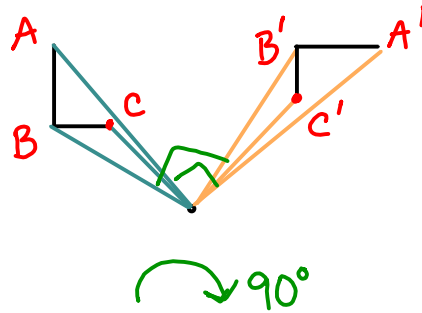


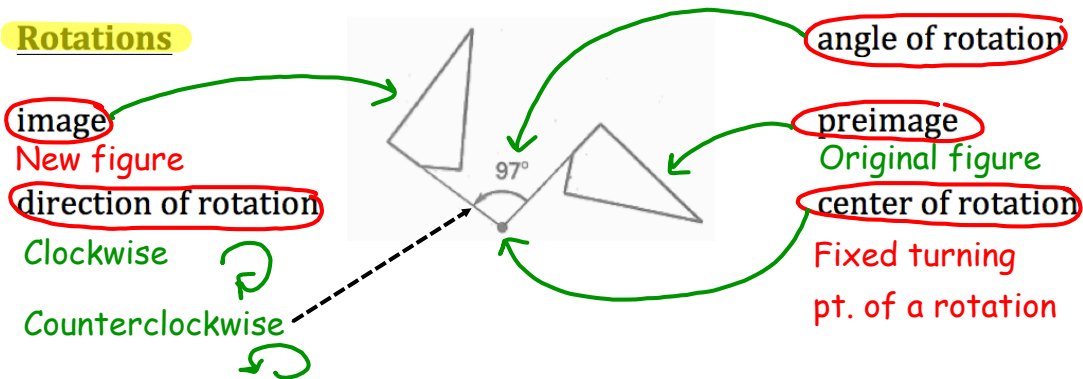
Rotate the "L" 90 degrees clockwise.



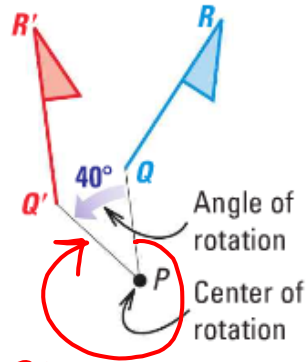
Section 9.4: Perform Rotations

EQ: How do you rotate a figure  $90^\circ$ ,  $180^\circ$ , or  $270^\circ$  about the origin?

**Rotations**



A  $40^\circ$  counterclockwise rotation is shown at the right.  
 Rotations can be *clockwise* or *counterclockwise*.



What would be the angle of rotation clockwise?

A full circle =  $360^\circ$

$$\begin{array}{r} 360 \\ -40 \\ \hline 320^\circ \end{array}$$

\*You can rotate more than 180 degrees.

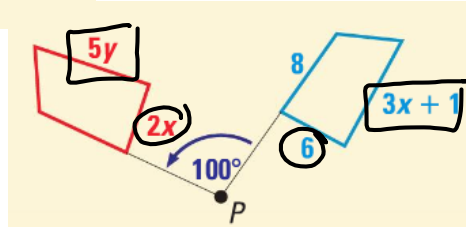
A rotation of 360 degrees returns a image to the preimage position.

\*A clockwise rotation of 100 degrees is the same as a counterclockwise rotation of 260 degrees!

$$\begin{array}{r} 360 \\ -100 \\ \hline 260 \end{array}$$



The quadrilateral is rotated about  $P$ .  
What is the value of  $y$ ?



1<sup>st</sup>

$$2x = 6$$

$$x = 3$$

2<sup>nd</sup>

$$5y = 3x + 1$$

$$5y = 3(3) + 1$$

$$5y = 9 + 1$$

$$5y = 10$$

$$y = 2$$



**Theorem 9.3: Rotation Theorem**

A rotation is an isometry.

→ preserves shape & size ( $\cong$ )

A1. In the rotation, find the value of  $r$  and  $s$ .

1<sup>st</sup>  $2s = 12$  2<sup>nd</sup>  $3r = 2s + 3$  \* look for CPCTC!

