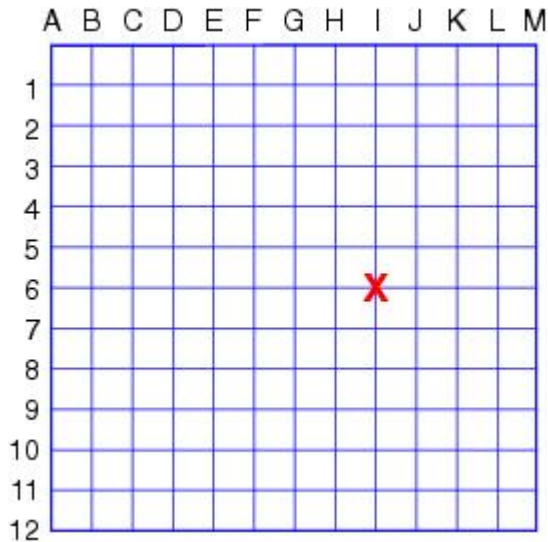**Directions:** Please choose the best answer choice for each of the following questions.

1. Beth's game piece is located at point I-6 on this strategy game board.

If Beth needs to maneuver around her opponent from her current position to point D-4, which translation describes her move?

A. 2 units left and 5 units up

B. 5 units left and 2 units up

C. 4 units right and 4 units down

D. 5 units right and 2 units down

Answer Choice Rationale

A. If Beth moved 2 units left and 5 units up, her new position would be G-1.

B. Correct answer

C. If Beth moved 4 units right and 4 units down, her new position would be M-10.

D. This answer moves the piece right instead of left and down instead of up.

ItemID A2K.1012162
Correct B
Standard(s) MA.9-12.G3.1.2, MA.9-12.G-CO.2

2. Jen and Beth are graphing triangles on this coordinate grid. Beth graphed her triangle as shown. Jen must now graph the reflection of Beth's triangle over the *y*-axis.
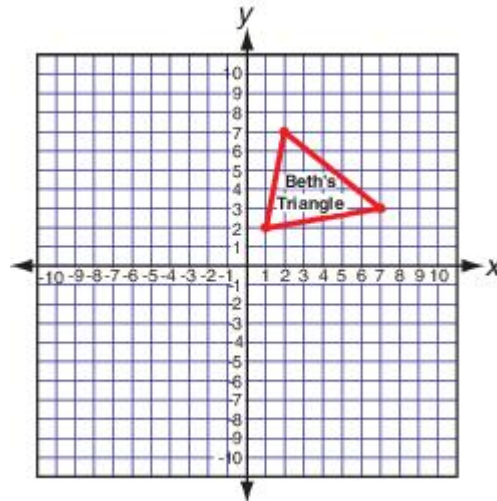
Which graph correctly shows Jen's and Beth's triangles on the coordinate grid?

A.

B.
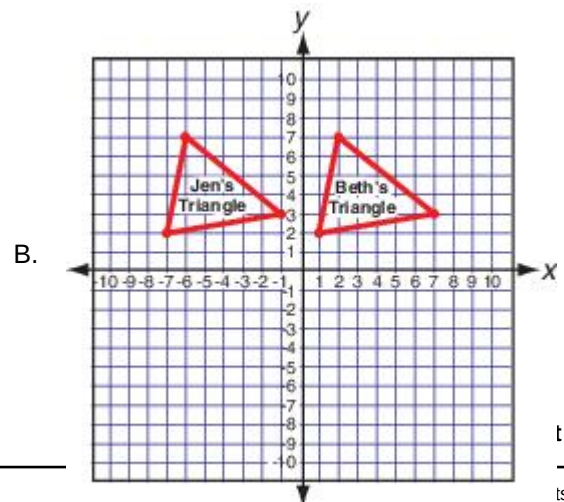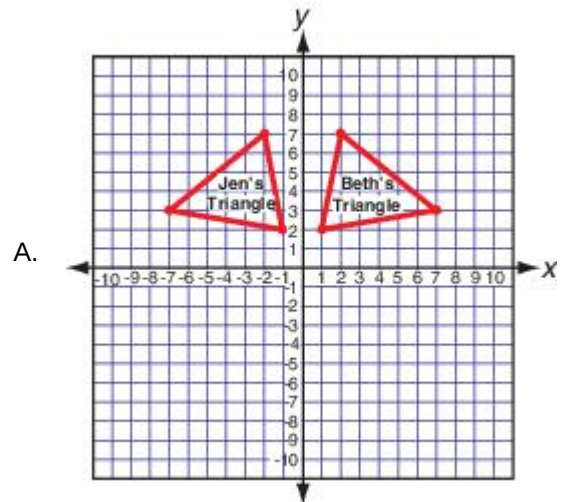
Answer Choice Rationale

A. Correct answer.

B. This graph is a translation of the triangle across the *y*-axis.

C. This graph is a translation of the triangle across the *x*-axis.

D. This graph is a reflection of the triangle across the *x*-axis.

> **ItemID** A2K.1012140
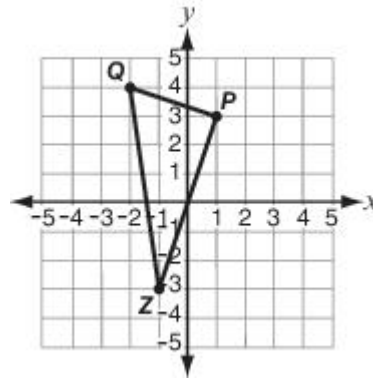> **Correct** A
> **Standard(s)** MA.9-12.A2.2.2, MA.9-12.G-CO.2

3. Akilah is using a coordinate graph to show the placement of vegetables in her garden. She places green peppers on the coordinate $(5, -6)$. If she decides to move the peppers by rotating them $180°$ clockwise about the origin, which coordinate will represent the new placement of the peppers?

