



Math

Spring Operational 2016

Geometry

Released Items

1.

VF543189

Classify each statement in the table as correct or incorrect.

Select one cell per row.

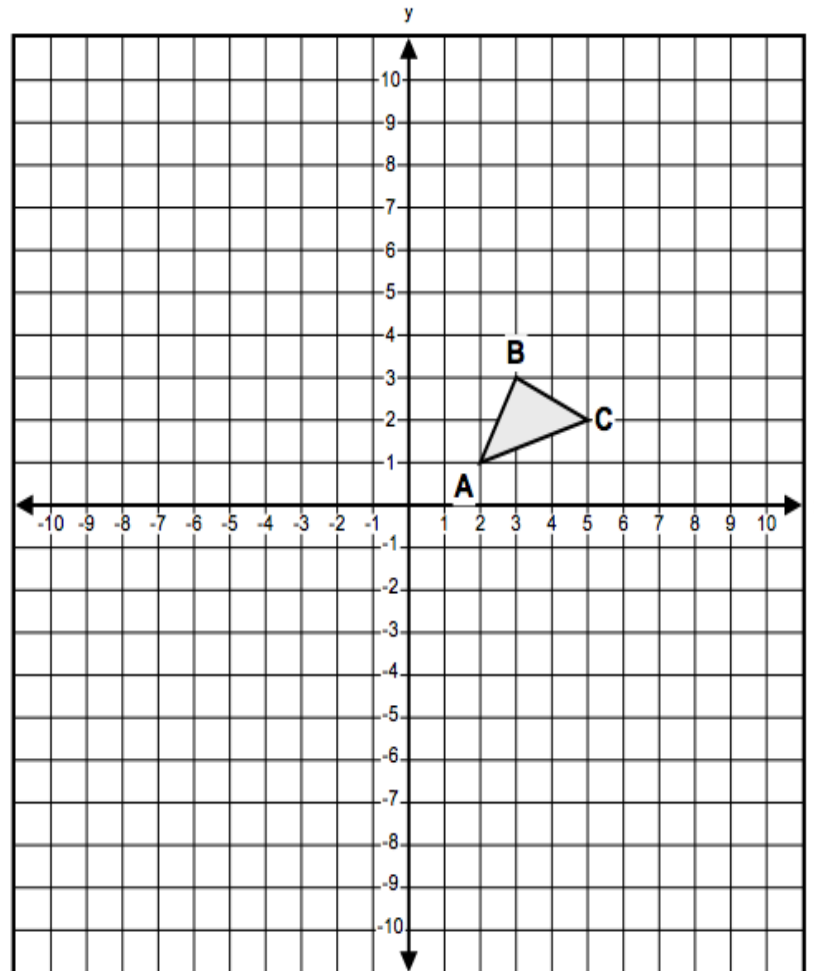
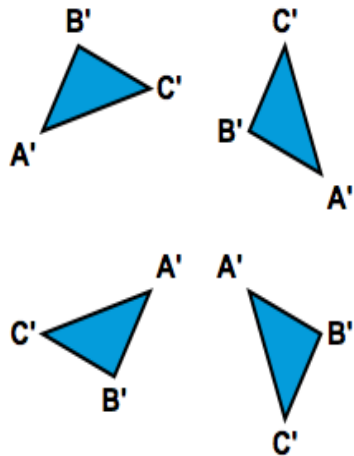
| | Correct | Incorrect |
|---|--------------------------|--------------------------|
| If two lines in the same <u>plane</u> do not intersect, the lines must be parallel. | <input type="checkbox"/> | <input type="checkbox"/> |
| If two lines in space do not intersect, the lines must be parallel. | <input type="checkbox"/> | <input type="checkbox"/> |
| If two lines are parallel, the lines must lie in the same plane. | <input type="checkbox"/> | <input type="checkbox"/> |

2.

VF815346

Triangle ABC is shown in the xy -coordinate plane. It will be rotated 90 degrees **clockwise** about the origin to form triangle $A'B'C'$.

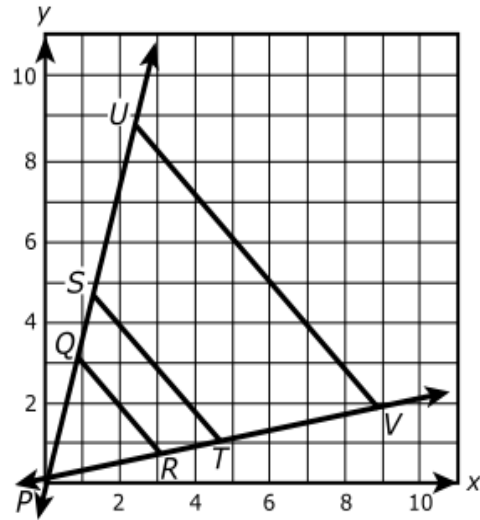
Select the correct orientation of $A'B'C'$ and place it correctly in the coordinate plane.



