

# GEOMETRY PLAYGROUND

Activities | Grades 3–5

[www.exploratorium.edu/geometryplayground/activities](http://www.exploratorium.edu/geometryplayground/activities)

## ROTATING STRING SHAPES

Make multi-sided shapes with string.

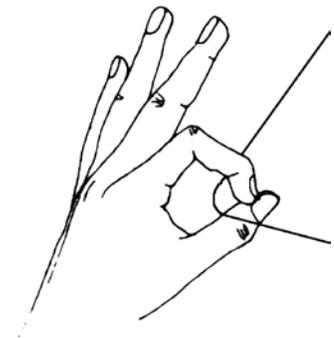
[45 minutes]

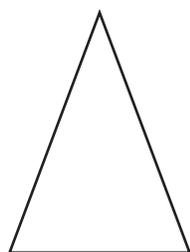
### Materials:

- String, about 2.5 meters (8 feet) long, tied at the ends to form a loop
- Large, flat table
- Masking tape
- Four people
- “Close to Me/Far from Me” page (attached), one copy per person
- Pencil

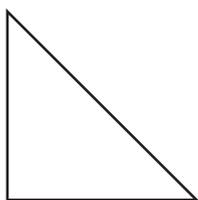
### Try This:

- Step 1 Sit around the table with your friends, facing one another. Start with four people to a table, but only three holding the string at first. Each person should have a piece of masking tape a few inches long, ready to use later.
- Step 2 Each person should take one hand and close the thumb and index finger around the string. The string should slide through easily. (If you have only two people, each person should use both hands.)  
Pull the string taut. What shapes can you make with three people, each using one hand?
- Step 3 By changing your hand positions while allowing the string to slide through your fingers, you can make many different kinds of triangles.

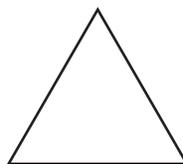




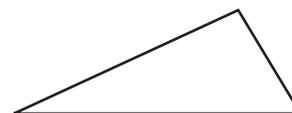
Isosceles



Right



Equilateral



Scalene

An *isosceles triangle* has two sides that are the same length.

*Right triangles* have one angle that measures 90 degrees, like a corner of a square.

A triangle with three sides the same length is an *equilateral triangle*.

If all three sides of a triangle are different lengths, it's a *scalene triangle*.

- Step 4 Have a fourth person join your group and hold the string with one hand. What interesting shapes can you make with four people? Four-sided shapes are called *quadrilaterals*. Notice that you can make *concave* shapes—where some of the points go inward—as well as *convex* shapes, where all the points go outward.



- Step 5 When the group finds a very interesting shape, carefully lower the string to the table, and leave it there. Then, one person at a time, carefully tape the corners of your shape to the table, keeping the string taut. Now each person should describe the shape from his or her point of view. What name would you give to this shape?
- Step 6 Each person should have a copy of the “Close to Me/Far from Me” page. Place it so the “Close to Me” side is closest to you. Find Rectangle 1, label it “my seat”, and draw the shape from your point of view.
- Step 7 After everyone has drawn the shape, all stand, move one seat to the right, and sit again. Bring your page with you.
- Step 8 Again, make sure the “Close to Me” side of the page is closest to you. Then in Rectangle 2, write whose seat you’re in and draw the shape from your new point of view. (It might look a little different from your first drawing.)

- Step 9 Stand again, move one seat to the right, and sit again.
- Step 10 Again, make sure the “Close to Me” side of the page is closest to you. Then in Rectangle 3, write whose seat you’re in and draw the shape from your new point of view. (It might look a little different from your other drawings.)
- Step 11 Stand again, move one seat to the right, and sit again.
- Step 12 Again, make sure the “Close to Me” side of the page is closest to you. Then in Rectangle 4, write whose seat it is and draw the shape from your new point of view. (It might look a little different than your other drawings.)
- Step 13 Compare your drawings with the others at your table. Do all the drawings made from your seat look the same?
- Step 14 Walk around to other groups and see what shapes they have drawn.
- Step 15 How can you make a shape with five sides? How many people would you need? If you have time, try making a five-sided shape with the string.

### **Make up your own question!**

Try to make up an interesting question that you can answer with this activity.

The question should begin with the phrase:

How can I make a \_\_\_\_\_?

### **What’s Going On?**

When three or more people hold the string taut, it creates a *polygon*. A polygon is any flat shape whose sides are straight lines. The number of hands holding the string determines how many sides and how many points, or *vertices*, the polygon will have. Three hands create triangles, which have three sides and three points. Four hands create *quadrilaterals*—four sides and four points. By adding hands, one at a time, you can make *pentagons* (5), *hexagons* (6), *heptagons* (7), and *octagons* (8).

Depending on where you hold your hands, you can make convex polygons, or concave polygons. Concave polygons have at least one point that goes in like a cave. In convex polygons all the points go outward.

Drawing the shapes from different points of view is similar to turning—or *rotating*—the shape. Instead of rotating the shape itself, you are moving around the shape. The shape itself never changes, yet each view of it looks a little different.

The four shapes on your page are *congruent*, which means they are the same shape and size.

# Close To Me / Far From Me

Keep this side FAR from me.

<p>1</p> <p>Draw in this box first.</p>	<p>2</p>
<p>3</p>	<p>4</p>

Keep this side CLOSE to me.

## ROTATING STRING SHAPES

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships:

- Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes;
- Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids.

Apply transformations and use symmetry to analyze mathematical situations:

- Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.

Use visualization, spatial reasoning, and geometric modeling to solve problems:

- Build and draw geometric objects.