

ROTATIONS

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with a pt  $P'$ , called the rotation image of  $P$ .  $P'$  is the pt in the plane such that  $m\angle POP' = x$  and  $OP = OP'$ .

A rotation is a transformation that associates each point  $P$  of the plane

- The fixed point is called the center of the rotation.
- Rays drawn from the center of rotation to a point and its image form an angle called the angle of rotation.



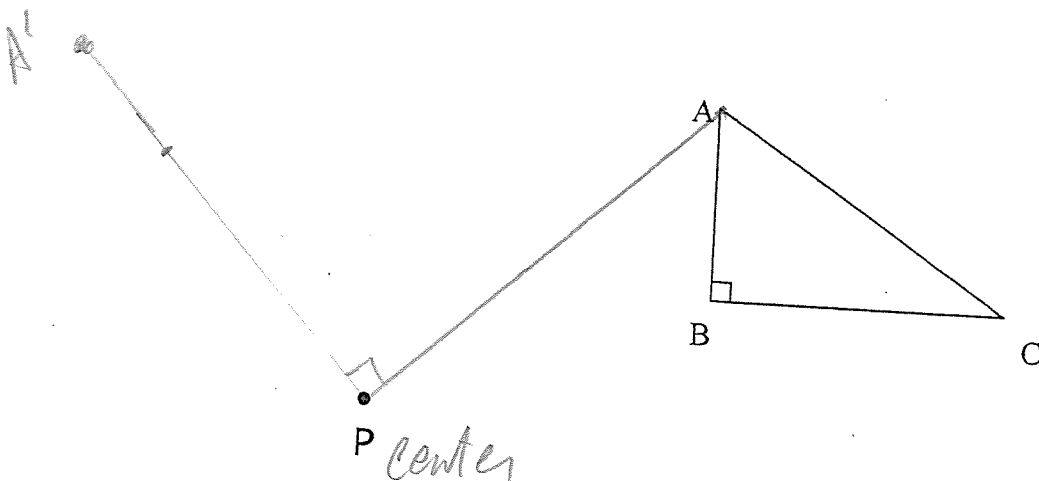
**ACTIVITY:** Use the following steps to draw the image of  $\triangle ABC$  after a  $90^\circ$  counterclockwise rotation about point  $P$ .

Step 1: Draw a segment connecting vertex  $A$  and the center of rotation point  $P$ .

Step 2: Use a protractor to measure a  $90^\circ$  angle counterclockwise and draw a ray.

Step 3: Place the point of the compass at  $P$  and draw an arc from  $A$  to locate  $A'$  on the ray.

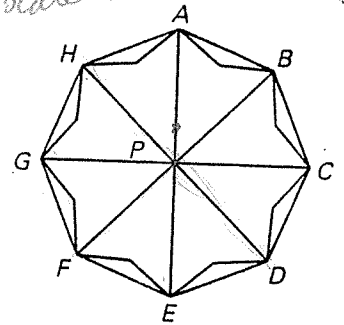
Step 4: Repeat Steps 1 to 3 for each vertex. Connect the vertices to form the image.



State the segment or triangle that represents the image.

- a)  $90^\circ$  clockwise rotation of  $\overline{AB}$  about  $P$   $\overline{CD}$
- b)  $90^\circ$  clockwise rotation of  $\overline{DE}$  about  $P$   $\overline{FG}$
- c)  $90^\circ$  counterclockwise rotation of  $\overline{GH}$  about  $P$   $\overline{EP}$
- d)  $180^\circ$  counterclockwise rotation of  $\overline{EF}$  about  $P$   $\overline{AB}$
- e)  $180^\circ$  clockwise rotation of  $\triangle DPE$  about  $P$   $\triangle HPA$
- f)  $45^\circ$  counterclockwise rotation of  $\triangle HPA$  about  $P$   $\triangle GPH$

