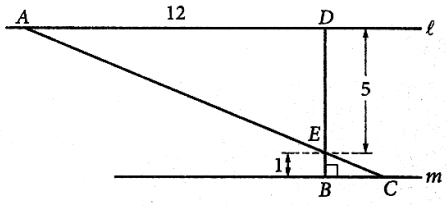
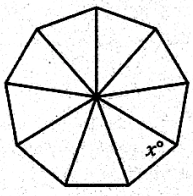
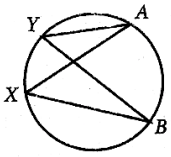
Geometry



1. In the figure above, line ℓ is parallel to line m, segment BD is perpendicular to line m, and segment AC and segment BD intersect at E. What is the length of segment AC?

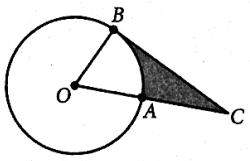


2. In the figure above, a regular polygon with 9 sides has been divided into 9 congruent isosceles triangles by line segments drawn from the center of the polygon to its vertices. What is the value of x?



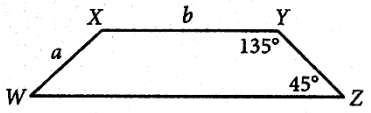
3. In the figure above, $\angle AXB$ and $\angle AYB$ are inscribed in the circle. Which of the following statements is true?

A) The measure of $\angle AXB$ is greater than the measure of $\angle AYB$.
B) The measure of $\angle AXB$ is less than the measure of $\angle AYB$.
C) The measure of $\angle AXB$ is equal to the measure of $\angle AYB$.
D) There is not enough information to determine the relationship between the measure of $\angle AXB$ and the measure of $\angle AYB$.



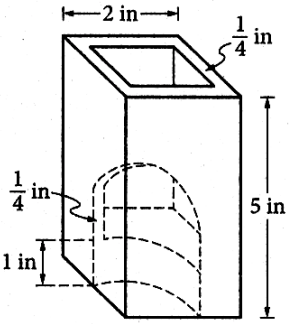
4. In the figure above, O is the center of the circle, segment BC is tangent to the circle at B, and A lies on segment OC. If $OB = AC = 6$, what is the area of the shaded region?

A) $18\sqrt{3} - 3\pi$
B) $18\sqrt{3} - 6\pi$
C) $36\sqrt{3} - 3\pi$
D) $36\sqrt{3} - 6\pi$



5. Trapezoid $WXYZ$ is shown above. How much greater is the area of this trapezoid than the area of a parallelogram with side lengths a and b and base angles of measure 45° and 135°?

A) $\frac{1}{2}a^2$
B) $\sqrt{2}a^2$
C) $\frac{1}{2}ab$
D) $\sqrt{2}ab$



Note: Figure not drawn to scale.

6. A glass vase is in the shape of a rectangular prism with a square base. The figure above shows the vase with a portion cut out. The external dimensions of the vase are height 5 inches (in), with a square base of side length 2 inches. The vase has a solid base of height 1 inch, and the sides are each $\frac{1}{4}$ inch thick. Which of the following is the volume, in cubic inches, of the glass used in the vase?

A) 6
B) 8
C) 9
D) 11

Coordinate Geometry

$$x^2 + (y + 1)^2 = 4$$

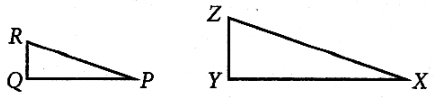
7. The graph of the equation above in the xy-plane is a circle. If the center of this circle is translated 1 unit up and the radius is increased by 1, which of the following is an equation of the resulting circle?

A) $x^2 + y^2 = 5$
B) $x^2 + y^2 = 9$
C) $x^2 + (y + 2)^2 = 5$
D) $x^2 + (y + 2)^2 = 9$

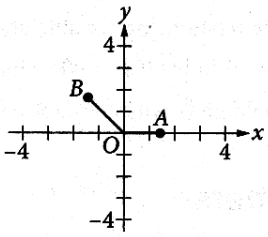
$$x^2 + 8x + y^2 - 6y = 24$$

8. The graph of the equation above in the xy-plane is a circle. What is the radius of the circle?

Trigonometry and Radians

9. 

