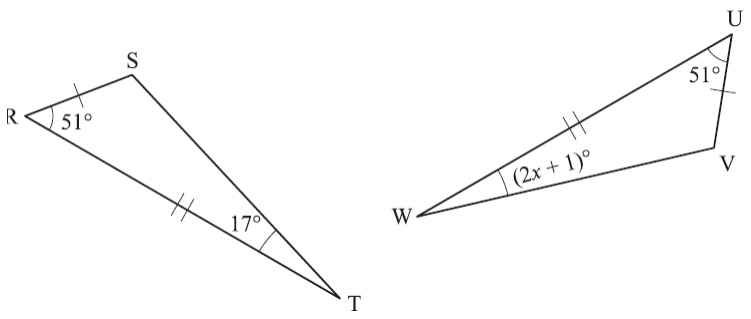
Geometry

Congruence, Similarity, and Constructions

Name: _____ Date: _____

1. Triangle RST and triangle UVW are shown.



What is the value of x?

A. 8

B. 9

C. 25

D. 35

2. The coordinates of the vertices of parallelogram $SWAN$ are $S(2,2)$, $W(2,4)$, $A(4,6)$, and $N(0,8)$.

   If parallelogram $S"W"A"N"$ with coordinates $S"(5,-1)$, $W"(5,0)$, $A"(6,1)$, and $N"(4,2)$ is the image of parallelogram $SWAN$, which of the following describes the transformation(s) that maps parallelogram $SWAN$ to $S"W"A"N"$?

   A. $(x,y) \rightarrow \left(\frac{1}{2}x + 4, \frac{1}{2}y - 2\right)$

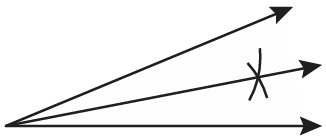
   B. $(x,y) \rightarrow \left(\frac{1}{2}x - 4, \frac{1}{2}y + 2\right)$

   C. $(x,y) \rightarrow (2x + 4, 2y - 2)$

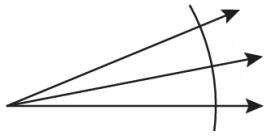
   D. $(x,y) \rightarrow (2x - 4, 2y + 2)$

3. Which illustration shows the correct construction of an angle bisector?

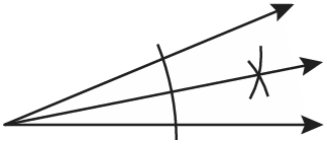
   A.



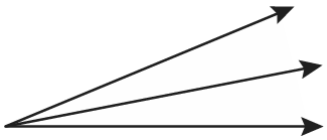
   B.



   C.



   D.



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4. A shipping company sells cylindrical boxes to ship items. The smallest box they offer has a height of 8 inches and a radius of 6 inches. The next larger box has the same radius as the smallest, but its height is 16 inches. How much does the volume change between the two cylinder sizes?

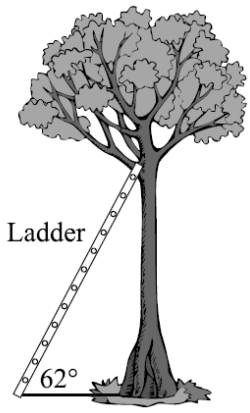
   A. The volume of the larger cylinder is 2 times the volume of the smaller cylinder.

   B. The volume of the larger cylinder is 4 times the volume of the smaller cylinder.

   C. The volume of the larger cylinder is 8 times the volume of the smaller cylinder.

   D. The volume of the larger cylinder is 16 times the volume of the smaller cylinder.

5. A cat is stuck in a tree. A firefighter's 15-foot ladder is leaning against the tree. The ladder and the ground form a 62-degree angle. How high above the ground does the ladder touch the tree?



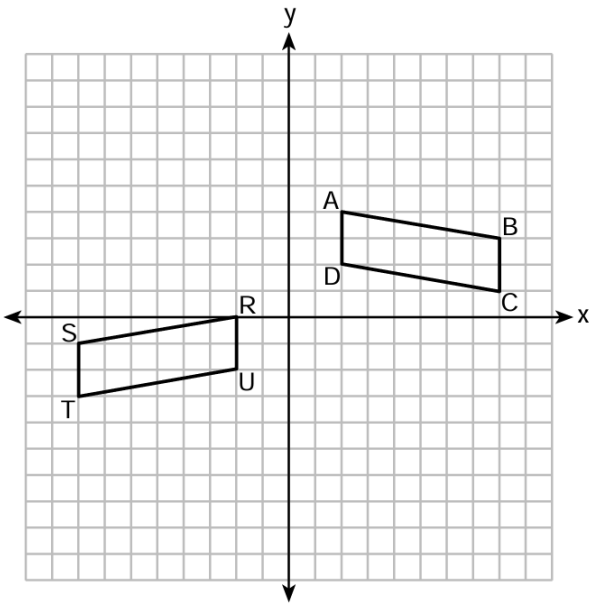
   A. 7.04 ft

   B. 13.24 ft

   C. 16.99 ft

   D. 28.21 ft

6. On the set of axes below, congruent parallelograms $ABCD$ and $RSTU$ are graphed.



   Which sequence of transformations maps $ABCD$ onto $RSTU$?

