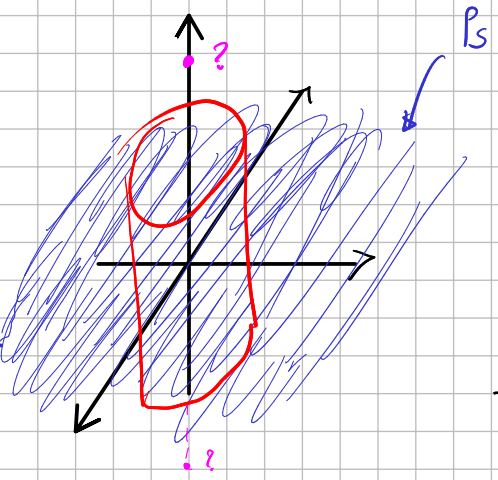
4. (6 pts.) Determine la intensidad de campo eléctrico de un plano de carga infinito con densidad superficial de carga uniforme ρ_S, para z>0 y z<0.

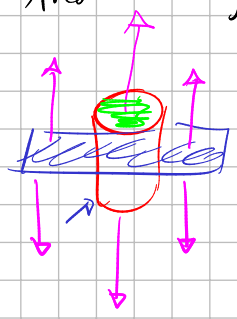
$\rho_L \rightarrow$ Línea

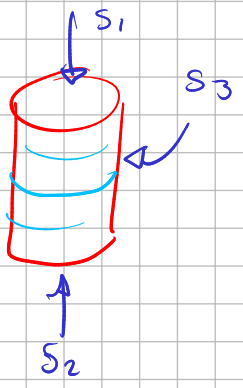
$\rho_S \rightarrow$ Área

$\rho_V \rightarrow$ Volumen

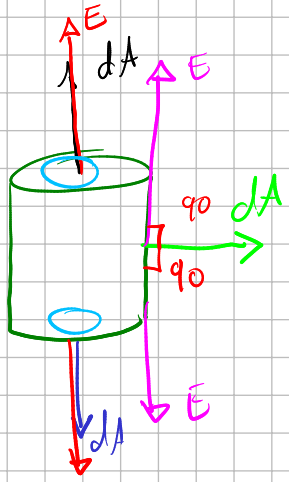


Ley de Gauss





$$\Phi_E = \Phi_{S_1} + \Phi_{S_2} + \Phi_{S_3}$$

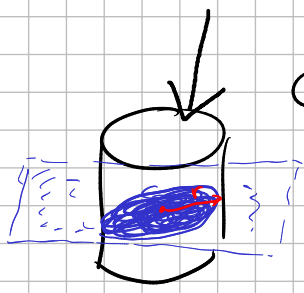


$$\Phi_E = \int_S \vec{E} \cdot d\vec{A}$$

$$\Phi_{S_1} = \int_{S_1} E\, dA \cos\theta^{\,0} \quad (\cos 0 = 1)$$

$$\Phi_{S_2} = \int_{S_2} E\, dA \cos\theta^{\,0} \quad (\cos 0 = 1)$$

$$\Phi_{S_3} = \int_{S_3} E\, dA \cos\theta^{\,90} = 0 \quad (\cos 90 = 0)$$



$$Q_s = \rho_S \cdot A$$

$$Q_{enc} = \rho_S \pi r^2$$

Ley de Gauss

$$\int \vec{E} \cdot d\vec{A} = \frac{Q_{enc}}{\epsilon_0}$$

$$2 \cdot \int E\, dA \cos 0 = \frac{Q_{enc}}{\epsilon_0} \quad (\cos 0 = 1)$$

$$2E \int dA = \frac{Q_{enc}}{\epsilon_0}$$

$$2EA = \frac{Q_{enc}}{\epsilon_0}$$

$$2E \cdot \pi r^2 = \frac{\rho_S \pi r^2}{\epsilon_0}$$

$$E = \frac{\rho_S}{2\epsilon_0}$$

$$\rho_L = \frac{Q}{L}$$

$$\Rightarrow \rho_S = \frac{Q}{A}$$

$$\rho_V = \frac{Q}{V}$$

Para $z > 0$

$$E = \frac{\rho_S}{2\epsilon_0} (a_z)$$

Para $z < 0$

$$E = -\frac{\rho_S}{2\epsilon_0} (a_z)$$