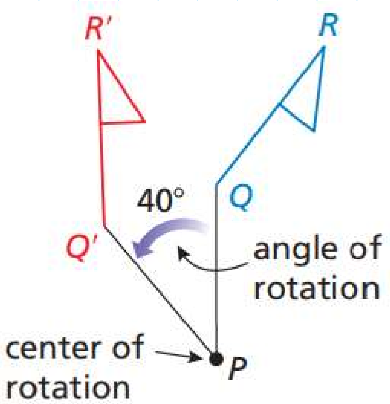
What You Will Learn

- Perform rotations.
- Perform compositions with rotations.
- Identify rotational symmetry.

Rotations

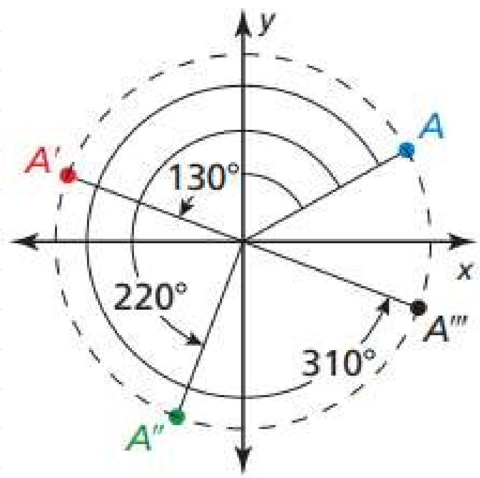
A **rotation** is a transformation in which a figure is turned about a fixed point called the **center of rotation**. Rays drawn from the center of rotation to a point and its image form the **angle of rotation**.



The figure above shows a 40° counterclockwise rotation. Rotations can be *clockwise* or *counterclockwise*. In this chapter, all rotations are counterclockwise unless otherwise noted.

You can rotate a figure more than 180°. The diagram shows rotations of point A 130°, 220°, and 310° about the origin. Notice that point A and its images all lie on the same circle. A rotation of 360° maps a figure onto itself.

all images are going to be a fixed distance from the center of rotation, regardless of direction or magnitude of rotation.

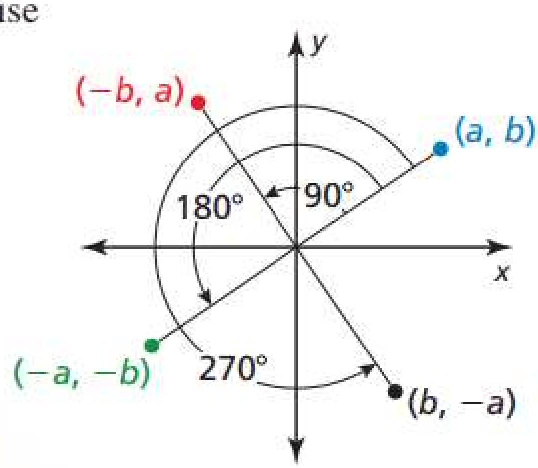


Mapping

Coordinate Rules for Rotations about the Origin

When a point (a, b) is rotated counterclockwise about the origin, the following are true.

- For a rotation of 90°, $(a, b) \rightarrow (-b, a)$.
- For a rotation of 180°, $(a, b) \rightarrow (-a, -b)$.
- For a rotation of 270°, $(a, b) \rightarrow (b, -a)$.

