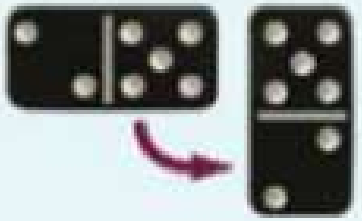
9-1 Translations

Objectives To identify rigid motions
To find translation images of figures

A **transformation** of a geometric figure is a function, or *mapping*, that results in a change in the position, shape, or size of the figure. When you play dominoes, you often move the dominoes by flipping them, sliding them, or turning them. Each move is a type of transformation. The diagrams below illustrate some basic transformations that you will study.

The domino flips.

The domino slides.

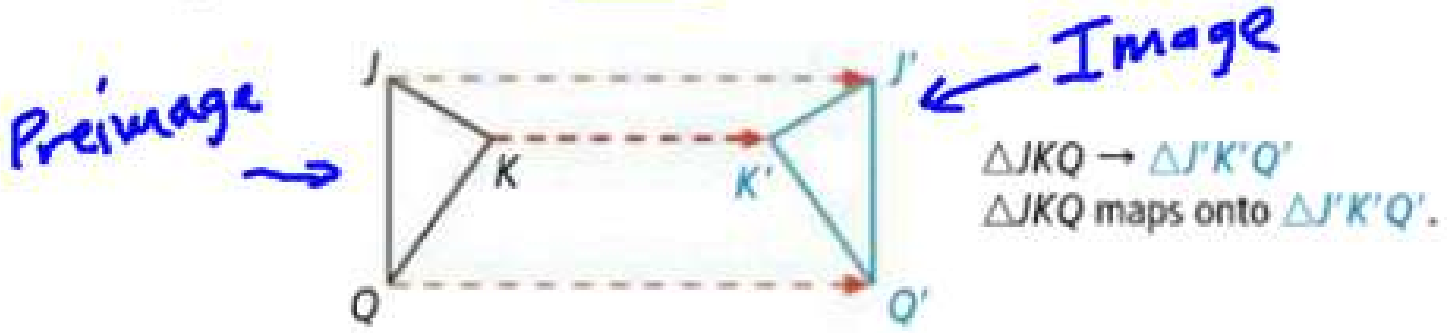


The domino turns.

In a transformation, the original figure is the **preimage**. The resulting figure is the **image**. Some transformations, like those shown by the dominoes, preserve distance and angle measures. To preserve distance means that the distance between any two points of the image is the same as the distance between the corresponding points of the preimage. To preserve angles means that the angles of the image have the same angle measure as the corresponding angles of the preimage. A transformation that preserves distance and angle measures is called a **rigid motion**.

SIZE SHAPE

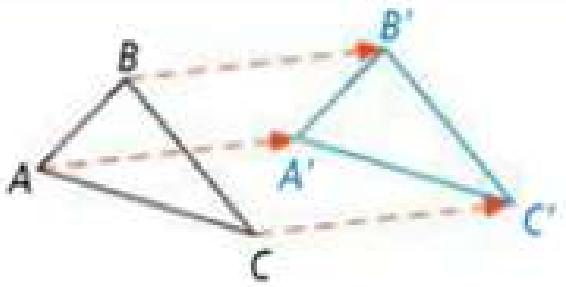
A transformation maps every point of a figure onto its image and may be described with arrow notation ($\rightarrow$). Prime notation ($'$) is sometimes used to identify image points. In the diagram below, K' is the image of K.



Notice that you list corresponding points of the preimage and image in the same order, as you do for corresponding points of congruent or similar figures.

Key Concept Translation

A **translation** is a transformation that maps all points of a figure the same distance in the same direction.



You write the translation that maps $\triangle ABC$ onto $\triangle A'B'C'$ as $T(\triangle ABC) = \triangle A'B'C'$. A translation is a rigid motion with the following properties.

