

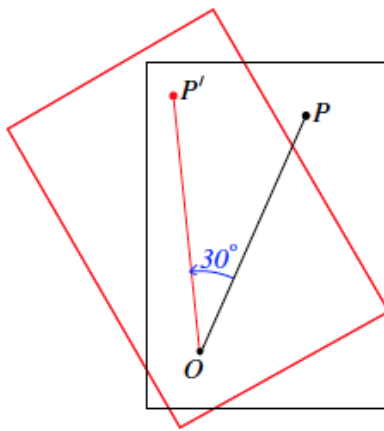
## Lesson 5: Definition of Rotation and Basic Properties

### Classwork

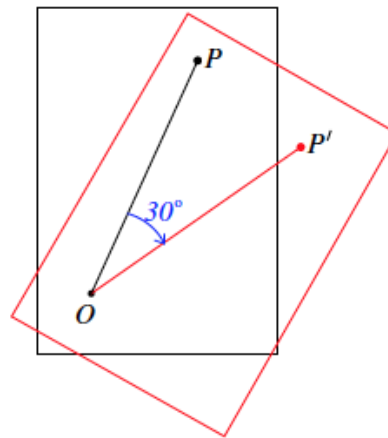
#### Example 1

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

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



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



### Exercises

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



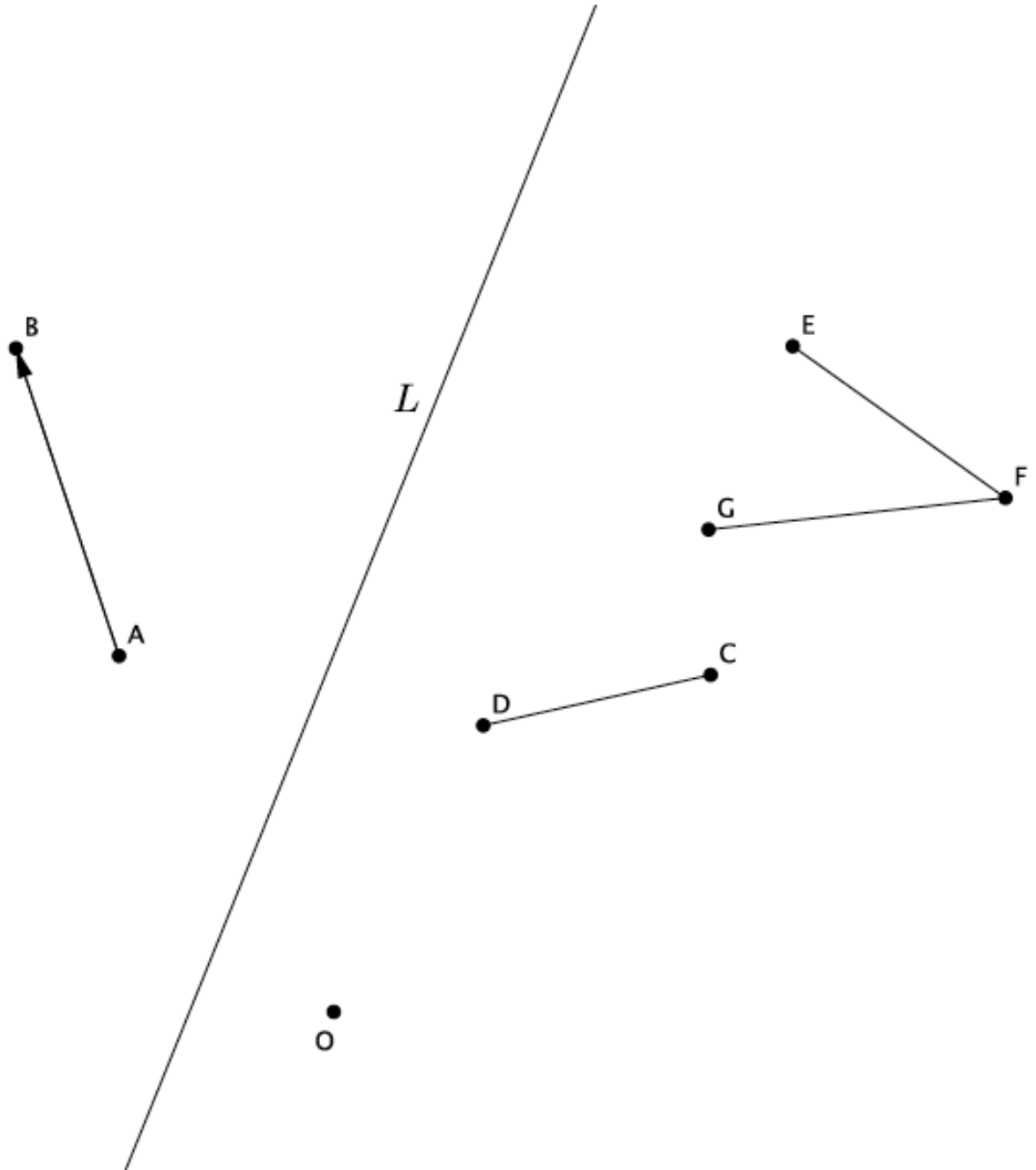
2. Let there be a rotation of  $d$  degrees around center  $O$ . Let  $P$  be a point other than  $O$ . Select a  $d$  so that  $d < 0$ . Find  $P'$  (i.e., the rotation of point  $P$ ) using a transparency.



