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Lesson 3: Transformations

OBJECTIVES: SWBA to

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

INTRODUCTION

The word “transform” means “to change.” In math (geometry), a transformation changes the **position** of a shape or object on a plane (coordinate plane). What that really means is that a shape is moving from one place to another without changing size or shape. There are four basic transformations: 1) Reflection (or flip), 2) Translation (or slide), and 3) Rotation (Or spin)—these three transformations keep shape and size of the original figure or object (pre-image)—only the position or orientation change. The fourth transformation is called dilation. A dilation changes the size of an object, either by enlarging it or shrinking it by a factor, but the shape and orientation of the object remains the same.

Here are some real life instances of the use of transformations. The image in a mirror is a reflection. When you enlarge an image on a computer or on photocopiers the enlargement or image is dilation. When you pushing an object across a table or room it is an example of translation; opening a door is a rotation, or a globe spinning.

Transformations are extensively used in computer animation. Computer animation requires a figure to be shifted and stretched on a plane. Computer animation software uses advanced transformation to achieve this. Transformations are also very common in painting, fashion design, and architecture due to the fact that these areas involve lots of patterns and symmetry.

In today’s lesson, we will focus on **reflection**. In the following two weeks we will tackle down translation, rotation and dilation.

MINI-LESSON (I DO):

THINKING ALOUD, say, “How many of you looked in a mirror before you left home today?” “What did you see when you looked in the mirror?” ---You saw your **reflection**! The reflection or image in the mirror is called the **image**, and the person in front of the mirror, you, is called the **pre-image**. In other words, the pre-image is what you what to transform or reflect. A few interesting things happen when you do a reflection. For instance in the mirror image or reflection everything is shown in in reverse—your left hand is the right hand of the image; if you touch your right ear, the image is touches its left ear.

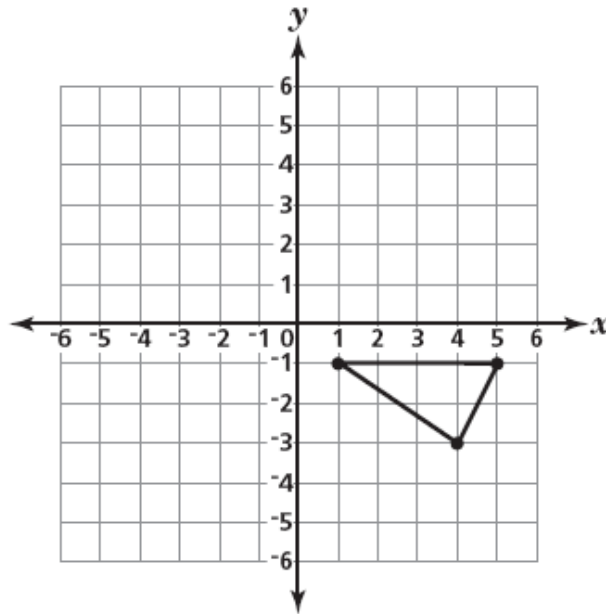
(Write a few numbers on a sheet of paper and invite students to look at the numbers in a mirror. By comparing reflections occurring with mirrors to reflections on the coordinate grid, the students have a better understanding of reflections (flips)).

Now, when reflecting an image on a coordinate grid, I need a **line of reflection**. The line of reflection could be any line. Commonly, we reflect over the x-axis or y-axis. Think of a line of reflection as where I will put the mirror that will generate the reflection or image. Remember that I said that in a reflection everything is reverse? Well when reflecting a point, say point $p(x, y)$, the image of the point will appear as $p'(-x, y)$ if I reflect the point over the x-axis. Or $p'(x, -y)$ if I reflect the point over the y-axis.

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Let me show you with an example.

Gary drew a triangle on the coordinate grid shown below.

**Step 1: Make out the question**

What are the new coordinates of the vertices of the triangle after Gary reflects the triangle?

Step 2: Identify important information

Reflect the triangle (over, across) in the y-axis. This means that the image of the triangle is going to be on the IV quadrant

Step 3: Create a plan

Each vertex (corner) of the triangle is exactly the same distance away from the y-axis, but on the opposite side.

