

Lesson 2.05 Translations

Students will be able to:

- Content Objective: Define a translation in terms of distance and vectors and represent a translation as a geometric function that takes points in the plane as input and gives points as outputs.
- Language Objective: Explain how translations preserve congruency.



Warm Up

Circle all transformations below that are **rigid motions**.

Rotation

Dilation

Translation

Reflection



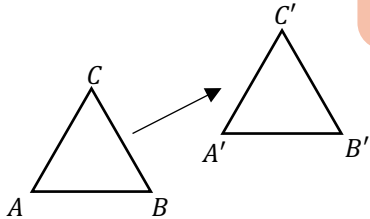
Vocabulary Review

Match each term to the correct definition.

- | | |
|---------------------------------|--|
| 1. _____ Rotation | a. Any point on this will be equidistant from the endpoints of the segment being bisected. |
| 2. _____ Line Reflection | b. Preserves distance and angle measure |
| 3. _____ Rigid Motion | c. Requires knowing the center/point and the measure/direction of the angle of rotation |
| 4. _____ Perpendicular Bisector | d. Requires a line and the knowledge of perpendicular bisectors |
| 5. _____ Isosceles Triangle | e. Has at least two congruent sides and congruent base angles |



Graphic Organizer

Definition	Notation
<p>A translation (slide) is a rigid motion that displaces every point in the plane by the same distance (in the same direction) and can be described using a vector.</p>  <p>Illustration</p>	<p>$T_{a,b}$ or $(x,y) \rightarrow (x+a, y+b)$</p> <p>$a$ is + → move right a units a is - → move left a units b is + → move up b units b is - → move down b units</p> <p style="text-align: center;">Translation</p> <p>$T_{-3,2}(\Delta ABC) = \Delta A'B'C'$</p> <p>Translate ΔABC 3 units to the left and 2 units up to get $\Delta A'B'C'$</p> <p style="text-align: right;">Example</p>


Skill 1: Function Notation

Describe, in words, the translation given by the notation shown below. Be sure to include the pre-image and image if necessary.

a. $(x, y) \rightarrow (x + 2, y - 8)$

b. $T_{-1,0}(\overrightarrow{FG}) = \overrightarrow{F'G'}$


Exercise 1: Function Notation

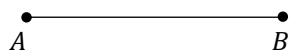
Describe, in words, the translation given by the notation shown below. Be sure to include the pre-image and image if necessary.

a. $T_{3,-7}(\triangle XYZ) = (\triangle X'Y'Z')$

b. $(x, y) \rightarrow (x - 6, y + 9)$


Investigate

Given \overline{AB} and vector \overrightarrow{EF} below, use a compass and protractor to translate \overline{AB} a distance of 1 inch in the direction of \overrightarrow{EF} . Label the image $\overline{A'B'}$.



Use your **protractor** to locate the **direction**.

Use the **compass** to measure the **distance**.

a. Is \overline{AB} the same length as $\overline{A'B'}$? Use measurement to justify your answer.

b. Construct $\overline{AA'}$ and $\overline{BB'}$. What can we conclude about these two segments?

c. Are \overline{AB} and $\overline{A'B'}$ parallel? Explain.

d. Finish the sentence below.

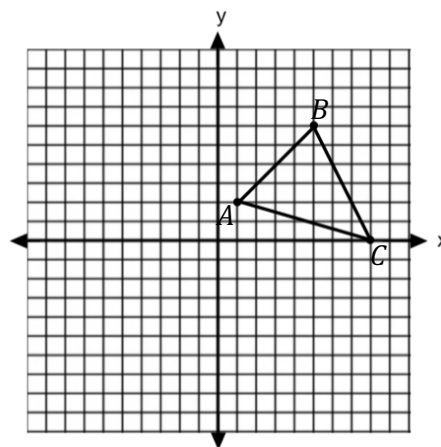
Translations will always map lines to _____ lines.


Investigate

Given $\triangle ABC$ shown on the coordinate plane below with vertices $A(1,2)$, $B(5,6)$, and $C(8,0)$.

- a. Find and plot its image after a translation of 9 units left and 8 units down. Label the image $A'B'C'$ and fill in the table below.

Input	$(x, y) \rightarrow (x - 9, y - 8)$	Output
$A(1,2)$		
$B(5,6)$		
$C(8,0)$		



- b. Are $\triangle ABC$ and $\triangle A'B'C'$ congruent? Explain.

- c. Finish the sentence below.

Translations will always preserve _____ measure and _____, therefore translations are rigid motions.


Investigate

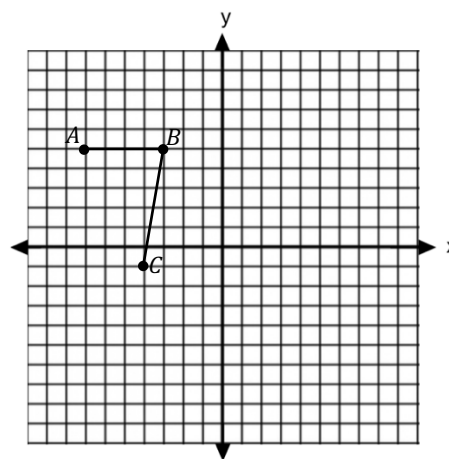
Shown below are \overline{AB} and \overline{BC} .

- a. Using the graph, translate \overline{AB} down 6 units and to the left 1 unit. Label the image of point A , D . What point does point B get mapped to?
- b. Translate \overline{BC} 4 units to the left. What points do B and C get mapped to? Fill in the blanks below.

$$B \rightarrow \underline{\hspace{2cm}}$$

$$C \rightarrow \underline{\hspace{2cm}}$$

- c. What is true about \overline{AB} and \overline{DC} ? What is true about \overline{AD} and \overline{BC} ? Explain.



- d. What shape is quadrilateral $ABCC'$?

- e. What sequence of transformations would have mapped $\angle ABC$ to $\angle ADC$? There is more than one correct answer.


Check Point

What is the image of the point $(-3,1)$ under the translation $T_{-4,5}$?



2.03- Problem Set

Name: _____

- What is the image of the point (6,11) under the translation $T_{4,-1}$?
 - (2,12)
 - (5,15)
 - (2,12)
 - (10,10)
- When the transformation $T_{1,-2}$ is performed on point A , its image is point $A'(-4,3)$. What are the coordinates of A ?
 - (-5,5)
 - (-3,1)
 - (5,-5)
 - (3,-1)
- Garret is constructing a design using two triangles $\triangle ABC$ and $\triangle A'B'C'$ where $\triangle A'B'C'$ is the image of $\triangle ABC$ after a translation. Use the table of translations is below to find the coordinated of points C and B' .

$\triangle ABC$	$\triangle A'B'C'$
$A(1,3)$	$A'(4,-2)$
$B(-2,-4)$	B'
C	$C'(6,-3)$

- Shown graphed below is $\triangle ABC$.
 - Rotate $\triangle ABC$ 180° counterclockwise about point C and label the image $\triangle A'B'C'$. This transformation can be represented using the notation $R_{C,180^\circ}(\triangle ABC)$
 - Translate $\triangle A'B'C'$ 7 units to the left and 4 units up. Label the image of point A' point A'' .
 - What shape is Quadrilateral $ABA''C$?