3.

M40299

The diagram represents a dilation with a center at P .



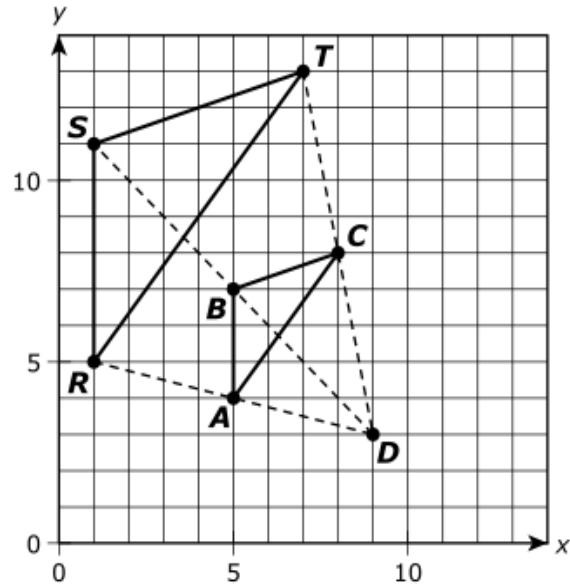
If the scale factor of the dilation is k , which statement about the diagram is true?

- A. If $k > 1$, then the image of \overline{ST} could be \overline{QR} .
- B. If $0 < k < 1$, then the image of \overline{QR} could be \overline{UV} .
- C. If $k > 1$, then the image of \overline{ST} could be \overline{UV} .
- D. If $k = 2$, then the image of \overline{QR} is itself.

4.

VH003583

Triangle ABC has been dilated from center D to form triangle RST .



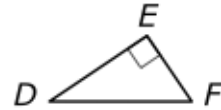
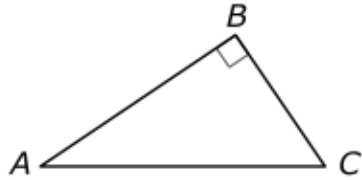
If the length of segment $BC = x$, which is the length of segment ST ?

- A. $2x$
- B. $3x$
- C. $4x$
- D. $5x$

5.

VH003332

Triangles ABC and DEF are right triangles, as shown. Triangle ABC is similar to triangle DEF .



Which ratios are equal to $\sin C$?

Select **all** that apply.

- A. $\frac{AB}{AC}$
- B. $\frac{AB}{BC}$
- C. $\frac{BC}{AC}$
- D. $\frac{DE}{DF}$
- E. $\frac{DE}{EF}$
- F. $\frac{EF}{DF}$

6.

VF558320

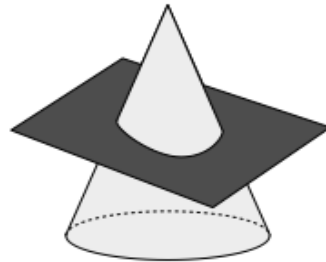
In the xy -coordinate plane, the coordinates of point S are $(-2, -6)$, and the coordinates of point T are $(18, 9)$. Point Q lies on line segment ST so that the ratio of the distance from point S to point Q to the distance from point Q to point T is 2 to 3. What are the coordinates of point Q ?

Enter your answer in the boxes.

The coordinates of point Q are (,).

7.

VH000451



The figure shows a plane slicing through a cone. The plane is neither parallel nor perpendicular to the base of the cone, and the plane does not intersect the base of the cone. What is the shape of the cross section created by the slice?

- A. circle
- B. ellipse
- C. parabola
- D. triangle

8.

M40993

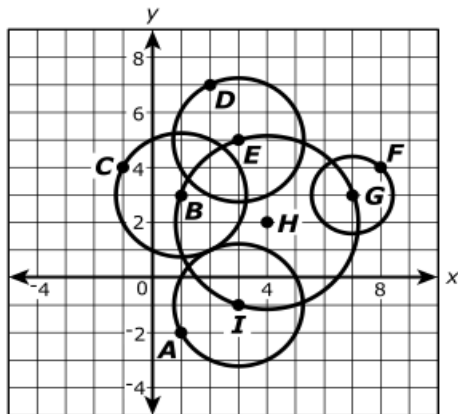
Anders is using casts to make plaster figures. He has a cylinder cast that has a diameter of 8 inches and is 24 inches tall. Anders uses a cone-shaped container with a diameter of 12 inches and a height of 16 inches to fill his casts. How many cone-shaped containers full of plaster will he need to completely fill the cylinder cast?

Enter your answer in the box.

9.

VH024196

In the xy -coordinate plane shown, points B , E , G , and I are on the circle with center H .

**Part A**

What is an equation for the circle with center H ?