In the figure above, right triangle PQR is similar to right triangle XYZ, with vertices P, Q, and R corresponding to vertices X, Y, and Z, respectively. If $\cos R = 0.263$ what is the value of $\cos Z$?



10. In the figure above, the coordinates of point B are $(-\sqrt{2}, \sqrt{2})$. What is the measure, in radians, of angle AOB?

A) $\frac{\pi}{4}$

B) $\frac{\pi}{2}$

C) $\frac{3\pi}{4}$

D) $\frac{5\pi}{4}$

11. $\sin(x) = \cos(K - x)$

In the equation above, the angle measures are in radians and K is a constant. Which of the following could be the value of K?

A) 0

B) $\frac{\pi}{4}$

C) $\frac{\pi}{2}$

D) π

Complex Numbers

12. $(-3 - 2i) + (4 - i) =$

13. $(-3 - 2i) - (4 - i) =$

14. $(-3 - 2i)(4 - i) =$

15. $\frac{-3 - 2i}{4 - i} =$

16. Which of the following is equal to $\frac{1 + i}{1 - i}$?

A) i

B) $2i$

C) $-1 + i$

D) $1 + i$

iMama No Calculator

2

For $i = \sqrt{-1}$, what is the sum $(7 + 3i) + (-8 + 9i)$?

A) $-1 + 12i$

B) $-1 - 6i$

C) $15 + 12i$

D) $15 - 6i$

3

What is the sum of the complex numbers $2 + 3i$ and $4 + 8i$, where $i = \sqrt{-1}$?

A) 17

B) $17i$

C) $6 + 11i$

D) $8 + 24i$

4

Which of the following complex numbers is equal to $(5 + 12i) - (9i^2 - 6i)$, for $i = \sqrt{-1}$?

A) $-14 - 18i$

B) $-4 - 6i$

C) $4 + 6i$

D) $14 + 18i$

11

Which of the following complex numbers is equivalent to $\frac{3 - 5i}{8 + 2i}$? (Note: $i = \sqrt{-1}$)

A) $\frac{3}{8} - \frac{5i}{2}$

B) $\frac{3}{8} + \frac{5i}{2}$

C) $\frac{7}{34} - \frac{23i}{34}$

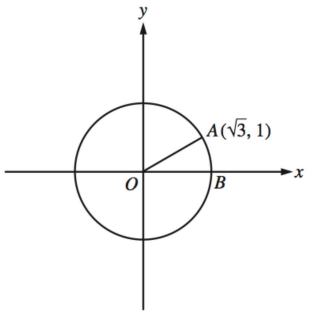
D) $\frac{7}{34} + \frac{23i}{34}$

Radianz No Calculator

18

The number of radians in a 720-degree angle can be written as $a\pi$, where a is a constant. What is the value of a ?

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 ?

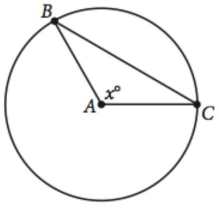
19

In a right triangle, one angle measures $x°$, where $\sin x° = \frac{4}{5}$. What is $\cos(90° - x°)$?

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 $\overset{\frown}{AB}$?

20

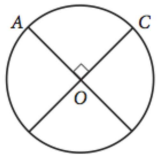


Note: Figure not drawn to scale.

In the circle above, point A is the center and the length of arc $\overset{\frown}{BC}$ is $\frac{2}{5}$ of the circumference of the circle. What is the value of x ?

Los Angles No Calculator

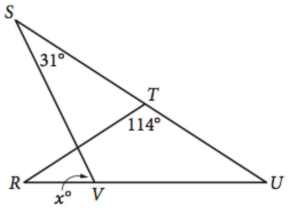
2



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

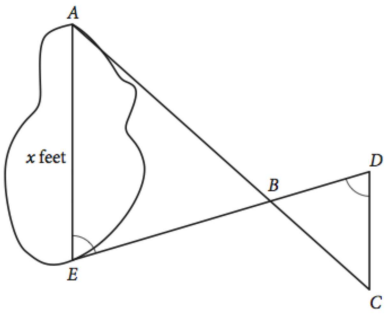
4



In the figure above, $RT = TU$. What is the value of x ?