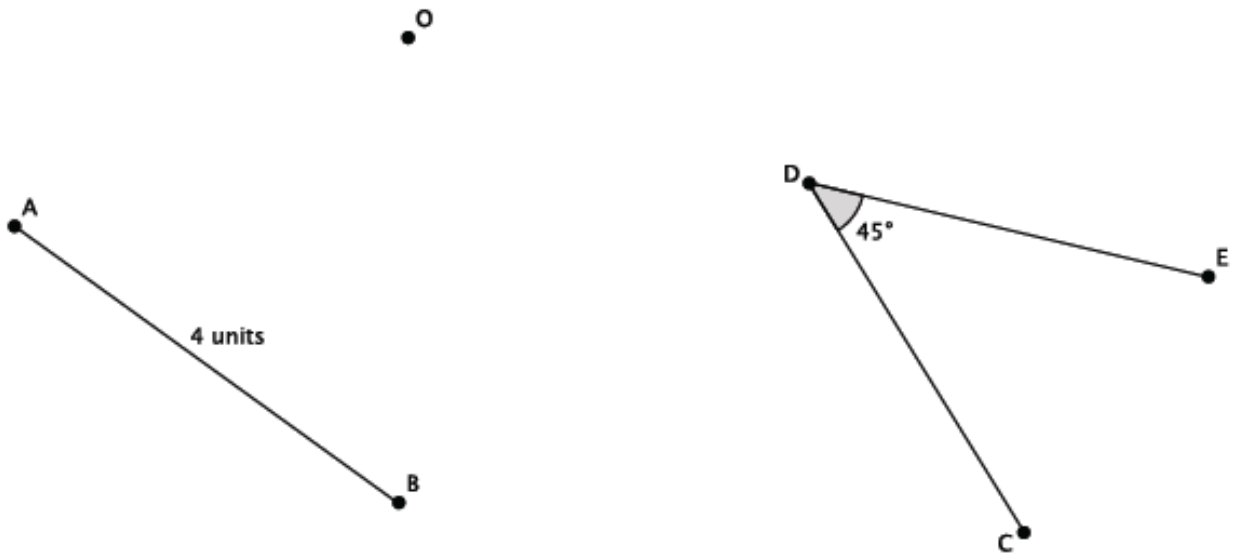
3. Which direction did the point  $P$  rotate when  $d \geq 0$ ?

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

5. Let  $L$  be a line,  $\overrightarrow{AB}$  be a ray,  $CD$  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  $d \geq 0$ .

