

1. The pyramid of Khufu, a regular square pyramid, is the largest of all the Egyptian pyramids. It is 147 meters tall and each edge of its square base is 231 meters. What is the volume, in cubic meters, of the pyramid of Khufu?

- a. 1029 b. 151,263 c. 2,614,689 d. 7,844,067 e. not given

2. A sphere has radius 6. A cone has radius 2 and height 6. The volume of the sphere is how many times greater than the volume of the cone?

- a. 24 b. 28 c. 32 d. 36 e. not given

3. What is the diameter of a sphere whose volume is numerically equal to twice its surface area?

- a. 6 b. 9 c. 12 d. 18 e. not given

4. A rectangular box with a base 6 inches by 8 inches has a diagonal of length 20 inches. Find the exact height of the box.

- a. $5\sqrt{3}$ b. $10\sqrt{2}$ c. $10\sqrt{3}$ d. $20\sqrt{3}$ e. not given

5. If the length and width of a rectangular solid are each diminished by 20%, by what percent must the height be increased if the volume is to remain unchanged?

- a. 80 b. 65.25 c. 56.5 d. 36 e. not given

6. In three dimensions, what is the set of all points for which $x = 0$?
- a. the origin b. a line parallel to the x-axis c. the yz-plane
 d. a plane containing the x-axis e. not given
7. A plane passes two centimeters from the center of a sphere with radius of four centimeters. What is the area of the circle of intersection?
- a. $12\pi \text{ cm}^2$ b. $16\pi \text{ cm}^2$ c. $18\pi \text{ cm}^2$ d. $20\pi \text{ cm}^2$ e. not given
8. The volume of a right circular cone is 96π cubic feet. Find the total surface area of this cone if its height is 8 feet.
- a. 96π b. 74π c. 60π d. 36π e. not given
9. The lateral area of a cylinder equals the surface area of a sphere. If the base radius of the cylinder is equal to the radius of the sphere, what is the ratio of the volume of the cylinder to the volume of the sphere?
- a. 1:3 b. 2:5 c. 3:2 d. 8:3 e. not given
10. What is the radius of a sphere, to the nearest hundredth, with center at the origin, that passes through point (2, 3, 4)?
- a. 3.32 b. 5.39 c. 3.00 d. 3.31 e. not given

11. If the sides of a cube are increased from 5 inches to 7 inches, find the percentage of increase in volume of the cube. Give your answer as a percentage, rounded to the nearest tenth

- a. 160.5% b. 174.4% c. 184.5% d. 210.0% e. not given

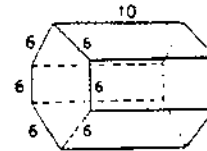
12. A square prism is inscribed in a cylinder with a radius six and height 10. What is the volume of this prism?

- a. 1080 b. 720 c. 360 d. 240 e. not given

13. Find the volume of the prism pictured on the right.

- a. $360\sqrt{3}$ b. $420\sqrt{3}$ c. $480\sqrt{3}$
 d. $540\sqrt{3}$ e. not given

Regular Hexagonal Prism



14. Two geometric solids are similar. The ratio of the volume of the larger geometric solid to the volume of the smaller geometric solid is 27 to 1. If a side of the smaller solid is of length 12, what is the length of the corresponding side of the larger solid?

- a. 4 b. 27 c. 36 d. 324 e. not given

15. How far down the altitude from the vertex of a right circular cone should a plane parallel to the base be passed to cut off a cone which will have a volume equal to one half the volume of the original cone. h is the height of the cone?

- a. $\frac{h}{8}$ b. $\frac{\sqrt[3]{4} h}{2}$ c. $\frac{h}{2}$ d. $\frac{\sqrt[3]{2} h}{3}$ e. not given

16. The sum of the volumes of two spheres is 105π cubic inches. The surface areas have the ratio 4 : 9. Find the volume of the larger sphere.

- a. 81π b. 42π c. $33\frac{4}{13}\pi$ d. 24π e. not given

17. A cylinder has a base radius of 2 and a height of 9. By how much does the lateral area exceed the sum of the areas of the two bases?

- a. 101 b. 96 c. 88 d. 81 e. not given

18. Find the radius of the sphere where the surface area is equal to the sum of the surface areas of two spheres having diameters of six centimeters and eight centimeters.

- a. $\sqrt{5}$ b. 2.5 c. 5 d. 10 e. not given

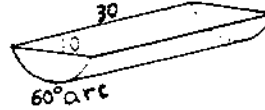
19. A cubical container without a top is to be made from plastic. It's outer dimensions are 5 cm by 5 cm by 5 cm and the walls and bottom are 0.25 cm thick. Find, in cubic centimeters, the volume of plastic used to make the container.

- a. 28.8125 b. 28.95 c. 57.125 d. 57.625 e. not given

20. The plane $ax + by + cz = 12$ intersects the x-axis at (2, 0, 0), the y-axis at (0, -3, 0), and the z-axis at (0, 0, -4). Find $a + b + c =$

- a. 13 b. 7 c. 6 d. 0 e. not given

21. A right cylindrical log was cut parallel to the axis. Find the volume of the piece shown.



- a. $450\pi - 600\sqrt{3}$ b. $650\pi - 500\sqrt{3}$
 c. $500\pi - 750\sqrt{3}$ d. $600\pi - 450\sqrt{3}$
 e. not given

22. For each vertex of a solid cube, consider the tetrahedron determined by the vertex and the midpoints of the three edges that meet at that vertex. The portion of the cube that remains when the eight tetrahedra are cut away is called a cuboctahedron. The ratio of the volume of the cuboctahedron to the volume of the original cube is closest to which of these?

