

TEST NAME: **NAMS MATH 8 Geo**
TEST ID: **316686**
GRADE: **09**
SUBJECT: **Mathematics**
TEST CATEGORY: **My Classroom**

Student: _____

Class: _____

Date: _____

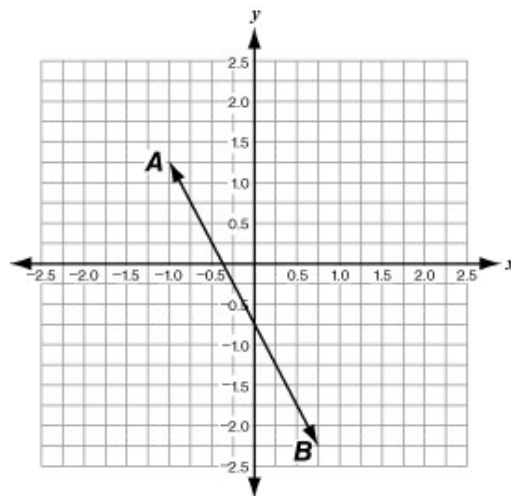
1.

On Your Mark ...

This task will explore the use of transformations in interpreting the tracks and paths of several different race cars. Each grid below represents a salt flat with an area of 25 square kilometers that is used by a racing association. Each unit in the grid represents 0.25 kilometer, and the positive y -axis represents movement north.

Part A. The grid below shows the path of a race car that may continue in either direction, represented by line AB . Another race car follows an identical track that is located 1 kilometer north of line AB .

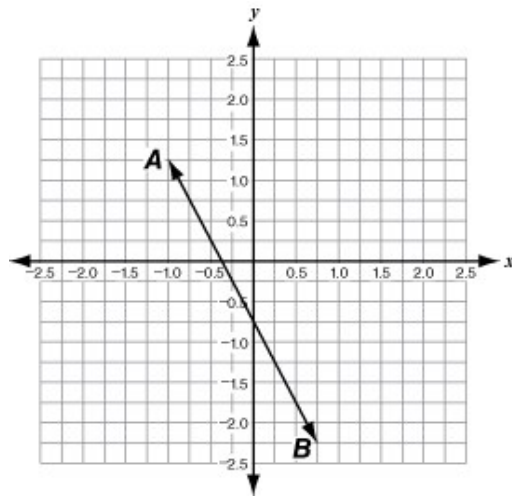
- Sketch the figure that represents the new track, CD , on the graph below and label it.



- What kind of figure is represented by CD ? Explain your answer, including the type of transformation that occurred.
- Write an equation to represent CD .
- If (x, y) is a point on line AB , what are the coordinates of the corresponding point on the new figure?

Part B. The track shown by line AB on the grid below goes from northwest to southeast. Another car follows a track that is identical to AB but goes in the direction from northeast to southwest, using the north-south line at $x = 0.5$ as a line of symmetry.

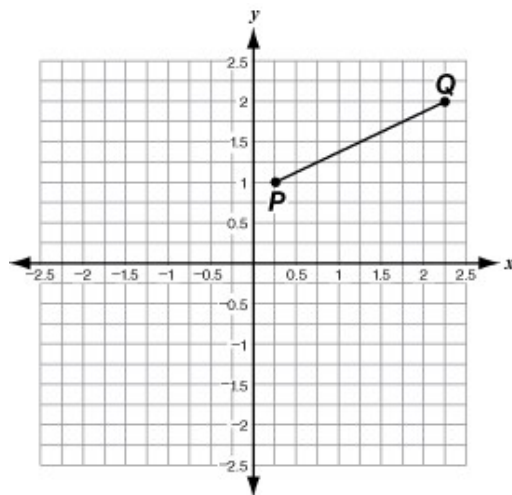
- Sketch the figure that represents the new track, EF , on the graph below and label it.



- What kind of figure is represented by EF ? Explain your answer, including the type of transformation that occurred.
- Write an equation to represent EF .
- If (x, y) is a point on line AB , what are the coordinates of the corresponding point on the new figure?

Part C. Line segment PQ represents the path of a race car that starts at point P and stops at point Q . When this path is reflected over the line $y = -0.25$, the path for the race car that starts at point R and stops at point S is obtained.

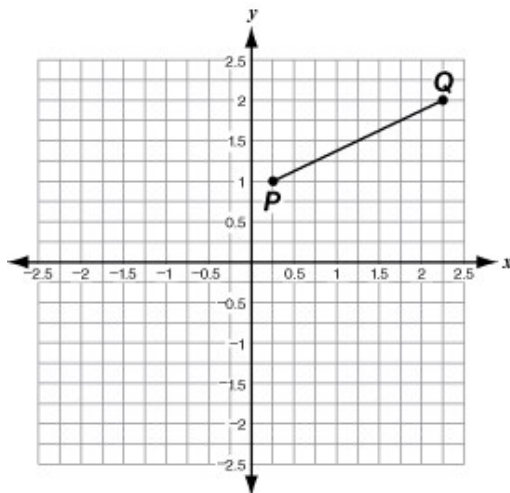
- Sketch the figure that represents the new path, RS , on the graph below and label it.



- What kind of figure is represented by RS ? Explain your answer.
- What are the lengths of paths PQ and RS ? Show your work.
- If (x, y) is a point on line segment PQ , what are the coordinates of the corresponding point on the new figure?

Part D. Another race car follows a path that is identical to path PQ but is located 2 kilometers west and 0.5 kilometer north.

