# Lesson 76

Symmetry

Symmetry – A property illustrated when the image of a transformation of a figure coincides with the preimage. There are several different kinds of symmetry.

A figure has line symmetry if the figure can be reflected across a line so that the image coincides with the preimage. The line that divides the figure into two congruent, reflected halves is a line of symmetry. The figure at the right has a vertical line of symmetry.
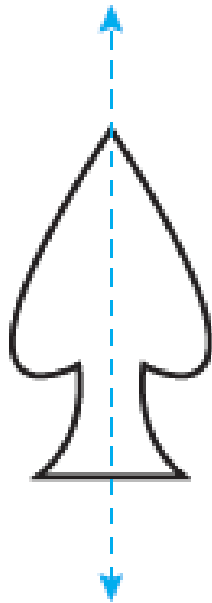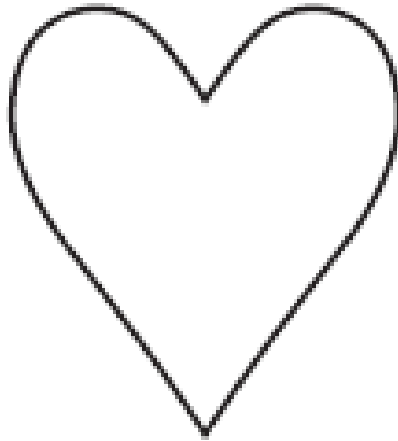
Math Language

If two figures coincide, it means they lie directly on top of one another.

Example 1 Identifying Lines of Symmetry

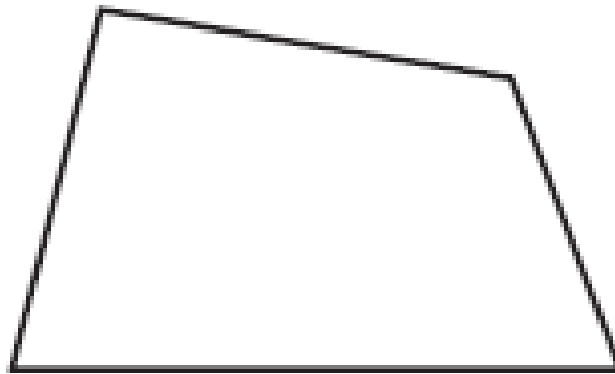Identify whether each figure has a line of symmetry. If it does, draw the line of symmetry.

a.

SOLUTION

The heart has one vertical line of symmetry, as shown in the diagram.

Example 1 Identifying Lines of Symmetry

Identify whether each figure has a line of symmetry. If it does, draw the line of symmetry.

b.

SOLUTION

The quadrilateral is not symmetric across any line.

Rotational symmetry is a type of symmetry which describes a figure that can be rotated about a point by an angle less than 360° so that the image coincides with the preimage.

The smallest angle through which a figure can be rotated in order to coincide with itself is an angle of rotational symmetry. The diagram shows half of a spade that has been rotated 180°. The angle of rotational symmetry is 180°.

The regular hexagon shown has both rotational symmetry and line symmetry. It is symmetrical across a vertical line, a horizontal line, and any line drawn through opposite vertices. It also has a 60° angle of symmetry.
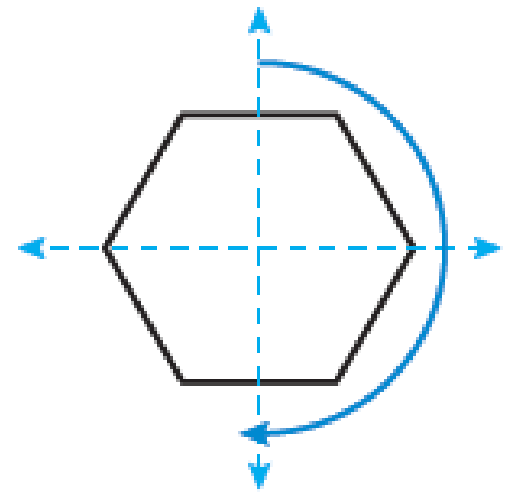
Example 2 Creating Symmetrical Figures Using Transformations

Rotate $\triangle RST$ 180° around point R. Does the new composite figure have symmetry? What type? Does it matter if you rotate the figure clockwise or counterclockwise?
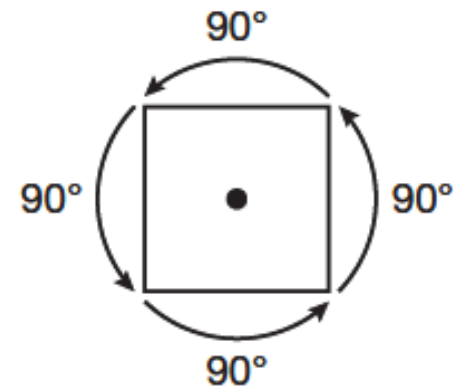
SOLUTION

The new figure has rotational symmetry of 180°.

