Introduction to Transformations

What does it mean to transform something?

Geometrical Transformation

- a change in the **position**, **size**, or **shape** of a geometric figure

What does rigid mean?

2 Types of Transformations

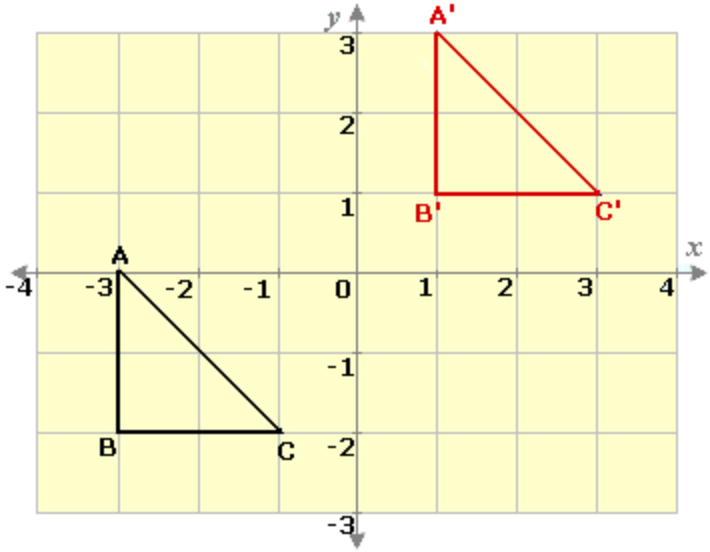
1. rigid motion (congruent motion)- preserves the **size** and **shape** of a figure
   - translations
   - reflections
   - rotations
2. non-rigid motion
   - dilation

Transformations

- are functions that take points in the plane as inputs and give other points as outputs

With transformations,

- the **pre-image** is the original figure (input)
- the **image** is the transformed figure (output)
- to distinguish the pre-image from the image**, prime notation** is used



points A, B, and C are inputs

points A', B', and C' are outputs

Is this transformation a rigid motion?