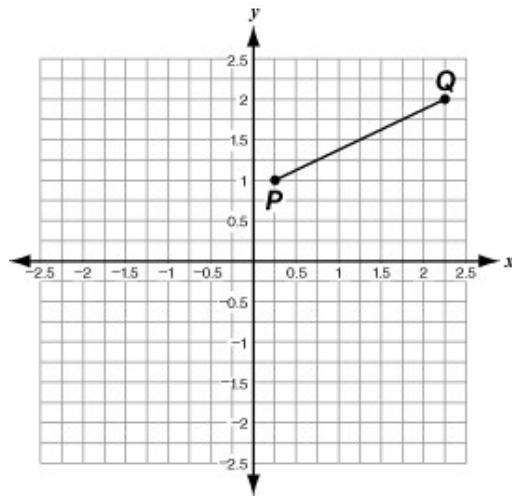
- Sketch the figure that represents the new path, TU , on the graph below and label it.



- What kind of figure is represented by TU ? Explain your answer, including the type of transformation that occurred.
- What is the length of path TU ? Show your work.
- If (x, y) is a point on line segment PQ , what are the coordinates of the corresponding point on the new figure?

Part E. Now consider the path of a race car that starts at point P but goes in a direction that is 90° clockwise from the car that is on path PQ . All other parts of the new path, PZ , are identical to PQ except the direction of travel.

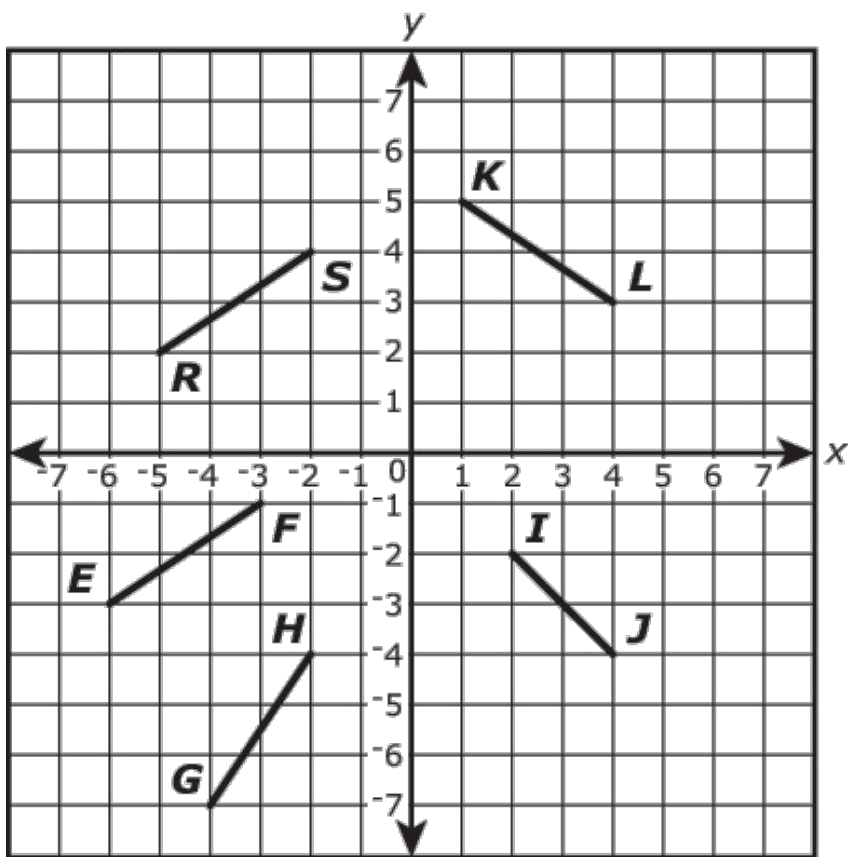
- What kind of figure is represented by PZ ? Explain your answer, including the type of transformation that occurred.
- Use the relationship between the slopes of perpendicular lines to determine the location of point Z .
- Sketch the figure that represents the new path, PZ , on the graph below and label it.



- What is the length of path PZ ?
- Do you think each point on PZ corresponds to a point on PQ ? Explain how you know and give an example to support your answer.

Part F. Use the results from parts A and B and from parts C through E to state a conclusion about the figure that results from translating, reflecting, or rotating a line or line segment. Include an explanation of the type of figure that results from transformation, the length of the figure, and the corresponding points.

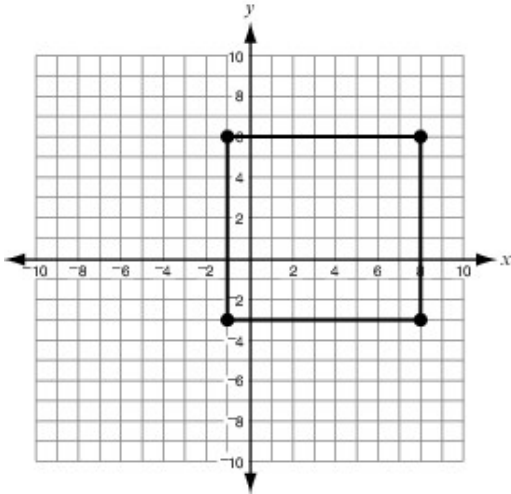
2. The coordinate plane shows \overline{RS} and possible transformations of \overline{RS} .



Which line segment is **not** a transformation of \overline{RS} ?

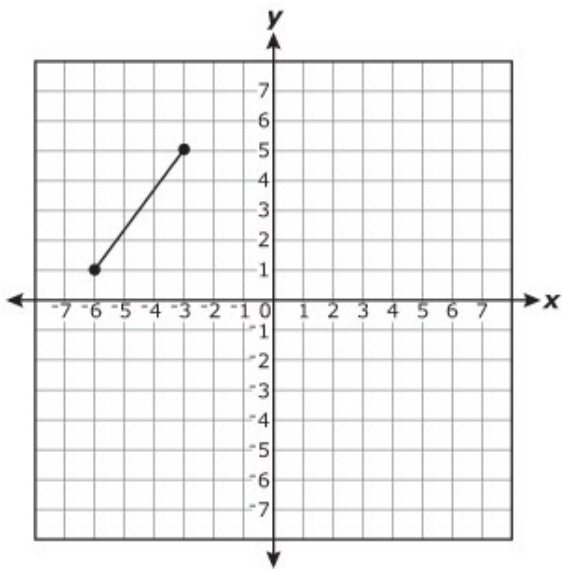
- A. \overline{EF}
- B. \overline{GH}
- C. \overline{IJ}
- D. \overline{KL}

