

Section 3.2 Translations

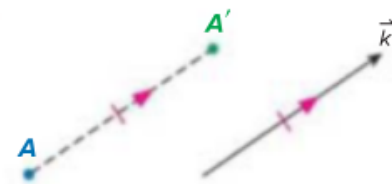
1 Draw Translations Recall that a translation or *slide* is a transformation that moves all points of a figure the same distance in the same direction. Since vectors can be used to describe both distance and direction, vectors can be used to define translations.

$\langle a, b \rangle$

Key Concept Translation

A translation is a function that maps each point to its image along a vector, called the **translation vector**, such that

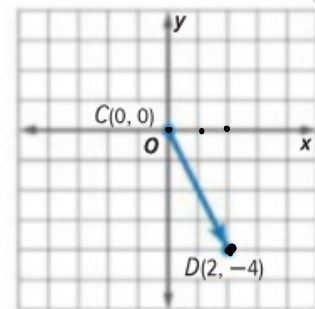
- each segment joining a point and its image has the same length as the vector, and
- this segment is also parallel to the vector.



Point A' is a translation of point A along translation vector \vec{k} .

2 Draw Translations in the Coordinate Plane Recall that a vector in the coordinate plane can be written as $\langle a, b \rangle$, where a represents the horizontal change and b is the vertical change from the vector's tip to its tail. \overrightarrow{CD} is represented by $\langle 2, -4 \rangle$.

Written in this form, called the component form, a vector can be used to translate a figure in the coordinate plane.

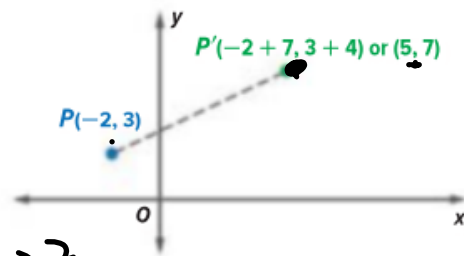


Key Concept Translation in the Coordinate Plane

Words To translate a point along vector $\langle a, b \rangle$, add a to the x -coordinate and b to the y -coordinate.

Symbols $(x, y) \rightarrow (x + a, y + b)$

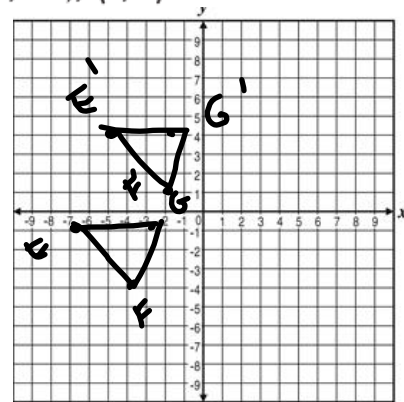
Example The image of $P(-2, 3)$ translated along vector $\langle 7, 4 \rangle$ is $P'(5, 7)$.



Graph each figure and its image along the given vector.

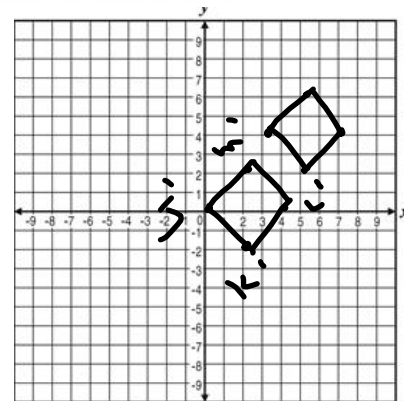
- a. $\triangle EFG$ with vertices $E(-7, -1)$, $F(-4, -4)$, and $G(-3, -1)$; $\langle 2, 5 \rangle$

$$\begin{aligned} E' &(-5, 4) \\ F' &(-2, +1) \\ G' &(-1, 4) \end{aligned}$$



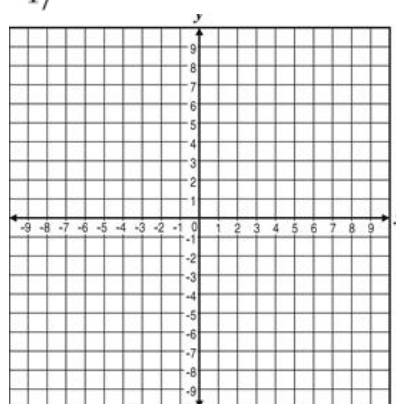
- b. square $JKLM$ with vertices $J(3, 4)$, $K(5, 2)$, $L(7, 4)$, and $M(5, 6)$; $\langle -3, -4 \rangle$

$$\begin{aligned} J' &(0, 0) \\ K' &(2, -2) \\ L' &(4, 0) \\ M' &(2, 2) \end{aligned}$$

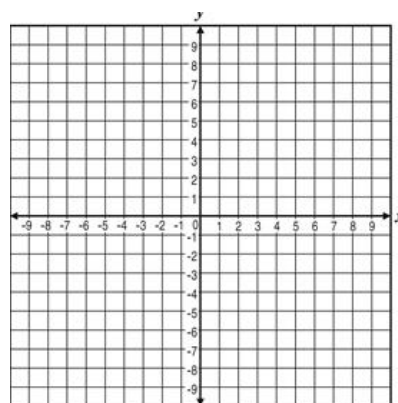


Guided Practice

2A. $\triangle ABC$ with vertices $A(2, 6)$, $B(1, 1)$, and $C(7, 5)$; $\langle -4, -1 \rangle$

