

Denver Math Club
March Meeting
3D Geometry

Half the volume of a 12 foot high cone-shaped pile is grade A ore while the other half is grade B ore. The pile is worth \$62. One-third of the volume of a similarly shaped 18 foot pile is grade A ore while the other two-thirds is grade B ore. The second pile is worth \$162. Two-thirds of the volume of a similarly shaped 24 foot pile is grade A ore while the other one-third is grade B ore. What is the value in dollars (\$) of the 24 foot pile?

Eight identical cubes with of size $1 \times 1 \times 1$ each have the numbers 1 through 6 written on their faces with the number 1 written on the face opposite number 2, number 3 written on the face opposite number 5, and number 4 written on the face opposite number 6. The eight cubes are stacked into a single $2 \times 2 \times 2$ cube. Add all of the numbers appearing on the outer surface of the new cube. Let M be the maximum possible value for this sum, and N be the minimum possible value for this sum. Find $M - N$.

A rectangular storage bin measures 10 feet by 12 feet, is 3 feet tall, and sits on a flat plane. A pile of dirt is pushed up against the outside of the storage bin so that it slants down from the top of the storage bin to points on the ground 4 feet away from the base of the storage bin. The number of cubic feet of dirt needed to form the pile can be written as $m + n\pi$ where m and n are positive integers. Find $m + n$.

A sphere is inscribed in a cube that has a surface area of 24 square meters. A second cube is then inscribed within the sphere. What is the surface area in square meters of the inner cube?

A cubic block with dimensions n by n by n is made up of a collection of 1 by 1 by 1 unit cubes. What is the smallest value of n so that if the outer two layers of unit cubes are removed from the block, more than half the original unit cubes will still remain?

We glue together 990 one inch cubes into a 9 by 10 by 11 inch rectangular solid. Then we paint the outside of the solid. How many of the original 990 cubes have just one of their sides painted?

A snowman is built on a level plane by placing a ball radius 6 on top of a ball radius 8 on top of a ball radius 10. If the average height above the plane of a point in the snowman is where m and n are relatively prime positive integers, find $m + n$.

A container is shaped like a square-based pyramid where the base has side length 23 centimeters and the height is 120 centimeters. The container is open at the base of the pyramid and stands in an open field with its vertex pointing down. One afternoon 5 centimeters of rain falls in the open field partially filling the previously empty container. Find the depth in centimeters of the rainwater in the bottom of the container after the rain.

A right circular cone has a height equal to three times its base radius and has volume 1. The cone is inscribed inside a sphere as shown. The volume of the sphere is m/n , where m and n are relatively prime positive integers. Find $m + n$.

You have a collection of small wooden blocks that are rectangular solids measuring $3 \times 4 \times 6$. Each of the six faces of each block is to be painted a solid color, and you have three colors of paint to use. Find the number of distinguishable ways you could paint the blocks. (Two blocks are distinguishable if you cannot rotate one block so that it looks identical to the other block.)