3. The square below is translated to the left and reflected across the y -axis.

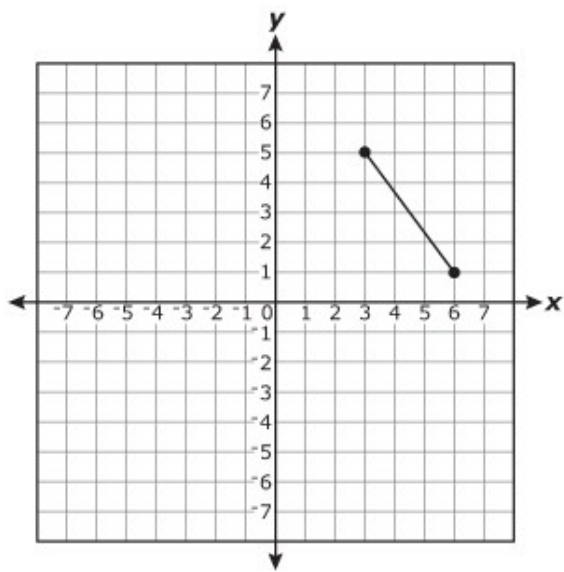


Which statement about the resulting figure is true?

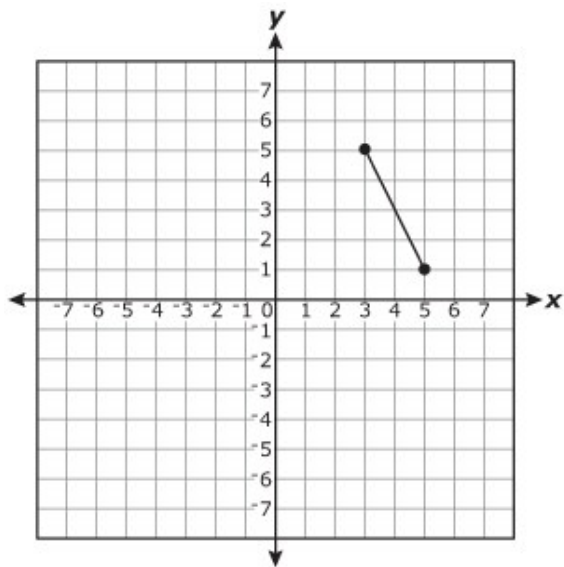
- A. It is congruent to the original square.
 - B. It is now a rectangle that is not a square.
 - C. It is similar but larger than the original square.
 - D. It is similar but smaller than the original square.
4. Triangle XYZ with vertices $X(5, 7)$, $Y(8, 3)$, and $Z(2, 3)$ is reflected over the y -axis and translated up 4 units to form triangle $X'Y'Z'$. What is the length of segment $Y'Z'$?
- A. 2 units
 - B. 4 units
 - C. 6 units
 - D. 10 units
5. A line segment \overline{PQ} is plotted on a coordinate plane and has a length of 5 units. This line segment is \overline{PQ} translated 3 units to the right to obtain the line segment $\overline{P'Q'}$. What will be the length of $\overline{P'Q'}$?
6. Which graph shows the line segment after it has been reflected over the x -axis?



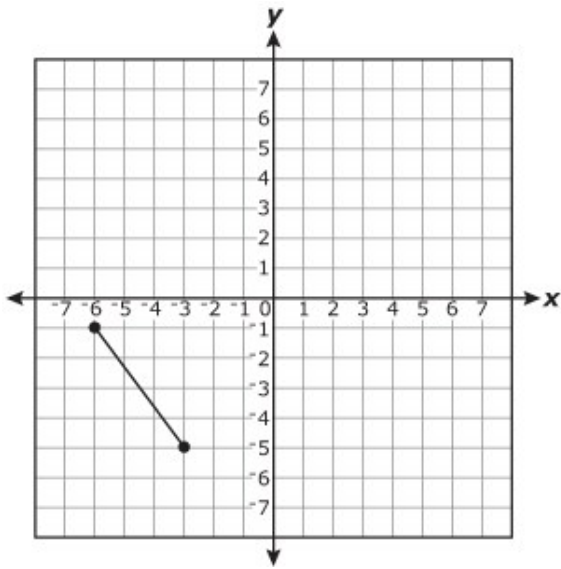
A.



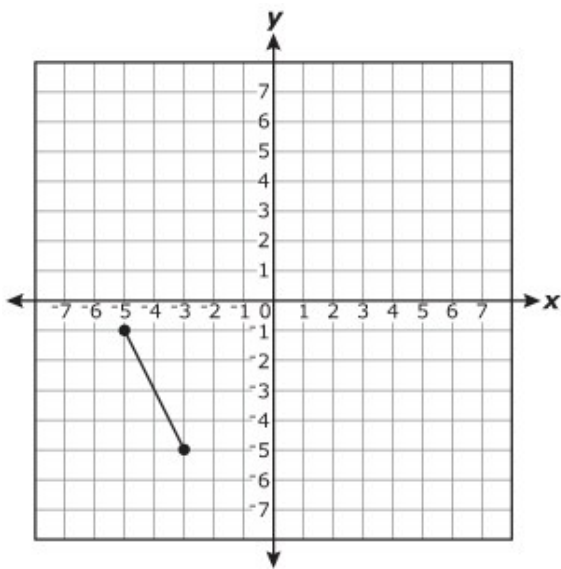
B.



