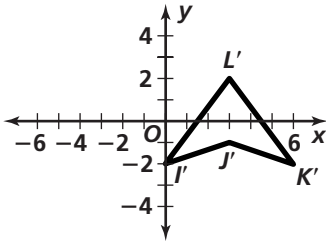# Chapter 9 Answers

Practice 9-1

1. No; the triangles are not the same size.　**2.** Yes; the hexagons are the same shape and size.　**3.** Yes; the ovals are the same shape and size.　**4a.** $\angle C'$ and $\angle F'$
4b. $\overline{CD}$ and $\overline{C'D'}$, $\overline{DE}$ and $\overline{D'E'}$, $\overline{EF}$ and $\overline{E'F'}$, $\overline{CF}$ and $\overline{C'F'}$　**5a.** $\angle M'$ and $\angle N'$　**5b.** $\overline{MN}$ and $\overline{M'N'}$, $\overline{NO}$ and $\overline{N'O'}$, $\overline{MO}$ and $\overline{M'O'}$　**6.** $(x, y) \to (x - 2, y - 4)$
7. $(x, y) \to (x - 2, y - 2)$　**8.** $(x, y) \to (x - 3, y - 1)$
9. $(x, y) \to (x + 4, y - 2)$　**10.** $(x, y) \to (x - 5, y + 1)$
11. $(x, y) \to (x + 2, y + 2)$　**12.** $W'(-2, 2), X'(-1, 4),$
$Y'(3, 3), Z'(2, 1)$　**13.** $J'(-5, 0), K'(-3, 4), L'(-3, -2)$
14. $M'(3, -2), N'(6, -2), P'(7, -7), Q'(4, -6)$
15. $(x, y) \to (x + 4.2, y + 11.2)$
16. $(x, y) \to (x + 13, y - 13)$　**17.** $(x, y) \to (x, y)$
18. $(x, y) \to (x + 3, y + 3)$　**19a.** $P'(-3, -1)$
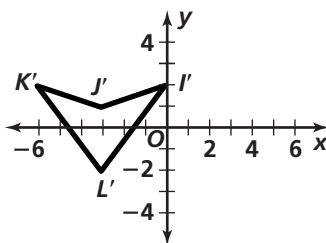**19b.** $P'(0, 8), N'(-5, 2), Q'(2, 3)$

Practice 9-2

1. $(-3, -2)$　**2.** $(-2, -3)$　**3.** $(-1, -4)$
4. $(4, -2)$　**5.** $(4, -1)$　**6.** $(3, -4)$
7a.

7b.

8a.
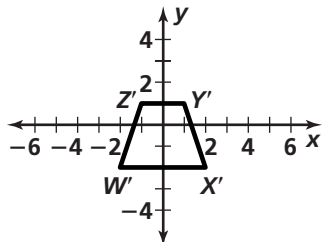
8b.
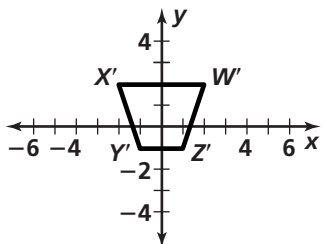
9.
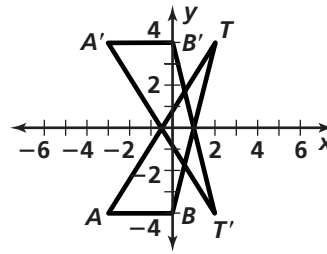
10.
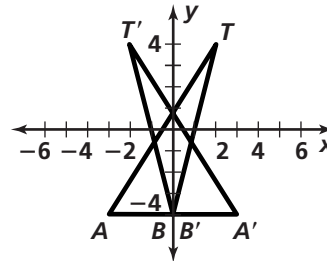
11.
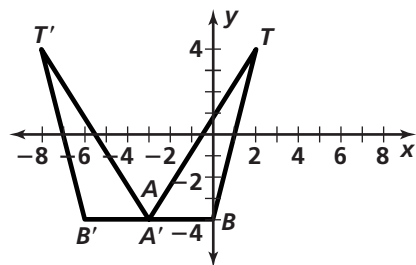
12.
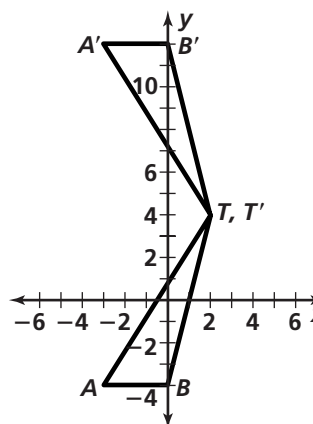
13. $(-6, 4)$　**14.** $(-8, 0)$　**15.** $(0, -12)$

Practice 9-3

1. I　**2.** I　**3.** I　**4.** $\overline{GH}$　**5.** G　**6.** $\overline{ST}$
7.

8.

9.

10.

11. L'

12.

