Name ______________________ Date ______________ Period 1

Transformation #3: Rotations

Lesson Objective IWBAT perform rotations, perform composition w/ rotations, and identify rotational symmetry.

Rotation: a rotation is a transformation in which a figure is turned about a fixed point called the center of rotation.

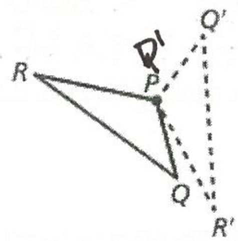
→ Rays drawn from the center of rotation to a point and its image form the angle of rotation

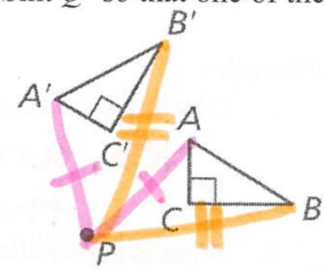
A rotation about a point P through an angle of $x°$ maps every point Q in the plane to a point Q' so that one of the following is true:

1. If Q is NOT the center of rotation P, then QP = Q'P and $m\angle QPQ' = x°$

   OR

2. If Q is the center of rotation P, then Q = Q'





$m\angle APA' = 60°$

$m\angle BPB' = 60°$

ROTATING COUNTERCLOCKWISE	ROTATING CLOCKWISE
 *default direction	

**"about" means "around" in math language

Coordinate Rules for Rotations about the Origin

When a point (x, y) is rotated COUNTERCLOCKWISE about the origin, the following are true:

1. For a rotation of 90°: $(x, y) \to (-y, x)$
2. For a rotation of 180°: $(x, y) \to (-x, -y)$
3. For a rotation of 270°: $(x, y) \to (y, -x)$

**Unless otherwise stated, a rotation will always be counter clockwise

Example:

1. Graph quadrilateral RSTU with vertices R(3, 1), S(5, 1), T(5, -3), and U(2, -1) and its image after a 270° rotation about the origin.

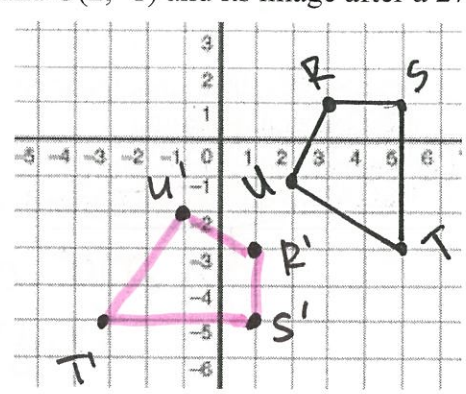
$(x,y) \to (y,-x)$

$R(3,1) \to R'(1,-3)$

$S(5,1) \to S'(1,-5)$

$T(5,-3) \to T'(-3,-5)$

$U(2,-1) \to U'(-1,-2)$



**REMEMBER: a full rotation is 360° °

Rotational Symmetry

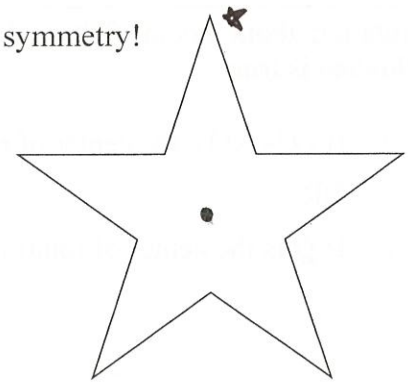
A figure in the plane has rotational symmetry when the figure can be mapped onto itself by a rotation of between 0° and 360° about the center of the figure.

→ The point in which the figure rotates is called the center of symmetry

→ Note that the rotation can be either clockwise OR counterclockwise.

→ A figure is said to have point symmetry when the figure has an angle of rotation of 180* °

**Use your trace paper to help you determine whether the figure has rotational symmetry!



Examples:

2. Determine whether the figure (the star) has rotational symmetry.

yes, a rotation of < 360° maps the ★ onto itself.

3. What is the smallest angle that maps the figure (the star) onto itself?

72°

4. Describe what your group did to find the answer to #3.

Divide a full rotation (360°) by the # of times the ★ can get mapped onto itself in that 360° rotation.

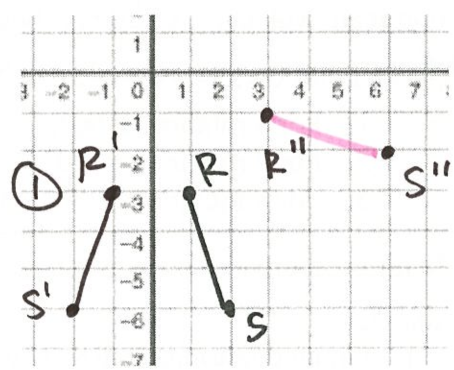
5. Describe the rotation(s) that map the figure onto itself.
In other words, what angle(s) between 0° and 360° map the figure onto itself?

72°, 144°, 216°, 288°

Compositions with Rotations

Example

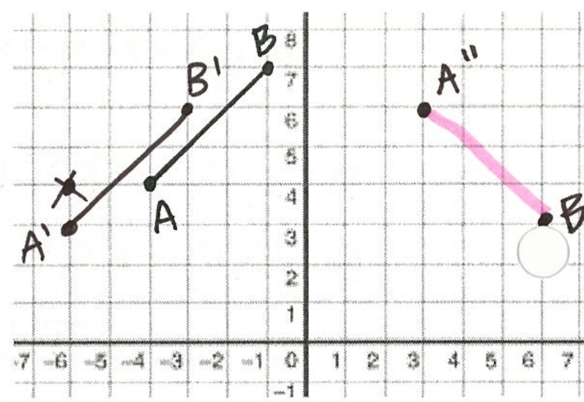
6. Graph $\overline{RS}$ with endpoints R(1, -3) and S(2, -6) and its image after the composition:
① **Reflection:** in the y-axis
② **Rotation**: 90° about the origin



R(1, -3) → R'(-1, -3) → R''(3, -1)
S(2, -6) → S'(-2, -6) → S''(6, -2)

7. Graph $\overline{AB}$ with endpoints A(-4, 4) and B(-1, 7) and its image after the composition:
① **Translation:** $(x, y) \rightarrow (x - 2, y - 1)$
Rotation: 90° clockwise about the origin

↳ 270° counterclockwise
(x, y) → (y, -x)



A(-4, 4) → A'(-6, 3) → A''(3, 6)
B(-1, 7) → B'(-3, 6) → B''(6, 3)