A. $(-5, -6)$

B. $(-5, 6)$

C. $(5, -6)$

D. $(5, 6)$

Answer Choice Rationale

A. These are the coordinates after a 90° clockwise rotation.

B. Correct answer.

C. These are the coordinates after a 360° clockwise rotation.

D. These are the coordinates after a 270° clockwise rotation.

> **ItemID** A2K.1012069
> **Correct** B
> **Standard(s)** MA.9-12.G3.1.1, MA.9-12.G-CO.2, MA.9-12.G-CO.5

4. Given: ΔPQZ on this coordinate grid

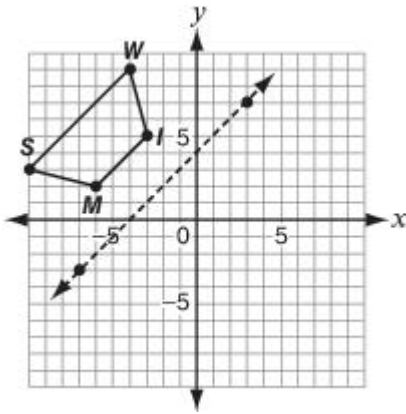If ΔPQZ is translated $< -2, 5 >$, what are the new coordinates of Z ?

A. $(-5, -1)$

B. $(-3, 2)$

C. $(2, -1)$

D. $(4, -5)$

Answer Choice Rationale

A. (x-3, y-2)

B. correct translation (x-3, y+2)

C. (x+3, y+2)

D. (x+3, y-2)

> **ItemID** A2K.1009716
> **Correct** B
> **Standard(s)** MA.9-12.A2.2.2, MA.9-12.G-CO.2

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5.   Trapezoid $SWIM$ is drawn on the coordinate grid.

If you reflected the trapezoid over the dashed line, what would be the coordinates of trapezoid $S'W'I'M'$?

A. $S'(-1,-6)$, $W'(5,0)$, $I'(1,1)$, $M'(-2,-2)$

B. $S'(-4,-3)$, $W'(2,3)$, $I'(3,-2)$, $M'(0,-5)$

C. $S'(3,-10)$, $W'(9,-4)$, $I'(5,-3)$, $M'(2,-6)$

D. $S'(3,5)$, $W'(-4,9)$, $I'(-3,5)$, $M'(-6,2)$

Answer Choice Rationale

A.   Correct answer.

B.   This answer translates the trapezoid across the line instead of reflecting it over the line.

C.   This answer reflects the trapezoid about the origin.

D.   This answer has 3 points the same as the original trapezoid.

6.   Cami is placing some play toys in her backyard for her kids. She used this coordinate plane to show the placement of the toys.
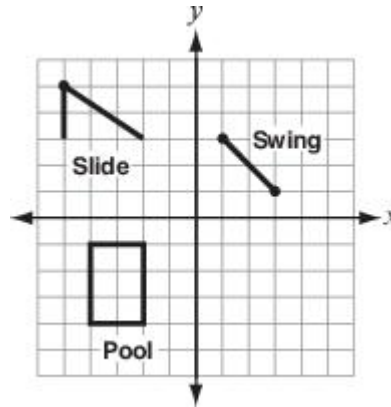
If she reflects the swing across the *x*-axis, what will the new coordinates of the swing be?

A. $(-3,-1)$ and $(-1,-3)$

B. $(-1,3)$ and $(-3,-1)$

C. $(1,-1)$ and $(3,-3)$

D. $(3,-1)$ and $(1,-3)$

Answer Choice Rationale

A.   These would be the coordinates if the swing was reflected across the origin.

B.   These would be the coordinates if the swing was reflected across the *y*-axis.

C.   These would be the coordinates if the swing was translated down 4 units.

D.   Correct answer.

7. Manuel constructed a triangle with vertices Q, M, and H on this coordinate grid.
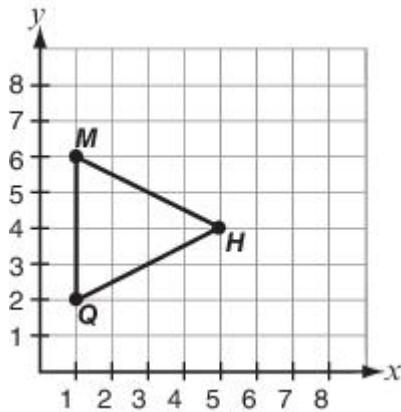

What is the image of ΔQMH under the translation $< 3, -2 >$?

A. $Q'(4,4)$, $M'(4,8)$, and $H'(8,6)$

B. $Q'(4,0)$, $M'(4,4)$, and $H'(8,2)$

C. $Q'(1,5)$, $M'(1,9)$, and $H'(5,7)$

D. $Q'(1,0)$, $M'(1,4)$, and $H'(5,2)$

Answer Choice Rationale

A. This would be the image if the translation were <3,2>.

B. Correct answer

C. This would be the image if the translation were <0,3>.

D. This would be the image if the translation were <0,-2>.

ItemID A2K.1013251
Correct B
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.2

8. Alissa is using this grid to redesign a golf course.
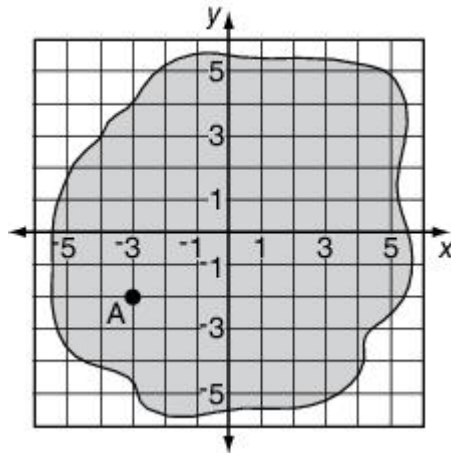
She moves the hole at point A 1 unit to the left and then rotates it $90°$ clockwise around the center. What are the coordinates of the point after it has been translated and rotated?

A. $(-4,2)$

B. $(-2,4)$

C. $(2,-4)$

D. $(4,-2)$

Answer Choice Rationale

A. This answer is found by completing the translation correctly, but then reflecting the point over the *x*-axis instead of rotating it.

