BUILDING HEXAGONS

GEOMETRY

- Properties of geometric figures
- Spatial visualization
- Congruence
- Transformational geometry

Getting Ready

What You'll Need

Pattern Blocks, at least 3 of each shape per pair

Overhead Pattern Blocks (optional)

Overview

Children investigate ways of making hexagons using different numbers of blocks. In this activity, children have the opportunity to:

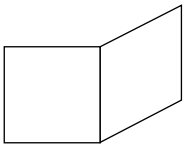
- explore how smaller polygons fit together to make larger polygons
- learn about transformations and congruence by investigating to see whether shapes are flips or turns of each other

The Activity

You may want to have one child show his or her hexagon on the overhead using transparent blocks. Invite children who think they have different solutions to display them, as well. Volunteers might then be asked to demonstrate how a flip and/or turn will show that the hexagons are congruent.

Introducing

- Show children the yellow Pattern Block, and elicit that it is a hexagon. Explain that it is a *regular* hexagon because it has six equal sides and six equal angles.
- Point out that any polygon with six sides is a hexagon, even though it may look very different from the yellow block.
- Ask children to use a square and a blue parallelogram to make a hexagon.



- Have children compare their shapes. Establish that there's only one way to build a hexagon using these two blocks. Show how any of the arrangements can be turned and/or flipped so that it will fit exactly on top of another. Tell children that shapes that match like this are said to be *congruent*.

On Their Own

How many ways can you think of to build hexagons using your Pattern Blocks?

- Working with your partner, build hexagons in as many different ways as you can first with 1 block, then 2 blocks, and then 3 blocks.
- Be sure to join blocks so that each block shares an entire unit of length with another. (Remember that the trapezoid has 2 units of length on its long side.)
- Trace around the blocks to record your solutions on paper. Check to make sure none of your solutions are congruent (are the same size and shape).
- Be prepared to talk about how you know that you've found all possible solutions.

The Bigger Picture

Thinking and Sharing

Ask children to tell how they "built" a hexagon using only one block (the only solution being to use the yellow hexagon.) Then have children take turns sharing their hexagons made with two blocks and then those made with three blocks. Children can post the solutions they traced, or rebuild them with transparent blocks on the overhead.

Use prompts like these to promote class discussion:

- What solutions did you find for two blocks? for three blocks?
- How did you go about finding solutions? Did you organize your search in some particular way? If so, tell about it.
- How did you check to make sure none of your solutions were congruent?
- Do you think you found all the possible solutions? Why or why not?
- Is there a limit to the number of blocks you could use to build a hexagon? Explain your answer.
- What other discoveries did you make?

Writing

Ask children to describe three things they discovered about making hexagons with Pattern Blocks.

Extending the Activity

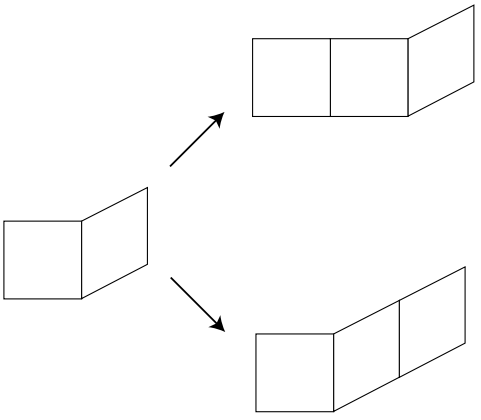
1. Challenge children to build other polygons—pentagons, heptagons, and so on—using different numbers of Pattern Blocks. Have them record their polygons and post the different solutions they find.

Teacher Talk

Where's the Mathematics?

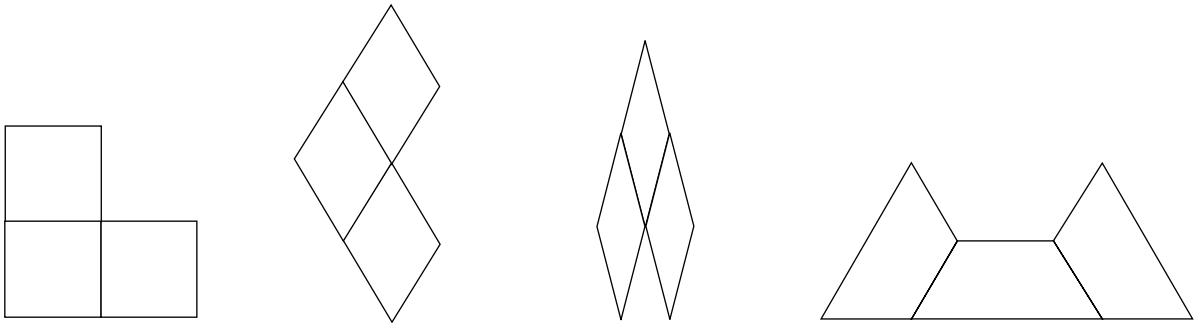
Although the only way to make a hexagon with one block is to use the yellow block, there are many ways to make hexagons using two or three blocks. Children may not find them all, or may not realize that they have found them all. However, there may be some children who work systematically, and may therefore feel certain that they have found all possible solutions. For example, a child may make a hexagon using a square and a blue parallelogram, and then try combining the square with every other block to find all possible 2-block hexagons that can be made using a square. He or she then might try putting the blue parallelogram together with each of the remaining blocks to see if any of these combinations make hexagons. The child may then go on to test other combinations using other blocks in the same way.

Children may realize that some of their 2-block hexagons can be extended using a second block of one of the shapes in the original arrangement. For example, the 2-block hexagon shown below can be extended to a 3-block hexagon by adding either another square or another parallelogram as shown. Some children may notice that no matter how many squares or parallelograms are added in this way, the shape will still be a hexagon.



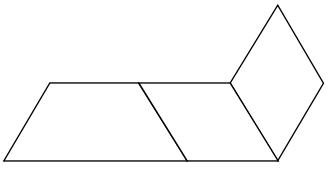
As children work with the blocks, they may begin to see relationships between their attributes and be able to predict—even before putting certain blocks together—whether the blocks will fit together to make a shape with six sides. For example, after discovering that three squares can be used to make a hexagon, children may hypothesize that three blocks of any one of the four-sided shapes can also be fitted together to make a hexagon. This proves to be the case.

2. Ask children to make the smallest hexagon they can using eight Pattern Blocks. Then ask them to make the largest hexagon they can using eight Pattern Blocks. Ask them to find the difference between the areas of the two hexagons, given that the triangle has an area of 1 square unit.



Children may then move on to investigate 3-block shapes formed by combining different four-sided blocks. Here they may find that similar arrangements of different combinations of shapes do not always produce hexagons. Other arrangements need to be explored. For instance, a trapezoid placed above two squares makes a hexagon; but a trapezoid placed above two parallelograms does not.

The parallelograms slant in such a way that one of the sides of one of the parallelograms continues a side of the trapezoid. However, the trapezoid can be used with parallelograms to form a hexagon, by arranging the blocks in a different way, as shown below.



To check for congruence, children may compare newly-made shapes to those already recorded. Whereas some children may be able to recognize congruence just by inspection, others may need to test by flipping and/or rotating their shapes to see if they match exactly. This experience will help children in their future work with transformational geometry.