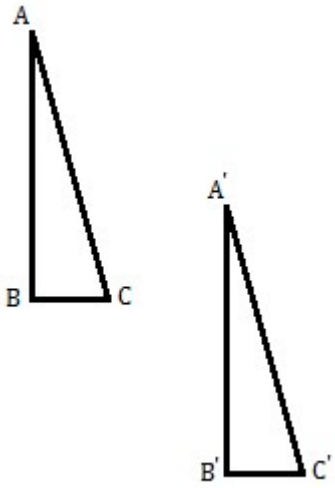
Name: **Answer Key**	Period:

Main Ideas and Questions	Notes
Translation Pre-Image Image Prime Symbol	**Experimenting with Geometric Translations** In geometry, the three types of rigid motion transformations are reflections, rotations, and translations. A **translation** consists of sliding a figure horizontally and or vertically. Let's first review some of the basic terminology of transformations. The **pre-image** of a transformation is the original figure. The **image** of a transformation is the new figure after the transformation occurred. We label the vertices of geometric figures in a particular way to make sure everyone know which figure is the pre-image and which figure is the image. On the pre-image, we label all the vertices with letters only. On the image, we label all the vertices with letters and a special symbol called prime. The **prime symbol** looks much like an apostrophe.

1.) Examine ΔABC and $\Delta A'B'C'$. Based on the definitions provided above, identify which triangle is the pre-image and which triangle is the image.

ΔABC is the pre-image and $\Delta A'B'C'$ is the image.



2.) Based on your observations, do you believe ΔABC and $\Delta A'B'C'$ are congruent? That is, do you believe they are the exact same size and shape?

There is no right or wrong answer to this question. Use this as a chance to get students talking and bouncing their ideas off each other.

3.) A classmate states the two triangles are the same size and shape, what are some possible methods you could use to prove or disprove this statement?

No one correct answer to this question. We would hope that one student mentions the idea of cutting one out and placing it on top of the other.

4.) Use a ruler to measure the side lengths of both ΔABC and $\Delta A'B'C'$. Record your measurements in the table provided below.

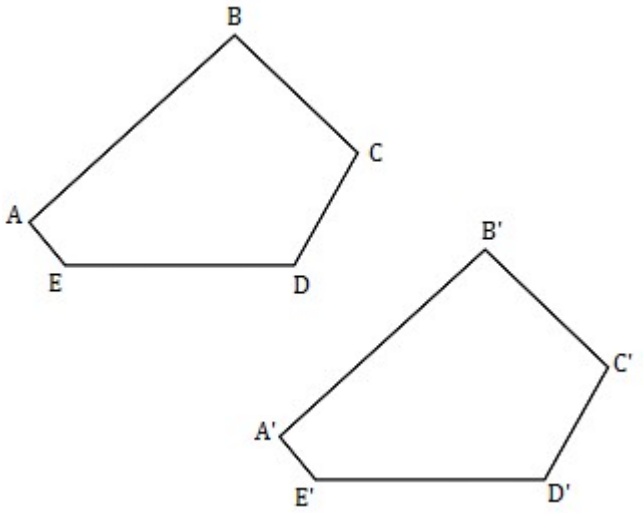
Line Segment	Measured Length	Line Segment	Measured Length
$\overline{AB}$	35 mm	$\overline{A'B'}$	35 mm
$\overline{BC}$	10 mm	$\overline{B'C'}$	10 mm
$\overline{AC}$	37 mm	$\overline{A'C'}$	37 mm

5.) **CCSS.8.G.1.A – Lines are taken to lines, and line segments to line segments of equal length.** Based on your measurements do you agree with this Common Core State Standard in regards to translations? Do you think every translation will take a line segment to a line segment of equal length? Explain your reasoning.

Students should get measurements that are equal or very close to each other. Have a class conversation about their measurements and explain the measures should be the exact same and that all translations will take a line segment to one of equal length.

6.) Examine pentagon *ABCDE* and pentagon *A'B'C'D'E'*. Based on the definitions provided above, identify which triangle is the pre-image and which triangle is the image.

Pentagon *ABCDE* is the pre-image and pentagon *A'B'C'D'E'* is the image.



7.) Based on your observations, do you believe pentagon *ABCDE* and pentagon *A'B'C'D'E'* are congruent? That is, do you believe they are the exact same size and shape?

There is no right or wrong answer to this question. Use this as a chance to get students talking and bouncing their ideas off each other.

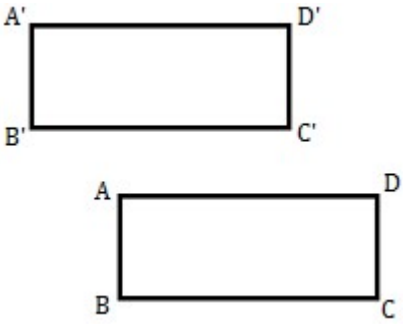
8.) Use a protractor to measure the angle of both pentagon *ABCDE* and pentagon *A'B'C'D'E'*. Record your measurements in the table provided below.