   A. a reflection over the x −axis followed by a translation ten units to the left and one unit up

   B. a translation four units down followed by a reflection over the y −axis

   C. a reflection over the y −axis followed by a translation of two units down

   D. a translation ten units to the left followed by a reflection over the x −axis

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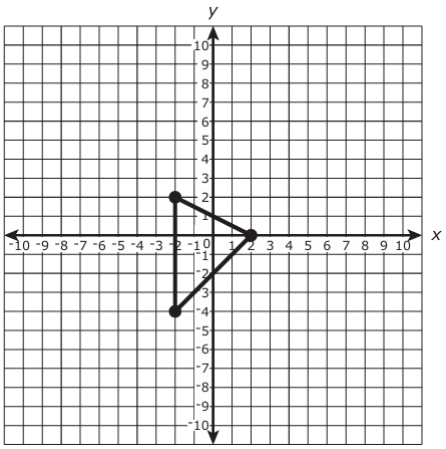
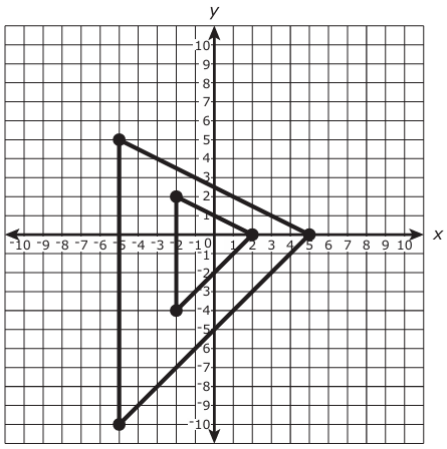
7. A triangle is shown on this coordinate plane. The triangle will be dilated by a scale factor of 2.5 with respect to the origin.

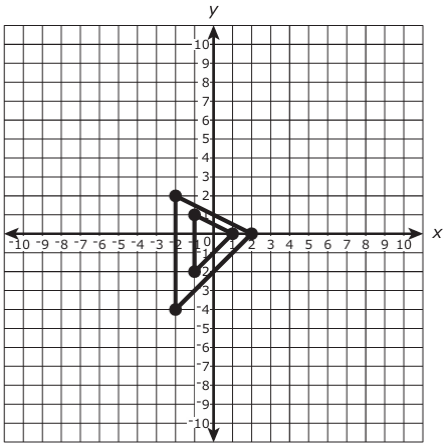


Which of the following graphs correctly shows the triangle and its image after the dilation?

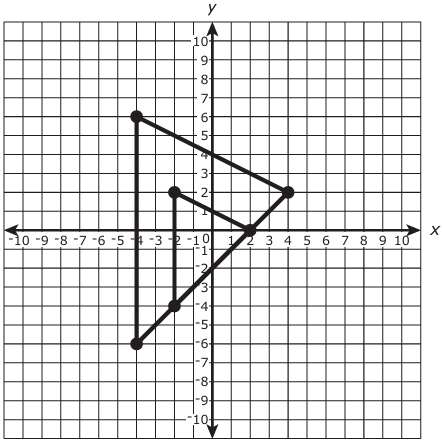
A.



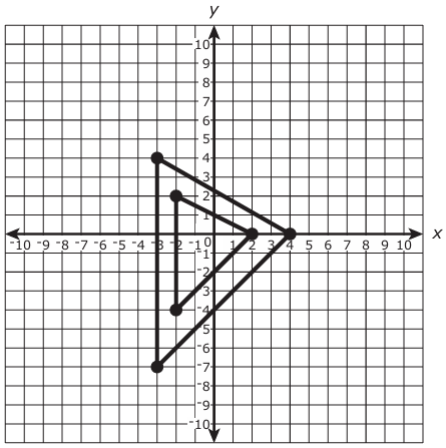
B.



C.



D.



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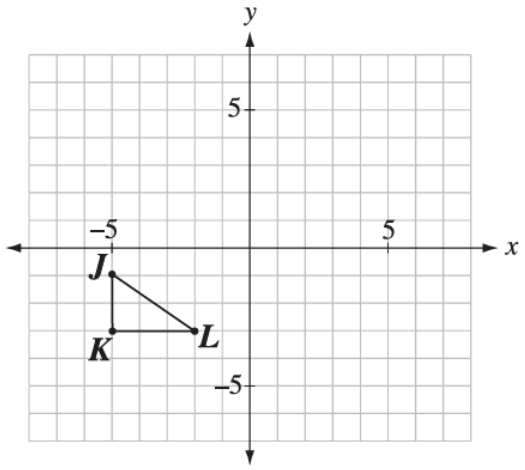
8. Triangle JKL, shown below, undergoes the following transformations:
   - a $90°$ clockwise rotation about vertex L
   - a translation of 3 units right and 4 units up



Which of the following represents the ordered pair for each vertex after both transformations described above have been completed?

A. $J''(1,1)$, $K''(1,4)$, and $L''(3,4)$

B. $J''(1,1)$, $K''(1,-2)$, and $L''(-1,-2)$

C. $J''(4,3)$, $K''(2,3)$, and $L''(2,0)$

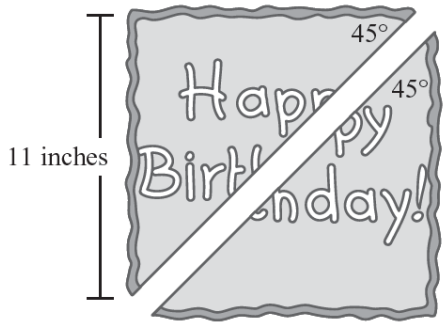
D. $J''(3,4)$, $K''(1,4)$, and $L''(1,1)$

9. The ratio of similarity of square $ABCD$ to square $WXYZ$ is $2:5$.

   If $AB = x + 3$ and $WX = 3x + 5$, then the perimeter of $ABCD$ is

   A. 8
   B. 20
   C. 32
   D. 80

10. Kareema cut her square birthday cake diagonally, making two triangular sections with 45-degree angles.



If the side of the cake is 11 inches, how long is the diagonal of the cake?

A. $5\frac{1}{2}$

B. $\frac{11}{\sqrt{2}}$

C. 11

D. $11\sqrt{2}$

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11. A cereal company uses a rectangular prism-shaped box for its cereal. The box holds $216\ in^3$ of cereal and requires $300\ in^2$ of cardboard.

    Part A: If the company increases each dimension of the box by a factor of 1.5, how much more cereal will the box be able to hold?

