

5.6 Reflections

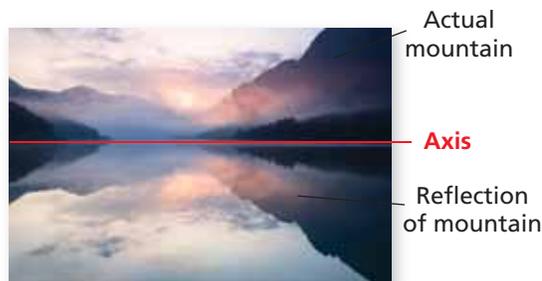
Essential Question How can you use reflections to classify a frieze pattern?



The Meaning of a Word ● Reflection

When you look at a mountain by a lake, you can see the **reflection**, or mirror image, of the mountain in the lake.

If you fold the photo on its axis, the mountain and its reflection will align.

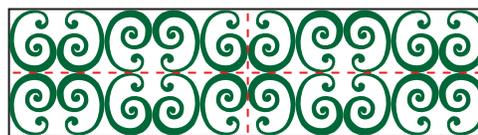


A *frieze* is a horizontal band that runs at the top of a building. A frieze is often decorated with a design that repeats.

- All frieze patterns are translations of themselves.
- Some frieze patterns are reflections of themselves.

1 EXAMPLE: Frieze Patterns

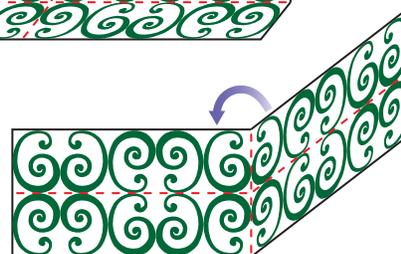
Is the frieze pattern a reflection of itself when folded horizontally? vertically?



- Fold (reflect) on horizontal axis. The pattern coincides.



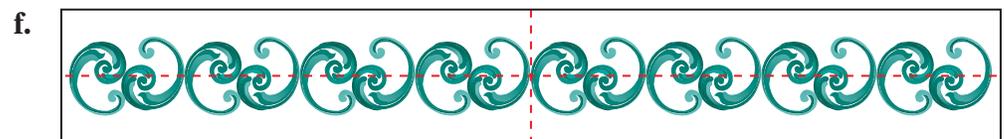
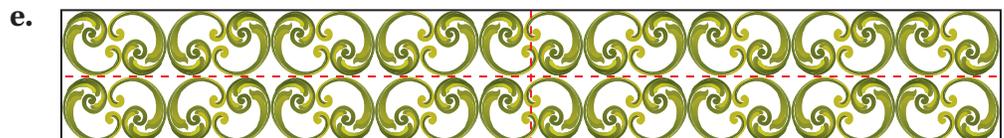
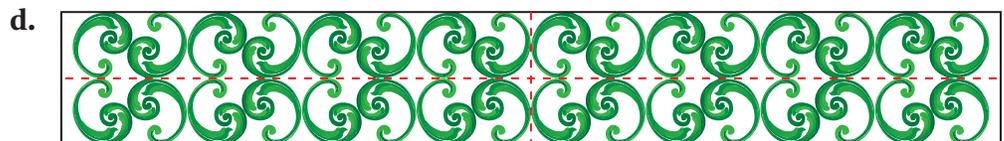
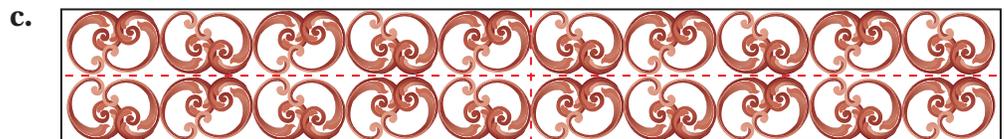
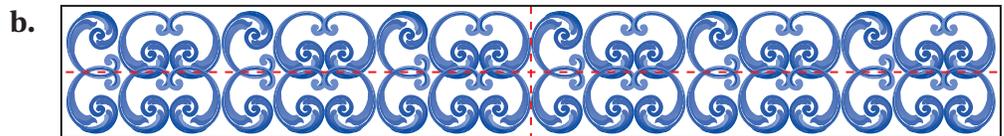
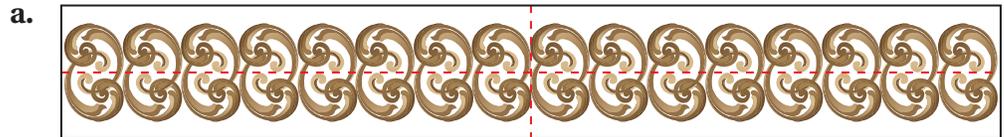
- Fold (reflect) on vertical axis. The pattern coincides.