13.
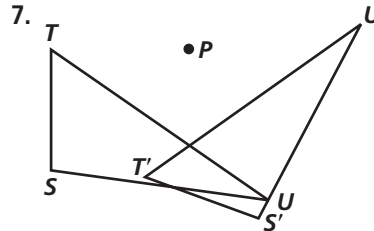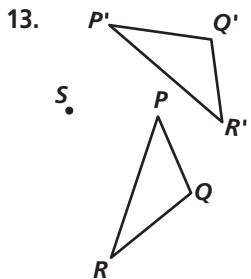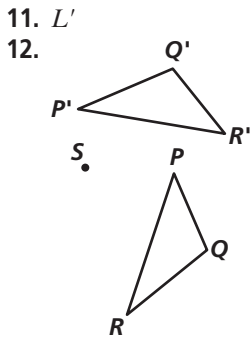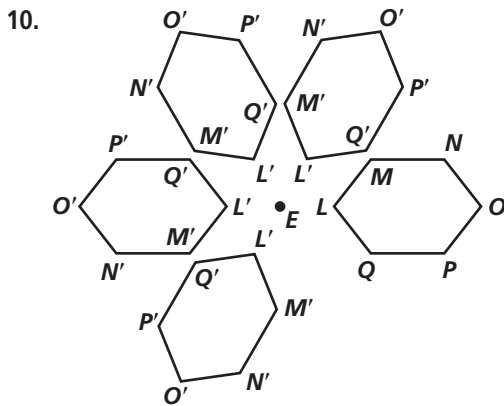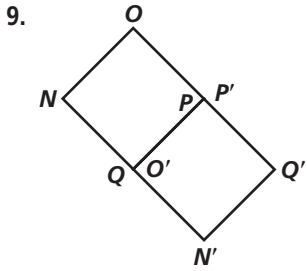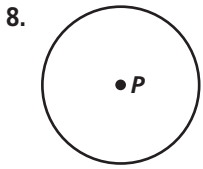
Practice 9-4

1. The helmet has reflectional symmetry.   **2.** The teapot has reflectional symmetry.   **3.** The hat has both rotational and reflectional symmetry.   **4.** The hairbrush has reflectional symmetry.

5.

6.

7. This figure has no lines of symmetry.
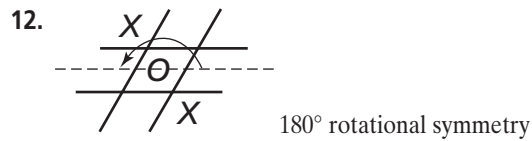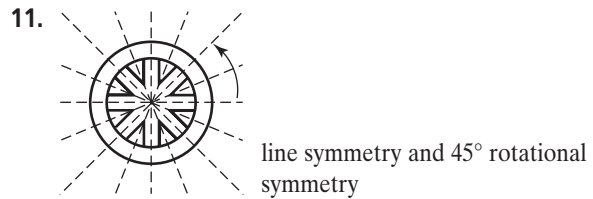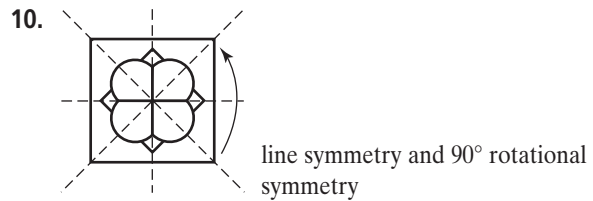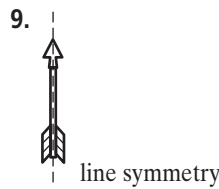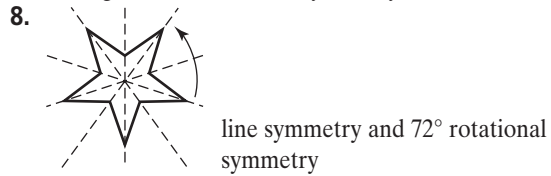
8.

line symmetry and 72° rotational symmetry

9.

line symmetry

10.

line symmetry and 90° rotational symmetry

11.

line symmetry and 45° rotational symmetry
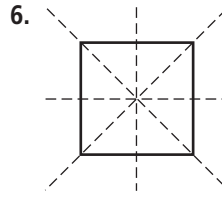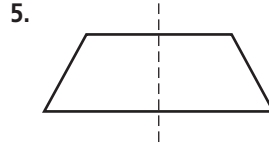
12.

180° rotational symmetry

13.

BOOK   line symmetry

Chapter 9 Answers (continued)

14.

line symmetry and 45° rotational symmetry

15.

180° rotational symmetry

16.

line symmetry

17.

18. COOK

19.

20. HOAX

21.
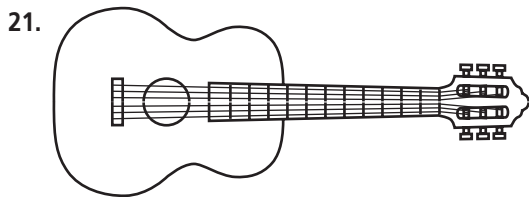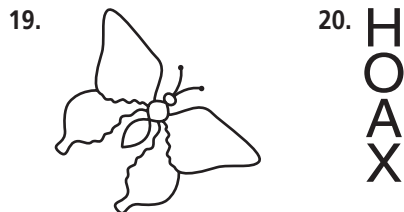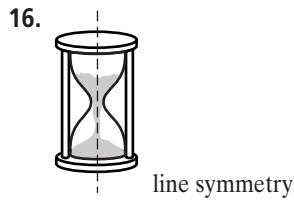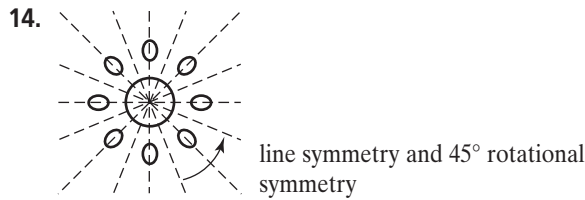
Practice 9-5

1. $L'(-2, -2), M'(-1, 0), N'(2, -1), O'(0, -1)$
2. $L'(-30, -30), M'(-15, 0), N'(30, -15), O'(0, -15)$
3. $L'(-12, -12), M'(-6, 0), N'(12, -6), O'(0, -6)$
4. $\frac{5}{3}$ **5.** $\frac{1}{2}$ **6.** 2   **7.** yes   **8.** no   **9.** no

10.

