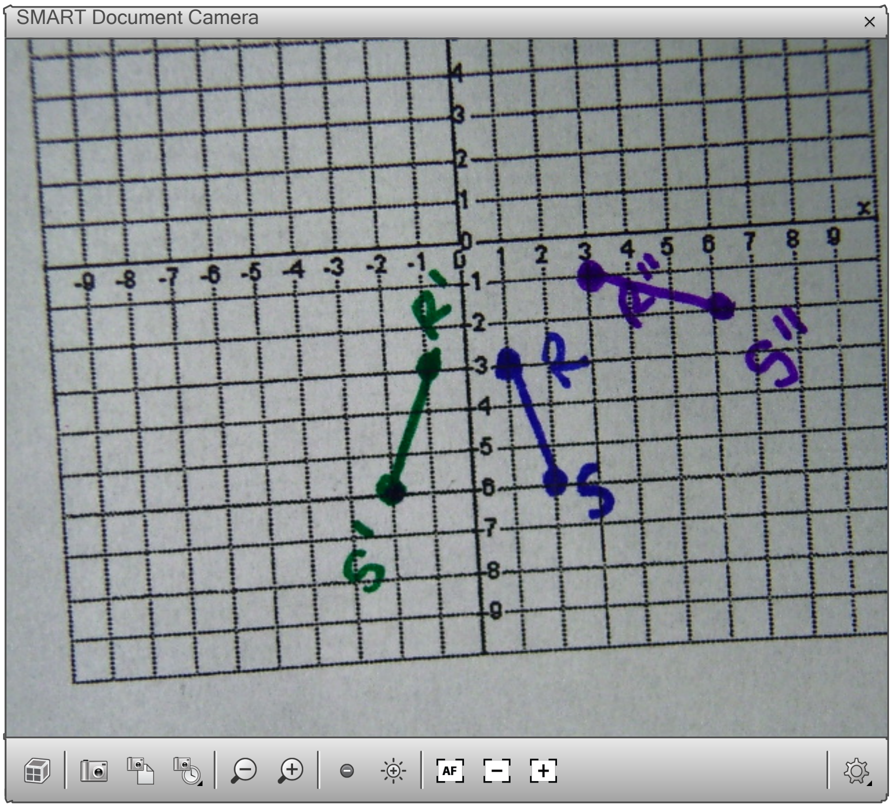
Graph $\triangle ABC$ with vertices $A(3, 2)$, $B(6, 3)$, and $C(7, 1)$ and its image after the glide reflection.

Translation: $(x, y) \rightarrow (x - 12, y)$

Reflection: in the x-axis



State the name of the property.

1. For any segment *AB*, $\overline{AB} \cong \overline{AB}$.

2. If $\angle A \cong \angle B$, then $\angle B \cong \angle A$.

Essential Question

How can you rotate a figure in a coordinate plane?

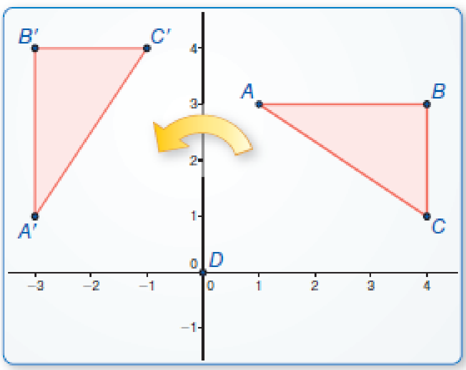
Work with a partner.

a. Use dynamic geometry software to draw any triangle and label it $\triangle ABC$.

b. *Rotate* the triangle 90° counterclockwise about the origin to form $\triangle A'B'C'$.

c. What is the relationship between the coordinates of the vertices of $\triangle ABC$ and those of $\triangle A'B'C'$?

d. What do you observe about the side lengths and angle measures of the two triangles?



