

1. A solid occupies the region above the plane $z = 1$, below the plane $z = y$, and inside the cylinder $x^2 + y^2 = 4$.

a) Express the volume of the solid as an triple integral in Cartesian coordinates.

b) Express the volume of the solid as a triple integral in cylindrical coordinates. Hint: $\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$.

c) Calculate the volume of the solid. It may be helpful to recall that $\int \csc^2 u \, du = -\cot u + C$.

2. A solid (the “sno-cone”) occupies the region above $z = \sqrt{x^2 + y^2}$ and below the sphere $x^2 + y^2 + z^2 = 4$.

a) Express the volume of the solid as an integral in cylindrical coordinates.

b) Express the volume of the solid as an integral in spherical coordinates.

c) Calculate the volume of the solid.