11.

12.
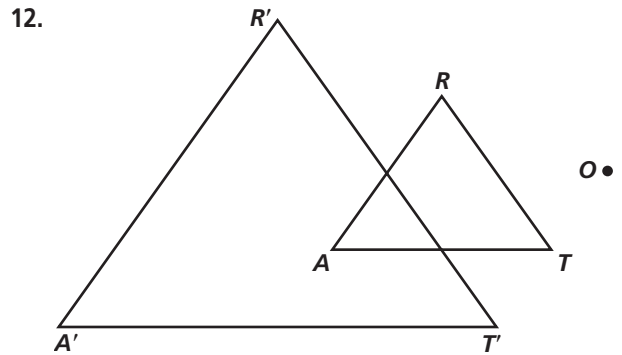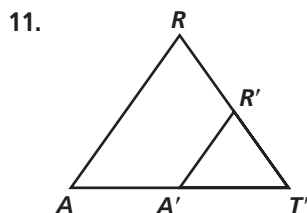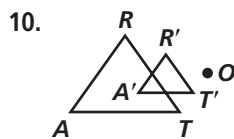
13. $P'(-12, -12), Q'(-6, 0), R'(0, -6)$ **14.** $P'(-\frac{1}{2}, \frac{1}{4})$, $Q'(1\frac{1}{4}, -\frac{1}{4}), R'(1\frac{3}{4}, 2)$ **15.** $P'(-21, 6), Q'(3, 24)$, $R'(-6, 6)$ **16.** $P'(-2, 1), Q'(-1, 0), R'(0, 1)$

Practice 9-6

1. I. D II. C III. B IV. A   **2.** I. B II. A III. C IV. D
3.

$\ell \parallel m$

4.

5.

$\ell \parallel m$

6.

Chapter 9 Answers (continued)

7.

8.

9.

10.

11.

12.

13.
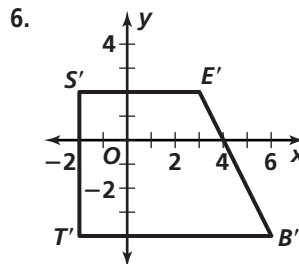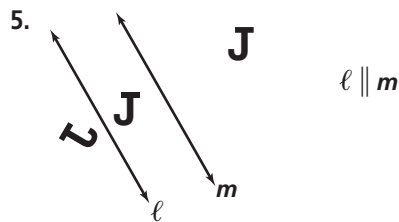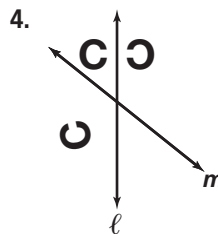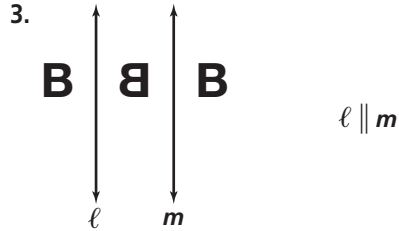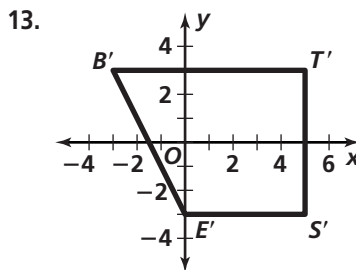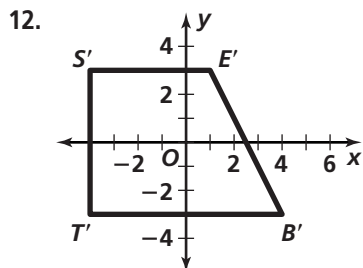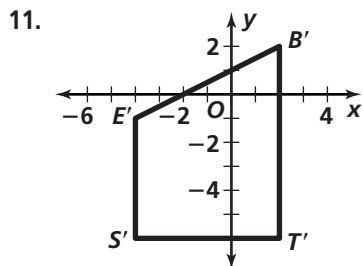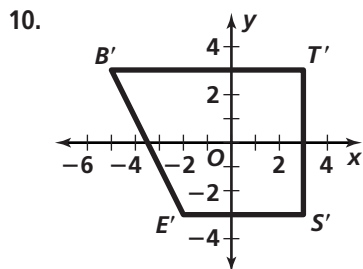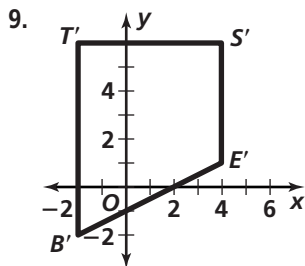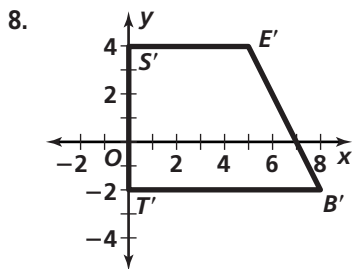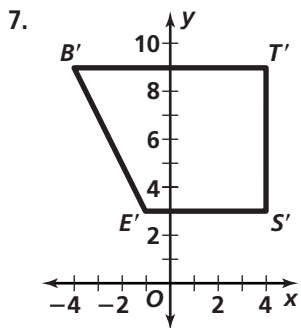
14. reflection **15.** rotation **16.** glide reflection

17. translation

Practice 9-7

1.

translational symmetry

2.

line symmetry,
rotational symmetry,
translational symmetry,
glide reflectional symmetry

3.

translational symmetry

4.

line symmetry,
rotational symmetry,
translational symmetry,
glide reflectional symmetry

5.

line symmetry,
rotational symmetry,
translational symmetry,
glide reflectional symmetry

6.

rotational symmetry,
translational symmetry

7.

