

Activities that explore line, dimension, and size

Young children use all their senses to explore their environment. Shape—an object’s characteristic surface form or contour—is as important to a toddler teething on a round rubber ball as it is to a mathematician writing a formula to describe the shape of a sandy coastline. Shape gives us vital information about the world.

Basic shapes include a line, circle, square, rectangle, and triangle. Typically teachers help children learn to identify shapes by providing art, number, block, and music activities.

But often teachers miss the ways that shape relates to other elements of children’s learning. Shape is an important part of visual acuity and discrimination as well as literacy and letter recognition. It’s key to body awareness (how the body senses itself) and spatial awareness (how we sense ourselves in relation to the people and things around us). In addition, shape is fundamental to math—specifically, the math of geometric forms.

The following activities, arranged in rough developmental sequence, offer new opportunities to help children explore basic shapes and relationships.

Toddlers

Toddlers need a clear introduction to shapes without the drill-and-kill of coloring sheets and copying teacher-made models. Make sure you provide classroom play materials that are inviting. Encourage sensory exploration.

Always have conversations that include descriptive information—a *round*, red ball, a *square* wooden block, and tasty *cubes* of oven-fried potatoes, for example. Invite responses and listen to gauge their understanding.

Art materials, such as paint and clay, and manipulatives, like locking bricks and jigsaw puzzles, invite explorations of shape. Make these available to children throughout the day.

Touch it

Here’s what you need:

- simple shapes in colored cardboard
- large outdoor area
- clothespins or tape

1. Invite the children to identify the shapes you’ve cut from colored cardboard.
2. Hang or tape the shapes to different areas of the playground.
3. Explain that you’ll call out the shape names, they will run and touch the shape, and then they will run back to you.
4. Play the game sporadically to maintain children’s interest.

Variation: Use the game as a transition activity. Call the shape name closest to you to gather the children to move to another activity area.





Shapely snacks

Here's what you need:

- whole wheat crackers in a variety of shapes
- cheese slices cut into matching shapes
- serving plates
- individual snack plates and napkins

1. After children wash their hands, invite them to serve themselves three crackers in different shapes.
2. Pass around the cheese plate and encourage children to match the cheese shape to their crackers.
3. Talk with children during snack time about shapes and tastes. Ask, "Do you think the square crackers taste the same as the round ones?" Respond, and extend the conversation.

Fingerpaint lines

Here's what you need:

- liquid laundry starch
- liquid tempera paint
- mixing bowl and spoon
- painting paper
- drawing tools like chopsticks, unsharpened pencils, or straws
- old newspaper
- plastic sheet

1. Make a batch of fingerpaint by mixing $\frac{1}{2}$ cup liquid starch with $\frac{1}{2}$ cup liquid tempera.
2. Protect the work area by covering it with a plastic sheet or old, clean shower curtain.
3. Pad the painting paper with several sheets of newspaper.
4. Spoon fingerpaint onto the painting paper. Some toddlers won't want to have paint on their hands. Invite them to use paint tools to make lines in the paint.

Shape days

Share lesson plans with parents alerting them to shape days. Designate square, circle, and star days, for example, and ask children to bring a safe and sturdy object from home in the appropriate shape. Prepare a classroom space for the collection and invite children to investigate and identify each object. Make sure children return objects to their homes at the end of the day.

Mystery shape

Here's what you need:

- fabric bag or pillow case
- objects with identifiable shapes such as a ball, block, domino, plastic banana, and cardboard tube

1. Before children arrive, place three to five objects in the bag.
2. Invite children, one at a time, to feel inside the bag and call the name of the object before pulling it out. Ask questions to help children build identification skills: For example, ask, "Is it smooth? Does it have one side? Are there corners? Is it hollow?"

3-year-olds

With experience, 3-year-olds are ready for deeper investigations of shapes. Typically, most can identify basic shapes—circles, squares, and triangles—but will need guidance in describing the characteristics of each. Help children observe and examine objects by asking questions—and responding to answers.

