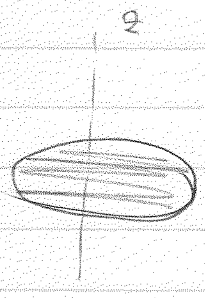
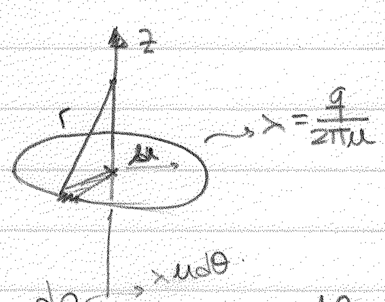
EJERCICIO 1

a)



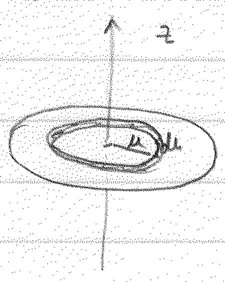
$V(z) = \,?$

PRIMERO calculamos POTENCIAL DE 1 ARO CON carga q Y radio u:



$$dV = \frac{\overbrace{dq}^{\lambda u d\theta}}{4\pi\varepsilon_0 r} = \frac{q \cdot d\theta}{4\pi\varepsilon_0 \cdot 2\pi\sqrt{z^2+u^2}} \Rightarrow V(z) = \int_0^{2\pi} dV = \frac{q}{4\pi\varepsilon_0\sqrt{z^2+u^2}}$$

Ahora consideramos el disco como la superposición de muchos aros.



$$dV = \frac{dq}{4\pi\varepsilon_0\sqrt{z^2+u^2}}$$

$$dq = \sigma \cdot 2\pi u\, du$$

$$V = \int_0^R \frac{\sigma 2\pi u\, du}{4\pi\varepsilon_0\sqrt{z^2+u^2}} = \frac{\sigma}{2\varepsilon_0}\cdot\frac{1}{2}\underbrace{\int_{z^2}^{z^2+R^2} v^{-1/2}\, dv}_{+v^{1/2}\Big|_{z^2}^{z^2+R^2}} = \boxed{\frac{\sigma}{2\varepsilon_0}\left[\sqrt{z^2+R^2} - |z|\right] = V(z)}$$

CV $\to v = u^2+z^2$, $dv = 2u\,du$

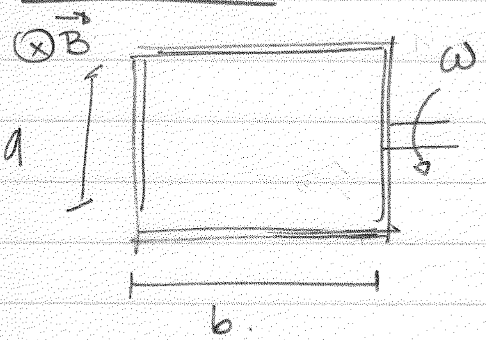
b) Por simetría, $\vec{E}_{ge} = E(z)\,\hat{z} = -\frac{\partial V}{\partial z}\,\hat{z} = \boxed{-\frac{\sigma}{2\varepsilon_0}\left[\frac{z}{\sqrt{z^2+R^2}} - \mathrm{sgn}(z)\right]\hat{z}}$

c) $$\vec{F} = \int dq\,\vec{E} = \int_0^L \lambda\, dz\, E(z)\,\hat{k} = \lambda \underbrace{\int_0^L -\frac{\partial V}{\partial z}\, dz}_{-V(z)\big|_0^L}\,\hat{k}$$

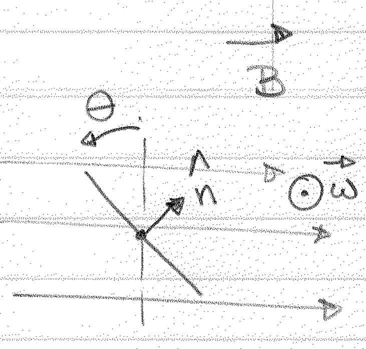
$$\Rightarrow \boxed{\vec{F} = -\frac{\lambda\sigma}{2\varepsilon_0}\left[\sqrt{L^2+R^2} - L - R\right]\hat{k}}$$

