

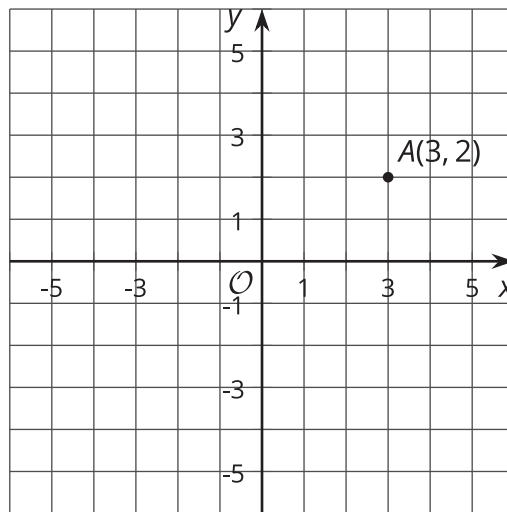


Transformations as Functions

Let's compare transformations to functions.

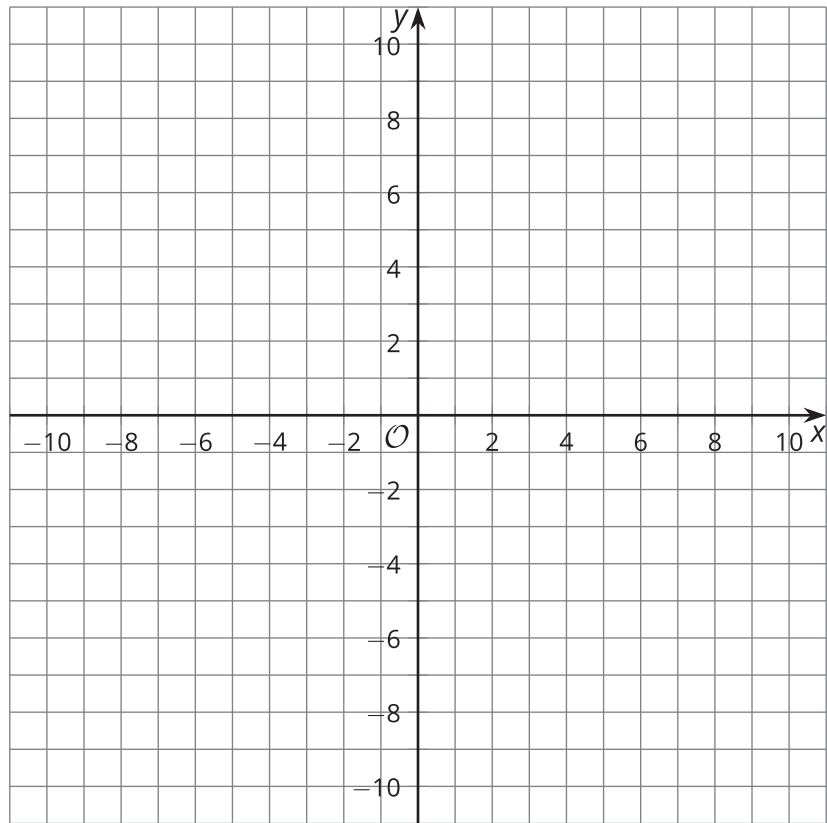
2.1 Math Talk: Transforming a Point

Mentally find the coordinates of the image of A under each transformation.



- Translate A by the directed line segment from $(0, 0)$ to $(0, 2)$.
- Translate A by the directed line segment from $(0, 0)$ to $(-4, 0)$.
- Reflect A across the x -axis.
- Rotate A 180 degrees clockwise using the origin as a center.