Sample

Points

$A(1, 3)$

$B(4, 3)$

$C(4, 1)$

$D(0, 0)$

Segments

$AB = 3$

$BC = 2$

$AC = 3.61$

Angles

$m\angle A = 33.69°$

$m\angle B = 90°$

$m\angle C = 56.31°$

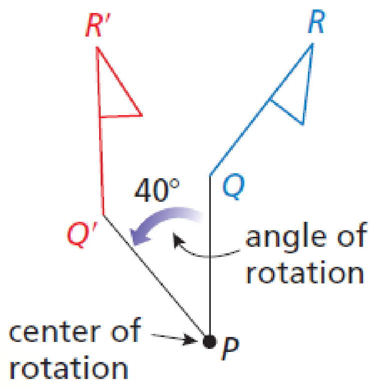
Core Concept

Rotations

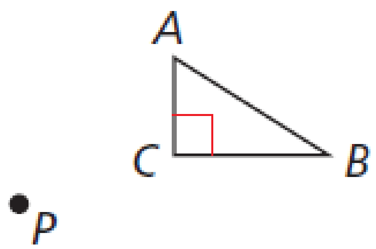
A **rotation** is a transformation in which a figure is turned about a fixed point called the **center of rotation**. Rays drawn from the center of rotation to a point and its image form the **angle of rotation**.

A rotation about a point P through an angle of $x°$ maps every point Q in the plane to a point Q' so that one of the following properties is true.

- If Q is not the center of rotation P, then $QP = Q'P$ and $m\angle QPQ' = x°$, or
- If Q is the center of rotation P, then $Q = Q'$.



Draw a 120° rotation of $\triangle ABC$ about point P.

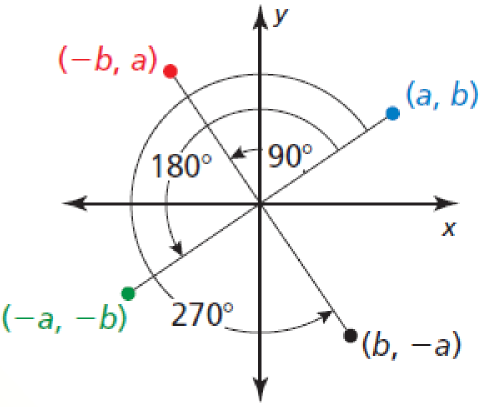


Core Concept

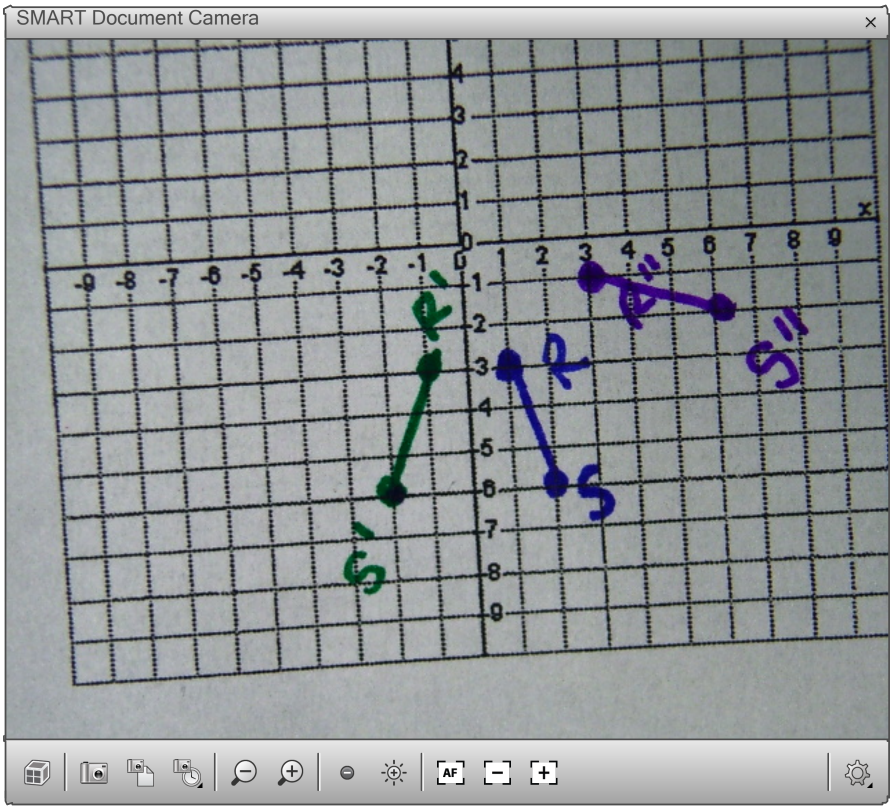
Coordinate Rules for Rotations about the Origin

