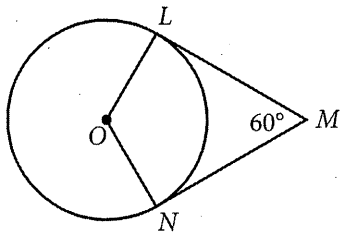
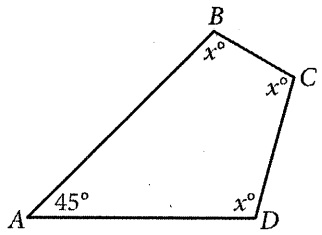
36



In the figure above, point O is the center of the circle, line segments LM and MN are tangent to the circle at points L and N, respectively, and the segments intersect at point M as shown. If the circumference of the circle is 96, what is the length of minor arc $\overset{\frown}{LN}$?

14



In the figure above, what is the value of x ?

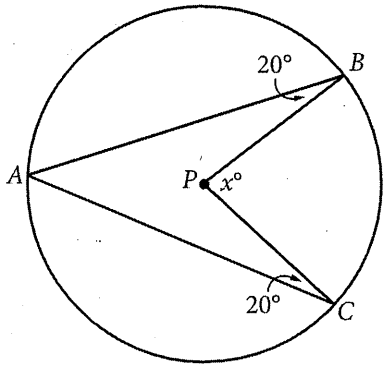
A) 45

B) 90

C) 100

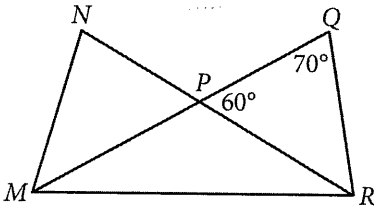
D) 105

36



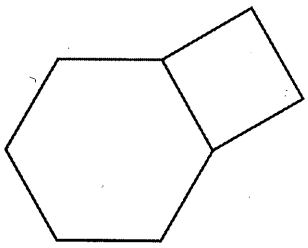
Point P is the center of the circle in the figure above. What is the value of x ?

17



In the figure above, $\overline{MQ}$ and $\overline{NR}$ intersect at point P, $NP = QP$, and $MP = PR$. What is the measure, in degrees, of $\angle QMR$? (Disregard the degree symbol when gridding your answer.)

30



The figure above shows a regular hexagon with sides of length a and a square with sides of length a. If the area of the hexagon is $384\sqrt{3}$ square inches, what is the area, in square inches, of the square?

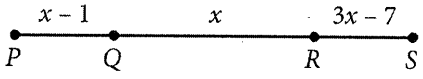
A) 256

B) 192

C) $64\sqrt{3}$

D) $16\sqrt{3}$

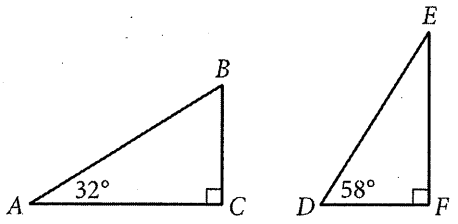
33



Note: Figure not drawn to scale.

On $\overline{PS}$ above, $PQ = RS$. What is the length of $\overline{PS}$?

16



Triangles ABC and DEF are shown above. Which of the following is equal to the ratio $\frac{BC}{AB}$?

