

Soda-Can Mirrors

Recommended Grade Level:

6th–12th grade

NGSS Science & Engineering Practices:

- Asking questions
- Planning and carrying out investigations
- Using mathematics and computational thinking
- Constructing explanations and designing solutions

Time:

45 minutes

Materials Needed:

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

Background Information:

Discover how to draw a picture that looks distorted on the page, but normal in a cylindrical mirror.

To Do and Notice:

1. Look at the morphed (distorted) images. Can you tell what they are?
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.
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?
4. Take your copy of the "Place Can Here" page and place the can on the circle.
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.)

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.

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.

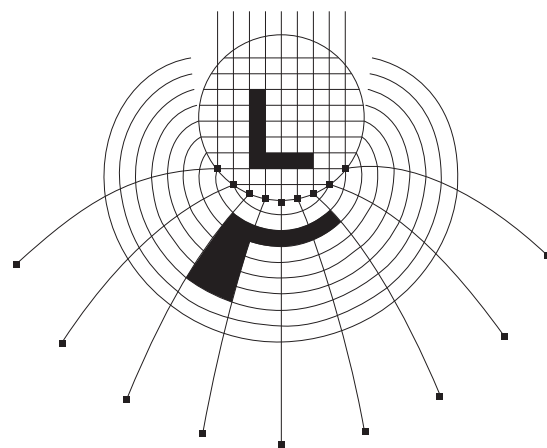
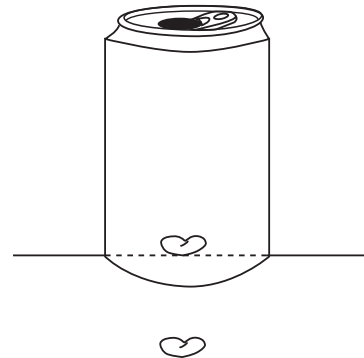
8. Once the reflection looks like a straight line of beans, notice the shape formed by the actual beans on the paper. How would you describe that shape?

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?

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

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.

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.

What's Going On?

Flat mirrors make normal reflections of whatever you put in front of them. A cylindrical mirror, like the one you made, still obeys the laws of reflection, but its curvature creates a squished or compressed image of the things around it. If you draw a normal shape, it will look squished in the mirror. But if you draw a horizontally stretched-out shape in front of the mirror, the reflection will squish into a normal-looking shape. This kind of transformation of one shape into another shape is called anamorphosis, which literally means re-shaping.

This activity was first developed for the Exploratorium exhibition Geometry Playground.



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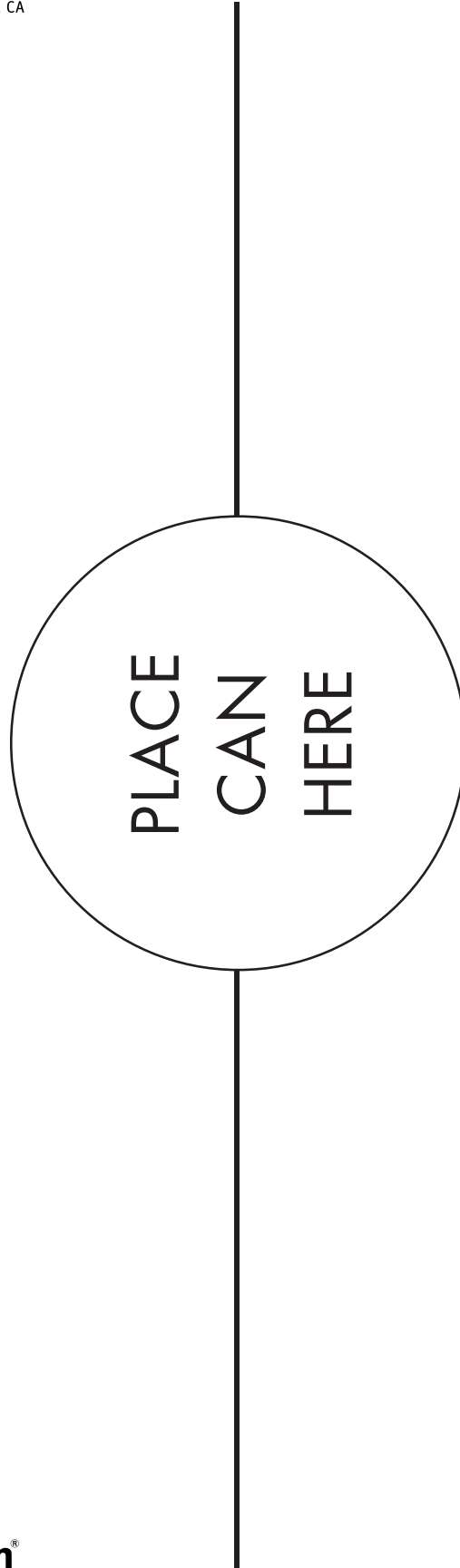


