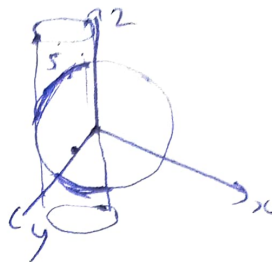
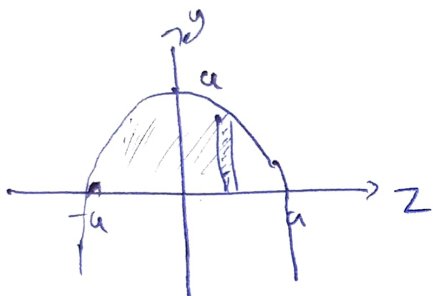


intersection surface

$$a^2 - z^2 = ay$$



$$\rightarrow x^2 + y^2 + z^2 = a^2$$

$$\rightarrow x^2 + y^2 = ay$$

$$x^2 + y^2 - 2y \times \frac{a}{2} + \left(\frac{a}{2}\right)^2 = \left(\frac{a}{2}\right)^2$$

$$x^2 + \left(y - \frac{a}{2}\right)^2 = \left(\frac{a}{2}\right)^2$$

Surface area = $\int \int \sqrt{1 + (x_y)^2 + (x_z)^2} dy dz$

$$= 2 \int \int \sqrt{1 + \frac{y^2}{a^2 - y^2 - z^2} + \frac{z^2}{a^2 - y^2 - z^2}} dy dz$$

$$\begin{aligned} x &= \sqrt{a^2 - y^2 - z^2} \\ x_y &= \frac{-y}{\sqrt{a^2 - y^2 - z^2}}, \quad x_z = \frac{-z}{\sqrt{a^2 - y^2 - z^2}} \end{aligned}$$

$$\Rightarrow 2a \int \int \frac{1}{\sqrt{a^2 - y^2 - z^2}} dy dz$$

$$\Rightarrow 4a \int_{z=0}^a \int_{y=0}^{\frac{a^2 - z^2}{a}} \frac{1}{\sqrt{a^2 - y^2 - z^2}} dy dz$$

simple calculation
you can do yourself