Investigation 3

Transforming Coordinates

The computer programs that manage video displays for television shows and video games all use coordinate graphing systems. The axes and grid lines are hidden from view, but are essential to setting the color of the pixels that you see.

Rules for geometric transformations guide the movement of characters on the screen. In this Investigation, you will develop your understanding of coordinate rules for transformations and skill in using that knowledge to solve geometry problems.

3.1 Flipping on a Grid

Coordinate Rules for Reflections

When you draw a geometric figure on a grid, each point has a pair of coordinates. Most graphics programs have methods for moving figures from one position to another. The programs move key points (like vertices of polygons) first and then automatically fill in line segments to connect the key points. Recall that you followed this process to draw the Wump family in *Stretching and Shrinking*.

Common Core State Standards

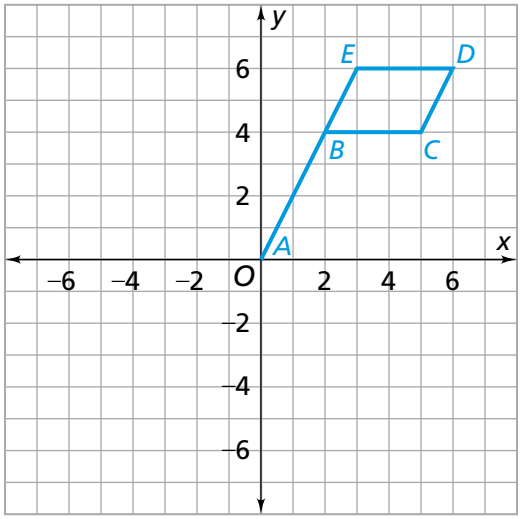
8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.

Also 8.G.A.1, 8.G.A.1b, 8.G.A.1c

The diagram below shows a flag located in the first quadrant. Notice the labels on key points.



- How can you find the coordinates of the images of those key points under flips, turns, slides, and other sequences of transformations?

In this Problem, you will find rules to relate coordinates of key points on the flag to coordinates of their images after line reflections.

Problem 3.1

A Copy and complete the table showing the coordinates of points *A*–*E* and their images under a reflection in the *y*-axis.

Point	*A*	*B*	*C*	*D*	*E*
Original Coordinates	(0, 0)	(2, 4)	■	■	■
Coordinates After a Reflection	■	■	■	■	■

1. Write a rule relating coordinates of key points and their images after a reflection in the *y*-axis: $(x, y) \rightarrow$ (■, ■).

2. Would your rule give the correct coordinates if the flag started in the second, third, or fourth quadrant? Justify your answer with sketches and samples of coordinates that match.

3. a. Do any points remain unchanged under this reflection? Explain.

b. Do the flag and its image make a symmetric design?

continued on the next page >

Problem 3.1 continued

B Copy and complete the table showing the coordinates of points A–E and their images under a reflection in the x-axis.

Point	A	B	C	D	E
Original Coordinates	(0, 0)	(2, 4)	■	■	■
Coordinates After a Reflection	■	■	■	■	■

1. Write a rule relating coordinates of key points and their images after a reflection in the x-axis: $(x, y) \rightarrow$ (■, ■).
2. Would your rule give the correct coordinates if the flag started in the second, third, or fourth quadrant? Justify your answer with sketches and samples of coordinates that match.
3. **a.** Do any points remain unchanged under this reflection? Explain.

   b. Do the flag and its image make a symmetric design?

C Copy and complete the table showing coordinates of points A–E and their images under a reflection in the line $y = x$.

Point	A	B	C	D	E
Original Coordinates	(0, 0)	(2, 4)	■	■	■
Coordinates After a Reflection	■	■	■	■	■

1. Write a rule relating coordinates of key points and their images after a reflection in the line $y = x$: $(x, y) \rightarrow$ (■, ■).
2. Would your rule give the correct coordinates if the flag started in the second, third, or fourth quadrant? Justify your answer with sketches and samples of coordinates that match.

Homework starts on page 61.