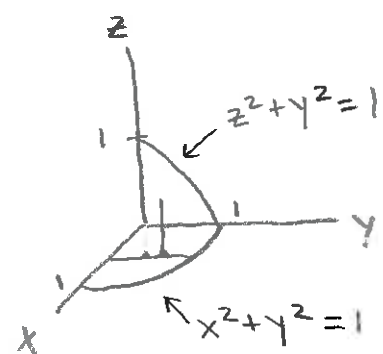


2. You are working for Online-Mathematics, another educational software development company. They are asking you to build a model for their calculus division. They want your team to build a module that derives the volume inside the two cylinders $x^2 + y^2 = 1$ and $z^2 + y^2 = 1$. Your display should be professional.



$$\begin{aligned} z^2 + y^2 &= 1 & x^2 + y^2 &= 1 \\ z^2 &= 1 - y^2 & y^2 &= 1 - x^2 \\ z &= \pm \sqrt{1 - y^2} & y &= \pm \sqrt{1 - x^2} \end{aligned}$$

Multiply the volume shown by 8.

$$V = 8 \int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-y^2}} dz dy dx$$

$$= 8 \int_0^1 \int_0^{\sqrt{1-x^2}} z \Big|_0^{\sqrt{1-y^2}} dy dx$$

$$= 8 \int_0^1 \int_0^{\sqrt{1-x^2}} \sqrt{1-y^2} dy dx$$

$$= 8 \int_0^1 \int_0^{\sqrt{1-y^2}} \sqrt{1-y^2} dx dy$$

$$= 8 \int_0^1 x \sqrt{1-y^2} \Big|_0^{\sqrt{1-y^2}} dy$$

$$= 8 \int_0^1 (1-y^2) dy = 8 \left(y - \frac{y^3}{3} \Big|_0^1 \right)$$

$$= 8 \left(1 - \frac{1}{3} \right) = \frac{16}{3}$$