

**2003 Theta Circles Topic Test
FAMAT State Convention 2003**

For all questions, E. NOTA means none of the above answers is correct.

1. Two points on a circle determine a minor arc and a major arc. If the measure of the major arc is forty less than three times the minor arc, find the measure of the major arc.

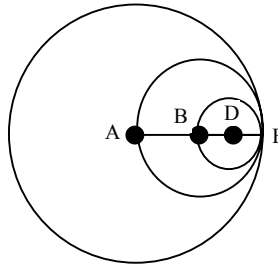
A. 100° B. 160° C. 260° D. 340° E. NOTA

2. If a triangle is inscribed in a circle, the center of the circle is located at the triangle's _____.

A. circumcenter B. incenter C. centroid D. orthocenter E. NOTA

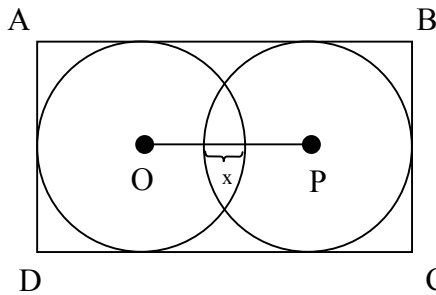
3. In the figure below, points A, B, and D are centers of the three circles that are tangent at E. If A, B, D, and E are collinear and the area of the circle with center D is π , find the length of the radius of the circle with center A.

A. 4
B. 6
C. 8
D. 12
E. NOTA



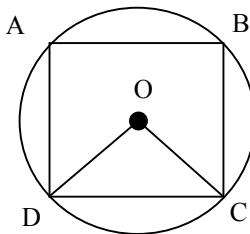
4. In the figure below, the circles with centers O and P each have a radius of 2. If $x = 1$, then find the perimeter of rectangle ABCD.

A. 18
B. 20
C. 22
D. 28
E. NOTA



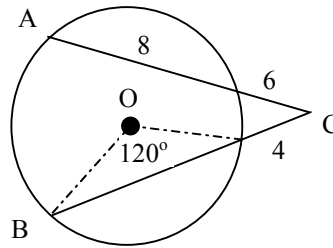
5. In the figure below, quadrilateral ABCD is inscribed in circle O so that A, B, C, and D are on circle O and $\overline{DO} \perp \overline{CO}$. If the area of $\triangle ODC$ is 12.5, find the area of circle O.

A. 5π
B. 10π
C. 25π
D. 100π
E. NOTA



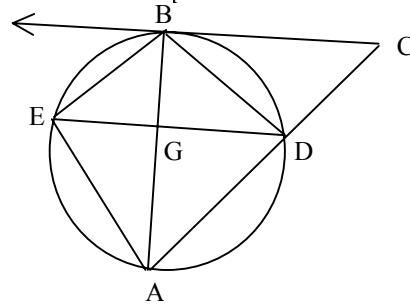
6. In the figure below, A and B are on circle O. Find the area of circle O.

- A. $\frac{289\pi}{12}$
- B. $\frac{147\pi}{4}$
- C. $\frac{289\pi}{3}$
- D. 147π
- E. NOTA



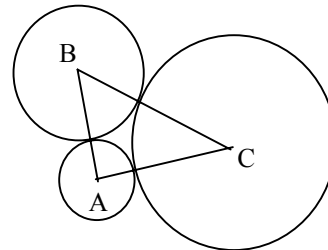
7. In the figure below, \overline{AB} is a diameter of the circle, and chord \overline{DE} is parallel to tangent \overline{BC} . If $AE = 8$ and the radius of the circle is 5, find the area of the quadrilateral ADBE.

- A. 24
- B. 48
- C. 72
- D. 96
- E. NOTA



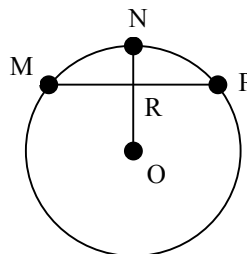
8. In the figure below, each of the circles with centers A, B, and C is tangent to the other two. If $AB = 10$, $AC = 14$, and $BC = 18$, find the sum of the radii of the three circles.

- A. 10.5
- B. 21
- C. 27
- D. 42
- E. NOTA



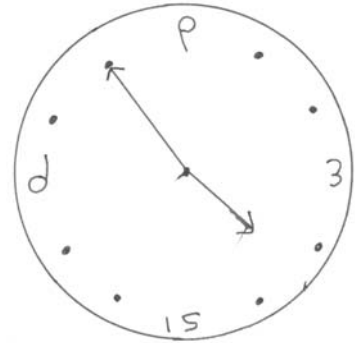
9. In circle O below, M, N, and P lie on the circle, \overline{MP} and \overline{NO} intersect at R with $\overline{NO} \perp \overline{MP}$. If $NR = 4$, find the length of the radius of circle O.

