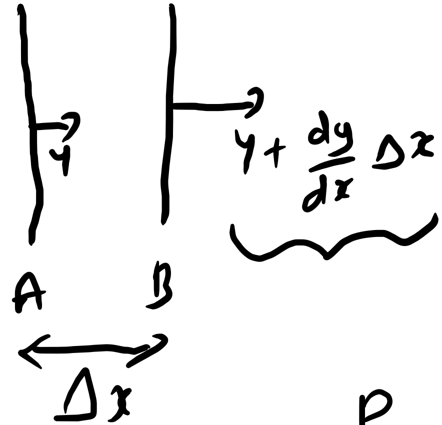


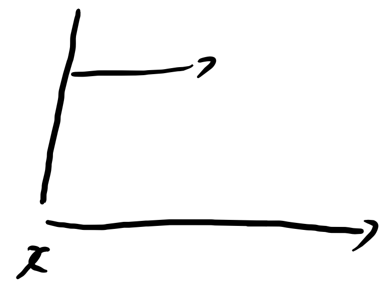
$$y_B > y_A$$

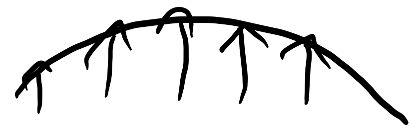
$$P_B > P_A$$

$$A \xrightarrow[F]{} B$$

$$A \xleftarrow[F_{restoring}]{} B$$

$$\frac{d^2 y}{dt^2} = v^2 \frac{d^2 y}{dx^2}$$





Separation of Variable Method

$$y(x,t) = X(x)\,T(t)$$

$$\frac{d^2}{dt^2}\left(X(x)\,T(t)\right) = v^2 \frac{d^2}{dx^2}\left(X(x)\,T(t)\right)$$

$$X(x)\,\frac{d^2 T(t)}{dt^2} = v^2\, T(t)\,\frac{d^2 X(x)}{dx^2}$$

$$\frac{1}{T(t)}\,\frac{d^2 T(t)}{dt^2} = v^2\,\frac{1}{X(x)}\,\frac{d^2 X(x)}{dx^2} = -\omega^2$$

$$\frac{1}{T(t)}\frac{d^2T(t)}{dt^2} = -\omega^2 \longrightarrow$$

$$v^2 \frac{1}{X(x)}\frac{d^2X(x)}{dx^2} = -\omega^2$$

$$\frac{d^2T(t)}{dt^2} = -\omega^2 T(t)$$

$$\frac{\omega^2}{v^2} = \frac{(2\pi\nu)^2}{v^2}$$

$$\boxed{\frac{d^2T(t)}{dt^2} + \omega^2 T(t) = 0}$$

$$\frac{\omega^2}{v^2} = \left(\frac{2\pi}{\lambda}\right)^2 \quad \frac{\nu}{v} = \frac{1}{\lambda}$$

