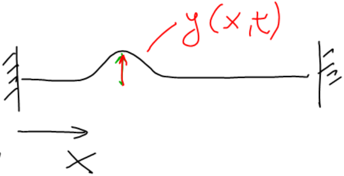
Hoy comenzamos con el estudio de las ONDAS

→ Perturbación en un medio flexible que se mueve de un lugar a otro sin que exista transporte de masa

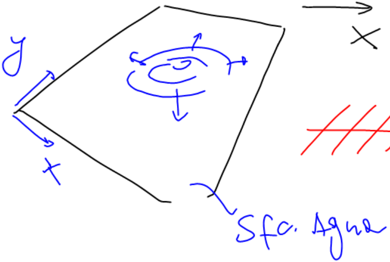
$$y(\vec{r}, t) \rightsquigarrow y(x, t)$$

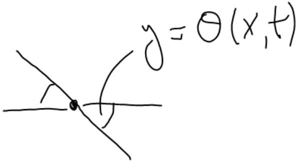
Ejemplos de ondas

Ondas Mecanicas $\qquad y = \text{Deformación}$



"y" $\rightarrow Z(x,y,t)$





Ondas mecánicas

- Transversales

cuerda

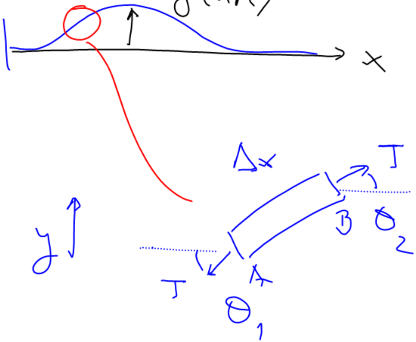
- Longitudinales

Resorte

~~Sonda~~

Sonido

Ejemplo. Cuerda tensa, y masa $\sim \sigma$



$\sum F_y : T \operatorname{sen} \theta_2 - T \operatorname{sen} \theta_1$

Perturbación pequeña

$\theta \to$ pequeño

$\operatorname{sen} \to \operatorname{tg} = \dfrac{\partial y}{\partial x}$

$$\to T\left(\left.\frac{\partial y}{\partial x}\right|_B - \left.\frac{\partial y}{\partial x}\right|_A \right)$$

Nota : $\dfrac{\partial y}{\partial x}$; Derivada "Parcial"

Reci: $y(x,t)$

$$\sum F_V : T\left(\left.\frac{\partial y}{\partial x}\right|_B - \left.\frac{\partial y}{\partial x}\right|_A\right) = m\, a_y$$

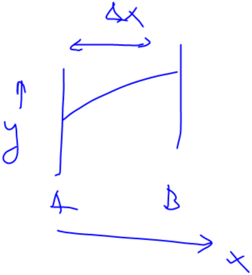
$$= \mu \cdot \Delta x \cdot \frac{\partial^2 y}{\partial t^2}$$

Δx

$$m = \mu \cdot \Delta x$$

$$\mu = \frac{M}{L}$$ Densidad lineal de masa

$$T\underbrace{\left(\left.\frac{\partial y}{\partial x}\right|_B - \left.\frac{\partial y}{\partial x}\right|_A\right)}_{f_B - f_A} = \mu\cdot\Delta x\cdot\frac{\partial^2 y}{\partial t^2} \qquad /\frac{1}{\Delta x}$$



$\lim_{\Delta x \to 0}$

$$T\frac{\partial}{\partial x}(f) = \mu\frac{\partial^2 y}{\partial t^2}$$

$$T\frac{\partial}{\partial x}\left(\frac{\partial}{\partial x}y\right) = \mu\frac{\partial^2 y}{\partial t^2}$$

$$\boxed{\frac{T}{\mu}\frac{\partial^2 y}{\partial x^2} = \frac{\partial^2 y}{\partial t^3}}$$

EC. ONDA

Recorder $\ddot{x} = -\omega^2 x \rightarrow x(t) = A\cos(\omega t + \phi)$

$$\frac{T}{\mu}\frac{\partial^2 y}{\partial x^2} = \frac{\partial^2 y}{\partial t^2} \rightarrow y(x,t)$$

la solución "general"

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

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

Noten $[c] = \sqrt{\dfrac{Kg \cdot m/s^2}{Kg/m}} = \sqrt{\dfrac{m^2}{s^2}}$

$$[c] = m/s$$