Math 2 Name: Key

Unit 1 Day 1 Notes – Rotations Date:____________

Warm-Up: Given triangle ABC with A(-1, 4), B(4, 3) and C(1, -5), graph the image points after the following transformations, identify the coordinates of the image, and write the Algebraic Rule for each.

1) Translate triangle ABC left 3, up 2

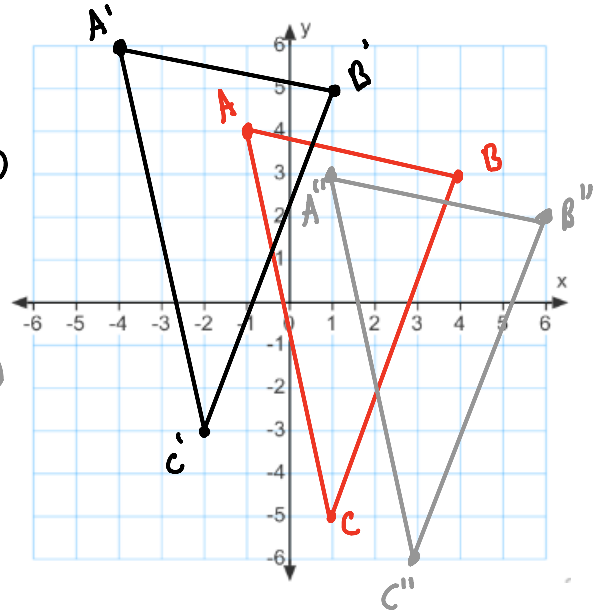
Points: A'(-4,6) C'(-2,-3) B'(1,5)

Algebraic Rule: $T: (x,y) \rightarrow (x-3, y+2)$

2) Translate triangle ABC right 2, down 1

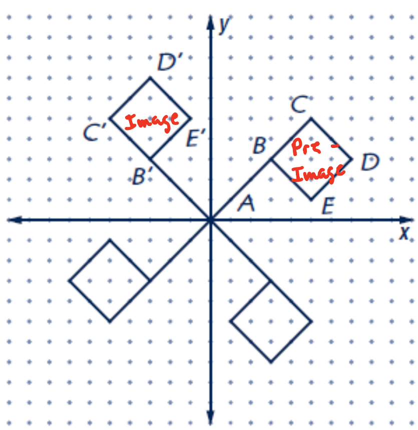
Points: A''(1,3) C''(3,-6) B''(6,2)

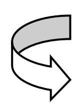
Algebraic Rule: $T: (x,y) \rightarrow (x+2, y-1)$



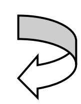
4. Visualizing Rotations Centered About the Origin

The flag shown below is rotated about the origin 90°, 180°, and 270°. Flag ABCDE is the preimage. Flag A'B'C'D'E' is a 90° counterclockwise rotation of ABCDE.





SAME



counter - clockwise	clockwise
90° Degrees!	270° Degrees!

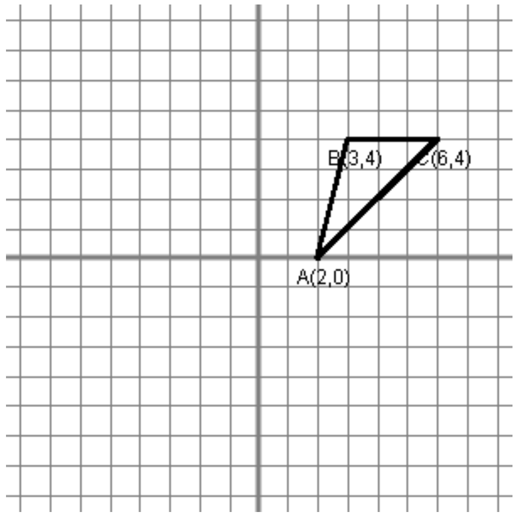
NOTE: Unless otherwise specified, the standard for rotations is **counterclockwise**!

Notation for Rotations

R origin , 90°

Example: $R_{0,\,90°}$

5. Rotations on the Coordinate Plane Exploration



x y

1) Triangle ABC has coordinates A(2, 0), B(3, 4), C(6, 4). Trace the triangle and the x- and y-axes on patty paper.

(1 turn)

2) Rotate Triangle ABC 90°, using the axes you traced to help you line it back up. Record the new coordinates. A'(0 , 2), B'(-4 , 3), C'(-4 , 6)

y x   -y x   -y x

R_O 90°: (x, y) → (-y, x)

(3 turns)

3) Rotate Triangle ABC 270°, using the axes you traced to help you line it up. Record the new coordinates. A'(0 , -2), B'(4 , -3), C'(4 , -6)

y -x   y -x   y -x

R_O 270°: (x, y) → (y, -x)

(2 turns)

4) Rotate Triangle ABC 180°, using the axes you traced to help you line it back up correctly. Record the new coordinates. A'(-2 , 0), B'(-3 , -4), C'(-6 , -4)

-x -y   -x -y   -x -y

R_O 180°: (x, y) → (-x, -y)

Checkpoint: Look at the patterns and complete the rule. Then write the rule using <u>proper notation</u> for 1 – 3.

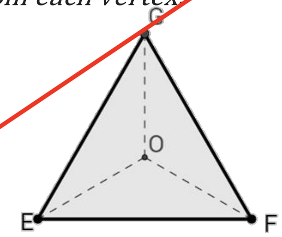
1. A 90° counter-clockwise rotation maps (x, y) → (-y , x). Notation: R_O 90°
2. A 270° counter-clockwise rotation maps (x, y) → (y , -x). Notation: R_O 270°
3. A 180° rotation maps (x, y) → (-x , -y). Notation: R_O 180°
4. A rotation of 270° clockwise is equivalent to a rotation of 90° counter-clockwise.
5. A rotation of 270° counterclockwise is equivalent to a rotation of 90° clockwise.