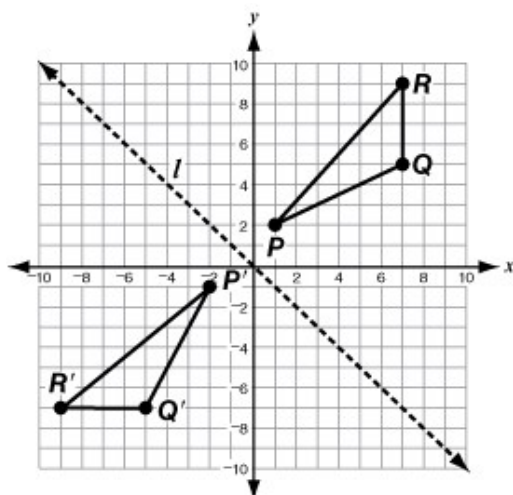
C.



D.



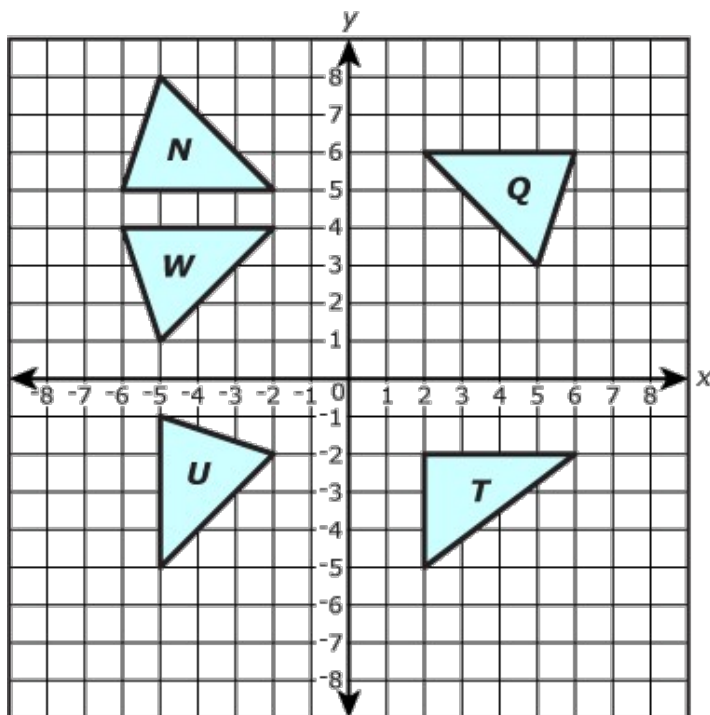
7. The coordinate grid below shows $\triangle PQR$ reflected along line l and its reflected image $\triangle P'Q'R'$.



Which statement is true about the measure of angle R' ?

- A. It is equal to $m\angle R$.
- B. It is complementary to $m\angle R$.
- C. It is equal to $m\angle Q$.
- D. It is complementary to $m\angle Q$.

8. The grid shows Triangle *N*. The other triangles are possible transformations of Triangle *N*.



Which statement is true?

- A. Triangle *Q* is not a transformation of Triangle *N* because the segment lengths in Triangle *Q* are not congruent to the segment lengths in Triangle *N*.
- B. Triangle *T* is not a transformation of Triangle *N* because the angles in Triangle *N* are not congruent to the angles in Triangle *T*.
- C. Triangle *U* is not a transformation of Triangle *N* because Triangle *U* is not in the same quadrant as Triangle *N*.
- D. Triangle *W* is not a transformation of Triangle *N* because Triangle *W* is not oriented in the same direction as Triangle *N*.

9. **Angles As Art**

TASK:

Create angles by using reflection and rotation on a coordinate grid.

Part A

- On a coordinate plane, graph and label the following points: (8, 3), (1, 1), (3, 8).
- Connect the points in order using a straight edge to make an angle.
- Reflect that angle across the *x*-axis. Label the coordinates for each point.
- Reflect both of those angles across the *y*-axis to create a total of 4 angles.
- Label the coordinates for each point.
- Graph and label the following points: (0, 13), (13, 0), (0, -13) and (-

13, 0).

- Connect the endpoints of the two nearest segments to the new point on each axis using a straight edge.

Part B

Write complete and detailed sentences to respond to each prompt:

- Give the figure a mathematically accurate description.
- Identify how many (if any) lines of symmetry the figure has along with where those lines lay.
- Measure, to the nearest 5 degrees, and label each internal angle with its degree measure. Classify the angles (i.e., acute, obtuse, right, straight, or reflex). Discuss congruence between the various angles.

Part C

- On a coordinate plane, graph and label the coordinates for two points in Quadrant 1.
- Connect each point to the origin using a straight edge to make an angle with the origin as the vertex.
- Rotate the angle into all four quadrants by rotating it 90° counterclockwise about the origin each time.
- Label the coordinates for each point. Within each quadrant connect the two endpoints to create a triangle.

Part D

Write complete and detailed sentences to respond to each prompt:

- Give the figure a mathematically accurate description.
- Identify how many (if any) lines of symmetry the figure has along with where those lines lay.
- Measure and label each internal angle of the triangles with its degree measure. Classify the triangles by both angles (i.e., acute, equiangular, obtuse, or right) and sides (i.e., equilateral, isosceles, or scalene). Discuss congruence between the various angles within the triangles.

Part E

Compare the drawings in Part A and Part C by identifying one way in which the drawings are the same and one way in which the drawings are different.

10. **Angles in Transformations**

Plot points $A(-8, 2)$, $B(-1, 2)$, and $C(-8, 7)$. Connect the points to form a triangle.

Measure and label each of the triangle's interior angles.

Part A

Draw the line $y = x$. Reflect points A , B , and C over the line $y = x$. Connect the images of the points to form a triangle. Measure and label each of the triangle's interior angles.

Part B

Rotate points A , B , and C clockwise 90° about the origin. Connect the images of the points to form a triangle. Measure and label each of the triangle's interior angles.