{OBS: $\sqrt{L^2+R^2} - L - R < 0 \Rightarrow F_z > 0$ ✓}

EJERCICIO 2



de perfil



a) $\varepsilon_{ind} = -\frac{d\phi_{TOT}}{dt} = -N \cdot \frac{d\phi}{dt}$

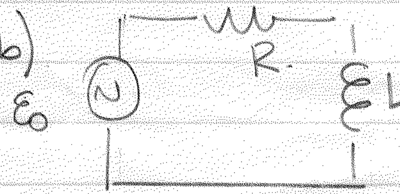
$$\phi = \int_{SUP} \vec{B} \cdot d\vec{A} = \int_{SUP} B \cdot \cos\theta \, dA = B \cdot \cos\theta \cdot \int_S dA = B\cos\theta \, ab$$

$\vec{B}$ uniforme

$$\boxed{\varepsilon_{ind} = \underbrace{NBab \cdot \omega}_{\varepsilon_0} \operatorname{sen}(\omega t)}$$

$\theta = \omega t$

b)



OBS. → Dado que nos piden $V_{R_{rms}}$ no nos importa la fase de $\varepsilon(t)$

$$\hat{I} = \frac{\varepsilon_0}{R + j\omega L} \Rightarrow \hat{V}_R = R \cdot \frac{\varepsilon_0}{R + j\omega L}$$

$$V_{R_{rms}} = \frac{1}{\sqrt{2}} \left| \hat{V}_R \right| = \boxed{\frac{R}{\sqrt{2(R^2 + \omega^2 L^2)}} NBab\omega = V_{R_{rms}}}$$

c) $P_{media} = \frac{V_{R_{rms}}^2}{R} = \frac{R}{2(R^2 + \omega^2 L^2)} \cdot (NBab\omega)^2 = P_0$

$$R \cdot (NBab)^2 \omega^2 = P_0 \cdot 2 (R^2 + \omega^2 L^2)$$

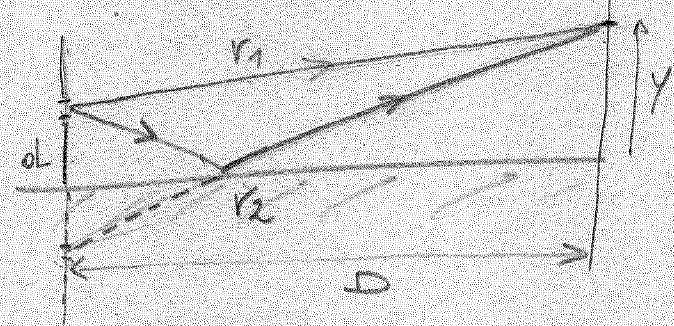
$$\omega^2 \left[R(NabB)^2 - 2P_0 L^2 \right] = 2P_0 R^2$$

$$\Downarrow$$

$$\boxed{\omega = \sqrt{\frac{2P_0 R^2}{R(NabB)^2 - 2P_0 L^2}} = 315 \text{ rad/s}}$$

Solución Problema 3

a)



$$\left.\begin{array}{l} r_1 = \sqrt{(y-d)^2+D^2} \simeq D + \frac{1}{2D}(y-d)^2 \\ r_2 = \sqrt{(y+d)^2+D^2} \simeq D + \frac{1}{2D}(y+d)^2 \end{array}\right\} \Rightarrow \delta = r_2 - r_1 \cong \frac{2d}{D} y$$

$$\phi_0 = \frac{2\pi\delta}{\lambda} = \frac{4\pi d}{\lambda D} y \; ; \; \phi = \phi_0 + \pi$$

I_{MAX} para $\phi = 2m\pi \Rightarrow \phi_0 = (2m-1)\pi = \pi; 3\pi; 5\pi; \ldots$

$$\Rightarrow \boxed{Y_1 = \frac{\lambda D}{4d}} = 15 \mu m$$

b) $\Delta = Y_{m+1} - Y_m \Rightarrow \boxed{\Delta = \frac{\lambda D}{2d}} = 30 \mu m$

c) $n = \frac{c}{v} = \frac{\lambda}{\lambda'} = \frac{d}{d'} = \frac{1}{3/4} = \frac{4}{3} = \underline{1.33}$