

What You'll Learn

- Identifying types of symmetry in figures

...And Why

To understand a topic that influences art, dance, and poetry, and is an important tool of scientists

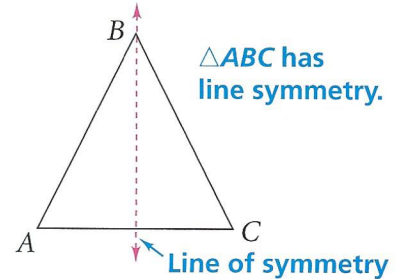
3-5

Symmetry

THINK AND DISCUSS

Reflectional Symmetry

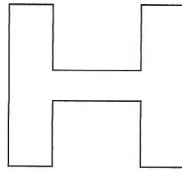
A figure has **symmetry** if there is an isometry that maps the figure onto itself. A plane figure has **reflectional symmetry**, or **line symmetry**, if there is a reflection that maps the figure onto itself. If you fold a figure along a line of symmetry, the halves match exactly.



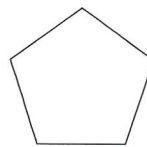
Example 1

Draw the lines of symmetry for each figure.

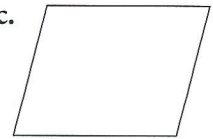
a.



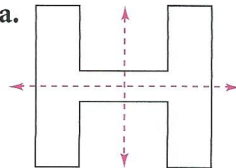
b.



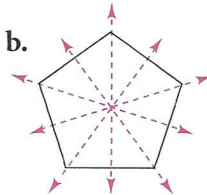
c.



a.



b.



c. This figure has no lines of symmetry.



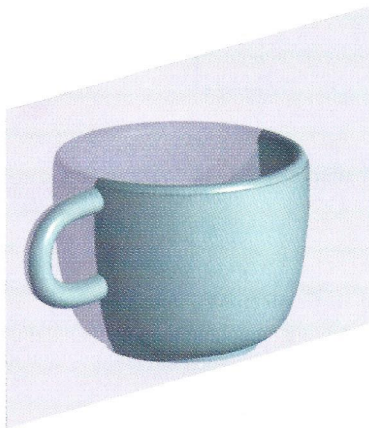
Paul McCartney of the Beatles used converted right-handed bass guitars until he was given a left-handed Rickenbacker bass in the mid-1960s.

Symmetry is especially important to left-handers. Because about 95% of people are right-handed, right-handed versions of objects are easier to find (and often less expensive!) than left-handed versions of the same objects.

Left-handed people appreciate reflectional symmetry because objects that have it can be used by both left-handers and right-handers.



Three-dimensional objects with reflectional symmetry can be divided into two congruent parts by a plane. You can sketch these symmetries in two dimensions by using orthographic views (top, front, or right side).

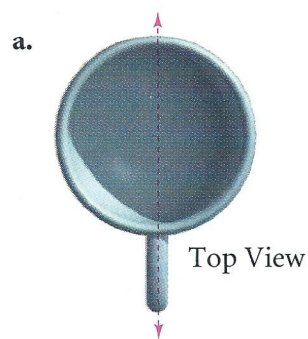


Example 2

Relating to the Real World



Technical Drawing Show the reflectional symmetries of each object by sketching an orthographic view.



1. **Critical Thinking** Name an object that has more than one plane of symmetry.

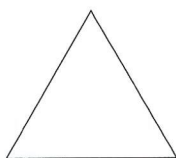
Rotational Symmetry

A figure has **rotational symmetry** if there is a rotation of 180° or less that maps the figure onto itself.

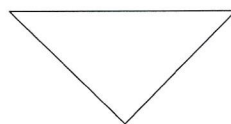
Example 3

Which figures have rotational symmetry? For those that do, give the angle of rotation.

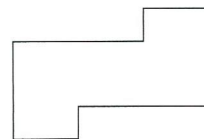
a.



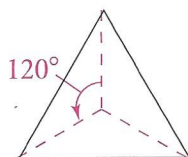
b.



c.

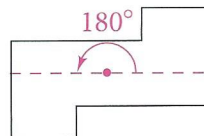


a.



b. This figure does not have rotational symmetry.

c.

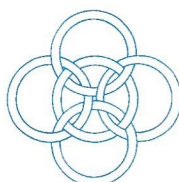


2. If a figure has rotational symmetry, must it also have line symmetry? Explain your answer.

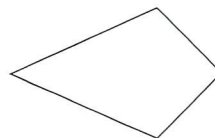
A rotation of 180° is known as a **half-turn**. If a half-turn maps a plane figure onto itself, the figure has **point symmetry**.

