CIRCUMFERENCE/PERIMETER/AREA/VOLUME
Mu Alpha Theta National Convention 2003

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

1. Which CANNOT be the perimeter of an equilateral triangle with integer side lengths?
   A. 16
   B. 24
   C. 36
   D. 48
   E. NOTA

2. The altitude to the hypotenuse of a right triangle divides the hypotenuse into segments of length 6 and 8. Find the area of the triangle.
   A. $4\sqrt{3}$
   B. $28\sqrt{3}$
   C. 48
   D. $56\sqrt{3}$
   E. NOTA

3. Two non-congruent circles are externally tangent. Each base of an isosceles trapezoid is a diameter of one of the circles. If the distance between the centers of the circles is 8, what is the area of the trapezoid?
   A. 16
   B. 32
   C. 64
   D. cannot be determined
   E. NOTA

4. Semicircles drawn on each side of a triangle have areas of $9\pi, 16\pi,$ and 25π. What is the area of the triangle?
   A. 3
   B. 16
   C. 48
   D. 96
   E. NOTA

5. A chord 16 inches long is 15 inches from the center of a circle. What is the circumference of the circle?
   A. 16π
   B. 17π
   C. 32π
   D. 34π
   E. NOTA

6. In rectangle RSTV, point W is on $\overline{ST}$ such that TW is $\frac{1}{3}$ the length of $\overline{ST}$. If the area of $\triangle VWT$ is 6, what is the area of rectangle RSTV?
   A. 12
   B. 24
   C. 36
   D. 48
   E. NOTA

7. Find the volume of a cube if the diagonal of one face is $\sqrt{6}$.
   A. $\sqrt{3}$
   B. 3
   C. $3\sqrt{3}$
   D. 9
   E. NOTA

8. A square and a rectangle have equal areas. The length of the diagonal of the square is $6\sqrt{2}$. If the ratio of the width to the length of the rectangle is 1:4, find the perimeter of the rectangle.
   A. 30
   B. 36
   C. 48
   D. 72
   E. NOTA

9. A circle is inscribed in a square. Find the area outside the circle and inside the square given the diagonal of the square is $8\sqrt{2}$.
   A. $64-4\pi$
   B. $64-16\pi$
   C. $128-16\pi$
   D. $128-64\pi$
   E. NOTA

10. Two circles intersect and have a common chord 24 cm long. The centers of the circles are 21 cm apart. The radius of one circle is 13 cm. Find the circumference of the other circle.
   A. 32π
   B. 40π
   C. 42π
   D. 48π
   E. NOTA

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11. Find the volume of a sphere circumscribed about a cube with edges of length 6.

A. $108\sqrt{3}\,\pi$
B. $216\sqrt{3}\,\pi$
C. $324\sqrt{3}\,\pi$
D. $972\sqrt{3}\,\pi$
E. NOTA

12. A rhombus has diagonals 8 and $8\sqrt{3}$. What is the exact product of its perimeter and area?

A. 128
B. 1024
C. $512\sqrt{3}$
D. $1024\sqrt{3}$
E. NOTA

13. A sector of area 20π is cut from a circle of radius 10. Find the arc length of this sector.

A. 4π
B. 10π
C. 20π
D. 100π
E. NOTA

14. The diagonal of a cube is 18. Find the area of a face of the cube.

A. 6
B. 9
C. $36\sqrt{3}$
D. 108
E. NOTA

15. A square pyramid is inscribed in a circular cone such that they have the same vertex and the base of the pyramid is inscribed in the base of the cone. The common altitude is 18 and a side of the square is 15. Find the volume of the cone.

A. 675π
B. 1350π
C. 2025π
D. 4050π
E. NOTA

16. In $\triangle PQR$, $\angle$ Q is obtuse, $m\angle P = 45, PR = 10$, PQ=4. Find the area of $\triangle PQR$.

A. $10\sqrt{2}$
B. 20
C. $20\sqrt{2}$
D. 40
E. NOTA

17. In a circle, a chord 12 inches long is parallel to a tangent and bisects the radius drawn to the point of tangency. Find the circumference of the circle.

A. $2\pi\sqrt{3}$
B. 4π
C. $4\pi\sqrt{3}$
D. 12π
E. NOTA

18. A plane 15 inches from the center of a sphere intersects the sphere in a circle with an area of 400π square inches. Find the diameter of the sphere.

A. 10
B. 15
C. 25
D. 50
E. NOTA

19. Find volume of a right rectangular prism with length 4, height 3 and whose diagonal has length $5\sqrt{2}$.

A. 60
B. $60\sqrt{2}$
C. $60\sqrt{3}$
D. 120
E. NOTA

20. If the length of a rectangle is increased by 50%, by what % must the width be decreased if the area is to remain the same?

A. 20%
B. 30%
C. 40%
D. 50%
E. NOTA

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21. In $\triangle RIT$, $\overrightarrow{TA}$ bisects $\angle RTI$ with A on $\overline{RI}$. TR=9,RA=6,TI=12. Find the perimeter of $\triangle TRI$.

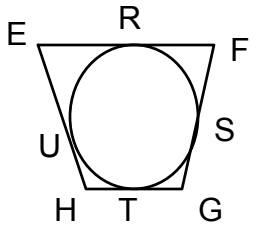
A. 27
B. 32
C. 35
D. 36
E. NOTA

22. Find the lateral surface area of the solid formed by revolving a line segment with endpoints $(2,-2)$ and (2,8) about the *y*-axis.

A. 40π
B. 48π
C. 112π
D. 160π
E. NOTA

23. Quadrilateral EFGH is circumscribed about circle Q. TURS are points of tangency. ER=RF and UH=SG. If FS=19 and GH=22, find the perimeter of EFGH. (Diagram not drawn to scale.)

A. 88
B. 114
C. 120
D. cannot be determined
E. NOTA



24. Find the volume of a rectangular solid which has length 12, height 8 and total surface area of 592.

A. 10
B. 96
C. 480
D. 960
E. NOTA

25. A spherical ball of radius 3 cm has a hollow center of radius 2 cm. What is the volume of the shell?

A. $\frac{4}{3}\pi$
B. $\frac{32}{3}\pi$
C. 20π
D. $\frac{76}{3}\pi$
E. NOTA

26. When the radius of a cylinder is doubled, how does the volume of the cylinder change?

A. doubles
B. triples
C. quadruples
D. 8 times as large
E. NOTA

27. A circle has its center at the origin and is tangent to the line $2x + y = 5$. Find the circumference of the circle.

A. $\sqrt{5}\pi$
B. 2π
C. $2\sqrt{5}\pi$
D. 4π
E. NOTA

28. A circle is inscribed in a right triangle. If the hypotenuse of the triangle is 20 and the radius of the circle is 4, find the perimeter of the triangle.

A. 40
B. $30+10\sqrt{3}$
C. $20+20\sqrt{2}$
D. 48
E. NOTA

29. A sphere is inscribed in a right circular cylinder. Find the ratio of the volume of the sphere to the volume of the cylinder.

A. 1:2
B. 5:8
C. 2:3
D. 3:4
E. NOTA

30. Two similar triangles have perimeters of 15 and 8. If the area of the larger triangle is 100, find the area of the smaller triangle rounded to the nearest tenth.

A. 14.2
B. 28.4
C. 40.1
D. 53.3
E. NOTA