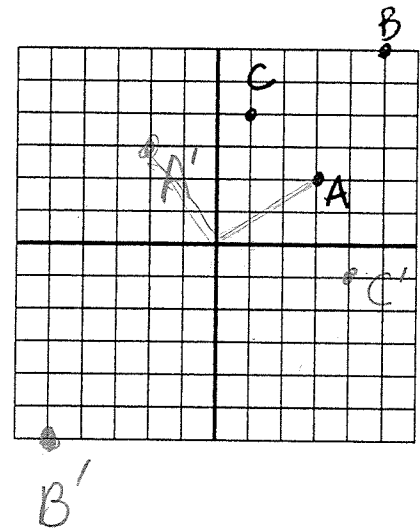
\* place a pt on one line, then locate  $90^\circ$ .



### Rotations in the Coordinate Plane

Rotate the following points about the origin in the given direction.

1.  $A(3, 2)$   $90^\circ$  counterclockwise:  $A'(-2, 3)$
2.  $B(5, 6)$   $180^\circ$  clockwise:  $B'(-5, -6)$
3.  $C(1, 4)$   $90^\circ$  clockwise:  $C'(4, -1)$



Do you see a pattern between the preimage and image coordinates?

- If we rotate a point  $P(a, b)$   $90^\circ$  counterclockwise, then the coordinates of the image point will be  $P'(-b, a)$
- If we rotate a point  $P(a, b)$   $180^\circ$  clockwise or counterclockwise, then the coordinates of the image point will be  $P'(-a, -b)$
- If we rotate a point  $P(a, b)$   $90^\circ$  clockwise, then the coordinates of the image point will be  $P'(b, -a)$

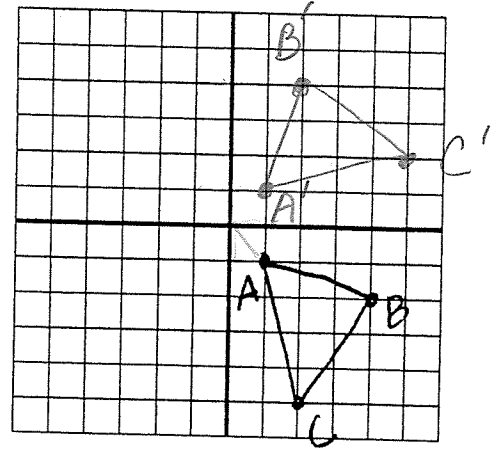
On the graphs below, plot and connect the following points. Then rotate them about the origin, with the given degree and direction. Connect the image points.

