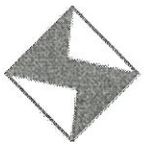
Honors Geometry
Sections 14.3 – 14.4

Name KEY

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

1.

180°

2. 

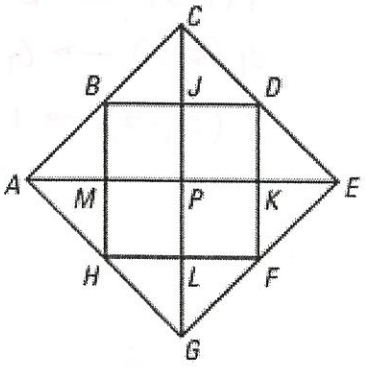
180°

3.

NO ROTATIONAL SYMMETRY

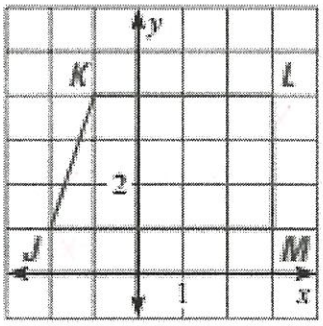
Use the diagram to complete each sentence.

4. 90° clockwise rotation of $\overline{AB}$ about point P is $\overline{CD}$.
5. 90° clockwise rotation of $\overline{KF}$ about point P is $\overline{LH}$.
6. 90° counterclockwise rotation of $\overline{CE}$ about point P is $\overline{AC}$.
7. 180° rotation of ΔKEF about point P is ΔMAB.
8. 180° rotation of ΔBCJ about point P is ΔFGL.
9. 90° clockwise rotation of ΔAPG about point P is ΔCPA.



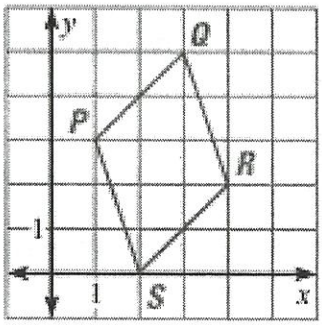
Name the coordinates of the vertices of the image after a clockwise rotation of the given number of degrees about the origin.

10. 90°



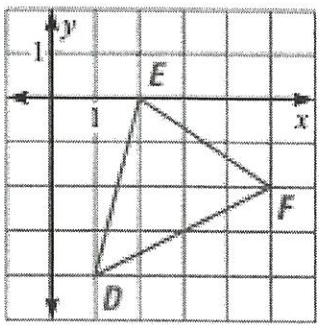
$J(-2,1) \rightarrow J'(1,2)$
$K(-1,4) \rightarrow K'(4,1)$
$L(3,4) \rightarrow L'(4,-3)$
$M(3,1) \rightarrow M'(1,-3)$

11. 180°



$P(1,3) \rightarrow P'(-1,-3)$
$Q(3,5) \rightarrow Q'(-3,-5)$
$R(4,2) \rightarrow R'(-4,-2)$
$S(2,0) \rightarrow S'(-2,0)$

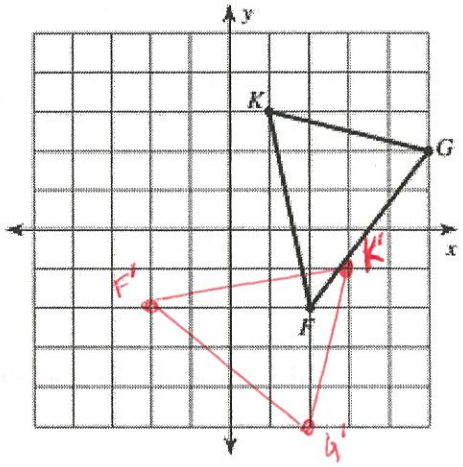
12. 270°



$D(1,-4) \rightarrow D'(4,1)$
$E(2,0) \rightarrow E'(0,2)$
$F(5,-2) \rightarrow F'(2,5)$

Graph the image of the figure using the following rotation about the origin.