8.

Chapter 9 Answers (continued)

9.–11. Samples:
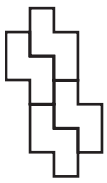
9. **10.**
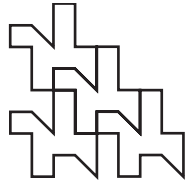
11.
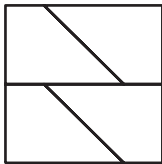
12. yes   **13.** yes   **14.** no   **15.** yes   **16.** no
17. no

Reteaching 9-1
1.–5. Check students' work.   **6.** $A'(0, -3), B'(1, 1),$
$C'(4, -1), D'(5, -4)$ **7.** $A'(4, -2), B'(5, 2), C'(8, 0),$
$D'(9, -3)$ **8.** $A'(3, 5), B'(4, 9), C'(7, 7), D'(8, 4)$

Reteaching 9-2
1.–5. Check students' work.   **6.** reflection across x-axis:
$F'(-1, -3), G'(-5, -1), H'(-3, -5)$; reflection across
y-axis: $F'(1, 3), G'(5, 1), H'(3, 5)$ **7.** reflection across
x-axis: $C'(2, -4), D'(5, -2), E'(6, -3)$; reflection across
y-axis: $C'(-2, 4), D'(-5, 2), E'(-6, 3)$ **8.** reflection
across x-axis: $J'(-1, 5), K'(-2, 3), L'(-4, 6)$; reflection
across y-axis: $J'(1, -5), K'(2, -3), L'(4, -6)$

Reteaching 9-3
1.–5.

6.
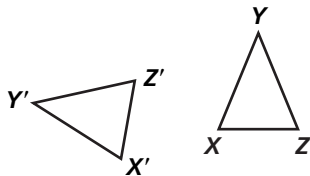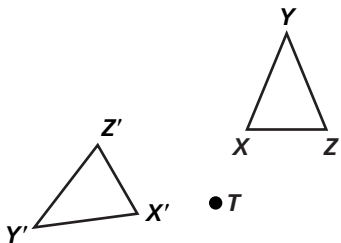
7. Sample:
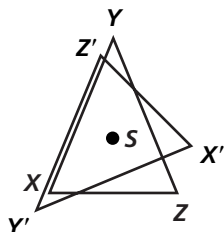
8.
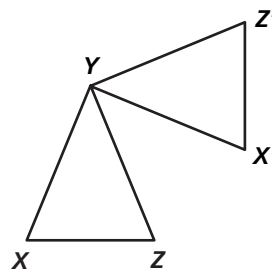
Reteaching 9-4
1. two lines of symmetry (vertical and horizontal), 180°
rotational symmetry (point symmetry)   **2.** one line of
symmetry (horizontal)   **3.** one line of symmetry (vertical)
4. two lines of symmetry (vertical and horizontal), 180°
rotational symmetry (point symmetry)   **5.** one line of
symmetry (vertical)   **6.** one line of symmetry (vertical)

Reteaching 9-5
1. Check students' work.

2.
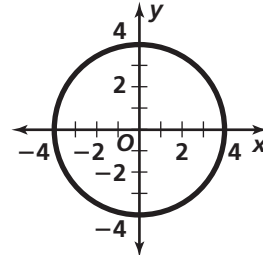
3.
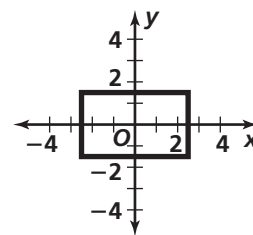
4.
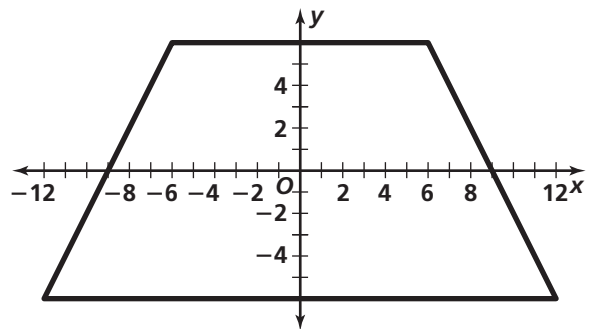
Chapter 9 Answers (continued)

5.
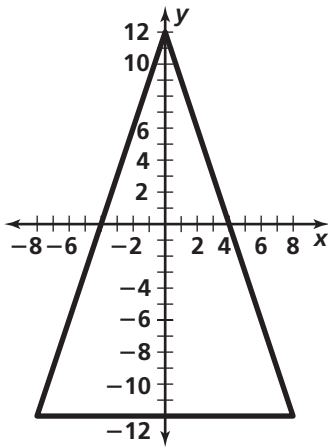
Reteaching 9-6

1. translation   **2.** reflection   **3.** rotation
4. glide reflection   **5.** rotation   **6.** glide reflection
7. reflection   **8.** translation

Reteaching 9-7
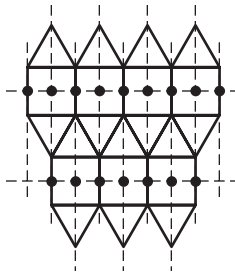
1.

