

Chapter Summary

WHAT did you learn?

Identify types of rigid transformations. (7.1)

Use properties of reflections. (7.2)

Relate reflections and line symmetry. (7.2)

Relate rotations and rotational symmetry. (7.3)

Use properties of translations. (7.4)

Use properties of glide reflections. (7.5)

Classify frieze patterns. (7.6)

WHY did you learn it?

Plan a stencil pattern, using one design repeated many times. (p. 401)

Choose the location of a telephone pole so that the length of the cable is a minimum. (p. 405)

Understand the construction of the mirrors in a kaleidoscope. (p. 406)

Use rotational symmetry to design a logo. (p. 415)

Use vectors to describe the path of a hot-air balloon. (p. 427)

Describe the transformations in patterns in architecture. (p. 435)

Identify the frieze patterns in pottery. (p. 442)

How does Chapter 7 fit into the BIGGER PICTURE of geometry?

In this chapter, you learned that the basic rigid transformations in the plane are reflections, rotations, translations, and glide reflections. Rigid transformations are closely connected to the concept of congruence. That is, two plane figures are congruent if and only if one can be mapped onto the other by exactly one rigid transformation or by a composition of rigid transformations. In the next chapter, you will study transformations that are not rigid. You will learn that some nonrigid transformations are closely connected to the concept of similarity.

STUDY STRATEGY

How did making sample exercises help you?

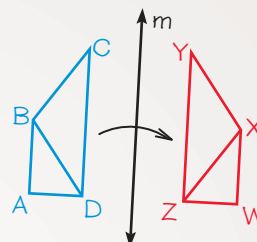
Some sample exercises you made, following the Study Strategy on p. 394, may resemble these.

Lesson 7.1 Rigid Motion in a Plane

Summary: This lesson is about the three basic rigid transformations—reflections, rotations, and translations.

Sample Exercises:

1. Name the preimage of \overline{XW} .
2. Name the image of \overline{BC} .
3. Name a triangle that appears to be congruent to $\triangle DBC$.



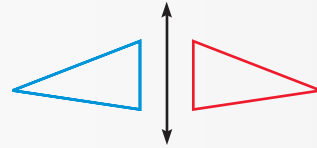
Chapter Review

- image, p. 396
- preimage, p. 396
- transformation, p. 396
- isometry, p. 397
- reflection, p. 404
- line of reflection, p. 404
- line of symmetry, p. 406
- rotation, p. 412
- center of rotation, p. 412
- angle of rotation, p. 412
- rotational symmetry, p. 415
- translation, p. 421
- vector, p. 423
- initial point, p. 423
- terminal point, p. 423
- component form, p. 423
- glide reflection, p. 430
- composition, p. 431
- frieze pattern, or border pattern, p. 437

7.1 RIGID MOTION IN A PLANE

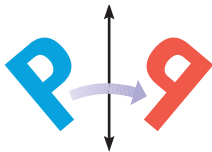
Examples on pp. 396–398

EXAMPLE The blue triangle is reflected to produce the congruent red triangle, so the transformation is an isometry.

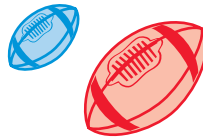


Does the transformation appear to be an isometry? Explain.

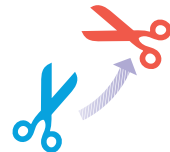
1.



2.



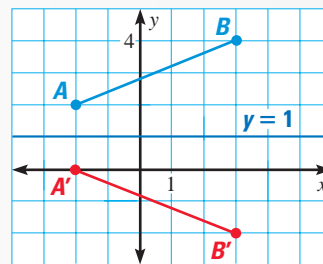
3.



7.2 REFLECTIONS

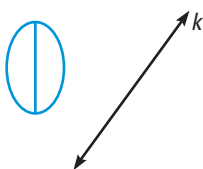
Examples on pp. 404–406

EXAMPLE In the diagram, \overline{AB} is reflected in the line $y = 1$, so $\overline{A'B'}$ has endpoints $A'(-2, 0)$ and $B'(3, -2)$.

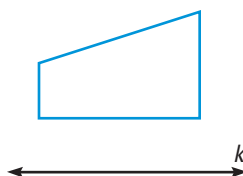


Copy the figure and draw its reflection in line k .

