$$= \int_0^{2\pi} d\varphi \cdot \frac{R^4}{2} \cdot \int_0^{\pi/2} (\sin\varphi \cdot \cos^2\theta + \sin\theta\cos\theta)\, d\theta =$$

$$= \int_0^{2\pi} d\varphi \cdot \frac{R^4}{2} \cdot I_1 =$$

$$I_1 = I_2 + I_3$$

$$I_2 = \int_0^{\pi/2} \sin\varphi \cos^2\theta\, d\theta = \sin\varphi \cdot \int_0^{\pi/2} \frac{1}{2}(1+\cos 2\theta)\, d\theta = \frac{1}{2}\sin\varphi \cdot \left(\theta + \frac{1}{2}\sin 2\theta\right)\Big|_0^{\pi/2} =$$

$$= \frac{1}{2}\sin\varphi \cdot \left(\frac{\pi}{2} + 0\right) = \frac{\pi}{4} \cdot \sin\varphi$$

$$I_3 = \int_0^{\pi/2} \sin\theta\cos\theta\, d\theta = \int_0^{\pi/2} \sin\theta\, d\sin\theta = \frac{\sin^2\theta}{2}\Big|_0^{\pi/2} = \frac{1}{2} \Rightarrow I = \frac{1}{2} + \frac{\pi}{4}\sin\varphi$$

$$\oiint_S \int_0^{2\pi} \left(\frac{1}{2} + \frac{\pi}{4}\sin\varphi\right) \cdot \frac{R^4}{2}\, d\varphi = \frac{R^4}{2}\left(\frac{1}{2}\varphi + \frac{\pi}{4}\cos\varphi\right)\Big|_0^{2\pi} = \frac{R^4}{2} \cdot (\pi - 0) = \frac{R^4\pi}{2}$$

$$\boxed{\oiint_S = \frac{R^4\pi}{2}}$$ – Поверхнина затворена площа!

– Покриюц B: $z = 0$, $dz = 0$

Почекіки редукціна ґлаки:

$$\oiint_B y^2 dy\overset{0}{dz} + (x^2+y^2)dx\overset{0}{dz} + (x^2+y^2+\overset{0}{z^2})dx dy =$$

$$= -\oiint_B (x^2+y^2)dx dy = \begin{pmatrix} x = R + \rho\cos\varphi, & 0 \le \varphi \le 2\pi \\ y = \rho\sin\varphi & \\ J = \rho, & 0 \le \rho \le R \end{pmatrix} =$$

$$= -\int_0^{2\pi} d\varphi \cdot \int_0^R (R^2 + 2R\rho\cos\varphi + \rho^2)\rho\, d\rho =$$

$$= -\int_0^{2\pi} d\varphi \cdot \left(R^2\frac{\rho^2}{2} + 2R\frac{\rho^3}{3}\cos\varphi + \frac{\rho^4}{4}\right)\Big|_0^R =$$

$$= -\int_0^{2\pi} d\varphi \cdot \left(\frac{1}{2}R^4 + \frac{2}{3}R^4\cos\varphi + \frac{1}{4}R^4\right) =$$

$$= -\int_0^{2\pi} \left(\frac{3}{4}R^4 + \frac{2}{3}R^4\cos\varphi\right) d\varphi = -\left(\frac{3}{4}R^4\varphi + \frac{2}{3}R^4\sin\varphi\right)\Big|_0^{2\pi} = -\frac{3R^4\pi}{2}$$

$$\Rightarrow \boxed{\oiint_B = -\frac{3R^4\pi}{2}}$$

$$I = \oiint_\Gamma = \oiint_S - \oiint_B = \frac{R^4\pi}{2} - \left(-\frac{3R^4\pi}{2}\right) = 2R^4\pi$$

$$\boxed{I = 2R^4\pi}$$