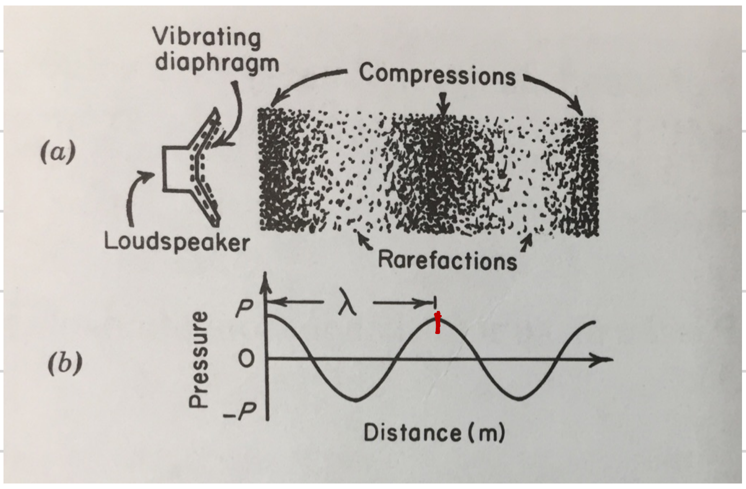
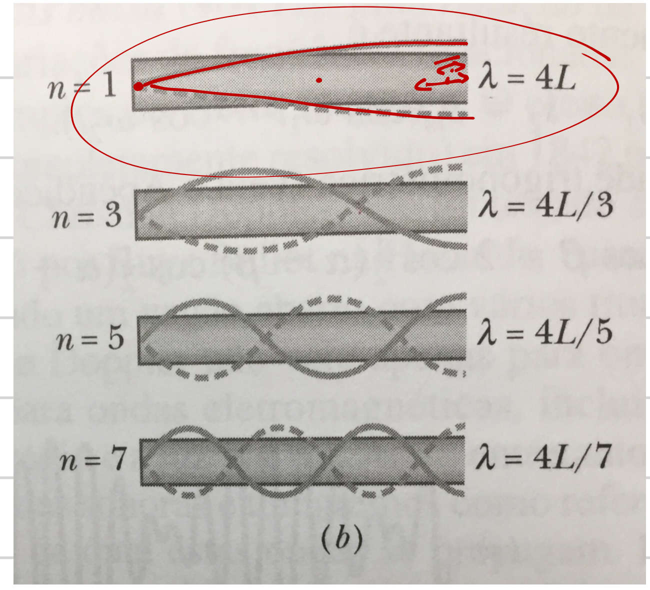
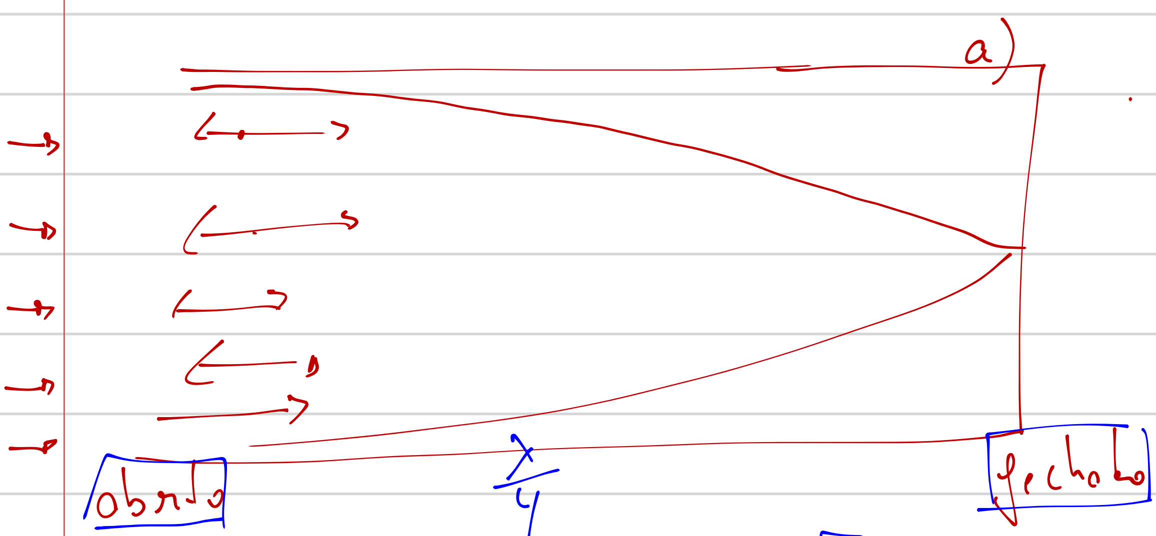
