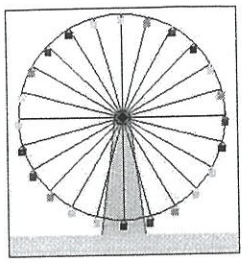
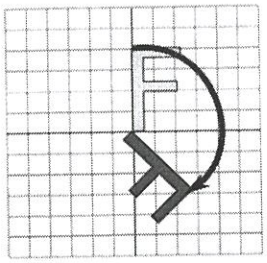
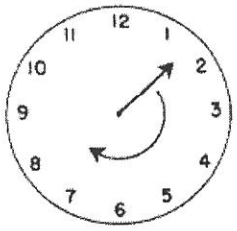
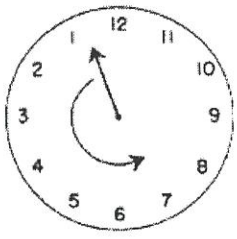




Section 2.3
Rotations

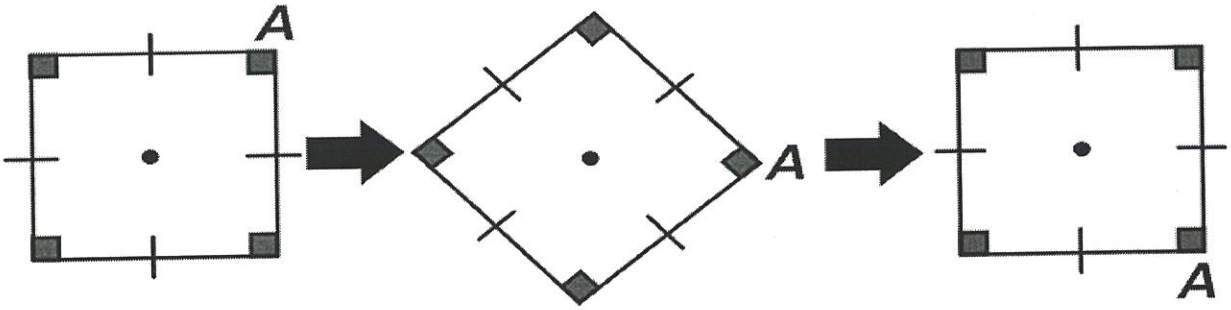




ROTATION: a transformation in which a figure is turned about a fixed point (center of rotation).

- A rotation is an isometry.

ROTATIONAL SYMMETRY: a figure can be mapped onto itself by a rotation of 180° or less.

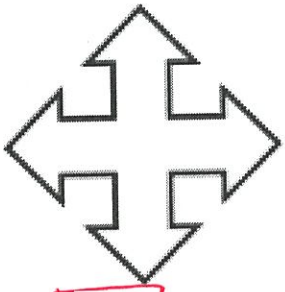


A square has a rotational symmetry because it maps onto itself by a rotation of 90°.

Examples

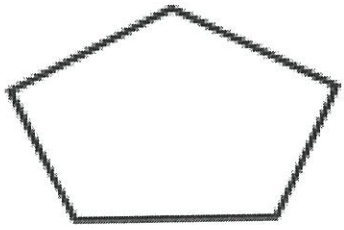
Determine whether the figure has rotational symmetry. If so, describe the rotations that map the figure onto itself.

1.



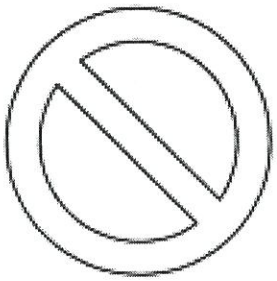
90°

2.



NO ROTATIONAL SYMMETRY

3.



180°

Use the diagram to complete each sentence.

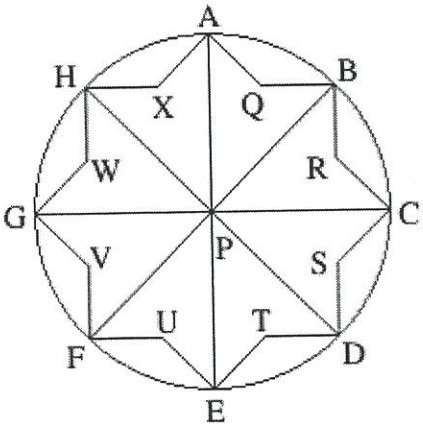
4. A clockwise rotation of 90° of point *A* is POINT C.

5. A counterclockwise rotation of 180° of point *B* is POINT F.

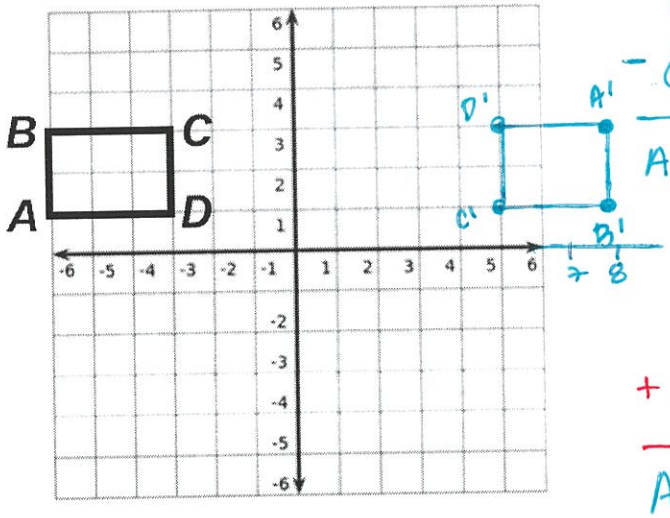
6. A clockwise rotation of 180° of $\overline{PD}$ is $\overline{PH}$.