- A. $(x - 4)^2 + (y - 2)^2 = \sqrt{10}$
- B. $(x - 4)^2 + (y - 2)^2 = 10$
- C. $(x + 4)^2 + (y + 2)^2 = \sqrt{10}$
- D. $(x + 4)^2 + (y + 2)^2 = 10$

Part B

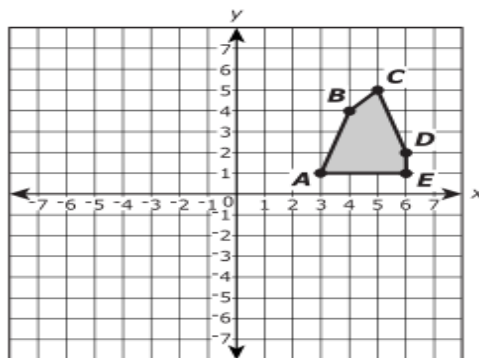
The equation $x^2 + y^2 - 6x + 2y + 5 = 0$ represents the circle with which center?

- A. B
- B. E
- C. G
- D. I

10.

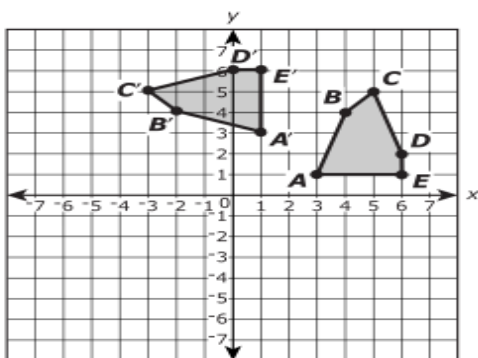
VH024816

Pentagon $ABCDE$ is shown in the xy -coordinate plane. Pentagon $ABCDE$ will be rotated 90° clockwise about the point $(1, 1)$ to form pentagon $A'B'C'D'E'$.

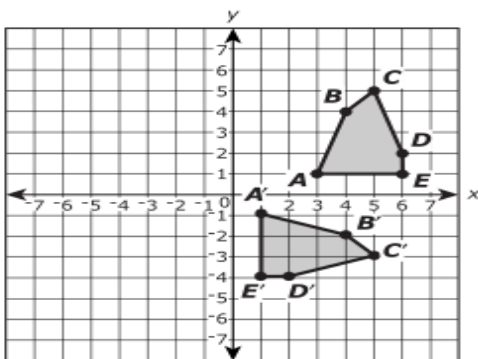


Choose the graph that shows the correct placement of $A'B'C'D'E'$ after the transformation.

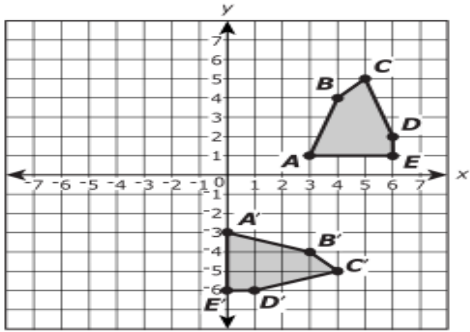
A.



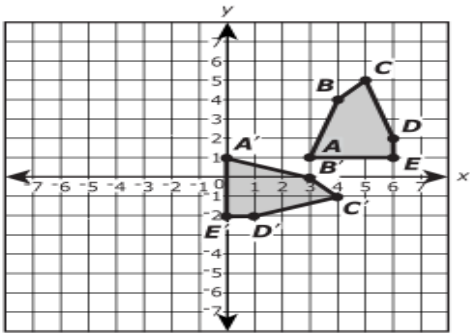
B.



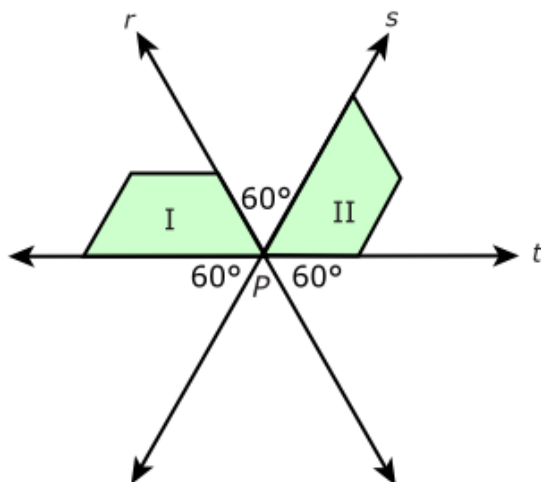
C.



D.



In the illustration, figure I and figure II are isosceles trapezoids.

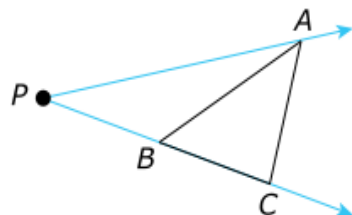


Tran makes a conjecture that figure I is congruent to figure II. Select **each** transformation or combination of transformations that can help Tran prove his conjecture.

