Name: ________________________________ # __________

Geometry: Period ____________
Ms. Pierre
Date: _____________

Transformations in the Coordinate Plane: Translations

Today's Objective

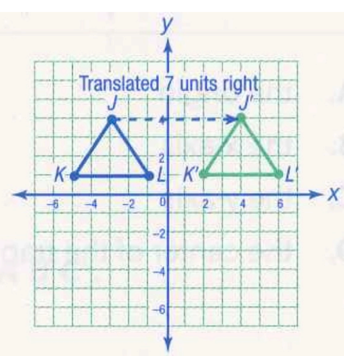
SWBAT understand how to represent a translation in the plane as a function and how to translate points, lines, lines segments, and figures.

A **translation** is a operation that slides a geometric figure in the plane. You can think of a translation of a geometric figure as a function in which the input is not a single value, x, but rather a point on the coordinate plane, (x, y). When you apply the function to a point, the output will be the coordinates of the translated image of that point.

You can translate not only individual points but also entire graphs and figures. When you apply a function to every point on the figure, the resulting points will form the translated figure. For each **line segment** on the original figure, the translated image will contain either a corresponding **parallel line segment** or a **collinear line segment** of equal length.

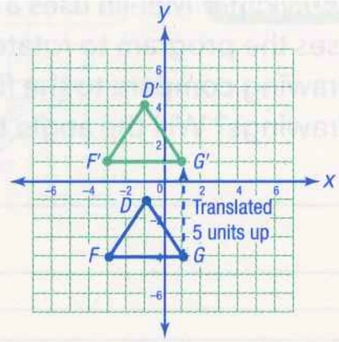
In a **horizontal translation,** the x-coordinate changes, but the y-coordinate stays the same. A horizontal translation of a units can be represented by the function $T(x, y) = (x + a, y)$. If $a > 0$, the figure slides to the right. If $a < 0$, the figure slides to the left.

The transformation shown on the right is the result of applying the function $T(x, y) = (x + 7, y)$ to $\triangle JKL$. In this example, a is a positive number, 7, so the figure slides to the right.



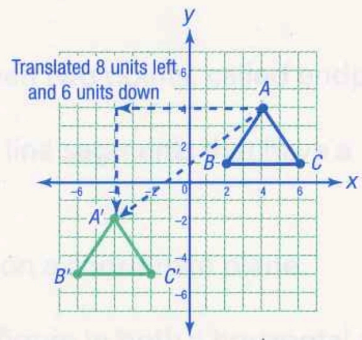
In a **vertical translation**, the *y*-coordinate changes, but the *x*-coordinate stays the same. A vertical translation of *b* units can be represented by the function $T(x, y) = (x, y + b)$. If $b > 0$, the figure slides up. If $b < 0$, the figure slides down.

The transformation shown on the right is the result of applying the function $T(x, y) = (x, y + 5)$ to $\triangle DFG$. In this example, *b* is a positive number, 5, so the figure slides up.

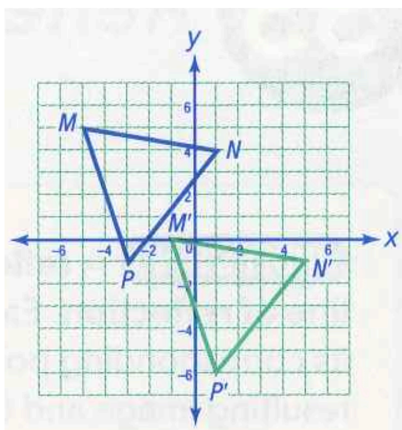


In a slant translation, both the *x*- and *y*-coordinates change. Slant translations can be described by the function $T(x, y) = (x + a, y + b)$.

The transformation shown on the right is the result of applying the function $T(x, y) = (x - 8, y - 6)$ to $\triangle ABC$. In this example, *a* and *b* are both negative, so the figure slides to the left and down.



Use the graph below for questions 1-3.



