

# Reteaching with Practice

For use with pages 421–428

**GOALS** Identify and use translations in the plane.

## VOCABULARY

A **translation** is a transformation that maps every two points  $P$  and  $Q$  in the plane to points  $P'$  and  $Q'$ , so that the following properties are true: 1)  $PP' = QQ'$  and 2)  $\overline{PP'} \parallel \overline{QQ'}$ , or  $\overline{PP'}$  and  $\overline{QQ'}$  are collinear.

A **vector** is a quantity that has both direction and *magnitude*, or size.

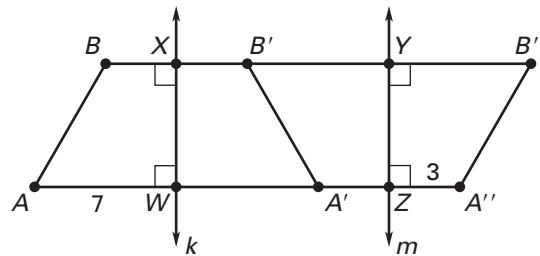
When a vector is drawn as  $\overrightarrow{PQ}$ , the **initial point**, or starting point, of the vector is point  $P$  and the **terminal point**, or ending point, of the vector is point  $Q$ .  $\overrightarrow{PQ}$  is read “vector  $PQ$ .”

The **component form** of a vector combines the horizontal and vertical components.

## EXAMPLE 1 Using Theorem 7.5

In the diagram, a reflection in line  $k$  maps  $\overline{AB}$  to  $\overline{A'B'}$ , a reflection in line  $m$  maps  $\overline{A'B'}$  to  $\overline{A''B''}$ ,  $k \parallel m$ ,  $AW = 7$ , and  $ZA'' = 3$ .

- Name some congruent segments.
- Does  $WZ = XY$ ? Explain.
- What is the length of  $\overline{BB''}$ ?



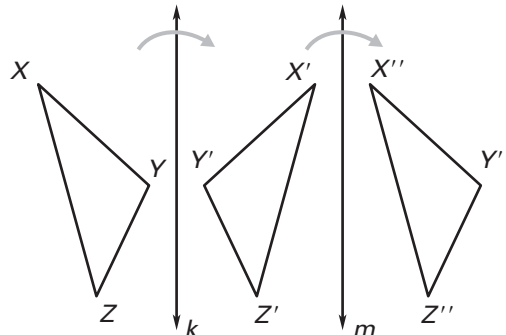
## SOLUTION

- Here are some sets of congruent segments:  $\overline{AB}$ ,  $\overline{A'B'}$ , and  $\overline{A''B''}$ ;  $\overline{BX}$  and  $\overline{XB'}$ ;  $\overline{B'Y}$  and  $\overline{YB''}$ .
- Yes,  $WZ = XY$  because  $\overline{WZ}$  and  $\overline{XY}$  are opposite sides of a rectangle.
- Because  $BB'' = AA''$ , the length of  $\overline{BB''}$  is  $7 + 7 + 3 + 3$ , or 20 units.

## Exercises for Example 1

In the diagram  $k \parallel m$ ,  $\triangle XYZ$  is reflected in line  $k$ , and  $\triangle X'Y'Z'$  is reflected in line  $m$ .

- Name two segments parallel to  $\overline{YY''}$ .
- If the length of  $\overline{ZZ''}$  is 6 cm, what is the distance between  $k$  and  $m$ ?
- A translation maps  $\triangle XYZ$  onto which triangle?
- Which lines are perpendicular to  $\overline{XX''}$ ?



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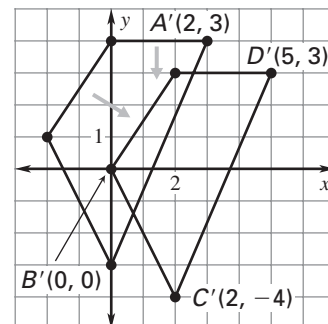
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### EXAMPLE 2 Translations in a Coordinate Plane

Sketch a quadrilateral with vertices  $A(0, 4)$ ,  $B(-2, 1)$ ,  $C(0, -3)$ , and  $D(3, 4)$ . Then sketch the image of the quadrilateral after the translation  $(x, y) \rightarrow (x + 2, y - 1)$ .

#### SOLUTION

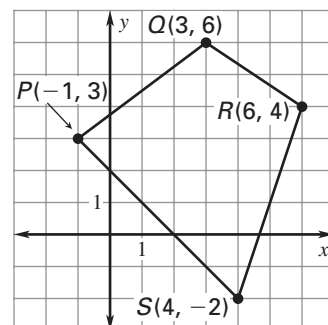
Plot the points as shown. Shift each point 2 units to the right and 1 unit down to find the translated vertices.



#### Exercises for Example 2

In Exercises 5–8, copy figure  $PQRS$  and draw its image after the translation.

5.  $(x, y) \rightarrow (x - 4, y + 1)$
6.  $(x, y) \rightarrow (x, y - 5)$
7.  $(x, y) \rightarrow (x - 2, y - 2)$
8.  $(x, y) \rightarrow (x + 7, y + 3)$

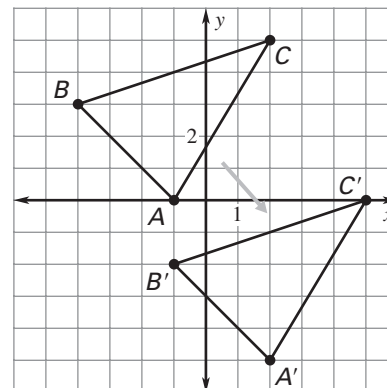


### EXAMPLE 3 Finding Vectors

In the diagram,  $\triangle ABC$  maps onto  $\triangle A'B'C'$  by a translation. Write the component form of the vector that can be used to describe the translation.

#### SOLUTION

Choose any vertex and its image, say  $A$  and  $A'$ . To move from  $A$  to  $A'$ , you move 3 units to the right and 5 units down. The component form of the vector is  $\langle 3, -5 \rangle$ .



#### Exercises for Example 3

In Exercises 9 and 10, write the component form of the vector that describes the translation which maps  $\triangle ABC$  onto  $\triangle A'B'C'$ .

9.  $A(3, 6)$ ,  $B(1, 0)$ ,  $C(4, 8)$ ;  $A'(1, 2)$ ,  $B'(-1, -4)$ ,  $C'(2, 4)$
10.  $A(-6, -2)$ ,  $B(-5, 3)$ ,  $C(1, -1)$ ;  $A'(-3, -5)$ ,  $B'(-2, 0)$ ,  $C'(4, -4)$