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

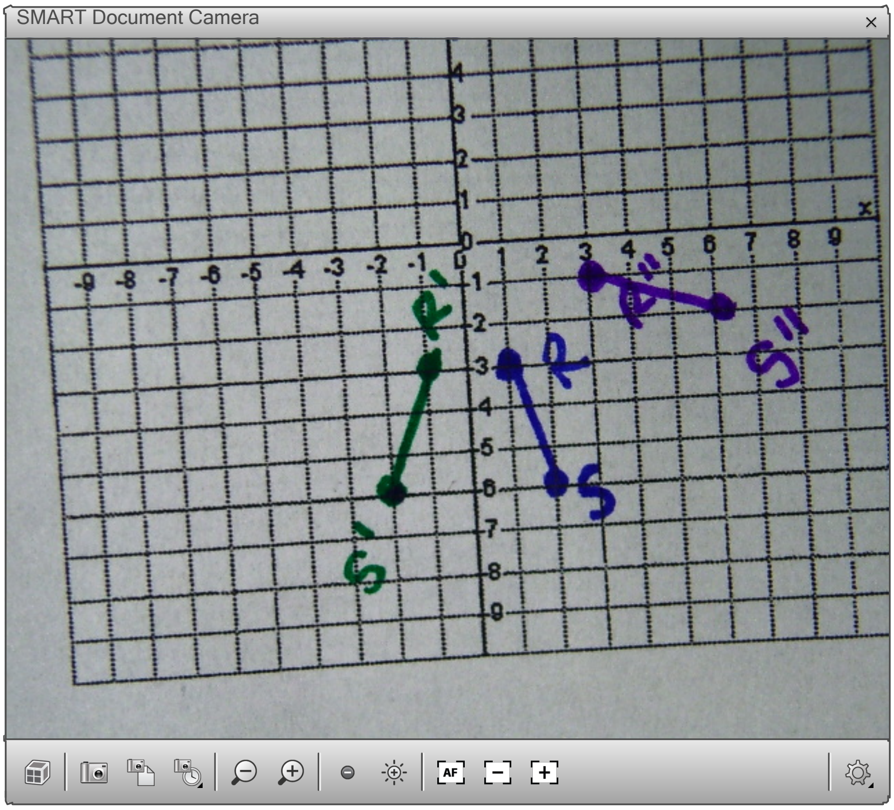
- For a rotation of 90°, $(a, b) \rightarrow (-b, a)$.
- For a rotation of 180°, $(a, b) \rightarrow (-a, -b)$.
- For a rotation of 270°, $(a, b) \rightarrow (b, -a)$.



Graph quadrilateral *RSTU* with vertices *R*(3, 1), *S*(5, 1), *T*(5, −3), and *U* (2, −1) and its image after a 270° rotation about the origin.



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.



