

Principle of Superposition

"When two waves exist at the same time in the same space in a medium."

- 1) Each wave pushes on the particles of the medium.
- 2) As the waves interact they temporarily change the medium they're acting on.
- 3) After the waves pass through the medium it returns to its original state. The waves continue unaffected too.

Principle of Superposition

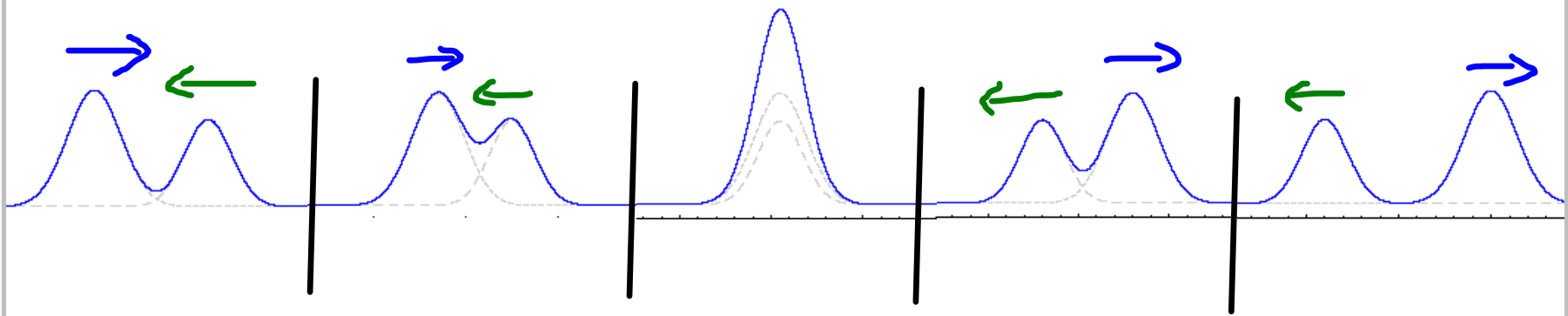
"When two waves exist at the same time in the same space in a medium."

The result of the interaction is called:

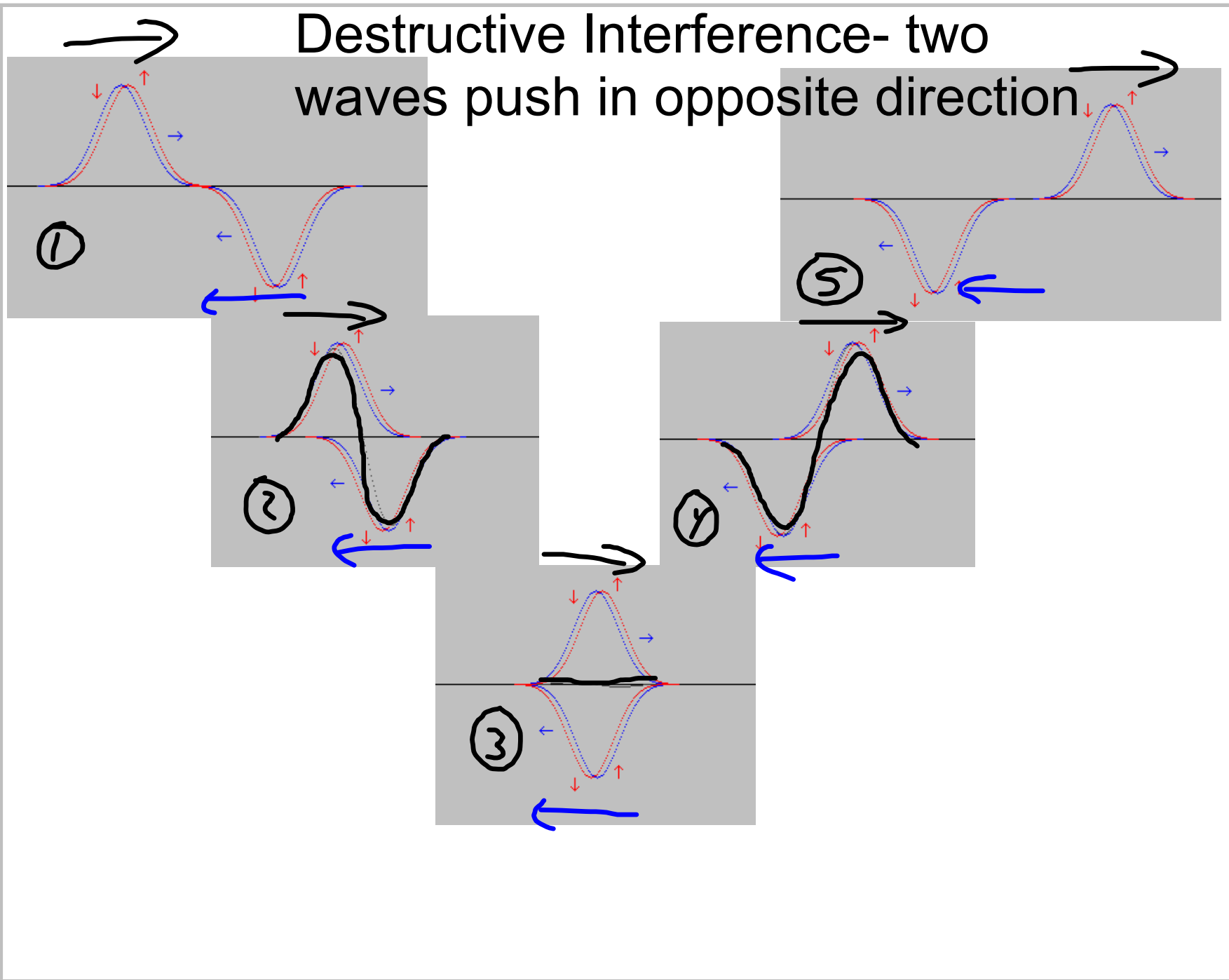
Constructive Interference- two waves push in the same direction

