Grades 1–2

Summary

Given a sheet of paper folded on a line of symmetry, students predict what the unfolded shape will look like. They also decide how to cut folded paper to create specific shapes.

Goals

Develop spatial reasoning

Explore shapes with line symmetry

Prior Knowledge

Familiarity with the concept of line symmetry

Materials

Plain paper

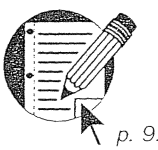
A copy of the blackline master "Cutouts" for each student

Scissors for each student

A cutout shape with symmetry (e.g., a heart)

A folded sheet of paper with a "half design" drawn on it for each student (See the "Explore" section.)

Drawing materials for each student



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Activity

Engage

Fold a piece of paper in half and draw the shape shown in figure 4.1. Ask the students to predict what the shape will look like when you cut it on the drawn lines and unfold the cutout. Unfold the cutout and talk about how the original shape is like the cut-and-unfolded shape and how the two shapes differ.

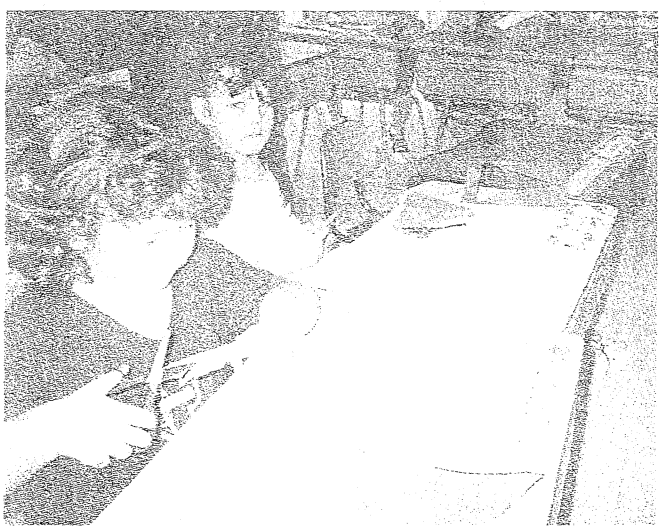


Fig. **4.1.**

A triangle on a folded piece of paper

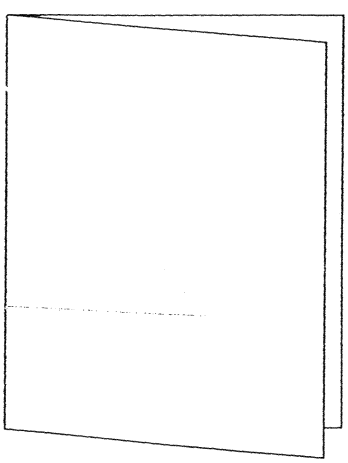
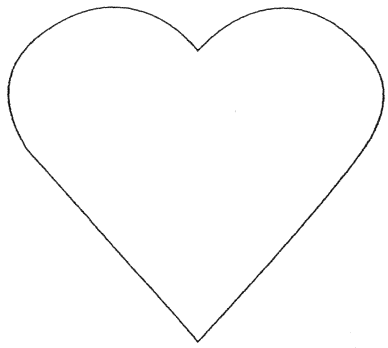


Fig. **4.2.**

A symmetric shape



Then show the students a shape with symmetry, for example, the heart in figure 4.2. Explain that you made this shape by folding a piece of paper, making a cut, and then unfolding the cutout. Ask the students to tell how they could make a similar heart following your procedure. Once they agree on what to do, call on one student to draw the shape and cut it out to check that it does result in a heart.

Explore

Give each student a sheet of folded paper with a design marked on it. Some examples are shown in figures 4.3 and 4.4. Have the children draw pictures of what they think the shapes will look like when they are cut out and unfolded. Ask questions like the following:

> How many sides will your cutout have? How do you know?
>
> Which sides of your unfolded cutout will be the same length as a side of your folded cutout? Which will be longer? Will any be shorter?
>
> How can you predict the number of corners, or vertices, your cutout will have just by looking at the drawing on the folded shape?

Distribute scissors, and have the students cut out their shapes to test their predictions. Then ask them to complete a chart like the one in figure 4.4. Talk about which shapes "kept the same name" (e.g., a triangle became a larger triangle) after they were cut out and opened up.

