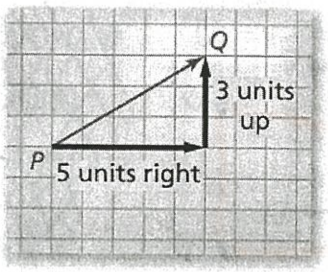
Name Key Date ______ Period ______

## Translations

*Lesson Objective* IWBAT perform translations + compositions of translations

Vector: A vector is a quantity that has both direction and magnitude (also known as size)

→ Represented in the coordinate plane by an arrow drawn from one point to another.




← This diagram shows a vector.

The initial point (or starting point) of this vector is point P

The terminal point (or ending point) of this vector is point Q

The name of the vector is $\overrightarrow{PQ}$, which is read as "vector PQ"

The horizontal component of $\overrightarrow{PQ}$ is 5 The vertical component of $\overrightarrow{PQ}$ is 3

The component form of a vector combines the horizontal and vertical components.
So, the component form of $\overrightarrow{PQ}$ is $\langle 5, 3 \rangle$

**IN GENERAL:** $h$ is the horizontal component, $k$ is the vertical component, so the vector is written as:

$\langle h, k \rangle$

Transformation: A transformation is a function that moves or changes a figure in some way to produce a *new* figure called an image.

→ Another name for the original figure is the preimage.

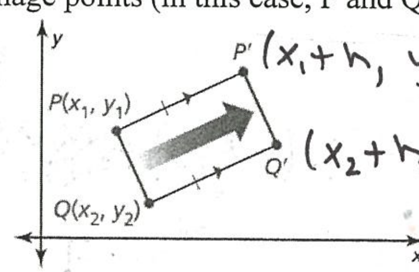
→ The points on the preimage are the inputs for the transformation

→ The points on the image are the outputs for the transformation.

**Transformation #1: Translation**

A translation moves every point of a figure the same distance in the same direction.

More specifically, a translation maps (or moves) the preimage points (in this case, P and Q) along some vector $\langle h, k \rangle$ to the image points (in this case, P' and Q')




P' $(x_1+h, y_1+k)$

Q' $(x_2+h, y_2+k)$

$\overline{PP'} \cong \overline{QQ'}$

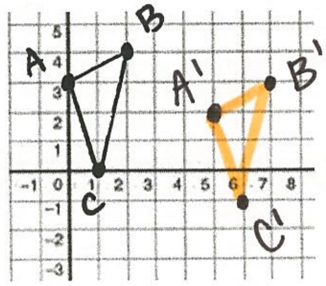
$\overline{PP'} \parallel \overline{QQ'}$

**Translations also map lines to parallel lines and segments to parallel segments. In this case,

$\overline{PQ} \parallel \overline{P'Q'}$

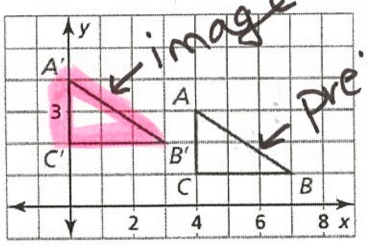
*Examples*:

1. The vertices of $\Delta ABC$ are A(0, 3), B(2, 4) and C(1, 0). Translate $\Delta ABC$ using the vector $\langle 5, -1\rangle$




$(x,y) \to (x+5, y-1)$

2. Write a rule for the translation of $\Delta ABC$ to $\Delta A'B'C'$




★ up 1 (h = 1)

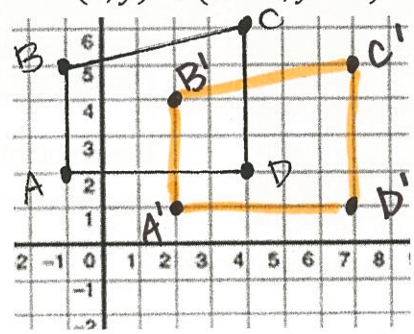
★ left 4 (k = -4)

moves along vector ⟨1, -4⟩

$(x,y) \to (x+1, y-4)$

3. Graph the image (and give its coordinates) of quadrilateral ABCD with vertices A(-1, 2), B(-1, 5), C(4, 6) and D(4, 2) with the translation:

$$(x, y) \to (x + 3, y - 1)$$




~~moves along vector ⟨3, -1⟩~~

A' ( 2 , 1 ) B' ( 2 , 4 )

C' ( 7 , 5 ) D' ( 7 , 1 )

Rigid Motions: A rigid motion is a transformation that preserves length and angle measure.

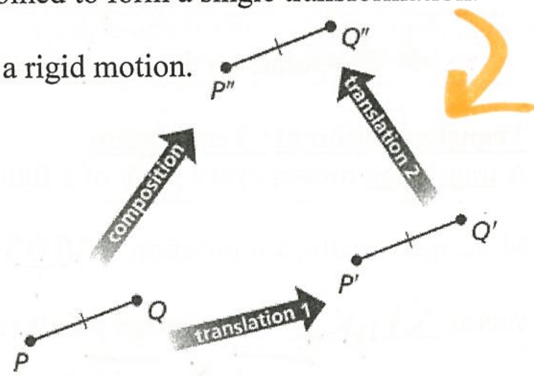
→ Another name for a rigid motion is an isometry.

→ A rigid motion maps lines to lines, rays to rays, and segments to segments.

Translation Postulate: A translation is a rigid motion.

Composition transformations: When two or more transformations are combined to form a single transformation.

Composition Theorem: The composition of two (or more) rigid motions is a rigid motion.

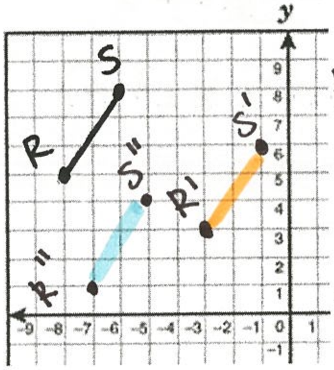



*Examples*:

4. Graph $\overline{RS}$ with endpoints R(-8, 5) and S(-6, 8) and its image after the following two translations

**Translation:** $(x, y) \to (x + 5, y - 2)$ $\overline{RS} \to \overline{R'S'}$

**Translation**: $(x, y) \to (x - 4, y - 2)$ $\overline{R'S'} \to \overline{R''S''}$




R(-8,5) [crossed out]

R''( -7 , 1 )

S(-6,8) → S''( -5 , 4 )

5. Write the rule for the single translation from $\overline{RS}$ to $\overline{R''S''}$ $(x,y) \to (x+1, y-4)$