Physics 113 - December 4, 2012

Last Time

Simple Harmonic Motion

$$\frac{d^2x}{dt^2} + (\text{const})\, x = 0$$

or cos

$$x = A \sin(\omega t + \phi) \quad \text{where} \quad \omega^2 = \text{const}$$

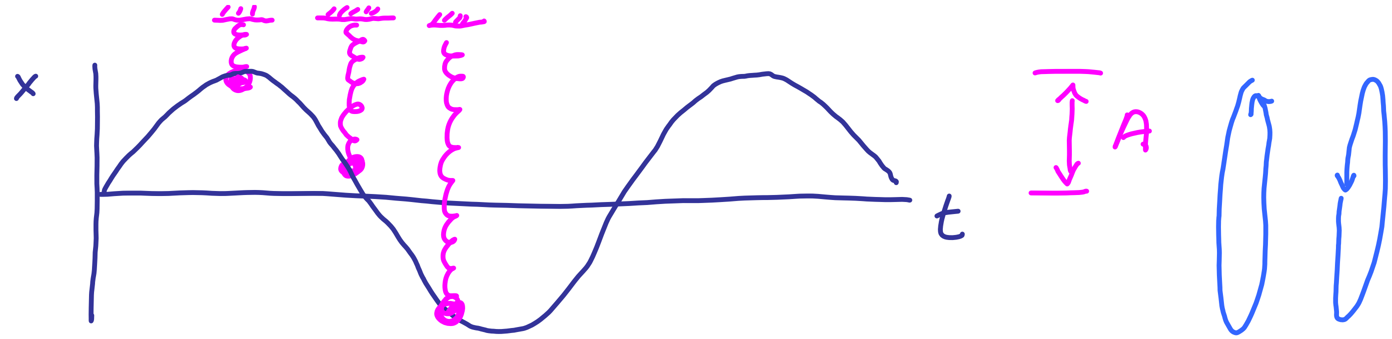
initial phase Angle → defines starting point