- A. 10
- B. 20
- C. 30
- D. 40
- E. NOTA



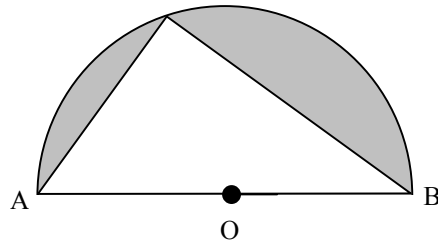
10. The figure below is the mirror image of a clock turned upside down so that the minute hand is on the 7. What will be the angle measure between the hour and minute hands in twenty minutes?

- A. 27.5°
 B. 32.5°
 C. 57.5°
 D. 87.5°
 E. NOTA



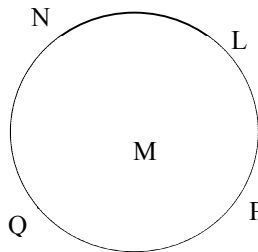
11. In the figure below, A, B, and C are on semicircle O and $m\angle ABC = 20^\circ$. Find the area to the nearest tenth of the shaded region if the radius of circle O is 5 units. C

- A. 16.1
 B. 31.6
 C. 39.3
 D. 78.5
 E. NOTA



12. In the figure below, \overline{LQ} and \overline{NP} are chords of the circle. Find xy using the figure below if $m\angle LMP = (x + 2y)^\circ$, $m\angle PMQ = (2x + 2y)^\circ$, arc LP measures $(2x + y)^\circ$, and arc NQ measures $(3x + y)^\circ$.

- A. 30
 B. 80
 C. 150
 D. 600
 E. NOTA

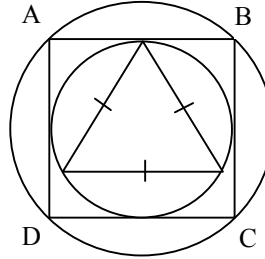


13. In a circle, a chord of length 16 is parallel to a tangent and bisects the radius drawn to the point of tangency. How long is the radius?

- A. 4 B. 8 C. $\frac{8\sqrt{3}}{3}$ D. $\frac{16\sqrt{3}}{3}$ E. NOTA

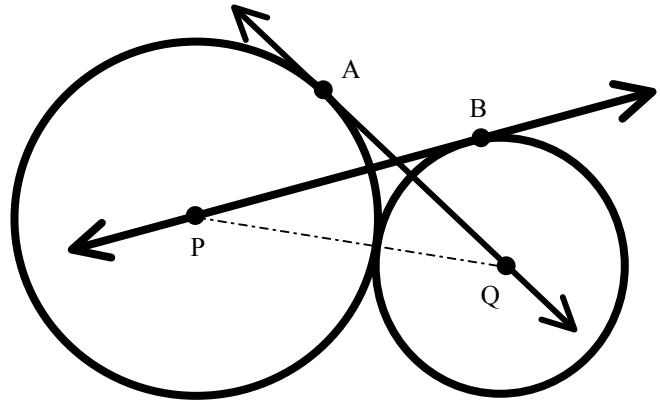
14. In the figure below, the equilateral triangle is inscribed in a circle, which is inscribed in a square, which is inscribed in a larger circle containing the points A, B, C, and D. If ABCD is a square and $AB = 36$, find the area of the region bound by the larger circle and the equilateral triangle below.

- A. $324\pi - 243\sqrt{3}$
- B. $324\pi - \frac{243\sqrt{3}}{2}$
- C. $648\pi - 243\sqrt{3}$
- D. $648\pi - \frac{243\sqrt{3}}{2}$
- E. NOTA



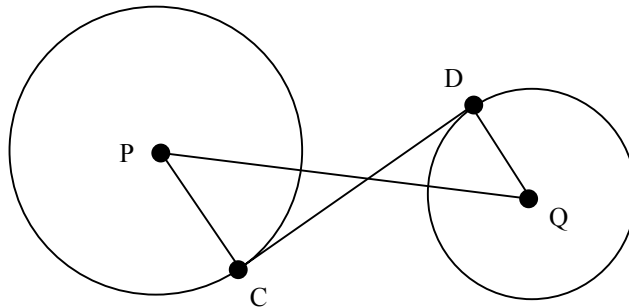
15. Given the figure below in which the circles are tangent, P and Q are the centers of the circles, and \overline{PB} and \overline{QA} are tangents at B and A, respectively. If the radius of circle P is 9 and the radius of circle Q is 6, find $PB + QA$.

