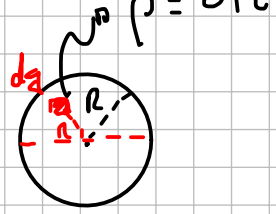
2.43.



Esfera c/ $\rho = cte$:

$$\rho = \frac{Q}{\frac{4}{3}\pi R^3}$$

$$\vec{E} = \frac{\rho}{3\varepsilon_0}\vec{r}$$

$$\vec{r} = x\hat{x} + y\hat{y} + z\hat{z}$$

$$d\vec{F} = dq\,\vec{E} = \rho\vec{E}\,dV = \frac{\rho^2}{3\varepsilon_0}\vec{r}\,dV$$

Simetria: $F_x = F_y = 0$

$$dF_z = \frac{\rho^2}{3\varepsilon_0} z\,dV = \frac{\rho^2}{3\varepsilon_0} r\cos\theta \cdot r^2 \operatorname{sen}\theta\, dr\, d\theta\, d\varphi$$

$$F_z = \frac{\rho^2}{3\varepsilon_0} \cdot \int_0^R \int_0^{\pi/2} \int_0^{2\pi} r^3 \operatorname{sen}\theta\cos\theta\, dr\, d\theta\, d\varphi$$

$$= \frac{\rho^2}{3\varepsilon_0} \cdot 2\pi \cdot \frac{R^4}{4} \cdot \int_0^{\pi/2} \operatorname{sen}\theta\cos\theta\, d\theta$$

$$= \frac{\rho^2}{3\varepsilon_0}\,\pi\frac{R^4}{2} \cdot \frac{\operatorname{sen}^2\theta}{2}\Big|_0^{\pi/2} = \frac{\rho^2}{3\varepsilon_0} \cdot \frac{\pi R^4}{4} = \frac{\left(\frac{Q}{\frac{4}{3}\pi R^3}\right)^2}{3\varepsilon_0} \cdot \frac{\pi R^4}{4}$$

$$= \frac{3Q^2}{16\pi\varepsilon_0 R^2} \cdot \frac{1}{4} = \frac{3Q^2}{64\pi\varepsilon_0 R^2} \;//$$