Slowly introduce more complex shapes and their characteristics. Use both indoor and outside time to point out relationships between shapes. During block play, for example, you might say, "Look, you made a square with these two triangle blocks."

Placemat faces

Here's what you need:

- sheets of colored mural paper
- scissors
- construction paper
- *Color Zoo* by Lois Ehlert
- glue
- markers
- laminator or adhesive-backed plastic

1. Cut the mural paper into 12-inch by 18-inch rectangles, one for each child.
2. Cut the construction paper into basic shapes: large circles, smaller circles, rectangles, triangles, and thin strips.
3. Share the book *Color Zoo*. Encourage children to talk about the shapes and colors of the animals.
4. Introduce the activity by explaining that children will make shape-face placemats to use at lunchtime or for snack.
5. Provide construction paper shapes and glue. Encourage the children to sign their faces.
6. Laminate the placemats and make them available for the children's use for as long as they are clean and in good condition.

Variation: If you celebrate Halloween, prepare the activity so children can make paper Jack-o-lantern placemats.

Follow the lines

Here's what you need:

- small photo albums with plastic sleeves
- washable markers
- colored construction paper
- scissors
- straight edge
- damp paper towels

1. Cut basic shapes from construction paper, and place each cut-out in one of the album sleeves.
2. Gather a small group of children, and show them how to trace around the shapes, using a straight edge and markers.
3. When finished, encourage the children to prepare the materials for the next user by wiping off marker lines with a damp paper towel.

Variation: Use pictures from magazines in place of the construction paper. Older children will be able to identify and trace several basic shapes in the same picture.

Resource books for the classroom library

These classics are generally available at public libraries and can be purchased in paperback for less money than hard cover.

- Crews, Donald. 1995. *Ten Black Dots*. New York: Greenwillow Books.
- Ehlert, Lois. 1989. *The Color Zoo*. New York: HarperCollins.
- Hoban, Tana. 1996. *Shapes, Shapes, Shapes*. New York: Greenwillow Books.
- Walsh, Ellen Stoll. 2007. *Mouse Shapes*. Harcourt Children's Books.

Geoboard shapes

Here's what you need:

- geoboards (see construction directions below)
- rubber bands
- basket
- drawings of basic shapes

1. Buy or build several geoboards so children can work together.
2. Make a collection of drawings of basic shapes. Place the shapes and rubber bands in a small basket or other storage container.
3. Encourage the children to pick a shape card and reproduce the shape pattern using rubber bands on the geoboard.

To make a geoboard: Cut plywood scraps into 14-inch squares. Sand the edges and coat with water-based varnish. Use a ruler and marker to make a grid 12 points across and 12 points down. Hammer a finishing nail into each point on the grid.

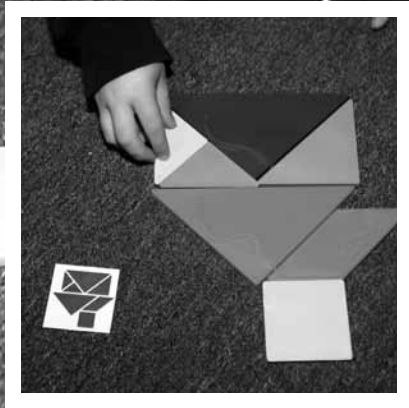


Building bricks

Here's what you need:

- magnifying glass
- containers such as empty milk cartons and loaf pans
- damp sand
- building brick
- brick molds (optional)

1. Indicate a building area such as a sand table indoors or a sand-box outdoors.
2. Introduce the activity by inviting children to explore a brick. Offer a magnifying glass and ask questions about weight, texture, and color. Talk with the children about how bricks are made from clay and minerals. Brickmakers mold the clay into standard rectangles and dry the clay in a hot oven or *kiln*.
3. Invite the children to make bricks by filling containers with wet sand, tamping it down, and turning it out as a brick.
4. Help children line up the bricks end to end. Ask questions that encourage the children to estimate how many bricks they'll need to make a wall between two points.



