Rotations

What You'll Learn

To graph rotations and to identify rotational symmetry

🔊 **New Vocabulary** rotation, center of rotation, angle of rotation, rotational symmetry

---

✓ **Check Skills You'll Need**

1. **Vocabulary Review** When a figure has *reflectional symmetry*, one half __?__ the other half exactly.

Classify each angle as *acute, right, obtuse,* or *straight.*

2. 180°   3. 150°

4. 95°   5. 20°

6. 35°   7. 90°

Why Learn This?

When you learn to recognize rotational symmetry, you can see it in everything from art and nature to architecture and science.

A **rotation** is a transformation that turns a figure about a fixed point called the **center of rotation.** A figure has **rotational symmetry** if it can be rotated 180° or less and exactly matches its original figure.

When you rotate a figure about a point, the image is congruent to the original figure. A rotation changes only the position of a figure. The **angle of rotation** is the number of degrees the figure rotates. A complete rotation is 360°.
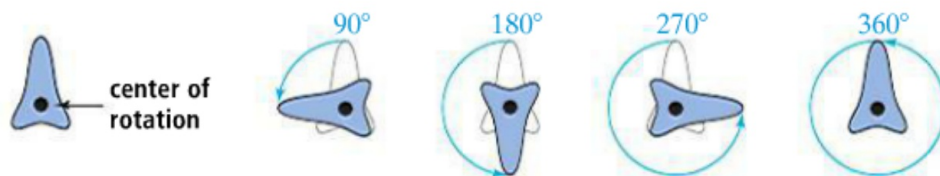
Rotational Symmetry
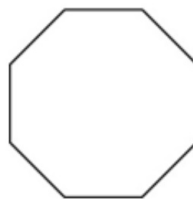
1 **Nature** Find the angle of rotation of the figure.

The image matches the original after $\frac{1}{5}$ of a complete rotation.

$\frac{1}{5} \cdot 360° = 72°$

The angle of rotation is $72°$.

---

1 **EXAMPLE** Find the angle of rotation for the figure below.

The image matches the original after $\frac{1}{8}$ of a complete rotation.
$\frac{1}{8} \cdot 360° = 45°$.
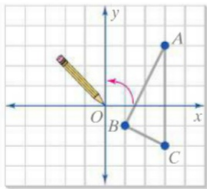
The angle of rotation is $45°$.

You can use the coordinate plane to graph rotations. In this book, all rotations are counterclockwise.

EXAMPLE **Graphing Rotations**
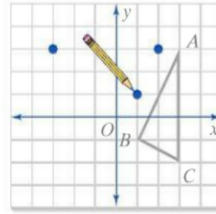
Graph △ABC and its image after a rotation of 90° about the origin. Name the coordinates of the vertices of △$A'B'C'$.

Step 1 Draw and trace.

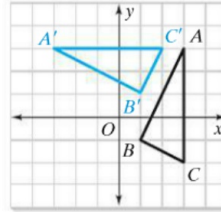- Draw △ABC on a piece of graph paper. Place a piece of tracing paper over your graph.
- Trace the vertices of the triangle, the x-axis, and the y-axis, as shown in blue.
- Place your pencil at the origin to rotate the paper.

Step 2 Rotate and mark each vertex of the image.

- Rotate the tracing paper 90° counterclockwise. The axes should line up.
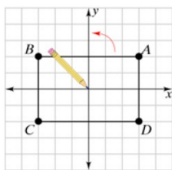- Mark the position of each vertex of the image by pressing your pencil through the paper.

Step 3 Draw the image.

- Remove the tracing paper.
- Draw △$A'B'C'$.
- Label the vertices to complete the image.

The coordinates of the vertices of △$A'B'C'$ are $A'(-3,3)$, $B'(1,1)$, and $C'(2,3)$.

② EXAMPLE Draw the image of rectangle $ABCD$ after a rotation of 90° about the origin.

Step 1 Draw and trace.

- Draw rectangle $ABCD$ on a piece of graph paper. Place a piece of tracing paper over your graph.
- Trace the vertices of the rectangle, the x-axis, and the y-axis.
- Place your pencil at the origin to rotate the paper.
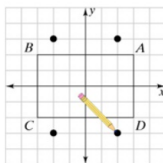
Step 2 Rotate and mark each vertex.

- Rotate the tracing paper 90° counterclockwise The axes should line up.
- Mark the position of each vertex by pressing your pencil through the paper.
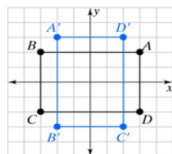
Step 3 Complete the new figure.

- Remove the tracing paper.
- Draw the rectangle.
- Label the vertices to complete the figure.

# 8-3 • Guided Problem Solving

GPS **Student Page 267, Exercise 12:**

Graph $\triangle JKL$ with vertices $J(1, -3)$, $K(6, -2)$, and $L(6, -4)$. Graph
the three images formed by rotating the triangle 90°, 180°, and 270°
about the origin. Give the coordinates of the vertices of each image.

Understand

1. What are you asked to do?

   _____

   _____
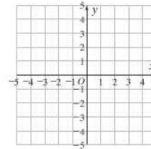
2. Around what point will the triangle be rotated?

   _____

Plan and Carry Out

3. Graph the triangle. _____

4. What is a rotation?

   _____

5. What direction does the figure rotate?

   _____

6. Rotate the figure 90° and mark each vertex.

   _____

7. Rotate the original figure 180° and mark each vertex.

   _____

8. Rotate the original figure 270° and mark each vertex.

   _____
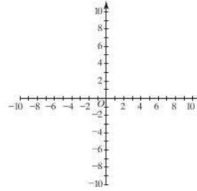
Check

9. How can you check that your figures are rotated correctly?

   _____

   _____

   _____

Solve Another Problem

10. **a.** Graph $\triangle ABC$ with vertices $A(2, 2)$, $B(1, 1)$, and $C(1, 3)$.
    b. Draw the three images formed by rotating the triangle 90°,
    180°, and 270° about the origin.