Angle	Angle Measure	Angle	Angle Measure
$\angle A$	92°	$\angle A'$	92°
$\angle B$	93°	$\angle B'$	93°
$\angle C$	105°	$\angle C'$	105°
$\angle D$	120°	$\angle D'$	120°
$\angle E$	130°	$\angle E'$	130°

9.) **CCSS.8.G.1.B – Angles are taken to angles of the same measure.** Based on your measurements do you agree with this Common Core State Standard in regards to translations? Do you think every translation will take an angle to an angle of the same measure? Explain your reasoning.

Students should get measurements that are fairly equivalent. Another chance to talk about human error with measuring. Explain to them that all angles are taken to angles of the same measure with translations and hopefully their measures agree.

10.) Examine rectangle *ABCD* and rectangle *A'B'C'D'*. Based on the definitions provided above, identify which triangle is the pre-image and which triangle is the image.



Rectangle *ABCD* is the pre-image and rectangle *A'B'C'D'* is the image.

11.) Based on your observations, do you believe rectangle *ABCD* and rectangle *A'B'C'D'* are congruent? That is, do you believe they are the exact same size and shape?

There is no right or wrong answer to this question. Use this as a chance to get students talking and bouncing their ideas off each other.

Parallel Lines

A rectangle has several important characteristics and one of those characteristics is that opposite sides are parallel. **Parallel lines** are two or more line are always the same distance apart and never touch.

12.) Use a ruler to measure the distance between lines $\overline{AB}$ and $\overline{CD}$ at three different locations. Then do the same for lines $\overline{A'B'}$ and $\overline{C'D'}$. Based on your measurements, do what can you conclude about lines $\overline{AB}$ and $\overline{CD}$? What about lines $\overline{A'B'}$ and $\overline{C'D'}$?

The students measurements should be the same distance, approximately 13 mm for both rectangles. Students should begin to notice that $\overline{AB}$, $\overline{CD}$, $\overline{A'B'}$, $\overline{C'D'}$ are all parallel.

13.) **CCSS.8.G.1.C – Parallel lines are taken to parallel lines.** Based on your measurements do you agree with this Common Core State Standard in regards to translations? Do you think every translation will take parallel lines to form more parallel lines? Explain your reasoning.

This is a little more abstract than the first two questions like this. For the students who think there may be a situation where this isn't the truth, ask for them to show you a counterexample. Eventually, they will realize translations always preserve parallel lines and actually produce more parallel lines.

Congruence Using Translations

In geometry, a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rigid motion transformations. In order to start performing translations within the coordinate plane, we must first understand the directions we can translate a figure.

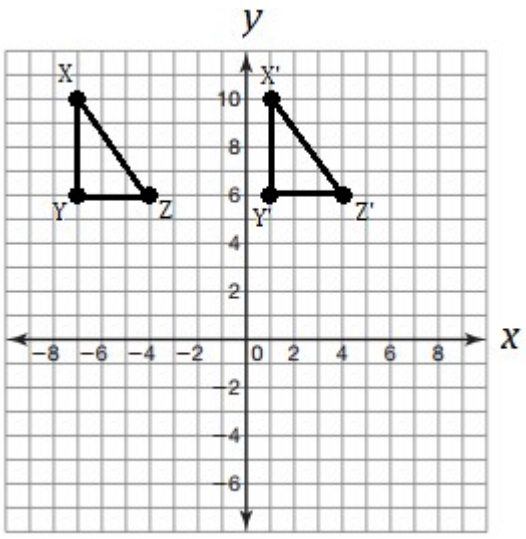
Horizontal Translation

A **horizontal translation** is the act of sliding a figure left or right within the coordinate plane.

Vertical Translation

A **vertical translation** is the act of sliding a figure up or down within the coordinate plane.

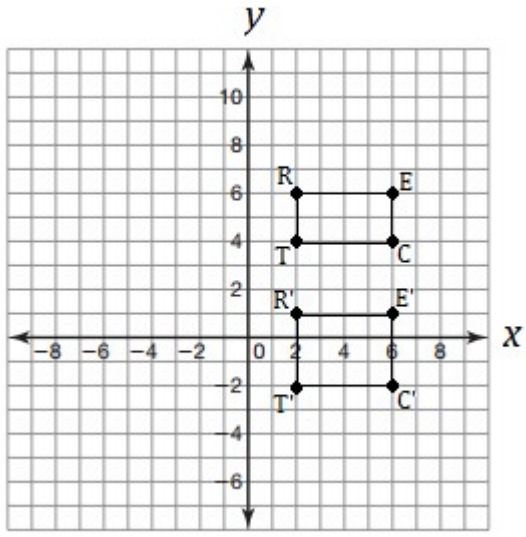
1.) Use a sequence of translations to determine whether ΔXYZ is congruent to $\Delta X'Y'Z'$. Write down the sequence of translations that proves or disproves the congruence.