6. Rotations with Polygons

Part 1 – Regular Polygons and rotation symmetry

A few definitions to support you as you work:

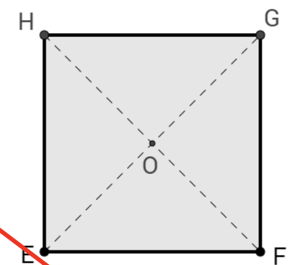
A ***regular polygon*** *is a* ***polygon*** *that is equiangular (all angles are equal in measure) and equilateral (all sides have the same length). In the case of* ***regular polygons*** *the* ***center*** *is the point that is equidistant from each vertex.*



1. Given regular triangle EFG with center O.
   a. F is rotated about O. If the image of F is G, what is the angle of rotation?
   b. $\overline{FG}$ is rotated 120° about O. What is the image of $\overline{FG}$?

General Rule: The regular triangle has rotation symmetry with respect to the center of the polygon and angles of rotation that measure ____ and ____.

Side note: A regular triangle is also called an ___________ triangle or an ____________ triangle.

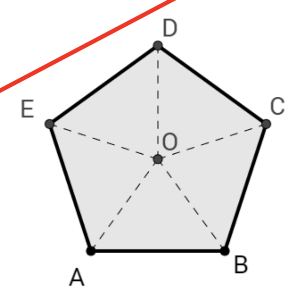


2. Given regular quadrilateral EFGH with center O.
   a. F is rotated about O. If the image of F is G, what is the angle of rotation?
   b. F is rotated about O. If the image of F is H, what is the angle of rotation?
   c. $\overline{FG}$ is rotated 270° about O. What is the image of $\overline{FG}$?

General Rule: The regular quadrilateral has rotation symmetry with respect to the center of the polygon and angles of rotation that measure ____, ____,_____ and ____.

Side note: A regular quadrilateral is often called a ____________.

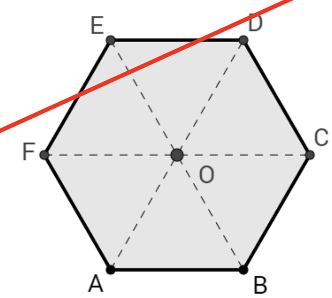
3. Given regular pentagon ABCDE with center O,



   a. C is rotated about O. If the image of C is D, what is the angle of rotation?
   b. C is rotated about O. If the image of C is E, what is the angle of rotation?
   c. C is rotated about O. If the image of C is A, what is the angle of rotation?
   d. $\overline{DC}$ is rotated 288° about O, what is the image of $\overline{DC}$?
   e. Pentagon ABCDE is rotated 72° about O, what is the image of pentagon ABCDE (in terms of the original points' labels – do not use A'B'C'D'E')?
   f. Explain the significance of the multiples of 72°.

General Rule: The regular pentagon has rotation symmetry with respect to the center of the polygon and angles of rotation that measure ____, ____,____, _____ and ____.

4. Given regular hexagon ABCDEF with center O,



   a. C is rotated 60° about O, what is the image of C?

   b. C is rotated 120° about O, what is the image of C?

   c. C is rotated 180° about O, what is the image of C?

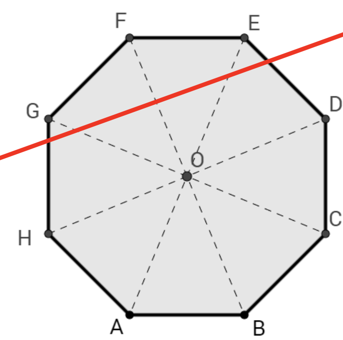
   d. $\overline{DC}$ is rotated 240° about O, what is the image of $\overline{DC}$?

   e. Explain the significance of the multiples of 60°.

General Rule: The regular hexagon has rotation symmetry with respect to the center of the polygon

and angles of rotation that measure ____, ____, ____, ____, _____ and ____.

5. Given regular octagon ABCDEFGH with center O,



   a. When point C is rotated about O, the image of point C is point D. Describe the rotation (be sure to include degree).

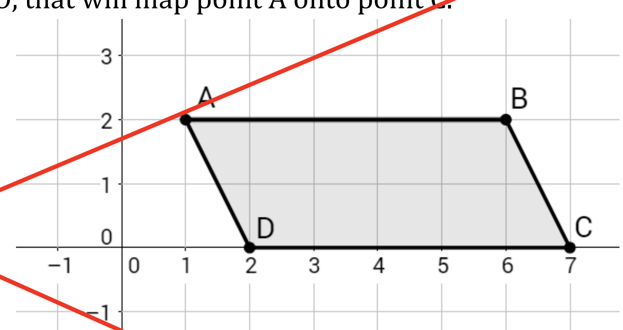
   b. When point C is rotated about O, the image of point C is point F. Describe the rotation (be sure to include degree).

A regular polygon can be mapped onto itself if we rotate in multiples of the central angle measure.

The central angle of a regular polygon is found by ________________________

Part 2 – Parallelograms and rotation symmetry

6. Given parallelogram ABCD, there is a center of rotation, O, that will map point A onto point C.



   a. What are the coordinates of O?

   b. What degree of rotation mapped C onto A using the center O?

   c. If we rotate the parallelogram around center O using the degree measure found in part b, angle D maps to angle _______.

   d. If angle A maps to angle C, then angle A and angle C are _______.

   e. If angle D maps to angle ___, then angle D and angle ____ are _______.