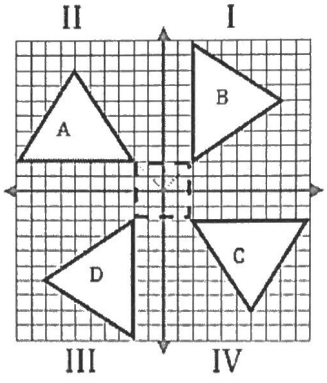
Delta Math Trans / Refl / Rot. Due 8/22 @ 11pm

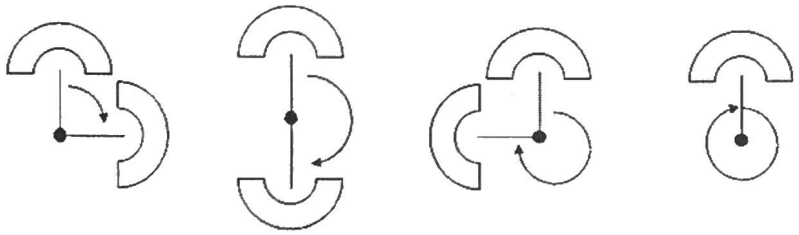
Day 2 – Rotations, Symmetry, and Multiple Transformations

A **rotation** is a circular movement around a central point that stays fixed and everything else moves around that point in a circle. A rotation maintains size and shape; therefore, it is our third type of rigid transformation.



When we rotate our figures around a fixed point, we classify our rotation by direction and degree of rotation.

Degrees of Rotation



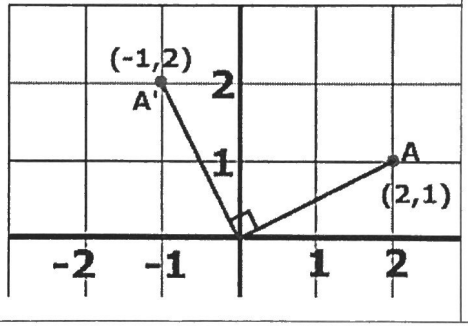
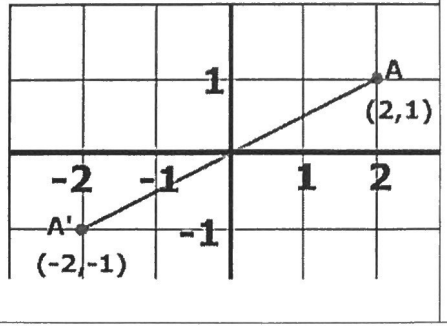
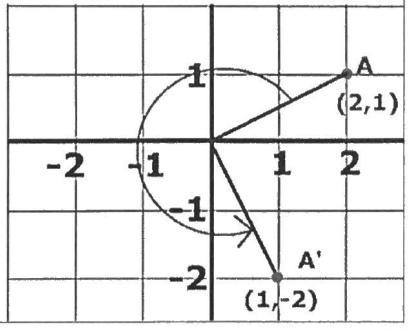
Direction of Rotation

It is important to understand that some rotations are the same depending on the degree and direction of the rotation. Most of the time, rotations are given using counterclockwise direction. Here are equivalent rotations:

