Lesson 5: Definition of Rotation and Basic Properties

Classwork

Exercises

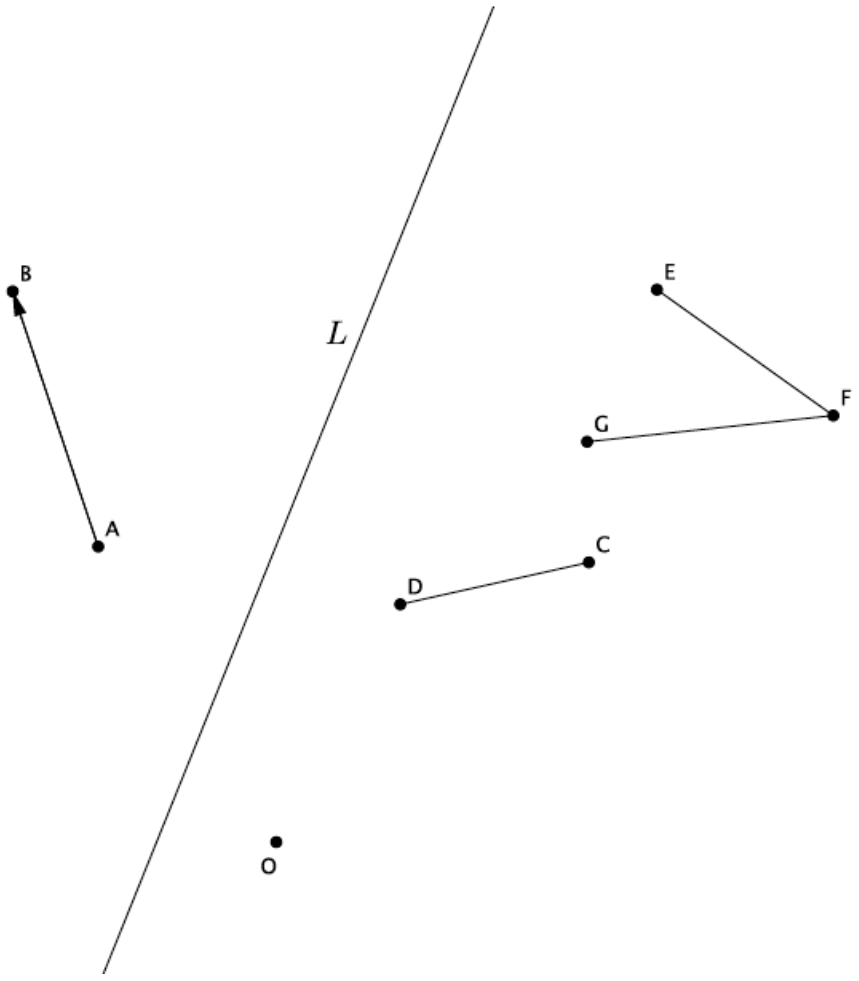
1. Let there be a rotation of d degrees around center O. Let P be a point other than O. Select d so that $d \geq 0$. Find P' (i.e., the rotation of point P) using a transparency.

2. Let there be a rotation of d degrees around center O. Let P be a point other than O. Select d so that $d < 0$. Find P' (i.e., the rotation of point P) using a transparency.