13. rotation of 90° clockwise

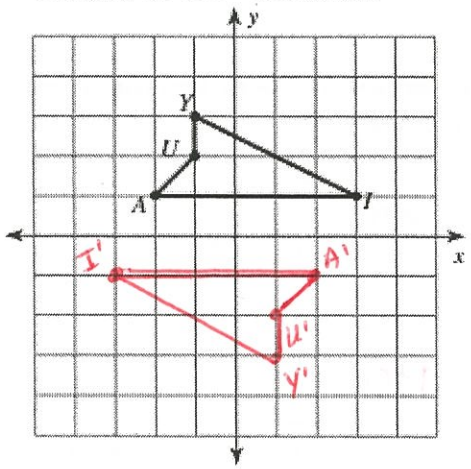


$K(1,3) \rightarrow K'(3,-1)$

$G(5,2) \rightarrow G'(2,-5)$

$F(2,-2) \rightarrow F'(-2,-2)$

14. rotation of 180° clockwise



$Y(-1,3) \rightarrow Y'(1,-3)$

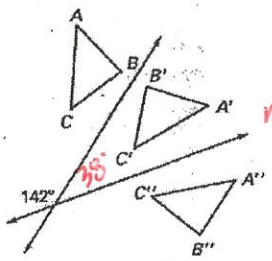
$I(3,1) \rightarrow I'(-3,-1)$

$A(-2,1) \rightarrow A'(2,-1)$

$U(-1,2) \rightarrow U'(1,-2)$

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

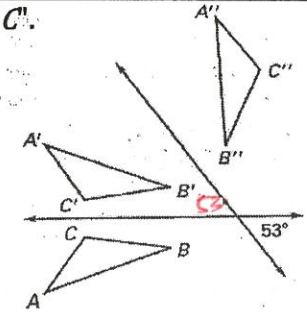
15.



$m\Delta A''B''C'' = 2(38)$

$= 76°$

16.



$m\Delta A''B''C'' = 2(53°)$

$= 106°$

Fill in the following properties.

17. If (x, y) is reflected over the x-axis, its image is the point (x , $-y$).

18. If (x, y) is reflected over the y-axis, its image is the point ($-x$, y).

19. If (x, y) is reflected over the $y = x$, its image is the point (y , x).

20. If (x, y) is rotated 90° clockwise rotation about the origin, its image is the point (y , $-x$).

21. If (x, y) is rotated 180° clockwise rotation about the origin, its image is the point ($-x$, y).

22. If (x, y) is rotated 270° clockwise rotation about the origin, its image is the point ($-y$, x).

Find the coordinates of the reflection without using a coordinate plane.

23. Point *L* with coordinates of (2, 3) reflected in the line $x = -5$. $L'(-12, 3)$

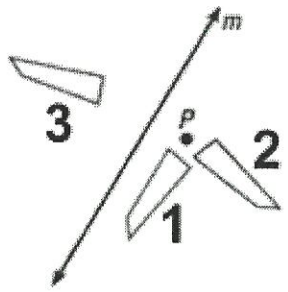
24. Point *M* with coordinates of (−2, −4) reflected in the line $y = 0$. $M'(-2, 4)$

25. Point *N* with coordinates of (−4, 0) reflected in the line $x = 2$. $N'(8, 0)$

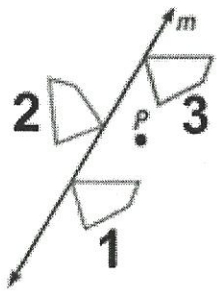
26. Point *P* with coordinates of (8, −3) reflected in the line $y = 4$. $P'(8, 11)$

Match the composition with the diagram, in which figure 1 is the preimage of figure 2, and figure 2 is the preimage of figure 3.

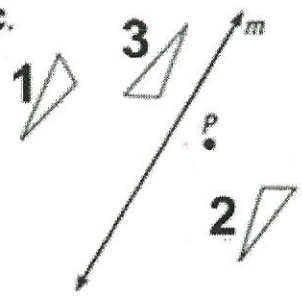
A.



B.



C.



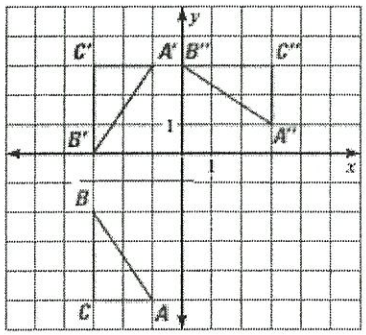
A 27. Rotate about point *P*, then reflected in line m.

C 28. Reflected in line m, then rotated about point *P*.

B 29. Translated parallel to line m, then rotated about point *P*.

Describe the composition (translation, reflection, rotation), along with the amount of the transformation from $\Delta ABC \rightarrow \Delta A'B'C' \rightarrow \Delta A''B''C''$.

30.



