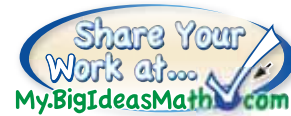


## 5.5 Translations

**Essential Question** How can you use translations to make a tessellation?



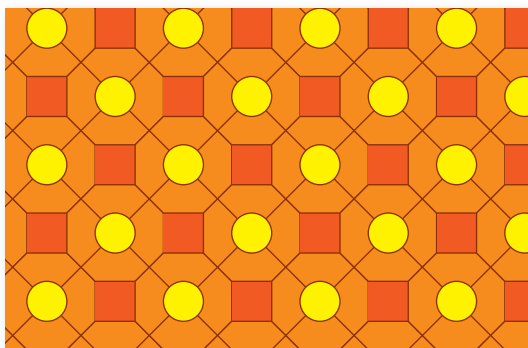
When you slide a tile it is called a **translation**. When tiles can be used to cover a floor with no empty spaces, the collection of tiles is called a *tessellation*.

### 1 ACTIVITY: Describing Tessellations

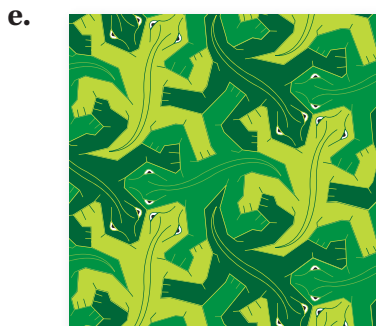
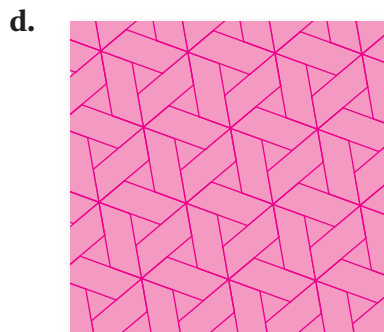
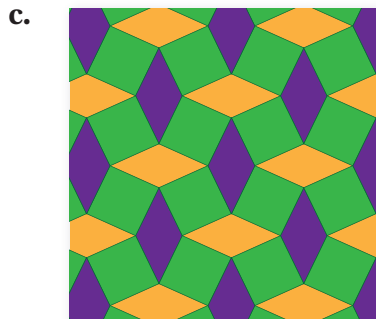
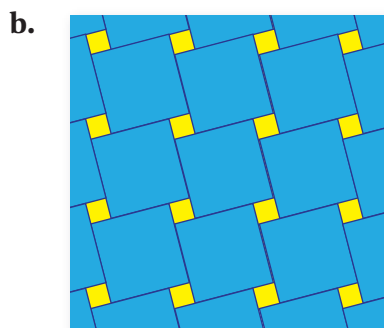
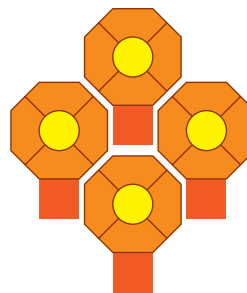
Work with a partner. Can you make the pattern by using a translation of single tiles that are all of the same shape and design? If so, show how.

a. Sample:

Tile Pattern



Single Tiles

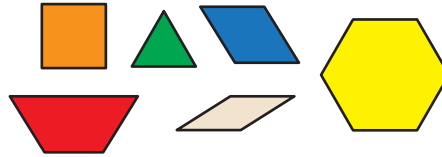


## 2 ACTIVITY: Tessellations and Basic Shapes



Work with a partner.

- a. Which pattern blocks can you use to make a tessellation?



- b. For each one that works, draw the tessellation.  
c. Can you make the tessellation using only translation, or do you have to rotate or flip the pattern blocks?

## 3 ACTIVITY: Designing Tessellations

Work with a partner. Design your own tessellation. Use one of the basic shapes from Activity 2.

Sample:



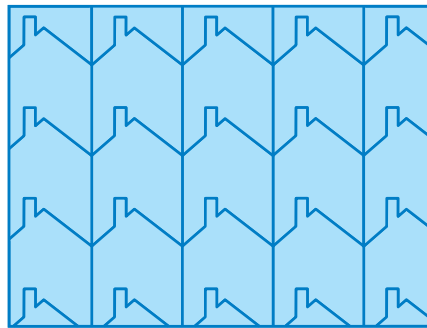
Start with a square.



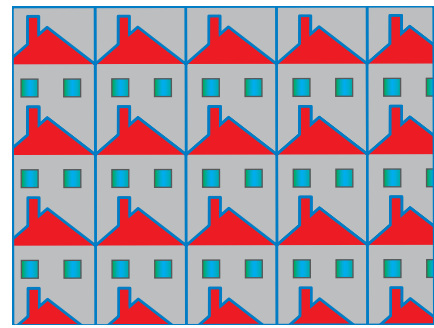
Cut a design out of one side.



Tape it to the other side to make your pattern.



Use the pattern and translations to make your tessellation.



Color the tessellation.