1.  $90^\circ$  counterclockwise

$$A(1, -1) \rightarrow A'(1, 1)$$

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

$$C(2, -5) \rightarrow C'(5, 2)$$

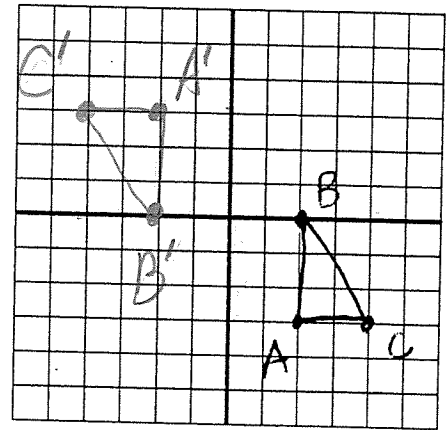


2.  $180^\circ$  clockwise

$$A(2, -3) \rightarrow A'(-2, 3)$$

$$B(2, 0) \rightarrow B'(-2, 0)$$

$$C(4, -3) \rightarrow C'(-4, 3)$$

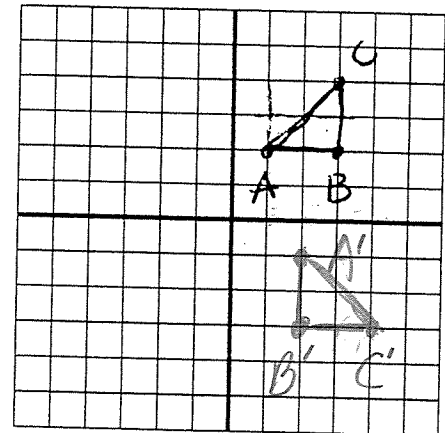


3.  $90^\circ$  clockwise

$$A(1, 2) \rightarrow A'(2, -1)$$

$$B(3, 2) \rightarrow B'(2, -3)$$

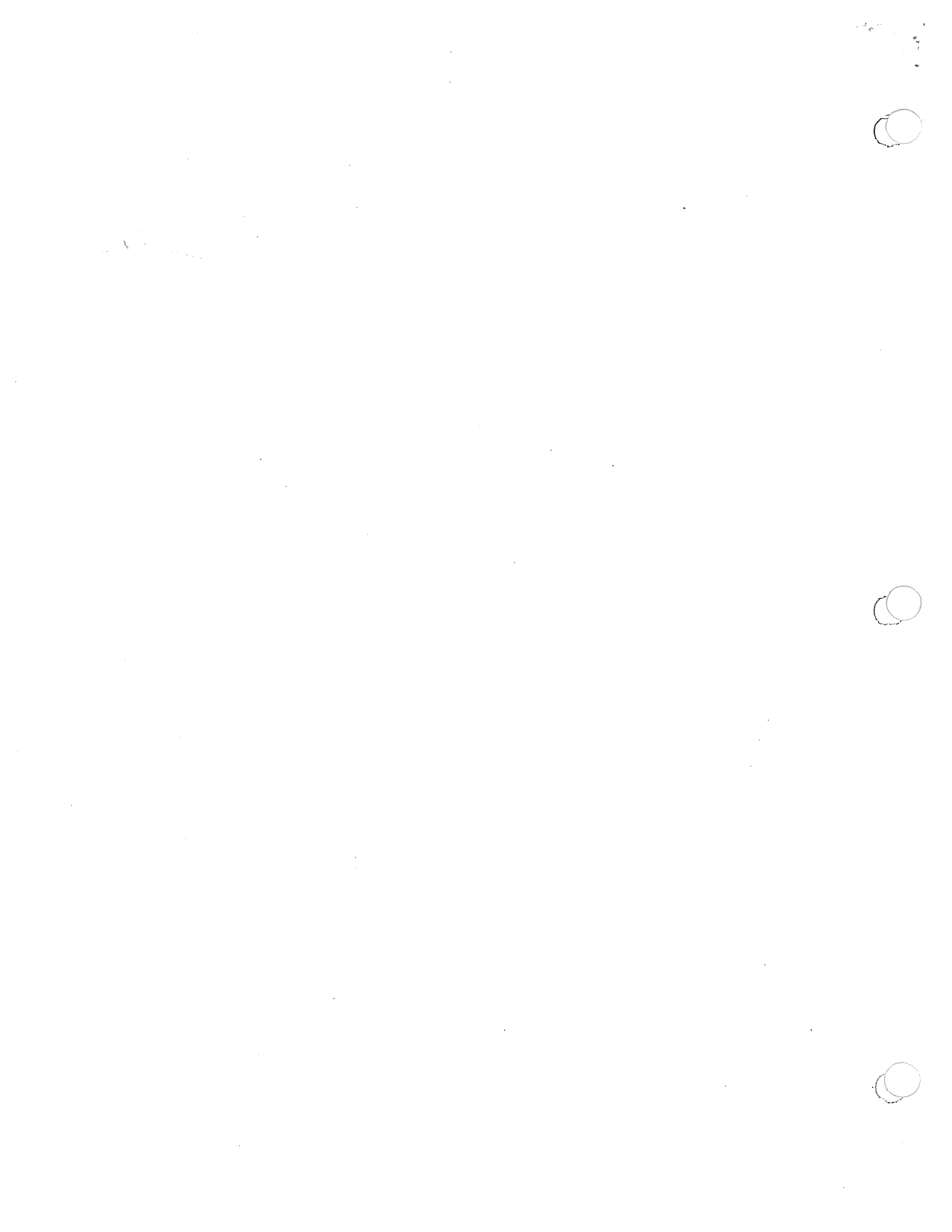
$$C(3, 4) \rightarrow C'(4, -3)$$



### NOTE

A  $90^\circ$  rotation counterclockwise is the same as  $270^\circ$  clockwise

A  $90^\circ$  rotation clockwise is the same as  $270^\circ$  counterclockwise

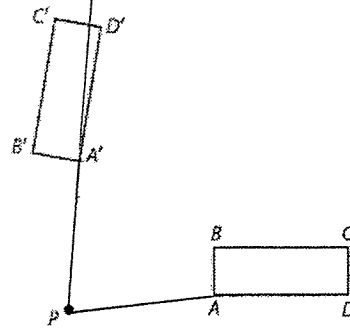


Geometry Honors  
2.3 Rotations

Name: KEY  
Date: \_\_\_\_\_