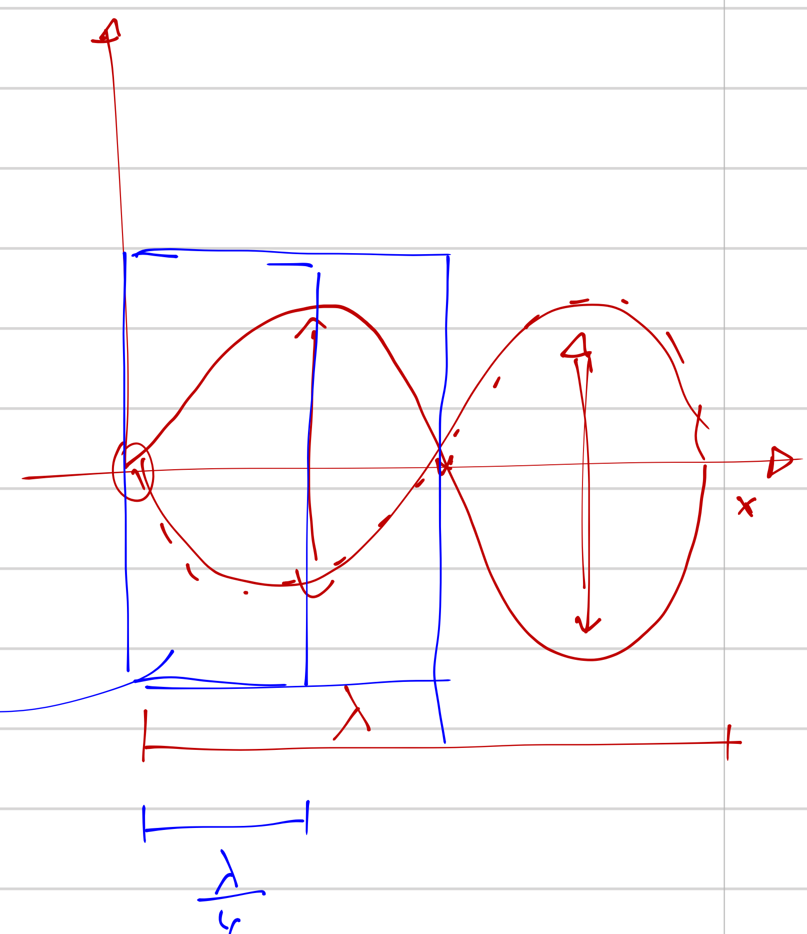
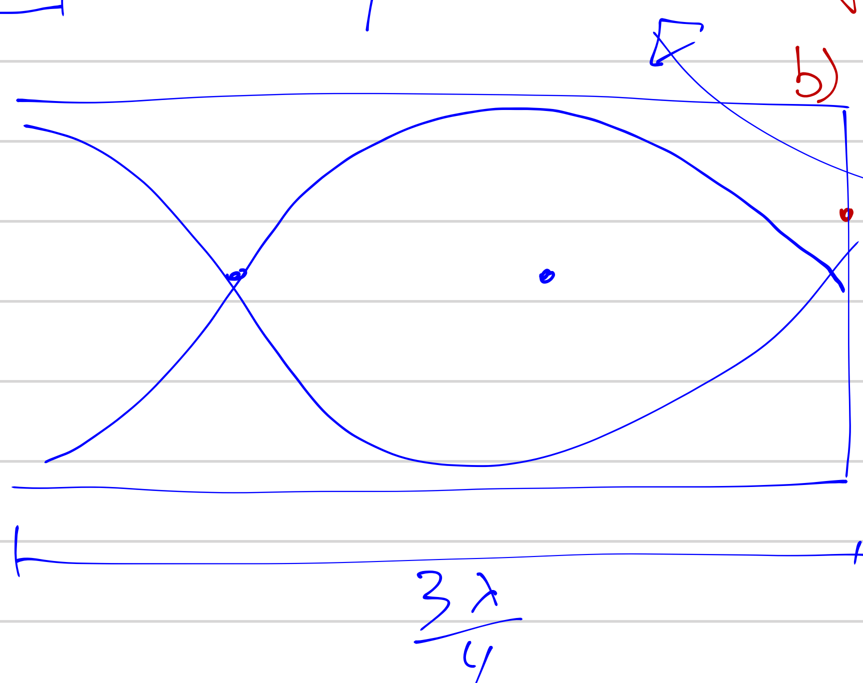