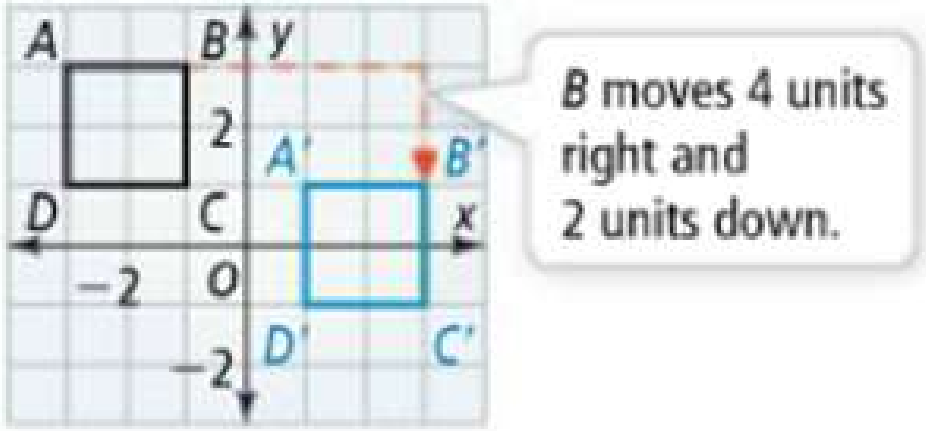
If $T(\triangle ABC) = \triangle A'B'C'$, then

- $AA' = BB' = CC'$
- $AB = A'B', BC = B'C', AC = A'C'$
- $m\angle A = m\angle A', m\angle B = m\angle B', m\angle C = m\angle C'$

The diagram at the right shows a translation in the coordinate plane. Each point of $ABCD$ is translated 4 units right and 2 units down. So each (x, y) pair in $ABCD$ is mapped to $(x + 4, y - 2)$. You can use the function notation $T_{<4, -2>}(ABCD) = A'B'C'D'$ to describe this translation, where 4 represents the translation of each point of the figure along the x-axis and -2 represents the translation along the y-axis.

Coordinate Notation

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



* Function Notation *

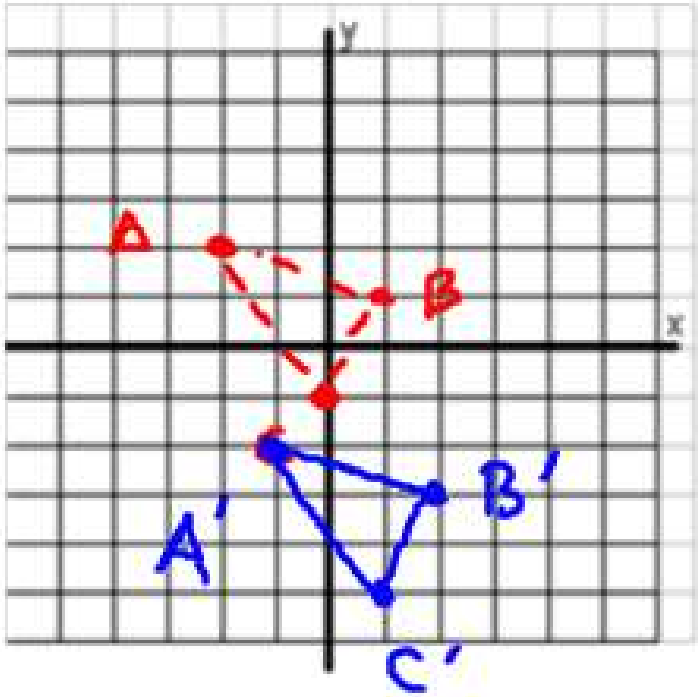
$T_{<4,-2>}(ABCD) = A'B'C'D'$

Got It? **3. a.** What are the vertices of $T_{\langle 1, -4 \rangle}(\triangle ABC)$? Copy $\triangle ABC$ and graph its image.

A(-2, 2), B(1, 1), C(0, -1)

$T_{\langle 1, -4 \rangle}$

R+1, Dn 4



Got It? **4.** The translation image of $\triangle LMN$ is $\triangle L'M'N'$ with $L'(1, -2)$, $M'(3, -4)$, and $N'(6, -2)$. What is a rule that describes the translation?

