

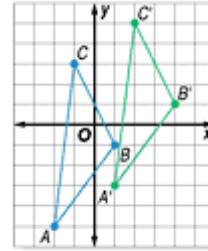
### Lesson 10-3

#### Example 1 Translation in a Coordinate Plane

The vertices of  $\triangle ABC$  are  $A(-2, -5)$ ,  $B(1, -1)$ , and  $C(-1, 3)$ . Graph the triangle and the image of  $\triangle ABC$  after a translation of 3 units right and 2 units up.

This translation can be written as the ordered pair  $(3, 2)$ . To find the coordinates of the translated image, add 3 to each  $x$ -coordinate and add 2 to each  $y$ -coordinate.

vertex	3 right, 2 up	translation
$A(-2, -5)$	+ $(3, 2)$	$\rightarrow (1, -3)$
$B(1, -1)$	+ $(3, 2)$	$\rightarrow (4, 1)$
$C(-1, 3)$	+ $(3, 2)$	$\rightarrow (2, 5)$



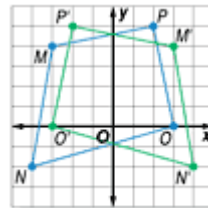
The coordinates of the vertices of  $\triangle A'B'C'$  are  $A'(1, -3)$ ,  $B'(4, 1)$ , and  $C'(2, 5)$ . The graph of the translated image is shown.

#### Example 2 Reflection in a Coordinate Plane

The vertices of the figure are  $M(-3, 4)$ ,  $N(-4, -2)$ ,  $O(3, 0)$ , and  $P(2, 5)$ . Graph the figure and the image of the figure after a reflection over the  $y$ -axis.

To find the coordinates of the vertices of the image after a reflection over the  $y$ -axis, use the same  $y$ -coordinate and multiply the  $x$ -coordinate by  $-1$ .

vertex	reflection
$M(-3, 4)$	$\rightarrow (-3 \cdot -1, 4) \rightarrow M'(3, 4)$
$N(-4, -2)$	$\rightarrow (-4 \cdot -1, -2) \rightarrow N'(4, -2)$
$O(3, 0)$	$\rightarrow (3 \cdot -1, 0) \rightarrow O'(-3, 0)$
$P(2, 5)$	$\rightarrow (2 \cdot -1, 5) \rightarrow P'(-2, 5)$



The coordinates of the vertices of the figure are  $M'(3, 4)$ ,  $N'(4, -2)$ ,  $O'(-3, 0)$ , and  $P'(-2, 5)$ . The graph of the reflection is shown.

**Example 3      Rotations in a Coordinate Plane**

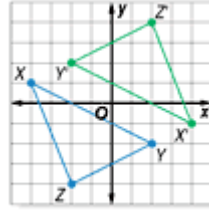
**A figure has vertices  $X(-4, 1)$ ,  $Y(2, -2)$ , and  $Z(-2, -4)$ . Graph the figure and the image of the figure after a rotation of  $180^\circ$ .**

To rotate the figure, multiply both coordinates of each point by  $-1$ .

$$X(-4, 1) \rightarrow X'(4, -1)$$

$$Y(2, -2) \rightarrow Y'(-2, 2)$$

$$Z(-2, -4) \rightarrow Z'(2, 4)$$



The coordinates of the vertices of the figure are  $X'(4, -1)$ ,  $Y'(-2, 2)$  and  $Z'(2, 4)$ . The graph of the rotation is shown.