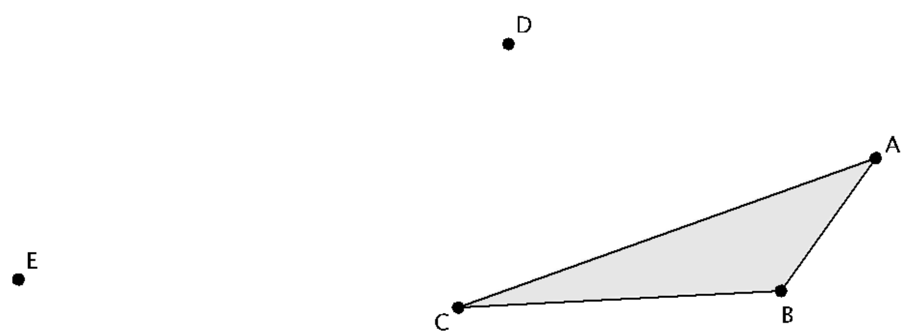
Lesson 9: Sequencing Rotations

Classwork

Exploratory Challenge

1.



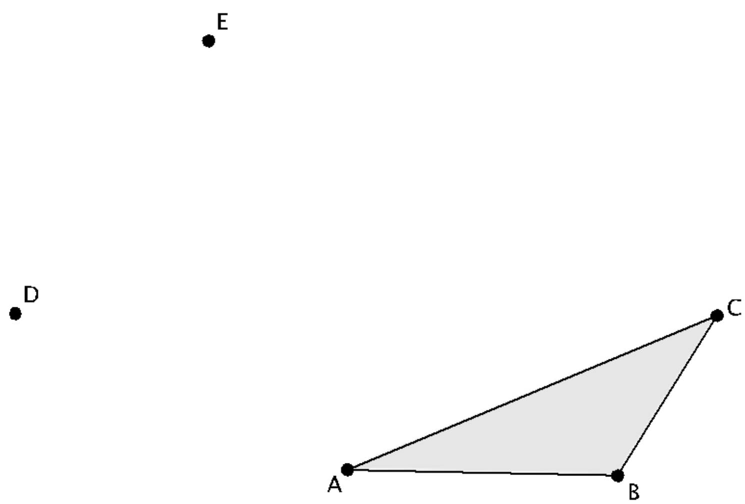
a. Rotate $\triangle ABC$ d degrees around center D. Label the rotated image as $\triangle A'B'C'$.

b. Rotate $\triangle A'B'C'$ d degrees around center E. Label the rotated image as $\triangle A''B''C''$.

c. Measure and label the angles and side lengths of $\triangle ABC$. How do they compare with the images $\triangle A'B'C'$ and $\triangle A''B''C''$?

d. How can you explain what you observed in part (c)? What statement can you make about properties of sequences of rotations as they relate to a single rotation?

2.



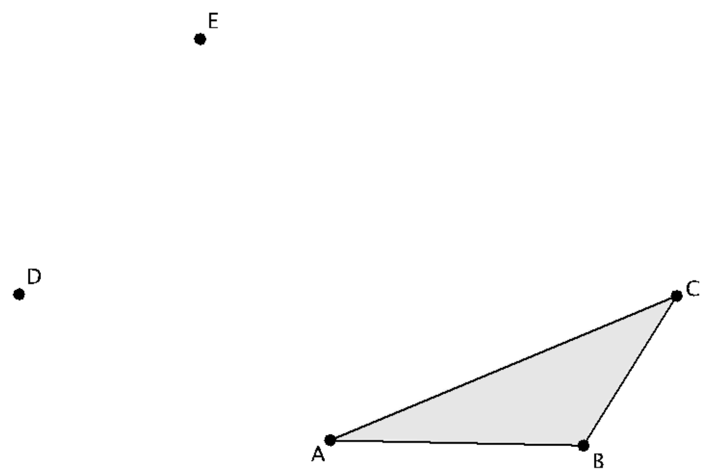
a. Rotate $\triangle ABC$ d degrees around center D, and then rotate again d degrees around center E. Label the image as $\triangle A'B'C'$ after you have completed both rotations.

b. Can a single rotation around center D map $\triangle A'B'C'$ onto $\triangle ABC$?

c. Can a single rotation around center E map $\triangle A'B'C'$ onto $\triangle ABC$?

d. Can you find a center that would map $\triangle A'B'C'$ onto $\triangle ABC$ in one rotation? If so, label the center F.

