Play Games, Learn Math!

Pattern Block Puzzles

Kristen E. Reed and Jessica Mercer Young

Anna is a dual language learner who was able to grasp ideas quickly from demonstrations. The puzzles put her at ease since she can get overwhelmed if there's too much language. She volunteered to share more, such as naming the colors and counting the pieces.

–Joan, Worcester, MA

Knowing the name of a geometric shape is just the beginning of understanding the details about it, just like remembering a person's name is only a small part of knowing that individual. It's important for children to look carefully at the characteristics of a shape, understand which attributes define it, and investigate its similarities to and differences from other shapes.

Children learn about shapes by playing with them and manipulating them. The games in this article guide children's learning as they do both.

Pattern blocks

Pattern blocks are a common preschool math tool. They include multiple copies of six different shapes: a green equilateral triangle, a yellow hexagon, and four quadrilaterals—an orange square, a red trapezoid, a blue rhombus, and a beige narrow rhombus. When children play with pattern blocks, use geometric language as you talk with them. Name the shapes and talk about their attributes and features. Use vocabulary like *sides, corners, angles, length, same,* and *different*. Children love to learn rare words and to show that they understand them. Just like children enjoy talking about all of the different types of dinosaurs they know and can name, the same can be true for geometry. The more we use geometric language and vocabulary, the more we can help build children's understanding of these key math concepts.

Ask questions and talk about shape attributes—the number of sides, the number of angles (or corners), the lengths of the sides, and the size of the angles. Open-ended questions invite children to notice and talk about defining attributes of shapes. Here are some sample questions about a square:

- How many sides does this square have? (4 sides) Let's count them.
- What do you notice about the length of the sides? Is the length the same or different? How can we tell? (same length)
- How many corners does a square have? (4 corners) Let's count them.

- Tell me about the angles (or corners) of a square. ("They are right angles, like the corners of this paper.")
- If you stand a square on one of its corners, is it still a square? (yes!)
- What other shapes have four sides? (rectangle, rhombus, trapezoid, etc.)

Expose children to different shapes and orientations

Young children's books and toys usually introduce twodimensional, closed, symmetrical shapes first, like squares, circles, rectangles, and *equilateral* triangles (triangles with sides of equal length). They tend to show the shapes as if they have a bottom and a top, like this:



These positions, or *orientations*, can be misleading. For example, children who recognize ▲ as a triangle may not think that ▼ is also a triangle. Children who recognize ■ as a square may not think that ◆ is also a square. (It's okay to call ◆ a diamond, but it's important for children to understand that it is still a square, just in a different orientation.) Using a physical object can help children understand that no matter how you turn it, it's still the same shape—the orientation doesn't matter. This is important because it's different from writing numbers and letters, where orientation *does* matter (3 and €, b and c). Encouraging children to pay attention to a shape's defining attributes—such as the number and length of sides and angles—helps them form a more accurate understanding of shapes.



Pattern blocks provide children with important experiences with shapes, such as putting them together to make new shapes and designs.

Help children become familiar with early math concepts, thinking, and vocabulary so they can...

- · Learn the names of familiar shapes
- Describe attributes of shapes: sides, corners/angles, same/equal
- Compare shapes: more than, fewer than, longer, shorter, narrower, wider
- · Compose (put together) and decompose (take apart) shapes
- Think flexibly and logically about shape

For more information about expectations for what children will be learning, see "Progression of Geometry Concepts for Young Children," at Add Link Address Here

Pattern Block Puzzles: Materials and Teacher Tips

Materials to create and collect

- Tub of pattern blocks
- Tray to keep pattern blocks organized (if needed)
- Templates for pattern block puzzles can be printed from www.ym.edc.org/patternblockpuzzles. (When possible, print the puzzles on card stock so they will last longer.)
 - > Set 1: Color Puzzles (puzzles with shape and color clues)
 - Set 2: Shape Puzzles (slightly more challenging puzzles without color clues)
 - > Set 3: "How Many Ways?" (most challenging puzzles without shape or color clues)

Tips for playing

- As children play, use language to support them, such as the names of the shapes (triangle, rhombus, square, trapezoid, hexagon) and the attributes of those shapes (sides, corners/angles). Also, encourage children to compare the similarities and differences among the shapes: Which shapes have 4 sides? 6 sides?
- Give children time to build their own designs with the pattern blocks.
- Place the pattern blocks in a large open container, such as a tray, to help keep them on the table and off the floor.
- Have children challenge each other to copy or build the same design a friend did (while they can still see it).



Pattern blocks help children understand part-whole relationships (such as fractions). Encourage them to notice how shapes can be combined or taken apart to make other shapes!



