

*F. M. J. B.*

Note: On this test, NOTA stands for "None of the Above," and figures are not drawn to scale.

1. The 3 sides of a right triangle can always be expressed as which of the following?

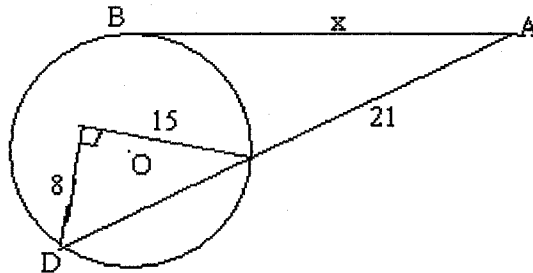
- A.  $a, b, \sqrt{\frac{a^2-2}{b^2-2}}+1$     B.  $a, b, a+b-2$     C.  $a, b, \sqrt{a^2+b^2}$     D.  $a, b, \sqrt{ab}$     E. NOTA

2. How many diagonals are in the regular polygon that has as many sides as an undecagon has diagonals?

- A. 971                      B. 945                      C. 927                      D. 902                      E. NOTA

3. AB is tangent to circle O. AD is a secant. What is the hundredths digit of x?

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



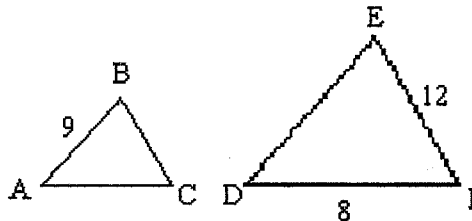
4. How many of the following sets of numbers are possible side lengths of a triangle?

- I. 4, 6, 7                      IV. 4, 6, 9  
II. 7, 10, 16                  V. 9, 53, 62  
III. 4, 0, 1                      VI. 1, 1000, 1000.375

- A. 2                      B. 3                      C. 4                      D. 5                      E. NOTA

5. If  $\triangle ABC$  is similar to  $\triangle DEF$ , what is the ratio of the area of  $\triangle ABC$  to  $\triangle DEF$ ?

- A. 3:4  
B. 9:16  
C. 81:64  
D. Cannot be determined  
E. NOTA



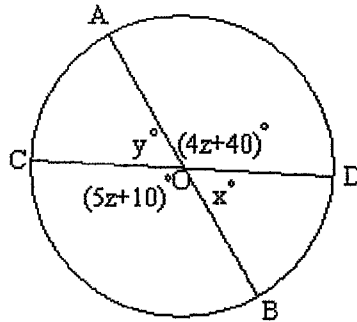
6. Two lines never touch each other. Which of these statements could be true?

- I. The lines are coincident.  
II. The lines intersect at the origin.  
III. The lines are in the same plane  
IV. The lines are in different planes

- A. II, III only              B. I, III, IV only    C. III, IV only              D. IV only              E. NOTA

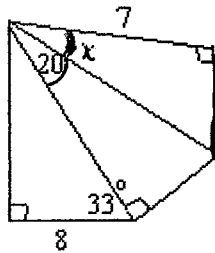
7. What is  $x + y$ ?  $\overline{AB}$  and  $\overline{CD}$  are diameters of circle O.

- A. 10  
B. 20  
C. 40  
D. 160  
E. NOTA



8. To the nearest tenth, what degree measure is angle  $x$ ?

- A. 32.7  
B. 36.4  
C. 41.8  
D. 46.4  
E. NOTA

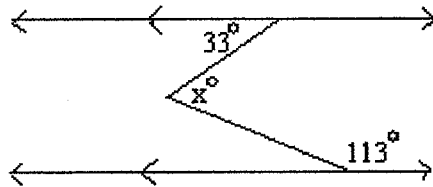


9. If the mean of the interior angle measures of a convex  $n$ -gon is 144, what is  $n$ ?

- A. 8      B. 9      C. 10      D. 11      E. NOTA

10. What is the degree measure of angle  $x$ ?

- A. 34  
B. 50  
C. 80  
D. 90  
E. NOTA



11. What is the equation of the line containing the points (3,6) and (7,11)?

- A.  $4y - 5x = 9$     B.  $4y - 5x = -9$     C.  $5y - 4x = -9$     D.  $5y - 4x = 9$     E. NOTA

12. What is the volume of the solid formed when the triangle with vertices (1,0), (7,8), and (7,0) is revolved about the  $x$ -axis?