3. **Try This** Which figures have point symmetry?

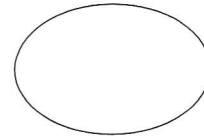
a.



b.



c.



The spinning motion of a lathe ensures that objects created on it have rotational symmetry.

So far, you've looked at figures with reflectional and rotational symmetry. As you may have guessed, figures may also have *translational* or *glide reflectional* symmetry. You will discuss these symmetries in the next lesson.

WORK TOGETHER

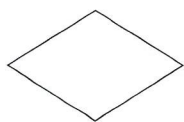
Type of Symmetry	Points
Reflectional Symmetry	1
Rotational Symmetry of 180°	2
Rotational Symmetry other than 180°	3

- Work in groups to find examples of symmetrical objects in your classroom. For each object that you find, sketch an orthographic view and list its symmetries. You will have only ten minutes in which to search, so plan your time wisely!
- Determine your group's score by using the chart at the left.

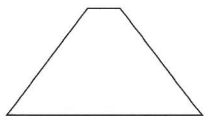
Exercises ON YOUR OWN

What types of symmetry does each figure have? If it has reflectional symmetry, sketch the figure and the line(s) of symmetry. If it has rotational symmetry, state the angle of rotation.

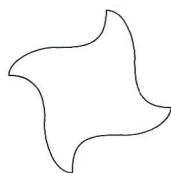
1.



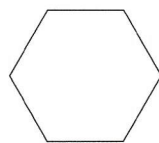
2.



3.



4.



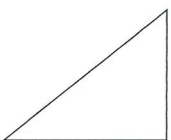
5.



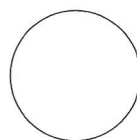
6.



7.



8.

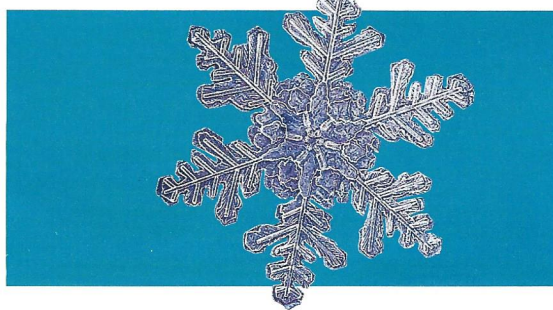


What types of symmetry are shown in each photograph?

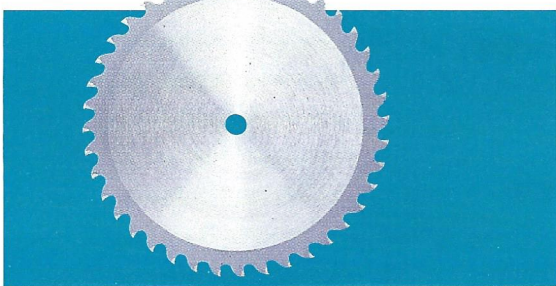
9.



10.



11.



12.



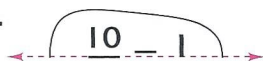
13. Sketch a triangle that has reflectional symmetry but not rotational symmetry.
14. a. Copy the tree diagram of quadrilaterals on page 92. Then draw each figure's lines of symmetry.
b. **Patterns** How do the symmetries of the figures in the top portion of the tree diagram compare with the symmetries of those lower in the diagram?

Each diagram shows a shape folded along a red line of symmetry. Sketch the unfolded figure.

15.



16.



17.



18. a. The word **CODE** has a horizontal line of symmetry through its center. Find three other words that have this type of symmetry.
 b. The word **WAXY**, when printed vertically, has a vertical line of symmetry. Find three other words that have this type of symmetry.

Advertising Many automobile manufacturers have symmetrical logos. Describe the symmetry, if any, in each logo.

19.



20.



21.



22.



23.



24.



25.



26.



27.



28.



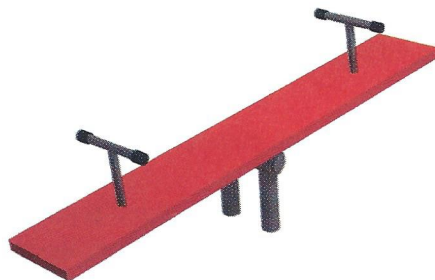
29. **Research** Many company logos are symmetrical. Find three symmetrical logos in the Yellow Pages of your local phone book. Copy each logo, identify the name of the business, and describe the type(s) of symmetry illustrated.

Geometry in 3 Dimensions Show the reflectional symmetries of each object by sketching an orthographic view.

30.



31.



32.

