

## Warm-Up

Write the coordinate of the image.

Reflection:	1. x-axis	2. y-axis	3. $y = x$
$(-3, 4)$			
$(5, -8)$			
$(-2, -9)$			







**Rotations are TURNS!!**

**Rotation:** A transformation in which the pre-image is rotated around a single point in a circular motion.

Notes about rotations:

- Rotation will be (0, 0) about the origin in a counterclockwise direction unless noted otherwise.
- One full rotation is 360 degrees.
- The distance from the center to any point on the shape stays the same.

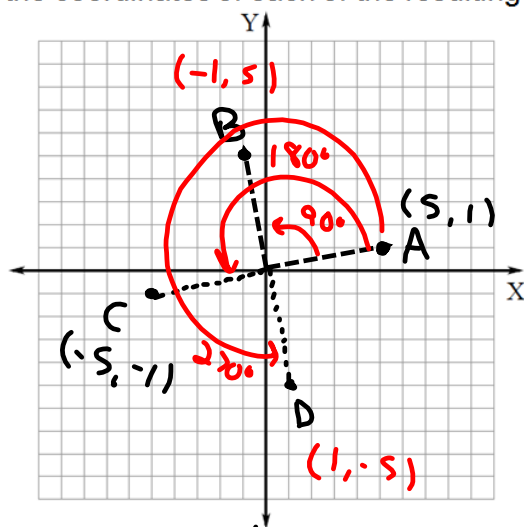
Rotations can be seen, in a variety of situations:

The Earth	Windmills	Pinwheel
<p>The Earth experiences one complete rotation on its axis every 24 hours.</p> 	<p>The blades on windmills convert the energy of wind into rotational energy.</p> 	<p>A children's toy that rotates when blown.</p> 
Amusement Park Swing	Ferris Wheel	Merry-Go-Round
<p>An amusement park rides, such as the swing, allow you to become the of the rotation.</p> 	<p>Ferris wheels rotate about a center hub. (Yes, the seats tilt to prevent falling.)</p> 	<p>On the merry-go-round, riders become part of the rotation about the center of the ride.</p> 

On the coordinate plane below...

- Graph the coordinate pre-image (5, 1) and label it with the letter A.
- Rotate point A 90 degrees about the origin and label the image with the letter B.
- Rotate point A 180 degrees about the origin and label the image with the letter C.
- Rotate point A 270 degrees about the origin and label the image with the letter D.

List the coordinates of each of the resulting images:



Start (5, 1)

Coordinates of image of B:  $(-1, 5)$

Coordinates of image of C:  $(-5, -1)$

Coordinates of image of D:  $(1, -5)$

In general, list the transformation rule for each of the following rotations:

90° about the origin:  $(x, y) \rightarrow (-y, x)$

180° about the origin:  $(x, y) \rightarrow (-x, -y)$

270° about the origin:  $(x, y) \rightarrow (y, -x)$

### Examples:

1. Using your transformation rules, determine the coordinates of the images of each of the following pre-images using the given rotations.

<p>a. Pre-Image: <math>(-4, 6)</math> <b>II</b></p> <p>90° Rotation: <math>(-6, -4)</math> <b>III</b></p> <p>180° Rotation: <math>(4, -6)</math> <b>IV</b></p> <p>270° Rotation: <math>(6, 4)</math> <b>I</b></p>	<p>b. Pre-Image: <math>(-2, -7)</math> <b>X, Y</b></p> <p>90° Rotation: <math>(7, -2)</math> <b>-Y, X</b></p> <p>180° Rotation: <math>(2, 7)</math> <b>-X, -Y</b></p> <p>270° Rotation: <math>(-7, 2)</math> <b>Y, -X</b></p>
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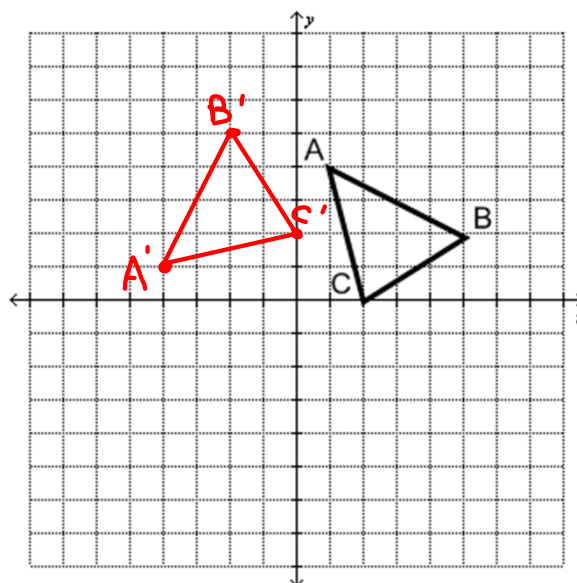
270° about the origin:  $(x, y) \rightarrow (y, -x)$

Triangle ABC is labeled on your graph below. Determine the coordinates of each of the following rotations and then graph each image.

a) Rotate Triangle ABC, 90° counterclockwise. Label the triangle A'B'C'.