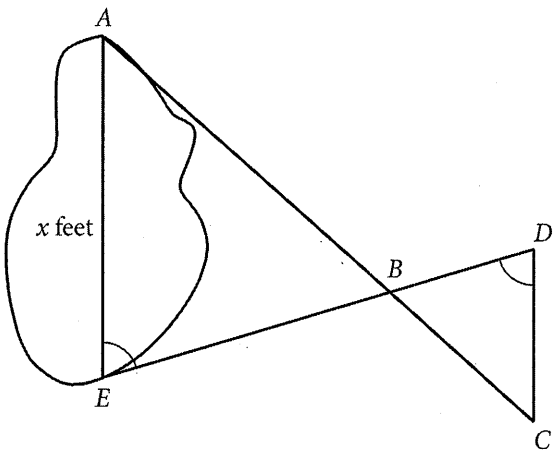
A) $\frac{DE}{DF}$

B) $\frac{DF}{DE}$

C) $\frac{DF}{EF}$

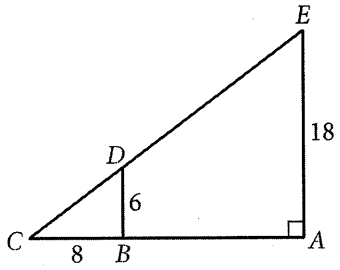
D) $\frac{EF}{DE}$

17



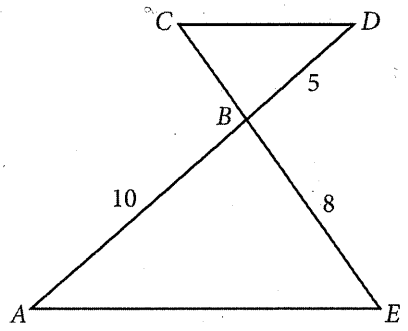
A summer camp counselor wants to find a length, x, in feet, across a lake as represented in the sketch above. The lengths represented by AB, EB, BD, and CD on the sketch were determined to be 1800 feet, 1400 feet, 700 feet, and 800 feet, respectively. Segments AC and DE intersect at B, and $\angle AEB$ and $\angle CDB$ have the same measure. What is the value of x ?

18



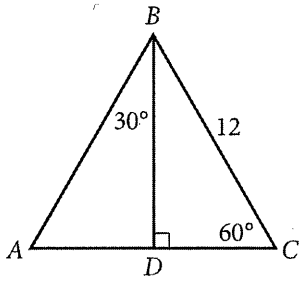
In the figure above, $\overline{BD}$ is parallel to $\overline{AE}$. What is the length of $\overline{CE}$?

18



In the figure above, $\overline{AE} \parallel \overline{CD}$ and segment AD intersects segment CE at B. What is the length of segment CE ?

19



In $\triangle ABC$ above, what is the length of $\overline{AD}$?

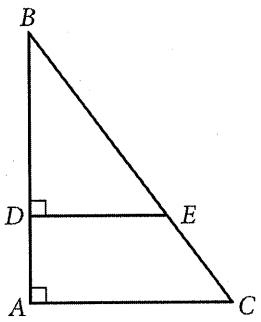
A) 4

B) 6

C) $6\sqrt{2}$

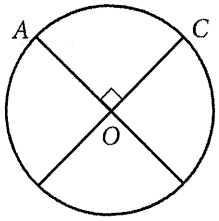
D) $6\sqrt{3}$

36



In the figure above, $\tan B = \frac{3}{4}$. If $BC = 15$ and $DA = 4$, what is the length of $\overline{DE}$?

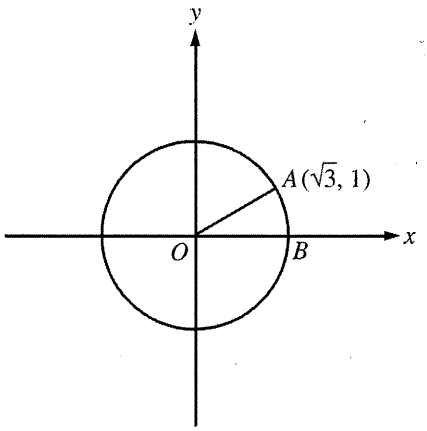
2



The circle above with center O has a circumference of 36. What is the length of minor arc $\overset{\frown}{AC}$?

A) 9
B) 12
C) 18
D) 36

19

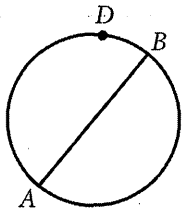


In the xy-plane above, O is the center of the circle, and the measure of $\angle AOB$ is $\frac{\pi}{a}$ radians. What is the value of a ?

20

Points A and B lie on a circle with radius 1, and arc $\overset{\frown}{AB}$ has length $\frac{\pi}{3}$. What fraction of the circumference of the circle is the length of arc $\overset{\frown}{AB}$?

