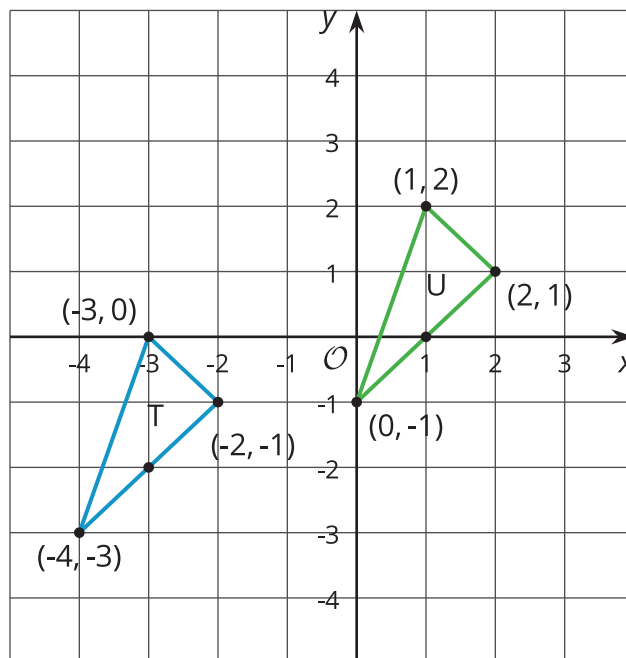


# Coordinate Moves

Let's transform some figures and see what happens to the coordinates of points.

## 4.1 Translating Coordinates

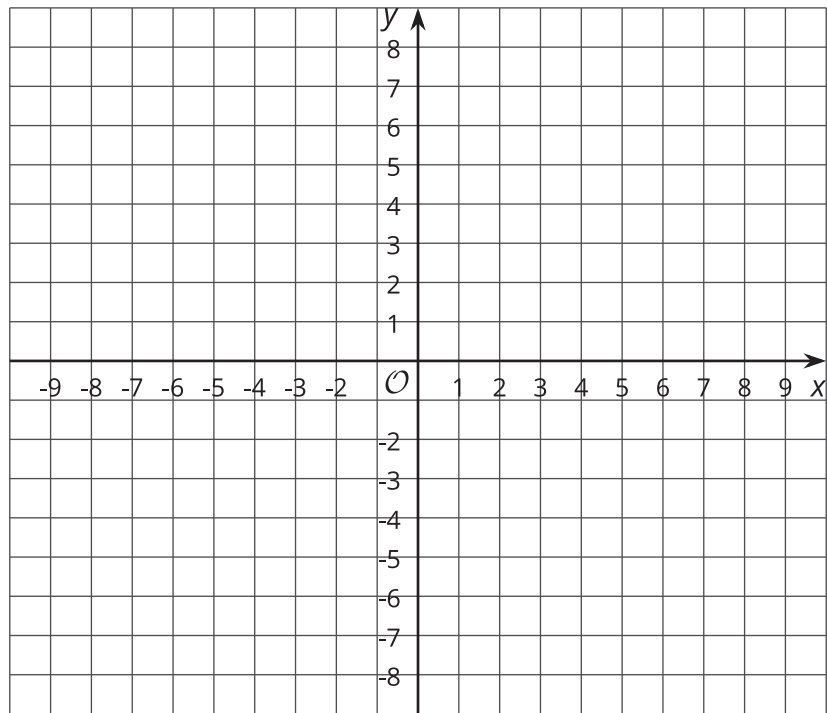
Select all of the translations that take Triangle T to Triangle U. There may be more than one correct answer.



- A. Translate  $(-3, 0)$  to  $(1, 2)$ .
- B. Translate  $(2, 1)$  to  $(-2, -1)$ .
- C. Translate  $(-4, -3)$  to  $(0, -1)$ .
- D. Translate  $(1, 2)$  to  $(2, 1)$ .

## 4.2

## Reflecting Points on the Coordinate Plane



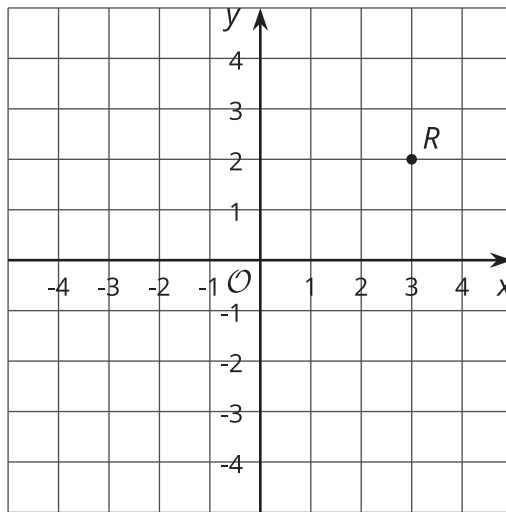
1. Here is a list of points:

$A(0.5, 4)$ ,  $B(-4, 5)$ ,  $C(7, -2)$ ,  $D(6, 0)$ ,  $E(0, -3)$

On the coordinate plane:

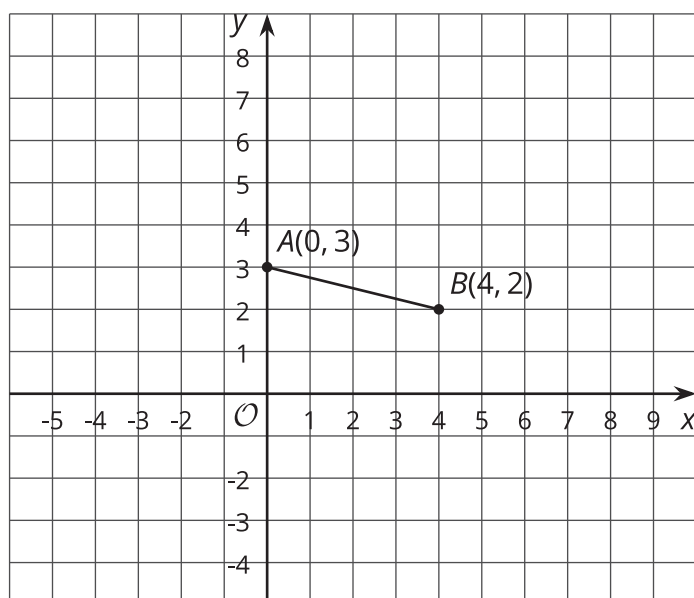
- Plot each point and label each with its coordinates.
  - Using the  $x$ -axis as the line of reflection, plot the image of each point.
  - Label the image of each point with its coordinates.
  - Include a label using a letter. For example, the image of point  $A$  should be labeled  $A'$ .
2. If the point  $(13, 10)$  were reflected using the  $x$ -axis as the line of reflection, what would be the coordinates of the image? What about  $(13, -20)$ ?  $(13, 570)$ ? Explain how you know.

3. The point  $R$  has coordinates  $(3, 2)$ .
- Without graphing, predict the coordinates of the image of point  $R$  if point  $R$  were reflected using the  $y$ -axis as the line of reflection.
  - Check your answer by finding the image of  $R$  on the graph.



- Label the image of point  $R$  as  $R'$ .
  - What are the coordinates of  $R'$ ?
4. Suppose you reflect a point using the  $y$ -axis as the line of reflection. How would you describe its image?

## 4.3 Transformations of a Segment



Apply each of the following transformations to segment  $AB$ .

1. Rotate segment  $AB$   $90^\circ$  counterclockwise around center  $B$ . Label the image of  $A$  as  $C$ . What are the coordinates of  $C$ ?
2. Rotate segment  $AB$   $90^\circ$  counterclockwise around center  $A$ . Label the image of  $B$  as  $D$ . What are the coordinates of  $D$ ?
3. Rotate segment  $AB$   $90^\circ$  clockwise around  $(0, 0)$ . Label the image of  $A$  as  $E$  and the image of  $B$  as  $F$ . What are the coordinates of  $E$  and  $F$ ?
4. Compare the two  $90^\circ$  counterclockwise rotations of segment  $AB$ . What is the same about the images of these rotations? What is different?

### Are you ready for more?

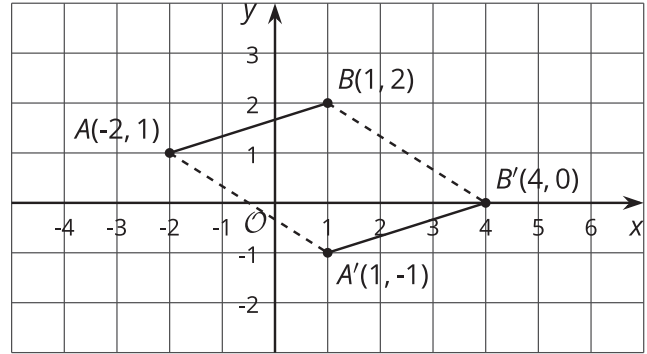
Suppose  $EF$  and  $GH$  are line segments of the same length. Describe a sequence of transformations that moves  $EF$  to  $GH$ .

## Lesson 4 Summary

We can use coordinates to describe points and find patterns in the coordinates of transformed points.

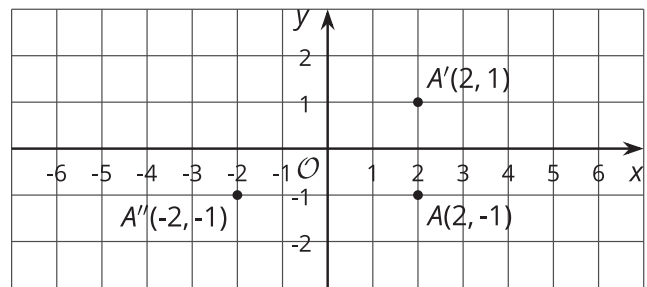
We can describe a translation by expressing it as a sequence of horizontal and vertical translations.

For example, segment  $AB$  is translated right 3 and down 2.



Reflecting a point across an axis changes the sign of one coordinate.

For example, reflecting the point  $A$  whose coordinates are  $(2, -1)$  across the  $x$ -axis changes the sign of the  $y$ -coordinate, making its image the point  $A'$  whose coordinates are  $(2, 1)$ . Reflecting the point  $A$  across the  $y$ -axis changes the sign of the  $x$ -coordinate, making the image the point  $A''$  whose coordinates are  $(-2, -1)$ .



Reflections across other lines are more complex to describe.

We don't have the tools yet to describe rotations in terms of coordinates in general. Here is an example of a  $90^\circ$  rotation with center  $(0, 0)$  in a counterclockwise direction.

Point  $A$  has coordinates  $(0, 0)$ . Segment  $AB$  is rotated  $90^\circ$  counterclockwise around  $A$ . Point  $B$  with coordinates  $(2, 3)$  rotates to point  $B'$  whose coordinates are  $(-3, 2)$ .

