Geometry 9.3

Draw rotations

Draw rotations in the coordinate plane

- center of rotation
- angle of rotation ccw
- clockwise
- counterclockwise
- whiteboards

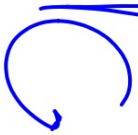
cw

clockwise

ccw

counterclockwise

default

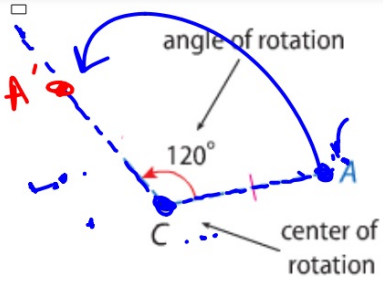


KeyConcept Rotation

(0, 0)

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.

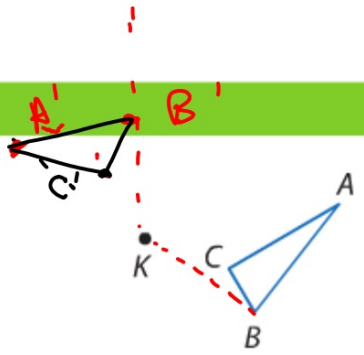


A' is the image of A after a 120° rotation about point C.

angle CCW

Example 1 Draw a Rotation

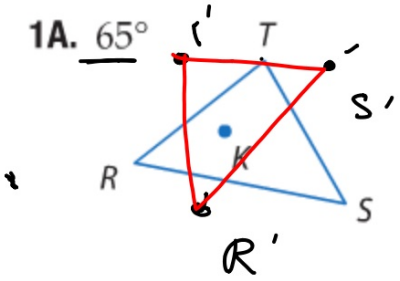
Copy $\triangle ABC$ and point K. Then use a protractor and ruler to draw a 140° rotation of $\triangle ABC$ about point K.



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

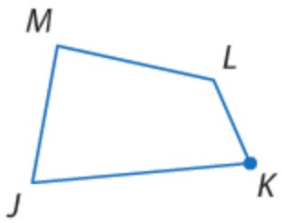
CCW

1A. 65°



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

CCW

1B. 170° 

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

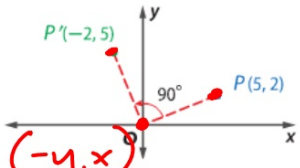
To rotate a point 90° counterclockwise about the origin, multiply the *y*-coordinate by −1 and then interchange the *x*- and *y*-coordinates.

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

(3,5) (−5, 3)

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

Example



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

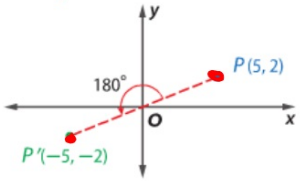
180° Rotation

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

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

(x, y) $(-x, -y)$

Example



What about -90 etc?
What is 360 degree rotation?

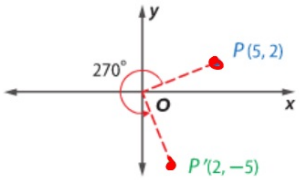
270° Rotation

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

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

(x, y) $(y, -x)$

Example

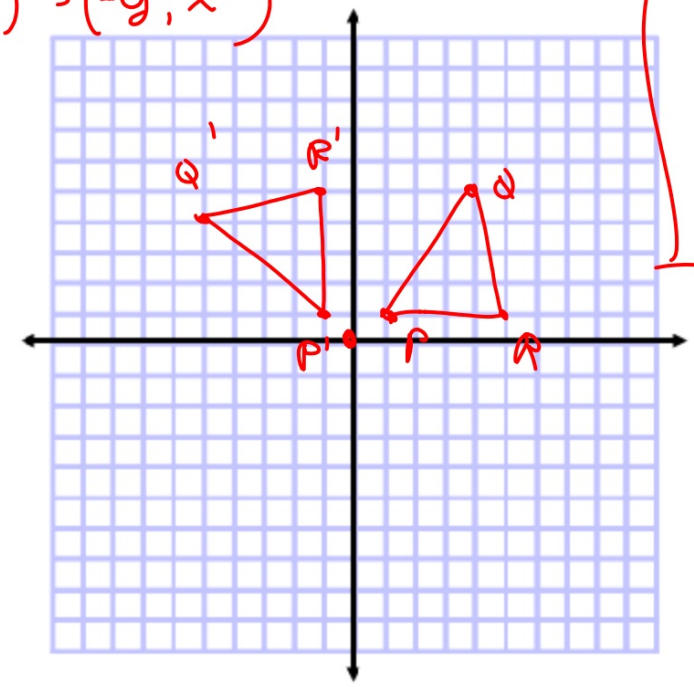


CCW (x,y)>>>>(-y,x)

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.

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



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

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

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.

$F'(-2,-1)$ $G'(-7,-1)$ $H'(-6,3)$ $J'(-1,3)$

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

Standardized Test Example 3 Rotations in the Coordinate Plane

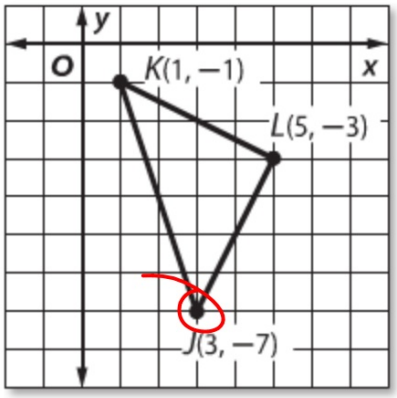
Triangle JKL is shown at the right. What is the image of point J after a rotation 270° counterclockwise about the origin?

A $(-3, -7)$

B $(-7, 3)$

C $(-7, -3)$

D $(7, -3)$



(-7,-3)

S-19 odd
22, 23 p. 643