2.2 Inputs and Outputs



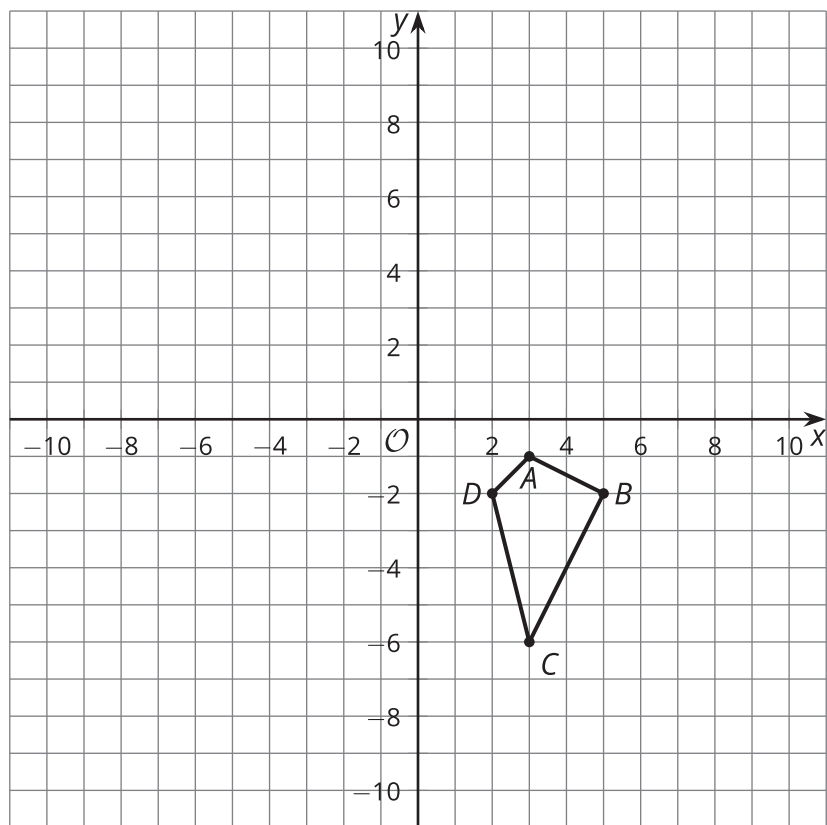
- For each point (x, y) , find its image under the transformation $(x + 12, y - 2)$.
 - $A(-10, 5)$
 - $B(-4, 9)$
 - $C(-2, 6)$
- Next, sketch triangle ABC and its image on the grid. What transformation is $(x, y) \rightarrow (x + 12, y - 2)$?

3. For each point (x, y) in the table, find $(2x, 2y)$.

| (x, y) | $(2x, 2y)$ |
|------------|------------|
| $(-1, -3)$ | |
| $(-1, 1)$ | |
| $(5, 1)$ | |
| $(5, -3)$ | |

4. Next, sketch the original figure (the (x, y) column) and image (the $(2x, 2y)$ column). What transformation is $(x, y) \rightarrow (2x, 2y)$?

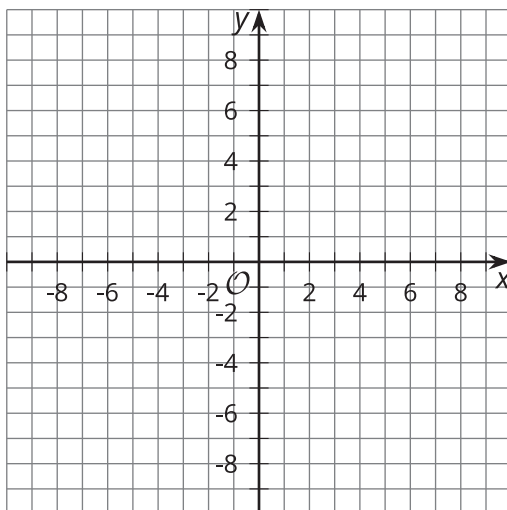
2.3 What Does It Do?



