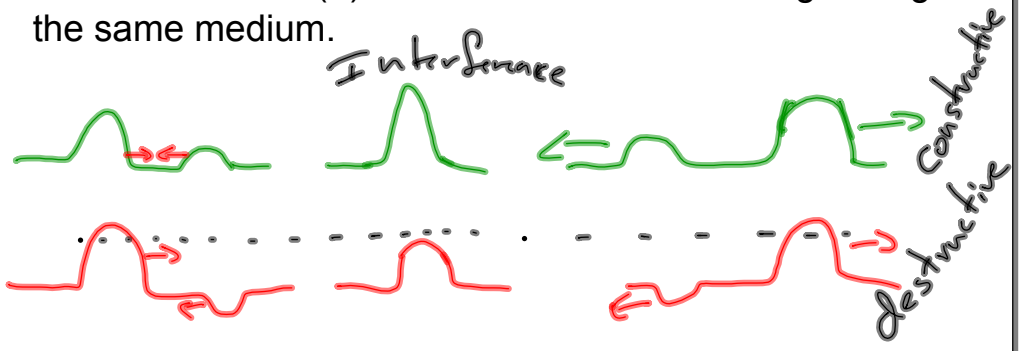
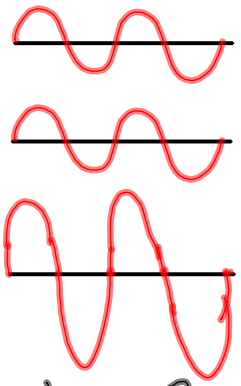
# Superposition

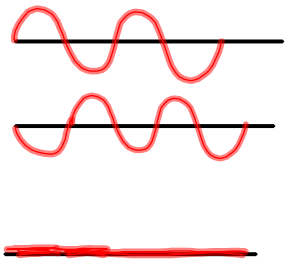
The combination (+) or 2 or more waves moving through the same medium.



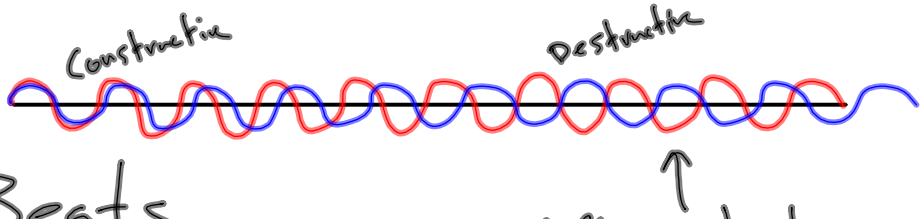

In Phase



Out of phase



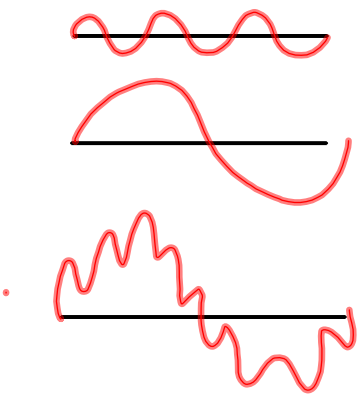
When they don't have the same $\lambda$ (f)




## Beats

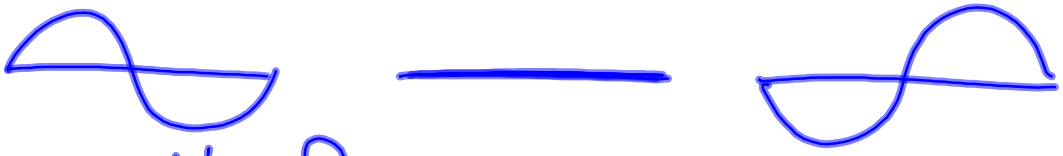
Beat frequency = difference between the 2 frequencies

Crazyness



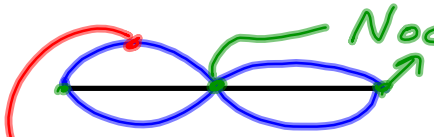
March 02, 2016

# Standing Waves



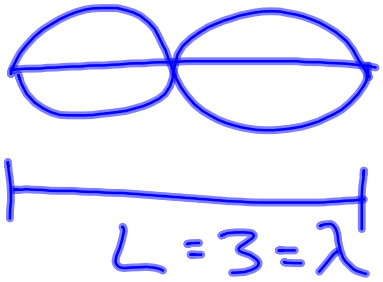
A result of 2 waves interfering with eachother.