B. Correct answer.

C. This answer is found by completing the translation correctly, but then rotating the point 90° anticlockwise instead of clockwise.

D. This answer is found by completing the translation correctly, but then reflecting the point over the *y*-axis instead of rotating it.

ItemID A2K.1014771
Correct B
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.2, MA.9-12.G-MG.3

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9. Triangle XYZ has been reflected over the line $x = -2$, resulting in triangle $X'Y'Z'$. Then that triangle has been reflected over the line $x = 3$, resulting in triangle $X''Y''Z''$. The result is a translation.
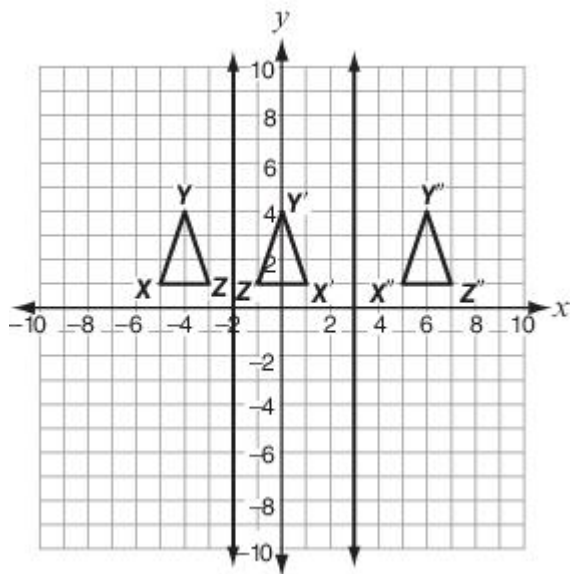
How does the distance of the slide compare with the distance between the two parallel lines?

A. The distance of the slide is one-half the distance between the parallel lines.

B. The distance of the slide is equal to the distance between the parallel lines.

C. The distance of the slide is 2 times the distance between the parallel lines.

D. The distance of the slide is 3 times the distance between the parallel lines.

Answer Choice Rationale

A. The distance between the parallel lines is one-half the distance of the slide.

B. This answer mistakes the two distances as being equal.

C. Correct answer.

D. This answer mistakes the distance of the slide as being 3 times the distance between the parallel lines instead of 2 times.

10. In a coordinate plane, point B is located at $(6, -2)$. Point B is rotated $90°$ counterclockwise about the point $(0, 0)$ to get image B'. Then B' is translated 3 units to the right to get image B. What are the coordinates of B?

A. $(-2, -3)$

B. $(1, -6)$

C. $(2, 9)$

D. $(5, 6)$

Answer Choice Rationale

A. This answer rotates the point clockwise instead of counterclockwise, and translates the point up instead of to the right.

B. This answer rotates the point clockwise instead of counterclockwise.

C. This answer completes the rotation correctly, but translates the point up instead of to the right.

D. Correct answer.

11. The polygon below has a center point.
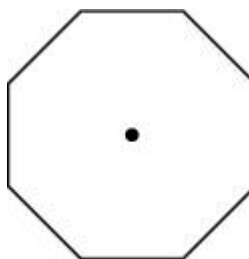
Which list of rotations about the center point will result in the figure being carried onto itself?

A. $30°$, $45°$, and $60°$

B. $45°$, $60°$, and $90°$

C. $60°$, $90°$, and $135°$

D. $45°$, $90°$, and $135°$

Answer Choice Rationale

A. 30° and 60° rotations will not result in the vertices lining up.

B. A 60° rotation will not result in the vertices lining up.

C. A 60° rotation will not result in the vertices lining up.

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D. Correct answer

ItemID A2K.1218539
Correct D
Standard(s) MA.9-12.G3.1.3, MA.9-12.G-CO.3

12. Which describes the relationship between the two trapezoids?
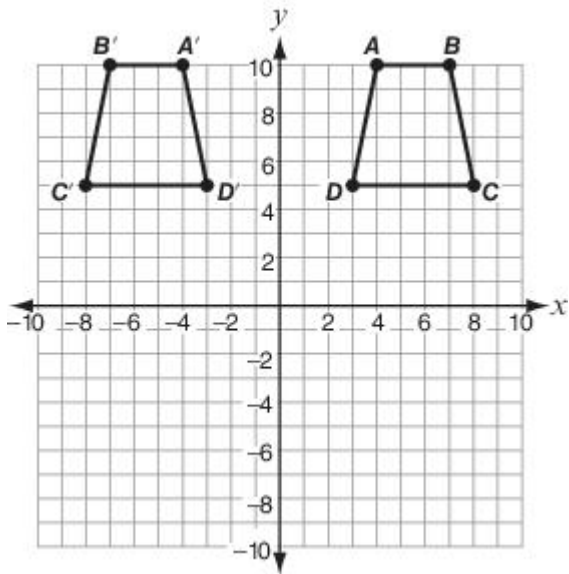

A. $A'B'C'D'$ is the result of reflecting $ABCD$.

B. $A'B'C'D'$ is the result of rotating $ABCD$ $180°$ clockwise.

C. $A'B'C'D'$ is the result of translating $ABCD$ to the right.

D. $A'B'C'D'$ is the result of rotating $ABCD$ $90°$ counterclockwise.

Answer Choice Rationale

A. Correct answer

B. The second trapezoid would have been upside down if it was rotated $180°$.

C. The student did not realize that this was not a translation to the right.

D. The student did not understand that a rotation would have it upside down.

ItemID A2K.1223044
Correct A
Standard(s) MA.9-12.G3.1.3, MA.9-12.G-CO.3

13. The regular pentagon shown below has rotational symmetry.
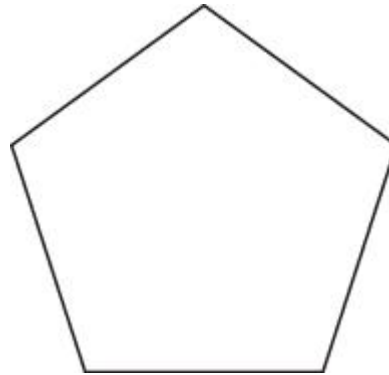
What is the angle of rotation?

