

# 8-1


# Translations

### © CONTENT STANDARDS

8.G.1.a, 8.G.1.b, 8.G.1.c, 8.G.3

## What You'll Learn

To graph and describe translations in the coordinate plane

 **New Vocabulary** transformation, translation, image

## What You've Learned

- In Chapter 1, you graphed points in the coordinate plane.
- In Chapter 7, you determined whether two figures were congruent and wrote congruence statements.
- You identified similar figures and used proportions to find missing measurements in similar figures.

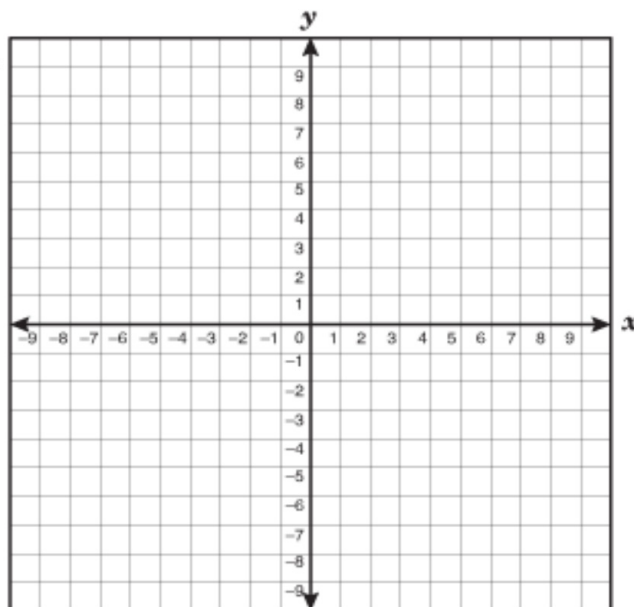


## Check Your Readiness

### The Coordinate Plane

Graph each point on the same coordinate plane.

1.  $A(3, -4)$
2.  $B(-5, 6)$
3.  $C(0, 5)$
4.  $D(-2, -3)$



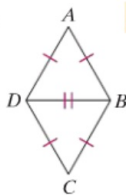


## Check Your Readiness

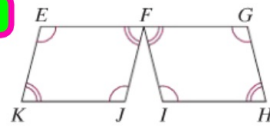
### Congruent Figures

Write a congruence statement for each pair of congruent figures.

5.



5.



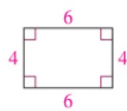
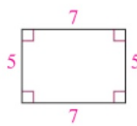
6.

### Similar Figures

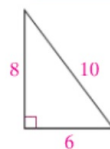
Are the figures in each pair similar? Explain.

7.

7.



8.



8.

## Why Learn This?

Translations are used in games and in the arts. You can use translations to plan a winning chess strategy or choreograph a figure-skating routine.

A **transformation** is a change in the position, shape, or size of a figure. A **translation** is a transformation that moves each point of a figure the same distance and in the same direction.

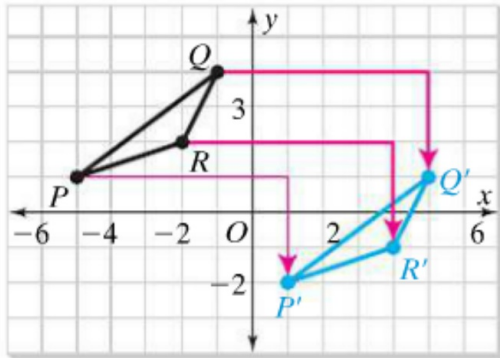
The figure you get after a transformation is an **image** of the original figure. To identify the image of point  $A$ , use prime notation ( $A'$ ). You read  $A'$  as "A prime."



**EXAMPLE****Graphing a Translation**

- 1 Multiple Choice** If  $\triangle PQR$  below is translated 6 units to the right and 3 units down, what are the coordinates of point  $P'$ ?

(A)  $P'(-1, -2)$  (B)  $P'(-2, 1)$  (C)  $P'(-2, -1)$  (D)  $P'(1, -2)$



Slide each vertex right 6 units and down 3 units. Label and connect the images of the vertices.

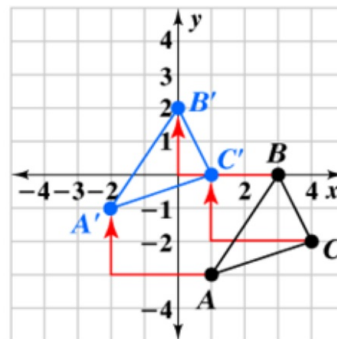
The answer is

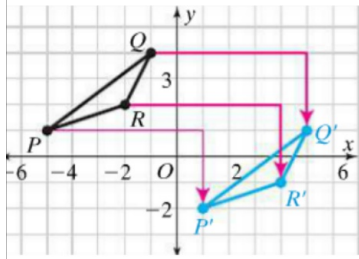
- 1 EXAMPLE**  $\triangle ABC$  has vertices  $A(1, -3)$ ,  $B(3, 0)$ , and  $C(4, -2)$ . Graph  $\triangle ABC$  and its image after a translation to the left 3 units and up 2 units. What are the coordinates of its images?