    A. $972\ in^3$
    B. $729\ in^3$
    C. $513\ in^3$
    D. $324\ in^3$

    Part B: Using the dimensions from Part A, how much cardboard will be needed to make the new box?

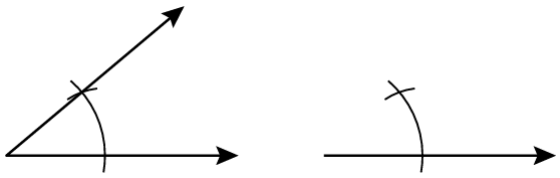
    A. $450\ in^2$
    B. $675\ in^2$
    C. $900\ in^2$
    D. $1{,}012.5\ in^2$

12. Isabella claims that any transformation applied to a rectangle will preserve its side lengths.

    Which of the following transformations could be used to prove Isabella's claim is incorrect? Select all that apply.

    A. A translation 6 units up followed by a dilation with scale factor of -1.
    B. A rotation of $90°$ about the origin followed by a reflection across the line $y = 3x + 2$.
    C. A dilation by a factor of 3 centered at the origin, followed by a translation 3 units down.
    D. A reflection over the y −axis followed by a reflection over the x −axis.
    E. A dilation with scale factor of $\frac{1}{4}$ centered at one of the rectangle's vertices followed by a dilation with scale factor of 8 centered at the origin.

13. A diagram of a construction is shown.



    Which construction does the diagram represent?

    A. a bisector of a given angle
    B. an angle congruent to a given angle
    C. a bisector of a given line
    D. perpendicular of a given line at a point on the line

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14. Given: Quadrilateral $PQRS$ on the coordinate plane.
    - Quadrilateral $P'Q'R'S'$ is the image of quadrilateral PQRS after a single transformation.
    - Quadrilateral $P"Q"R"S"$ is the image of quadrilateral P'Q'R'S' after a single transformation.

    Which statement is true? Select all that apply.

    A. If $P'Q'R'S'$ is formed by translating $PQRS$ 4 units to the right and 5 units down, then $PQRS \cong P'Q'R'S'$.

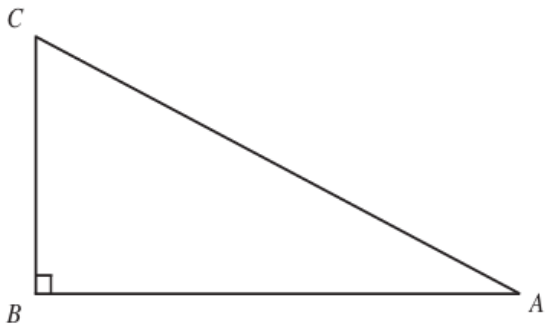
    B. If $P'Q'R'S'$ is formed by dilating $PQRS$ with scale factor $\frac{2}{5}$ and center P, then $PQRS \cong P'Q'R'S'$.

    C. If $P'Q'R'S'$ is formed by rotating $PQRS$ $60°$ clockwise about the origin, then $PQRS \cong P'Q'R'S'$.

    D. If $P'Q'R'S'$ is formed by rotating $PQRS$ $90°$ clockwise about point Q and $P"Q"R"S"$ is formed by dilating $P'Q'R'S'$ with scale factor $\frac{1}{2}$ and center R, then $PQRS \cong P''Q''R''S''$.

    E. If $P'Q'R'S'$ is formed is formed by dilating $PQRS$ with scale factor $\frac{3}{4}$ and center S and $P"Q"R"S"$ is formed by dilating $P'Q'R'S'$ with scale factor $\frac{4}{3}$ and center S', then $PQRS \cong P''Q''R''S''$.

15. Triangle ABC is shown below.



Part A: Which of the following expressions are correct? Select all that apply.

A. $\sin C = \frac{AC}{AB}$

B. $\cos C = \frac{AB}{AC}$

C. $\tan A = \frac{AB}{BC}$

D. $\cos A = \frac{AB}{AC}$

E. $\sin C = \frac{AB}{AC}$

16. The ramp for a loading van is 2.0 meters long. The floor of the loading van is 0.8 meters above the ground. What is the measure of the angle that the ramp forms with the ground, x? Round to the nearest tenth.

A. $21.8°$

B. $23.6°$

C. $66.4°$

D. $68.2°$

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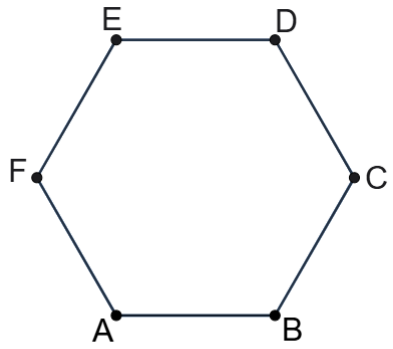
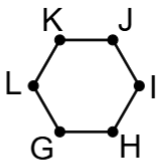
17. Regular hexagons $ABCDEF$ and $GHIJKL$ are shown.



$Perimeter = 36$



$Perimeter = 12$

Based on the given information, which of the following statements support that $ABCDEF \sim GHIJKL$? Select all that apply.

A. $ABCDEF$ and $GHIJKL$ are similar because they both have the same number of sides.

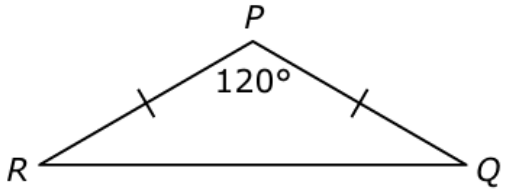
B. $ABCDEF$ and $GHIJKL$ are similar because they both have proportional sides and angles.

C. $ABCDEF$ and $GHIJKL$ are similar because their corresponding sides are congruent; $\frac{AB}{GH} = \frac{BC}{HI} = \frac{CD}{IJ} = \frac{DE}{JK} = \frac{EF}{KL} = \frac{FA}{LG} = 1$.