❖ This frieze pattern is a reflection of itself when folded horizontally *and* vertically.

2 ACTIVITY: Frieze Patterns and Reflections

Work with a partner. Is the frieze pattern a reflection of itself when folded *horizontally, vertically, or neither*?



What Is Your Answer?

3. Draw a frieze pattern that is a reflection of itself when folded horizontally.
4. Draw a frieze pattern that is a reflection of itself when folded vertically.
5. Draw a frieze pattern that is not a reflection of itself when folded horizontally or vertically.
6. **IN YOUR OWN WORDS** How can you use reflections to classify a frieze pattern?

Practice

Use what you learned about reflections to complete Exercises 4–6 on page 230.

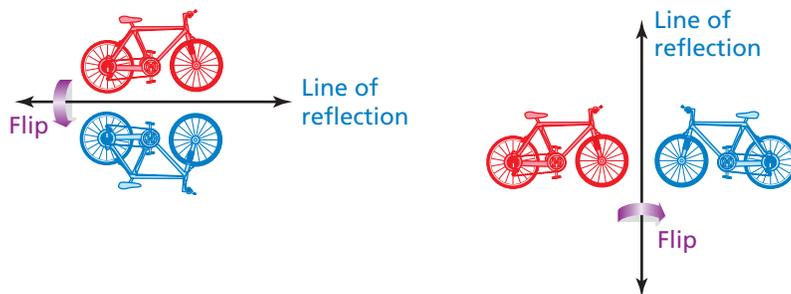
Key Vocabulary

reflection, p. 228
line of reflection,
p. 228

Key Idea

Reflections

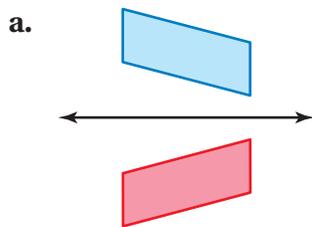
A **reflection**, or flip, is a transformation in which a figure is reflected in a line called the **line of reflection**. A reflection creates a mirror image of the original figure.



The original figure and its image have the same size and shape.

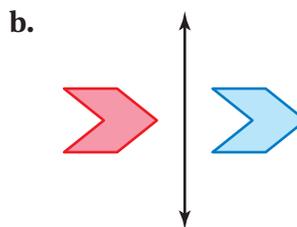
EXAMPLE 1 Identifying a Reflection

Tell whether the blue figure is a reflection of the red figure.



The red figure can be *flipped* to form the blue figure.

So, the blue figure is a reflection of the red figure.

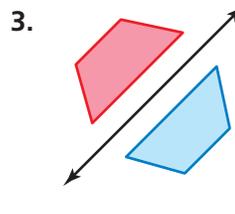
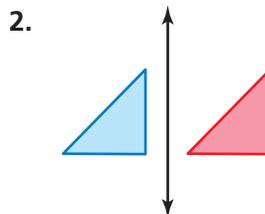
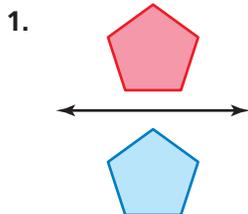


If the red figure were *flipped*, it would point to the left.

So, the blue figure is *not* a reflection of the red figure.