Select **all** that apply.

- A. Rotate figure I 60° clockwise around point P .
- B. Rotate figure I 120° clockwise around point P .
- C. Reflect figure I across line r , and then reflect the image across line s .
- D. Reflect figure I across line s , and then reflect the image across line t .
- E. Rotate figure I 180° around point P , and then reflect the image across line t .
- F. Rotate figure I 120° counterclockwise around point P , and then reflect the image across line r .

In the figure, point P will be the center of a dilation of triangle ABC . Point P is collinear with vertices B and C . The scale factor of the dilation will be 3.



Consider the relationship between the sides of triangle ABC and the sides of its dilation image, triangle $A'B'C'$.

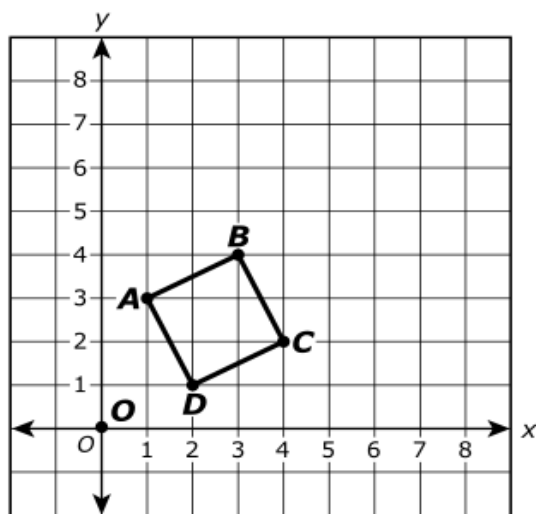
Select from the drop-down menus to correctly complete each sentence.

Side $A'B'$ will side AB .

Side $A'C'$ will side AC .

Side $B'C'$ will side BC .

be parallel to
be perpendicular to
lie on the same line as

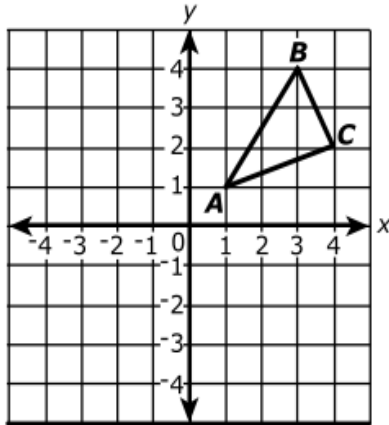


Square $ABCD$ is shown in the xy -coordinate plane. The square will be dilated with the center O by a scale factor of 2 to create square $A'B'C'D'$. Which statements are true?

Select **all** that apply.

- A. $\overline{BC} \parallel \overleftrightarrow{B'C'}$
- B. $\overline{AC} \cong \overline{A'C'}$
- C. $\overline{AD} \perp \overleftrightarrow{C'D'}$
- D. Point D' has the same coordinates as point C .
- E. Point C' lies on the line containing points O and C .

Triangle ABC is defined in the coordinate plane by the points $A = (1, 1)$, $B = (3, 4)$, and $C = (4, 2)$, as shown.



Under which transformations will the image of triangle ABC be similar to the preimage?

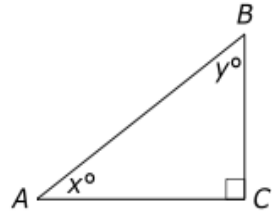
Select **all** that apply.

- A. $T(x, y) \rightarrow (-x, -y)$
- B. $T(x, y) \rightarrow (x + 2, 2y)$
- C. $T(x, y) \rightarrow (0.5x, 0.5y)$
- D. $T(x, y) \rightarrow (x + 4, y - 2)$
- E. $T(x, y) \rightarrow (2x, 3y)$

15.

VH003171

The figure shows triangle ABC .



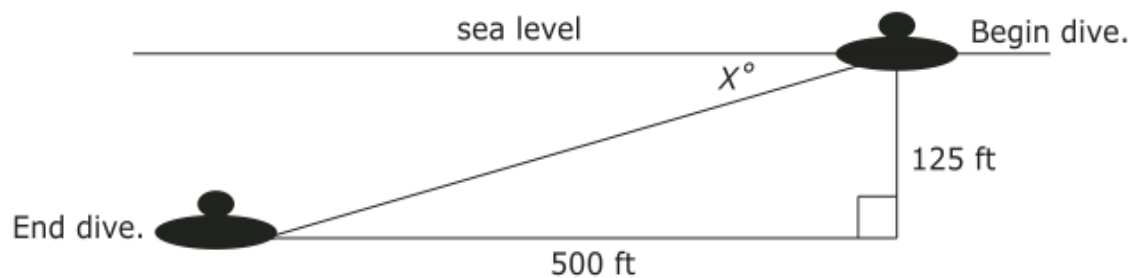
Select **all** expressions that **must be** equivalent to $\cos A$.

