**Investigate!!!!**

Rotations about the origin have similar coordinate models. A **rotation**, or turning motion, is determined by a point called the *center of rotation* and a *directed angle of rotation.* A flag *ABCDE* and its images under counterclockwise rotations of 90°, 180°, and 270° about the origin are shown below.



**Problem 1:**

Consider flag *ABCDE* above and its image under a 90° counterclockwise rotation about the origin.

1. On a copy of the table below, record the coordinates of the images of the five points on the flag under a 90° counterclockwise rotation about the origin.

Is there a pattern that you see between the original image and the 90° counterclockwise rotation about the origin? Be sure to explain using only the rotated images of points *A, B, C, D, and E.*

1. Use any patterns you see between preimage and image points in your completed table in **part a** to help plot the points (-2, -5), (-4, 1), (5, -3), and their images under a 90° counterclockwise rotation about the origin on a new coordinate grid. Be sure to label each pre-image point and image point.



1. Write a rule relating the coordinates of any preimage point *(x,y)* and its image point under a 90° counterclockwise rotation about the origin. State your rule in words and in symbolic form.



1. According to your rule, what is the image of (0,0)? Why does this image make sense?

**Problem 2:**

As you probably expect, counterclockwise rotations of 180° and 270° about the origin also have predictable coordinate patterns. Use the graphs of flag *ABCDE* from the previous problems to explore these patterns (the graph below).



1. Investigate patterns in the coordinates of the preimage and image pairs when points are rotated 180° about the origin.



Is there a pattern that you see between the original image and the 180° counterclockwise rotation about the origin?

1. Write a rule relating the coordinates of any preimage point (*x,y)* and its image point under a 180° rotation about the origin. State your rule in words and in symbols.



1. Similarly, search for patterns in the coordinates of the preimage and image pairs when points are rotated 270° counterclockwise about the origin.



Is there a pattern that you see between the original image and the 270° counterclockwise rotation about the origin?

1. Write a rule relating the coordinates of any preimage point *(x,y)* and its image point under a 270° counterclockwise rotation about the origin. State your rule in words and in symbols.



**Problem 3:**

1. Take a look at the rotations in Problems 1 and 2. What type of rotation would a 90° Clockwise rotation be identical to?
2. Write a rule relating the coordinates of any preimage point *(x,y)* and its image point under a 90° clockwise rotation about the origin. State your rule in words and in symbols.
3. What type of rotation would a 180° Clockwise rotation be identical to?
4. Write a rule relating the coordinates of any preimage point *(x,y)* and its image point under a 180° clockwise rotation about the origin. State your rule in words and in symbols.
5. What type of rotation would a 270° Clockwise rotation be identical to?
6. Write a rule relating the coordinates of any preimage point *(x,y)* and its image point under a 270° clockwise rotation about the origin. State your rule in words and in symbols.