Name: ____ Date: ____________________

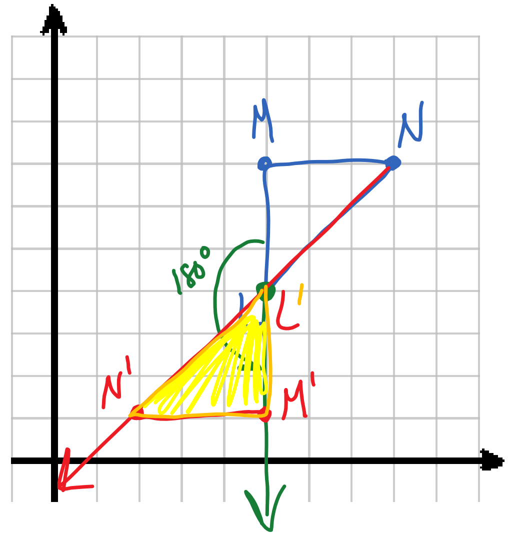
Rotations

Rotate a Figure About a Point

A **rotation** is a transformation in which a figure is rotated, or turned, about a fixed point. The **center of rotation** is the fixed point. A rotation does not change the size or shape of the figure. So, the preimage and the image are congruent.

Example

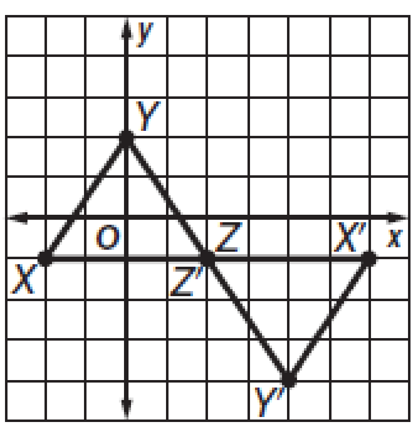
1. **Triangle *LMN* with vertices *L*(5, 4), *M*(5, 7), and *N*(8, 7) represents a desk in Jackson's bedroom. He wants to rotate the desk counterclockwise 180° about vertex *L*. Graph the figure and its image. Then give the coordinates of the vertices for △*L′M′N′*.**



L'(5,4)
M'(5,1)
N'(2,1)

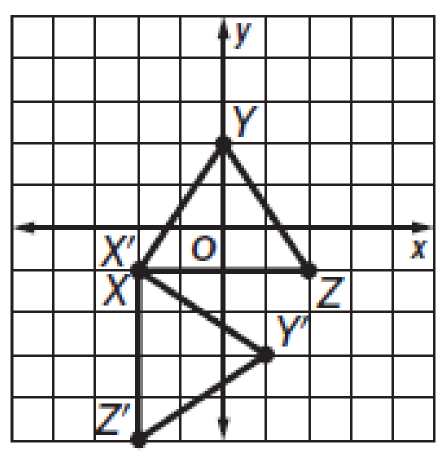
Now you try! **For Exercises 1 and 2, graph Δ*XYZ* and its image after each rotation. Then give the coordinates of the vertices for Δ*X′Y′Z′*.**

a. 180° clockwise about vertex *Z*



X′(6,1), *Y′*(4, –4), *Z′*(2, –1)

b. 90° clockwise about vertex *X*

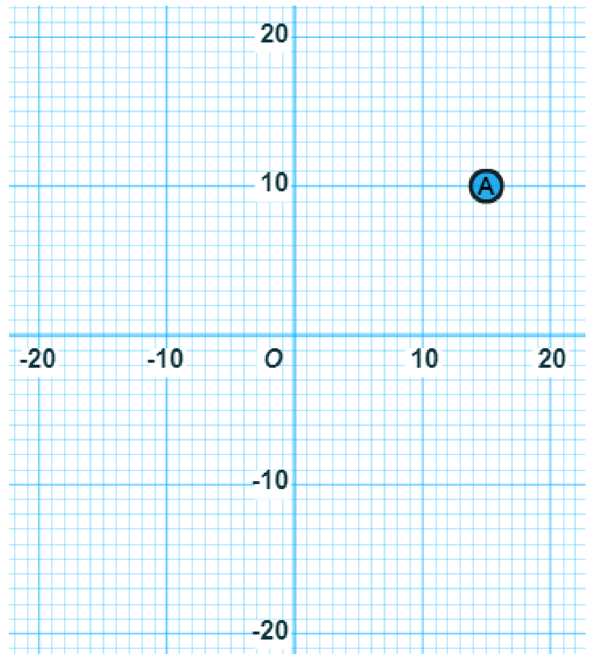


X′(–2, –1), *Y′*(1, –3), *Z′*(–2, –5)

How do you rotate geometric figures about the origin?

Point A is located at (15, 10) on the coordinate plane to the right.
Point B will be the rotation of Point A about the origin.