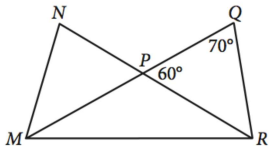
A) 72
B) 66
C) 64
D) 58

17



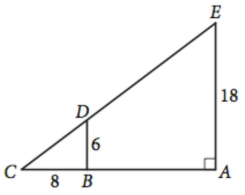
A summer camp counselor wants to find a length, x, in feet, across a lake as represented in the sketch above. The lengths represented by AB, EB, BD, and CD on the sketch were determined to be 1800 feet, 1400 feet, 700 feet, and 800 feet, respectively. Segments AC and DE intersect at B, and $\angle AEB$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

17



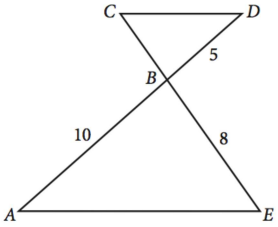
In the figure above, $\overline{MQ}$ and $\overline{NR}$ intersect at point P, $NP = QP$, and $MP = PR$. What is the measure, in degrees, of $\angle QMR$? (Disregard the degree symbol when gridding your answer.)

18



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

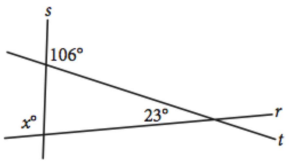
18



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

20

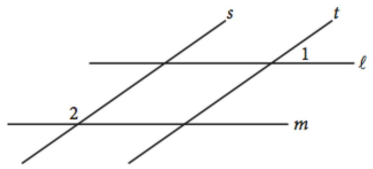
Intersecting lines r, s, and t are shown below.



What is the value of x ?

Los Angles With Calculator

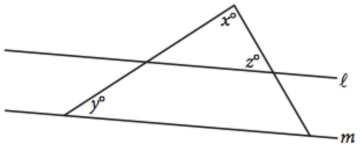
3



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°

5

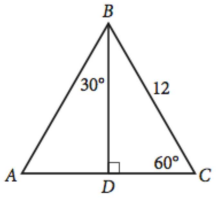


Note: Figure not drawn to scale.

In the figure above, lines ℓ and m are parallel, $y = 20$, and $z = 60$. What is the value of x ?

A) 120
B) 100
C) 90
D) 80

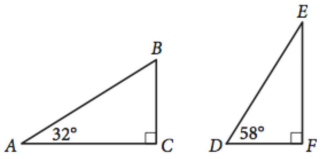
19



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

A) 4
B) 6
C) $6\sqrt{2}$
D) $6\sqrt{3}$

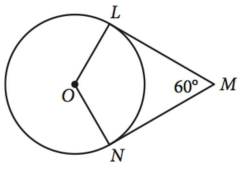
16



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

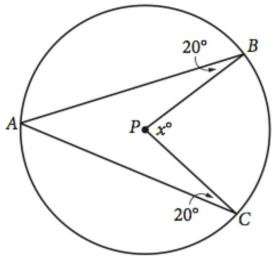
A) $\frac{DE}{DF}$
B) $\frac{DF}{DE}$
C) $\frac{DF}{EF}$
D) $\frac{EF}{DE}$

36



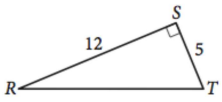
In the figure above, point O is the center of the circle, line segments LM and MN are tangent to the circle at points L and N, respectively, and the segments intersect at point M as shown. If the circumference of the circle is 96, what is the length of minor arc $\overset{\frown}{LN}$?

36



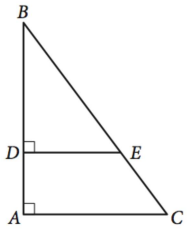
Point P is the center of the circle in the figure above. What is the value of x ?

36



In triangle RST above, point W (not shown) lies on $\overline{RT}$. What is the value of $\cos(\angle RSW) - \sin(\angle WST)$?