2. Find the angle of rotation and the direction of rotation in the given figure. Point P is the center of rotation.

$80^\circ$  counterclockwise

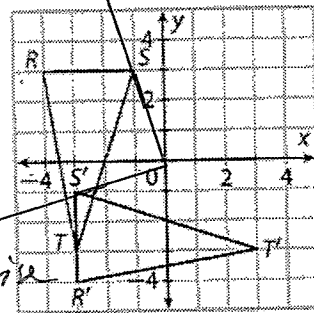


3. Write an algebraic rule for the rotation shown. Then describe the transformation in words.

$S(-1, 3)$   $S'(-3, -1)$

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

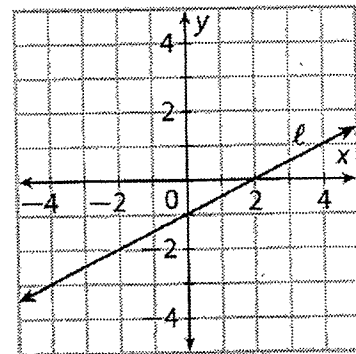
Rotate about the origin  $90^\circ$  counterclockwise



5. Write the equation of the image of line  $l$  after a clockwise rotation of  $90^\circ$ .

$m = -2$   $b = -1$

$y = -2x - 1$



$m = \frac{1}{2}$

7. The Skylon Tower, in Niagara Falls, Canada, has a revolving restaurant 775 feet above the falls. The restaurant makes a complete revolution once every hour. While a visitor was at the tower, the restaurant rotated through  $135^\circ$ . How long was the visitor at the tower?