On Your Own

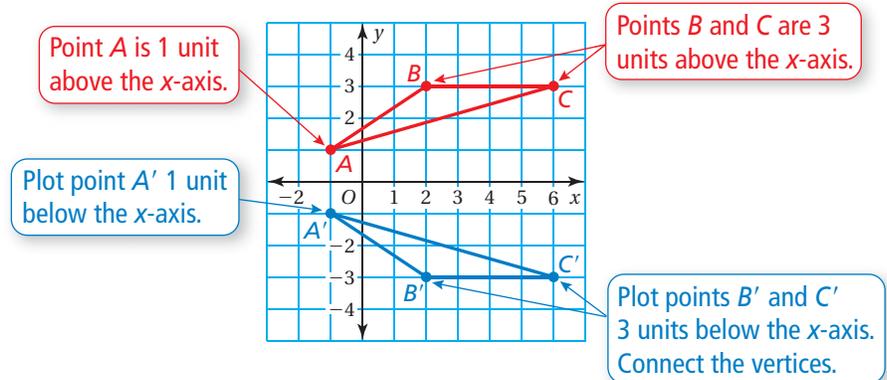
Tell whether the blue figure is a reflection of the red figure. Explain.



Now You're Ready
Exercises 4–9

EXAMPLE 2 Reflecting a Figure in the x -axis

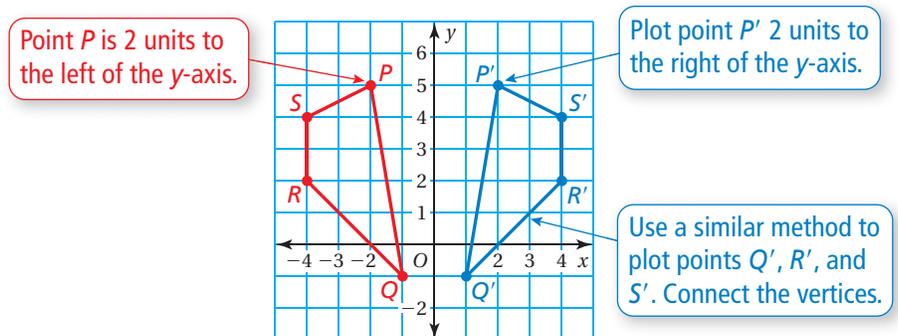
The vertices of a triangle are $A(-1, 1)$, $B(2, 3)$, and $C(6, 3)$. Draw this triangle and its reflection in the x -axis. What are the coordinates of the image?



∴ The coordinates of the image are $A'(-1, -1)$, $B'(2, -3)$, and $C'(6, -3)$.

EXAMPLE 3 Reflecting a Figure in the y -axis

The vertices of a quadrilateral are $P(-2, 5)$, $Q(-1, -1)$, $R(-4, 2)$, and $S(-4, 4)$. Draw this quadrilateral and its reflection in the y -axis. What are the coordinates of the image?



∴ The coordinates of the image are $P'(2, 5)$, $Q'(1, -1)$, $R'(4, 2)$, and $S'(4, 4)$.

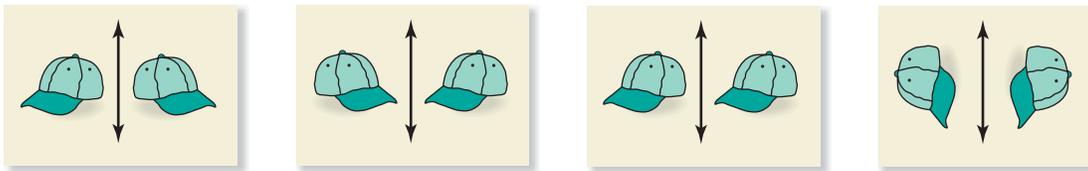
On Your Own

Now You're Ready
Exercises 10–17

- The vertices of a rectangle are $A(-4, -3)$, $B(-4, -1)$, $C(-1, -1)$, and $D(-1, -3)$.
 - Draw the rectangle and its reflection in the x -axis.
 - Draw the rectangle and its reflection in the y -axis.
 - Are the images in parts (a) and (b) the same size and shape? Explain.