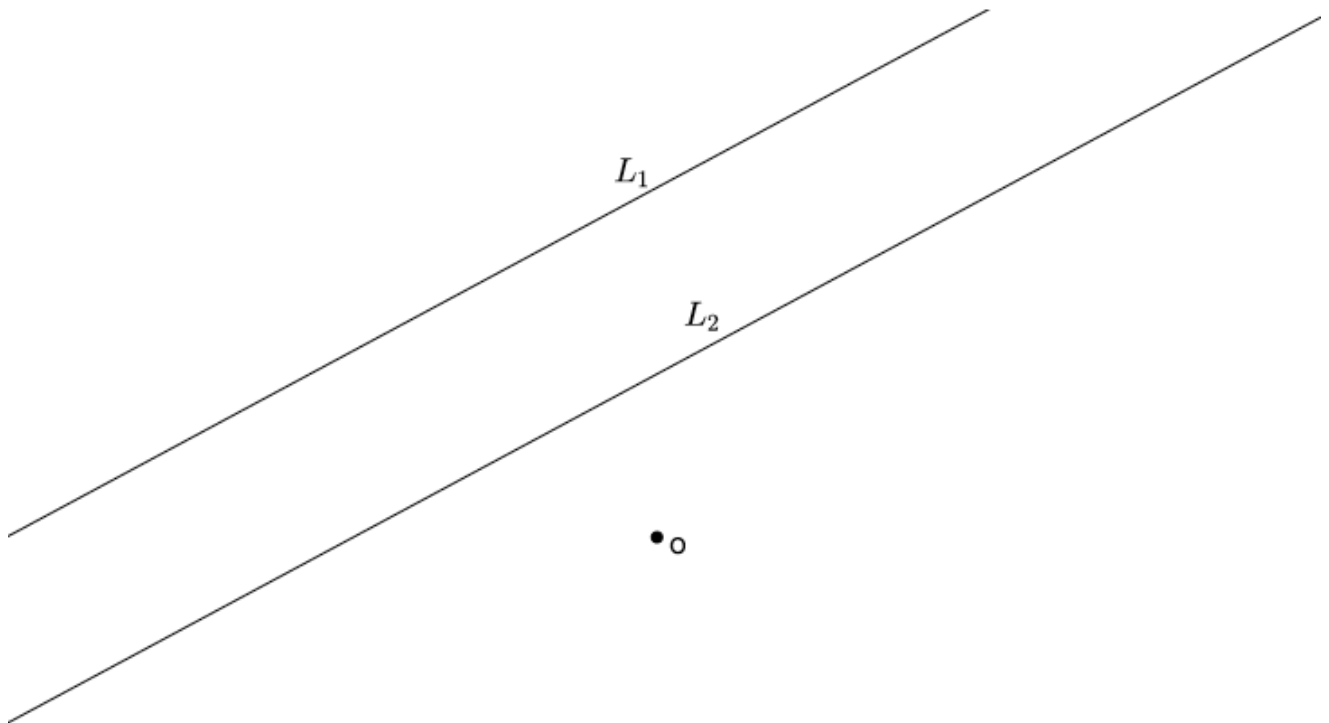


6. Let  $AB$  be a segment of length 4 units and  $\angle CDE$  be an angle of size  $45^\circ$ . Let there be a rotation by  $d$  degrees, where  $d < 0$ , about  $O$ . Find the images of the given figures. Answer the questions that follow.

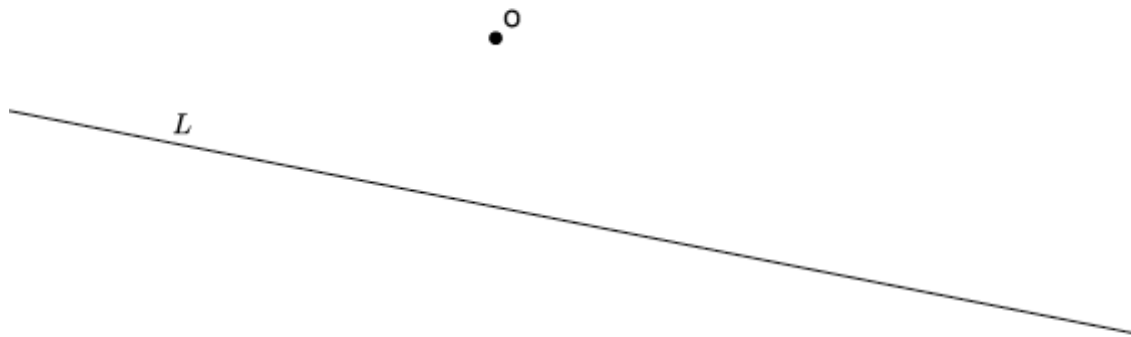


- a. What is the length of the rotated segment  $Rotation(AB)$ ?
  
- b. What is the degree of the rotated angle  $Rotation(\angle CDE)$ ?

7. Let  $L_1, L_2$  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:

(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.

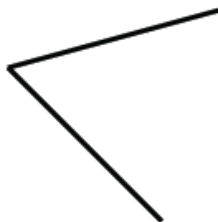
When parallel lines are rotated, their images are also parallel. A line is only parallel to itself when rotated exactly  $180^\circ$ .

**Problem Set**

1. Let *there be* a rotation by  $-90^\circ$  around the center  $O$ .



•  $O$



2. Explain why a rotation of 90 degrees 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  $124^\circ$  has been rotated  $d$  degrees around a center  $O$ . What is the size of the rotated angle? How do you know?