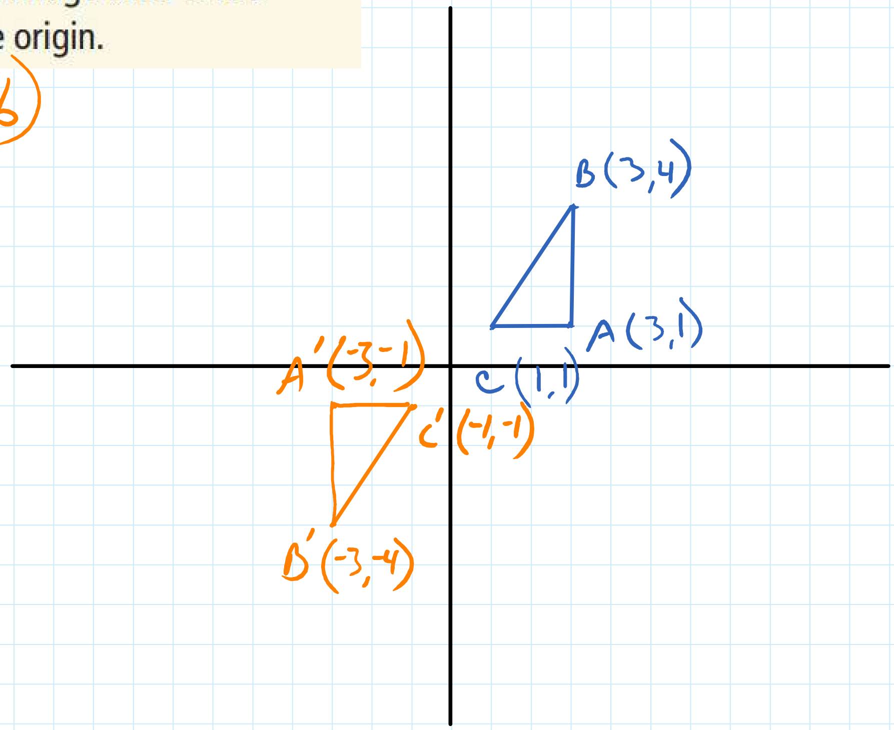


- What would the mapping be for a rotation of 360°?

$(a,b) \rightarrow (a,b)$

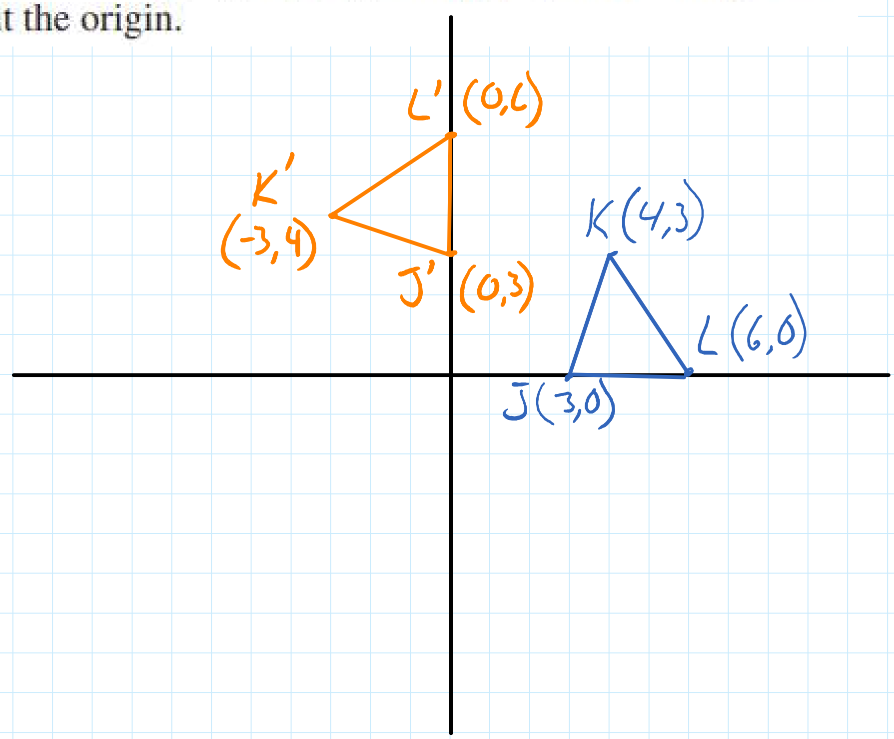
Graph $\triangle ABC$ with vertices $A(3, 1)$, $B(3, 4)$, and $C(1, 1)$ and its image after a 180° rotation about the origin.