- A. $12 + 3\sqrt{21}$
- B. $3\sqrt{34} + \sqrt{117}$
- C. $15\sqrt{2}$
- D. 15
- E. NOTA

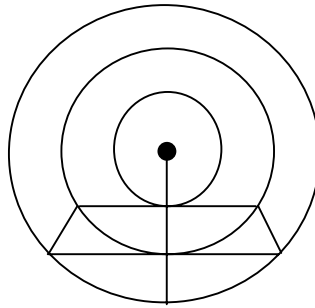


16. The distance between the centers of the two circles below is 18. The radius of circle P is 6, and the radius of circle Q is 3. Find the length of the common internal tangent segment CD.

- A. 9
- B. $9\sqrt{3}$
- C. 27
- D. $\sqrt{135}$
- E. NOTA

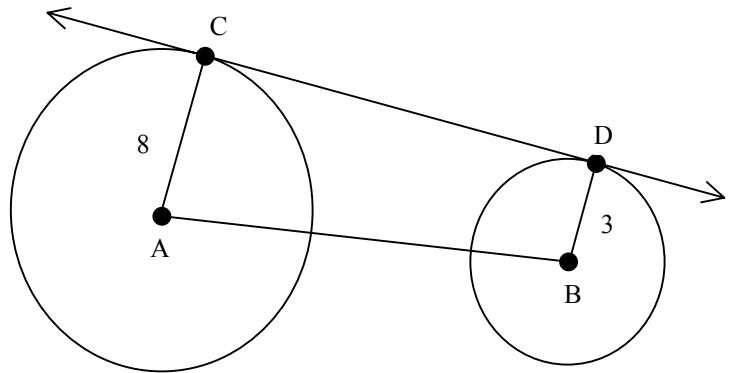


17. Three concentric circles have radii 3, 6, and 9. Chords of the two larger circles are tangent to the smaller circles as shown in the figure below, and the points of tangency lie on the same radius of the largest circle. Find the area of the quadrilateral region formed by the endpoints of the chords.



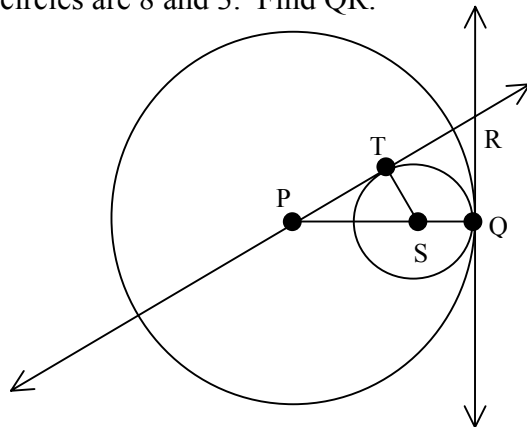
- A. $9\sqrt{3} + 9\sqrt{5}$
- B. $18\sqrt{3} + 18\sqrt{5}$
- C. $36\sqrt{2}$
- D. $9\sqrt{15}$
- E. NOTA

18. The radii of the two circles below are 8 and 3, and the distance between their centers, AB, is 13. Find the length of their common external tangent segment CD.



- A. $\sqrt{73}$
- B. 12
- C. 13
- D. $\sqrt{233}$
- E. NOTA

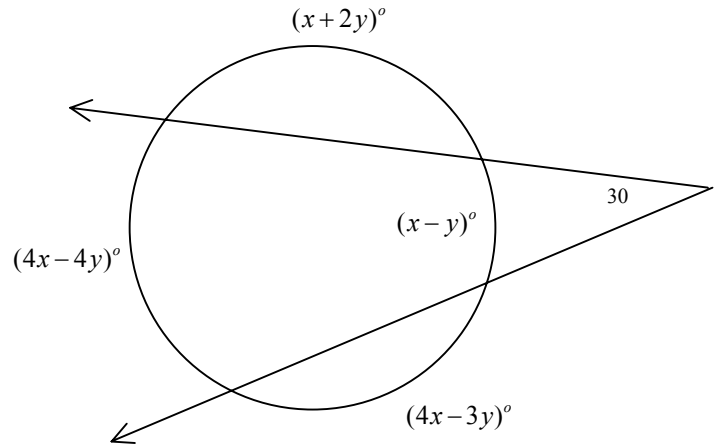
19. In the figure below, P and S are centers of the circles. \overline{QR} is tangent to circle P and circle S, and \overline{PR} is tangent to circle S. The radii of the circles are 8 and 3. Find QR.



