3.2 Translations

Monday, September 23, 2019 7:46 AM

Warm Up

For each set of coordinate points, write the new set of coordinate points after: Moving them up 4 units, then right 6 units then down 8 units.

1) (-2, 0) (-2,4) (4,4) (4,-4)

2) (0, 2) (Ø,6) (6,6) (6,-2)

3) (-4, -1) (-4,3) (2,3) (2,-5)

4) (-3, -6) (-3,-2) (3,-2) (3,-10)

5) (5, -3) (5,1) (11,1) (11,-7)

6) (4, 4) (4,8) (10,8) (10,Ø)

Essential Question

What are the properties of a translation?

Needed Vocab:

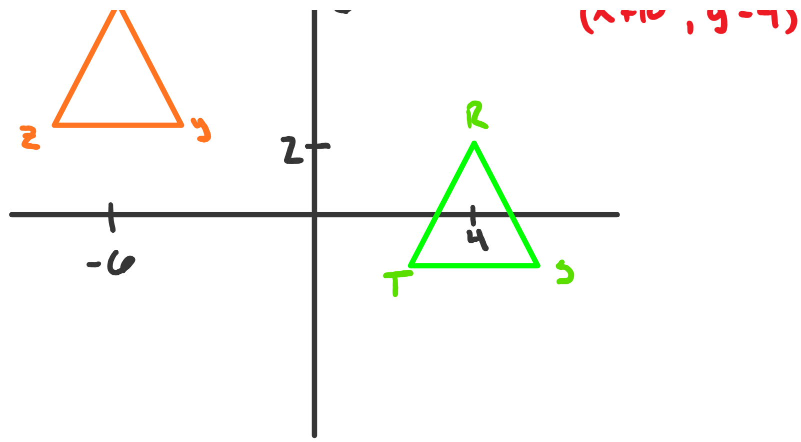
► **Composition of Rigid Motions**

Goal: "I can. . .

Describe the properties of a figure before and after translation."

Draw ΔXYZ on a coordinate plane. Then copy the triangle to somewhere else on the same coordinate plane and label it ΔRST. Describe how you could move the original to map it to its new location.

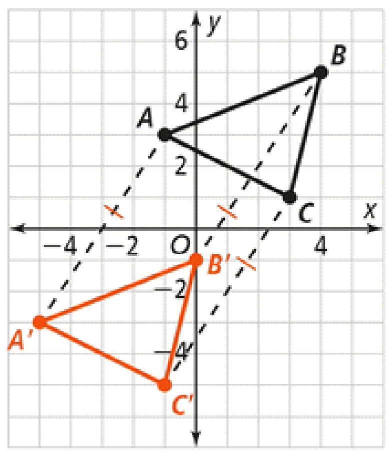
(x+10 , y-4)



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:

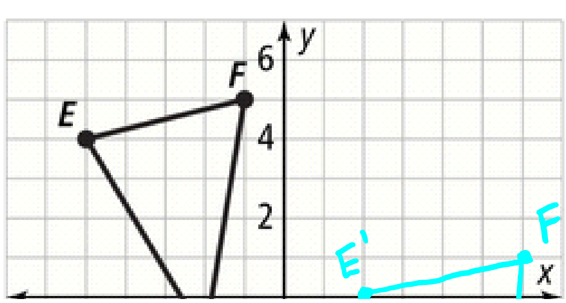
If $T_{\langle x,\, y\rangle}(\triangle ABC) = \triangle A'B'C'$, then

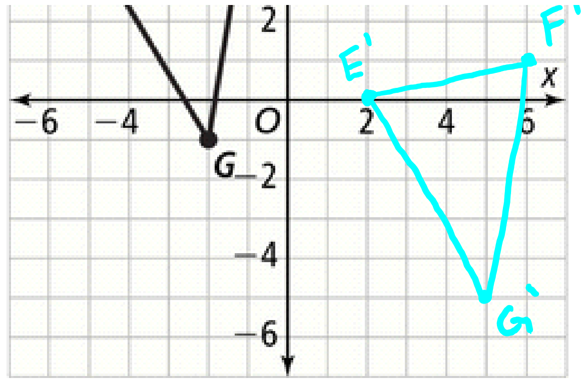
- $\overline{AA'} \parallel \overline{BB'} \parallel \overline{CC'}$.
- $\overline{AA'} \cong \overline{BB'} \cong \overline{CC'}$.
- $\triangle ABC$ and $\triangle A'B'C'$ have the same orientation.