D. $ABCDEF$ and $GHIJKL$ are similar because their corresponding sides are proportional; $\frac{AB}{GH} = \frac{BC}{HI} = \frac{CD}{IJ} = \frac{DE}{JK} = \frac{EF}{KL} = \frac{FA}{LG} = 3$.

E. $ABCDEF$ and $GHIJKL$ are similar because their corresponding angles are congruent; $m\angle A \cong m\angle G, m\angle B \cong m\angle H, m\angle C \cong m\angle I, m\angle D \cong m\angle J, m\angle E \cong m\angle K$, and $m\angle F \cong m\angle L$.

18. Consider isosceles triangle PQR.



Which of the following transformations, if performed on triangle PQR, would not create a congruent image?

A. a $270°$ counterclockwise rotation about the midpoint of $\overline{PQ}$

B. a dilation by a scale factor of 2 with respect to point P

C. a $180°$ counterclockwise rotation about point R

D. a reflection over side $\overline{QR}$

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19. Triangle TAP has coordinates $T(1,4)$, $A(2,4)$, and $P(2,0)$. What are the coordinates of $\Delta T'A'P'$ after the transformation $(x, y) \rightarrow (x - 5, y - 1)$.

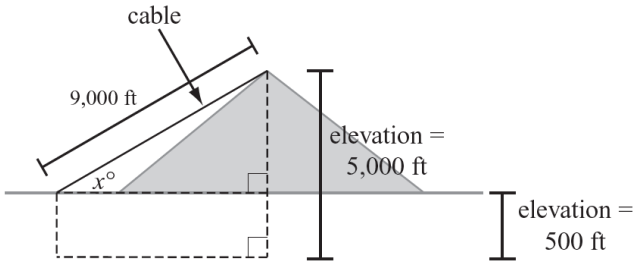
    A. $T'(-6, 4)$, $A'(-3, 4)$, and $P'(-3, 0)$

    B. $T'(1, 3)$, $A'(2, 3)$, and $P'(2, -1)$

    C. $T'(6, 5)$, $A'(7, 5)$, and $P'(7, 1)$

    D. $T'(-4, 3)$, $A'(-3, 3)$, and $P'(-3, -1)$

20. A cable car starts at an elevation of 500 feet above sea level and rises to the top of a peak that is 5,000 feet above sea level. The cable is 9,000 feet long.



What is x, the measure of the angle of elevation of the cable?

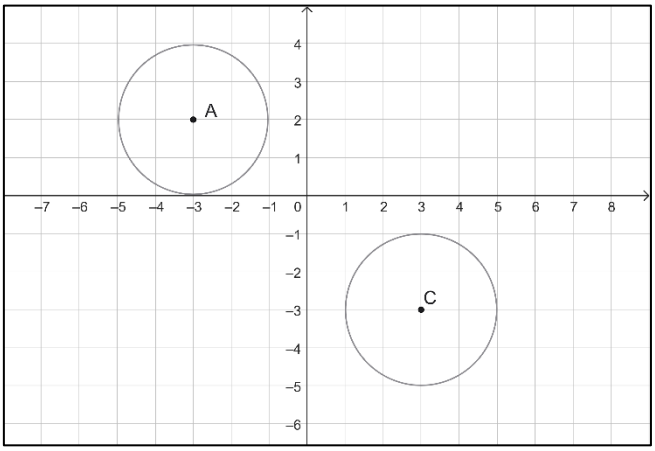
    A. $3°$

    B. $6°$

    C. $30°$

    D. $33°$

21. Given circles A and C.



Which sequence of transformations maps Circle A onto Circle C?

    A. A reflection of Circle A over the line $y = -1$ followed by a translation of 6 units to the right.

    B. A reflection of Circle A over the line $y = 0$ followed by a translation of 6 units to the right.

    C. A reflection of Circle A over the line $x = 0$ followed by a translation of 5 units down.

    D. A reflection of Circle A over the line $x = -1$ followed by a translation of 5 units down.

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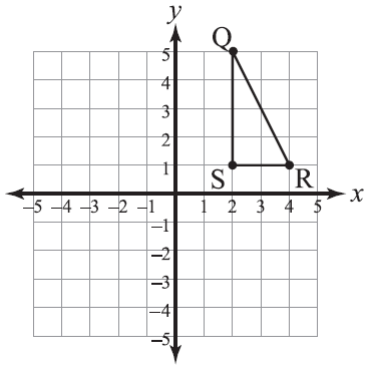
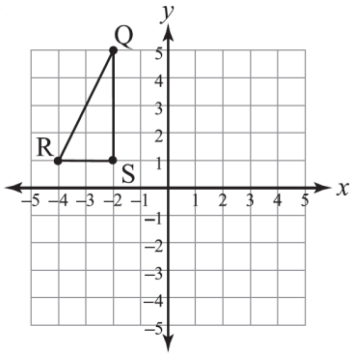
22. Triangle QRS is shown in the graph below.

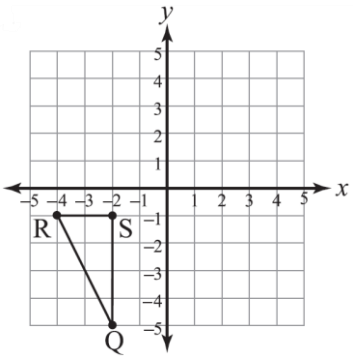


Which of the following graphs shows ΔQRS rotated 90 degrees counterclockwise about the origin and then reflected across the line $y = x$?

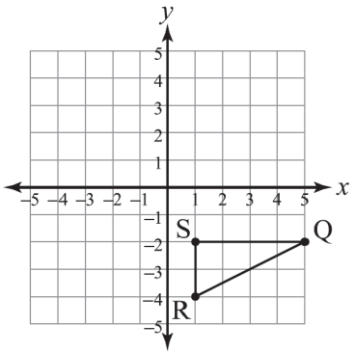
A.