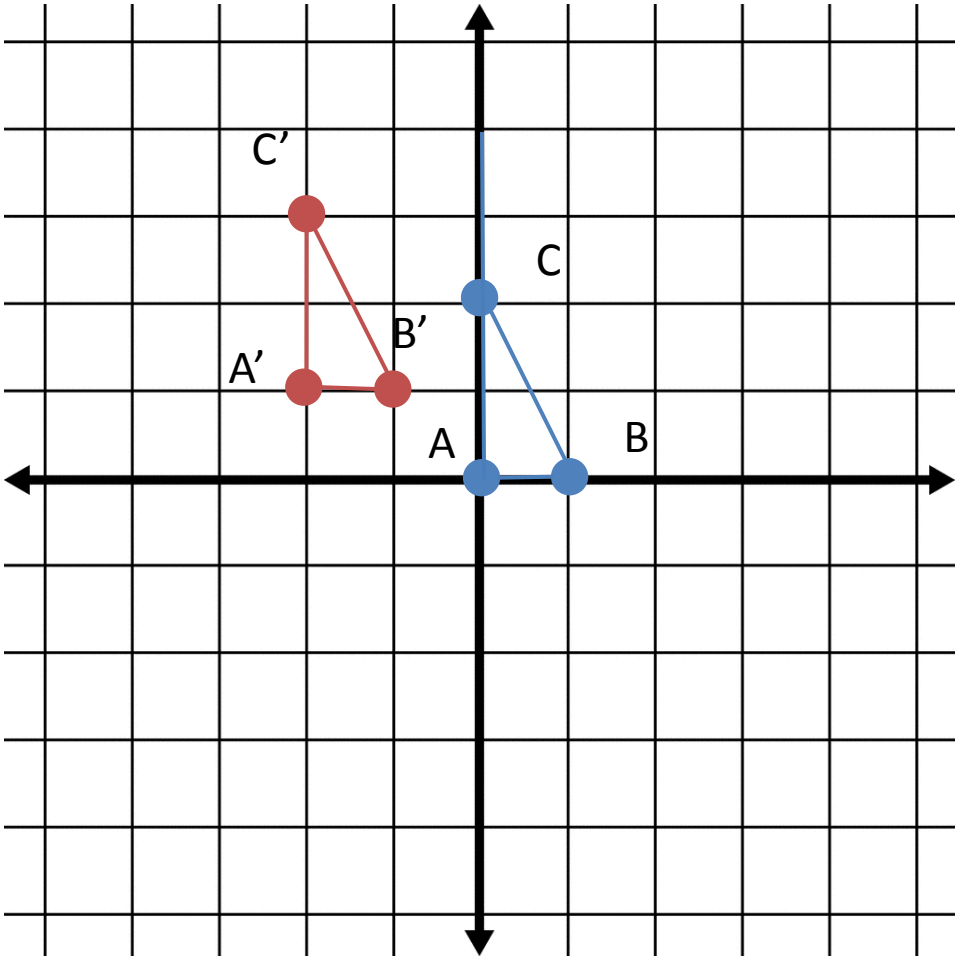
$(x,y) \rightarrow (x-4,y+1)$

pre-image points

A(0,0)

B(2,0)

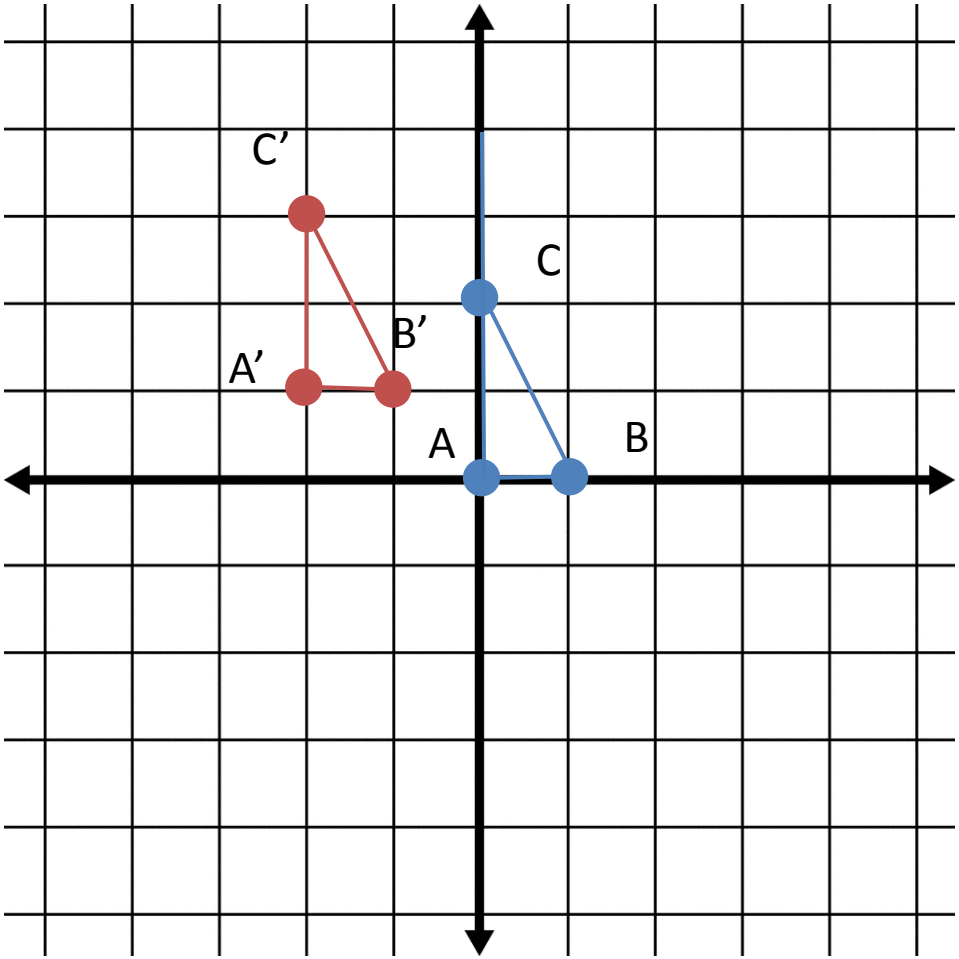
C(0,4)



Is this transformation a rigid motion?

