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SHAPE UP



AS A RESULT OF THIS STEM GEM, YOUNG PEOPLE WILL LEARN TO USE INEXPENSIVE CRAFT MATERIALS TO MAKE A HANDS-ON MATH MANIPULATIVE. The focus of this lesson is a hands-on activity to help younger children master simple shapes. However, the project is so fun that young people of all ages will enjoy it. This project can be used by older children to explore the geometry of complex polygons and angles or as a unique building block for engineering challenges.



WHAT IS A SHAPE?

Any object can be described by its properties or attributes. An object can be described by its size, weight, color, texture or shape. The shape of an object refers to its form or its external boundary, outline, or external surface.

WHAT IS A POLYGON?

A polygon is any two-dimensional shape that is made with straight lines. A polygon is made by a chain of straight line segments that close in a loop. Simple polygons are classified by the number of sides they have. For example, a triangle has three sides and a square has four sides. Any shape that can be drawn by connecting three straight lines is called a triangle.



CIRCLE: A simple shape made from points that are at an equal distance from the center. | **PARALLELOGRAM:** A four-sided shape with straight sides, in which opposite sides are parallel. | **POLYGON:** Shapes that are bound by a chain of straight line segments that close in a loop. | **RECTANGLE:** A polygon with four sides and four equal angles. | **SQUARE:** A regular polygon with four equal sides and four equal angles. | **TRIANGLE:** A polygon with three edges.



- ① **What words can be used to describe some of the objects that you see in this room?** *Young people's choice.*
- ② **What is a shape?** *Young people's choice.*
- ③ **Look around the room and name some of the shapes that you see?** *Young people's choice.*
- ④ **What is the difference between a circle and a square?** *Young people's choice.*

what YOU WILL NEED & before YOU BEGIN

- ① **Colored craft sticks**
- ② **Two balls, one larger than the other**
- ③ **Velcro® fastener circles (small enough to fit on the end of craft sticks)**
- ④ **Five sheets of paper**
- ⑤ **Drawing utensils**

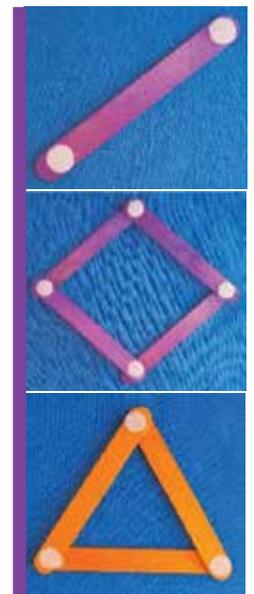
Draw or print a large outline of a simple shape on each sheet of paper. You will need one sheet with a circle, one with a square, one with a triangle, one with a rectangle, and one with a simple five-corner star.

EXPLORE & EXPERIMENT

- ① **Have each young person collect both halves** of a Velcro® fastener circle.
- ② **Invite young people to pull the circles apart** and describe how they are different.
- ③ **Explain that there are two parts of the Velcro® fastener;** one part is rough and prickly and the other part is softer and fuzzy. The rough part sticks into the fuzzy part to hold the pieces together.
- ④ **Ask young people to collect several craft sticks.**
- ⑤ **Have them adhere the rough side of a Velcro® fastener circle** to both ends of a craft stick.
- ⑥ **Have young people flip the craft stick over and adhere the fuzzy side of a Velcro® fastener circle to both ends of the craft stick.** The craft stick should now have four Velcro® fastener circles on it – two rough-sided circles on one side and two fuzzy-sided circles on the other side.

EXPLORE & EXPERIMENT (continued...)