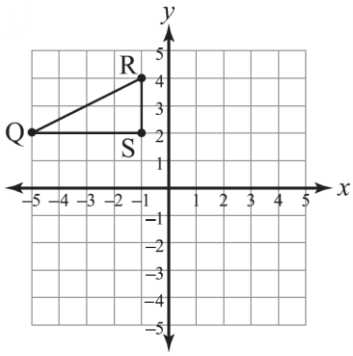
B.



C.



D.



23. Krystal performs a transformation on a triangle. The resulting triangle is similar but not congruent to the original triangle.

Which transformation did Krystal perform on the triangle?

A. Dilation

B. Reflection

C. Rotation

D. Translation

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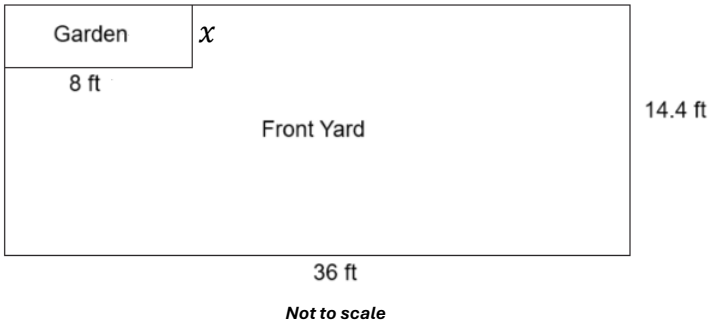
24. Ms. Smith wants to make a rectangular garden with dimensions similar to her backyard.

A diagram of the backyard and the garden are shown.



If the width of her backyard is 14.4 ft, what is the width, x, of the garden?

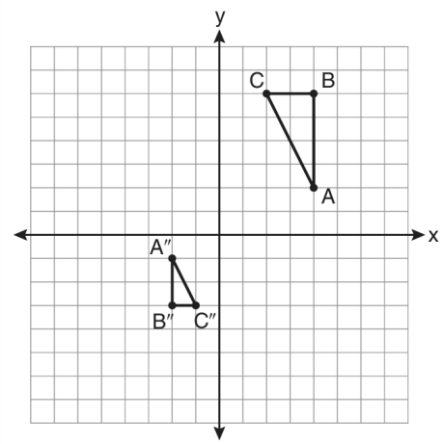
A. 3.2 ft

B. 3.6 ft

C. 4 ft

D. 5.6 ft

25. The diagram below shows triangle ABC and its image triangle $A''B''C''$.



Which sequence of transformations maps ΔABC onto ΔA"B"C"?

A. A rotation of $180°$ about the origin followed by a dilation with a scale factor of 2 centered at the origin.

B. A rotation of $90°$ clockwise about the origin followed by a dilation with a scale factor of 2 centered at the origin.

C. A dilation with a scale factor of $\frac{1}{2}$ centered at the origin followed by a rotation of $180°$ about the origin.

D. A dilation with a scale factor of $\frac{1}{2}$ centered at the origin followed by a rotation of $90°$ clockwise about the origin.

26. Triangle VXY is graphed on a coordinate grid. Which series of transformations will result in a triangle that is similar, but not congruent, to triangle VXY? Select all that apply.

A. a translation 4 units down followed by a translation 6 units left

B. a translation 3 units left followed by a rotation of 180° about the origin

C. a rotation of 60° about the origin followed by a translation 0.5 unit left

D. a dilation with a factor of 0.25 using the origin as the center of dilation followed by a translation 4 units down

E. a rotation of 90° about the origin followed by a dilation with a factor of 4 using the origin as the center of dilation

F. a dilation with a factor of 0.5 followed by a dilation with a factor of 2 using the origin as the center of dilation for both

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27. Triangle PQR with vertices of $P(-2,-1)$, $Q(1,6)$, and $R(3,-2)$ is transformed to obtain triangle $P'Q'R'$ with vertices $P'(2,2)$, $Q'(5,9)$, and $R'(7,1)$.

    Which of the following represents the transformation that maps ΔPQR onto $\Delta P'Q'R'$?

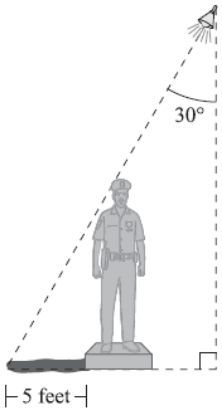
    A. $(x,y) \rightarrow (x+3, y-4)$

    B. $(x,y) \rightarrow (x-3, y+4)$

    C. $(x,y) \rightarrow (x-4, y-3)$

    D. $(x,y) \rightarrow (x+4, y+3)$

28. In an art gallery, a light shines on a statue, creating a shadow on the floor, as shown in the diagram below.



If the shadow is 5 feet long, how tall is the statue?

