Translate point *P*. State the coordinates of *P′*.

1. $P(-4, 4)$; 2 units down, 2 units right

2. $P(-3, -2)$; 3 units right, 3 units up

3. $P(2, 2)$; 2 units down, 2 units right

Review the theorem.

Alternate Interior Angles Theorem (Theorem 3.2)

Alternate Exterior Angles Theorem (Theorem 3.3)

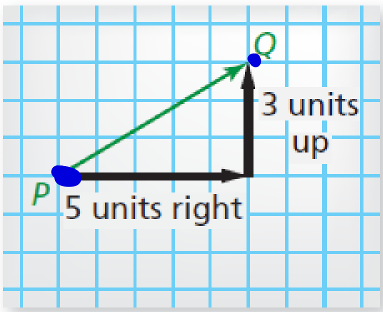
Essential Question

How can you translate a figure in a coordinate plane?

Core Concept

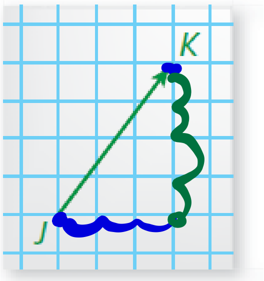
Vectors

The diagram shows a vector. The **initial point**, or starting point, of the vector is P, and the **terminal point**, or ending point, is Q. The vector is named $\overrightarrow{PQ}$, which is read as "vector PQ." The **horizontal component** of $\overrightarrow{PQ}$ is 5, and the **vertical component** is 3. The **component form** of a vector combines the horizontal and vertical components. So, the component form of $\overrightarrow{PQ}$ is $\langle 5, 3 \rangle$.



$\overrightarrow{PQ}$

In the diagram, name the vector and write its component form.



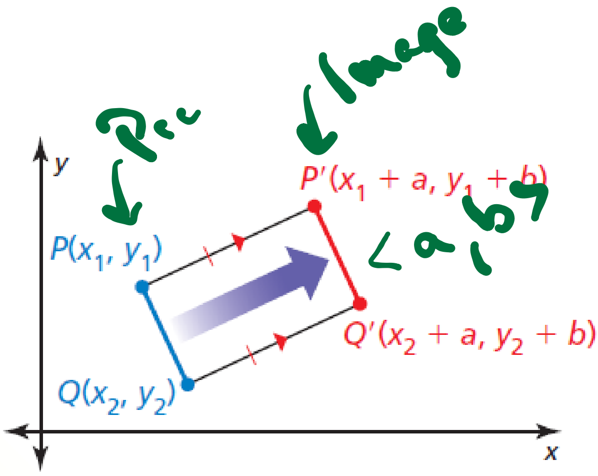
$\overrightarrow{JK}$ 3 right
4 up

Horizontal: 3 units RIGHT
Vertical: 4 units up

Core Concept

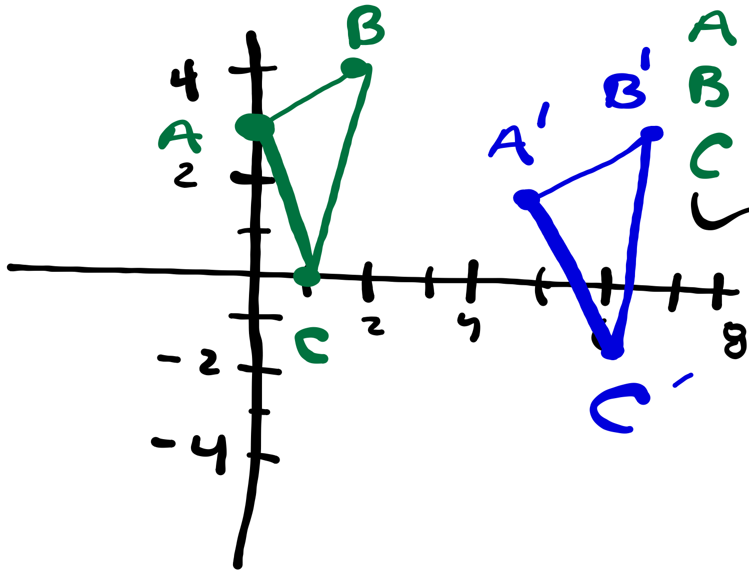
Translations

A **translation** moves every point of a figure the same distance in the same direction. More specifically, a translation *maps*, or moves, the points P and Q of a plane figure along a vector $\langle a, b \rangle$ to the points P' and Q', so that one of the following statements is true.