Slide each vertex left 3 units and up 2 units.

Connect the images of the vertices.

The coordinates of its image are  $A'(-2, -1)$ ,  $B'(0, 2)$ ,  $C'(1, 0)$ .





Notice in Example 1 that  $\triangle P'Q'R'$  is congruent to  $\triangle PQR$ . A translation of a figure preserves the side lengths and angle measures of the figure. You can use arrow notation to describe the translation. The translation of each point is shown below.

$$P(-5, 1) \rightarrow P'(1, -2) \quad \leftarrow \text{Read } P \rightarrow P' \text{ as "point } P \text{ goes to point } P \text{ prime."}$$

$$Q(-1, 4) \rightarrow Q'(5, 1)$$

$$R(-2, 2) \rightarrow R'(4, -1)$$

The arrow notation for the translation of the triangle is  $\triangle PQR \rightarrow \triangle P'Q'R'$ .

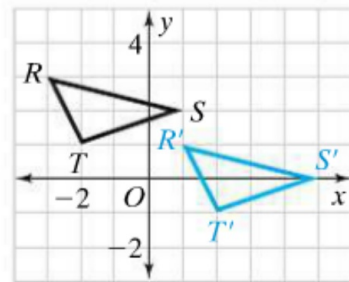
You can use arrow notation to write a general rule that describes a translation. For Example 1,  $(x, y) \rightarrow (x + 6, y - 3)$  shows an ordered pair  $(x, y)$  and describes a translation to the right 6 units and down 3 units.

## EXAMPLE Describing a Translation

- 2 Write a rule to describe the translation of the black triangle to the blue triangle.

Each point has moved 4 units to the right and 2 units down. So the translation adds 4 to the  $x$ -coordinate and subtracts 2 from the  $y$ -coordinate.

The rule is  $(x, y) \rightarrow (x + 4, y - 2)$ .

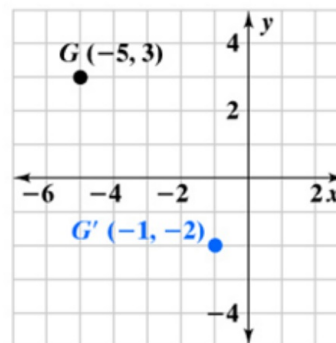


**2 EXAMPLE** Write a rule to describe the translation of  $G(-5, 3)$  to  $G'(-1, -2)$ .

Point  $G$  is moved 4 units to the right and 5 units down.

So, the translation adds 4 to the  $x$ -coordinate and subtracts 5 from the  $y$ -coordinate.

The rule is  $(x, y) \rightarrow (x + 4, y - 5)$ .



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***6 questions to answer on matching rules to translations***

**8-1 • Guided Problem Solving****gps Student Page 257, Exercises 16–18:**

Match each rule with the correct translation.

- A.  $(x, y) \rightarrow (x - 6, y + 2)$       I.  $P(4, -1) \rightarrow P'(3, -6)$   
 B.  $(x, y) \rightarrow (x + 3, y)$       II.  $Q(3, 0) \rightarrow Q'(-3, 2)$   
 C.  $(x, y) \rightarrow (x - 1, y - 5)$       III.  $R(-2, 4) \rightarrow R'(1, 4)$

**Understand**

1. What are you asked to do?
- 
- \_\_\_\_\_

**Plan and Carry Out**

2. Use the words
- left or right*
- and
- up or down*
- to describe the movement between each point and its image. Be sure to give the number of units each coordinate is translated.

Point  $P(4, -1)$  to  $P'(3, -6)$  \_\_\_\_\_Point  $Q(3, 0)$  to  $Q'(-3, 2)$  \_\_\_\_\_Point  $R(-2, 4)$  to  $R'(1, 4)$  \_\_\_\_\_

3. Which movements are written as addition? \_\_\_\_\_  
 4. Which movements are written as subtraction? \_\_\_\_\_  
 5. Match each rule with its translation.

A = \_\_\_\_\_      B = \_\_\_\_\_      C = \_\_\_\_\_

**Check**

6. How could you check your answers?
- 
- \_\_\_\_\_
- 
- \_\_\_\_\_

**Solve Another Problem**

7. Match each rule with the correct translation.

- A.  $(x, y) \rightarrow (x - 3, y - 4)$       I.  $P(5, -2) \rightarrow P'(5, -5)$   
 B.  $(x, y) \rightarrow (x + 4, y + 2)$       II.  $Q(1, 6) \rightarrow Q'(5, 8)$   
 C.  $(x, y) \rightarrow (x, y - 3)$       III.  $R(-4, 2) \rightarrow R'(-7, -2)$