A. 60 degrees
B. 72 degrees
C. 144 degrees
D. 360 degrees

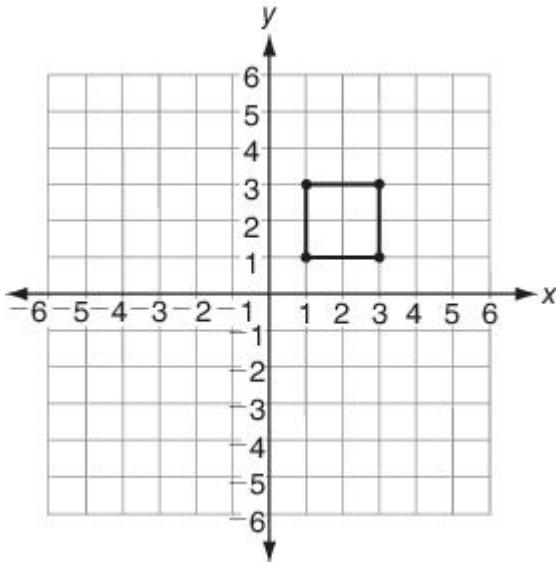**Answer Choice Rationale**

A. This answer is true for a hexagon.
B. Correct answer
C. This answer is not the minimum number of degrees.
D. This answer is one full turn.

ItemID A2K.1236198
Correct B
Standard(s) MA.9-12.G-CO.3

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14. Which of these transformations will result in the figure being carried onto itself?

A. a reflection over the *x*-axis

B. a reflection over the *y*-axis

C. a reflection over the *x*-axis, followed by a clockwise rotation about the origin of $270°$

D. a reflection over the *x*-axis, followed by a counterclockwise rotation about the origin of $180°$

Answer Choice Rationale

A. This will result in the square being in the fourth quadrant, not back on the original.

B. This will result in the figure being in the second quadrant instead of the first.

C. Correct answer

D. This results in a figure in the second quadrant, instead of one carried back onto itself in the first quadrant.

ItemID A2K.1232762
**Correct** C
Standard(s) MA.9-12.G3.1.3, MA.9-12.G-CO.3

15. Given a regular octagon, how many lines exist such that a reflection across the line would take the octagon onto itself?

A. 2

B. 4

C. 8

D. ∞

Answer Choice Rationale

A. This is a result of not including all of the lines and perhaps thinking of the *x*- and *y*-axes as the only possible lines to reflect over.

B. This is a result of including only the lines through the midpoints of the sides or only the lines through the vertices.

C. Correct answer

D. This is the result of incorrectly assuming that a regular polygon has infinitely many lines of symmetry.

ItemID A2K.1309171
Correct C
Standard(s) MA.9-12.G-CO.3

16. Look at figure A and its image, A'.
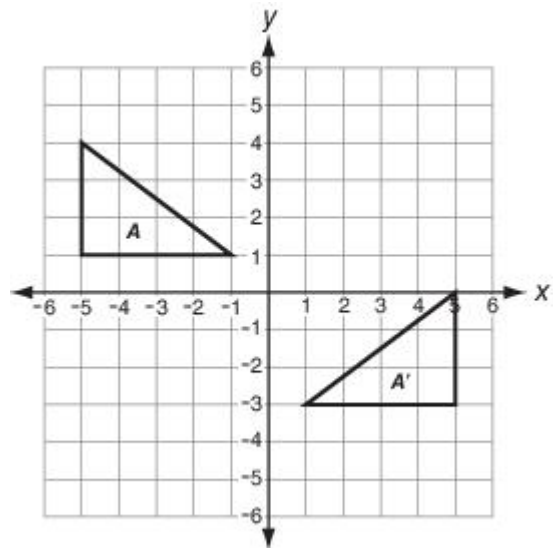
Which best describes the series of transformations that were performed on figure A?

A. a rotation of $180°$ and a translation of 4 units down

B. a reflection across the *y*-axis and a translation of 4 units down

C. a reflection across the *y*-axis and a reflection across the *x*-axis

D. a rotation of $90°$ counterclockwise and a translation of 6 units to the right

Answer Choice Rationale

A. While this series of transformations could result in the correct location for the image, the orientation of the image would not be correct.

B. Correct answer

C. This series of transformations would result in an image with a different orientation and location.
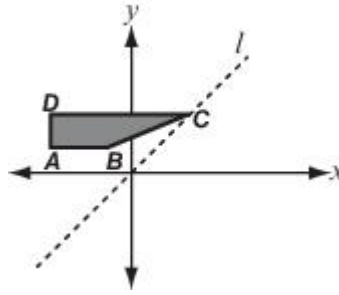
Go on to the next page »

D. While this series of transformations could place the image in the correct location, its orientation would not be correct.

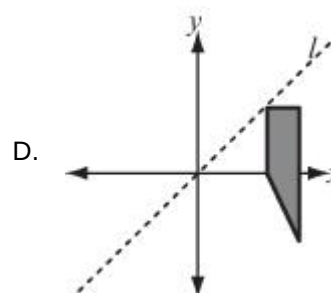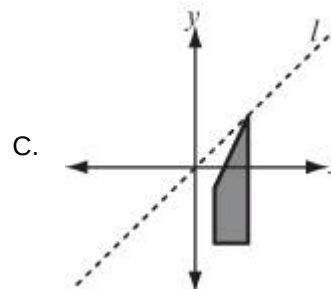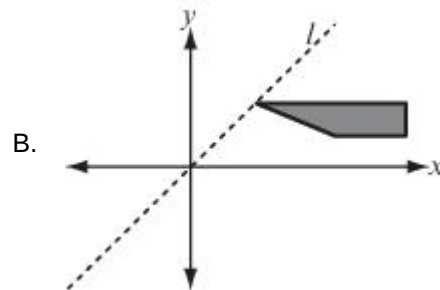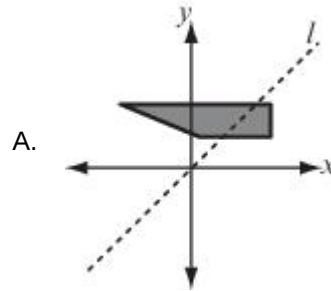17. Given: Quadrilateral *ABCD* on this graph.