Shape lacing

Here's what you need:

- 12-inch squares of heavy cardboard
- marker
- straight edge
- hole punch
- colored yarn
- plastic embroidery needles
- classroom scissors

1. Use a permanent marker and straight edge to draw basic shapes on cardboard squares.
2. Punch holes along the sides of the shapes.
3. Introduce the activity with instructions on how to thread and hold a sewing needle to stitch along the shape outline. A double, knotted length of yarn is easiest for children to use.
4. Show the children how to undo their sewing for other children to use. Clip off the knot and gently pull the yarn out of the cardboard one hole at a time.

Variation: Use 12-inch squares of pegboard (2-foot by 4-foot sheets are usually available at home supply stores). Cut to size and sand edges. Use a permanent marker to draw basic shapes on the board. Encourage children to place golf tees in the holes following the outline.

4-year-olds and kindergarten

Building on prior experiences, older children are ready to manipulate shapes and explore spatial relationships—the basics of geometry. According to the National Council of Teachers of Mathematics guidelines (2002), children should be supported as they

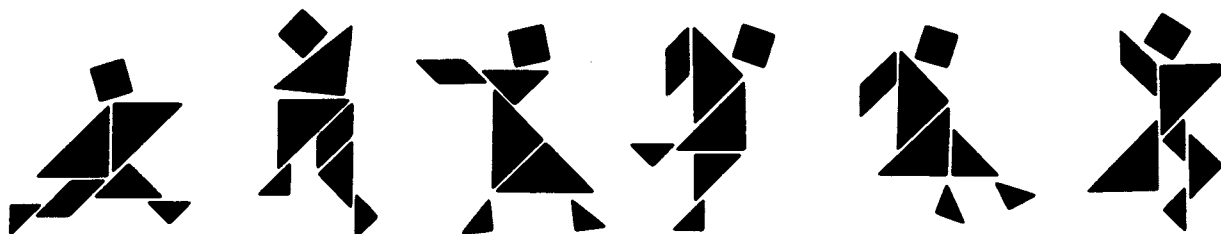
- analyze the characteristics and properties of two- and three-dimensional geometric shapes and consider their geometric relationships;
 - specify locations and describe spatial relationships using coordinate geometry and other representational systems;
 - apply transformations by recognizing and applying slides, flips, and turns as well as recognizing and creating symmetric shapes; and
 - use visualization to create mental images of geometric shapes, recognize and represent shapes from different perspectives, and recognize geometric shapes and structures in the environment.
- Spatial sense—essential to developing mathematical skills—is reinforced in art, music, science, construction, movement, vocabulary, reading, and writing activities. Skilled teachers find ways to help children bridge the informal knowledge learned from playing with shapes and formal numeracy and mathematical skills.

Making squares

Here's what you need:

- colored construction paper
- basket
- paper cutter
- mural paper
- marker
- ruler
- glue

1. Cut hundreds of 2-inch squares from colored construction paper. Place in a basket or other storage container.
2. Talk with children about squares. Encourage clear definitions: A square is a rectangle (four-sided shape) with equal sides. A square can be of any size but each of the four sides must be the same length.
3. Show the 2-inch squares. Encourage the children to measure them.
4. Use the ruler and draw a 4-inch square on the paper. Encourage the children to observe and determine (hypothesize) how many 2-inch squares are needed to fill the 4-inch square. Invite children to glue the construction paper squares into place. It takes four 2-inch squares to fill the 4-inch square.
5. Repeat the activity with 8-, 16-, and 32-inch outlines.
6. Encourage children to build their own squares. Observe and reinforce *four equal sides*, counting squares as necessary.



Tangram explorations

A tangram is a set of seven geometric pieces, or *tans*, sized to fit together to make a square. This old game, likely from China, challenges the imagination with the possibility of forming at least 1,600 designs from the seven tans.