- A. $\sin x^\circ$
- B. $\sin y^\circ$
- C. $\cos y^\circ$
- D. $\cos(90 - y)^\circ$
- E. $\cos(90 - x)^\circ$
- F. $\sin(90 - y)^\circ$
- G. $\sin(90 - x)^\circ$

16.

M41891

A submarine dives as shown in the diagram.



To the nearest degree, determine the dive angle whose measure is X .

Enter your answer in the box.

17.

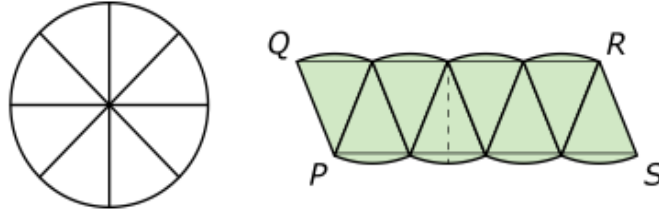
M41812

On a coordinate plane, the endpoints of line segment JK are $J(-10, 12)$ and $K(8, -12)$. Point L lies on line segment JK and divides it into two line segments such that the ratio of JK to KL is 5:1.

What are the coordinates of point L ?

- A. $(-7, 8)$
- B. $(-6.4, 7.2)$
- C. $(4.4, -7.2)$
- D. $(5, -8)$

A circle with radius r is divided into sectors as shown. The sectors are arranged in a shape that resembles a parallelogram.



Which of the given statements are true?

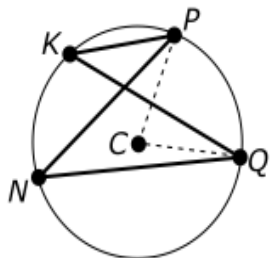
Select **all** that apply.

- A. The length of base \overline{PS} of the parallelogram $PQRS$ is approximately equal to $\frac{1}{2} \pi r$.
- B. The length of base \overline{PS} of the parallelogram $PQRS$ is approximately equal to πr .
- C. The length of base \overline{PS} of the parallelogram $PQRS$ is approximately equal to $2\pi r$.
- D. The height of the parallelogram $PQRS$ is approximately equal to π .
- E. The height of the parallelogram $PQRS$ is approximately equal to r .
- F. The area of the parallelogram $PQRS$ is approximately equal to $2\pi r$.
- G. The area of the parallelogram $PQRS$ is approximately equal to $2\pi r^2$.
- H. The area of the parallelogram $PQRS$ is approximately equal to πr^2 .

19.

M40314

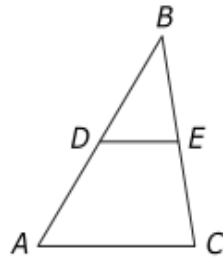
The diagram shows circle C .



Which of these statements is true?

- A. $m\angle PKQ = \frac{1}{2} m\angle PNQ$
- B. $m\angle PKQ = \frac{1}{2} m\angle PCQ$
- C. $m\angle PKQ = m\angle PCQ$
- D. $m\angle PKQ = 2m\angle PCQ$

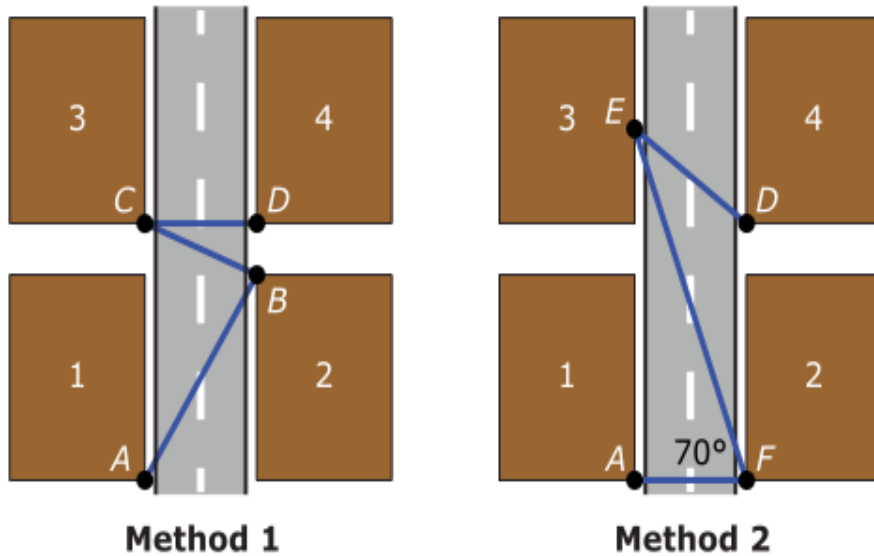
The figure shows triangle ABC . Segment DE connects the midpoints of respective sides \overline{AB} and \overline{BC} .



Which of the statements about the figure **cannot** be proven?

