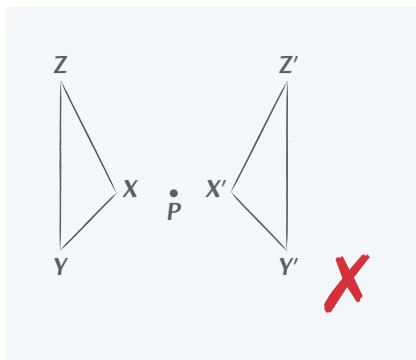


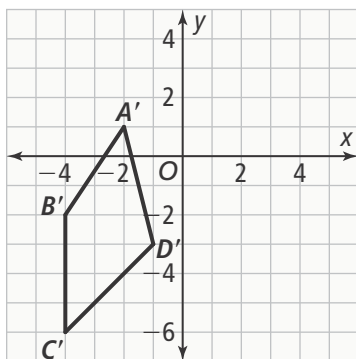


**UNDERSTAND**

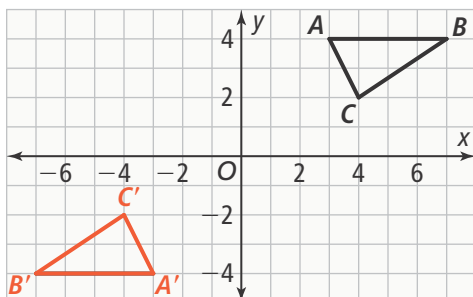
11. **Construct Arguments** When you rotate a figure, does every point move the same distance? Explain.
12. **Error Analysis** Shannon says that  $\triangle X'Y'Z'$  is a rotation of  $\triangle XYZ$  about  $P$ . What is the correct transformation from  $\triangle XYZ$  to  $\triangle X'Y'Z'$ ?



13. **Mathematical Connections** Points  $A'$  and  $B'$  are the images of points  $A$  and  $B$  after a  $270^\circ$  rotation about the origin. If the slope of  $\overline{AB}$  is  $-3$ , what is the slope of  $\overline{A'B'}$ ? Explain.
14. **Use Structure** The diagram shows  $r_{(90^\circ, O)}(ABCD)$ . What are the coordinates of  $ABCD$ ?



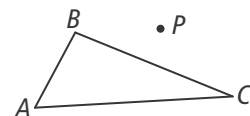
15. **Higher Order Thinking** In the diagram,  $r_{(180^\circ, O)}(\triangle ABC) = \triangle A'B'C'$ . Describe a composition of a rotation and a translation that results in the same image.



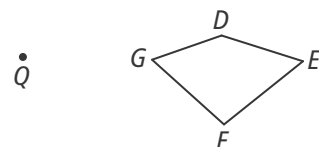
**PRACTICE**

For Exercises 16–18, trace each figure and draw its rotated image. SEE EXAMPLES 1 AND 3

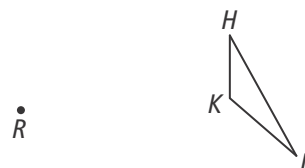
16.  $r_{(80^\circ, P)}(\triangle ABC)$



17.  $r_{(110^\circ, Q)}(\triangle DEFG)$



18.  $r_{(175^\circ, R)}(\triangle HJK)$



For Exercises 19–22, give the coordinates of each image. SEE EXAMPLE 2

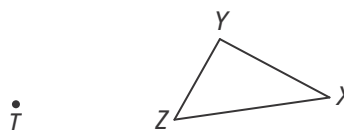
19.  $r_{(90^\circ, O)}(\triangle DEF)$  for  $D(0, 5)$ ,  $E(-2, 8)$ ,  $F(-3, -5)$

20.  $r_{(270^\circ, O)}(WXYZ)$  for  $W(4, -2)$ ,  $X(7, 3)$ ,  $Y(1, 11)$ ,  $Z(-4, 6)$

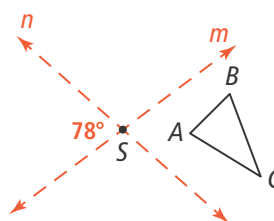
21.  $r_{(180^\circ, O)}(\triangle STU)$  for  $S(-2, -6)$ ,  $T(-5, 3)$ ,  $U(1, 0)$

22.  $r_{(360^\circ, O)}(JKLM)$  for  $J(-4, 7)$ ,  $K(1, 5)$ ,  $L(6, 1)$ ,  $M(3, -9)$

23. Trace the point and triangle. Draw the image  $r_{(160^\circ, T)}(\triangle XYZ)$ . Then draw two reflections that result in the same image. SEE EXAMPLES 4 AND 5

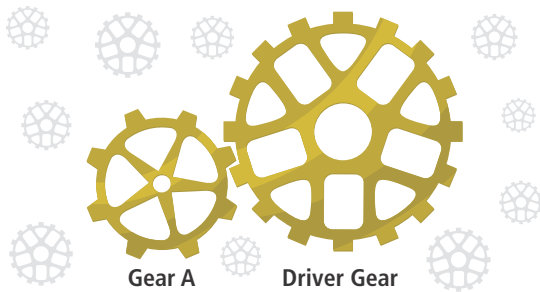


24. Find the angle of rotation for the rotation about point  $S$  that is the composition  $R_n \circ R_m$ . Then trace the figure and draw the image.

