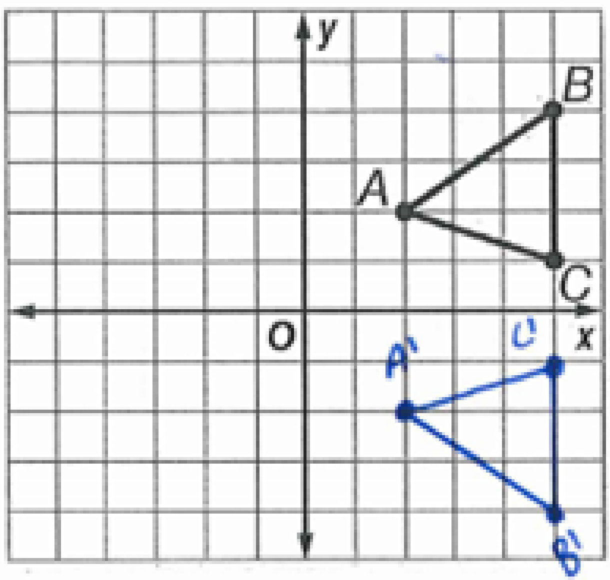
Get out your homework and have it ready to check. Target Check has been moved to Friday and will cover translations, reflections, and rotations.

Classwork - Rotations

1. Graph ΔABC with vertices $A(2, 2)$, $B(5, 4)$,and $C(5,1)$ and its reflection over the x-axis. Then find the coordinates of the reflected image.

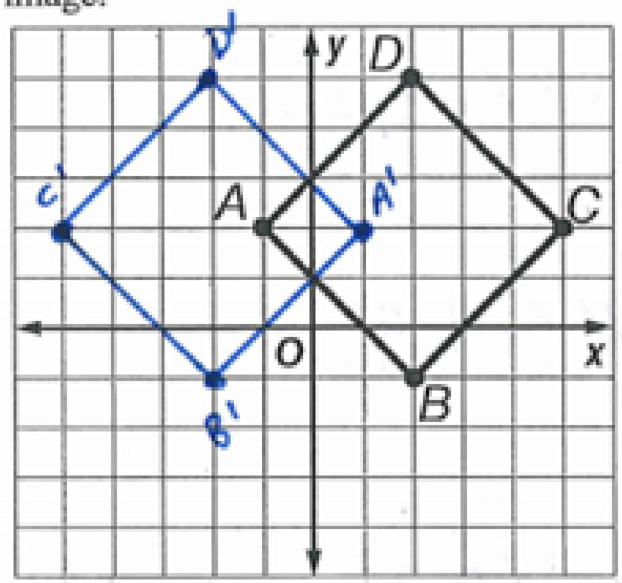


A'→(2 , -2)

B'→(5 , -4)

C'→(5 , -1)

2. Graph square $ABCD$ with vertices $A(-1, 2)$, $B(2, -1)$, $C(5, 2)$, and $D(2, 5)$ and its reflection over the y-axis. Then find the coordinates of the reflected image.



A'→(1 , 2)

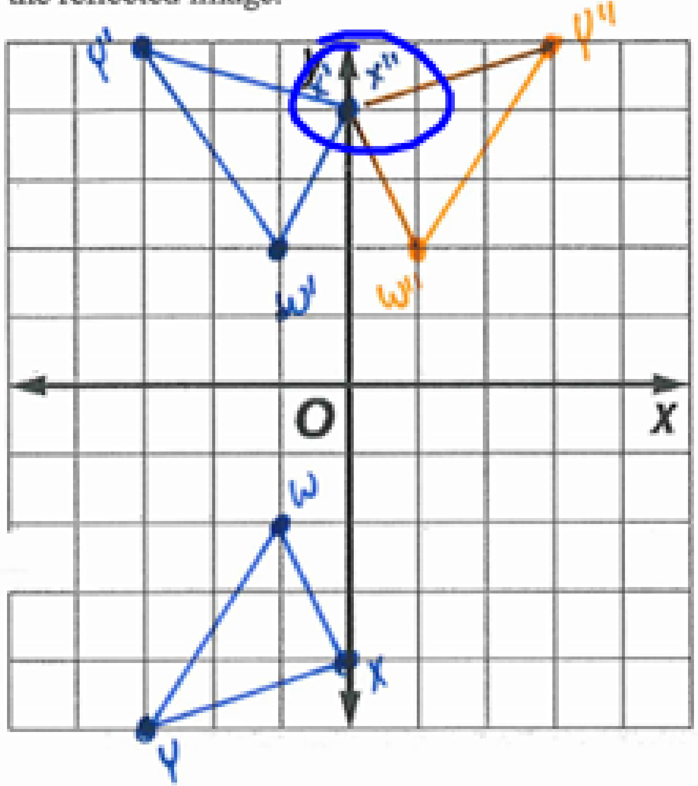
B'→(-2 , -1)

C'→(-5 , 2)

D'→(-2 , 5)

3. Graph the original triangle and then reflect it twice using the instructions below. Graph all triangles on the same coordinate grid given below.

