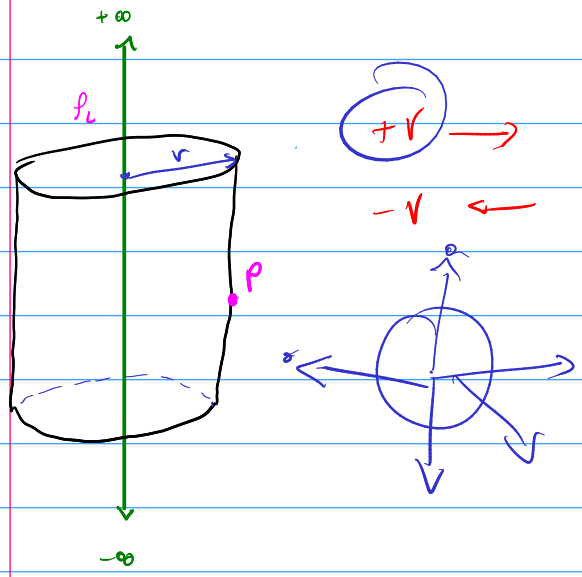
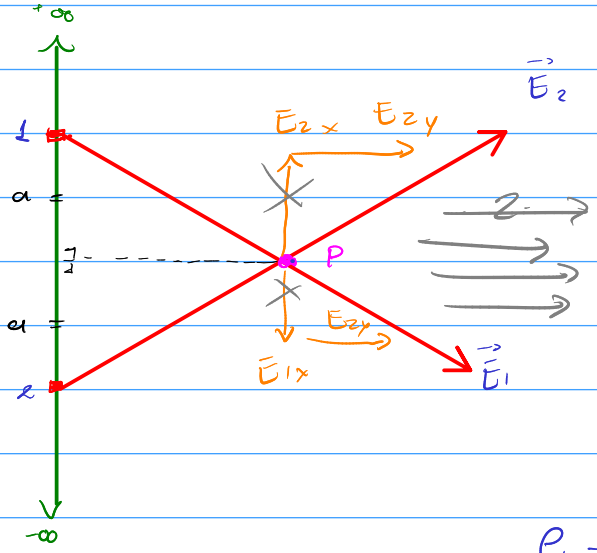
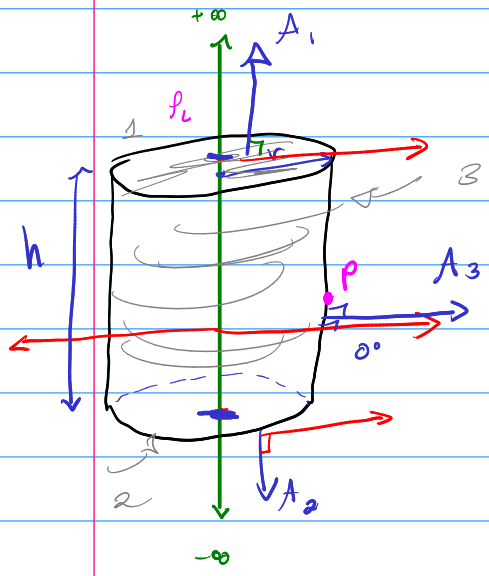
Determine la intensidad de campo eléctrico de una línea de carga recta, infinitamente larga, con densidad uniforme ρ_L , en el aire





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



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

$$Q = \rho_L \cdot \ell$$

$$\Phi_1 + \Phi_2 + \Phi_3$$

$$\Phi_E = \int E\,dA\cos\theta = \frac{Q_{en}}{\epsilon_0}$$

$$E\int dA = \frac{Q_{en}}{\epsilon_0}$$

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

$$Q_{enc} = \rho_L \ell$$

$$Q_{enc} = \rho_L \cdot h$$

$$E(2\pi r h) = \frac{Q_{enc}}{\epsilon_0}$$

$$E = \frac{Q_{enc}}{2\pi r \epsilon_0 h}$$

$$E = \frac{\rho_L h}{2\pi r \epsilon_0 h}$$

$$E = \frac{\rho_L}{2\pi r \epsilon_0}\,a_r$$

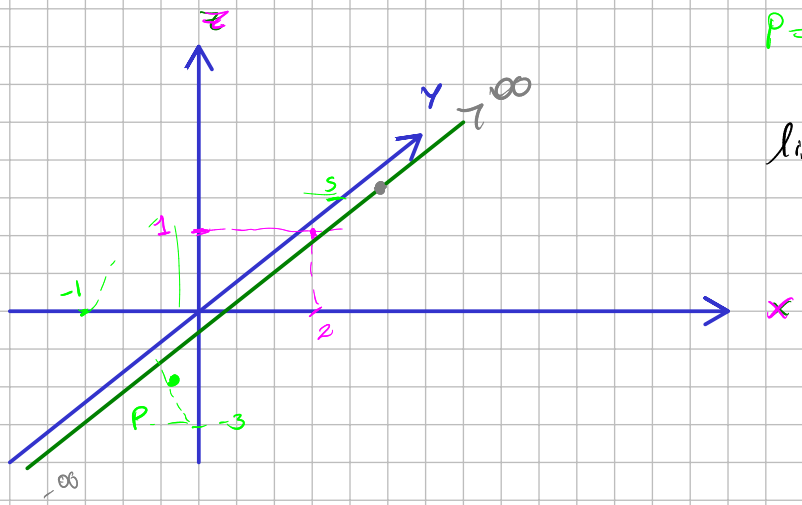
$$E = \frac{\rho_L}{2\pi r \epsilon_0} a_r$$

$\rho_L = 50\ nC/m$

línea eje z

$x = 2 \quad -\infty < y < \infty$

$z = 1$



$P = (-1, 5, 3)$

$\text{línea } (2, 5, 1)$

$$\vec{r} = P - \text{línea}$$

$$= (-1-2, 5-5, 3-1)$$

$$= (-3, 0, 2)$$

$$r = \sqrt{(-3)^2 + (0)^2 + (2)^2}$$

$$r = \sqrt{13}$$

$$\vec{E} = \frac{\rho_L}{2\pi r \epsilon_0} a_r$$

$$\vec{E} = \frac{50\ \frac{nC}{m}}{2\pi(\sqrt{13})\cdot \epsilon_0} a_r$$

$$\vec{E} = 2,21\ \frac{nC}{m^2} \cdot \frac{1}{\epsilon_0} a_r$$

$$\boxed{\vec{E} = 249\ \frac{nC}{Fm} a_r}$$ R/a

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b) Calcular D en $(-1, 5, 3)$

$$D = \frac{\rho_L}{2\pi r} a_r$$

$$D = \frac{50\ nC/m}{2\pi(\sqrt{13}\ m)} a_r$$

$$\boxed{D = 2,21\ \frac{nC}{m^2} a_r}$$ R/b