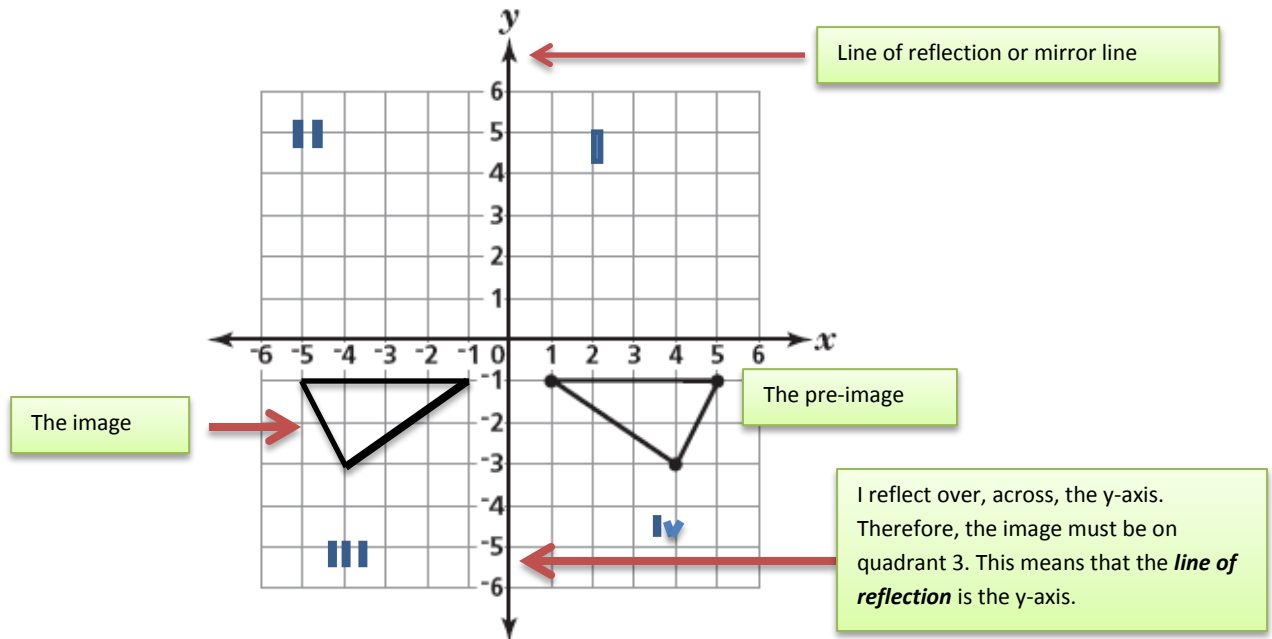
If Gary reflects the triangle in the y-axis, what will be the new coordinates of the vertices of the triangle?

- F** $(-1, -1), (4, -3), (-5, 1)$
- G** $(-1, -1), (-4, -3), (-5, -1)$
- H** $(-1, 1), (-4, 3), (5, -1)$
- J** $(1, 1), (4, 3), (5, 1)$

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Solution:

Gary drew a triangle on the coordinate grid shown below.



If Gary reflects the triangle in the y -axis, what will be the new coordinates of the vertices of the triangle?

- F** $(-1, -1), (4, -3), (-5, 1)$
- G** $(-1, -1), (-4, -3), (-5, -1)$
- H** $(-1, 1), (-4, 3), (5, -1)$
- J** $(1, 1), (4, 3), (5, 1)$

The coordinates of the pre-image are:

$(1, -1), (4, -3),$ and $(5, -1)$

Reflecting in the y -axis means that for each vertex the image of the triangle will keep the same y -coordinate, but the opposite of each x -coordinate. Therefore the coordinate of the image are:

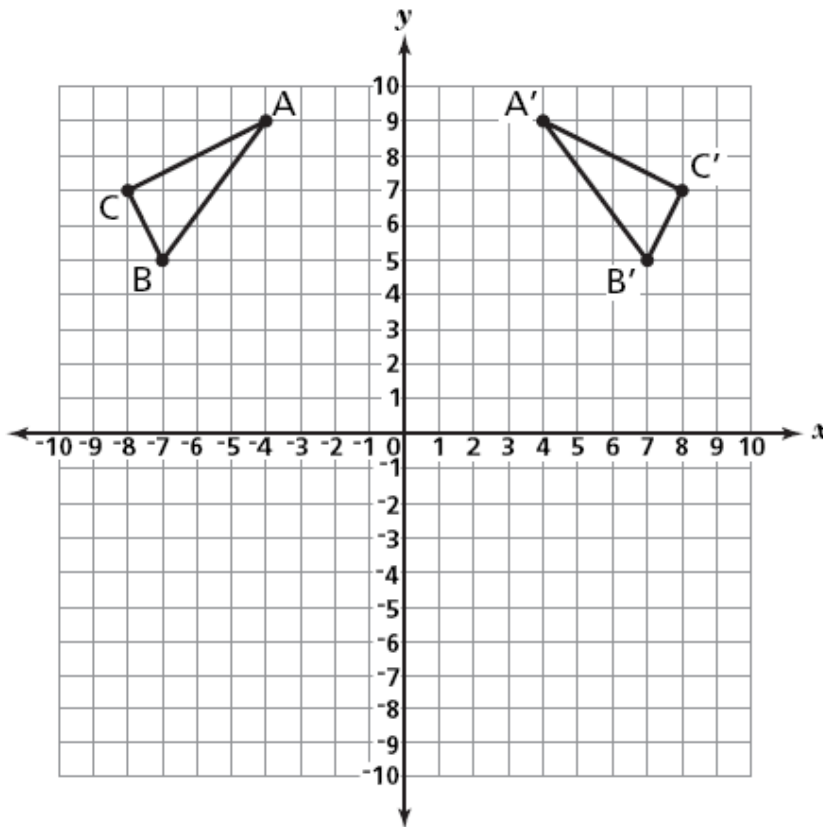
$(-1, -1), (-4, -3),$ and $(-5, -1)$

The correct answer choice is **G**.

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Summarize what you have taught them—Assess for understanding by show of thumbs up/down.**Guide Practice (We do):**

Triangle ABC and triangle A'B'C' are plotted on the coordinate plane below.



What is the name of the transformation applied to triangle ABC that resulted in triangle A'B'C' ?

Answer It is a reflection

How do we know? Remember reflection means the opposite or a flip.

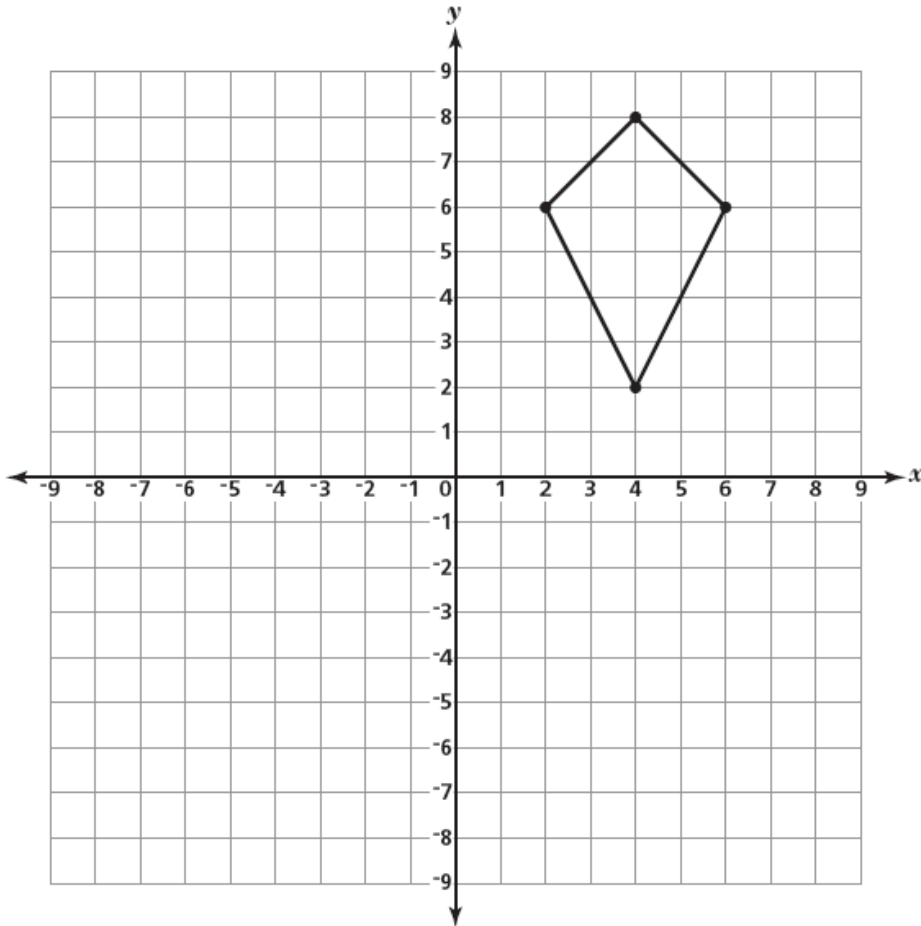
Triangle ABC was reflected in the y-axis. Point A is 4 units away from the y-axis. A' is 4 units away from the y-axis, in the opposite side. Point B is 7 units from the y-axis, and B' is also 7 units from the y-axis, but on the opposite side. Point C is 8 units away from the y-axis, and C' is 8 units away from the y-axis, but in the opposite side.

