Investigating Pattern Blocks

▶ **GOAL**

Use transformations and properties of congruent shapes to solve problems.
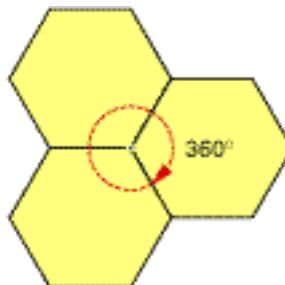
Explore the Math

The shapes of the six different pattern blocks are shown below.

? What are the angle measurements and the area relationships for each pattern block?

regular polygon

a polygon with all sides equal and all angles equal

A. Which blocks are **regular polygons**? Explain how you can find out, using only the blocks and measuring tools. Explain how you can find out by folding a paper copy of each block.

B. The diagram at the right shows a tessellation of three yellow hexagons around a single point. How does this diagram help you calculate each vertex angle?
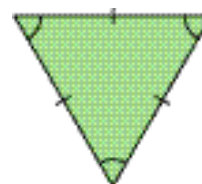
C. Trace each block to show tessellations around a single point for all the pattern blocks. Use these tessellations to determine each block's vertex angles.

D. Show how to tile the hexagon with the green triangle. What fraction of the area of the hexagon is the area of the triangle?

E. Repeat step D with the red trapezoid, and then with the blue rhombus.

F. Try step E with the orange square and the beige rhombus. What do you notice?

G. Summarize your findings in steps A to F by completing the following table. If the area of a block cannot be compared with the area of the hexagon block by using a fraction with the numerator 1, write "larger than the hexagon" or "smaller than the hexagon" in the third column.

Pattern block	Regular or irregular?	Relationship of area to area of hexagon	Number of tessellated blocks that meet at a vertex	Angle measures
yellow hexagon			3	
red trapezoid		$\frac{1}{2}$ hexagon		
blue rhombus				
orange square				
green triangle				
beige rhombus				

H. Use a protractor to check the accuracy of the angle measures you calculated.

Reflecting

1. a) How did you use properties of congruent shapes to find the measures of the vertex angles in the pattern blocks?

   b) For which blocks did you use a transformation to help you find the angle measures?

2. What is the relationship between the vertex angles in a pattern block and the ability of the pattern block to tessellate?

3. a) A regular octagon has eight sides, and each vertex angle is 135°. Use the relationship you described in question 2 to explain why a regular octagon cannot be used to create a tessellation.

   b) What figure can be used to fill the gaps in a tiling created with regular octagons?

4. a) Identify several other polygons (regular and irregular) that can be used to tessellate a plane.

   b) For each polygon you identified in part (a), verify that the relationship you described in question 2 is satisfied.