Regardless of whether you rotate the preimage clockwise or counterclockwise, the image will look the same.
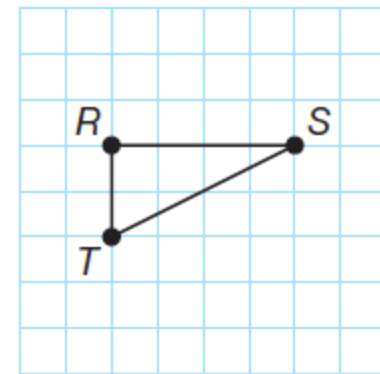
Order of Rotational Symmetry – The number of times a figure with rotational symmetry coincides with itself as it rotates 360°. A square has an order of 4, as shown in the diagram.

The order of rotational symmetry is equal to 360° divided by the angle of rotational symmetry.
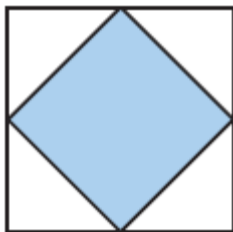
Example 3 Finding Orders of Rotational Symmetry

Tell whether each figure has rotational symmetry. If so, give the angle of rotational symmetry and the order.

a.

b.

c.

SOLUTION
a. yes; 180°; order 2
b. yes; 90°; order 4
c. no rotational symmetry

Example 4 Application: Tiling

a. Tiles often have many lines of symmetry so they can fit easily into patterns. How many lines of symmetry does each regular polygon with up to ten sides have?

SOLUTION

Make a chart to answer this question.

Number of Sides	Lines of Symmetry
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Example 4 Application: Tiling

b. How many lines of symmetry does a 15-sided tile have?

SOLUTION

The table suggests that a regular polygon has as many lines of symmetry as it has sides, so a 15-sided tile would have 15 lines of symmetry.
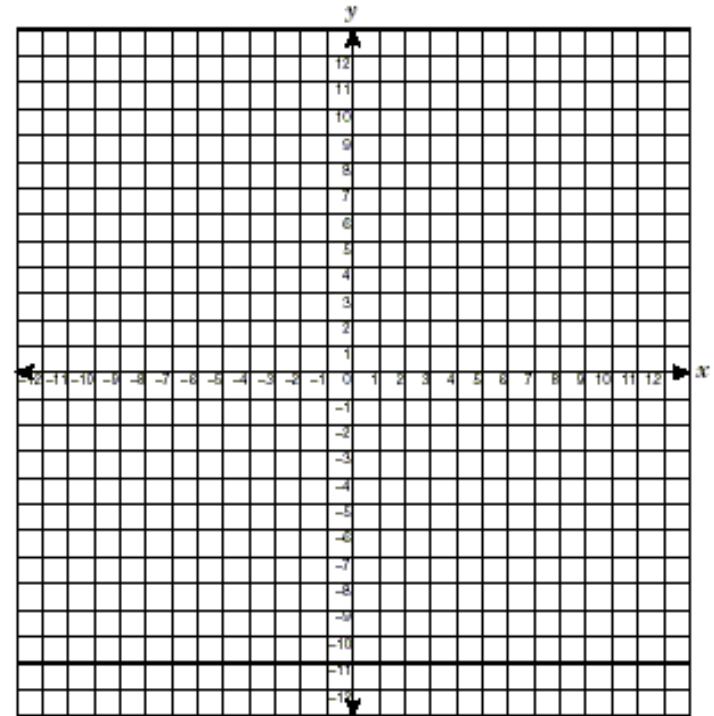
You Try!!!!!

a. Does the star have any lines of symmetry? If so, how many?

b. What is the order of rotational symmetry of the star? What is the angle of rotational symmetry?

You Try!!!!!

c. Triangle *ABC* has vertices *A*(0, 0), *B*(2, 0), and *C*(2, 3). If the triangle is reflected over the *x*-axis, will the first triangle and the reflected triangle have a line of symmetry? If so, where is the line?

You Try!!!!!

d.If there were a regular polygon with 50 sides, how many lines of symmetry would it have?

Assignment

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     Lesson Practice (Ask Mr. Heintz)

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     Practice 1-30 (Do the starred ones first)