$(x,y) \rightarrow (x-4,y+2)$

Yes, this transformation is a rigid motion because the size and shape of the pre-image is preserved



Is this transformation a rigid motion?

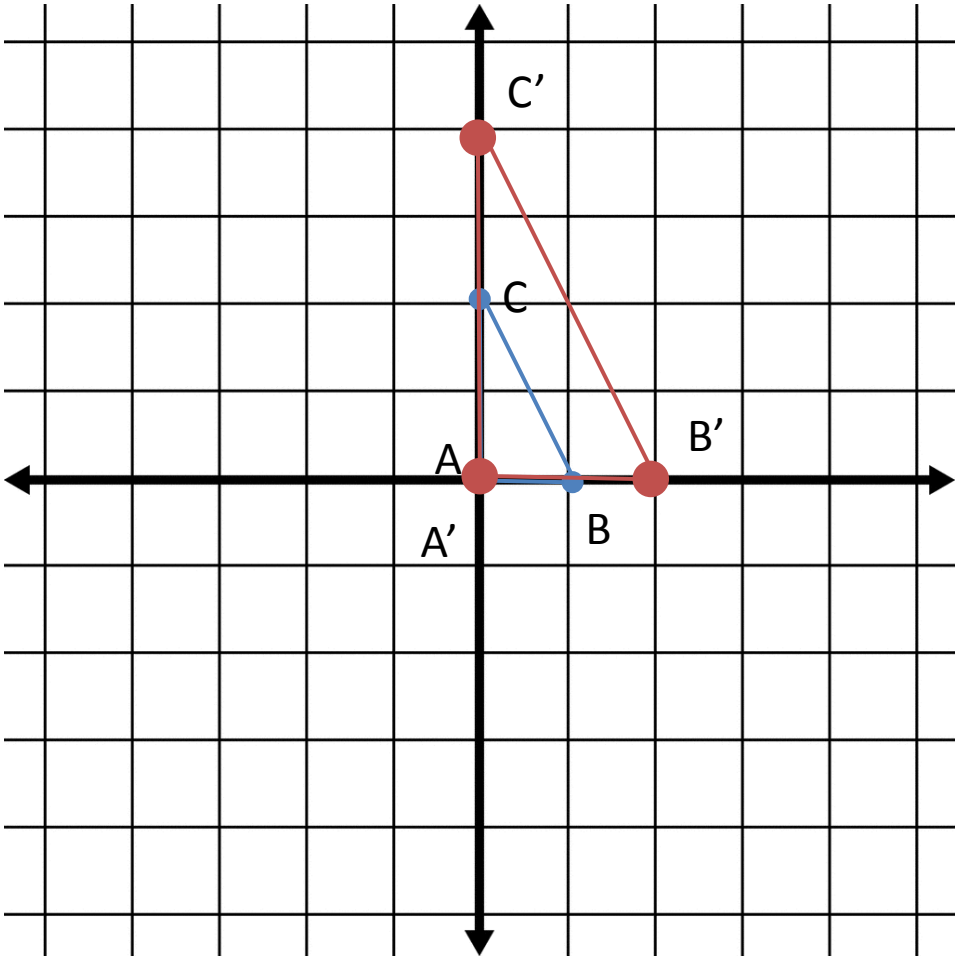
$(x,y) \rightarrow (2x,2y)$

<u>pre-image points</u>

(0,0)

(2,0)