2. Sample:

line symmetry across the dashed lines, rotational symmetry around points, translational symmetry, glide reflectional symmetry

3.
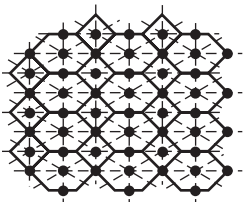
line symmetry across the dashed lines, rotational symmetry around points, translational symmetry, glide reflectional symmetry

4.
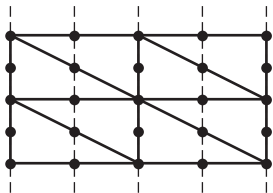
rotational symmetry around points, translational symmetry

5.
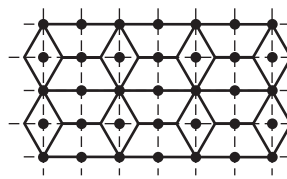
line symmetry across the dashed lines, rotational symmetry around points, translational symmetry, glide reflectional symmetry

Enrichment 9-1

1. $(x, y) \rightarrow (x - 7, y - 2)$ **2.** $(x, y) \rightarrow (x + 4, y - 7)$
3. $(x, y) \rightarrow (x - 10, y + 5)$ **4.** $(x, y) \rightarrow (x - 3, y - 4)$
5. Foster   **6.** yes   **7.** Wilson
8. $(x, y) \rightarrow (x - 7, -3)$ **9.** C

Enrichment 9-2

1. $(-3, -1)$ **2.** $(-1, 0)$ **3.** $(5, 3)$
4. the midpoint formula: $M = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$
5.
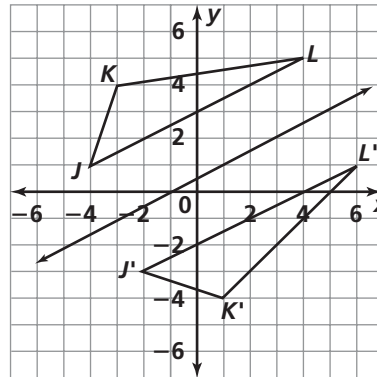
6. $y = \frac{1}{2}x + \frac{1}{2}$
7.

$y = -4$
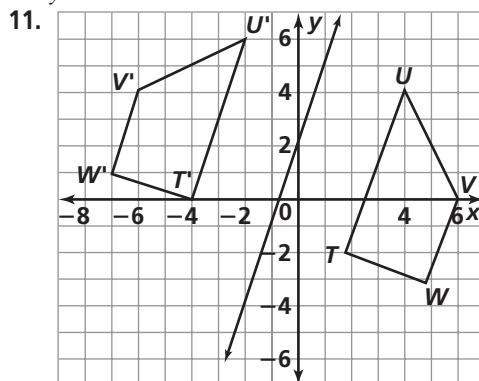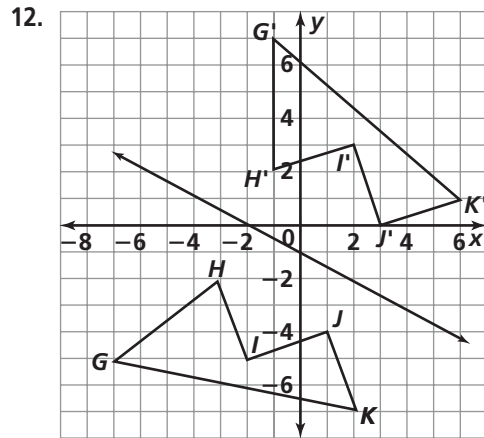
8.

$y = -x$

9.

$x = 1$

10.

$y = -2x - 2$

11.

$y = 3x + 2$

12.

$y = -\frac{1}{2}x - 1$

Enrichment 9-3

1. $(0, -2, 3)$ **2.** $(-2, -2, 3)$ **3.** $(-2, -2, 0)$
4. $(0, -2, 0)$ **5.** $(0, -6, 0)$ **6.** $(0, -6, 3)$
7. $(-2, -6, 3)$ **8.** $(-2, -6, 0)$ **9.** $(2, 0, 3)$
10. $(2, -2, 3)$ **11.** $(2, -2, 0)$ **12.** $(2, 0, 0)$
13. $(6, 0, 0)$ **14.** $(6, 0, 3)$ **15.** $(6, -2, 3)$
16. $(6, -2, 0)$

Enrichment 9-4

1. yes; rotational and point symmetry **2.** no **3.** yes;
rotational and point symmetry **4.** yes; rotational and point
symmetry **5.** no **6.** no **7.** diamonds **8.** 12
9. Seven of diamonds; this does not have symmetry because
the diamond in the middle is toward either the bottom or top
of the card, and when you rotate the card 180°, the position
will be reversed. **10.** All the face cards have symmetry.
11. yes; 2, 4, 10 **12.** No; Sample: When you look at the
card one way, three of the points of the hearts are pointing
down, and five are pointing up. When you rotate the card 180°,
five of the points of the hearts are pointing down, and three
are pointing up. **13.** No; because the number and suit of
each card are placed in opposite corners, none of the cards
have line symmetry. **14.** You can add a backward 3 with
the small club below it to the two empty corners to create line
symmetry, or you can remove the 3 with the small club below
it from each of the two corners.