Vocabulary and Concept Check

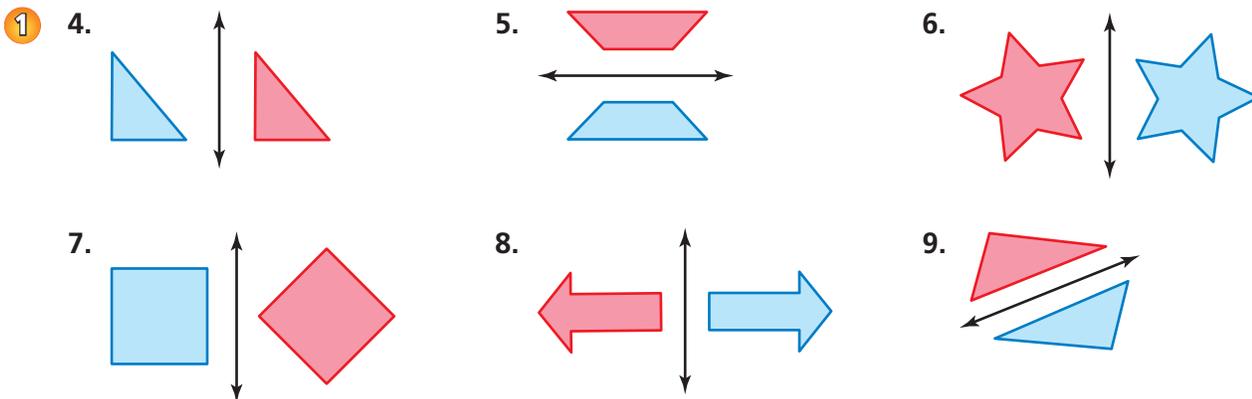
1. **WHICH ONE DOESN'T BELONG?** Which transformation does *not* belong with the other three? Explain your reasoning.



2. **WRITING** How can you tell when one figure is a reflection of another figure?
3. **REASONING** A figure lies entirely in Quadrant I. The figure is reflected in the x -axis. In which quadrant is the image?

Practice and Problem Solving

Tell whether the blue figure is a reflection of the red figure.



Find the coordinates of the figure after reflecting in the x -axis.

10. $A(3, 2), B(4, 4), C(1, 3)$ 11. $M(-2, 1), N(0, 3), P(2, 2)$
 12. $H(2, -2), J(4, -1), K(6, -3), L(5, -4)$ 13. $D(-2, -1), E(0, -2), F(1, -5), G(-1, -4)$

Find the coordinates of the figure after reflecting in the y -axis.

14. $Q(-4, 2), R(-2, 4), S(-1, 1)$ 15. $T(1, -1), U(4, 2), V(6, -2)$
 16. $W(2, -1), X(5, -2), Y(5, -5), Z(2, -4)$ 17. $J(2, 2), K(7, 4), L(9, -2), M(3, -1)$

18. **ALPHABET** Which letters look the same when reflected in the line?



The coordinates of a point and its image are given. Is the reflection in the x -axis or y -axis?

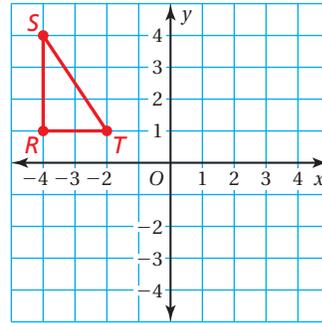
19. $(2, -2) \rightarrow (2, 2)$

20. $(-4, 1) \rightarrow (4, 1)$

21. $(-2, -5) \rightarrow (2, -5)$

22. $(-3, -4) \rightarrow (-3, 4)$

23. Translate the triangle 1 unit right and 5 units down. Then reflect the image in the y -axis.



24. **PROJECT** Use a computer drawing program to create photographs of people by copying one side of the person's face and reflecting it in a vertical line. Does the person look normal or very different?

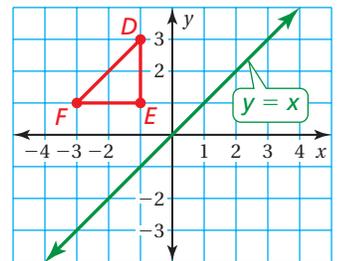
25. **MIRROR IMAGE** One of the faces shown is an exact reflection of itself. Which one is it? How can you tell?



26. **EMERGENCY VEHICLE** Hold a mirror to the left side of the photo of the vehicle.

- What word do you see in the mirror?
- Why do you think it is written that way on the front of the vehicle?

27. **Critical Thinking** Reflect the triangle in the line $y = x$. How are the x - and y -coordinates of the image related to the x - and y -coordinates of the original triangle?



Fair Game Review

what you learned in previous grades & lessons

Classify the angle as *acute*, *right*, *obtuse*, or *straight*.



32. **MULTIPLE CHOICE** 36 is 75% of what number?

(A) 27

(B) 48

(C) 54

(D) 63