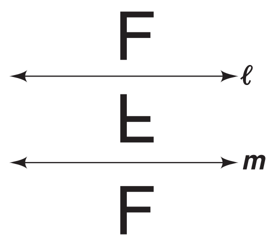
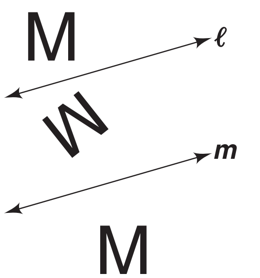
1. rotation

2. translation

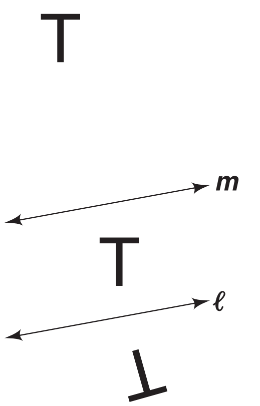
3. Neither; the figures do not have the same orientation.

4. 

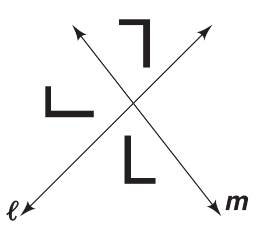
F is translated down twice the distance between ℓ and *m*.

5. 

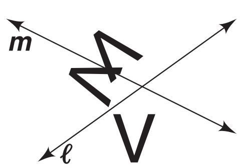
M is translated across line *m* twice the distance between ℓ and *m*.

6. 

T is translated across line *m* twice the distance between ℓ and *m*.

7. 

L is rotated clockwise about 180°.

8. 

V is rotated clockwise about 145°.

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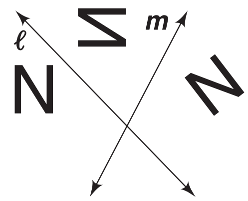
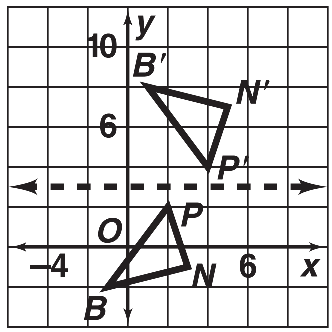
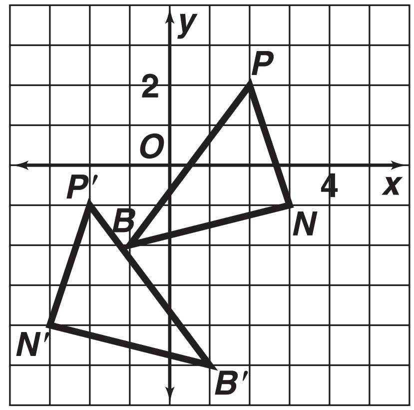
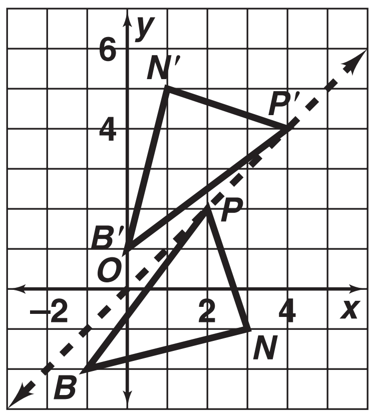
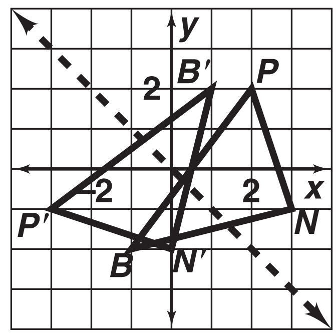
9. 

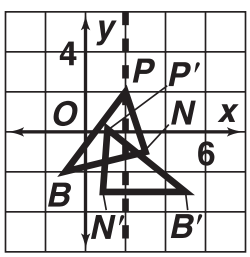
N is rotated clockwise about 160°.

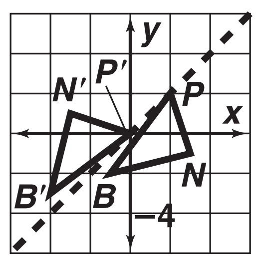
10. 

11. 

12. 

13. 

14. 

15. 

16. opp.; reflection

17. opp.; glide reflection

18. same; translation

19. same; rotation

20. same; rotation

21. same; translation

22. opp.; reflection

23. opp.; glide reflection

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24. glide reflection; $(x, y) \rightarrow (x - 2, y - 2)$ followed by refl. in $y = x - 1$

25. rotation; 180° about the pt. $\left(\frac{1}{2}, 0\right)$

26. C

27. Odd isometries can be expressed as the composition of an odd number of reflections. Even isometries are the composition of an even number of reflections.

28. Check students' work.

29. Yes; a rotation of $x°$ followed by a rotation of $y°$ is equivalent to a rotation of $(x + y)°$.

30. No; explanations may vary.

31. 60° **32.** 60° **33.** $51\frac{3}{7}°$ **34.** 30°

35. rotation; center C, $\angle$ of rotation 180°

36. glide reflection; $(x, y) \rightarrow (x + 11, y)$, $y = 0$

37. translation; $(x, y) \rightarrow (x - 9, y)$

38. reflection; $y = 0$ **39.** reflection; $x = 4$

40. reflection; $x = -\frac{1}{2}$

41. rotation; center $(3, 0)$, $\angle$ of rotation 180°

42. glide reflection; $(x, y) \rightarrow (x, y + 4)$, $x = 4$

43. translation; $(x, y) \rightarrow (x - 11, y - 4)$

44. rotation; center $(0, 2)$, $\angle$ of rotation 180°

45. Sample: Translate the red R so that one point moves to its corresponding point on the blue R. Then reflect across a line passing through that point.

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46–48. Answers may vary. Samples are given.

46. If $\overline{XY}$ is reflected in line ℓ, then ℓ is the $\perp$ bis. of $\overline{XX'}$ and $\overline{YY'}$, so $\overline{XX'} \parallel \overline{YY'}$ and $XX'YY'$ is an isosc. trap. Therefore $\overline{XY} \cong \overline{X'Y'}$.

47. $\overline{XX'} \parallel \overline{YY'}$ and $\overline{XX'} \cong \overline{YY'}$, so $XX'Y'Y$ is a $\square$. Therefore, $\overline{XY} \cong \overline{X'Y'}$.

48. If $\overline{XY}$ is rotated $x°$ about pt. R, then $\overline{RX} \cong \overline{RX'}$ and $\overline{RY} \cong \overline{RY'}$. Also, $m\angle XRY + m\angle YRX' = m\angle YRX' + m\angle X'RY' = x$, so $\angle XRY \cong \angle X'RY'$. So $\triangle XRY \cong \triangle X'RY'$ by SAS and $\overline{XY} \cong \overline{X'Y'}$ by CPCTC.

49. Answers may vary. Sample: Since a reflection moves a pt. in the direction $\perp$ to the translation, the order does not matter.

50. No; explanations may vary. Sample: If (1, 1) is reflected over the line $y = x$ and then the x-axis, the image is $(1, -1)$. If the reflections are reversed, the image is $(-1, 1)$.

51. (6, 5) **52.** (3, 8) **53.** (2, 6) **54.** $(-3, 1)$

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