Amplitude

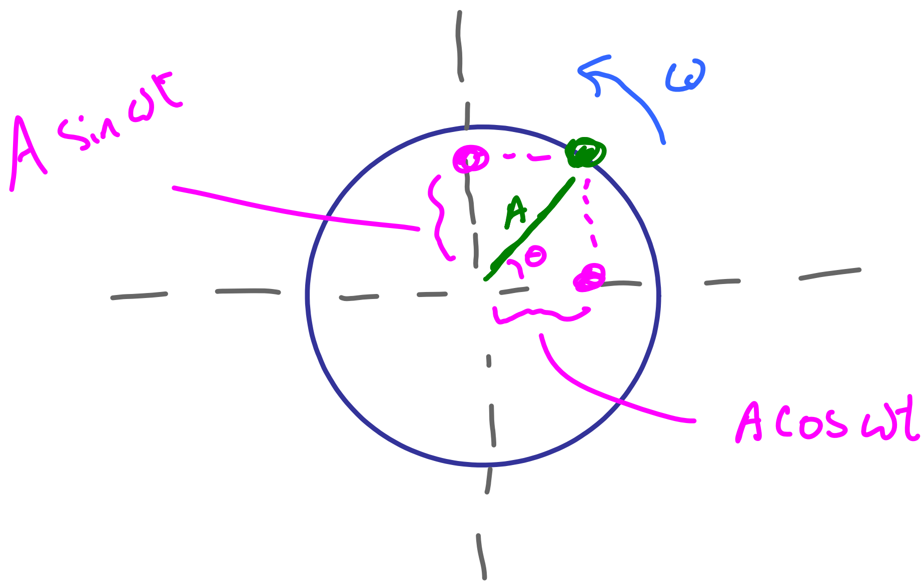
Frequency $= \frac{2\pi}{T}$ — Period

Think of springs

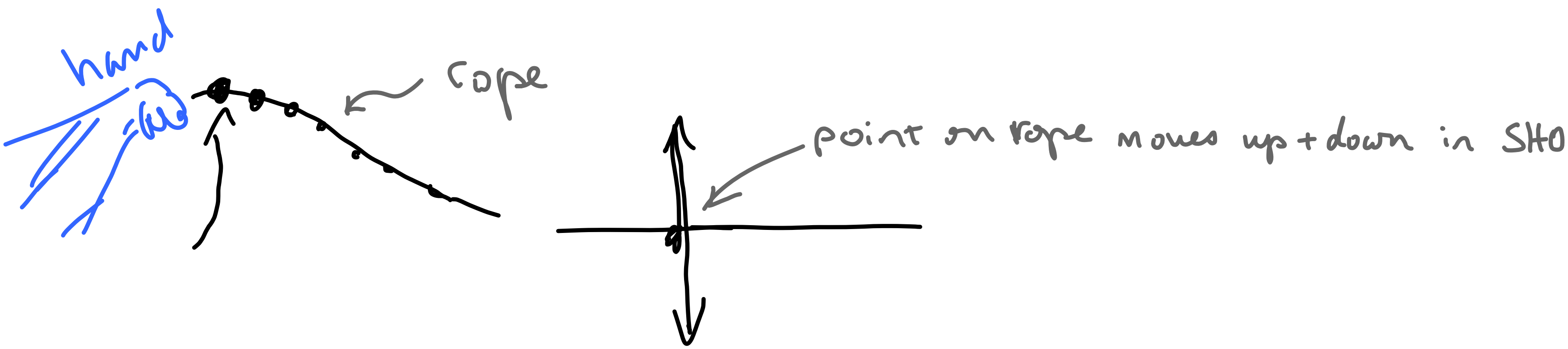
SHO
&
