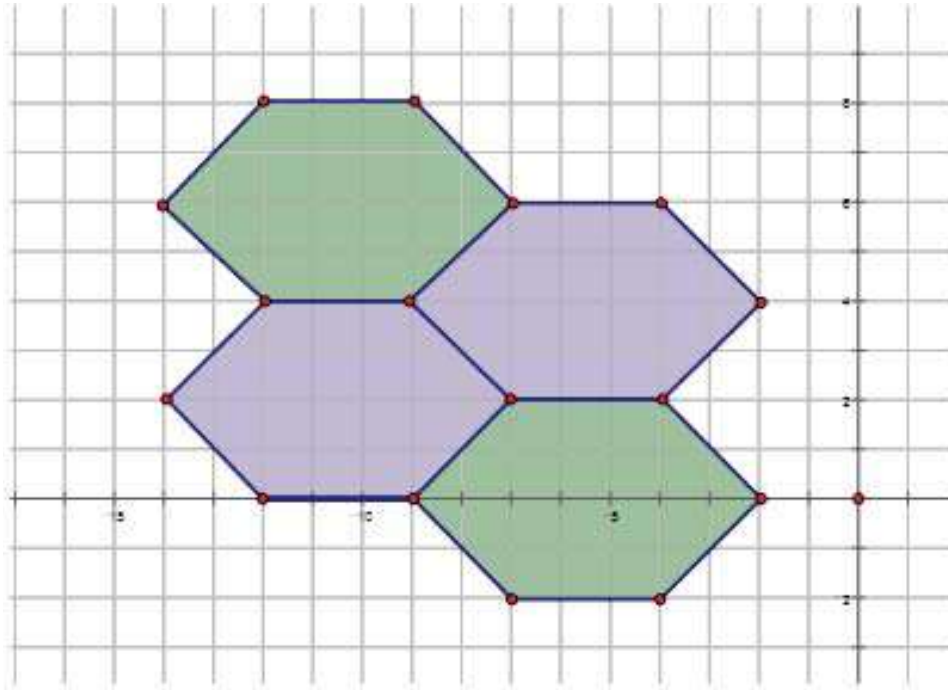


1.2 Rules for Translations

Here you will learn the different notation used for translations.

The figure below shows a pattern of a floor tile. Write the mapping rule for the translation of the two blue floor tiles.



Watch This

First watch this video to learn about writing rules for translations.



MEDIA

Click image to the left for more content.

[CK-12 FoundationChapter10RulesforTranslationsA](#)

Then watch this video to see some examples.



MEDIA

Click image to the left for more content.

[CK-12 FoundationChapter10RulesforTranslationsB](#)

Guidance

In geometry, a transformation is an operation that moves, flips, or changes a shape (called the preimage) to create a new shape (called the image). A translation is a type of transformation that moves each point in a figure the same distance in the same direction. Translations are often referred to as slides. You can describe a translation using words like "moved up 3 and over 5 to the left" or with notation. There are two types of notation to know.

1. One notation looks like $T_{(3, 5)}$. This notation tells you to add 3 to the x values and add 5 to the y values.
2. The second notation is a mapping rule of the form $(x, y) \rightarrow (x - 7, y + 5)$. This notation tells you that the x and y coordinates are translated to $x - 7$ and $y + 5$.

The mapping rule notation is the most common.

Example A

Sarah describes a translation as point P moving from $P(-2, 2)$ to $P'(1, -1)$. Write the mapping rule to describe this translation for Sarah.

Solution: In general, $P(x, y) \rightarrow P'(x + a, y + b)$.

In this case, $P(-2, 2) \rightarrow P'(-2 + a, 2 + b)$ or $P(-2, 2) \rightarrow P'(1, -1)$

Therefore:

$$\begin{array}{rcl} -2 + a = 1 & \text{and} & 2 + b = -1 \\ a = 3 & & b = -3 \end{array}$$

The rule is:

$$(x, y) \rightarrow (x + 3, y - 3)$$

Example B

Mikah describes a translation as point D in a diagram moving from $D(1, -5)$ to $D'(-3, 1)$. Write the mapping rule to describe this translation for Mikah.

Solution: In general, $P(x, y) \rightarrow P'(x + a, y + b)$.

