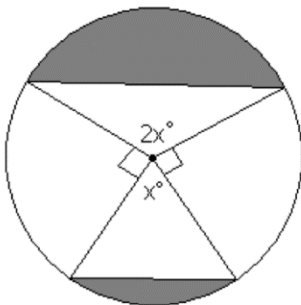


1. A circle is circumscribed around a regular hexagon with diameter equal to 12. Find the area that is inside the circle but outside the hexagon.

- A. $36\pi - 54\sqrt{3}$ B. $36\pi - \frac{81\sqrt{3}}{2}$
 C. $36\pi + 54\sqrt{3}$ D. $144\pi - 216\sqrt{3}$ E. NOTA

2.



Consider the diagram above. Let $A\pi - B\sqrt{3}$ be the value of the shaded area where A, B are rational. Find the value of $\frac{A}{B}$.

- A. 12 B. 1 C. 36 D. 72 E. NOTA
3. Consider two circles with equations:

$$(x - 4)^2 + (y - 4)^2 = 92$$

$$(x - 4)^2 + (y - 4)^2 = 164$$

Find the area that is between the two circles.

- A. $2\sqrt{41} - 2\sqrt{23}$ B. 72
 C. $(2\sqrt{41} - 2\sqrt{23})\pi$ D. 72π E. NOTA
4. What is the measure of the obtuse angle formed by the hour hand and the minute hand of a clock at 9:22?
- A. 111° B. 136° C. 174° D. 149° E. NOTA

For questions 5 and 6, consider the figure formed when the circle $(x - 12)^2 + (y - 12)^2 = 36$ is rotated about the x-axis.

5. Find the surface area of the figure.
A. $288\pi^2$ B. $144\pi^2$ C. $72\pi^2$ D. $36\pi^2$ E. NOTA

6. Find the volume of the figure.
A. $288\pi^2$ B. $576\pi^2$ C. $864\pi^2$ D. $984\pi^2$ E. NOTA

7. Find the x-coordinate of the center of the circle that contains the points $(-5, -4)$, $(6, 9)$, and $(12, 13)$.
A. 31 B. 32 C. 33 D. 34 E. NOTA

8. Ben and Jerry are running around a circle with diameter $\frac{50}{\pi}$ starting at the same point. If they run in the same direction, they meet in 10 seconds, if they run in the opposite direction, they meet in 5 seconds. Find the speed of the faster person in units per second.
A. 2.5 B. 5 C. 7.5 D. 15 E. NOTA

9. Find the radius of the circle that circumscribes the triangle with side lengths 13, 14, and 15.
A. $\frac{65}{4}$ B. $\frac{65}{8}$ C. $\frac{130}{7}$ D. $\frac{65}{12}$ E. NOTA

10. A square has perimeter of 16π . A circle also has a circumference of 16π . What is the ratio of the area of circle to the area of the square?
A. $3:\pi$ B. $4:\pi$ C. $\pi:3$ D. $\pi:4$ E. NOTA

11. What is the area of a regular octagon with side length 2?
A. $2(1 + \sqrt{2})$ B. $4(1 + \sqrt{2})$ C. $6(1 + \sqrt{2})$ D. $8(1 + \sqrt{2})$ E. NOTA