1. Name the line segment that is parallel to $\overline{MN}$. ___________________________

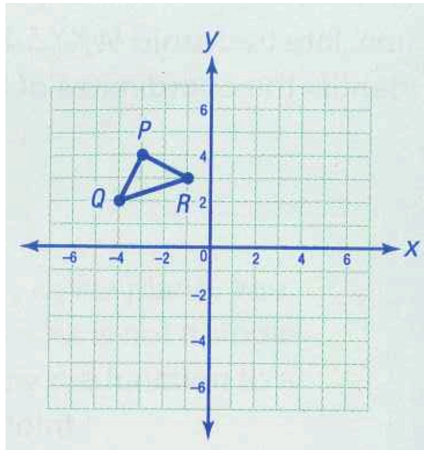
2. Name a line segment that is parallel to $\overline{MP}$. ____________________________

3. How does $\overline{NP}$ compare to $\overline{N'P'}$? ____________________________________

____

Example 1

Translate ΔPQR according to the rule: $\mathrm{T}(\mathrm{x}, \mathrm{y}) = (\mathrm{x} + 6, \mathrm{y} - 1)$



Step 1: Identify the coordinates of the vertices of ΔPQR.

The vertices are P (______ ,______) , Q (______ ,______) , and R (______ ,______).

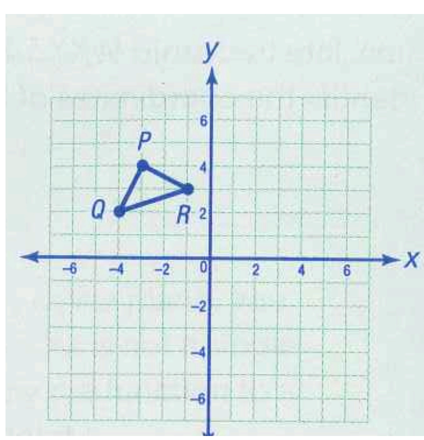
Step 2: Treat each point as an input and substitute it into the rule above to find the coordinates of the translated image.

T(-3, 4) = (-3 +6, 4 – 1) = (3, 3)

T(-4, 2) = (______ +6, ______ – 1) = (______,______)

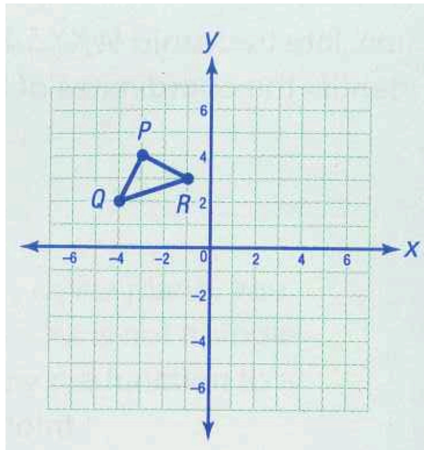
T(-1, 3) = (______ +6, ______ – 1) = (______,______)

Step 3: Plot points P', Q', and R'. Connect them to form the translated image.



☑ Check for Understanding

Translate ΔPQR according to the rule: $\mathrm{T(x, y)} = (\mathrm{x} - 2, \mathrm{y} - 6)$



Step 1: Identify the coordinates of the vertices of ΔPQR.

The vertices are P (______ ,______) , Q (______ ,______) , and R (______ ,______).

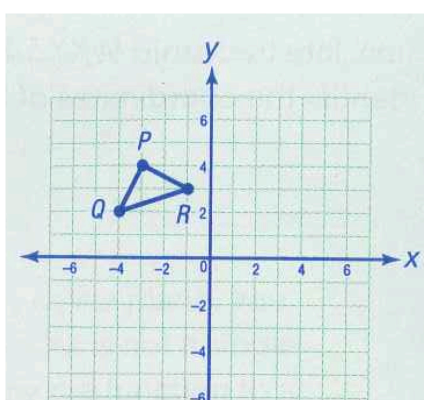
Step 2: Treat each point as an input and substitute it into the rule above to find the coordinates of the translated image.

T(-3, 4) = (______– 2, ______ – 6) = (______, ______)

T(-4, 2) = (______– 2, ______ – 6) = (______, ______)

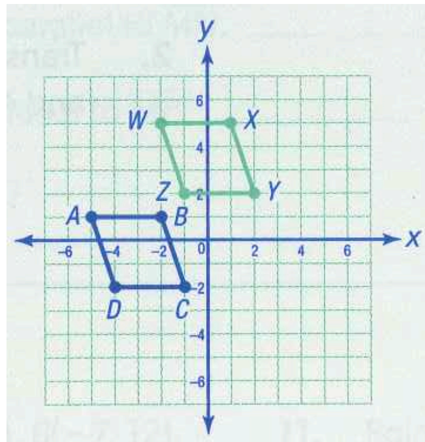
T(-1, 3) = (______– 2, ______ – 6) = (______, ______)

Step 3: Plot points P', Q', and R'. Connect them to form the translated image.