- A.  $96\pi$       B.  $128\pi$       C.  $288\pi$       D.  $384\pi$       E. NOTA

13. An equilateral triangle and a square both have side length  $x$ . What is the ratio of the area of the triangle to the area of the square?

- A.  $\sqrt{3}:1$     B.  $\sqrt{3}:2$     C.  $\sqrt{3}:4$     D.  $1:1$     E. NOTA

14. If the length of an internal diagonal of a cube is  $4\sqrt{6}$  inches, what is the area of one face?

- A.  $16\sqrt{6} \text{ in}^2$     B.  $16\sqrt{3} \text{ in}^2$     C.  $32 \text{ in}^2$     D.  $48 \text{ in}^2$     E. NOTA

15. What is the name given to the point where the perpendicular bisectors of a triangle meet?

- A. Orthocenter    B. Centroid    C. Circumcenter    D. Incenter    E. NOTA

16. What is the maximum number of regions into which 4 congruent circles can divide a plane?

- A. 13    B. 14    C. 15    D. 16    E. NOTA

17. Given a regular hexagon  $ABCDEF$  circumscribed about circle  $O$ , which is circumscribed about equilateral triangle  $GHI$ . Triangle  $JKL$  has as its vertices the midpoints of the sides of triangle  $GHI$ . If  $BE = 24$ , what is the area of triangle  $JKL$ ?

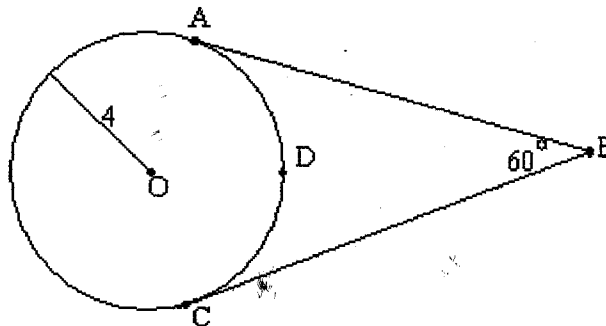
- A.  $\frac{81\sqrt{3}}{8}$     B.  $\frac{81\sqrt{3}}{4}$     C.  $\frac{81\sqrt{3}}{2}$     D.  $81\sqrt{3}$     E. NOTA

18. If square  $A$  is inscribed in circle  $O$ , and square  $B$  is inscribed in semicircle  $P$  (of identical radius to  $O$ ), then the ratio of the area of square  $B$  to the area of square  $A$  is

- A.  $< \frac{1}{2}$     B.  $= \frac{1}{2}$     C.  $> \frac{1}{2}$     D. Cannot be Determined    E. NOTA  
Without Actual Radius

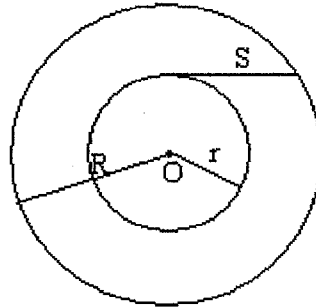
19.  $BA$  and  $BC$  are tangent to circle  $O$ .  $O$ ,  $B$ , and  $D$  are collinear. What is the area of  $\triangle ABD$ ?

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



20. Given concentric circles centered at O. If  $S = 40$  and  $R + r = 50$ , what is  $R - r$ ?

- A. 30  
B. 32  
C. 36  
D. 48  
E. NOTA



Note: R is the radius of the larger circle.

