English Spanish

5.5 Translations

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

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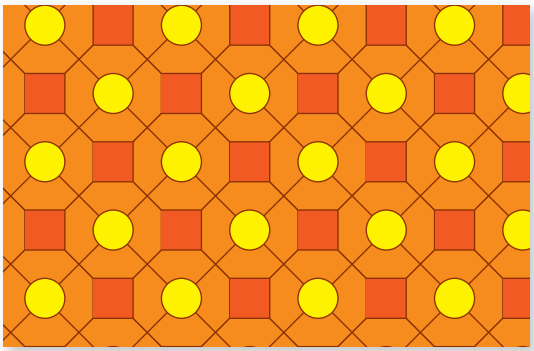
When you slide a tile it is called a **translation**. When tiles can be used to cover a floor with no empty spaces, the collection of tiles is called a *tessellation*.

1 ACTIVITY: Describing Tessellations

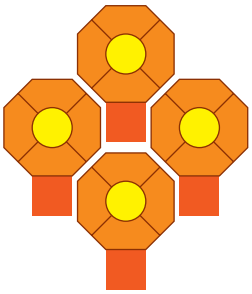
Work with a partner. Can you make the pattern by using a translation of single tiles that are all of the same shape and design? If so, show how.

a. Sample:

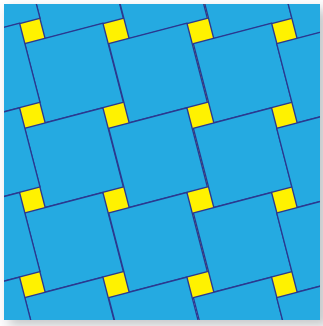
Tile Pattern



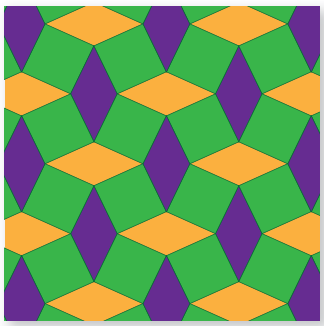
Single Tiles



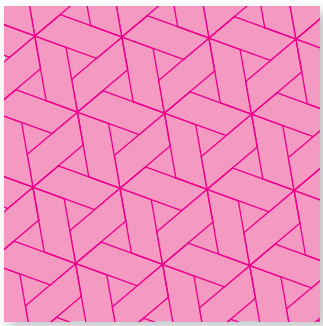
b.



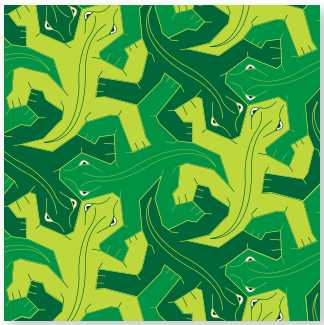
c.



d.



e.

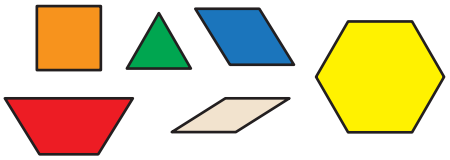


English Spanish

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

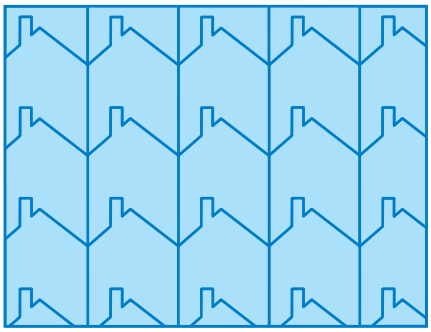
Work with a partner. Design your own tessellation. Use one of the basic shapes from Activity 2.

Sample:

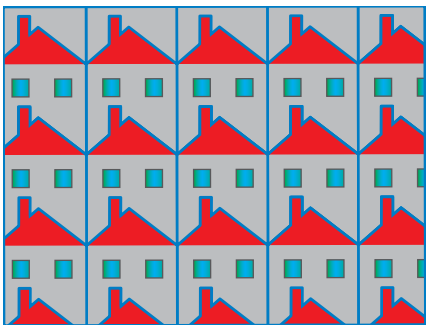
Start with a square.