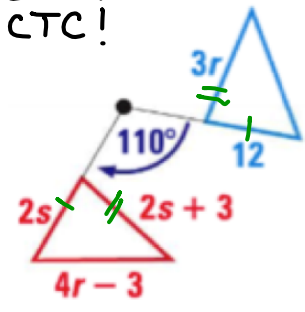
$$s = 6$$

$$3r = 2(6) + 3$$

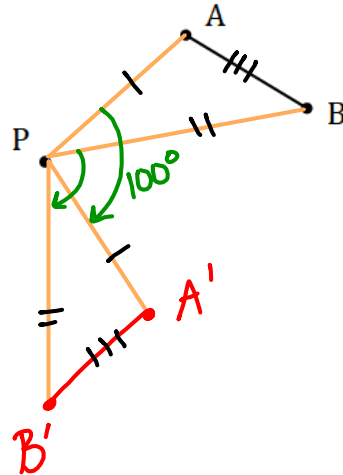
$$3r = 12 + 3$$

$$3r = 15$$

$$r = 5$$



A2. Sketch the  $100^\circ$  clockwise rotation of  $\overline{AB}$  about point  $P$ . Be sure to include marks, labels, and measures.



$$\begin{aligned} \overline{PA} &\cong \overline{PA'} \\ \overline{PB} &\cong \overline{PB'} \\ \overline{AB} &\cong \overline{A'B'} \end{aligned}$$

$$m\angle APA' = m\angle BPB' = 100^\circ$$

**Coordinate Rules for Rotations**



$(0,0)$

When a point  $(a, b)$  is rotated **counterclockwise** about the **origin**,

for a rotation of  $90^\circ \dots (a, b) \rightarrow (-b, a)$ ,  
 for a rotation of  $180^\circ \dots (a, b) \rightarrow (-a, -b)$ , and  
 for a rotation of  $270^\circ \dots (a, b) \rightarrow (b, -a)$ .

*make value the opposite*

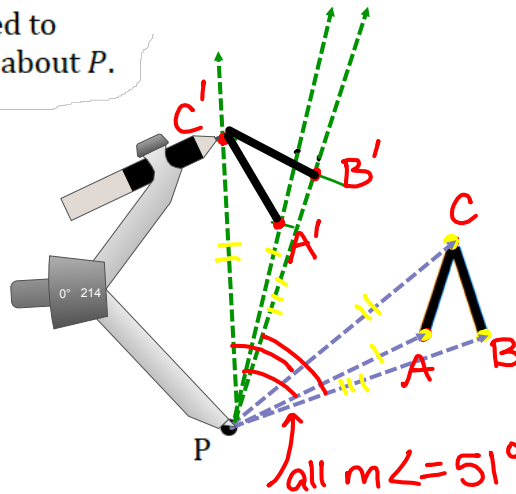
$(a,b) \rightarrow (b,-a)$  OR  
 $(x,y) \rightarrow (y,-x)$   
 rule

A3. Give the coordinates of image quadrilateral  $D'E'F'G'$  after a counterclockwise rotation of  $270^\circ$  about the origin of its preimage  $DEFG$ , if  $D(0,7)$ ,  $E(-3,4)$ ,  $F(-1,-5)$  and  $G(2,0)$ .

$D'(7,0)$     $E'(4,3)$     $F'(-5,1)$     $G'(0,-2)$

flip  $7,0$     $4,-3$     $-5,-1$     $0,2$   
 then  $7,-0$    then  $+3$    then  $+1$    then  $-2$

A4. Draw the  $51^\circ$  counterclockwise of the caret symbol, used to signify exponentiation, about  $P$ .



