

NOTA = None of these answers

1. What is the volume of a cube whose surface area is 96 square inches?

A. $16 \text{ in}^3$	B. $32 \text{ in}^3$	C. $64 \text{ in}^3$	D. $128 \text{ in}^3$	E. NOTA
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2. What is the greatest length, in inches, a pencil can be and still fit completely inside a 3x4x6 inch pencil holder?

A. 13 in	B. $\sqrt{41}$	C. $\sqrt{52}$	D. $\sqrt{61}$	E. NOTA
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3. If a sphere has a surface area of  $100\pi$ , what is its volume?

A. $\frac{400\pi}{3}$	B. $\frac{500\pi}{3}$	C. $\frac{700\pi}{3}$	D. $\frac{1000\pi}{3}$	E. NOTA
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4. A lampshade is in the shape of a right cone whose tip was cut off by a plane parallel to and 8 inches from the base of the shade. If the larger base has a 6 inch radius and a base angle of 60 degrees, what is the surface area of the outside of the lampshade, in square inches? (remember the shade is open on top and bottom, and do not count the inside surfaces of the lampshade)

A. $72\pi$	B. $64\sqrt{3} - \frac{128\pi}{3}$	C. $\left(\frac{88}{3} - 64\sqrt{3}\right)\pi$	D. $\frac{(128 + 192\sqrt{3})\pi}{3}$	E. NOTA
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5. A plane cuts through a sphere a distance of 7 feet from the center of a great circle. If the circumference of the cross section is  $48\pi$ , what is the surface area of the sphere, in square feet?

A. $2500\pi$	B. $15625\pi$	C. $9216\pi$	D. $110592\pi$	E. NOTA
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6. A conical ice cream cone is filled with densely packed ice cream capped by a disk that is the size of the circular opening of the cone. It is then surmounted by a half scoop (hemisphere) of ice cream. Joe, not aware of the disk, tries to insert a decoration, attached to a wooden skewer, into the cone. The skewer hits the diameter of the disk 1 centimeter from the outer edge, at a right angle and snaps off at the surface of the ice cream hemisphere. The length of the skewer stuck in the ice cream is  $2\sqrt{3}$  centimeters, what is the area of the disk, in centimeters?

A. $13\pi$	B. $\frac{196\pi}{3}$	C. $26\pi$	D. $\frac{196\pi}{5}$	E. NOTA
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7. A walking stick is formed by joining a cylindrical piece of wood with a 6 centimeter diameter and 30 centimeters long to a semicircular (half a torus) metal handle with the same 6 centimeter diameter. If the volume of the metal used is half the volume of the wood used, what is the length of the walking stick at its tallest point, in centimeters?

A. $33 + \frac{15\pi}{3}$	B. 33	C. $30 + 15\pi$	D. $33 + \frac{15}{\pi}$	E. NOTA
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8. An ice machine's shape is almost a 4 x 4 x 4 foot cube but the top front of the ice machine is truncated so that a prism with a  $45^\circ - 45^\circ$  right triangle base (area  $.5 \text{ ft}^2$ ) is removed to attach a flat lid to enable access to the ice. The ice machine is mistakenly left on so that it fills completely. How many cubic feet of ice are in the machine?

A. 62	B. 63.5	C. 64	D. $64 - 2\sqrt{2}$	E. NOTA
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9. Refer to problem number 8. What is the surface area of the hinged lid, in square feet?

A. $2\sqrt{2}$	B. $2\sqrt{3}$	C. $4\sqrt{2}$	D. $4\sqrt{3}$	E. NOTA
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10. The “Be Unique Shop” ordered unusual shopping bags to give their purchasing customers. The bag is constructed using two parallel isosceles (legs each 12 inches) trapezoids joined by parallelograms that connect the trapezoids’ corresponding legs and their short bases. Twenty nine inches of one inch wide material is used to make each of the two straps for the bag. Seams and the opening of the bag are bound with the same material used for the straps. If the opening of the bag is a 16 x 6 inch rectangle and the bottom of the bag is a 12 x 6 inch rectangle, how many total square inches of material are used to construct each bag?