90° Counterclockwise = 270° Clockwise **90° Clockwise = 270° Counterclockwise**

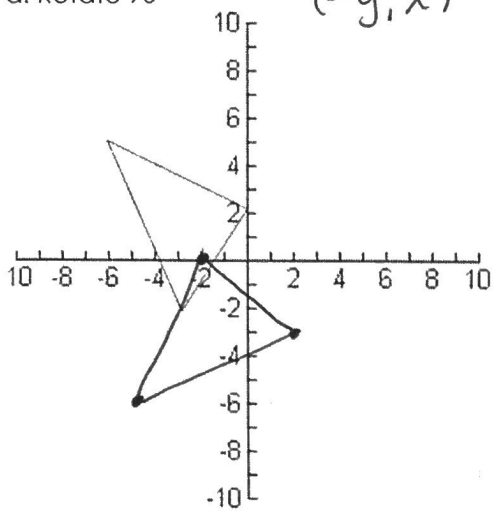
180° Counterclockwise = 180° Clockwise

Rules for Rotations

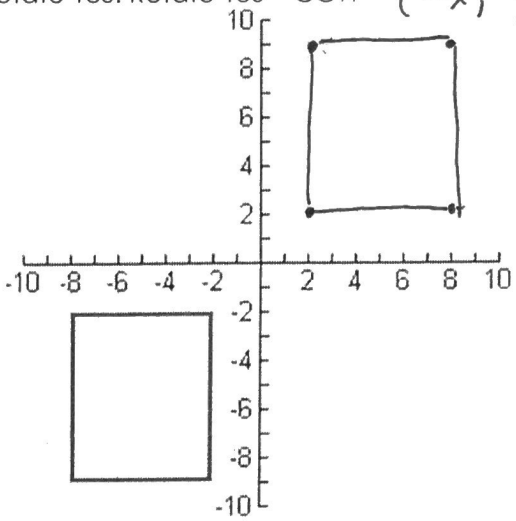
90°CCW / 270°CW	180°CCW / 180°CW	90°CW/270°CCW
(x, y) → (-y, x)	(x, y) → (-x, -y)	(x, y) →(y, -x)
		

Practice with Rotations

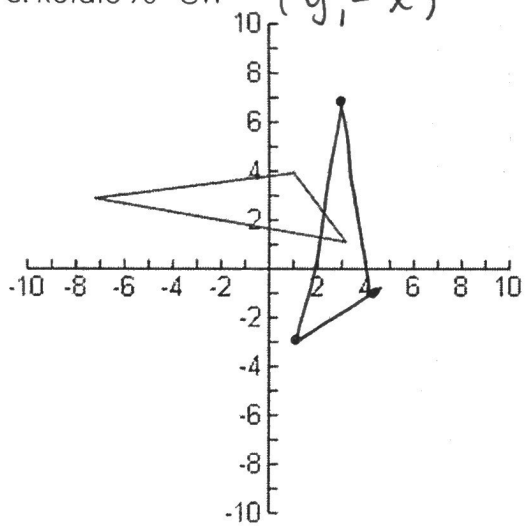
a. Rotate 90° $(-y, x)$



bb. Rotate 180. Rotate 180° CCW $(-x, -y)$



c. Rotate 90° CW $(y, -x)$



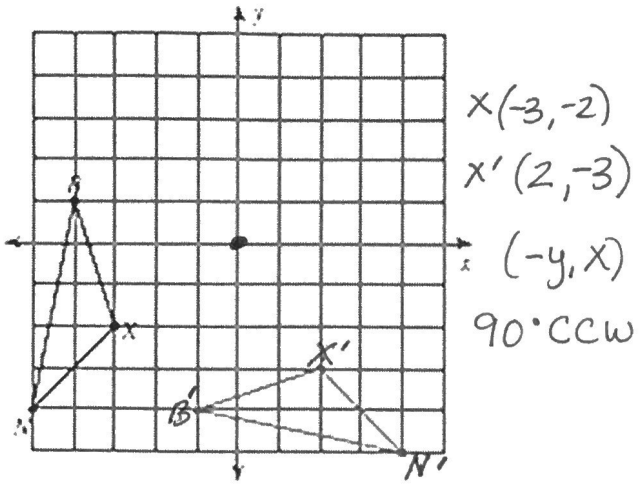
d. The line segment with endpoints (7, -8) and (-3, -5) are rotated 90° CW. What are its new endpoints?

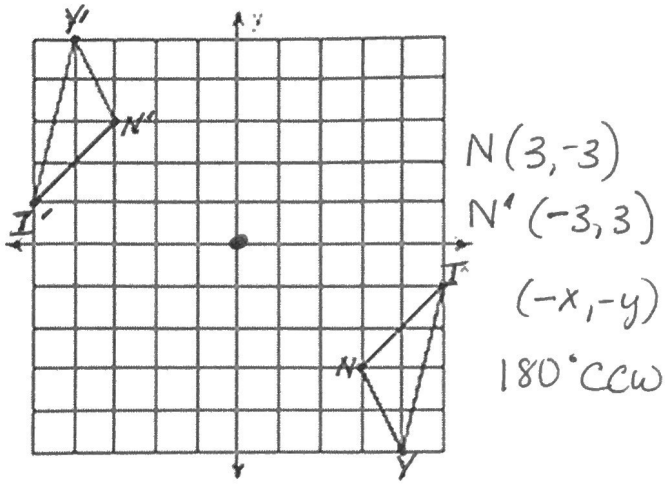
$(y, -x)$

$(7, -8) \rightarrow (-8, -7)$

$(-3, -5) \rightarrow (-5, 3)$

e. Describe the rotations:

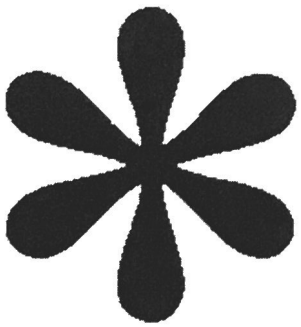




Rotational Symmetry

A figure has **rotational symmetry** If there is a center point around which the object is turned a certain number of degrees and the object looks the same. The degree of rotational symmetry that an object has is called its **order.** The order of rotational symmetry that an object has is the number of times that it fits onto itself during a full rotation of 360 degrees. To determine the **angle of rotation**, divide 360 degrees by its order.