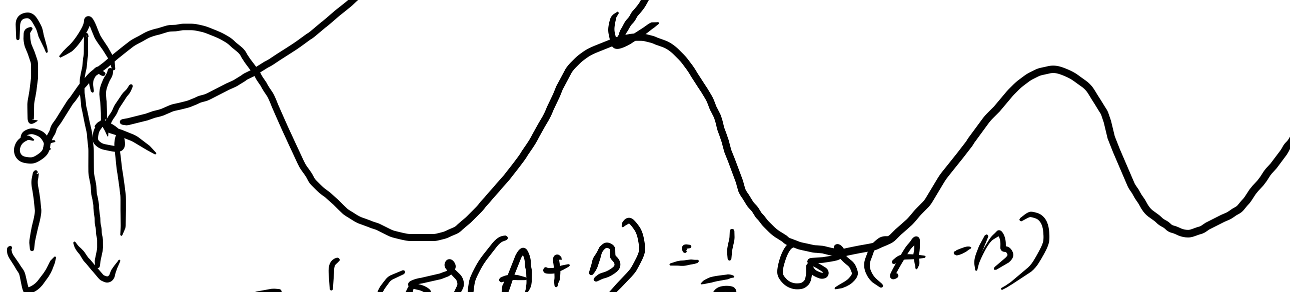
$$= (k)^2$$

$$\frac{d^2X(x)}{dx^2} + \frac{\omega^2}{v^2}X(x) = 0$$

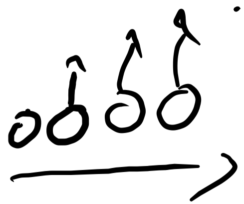
$$\frac{d^2X}{dx^2} + k^2X(x) = 0$$

$$Y(x,t) = X(x)\,T(t)$$

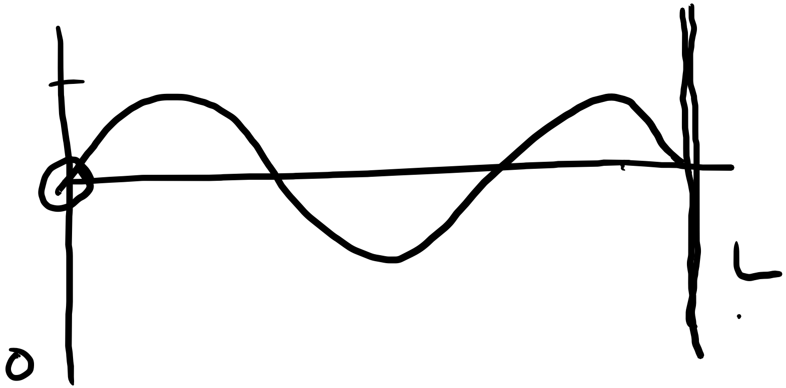
$$= \underbrace{\sin(kx)}\;\underbrace{\sin(\omega t)}$$



$$= \frac{1}{2}\cos(A+B) - \frac{1}{2}\cos(A-B)$$



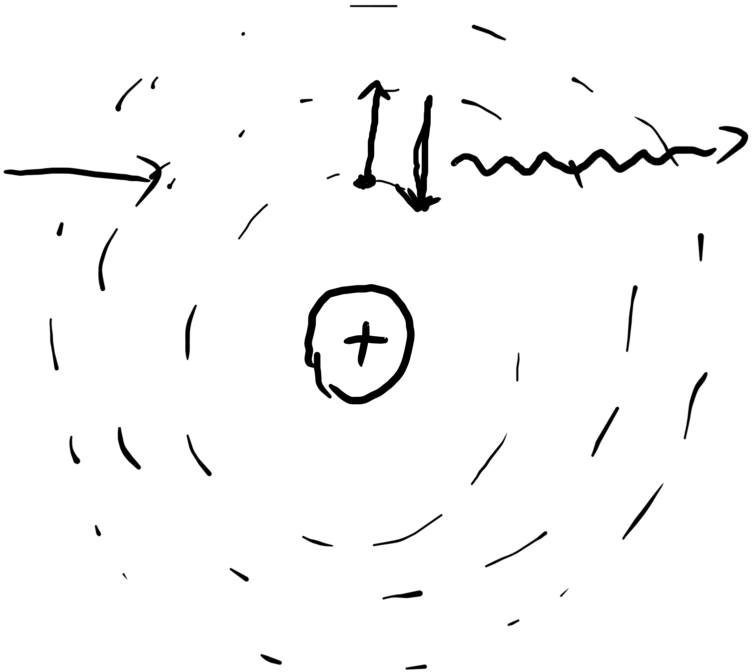
$$Y(x,t) = A_x \cos(kx+\omega t) + B_x \cos(kx-\omega t)$$