A.  $358\sqrt{35}$       B.  $458\sqrt{35}$       C.  $330+56\sqrt{35}$       D.  $402+56\sqrt{35}$       E. NOTA

11. An overhead ceiling fan is made from a single rectangular blade tilted with a 30 degree angle of elevation. The blade is four feet in length with its midpoint as the center of rotation. If the blade has a width of 8 inches what is the volume (in cubic feet) swept out when the fan is on?

A. $\frac{32\pi}{3}$	B. $\frac{16\pi}{3}$	C. $\frac{8\pi}{3}$	D. $\frac{4\pi}{3}$	E. NOTA
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12. A New Year’s Eve noisemaker is a rectangular piece attached to a straight handle on its short side so that the handle and the short side of the rectangular piece intersect in infinitely many places. If the rectangular piece has a diagonal of 13 centimeters and a length of 12 centimeters, what is the volume swept out as it spins around, in cubic centimeters?

A. $144\pi$	B. $720\pi$	C. $27\pi$	D. $702\pi$	E. NOTA
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13. A regular hexagon with a side of 6 inches is attached to a rod that connects the midpoints of two opposite sides of the hexagon. The hexagon is then spun using the rod as an axis of rotation. What is the volume swept out as it spins around, in cubic inches?

A. $21\pi\sqrt{3}$	B. $63\pi\sqrt{3}$	C. $126\pi\sqrt{3}$	D. $189\pi\sqrt{3}$	E. NOTA
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14. What is the length of the space diagonal of an 8 x 10 x 12 rectangular solid?

A. 30	B. 15	C. 7.5	D. $2\sqrt{77}$	E. NOTA
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15. What is the outer surface area of an open topped cube box whose space diagonal is 10 inches? Do not count surfaces on the “inside” of the box.

A. $\frac{600}{3}$	B. $\frac{500}{9}$	C. $\frac{50000}{81}$	D. $\frac{500}{3}$	E. NOTA
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16. The line whose equation is  $2x + 3y = 6$ , the y-axis, and the x-axis form the sides of a triangle. If this triangle is rotated around the x-axis, what is the surface area of the shape that is formed, including the base of the resulting solid?

A. $6\pi\sqrt{13}$	B. $12\pi\sqrt{3}$	C. $4\pi + 2\pi\sqrt{13}$	D. $9\pi + 3\pi\sqrt{13}$	E. NOTA
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17. Pedro has a globe whose diameter is 16 centimeters. Radii drawn to the locations of two points on his globe form a 40 degree angle. How far apart on the surface of the globe are the two points, in centimeters?

A. $16\pi/9$	B. $8\pi/3$	C. $8\pi/9$	D. $32\pi/9$	E. NOTA
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18. A 120 degree angle is bisected by a line. If a point on the line is 10 inches from the closest side of the angle how far is the point from the vertex of the angle?

A. $5\sqrt{3}$ inches	B. 5 inches	C. 10 inches	D. $10\sqrt{3}$ inches	E. NOTA
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19. A spherical ball is resting on a table. If it rolls a distance of one foot in a quarter revolution, what is the volume of the ball?

A. $16\pi/3$	B. $32/3\pi$	C. $32/3\pi^2$	D. $\pi^3/3$	E. NOTA
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20. An isosceles trapezoid with a base angle of 135 degrees, whose upper base is 5 inches and lower base is 7 inches is rotated around its lower base. What is the surface area of the solid that is formed?

A. $10 + 2\sqrt{2}$	B. $12\pi\sqrt{2}$	C. $10\pi + 2\pi\sqrt{2}$	D. $5\pi + \pi\sqrt{2}$	E. NOTA
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21. A dihedral angle has the measure of  $15^\circ$  (degrees),  $31'$  (minutes), and  $4''$  (seconds). What is the measure of its supplement?