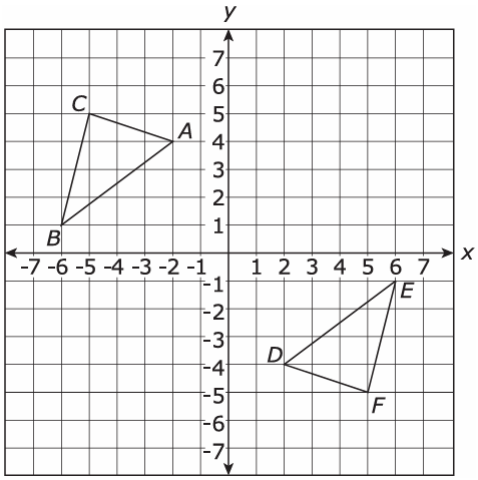
A. $\frac{5}{\sqrt{3}}$ feet

B. 5 feet

C. $5\sqrt{2}$ feet

D. $5\sqrt{3}$ feet

29. Which transformation proves $\Delta ABC \cong \Delta DEF$?



A. Reflection of ΔABC over the line $y = x$

B. Translation of ΔABC 7 units right and 9 units down

C. Rotation of $90°$ clockwise, centered at the origin

D. Reflection of ΔABC over the y −axis and then over the x −axis.

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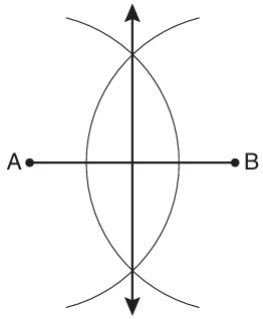
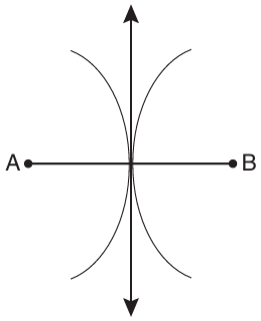
30. Which diagram shows the construction of the perpendicular bisector of $\overline{AB}$?

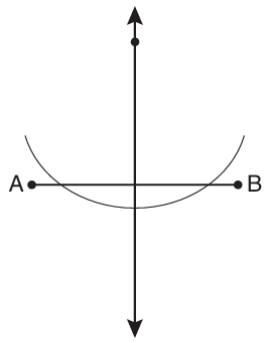
A.



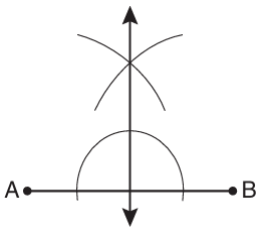
B.



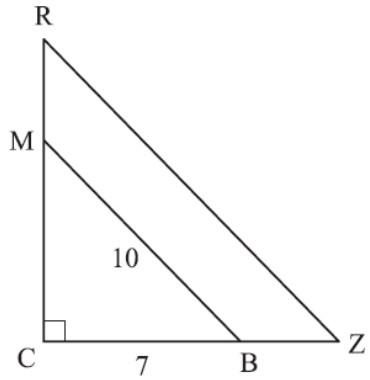
C.



D.



31. In the diagram, $\Delta CMB \sim \Delta CRZ$, $CB = 7$, and $BM = 10$.



Which equation could be used to find the $m\angle Z$?

A. $\sin Z = \frac{7}{10}$

B. $\tan Z = \frac{7}{10}$

C. $\cos Z = \frac{7}{10}$

D. $\sin Z = \frac{10}{7}$

32. The radius of sphere A is 3 times the radius of sphere B. Which best describes the relationship between the surface area of sphere A and the surface area of sphere B?

A. The surface area of A is $\frac{1}{9}$ of the surface area of B.

B. The surface area of A is $\frac{1}{27}$ of the surface area of B.

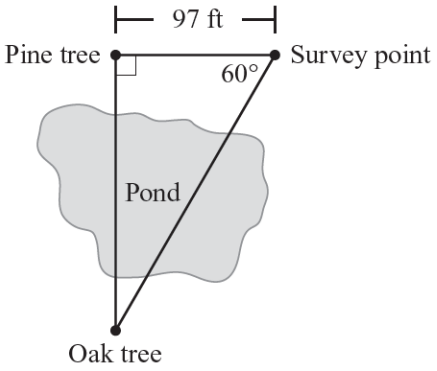
C. The surface area of A is 9 times greater than the surface area of B.

D. The surface area of A is 27 times greater than the surface area of B.

Geometry

Congruence, Similarity, and Constructions

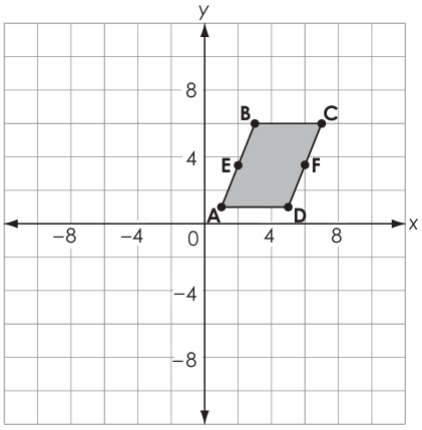
33. As an assignment, two students in a surveying class had to find the distance between two trees separated by a pond. Starting at the pine tree, they walked until they found a point at which the angle formed between the pine tree, the survey point, and the oak tree was . Their sketch is shown below.



To the nearest foot, what is the distance between the pine tree and the oak tree?

A. 168 ft
B. 194 ft
C. 291 ft
D. 336 ft

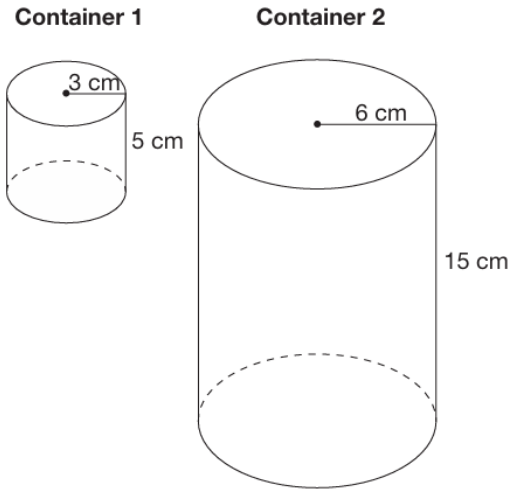
34. Parallelogram $ABCD$ is shown. Point E is the midpoint of segment AB. Point F is the midpoint of segment CD.



Which transformation carries the parallelogram onto itself?

A. a reflection across line segment AC
B. a reflection across line segment EF
C. a rotation of 180 degrees clockwise about the origin
D. a rotation of 180 degrees clockwise about the center of the parallelogram

35. Two different cylindrical containers are shown below.



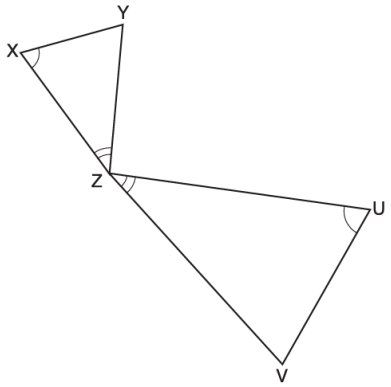
When the containers are full of milk, what is the ratio of the amount in Container 1 to the amount in Container 2?