3.

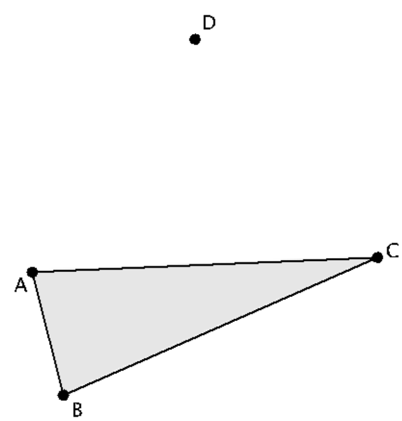


a. Rotate $\triangle ABC$ $90°$ (counterclockwise) around center D, and then rotate the image another $90°$ (counterclockwise) around center E. Label the image $\triangle A'B'C'$.

b. Rotate $\triangle ABC$ $90°$ (counterclockwise) around center E, and then rotate the image another $90°$ (counterclockwise) around center D. Label the image $\triangle A''B''C''$.

c. What do you notice about the locations of $\triangle A'B'C'$ and $\triangle A''B''C''$? Does the order in which you rotate a figure around different centers have an impact on the final location of the figure's image?

4.

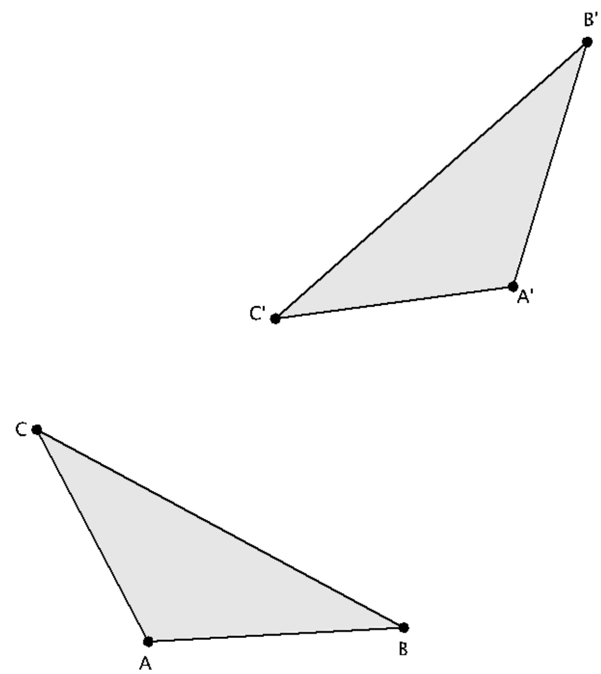


a. Rotate $\triangle ABC$ $90°$ (counterclockwise) around center D, and then rotate the image another $45°$ (counterclockwise) around center D. Label the image $\triangle A'B'C'$.

b. Rotate $\triangle ABC$ $45°$ (counterclockwise) around center D, and then rotate the image another $90°$ (counterclockwise) around center D. Label the image $\triangle A''B''C''$.

c. What do you notice about the locations of $\triangle A'B'C'$ and $\triangle A''B''C''$? Does the order in which you rotate a figure around the same center have an impact on the final location of the figure's image?

5. $\triangle ABC$ has been rotated around two different centers, and its image is $\triangle A'B'C'$. Describe a sequence of rigid motions that would map $\triangle ABC$ onto $\triangle A'B'C'$.

