

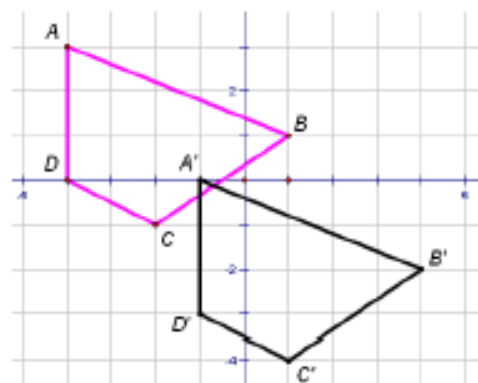
Translations

SOL G.3d (2009)

A **translation** is a transformation that moves a figure horizontally and/or vertically across a plane. Like reflections, translations are *isometric*. The preimage and image are always congruent.

Example 1: Quadrilateral $ABCD$ has vertices $A(-4, 3)$, $B(1, 1)$, $C(-2, -1)$, and $D(-4, 0)$. Graph $ABCD$ and its image for the translation $(x, y) \rightarrow (x + 3, y - 3)$.

The rule $(x, y) \rightarrow (x + 3, y - 3)$ indicates that the x -coordinate will increase by 3, moving the figure 3 units to the right and the y -coordinate will decrease by 3, moving the figure 3 units down.



$$\begin{aligned} A(-4, 3) &\rightarrow A'(-4 + 3, 3 - 3) \\ &\rightarrow A'(-1, 0) \end{aligned}$$

$$\begin{aligned} B(1, 1) &\rightarrow B'(1 + 3, 1 - 3) \\ &\rightarrow B'(4, -2) \end{aligned}$$

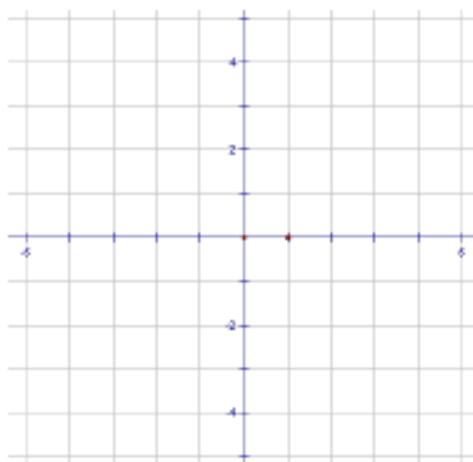
$$\begin{aligned} C(-2, -1) &\rightarrow C'(-2 + 3, -1 - 3) \\ &\rightarrow C'(1, -4) \end{aligned}$$

$$\begin{aligned} D(-4, 0) &\rightarrow D'(-4 + 3, 0 - 3) \\ &\rightarrow D'(-1, -3) \end{aligned}$$

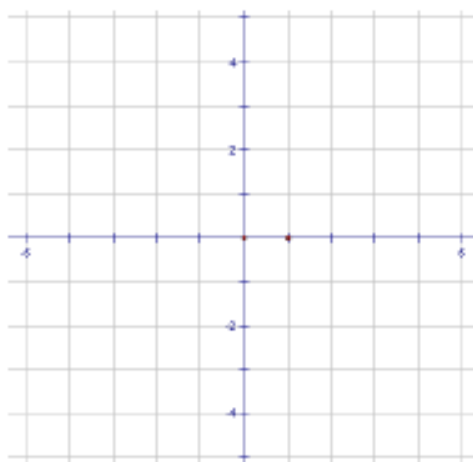
Practice

Graph each figure and its image under the given translation.

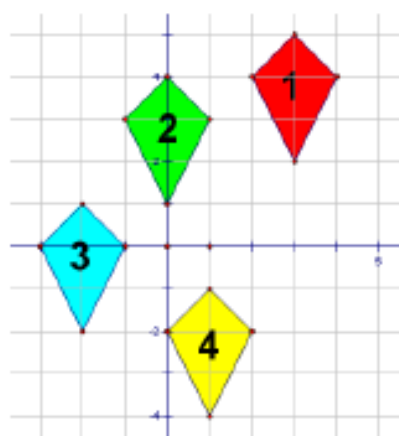
- triangle GUT with vertices $G(5, 1)$, $U(3, -2)$, $T(1, 0)$ under the translation $(x, y) \rightarrow (x - 5, y + 3)$



- quadrilateral $TIRE$ with vertices $T(-3, -5)$, $I(-1, -4)$, $R(2, 2)$, and $E(-2, 3)$ under the translation $(x, y) \rightarrow (x + 1, y + 2)$



Example 2: Translations are used in computer animation to create movement of objects. The following graph shows repeated translation of a kite. Write a translation to move kite 1 to kite 2 and kite 3 to kite 4.



Right: $x + \text{distance in units}$

Left: $x - \text{distance in units}$

Up: $y + \text{distance in units}$

Down: $y - \text{distance in units}$

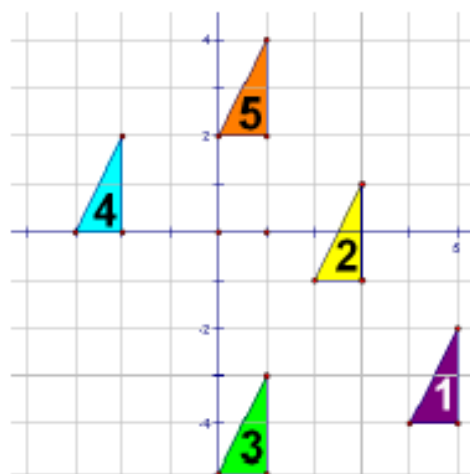
1 to 2: $(x, y) \rightarrow (x - 3, y - 1)$

This indicates movement 3 units left and 1 unit down.

3 to 4: $(x, y) \rightarrow (x + 3, y - 2)$

This indicates movement 3 units right and 2 units down.

Write a translation rule that moves the figure on the coordinate plane.



3. figure 1 \rightarrow figure 5

4. figure 3 \rightarrow figure 5

5. figure 4 \rightarrow figure 1

6. figure 2 \rightarrow figure 3