Enrichment 9-5

1a. $(2, 0, 2)$ **1b.** $(0, 0, 2)$ **1c.** $(0, 2, 2)$ **1d.** $(2, 2, 2)$
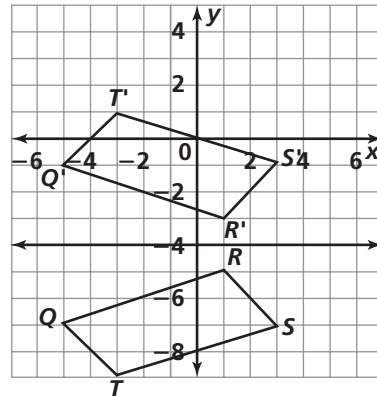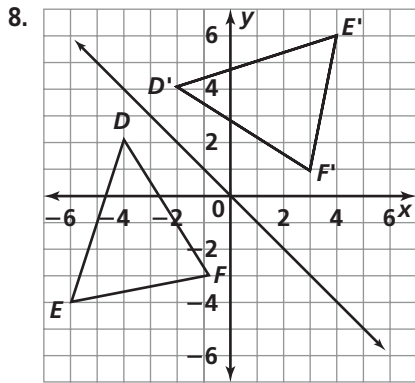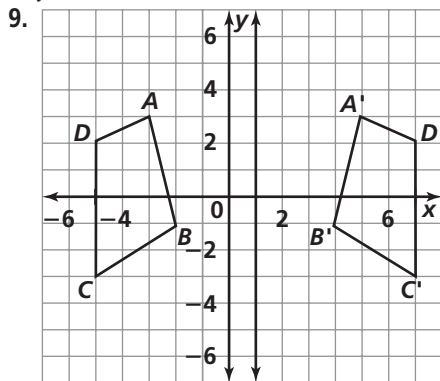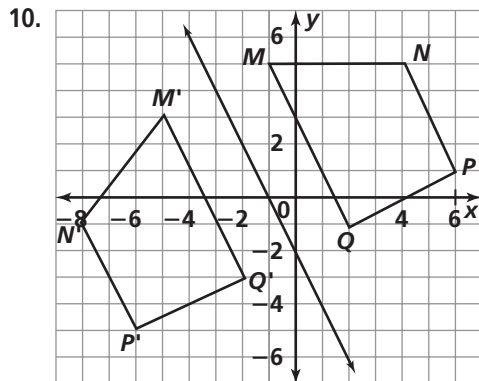**1e.** $(2, 0, 0)$ **1f.** $(0, 0, 0)$ **1g.** $(0, 2, 0)$ **1h.** $(2, 2, 0)$
2a. $(4, 0, 4)$ **2b.** $(0, 0, 4)$ **2c.** $(0, 4, 4)$ **2d.** $(4, 4, 4)$
2e. $(4, 0, 0)$ **2f.** $(0, 0, 0)$ **2g.** $(0, 4, 0)$ **2h.** $(4, 4, 0)$
3. $(0, 0, 0)$ **4.** 2 **5.** Each edge in the image is double
that in the preimage. **6.** Samples: Three faces are
coplanar for image and preimage; three faces are parallel;
each face in the image has two times the perimeter and four
times the area of the corresponding face in the preimage.
7. Surface area of image = 96 sq. units; surface area of
preimage $= 24$ sq. units; the ratio of the surface areas is $4 : 1$.

Chapter 9 Answers (continued)

8. Volume of image $= 64$ cubic units; volume of preimage $= 8$ cubic units; the ratio of the volumes is $8:1$. **9.** Dilations in three dimensions are proportional to dilations in two dimensions.
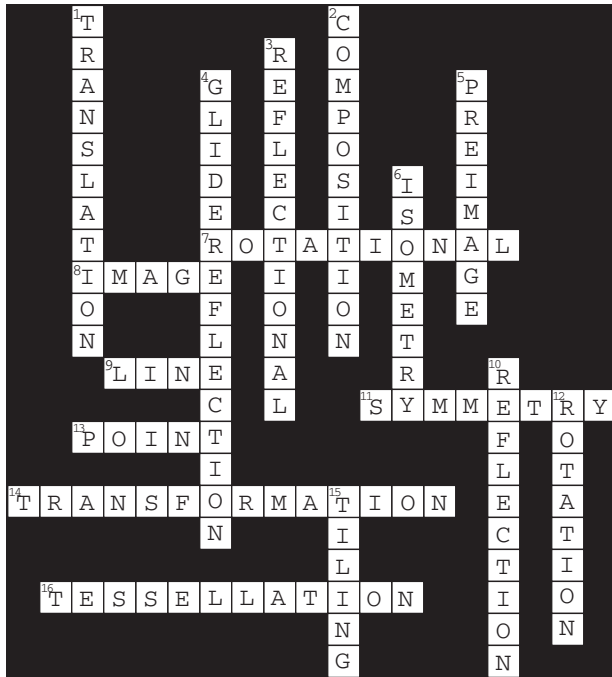
Enrichment 9-6
1.–9. Check students' work. **10.** 12-3; rotation; twice
11. 130 **12.** 100 **13.** 160

Enrichment 9-7

Chapter Project

Activity 1: Investigating
a. vertical
b. vertical
c. both

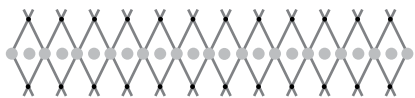### Activity 2: Modeling
a. Ancient Egyptian ornament

b. Oriental design

c. Greek vase design

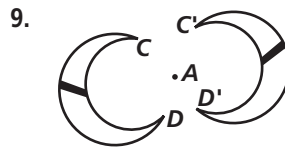### Activity 3: Investigating
a, b

Activity 4: Classifying
a. *mg*
b. 12

Activity 5: Creating
Check students' work.