connection to
circular motion

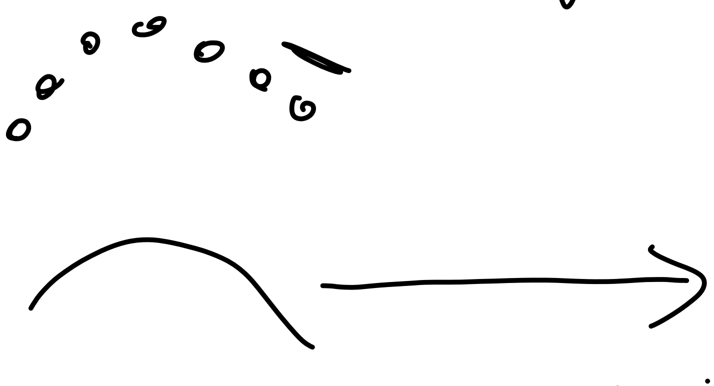


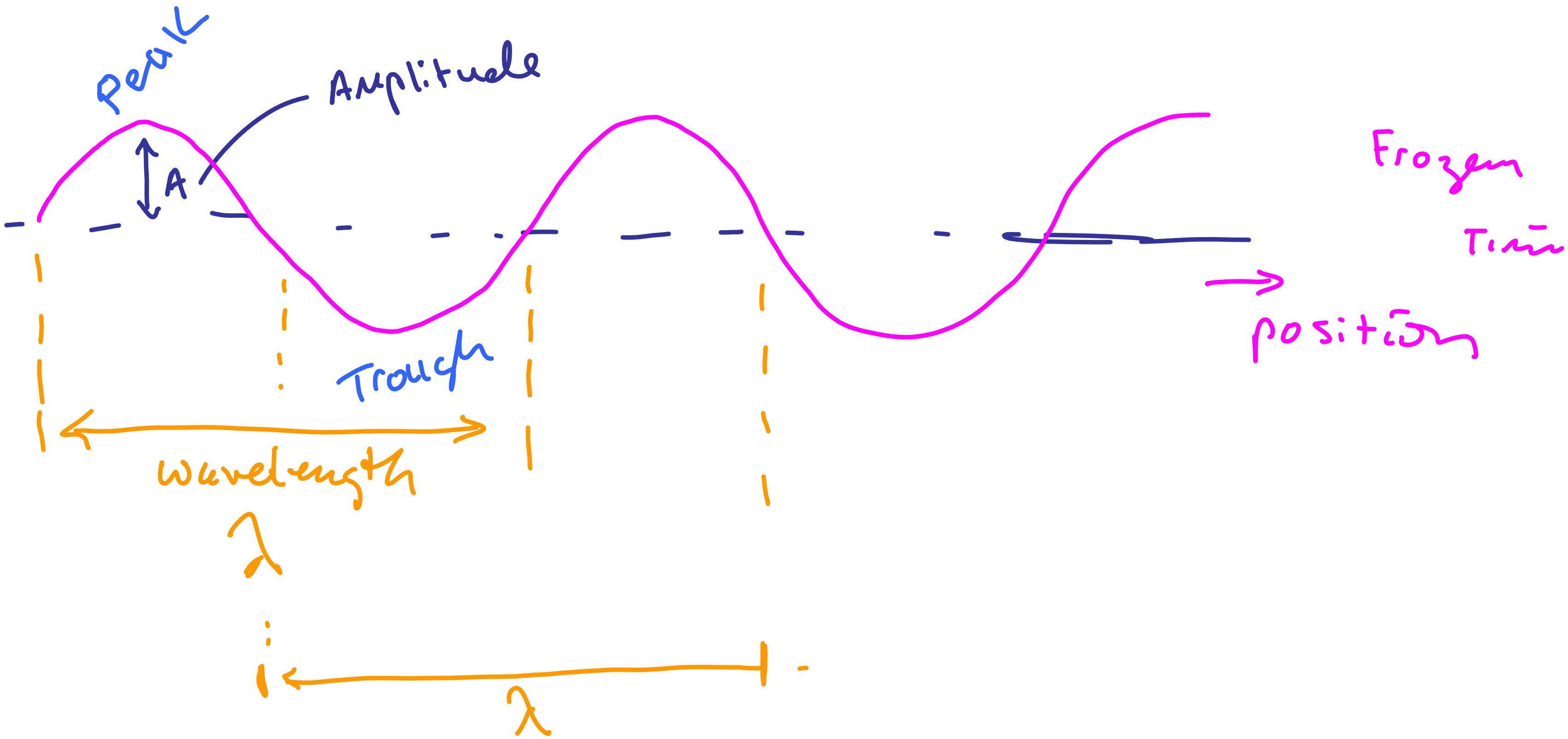
one full cycle
of motion in
time of one
"period"