para o caso a)

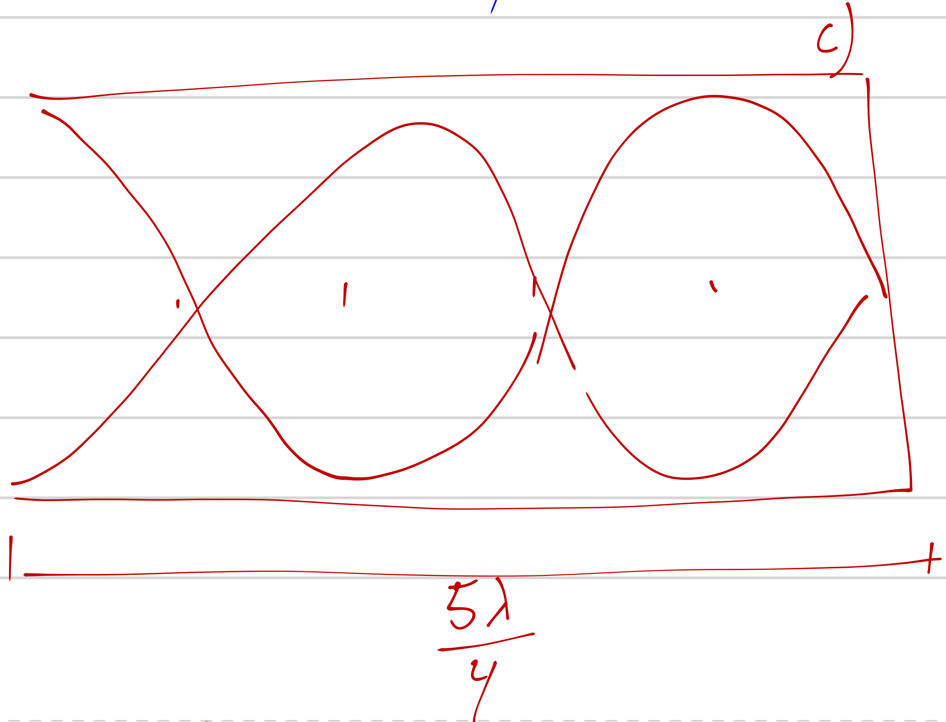
$L_a = \frac{\lambda}{4}$

$L_b = \frac{3\lambda}{4}$

$L_c = \frac{5\lambda}{4}$

$v = \lambda f$

$$\boxed{\begin{aligned} \lambda_a &= 4L \\ \lambda_b &= \frac{4L}{3} \\ \lambda_c &= \frac{4L}{5} \end{aligned}}$$



$\boxed{v = 340\ m/s}$

frequências que serão ressonantes para a cavidade de tamanho L quando uma das extremidades são fechado, a outra