A. $164^\circ 28' 56''$	B. $74^\circ 28' 56''$	C. $165^\circ 38' 56''$	D. $344^\circ 28' 56''$	E. NOTA
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22. A triangle is drawn in a sphere so that one vertex is at the center of the sphere and the other two vertices, A and B, lie on the sphere. If the length of  $\widehat{AB}$  is  $6\pi$  feet and the radius of the sphere is 9 feet, what is the length of the line segment AB (which lies inside the sphere)?

A. 4.5 feet	B. $4.5\sqrt{3}$ feet	C. $9\sqrt{3}$ feet	D. 9 feet	E. NOTA
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23. A square based pyramid has a lateral edge whose length is 13 feet and a base edge length is 10 feet. How tall is the pyramid, in feet?

A. $\sqrt{69}$	B. $2\sqrt{11}$	C. $12\sqrt{69}$	D. $\sqrt{119}$	E. NOTA
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24. A satellite dish is a 100 degree segment of a sphere. If a 4 foot brace from one edge of the dish to the other passes over the center of the dish, what is the length of the radius of the sphere?

A. $2\sin(50^\circ)$	B. $2\cos(50^\circ)$	C. $2\tan(50^\circ)$	D. $2\sin(100^\circ)$	E. NOTA
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25. Two of the vertical walls of an attic room are 10 feet and 8 feet tall respectively. Measuring on the floor, the distance between these walls is 15 feet. If the two aforementioned walls are rectangles while the other two vertical walls are trapezoids, and if wall area of the room is 630 square feet, what is the volume of the room?

A. $5400 \text{ ft}^3$	B. $2700 \text{ ft}^3$	C. $7100 \text{ ft}^3$	D. $10800 \text{ ft}^3$	E. NOTA
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26. An office building is a square based right pyramid with the square being the foundation of the building. The outside walls of the building form a  $60^\circ$  dihedral angle with the foundation and the only two floors in the building are evenly spaced vertically. The lateral edges (the ones that meet at the vertex of the pyramid) of the building are 200 feet in length. What is the height of the first floor of the building?

A. $\sqrt{30}$	B. $2\sqrt{30}$	C. $2\sqrt{5}$	D. $20\sqrt{15}$	E. NOTA
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27. A coffee urn is in the shape of a cylinder. Belinda is using the urn to make hot spiced cider and while stirring the cider drops her one foot long wooden spoon into the urn. The spoon lands with one end against the base edge and the other end 2 inches below the opposite top edge, making a  $135^\circ$  angle with the vertical side of the urn. How many cubic feet of cider the urn can hold?

A. $(2\pi\sqrt{2} + \pi)/49$	B. $(3\pi\sqrt{2} + \pi)/48$	C. $(2\pi\sqrt{2} + 2\pi)/16$	D. $(4\pi + \sqrt{2})\pi/16$	E. NOTA
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28. An oblique cone has a base area of  $25\pi$  square inches and a  $10\sqrt{3}$  inch segment from the vertex to the center of the base that makes an  $120^\circ$  angle with the diameter. The cone is accidentally dropped into a cube shaped tank that is three quarters full of liquid. How much did the level of the liquid rise, if the diagonal of a side of the tank is 20 inches?

A. 2 inches	B. 3 inches	C. $5\pi/8$	D. $3\pi/16$	E. NOTA
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29.  $\overline{AB}$  is 10 centimeters in length and perpendicular to plane W at point B.  $\overline{CB}$  and  $\overline{DB}$  are congruent, lie in plane W and intersect to form a right angle. If the angle formed by  $\overline{AC}$  and  $\overline{CB}$  is thirty degrees, what is the surface area of the space figure ABCD?

A. $150 + 50\sqrt{3}$	B. $150 + 100\sqrt{3}$	C. $300 + 50\sqrt{3}$	D. $300 + 100\sqrt{3}$	E. NOTA
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30. Three congruent spheres are all externally tangent to each other. The area of the triangle formed by connecting the centers of the spheres is  $4\sqrt{3}$ . What is the surface area of one of the spheres?

A. $64\pi$	B. $\frac{64\pi}{3}$	C. $16\pi$	D. $\frac{16\pi}{3}$	E. NOTA
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