Example: Determine the order and angle of rotation:

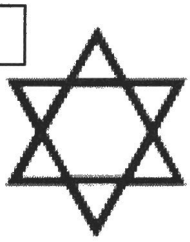


$\frac{360}{6} = 60°$

$\frac{360}{5} = 72°$

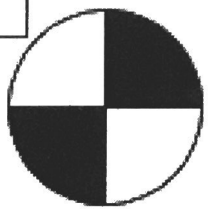
Practice: For the following figures, name the order and degrees of rotation:

1



60°

2

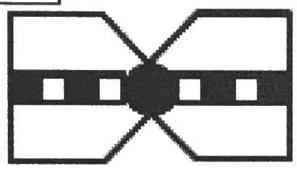


90°

3

120°

4

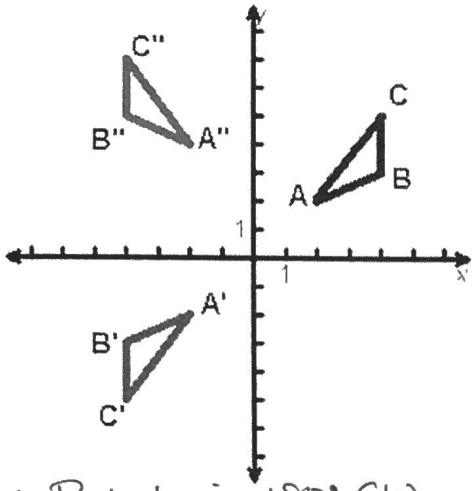


180°

Combined Transformations

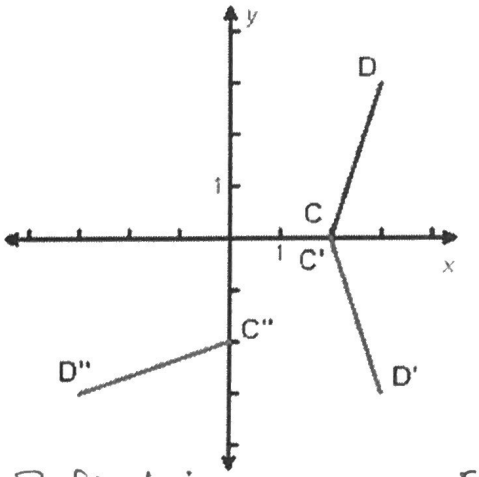
Practice: Describe that transformations that occurred from the pre-image to each image (in order).

A.



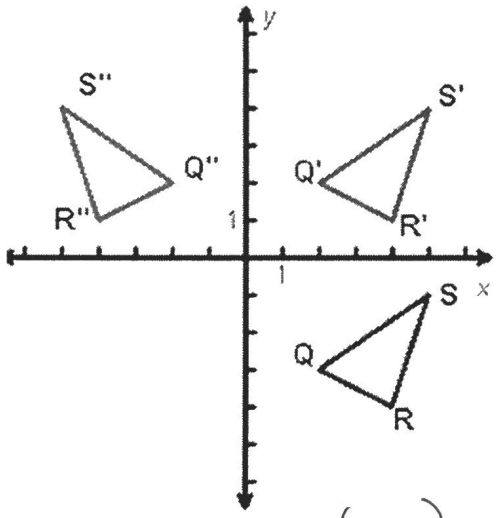
1. Rotation 180° CW
2. Reflection over $y=1$

B.



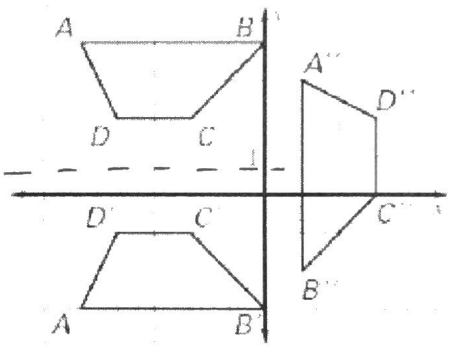
1. Reflection over x-axis $(y=0)$
2. Rotation 90° CW

C.