Summarize what you have taught the students one more time—Assess for understanding by show of thumbs up/down

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Independent Practice (We Do):**Problem 1:**

Melissa drew the shape on the grid shown below. Draw the reflection of this shape in the x -axis. Label the coordinates of each point on the new figure.

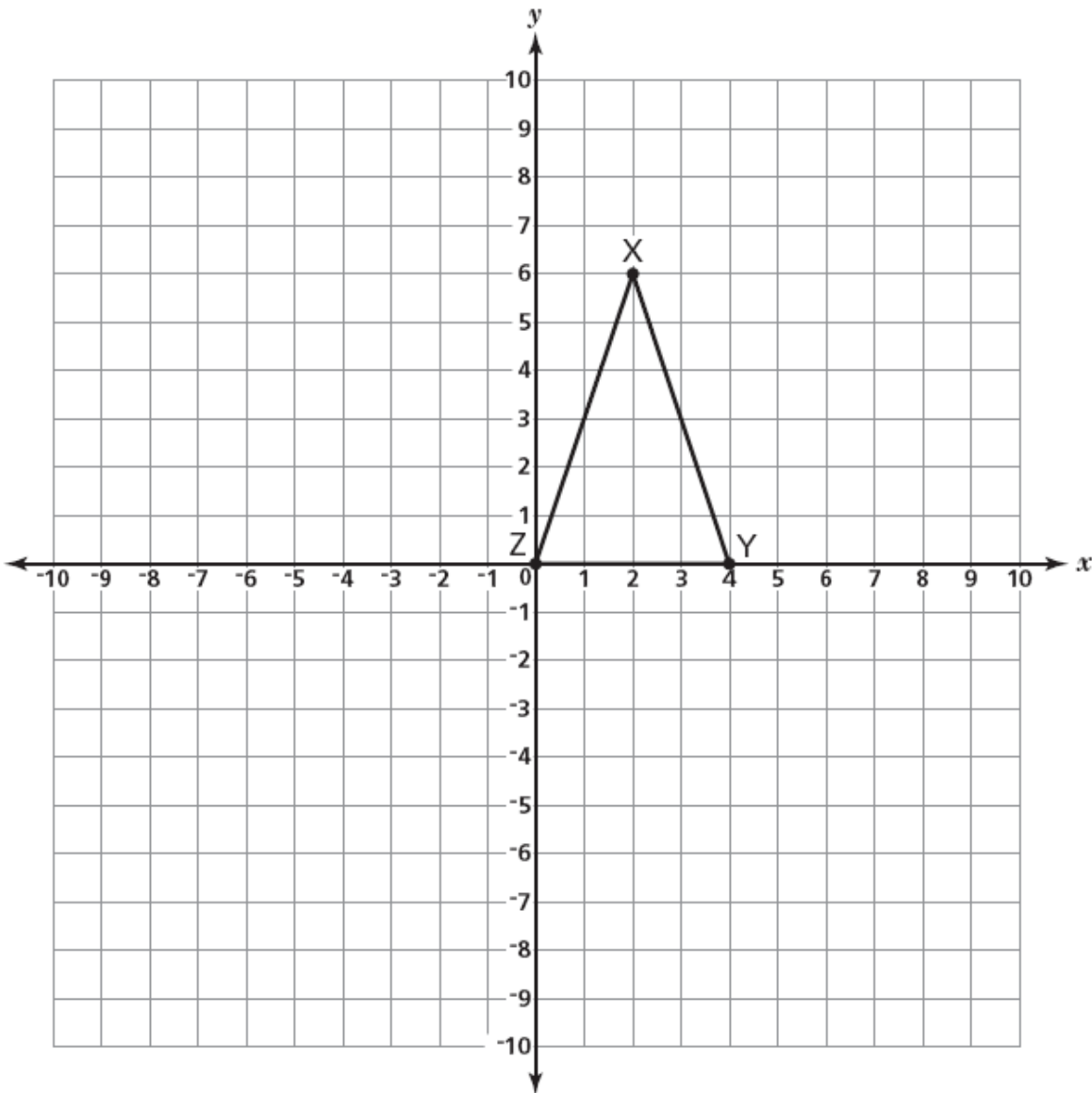


On the lines below, explain how you determined the reflection of the shape.

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Problem 2:

Triangle XYZ is plotted on the grid below.