A translation is a rigid motion, so length and angle measure are preserved.

Example 1 **Finding the Image of a Translation.**

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

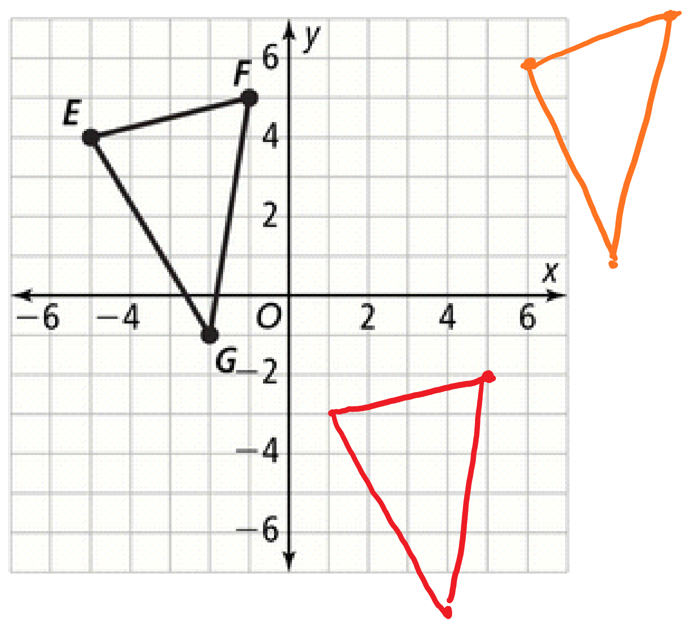




1. What are the vertices of $\triangle E'F'G'$ for each translation?

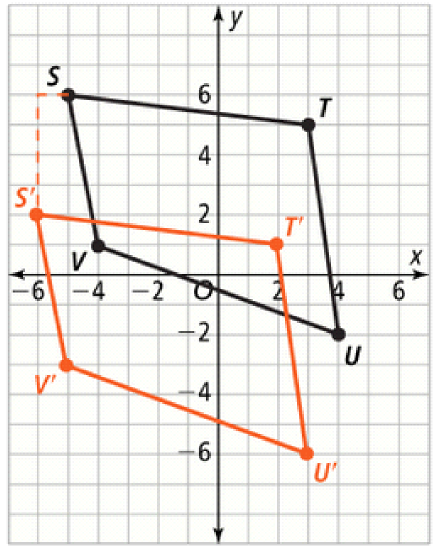
a. $T_{\langle 6,\,-7\rangle}(\triangle EFG) = \triangle E'F'G'$

b. $T_{\langle 11,\,2\rangle}(\triangle EFG) = \triangle E'F'G'$



Example 2 Write a Translation Rule

What translation rule maps $STUV$ onto $S'T'U'V'$?



$T_{\langle -1, -4 \rangle}(STUV) = (S'T'U'V')$

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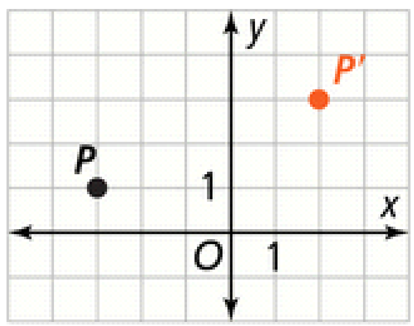
2. What translation rule maps $P(-3, 1)$ to its image $P'(2, 3)$?



$T_{\langle 5, 2 \rangle}(P) = (P')$

Composition of Rigid Motions

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.