- A. 6
- B. 7
- C. 8
- D. 9
- E. NOTA

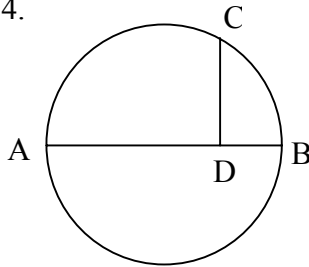
20. In the figure to the right, the variable expressions are arc measures. Find $x + y$.

- A. 40
- B. 72
- C. 100
- D. 132
- E. NOTA



21. In semicircle ACB , $\overline{CD} \perp \overline{AB}$. Find the diameter if $CD = 6$ and $DB = 4$.

- A. $2\sqrt{6}$
- B. $4\sqrt{6}$
- C. 9
- D. 13
- E. NOTA



22. Find the area of a circle formed by a plane 4 units from the center of a sphere with diameter 10 units.

- A. 3π
- B. 6π
- C. 9π
- D. 12π
- E. NOTA

23. Find the volume of the figure formed by rotating the graph of $y = \sqrt{4 - x^2}$ with a restricted domain of $0 \leq x \leq 2$ around the y axis.

- A. 2π
- B. 4π
- C. $\frac{16}{3}\pi$
- D. $\frac{32}{3}\pi$
- E. NOTA

24. Find the equation of a circle that passes through the points $A(1,-2)$, $B(5,4)$, and $C(10,5)$.

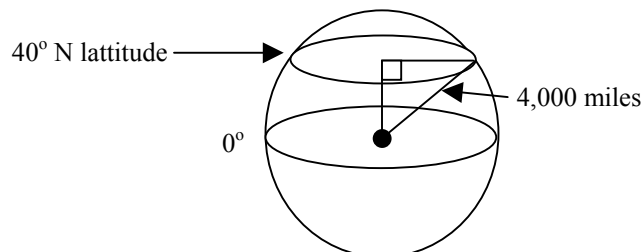
- A. $x^2 + y^2 - 6x - 2y - 3 = 0$
- B. $x^2 + y^2 - 11x - 3y = 0$
- C. $x^2 + y^2 - 15x - 9y + 70 = 0$
- D. $x^2 + y^2 - 18x + 6y + 25 = 0$
- E. NOTA

25. Two circles intersect at a single point $(9,4)$. One circle has center $(1,10)$, and the other circle has center $(13,1)$. What is the equation of the common tangent to the two circles passing through $(9,4)$?

- A. $y = \frac{3}{4}x - \frac{11}{4}$
- B. $y = -\frac{3}{4}x + \frac{43}{4}$
- C. $y = \frac{4}{3}x - 8$
- D. $y = -\frac{4}{3}x + 16$
- E. NOTA

26. The radius of the earth is 4,000 miles. How far is a city located on the 40° N. latitude from the axis passing through the north and south poles to the nearest hundredth of a mile?

A. 2571.15
 B. 3064.18
 C. 5221.63
 D. 6222.90
 E. NOTA



27. A bicycle has a front and back wheel each with diameter 24 in. The horizontal distance between the centers of the front and back 24-inch wheels is 12π inches. The bicycle travels at a constant rate so that the 24-inch wheels rotate every 4 seconds. The bicycle runs over a freshly painted parking strip and each wheel picks up a narrow spot of fresh paint. From the time the front 24-inch wheel goes over the paint strip, how many seconds will it take for the back 24-inch wheel to go over the paint strip?

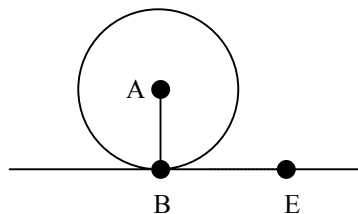
A. 1 B. 2 C. 3 D. 4 E. NOTA

28. Given the circle with equation $x^2 + y^2 = 36$, which of the following points are in the exterior of the circle?

A. (-4,4) B. (-6,0) C. $(2\sqrt{2}, 2\sqrt{7})$ D. (4,-5) E. NOTA

29. The distance of a point E to the center A, of a circle is 20. The circumference of the circle is 10π . A line through E is tangent to the circle at B. Find BE.

A. $5\sqrt{15}$
 B. $10\sqrt{5}$
 C. $15\sqrt{5}$
 D. $5\sqrt{10}$
 E. NOTA



30. In each statement below, the figures are coplanar. Which of the following statements is false?

A. A point which is a midpoint of two chords of a circle is the center of the circle.
 B. A tangent to a circle at the midpoint of an arc is parallel to the chord of the arc.
 C. If a line is a perpendicular bisector of a chord of a circle, then it bisects the minor arc of the chord.
 D. Two tangents to the same circle may be perpendicular to each other.
 E. NOTA