$\frac{135}{365} = \frac{27}{73}$

$\frac{27}{73} \times \frac{60}{1} = 22.19 \rightarrow$

22 minutes

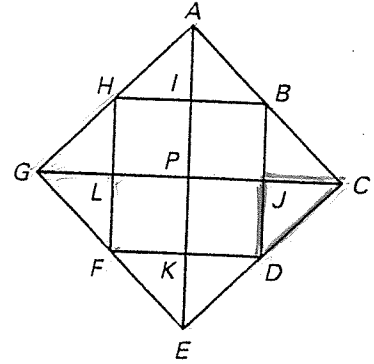


# Rotation Homework

KEY

1. State the segment or triangle that represents the image.

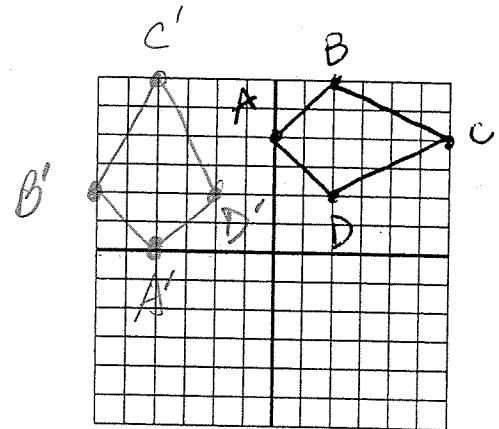
- a)  $90^\circ$  clockwise rotation of  $\overline{AB}$  about  $P$   $\overline{CD}$
- b)  $90^\circ$  clockwise rotation of  $\overline{DE}$  about  $P$   $\overline{FG}$
- c)  $90^\circ$  counterclockwise rotation of  $\overline{GH}$  about  $P$   $\overline{EF}$
- d)  $180^\circ$  counterclockwise rotation of  $\overline{EF}$  about  $P$   $\overline{AB}$
- e)  $180^\circ$  clockwise rotation of  $\triangle CJD$  about  $P$   $\triangle GLH$
- f)  $90^\circ$  counterclockwise rotation of  $\triangle GLF$  about  $P$   $\triangle AIH$



2. On the graphs below, plot and connect the following points. Then rotate them about the origin, with the given degree and direction. Connect the image points.

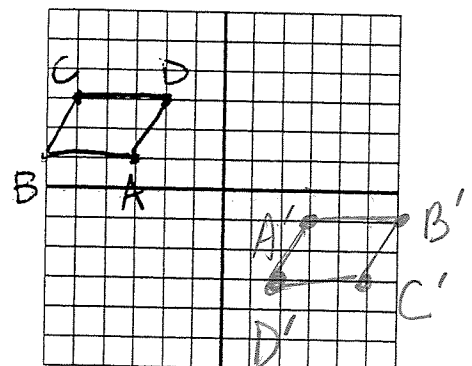
a)  $90^\circ$  counterclockwise

- $A(0, 4) \rightarrow A'(-4, 0)$
- $B(2, 6) \rightarrow B'(6, 2)$
- $C(6, 4) \rightarrow C'(-4, 6)$
- $D(2, 2) \rightarrow D'(-2, 2)$



b)  $180^\circ$  clockwise

- $A(-3, 1) \rightarrow A'(3, -1)$
- $B(-6, 1) \rightarrow B'(6, -1)$
- $C(-5, 3) \rightarrow C'(5, -3)$
- $D(-2, 3) \rightarrow D'(2, -3)$



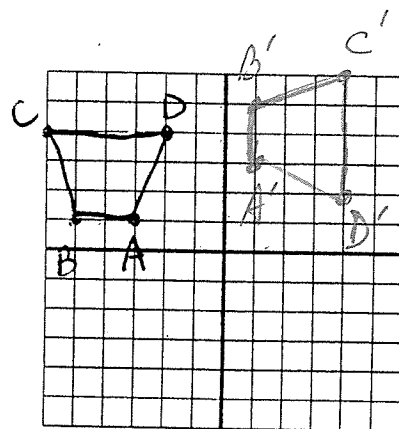
c) 90° clockwise

$$A(-3,1) \rightarrow A'(1,3)$$

$$B(-5,1) \rightarrow B'(1,5)$$

$$C(-6,4) \rightarrow C'(4,6)$$

$$D(-2,4) \rightarrow D'(4,2)$$



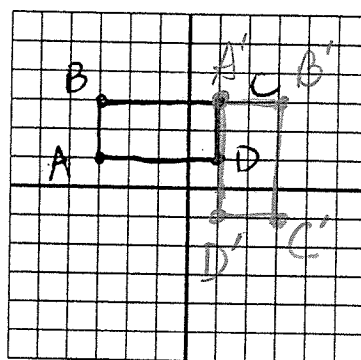
d) 90° clockwise

$$A(-3,1) \rightarrow A'(1,3)$$

$$B(-3,3) \rightarrow B'(3,3)$$

$$C(1,3) \rightarrow C'(3,-1)$$

$$D(1,1) \rightarrow D'(1,-1)$$



e) 90° counterclockwise

$$A(0,2) \rightarrow A'(0,-2)$$

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

$$C(5,4) \rightarrow C'(-4,5)$$

$$D(4,2) \rightarrow D'(-2,4)$$