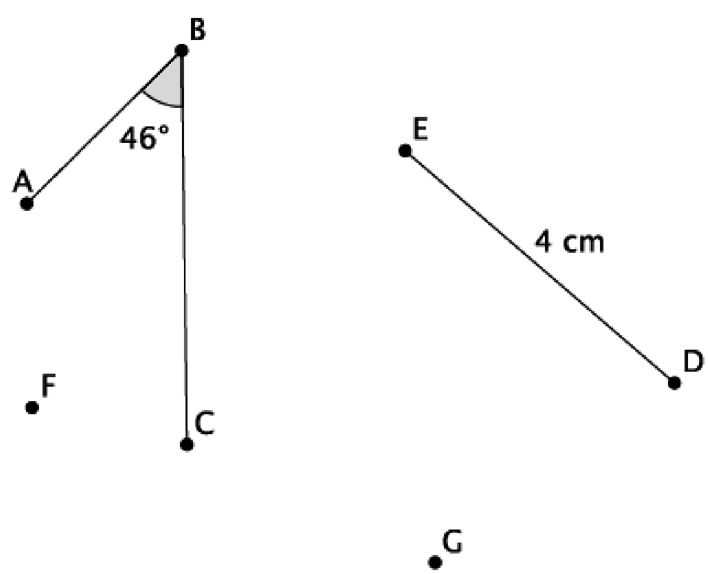


Lesson Summary

- Sequences of rotations have the same properties as a single rotation:
  - A sequence of rotations preserves degrees of measures of angles.
  - A sequence of rotations preserves lengths of segments.
- The order in which a sequence of rotations around different centers is performed matters with respect to the final location of the image of the figure that is rotated.
- The order in which a sequence of rotations around the same center is performed does not matter. The image of the figure will be in the same location.

Problem Set

1. Refer to the figure below.

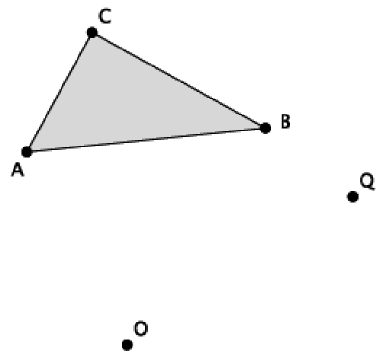


a. Rotate $\angle ABC$ and segment DE d degrees around center F and then d degrees around center G. Label the final location of the images as $\angle A'B'C'$ and segment $D'E'$.

b. What is the size of $\angle ABC$, and how does it compare to the size of $\angle A'B'C'$? Explain.

c. What is the length of segment DE, and how does it compare to the length of segment $D'E'$? Explain.

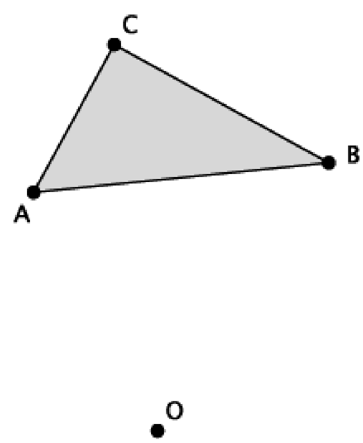
2. Refer to the figure given below.



   a. Let $Rotation_1$ be a counterclockwise rotation of $90°$ around the center O. Let $Rotation_2$ be a clockwise rotation of $(-45)°$ around the center Q. Determine the approximate location of $Rotation_1(\triangle ABC)$ followed by $Rotation_2$. Label the image of $\triangle ABC$ as $\triangle A'B'C'$.

   b. Describe the sequence of rigid motions that would map $\triangle ABC$ onto $\triangle A'B'C'$.

3. Refer to the figure given below.



Let R be a rotation of $(-90)°$ around the center O. Let $Rotation_2$ be a rotation of $(-45)°$ around the same center O. Determine the approximate location of $Rotation_1(\triangle ABC)$ followed by $Rotation_2(\triangle ABC)$. Label the image of $\triangle ABC$ as $\triangle A'B'C'$.