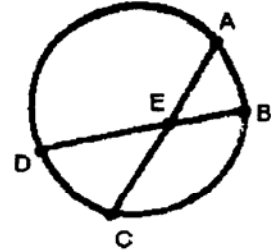


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NOTE:

- For all questions, answer E) NOTA means “none of the above”.
- Figures are not drawn to scale.

1. Find the measure of angle AED in the figure to the right if E is the intersection point of AC and BD, arc AB is 41° , and arc DC is 53° .



- A) 133° B) 127° C) 139°
 D) 135° E) NOTA

2. A garden contains a circular flowerbed with a radius of 8 ft. The owners wish to put a 3 ft wide path running along the outside edge of the flowerbed. If one bag of cement will cover 20 ft^2 , how many bags must they buy to cover the entire path?

- A) 7 B) 8 C) 9 D) 10 E) NOTA

3. What is the volume of the largest sphere that fits inside a right cone with a slant height and base diameter of $6\sqrt{3}$?

- A) $15\pi\sqrt{3}$ B) 27π C) 36π D) $39\pi\sqrt{3}$ E) NOTA

4. The diameters of a series of circles follows the pattern 4, 10, 18, 28, ... What is the area of the sixth circle in the series?

- A) 729π B) 54π C) 2916π D) 400π E) NOTA

5. A circle of diameter 10 is inscribed in a semicircle with a radius of 10. What is the area of the region that is contained within the semicircle but outside of the circle?

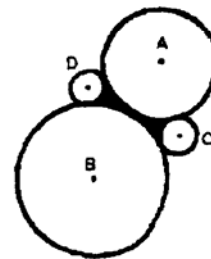
- A) 25π B) 50π C) 75π D) 100π E) NOTA

6. What is the ratio of the area of a square circumscribed about a circle to the area of a square inscribed in the same circle?

- A) 3:2 B) 2:1 C) 5:2 D) 3:1 E) NOTA

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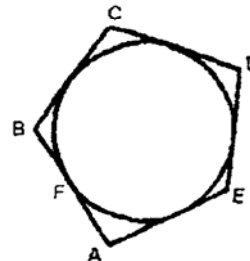
7. Circles A, B, C, and D, with radii of 2, 3, 1, and 1, respectively, are externally tangent as shown in the diagram to the right. What is the area of the shaded region to the nearest thousandth?



- A) 0.219 B) 1.811 C) 0.929
 D) 0.906 E) NOTA
8. A $24\pi\text{cm}^3$ cylindrical candle is melting so that it decreases its height by .5 cm every 8 minutes. If the candle has a radius of 2 cm, how many minutes will it take to melt to half of its original height?

- A) 28 B) 36 C) 48 D) 52 E) NOTA

9. ABCDE is circumscribed about a circle, as shown to the right. Given that the perimeter of ABCDE is 38, $AB=8$, $AF=6$, $AE=10$, and $ED=7$, what is the length of CD?

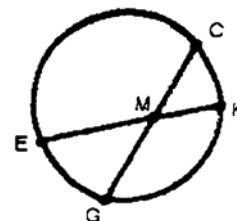


- A) 4 B) 6 C) 8
 D) 10 E) NOTA

10. What is the circumference of a circle whose radius squared times negative eight is six less than its diameter?

- A) $\frac{3}{2}\pi$ B) π C) $\frac{3}{4}\pi$ D) $\pi\sqrt{2}$ E) NOTA

11. In the circle to the right, $KE=7$, $KM=4$, and $CM=2$. If $\angle CMK$ is a right angle, what is the length of CG ?



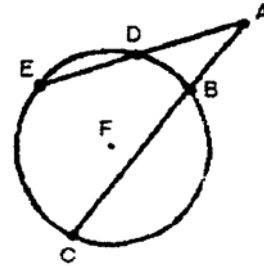
- A) 5 B) 6 C) 7
 D) 8 E) NOTA

12. What is the power of the point (2,4) with respect to a circle of radius 2 centered at the origin?

- A) 2 B) 4 C) 8 D) 16 E) NOTA

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13. In the diagram to the right of circle F, AB is of length $\frac{1}{2}(x - \frac{2}{3})$, BC is of length $\frac{3}{2}x - 1$, AD is of length $\frac{3}{5}x$, and DE is of length $x - \frac{5}{3}$. Find the average of all possible values of x .



- A) $\frac{20}{3}$ B) $\frac{2}{3}$ C) $\frac{25}{6}$
 D) $\frac{3}{2}$ E) NOTA

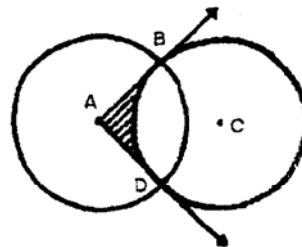
14. In the Fat-Free Software Factory, two wheels with diameters of 12 cm are placed with their centers 24 cm apart. What length belt (in centimeters), made of a non-stretching material, is needed to fit exactly around the two wheels, connecting them with no slack left over?

- A) $48 + 12\pi$ B) $25 + 38\pi$ C) $48 + 38\pi$ D) $24 + 19\pi$ E) NOTA

15. A dartboard is made up of three concentric circles. The innermost circle, or bullseye, has a radius of 2, the next has a radius of 5, and the outer circle has a radius of 9. If you are given one dart to throw and you are guaranteed that it will hit the dartboard, what is the probability you will get a bullseye?

- A) $\frac{1}{3}$ B) $\frac{\pi}{4}$ C) $\frac{4}{81}$ D) $\frac{7}{27}$ E) NOTA

16. AB and AD are tangents to circle C at the points where circles C and A intersect. Find the area of the shaded region in terms of r , where r is the length of the radii of circles C and A and also the distance between their points of intersection.