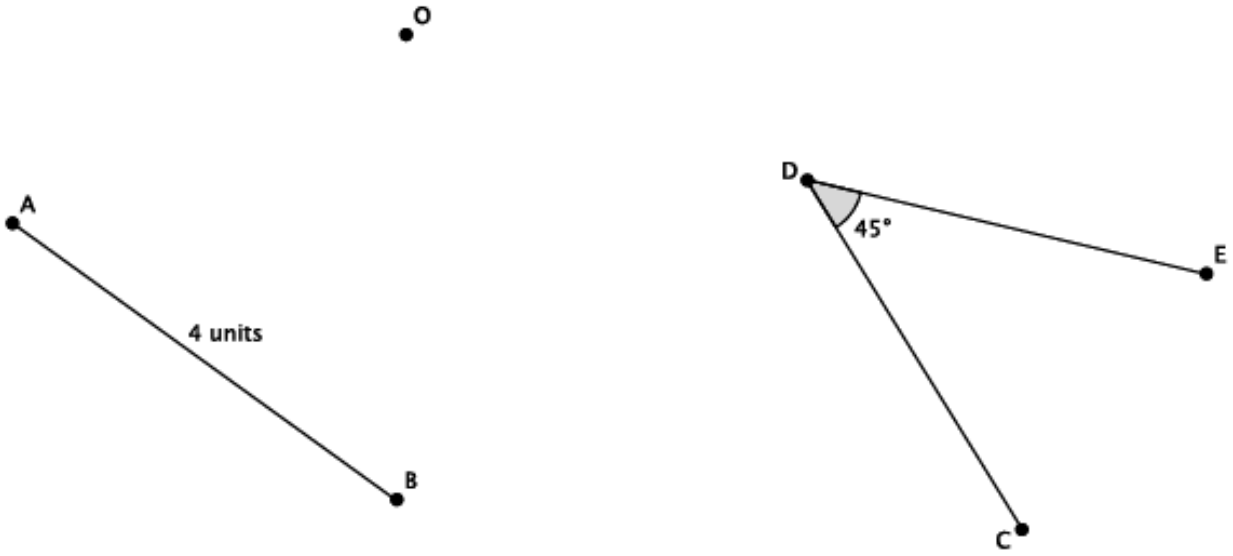
3. Which direction did the point P rotate when $d \geq 0$?

4. Which direction did the point P rotate when $d < 0$?

5. Let L be a line, $\overrightarrow{AB}$ be a ray, $\overline{CD}$ be a segment, and $\angle EFG$ be an angle, as shown. Let there be a rotation of d degrees around point O. Find the images of all figures when $d \geq 0$.



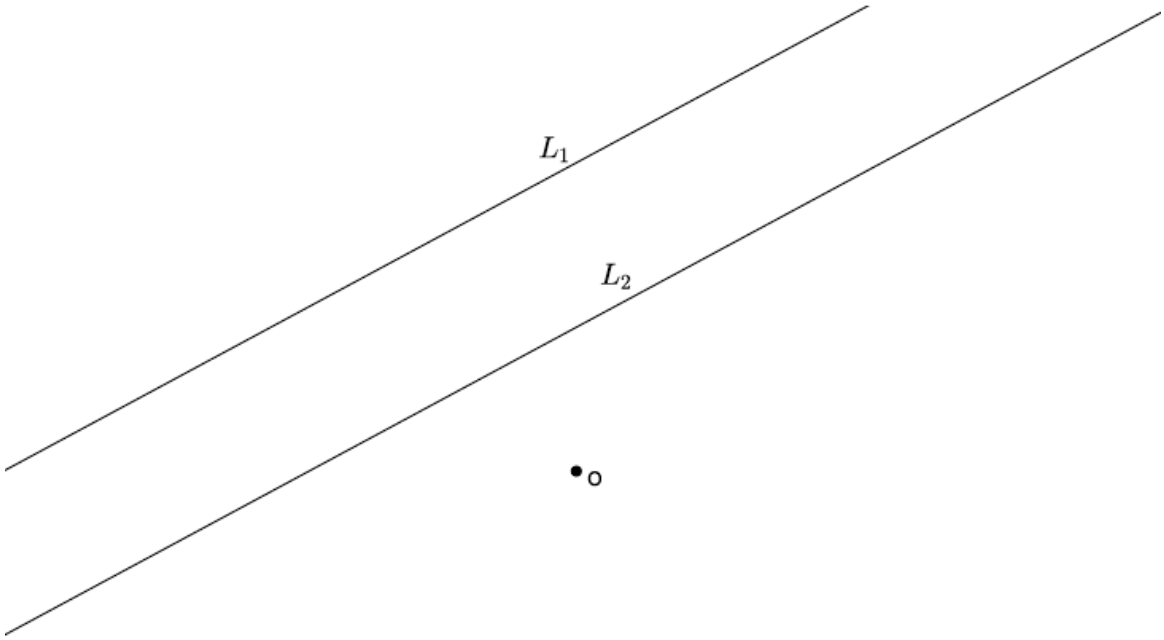
6. Let $\overline{AB}$ be a segment of length 4 units and $\angle CDE$ be an angle of size $45°$. Let there be a rotation by d degrees, where $d < 0$, about O. Find the images of the given figures. Answer the questions that follow.