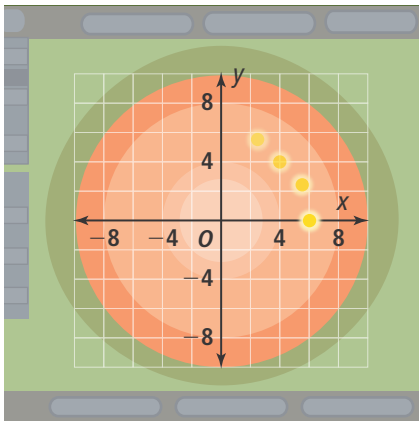


**APPLY**

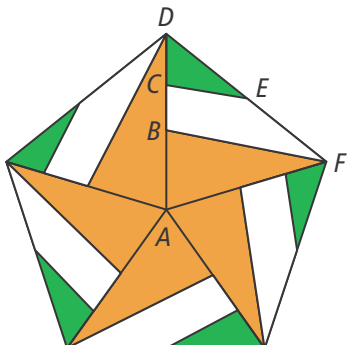
25. **Make Sense and Persevere** What rotation must the driver gear make for gear A to rotate  $90^\circ$  clockwise? Explain how you found your answer.



26. **Reason** Luis is programming an animation for a countdown timer where points flash in sequence, one at a time, around in a circle. He calculates that the coordinates of the first four points in his sequence are  $(6, 0)$ ,  $(5.5, 2.3)$ ,  $(4.2, 4.2)$ , and  $(2.3, 5.5)$ . He can find the rest of the coordinates by rotating the first four points by  $90^\circ$ ,  $180^\circ$ , and  $270^\circ$ . What are the coordinates of the points that complete the sequence around in a circle?



27. **Communicate Precisely** Lourdes created the design below by rotating  $\triangle ABF$ , quadrilateral  $BCEF$ , and  $\triangle CDE$ . Describe the rotations she used. How do you determine the angles of rotation?



**ASSESSMENT PRACTICE**

28. Quadrilateral  $J'K'L'M'$  is the image of  $JKLM$  rotated about point  $P$ . What completes each statement?

$$\overline{KP} \quad ? \quad \overline{K'P'}$$

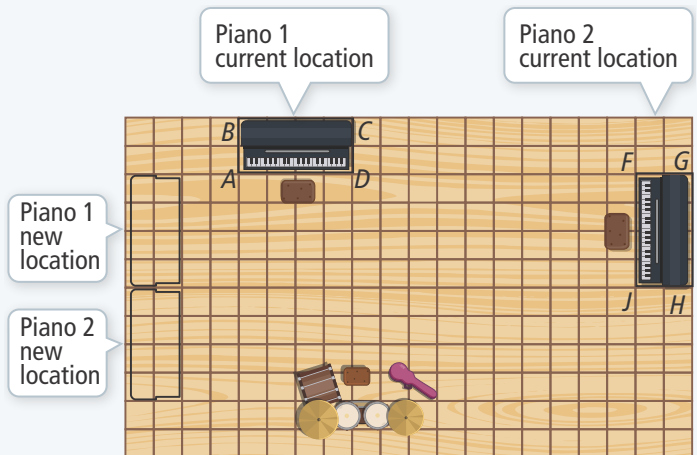
$$\overline{LM} \quad ? \quad \overline{L'M'}$$

$$\overline{JJ'} \quad ? \quad \overline{KK'}$$

$$m\angle KPK' \quad ? \quad m\angle LPL'$$

29. **SAT/ACT** A point is rotated  $270^\circ$  about the origin. The image of the point is  $(-11, 7)$ . What are the coordinates of the preimage?
- (A)  $(7, -11)$   
(B)  $(-7, -11)$   
(C)  $(7, 11)$   
(D)  $(11, 7)$

30. **Performance Task** Movers need to move the pianos as shown in the diagram.



**Part A** Describe a sequence of rigid motions for each piano that maps the piano from its current location to the new location.

**Part B** Describe a single rotation for each piano that maps the piano from its current location to the new location. (Hint: You can find two reflections to determine the center of rotation.)