In this case, $D(1, -5) \rightarrow D'(1 + a, -5 + b)$ or $D(1, -5) \rightarrow D'(-3, 1)$

Therefore:

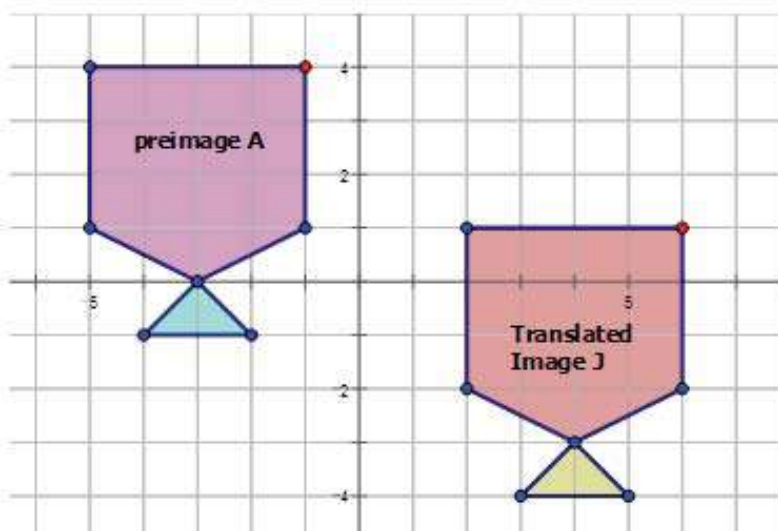
$$\begin{array}{rcl} 1 + a = -3 & \text{and} & -5 + b = 1 \\ a = -4 & & b = 6 \end{array}$$

The rule is:

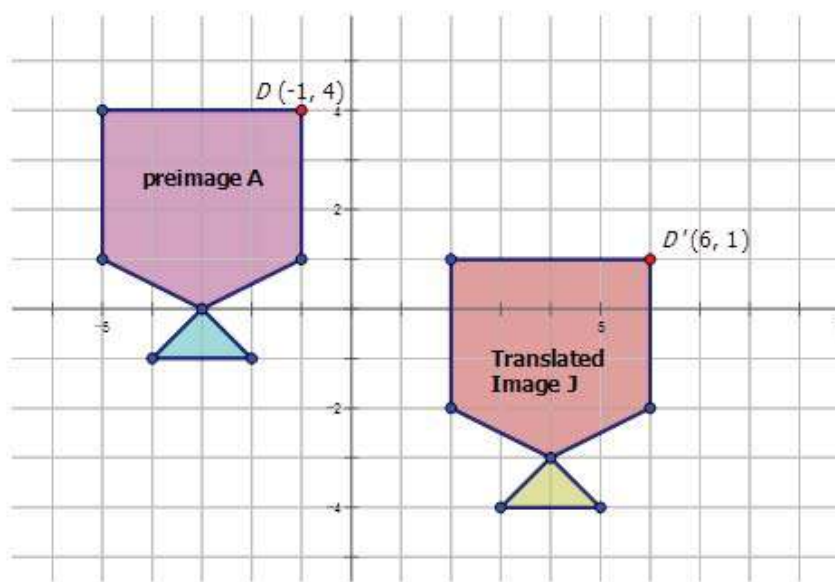
$$(x, y) \rightarrow (x - 4, y + 6)$$

Example C

Write the mapping rule that represents the translation of the preimage A to the translated image J in the diagram below.



Solution: First, pick a point in the diagram to use to see how it is translated.



$$D : (-1, 4) \quad D' : (6, 1)$$

$$D(x, y) \rightarrow D'(x + a, y + b)$$

$$\text{So: } D(-1, 4) \rightarrow D'(-1 + a, 4 + b) \text{ or } D(-1, 4) \rightarrow D'(6, 1)$$

Therefore:

$$\begin{array}{l} -1 + a = 6 \quad \text{and} \quad 4 + b = 1 \\ a = 7 \quad \quad \quad b = -3 \end{array}$$

The rule is:

$$(x, y) \rightarrow (x + 7, y - 3)$$

Vocabulary

Mapping Rule

A **mapping rule** has the following form $(x, y) \rightarrow (x - 7, y + 5)$ and tells you that the x and y coordinates are translated to $x - 7$ and $y + 5$.

Translation

A **translation** is an example of a transformation that moves each point of a shape the same distance and in the same direction. Translations are also known as **slides**.

Image

In a transformation, the final figure is called the **image**.