Part C

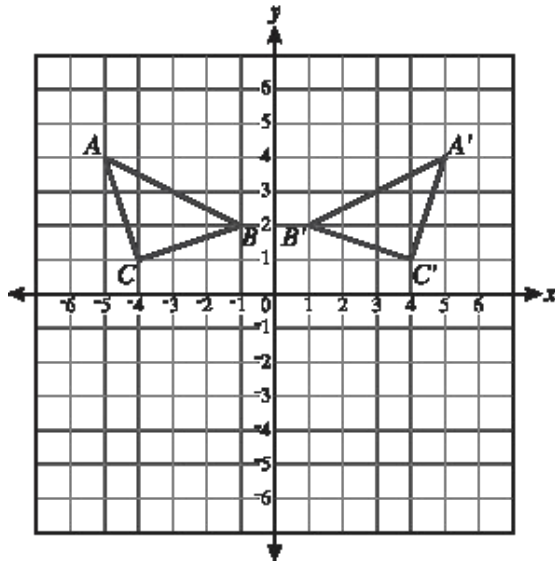
Translate points A , B , and C down 5 units and 12 units right. Connect the images of the points to form a triangle. Measure and label each of the triangle's interior angles.

Part D

Is there a sequence of reflections, rotations, and translations that would result in a triangle with interior angles that differ from those in the original triangle?

- If so, perform the sequence and verify the change in the angles.
- If not, explain why the measures of the angles will not change under these transformations.

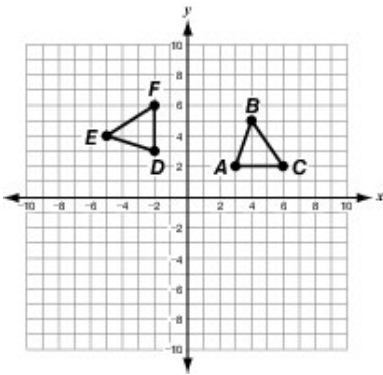
11. Triangle ABC is reflected across the y -axis to form Triangle $A'B'C'$ as shown below.



How can angle C and angle C' be proven congruent?

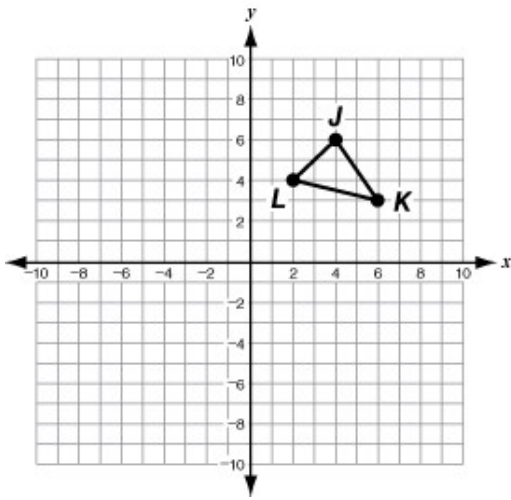
- A. The slopes of the legs that form Angle C are equivalent to the corresponding slopes of the legs that form Angle C' , except they have opposite signs.
- B. The slopes of the legs that form Angle C are equivalent to the corresponding slopes of the legs that form Angle C' .
- C. The ratio of the rise to the run of the slopes of the legs that form Angle C is equivalent to the ratio of the run to the rise of the corresponding slopes of the legs that form Angle C' .
- D. The ratio of the rise to the run of the slopes of the legs that form Angle C is equivalent to the ratio of the rise to the run of the corresponding slopes of the legs that form Angle C' .

12. Triangle ABC is rotated 90 degrees counterclockwise about the origin, resulting in triangle DEF , as shown.



If $m\angle A$ is equal to 65° , what angle in triangle DEF must also equal 65° ?

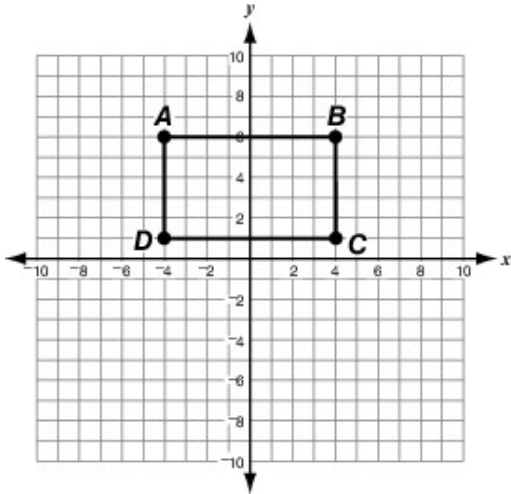
13. The triangle below is rotated 180° clockwise about the origin and reflected over the x -axis.



What is the relationship between the measure of angle K in the original triangle and the measure of the corresponding angle K' in the transformed triangle?

- A. $m \angle K' = m \angle K$
- B. $m \angle K' > m \angle K$
- C. $m \angle K' < m \angle K$
- D. $m \angle K' = -m \angle K$

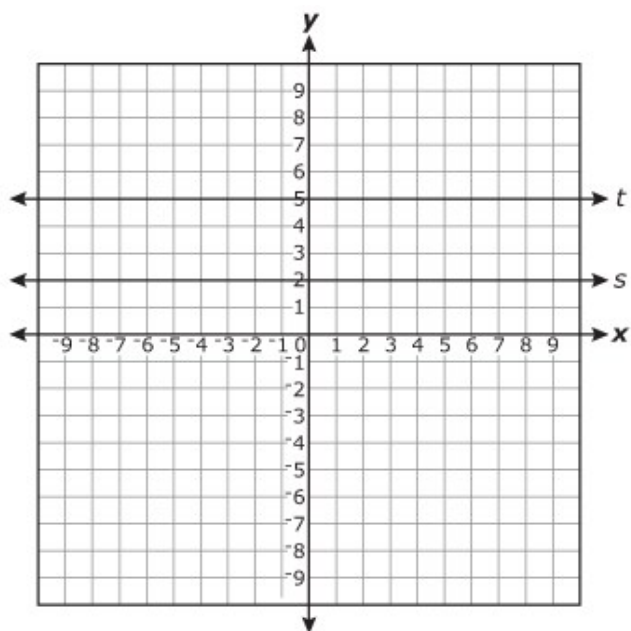
14. The rectangle $ABCD$, shown below, is reflected across the x -axis and then across the y -axis, resulting in figure $A'B'C'D'$.



