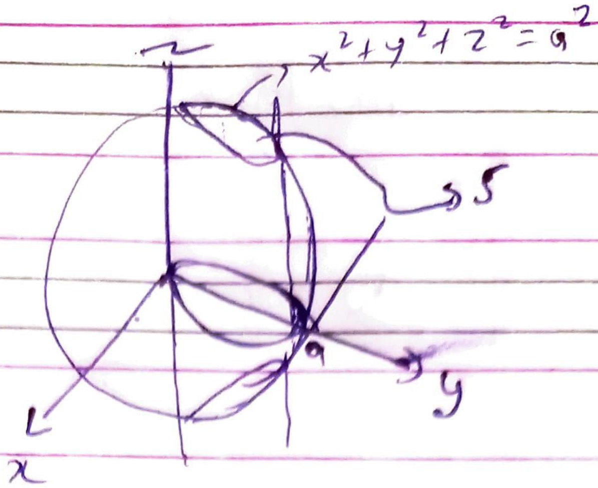

$S: \quad z = \sqrt{a^2 - x^2 - y^2}$

$z_x = \dfrac{-x}{\sqrt{a^2-x^2-y^2}}$

$z_y = \dfrac{-y}{\sqrt{a^2-x^2-y^2}}$

$x^2 + y^2 = ay$

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

Surface area $= \iint \sqrt{1 + (z_x)^2 + (z_y)^2}\, dx\, dy$

$= \iint \sqrt{1 + \dfrac{x^2}{a^2 - x^2 - y} + \dfrac{y^2}{a^2 - x^2 - y^2}}\; dx\, dy$

$= \iint_A \dfrac{a}{\sqrt{a^2-x^2-y^2}}\, dx\, dy \qquad A: x^2 + \left(y - \frac{a}{2}\right)^2 = \left(\frac{a}{2}\right)^2$

$\Rightarrow a \displaystyle\int_{\theta = -\frac{\pi}{2}}^{\frac{\pi}{2}} \int_{r=0}^{a\sin\theta} \dfrac{r}{\sqrt{a^2 - r^2}}\, dr\, d\theta \Rightarrow a \int_{\theta=-\frac{\pi}{2}}^{\frac{\pi}{2}} \int_{r=0}^{a\sin\theta} \dfrac{r}{\sqrt{t}} \times \dfrac{dt}{-2r}\, d\theta$

$\left[\begin{array}{l} a^2 - r^2 = t \\ \frac{dt}{dr} = -2r \end{array}\right]$

$\Rightarrow -a2 \displaystyle\int_{\theta=0}^{\frac{\pi}{2}} \left[\sqrt{(a^2 - r^2)}\right]_0^{a\sin\theta} d\theta$

$\Rightarrow -2a \displaystyle\int_{\theta=0}^{\frac{\pi}{2}} a\cos\theta - a\, d\theta = 2a^2 \int_{\theta=0}^{\frac{\pi}{2}} (1 - \cos\theta)\, d\theta$

$\Rightarrow 2a^2 \left[\theta - \sin\theta\right]_0^{\frac{\pi}{2}} \Rightarrow 2a^2\left[\frac{\pi}{2} - 1 - (0)\right] \Rightarrow a^2(\pi - 2)$

Due to symmetry $\boxed{2 \times a^2(\pi - 2)}$