

CIRCLES TOPIC TEST

FAMAT STATE CONVENTION 2009
THETA DIVISION

For all questions, choice **E** is **NOTA**,
meaning "None of These Answers."

All diagrams are coplanar and are
not necessarily drawn to scale.

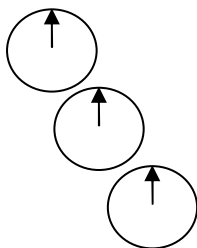
1. Consider a sphere. If the area of its great circle is 36π , then what is the volume of the sphere?

- A) 144π
- B) 196π
- C) 288π
- D) 324π
- E) NOTA

2. Three circular dials spin, each at its own constant rate. The first dial makes exactly 3 complete rotations per hour. The second and third dials make exactly 5 and 6 complete rotations per hour, respectively.

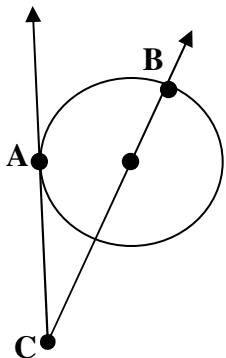
If all three dials point due north at 1:00 PM, then what is the next time at which they will all point due north again?

- A) 1:30 PM
- B) 1:45 PM
- C) 2:00 PM
- D) 2:30 PM
- E) NOTA



3. \overline{BC} passes through the center of the circle shown, and \overline{AC} is tangent to the circle at A . If $\angle A$ measures 100° , then find $m\angle BCA$.

- A) 10°
- B) 20°
- C) 25°
- D) 40°
- E) NOTA

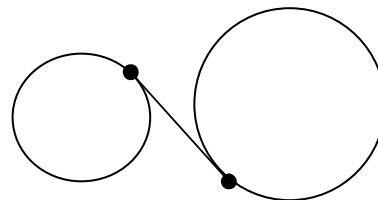


4. Consider the circle defined by the equation $(x+2)^2 + (y-1)^2 = 3$. In how many quadrants of the Cartesian plane does the circle lie?

- A) 1
- B) 2
- C) 3
- D) 4
- E) NOTA

5. Two circles have radii measuring 14 and 22. Their centers are 45 units apart. Find the length of one of the internal tangent segments.

- A) 18
- B) 14
- C) 27
- D) 28
- E) NOTA

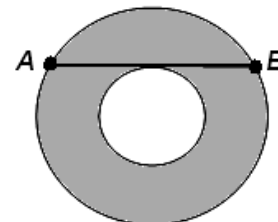


6. When a circle's circumference is increased by 20%, its area increases by what percent?

- A) 20%
- B) 44%
- C) 88%
- D) 400%
- E) NOTA

7. Consider two distinct concentric circles. Chord \overline{AB} of the larger circle is tangent to the inner circle. If $AB = 12$, then find the area of the annulus (shaded in the diagram).

- A) 24π
- B) 36π
- C) 72π
- D) 108π
- E) NOTA

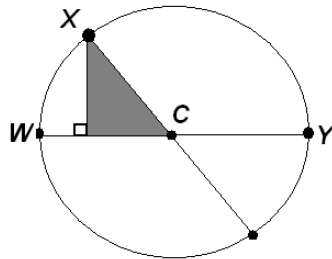


8. Quadrilateral $ABCD$ is inscribed in a circle. If $m\angle A = 80^\circ$, then find $m\angle C$.

A) 80°
B) 90°
C) 100°
D) 120°
E) NOTA

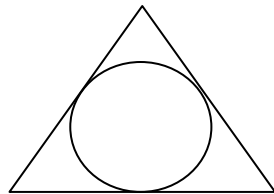
9. In the circle shown below with center C , diameter $WY = 12$ and $m\widehat{XY} = 135^\circ$. What is the area of the shaded triangle?

A) 9
B) 12
C) 18
D) 24
E) NOTA



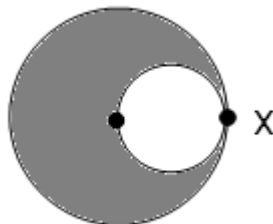
10. A circle is inscribed in an equilateral triangle with an area of $108\sqrt{3}$. Find the radius of the circle.

