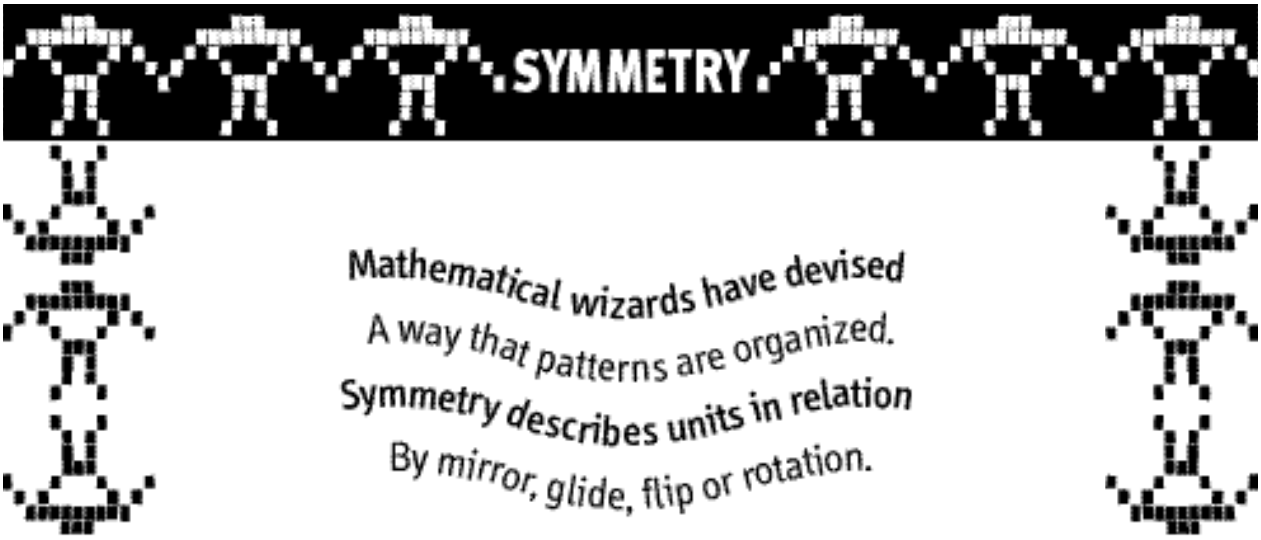


BACKGROUND FOR TEACHERS: SYMMETRY

Symmetry is a way that units of pattern are organized. A figure is symmetric if you can pick up a copy of it, move it to a new location or orientation, and set it down so that it exactly matches. There are twenty-four two-dimensional symmetries. In this kit we examine two: mirror and rotational symmetry.

Mirror or reflection symmetry divides a figure or design into halves that are mirror images. The axis can be located either vertically or horizontally. Mirror symmetry is found in both natural and man-made objects. Butterflies are good examples of mirror symmetry. Human faces have symmetry! In fact, most animals and plants exhibit some form of symmetry in their body shape and their markings.

Rotational symmetry occurs when an object is turned a certain number of degrees around a center point and still looks the same (i.e., it matches itself a number of times while it is being rotated). The number of repeated elements in this type of symmetry can vary significantly, although three is the minimum number of repetitions. Natural examples of rotational symmetry can be found in starfish, flowers, and snowflakes. Many cultural objects exhibit rotational symmetry including tile work, basket patterns, and kaleidoscopes.

CONVERSATION STARTERS

Use these questions to guide your class in a conversation about symmetry objects and images. In your discussion, listen for ideas that could lead to interesting classroom investigations.

What do you notice about the symmetrical objects? **How** are they the same and how are they different? **Create** a list of words describing what you see.

Where around the classroom do you see symmetry? **What** type of symmetry do you see? **Make** a chart categorizing the symmetry objects. **Which** type of symmetry is most common?

Why do you think things have symmetry?

SYMMETRY ACTIVITIES

SYMMETRY MASKS—Create a mask with mirror symmetry.

Skills: artistic expression, comparing and contrasting, making cultural connections, using fine motor skills, and observing objects

Start your conversations about symmetry by discussing the objects and images in the kit. Introduce the concept of mirror symmetry by having the children experiment with the mirrors and various pictures, letters, and drawings. Demonstrate rotational symmetry by placing two mirrors together. Play with the angle between the two mirrors and discuss what happens to the reflected image.

Mask making is a playful way to introduce the concept of mirror symmetry. Consider connecting this activity with cultural and life science topics the class is studying.