21. What is the lateral area of a rectangular pyramid with height 9 and base dimensions 24 X 80?

- A. 5760      B. 8640      C. 2184      D. 4104      E. NOTA

22. What is the area of a triangle with side lengths 5, 8, and 9?

- A.  $6\sqrt{11}$       B.  $3\sqrt{11}$       C.  $2\sqrt{17017}$       D. 20      E. NOTA

23. For Matt's birthday, his parents bought him a huge, cylindrical cake of radius 6 inches and height 12 inches. Matt first cut a slice (in the shape of a sector with vertex at the center) with an angle of 20 degrees. His sister, Monique, cut a 30 degree slice that did not share a side with Matt's slice (also in the shape of a sector with vertex at the center). When the 2 slices are removed, what is the total surface area (including the bottom), in inches squared, of the remaining cake?

- A.  $\frac{217\pi}{3} + 24$       B.  $372\pi$       C.  $186\pi + 288$       D.  $31\pi$       E. NOTA

24. Augie's favorite number is N. N has 3 digits and it is divisible by 7. It reads the same forwards and backwards. If  $7N + 133$  is the sum of the interior angles of a regular polygon, how many sides does this polygon have?

- A. 8      B. 9      C. 10      D. 11      E. NOTA

25. An equilateral triangle is placed inside a circle of radius 7. The triangle does not intersect the circle at any points. The area outside the triangle but inside the circle is shaded. If the area of the triangle is equal to the area of the shaded region, then the semiperimeter of the triangle

can be written as  $Q\sqrt{\frac{R\pi\sqrt{R}}{Z}}$ , where Q, R, and Z are positive integers and Z is not divisible by the square of any prime. What is the product of Q, R, and Z?

- A. 42      B. 48      C. 56      D. 70      E. NOTA

26. A fully inflated spherical ball of uniform thickness 1 inch (and empty center) is circumscribed by a 12 in X 12 in X 12 in cube. If the ball is removed from the cube, melted down, and poured into a very long, empty cylinder with radius 2 inches, how high, in inches, will the melted ball rise?

A.  $\frac{91}{3}$       B. 91      C.  $\frac{728}{3}$       D.  $91\pi$       E. NOTA

27. Fred the dachshund is attached to the corner of an 80 ft X 100 ft building by a 30 yd chain and wishes to explore the land. How much **more** land, in square feet, would Fred be able to explore were the building not present? Fred, like most dachshunds, is of negligible size. (Note: When the building is removed, one end of Fred's chain is still anchored to the ground.)

A.  $1000\pi$       B.  $1500\pi$       C.  $2000\pi$       D.  $2500\pi$       E. NOTA

28. Euclid the giant was standing 10 feet away from a 20-foot-tall light pole and noted, "Wow! My shadow's length in feet is exactly three times my height in feet!" If Euclid was 2 feet tall on his first birthday (when he turned 1 year old), and he grows at a constant rate of 1 inch per month, how many years old was he when he made this statement? (Note: Round down, as you normally would when announcing your age.)

A. 15      B. 18      C. 9      D. 17      E. NOTA

29. The Greek letter  $\sum$  (sigma) is commonly used to indicate a sum in the following fashion: the number on the bottom is the starting number, the number on the top is the ending number, and whatever lies after the sigma is what needs to be summed. For example,  $\sum_{n=3}^{19} (n^2)$  would translate to  $3^2 + 4^2 + 5^2 \dots + 18^2 + 19^2$ , or 2465. What is  $\sum_{x=1}^6 (f(x))$ , where  $f(x)$  = the surface area of a regular tetrahedron of side length  $x$ ?

A.  $\frac{147\sqrt{2}}{4}$       B.  $91\sqrt{3}$       C. 546      D. 441      E. NOTA

30. A cylinder of radius 6 is inscribed in a cone of radius 10 and height 12. How tall is the cylinder?

A. 4.8      B. 3.6      C. 6      D. 2.4      E. NOTA