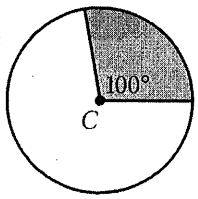
24



In the circle above, segment AB is a diameter. If the length of arc $\overset{\frown}{ADB}$ is 8π, what is the length of the radius of the circle?

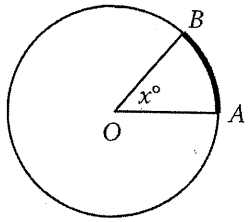
A) 2
B) 4
C) 8
D) 16

34



Point C is the center of the circle above. What fraction of the area of the circle is the area of the shaded region?

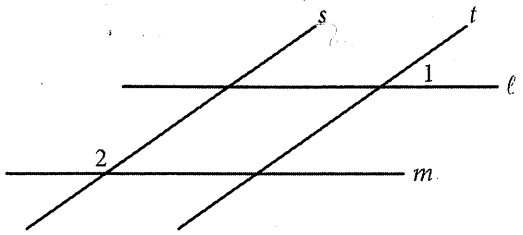
36



Note: Figure not drawn to scale.

In the figure above, the circle has center O and has radius 10. If the length of arc $\overset{\frown}{AB}$ (shown in bold) is between 5 and 6, what is one possible integer value of x ?

3



In the figure above, lines ℓ and m are parallel and lines s and t are parallel. If the measure of $\angle 1$ is 35°, what is the measure of $\angle 2$?

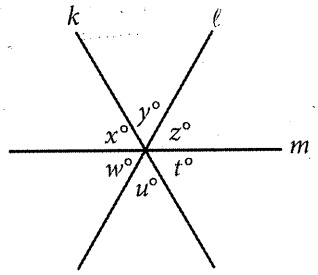
A) 35°

B) 55°

C) 70°

D) 145°

11



Note: Figure not drawn to scale.

In the figure above, lines k, ℓ, and m intersect at a point. If $x + y = u + w$, which of the following must be true?

I. $x = z$

II. $y = w$

III. $z = t$

A) I and II only

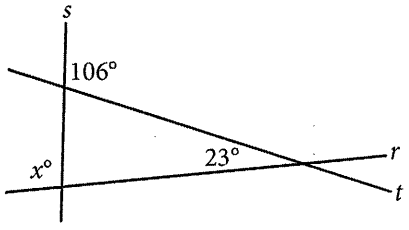
B) I and III only

C) II and III only

D) I, II, and III

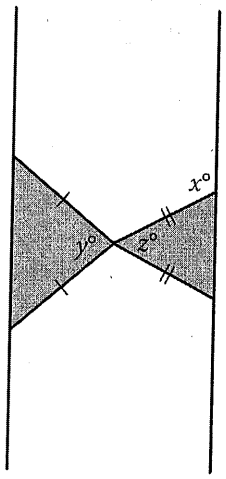
20

Intersecting lines r, s, and t are shown below.



What is the value of x ?

18



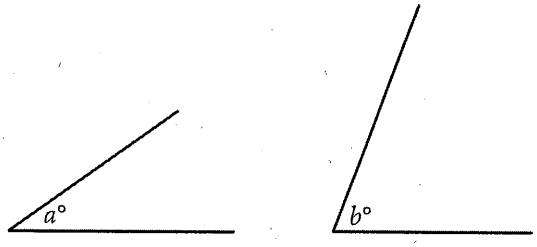
Note: Figure not drawn to scale.

Two isosceles triangles are shown above. If $180 - z = 2y$ and $y = 75$, what is the value of x ?

20

In triangle ABC, the measure of $\angle B$ is 90°, $BC = 16$, and $AC = 20$. Triangle DEF is similar to triangle ABC, where vertices D, E, and F correspond to vertices A, B, and C, respectively, and each side of triangle DEF is $\frac{1}{3}$ the length of the corresponding side of triangle ABC. What is the value of $\sin F$?

23



Note: Figures not drawn to scale.

