Transformations: Rotations

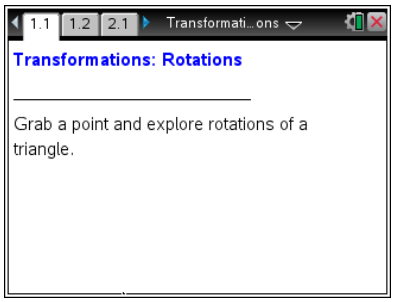
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Transformation_Rotations.tns.*

A rotation is the turning of an object by an angle about a fixed point. How does the image of a rotated object compare to its pre-image? In this activity, you will use clockwise and counterclockwise rotation as you investigate the properties of the pre-image and image of a triangle.



Move to page 1.2.

1. Determine if a rotation of a figure changes the size or the shape of the figure.

   a. Two figures are said to be *congruent* if they have the same size and same shape. Move point *P* on the *Clockwise* circle and observe the rotated image. Does the rotated image appear to be congruent to the pre-image? Why or why not?

   b. Move point *Q* on the *Counterclockwise* circle and observe the rotated image. Does the rotated image appear to be congruent to the pre-image?

2. An **isometry** is a transformation that produces an image that is congruent to the pre-image. Is a transformation by using a rotation an isometry? Explain your reasoning.

3. Move point *Q* (on the *Counterclockwise* circle) until the degree of rotation is 60^{o}.

   a. If you move point *P* (on the *Clockwise* circle), when will the 2 rotated triangles be in the same position?

   b. What do you notice about these 2 numbers?

4. Move point *P* (on the *Clockwise* circle) until the degree of rotation is 150^{o}.

   a. If you move point *Q* (on the *Counterclockwise* circle), when will the 2 rotated triangles be in the same position?

   b. What do you notice about the sum of these 2 numbers?

5. a. If the angle of the clockwise rotation of the pre-image is 135^{o}, then what counterclockwise rotation will give you the same image? Why?

   b. If the angle of the clockwise rotation of the pre-image is $n°$, then what counterclockwise rotation will give you the same image?

Move to page 2.1.

6. Use the slider to examine the difference between a positive and a negative angle of rotation.

   a. Start with the slider on an angle of rotation of 0^{o}. Move the slider from 0^{o} toward 360^{o} and watch the image as it rotates. Does the triangle rotate in a clockwise or counterclockwise direction?

   b. Start with the slider on an angle of rotation of 0^{o}. Move the slider from 0^{o} toward $–360^{o}$ and watch the image as it rotates. Does the triangle rotate in a clockwise or counterclockwise direction?

   c. What can you conclude about positive and negative angles of rotation and their relationship to clockwise and counterclockwise rotation?

7. Use the slider to change the angle of rotation.

   a. Complete the first row of the table below with coordinates of vertex $A(-6, 1)$.

   b. Move vertex A to a different location and record the new coordinates for each rotation in the second row of the table.

   c. Generalize your findings using the point (x, y) in the third row of the table.

		Coordinates of point A'								
		–360°	–270°	–180°	–90°	0°	90°	180°	270°	360°
a.	(–6, 1)					(–6, 1)			(1, 6)	
b.	new point (__ , __)									
c.	(x, y)		$(-y, x)$							

8. If the clockwise (or counterclockwise) order of the vertices of the image and the pre-image is the same, the figures are said to have the same **orientation.**
   a. Do $\triangle ABC$ and $\triangle A'B'C'$ have the same orientation? Why or why not?

   b. Does your answer to question 8a depend on the direction of rotation? Does it depend on the angle of rotation?

Move to page 3.1.

9. Use the point on the circle to change the angle of rotation. Use the slider to change from counterclockwise rotation to clockwise rotation.
   a. Record your observations as you change the angle and direction of rotation. What changes? What stays the same?

   b. Move any of the vertices of the pre-image triangle. Does the new location of these points affect your observations in part a?

10. Consider the properties of side length, angle measure, perimeter, area, and orientation. Which of these properties are preserved in a transformation using rotation? How do you know?