

GEOMETRY PLAYGROUND

Activities | Grades 6–8

www.exploratorium.edu/geometryplayground/activities

SODA CAN MIRRORS

See how pictures change in a curved mirror.

[50 minutes]

Materials:

- Empty soda can
- 8.5" x 5" piece of .002" mirrored Mylar (available from Tap Plastics www.tapplastics.com)
- Morphed Images (attached)
- Tape
- Pencil
- Cup of small dried beans
- Place Can Here page (attached)
- Anamorphic Grid (attached)

Try This:

- Step 1 Look at the Morphed Images (distorted images). Can you tell what they are?
- Step 2 Make a cylindrical mirror—a mirror shaped like a cylinder—by wrapping the piece of Mylar around the soda can. Use tape to hold it in place. The Mylar should be loose enough that it doesn't reveal the wrinkles and imperfections in the can's surface.
- Step 3 Place the cylindrical mirror in the circle next to one of the morphed images. Look into the mirror. Now can you tell what the image is? A mirror that distorts shapes in its reflection is called an *anamorphic* (An-uh-MORF-ick) mirror.
- Step 4 Take your copy of the Place Can Here page and place the can on the circle.

Step 5 Imagine that the line that you see on each side of the can continues underneath the can, and forms the diameter of the cylinder. (Shown as "—— ————" in the drawing.)

Step 6 How can you use beans to make this straight line diameter in the reflection? Place one bean in front of the can so you can see it in the mirror. Keeping your eye on the reflection of the bean, move the bean so its reflection lines up with the imaginary extension of the diameter line.

Step 7 Keep adding beans, one at a time, to create a straight line in the mirror that connects the lines on either side of the can. The key is to keep looking in the mirror as you position each bean.

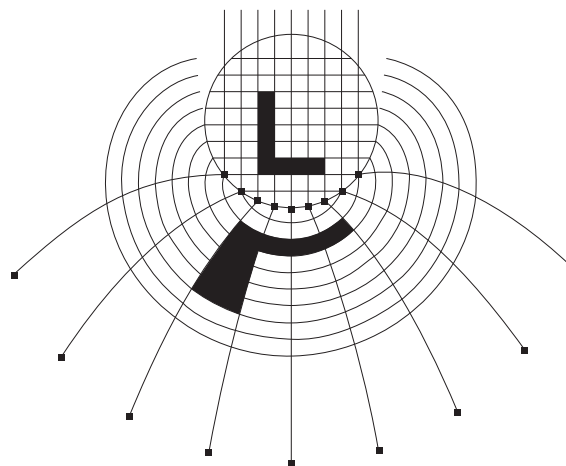
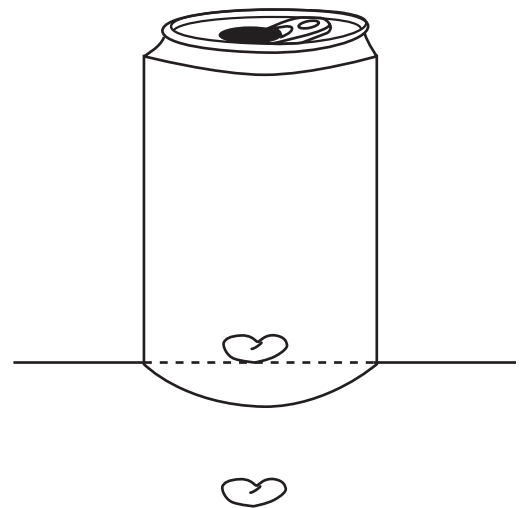
Step 8 Once the reflection looks like a straight line of beans, notice the shape formed by the actual beans on the paper. How would you describe that shape?

Step 9 Now take a look at the Anamorphic Grid—some of those lines should look like your bean line. How do you think the reflection will look when you place the mirror on the circle?

Step 10 Place the can in the circle on the grid and see what happens to the curved lines.

