

For all questions, answer choice "E) NOTA" means none of the above answers is correct.

1. What is the area enclosed by a square inscribed in a circle with circumference  $36\pi$  ?

- A) 72                      B) 288                      C) 324                      D) 648                      E) NOTA

2. A triangle is inscribed in a semicircle so that one of its sides is the diameter of the circle. The radius of the semicircle is 5; one of the angles of the triangle has a measure of  $60^\circ$ . What is the area enclosed by the triangle?

- A)  $5\sqrt{3}$                       B)  $6.25\sqrt{3}$                       C)  $12.5\sqrt{3}$                       D)  $25\sqrt{3}$                       E) NOTA

3. A parallelogram inscribed in a circle MUST be what shape?

- A) rhombus                      B) square                      C) rectangle                      D) kite                      E) NOTA

4.  $\triangle ABC$  is inscribed in a circle. If the vertices of the triangle divide the circle into arcs whose lengths are in the ratio of 16:63:65, the triangle MUST be which of the following?

- A) isosceles                      B) equilateral                      C) scalene                      D) right                      E) NOTA

5. All but one of the following vertices of a polygon lie on the circle whose equation is  $x^2 + y^2 = 25$ . Which of the vertices below is not on the circle?

- A) (5,5)                      B)  $(-1, 2\sqrt{6})$                       C)  $(-3, -4)$                       D)  $(2, \sqrt{21})$                       E) NOTA

6.  $\triangle ABC$  is inscribed in a circle. If  $m\angle C = 90^\circ$  and  $|\overline{AC}| = |\overline{BC}|$ , find the measure of arc  $AC$ .

- A)  $30^\circ$                       B)  $45^\circ$                       C)  $60^\circ$                       D)  $75^\circ$                       E) NOTA

7. An isosceles triangle has its base as a chord of a circle whose radius is 5; the chord is a distance of 4 from the center of the circle. If the base angles of the isosceles triangle each have measure  $45^\circ$ , what is the perimeter of the triangle?

- A)  $12\sqrt{2}$                       B)  $6+6\sqrt{2}$                       C)  $6+9\sqrt{2}$                       D) 16                      E) NOTA

8. What is the area enclosed by a regular octagon inscribed in a circle with radius 5?

- A)  $50+50\sqrt{2}$                       B)  $50\sqrt{2}$                       C)  $200+200\sqrt{2}$                       D)  $100\sqrt{2}$                       E) NOTA

9. Two tangents are drawn to a circle from an external point. The larger intercepted arc contains three times as many degrees as the smaller arc. A radius is drawn to each point of tangency in order to form a quadrilateral. Which of the following choices is the best description of this quadrilateral?

- A) square      B) rhombus      C) rectangle      D) parallelogram      E) NOTA

10. A regular hexagon is drawn so that one of its sides is the longest chord of a circle. If the figure formed by connecting every other vertex of the hexagon has a perimeter of 9, what is the area enclosed by the circle?

- A)  $3\pi$       B)  $\frac{3\pi}{4}$       C)  $\frac{3\pi}{16}$       D)  $9\pi$       E) NOTA

11. Isosceles triangle  $ABC$  is inscribed in a circle. If base angles  $A$  and  $B$  each measure  $70^\circ$ , find the degree measure of the largest angle in the triangle formed by tangents to the circle at points  $A$ ,  $B$ , and  $C$ .

- A)  $35^\circ$       B)  $40^\circ$       C)  $70^\circ$       D)  $100^\circ$       E) NOTA

12. Three circles are externally tangent to each other. If the ratio of the areas enclosed by the circles is 25:49:121, and the smallest circle has circumference  $10\pi$ , what is the area enclosed by the triangle formed by connecting the centers of the three circles?

- A)  $9\sqrt{35}$       B)  $\frac{35}{2}$       C)  $48\sqrt{23}$       D)  $\sqrt{8855}$       E) NOTA

13. Leg  $\overline{AB}$  of isosceles triangle  $ABC$  is the diameter of a circle;  $D$  is the point at which the circle intersects side  $\overline{BC}$ . If the radius of the circle is 5 and  $|\overline{BC}| = 4$ , find  $|\overline{AD}|$ .