- Here are some transformation rules. Apply each rule to quadrilateral $ABCD$, and graph the resulting image. Then describe the transformation.
 - Label this transformation Q : $(x, y) \rightarrow (2x, y)$
 - Label this transformation R : $(x, y) \rightarrow (x, -y)$
 - Label this transformation S : $(x, y) \rightarrow (y, -x)$



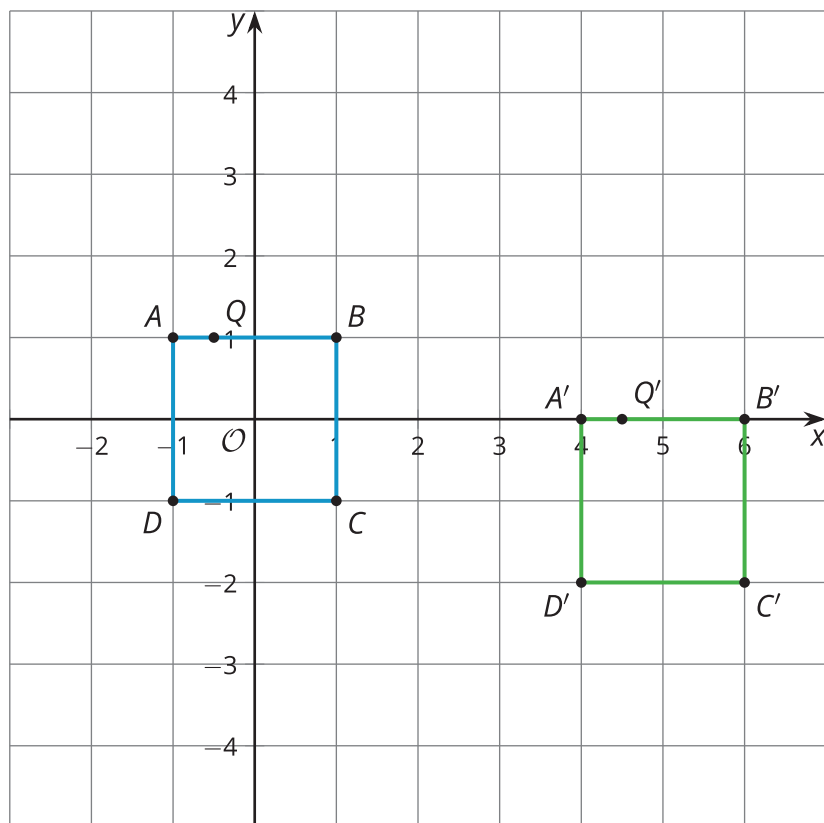
Are you ready for more?



1. Plot the quadrilateral with vertices $(4, -2)$, $(8, 4)$, $(8, -6)$, and $(-6, -6)$. Label this quadrilateral A .
2. Plot the quadrilateral with vertices $(-2, 4)$, $(4, 8)$, $(-6, 8)$, and $(-6, -6)$. Label this quadrilateral A' .
3. How are the coordinates of quadrilateral A related to the coordinates of quadrilateral A' ?
4. What single transformation takes quadrilateral A to quadrilateral A' ?

Lesson 2 Summary

Square $ABCD$ has been translated by the directed line segment from $(-1, 1)$ to $(4, 0)$. The result is square $A'B'C'D'$.



Here is a list of coordinates in the original figure and corresponding coordinates in the image. Do you see the rule for taking points in the original figure to points in the image?

| original figure | image |
|-----------------|--------------|
| $A(-1, 1)$ | $A'(4, 0)$ |
| $B(1, 1)$ | $B'(6, 0)$ |
| $C(1, -1)$ | $C'(6, -2)$ |
| $D(-1, -1)$ | $D'(4, -2)$ |
| $Q(-0.5, 1)$ | $Q'(4.5, 0)$ |

This table looks like a table that shows corresponding inputs and outputs of a function. A transformation is a special type of function that takes points in the plane as inputs and gives other points as outputs. In this case, the function's rule is to add 5 to the x -coordinate and subtract 1 from the y -coordinate.

We write the rule this way:

$$(x, y) \rightarrow (x + 5, y - 1).$$