

LESSON
9.1**Study Guide**

For use with pages 572–579

GOAL Use a vector to translate a figure.**Vocabulary**

An **image** is a new figure that is produced from the transformation of another figure.

A **preimage** is the original figure in the transformation of a figure.

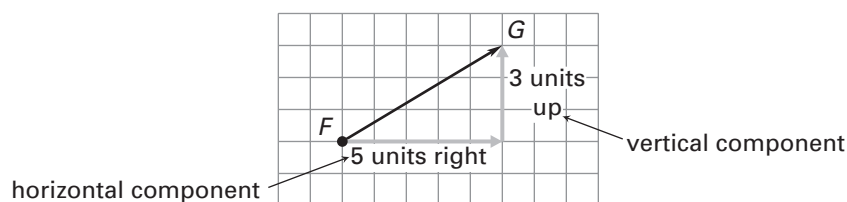
An **isometry** is a transformation that preserves length and angle measure.

Theorem 9.1 Translation Theorem: A translation is an isometry.

A **vector** is a quantity that has both direction and magnitude, and is represented in the coordinate plane by an arrow drawn from one point to another.

The **initial point**, or starting point, of the vector below is F .

The **terminal point**, or ending point, of the vector below is G .



The **component form of a vector** combines the horizontal and vertical components. The component form of \overline{FG} is $\langle 5, 3 \rangle$.

EXAMPLE 1 Translate a figure in the coordinate plane

Graph quadrilateral $ABCD$ with vertices $A(-3, 4)$, $B(-3, 7)$, $C(2, 8)$, and $D(2, 4)$. Find the image of each vertex after the translation $(x, y) \rightarrow (x + 4, y - 3)$. Then, graph the image using prime notation.

Solution

STEP 1 Draw quadrilateral $ABCD$.

STEP 2 Find the translation of each vertex by adding 4 to its x -coordinate and subtracting 3 from its y -coordinate.

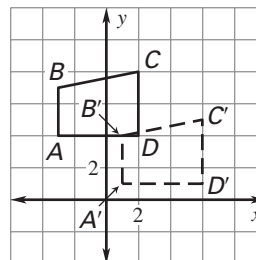
$$(x, y) \rightarrow (x + 4, y - 3)$$

$$A(-3, 4) \rightarrow A'(1, 1)$$

$$B(-3, 7) \rightarrow B'(1, 4)$$

$$C(2, 8) \rightarrow C'(6, 5)$$

$$D(2, 4) \rightarrow D'(6, 1)$$



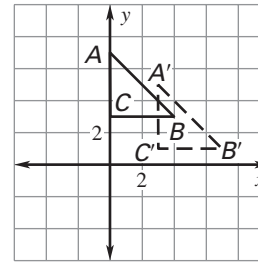
STEP 3 Graph the image.

LESSON
9.1**Study Guide** *continued*
For use with pages 572–579**EXAMPLE 2** Write a rule for the translation

Write a rule for the translation of $\triangle ABC$ to $\triangle A'B'C'$.

Solution

To go from A to A' , move 3 units right and 2 units down. So, a rule for the translation is $(x, y) \rightarrow (x + 3, y - 2)$.

**Exercises for Examples 1 and 2**

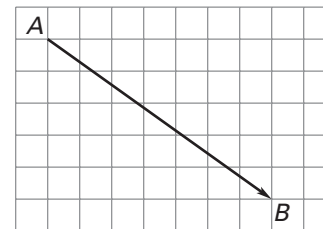
1. Draw $\triangle RST$ with vertices $R(1, 1)$, $S(4, 1)$, and $T(2, 4)$. Find the image of each vertex after the translation $(x, y) \rightarrow (x + 2, y - 3)$. Graph the image using prime notation.
2. The image of $(x, y) \rightarrow (x + 5, y - 6)$ is $\overline{P'Q'}$ with endpoints $P'(-2, 5)$ and $Q'(3, 2)$. Find the coordinates of the endpoints of the preimage.
3. In Example 2, write a rule to translate $\triangle A'B'C'$ to $\triangle ABC$.

EXAMPLE 3 Identify vector components

Name the vector and write its component form.

Solution

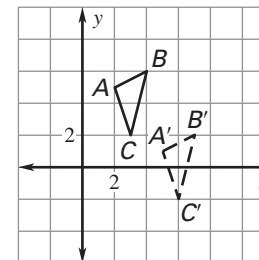
The vector is \overrightarrow{AB} . From initial point A to terminal point B , you move 7 units right and 5 units down. So, the component form is $\langle 7, -5 \rangle$.

**EXAMPLE 4** Use a vector to translate a figure

The vertices of $\triangle ABC$ are $A(2, 5)$, $B(4, 6)$, and $C(3, 2)$. Translate $\triangle ABC$ using the vector $\langle 3, -4 \rangle$.

Solution

First, graph $\triangle ABC$. Use $\langle 3, -4 \rangle$ to move each vertex 3 units to the right and 4 units down. Label the image vertices. Draw $\triangle A'B'C'$.

**Exercises for Examples 3 and 4**

4. Name the vector and write its component form.
5. The vertices of $\triangle LMN$ are $L(3, 3)$, $M(6, 4)$, and $N(10, 2)$. Translate $\triangle LMN$ using the vector $\langle -3, 5 \rangle$.