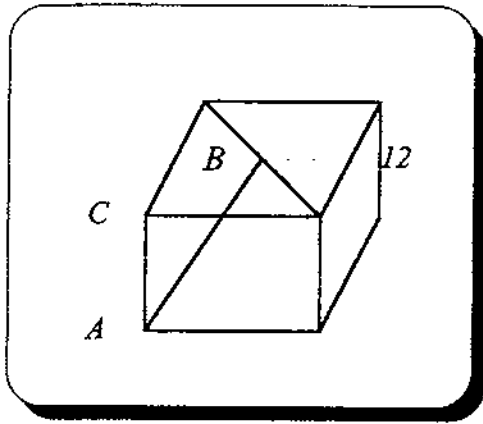
- a. 3 : 4 b. 39 : 50 c. 4 : 5 d. 5 : 6 e. not given

23. The region bounded by $y = 5$, $y = 2x - 1$, and the y -axis is rotated about the y -axis. What is the volume of the resulting cone?

- a. 14π b. 18π c. 20π d. 21π e. not given

24. A sphere of radius ten inches is sitting on a hole of radius six inches in a board. If the board is three-fourths inches thick, how far in inches does the sphere protrude from the bottom of the board?

- a. 1 inch b. 1.25 inches c. 1.5 inches d. 2 inches e. not given



25. Each edge of the cube shown is 12 cm. Find the exact distance from the midpoint of one of the top face diagonals to a vertex of the bottom face.

- a. $6\sqrt{2}$ b. $6\sqrt{3}$ c. $6\sqrt{6}$ d. $12\sqrt{2}$ e. not given

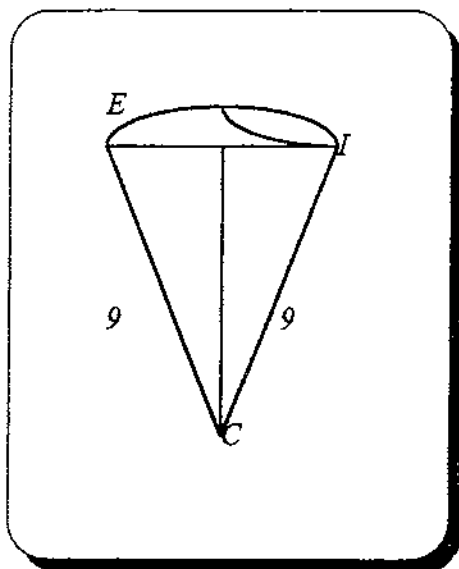
26. Find the volume, rounded to the nearest tenth, of the frustrum formed by cutting a regular square pyramid of altitude 8 inches and base edge 4 inches with a plane parallel to the base and cutting the altitude of the pyramid two inches from the vertex..

- a. 63.1 inches b. 61.1 inches c. 42.0 inches d. 24.0 inches e. not given

27. How far is the point (3, 5, 9) from the plane whose equation is $3x + 4y + 5z = 24$?

- a. $5\sqrt{2}$ b. $5\sqrt{3}$ c. $5\sqrt{5}$ d. $5\sqrt{6}$ e. not given

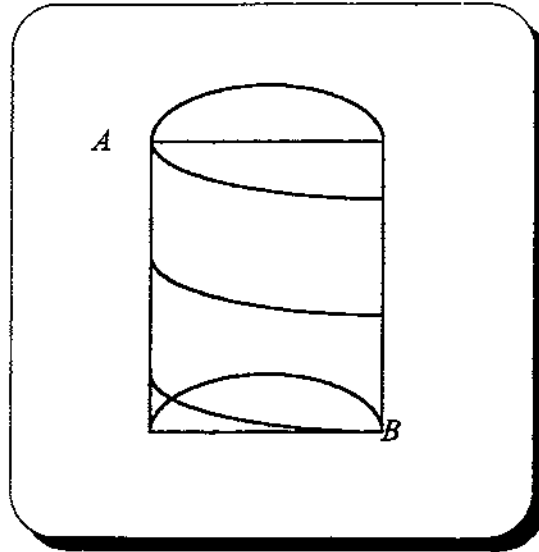
28. The ice cream below has a slant height of 9 cm and the $m\angle ICE = 40^\circ$. To the nearest hundredth, what is the lateral area (surface area without the base of the cone?)



- a. 9.67 b. 87.03 c. 174.06 d. 348.12 e. not given

29. A regular tetrahedron has coordinates $(0, 0, 0)$, $(6, 0, 0)$, $(a, b, 0)$, and (c, d, e) where a, b, c, d and e are all positive real numbers. Give exact values for (a, b, c, d, e) .

- a. $(\sqrt{3}, \sqrt{3}, \sqrt{3}, \sqrt{3}, \sqrt{3})$ b. $(\sqrt{3}, 3\sqrt{3}, 3\sqrt{3}, \sqrt{3}, 2\sqrt{6})$
 c. $(3, 3, 3, 3, 3)$ d. $(\sqrt{3}, 3\sqrt{3}, 3, \sqrt{3}, 2\sqrt{6})$
 e. not given



(Picture is NOT drawn to scale.)

30. B is the furthest point from A on the cardboard roll (a right circular cylinder) shown above. A lady bug has crawled from point A to point B in a perfect spiral crossing our plane of vision three times. If the height of the roll is eleven inches and the radius of the base is 1.5 inches, we nearest tenth) is the distance crawled by the ladybug?

- a. 4.4
- b. 22.2
- c. 26.0
- d. 27.0
- e. not given