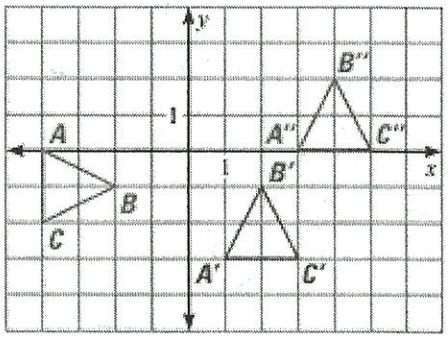
- $\Delta ABC \rightarrow \Delta A'B'C'$: REFLECTION

  Amount: $y = -1$

- $\Delta A'B'C' \rightarrow \Delta A''B''C''$: ROTATION

  Amount: 90° CLOCKWISE
  270° COUNTERCLOCKWISE

31.



$\Delta ABC \rightarrow \Delta A'B'C'$: ROTATION

Amount: 90° COUNTERCLOCKWISE, 270° CLOCKWISE

$\Delta A'B'C' \rightarrow \Delta A''B''C''$: TRANSLATION

Amount: $(x, y) \rightarrow (x+2, y+3)$

For #32 and 33, the first translation maps point *A* to point *A'* and the second translation maps point *A'* to point *A''*. Find the translation that maps point *A* to point *A''*.

32. Point *A*: $(-1, -6)$
Translation 1: $(x, y) \rightarrow (x + 7, y - 2)$
Translation 2: $(x, y) \rightarrow (x - 9, y - 5)$

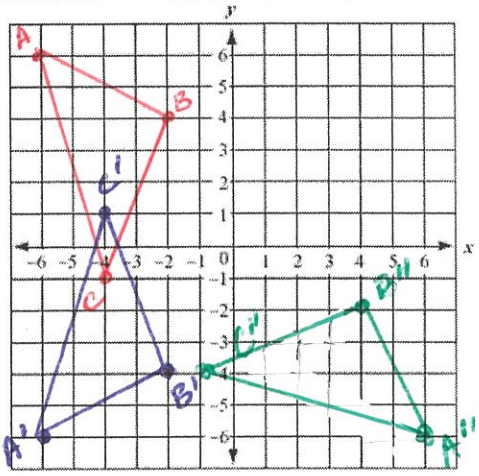
Point *A''*: $(-3, -13)$

33. Point *A*: $(5, -14)$
Translation 1: $(x, y) \rightarrow (x - 8, y - 3)$
Translation 2: $(x, y) \rightarrow (x - 4, y + 6)$

Point *A''*: $(-7, -11)$

Use the information below to sketch the image of ΔABC after the composition.

34. Coordinates: $A(-6, 6)$, $B(-2, 4)$, $C(-4, -1)$
    Reflection: in the x-axis
    Rotation: 270° clockwise



Reflection (X-Axis) $(x, -y)$

A' (-6, -6) B' (-2, -4) C' (4, 1)

Rotation (270°) $(-y, x)$

A'' (6, -6) B'' (4, -2) C'' (-1, -4)

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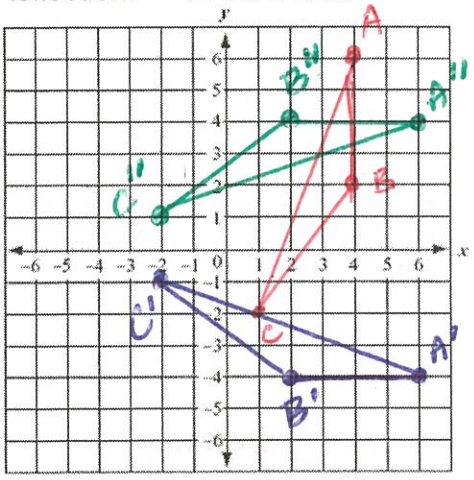
35. Coordinates: $A(4, 6)$, $B(4, 2)$, $C(1, -2)$
    Rotation: 90° clockwise
    Reflection: in the x-axis



Rotation (90°) $(-y, x)$

A' (6, -4) B' (2, -4) C' (-2, -1)

Reflection

A'' (6, 4) B'' (2, 4) C'' (-2, 1)

