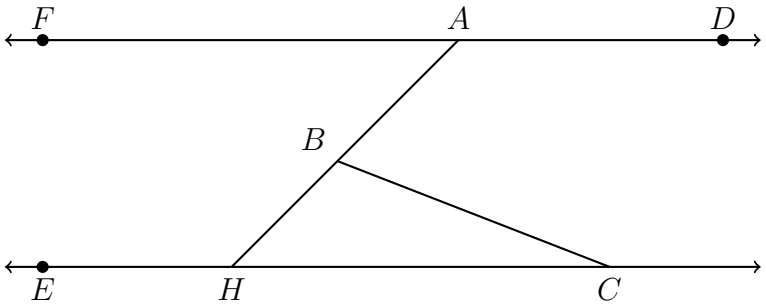
Regents January 2020

1. In the diagram below, $\overline{FAD} \parallel \overline{EHC}$, and $\overline{ABH}$ and $\overline{BC}$ are drawn.



If $m\angle FAB = 48°$ and $m\angle ECB = 18°$, what is $m\angle ABC$?

(a) 18° (c) 66°

(b) 48° (d) 114°

2. A cone has a volume of 108π and a base diameter of 12. What is the height of the cone?

3. The endpoints of directed line segment PQ have coordinates of $P(-7, -5)$ and $Q(5, 3)$. What are the coordinates of point A, on $\overline{PQ}$, that divide $\overline{PQ}$ into a ratio of 1:3?

4. Jaden is comparing two cones. The radius of the base of cone A is twice as large as the radius of the base of cone B. The height of cone B is twice the height of cone A. The volume of cone A is

(a) twice the volume of cone B

(b) four times the volume of cone B

(c) equal to the volume of cone B

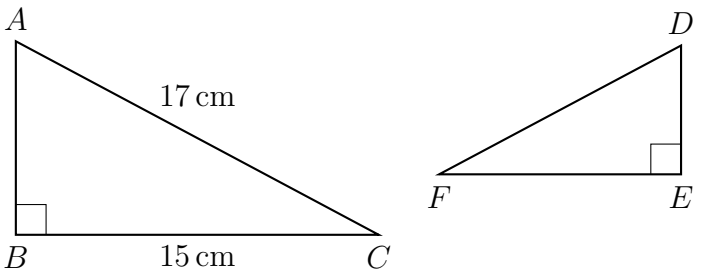
(d) equal to half the volume of cone B

5. A regular hexagon is rotated about its center. Which degree measure will carry the regular hexagon onto itself?

(a) 45° (c) 120°

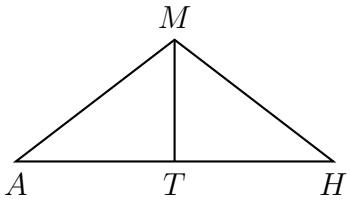
(b) 90° (d) 135°

6. Kayla was cutting right triangles from wood to use for an art project. Two of the right triangles she cut are shown below.



If $\triangle ABC \sim \triangle DEF$, with right angles B and E, $BC = 15$ cm, and $AC = 17$ cm, what is the measure of $\angle F$, to the *nearest degree*?

7. In triangle MAH below, $\overline{MT}$ is the perpendicular bisector of $\overline{AH}$.



Which statement is *not* always true?

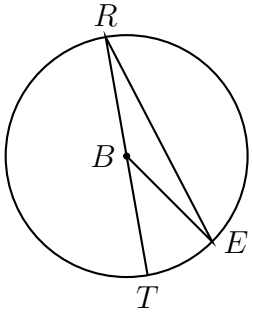
(a) $\triangle MAH$ is isosceles.

(b) $\triangle MAT$ is isosceles.

(c) $\overline{MT}$ bisects $\angle AMH$.

(d) $\angle A$ and $\angle TMH$ are complementary.

8. In circle B below, diameter $\overline{RT}$, radius $\overline{BE}$, and chord $\overline{RE}$ are drawn.



It $m\angle TRE = 15°$ and $BE = 9$, then the area of sector EBR is what in terms of π?

9. Lou has a solid clay brick in the shape of a rectangular prism with a length of 8 inches, a width of 3.5 inches, and a height of 2.25 inches. If the clay weighs 1.055 oz/in^3, how much does Lou's brick weigh, to the nearest ounce?