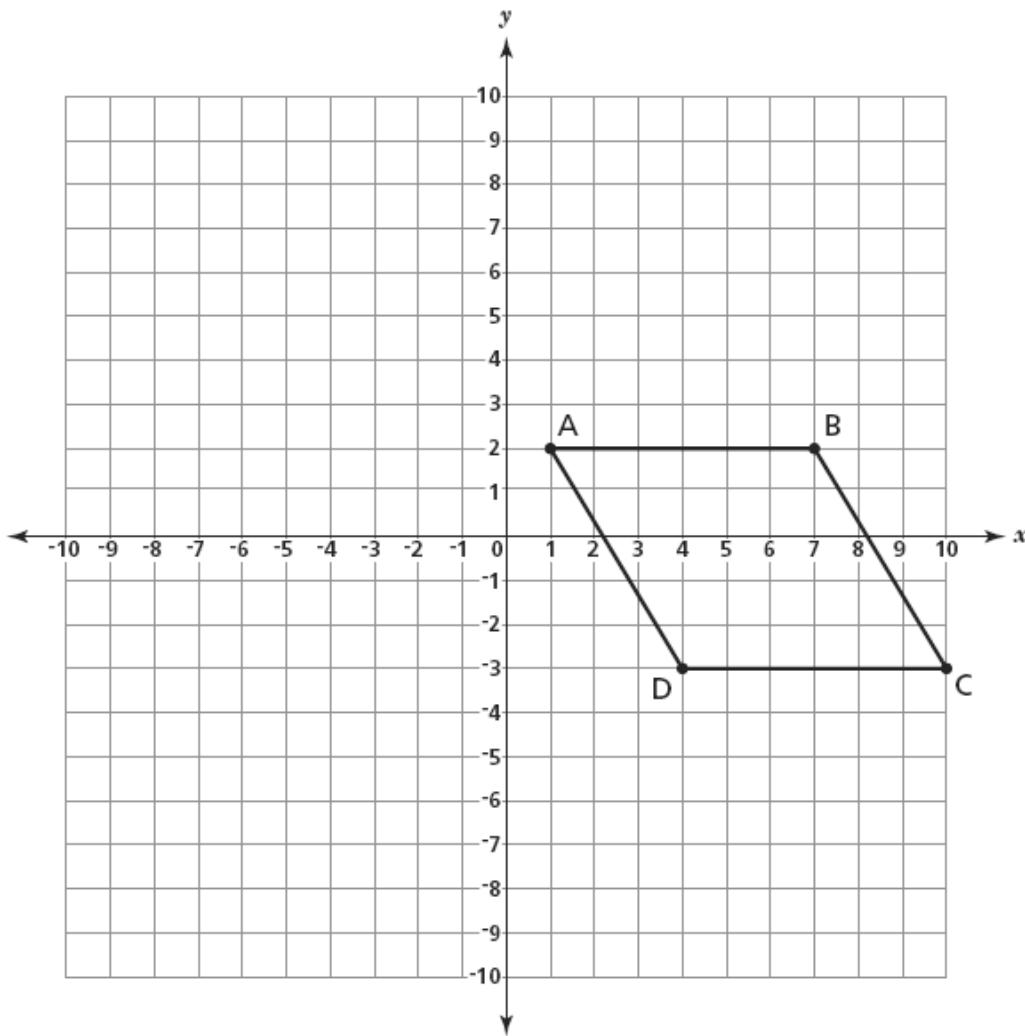


Draw the image of triangle XYZ after being reflected over the x-axis. Draw the image on the same coordinate grid

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Problem 3:

Alexis started making a design by drawing figure ABCD. The next figure in her design is the reflection of figure ABCD in the y -axis. On the coordinate plane below, draw the reflection of figure ABCD. Label the image $A'B'C'D'$.

