

Lesson Objectives

- Perform translations on points and figures
- Perform composition transformations
- Solve real-life problems involving compositions

Transformations

What are transformations?

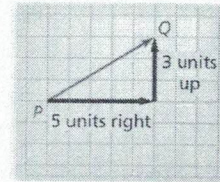
- Transform = to change or alter
- Transformation = A **function** that moves or changes a figure in some way to produce a new figure.
- 4 types of transformations (verb in parenthesis)
 - 1.) Translations (translate) *MOVE OR SLIDE*
 - 2.) Reflections (reflect) *MIRROR IMAGE OVER A LINE*
 - 3.) Rotations (rotate) *TURN OR SPIN AROUND A POINT*
 - 4.) Dilations (dilate) *INCREASE/DECREASE SCALE (SIZE)*

- 1.) Translations
 - Move every point the same distance in the same direction
- Homework
 - 4.1 p.178
 - Day 1: #3,4,7-12,14,15 (Mon 11/1)
 - Day 2: #19,20,23,32,34 (Tues 11/2)

Station 1: Translations using vector notation

One way to describe a translation on the coordinate plane is to use something called a **vector**.

A vector is a format where you describe the distance you translate an object in the x and y directions.

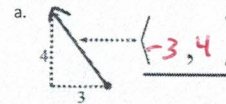


Above, you are given two points P and Q. If you were to move an object from point P to point Q, you would move it right 5 units and up 3 units. The vector form is written using special arrow brackets $\langle x, y \rangle$ that look similar to greater than and less than symbols.

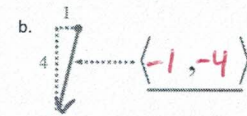
So, the vector above would be written as $\langle 5, 3 \rangle$. This is called the **component form of a vector**.

Examples

- 1.) Write the vector form of the following translations.



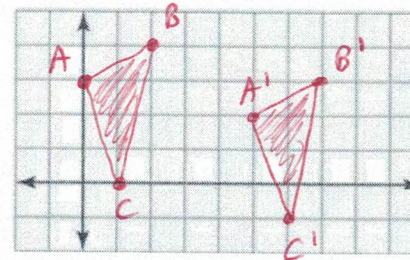
LEFT 3, UP 4



LEFT 1, DOWN 4

- 2.) The vertices of $\triangle ABC$ are $A(0,3)$, $B(2,4)$, and $C(1,0)$.

Translate $\triangle ABC$ using the vector $\langle 5, -1 \rangle$, drawing both the original and new triangles.



RIGHT 5, DOWN 1

Station 2: Translations using translation rule

Another way to describe a translation is using a form called a **translation rule**. The goal of a translation rule is to describe how much you are translating a point or figure in the x and y directions.

Translation rules are written in the following form:

- A translation that moves a point right 5 and down 6 would be written as $(x, y) \rightarrow (x+5, y-6)$.
- A translation that moves a point up 5 only would be written as $(x, y) \rightarrow (x, y+5)$.

Examples:

1.) Write a translation rule for the following:

a. Left 3 and down 4

$$(x, y) \rightarrow (x-3, y-4)$$

b. Right 4

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

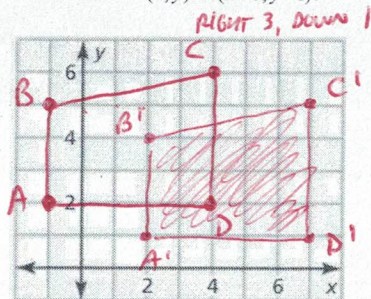
2.) The points $P(1, -3)$ and $R(0, 4)$ are translated using the rule $(x, y) \rightarrow (x-4, y+1)$. What are the coordinates for P' and R' ?

$$P(1, -3) \rightarrow P'(-3, -2)$$

$$R(0, 4) \rightarrow R'(-4, 5)$$

LEFT 4, UP 1

3.) Graph quadrilateral ABCD with vertices $A(-1, 2)$, $B(-1, 5)$, $C(4, 6)$, and $D(4, 2)$ and its image after the translation $(x, y) \rightarrow (x+3, y-1)$.

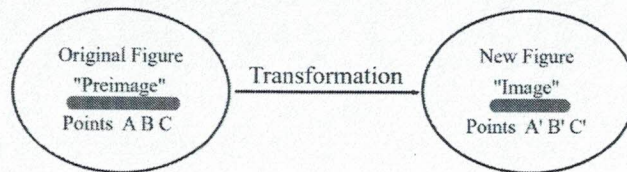


Station 3: Describing translation using image vs preimage

When you are given what appear to be identical shapes, how do you know which shape is the original and which one is the new shape?

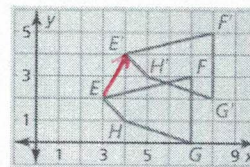
We have several ways we can tell or show which shape is which. One of the easiest is to use terms called an image and a preimage.

- Preimage vs Image
 - Preimage = Original Figure
 - Image = New figure after you have performed one or more transformations
- Notation
 - The preimage points are labeled using normal notation, with capital letters as the points
 - The image, or new points, are labeled using the same letters but with an apostrophe



Examples

1.) Describe the translation below (up/down and left/right). Note: You do not have to use any special notation if you have already done either station 1 or 2. Just describe the translation, such as "left 8 and down 6".



RIGHT 1, UP 2
(1, 2)

$$(x, y) \rightarrow (x+1, y+2)$$

2.) You are asked to translate the points A and B up 5 and left 7.

$\langle -7, 5 \rangle$

a. If point A is located at $(-3, 4)$, what is the location of A'?

$$A(-3, 4) \rightarrow A'(-10, 9)$$

b. If point B' is located at $(-8, 0)$, what is the location of B?

$$B(-1, -5) \leftarrow B'(-8, 0)$$

3.) You are given two points, $M(-2, 3)$ and $M'(-1, 5)$, that have undergone a translation.

Using this same translation, find:

$\langle 1, 2 \rangle$ or $(x, y) \rightarrow (x+1, y+2)$

a. N' if $N(0, 3)$

$$N'(1, 5)$$

b. P if $P(4, 10)$

$$P(3, 8) \leftarrow P'(4, 10)$$