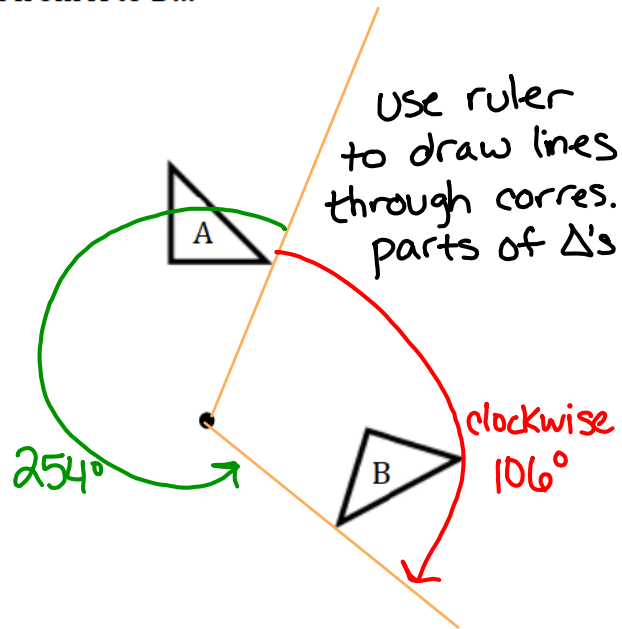
- ① Use protractor to measure  $51^\circ$
- ② Use compass to mark  $\cong$  segments

$$\overline{PB} \cong \overline{PB'}, \overline{PA} \cong \overline{PA'}, \overline{PC} \cong \overline{PC'}$$

A5. Find the degrees of rotation from A to B...

- a. clockwise  $106^\circ$
- b. counterclockwise

$$\begin{array}{r} 360 \\ - 106 \\ \hline 254^\circ \end{array}$$



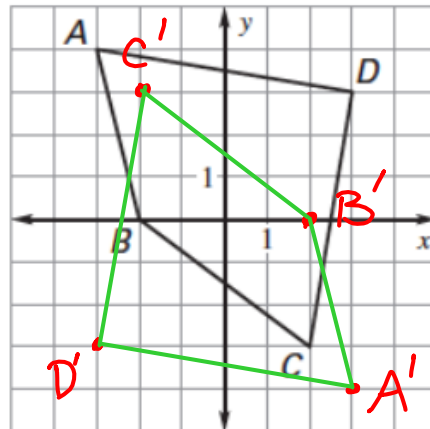
A6.  $A'B'C'D'$  is the  $180^\circ$  rotation of  $ABCD$  about  $(0,0)$ . List image's coordinates.  $(x,y) \rightarrow (-x,-y)$

$A(-3,4)$       $A'(3,-4)$

$B(-2,0)$       $B'(2,0)$

$C(2,-3)$       $C'(-2,3)$

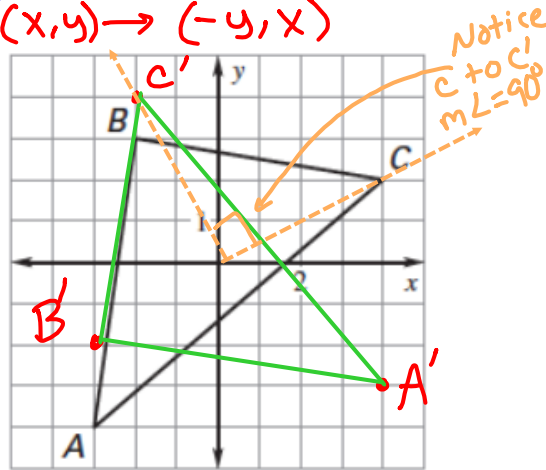
$D(3,3)$       $D'(-3,-3)$



A7. Graph the clockwise rotation of  $270^\circ$  about the origin.  $\rightarrow$  Need counterclockwise to apply rotation rule

$360 - 270 = 90^\circ$  counterclockwise  
 $(x, y) \rightarrow (-y, x)$

- $A(-3, -4)$   $A'(4, -3)$
- $B(-2, 3)$   $B'(-3, -2)$
- $C(4, 2)$   $C'(-2, 4)$



A8. List the vertices of the  $\Delta A'B'C'$  after  $\Delta ABC$  is reflected over the x-axis. Then list the the vertices of  $\Delta A''B''C''$  after  $\Delta A'B'C'$  is rotated about the origin  $180^\circ$ .

- $A(-2, 1)$  } reflect over x-axis  $A'(-2, -1)$  } Rotate  $180^\circ$
- $B(3, 7)$  }  $B'(3, -7)$  }  $(-x, -y)$
- $C(9, 0)$  }  $C'(9, 0)$  }

- $A''(2, 1)$
- $B''(-3, 7)$
- $C''(-9, 0)$

## 9.4 Summary:

