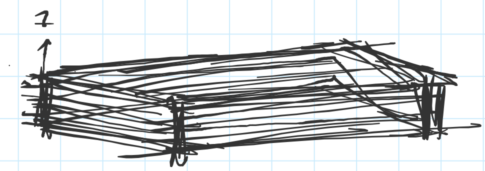
Ley de Gauss

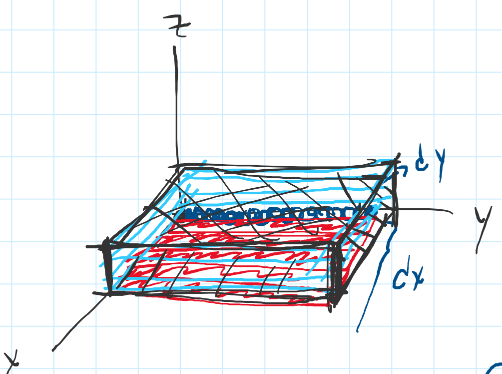
Friday, May 30, 2025 7:19 PM

$$\left(\begin{array}{ccc|c} 4 & 1 & 2 & 4 \\ 3 & 2 & 1 & 3 \\ 2 & 3 & 4 & 1 \end{array}\right) \xrightarrow{\frac{f_1}{4}} \left(\begin{array}{ccc|c} 1 & 1/4 & 1/2 & 1 \\ 3 & 2 & 1 & 3 \\ 2 & 3 & 4 & 1 \end{array}\right)$$

$$\xrightarrow[-2f_1+f_3]{-3f_1+f_2} \left(\begin{array}{ccc|c} 1 & 1/4 & 1/2 & 1 \\ 0 & 5/4 & -1/2 & 0 \\ 0 & & & \end{array}\right)$$

Ley de Gauss: $\oint \vec{E} \cdot d\vec{A} = \frac{Q_{enc}}{\epsilon_0}$





$$\underbrace{\oiint \vec{E} \cdot d\vec{s}}_{\text{Campo E en una superficie}} = \frac{\overbrace{\iiint \rho \, dV}^{\text{Carga en un Volumen } (Q)}}{\epsilon_0}$$

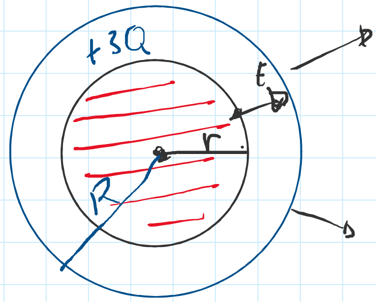
$$\rho = \frac{Q}{V} \Rightarrow Q = \rho \cdot V$$

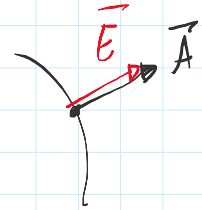
↳ Φ = Flujo eléctrico

$\phi = \oint \vec{E} \cdot d\vec{A}$ $\Rightarrow$ Ley de Gauss nos dice que el flujo eléctrico en una superficie cerrada es proporcional a la carga que esta superficie encierra.

"Cuanto campo atraviesa
a un area"

$$\int \vec{E}\cdot d\vec{A} = \int E\cos\theta\, dA = E\int d\vec{A} = EA$$





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

$$E = \frac{Q_{enc}}{A\epsilon_0} = \frac{Q_{enc}}{4\pi r^2\epsilon_0} = \frac{1}{4\pi\epsilon_0}\cdot\frac{Q_{enc}}{r^2}$$

$$\vec{E} = \frac{KQ_{enc}}{r^2}$$

$$\frac{V_T}{Q_T} = \frac{V_G}{Q_{enc}} \Rightarrow Q_{enc} = \frac{V_G}{V_T}\cdot Q_T = V_G\cdot\frac{Q_T}{V_T} \rightarrow \rho = \frac{Q}{V}$$

$$\Rightarrow Q_{enc} = \rho\cdot V$$

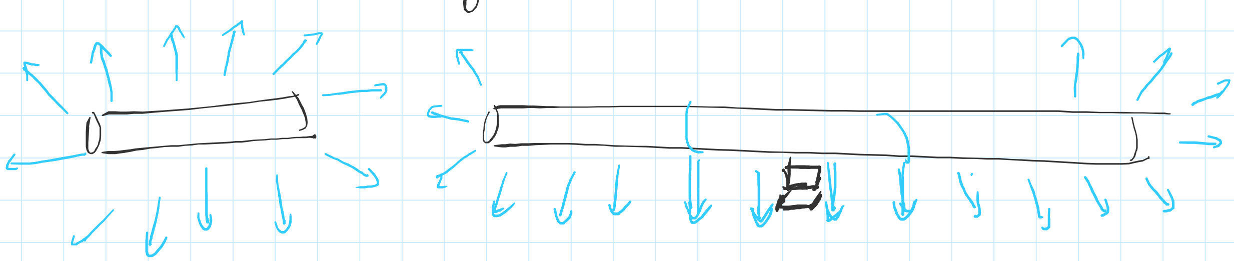
$$Q_{enc} = \int \rho\cdot dV$$

Esfera: $dV = 4\pi r^2 dr$ ← $dx\,dy\,dz$

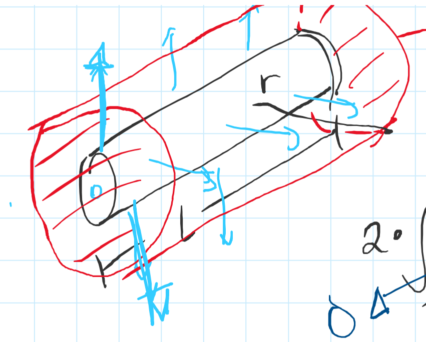
Cilindro: $dV = \pi r^2 \cdot dz$

Gauss es útil para Campos de:

- Esferas
- Planos
- Cilindros
- "Cosas infinitas"



Campo de un cilindro infinito:



$$\oint E \cdot dA = \frac{Q_{enc}}{\epsilon_0}$$

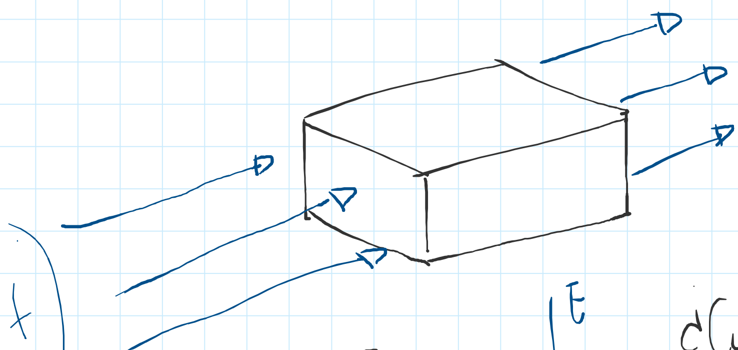
$$2 \cdot \cancel{\int_{Tapas} \vec{E} \cdot d\vec{A}} + \int_{Curva} \vec{E} \cdot d\vec{A} = \int_0^L \lambda \cdot dx$$

0

$$E \cdot A_{curva} = \lambda \int_0^L \cdot dx / \epsilon_0$$

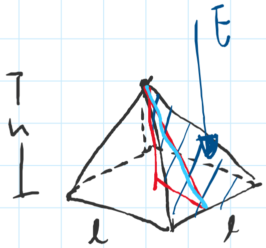
$$E = \frac{\lambda \cdot L}{A_{curva} \epsilon_0} = \frac{\lambda \cancel{L}}{2\pi r \cdot \cancel{L} \cdot \epsilon_0}$$

$$\vec{E} = \frac{\lambda}{2\pi r \cdot \epsilon_0}$$



¿ϕ en ⬚?

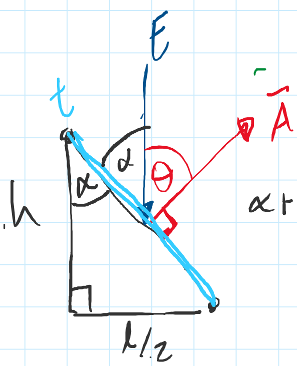
$$\phi = \frac{Q_{enc}}{\epsilon_0}$$



¿Cuanto flujo atraviesa a una cara lateral de la pirámide?

$$\phi = E \cdot A \cdot \cos\theta$$

$$\phi = \frac{Q_{enc}}{\epsilon_0}$$



$\alpha + \theta = 90$

$$t = \sqrt{h^2 + \left(\frac{l}{2}\right)^2}$$

$$\alpha = \tan^{-1}\left(\frac{l/2}{h}\right)$$

$$A = \frac{b \cdot h}{2} = \frac{l \cdot t}{2} = \frac{l\sqrt{h^2 + l^2/4}}{2}$$

$$\theta = 90 - \tan^{-1}\left(\frac{l/2}{h}\right)$$

$$\Rightarrow \phi = E \cdot \frac{l\sqrt{h^2 + l^2/4}}{2} \cdot \cos\left(90 - \tan^{-1}\left(\frac{l/2}{h}\right)\right)$$

$$\phi = \frac{Q_{enc}}{\varepsilon_0} \Rightarrow \phi = 0$$

$$\phi_1 + \phi_2 + \phi_3 + \phi_4 - \phi_5 = 0$$

$$4\phi_L - \phi_B = 0$$

$$\phi_L = \frac{\phi_B}{4}$$

$$\phi_L = \frac{EA\cos\theta}{4}$$

$$\boxed{\phi_L = \frac{E \cdot l^2}{4}}$$