10. For the acute angles in a right triangle, $\sin(4x)^\circ = \cos(3x + 13)^\circ$. What is the number of degrees in the measure of the smaller angle?

11. A rectangular tabletop will be made of maple wood that weighs 43 pounds per cubic foot. The tabletop will have a length of eight feet, a width of three feet, and a thickness of one inch. Determine and state the weight of the tabletop, in pounds.

12. Determine and state an equation of the line perpendicular to the line $5x - 4y = 10$ and passing through the point $(5, 12)$.

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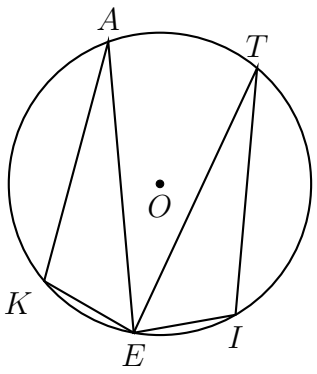
13. After a dilation with center $(0, 0)$, the image of $\overline{DB}$ is $\overline{D'B'}$. If $DB = 4.5$ and $D'B' = 18$, then what is the scale factor of this dilation?

14. In the diagram below of circle O, points K, A, T, I, and E are on the circle, $\triangle KAE$ and $\triangle ITE$ are drawn, $\overset{\frown}{KE} \cong \overset{\frown}{EI}$, and $\angle EKA \cong \angle EIT$.



Which statement about $\triangle KAE$ and $\triangle ITE$ is always true?

(a) They are neither congruent nor similar.

(b) They are similar but not congruent.

(c) They are right triangles.

(d) They are congruent.

15. From a point on the ground one-half mile from the base of a historic monument, the angle of elevation to its top is 11.87°. To the nearest foot, what is the height of the monument? (1 mile = 5280 feet)

16. The area of a sector of a circle with a radius measuring 15 cm is 75π cm^2. What is the measure of the central angle that forms the sector?

17. Point M divides $\overline{AB}$ so that $AM : MB = 1 : 2$. If A has coordinates $(-1, -3)$ and B has coordinates $(8, 9)$, what are the coordinates of M?

18. What is an equation of the image of the line $y = \frac{3}{2}x - 4$ after a dilation of a scale factor of $\frac{3}{4}$ centered at the origin?

19. Which three-dimensional figure will result when a rectangle 6 inches long and 5 inches wide is continuously rotated about the longer side?

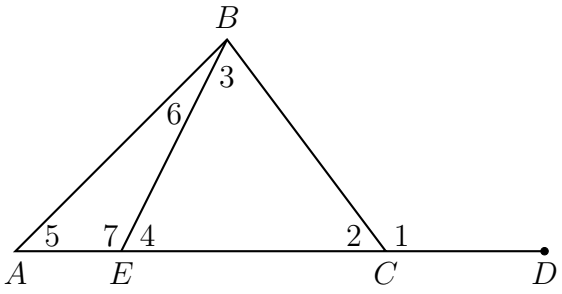
    (a) a rectangular prism with a length of 6 inches, width of 6 inches, and height of 5 inches

    (b) a rectangular prism with a length of 6 inches, width of 5 inches, and height of 5 inches

    (c) a cylinder with a radius of 5 inches and a height of 6 inches

    (d) a cylinder with a radius of 6 inches and a height of 5 inches

20. In the diagram below of triangle ABC, $\overline{AC}$ is extended through point C to point D, and $\overline{BE}$ is drawn to $\overline{AC}$.



Which equation is always true?

(a) $\angle 1 = m\angle 3 + m\angle 2$

(b) $\angle 5 = m\angle 3 - m\angle 2$

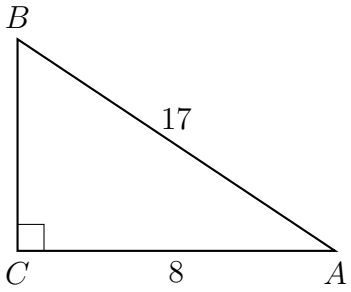
(c) $\angle 6 = m\angle 3 - m\angle 2$

(d) $\angle 7 = m\angle 3 + m\angle 2$

21. In right triangle ABC, $m\angle C = 90°$ and $AC \neq BC$. Which trigonometric ratio is equivalent to $\sin B$?

(a) $\cos A$
(c) $\tan A$
(b) $\cos B$
(d) $\tan B$

22. In the diagram below of right triangle ABC, $AC = 8$, and $AB = 17$.



Which equation would determine the value of angle A?