Preimage

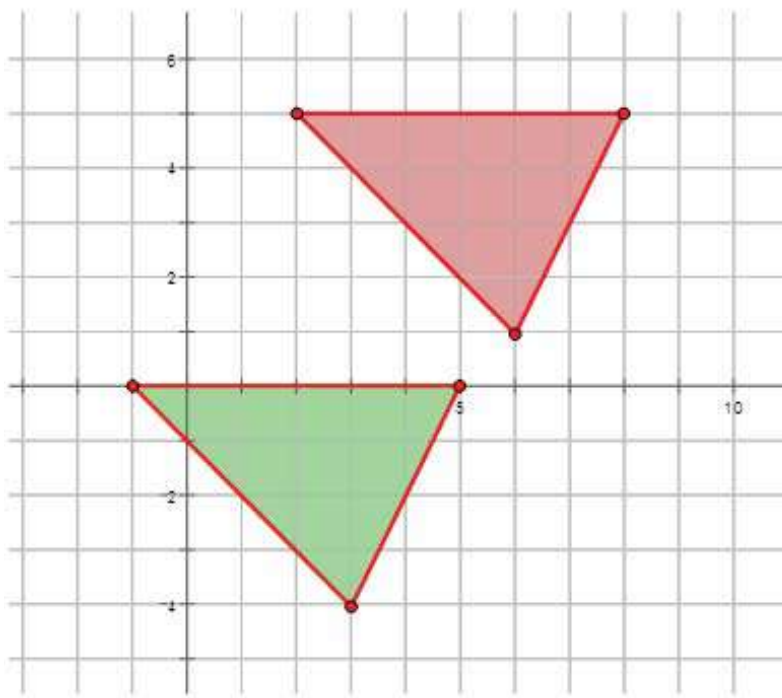
In a transformation, the original figure is called the **preimage**.

Transformation

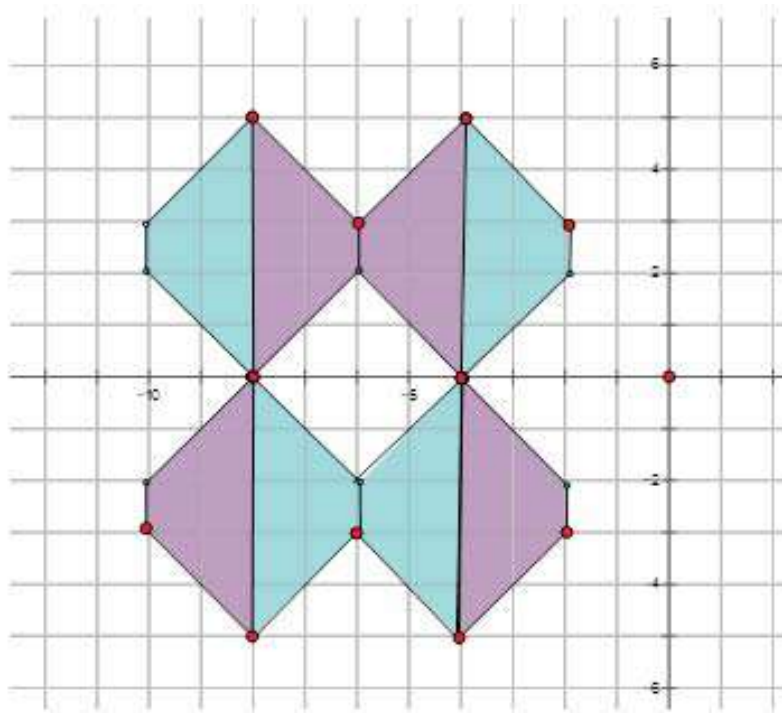
A **transformation** is an operation that is performed on a shape that moves or changes it in some way. There are four types of transformations: translations, reflections, dilations and rotations.

Guided Practice

- Jack describes a translation as point J moving from $J(-2, 6)$ to $J'(4, 9)$. Write the mapping rule to describe this translation for Jack.
- Write the mapping rule that represents the translation of the red triangle to the translated green triangle in the diagram below.



- The following pattern is part of wallpaper found in a hotel lobby. Write the mapping rule that represents the translation of one blue trapezoid to a translated blue trapezoid shown in the diagram below.