Which graph shows the reflection of *ABCD* over line *l?*

A.

B.

C.

D.

Answer Choice Rationale

A. This graph shows a reflection of the figure over the *y*-axis.
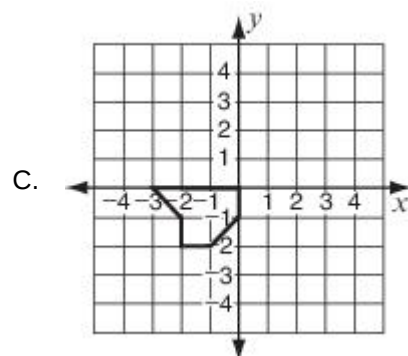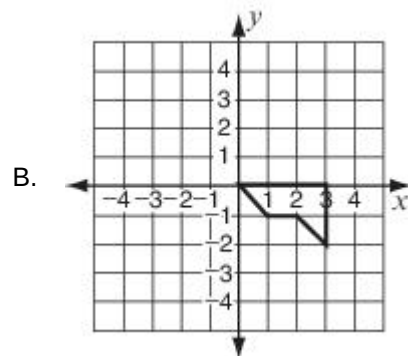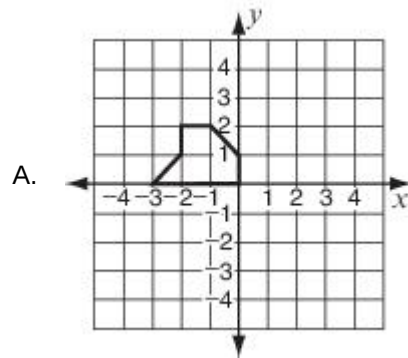
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B. This graph reflects the figure over a vertical line instead of a sloping line.

C. Correct answer.

D. This answer has an incorrect orientation of the figure.

ItemID A2K.1009717
Correct C
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.5, MA.9-12.G-CO.6

18. Gabrielle is making a snowflake decoration for her classroom window. She started the design by constructing the figure shown on the grid below. Then Gabrielle reflected the figure over the *x*-axis to continue the pattern.
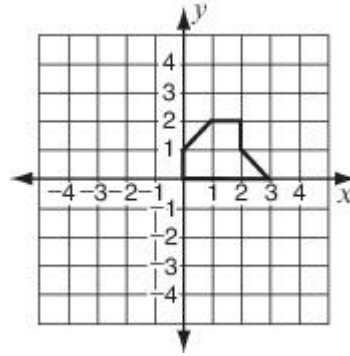
Which of these shows the reflected figure?
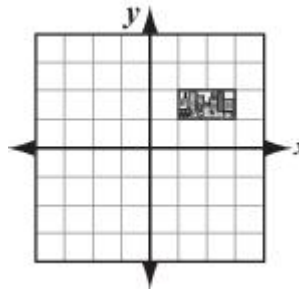
A.

B.

C.

Answer Choice Rationale

A. This answer reflects the figure over the *y*-axis.

B. This shape is not congruent to the figure shown.

C. This answer rotates the figure about the origin.

D. Correct answer.

ItemID A2K.1012191
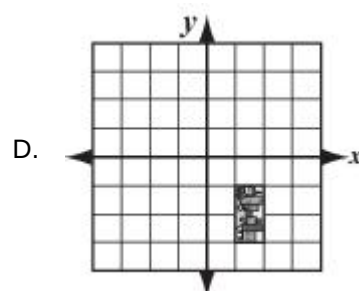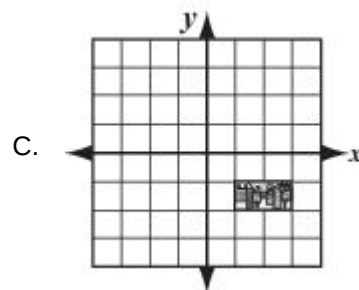**Correct** D
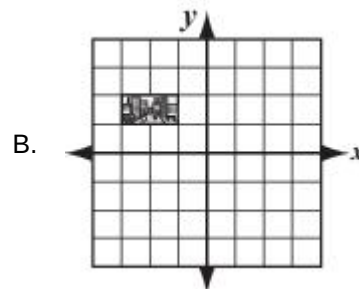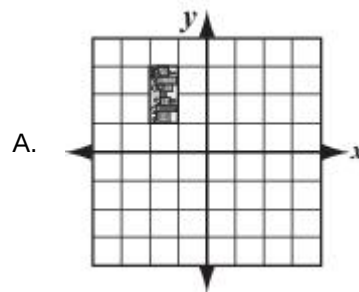**Standard(s)** MA.9-12.G3.1.1, MA.9-12.G-CO.5

19. Don took a picture with his digital camera and is now viewing it on his computer. Using a feature on his photo viewer, he can rotate his picture on a coordinate grid.

Which of these shows the image of Don's picture under a $270°$ rotation counterclockwise about the origin on a coordinate grid?

A.

B.

C.

D.

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Answer Choice Rationale

A. This diagram shows a 270° clockwise rotation.

B. This diagram shows a translation.

C. This diagram has the picture in the correct quadrant, but the orientation of the picture is incorrect.

D. Correct answer.

ItemID A2K.1012488
Correct D
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.5

20. Angela was shown this quadrilateral on a coordinate plane.
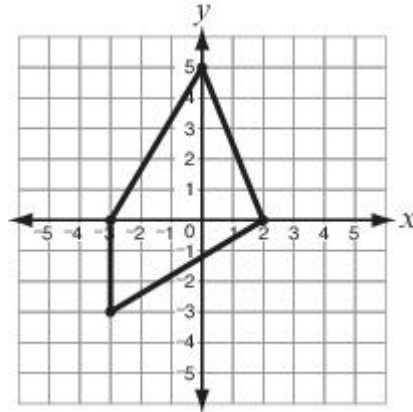
Angela drew a reflection of the quadrilateral across the *x*-axis. Which figure did she draw?