Which statement is correct of the lines in figure $A'B'C'D'$?

- A. On reflection, parallel lines are taken to parallel lines, so $\overline{A'B'}$ will be parallel to $\overline{C'D'}$.
- B. On reflection, parallel lines are taken to parallel lines, so $\overline{A'D'}$ will be parallel to $\overline{C'D'}$.
- C. On reflection, perpendicular lines are taken to parallel lines, so $\overline{A'D'}$ will be parallel to $\overline{C'D'}$.
- D. On reflection, parallel lines are taken to perpendicular lines, so $\overline{A'B'}$ will be perpendicular to $\overline{C'D'}$.

15. Avery drew parallel lines t and s as shown on the grid below.



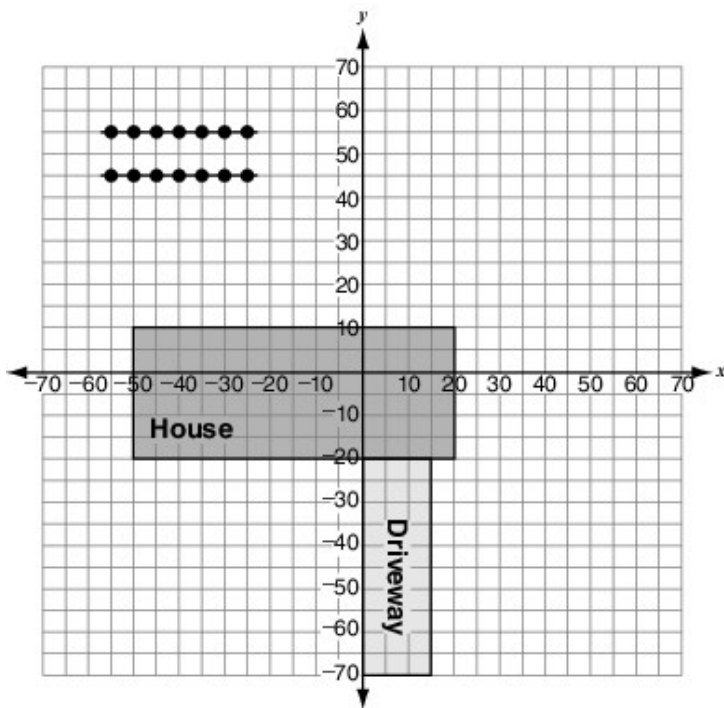
She reflects both line t and line s across the x axis.

What word best describes the relationship between the reflected images of line t and line s ?

16. **Transforming the Landscape**

The DeAngelos have a new house on a large lot that is 140 feet by 140 feet. The family is making sketches on a grid to decide how to lay out the yard. To begin with, the DeAngelos are thinking about planting two parallel rows of shrubs on the back west side of the property, along the lines $y = 55$ and $y = 45$. There will be 7 shrubs per row, spaced a minimum of 5 feet apart. It is very important that these rows of shrubs be parallel in order to allow space for the underground roots to grow.

Part A. The grid below shows the DeAngelos house and lot, labeled in feet, with a sketch of the rows of shrubs the family is considering planting. The positive direction on the y -axis represents movement north on the property.



Suppose the DeAngelos decided to move the location of the shrubs 70 feet east and 25 feet south. What would be the new equations for the rows after these transformations? Sketch the lines on the grid and label them Part A. Then, describe whether the rows are still parallel and explain your answer.

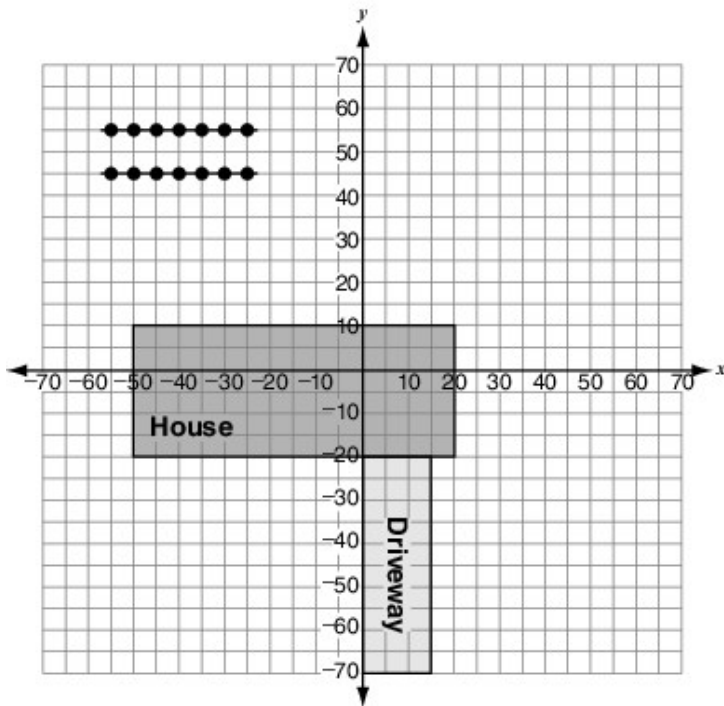
Part B. The DeAngelos have also thought about putting the rows of shrubs in the front yard, to the east of the driveway. To do this, both lines would be reflected across the x -axis and then across the y -axis. What would be the new equations for the rows after these transformations? Sketch the lines on the grid and label them Part B. Then, describe whether the rows are still parallel and explain your answer.

Part C. Another possibility would be to rotate and translate the rows of shrubs so that they are on a diagonal in the northeast corner of the lot. To do this, both lines will be rotated at an angle of 45° clockwise about the point that represents the shrub farthest to the left. Then, they will be moved 10 feet north and 95 feet east. What are the new equations for the rows after these transformations? Show all of your work. Sketch the lines on the grid and label them Part C. Then, describe whether the rows are still parallel and explain your answer.

