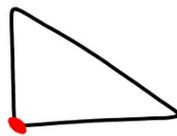Geometry   9.3
Draw rotations
Draw rotations in the coordinate plane

center of rotation
angle of rotation
clockwise
counterclockwise
whiteboards

clockwise   counterclockwise   *

default

KeyConcept Rotation

A rotation about a fixed point, called the **center of rotation**, through an angle of $x°$ is a function that maps a point to its image such that

- if the point is the center of rotation, then the image and preimage are the same point, or
- if the point is not the center of rotation, then the image and preimage are the same distance from the center of rotation and the measure of the **angle of rotation** formed by the preimage, center of rotation, and image points is x.

angle of rotation

120°

A

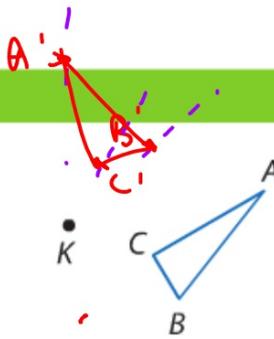C — center of rotation

A' is the image of *A* after a 120° rotation about point *C*.
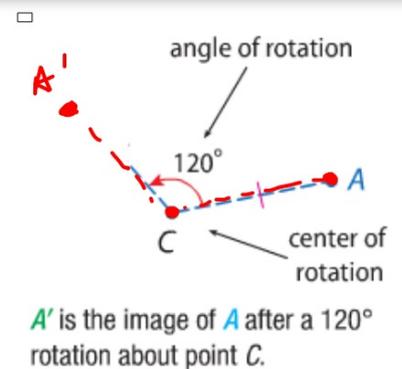
angle CCW

Example 1 Draw a Rotation

Copy △ABC and point K. Then use a protractor and ruler to draw a ⟨80°⟩ rotation of △ABC about point K.

CCW

A'

B'

C'

K

C

A

B

-50°

50° CW

1. connect to center
2. measure angle
3. measure distance
4. repeat for each point on preimage
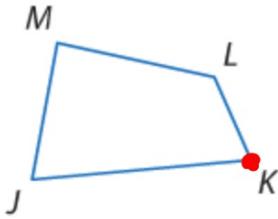
PT

CCW

1A. 65°

T' T S'

R K S

R'

1. connect to center
2. measure angle
3. measure distance
4. repeat for each point on preimage

CCW

1B. 170° *M*

1. connect to center
2. measure angle
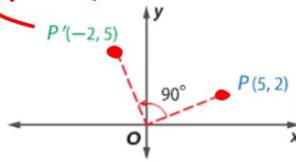3. measure distance
4. repeat for each point on preimage

KeyConcept Rotations in the Coordinate Plane

90° Rotation

To rotate a point 90° counterclockwise about the origin, multiply the y-coordinate by -1 and then interchange the x- and y-coordinates.
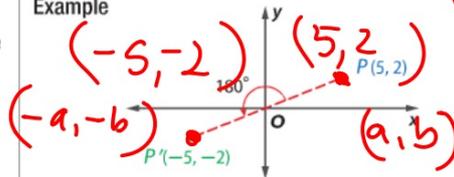
Symbols $(x, y) \rightarrow (-y, x)$

Example

(handwritten) $(-b, a)$
$(-2, 5)$

$P'(-2, 5)$
$90°$
$P(5, 2)$
O

(handwritten) $(5, 2)$
(a, b)

(handwritten note, right)
90 = perpendicular
(slopes are alw ays reciprocal & opposite)
coordinates trade places & one becomes negative

180° Rotation

To rotate a point 180° counterclockwise about the origin, multiply the x- and y-coordinates by -1.

Symbols $(x, y) \rightarrow (-x, -y)$

Example
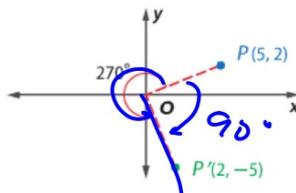
(handwritten) $(-5, -2)$ $(5, 2)$
$(-a, -b)$

$180°$
$P(5, 2)$
O
$P'(-5, -2)$

(handwritten) (a, b)

(handwritten note, right)
What about -90 etc?
What is 360 degree
rotation?

270° Rotation

To rotate a point 270° counterclockwise about the origin, multiply the x-coordinate by -1 and then interchange the x- and y-coordinates.