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?

4. **IN YOUR OWN WORDS** How can you use translations to make a tessellation? Give an example.

5. 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.

English Spanish

5.5 Lesson

Check It Out
Lesson Tutorials
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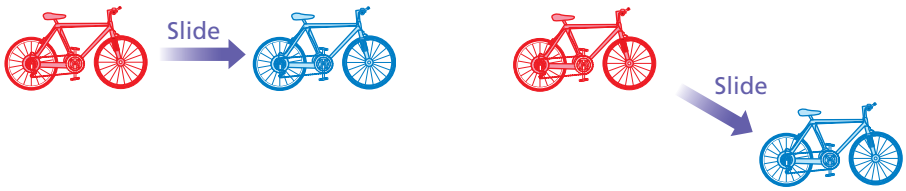
A **transformation** changes a figure into another figure. The new figure is called the **image**.

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.

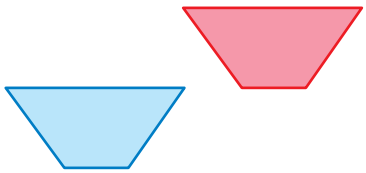


The original figure and its image have the same size and shape.

EXAMPLE 1 Identifying a Translation

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

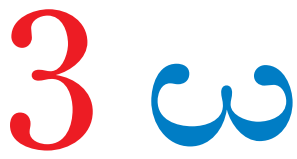
a.



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.

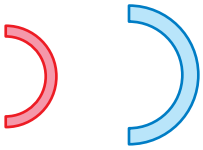
So, the blue figure is *not* a translation of the red figure.

On Your Own

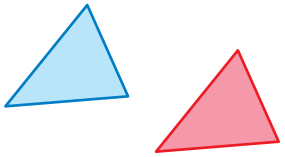
Now You're Ready
Exercises 4–9

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

1.

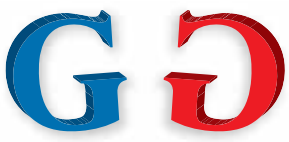


2.



3.

4.



Multi-Language Glossary at BigIdeasMath.com

English Spanish

EXAMPLE 2 Translating a Figure

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

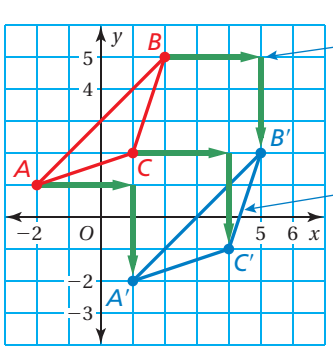
Reading

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

$A \rightarrow A'$

$B \rightarrow B'$

$C \rightarrow C'$



∴ 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?

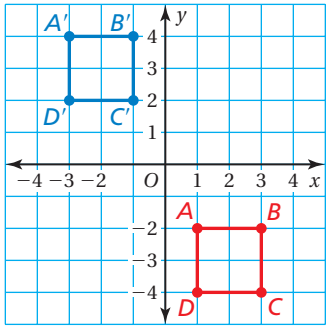
EXAMPLE 3 Translating a Figure

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.

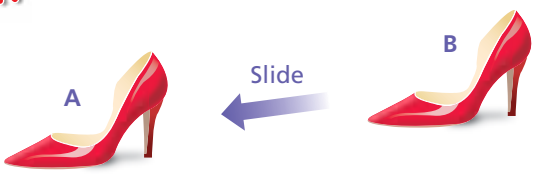
English Spanish

5.5 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

Vocabulary and Concept Check

1. **VOCABULARY** Which figure is the image?
2. **VOCABULARY** How do you translate a figure in a coordinate plane?

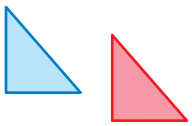


3. **CRITICAL THINKING** Can you translate the letters in the word TOKYO to form the word KYOTO? Explain.