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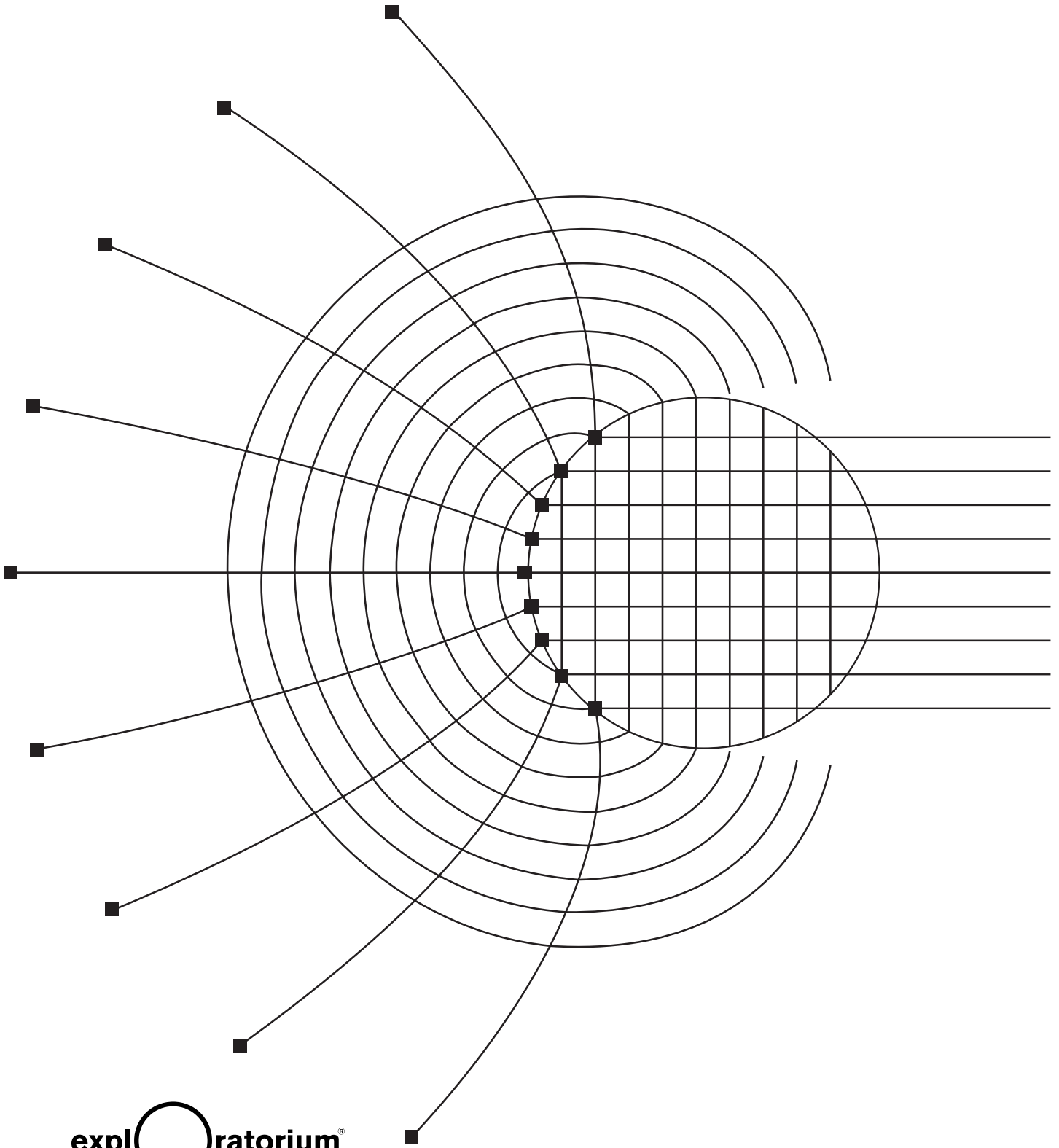
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Anamorphic Grid



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