1. Translation $(x,y) \rightarrow (x,y+5)$
2. Reflection over y-axis $(x=0)$

D.



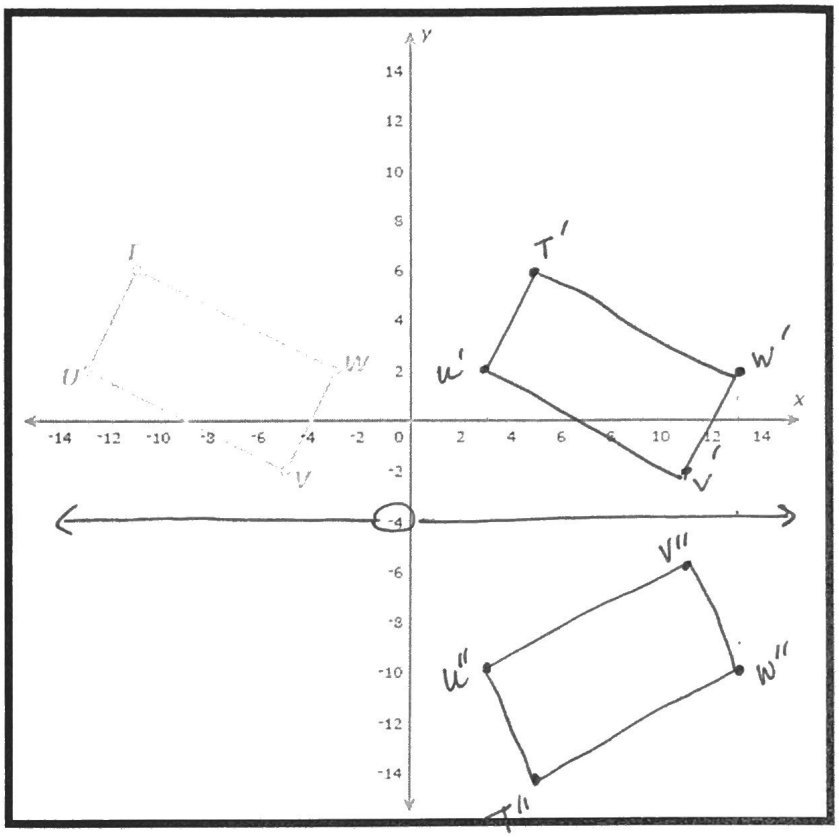
1. Reflection over $y = \frac{1}{2}$
2. Rotation 90° CW @ B *
3. Translate $(x+1, y+1)$

$A'(-5,-3)$ $A''(1,3)$

Perform the following transformations:

a. Translation (x, y) → (x + 16, y):

b. Reflection across y = -4:

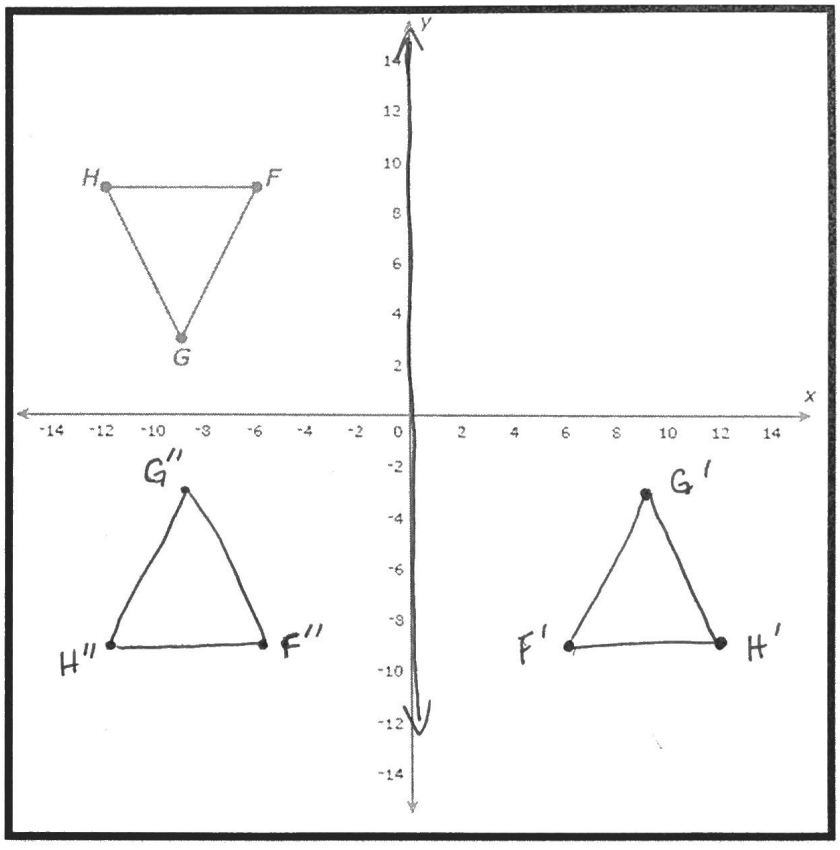


Perform the following transformations:

a. Rotation 180° CW around the origin:

$(-x, -y)$

b. Reflection across the y-axis:



Perform the following transformations:

a. Rotation 90° CCW around the origin:

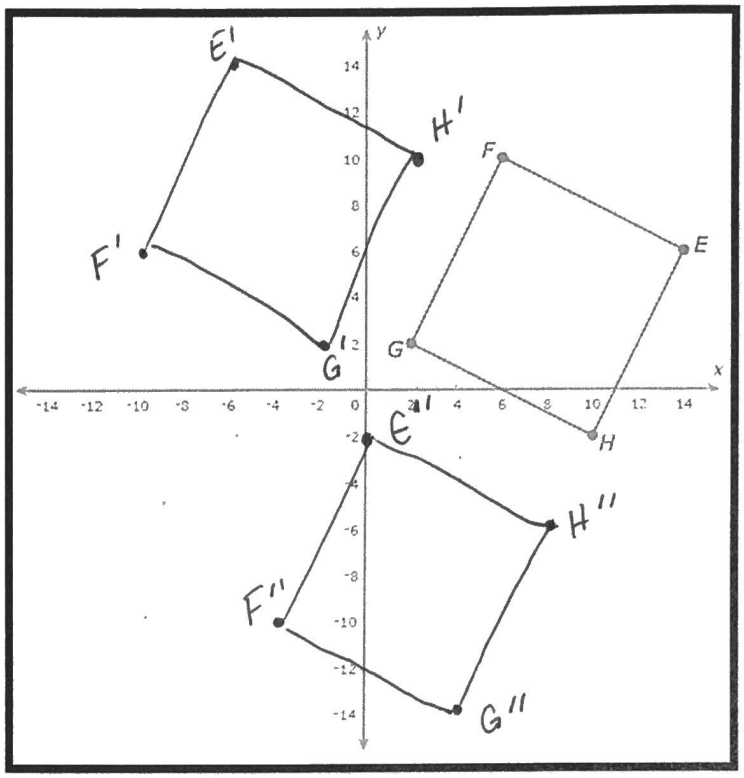
G (2,2) → (-2,2)

F (6,10) → (-10,6)

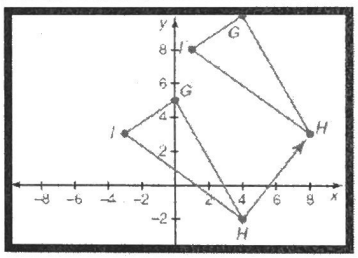
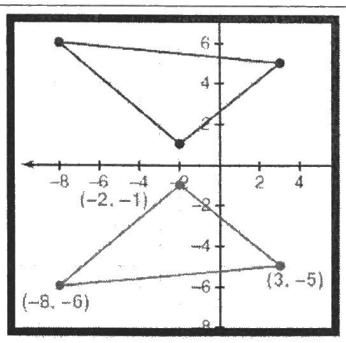
E (14,6) → (-6,14)

H (10,-2) → (2,10)

b. Translation (x, y) → (x + 6, y – 16)



Summary of Transformation Rules

Transformation	Rules	Examples
Translations *"slide"*	(x, y) → (x ± a, y ± b) a: horizontal slide (+ right, - left) b: vertical slide (+ up, - down)	
Reflections *"flip"*	x-axis: (x, y) → (x, -y) y-axis: (x, y)→(-x, y) y = x: (x, y) → (y, x) y = -x: (x, y) → (-y, -x)	
Rotations *"turn"*	90°CW = 270°CCW: (x, y)→ (y, -x) 180°CW = 180°CCW : (x, y) → (-x, -y) 90° CCW = 270°CW: (x, y) → (-y, x)