They must
- Be moving in opposite directions
- Have the same frequency



Node - a point on the wave that does not move
- inflection point

Antinodes
↓
points of maximum displacement



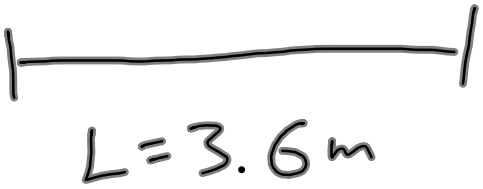

$V = 6\ m/s$

$f = \frac{V}{\lambda} = \frac{6\ m/s}{3\ m} = 2\ \frac{1}{s}$

$V = \lambda \cdot f$

$f = \frac{V}{\lambda}$

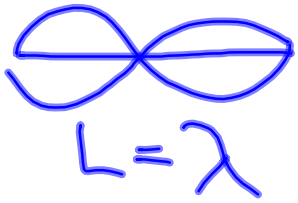
# Demonstration




$V = \frac{d}{t} = \frac{7.2\ m}{1\ s} = 7.2\ m/s$

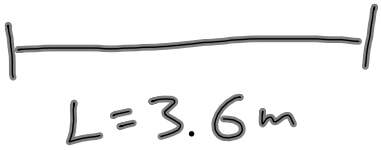
$2.5\ s = 5\ periods$

$1\ period = 0.5\ s$




$T = 0.5\ s$

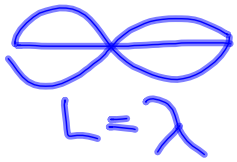
$V = \frac{\lambda}{T} = \frac{3.6}{0.5} = 7.2\ m/s$



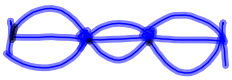

$V = \frac{d}{t} = \frac{7.2m}{1s} = 7.2 m/s$

$2.5s = 5 \text{ periods}$

$1 \text{ period} = 0.5s$




$T = 0.5s$ $\quad V = \frac{\lambda}{T} = \frac{3.6}{0.5} = 7.2 m/s$




$3.6 = 1.5\lambda$

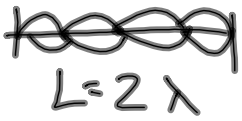
$\lambda = \frac{3.6}{1.5} = 2.4$

$t = 1.83$
$1.88$
$1.7$
$1.73$
$1.76$
$1.62$
$1.74$
$1.6$

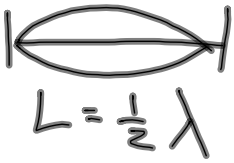
$t = 1.7$

$T = 0.34$

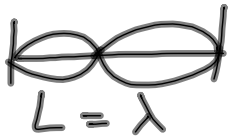
$V = \frac{\lambda}{T} = \frac{2.4m}{0.34s} = 7.06 m/s$



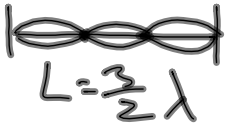

$V = 7.2$



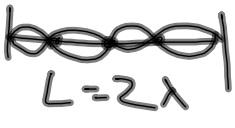

Fundamental frequency
1st Mode




1st harmonic
↳ 2nd mode




2nd Harmonic
↳ 3rd mode

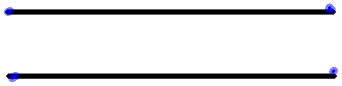


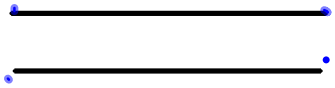

3rd harmonic
↳ 4th mode

3.5 m long rope, velocity of 4m/s. determine the wavelength and frequency for each.

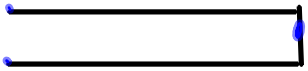
# Different Types of standing waves

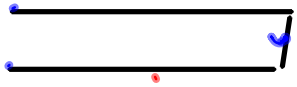
open/open





open/closed





Node on Fixed/closed end

Antinode on Open/loose end