12. A rectangle has vertices $(2, 3)$, $(7, 3)$, $(2, 8)$, and $(7, 8)$. The rectangle is then revolved around the x -axis. Find the volume of the figure formed.
- A. 135π B. 275π C. 225π D. 95π E. NOTA
13. Chord \overline{AB} of a circle is bisected by chord \overline{CD} intersecting at point E where chord AB, CD are perpendicular. If chord \overline{AC} has length 13 and chord \overline{AB} has length 10, then what is the diameter of the circle?
- A. 12 B. 18 C. $\frac{169}{24}$ D. $\frac{169}{48}$ E. NOTA
14. A triangle has side lengths of 6, 7, and 8. Let the length of the median to the longest side of the triangle be x . Find the value of x^2 .
- A. $\frac{53}{4}$ B. $\frac{51}{2}$ C. 26 D. $\frac{53}{2}$ E. NOTA
15. A triangle has side lengths $AB = 5, BC = 12, CA = 13$. Point C is folded such that it now lies on point B . What is the length in inches of the crease?
- A. $\frac{5}{2}$ B. $\frac{5}{3}$ C. $\frac{7}{2}$ D. $\frac{12}{5}$ E. NOTA
16. Ben has a 3×3 square which he then partitioned into 9 unit squares. After, he shades four squares, one in each corner of the 3×3 square. He repeats this process with the middle square, which is also subdivided into 9 smaller squares and shades the corner squares of said middle square. If he repeats this process indefinitely, what is the total area that is shaded?
- A. 4 B. $\frac{17}{4}$ C. $\frac{9}{2}$ D. 5 E. NOTA
17. A triangle has sides of length 15, 16, and 17. Find the length of the altitude to the longest side of the triangle.
- A. 6 B. $\frac{48\sqrt{21}}{17}$ C. 9 D. $\frac{24\sqrt{21}}{17}$ E. NOTA

18. Find the area of the cyclic quadrilateral with side lengths 5, 6, 7, and 8.
A. $4\sqrt{105}$ B. $4\sqrt{905}$ C. $4\sqrt{1365}$ D. $2\sqrt{91}$ E. NOTA
19. Circle O has radius equal to 10. Two lines from point P outside of the circle are tangent to O at points A and B. Angle APB measure 60° . What is the shortest distance from point P to the circle?
A. 10 B. $10\sqrt{3}$ C. 20 D. $20\sqrt{3}$ E. NOTA
20. Trapezoid ABCD is circumscribed around a circle, with side AB parallel to CD. Points E and F lie on sides AD and BC such that they are the midpoints. Line segment EF has length 20. Find the perimeter of trapezoid ABCD.
A. 50 B. 58 C. 80 D. 88 E. NOTA
21. Ben's house is located at (5,3). He is currently at (-4,9) and wants to get home. Before he goes home, he remembered that his mother told him to bring a bucket of water. The only source of water in the whole town is the river located along the x-axis. What is the shortest distance Ben has to travel to bring a bucket of water home?
A. 15 B. $15\sqrt{2}$ C. $15\sqrt{3}$ D. $15\sqrt{5}$ E. NOTA
22. A triangle has side lengths of 13, 14, and 15. There are three circles, centered at each of the three vertices, and draw such that each circle is tangent to the other two circles. Find the sum of the areas of the three circles.
A. 129π B. 130π C. 149π D. 150π E. NOTA
23. Two circles of radii 7 and 5 are externally tangent to each other. Find the length of their common external tangent.
A. $2\sqrt{21}$ B. $2\sqrt{35}$ C. $4\sqrt{21}$ D. $4\sqrt{35}$ E. NOTA

24. Circle O has diameter 50. Let points A and B lie on the O such that AB is the diameter. Points C and D lie on the circle, and they are on opposite sides of diameter AB. Given $AC = 30$ and $BD = 14$. Find the length of CD .
- A. $2\sqrt{274}$ B. $2\sqrt{449}$ C. $\frac{234}{5}$ D. 50 E. NOTA
25. 12 distinct points lie on a circle. How many convex pentagons can you make when using some subset of these points as vertices?
- A. 792 B. 814 C. 396 D. 407 E. NOTA
26. An inverted cone when radius 6 ft and height 12 ft is being filled up with sand at a rate of 6π cubic ft per second. After 3 seconds what is the area of the top surface of sand?
- A. 3π B. 9π C. $3^3\sqrt{3}\pi$ D. $9^3\sqrt{9}\pi$ E. NOTA
27. The altitude to the hypotenuse of a right triangle divides the hypotenuse into segments of length 16 and 25. What is the length of the altitude?
- A. 16 B. 8 C. 25 D. 20 E. NOTA
28. A certain polyhedron has 8 vertices and 6 faces. How many edges does it contain?
- A. 9 B. 10 C. 11 D. 12 E. NOTA
29. How many Platonic solids are there?
- A. 3 B. 5 C. 7 D. 9 E. NOTA
30. How many Archimedean solids are there?
- A. 7 B. 9 C. 11 D. 13 E. NOTA