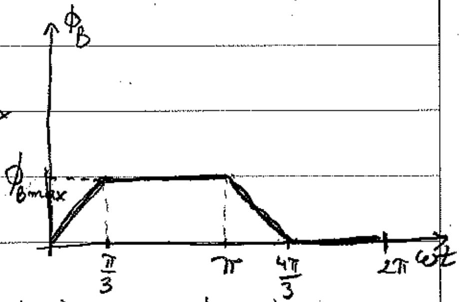
1.a) Área $= \frac{1}{2}\theta(b^2-a^2)$; $\phi_B = B\cdot\frac{1}{2}\theta(b^2-a^2)$, θ = ángulo en la región con B

$\Rightarrow 0<\omega t<\frac{\pi}{3}$, $\theta=\omega t$ $\quad \phi_B = B\cdot\frac{1}{2}\omega t(b^2-a^2)$

$\frac{\pi}{3}<\omega t<\pi$, $\theta=\frac{\pi}{3}$ $\quad \phi_B = B\cdot\frac{\pi}{6}(b^2-a^2) \equiv \phi_{B\,max}$

$\pi<\omega t<\frac{4\pi}{3}$, $\phi=\frac{4\pi}{3}-\omega t$ $\quad \phi_B = B\cdot\frac{1}{2}\left(\frac{4\pi}{3}-\omega t\right)(b^2-a^2)$

$\frac{4\pi}{3}<\omega t<2\pi$, $\phi=0$

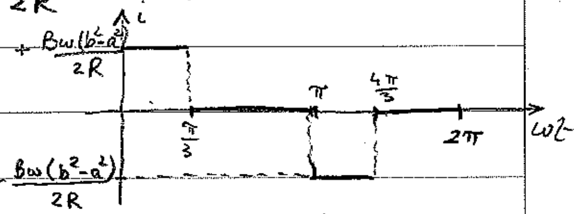


b) $0<\omega t<\frac{\pi}{3}$, $\left|\frac{d\phi_B}{dt}\right| = B\frac{\omega}{2}(b^2-a^2) \Rightarrow i = +\frac{B\omega(b^2-a^2)}{2R}$ (signo + por Lenz)

$\frac{\pi}{3}<\omega t<\pi$, $\left|\frac{d\phi_B}{dt}\right| = 0 \Rightarrow i=0$

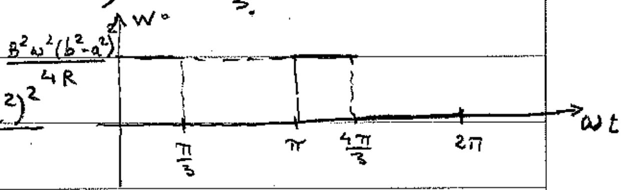
$\pi<\omega t<\frac{4\pi}{3}$, $\left|\frac{d\phi_B}{dt}\right| = B\frac{\omega}{2}(b^2-a^2) \Rightarrow i = -\frac{B\omega(b^2-a^2)}{2R}$ (signo − por Lenz

$\frac{4\pi}{3}<\omega t<2\pi$, $\left|\frac{d\phi_B}{dt}\right| = 0 \Rightarrow i=0$



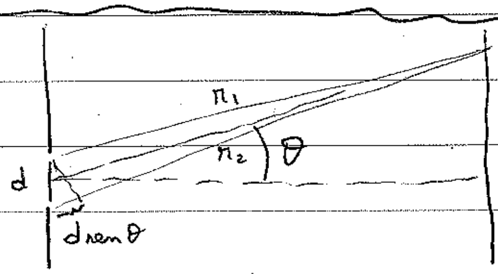
c) $W = Ri^2 \Rightarrow W = \frac{B^2\omega^2(b^2-a^2)^2}{4R}$ $\quad 0<\omega t<\frac{\pi}{3}$ y en $\pi<\omega t<\frac{4\pi}{3}$

$W=0$ $\quad \frac{\pi}{3}<\omega t<\pi$ y en $\frac{4\pi}{3}<\omega t<2\pi$



d) $\mathcal{E} = \frac{B^2\omega^2(b^2-a^2)^2}{4R}\cdot 2\cdot\frac{\pi}{3\omega} = \frac{\pi B^2\omega(b^2-a^2)^2}{6R}$

2.