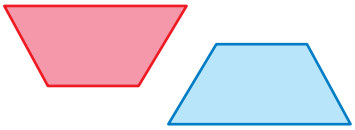
Practice and Problem Solving

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

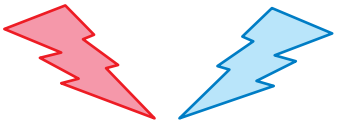
1 4.



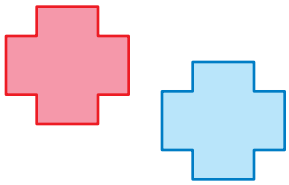
5.



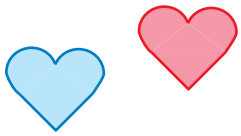
6.



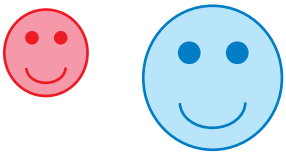
7.



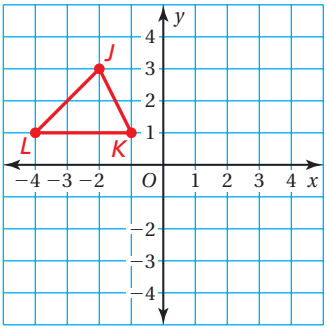
8.



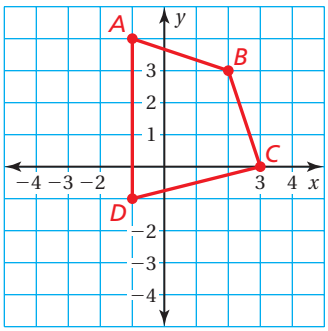
9.



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



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



3 **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.**

12. 1 unit left and 6 units up

13. 5 units right

14. 2 units right and 3 units up

15. 3 units left and 4 units down

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

English Spanish

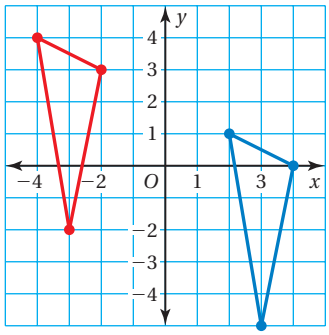
Describe the translation of the point to its image.

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

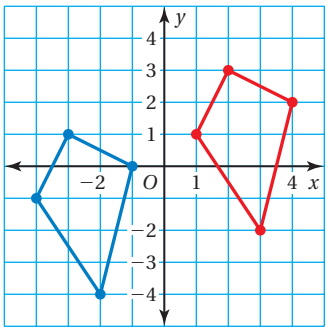
18. $(-8, -4) \rightarrow (-3, 5)$

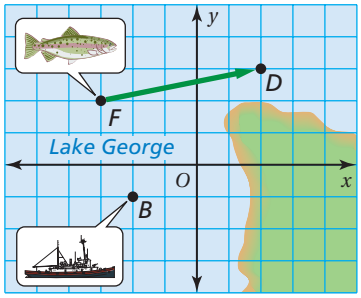
Describe the translation from the red figure to the blue figure.

19.



20.





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

a. Describe the translation of the school of fish.

b. Can the fishing boat make a similar translation? Explain.

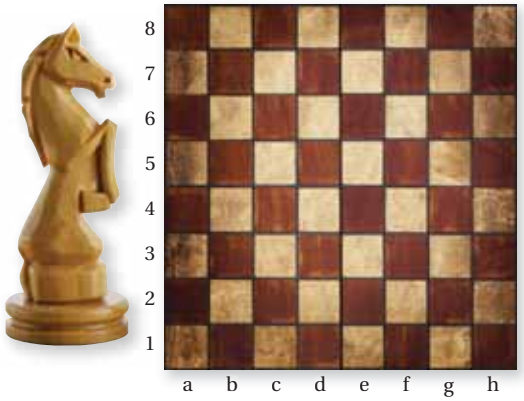
c. Describe a translation the fishing boat could make to get to point D.

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

24.

25.

26.

27.

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

Ⓐ \$1.21 Ⓑ \$12.10 Ⓒ \$121.00 Ⓓ \$145.20