A. $1:2$
B. $1:3$
C. $1:6$
D. $1:12$

Geometry

Congruence, Similarity, and Constructions

36. In the diagram below, triangles XYZ and UVZ are drawn such that $\angle X \cong \angle U$ and $\angle XZY \cong \angle UZV$.



Which sequence of transformation can be used to justify that triangles XYZ and UVZ are similar?

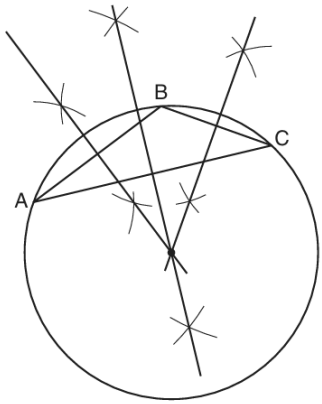
A. A rotation of ΔXYZ about Z such that $\overline{XY}$ coincides with $\overline{UV}$ followed by a dilation with scale factor $\frac{UV}{XY}$ centered at Z.

B. A rotation of ΔXYZ about Z such that $\overline{XY}$ coincides with $\overline{UV}$ followed by a dilation with scale factor $\frac{XY}{UV}$ centered at Z.

C. A rotation of ΔXYZ about Z such that $\overline{ZX}$ coincides with $\overline{ZU}$ followed by a dilation with scale factor $\frac{ZU}{ZX}$ centered at Z.

D. A rotation of ΔXYZ about Z such that $\overline{ZX}$ coincides with $\overline{ZU}$ followed by a dilation with scale factor $\frac{ZX}{ZU}$ centered at Z.

37. Examine the construction below.



Which of the following statements are true about the construction? Select all that apply.

A. The diagram represents the construction of the circumscribed circle of ΔABC.

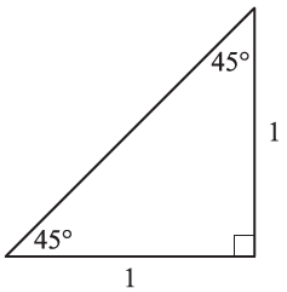
B. The diagram represents the construction of the inscribed circle of ABC.

C. The center of the inscribed circle is the point where the medians to the sides of ΔABC intersect.

D. The center of the circumscribed circle is the point where the perpendicular bisectors of the sides of ΔABC intersect.

E. The center of the circumscribed circle is the point where the medians to the sides of ΔABC intersect.

38. A right triangle is shown.



What is the length of the hypotenuse in the triangle?

A. 1

B. $\sqrt{2}$

C. 2

D. $2\sqrt{2}$

Geometry

Congruence, Similarity, and Constructions

39. Parallelogram $JKLM$ is drawn in the coordinate plane. Which transformation must produce a parallelogram that is similar to parallelogram $JKLM$? Select **all** that apply.

A. a transformation that doubles the x −coordinates and divides the y −coordinates of each point by 2

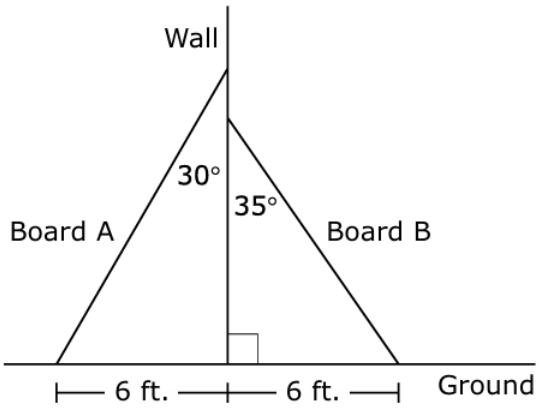
B. a dilation with scale factor 2 and center J, followed by a dilation with scale factor $\frac{1}{3}$ and center L

C. a transformation that adds 1 to each x −coordinate and multiplies each y −coordinate by 2

D. a dilation with center at the origin and scale factor 3, followed by a reflection over $\overleftrightarrow{KM}$

E. a transformation that triples both coordinates of each point

40. Two boards are leaning against opposite sides of a wall. Each of the boards touches the ground at a distance of $6\ feet$ from the base of the wall. The boards and the angles they create with the wall are shown in this diagram.



Part A: Based on the diagram, what is the length, in feet, of board A?

Part B: Which of the following represents the length, in feet, of board B?

A. $6 \sin 35°$

B. $6 \cos 35°$

C. $\frac{6}{\sin 35°}$

D. $\frac{6}{\cos 35°}$

41. The side length of a smaller square is one-third the side length of a larger square. Which of the following statements describes the area of the smaller square?

A. The area of the smaller square is $\frac{1}{27}$ the area of the larger square.

B. The area of the smaller square is $\frac{1}{6}$ the area of the larger square.

C. The area of the smaller square is $\frac{1}{9}$ the area of the larger square.

D. The area of the smaller square is $\frac{1}{3}$ the area of the larger square.

Geometry

Congruence, Similarity, and Constructions

42. Joan wants to construct a segment congruent to segment AB using a compass and straightedge.

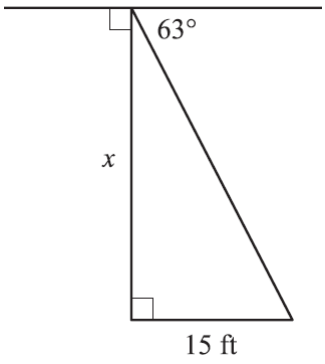
The steps to construct a copy of segment AB using a compass and a straightedge are below. The steps are not in the correct order.

