

The abbreviation **NOTA** means "None of These Answers."  
Diagrams are not necessarily drawn to scale.

1. The great circle of a sphere has area 6. What is the surface area of the sphere?

A.  $\frac{6}{\pi}$       B.  $\sqrt{\frac{6}{\pi}}$       C. 24      D.  $24\pi$       E. NOTA

2. A cone has slant height 5 and diameter 6. What is the volume of the cone?

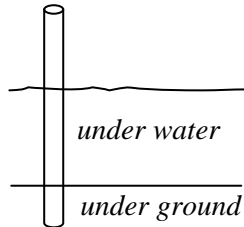
A.  $12\pi$       B.  $15\pi$       C.  $36\pi$       D.  $45\pi$       E. NOTA

3. A sphere has volume  $36\pi$  and is inside a right circular cylinder so that the sphere is tangent to both bases and the cylinder has the least possible diameter and height. What is the volume of the cylinder?

A.  $81\pi$       B.  $54\pi$       C.  $36\pi$       D.  $27\pi$       E. NOTA

4. A right cylindrical pole is vertical so that  $\frac{1}{8}$  of the pole is under ground,  $\frac{1}{4}$  is above ground but under water, and 20 inches are above water. If the radius of the pole is 2 inches then what is the volume of the pole in cubic inches?

A.  $8\pi$   
B.  $32\pi$   
C.  $64\pi$   
D.  $128\pi$   
E. NOTA

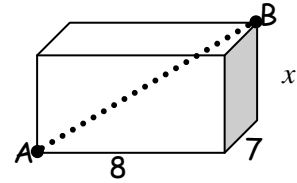


5. A water tower is in the shape of a right circular cylinder of inner height 20 feet, and inner radius 6 feet. It is half-filled with water. A spherical ball is dropped into the tower and completely submerges. The water level rises to 12 feet. What is the volume of the spherical ball, in cubic feet?

A.  $72\pi$       B.  $36\pi$       C. 72      D. 36      E. NOTA

6. A right rectangular solid has dimensions 7, 8 and  $x$ . What is the greatest possible integral value of  $x$  so that the diagonal ( $\overline{AB}$  shown) is less than 12?

A. 5                      B. 6                      C. 15                      D. 16                      E. NOTA



7. A right square pyramid has base edges 1 each and height  $x$ . The total surface area of the pyramid is  $1 + \sqrt{2}$ . Give the value of  $x$ .

A.  $\frac{1}{8}$                       B.  $\frac{1}{6}$                       C.  $\frac{1}{4}$                       D.  $\frac{1}{2}$                       E. NOTA

8. A cube has each edge 4 and is composed of 64 smaller cubes with each edge 1. The cubes are originally unpainted and then the large cube is painted pink on its surface. What fraction of the smaller cubes have one and only one pink face?

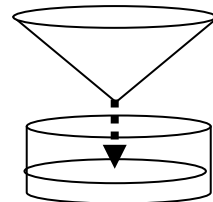
A.  $\frac{5}{8}$                       B.  $\frac{3}{8}$                       C.  $\frac{1}{4}$                       D.  $\frac{1}{6}$                       E. NOTA

9. A cone has height 12 and radius 4. A regular hexagonal pyramid has height 12. Their bases are on the same plane. Each cross section of both solids, parallel to the base plane and the same distance from it has the same area. What is the ratio of the volumes of the two solids?

A.  $\frac{1}{\pi}$                       B.  $\frac{\pi}{4}$                       C.  $\pi$                       D. 1                      E. NOTA

10. A conical coffee container has diameter 10 inches and height 12 inches. It is draining into a right circular cylindrical container with height 50 inches and radius 8 inches. The cylinder is initially empty. If the cone begins full, and stops dripping when it is empty, then what is the height in inches of coffee in the cylinder when the cone is empty?

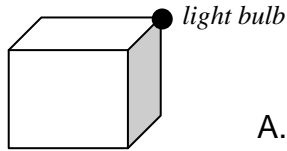
A. 50                      B. 25                      C.  $\frac{25}{4}$   
D.  $\frac{25}{16}$                       E. NOTA



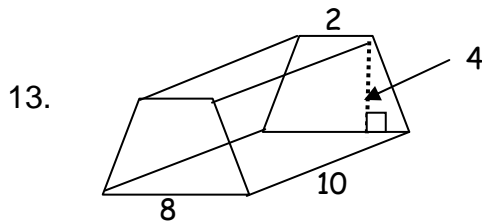
11. A convex polyhedron has 54 edges and 40 faces. How many vertices does it have?