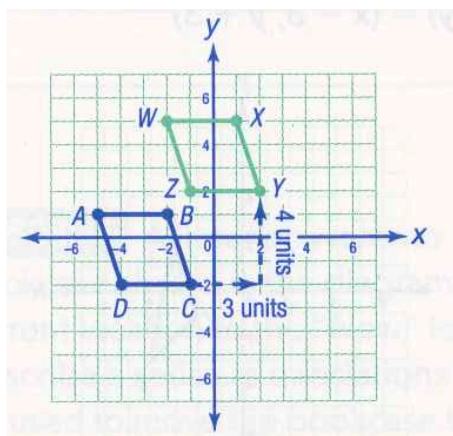


Example 2

Use a function to describe how parallelogram ABCD could be translated so it covers parallelogram WXYZ exactly.



Step 1: Describe the slide needed to move vertex c of parallelogram ABCD onto point Y, the corresponding point on parallelogram WXYZ.



The diagram show that point C must slide ______ units to the right and ______ units up to move onto point Y. Every other point in ABCD must slide in the same way.

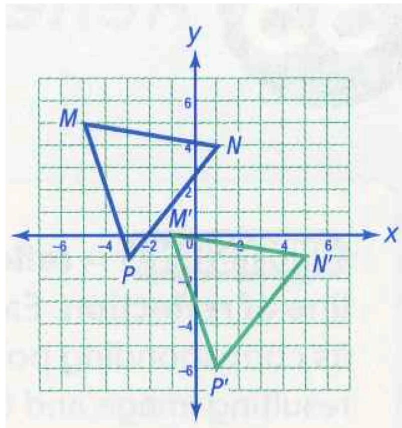
Step 2: Use a function to describe the translation.

A horizontal translation of ______ units to the right is in the positive direction. It can be represented by the expression ________________.
A vertical translation of ______ units up is also in the positive direction. It can be represented by the expression ________________.

The rule for the translation is : $T(x, y) =$ ______________________

☑ Check for Understanding

Use a function to describe how triangle MNP could be translated so it covers triangle $M'N'P'$ exactly.



Step 1: Describe the slide needed to move vertex M of triangle MNP onto point M', the corresponding point on triangle M′N′P′.

The diagram shows that point M must slide ______ units to the __________________ and ______ units ______________________ to move onto point **M′** . Every other point in MNP must slide in the same way.

Step 2: Use a function to describe the translation.

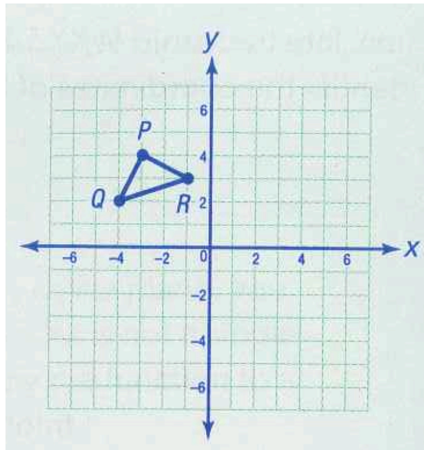
A horizontal translation of ______ units to the ____________________ is in the ______________________ direction. It can be represented by the expression ______________________.

A vertical translation of ______ units __________________ is in the ______________________ direction. It can be represented by the expression ______________________.

The rule for the translation is : $T(x, y) =$ ______________________

Independent Practice

1.) Translate ΔPQR according to the rule: $\mathrm{T}(\mathrm{x}, \mathrm{y}) = (\mathrm{x} + 4, \mathrm{y} - 3)$



Step 1: Identify the coordinates of the vertices of ΔPQR.

The vertices are P (______ ,______) , Q (______ ,______) , and R (______ ,______).

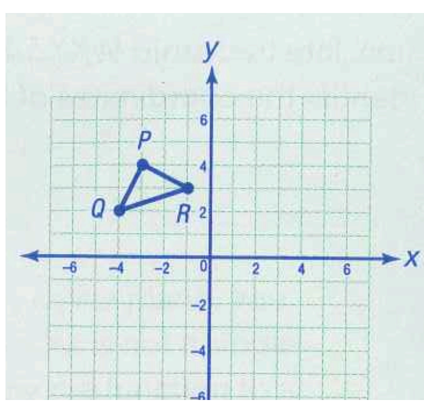
Step 2: Treat each point as an input and substitute it into the rule above to find the coordinates of the translated image.