I. Place a starting point on the reference line. Label the point C.
II. Draw a reference line using a straightedge.
III. Without changing the opening of the compass, place the compass point on the starting point on the reference line, C, and draw an arc that intersects the reference line. Label the intersection, D.
IV. Place the point of the compass on point A. Open the compass so that the pencil is exactly on B.
V. Label segment CD; $\overline{CD} \cong \overline{AB}$

What is the correct order of these steps?

A. I, II, II, IV, and V
B. II, III, I, IV, and V
C. IV, II, III, I, and V
D. II, I, IV, III, and V

43. Pierre looks out the apartment window down to the street to see if a friend is there.



If Pierre's friend is standing 15 ft away from the building and the angle of depression is 63°, approximately how high up is Pierre's window?

A. 7 ft
B. 8 ft
C. 13 ft
D. 29 ft

44. A dilation with scale factor 1.75 is performed on triangle PQR to produce triangle $P'Q'R'$.

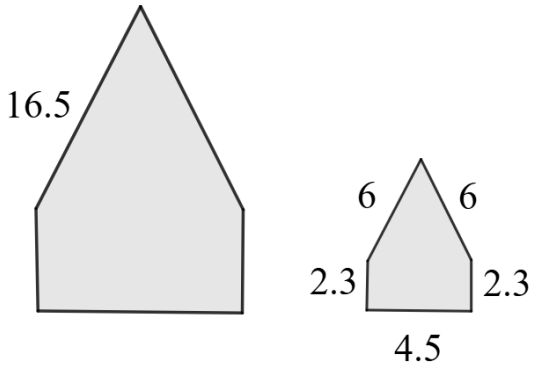
Which statement must be true about the two triangles?

A. Their corresponding angles are congruent, and triangle $P'Q'R'$ is similar to triangle PQR.
B. Their corresponding sides are equal in length, and their angles are all increased by 1.75 times.
C. Their corresponding sides and angles are all 1.75 times larger.
D. Their corresponding angles are 1.75 times larger, and their corresponding sides are congruent.

Geometry

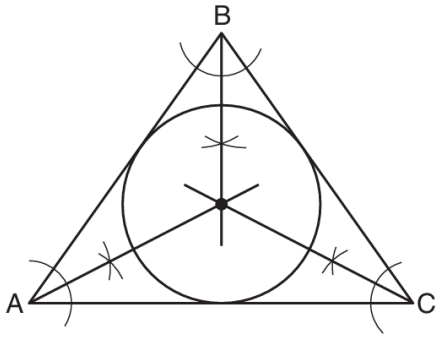
Congruence, Similarity, and Constructions

45. A designer is creating two decorative glass panels for a building's entryway. The panels are similar pentagons, but the larger one is being scaled to fit a main window frame. Both glass panels are shown.



The designer plans to use a metal rod to build a frame around the larger pentagon for stability. How many units of the metal rod will be needed to build the frame?

46. Examine the construction below.



Which of the following statements are true about the construction ? Select all that apply.

A. The diagram represents the construction of the circumscribed circle of ΔABC.

B. The diagram represents the construction of the inscribed circle of ABC.

C. The intersection of the angle bisectors of ΔABC is the center of the inscribed circle.

D. The intersection of the angle bisectors of ΔABC is the center of the circumscribed circle.

E. The intersection of the perpendicular bisectors of the sides of ΔABC is the center of the inscribed circle.

F. The intersection of the perpendicular bisectors of the sides of ΔABC is the center of the circumscribed circle.

47. If $\sin A = \frac{7}{10}$, which of the following statements is correct?

A. $BC = 10$

B. $AB = 10$

C. $BC = 7$

D. $AB = 7$

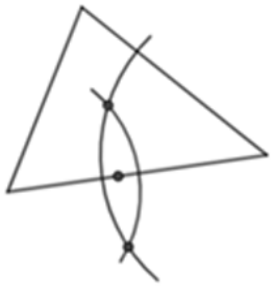
Geometry

Congruence, Similarity, and Constructions

48. Milly wants to find a point that is equidistant from the three vertices of a triangle.

Which construction would be most helpful to begin his construction?

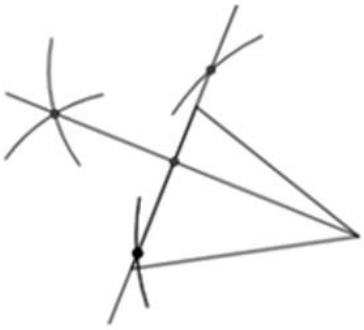
A.



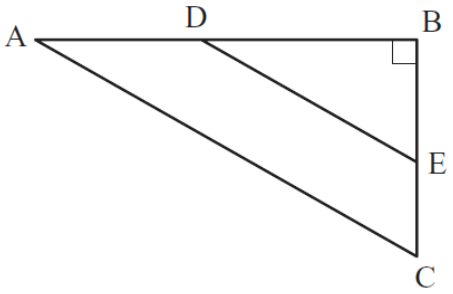
B.

C.

D.



49. In the diagram, $\Delta ABC \sim \Delta DBE$.



What is tan of $\angle DEB$?

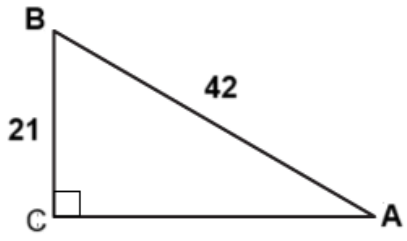
A. $\frac{DB}{BE}$

B. $\frac{BE}{DB}$

C. $\frac{DB}{DE}$

D. $\frac{BC}{AB}$

50. Right triangle ABC is shown.



What is the measure of $\angle B$?

A. $m\angle B = 30°$

B. $m\angle B = 45°$

C. $m\angle B = 60°$

D. $m\angle B = 90°$