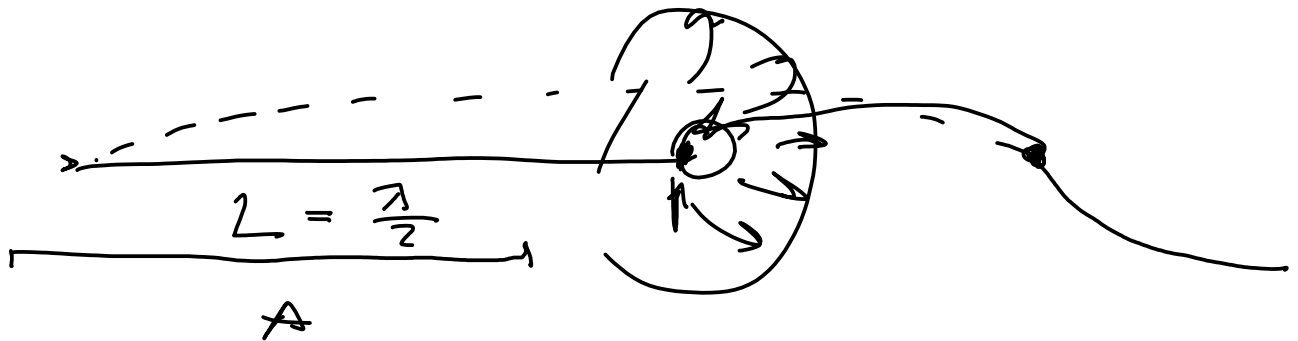


# TALLER 7

Modos Normales. → Resonancia.

↑



1er modo normal  
Node  
→ frecuencia fundamental

o primer armónico.

$$2\lambda/2 = L$$

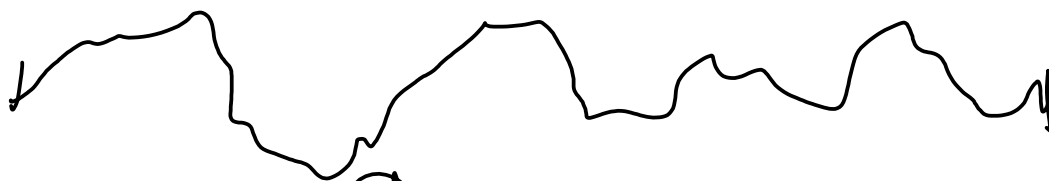


2do armónico.

$$L = n \frac{\lambda}{2} \rightarrow \lambda_n = \frac{2L}{n}$$

$$f_n = n \frac{v}{2L} = n f_1$$

$$\rightarrow \boxed{f_n = n f_1}$$



$f(x, t) \sim a_0 + a_1 \sin(\dots) + a_2 \sin(\dots) + \dots$

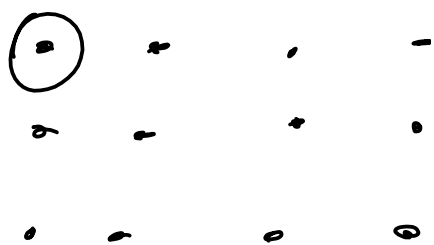
(An arrow points from  $a_0$  to the first term, and another from  $a_2$  to the second term.)

Transp. de Fourier

$\rightarrow 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$

# Sonido

Aire.



$$y(x, t) = A \cos(kx - \omega t)$$

$p(x, t) = ?$

Esfuerzo

$$B = - \frac{p(x, t)}{dV/V}$$

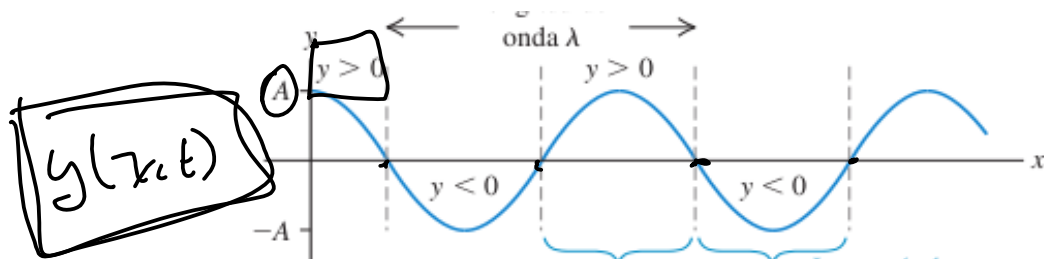
$$\frac{\partial V}{\partial x} = \frac{\partial y(x,t)}{\partial x}$$

Ampl.  $\leftarrow$  Derivada parcial.