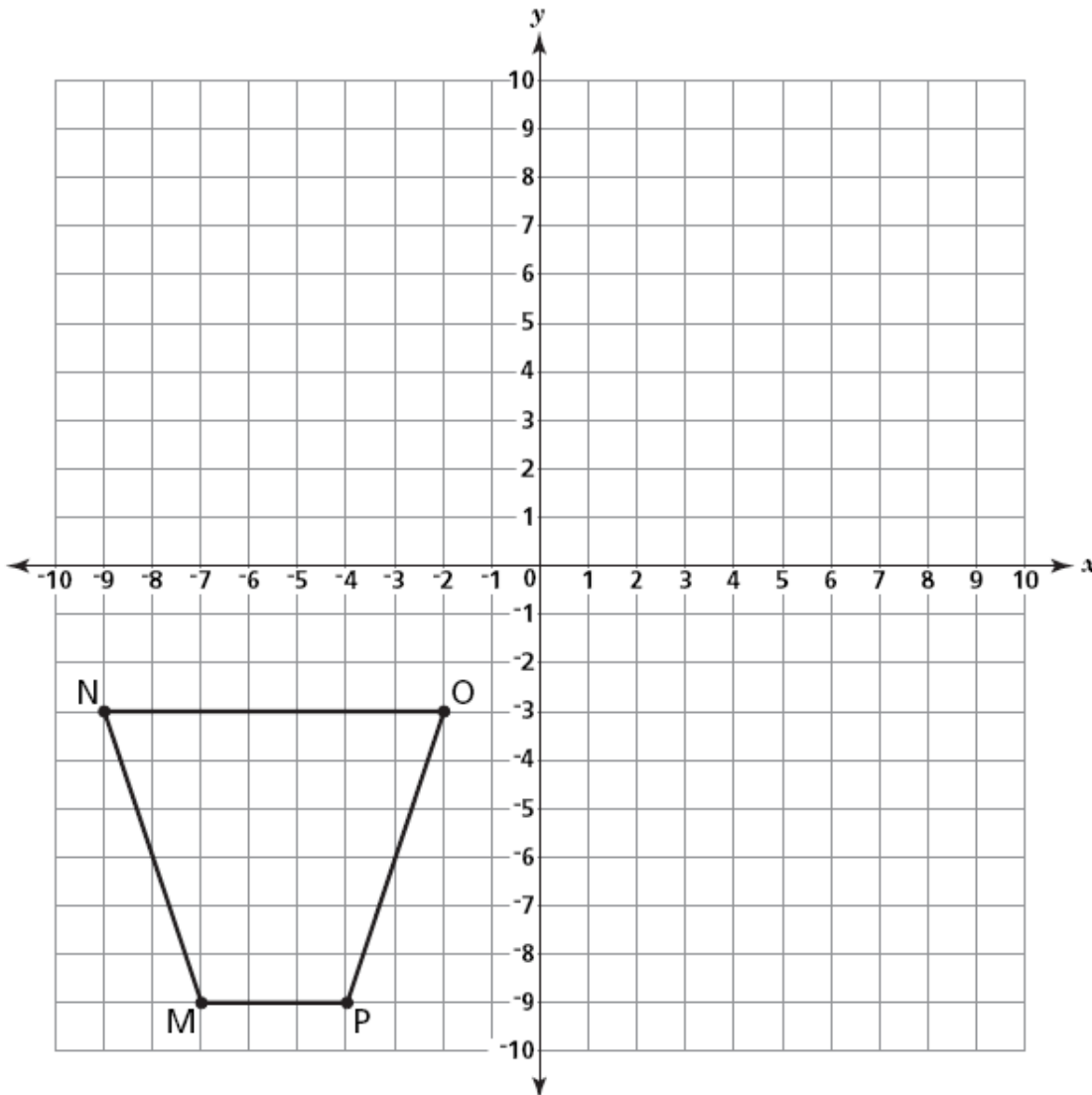


On the lines below, explain how you determined the location of B' .

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Problem 4:

Trapezoid MNOP is plotted on the grid below.

**Part A**

On the grid, draw the image of trapezoid MNOP after a reflection over the y -axis. Label the new trapezoid $M'N'O'P'$.