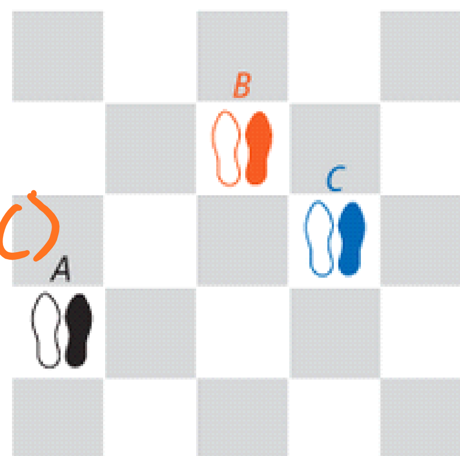
$$(R_{\ell} \circ T_{\langle -2,\, 5\rangle})(\triangle ABC)$$

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

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

EXAMPLE 3 Compose Translations

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?



$$(T_{\langle 1,-1\rangle} \circ T_{\langle 2,2\rangle})(A) = (C)$$

$$T_{\langle 3,1\rangle}(A) = (C)$$

Compose Translations

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

a. $T_{\langle 3,\ -2\rangle} \circ T_{\langle 1,\ -1\rangle}$ $T_{<4,-3>}$

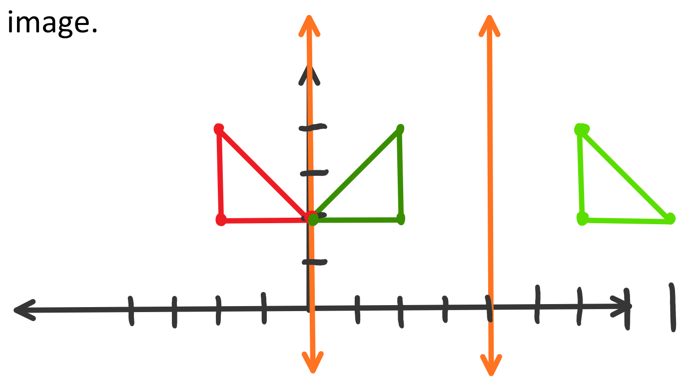
b. $T_{\langle -4,\ 0\rangle} \circ T_{\langle -2,\ 5\rangle}$ $T_{<-6,5>}$

EXAMPLE 4 Relate Translations and Reflections

How is a composition of reflections across parallel lines related to a translation?

Reflect ΔABC across the y-axis and then reflect the image across the line x=4. What do you notice about the points of the preimage and the final image.

ΔABC: A(-2, 2), B(-2, 4), C(0, 2)



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4. Suppose n is the line with equation $y = 1$. Given $\triangle DEF$ with vertices $D(0,\ 0)$, $E(0,\ 3)$, and $F(3,\ 0)$, what translation image is equivalent to $(R_n \circ R_{x\text{-axis}})(\triangle DEF)$?

$T_{<2,0>}(\Delta DEF) = (\Delta D'E'F')$

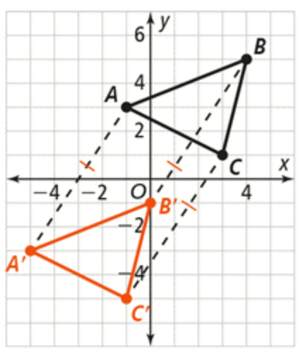
Translations and Compositions of Rigid Motions

WORDS

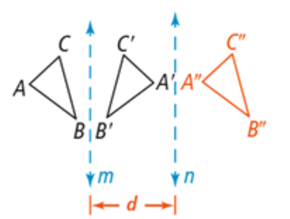
A translation is a transformation that maps all points the same distance and in the same direction.

A composition of two reflections across parallel lines is a translation.

GRAPH



DIAGRAM



SYMBOLS

$T_{\langle -4,-6\rangle}(\triangle ABC) = \triangle A'B'C'$

$\overline{AA'} \parallel \overline{BB'} \parallel \overline{CC'}$

$\overline{AA'} \cong \overline{BB'} \cong \overline{CC'}$

$T(ABC) = (R_n \circ R_m)(ABC)$

$AA'' = BB'' = CC'' = 2d$

Homework

Pg. 119
14, 15-18, 21-24, 30, 34