$(a, b) \rightarrow (-a, -b)$



2. Graph $\triangle JKL$ with vertices $J(3, 0)$, $K(4, 3)$, and $L(6, 0)$ and its image after a 90° rotation about the origin.

$(a, b) \rightarrow (-b, a)$



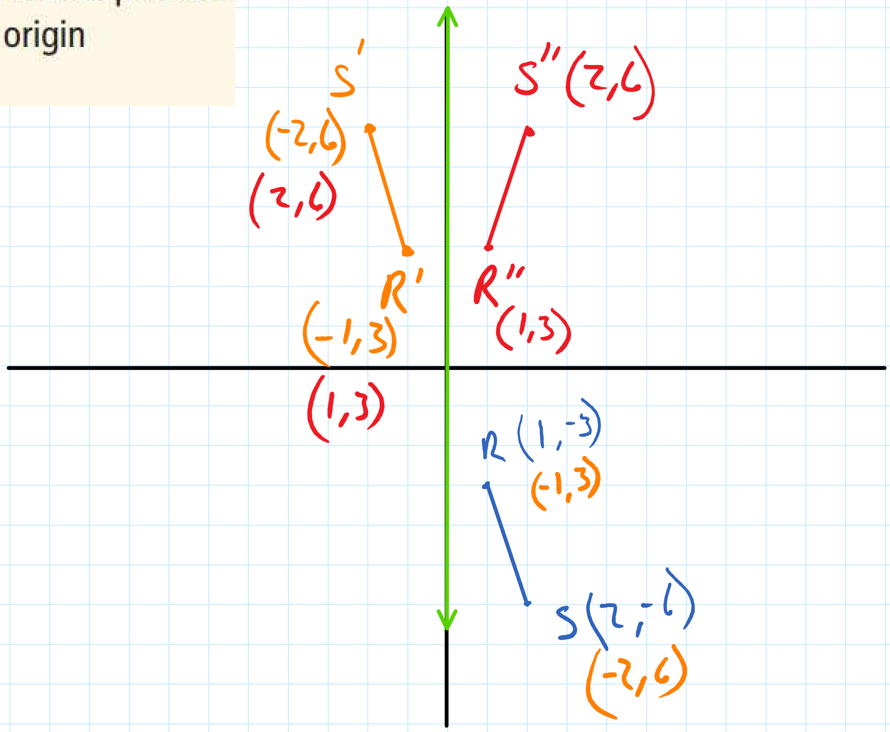
Graph $\overline{RS}$ with endpoints $R(1, -3)$ and $S(2, -6)$ and its image after the composition.