✔ Checkpoint Quiz 1
1. No; the figures are not the same size. **2.** yes
3. yes **4.** $(x, y) \rightarrow (x - 3, y - 2)$ **5.** 6 units right and 4 units down **6.** a resultant translation of 4 units right and 11 units up
7.

8.

9.
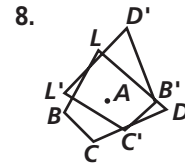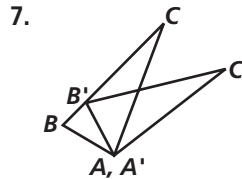
10. $T'(8, -5), Q'(2, -3)$ and $R'(4, 0)$

✔ Checkpoint Quiz 2
1. line symmetry; rotational; 180°

2. line symmetry; rotational; 180°
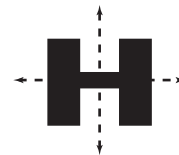
3. line symmetry
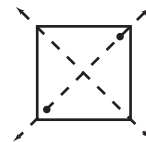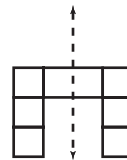
4. rotational; 180° **5.** translational; no turns
6. rotational; preimage turns **7.** translational
8. rotational, reflectional, translational **9.** translational

Chapter Test, Form A
1. $P'(13, 0), Q'(10, -2), R'(11, -4), S'(13, -6)$
2. $P'(-1, -2), Q'(2, -4), R'(1, -6), S'(-1, -8)$
3. $P'(0, -5), Q'(2, -2), R'(4, -3), S'(6, -5)$
4. $P'(-2.5, 0), Q'(-1, -1), R'(-1.5, -2), S'(-2.5, -3)$
5. $P'(5, 2), Q'(2, 0), R'(3, -2), S'(5, -4)$ **6.** $P'(-11, 3),$ $Q'(-8, 1), R'(-9, -1), S'(-11, -3)$ **7.** glide reflection
8. translation **9.** translation **10.** rotation

Chapter 9 Answers (continued)

11.
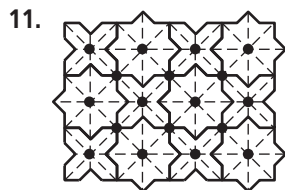
12. line symmetry   **13.** rotational symmetry
14a. Any two of the following: ABCDEHIKMOTUVWXY
14b. Any two of the following: HINOSXZ
15. Translations can be performed on the pieces because they can slide. Rotations can be performed on the pieces because each piece can be turned. Reflections and glide reflections cannot be performed on the pieces because the back of a puzzle piece is useless in solving the puzzle. Dilations are impossible because the pieces cannot change size.
16. A   **17.** Sample: glide reflectional, rotational, line, and translational
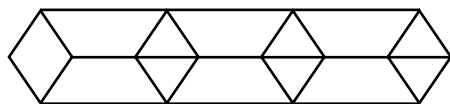
**18.** $L'(-3, 6), M'(6, 6), N'(3, -9)$ **19.** $L'\left(\frac{1}{2}, -\frac{3}{4}\right),$ $M'\left(\frac{3}{4}, 1\right), N'\left(\frac{5}{4}, -\frac{1}{2}\right)$ **20.** $L'(-18, -18), M'(-18, 18),$ $N'(0, 0)$ **21.** $L'(3, -2), M'\left(0, -\frac{5}{3}\right), N'\left(\frac{7}{3}, -2\right)$
22. $Y'Z' = 15$ cm; $X'Z' = 24$ cm; scale factor $= \frac{3}{7}$
23. $X'Y' = 25$ in.; $Y'Z' = 40$ in.; scale factor $= \frac{5}{3}$
24. $(-1, 3)$ **25.** $(5, 4)$ **26.** $(-2, -7)$ **27.** $(2, -7)$
28. $(1, -1)$ **29.** $(-3, 1)$

Chapter Test, Form B

1. Yes; the figures are the same shape and size.   **2.** No; the figures are not the same size.   **3.** Yes; the figures are the same shape and size.   **4.** $(x, y) \rightarrow (x - 6, y + 1)$
5. $(x, y) \rightarrow (x + 3, y - 7)$ **6.** $A'(0, -3), B'(-4, 0),$ $C'(-6, -4), D'(-3, -5)$ **7.** $A'(6, 3), B'(10, 0), C'(12, 4),$ $D'(9, 5)$ **8.** $A'(3, 8), B'(-1, 5), C'(-3, 9), D'(0, 10)$
9. $A'(5, 2), B'(1, -1), C'(-1, 3), D'(2, 4)$ **10.** $A'(-3, 0),$ $B'(0, -4), C'(-4, -6), D'(-5, -3)$ **11.** $A'(0, 3), B'(4, 6),$ $C'(6, 2), D'(3, 1)$ **12.** $(x, y) \rightarrow (x + 4, y - 3)$
13. $(x, y) \rightarrow (x - 3, y + 6)$ **14.** rhombus and two triangles; translation

15.