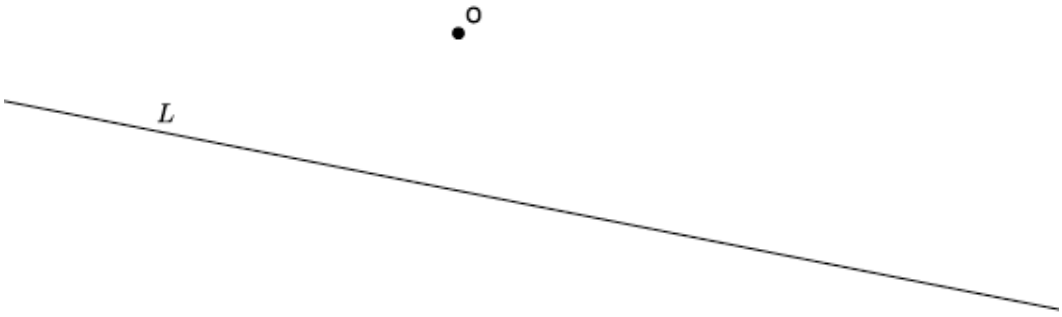
a. What is the length of the rotated segment $Rotation(AB)$?

b. What is the degree of the rotated angle $Rotation(\angle CDE)$?

7. Let L_1 and L_2 be parallel lines. Let there be a rotation by d degrees, where $-360 < d < 360$, about O. Is $(L_1)' \parallel (L_2)'$?



8. Let L be a line and O be the center of rotation. Let there be a rotation by d degrees, where $d \neq 180$ about O. Are the lines L and L' parallel?



Lesson Summary

Rotations require information about the center of rotation and the degree in which to rotate. Positive degrees of rotation move the figure in a counterclockwise direction. Negative degrees of rotation move the figure in a clockwise direction.

Basic Properties of Rotations:

- (Rotation 1) A rotation maps a line to a line, a ray to a ray, a segment to a segment, and an angle to an angle.
- (Rotation 2) A rotation preserves lengths of segments.
- (Rotation 3) A rotation preserves measures of angles.

When parallel lines are rotated, their images are also parallel. A line is only parallel to itself when rotated exactly $180°$.

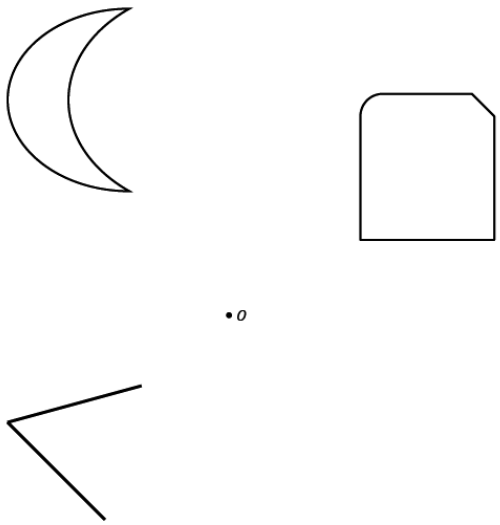
Terminology

ROTATION (DESCRIPTION): For a number d between 0 and 180, the *rotation of d degrees around center O* is the transformation of the plane that maps the point O to itself, and maps each remaining point P of the plane to its image P' in the counterclockwise half-plane of ray $\overrightarrow{OP}$ so that P and P' are the same distance away from O and the measurement of $\angle P'OP$ is d degrees.

The *counterclockwise half-plane* is the half-plane that lies to the left of $\overrightarrow{OP}$ while moving along $\overrightarrow{OP}$ in the direction from O to P.

Problem Set

1. Let there be a rotation by $-90°$ around the center O.



2. Explain why a rotation of 90 degrees around any point O never maps a line to a line parallel to itself.

3. A segment of length 94 cm has been rotated d degrees around a center O. What is the length of the rotated segment? How do you know?

4. An angle of size $124°$ has been rotated d degrees around a center O. What is the size of the rotated angle? How do you know?