### What Is Your Answer?

- IN YOUR OWN WORDS** How can you use translations to make a tessellation? Give an example.
- Draw any parallelogram. Does it tessellate? Is it true that any parallelogram can be translated to make a tessellation? Explain why.

**Practice** →

Use what you learned about translations to complete Exercises 4–6 on page 224.

A **transformation** changes a figure into another figure. The new figure is called the **image**.

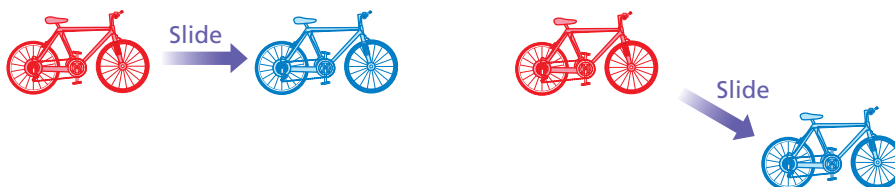
### Key Vocabulary

transformation, p. 222  
image, p. 222  
translation, p. 222

## Key Idea

### Translations

A **translation** is a transformation in which a figure *slides* but does not turn. Every point of the figure moves the same distance and in the same direction.

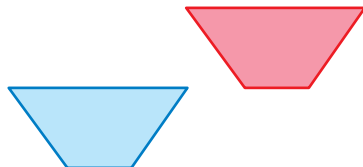


The original figure and its image have the same size and shape.

## EXAMPLE 1 Identifying a Translation

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

a.



The red figure *slides* to form the blue figure.

❖ So, the blue figure is a translation of the red figure.

b.



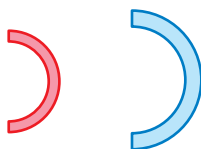
The red figure *turns* to form the blue figure.

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

### On Your Own

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

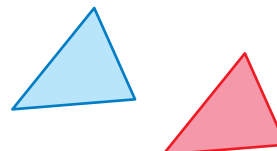
1.



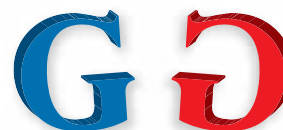
3.



2.



4.



Now You're Ready  
Exercises 4–9

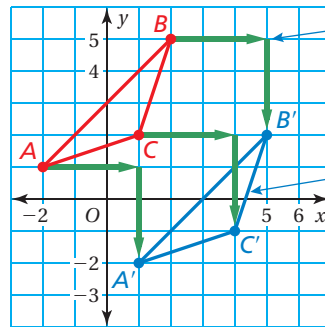
## EXAMPLE 2 Translating a Figure

Translate the red triangle 3 units right and 3 units down. What are the coordinates of the image?

### Reading

$A'$  is read "A prime."  
Use *prime* symbols when naming an image.

$A \rightarrow A'$   
 $B \rightarrow B'$   
 $C \rightarrow C'$



Move each vertex 3 units right and 3 units down.

Connect the vertices.  
Label as  $A'$ ,  $B'$ , and  $C'$ .

∴ The coordinates of the image are  $A'(1, -2)$ ,  $B'(5, 2)$ , and  $C'(4, -1)$ .

### On Your Own

Now You're Ready  
Exercises 10 and 11

5. The red triangle is translated 4 units left and 2 units up. What are the coordinates of the image?

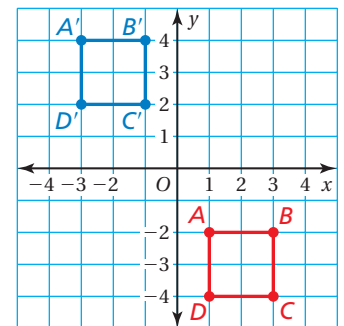
## EXAMPLE 3 Translating a Figure

The vertices of a square are  $A(1, -2)$ ,  $B(3, -2)$ ,  $C(3, -4)$ , and  $D(1, -4)$ . Draw the figure and its image after a translation 4 units left and 6 units up.

Subtract 4 from each  $x$ -coordinate.

Add 6 to each  $y$ -coordinate.

Vertices of $ABCD$	$(x - 4, y + 6)$	Vertices of $A'B'C'D'$
$A(1, -2)$	$(1 - 4, -2 + 6)$	$A'(-3, 4)$
$B(3, -2)$	$(3 - 4, -2 + 6)$	$B'(-1, 4)$
$C(3, -4)$	$(3 - 4, -4 + 6)$	$C'(-1, 2)$
$D(1, -4)$	$(1 - 4, -4 + 6)$	$D'(-3, 2)$



∴ The figure and its image are shown at the right.

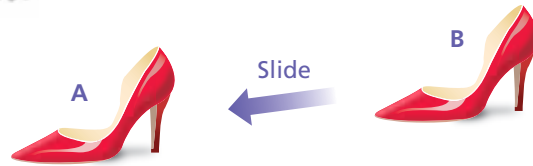
### On Your Own

Now You're Ready  
Exercises 12–15

6. The vertices of a triangle are  $A(-2, -2)$ ,  $B(0, 2)$ , and  $C(3, 0)$ . Draw the figure and its image after a translation 1 unit left and 2 units up.