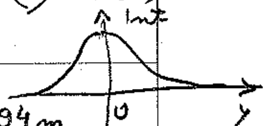
Máximos en $d\,\text{sen}\,\theta = m\lambda$

Ceros en $d\,\text{sen}\,\theta = (m+\frac{1}{2})\lambda$

a) $\lambda = 2d \Rightarrow \text{sen}\,\theta = 2m$; único máximo para $m=0 \Rightarrow \theta=0$, $y=0$

$\text{sen}\,\theta = 2(m+\frac{1}{2})$; único cero en $m=0 \Rightarrow \theta=\frac{\pi}{2}$ ($y\to\infty$)

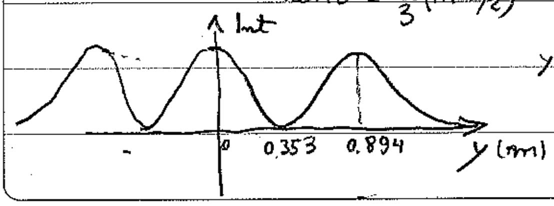
b) $\lambda = \frac{2d}{3}$, $\text{sen}\,\theta = \frac{2m}{3}$; máximos en $m=0 \Rightarrow \theta=0$, $y=0$



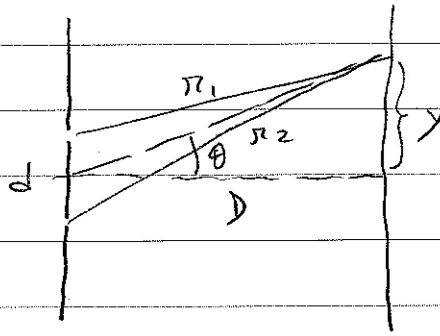
y en $m=1$, $\text{sen}\,\theta=\frac{2}{3}$, $\theta=41{,}8^\circ$, $y = D\,\text{tg}\,\theta = 0{,}894$ m

$\text{sen}\,\theta = \frac{2}{3}(m+\frac{1}{2})$, cero en $m=0$, $\text{sen}\,\theta=\frac{1}{3}$, $\theta=19{,}5^\circ$, $y=0{,}353$ m

y en $m=1$, $\text{sen}\,\theta=1$, $\theta=\frac{\pi}{2}$, $y=\infty$



2. Otra forma (sin usar θ): $r_1 = \sqrt{D^2+(y-\frac{d}{2})^2}$, $r_2 = \sqrt{D^2+(y+\frac{d}{2})^2}$



$$r_2 - r_1 = \sqrt{D^2+y^2+\frac{d^2}{4}+dy} - \sqrt{D^2+y^2+\frac{d^2}{4}-dy}$$
$$= \sqrt{D^2+y^2}\left[\sqrt{1+\frac{d^2/4+dy}{D^2+y^2}} - \sqrt{1+\frac{d^2/4-dy}{D^2+y^2}}\right]$$
$$\approx \sqrt{D^2+y^2}\left[1+\frac{1}{2}\left(\frac{d^2/4+dy}{D^2+y^2}\right) - \left(1+\frac{d^2/4-dy}{D^2+y^2}\right)\right]$$
$$= \frac{dy}{\sqrt{D^2+y^2}} = \begin{cases} m\lambda & \text{- constructiva} \\ (m+1/2)\lambda & \text{- destructiva} \end{cases}$$

$\lambda = 2d \Rightarrow \frac{y}{\sqrt{D^2+y^2}} = \begin{cases} 2m & \to \text{Sólo } m=0,\ y=0 \\ 2(m+1/2) & \to \text{Sólo } m=0,\ y=+\infty \end{cases}$

$\lambda = \frac{2d}{3} \Rightarrow \frac{y}{\sqrt{D^2+y^2}} = \begin{cases} \frac{2}{3}m & \to m=0 \to y=0;\ \frac{y}{\sqrt{D^2+y^2}} = \frac{2}{3},\ y = \frac{2}{\sqrt{5}}D = 0{,}894\ m \\ \frac{2}{3}(m+1/2) & \to m=0 \to \frac{y}{\sqrt{D^2+y^2}} = 1/3 \Rightarrow y = \frac{1}{\sqrt{8}}D = 0{,}353;\ m=1\ \frac{y}{\sqrt{D^2+y^2}} = 1,\ y=\infty \end{cases}$

3. a) $V_{ef} = R\cdot i_{ef} \Rightarrow R = \frac{220}{5} = 44\,\Omega$, $W = R\cdot i_{ef}^2 = 44\times5^2 = 1100\,W$

b) $i_{ef} = \frac{V_{ef}}{\sqrt{R^2+(\omega L)^2}} \Rightarrow R^2+(\omega L)^2 = \left(\frac{V_{ef}}{i_{ef}}\right)^2 = \left(\frac{220}{4}\right)^2 = 55^2 \Rightarrow \omega L = \sqrt{55^2-44^2} = 33\,\Omega$

$\Rightarrow L = \frac{33}{100\pi} = 0{,}105\ H$

$W = R\, i_{ef}^2 = 44\times4^2 = 704\,W$

c) $i_{ef} = \frac{V_{ef}}{\sqrt{R^2+(\omega L - \frac{1}{\omega C})^2}}$

$\to R^2+(\omega L-\frac{1}{\omega C})^2 = \left(\frac{V_{ef}}{i_{ef}}\right)^2 = \left(\frac{220}{5}\right)^2 = 44^2 \Rightarrow \omega L - \frac{1}{\omega C} = 0$

$C = \frac{1}{\omega^2 L} = \frac{1}{(100\pi)^2\times0{,}105} = 96{,}5\,\mu F$

$W = R\, i_{ef}^2 = 44\times5^2 = 1100\,W$

d) $i_{ef} = \frac{V_{ef}}{\sqrt{R^2+(\omega' L - \frac{1}{\omega' C})^2}}$; $\omega' L = 120\pi\times0{,}105 = 39{,}6\,\Omega$

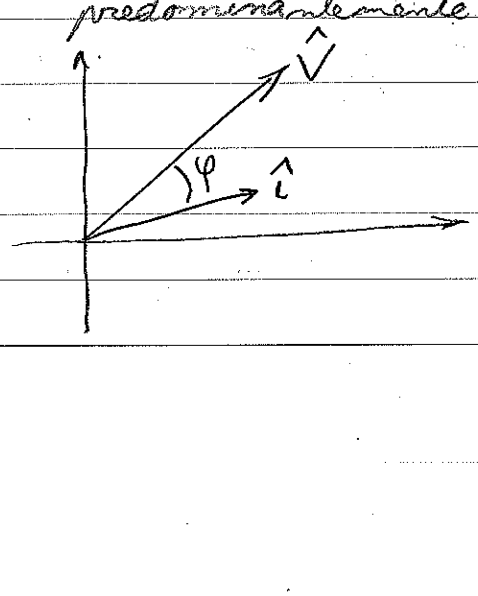
$\frac{1}{\omega' C} = \frac{1}{120\pi\times96{,}5\times10^{-6}} = 27{,}5\,\Omega$

$\Rightarrow i_{ef} = \frac{220}{\sqrt{44^2+(39{,}6-27{,}5)^2}} = 4{,}82\,A$

$W = R\cdot i_{ef}^2 = 44\times4{,}82^2 = 1023\,W$

$W = V_{ef}\cdot i_{ef}\cdot\cos\varphi = 1023\,W \Rightarrow \cos\varphi = \frac{1023}{220\times4{,}82} = 0{,}965$ = factor de pot.

e) Como $\omega' L > \frac{1}{\omega' C}$ predominantemente inductivo



$\varphi = \text{Arccos}\,0{,}965 = 15{,}3^\circ$