T(-3, 4) = (_______+ 4, ______ – 3) = (______, ______)

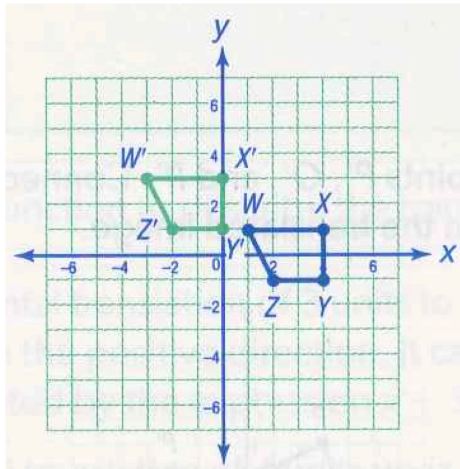
T(-4, 2) = (______+ 4, ______ – 3) = (______, ______)

T(-1, 3) = (______+ 4, ______ – 3) = (______, ______)

Step 3: Plot points P', Q', and R'. Connect them to form the translated image.



2.) Use a function to describe how triangle WXYZ could be translated so it covers triangle $W'X'Y'Z'$ exactly.



Step 1: Describe the slide needed to move vertex W of triangle WXYZ onto point W', the corresponding point on triangle W′X′Y′Z′.

The diagram shows that point W must slide _____ units to the _______________ and _____ units ___________________ to move onto point **M′** .
Every other point in MNP must slide in the same way.

Step 2: Use a function to describe the translation.

A horizontal translation of _____ units to the _________________ is in the ___________________ direction. It can be represented by the expression ___________________.

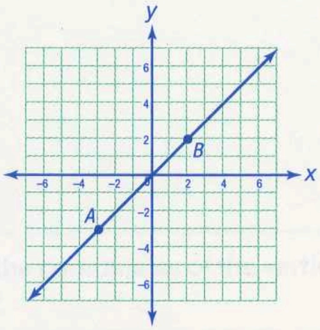
A vertical translation of _____ units _______________ is in the ___________________ direction. It can be represented by the expression ___________________.

The rule for the translation is: $T(x, y) =$ ___________________

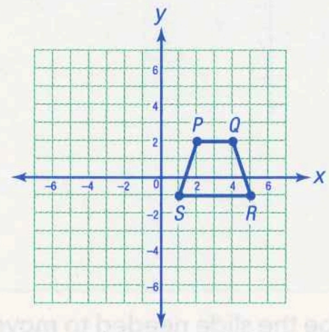
Homework

Draw the image for each translation of the given preimage. Use prime (′) symbols to name points on each image.

1. Translate $\overleftrightarrow{AB}$ 3 units to the right.

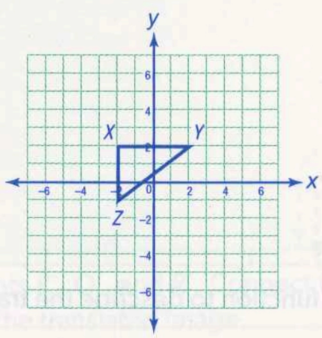


2. Translate trapezoid *PQRS* 7 units to the left and 4 units down.

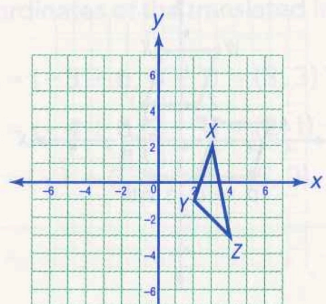


HINT A translation to the right affects the *x*-coordinate.

3. $T(x, y) = (x, y - 4)$



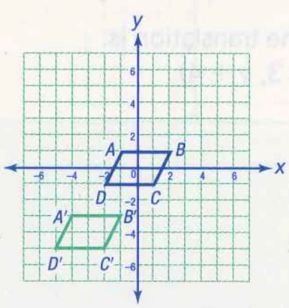
4. $T(x, y) = (x - 8, y + 3)$



REMEMBER The preimage and the image should be the same size and same shape.

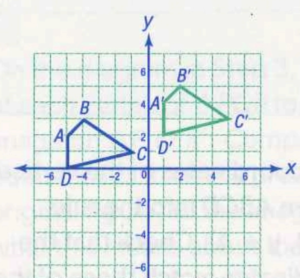
Write a function to describe how the quadrilateral *ABCD* was translated to form *A′B′C′D′* in each graph.

5.



$T(x, y) =$ ____________________

6.



$T(x, y) =$ ____________________