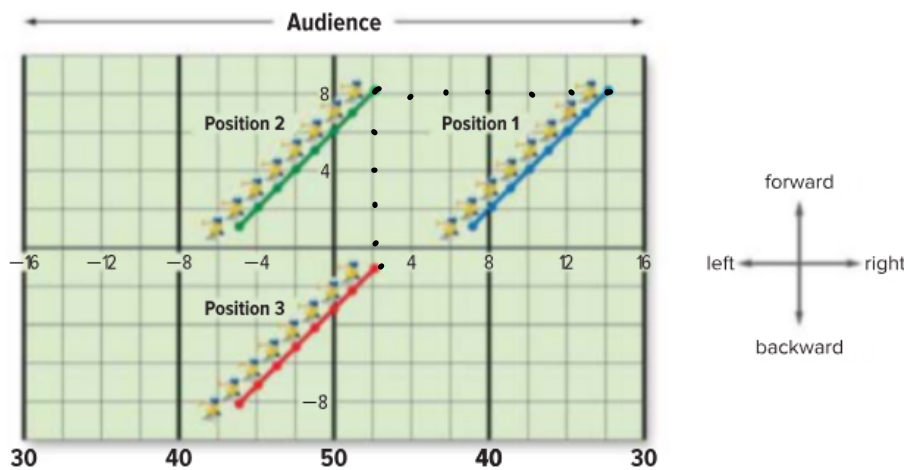


2B. quadrilateral $QRST$ with vertices $Q(-8, -2)$, $R(-9, -5)$, $S(-4, -7)$, and $T(-4, -2)$; $\langle 7, 1 \rangle$



Real-World Example 3 Describing Translations


MARCHING BAND In one part of a marching band's performance, a line of trumpet players starts at position 1, marches to position 2, and then to position 3. Each unit on the graph represents one step.



- a. Describe the translation of the trumpet line from position 1 to position 2 in coordinate notation and in words.

$$\langle -12, 0 \rangle$$

- b. Describe the translation of the line from position 1 to position 3 using a translation vector.

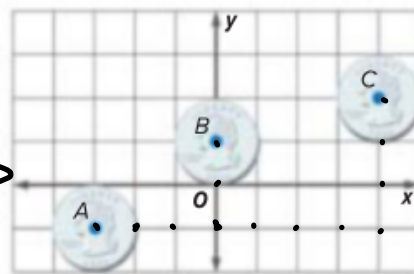
$$\langle -12, -9 \rangle$$

Guided Practice

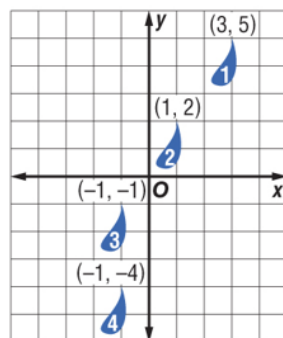
3. **ANIMATION** A coin is filmed using stop-motion animation so that it appears to move.

A. Describe the translation from A to B in coordinate notation and in words. $\langle 3, 2 \rangle$

B. Describe the translation from A to C using a translation vector. $\langle 7, 3 \rangle$



A. ANIMATION The graph shows repeated translations that result in the animation of the raindrop. Describe the translation of the raindrop from position 2 to position 3 in function notation and in words.



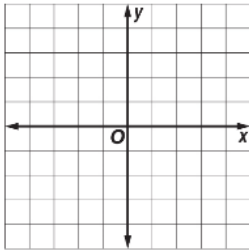
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3-2 Skills Practice

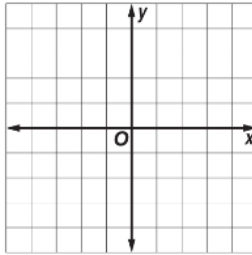
Translations

Graph each figure and its image along the given vector.

1. $\triangle JKL$ with vertices $J(-4, -4)$, $K(-2, -1)$, and $L(2, -4)$; $\langle 2, 5 \rangle$

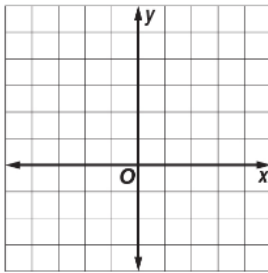


2. quadrilateral $LMNP$ with vertices $L(4, 2)$, $M(4, -1)$, $N(0, -1)$, and $P(1, 4)$; $\langle -4, -3 \rangle$

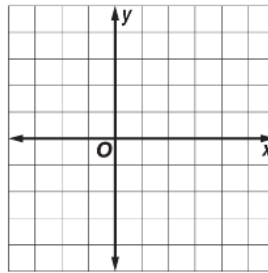


Graph each figure and its image along the given vector.

3. quadrilateral $TUWX$ with vertices $T(-1, 1)$, $U(4, 2)$, $W(1, 5)$, and $X(-1, 3)$; $\langle -2, -4 \rangle$



4. pentagon $DEFGH$ with vertices $D(-1, -2)$, $E(2, -1)$, $F(5, -2)$, $G(4, -4)$, and $H(1, -4)$; $\langle -1, 5 \rangle$



ANIMATION Find the translation that moves the figure on the coordinate plane.

5. figure 1 \rightarrow figure 2
6. figure 2 \rightarrow figure 3
7. figure 3 \rightarrow figure 4