Part D. After looking at your answers to parts A through C, make a general statement about what happens to parallel lines that are put through the same translations.

Part E. The DeAngelos like the look of the diagonal rows of shrubs. However, they want to leave about 50 feet of space behind the house to

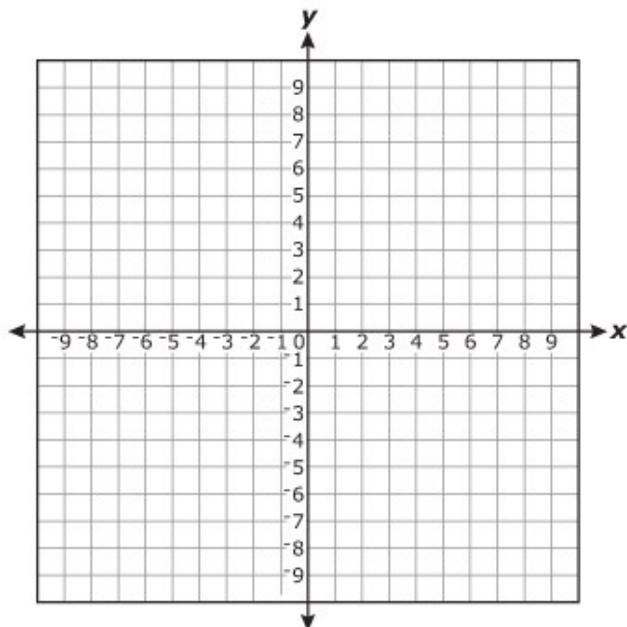
eventually put in a pool. They would also like to put a shed in the northeast corner of the yard. Describe a series of transformations on the original rows of shrubs such that the rows will still be parallel and that would allow the DeAngelos to place them diagonally but still allow for the pool and shed. Sketch these lines on the grid below and label them Part E.



17. Quadrilateral $ABCD$ has vertices $A(5, 8)$, $B(9, 4)$, $C(8, 0)$, and $D(1, 7)$.
Quadrilateral $ABCD$ is reflected over the y -axis to form Quadrilateral $A'B'C'D'$.

Part A

Graph Quadrilateral $ABCD$ and Quadrilateral $A'B'C'D'$ on the coordinate plane. Label the vertices.



Part B

Find the slopes of all sides of both quadrilaterals.

In what ways are the slopes of Quadrilateral $A'B'C'D'$ like the slopes of Quadrilateral $ABCD$?

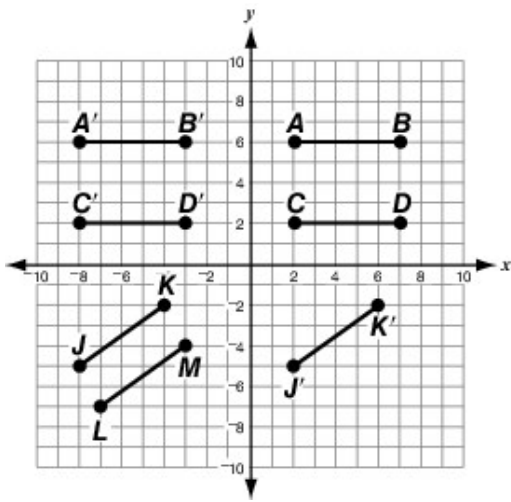
Part C

Prove that Quadrilateral $A'B'C'D'$ is a trapezoid.

18. **Are They Still Parallel?**

In this activity you will test whether parallel lines are still parallel after being transformed in the same way.

Part A. Segments AB and CD are both horizontal and parallel to one another. If you translate them 10 units to the left, you can see that they are still parallel because they are both still horizontal.



What about slanted lines? If you translate segment JK 10 units to the right, the new coordinates are $J'(2, -5)$ and $K'(6, -2)$. If you translate segment LM 10 units to the right, what are the new coordinates?

$$L' = (\underline{\quad}, \underline{\quad})$$

$$M' = (\underline{\quad}, \underline{\quad})$$

One way to tell whether two lines or segments are parallel is to find whether they both have the same slope, or steepness. You can find the slope of a line by picking two points on the line and finding the change in a vertical direction compared with the change in a horizontal direction.

What is the change in y-value from J' to K' ?

$$\text{change in } y = \underline{\quad}$$

What is the change in x-value from J' to K' ?

$$\text{change in } x = \underline{\quad}$$

What is the change in y divided by the change in x? This is the slope of $J'K'$.

Part B. Find the slope of $L'M'$.

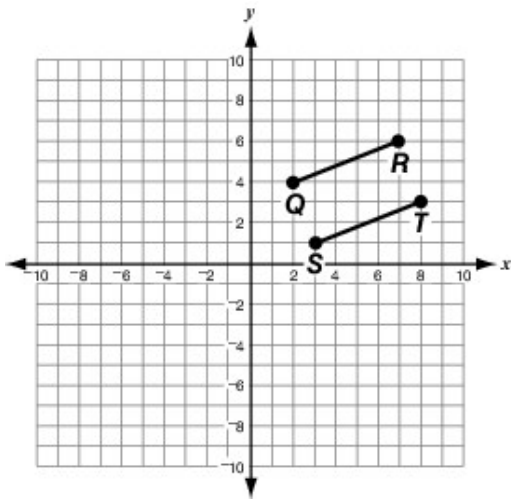
$$\text{change in } y = \underline{\quad}$$

$$\text{change in } x = \underline{\quad}$$

$$\text{slope of } L'M' = \underline{\quad}$$

Are $J'K'$ and $L'M'$ parallel? How do you know? Do you think that any two parallel lines would still be parallel after being translated? Explain your answer.

Part C. Now let's see what happens when two parallel lines are reflected, or flipped. Line segments QR and ST , shown below, are parallel.



