

$$Z = 8 - x^2 - y^2$$

$$Z_x = -2x, \quad Z_y = -2y$$

$$\text{area} = \int \int_D \sqrt{1 + (Z_x)^2 + (Z_y)^2} \, dx \, dy$$

$$D: x^2 + y^2 = 4$$

$$\Rightarrow \int \int_D \sqrt{1 + 4x^2 + 4y^2} \, dx \, dy$$

convert into polar

$$\Rightarrow \int_{\theta=0}^{2\pi} \int_{r=0}^2 \sqrt{1 + 4r^2} \times r \, dr \, d\theta$$

$$\left[\begin{array}{l} 1 + 4r^2 = t \\ \frac{\partial t}{\partial r} = 8r \end{array} \right]$$

$$\Rightarrow 2\pi \times \int_{r=0}^2 \sqrt{t} \times r \times \frac{\partial t}{8r}$$

$$\Rightarrow \frac{\pi}{4} \times \frac{2}{3} \left[(1 + 4r^2)^{3/2} \right]_0^2 \Rightarrow \boxed{\frac{\pi}{6} [(17)^{3/2} - 1]}$$