Here's what you need:

- tangram sets (see construction directions below)
- flat work surface
- shape patterns

1. Introduce tangrams by first exploring the pieces: two large triangles, one medium triangle, two small triangles, one square, and one quadrilateral. Encourage the children to sort, combine, and stack the seven pieces.
2. Give each child in the group a tangram set. Explain that children will work at copying a

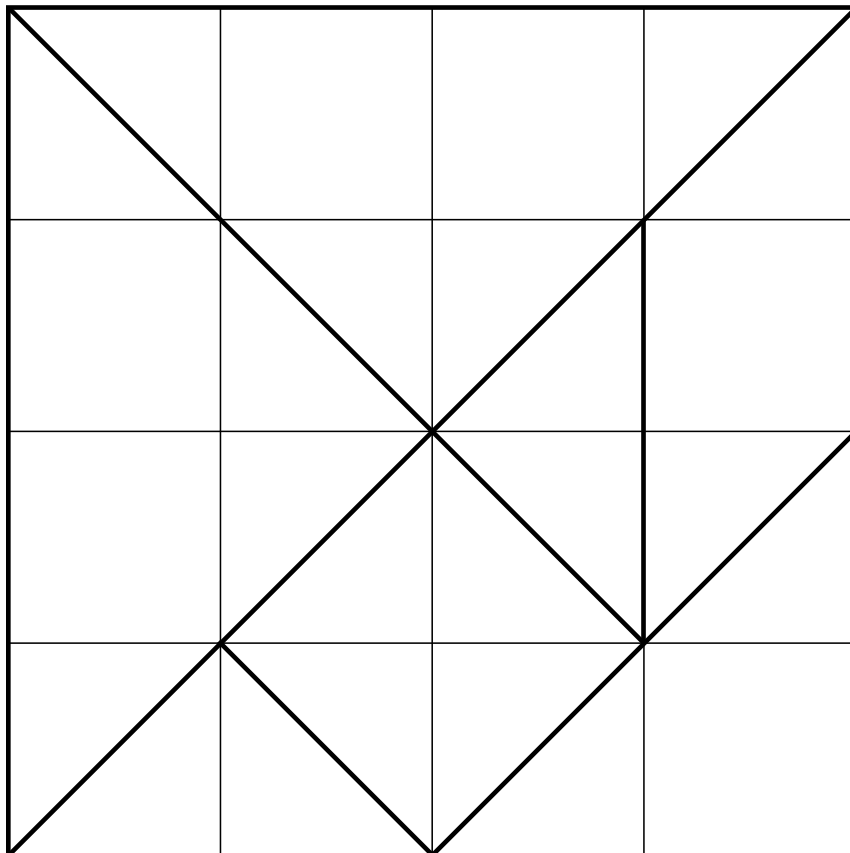
construction shape you create. Ask them to stack their seven pieces and place their hands on their tummies until you give three signals: Observe, create, and repair.

3. Use two pieces (the square and a large triangle, for example) to make a shape. Give the observe signal and allow a couple of seconds for children to study the design. Cover the shape with a sheet of paper.
4. Give the create signal. Watch the children recreate the shape. Give the children about 30 seconds to work on their shapes. Some will be successful, others not.
5. Uncover your shape and give the repair signal.
6. Repeat with increasingly challenging designs. Remember to have conversations with the children about what they have

recreated, how hard the puzzles can be, and what trial-and-error steps they've taken. Remember the repair part of the activity builds as many skills as the create one.

Variation: Copy tangram patterns from Google™ images—there are many links to simple designs. Challenge children to copy the design but remember to give lots of time to concentrate, experiment, and create.

Build a tangram: You can use either heavy cardboard or thin ($\frac{1}{4}$ inch) plywood for the puzzle, but it's essential that the measurements be precise and cuts accurate. Cut the puzzle material 6-inches square. With a ruler and light pencil line, mark a grid on the square dividing the surface into 16 squares of $1\frac{1}{2}$ inches each. Use the diagram below as a guide and cut along the heavy lines to make the seven tans. If you're using wood, lightly sand and varnish the pieces. Store the pieces in a cloth bag.