Exemplo: Canal auditivo $\boxed{L = 23\,mm}$ aberta

$f_a =$

$v = \lambda f$

$340 = 4L \cdot f_a = 4 \cdot (23 \times 10^{-3}\,m) \cdot f_a$

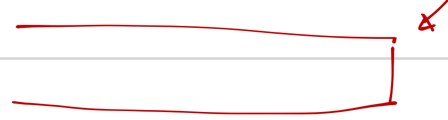
$340 = \left(\frac{4L}{3}\right) \cdot f_b$

$f_a = 3,7\,KHz$
$f_b = 11,1\,KHz$
$f_c = 18,5\,KHz$

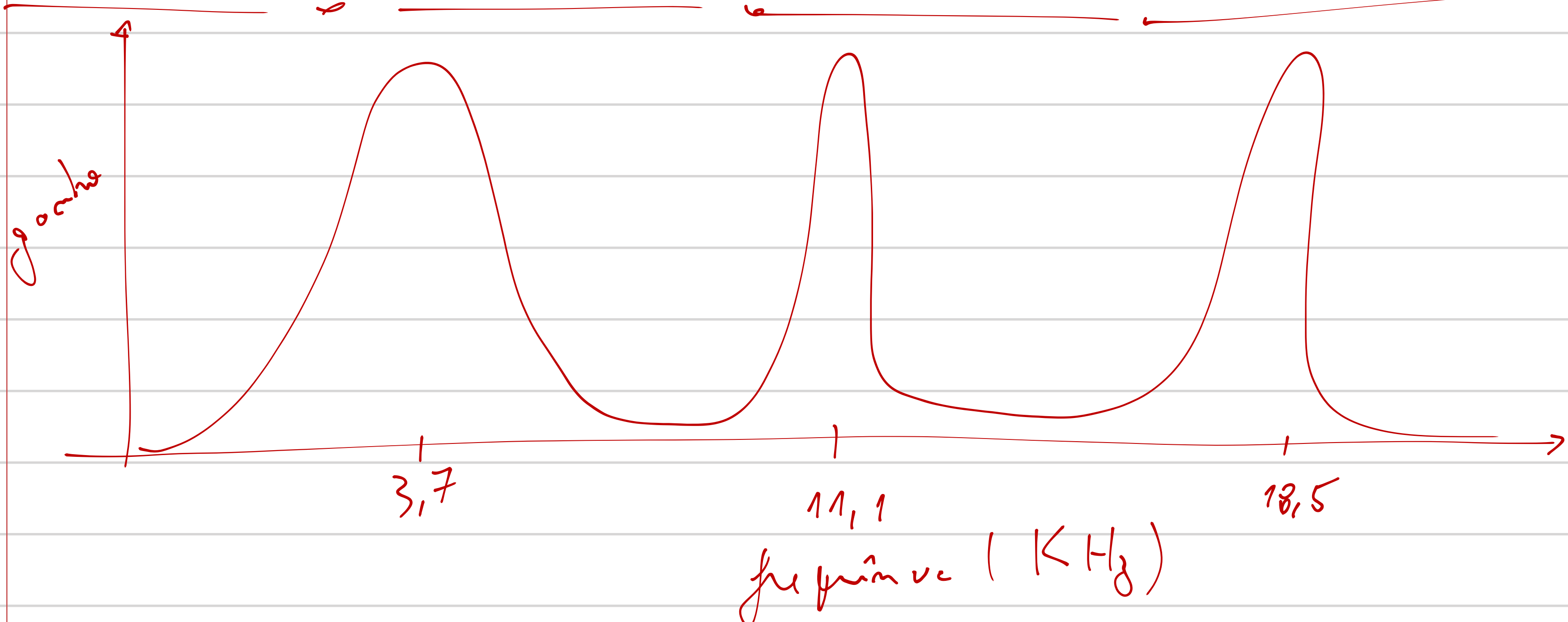
20 Hz - 20.000 Hz

fonte sonora com a mesma intensidade para diferentes frequências

Canal audit. tímpano

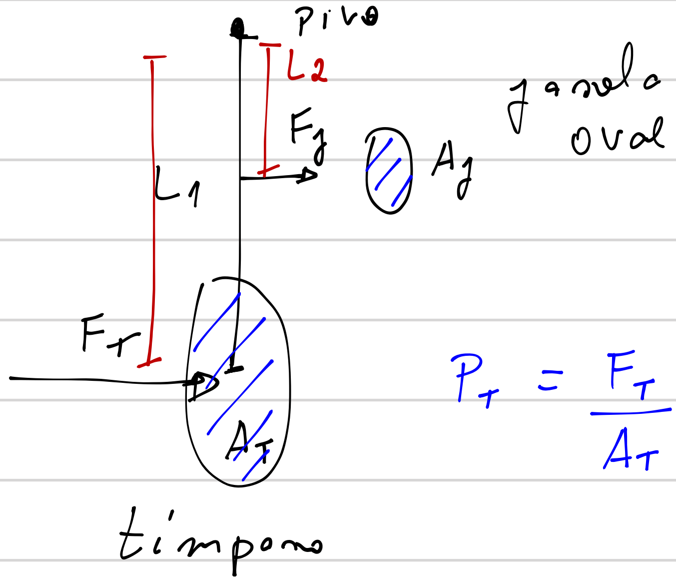


f_a
f_b
f_c



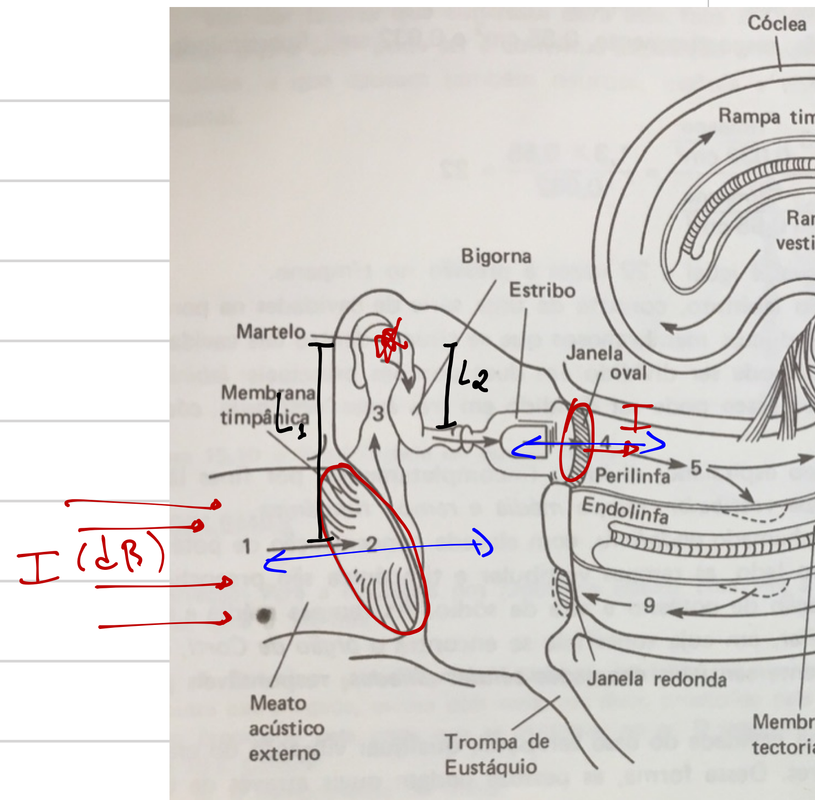
Efeito alavanca do ouvido médio

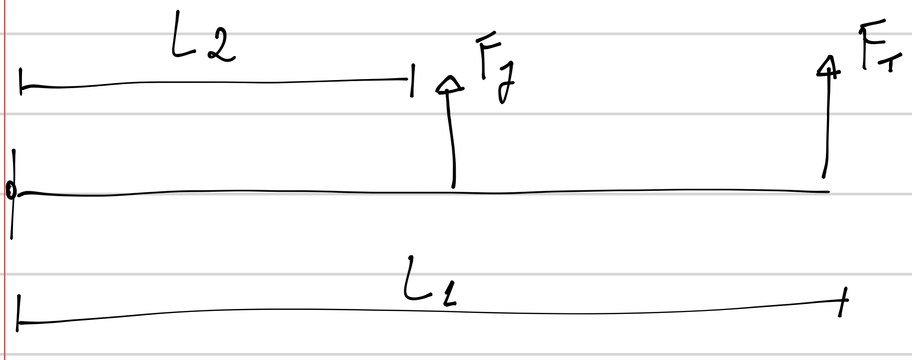
Diagramando o ouvido médio



$$P_J = \frac{F_J}{A_J}$$

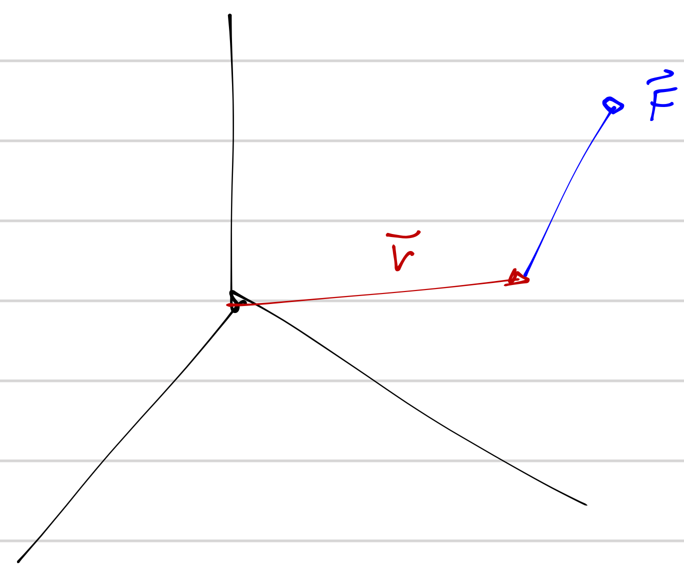
$$P_T = \frac{F_T}{A_T}$$





τ = torque

$$\vec{\tau} = \vec{r} \times \vec{F}$$



$$\tau_J = L_2 F_J$$

$$\tau_T = L_1 \cdot F_T$$

$$\tau_T = \tau_J$$

$$L_1 F_T = L_2 F_J$$

$$\boxed{F_J = \left(\frac{L_1}{L_2}\right) \cdot F_T}$$

p/ os ossos do ouvido

$$\boxed{\frac{L_1}{L_2} = 1{,}3}$$

$$P_J \cdot A_J = \left(\frac{L_1}{L_2}\right) \cdot P_T \cdot A_T$$

$$\boxed{\frac{A_T}{A_J} = 15}$$

$$P_J = \left(\frac{L_1}{L_2}\right) \cdot \left(\frac{A_T}{A_J}\right) \cdot P_T$$

$\boxed{P_J \text{ , } P_T \text{ é pressão}}$

$$I\left[\frac{W}{m^2}\right] = \frac{\text{Potência}}{\text{área}} = \frac{P}{A}$$

$$I\left(\frac{W}{m^2}\right) = \frac{P^2}{2 \cdot Z}$$

$P =$ pressão
$Z =$ impedância acústica

impedância acústica representa a resistência do meio para a propagação da onda acústica

$$\boxed{I(dB) = 10 \log\left(\frac{I}{I_0}\right)} = 10 \log\left[\frac{\frac{P^2}{\cancel{2Z}}}{\frac{P_0^2}{\cancel{2Z}}}\right] = 10 \log\left(\frac{P}{P_0}\right)^2$$

$$\boxed{I(dB) = 20 \log\left(\frac{P}{P_0}\right)}$$

$$\frac{P_g}{P_T} = \left(\frac{L_1}{L_2}\right) \cdot \left(\frac{A_T}{A_1}\right)$$

$$1{,}3 \cdot 15$$

$$I(dB) = 20 \cdot \log(1{,}3 \cdot 15) = \boxed{25{,}8}\ dB$$

$Z_{ar} = 4{,}3 \times 10^2\ Kg/m^2 \cdot s$

$Z_{água} = 1{,}48 \times 10^6\ Kg/m^2 \cdot s$

$Z = Z(Hz)$