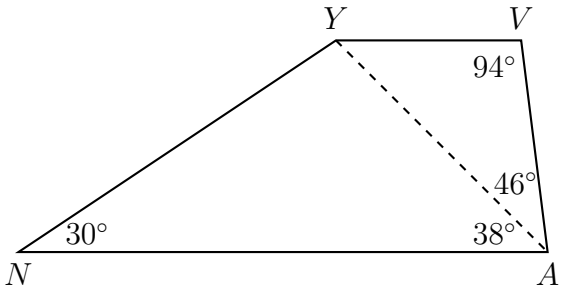
(a) $\sin A = \frac{8}{17}$
(c) $\cos A = \frac{15}{17}$
(b) $\tan A = \frac{8}{15}$
(d) $\tan A = \frac{15}{8}$

23. Which equation represents a line that is perpendicular to the line represented by

$y = \frac{2}{3}x + 1$?

(a) $3x + 2y = 12$
(c) $y = \frac{3}{2}x + 2$
(b) $3x - 2y = 12$
(d) $y = -\frac{2}{3}x + 4$

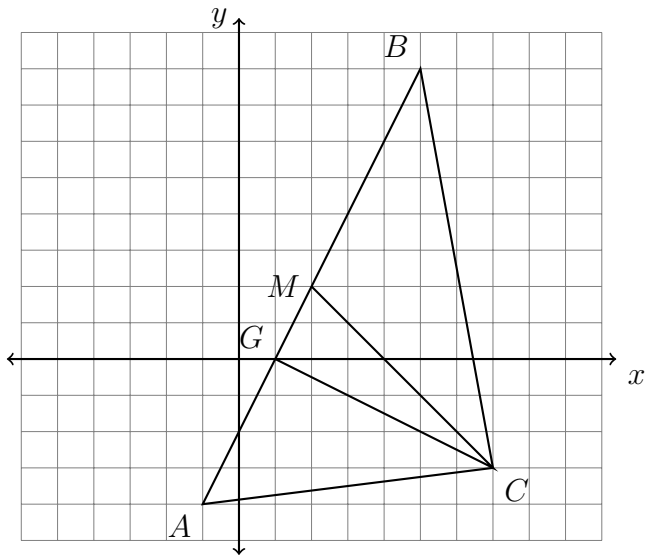
24. In diagram of quadrilateral $NAVY$, $m\angle YNA = 30°$, $m\angle YAN = 38°$, $m\angle AVY = 94°$, and $m\angle VAY = 46°$.



Which segment has the shortest length?

(a) $\overline{AY}$
(b) $\overline{NY}$
(c) $\overline{VA}$
(d) $\overline{VY}$

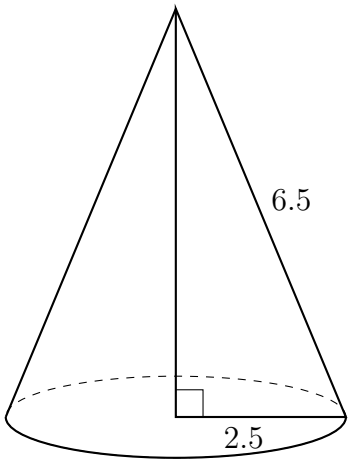
25. In the diagram below, $\triangle ABC$, altitude $\overline{CG}$, and median $\overline{CM}$ are drawn.



Which expression represents the area of $\triangle ABC$?

(a) $\frac{(BC)(AC)}{2}$
(b) $\frac{(GC)(BC)}{2}$
(c) $\frac{(CM)(AB)}{2}$
(d) $\frac{(GC)(AB)}{2}$

26. As shown in the diagram below, the radius of a cone is 2.5 cm and its slant height is 6.5 cm.



How many cubic centimeters are in the volume of the cone? Express your answer in terms of π.