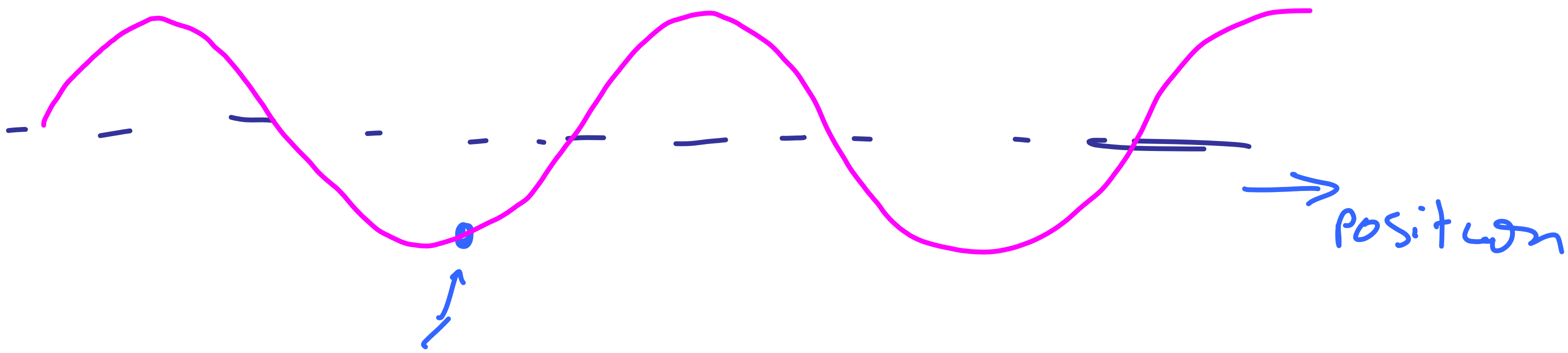


Waves






Peak
Amplitude
A
Frozen
Time
position
Trough
wavelength
λ
λ



T = time for element to execute one full cycle

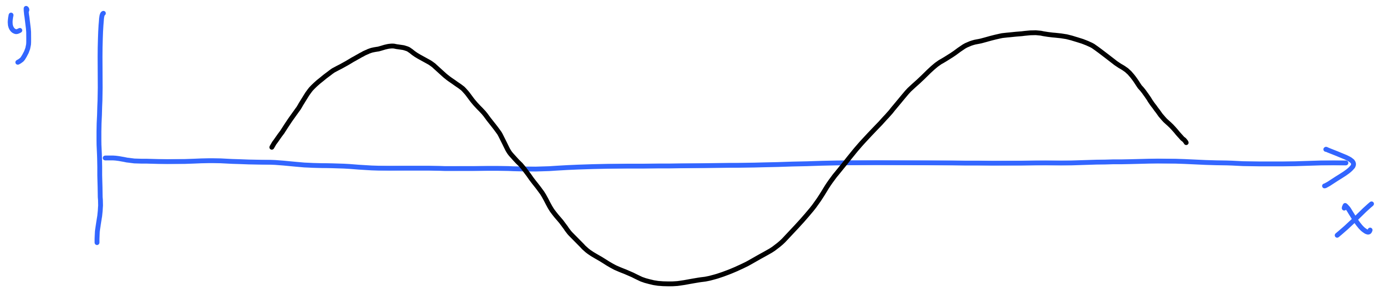
frequency $= \dfrac{1}{T} = f$

ν

$$\boxed{v = \frac{\lambda}{T} = \lambda f = \lambda \nu}$$

velocity $= \dfrac{\lambda}{T}$

v "



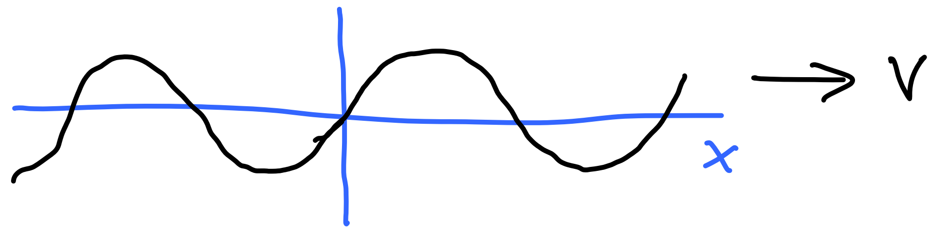
$$y(x) = A \sin(kx)$$

wave #

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

allow time to move, what is y at $x=0$

$2\pi/T$

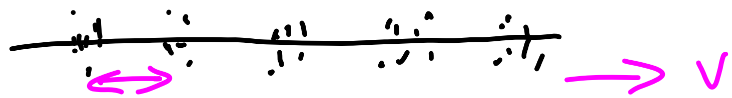


$y \sim A\sin(\omega t)$

Try $y(x,t) = A\sin(\underbrace{kx-\omega t}_{\text{fix this}})$ wave to right

$y(x,t) = A\sin(kx+\omega t)$ wave to left

Transverse wave



Longitudinal wave

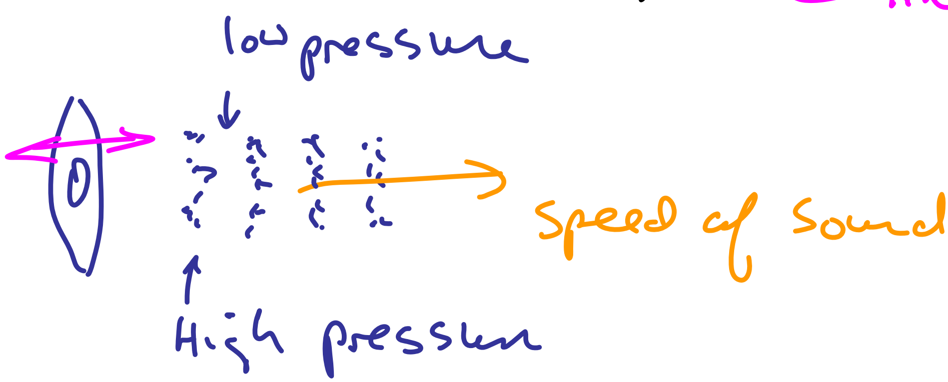
Think of a wave on a "slinky"