A) Graph ΔWXY with vertices $W(-1,-2)$, $X(0,-4)$,and $Y(-3,-5)$ and its reflection over the x-axis. Then find the coordinates of the reflected image.



B) Reflect $\Delta W'X'Y'$ (the new image) from problem A over the y-axis. Then find coordinates of the reflected image. Label this new triangle with W'', X'', and Y''.

Problem A	Problem B
W'→(-1 , 2)	W''→(1 , 2)
X'→(0 , 4)	X''→(0 , 4)
Y'→(-3 , 5)	Y''→(3 , 5)

The coordinates of a point and its image after a reflection are given. Describe the reflection as over the *x*-axis or *y*-axis.

4. $B(1, -2) \rightarrow B'(1, 2)$

Reflection over the x -axis

5. $J(-3, 5) \rightarrow J'(-3, -5)$

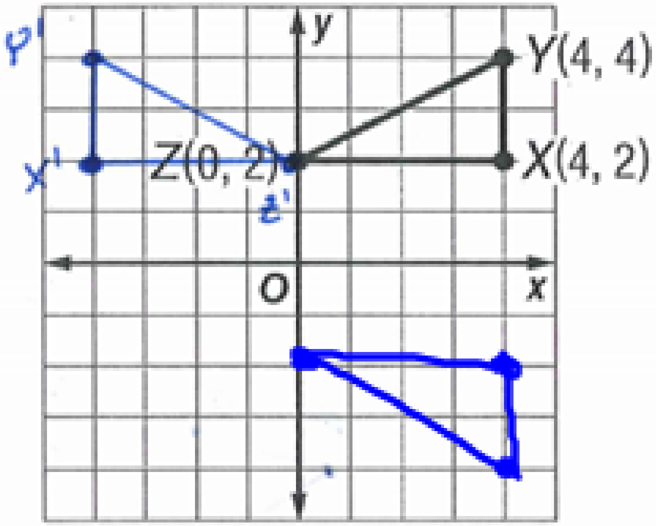
Reflection over the x -axis

6. $W(-7, -4) \rightarrow W'(7, -4)$

Reflection over the y -axis

For Exercises 7–10, use the following information.

Triangle *XYZ* has vertices *X*(4, 2), *Y*(4, 4), and *Z*(0, 2).



7. What are the coordinates of the image of point *X* after a reflection over the *y*-axis?

x' (-4, 2)

8. What are the coordinates of the image of point *Y* after a reflection over the *y*-axis?

y' (-4, 4)

9. What are the coordinates of the image of point *Z* after a reflection over the *y*-axis?

z' (0, 2)

10. Graph triangle *XYZ* and its image after a reflection over the *x*-axis.

Real-World Link

Prizes Pablo is spinning the prize wheel shown below.

1. A spin can be *clockwise* or *counterclockwise*. Define these two words in your own words.

   clockwise rotate to the right

   counterclockwise rotate to the left

2. If the section labeled 8 on the left part of the wheel spins 90° clockwise, where will it land? The top of the wheel

3. If one of the sections labeled 4 makes three complete turns counterclockwise, how many degrees will it have traveled? 1080°

4. Are there any points on the wheel that stay fixed, or do not move, when the wheel spins? If so, what are the points?

   Yes, the center of the wheel

5. Does the center of the wheel change if the wheel is spun counterclockwise as opposed to clockwise? No

6. Does the distance from the center to the edge change as it spins? Explain. No

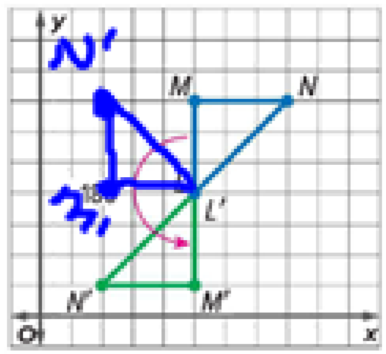
Rotate a Figure About a Point

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′*.