- A. $\overline{DE} \parallel \overline{AC}$
- B. $2(DE) = AC$
- C. $\frac{BD}{DA} = \frac{DE}{AC}$
- D. $\triangle BDE \sim \triangle BAC$

Two overhead views of the same four buildings, two on either side of a street, are shown in the figures.



not to scale

Two proposed methods for connecting the buildings (1, 2, 3, and 4) with electrical wires are shown. The buildings are 30 feet wide and 40 feet long; buildings on the same side of the street are separated by 10 feet, and buildings on opposite sides of the street are separated by 20 feet. All the corners of the buildings form right angles, and the sides of the buildings facing one another on opposite sides of the street are parallel.

In Method 1 wire runs from point A to B to C to D. In Method 2 wire runs from point A to F to E to D, and the measure of angle AFE is 70 degrees.

Part A

Find the amount of wire used in Method 1 to the nearest foot.

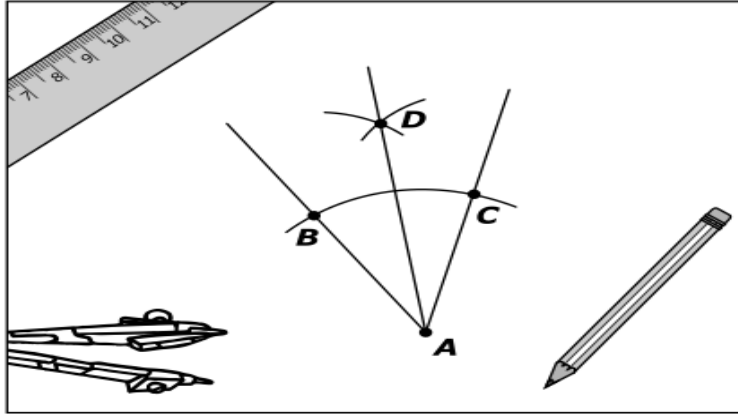
Enter your answer in the box.

Part B

Find the amount of wire used in Method 2 to the nearest foot.

Enter your answer in the box.

The figure shows a geometric construction. The markings at point D were made with the compass open to a length less than the length used to draw the arc from point A .



Part A

Based on such a construction, which statements must be true?

Select **all** that apply.

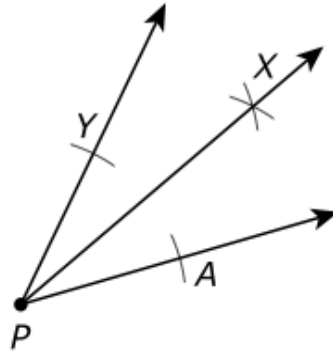
- A. $\overline{AB} \cong \overline{AC}$
- B. $\overline{BD} \cong \overline{CD}$
- C. $\overline{AB} \cong \overline{BD}$
- D. $\overline{AD} \cong \overline{AD}$
- E. $\overline{AB} \cong \overline{AD}$

Part B

Based on the construction, which two angles must be congruent?

- A. $\angle BAD \cong \angle BAC$
- B. $\angle BAD \cong \angle BDA$
- C. $\angle BAD \cong \angle CDA$
- D. $\angle BAD \cong \angle CAD$

The figure shows the results of a construction of the bisector of $\angle P$.



Drag and drop the steps into the correct order from first to last.

Name the intersection of the two arcs X .

Draw arcs with the same radius, centered at P , that intersect \overline{PY} and \overline{PA} .

Using a straightedge, draw the line through P and X .

Draw two intersecting arcs with the same radius, one centered at Y and one centered at A , on the interior of $\angle P$.

First

Last

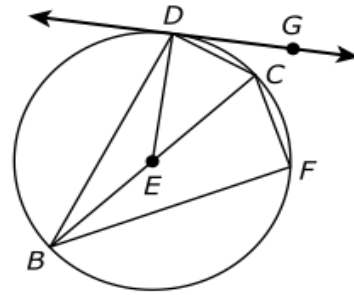
An explanation of why \overrightarrow{PX} is the angle bisector is described.

Select from the drop-down menus to correctly complete the proof.

The angle bisector of $\angle P$ is \overrightarrow{PX} because $\triangle YPX$ is congruent to $\triangle APX$ by .

Therefore $\angle YPX$ is congruent to $\angle APX$ because they are corresponding angles of congruent triangles.

AAA
ASA
SAS
SSS



The figure shows a circle with center E and diameter BC . Line DG is tangent to the circle at point D .

Part A

Which of the angles **must** be right angles?

Select **all** that apply.

- A. $\angle BDC$
- B. $\angle BCD$
- C. $\angle BFC$
- D. $\angle CBF$
- E. $\angle EDG$

Part B

If point K can be located anywhere between points C and B on semicircle \widehat{CFB} , which of the angles listed could also be a right angle?