velocity waves on a String

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

Tension

linear Mass density



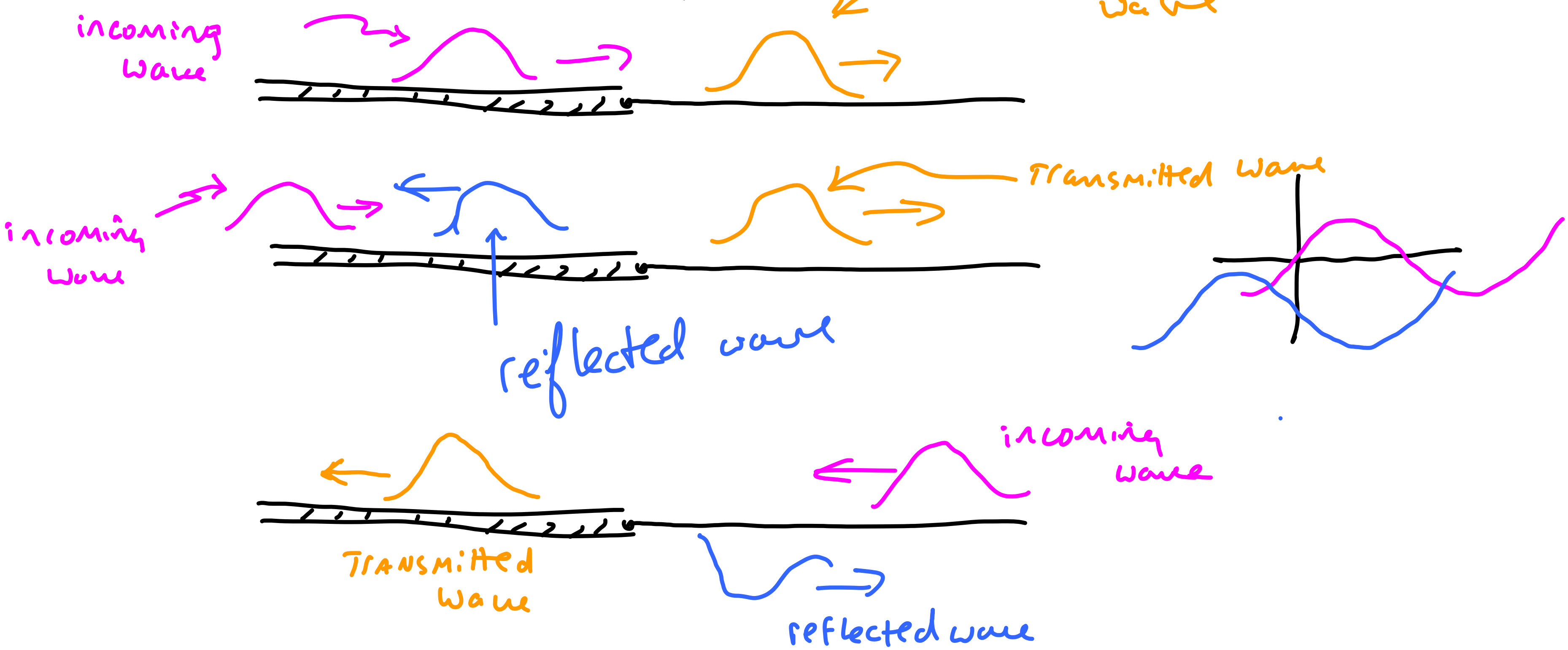
$$V_{\text{sound wave}} = \sqrt{\frac{B}{\rho}}$$

Bulk Modulus

density

Waves and boundaries

Boundaries between "media"