- A. 26      B. 24      C. 16      D. 14      E. NOTA

12. A light bulb is at the corner of the roof of a building which is a right rectangular solid. The building has dimensions 10 by 10 by 12 feet. The light shines at "acceptable brightness for security purposes" for a radius of 2 feet from the bulb. How many cubic feet does the light illuminate at "acceptable brightness" ?



- A.  $\frac{4\pi}{3}$       B.  $\frac{8\pi}{3}$       C.  $8\pi$       D.  $\frac{28\pi}{3}$       E. NOTA



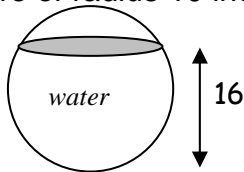
A right prism has bases which are isosceles trapezoids. The trapezoids have parallel sides of lengths 2 and 8 respectively. The prism height is 10 and base height is 4. Find the total surface area of the prism.

- A. 400      B. 240      C. 220      D. 100      E. NOTA

14. A regular right hexagonal pyramid has height  $\sqrt{13}$  and slant height 5. What is the volume of the pyramid?

- A.  $8\sqrt{39}$       B.  $6\sqrt{39}$       C.  $16\sqrt{13}$       D.  $39\sqrt{3}$       E. NOTA

15. A sphere of radius 10 inches is filled with water so that the water is 16 inches high.

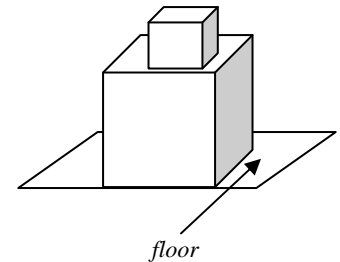


What is the surface area of the water (shaded) in square inches?

- A.  $64\pi$       B.  $36\pi$       C.  $12\pi$       D.  $6\pi$       E. NOTA

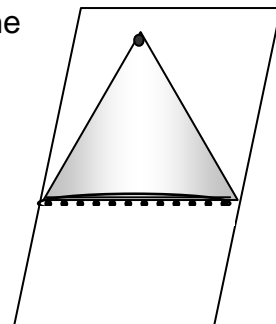
16. A cone has height that is twice its radius. If the cone has volume  $18\pi$  then what is its height?
- A. 1      B. 3      C. 6      D. 9      E. NOTA
17. The surface area of sphere A is four times that of sphere B. What is the ratio of the volume of the smaller sphere to that of the larger sphere?
- A. 1:4      B. 1:6      C. 1:8      D. 1:64      E. NOTA
18. How many planes of symmetry does a right square pyramid have?
- A. 8      B. 4      C. 2      D. 0      E. NOTA
19. How many planes of symmetry does a sphere have?
- A. 8      B. 4      C. 2      D. 0      E. NOTA
20. A cube is on the floor and five faces are showing. A smaller cube is then placed on top as shown, so five of its faces are showing. If the cubes have edges 6 and 3 respectively, then when they are stacked as shown, what fraction of the total surface area of both cubes is showing?

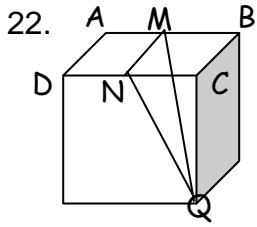
- A.  $\frac{2}{3}$       B.  $\frac{4}{5}$       C.  $\frac{5}{6}$       D.  $\frac{9}{10}$       E. NOTA



21. A cone is cut by a plane so that the plane contains the vertex of the cone as well as one of its diameters. The height and radius of the cone are whole numbers. The cross section of the intersection of the cone and plane has area 12. Which could **NOT** be the volume of the cone?

- A.  $4\pi$       B.  $10\pi$       C.  $16\pi$       D.  $24\pi$       E. NOTA





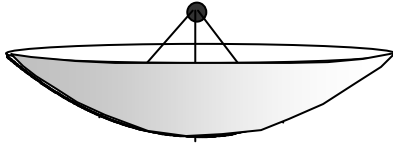
A cube of edge 4 has one face square ABCD. The midpoint of  $\overline{AB}$  is M and the midpoint of  $\overline{CD}$  is N. Opposite of square ABCD, is square PQRS. Find the area of triangle MNQ.