16.
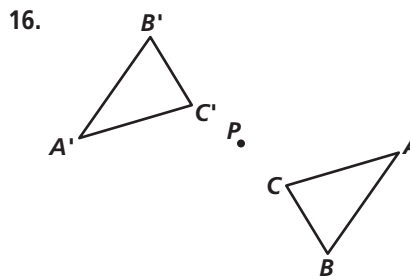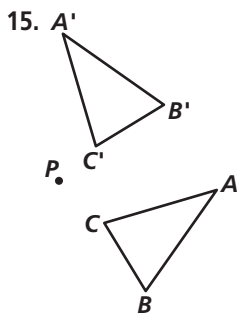
17. 180° rotational symmetry
18. line symmetry
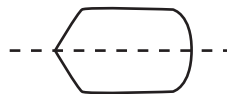
19. line symmetry; 180° rotational symmetry
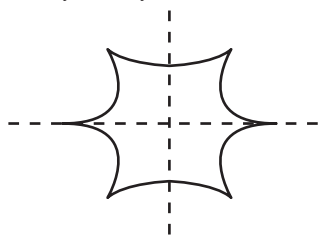
20. $(-7, 0)$ **21.** $(0, -3)$ **22.** $(-6, 1)$ **23.** $(-9, -4)$
24. $(2, -2)$ **25.** $(-5, 11)$

Alternative Assessment, Form C

TASK 1: Scoring Guide
20; 200 cm; all distances are magnified 20 times.

3 Student gives correct answers and a clear and accurate explanation.
2 Student gives answers and an explanation that are largely correct.
1 Student gives answers or an explanation that may contain serious errors.
0 Student makes little or no effort.

TASK 2: Scoring Guide
Sample:
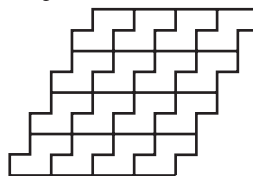
3 Student draws a figure that accurately reflects the stated conditions.
2 Student draws a figure that is mostly correct but falls just short of satisfying all the stated conditions.
1 Student draws a figure that has significant flaws relative to the stated conditions.
0 Student makes little or no effort.

Chapter 9 Answers (continued)

TASK 3: Scoring Guide
Sample:
The car can undergo translations and rotations as it moves and turns. But it can undergo neither a dilation, which would change its size, nor a reflection, which would, for example, put the steering wheel on the passenger side.

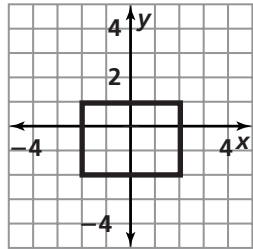**3** Student gives a correct and thorough explanation.
2 Student gives an explanation that demonstrates understanding of transformations but may contain minor errors or omissions.
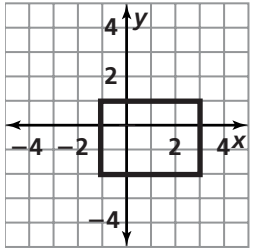**1** Student gives an explanation containing major errors or omissions.
0 Student makes little or no effort.

TASK 4: Scoring Guide
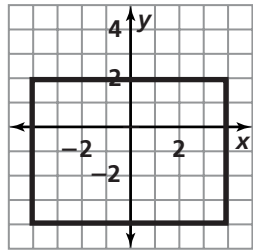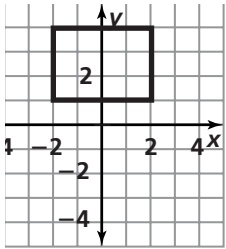Sample:

a. translation:

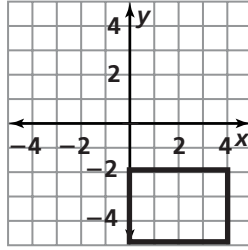translation vector: $\langle 1, 0 \rangle$

b. dilation:
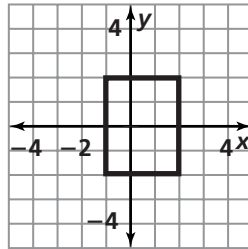

scale factor: 2

c. reflection:

line of reflection: $y = 1$

d. glide reflection:

The glide reflection is equivalent to a translation $\langle 2, 0 \rangle$ followed by a reflection across the line $y = -2$.

e. rotation:

degrees of rotation: 90

3 Student gives accurate graphs and correctly identifies the details the problem calls for.
2 Student gives generally correct graphs and details, although the work may contain some errors.
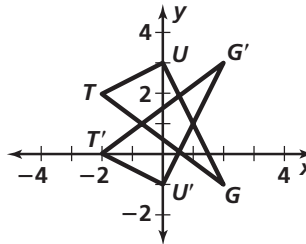**1** Student gives graphs and accompanying details that contain significant errors or omissions.
0 Student makes little or no effort.

Cumulative Review

1. D   **2.** G   **3.** B   **4.** H   **5.** A   **6.** J   **7.** B
8. H   **9.** C   **10.** J   **11.** B   **12.** H   **13.** A
14. J   **15.** B   **16.** 49 cm^3 **17.** A, H, I, M, O, T, U, V, W, X, Y   **18.** Rotational; it is turning around a fixed point, the corner.
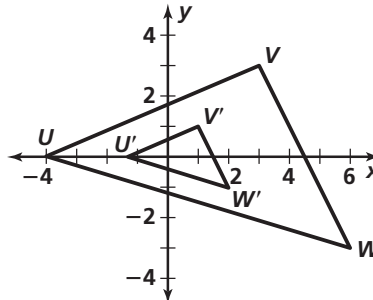**19.**

20. Equilateral triangle, square, and regular hexagon; the measure of each interior angle is a factor of 360.
21. If a triangle is not a right triangle, then the Pythagorean Theorem cannot be applied.
22.

23. 21.21