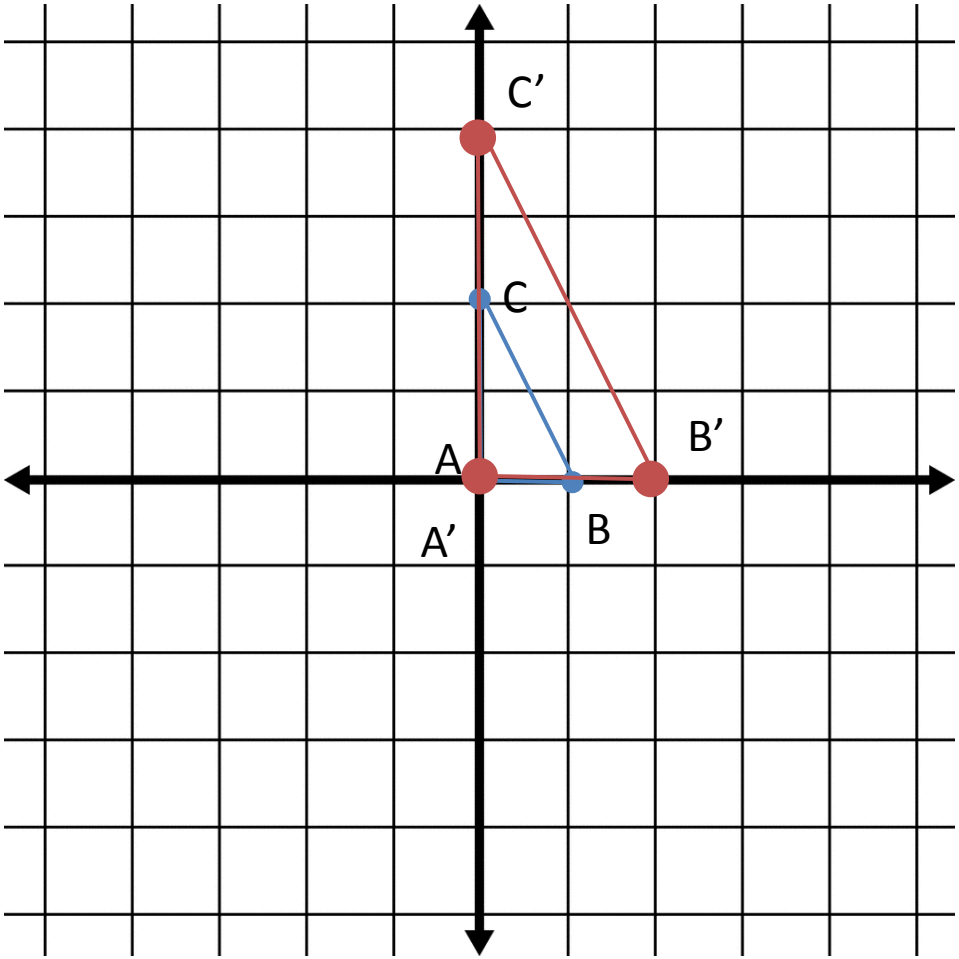
(0,4)



Is this transformation a rigid motion?

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

No, this transformation is not rigid motion because the size of the pre-image is not preserved