A.

B.

C.

Answer Choice Rationale

A. This graph shows a reflection across the *y*-axis.

B. Correct answer.

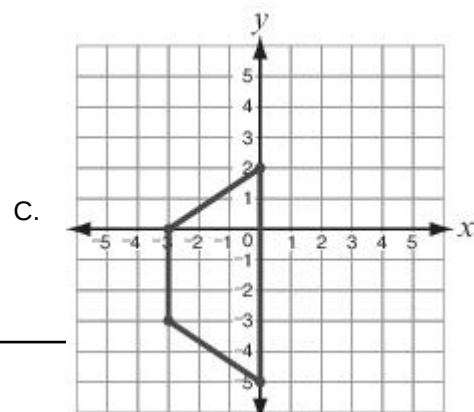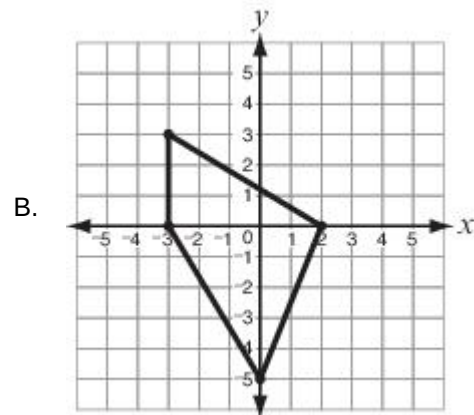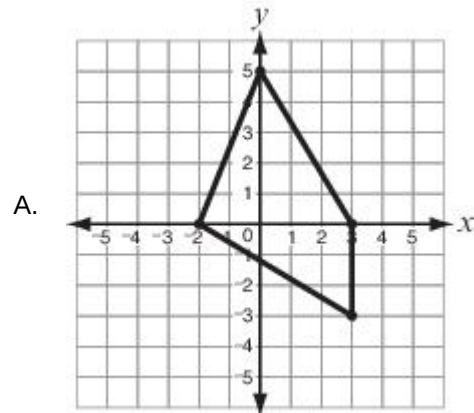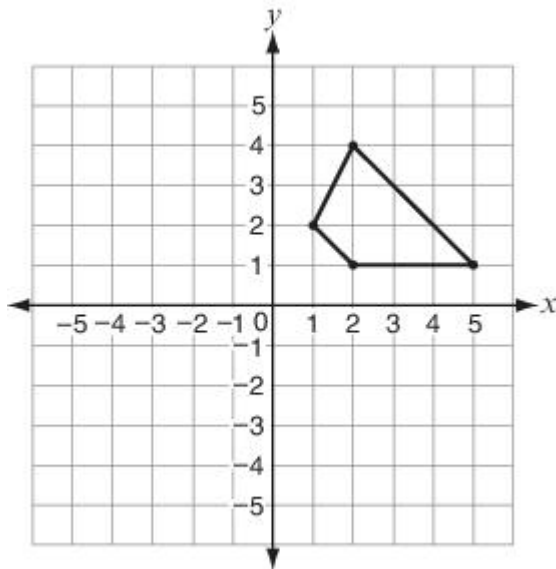C. This graph shows a figure that is not congruent to the figure in the graph.

D. A figure that is reflected is congruent to the original figure, but this figure is not congruent to the original figure.

ItemID A2K.1019603
Correct B
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.5

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21. Margret drew a quadrilateral on this coordinate grid.

If she reflects this figure across the *y*-axis, what will be the new coordinates of her figure?

A. $(-2,-1)$, $(-1,-2)$, $(-5,-1)$, and $(-2,-4)$

B. $(-2,1)$, $(-1,2)$, $(-5,1)$, and $(-2,4)$

C. $(2,-1)$, $(1,-2)$, $(5,-1)$, and $(2,-4)$

D. $(2,1)$, $(1,2)$, $(5,1)$, and $(2,4)$

Answer Choice Rationale

A. These would be the coordinates of the figure if it was reflected about the origin.

B. Correct answer.

C. These would be the coordinates of the figure if it was reflected over the *x*-axis.

D. These are the coordinates of the figure before it is reflected.

ItemID A2K.1014457
Correct B
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.5

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22. On this coordinate grid, $\triangle A'B'C'$ is the image of $\triangle ABC$ under the composite transformation that reflected $\triangle ABC$ over the line $y = 0$ and then over the line $y = -4$.
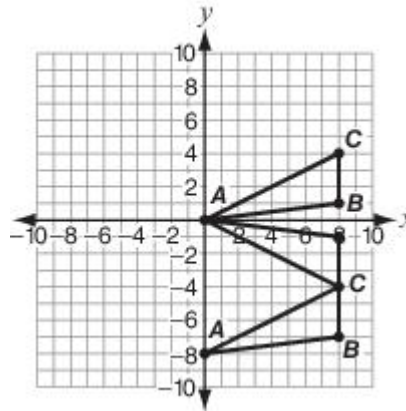
Which single transformation maps $\triangle ABC$ onto $\triangle A'B'C'$?

A. a dilation

B. a rotation

C. a reflection

D. a translation

Answer Choice Rationale

A. The size of the triangle has not changed, so the transformation cannot be a dilation.

B. The transformed triangle does not share a point with the original triangle, so the transformation cannot be a rotation.

C. Each transformation in the composite transformation is a reflection, but a single reflection does not map the original triangle onto the transformed triangle.