$A (1, 4) \rightarrow A' (-4, 1)$   
 $B (5, 2) \rightarrow B' (-2, 5)$   
 $C (2, 0) \rightarrow C' (0, 2)$

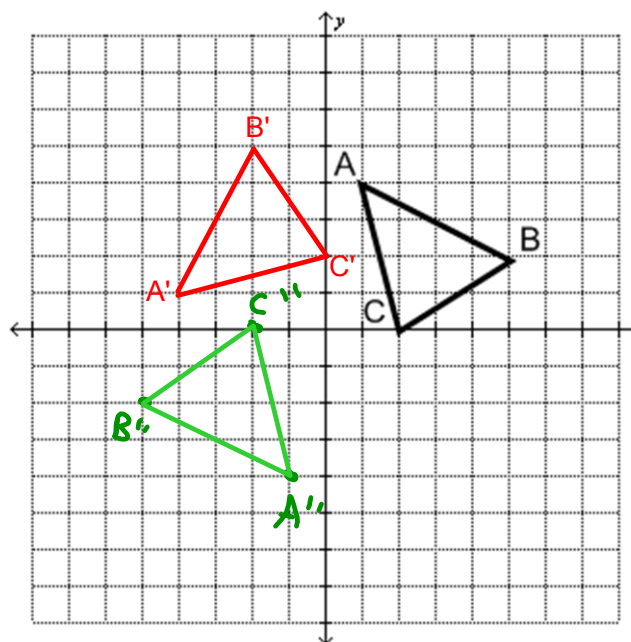
$(x, y) \rightarrow (-y, x)$



b) Rotate Triangle ABC, 180° counterclockwise. Label the triangle A''B''C''.

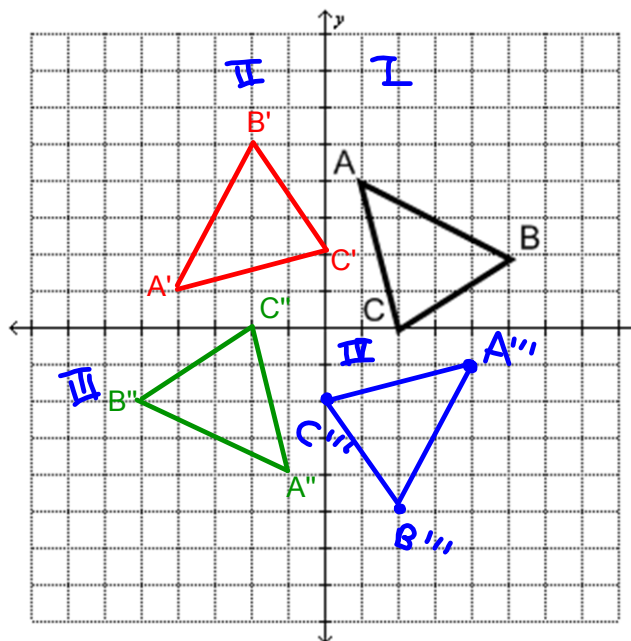
$A (1, 4) \rightarrow A'' (-1, -4)$   
 $B (5, 2) \rightarrow B'' (-5, -2)$   
 $C (2, 0) \rightarrow C'' (-2, 0)$

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



c) Rotate Triangle ABC,  $270^\circ$  counterclockwise. Label the triangle  $A'''B'''C'''$ .