A) 6
B) 12
D) 18
E) 24
E) NOTA



11. Two circles are internally tangent at point X , as shown. The smaller circle passes through the center of the larger circle. If the radius of the smaller circle is 2, then find the area of the shaded region.

A) 8π
B) 10π
C) 12π
D) 14π
E) NOTA

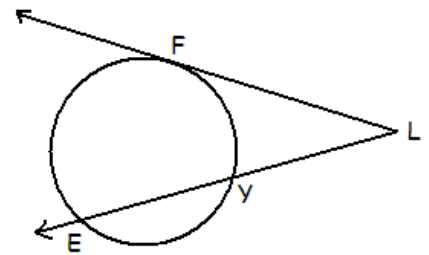


12. Six concentric circles have radii in an arithmetic sequence. The innermost circle's radius is 5, and the outermost circle's radius is 35. Find the area of the annulus between the third largest and fourth largest circles.

A) 175π
B) 180π
C) 225π
D) 240π
E) NOTA

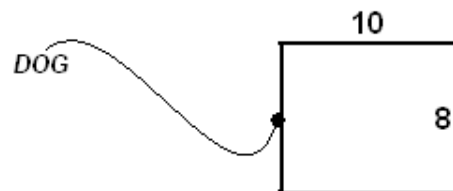
13. \overline{LF} is tangent to the circle shown below at F , and \overline{LE} intersects the circle at both Y and E . If $LF = 12$ and $LY = 8$, then find the length of \overline{EY} .

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



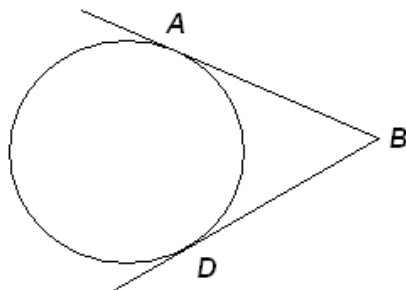
14. A rectangular shed's dimensions are 8 ft by 10 ft. A dog is tied to the center of one of the outer 8-foot walls with a 20-foot rope. The dog's available roaming area is $M\pi$ square feet. Find the sum of the digits of M .
(The rope is tied at ground level; disregard the length and height of the dog.)

A) 9
B) 11
C) 13
D) 15
E) NOTA



15. In the circle with center C , \overline{AB} and \overline{BD} are tangent to the circle at points A and D , respectively. If $CB = 4$ and $AB = AD$, then find the circle's area.

- A) 3π
B) 4π
C) 6π
D) 8π
E) NOTA

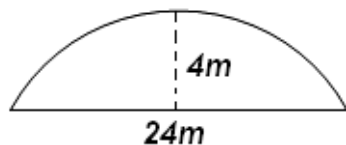


16. Points Q and R lie on a circle with center C . The diameter of the circle measures 36. If $m\angle QCR = 40^\circ$, then what exactly is the length of minor arc \overline{QR} ?

- A) 2π
B) 3π
C) 4π
D) 9π
E) NOTA

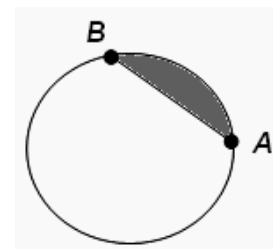
17. A bridge over a river has the shape of a circular arc. The span of the bridge along the ground measures 24 meters. (The span is the length of the chord of the arc.) The midpoint of the arc is 4 meters higher than the endpoints. What is the radius of the circle that contains this arc?

- A) 15m
B) 18m
C) 20m
D) 24m
E) NOTA



18. In the circle shown below, minor arc \overline{AB} measures 120° and $AB = 12$. Find the area of the segment defined by \overline{AB} (shaded in the diagram).

- A) $16\pi - 12\sqrt{3}$
B) $24\pi - 12$
C) $30\pi - 18\sqrt{3}$
D) $36\pi - 18$
E) NOTA



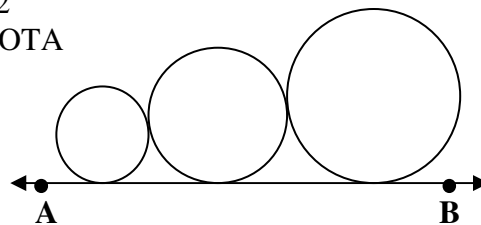
19. Six distinct points are chosen on a circle. How many distinct chords have two of these points as endpoints?