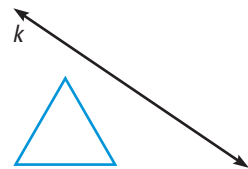
4.



5.



6.

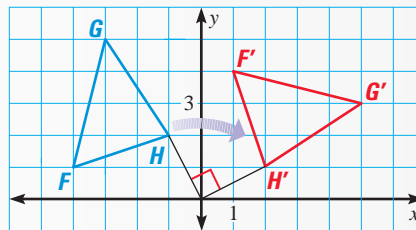


7.3

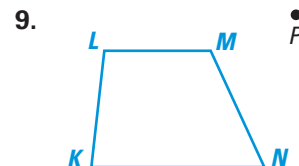
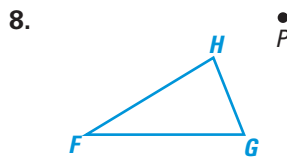
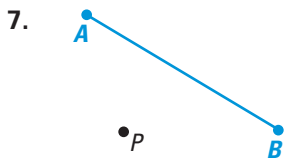
ROTATIONS

Examples on pp. 412–415

EXAMPLE In the diagram, $\triangle FGH$ is rotated 90° clockwise about the origin.



Copy the figure and point P . Then, use a straightedge, a compass, and a protractor to rotate the figure 60° counterclockwise about P .



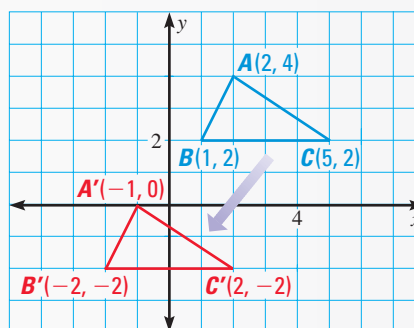
7.4

TRANSLATIONS AND VECTORS

Examples on pp. 421–424

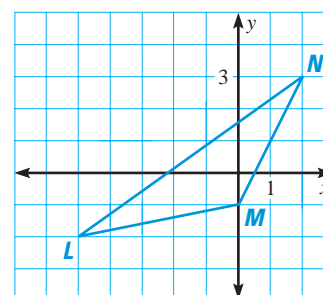
EXAMPLE Using the vector $\langle -3, -4 \rangle$, $\triangle ABC$ can be translated to $\triangle A'B'C'$.

- | | |
|-----------|--------------|
| $A(2, 4)$ | $A'(-1, 0)$ |
| $B(1, 2)$ | $B'(-2, -2)$ |
| $C(5, 2)$ | $C'(2, -2)$ |



The vertices of the image of $\triangle LMN$ after a translation are given. Choose the vector that describes the translation.

- | | |
|---------------------------------------|---------------------------------------|
| 10. $L'(-1, -3), M'(4, -2), N'(6, 2)$ | A. $\vec{PQ} = \langle 0, 3 \rangle$ |
| 11. $L'(-5, 1), M'(0, 2), N'(2, 6)$ | B. $\vec{PQ} = \langle -2, 5 \rangle$ |
| 12. $L'(-3, 2), M'(2, 3), N'(4, 7)$ | C. $\vec{PQ} = \langle 4, -1 \rangle$ |
| 13. $L'(-7, 3), M'(-2, 4), N'(0, 8)$ | D. $\vec{PQ} = \langle 2, 4 \rangle$ |