- A.  $4\sqrt{5}$       B.  $4\sqrt{3}$       C. 8      D.  $8\sqrt{2}$       E. NOTA

23. A segment is on line  $f(x) = \frac{1}{2}x$  with endpoints (0,0) and (2,  $f(2)$ ). The segment is rotated about the x-axis. What is the lateral surface area of the resultant shape?

- A.  $\pi$       B.  $\sqrt{2}\pi$       C.  $\sqrt{3}\pi$       D.  $\sqrt{5}\pi$       E. NOTA

24. A satellite dish has vertical cross sections which are parabolas. The receiver of the dish is at the focus of the largest cross section which contains the minimum point of the dish, and the diameter of the largest horizontal circular cross section of the dish.



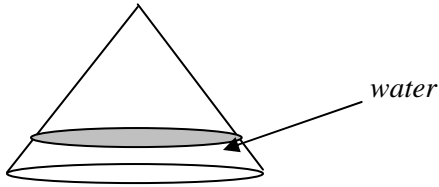
If the dish is 10 feet wide and 4 feet deep how far from the bottom of the dish is the receiver? Disregard thickness of the dish in your computations.

- A. 25 feet      B.  $\frac{25}{4}$  feet      C.  $\frac{25}{8}$  feet      D.  $\frac{25}{16}$  feet      E. NOTA

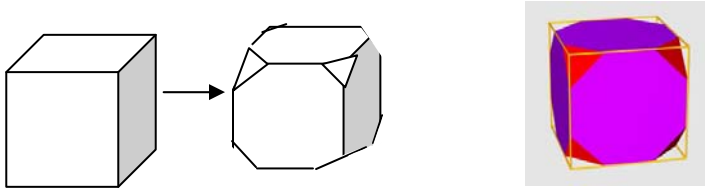
25. A rectangle 4 by 6 is rolled to make a cylinder of maximum height. One entire edge is joined with its opposite edge. The volume of the cylinder is  $\frac{A}{\pi}$ . Give the value of A.

- A. 3      B. 12      C. 24      D. 36      E. NOTA

26. Water is being poured into a right circular cone, vertex up. The cone has diameter 8 and height 4. When the cone is  $\frac{1}{8}$  filled (volume of water is  $\frac{1}{8}$  of the volume of the cone) then give the distance of the water's surface from the vertex or top of the cone.



- A.  $\frac{7}{2}$       B.  $2\sqrt[3]{7}$       C. 2      D.  $\frac{\sqrt[3]{4}}{2}$       E. NOTA
27. A solid cube has each edge 4 cm and all vertices are then truncated (chopped off) so that the "new" faces created are each equilateral triangles with sides 1 cm each.

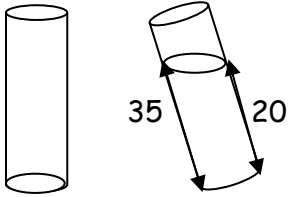


The surface area of the truncated solid is  $A + B\sqrt{C}$  for  $C$  a prime number. Give the value of  $A + B + C$ .

- A. 15      B. 90      C. 95      D. 96      E. NOTA
28. A sphere has volume  $36\pi$ . What is its surface area?
- A.  $20\pi$       B.  $27\pi$       C.  $30\pi$       D.  $36\pi$       E. NOTA
29. A spherical gumball has a candy coating that is one inch thick. If there  $\frac{364\pi}{3}$  cubic inches of candy, then how many cubic inches of gum is there?

- A.  $216\pi$       B.  $288\pi$       C.  $\frac{500\pi}{3}$       D.  $125\pi$       E. NOTA

30. A right cylindrical cup has water in it. The cup is tilted so that the surface of the water (shown) has lowest point 20 inches above the lower base, and the highest point 35 inches above the base. The surface of the water in the tilted position has a maximum width of 17 inches.



Find the number of cubic inches of water in the cup.

- A.  $320\pi$     B.  $340\pi$     C.  $400\pi$     D.  $440\pi$     E. NOTA