Step 1 Graph the original triangle.



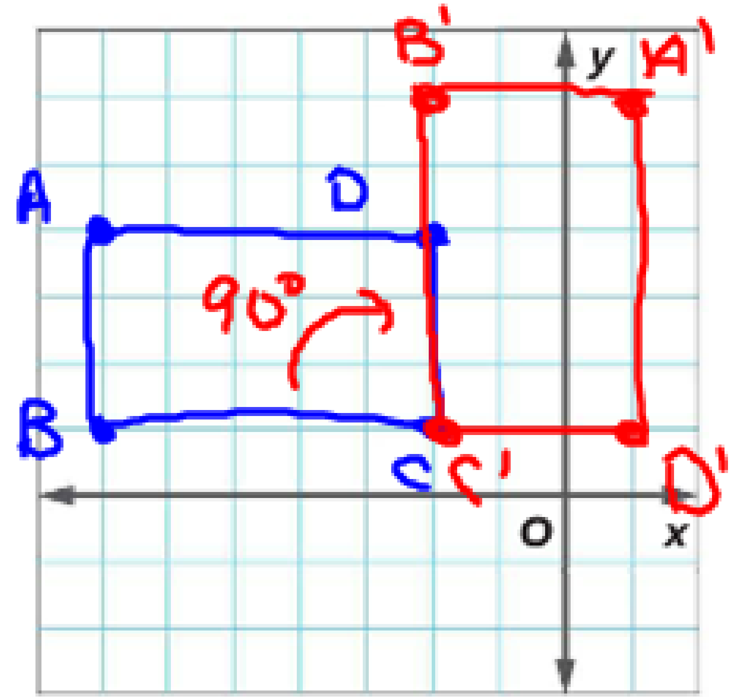
Step 2 Graph the rotated image. Use a protractor to measure an angle of 180° with *M* as one point on the ray and *L* as the vertex. Mark off a point the same length as $\overline{ML}$. Label this point *M′* as shown.

Step 3 Repeat Step 2 for point *N*. Since *L* is the point at which △*LMN* is rotated, *L′* will be in the same position as *L*.

So, the coordinates of the vertices of △*L′M′N′* are *L′*(5, 4), *M′*(5, 1), and *N′*(2, 1).

Got it? Do this problem to find out.

a. Rectangle *ABCD* with vertices *A*(−7, 4), *B*(−7, 1), *C*(−2, 1), and *D*(−2, 4) represents the bed in Jackson's room. Graph the figure and its image after a clockwise rotation of 90° about vertex *C*. Then give the coordinates of the vertices for rectangle *A′B′C′D′*.



A'(1, 6) C'(-2, 1)

B'(-2, 6) D'(1, 1)

Rotations About the Origin

clockwise

Words A rotation is a transformation around a fixed point. Each point of the original figure and its image are the same distance from the center of rotation.

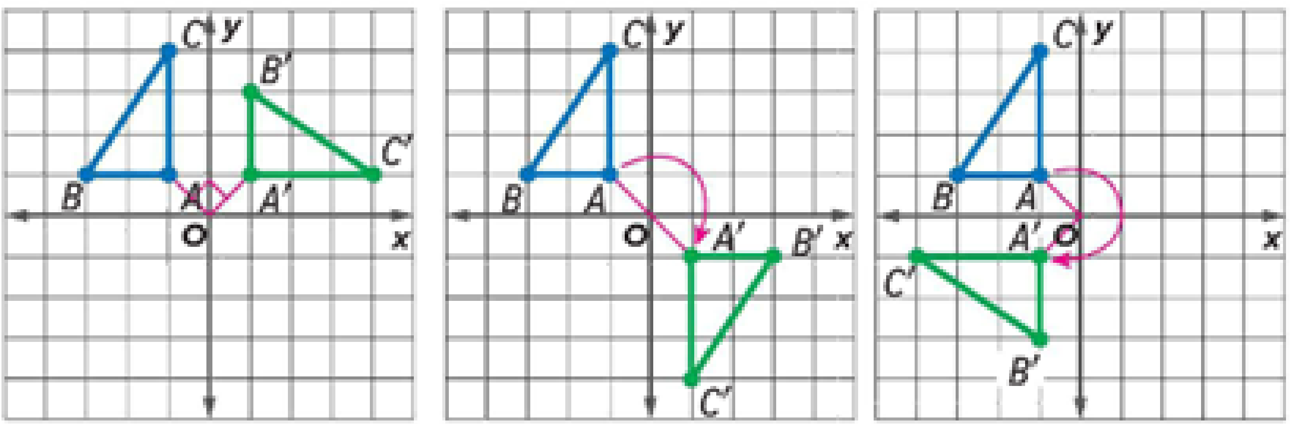
$90° = 270°$ counter clockwise

Models The rotations shown are clockwise rotations about the origin.