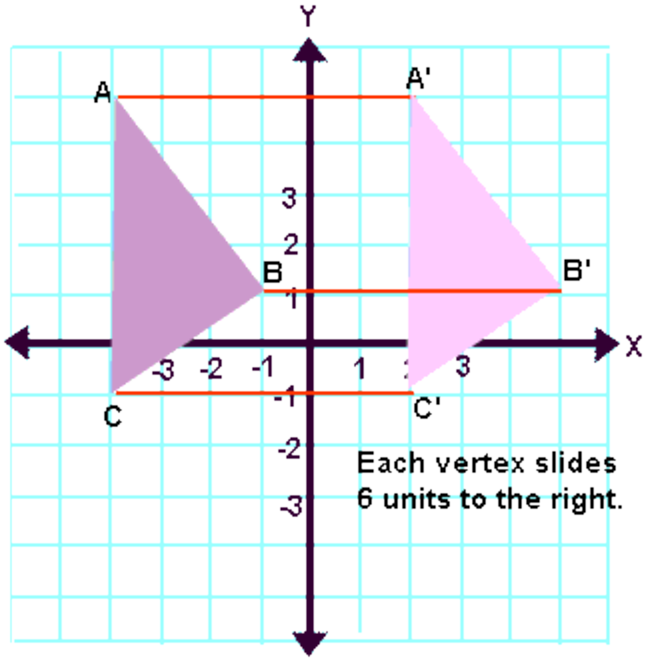
What happens as you go down a water slide?

Define Translate

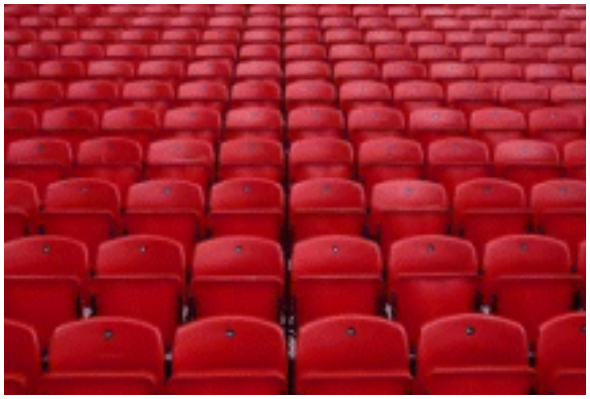
- In Latin: Translate means “carried across”

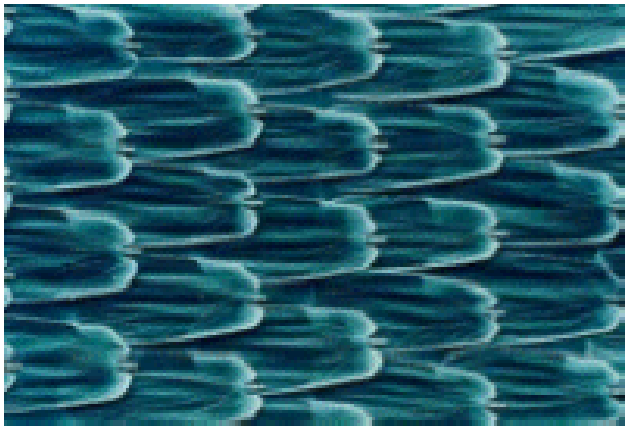
Translations

- a translation is a transformation that **SLIDES** all points of an image a fixed distance in a given direction

