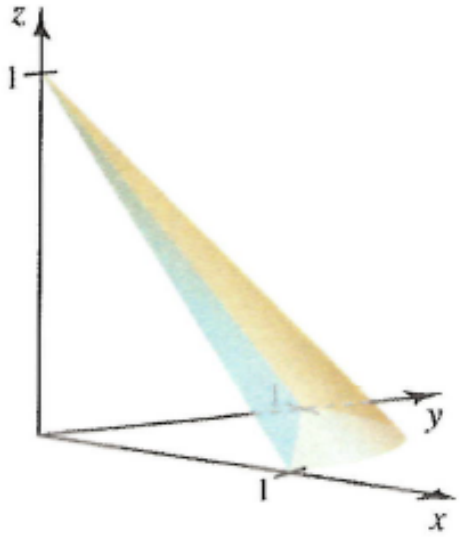
Problem 1: Find the volume of the solid S in the first octant that is bounded by the cone $z = 1 - \sqrt{x^2 + y^2}$ and the plane $x + y + z = 1$.

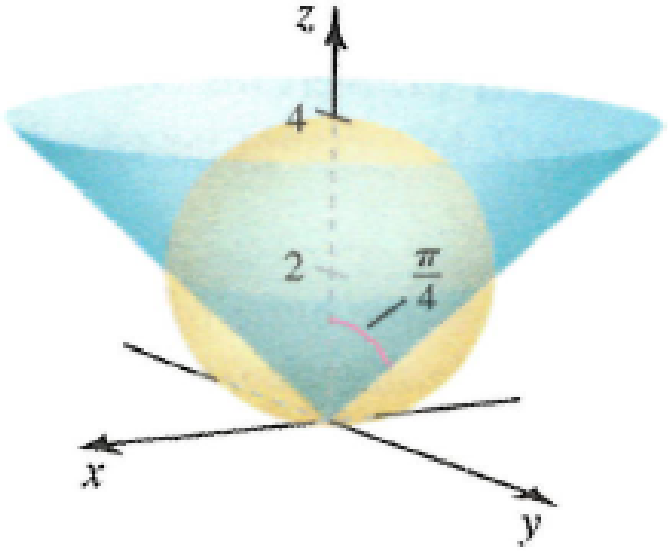


Problem 2: Evaluate

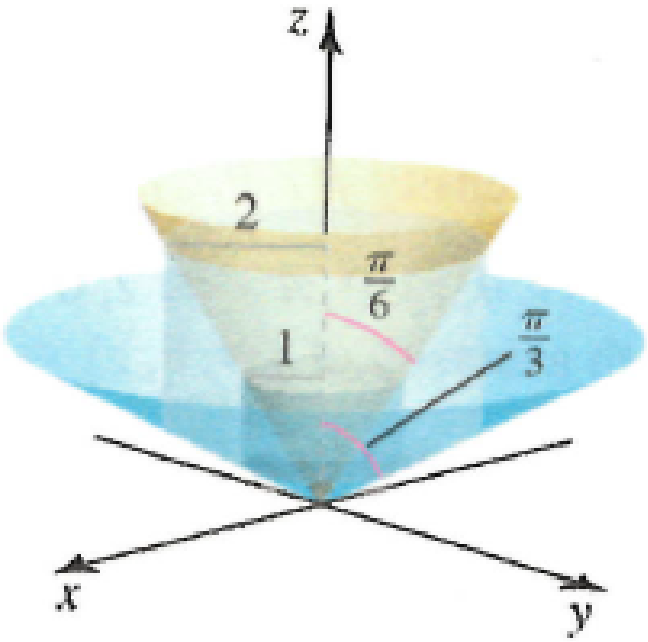
$$\int_1^4 \int_z^{4z} \int_0^{\pi^2} \frac{\sin(\sqrt{yz})}{x^{\frac{3}{2}}} dydxdz. \tag{1}$$

Hint: A different order of integration can make the problem easier, even though it is not necessary.

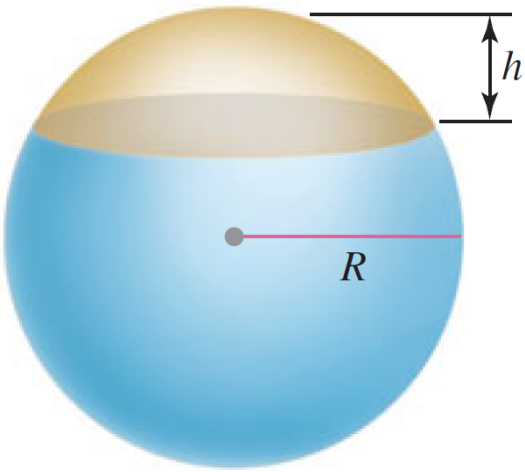
Problem 3: Find the volume of the solid region S outside the cone $\varphi = \frac{\pi}{4}$ and inside the sphere $\rho = 4\cos(\varphi)$.



Problem 4: Find the volume of the solid region S that is bounded by the cylinders $r = 1$ and $r = 2$, and the cones $\varphi = \frac{\pi}{6}$ and $\varphi = \frac{\pi}{3}$.



Problem 5: Find the volume of S, the cap of a sphere of radius R with thickness h.



Problem 6: Find the volume of the solid cylinder E whose height is 4 and whose base is the disk $\{(r, \theta) : 0 \leq r \leq 2\cos(\theta)\}$.