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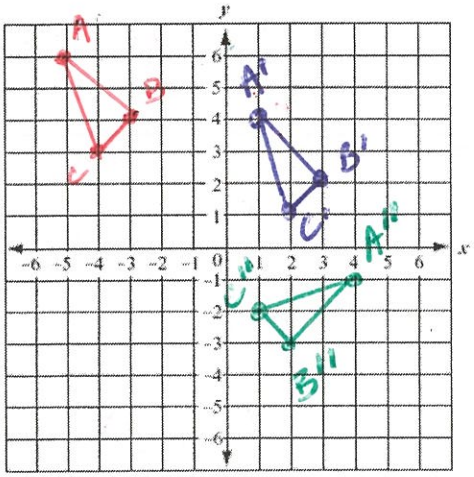
36. Coordinates: $A(-5, 6)$, $B(-3, 4)$, $C(-4, 3)$
    Translation: $(x, y) \rightarrow (x + 6, y - 2)$
    Rotation: 90° clockwise



Translation (6 →, 2 ↓)

A' (1, 4) B' (3, 2) C' (2, 1)

Rotation (90°) $(y, -x)$

A'' (4, -1) B'' (2, -3) C'' (1, -2)

For #37 – 42, $R_k: A \to A'$. Find an equation of line k.

	37.	38.	39.	40.	41.	42.
A	$(5, 0)$	$(1, 4)$	$(4, 0)$	$(5, 1)$	$(0, 2)$	$(-1, 2)$
A'	$(9, 0)$	$(3, 4)$	$(4, 6)$	$(1, 5)$	$(4, 6)$	$(4, 5)$
	$x=7$	$x=2$	$y=3$	$y=x$	$y=-x+6$	$y=-\frac{5}{3}x+6$

43. A reflection maps point $Q(-1, 8)$ to point $Q'(2, 0)$. Find the equation of the line of the reflection.

$M=\left(\frac{-1+2}{2}, \frac{8+0}{2}\right)=\left(\frac{1}{2}, 4\right)$

$m=\frac{0-8}{2-(-1)}=\frac{-8}{3}$

$\perp m=\frac{3}{8}$

$y=mx+b$

$4=\frac{3}{8}\left(\frac{1}{2}\right)+b$

$4=\frac{3}{16}+b$

$\frac{61}{16}=b$

$y=\frac{3}{8}x+\frac{61}{16}$

44. A reflection maps point $Q(5, -3)$ to point $Q'(-4, -10)$. Find the equation of the line of the reflection.

$M=\left(\frac{5-4}{2}, \frac{-3-10}{2}\right)=\left(\frac{1}{2}, \frac{-13}{2}\right)$

$m=\frac{-10+3}{-4-5}=\frac{-7}{-9}=\frac{7}{9}$

$\perp m=\frac{-9}{7}$

$y=mx+b$

$-\frac{13}{2}=-\frac{9}{7}\left(\frac{1}{2}\right)+b$

$-\frac{13}{2}=-\frac{9}{14}+b$

$-\frac{41}{7}=b$

$y=-\frac{9}{7}x-\frac{41}{7}$

Use *coordinate notation* to describe the translation.

45. 6 units to the right and 2 units down

$(x, y) \to (x+6, y-2)$

46. 3 units up and 4 units to the right

$(x, y) \to (x+4, y+3)$

47. 7 units to the left and 1 unit up

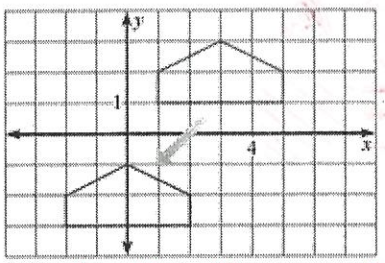
$(x, y) \to (x-7, y+1)$

48. 8 units down and 5 units to the left

$(x, y) \to (x-5, y-8)$

Describe the translation using (a) *coordinate notation* and (b) a vector in *component form*.

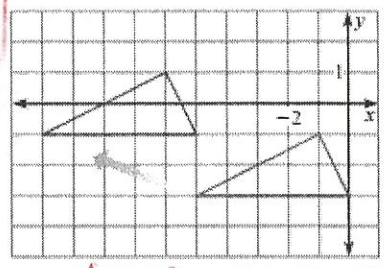
49.



$(x, y) \to (x-3, y-4)$

$\langle -3, -4 \rangle$

50.



$(x, y) \to (x-5, y+2)$

$\langle -5, 2 \rangle$

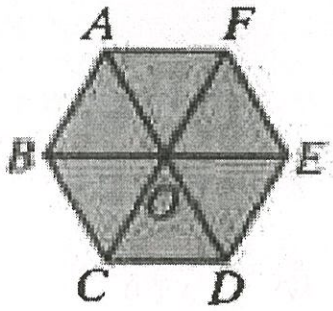
For #51 – 53, determine the new coordinates given the translation.