Postulate

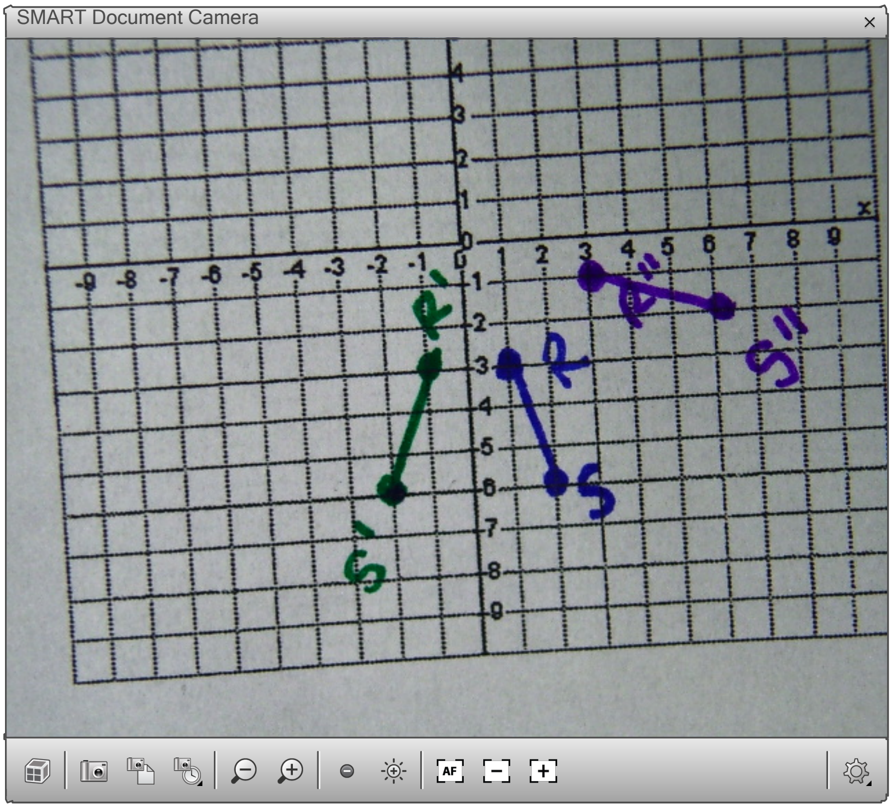
Postulate 4.3 Rotation Postulate

A rotation is a rigid motion.

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

Reflection: in the *y*-axis

Rotation: 90° about the origin



3. Graph $\overline{RS}$ from Example 3. Perform the rotation first, followed by the reflection. Does the order of the transformations matter? Explain.

4. WHAT IF? In Example 3, $\overline{RS}$ is reflected in the *x*-axis and rotated 180° about the origin. Graph $\overline{RS}$ and its image after the composition.

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

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

Rotation: 90° about the origin

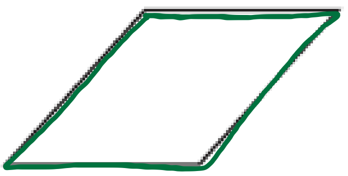
6. Graph $\triangle TUV$ with vertices $T(1, 2)$, $U(3, 5)$, and $V(6, 3)$ and its image after the composition.

Rotation: 180° about the origin

Reflection: in the *x*-axis

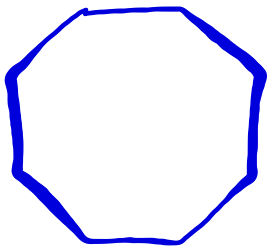
Does the figure have rotational symmetry? If so, describe any rotations that map the figure onto itself.

a. parallelogram



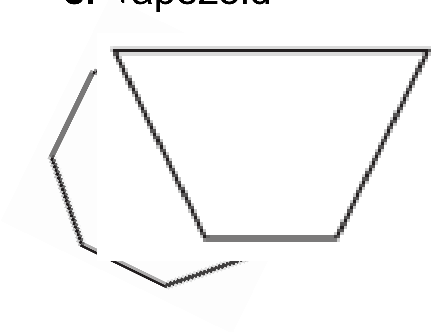
~~0°~~
180°
~~360°~~

b. regular octagon



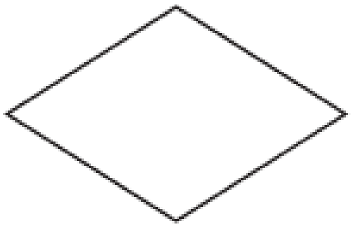
45°
90°
180°
270

c. trapezoid

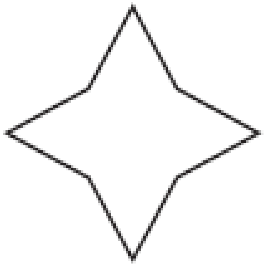


Determine whether the figure has rotational symmetry. If so, describe any rotations that map the figure onto itself.

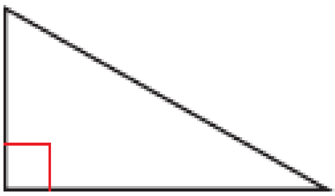
7. rhombus



8. octagon



9. right triangle



Homework 4.3

pg194 #7-12, 21-24, 29 and 34