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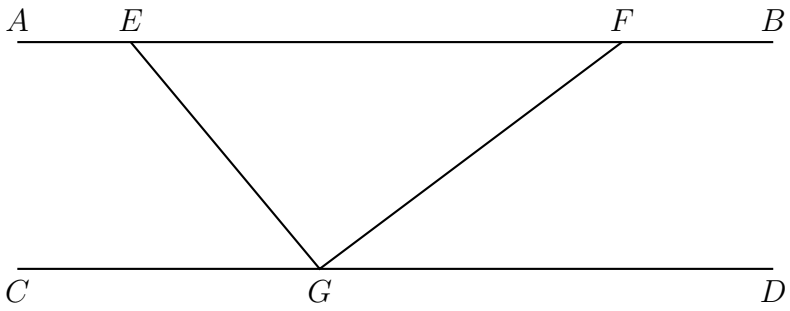
27. In the diagram below, $\overline{AEFB} \parallel \overline{CGD}$, and $\overline{GE}$ and $\overline{GF}$ are drawn.



If $m\angle EFG = 32°$ and $m\angle AEG = 137°$, what is $m\angle EGF$?

(a) 11° (c) 75°

(b) 43° (d) 105°

28. An isosceles right triangle whose legs measure 6 is continuously rotated about one of its legs to form a three-dimensional object. The three-dimensional object is a

    (a) cylinder with a diameter of 6

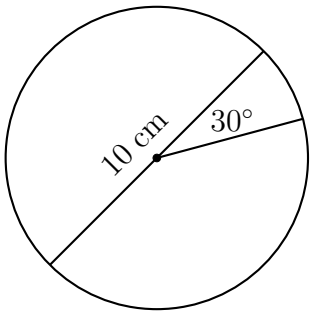
    (b) cylinder with a diameter of 12

    (c) cone with a diameter of 6

    (d) cone with a diameter of 12

29. The coordinates of the endpoints of directed line segment ABC are $A(-8, 7)$ and $C(7, -13)$. If $AB : BC = 3 : 2$, what are the coordinates of B?

30. A circle with a diameter of 10 cm and a central angle of 30° is drawn below.



    What is the area, to the *nearest tenth of a square centimeter*, of the sector formed by the 30° angle?

31. A child's tent can be modeled as a pyramid with a square base whose sides measure 60 inches and whose height measures 84 inches. What is the volume of the tent, to the *nearest cubic foot*?

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32. Given square $RSTV$, where $RS = 9$ cm. If square $RSTV$ is dilated by a scale factor of 3 about a given center, what is the perimeter, in centimeters, of the image of $RSTV$ after the dilation?

33. In right triangle ABC, hypotenuse $\overline{AB}$ has a length of 26 cm, and side $\overline{BC}$ has a length of 17.6 cm. What is the measure of angle B, to the *nearest degree*?

34. In a right triangle, the acute angles have the relationship $\sin(2x + 4) = \cos(46)$.

What is the value of x?

35. The base of a pyramid is a rectangle with a width of 4.6 cm and a length of 9 cm. What is the height, in centimeters, of the pyramid if its volume is 82.8 cm^3?

36. What is an equation of the line that passes through the point $(6, 8)$ and is perpendicular to a line with equation $y = \frac{3}{2}x + 5$?

(a) $y - 8 = \frac{3}{2}(x - 6)$
(b) $y - 8 = -\frac{3}{2}(x - 6)$
(c) $y + 8 = \frac{3}{2}(x + 6)$
(d) $y + 8 = -\frac{3}{2}(x + 6)$

37. Directed line segment DE has endpoints $D(-4, -2)$ and $E(1, 8)$. Point F divides such that $DF : FE$ is $2 : 3$. What are the coordinates of F?

38. Line segment CD is the altitude drawn to hypotenuse in right triangle ECF. If $EC = 10$ and $EF = 24$, then, to the *nearest tenth*, ED is what length?

39. Line MN is dilated by a scale factor of 2 centered at the point $(0, 6)$. If $\overline{MN}$ is represented by $y = -3x + 6$, which equation can represent $\overline{M'N'}$, the image of $\overline{MN}$?

(a) $y = -3x + 12$
(b) $y = -3x + 6$
(c) $y = -6x + 12$
(d) $y = -6x + 6$

40. Triangle $A'B'C'$ is the image of triangle ABC after a translation of 2 units to the right and 3 units up. Is triangle ABC congruent to triangle $A'B'C'$? Explain why.

41. Randy's basketball is in the shape of a sphere with a maximum circumference of 29.5 inches. Determine and state the volume of the basketball, to the *nearest cubic inch*.