51. If $A:(0,\ 0) \rightarrow (5,\ 1)$, *then* $A:(3,\ 3) \rightarrow$ (8 , 4).

52. If $A:(1,\ 1) \rightarrow (3,\ 0)$, *then* $A:(0,\ 0) \rightarrow$ (2 , -1).

53. If $A:(-2,\ 3) \rightarrow (2,\ 6)$, *then* $A:$ (-4 , -3) $\rightarrow (0,\ 0)$.

The diagonals of regular hexagon ABCDEF form six equilateral triangles as shown. Complete each statement below.



54. $\mathcal{R}_{O,\ 60°}: E \rightarrow$ F

55. $\mathcal{R}_{O,-60°}: D \rightarrow$ C

56. $\mathcal{R}_{O,\ 120°}: F \rightarrow$ B

57. $\mathcal{R}_{O,60°}:$ E $\rightarrow O$

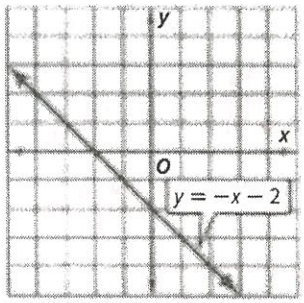
58. $\mathcal{R}_{O,-60°}: O \rightarrow$ C

58. $\mathcal{R}_{O,180°}: A \rightarrow$ D

59. $\mathcal{R}_{O,\ 240°}: C \rightarrow$ E

60. $\mathcal{R}_{O,-300°}: B \rightarrow$ A

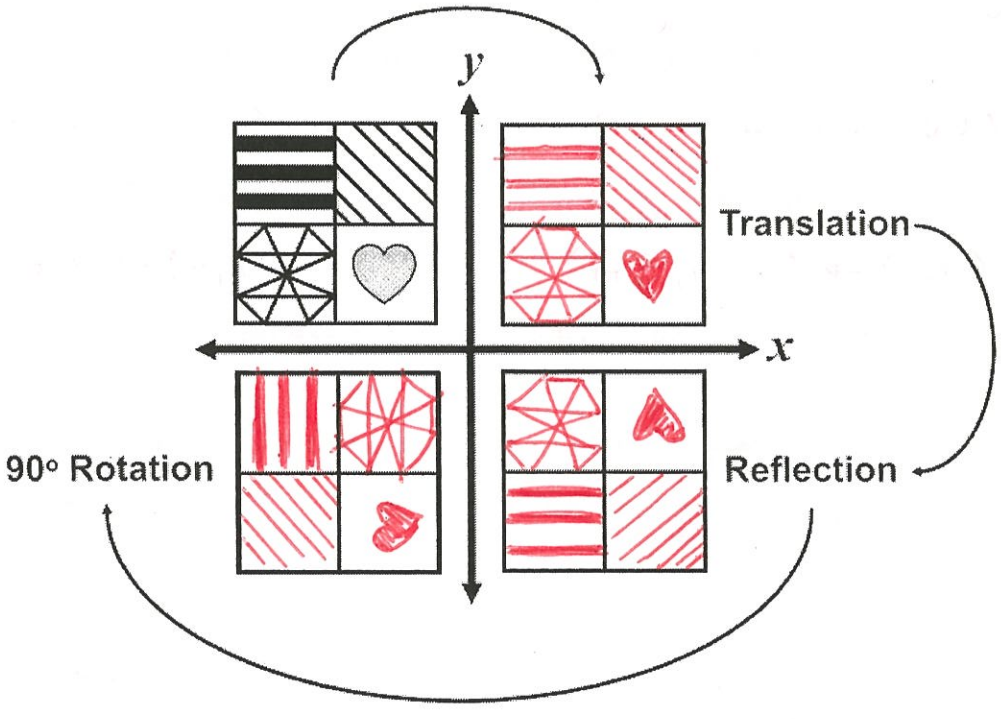
Give the equation of the line $y = -x - 2$ after a rotation about the origin through the given angle. Then describe the relationship (parallel, perpendicular, collinear, or neither) between the equations of the image and preimage.



61. 90° $y = x - 2$ (PERPENDICULAR)

62. 180° $y = -x + 2$ (PARALLEL)

63. 270° $y = x + 2$ (PERPENDICULAR)

64. 360° $y = -x - 2$ (COLLINEAR)

Fill in the other boxes by starting with the preimage and performing a translation, then a reflection of the translation, and finally a rotation of 90° of the reflection.