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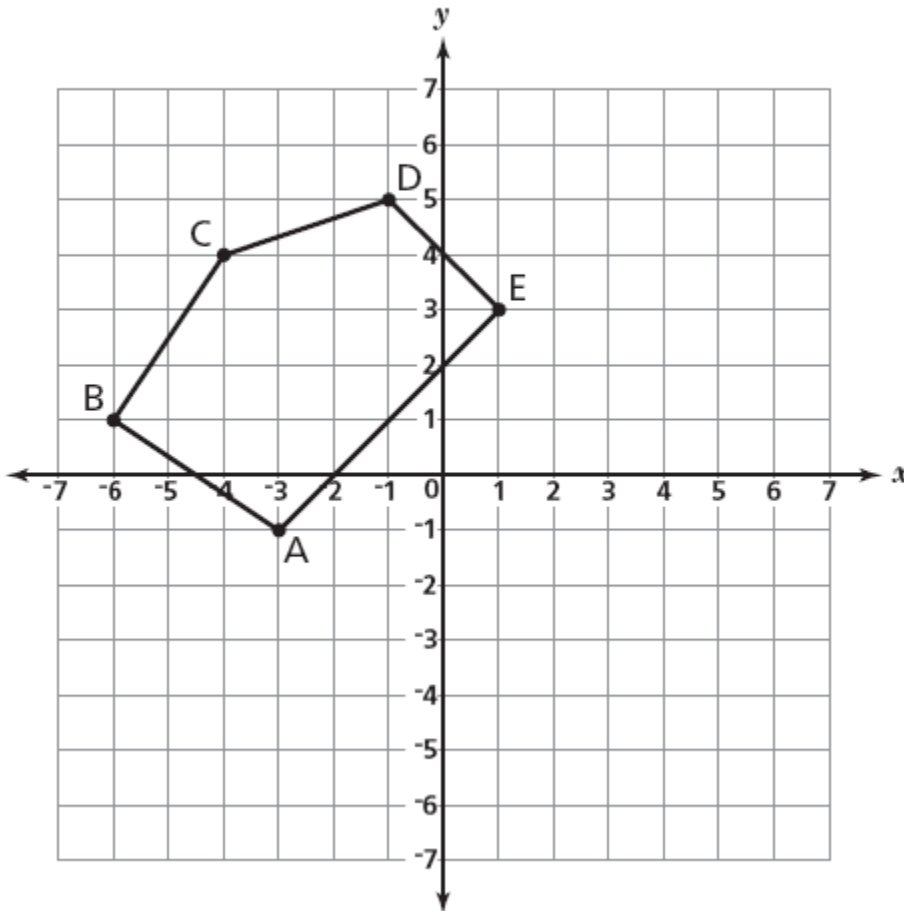
Part B

On the lines below, explain how you determined the location of point M'.

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Challenge**Problem 5:**

Pentagon ABCDE is drawn on the grid below.



Reflect Polygon ABCDE over the y-axis.