## Vocabulary and Concept Check

- VOCABULARY** Which figure is the image?
- VOCABULARY** How do you translate a figure in a coordinate plane?
- CRITICAL THINKING** Can you translate the letters in the word TOKYO to form the word KYOTO? Explain.

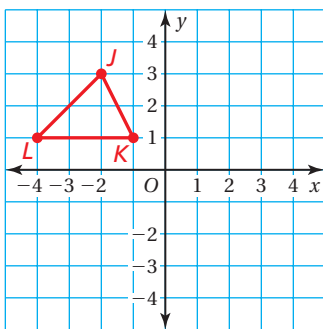


## Practice and Problem Solving

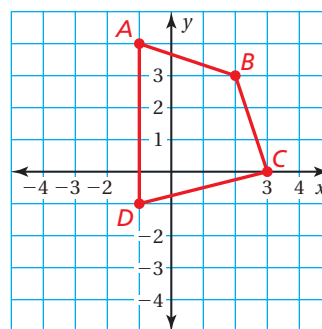
Tell whether the blue figure is a translation of the red figure.

- - 
  -
- - 
  -

- Translate the triangle 4 units right and 3 units down. What are the coordinates of the image?



- Translate the figure 2 units left and 4 units down. What are the coordinates of the image?



- The vertices of a triangle are  $L(0, 1)$ ,  $M(1, -2)$ , and  $N(-2, 1)$ . Draw the figure and its image after the translation.

- 1 unit left and 6 units up
- 5 units right
- 2 units right and 3 units up
- 3 units left and 4 units down

- ICONS** You can click and drag an icon on a computer screen. Is this an example of a translation? Explain.

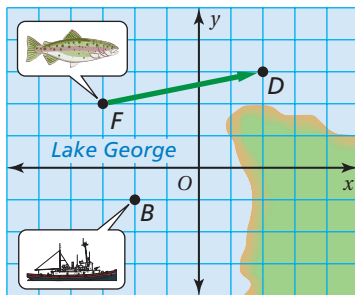
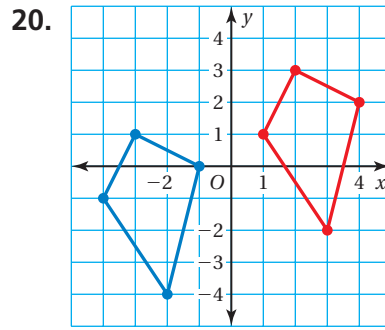
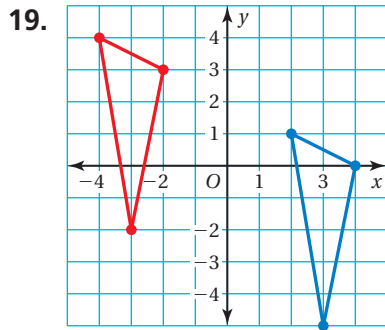


Describe the translation of the point to its image.

17.  $(3, -2) \rightarrow (1, 0)$

18.  $(-8, -4) \rightarrow (-3, 5)$

Describe the translation from the red figure to the blue figure.



21. **FISHING** A school of fish translates from point  $F$  to point  $D$ .

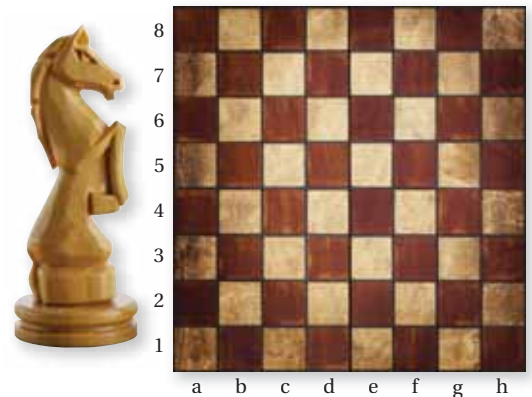
- Describe the translation of the school of fish.
- Can the fishing boat make a similar translation? Explain.
- Describe a translation the fishing boat could make to get to point  $D$ .

22. **REASONING** A triangle is translated 5 units right and 2 units up. Then the image is translated 3 units left and 8 units down. Write a translation of the original triangle to the ending position.

23. **Critical Thinking** In chess, a knight can move only in an L-shape pattern:

- two vertical squares then one horizontal square;
- two horizontal squares then one vertical square;
- one vertical square then two horizontal squares; or
- one horizontal square then two vertical squares.

Write a series of translations to move the knight from g8 to g5.



## Fair Game Review what you learned in previous grades & lessons

Tell whether each figure can be folded in half so that one side matches the other. *(Skills Review Handbook)*



28. **MULTIPLE CHOICE** You put \$550 in an account that earns 4.4% simple interest per year. How much interest do you earn in 6 months? *(Section 4.4)*

- (A) \$1.21      (B) \$12.10      (C) \$121.00      (D) \$145.20