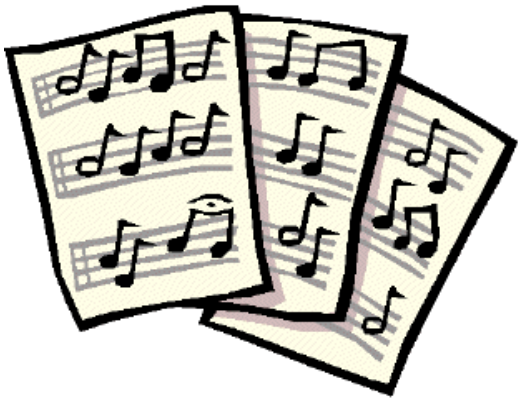


Real world examples of Translations



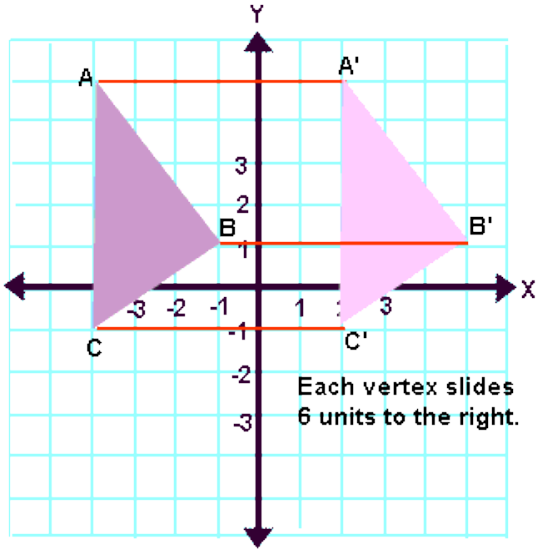


Scales of a butterfly



Translations

- lines that connect the corresponding points of a pre-image and its translated image are parallel.
- corresponding segments of a pre-image and its translated image are also parallel



Descriptive Notation

- Description using words to characterize a given translation

- Example:

  7 units to the left and 3 units up

Coordinate Notation

- coordinate notation is a way to write a function rule for a transformation in the coordinate plane

- example: (x,y) → (x+2, y-3)
  (x+2, y-3) is our function rule written in coordinate notation
  the pre-image is moving 2 units right and 3 units down

<u>applying this rule</u>

- if (6,12) is a point on our pre-image, then (6,12) becomes (6+2,12-3), which is point (8,9)
- so point (6,12) on our pre-image transformed to point (8,9) on our image

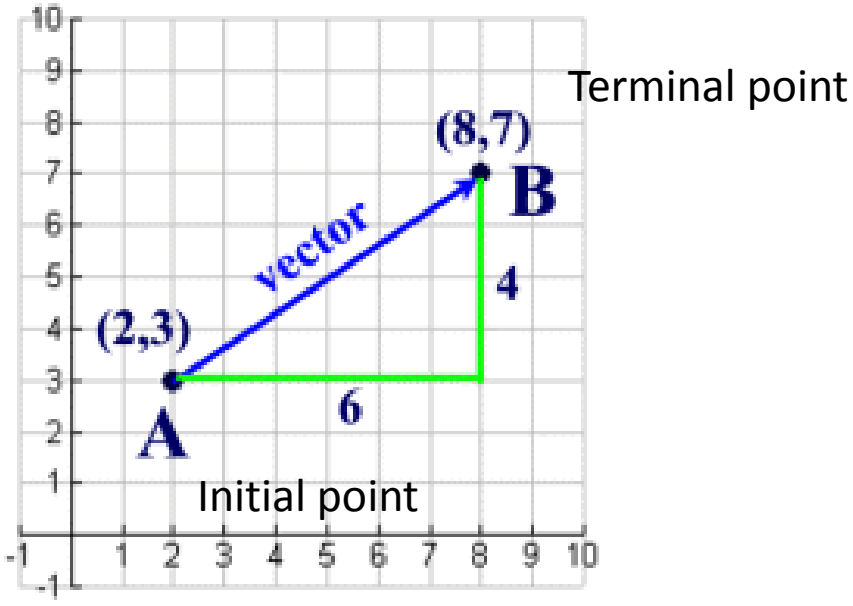
Vector Notation

- Utilizes a vector to describe the translation.

- A vector is a quantity that has magnitude (size) and direction
  - Velocity is a vector (3 mph due north)

Vector

- the **initial point** of a vector is the starting point
- the **terminal point** of a vector is the ending point