- A. $\angle BCK$
- B. $\angle BDK$
- C. $\angle CDK$
- D. $\angle DCK$

A landscaper is putting a border on each side of a triangular garden. She plots the vertices of the garden $(-2, 3)$, $(5, 5)$, and $(7, -3)$ on a coordinate grid. She estimates that she will need 2 feet of material for the border for every unit of length represented in the graph of the garden.

Part A

Which expression can be used to determine the amount of material needed for the border on the side of the garden represented by the vertices $(5, 5)$ and $(7, -3)$ on the graph?

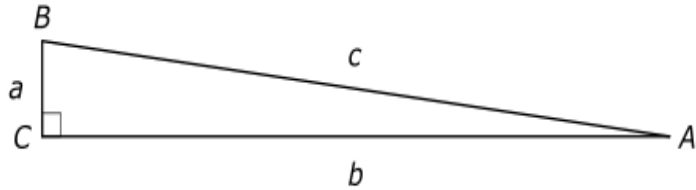
- A. $2\sqrt{(5-7)^2 + (5-(-3))^2}$
- B. $2\sqrt{(5+7)^2 + (5+(-3))^2}$
- C. $2\sqrt{\left(\frac{5+7}{2}\right)^2 + \left(\frac{5+(-3)}{2}\right)^2}$
- D. $2\sqrt{\left(\frac{5-7}{2}\right)^2 + \left(\frac{5-(-3)}{2}\right)^2}$

Part B

The material for the border costs \$1.50 per foot. To the nearest dollar, what is the total cost of the material needed to put a border around the entire garden?

- A. \$26
- B. \$40
- C. \$52
- D. \$79

An entrance ramp from a walkway will be installed at a public library, as modeled in the figure. In the figure, a represents the rise of the ramp, b represents the distance from the walkway to the base of the library, and c represents the length of the ramp.

**Part A**

If $\angle B$ measures x° , what is the measure of $\angle A$?

- A. x°
- B. $(45 - x)^\circ$
- C. $(90 - x)^\circ$
- D. $(180 - x)^\circ$

Part B

The length of the ramp will be 25 feet. If the ramp needs to rise 1.3 feet, which is closest to the distance, in feet, from the walkway to the base of the library?

- A. 23.70
- B. 24.97
- C. 25.03
- D. 26.30

Part C

Which statements are true?

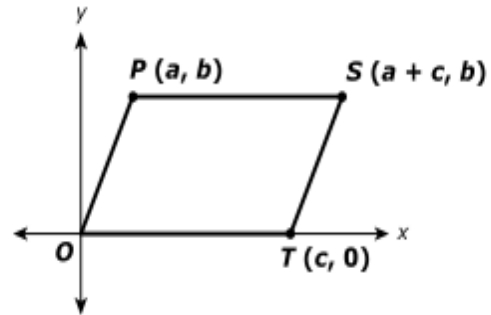
Select all that apply.

- A. The measure of $\angle A = \sin^{-1}\left(\frac{a}{c}\right)$.
- B. The measure of $\angle A = \cos^{-1}\left(\frac{a}{c}\right)$.
- C. The measure of $\angle A = \tan^{-1}\left(\frac{a}{b}\right)$.
- D. The measure of $\angle B = \sin^{-1}\left(\frac{a}{c}\right)$.
- E. The measure of $\angle B = \cos^{-1}\left(\frac{a}{c}\right)$.
- F. The measure of $\angle B = \tan^{-1}\left(\frac{a}{b}\right)$.

Part D

If the length of the ramp will be 25 feet, but the rise of the ramp will be 3.0 feet, approximately what will be the measure, in degrees, of the angle of elevation, $\angle A$?

- A. 3°
- B. 5°
- C. 7°
- D. 9°



Is the figure shown in the xy -coordinate plane a parallelogram? Why or why not? Use the given coordinates to justify your answer.



▶ Math symbols

▶ Relations

▶ Geometry

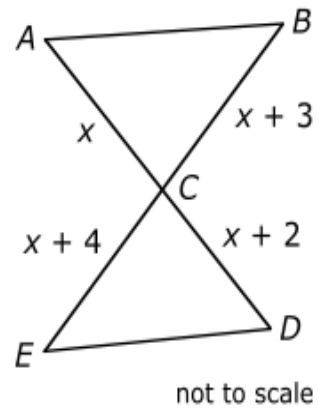
▶ Groups

▶ Trigonometry

▶ Statistics

▶ Greek

In the figure shown, the lengths of segments AC , BC , CD , and CE are given in terms of the variable x .



If $\overline{AB} \parallel \overline{DE}$, are the dimensions reasonable? Justify your answer.

Enter your answer and your justification in the space provided.