- A) 2      B)  $4\sqrt{6}$       C)  $7\sqrt{2}$       D) 4      E) NOTA

14. An isosceles trapezoid is inscribed in a circle of radius 17. The longest base is a distance 8 away from the center of the circle, and the shorter base of the trapezoid has length 10. The two bases are on opposite sides of the circle's diameter that is parallel with those bases. What is the area enclosed by the trapezoid?

- A)  $640\sqrt{66}$       B) 680      C)  $160 + 40\sqrt{66}$       D)  $108 + 27\sqrt{66}$       E) NOTA

15. What is the ratio of the area enclosed by a circle whose circumference is 45 to the area of a triangle whose vertices are at the points  $(2,0)$ ,  $(4,6)$ , and  $(5,-2)$ ?

- A)  $135:4\pi$       B)  $2025:44\pi$       C)  $45:2\pi$       D)  $45:44\pi$       E) NOTA

16. Pentagon  $ABCDE$  is inscribed in a circle; its angles are in the ratio  $8:8:7:7:6$ . If angles  $A$  and  $B$  are the largest, and angles  $C$  and  $E$  are equal, what is the degree of minor arc  $BD$ ?

- A)  $54^\circ$       B)  $150^\circ$       C)  $162^\circ$       D)  $210^\circ$       E) NOTA

17. Two circles with radii of lengths 8 cm and 5 cm are 5 cm apart. Find, in cm, the sum of the lengths of one of their common external tangents and one of their common internal tangents.

- A)  $3\sqrt{35} + \sqrt{155}$       B)  $3\sqrt{35} + 2\sqrt{65}$       C)  $3\sqrt{37} + \sqrt{155}$       D)  $3\sqrt{37} + 5\sqrt{31}$       E) NOTA

18. A circle has equation  $4x^2 = 8x - 4y^2 + 12y + 1$ . What is the area enclosed by a square that could circumscribe this circle?

- A) 7      B) 11      C) 14      D) 53      E) NOTA

19. Find the area enclosed by a circle inscribed in a right triangle with legs with integer lengths whose shortest leg is 8 and whose perimeter is 40.

- A)  $3\pi$       B)  $9\pi$       C)  $189\pi/4$       D)  $189\pi$       E) NOTA

20. Find the distance a circle will travel when it rolls 7 revolutions if an isosceles right triangle inscribed in the circle has area 8.

- A)  $7\pi\sqrt{2}$       B)  $14\pi\sqrt{2}$       C)  $21\pi\sqrt{2}$       D)  $28\pi\sqrt{2}$       E) NOTA

21. The center of a circle is the centroid of the triangle with vertices at the points  $(2,0)$ ,  $(0,3)$ , and  $(7,6)$ . If the circle passes through the origin, what is its circumference?

- A)  $6\pi$       B)  $9\pi$       C)  $6\pi\sqrt{2}$       D)  $9\pi\sqrt{2}$       E) NOTA

22. A sector of a circle has central angle  $60^\circ$  and arc length 10. The triangle whose vertices are the center of the circle and the two points of the sector where the radii intersect the arc is removed from the sector. Find the perimeter of the part of the sector that remains.

- A)  $10 + \frac{30}{\pi}$       B)  $10 + \frac{60}{\pi}$       C)  $\frac{90}{\pi}$       D)  $10 + \frac{180}{\pi}$       E) NOTA

23.  $W$  is the point of dilation for a regular hexagon whose perimeter is  $44\sqrt{3}$ . If the dilation factor is 5, what is the area enclosed by the circle that can be inscribed in the image of the dilation?

- A)  $12100\pi/3$       B)  $55\pi\sqrt{3}$       C)  $55\pi\sqrt{30}/2$       D)  $3025\pi$       E) NOTA

24. A circle with radius of length 3 is drawn using the circumcenter of a triangle as its center. The triangle has side lengths of 85, 13, and 84. What is the area of the intersection of the enclosures of the triangle and the circle?