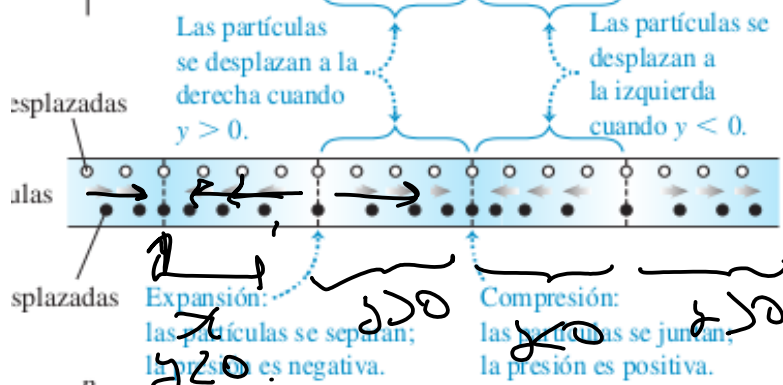
$$\rightarrow P(x,t) = B \left[ \frac{A}{\lambda} \sin(kx - \omega t) \right]$$

$$y(x,t) = A \sin(kx - \omega t)$$

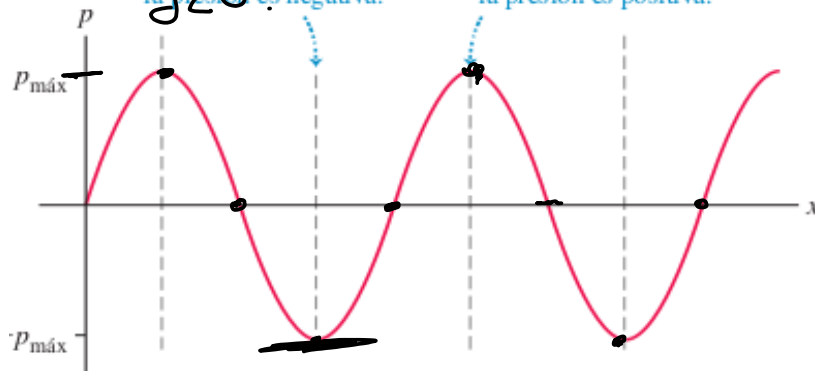
$\pi/2$



$t \rightarrow$  fijo.



$P(x,t)$

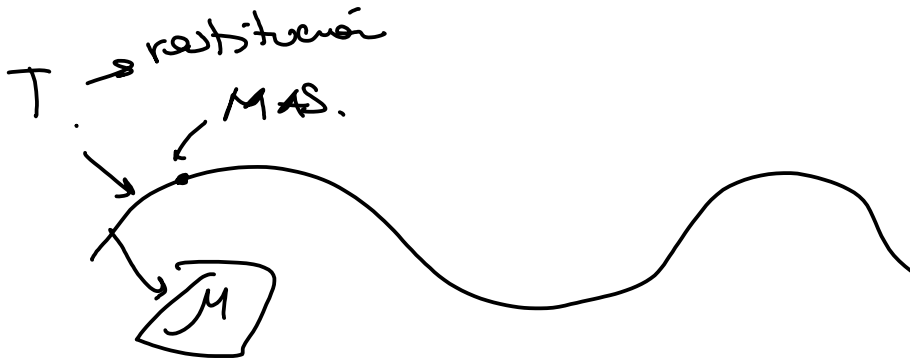


Velocidad de las ondas.

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

densidad lineal  
de masa

Para  
cualquier onda.



$$v = \sqrt{\frac{F \cdot \text{restricción}}{\text{Medida de inercia}}}$$

Agua

$$v = \sqrt{B/\rho}$$

Solids

$$v = \sqrt{\gamma / \rho}$$

Gas ideal

$$v = \sqrt{\frac{\gamma R T}{M}}$$

---

¿Cómo funciona un ultrasounds?

20 → 20,000 Hz  
OH.

125,000 Hz  
Sonares.

0.7 → 3.3 MHz

U.S.