D. Correct answer

ItemID A2K.1014830
Correct D
Standard(s) MA.9-12.G3.1.1, MA.9-12.G-CO.5

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23. What is the rule for the translation of $\triangle DEF$ to $\triangle D'E'F'$ shown on the graph below?
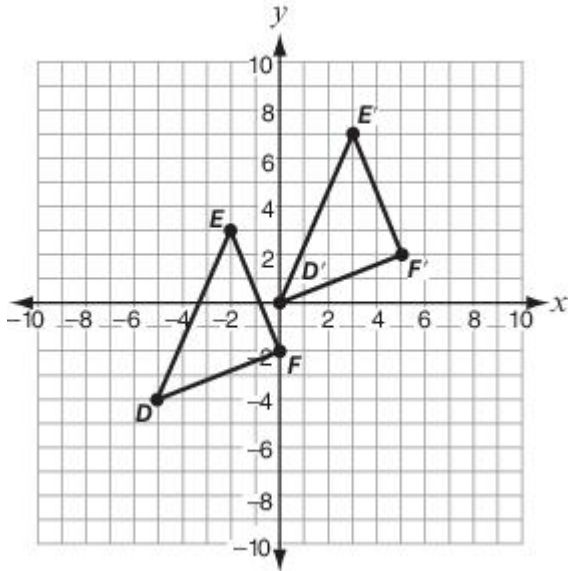
A. $(x,y) \rightarrow (x+5, y+4)$

B. $(x,y) \rightarrow (x-5, y-4)$

C. $(x,y) \rightarrow (x+5, y-4)$

D. $(x,y) \rightarrow (x-5, y+4)$

Answer Choice Rationale

A. Correct answer

B. The student gets the correct number of units moved, but the signs are incorrect for both coordinates.

C. The student counted the translation for the *y*-coordinate incorrectly.

D. The student counted the translation for the *x*-coordinate incorrectly.

ItemID A2K.1223084
Correct A
Standard(s) MA.9-12.G-CO.5

24. The point (2, 3) is reflected over the *x*-axis and then translated 4 units to the left and 2 units up. What are the new coordinates of the point?

A. $(-2, -1)$

B. $(2, 1)$

C. $(6, -5)$

D. $(-6, 5)$

Answer Choice Rationale

A. Correct answer.

B. The student understands how to reflect a point over an axis and translate a point left, but when translating the point $(-2, -3)$ two units up misses both signs of the coordinates.

C. The student confuses the *x*- and *y*-axes and does not always attach the correct sign to the coordinates.

D. The student confuses the *x*- and *y*-axes.

ItemID A2K.1016957
Correct A
**Standard(s)** MA.8.G.TR.08.10, MA.5-8.G.2.c, MA.9-12.G-CO.6

25. A triangle is rotated $90°$ counterclockwise and then translated 2 units down and 4 units to the right. The vertices of the final image are $(-6, 3)$, $(1, 1)$, and $(-10, 5)$. What were the vertices of the original triangle?

A. $(1, 2), (1, -5), (5, -1)$

B. $(2, 1), (5, -1), (1, 5)$

C. $(5, -10), (3, -3), (9, -7)$

D. $(5, 10), (3, 3), (9, 7)$

Answer Choice Rationale

A. The triangle vertices are incorrect because the student did not do the reflection.

B. The triangle vertices are not correct because the student counted the clockwise rotation.

C. The triangle vertices are not correct because the student did not change the signs in the *y*-coordinates.

D. Correct answer

ItemID A2K.1223046
Correct D
Standard(s) MA.9-12.G-CO.6

26. Square $PQRS$ is shown on the coordinate plane below. The square undergoes a dilation of 0.5 with the center of dilation at point P. The result of the dilation is square $P'Q'R'S'$.
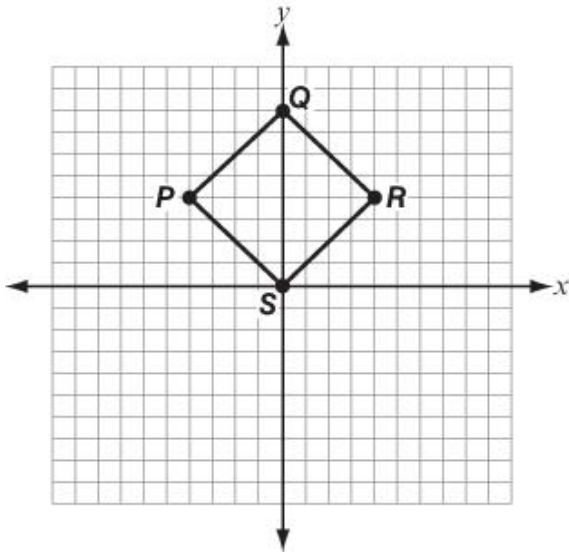
Which line segments in the figure have the same equation before and after the dilation, and why?

A. the line segments with an endpoint at S, because S is the origin

B. the line segments with an endpoint at R, because R is in the first quadrant

C. the line segments with an endpoint at P, because P is the center of dilation

D. the line segments with an endpoint at Q, because Q is on the positive *y*-axis

Answer Choice Rationale

A. This would be correct if the center of dilation was at the origin. After the figure is dilated, these line segments would be parallel to the ones shown.

B. This response may be the result of inappropriately applying the fact that the *x*- and *y*-values in the first quadrant are positive. After the figure is dilated, these line segments would be parallel to the ones shown.

C. Correct answer

D. This response may be the result of inappropriately applying the fact that the *y*-values are positive. After the figure is dilated, these line segments would be parallel to the ones shown.

ItemID A2K.1307821
Correct C
Standard(s) MA.9-12.G-SRT.1.a

27. Which description MOST accurately describes a dilation?

A. When a shape is dilated, the parallel lines remain parallel.

B. When a shape is dilated, the angles within the shape change.

C. When a shape is dilated, the orientation of the shape changes.

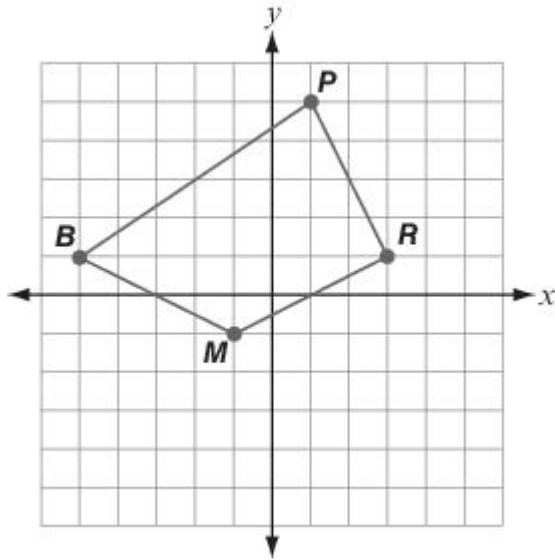D. When a shape is dilated, the distance between points remains the same.