Some definitions

The dimension of a space, in physics and mathematics, is the minimum number of coordinates needed to specify each point within it. For most of the population, this translates into descriptions of objects that are single-dimensional (a line), two-dimensional (a surface that has length and width), and three-dimensional like cubes, cylinders, and spheres, that have length, width, and depth.

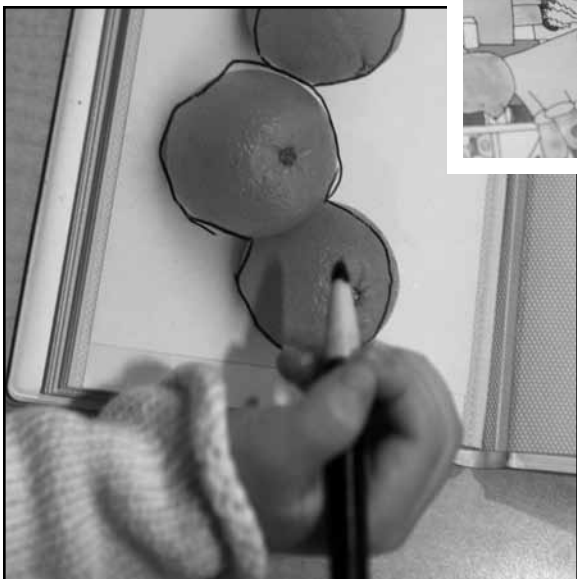
Symmetry explorations

Here's what you need:

- examples of symmetrical objects
- paper
- markers
- scissors
- mirror

1. Introduce the activity with definitions. Symmetry divides a figure into two parts that are mirror images of each other. Share examples and ask children to suggest other objects.
2. Invite the children to explore symmetry by drawing half of a picture—a person, flower, or butterfly, for example.
3. Show how to hold the completed drawing at a right angle on a mirror to see the complete image.

Variation: Find large, simple images in magazines—animals, houses, or trees, for example. Cut the image up the middle and tape one half to the edge of a sheet of paper. Challenge children to complete the other half of the picture using paint, crayons, markers, or watercolors.

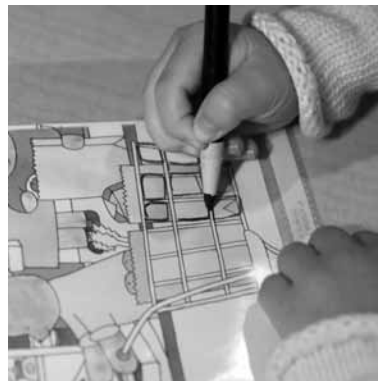


Parts of the whole

Here's what you need:

- large color pictures from old magazines
- plastic sheet-protector sleeves
- washable markers
- damp paper towels

1. Gather pictures from old magazines. Place each picture in a plastic sheet protector.
2. Challenge children to identify the unique shapes that make up the whole picture. Show a few examples—a circle clock, a cube ottoman, or french fry rectangles, for instance.
3. Encourage the children to use a marker to outline each distinct shape.
4. Ask that the plastic sleeves be wiped clean with a damp paper towel to prepare the activity for another child.



Master art

The modern artist Piet Mondrian used geometric designs and primary colors to express thoughts and feelings. Find samples of his paintings by searching his name on Google images.

Here's what you need:

- samples of Mondrian's art
- graph paper
- ½-inch wide black tape
- straight edges
- scissors
- heavy cardboard
- glue
- crayons
- colored pencils

1. Prepare for the activity by gluing graph paper to sheets of cardboard to strengthen the paper and provide a working surface for the children's art. Let dry thoroughly.
2. Introduce Mondrian's art to the children. Engage the children in conversation about what they see and feel in the pictures. Encourage questions and observations about color and geometric shapes.
3. Encourage the children to imitate Mondrian's geometric art with tape and color.
4. Show how to use the lines on the graph paper as a guide for placing tape around the perimeter of the paper and then in different sized rectangles and squares.
5. Invite the children to choose colors to fill in some of the geometric areas.

Reference

National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. www.standards.nctm.org