Symbols $(x, y) \rightarrow (y, -x)$

Example

$270°$
$P(5, 2)$
O *(handwritten)* $90°$
$P'(2, -5)$

(handwritten) $(2, -5)$
$(b, -a)$

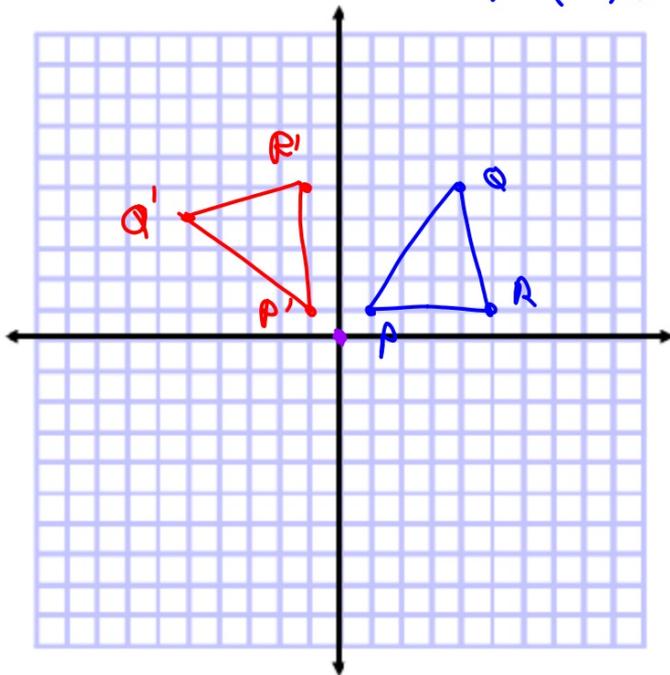ccw $(x,y) >>>>> (-y,x)$

Example 2 Rotations in the Coordinate Plane

Triangle PQR has vertices $P(1, 1)$, $Q(4, 5)$, and $R(5, 1)$. Graph $\triangle PQR$ and its image after a rotation $90°$ about the origin.

$(0,0)$

$P'(-1, 1)$ $Q'(-5, 4)$

$R'(-1, 5)$

CCW   (x,y)>>>>(-x,-y)

90, 180, 270
-90

2. Parallelogram *FGHJ* has vertices $F(2, 1)$, $G(7, 1)$, $H(6, -3)$, and $J(1, -3)$.
Graph *FGHJ* and its image after a rotation $180°$ about the origin.

F $(2, 1)$ F' $(-2, -1)$

G $(7, 1)$ G' $(-7, -1)$

H $(6, -3)$ H' $(-6, 3)$

J $(1, -3)$ J' $(-1, 3)$

(x,y)>>>>(y, -x)

Triangle *JKL* is shown at the right. What is the image of point *J* after a rotation 270° counterclockwise about the origin?

A (−3, −7)

B (−7, 3)
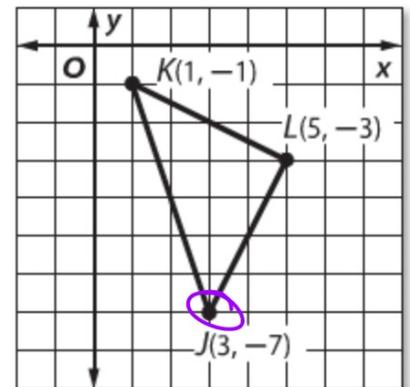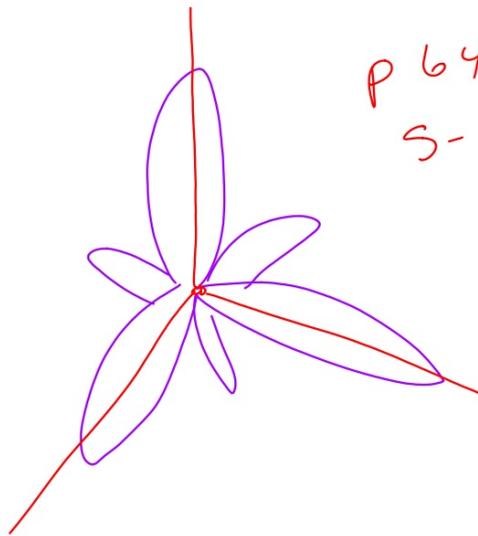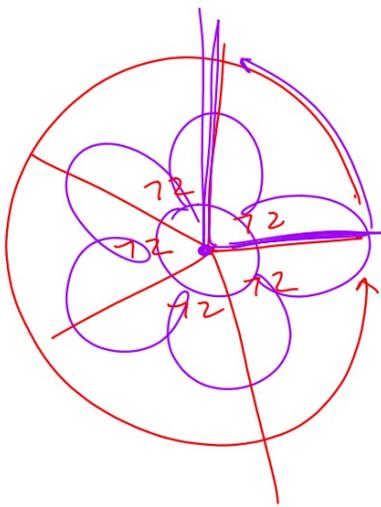
C (−7, −3)

D (7, −3)

$$\left(3, -7\right)$$

$$\left(-7, -3\right)$$

K(1, −1)

L(5, −3)

J(3, −7)

72
72
72
72
72
72

p 643
S-23 all