fast to slow

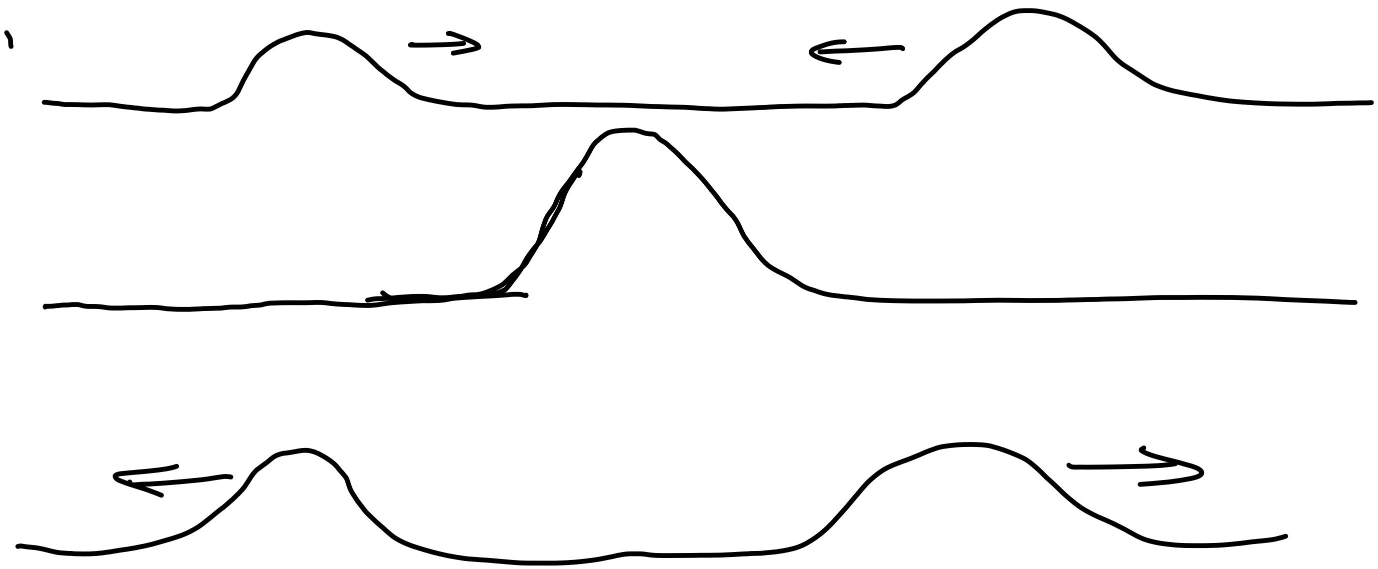
low μ to high μ — 180° phase change

slow to fast

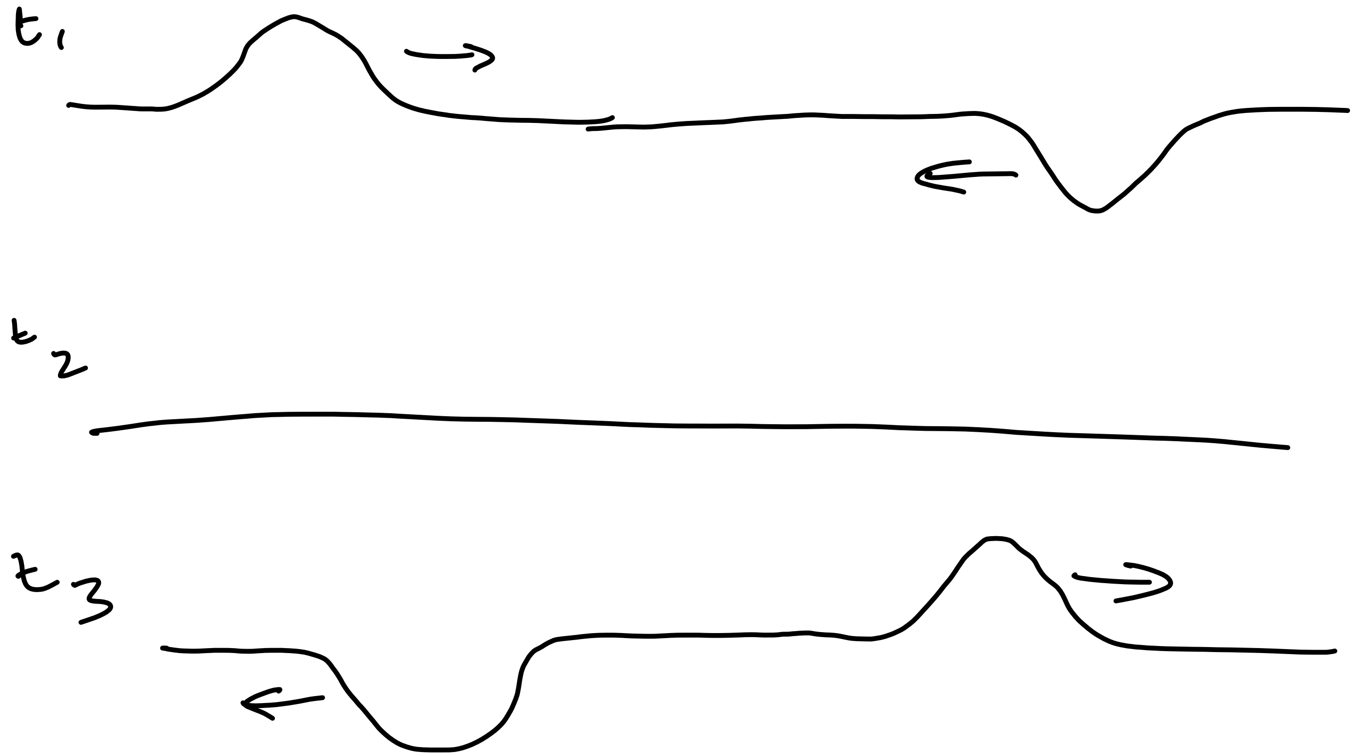
high μ to low μ $\rightarrow$ no phase change

Waves exhibit "Superposition"

t_1



constructive "interference"



destructive interference