What are the new coordinates if QR is reflected over the y -axis to form $Q'R'$?

$$Q' = (\underline{\quad}, \underline{\quad})$$

$$R' = (\underline{\quad}, \underline{\quad})$$

What is the slope of $Q'R'$? Notice that the y -value decreases from left to right, (from R' to Q'), so the slope is negative.

Part D. Find the coordinates of S' and T' and the slope of $S'T'$ if ST is reflected over the y -axis to form $S'T'$.

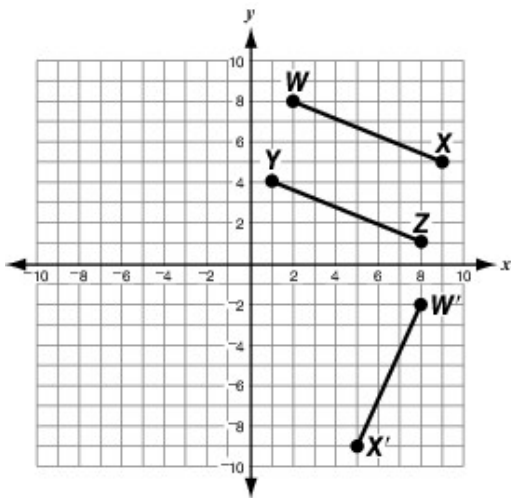
$$S' = (\underline{\quad}, \underline{\quad})$$

$$T' = (\underline{\quad}, \underline{\quad})$$

$$\text{slope of } S'T' = \underline{\quad}$$

Are the transformed segments of $Q'R'$ and $S'T'$ still parallel? How can you tell? Do you think any two parallel lines will still be parallel after being reflected over the same line?

Part E. Line segments WX and YZ are parallel and shown below.



If each one is rotated 90° clockwise about the origin, what are the new coordinates? The rotation of WX is shown above.

$$W' = (\underline{\quad}, \underline{\quad})$$

$$X' = (\underline{\quad}, \underline{\quad})$$

$$Y' = (\underline{\quad}, \underline{\quad})$$

$$Z' = (\underline{\quad}, \underline{\quad})$$

What are the slopes of $W'X'$ and $Y'Z'$?

$$\text{slope of } W'X' = \underline{\quad}$$

$$\text{slope of } Y'Z' = \underline{\quad}$$

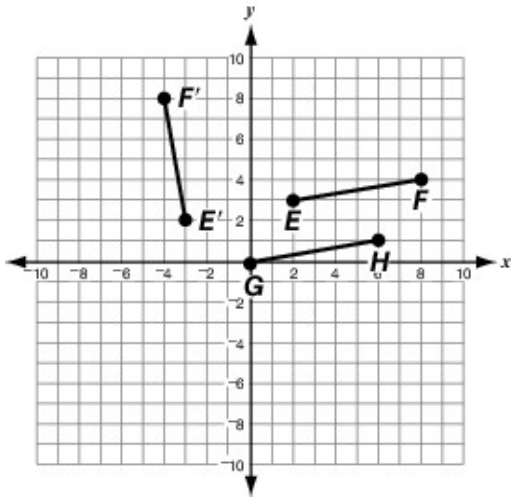
Are the transformed segments of $W'X'$ and $Y'Z'$ still parallel? How can you tell? Do you think any two parallel lines will still be parallel after being rotated?

Part F. Now try performing all three transformations on two parallel line segments and see if the new line segments are still parallel.

Draw each of these transformations on the grid.

1) Rotate the segments 90° counterclockwise about the origin. (The first line segment, EF , has already been rotated below).

- 2) Reflect the segments over the x -axis.
- 3) Translate the segments 8 units to the right.

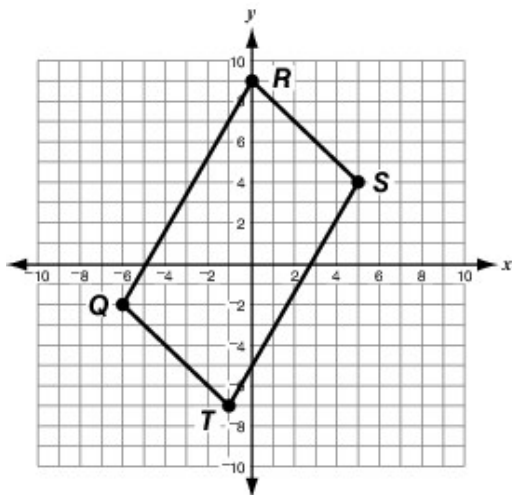


slope of $E''F''$ = ____

slope of $G''H''$ = ____

Are the transformed line segments of EF and GH still parallel? How can you tell? Do you think any two parallel lines will still be parallel after being transformed?

19. Parallelogram $QRST$, shown below, is rotated 135° clockwise about the point $(5, 4)$ and reflected across the x -axis. Which statement about the resulting figure, $Q'R'S'T'$, is true?



- A. $\overline{R'S'} \nparallel \overline{Q'T'}$ and $\overline{Q'R'} \nparallel \overline{S'T'}$
- B. $\overline{R'S'} \parallel \overline{Q'T'}$ and $\overline{Q'R'} \nparallel \overline{S'T'}$
- C. $\overline{R'S'} \nparallel \overline{Q'T'}$ and $\overline{Q'R'} \parallel \overline{S'T'}$
- D. $\overline{R'S'} \parallel \overline{Q'T'}$ and $\overline{Q'R'} \parallel \overline{S'T'}$
20. In quadrilateral $JKLM$, \overline{JK} is parallel to \overline{LM} . What must be true of quadrilateral $RSTU$ if it is a transformation of quadrilateral $JKLM$?
- A. \overline{RS} is parallel to \overline{TU} .
- B. $\angle R$ is congruent to $\angle K$.
- C. Quadrilateral $RSTU$ must be a translation of quadrilateral $JKLM$.
- D. Quadrilateral $RSTU$ must be in the same quadrant as quadrilateral $JKLM$.