

The intersection of these surfaces is given by

$$\begin{aligned}4 &= 16 - 3x^2 - 3y^2 \\3x^2 + 3y^2 &= 12 \\x^2 + y^2 &= 4.\end{aligned}$$

The projection of this solid onto the xy -plane is the disk $x^2 + y^2 \leq 4$. In polar coordinates,

$$D = \{(r, \theta) | 0 \leq r \leq 2, 0 \leq \theta \leq 2\pi\}.$$

The volume of this solid is

$$\begin{aligned}V &= \iint_D (16 - 3x^2 - 3y^2 - 4) dA \\&= \int_0^{2\pi} \int_0^2 (12 - 3r^2) r dr d\theta \\&= 2\pi \int_0^2 (12r - 3r^3) dr \\&= 2\pi \left(6r^2 - \frac{3}{4}r^4 \right) \Big|_0^2 \\&= 24\pi.\end{aligned}$$