- 7 **Invite young people to adhere the Velcro® fasteners in this manner** until there are enough craft sticks for them to experiment joining together to make flat shapes or polygons. These sticks can also be used repeatedly for many different projects.
- 8 **Split young people into small groups** and have each group gather a small pile of the Velcro® fastener craft sticks.
- 9 **Challenge each group to freely build shapes with the sticks** by sticking opposing Velcro® fastener ends together and pulling them apart.
- 10 **Place a big ball and a small ball in front of young people**, ensuring that each small group can see both. Ask young people to point to the big ball and have them explain how they knew which ball to point to.
- 11 **Discuss with young people that everything around us can be described by how it looks and feels.** We can describe objects by their color, size, weight, or texture. Name several adjectives for size (big or small), weight (light or heavy), and texture (soft, hard, rough, or smooth). As you name each adjective, show an object that illustrates the adjective. For example, you might show a fuzzy sweater to illustrate the adjective soft.
- 12 **Explain to young people that a great way to describe an object is by its shape.** Ask them to name the shape of the ball. The ball is a round or a circle. Show young people the prepared sheet of paper with a circle on it.
- 13 **Have young people name other objects that they have seen that are circles, such as plates and clocks.** Explain that circles are a very special shape because they do not contain straight lines. Most other shapes are made with straight lines to create sides. The number of sides a shape has tells what kind of shape it is.
- 14 **Tell young people they will next learn about squares.** Show them the prepared sheet of paper with a square on it. Explain that squares have four straight sides and each side has to be the exact same length or size. Each side of a square meets to form a corner and squares have four corners.
- 15 **Challenge each small group to build a square** using their craft sticks.
- 16 **Ask young people to identify squares in the room.** Ask them to name other objects in life that are square.
- 17 **Tell young people they will now learn about triangles.** Show them the prepared sheet of paper with a triangle on it. Explain that triangles have three straight sides that meet to form three corners.
- 18 **Challenge each small group to build a triangle** using their craft sticks.
- 19 **Ask young people to identify triangles in the room.** Ask them to name other objects in life that are triangles.
- 20 **Tell young people that they will learn about rectangles.** Show them the prepared sheet of paper with a rectangle on it. Explain that rectangles have four straight sides like a square, but the sides are not all the same length. The opposite sides of a rectangle are the same length. Each side of a rectangle meets to form a corner and rectangles have four corners.



EXPLORE & EXPERIMENT (continued...)

21 Challenge each small group to build a rectangle using their craft sticks.

22 Ask young people to identify rectangles in the room. Ask them to name other objects in life that are rectangles.

23 Tell young people they will now learn about stars. Show them the prepared sheet of paper with a star on it. Explain that stars are made from triangles. The star on the paper has five corners and ten sides.



24 Challenge each small group to build a star using their craft sticks. Encourage young people to choose the type of star to create. Explain that a five-pointed star can be made using ten craft sticks stuck together or a six-pointed star can be made by building two triangles and placing one of the triangles on top of the other and rotating it.

25 Now that young people are shape experts, provide them some of the shape-building challenges listed below to complete with their craft sticks.

1. Build a triangle using six sticks
2. Try to make a shape with two sticks and name the shape (A closed shape cannot be made with two sticks.)
3. Try to build a circle with the sticks (You can get close to a circle if enough sticks are used, but the shape will still be a polygon.)
4. Build as many different shapes as possible with four sticks
5. Build a shape with six sticks (Young people will make a hexagon. Five sides make a pentagon, seven sides make a heptagon, and an octagon has eight sides.)
6. Build two shapes and put them together to make something new (For example, a square and a triangle make a house shape.)
7. Build several triangles and find out what shapes can be made with a group of triangles (For example, six triangles placed in a circle can be used to make a hexagon.)

26 Challenge young people to invent their own shape-building challenges.

make THE CONNECTION

Hand out drawing tools and invite young people to draw a picture of their choosing. Explain that everything in their pictures can be drawn using only simple shapes. You can restrict them to drawing their pictures using only one shape, such as a triangle, or allow them to use several shapes.

EXTEND & EVALUATE

Create a shape quiz. Distribute some clearly defined, simple-shaped objects around the program space, such as a round paper plate. Invite young people to complete the quiz. Use the example questions below at your discretion when creating the quiz.

Example Questions:

- Which shape has three corners?
- Which shape is round?
- Which shape has four sides that are all the same length?
- Which shape can be made from small triangles?
- Which shape has no straight edges?
- Which shape has five corners?
- Which shape has four sides that are different lengths?
- Which shape has three sides and three corners?
- List three objects found in the room that are circles.
- Find a green triangle in the room.
- Find something in the room that is made from a triangle and a square.
- Find something in the room that is made from two squares.
- Find something outside that is a circle.
- What shapes make up a car?