36



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

Circle Formula No Calculator

9

$$(x-6)^2+(y+5)^2=16$$

In the xy-plane, the graph of the equation above is a circle. Point P is on the circle and has coordinates $(10,-5)$. If $\overline{PQ}$ is a diameter of the circle, what are the coordinates of point Q ?

A) $(2,-5)$

B) $(6,-1)$

C) $(6,-5)$

D) $(6,-9)$

Circle Formula With Calculator

24

Which of the following is an equation of a circle in the xy-plane with center $(0,4)$ and a radius with endpoint $\left(\frac{4}{3},5\right)$?

A) $x^2+(y-4)^2=\frac{25}{9}$

B) $x^2+(y+4)^2=\frac{25}{9}$

C) $x^2+(y-4)^2=\frac{5}{3}$

D) $x^2+(y+4)^2=\frac{3}{5}$

24

$$x^2+y^2+4x-2y=-1$$

The equation of a circle in the xy-plane is shown above. What is the radius of the circle?

A) 2

B) 3

C) 4

D) 9

27

In the xy-plane, the graph of $2x^2-6x+2y^2+2y=45$ is a circle. What is the radius of the circle?

A) 5

B) 6.5

C) $\sqrt{40}$

D) $\sqrt{50}$

Circle Formula With Calculator

29

A circle in the xy-plane has equation $(x+3)^2+(y-1)^2=25$. Which of the following points does NOT lie in the interior of the circle?

A) $(-7,3)$

B) $(-3,1)$

C) $(0,0)$

D) $(3,2)$

29

$$x^2+20x+y^2+16y=-20$$

The equation above defines a circle in the xy-plane. What are the coordinates of the center of the circle?

A) $(-20,-16)$

B) $(-10,-8)$

C) $(10,8)$

D) $(20,16)$

Cylyee No Calculator

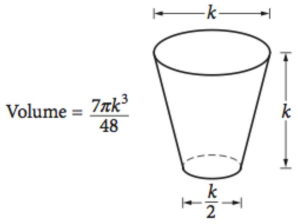
11

The volume of right circular cylinder A is 22 cubic centimeters. What is the volume, in cubic centimeters, of a right circular cylinder with twice the radius and half the height of cylinder A?

A) 11
B) 22
C) 44
D) 66

Cylyee With Calculator

Questions 9-11 refer to the following information.



The glass pictured above can hold a maximum volume of 473 cubic centimeters, which is approximately 16 fluid ounces.

9

What is the value of k, in centimeters?

A) 2.52
B) 7.67
C) 7.79
D) 10.11

23

A cylindrical can containing pieces of fruit is filled to the top with syrup before being sealed. The base of the can has an area of 75 cm^2, and the height of the can is 10 cm. If 110 cm^3 of syrup is needed to fill the can to the top, which of the following is closest to the total volume of the pieces of fruit in the can?

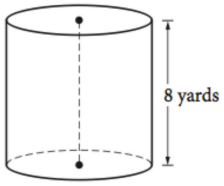
A) 7.5 cm^3
B) 185 cm^3
C) 640 cm^3
D) 750 cm^3

Cylyee With Calculator

33

A laboratory supply company produces graduated cylinders, each with an internal radius of 2 inches and an internal height between 7.75 inches and 8 inches. What is one possible volume, rounded to the nearest cubic inch, of a graduated cylinder produced by this company?

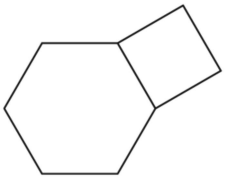
35



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?

Fish Nasty

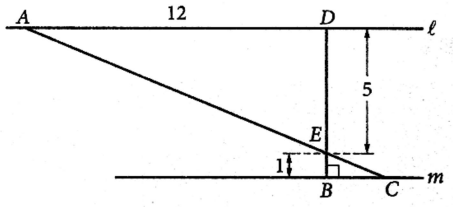
30



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) $16\sqrt{3}$

Geometry



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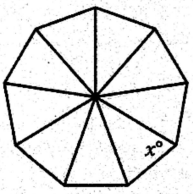
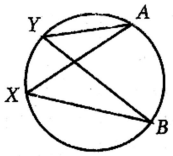


2. In the figure above, a regular polygon with 9 sides has been divided into 9 congruent isosceles triangles by line segments drawn from the center of the polygon to its vertices. What is the value of x?