Answer Choice Rationale

A. Correct answer.

B. The student mistakenly believes that when the side lengths change, the angles change too.

C. The student confuses dilation with reflection.

D. The student does not understand the definition of dilation.

ItemID A2K.1196713
Correct A
Standard(s) MA.9-12.G3.2.1, MA.9-12.G-SRT.1.a

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28. Which coordinates are the vertices of the image of $MBPR$ using the origin as the center of dilation and a scale factor of $\dfrac{1}{5}$?


A. $\left(-\dfrac{1}{5}\,,\dfrac{1}{5}\right),\left(1\,,-\dfrac{1}{5}\right),\left(\dfrac{1}{5}\,,-1\right),\left(\dfrac{3}{5}\,,-\dfrac{1}{5}\right)$

B. $\left(-\dfrac{1}{5}\,,-\dfrac{1}{5}\right),\left(-1\,,\dfrac{1}{5}\right),\left(\dfrac{1}{5}\,,1\right),\left(\dfrac{3}{5}\,,\dfrac{1}{5}\right)$

C. $(-5\,,-5)\,,(-25\,,5)\,,(5\,,25)\,,(15\,,3)$

D. $(-5\,,-5)\,,(25\,,-5)\,,(-5\,,-25)\,,(-15\,,-3)$

Answer Choice Rationale

A. This answer changes the coordinates by the correct scale factor, but incorrectly determines the coordinates of the original points as (-1, 1), (5, -1), (1, -5), and (3, -1) instead of (-1, -1), (-5, 1), (1, 5), and (3, 1).

B. Correct answer.

C. These are the coordinates of the vertices using a scale factor of 5.

D. This answer determines the coordinates of the original points as (-1, 1), (5, -1), (1, -5), and (3, -1) instead of (-1, -1), (-5, 1), (1, 5), and (3, 1), and incorrectly uses a scale factor of 5.

29. Square $EFGH$ is shown below. A dilation of 2 centered at $(2, 2)$ is performed. The resulting square is labeled $E'F'G'H'$.
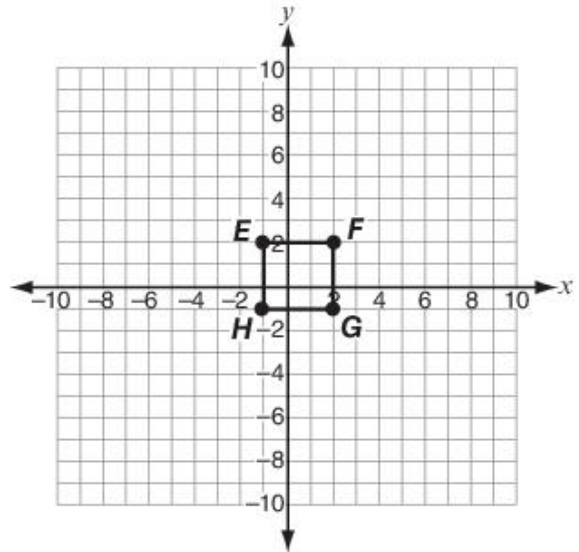
What is the length of $\overline{F'G'}$?

A. 2 units

B. 3 units

C. 5 units

D. 6 units

Answer Choice Rationale

A. This is the scale factor for the dilation, not the length of the resulting side. This could also be the result of using either the *x*- or *y*-value in the point given as the center of dilation.

B. This is the length of $\overline{FG}$ and does not include the dilation.

C. This is the result of adding the scale factor and the length of the original side. These numbers should have been multiplied.

D. Correct answer

30.   Which model shows the shaded figure dilated by a
       scale factor of 3?

A.

B.

C.

D.
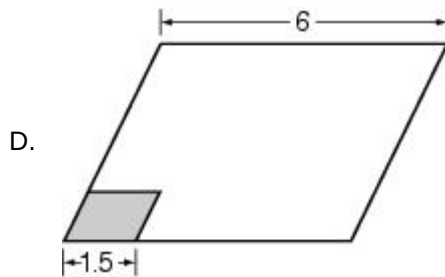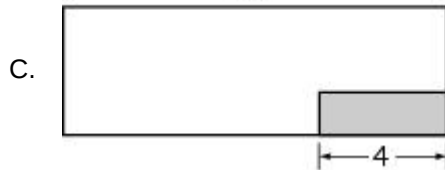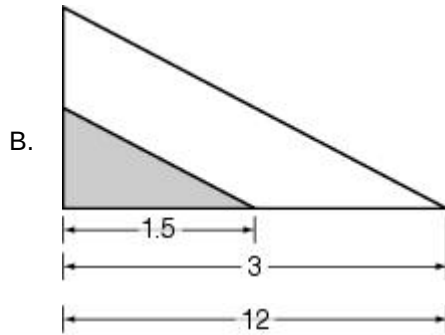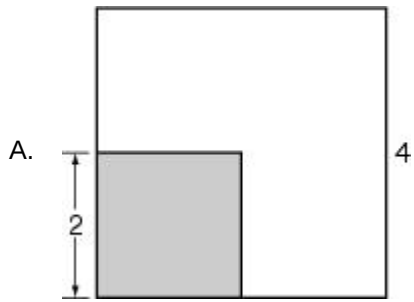
Answer Choice Rationale

   A.   No rationale available
   B.   No rationale available
   C.   Correct
   D.   No rationale available

ItemID A2K.1114458
Correct C
Standard(s) MA.7.G.TR.07.03, MA.5-8.G.2.c, MA.8.8.G.3, MA.9-12.G-SRT.1.b

Stop! You have finished this exam.