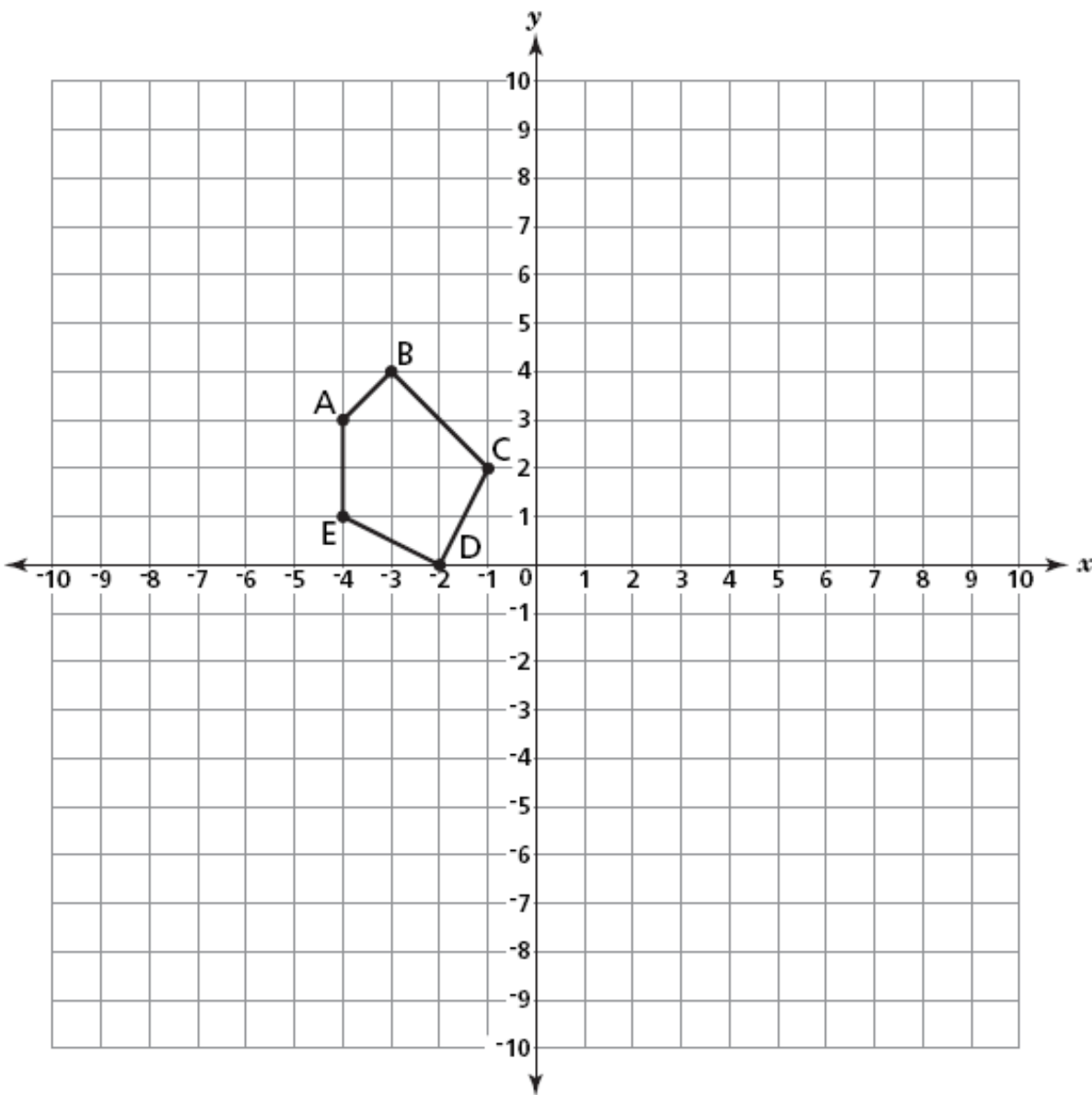
What are the coordinates of point E'?

Answer: _____

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Problem 6:

Pentagon ABCDE is plotted on the grid below.



Reflect pentagon ABCDE in the x-axis. What are the coordinates of point D'?

Answer: _____

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Final Summary

In a U-Shape:

1. Re-state the objective to assess if students learn it
2. Elicit from students what they have learned and what they want to learn more about.
3. Tie what they learn to the lesson, and upcoming lessons (Next Saturday, they will learn about translations)