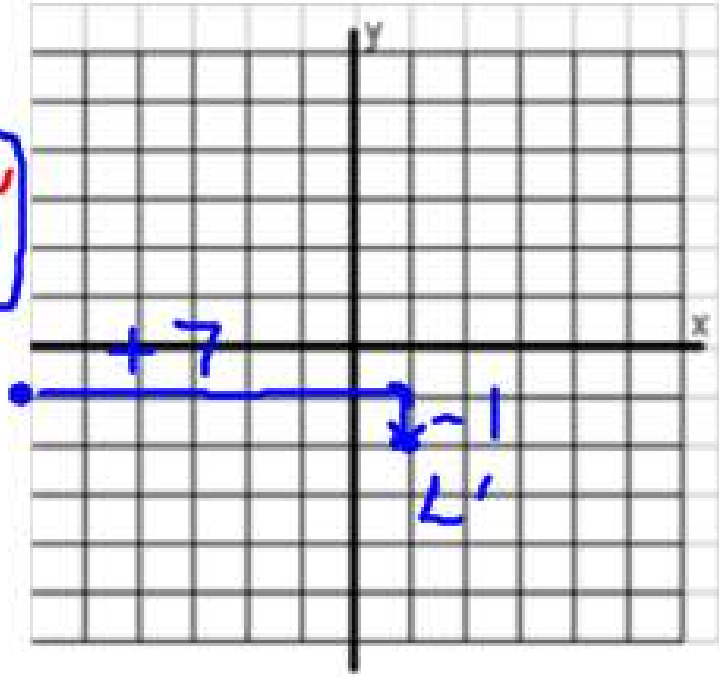
*Don't Graph All 3! Just 1 pair L & L'

L(-6, -1), M(-4, -3), N(-1, -1)

$T_{\langle 7, -1 \rangle}(\triangle LMN) = \triangle L'M'N'$

?, ?

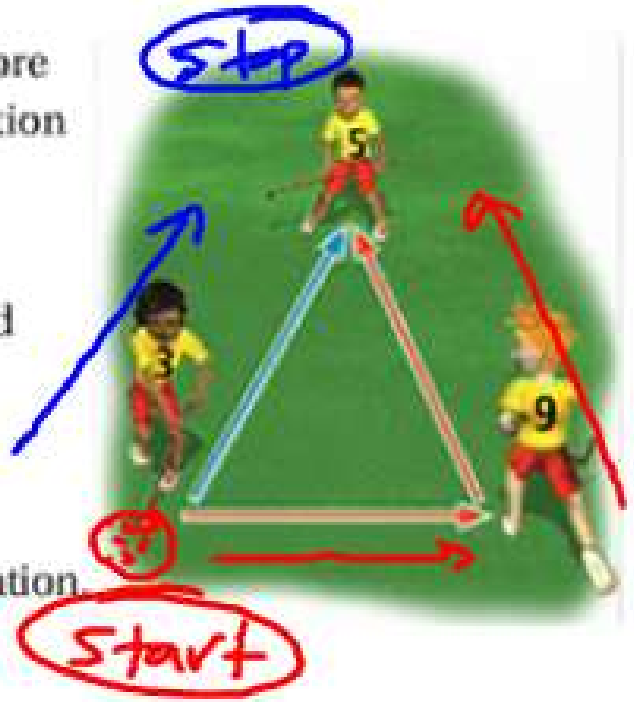
L



A **composition of transformations** is a combination of two or more transformations. In a composition, you perform each transformation on the image of the preceding transformation.

In the diagram at the right, the field hockey ball can move from Player 3 to Player 5 by a direct pass. This translation is represented by the blue arrow. The ball can also be passed from Player 3 to Player 9, and then from Player 9 to Player 5. The two red arrows represent this composition of translations.

In general, the composition of any two translations is another translation.



← Diag.

Got It? **5.** The bishop next moves 3 squares left and 3 squares down. Where is the bishop in relation to its original position?

3 Unit Rt
5 Units Dn

Inclass: p. 550-552 #20, 22, 30, 32

Homework: p. 550-552 #7-33(odd), not #27 or 31

Interactmath: #7, 11, 13, 14, 17, 19, 32