- A)  $9\pi/2$       B)  $546 - 9\pi$       C)  $546 - \frac{9\pi}{4}$       D)  $3570 - 9\pi$       E) NOTA

25. Find the perimeter of the largest regular hexagon inscribed in a right triangle with hypotenuse of length 36 such that one side of the hexagon lies on the hypotenuse and one side lies on the shortest leg of the triangle.

- A)  $36\sqrt{3}$       B)  $216/5$       C)  $36/5$       D)  $6\sqrt{3}$       E) NOTA

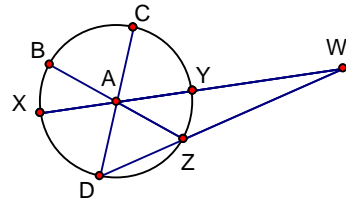
26. One side of a quadrilateral is the 8-in diameter of a circle. Two other sides of the quadrilateral are tangent to the circle at the two ends of the diameter. The fourth side is also tangent to the circle and forms a  $60^\circ$  angle with one of the tangents to the circle at the diameter. What is the area enclosed by the quadrilateral, in  $\text{in}^2$ ?

- A)  $128 - \frac{32\sqrt{3}}{3}$       B)  $\frac{64\sqrt{3}}{3}$       C)  $64\sqrt{3}$       D) 64      E) NOTA

27. Let  $A$  = the area enclosed by a regular triangle with side length 4,  $B$  = the area enclosed by a regular octagon with side length 4,  $C$  = the radius of a circle inscribed in a regular triangle with side length 4, and  $D$  = the radius of a circle inscribed in a regular hexagon with side length 4. Find the value of  $\frac{AB}{CD}$ .

- A)  $32\sqrt{3} + 32\sqrt{6}$     B)  $64\sqrt{3}$     C)  $16\sqrt{3}$     D)  $128\sqrt{3} + 128\sqrt{6}$     E) NOTA

28. The diagram to the right is composed of one circle and four line segments.  $A$  is the midpoint of segment  $\overline{XY}$ , and  $Y$  is the midpoint of segment  $\overline{XW}$ . Additionally,  $|\overline{AB}| = 2$ ,  $|\overline{AC}| = 4$ ,  $|\overline{AD}| = 6$ , and  $|\overline{DZ}| = 8$ . What is the perimeter of  $\triangle AZW$ ?



- A)  $12 + 8\sqrt{3} + 6\sqrt{6}$     B)  $12 + 6\sqrt{2} + 6\sqrt{6}$     C)  $8 + 6\sqrt{6} + 4\sqrt{13}$     D)  $48 + 5\sqrt{3} + 6\sqrt{6}$     E) NOTA

29. Segments  $\overline{CA}$  and  $\overline{CB}$  are tangents to a circle at points  $D$  and  $G$ , respectively. Segment  $\overline{AB}$  is a secant of the circle that intersects the circle at points  $E$  and  $F$ , where  $E$  is closer to  $A$  than  $B$ .  $FG$  is a  $45^\circ$  arc,  $DG$  is a  $90^\circ$  arc, and  $|\overline{DG}| = 8$ . If  $|\overline{AD}| = |\overline{BG}|$ , find the perimeter of the region bounded by segments  $\overline{AD}$  and  $\overline{AE}$  and arc  $ED$ .

- A)  $4 + 16\pi\sqrt{2}$     B)  $8 + \pi\sqrt{2}$     C)  $12 + 10\pi\sqrt{2}$     D)  $16 + 2\sqrt{2} + \pi\sqrt{2}$     E) NOTA

30. A solid cube is inscribed in a sphere whose radius has length 10. A plane passes through the sphere and the cube so that it contains parallel diagonals of opposite faces of the cube. The intersection of the plane with the sphere is a circle. What is the area enclosed by the circle that has no points in common with the cube?

- A)  $100\pi - 400\sqrt{2}$     B)  $100\pi - 200$     C)  $100\pi - \frac{400}{3}$     D)  $100\pi - \frac{400\sqrt{2}}{3}$     E) NOTA