MATERIALS

- construction paper
- string, yarn, or ribbons
- scissors
- markers
- paints
- glue
- one-hole punch

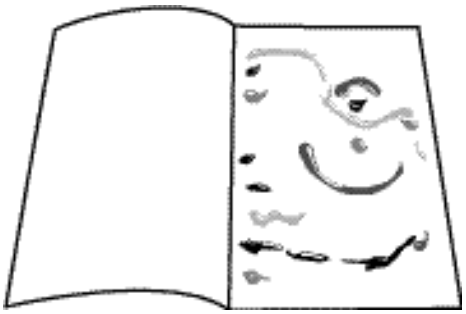
INSTRUCTIONS

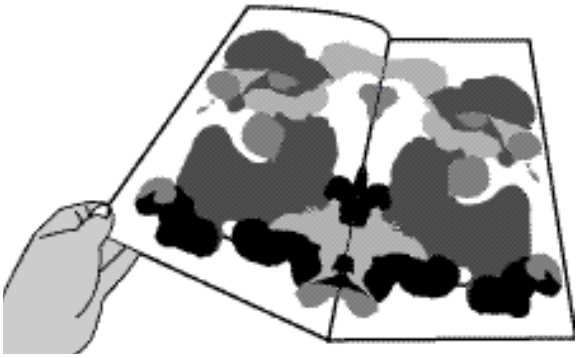
This technique produces fun, random results.

1. Have children turn the paper so the long edge is at the top, then fold the paper in half, like a book (the two short edges should be together). Have them press along the fold to create a sharp crease. Then open the paper completely and lay it flat.

2. Put paint on one half of the paper. Be careful not to get paint on both halves. It is okay if the paint is thickly applied. While the paint is still wet, fold the undecorated side of the paper onto the painted side. Press down gently, but firmly, along the whole surface. Open the two halves of the paper to reveal the symmetrical pattern. Allow the paint to dry.

3. Ask the children to look at the images they have created and to envision them as masks. Ask: Where is the top? Do they need any further decoration? Invite students to cut out the masks' outlines and eyeholes. Punch holes on both sides of the masks and attach ribbons. Encourage children to wear their unique creations.





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WRAP UP

Ask students to share how they created their patterns, if what they created surprised them, and what they learned. Have children look at the **Green-Spotted Triangle Butterfly** in the kit and discuss its pattern and origin. Discuss ways in which the butterfly and the other symmetry objects and images are both similar to and different from the masks.

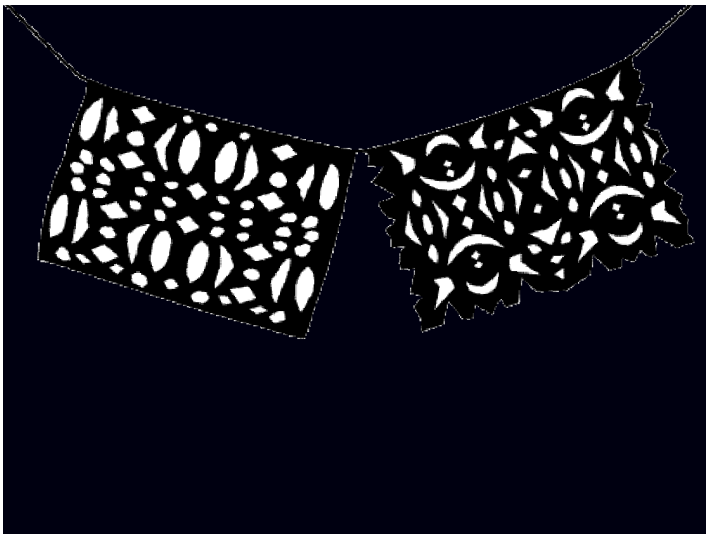
ADDITIONAL ACTIVITIES

Look for opportunities to connect your symmetry activities with cultural studies, math topics like geometry, and life science topics like life cycles.

PAPEL PICADO

Skills: artistic expression, creating and extending patterns, making cultural connections, using fine motor skills, and observing objects

In Mexico, *papel picado* (perforated paper) banners are cut from colorful paper in whimsical and symbolic patterns to decorate for festivals like the Day of the Dead. The patterns of papel picado can be simple or very ornate. To make banners for the classroom, have each student fold one or more pieces of colorful tissue paper in half. Ask them to sketch a design in pencil on one half of the paper and cut out the shapes. (The images that are used in the design can be drawn from any topic the class is currently studying.) Glue the banners to a string along their top edge as shown. Use the finished papel picado strings to decorate the classroom!



BUTTERFLIES

Skills: artistic expression, creating and extending patterns, using fine motor skills, observing objects, and spatial awareness

Illustrate mirror symmetry by making playful butterflies. Have children research different kinds of butterflies and moths, looking at examples of the symmetry within the patterning of butterfly wings. When students are ready, have them fold pieces of construction paper in half. Tell them to cut out the shape of a half of a butterfly, leaving the folded area of their paper intact. (You may want to create simple templates for the children to follow.) Have the children decorate their unique butterflies' wings.

SYMMETRY PINWHEELS

Skills: artistic expression, creating and extending patterns, using fine motor skills, observing objects, and spatial awareness

Make playful pinwheels to illustrate rotational symmetry. Pinwheels are bright, eye catching, kinetic, and demonstrate rotational symmetry. Create an "x" in the middle of each square of paper by folding opposite corners together. Open the paper and cut the creases to within one inch of the center. Invite children to decorate their pinwheels, creating the same pattern in each of the four quadrants. (You may want to suggest children use imagery from ongoing science or cultural studies.) Fold one flap from each corner to the center, as shown, without creasing the paper. Affix the corners in place. Attach the pinwheel to a craft stick or straw with a brass fastener and blow. Watch how the pattern spins!