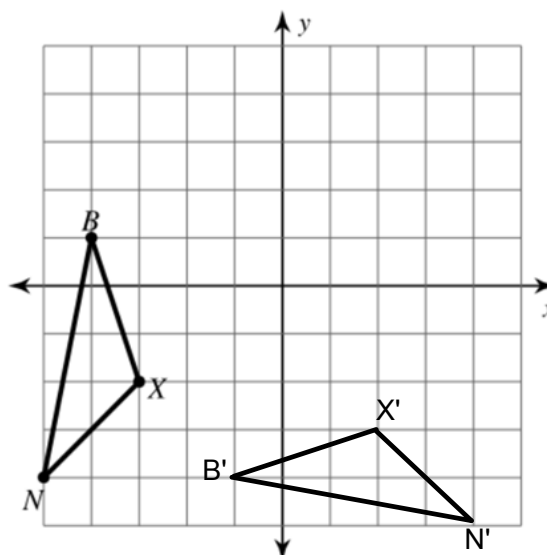
$$\begin{array}{lcl} A \underline{(1, 4)} & \rightarrow & A''' \underline{(4, -1)} \quad (x, y) \rightarrow (y, -x) \\ B \underline{(5, 2)} & \rightarrow & B''' \underline{(2, -5)} \\ C \underline{(2, 0)} & \rightarrow & C''' \underline{(0, -2)} \end{array}$$



Determine the coordinates of each of the following rotations and then graph each image.

3. Rotate  $90^\circ$  counterclockwise.  
 $(x, y) \rightarrow (-y, x)$

$$\begin{array}{lcl} B \underline{(-4, 1)} & \rightarrow & B' \underline{(-1, -4)} \\ N \underline{(-5, -4)} & \rightarrow & N' \underline{(4, -5)} \\ X \underline{(-3, -2)} & \rightarrow & X' \underline{(2, -3)} \end{array}$$



4. Rotate  $180^\circ$  counterclockwise.

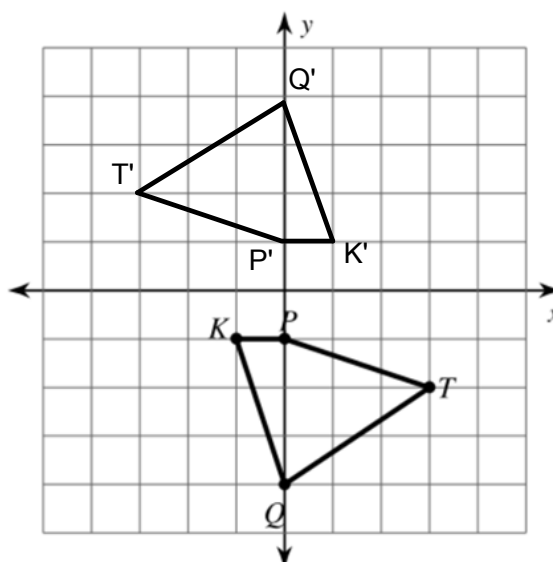
$$(x, y) \rightarrow (-x, -y)$$

$$P \underline{(0, -1)} \rightarrow P' \underline{(0, 1)}$$

$$K \underline{(-1, -1)} \rightarrow K' \underline{(1, 1)}$$

$$Q \underline{(0, -4)} \rightarrow Q' \underline{(0, 4)}$$

$$T \underline{(3, -2)} \rightarrow T' \underline{(-3, 2)}$$



5. Rotate  $270^\circ$  counterclockwise.

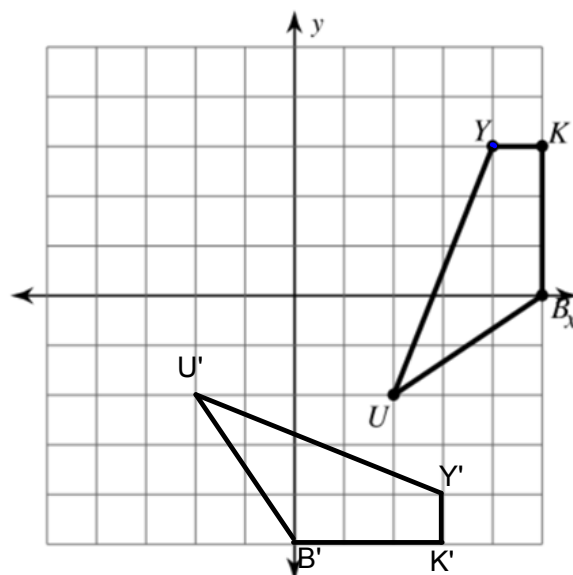
$$(x, y) \rightarrow (y, -x)$$

$$Y \underline{(4, 3)} \rightarrow Y' \underline{(3, -4)}$$

$$U \underline{(2, -2)} \rightarrow U' \underline{(-2, -2)}$$

$$B \underline{(5, 0)} \rightarrow B' \underline{(0, -5)}$$

$$K \underline{(5, 3)} \rightarrow K' \underline{(3, -5)}$$



# Preserves shape and size

- Translation

- Reflection

- Rotation