- A) $\frac{r(\sqrt{3} - r\pi)}{4}$ B) $\frac{r^2(2\sqrt{3} - \pi)}{6}$ C) $\frac{r(\sqrt{3} - \pi)}{4}$ D) $\frac{r^2(3\sqrt{3} - \pi)}{6}$ E) NOTA

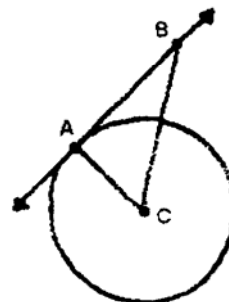
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17. A plane intersects a sphere of radius 5 at a distance of 4 units from its center. What is the area of the cross-section formed?

A) 9π B) 12π C) 15π D) 16π E) NOTA

18. AB is tangent to circle C at point A and the distance between A and B is 3. If the area of triangle ABC is 6, what is the circumference of the circle centered at C and passing through point B ?

A) 4π B) 6π C) 8π
 D) 10π E) NOTA



19. The warning on a home firework set reads as follows:

CAUTION – When a firework explodes it is dangerous to be within a circle of area $8\pi x^2$ ft² centered around the launch point, where x is the height the firework reaches in feet before exploding.

If you light a firework that reaches a height of 25 ft before exploding, how far must you run to be just out of the danger zone (assuming you start running from the launch point)?

A) 200π ft B) $25\pi\sqrt{2}$ ft C) $25\sqrt{2}$ ft D) $10\sqrt{2}$ ft E) NOTA

20. Three semicircles with areas 4π , 9π , and 16π are drawn on a triangle such that each side of the triangle is the diameter of one of the semicircles. Find the area of the triangle.

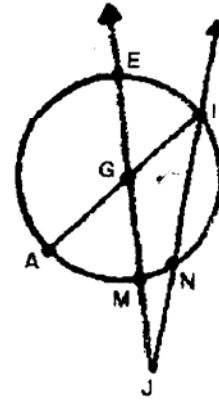
A) 24 B) $6\sqrt{15}$ C) $18\sqrt{2}$ D) $9\sqrt{10}$ E) NOTA

21. What is the area of an equilateral triangle circumscribed about a circle that is circumscribed about a regular hexagon of area $\frac{243\sqrt{3}}{2}$?

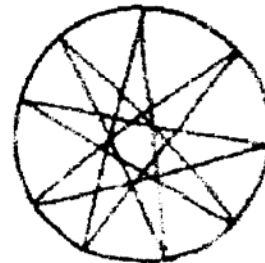
A) $\frac{729\sqrt{3}}{2}$ B) $243\sqrt{3}$ C) $729\sqrt{3}$ D) $486\sqrt{3}$ E) NOTA

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22. In the diagram to the right of circle G with diameter AI, what is the measure of angle AGE if arc MN is 20° and angle EJI is 15° ?



- A) 120°
 B) 130°
 C) 135°
 D) 145°
 E) NOTA
23. A circle of circumference $4\pi\sqrt{2}$ has inscribed and circumscribed squares such that each of their corresponding sides are parallel. What is the difference between the perimeter and the area of the square whose sides are parallel to and located exactly half-way between the sides of the other two squares?
- A) $4\sqrt{2} + 4$ B) $8\sqrt{2} + 12$ C) 5 D) 4 E) NOTA
24. A circle is located somewhere on the Cartesian plane. If it must pass through the points (7,9) and (10,31) which of the following could not be the radius of the circle?
- A) $\sqrt{570}$ B) 21.659 C) 13π D) 45.320 E) NOTA
25. A rice cake is in the shape of a cylinder 2 cm high with a 10 cm diameter. If there is .01 grams of fat in each cm^3 of rice cake, about how many grams of fat are in one whole rice cake?
- A) 0.51 B) 0.86 C) 1.57 D) 1.72 E) NOTA
26. In the figure to the right, what is the sum of the measures of all the angles contained in the points of the star within the circle?



- A) 90° B) 135° C) 270°
 D) 360° E) NOTA

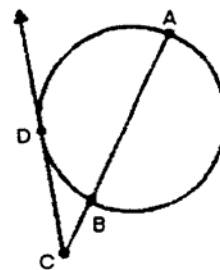
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27. The first time Gill did laundry at Princeton he put way too much soap in the washing machine and it filled the laundry room with bubbles. Amidst this bubbly mess there was one giant bubble consisting of two smaller spherical bubbles stuck together, one with a radius of 30 cm. If the centers of the two smaller bubbles were 25 cm apart and the circle at which they intersected had a radius of 24 cm, find the radius of the other spherical soap bubble.

A) 18 cm B) 24 cm C) 25 cm D) 32 cm E) NOTA

28. What is the length of CD in the figure to the right if AC is of length 10 and BC is of length 2?

A) 2 B) 3 C) 5
 D) 7 E) NOTA



29. A barbell consists of a cylindrical rod that goes exactly through the center of two cylindrical weights. If the weights are each 1 inch thick with a diameter of 1 foot and the rod is 4 feet long with a diameter of 1 inch, what is the surface area of the barbell?

A) $70.5\pi \text{ in}^2$ B) $216\pi \text{ in}^2$ C) $144\pi \text{ in}^2$ D) $213.5\pi \text{ in}^2$ E) NOTA

30. Consider a circle of radius 10 that is surrounded by a ring of 10 smaller circles such that each of the smaller circles is congruent to and externally tangent to its adjacent circles in the ring and each of the ten circles in the ring is externally tangent to the inner circle. What is the radius of the smaller circles that make up the surrounding ring (to the nearest hundredth of a centimeter)?

A) 3.14 B) 4.47 C) 5.21 D) 5.37 E) NOTA