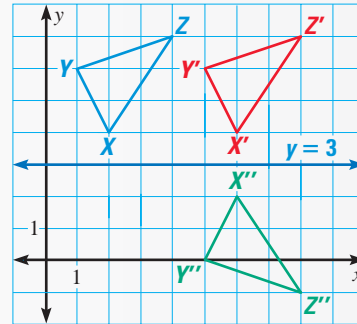
GLIDE REFLECTIONS AND COMPOSITIONS

Examples on
pp. 430–432

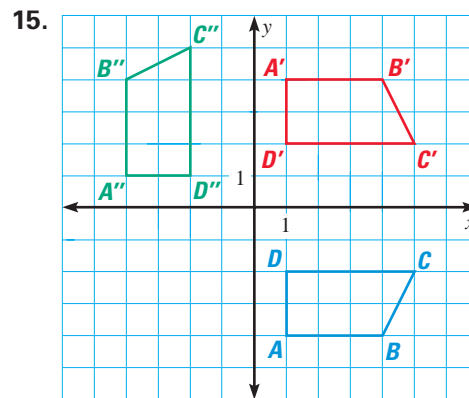
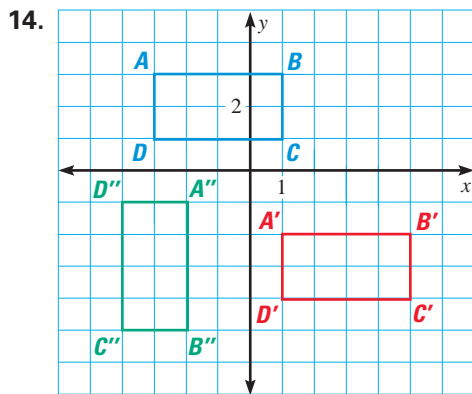
EXAMPLE The diagram shows the image of $\triangle XYZ$ after a glide reflection.

Translation: $(x, y) \rightarrow (x + 4, y)$

Reflection: in the line $y = 3$



Describe the composition of the transformations.



FRIEZE PATTERNS

Examples on
pp. 437–439

EXAMPLE The corn snake frieze pattern at the right can be classified as TRHVG because the pattern can be mapped onto itself by a translation, 180° rotation, horizontal line reflection, vertical line reflection, and glide reflection.



Classify the snakeskin frieze pattern.

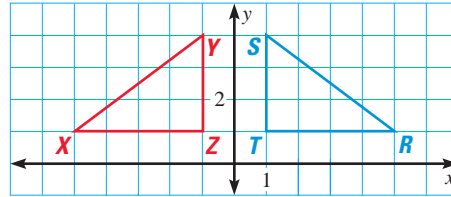
16. Rainbow boa



17. Gray-banded kingsnake

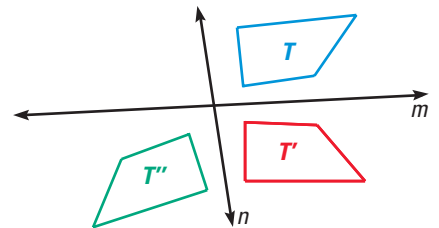


In Exercises 1–4, use the diagram.



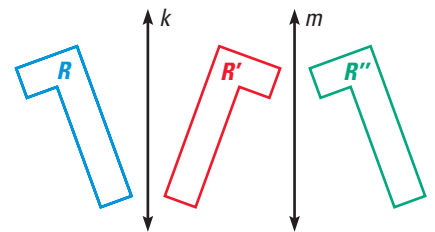
1. Identify the transformation $\triangle RST \rightarrow \triangle XYZ$.
2. Is \overline{RT} congruent to \overline{XZ} ?
3. What is the image of T ?
4. What is the preimage of Y ?
5. Sketch a polygon that has line symmetry, but not rotational symmetry.
6. Sketch a polygon that has rotational symmetry, but not line symmetry.

Use the diagram, in which lines m and n are lines of reflection.



7. Identify the transformation that maps figure T onto figure T' .
8. Identify the transformation that maps figure T onto figure T'' .
9. If the measure of the acute angle between m and n is 85° , what is the angle of rotation from figure T to figure T'' ?

In Exercises 10–12, use the diagram, in which $k \parallel m$.



10. Identify the transformation that maps figure R onto figure R' .
11. Identify the transformation that maps figure R onto figure R'' .
12. If the distance between k and m is 5 units, what is the distance between corresponding parts of figure R and figure R'' ?
13. What type of transformation is a composition of a translation followed by a reflection in a line parallel to the translation vector?

Give an example of the described composition of transformations.

14. The order in which two transformations are performed affects the final image.
15. The order in which two transformations are performed does not affect the final image.

 **FLAGS** Identify any symmetry in the flag.

16. Switzerland



17. Jamaica



18. United Kingdom



Name all of the isometries that map the frieze pattern onto itself.

19.



20.



21.