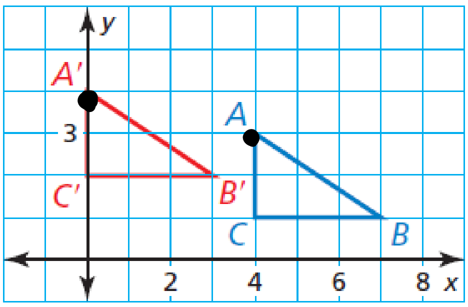
- $PP' = QQ'$ and $\overline{PP'} \parallel \overline{QQ'}$, or
- $PP' = QQ'$ and $\overline{PP'}$ and $\overline{QQ'}$ are collinear.

The vertices of $\triangle ABC$ are $A(0, 3)$, $B(2, 4)$, and $C(1, 0)$. Translate $\triangle ABC$ using the vector $\langle 5, -1 \rangle$.



$\triangle ABC$	$\xrightarrow{\langle 5,-1\rangle}$	$\triangle A'B'C'$
$A(0,3)$		$A'(5,2)$
$B(2,4)$	$\Longrightarrow$	$B'(7,3)$
$C(1,0)$		$C'(6,-1)$
Preimage		Image

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



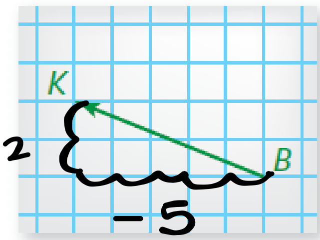
$\langle -4, 1 \rangle$

$A(4,3)$ $A'(0,4)$
$B(7,1)$ $B'(3,2)$

Graph quadrilateral *ABCD* with vertices *A*(−1, 2), *B*(−1, 5), *C*(4, 6), and *D*(4, 2) and its image after the translation $\boxed{(x, y) \rightarrow (x + 3, y - 1)}$.

$\langle 3, -1 \rangle$

1. Name the vector and write its component form.



+2

-5

$\overrightarrow{BK}$ $\langle -5, 2 \rangle$

2. The vertices of △*LMN* are *L*(2, 2), *M*(5, 3), and *N*(9, 1). Translate △*LMN* usingthe vector ⟨−2, 6⟩.

L(2, 2)
M(5, 3)
N(9, 1)

$\xRightarrow[\langle -2, 6 \rangle]{}$

L′(0, 8)
M′(3, 9)
N′(7, 7)

Preimage

Image

Postulate

Postulate 4.1 Translation Postulate

A translation is a rigid motion.

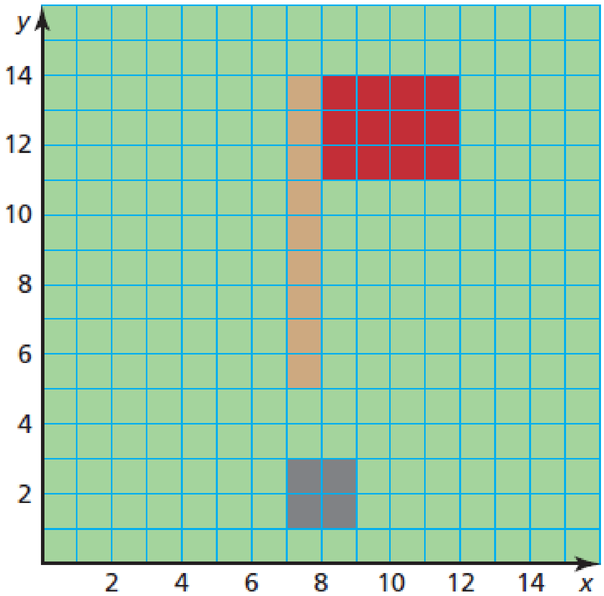
Theorem

Theorem 4.1 Composition Theorem

The composition of two (or more) rigid motions is a rigid motion.

Proof Ex. 35, p. 180

You are designing a favicon for a golf website. In an image-editing program, you move the red rectangle 2 units left and 3 units down. Then you move the red rectangle 1 unit right and 1 unit up. Rewrite the composition as a single translation.



6. Graph $\overline{VW}$ with endpoints $V(-6, -4)$ and $W(-3, 1)$ and its image after the composition.

Translation: $(x, y) \rightarrow (x + 3, y + 1)$

Translation: $(x, y) \rightarrow (x - 6, y - 4)$

Homework

p 178 #1, 5, 6, 9

11 - 14, 26 + 27