

## Definition of Rotation and Basic Properties

## Student Objectives

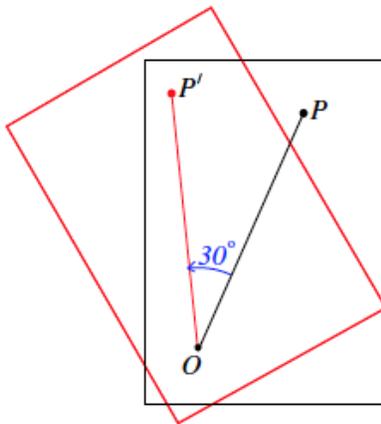
- I know how to rotate a figure a given degree around a given center.
- I know that rotations move lines to lines, rays to rays, segments to segments, and angles to angles. I know that rotations preserve lengths of segments and degrees of measures angles. I know that rotations move parallel lines to parallel lines.

## Classwork

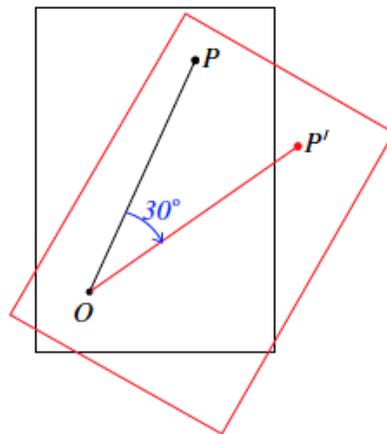
## Example 1

Let there be a rotation around center  $O$ ,  $d$  degrees.

If  $d = 30$ , then the plane moves counter clockwise as shown:



If  $d = -30$ , then the plane moves clockwise as shown:



<http://www.harpercollege.edu/~skoswatt/RigidMotions/rotateccw.html>

<http://www.harpercollege.edu/~skoswatt/RigidMotions/rotatecw.html>

## Exercises

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



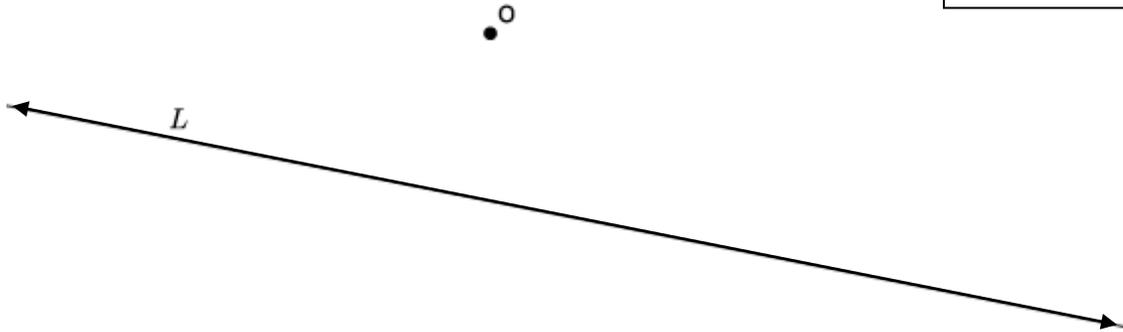
2. Let there be a rotation of  $d$  degrees around center  $O$ . Let  $P$  be a point other than  $O$ . Select a  $d$  so that  $d < 0$ . Find  $P'$  (i.e., the rotation of point  $P$ ) using a transparency.



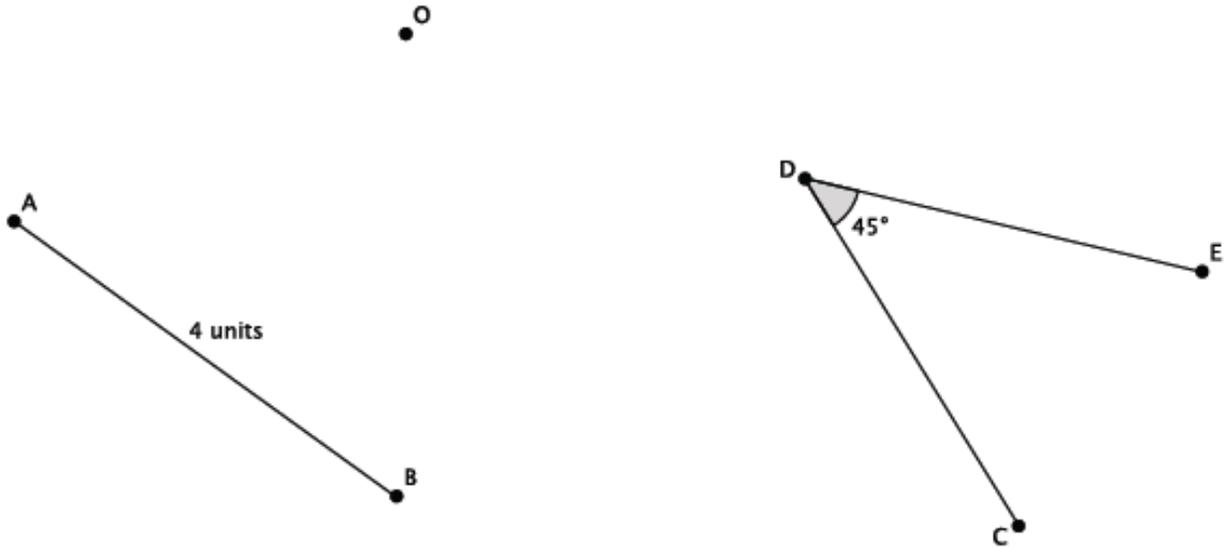
3. Which direction did the point  $P$  rotate when  $d > 0$ ?                      4. Which direction did the point  $P$  rotate when  $d < 0$ ?

5. 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?

<p><b>Parallel lines</b> _____ intersect.</p> <p><b>Perpendicular lines</b> intersect at _____.</p>
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6. Let  $\overline{AB}$  be a segment of length 4 units and  $\angle CDE$  be an angle of size  $45^\circ$ . 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  $Rotation(\angle CDE)$ ?

### 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.

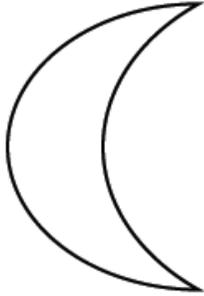
Basic Properties of Rotations:

- (R1) A rotation maps a line to a line, a ray to a ray, a segment to a segment, and an angle to an angle.
- (R2) A rotation preserves lengths of segments.
- (R3) A rotation preserves degrees of angles.

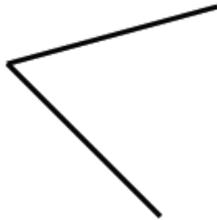
When parallel lines are rotated, their images are also parallel. A line is only parallel to itself when rotated an exact multiple of  $180^\circ$ .

**Homework Homework Homework Homework Homework**

1. Rotate the figures by  $-90^\circ$  around the center  $O$ . You may leave your solution on the transparency paper.



•  $O$



2. Explain why a rotation of  $-90^\circ$  never maps a line to a line parallel to itself.
3. A line 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  $124^\circ$  has been rotated  $d$  degrees around a center  $O$ . What is the size of the rotated angle? How do you know?