$$\frac{\partial^2 y(x,t)}{\partial t^2} = v^2 \frac{\partial^2 y(x,t)}{\partial x^2}$$

$$y(x,t) = f(x - vt) + g(x + vt)$$

$$y(x,t) = A\cos(kx \mp \omega t + \delta)$$

$$\omega = kv \qquad \tau = \frac{1}{\nu} = \frac{2\pi}{\omega}$$

$$y(x,t) = A\cos(kx + \phi)\cos(\omega t + \delta)$$

$$\lambda = \frac{2\pi}{k} \qquad v = \lambda\nu$$

$$k_n = n\frac{\pi}{L} \qquad k_n = (2n+1)\frac{\pi}{2L}$$

$$\omega_n = n\frac{\pi v}{L} \qquad \omega_n = (2n+1)\frac{\pi v}{2L}$$

$$\lambda_n = \frac{2L}{n} \qquad \lambda_n = \frac{4L}{2n+1}$$

$$\nu_n = n\frac{v}{2L} \qquad \nu_n = (2n+1)\frac{v}{4L}$$

$$v_\mathrm{s} = \sqrt{\frac{B}{\rho}} \quad v_\mathrm{s} = \sqrt{\gamma\frac{P_0}{\rho_0}} = \sqrt{\gamma\frac{RT}{M}}$$

$$v = \sqrt{\frac{T}{\mu}}$$

$$p = -B\frac{\partial u}{\partial x} = -\rho_0 v_\mathrm{s}^2\frac{\partial u}{\partial x} \quad A_p = BkA_u = \rho_0 v_\mathrm{s}\omega A_u$$

$$I = \tfrac{1}{2}\frac{A_p^2}{\rho_0 v_\mathrm{s}} = \tfrac{1}{2}\rho_0 v_\mathrm{s}\,(\omega A_u)^2$$

$$I = P = \tfrac{1}{2}\mu v(\omega A)^2$$

$$I = \frac{\bar{P}}{S} \propto A(r)^2 \qquad \beta = 10\log_{10}(I/I_0)\ \ (\mathrm{dB})$$

$$I_0 = 1\times10^{-12}\ \mathrm{W/m^2}$$

$$A^2 = A_1^2 + A_2^2 + 2A_1A_2\cos\Delta\phi$$

$$\Delta\phi = 2\pi\Delta r/\lambda + \delta$$

$$y = y_1 + y_2 = A\cos(kx \mp \omega t + \delta)$$

$$\delta = \delta_1 + \beta, \text{com } \beta = \mathrm{arcsen}\,(A_2\,\mathrm{sen}\,\delta_{12}/A)$$

$$A^2 = A_1^2 + A_2^2 + 2A_1A_2\cos\delta_{12},$$

$$\text{onde } \delta_{12} = \delta_2 - \delta_1$$

$$y(x,t) = 2A\cos\left(\tfrac{1}{2}\Delta k\,x - \tfrac{1}{2}\Delta\omega\,t\right)\cos\left(\bar{k}x - \bar{\omega}t\right)$$

$$\nu = \nu_0\frac{1 \pm \frac{u}{v_\mathrm{s}}}{1 \mp \frac{V}{v_\mathrm{s}}} \begin{cases} u \to \text{observador} \\ V \to \text{fonte} \end{cases}$$

$$\mathrm{sen}\,\alpha = \frac{v_\mathrm{s}}{V}$$