Plot point B after a 90°, 180°, 270°, and 360° rotation and label the rotations on the coordinate plane. Then, provide the coordinates of point B at each rotation in the table below.



1. *What direction are the points moving in as the degrees of rotation increases? Decreases?*

Counter-clockwise ; Clockwise
(+) (-)

2. *What angle of rotation beings point B back to point A?*

360°

3. *Provide the coordinates of point B at each rotation in the table below. Then, determine if you see any patterns with the ordered pairs and point A's coordinates.*

Rotation Angle	Coordinates
90°/-270°	(-10, 15)
180°/-180°	(-15, -10)
270°/-90°	(10, -15)
360°	(15, 10)

(15, 10)

4. Based on the patterns that you have observed, write the general coordinates of the image of a point rotated about the origin with coordinates (*x, y*) in the table below.

Angle of rotation	0°	90°/-270°	180°/-180°	270°/-90°	360°
Coordinates of image of (*x*, *y*)	(x, y)	(-y, x)	(-x, -y)	(y, -x)	(x, y)

Example

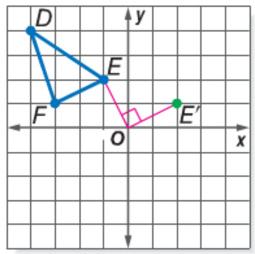
2. **Triangle *DEF* has vertices *D*(−4, 4), *E*(−1, 2), and *F*(−3, 1). Graph the figure and its image after a clockwise rotation of 90° about the origin. Then give the coordinates of the vertices for △*D′E′F′*.**

(y, -x)

D'(4,4) F'(1,3)

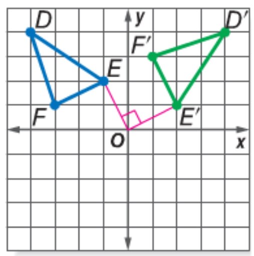
E'(2,1)

Step 1 Graph △*DEF* on a coordinate plane.

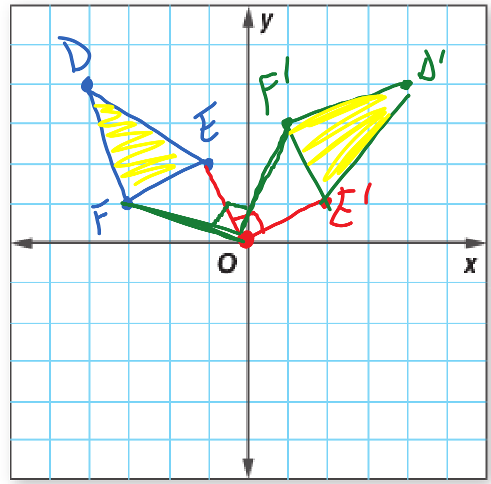


Step 2 Sketch segment $\overline{EO}$ connecting point *E* to the origin. Sketch another segment, $\overline{E'O}$, so that the angle between point *E*, *O*, and *E′* measures 90° and the segment is the same length as $\overline{EO}$.

Step 3 Repeat Step 2 for points *D* and *F*. Then connect the vertices to form △*D′E′F′*.

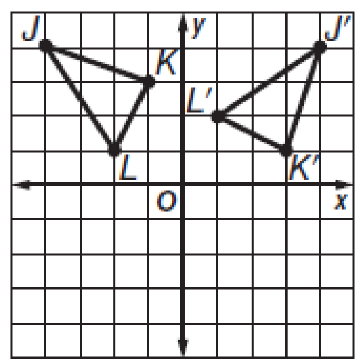


So, the coordinates of the vertices of △*D′E′F′* are *D′*(4, 4), *E′*(2, 1), and *F′*(1, 3).



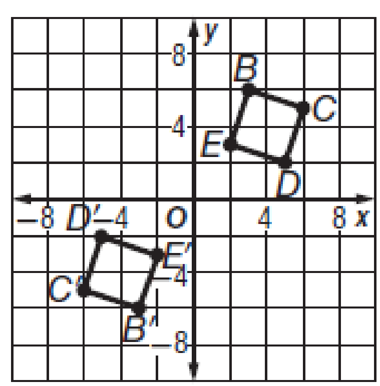
Now you try!

a. Triangle *JKL* has vertices *J*(-4, 4), *K*(-1, 3), and *L*(-2, 1). Graph the figure and its rotated image after a clockwise rotation of 90° about the origin. Then give the coordinates of the vertices for triangle *J'K'L'*.



***J′*(4, 4), *K′*(3, 1), and *L′*(1, 2)**

b. Quadrilateral *BCDE* has vertices *B*(3, 6), *C*(6, 5), *D*(5, 2), and *E*(2, 3). Graph the figure and its rotated image after a counterclockwise rotation of 180° about the origin. Then give the coordinates of the vertices for quadrilateral *B′C′D′E′*.



***B′*(−3, −6), *C′*(−6, −5), *D′*(−5, −2), and *E′*(−2, −3)**