$180° = 180°$ counter clockwise

$270° = 90°$ counter clockwise

90° Rotation **180° Rotation** **270° Rotation**



Symbols

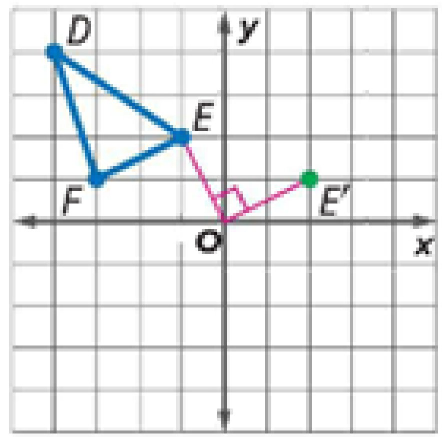
$(x, y) \to (y, -x)$ $(x, y) \to (-x, -y)$ $(x, y) \to (-y, x)$

Figures can also be rotated about the origin.

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′*.**

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

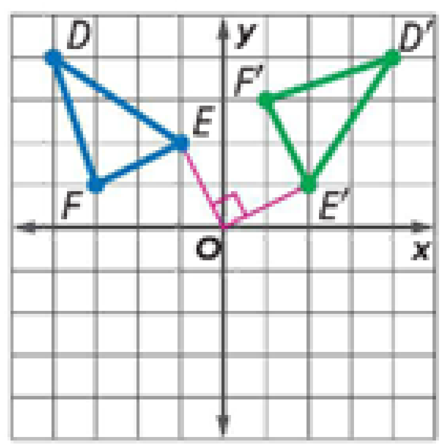


D'(4,4)
E'(2,1)
F'(1,3)

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

x

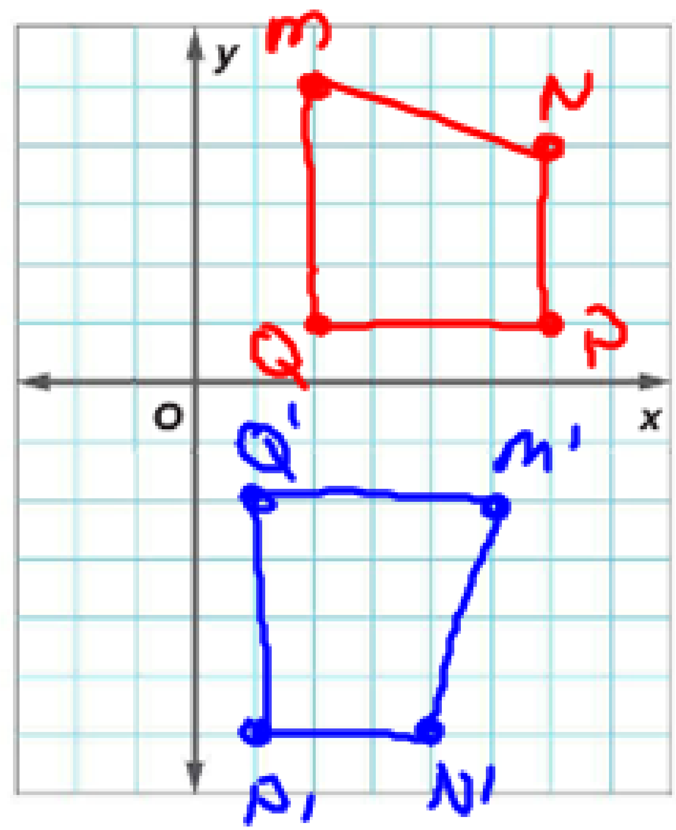
Step 3 Repeat Step 2 for points *D* and *F*. Then connect the vertices to form △*D′E′F′*.



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

Got it? **Do this problem to find out.**

b. Quadrilateral *MNPQ* has vertices *M*(2, 5), *N*(6, 4), *P*(6, 1), and *Q*(2, 1). Graph the figure and its image after a counterclockwise rotation of 270° about the origin. Then give the coordinates of the vertices for quadrilateral *M′N′P′Q′*.



M'(5, -2)

N'(4, -6)

P'(1, -6)

Q(1, -2)