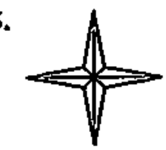
Palekar

1. Let k represent any transformation of the plane.
   a. State the domain of k. b. State the range of k.
   c. *True* or *False*: Transformation k is a one-to-one function.

In 2–8, for each figure drawn or named:
a. Does the figure have *line symmetry*? If yes, how many lines of symmetry does the figure have?
b. Does the figure have *point symmetry*?
c. Does the figure have *rotational symmetry*? If yes, find the degree measure of the smallest angle of rotation for which the figure is its own image.

2. 
3. 
4. 
5. 

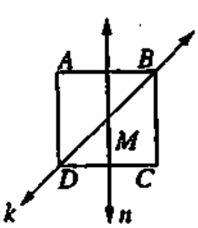
6. Parallelogram
7. Regular pentagon
8. Equilateral triangle

In 9–20, find the image of $(6, -5)$ under each given transformation.

9. Reflection in the x-axis.
10. Reflection in the y-axis.
11. Reflection in the line $x = 4$.
12. Reflection in the line $y = 2$.
13. Reflection in the line $y = x$.
14. Reflection in the origin.
15. Quarter-turn about the origin.
16. Dilation of $1\frac{1}{2}$, center at origin.
17. $T_{3,-8}$
18. $T_{-6,5}$
19. D_{-4}
20. $R_{270°}$

In 21–24, in each case, write the coordinate rule of the composition using the transformations $F(x, y) = (2x, y)$ and $G(x, y) = (x + 3, -y)$.

21. $G \circ F$
22. $F \circ G$
23. $G \circ G$
24. $F \circ F$



Ex. 25–37

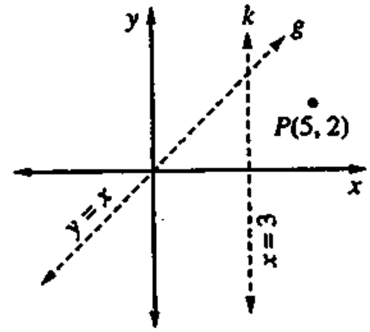
In 25–37, k and n are lines of symmetry for square $ABCD$, and M is the midpoint of diagonal $\overline{BD}$. In each case, find the image under the given composition.

25. $r_k \circ r_n(B)$
26. $r_n \circ r_k(B)$
27. $r_n \circ r_k \circ r_n(D)$
28. $r_k \circ r_n \circ r_k(D)$
29. $r_M \circ r_k(C)$
30. $r_n \circ r_M(A)$
31. $r_M \circ r_n \circ r_k(A)$
32. $r_k \circ r_n(\overline{BC})$
33. $r_n \circ r_k(\overline{BC})$
34. $R_{M,270°} \circ r_k(\overline{DA})$
35. $r_n \circ R_{M,90°}(\overline{BA})$
36. $r_n \circ R_{M,-90°}(\overline{BC})$
37. By finding the image for each vertex of the square under the given composition, we can show that $r_M \circ r_k \circ r_n$ is equivalent to
   (1) $R_{M,90°}$ (2) $R_{M,270°}$ (3) r_k (4) r_n
38. The vertices of $\triangle ABC$ are $A(1, -4)$, $B(3, 1)$, and $C(3, -3)$.
   a. On graph paper, draw and label $\triangle ABC$.
   b. Find the coordinates of the vertices of $\triangle A'BC'$, the image of $\triangle ABC$ reflected over the y-axis. Graph $\triangle A'B'C'$.
   c. Find the coordinates of the vertices of $\triangle A''B''C''$, the image of $\triangle A'B'C'$ reflected over the line $y = -x$. Graph $\triangle A''B''C''$.
   d. Find the coordinates of the vertices of $\triangle A'''B'''C'''$, the image of $\triangle A''B''C''$ under translation $T_{7,-2}$. Graph $\triangle A'''B'''C'''$.

39. The coordinates of point P are $(5, 2)$, the equation of line k is $x = 3$, and the equation of line g is $y = x$. Find the coordinates of:

a. $r_k \circ r_g(P)$ b. $r_k \circ r_{x\text{-axis}}(P)$

c. $r_g \circ r_{y\text{-axis}}(P)$ d. $r_g \circ r_k(P)$



Ex. 39

In 40–43, in each case, write the rule of the single transformation that is equivalent to the stated composition.

40. $r_{y\text{-axis}} \circ T_{2,3}$ 41. $D_2 \circ r_{y=x}$

42. $r_{y=-x} \circ R_{180°}$ 43. $r_{x\text{-axis}} \circ T_{-1,-2} \circ D_3$

44. The vertices of $\triangle ABC$ are $A(1, 2)$, $B(4, 4)$, and $C(4, 2)$.

$\triangle ABC \rightarrow \triangle A'B'C'$ under transformation $F(x, y) = (4 - x, -y)$.

$\triangle ABC \rightarrow \triangle A''B''C''$ under transformation $G(x, y) = (-x, y - 1)$.

$\triangle ABC \rightarrow \triangle A'''B'''C'''$ under transformation $H(x, y) = (2x, y + 3)$.

a. On one set of axes, graph and label $\triangle ABC$, $\triangle A'B'C'$, $\triangle A''B''C''$, and $\triangle A'''B'''C'''$.

b. Which transformation, F, G, or H, does *not* preserve order?

c. Which transformation, F, G, or H, is *not* an isometry?

In 45–47, select the *numeral* preceding the expression that best completes the sentence or answers the question.

45. If lines a and b are parallel, then the composition $r_a \circ r_b$ is equivalent to a
(1) rotation (2) translation (3) glide reflection (4) dilation

46. If line c intersects line d, the composition $r_c \circ r_d$ is equivalent to a
(1) rotation (2) translation (3) glide reflection (4) dilation

47. The single transformation that is equivalent to the composition $r_{y=x} \circ r_{x\text{-axis}}$ is
(1) $R_{90°}$ (2) $R_{180°}$ (3) $R_{270°}$ (4) $r_{y=-x}$

In 48–50, in each case: **a.** Tell whether the given set of transformations is a group under the operation of composition. **b.** If the system is *not* a group, explain why.

48. (Isometries, $\circ$) 49. (Translations, $\circ$) 50. (Line reflections, $\circ$)

CUMULATIVE REVIEW

1. Simplify: $\dfrac{4 - \frac{1}{x^2}}{2 + \frac{1}{x}}$.

2. Solve and check: $x - \sqrt{2x + 1} = 7$.

3. Two secants, $\overline{PAB}$ and $\overline{PCD}$ are drawn to a circle from P. Chord $\overline{DE}$ bisects $\overline{AB}$ at F. $DF = 9$, $FE = 4$, $AP = 8$, and CD is 4 less than PC.
Find a. AB b. PC c. CD

4. Let $f(x) = 3x - 4$ and $g(x) = x^2$. Find:
a. $f(0)$ b. $g(-2)$ c. $f(g(-1))$
d. $f \circ g(x)$ e. $g \circ f(x)$ f. $f^{-1}(x)$