3. In the figure above, $\angle AXB$ and $\angle AYB$ are inscribed in the circle. Which of the following statements is true?

A) The measure of $\angle AXB$ is greater than the measure of $\angle AYB$.
B) The measure of $\angle AXB$ is less than the measure of $\angle AYB$.
C) The measure of $\angle AXB$ is equal to the measure of $\angle AYB$.
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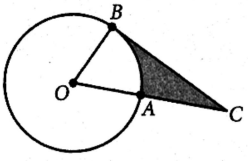

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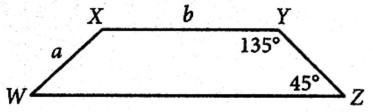
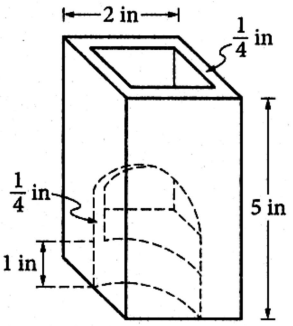
C) $36\sqrt{3} - 3\pi$
D) $36\sqrt{3} - 6\pi$



5. Trapezoid $WXYZ$ is shown above. How much greater is the area of this trapezoid than the area of a parallelogram with side lengths a and b and base angles of measure 45° and 135°?

A) $\frac{1}{2}a^2$
B) $\sqrt{2}a^2$
C) $\frac{1}{2}ab$
D) $\sqrt{2}ab$



Note: Figure not drawn to scale.

6. A glass vase is in the shape of a rectangular prism with a square base. The figure above shows the vase with a portion cut out. The external dimensions of the vase are height 5 inches (in), with a square base of side length 2 inches. The vase has a solid base of height 1 inch, and the sides are each $\frac{1}{4}$ inch thick. Which of the following is the volume, in cubic inches, of the glass used in the vase?

A) 6
B) 8
C) 9
D) 11

Coordinate Geometry

$$x^2 + (y + 1)^2 = 4$$

7. The graph of the equation above in the xy-plane is a circle. If the center of this circle is translated 1 unit up and the radius is increased by 1, which of the following is an equation of the resulting circle?

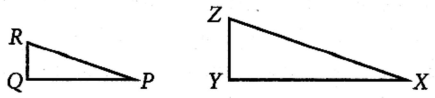
A) $x^2 + y^2 = 5$
B) $x^2 + y^2 = 9$
C) $x^2 + (y + 2)^2 = 5$
D) $x^2 + (y + 2)^2 = 9$

$$x^2 + 8x + y^2 - 6y = 24$$

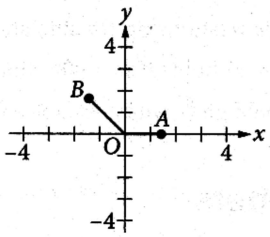
8. The graph of the equation above in the xy-plane is a circle. What is the radius of the circle?

Trigonometry and Radians

9.



In the figure above, right triangle PQR is similar to right triangle XYZ, with vertices P, Q, and R corresponding to vertices X, Y, and Z, respectively. If $\cos R = 0.263$ what is the value of $\cos Z$?



10. In the figure above, the coordinates of point B are $(-\sqrt{2}, \sqrt{2})$. What is the measure, in radians, of angle AOB?

A) $\frac{\pi}{4}$

B) $\frac{\pi}{2}$

C) $\frac{3\pi}{4}$

D) $\frac{5\pi}{4}$

11. $\sin(x) = \cos(K - x)$

In the equation above, the angle measures are in radians and K is a constant. Which of the following could be the value of K?

A) 0

B) $\frac{\pi}{4}$

C) $\frac{\pi}{2}$

D) π

Complex Numbers

12. $(-3 - 2i) + (4 - i) =$

13. $(-3 - 2i) - (4 - i) =$

14. $(-3 - 2i)(4 - i) =$

15. $\frac{-3 - 2i}{4 - i} =$

16. Which of the following is equal to $\frac{1 + i}{1 - i}$?

A) i

B) $2i$

C) $-1 + i$

D) $1 + i$