**Answers:**

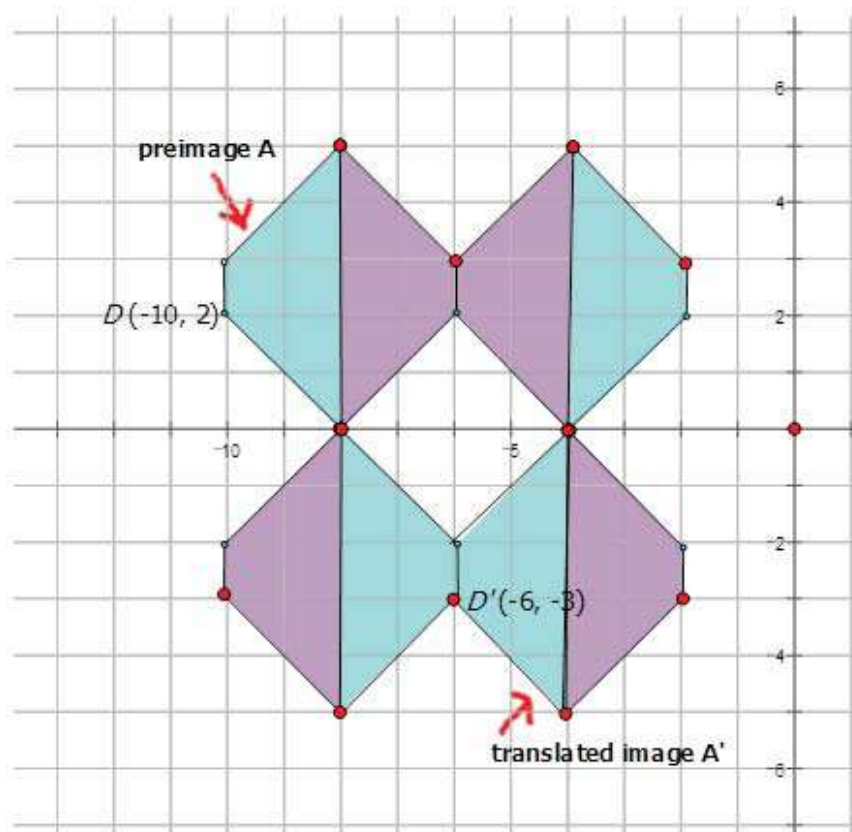
1.

$$(x, y) \rightarrow (x + 6, y + 3)$$

2.

$$(x, y) \rightarrow (x - 3, y - 5)$$

3. If you look closely at the diagram below, there two pairs of trapezoids that are translations of each other. Therefore you can choose one blue trapezoid that is a translation of the other and pick a point to find out how much the shape has moved to get to the translated position.



For those two trapezoids:

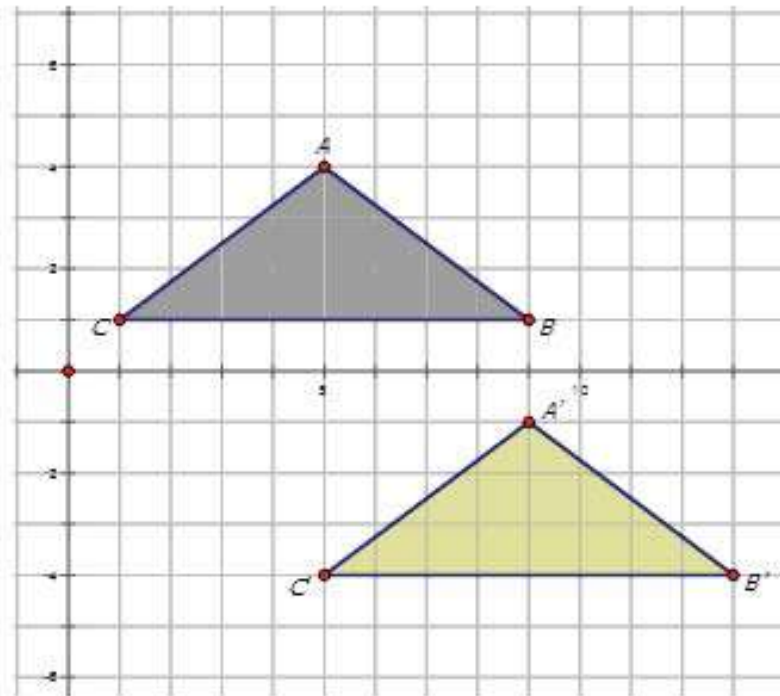
$$(x, y) \rightarrow (x + 4, y - 5)$$

Practice

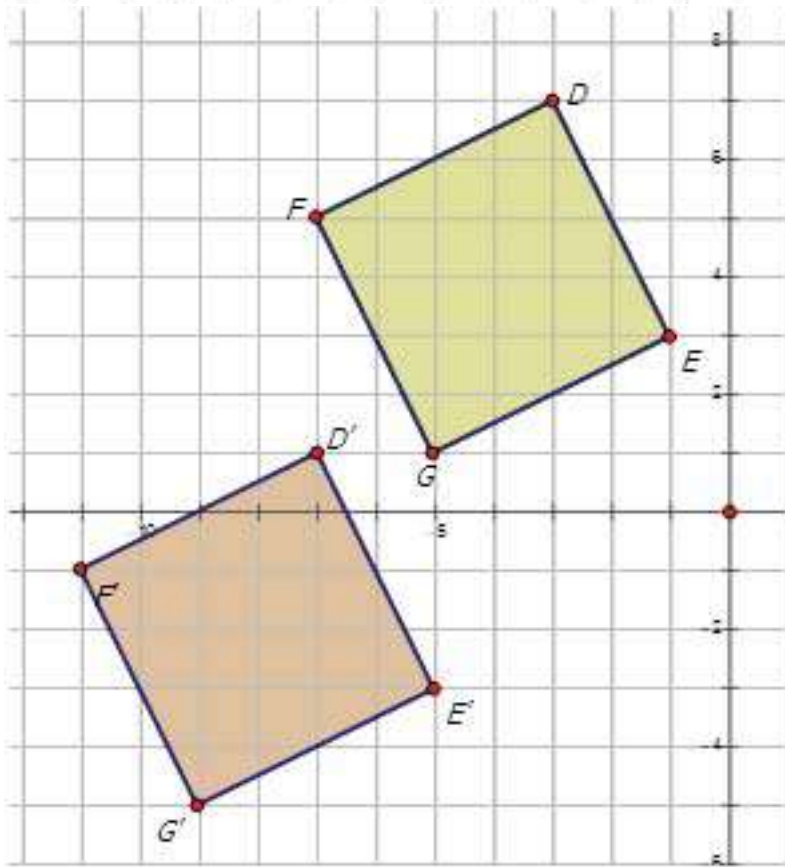
Write the mapping rule to describe the movement of the points in each of the translations below.

1. $S(1, 5) \rightarrow S'(2, 7)$
2. $W(-5, -1) \rightarrow W'(-3, 1)$
3. $Q(2, -5) \rightarrow Q'(-6, 3)$
4. $M(4, 3) \rightarrow M'(-2, 9)$
5. $B(-4, -2) \rightarrow B'(2, -2)$
6. $A(2, 4) \rightarrow A'(2, 6)$
7. $C(-5, -3) \rightarrow C'(-3, 4)$
8. $D(4, -1) \rightarrow D'(-4, 2)$
9. $Z(7, 2) \rightarrow Z'(-3, 6)$
10. $L(-3, -2) \rightarrow L'(4, -1)$

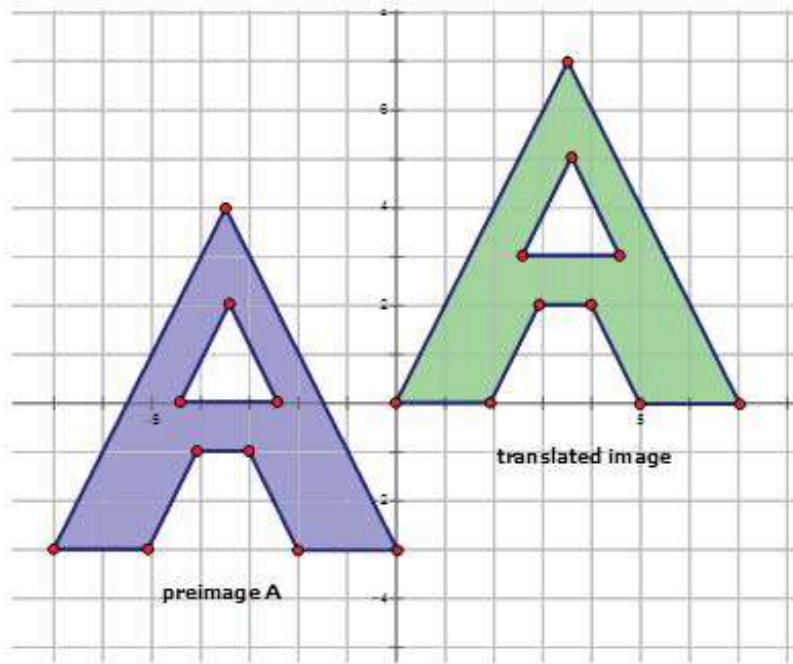
Write the mapping rule that represents the translation of the preimage to the image for each diagram below.