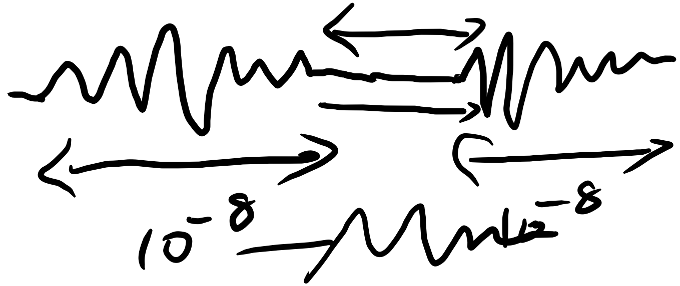
$x = 0 \quad y = 0 \qquad 0 = 1$

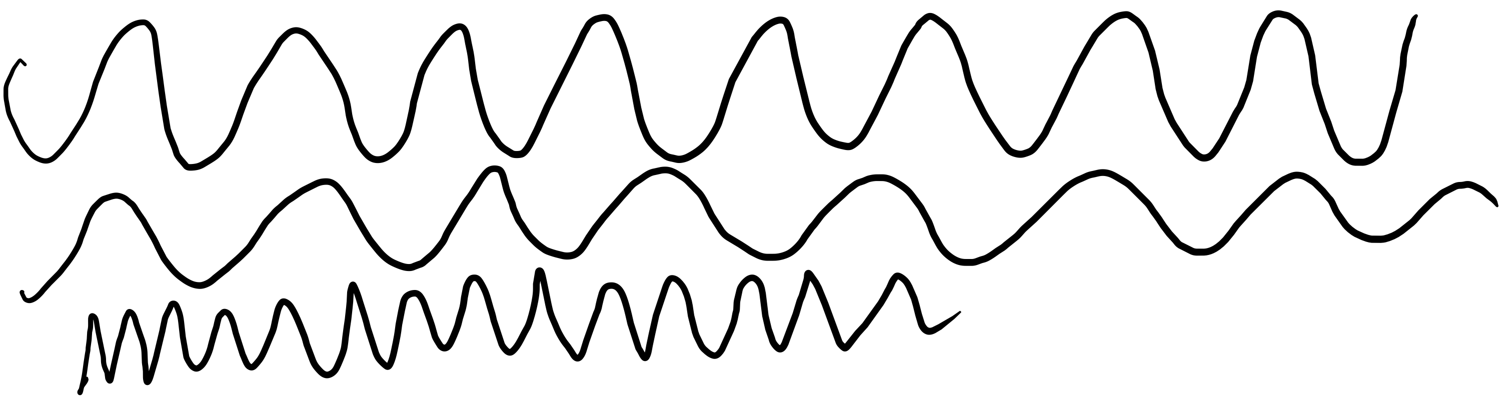
$x = 0 \quad y = 0$

$x = L \quad y = 0$



10^{-8} s





$\underline{v = \nu \lambda}$

$$v = \frac{2\pi \nu \lambda}{2\pi} = \frac{2\pi \nu}{2\pi/\lambda}$$

$$\boxed{v = \frac{\omega}{k}}$$

$T =$ 

$$\frac{\lambda}{T}$$

$$v = \frac{\lambda}{T} = \frac{1}{T}\lambda = \nu\lambda$$

$k = 2\pi \frac{1}{\lambda} =$ 

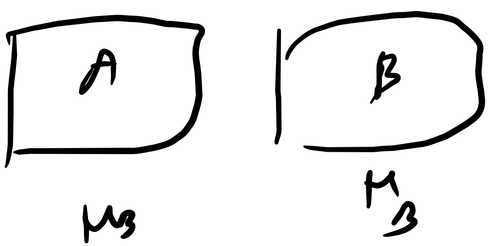
$\Phi = \underline{kx}$

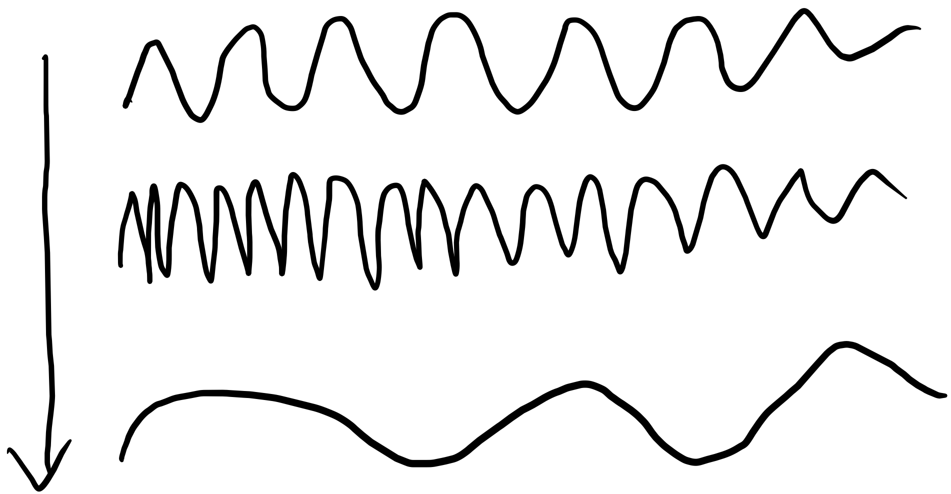