7. A counterclockwise rotation of 270° of $\overline{GP}$ is $\overline{AP}$.

8. A clockwise rotation of 45° of $\overline{FP}$ is $\overline{GP}$.



17. Graph the image of the figure using a rotation of 180° around (1, 2). Then write the Coordinates of the image.



A(-6,1) B(-6,3) C(-3,3) D(-3,1)

-(1,2) -(1,2) -(1,2) -(1,2)

A*(-7,-1) B*(-7,1) C*(-4,1) D*(-4,-1)

180° ROTATION = (-x,-y)

(7,1) (7,-1) (4,-1) (4,1)

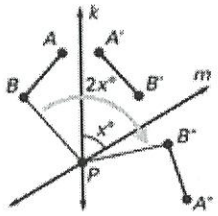
+(1,2) +(1,2) +(1,2) +(1,2)

A'(8,3) B'(8,1) C'(5,1) D'(5,3)

If lines k and m intersect at point P, then a reflection in k followed by a reflection in m is a rotation about point P.

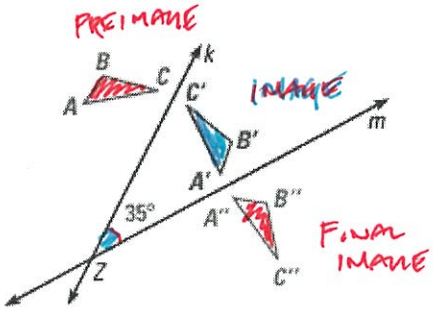
The angle of rotation is $\underline{X}$ °, where x° is the measure of the acute or right angle formed by k and m.

$m\angle BPB'' = \underline{2X}$ °



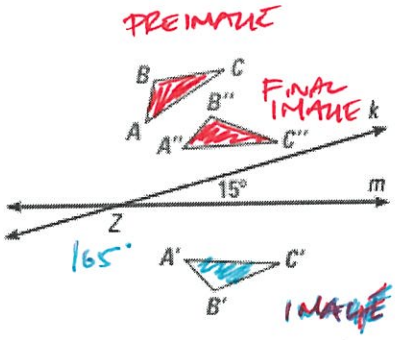
Find the angle of rotation that maps ΔABC onto $\Delta A''B''C''$.

18.



35(2) = 70°

19.



165(2) = 330°

Special Rotations about the Origin

90° clockwise rotation about the origin. $(x, y) \rightarrow (y, -x)$

180° clockwise rotation about the origin. $(x, y) \rightarrow (-x, -y)$

270° clockwise rotation about the origin. $(x, y) \rightarrow (-y, x)$

9. 90° clockwise rotation of $(3, -5)$

$(-5, -3)$

10. 180° clockwise rotation of $(1, 4)$

$(-1, -4)$

11. 270° clockwise rotation of $(4, -1)$

$(1, 4)$

12. 180° clockwise rotation of $(-2, -1)$

$(2, 1)$

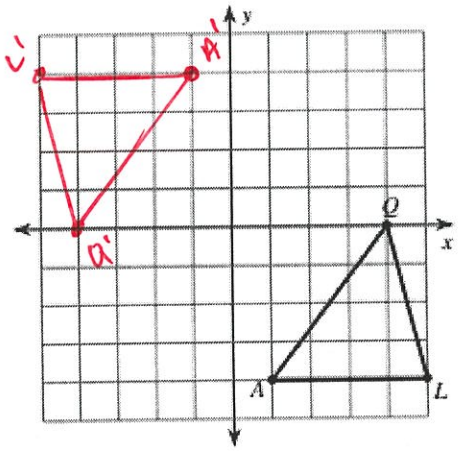
13. 90° clockwise rotation of $(-1, 2)$

$(2, 1)$

14. 270° clockwise rotation of $(1, 2)$

$(-2, 1)$

15. Graph the image of the figure using a rotation of 180° about the origin.



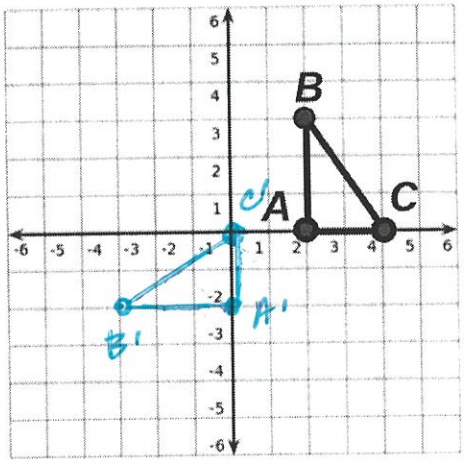
$A(1,-4) \rightarrow A'(-1,4)$

$Q(4,0) \rightarrow Q'(-4,0)$

$L(5,-4) \rightarrow L'(-5,4)$

Special Rotations Around a Point

16. Graph the image of the figure using a rotation of 90° around $(2, -2)$. Then write the coordinates of the image.



$A(2,0) \quad B(2,3) \quad C(4,0)$

$-(2,2) \quad -(2,2) \quad -(2,2)$

$A^*(0,2) \quad B^*(0,5) \quad C^*(2,-2)$

90° COUNTERCLOCKWISE = 270° CLOCKWISE

$(-y, x)$

$(-2,0) \quad (-5,0) \quad (-2,2)$

$+(2,-2) \quad +(2,-2) \quad +(2,-2)$

$A'(0,-2) \quad B'(-3,-2) \quad C'(0,0)$