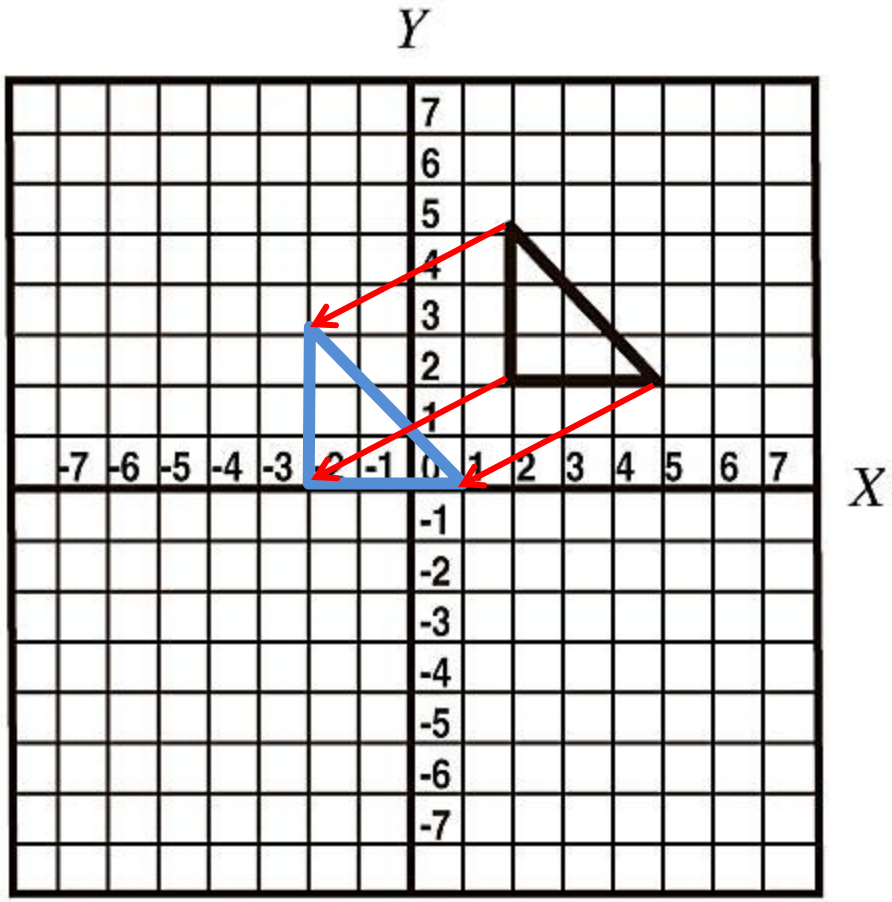


Component Form of Vectors

- denoted by <a,b>

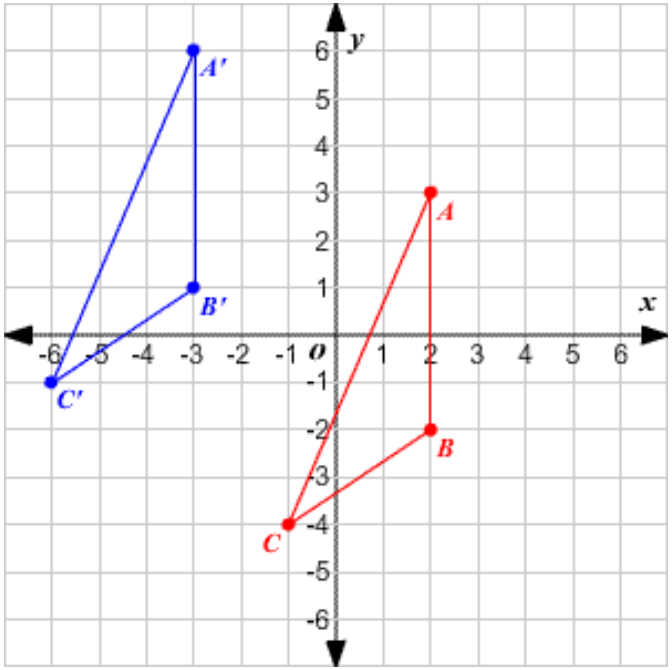
- specifies the horizontal change **a** and the vertical change **b** from the initial point to the terminal point
  - Negative indicates a motion of left or down

Draw the image of the pre-image shown below under the given translation vector: <-4,2>



Determining the translation vector

- given a pre-image and its translated image, determine the translation vector.



Give a verbal description of the translation vector.

Practice

http://www.regentsprep.org/Regents/math/geometry/GT2/PracT.htm