General questions

- How many triangles/rhombuses/ hexagons did you use?
- Which shapes have 3 sides? 4 sides? Are some of the sides longer or shorter than others?
- Which shapes have 3 corners? 4 corners? Are some corners wider or narrower than others?
- If we turn this, is it still the same shape?
- What's the difference between a triangle and a square? A square and a rectangle? A rhombus and a square?
- Can you find other shapes like that in the classroom? On the playground?
- Can you build that another way using different shapes?

Pattern Block Puzzles

Game 1: Color Puzzles

Focus on learning the names of shapes and their attributes.

Ages 3 + / 5 minutes or longer

- 1. Provide each child with pattern blocks and Set 1 puzzle templates, in color. (See bottom of page 21 for URL.)
- 2. Start children on the cards that have them match individual blocks to the shapes on the paper. As they gain experience, provide more complicated puzzles, still in color.

Things to notice as children play

Do they match the color on the template to the color of the pattern blocks to help them solve the puzzle? Notice if they can place the blocks in the lines so shapes can fit. Observe if they are able to flip or rotate the blocks (manipulate the blocks spatially) to fit inside the lines. These early puzzles provide scaffolding for children to see how shapes can be

66 When Sabas

first started he

would say, "I can't do it," but with positive

reinforcement he kept at it. He now asks to do the

Springfield, MA

puzzles almost daily. 🤊 🤊

put together to make a picture or design. Some children may find it challenging to place the blocks inside the lines, and that's okay. The more they practice, the more they will improve, as will their fine motor skills.

Game 2: Shape Puzzles

Focus on describing and comparing shape attributes and composing (putting together) and decomposing (taking apart) these shape puzzles.

Ages 4 + / 10 minutes or longer

- 1. Give each child pattern blocks and Set 2 puzzle templates (black and white with shapes outlined).
- 2. Have children begin with the simpler puzzle designs, where they can easily see the shape outlines. As they gain experience, offer them more complicated puzzles.

Things to notice as children play

Notice whether they can easily fit the blocks into the outline of the shapes or if they struggle. Do they know ahead of time which block to choose, or do they use trial and error to find ones that fit? Are they able to rotate and flip the shapes to make them fit? As children gain more experience, they will be able to see which block they need and how to orient it to fit into the outline. Many of these puzzles are identical to the ones the children solved in color. If children need more support, provide them with the same puzzle in color as a reference. Use lots of geometric language (names of shapes, attributes of shapes) during children's play to support their math vocabulary development and to encourage comparisons of the similarities and differences between shapes.

Game 3: How Many Ways?

Focus on describing and comparing shape attributes and composing (putting together) and decomposing (taking apart) these shape puzzles.

Ages 5 + / 10 minutes or longer

- 1. Provide each child with pattern blocks and Set 3 puzzle templates (black and white with no internal outlines).
- 2. Have children begin with the simpler puzzles and those that they're already familiar with. As they practice more, have them try puzzles with larger empty spaces.
- 3. Encourage children to solve a puzzle one way and then try solving it a different way, with different shapes. You may want to have more than one copy of each puzzle template so they can show you how many different ways they could solve the puzzle.

Things to notice as children play

Solving open puzzles is challenging and often requires trial and error to see how to fit the pieces. Encourage children to keep trying. Observe if children are able to see which shapes will likely fit using their knowledge of the angles and side lengths. Notice if they can substitute groups of shapes for other shapes to solve the puzzle in different ways (for example, use two trapezoids in place of one hexagon).

Some attributes will define a shape (a triangle always has 3 sides) while other attributes will describe it (color, size). The table below has the defining attributes of each of the pattern block shapes.

Pattern block	Shape name	Defining attributes
	Equilateral triangle	All triangles have 3 straight sides. An equilateral triangle's sides are all the same length. Triangles can also have only two sides of the same length (isosceles triangle), or three sides of different lengths (scalene triangle).
	Rhombus	All rhombuses have 4 straight sides, and opposite sides are the same length and parallel (like train tracks). All rhombuses have opposite angles that are the same size.
	Square	All squares have 4 straight sides of equal length, and opposite sides are parallel (like train tracks). All squares have 4 angles that are right angles (like the corners of a piece of paper). A square is both a special kind of rectangle and a special kind of rhombus.
	Narrow rhombus	All rhombuses have 4 straight sides, and opposite sides are the same length and parallel (like train tracks). All rhombuses have opposite angles that are the same size.
	Trapezoid	All trapezoids have 4 straight sides and one pair of parallel sides.
	Regular hexagon	All hexagons have 6 straight sides. A regular hexagon's sides are all the same length. Hexagons can have sides that are different lengths.

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