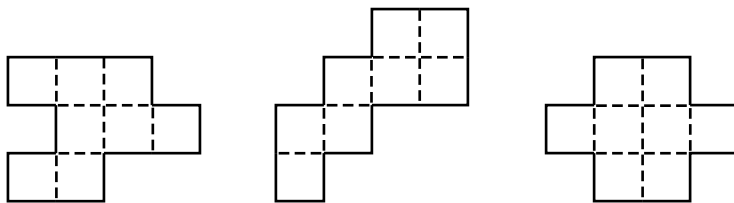


if they can predict the fewest and greatest numbers of sides and angles for a shape made from nine tiles. Record their predictions, then have them build the shapes to verify their predictions.

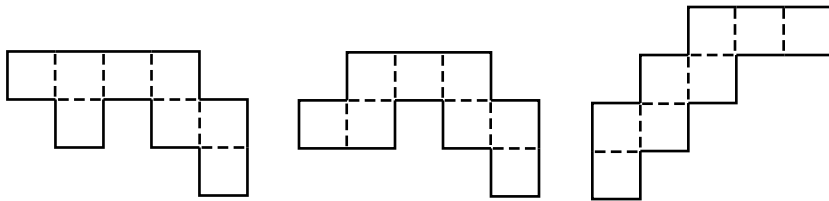
10 Angles and 10 Sides



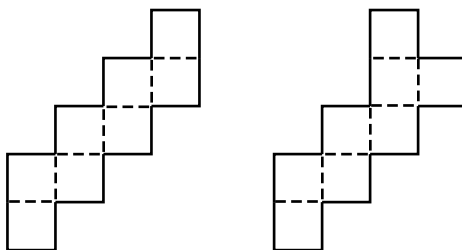
12 Angles and 12 Sides



14 Angles and 14 Sides



16 Angles and 16 Sides



It may be difficult for children to explain why four is the fewest number of sides and angles that a shape made from eight tiles can have and why 16 is the greatest. You may want to help them by pointing out that four is also the fewest number of sides and angles that a shape made from six tiles can have, but, in this case, 12 is the greatest. Similarly, four is the fewest number for a 9-tile shape, while 18 is the greatest.

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# COLOR TILE GRID PAPER

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