$N \to 2\pi \underline{x}$

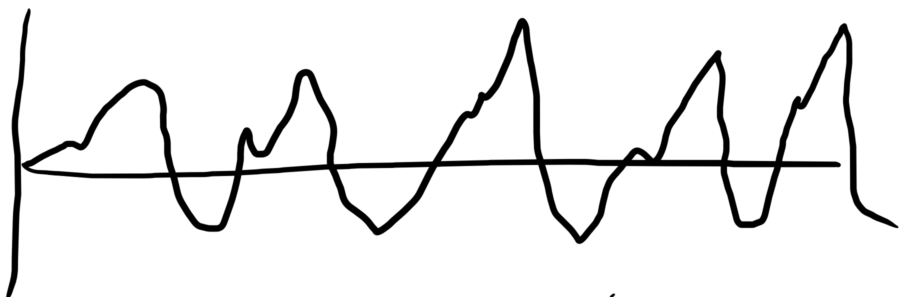
c

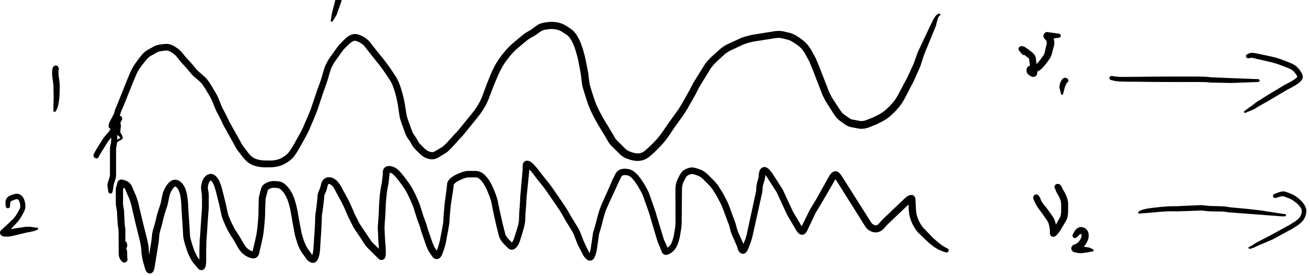
$$v_{med.} = \frac{c}{\mu} \qquad \mu = \frac{c}{v}$$

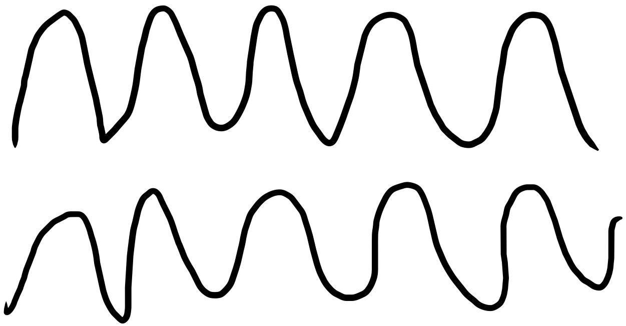
$\mu \to$








1
2
ν_1
ν_2



$\lambda \rightarrow$

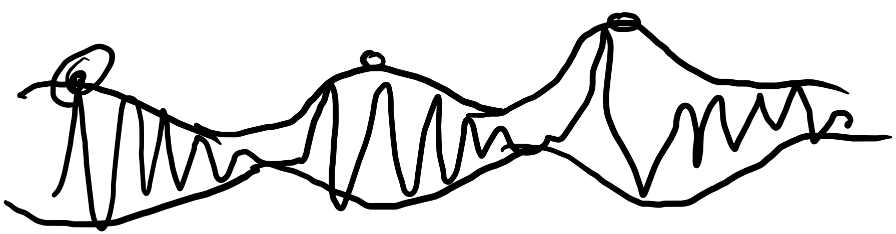
$\lambda \rightarrow$

$v = \frac{\omega}{k}$ = phase velocity of the velocity

one single wave

v_g = velocity of envelope

$$v_g = \frac{d\omega}{dk}$$



$$\omega = ck$$

$$\boxed{\frac{d\omega}{dk} = c}$$