Rotation: 180° about the origin

Reflection: in the y-axis

$(a,b) \to (-a,-b)$

$(a,b) \to (-a,b)$

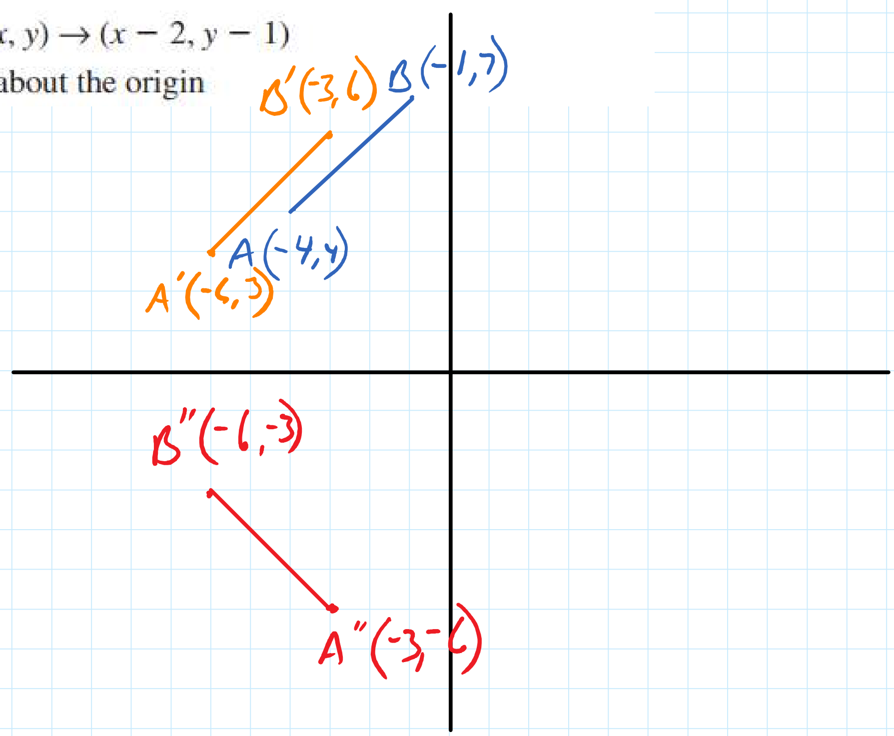


5. Graph $\overline{AB}$ with endpoints $A(-4, 4)$ and $B(-1, 7)$ and its image after the composition.

Translation: $(x, y) \to (x - 2, y - 1)$

Rotation: 90° about the origin

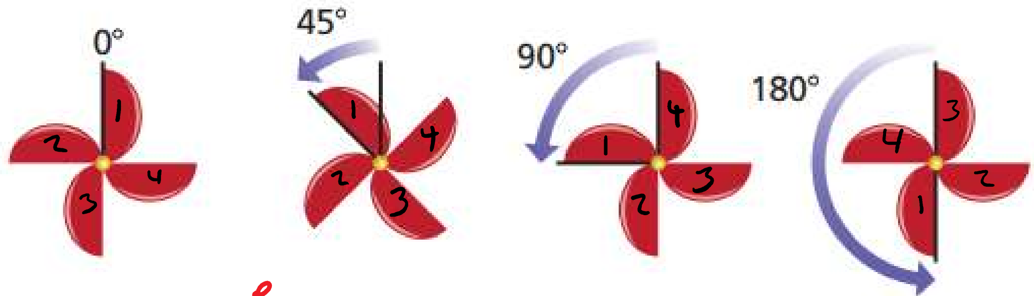
$(a,b) \to (-b,a)$



Identifying Rotational Symmetry

A figure in the plane has **rotational symmetry** when the figure can be mapped onto itself by a rotation of 180° or less about the center of the figure. This point is the **center of symmetry**. Note that the rotation can be either clockwise or counterclockwise.

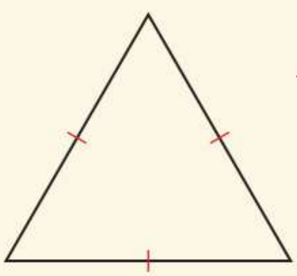
For example, the figure below has rotational symmetry, because a rotation of either 90° or 180° maps the figure onto itself (although a rotation of 45° does not).



yes, 90°

Does the figure have rotational symmetry? If so, describe any rotations that map the figure onto itself.

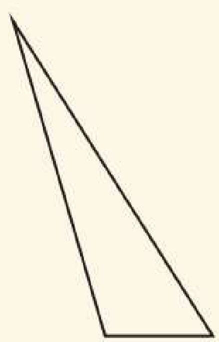
a.



$\frac{360}{3}$

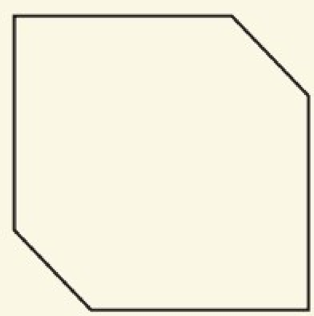
yes, 120°

b.



no.

c.



$\frac{360}{2}$

yes, 180°

Practice sec 4.3 **pg. 194: 7-23EO**