- A) 12
B) 15
C) 18
D) 24
E) NOTA

20. Three circles are arranged in a row, such that the circles on the ends are tangent to the middle circle, as shown below. The centers of the three circles are collinear, and all three circles are tangent to \overline{AB} .

If the circles on the ends have radii measuring 6 and 10, then the area of the circle in the middle is $M\pi$. Find the sum of the digits of M .

- A) 6
B) 9
C) 10
D) 12
E) NOTA



21. A circle centered at $(4, -1)$ on the Cartesian plane has a radius measuring 10. Find the sum of the circle's x -intercepts.

- A) 8
- B) $3\sqrt{11}$
- C) 12
- D) $6\sqrt{11}$
- E) NOTA

22. A right triangle with legs measuring 6 and 8 is inscribed in a circle. A point in the circle is selected at random. The probability that this

point is also inside the triangle is $\frac{k}{\pi}$.

Find the hundredths digit of k .

- A) 2
- B) 4
- C) 6
- D) 8
- E) NOTA

23. Eleanor wants to represent the data below in a pie graph. What should the measure of the central angle of the "Math" sector be?

- A) 64°
- B) 72°
- C) 80°
- D) 90°
- E) NOTA

Favorite Subject	# of students
Math	16
English	18
History	14
Art	9
Other	15

24. A circle's area is 30π more than half its circumference. If the area of the circle is $M\pi$, then find the sum of the digits of M .

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

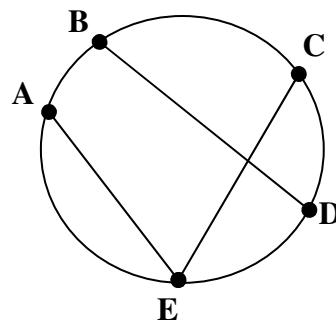
25. A circular wheel's radius measures 7 inches. The wheel is rolled down a smooth 10-foot long ramp. How many complete revolutions does the wheel make?

- A) 2
- B) 3
- C) 5
- D) 6
- E) NOTA

26. Points $A, B, C, D,$ and E lie on the circle shown.

Chords \overline{BD} and \overline{CE} intersect at point X . If $m\angle EXB = 100^\circ$, $m\angle AEC = 70^\circ$, and $m\widehat{DE} = 50^\circ$, then find the measure of minor arc \widehat{AB} .

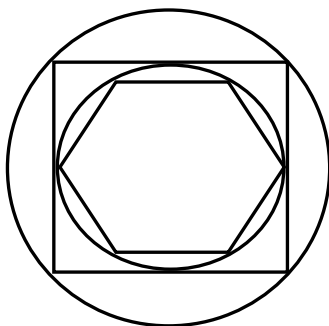
- A) 20°
- B) 30°
- C) 40°
- D) 50°
- E) NOTA



27. A regular hexagon is inscribed in a circle, which is inscribed in a square, which is inscribed in a circle, as shown.

If the area of the hexagon is $36\sqrt{3}$, then the area of the larger (outer) circle is $M\pi$. Find the units digit of M .

- A) 2
B) 4
C) 6
D) 8
E) NOTA



28. In the Cartesian Plane, a triangle's vertices are at the points $(0,0)$, $(8,2)$, and $(4,6)$. The circle circumscribed about the triangle has center (m,n) . Find the tenths digit of m .

- A) 2
B) 4
C) 6
D) 8
E) NOTA

29. Two chords of a circle are congruent. Which of the following must true of the chords?

- I. They are parallel.
II. Their intercepted arcs are congruent.
III. They are equidistant from the center of the circle.

- A) I and II only
B) I and III only
C) II and III only
D) I, II, and III
E) NOTA

30. In the diagram shown, a circle passes through two adjacent vertices of a square, and is tangent to the opposite side of the square.

If one side of the square measures 6, then the area of the circle is $\frac{A\pi}{B}$, where A and B are positive and relatively prime integers.

Find the units digit of $(A+B)$.

- A) 1
B) 3
C) 5
D) 7
E) NOTA