Step 11 Remove the can, and draw a simple design on the square grid inside the circle. You might choose to draw the first letter of your name, or some other simple design. Use your pencil to fill in inside of your design.

Step 12 Let's change your design into anamorphic art! Draw a reflection of your design in the curved grid. Do this by copying the shading in each square to the corresponding "square" on the curved grid. Here's an example with a letter L:



Hints for success: Copy one square of your shape at a time. Make sure to count how many empty squares are between your original shape and the circle, and then start drawing the edge of your shape the same number of squares away outside of the circle.

Keep counting and drawing in squares as you map the complete reflection of your design onto the curved grid. When you're finished, check your design by placing your mirror back on the circle.

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?

Flat mirrors make normal reflections of whatever you put in front of them. But a cylindrical mirror, like the one you made, creates a squished or compressed reflection of the things around it.

If you draw a normal shape, it will look squished in the mirror. But if you draw a stretched-out shape in front of the mirror, the reflection is squished into a normal-looking shape.

This kind of transformation of one shape into another shape is called *anamorphosis*, which means literally re-shaping.

Morphed Image

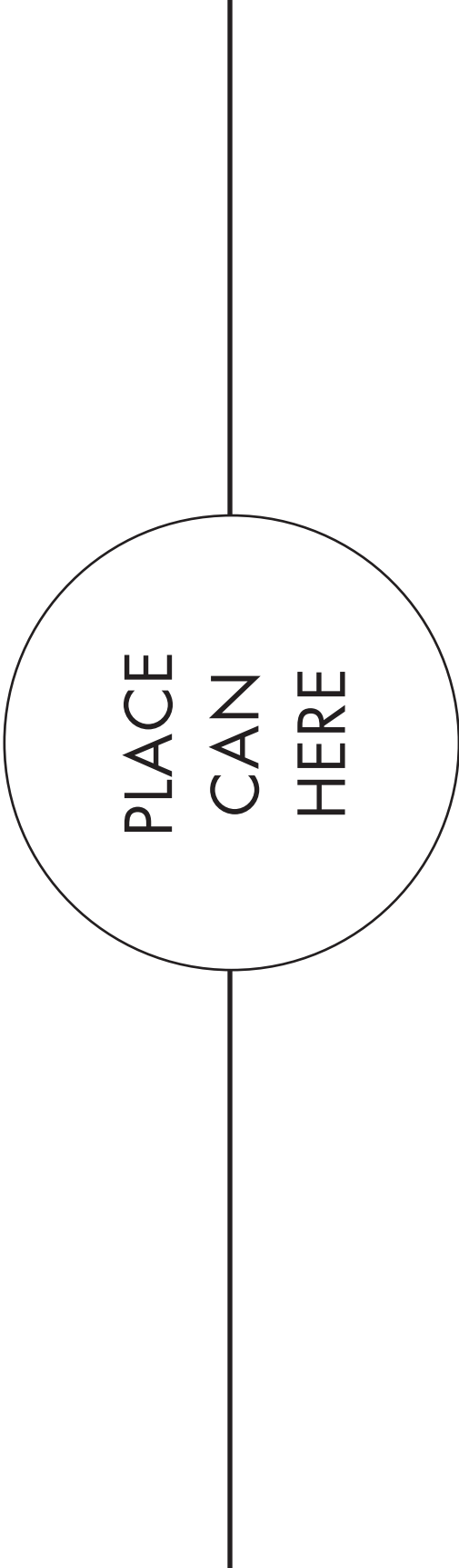


PLACE
CAN
HERE

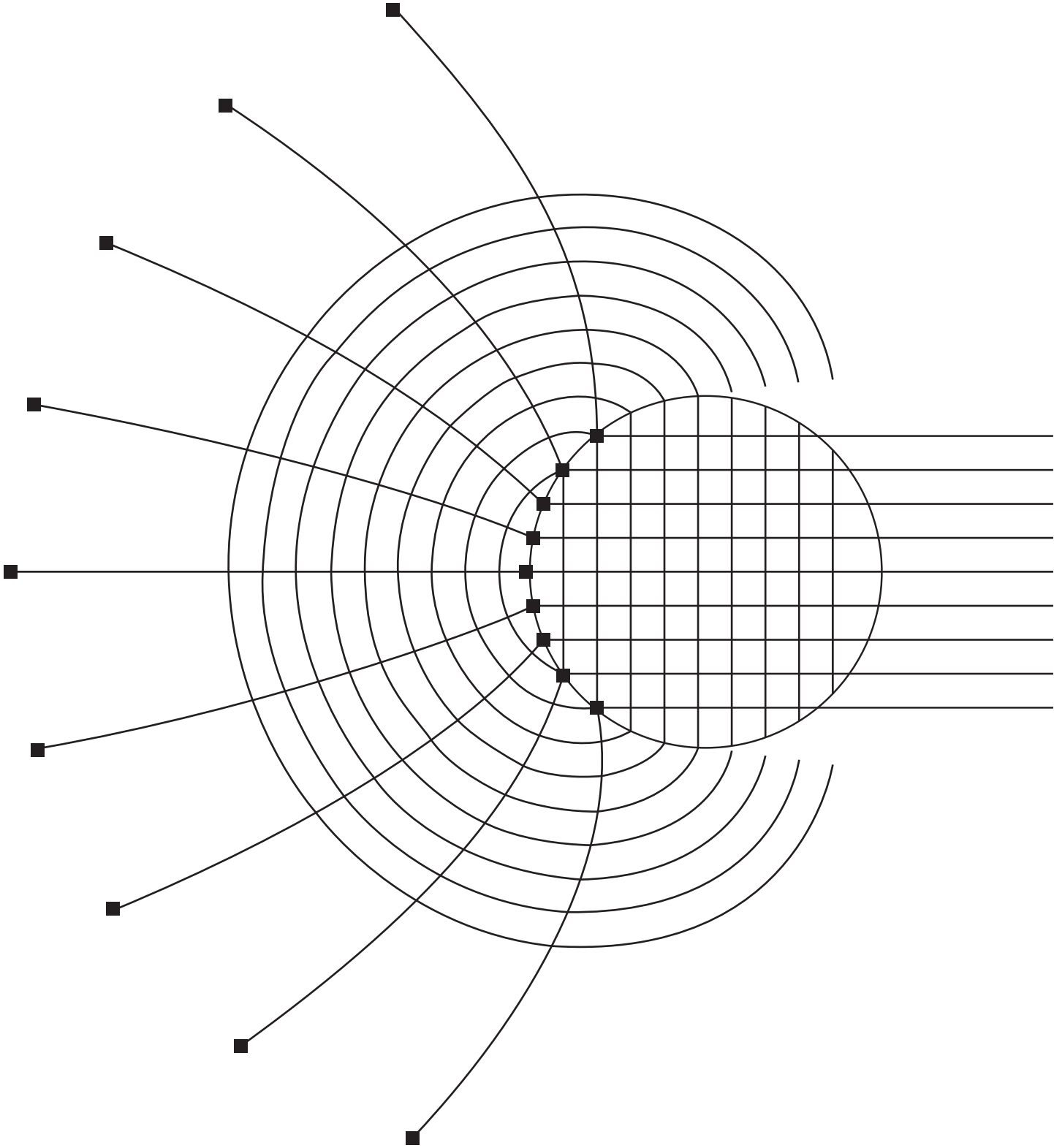
Morphed Image



PLACE
CAN
HERE



Anamorphic Grid



National Education Standards | Grades 6–8

From the National Council of Teachers of Mathematics (NCTM)

SODA CAN MIRRORS

Specify locations and describe spatial relationships using coordinate geometry and other representational systems:

- Use coordinate geometry to represent and examine the properties of geometric shapes.

Apply transformations and use symmetry to analyze mathematical situations:

- Describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling;
- Examine the congruence, similarity, and line or rotational symmetry of objects using transformations.

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

- Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.