Translations

A translation is a transformation in a plane that maps all points of a preimage the same distance and in the same direction.
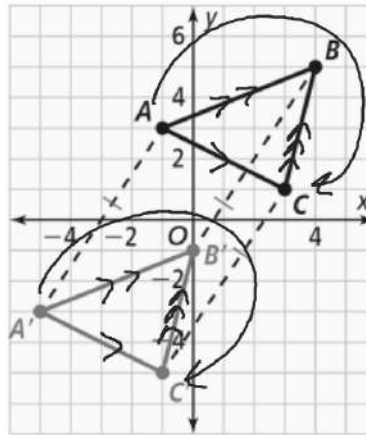
The translation of $\triangle ABC$ by x units along the x-axis and by y units along the y-axis can be written as $T_{\langle x, y \rangle}(\triangle ABC) = \triangle A'B'C'$.

A translation has the following properties:

If $T_{\langle x, y \rangle}(\triangle ABC) = \triangle A'B'C'$, then

- $\overline{AA'} \parallel \overline{BB'} \parallel \overline{CC'}$.
- $\overline{AA'} \cong \overline{BB'} \cong \overline{CC'}$.
- $\triangle ABC$ and $\triangle A'B'C'$ have the same orientation.

A translation is a rigid motion, so length and angle measure are preserved.
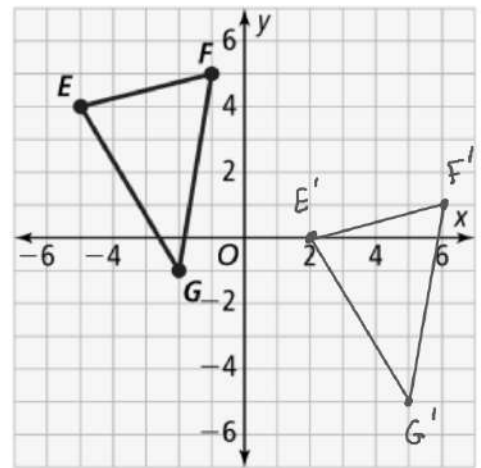
$T_{\langle x, y \rangle}$

What is the graph of $T_{\langle 7, -4 \rangle}(\triangle EFG) = \triangle E'F'G'$?
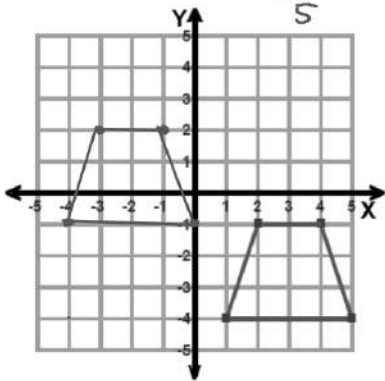
Right 7 ← ⌐ ⌐→ Down 4

$E(-5,4)$ $E'(2,0)$

$F(-1,5)$ $F'(6,1)$

$G(-2,-1)$ $G'(5,-5)$

What is the graph of $T_{\langle -5,3 \rangle}$

Left 5 and up 3
5

What is the graph of $T_{\langle 4,-4 \rangle}$ Right 4
Down 4
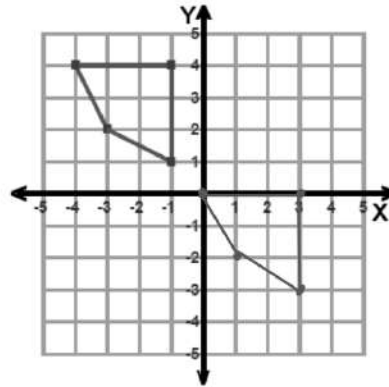
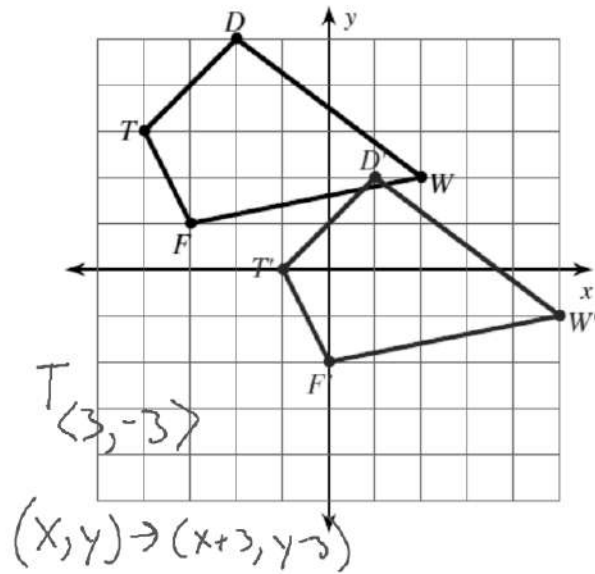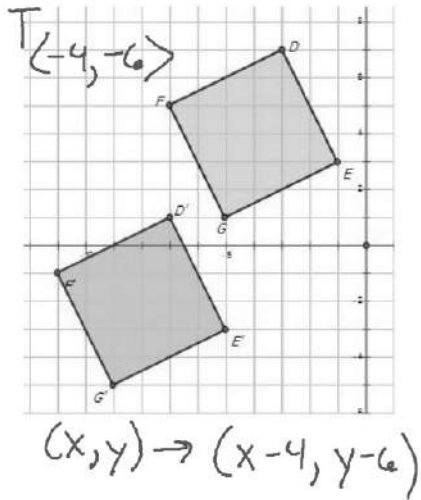What is the graph of $T_{\langle 2,5 \rangle}$
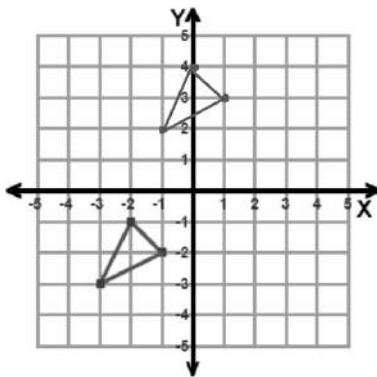
What is the graph of $T_{\langle -2,-4 \rangle}$ Left 2
Down 4
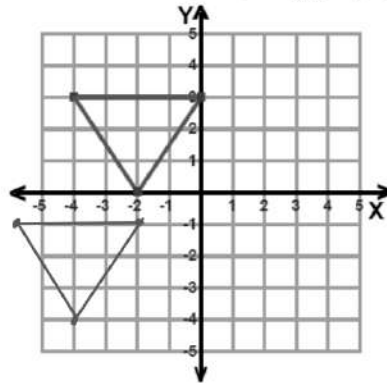
$\overline{F'G'}$ is a translation of $\overline{FG}$. Write the translation rule.