The angles shown above are acute and $\sin(a°) = \cos(b°)$. If $a = 4k - 22$ and $b = 6k - 13$, what is the value of k ?

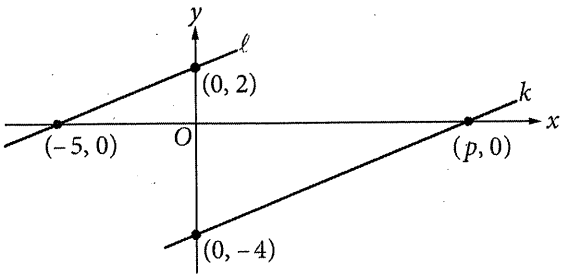
A) 4.5

B) 5.5

C) 12.5

D) 21.5

6



In the xy-plane above, line ℓ is parallel to line k. What is the value of p ?

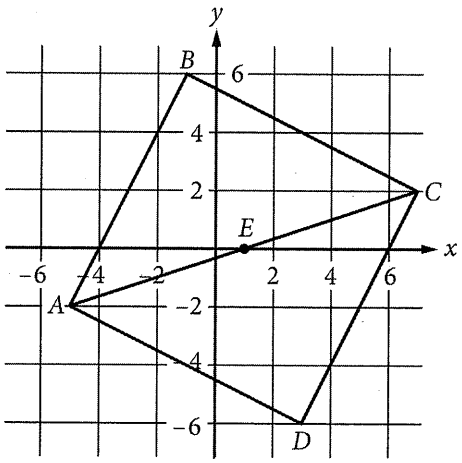
A) 4

B) 5

C) 8

D) 10

28



In the xy-plane above, $ABCD$ is a square and point E is the center of the square. The coordinates of points C and E are $(7, 2)$ and $(1, 0)$, respectively. Which of the following is an equation of the line that passes through points B and D ?

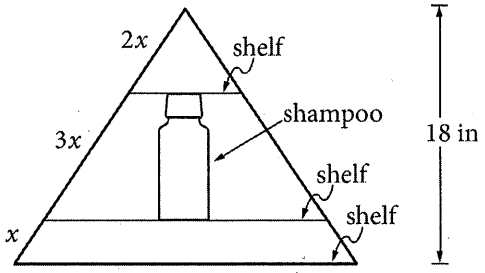
A) $y = -3x - 1$

B) $y = -3(x - 1)$

C) $y = -\frac{1}{3}x + 4$

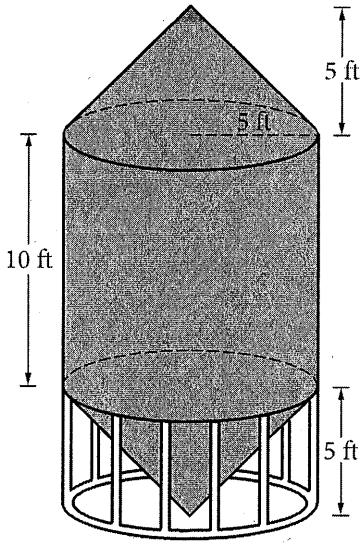
D) $y = -\frac{1}{3}x - 1$

16



Jim has a triangular shelf system that attaches to his showerhead. The total height of the system is 18 inches, and there are three parallel shelves as shown above. What is the maximum height, in inches, of a shampoo bottle that can stand upright on the middle shelf?

25



A grain silo is built from two right circular cones and a right circular cylinder with internal measurements represented by the figure above. Of the following, which is closest to the volume of the grain silo, in cubic feet?

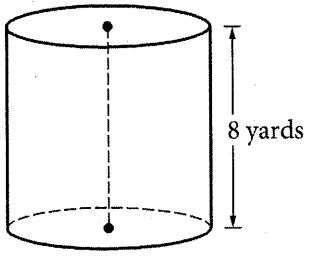
A) 261.8

B) 785.4

C) 916.3

D) 1,047.2

35



A dairy farmer uses a storage silo that is in the shape of the right circular cylinder above. If the volume of the silo is 72π cubic yards, what is the diameter of the base of the cylinder, in yards?