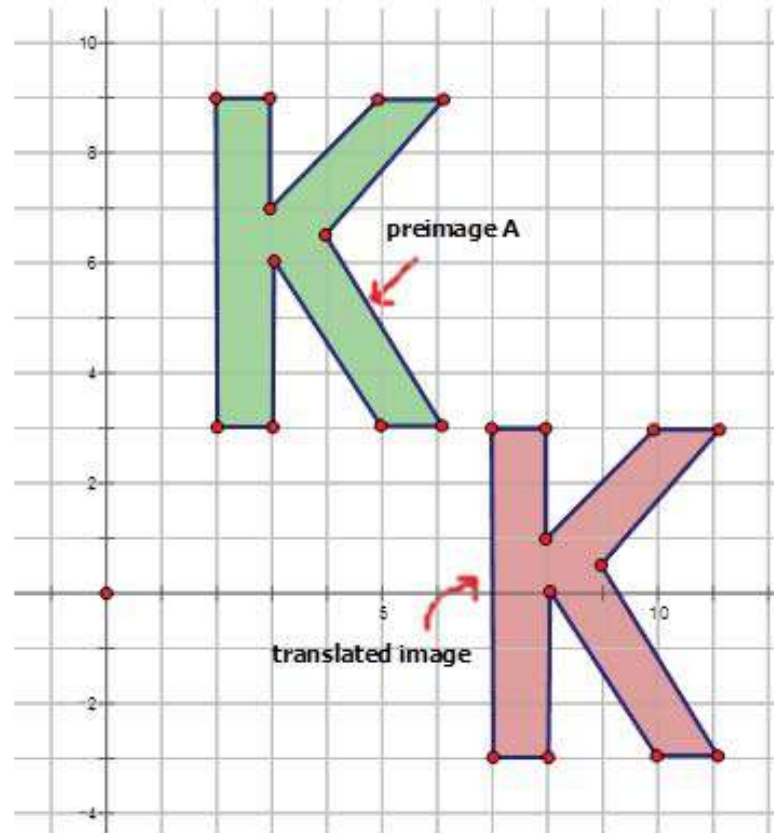
11.



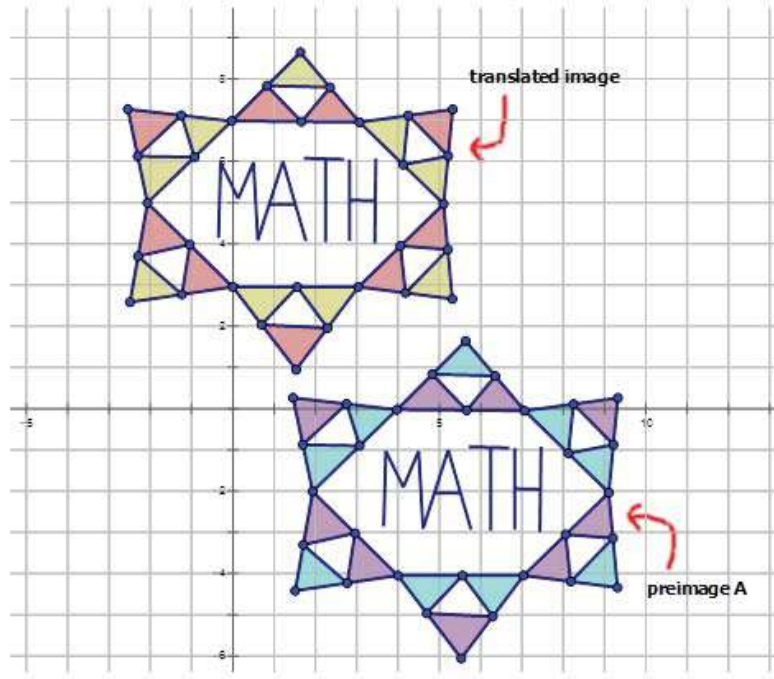
12.



13.



14.



15.