The two triangles are congruent.

Translate ΔXYZ 8 units horizontally and the two triangles will be directly on top of each other.

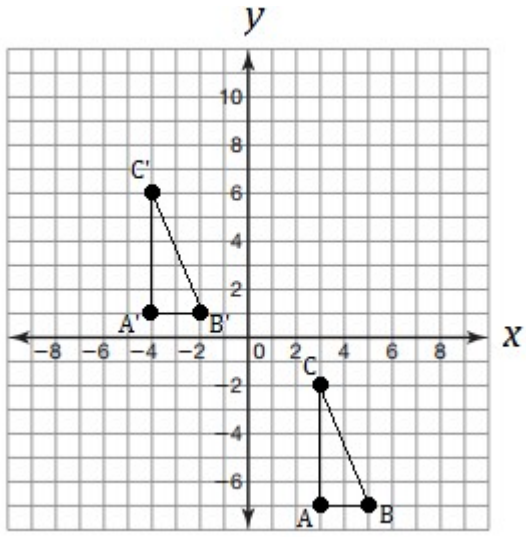
2.) Use a sequence of translations to determine whether rectangle $RECT$ is congruent to rectangle $R'E'C'T'$. Write down the sequence of translations that proves or disproves the congruence.



The two triangles are not congruent.

Translate rectangle RECT -5 units vertically and the two triangles will be partially on top of each other, but not a perfect match.

3.) Use a sequence of translations to determine whether ΔABC is congruent to $\Delta A'B'C'$. Write down the sequence of translations that proves or disproves the congruence.

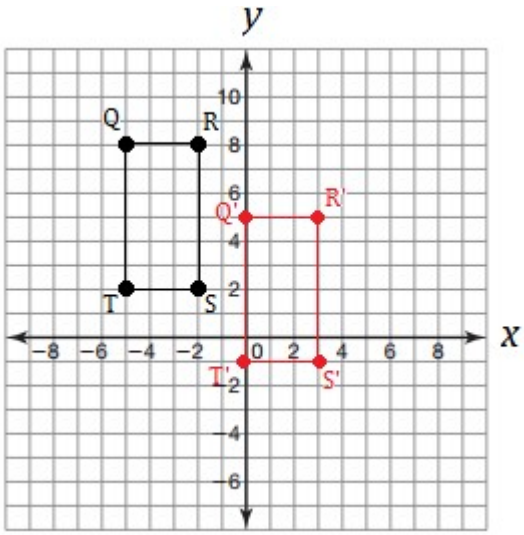


The two triangles are congruent.

Translate ΔABC -7 units horizontally and 8 units vertically for the two triangles to be directly on top of each other.

The Effect of Translations on Coordinates

1.) Translate rectangle *QRST* 5 units horizontally and -3 units vertically. Label the image *Q'R'S'T'*.



2.) What do you think happens to the *x*-coordinates and *y*-coordinates when performing a translation? Justify your reasoning.

Some students will begin to realize that horizontal translations affect the x-coordinate and vertical translations will affect the y-coordinate. I would use this question just to get students talking about the topic.

3.) Using rectangle *QRST* and rectangle *Q'R'S'T'*, fill out the table below with the coordinates for each vertex.

Vertex	Coordinates	Vertex	Coordinates
Q	(-5, 8)	*Q'*	(0, 5)
R	(-2, 8)	*R'*	(3, 5)
S	(-2, 2)	*S'*	(3, -1)
T	(-5, 2)	*T'*	(0, -1)

4.) Based on the coordinates you identified in the table above, how are coordinates affected by translations?

Hopefully more students are beginning to see that the x-coordinate went up by 5 which was affected by the horizontal part and the y-coordinate went down by 3 which was affected by the vertical part of the translation.

5.) Suppose we have a new point *A* located at (*x*, *y*).

a.) How would the coordinates of point A be affected by a translation 3 units horizontally? Write the coordinates of A' using expressions.

The x-coordinate would go up by 3. $(x + 3, y)$

b.) How would the coordinates of point A be affected by a translation -4 units horizontally? Write the coordinates of A' using expressions.

The x-coordinate would go down by 4. $(x - 4, y)$

c.) How would the coordinates of point A be affected by a translation 5 units vertically? Write the coordinates of A' using expressions.

The y-coordinate would go up by 5. $(x, y + 5)$

d.) How would the coordinates of point A be affected by a translation -2 units vertically? Write the coordinates of A' using expressions.

The y-coordinate would go down by 2. $(x, y - 2)$