15

7

$T_{\langle 7, 15 \rangle}$

$(x, y) \rightarrow (x+7, y+15)$
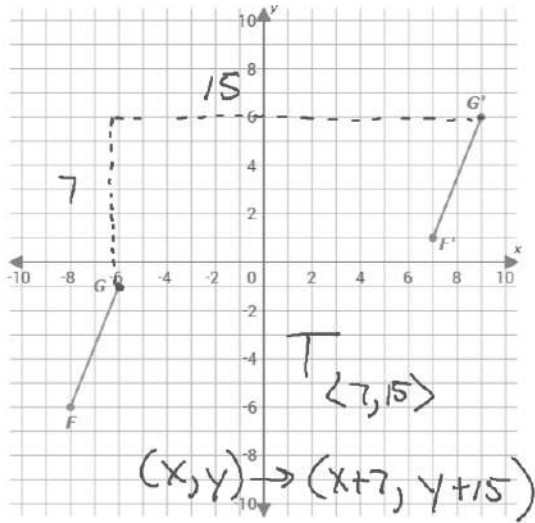
$\triangle Q'R'S'$ is a translation of $\triangle QRS$. Write the translation rule.

$T_{\langle 9, 8 \rangle}$

$(x, y) \rightarrow (x+9, y+8)$

$T_{\langle -4, -6 \rangle}$

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

$T_{\langle 3, -3 \rangle}$

$(x, y) \rightarrow (x+3, y-3)$
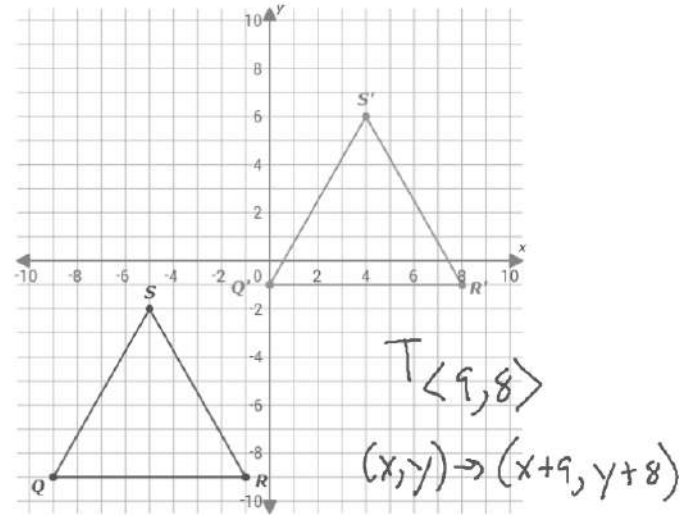
A **composition of rigid motions** is a transformation with two or more rigid motions in which the second rigid motion is performed on the image of the first rigid motion.

Step 1 Translate $\triangle ABC$ left 2 units and up 5 units.

$$(R_\ell \circ T_{\langle -2,\ 5\rangle})(\triangle ABC)$$

This notation uses a small open circle to indicate a composition of rigid motions on $\triangle ABC$.

Step 2 Reflect $\triangle A'B'C'$ across line ℓ.

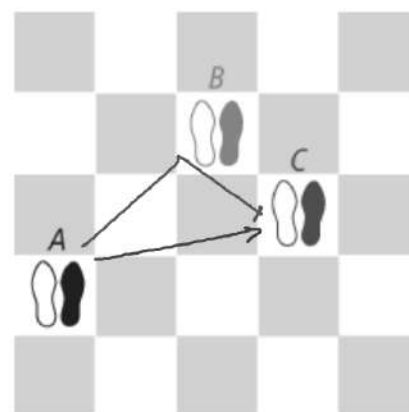$$\left(R_\ell \circ T_{\langle -2, 5\rangle}\right)\ \triangle ABC$$

In learning a new dance, Kyle moves from position A to position B and then to position C. What single transformation describes Kyle's move from position A to position C?

SOLUTION

$A \to B \quad T_{\langle 2,2 \rangle}$

$B \to C \quad T_{\langle 1,-1 \rangle}$

$A \to C \quad T_{\langle 3,1 \rangle}$

3. What is the composition of the transformations written as one transformation?

a. $T_{\langle 3, -2 \rangle} \circ T_{\langle 1, -1 \rangle}$

$T_{\langle 4, -3 \rangle}$

3. What is the composition of the transformations written as one transformation?

b. $T_{\langle -4, 0 \rangle} \circ T_{\langle -2, 5 \rangle}$

$T_{\langle -6, 5 \rangle}$