▶ Math symbols

▶ Relations

▶ Geometry

▶ Groups

▶ Trigonometry

▶ Statistics

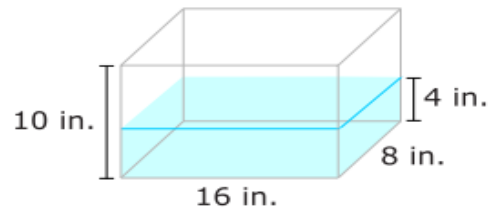
▶ Greek

Part A

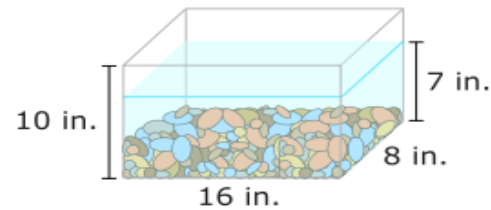
Moira collected some stones at the beach. Now she wants to make a clear plastic container to display the stones. To plan the container, Moira decides that she must first find the volume of the stones.

Moira has an aquarium that is shaped like a rectangular prism. It is 8 inches wide, 16 inches long, and 10 inches high. She plans to use the aquarium to find the volume of the stones.

First, Moira pours some water into the aquarium. She measures and finds that the water reaches to a height of 4 inches.



Then Moira puts the stones in the aquarium. She measures and finds that the water reaches to a new height of 7 inches.



Using this information, find the volume of the stones. Show your work.

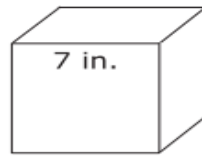
Enter your answer and show your work in the space provided.



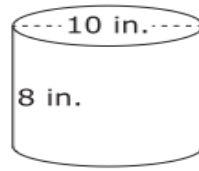
- ▶ Math symbols
- ▶ Relations
- ▶ Geometry
- ▶ Groups
- ▶ Trigonometry
- ▶ Statistics
- ▶ Greek

Part B

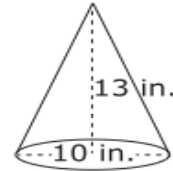
Moira is considering three possible shapes for the container that will hold the stones. The shapes are shown.



cube



cylinder



cone

Find the volume of **each** shape. Show your work.

Enter your answer and show your work in the space provided.



- [▶ Math symbols](#)
- [▶ Relations](#)
- [▶ Geometry](#)
- [▶ Groups](#)
- [▶ Trigonometry](#)
- [▶ Statistics](#)
- [▶ Greek](#)

Part C

Based on Parts A and B, which of the three shapes would be Moira's **best** choice for a container for the stones? Explain your answer.

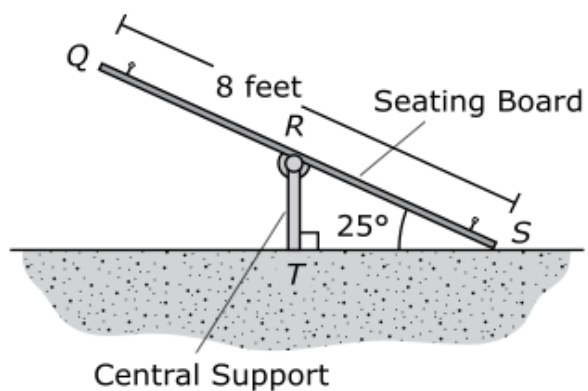
Enter your answer and your explanation in the space provided.



- [▶ Math symbols](#)
- [▶ Relations](#)
- [▶ Geometry](#)
- [▶ Groups](#)
- [▶ Trigonometry](#)
- [▶ Statistics](#)
- [▶ Greek](#)

Part A

A seesaw with the construction shown is being built at a playground. The seating board will be 8 feet long, and the board will make an angle of 25° when it touches the ground.



Create and use a model to find the height of the central support. Show your work or explain your answer. Round your final answer to the nearest tenth of a foot.

Enter your model, your answer, and your work or explanations in the space provided.



▶ Math symbols

▶ Relations

▶ Geometry

▶ Groups

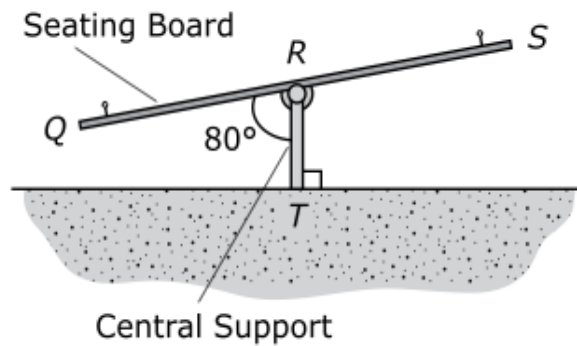
▶ Trigonometry

▶ Statistics

▶ Greek

Part B

The seesaw moves and the angle created by the left side of the seating board and the central support is now 80° .



Create and use a model, to find the distance from point Q to the ground when the angle created by the left side of the seating board and the central support is 80° . Show your work or explain your answer. Round your final answer to the nearest tenth of a foot.

Enter your model, your answer, and your work or explanations in the space provided.



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