Fig. **4.3.**

Designs drawn on folded sheets of paper

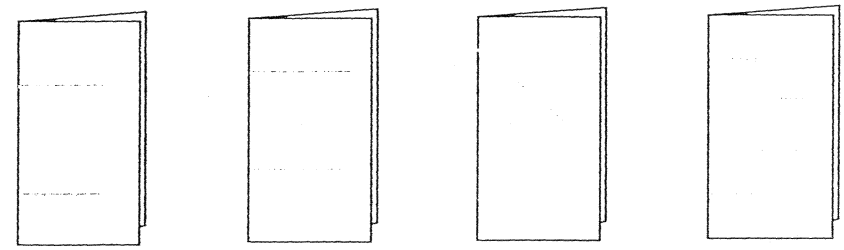
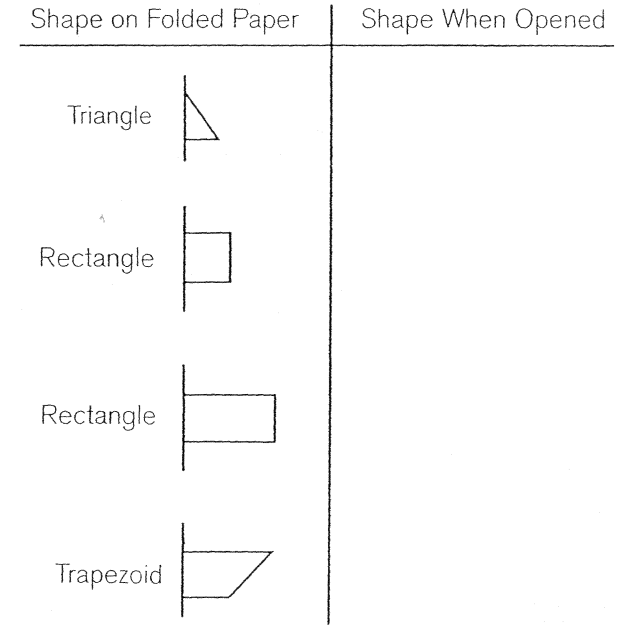


Fig. **4.4.**

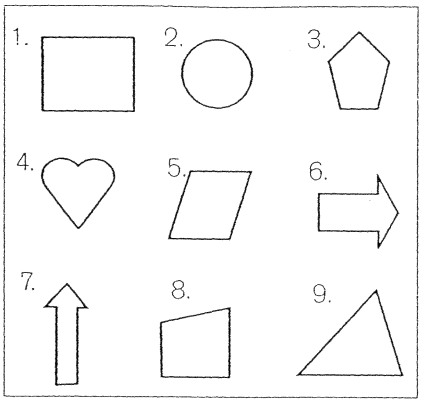
A chart of the shapes of folded and unfolded figures



Give each student a copy of the blackline master "Cutouts," and ask which shapes they believe could have been cut from folded paper and how they know. Give the students paper, drawing materials, and scissors to test their predictions.

Extend

Make available folded sheets of paper. Challenge the students to figure out how many different unfolded shapes they could make with three straight cuts on the folded paper. For example, they could make a square, a nonsquare rectangle, a trapezoid, or a hexagon (see fig. 4.5). Then ask the students which shapes they could make with two straight cuts or one straight cut. In particular, you might challenge them to make a square with three, two, or one cut.



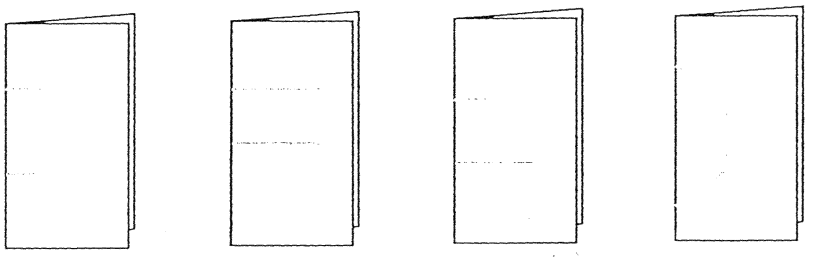


Fig. **4.5.**

Making shapes with three straight cuts on folded paper

Discussion

One important aspect of spatial reasoning is the ability to visualize how the congruent halves of a line-symmetric shape are related to the whole shape. Often, even though students can identify that a shape has symmetry, they may have difficulty visualizing how half of the shape could be cut from a folded piece of paper to create the whole shape. This simple activity makes this concept concrete. Students wrestle with significant mathematical ideas when they are challenged to figure out what the shape will look like when unfolded, which shapes can be created with a certain number of cuts, or which shapes cannot be cut out in this manner.