Destructive Interference- two waves push in opposite direction

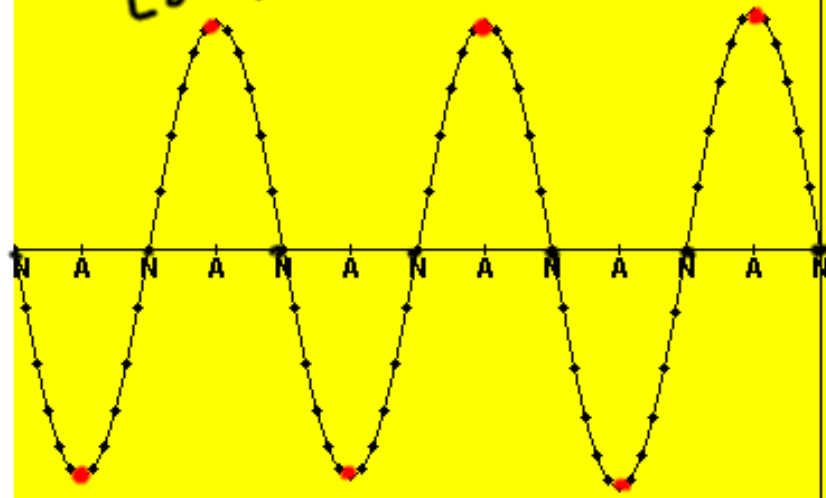
Constructive Interference- two waves push in the same direction



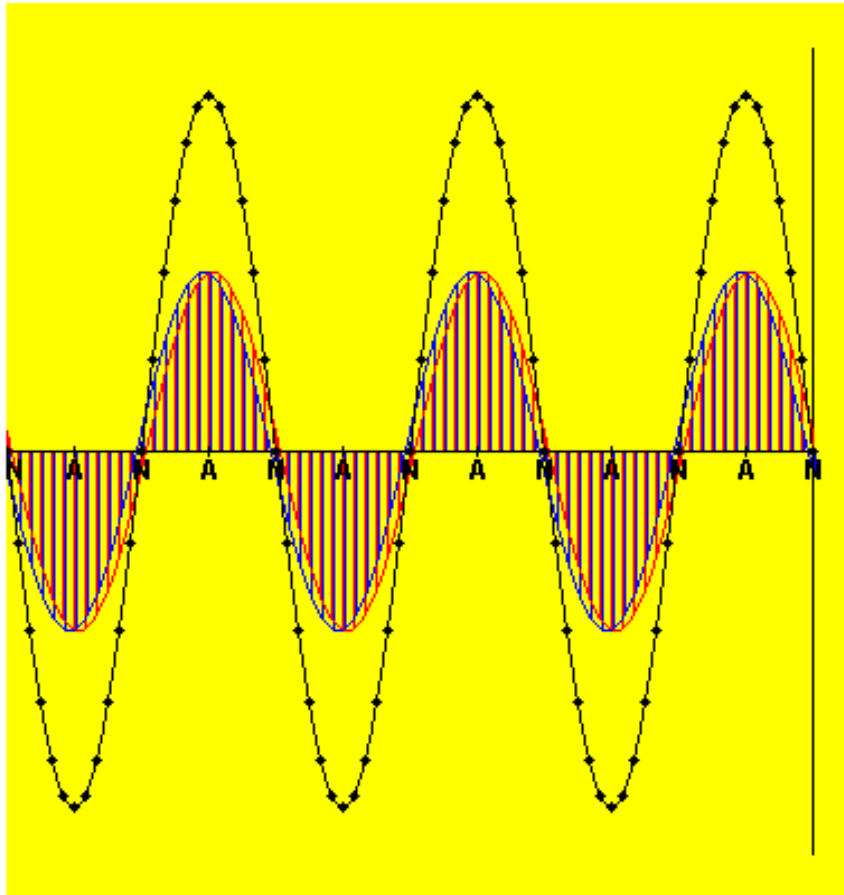
Destructive Interference- two waves push in opposite direction



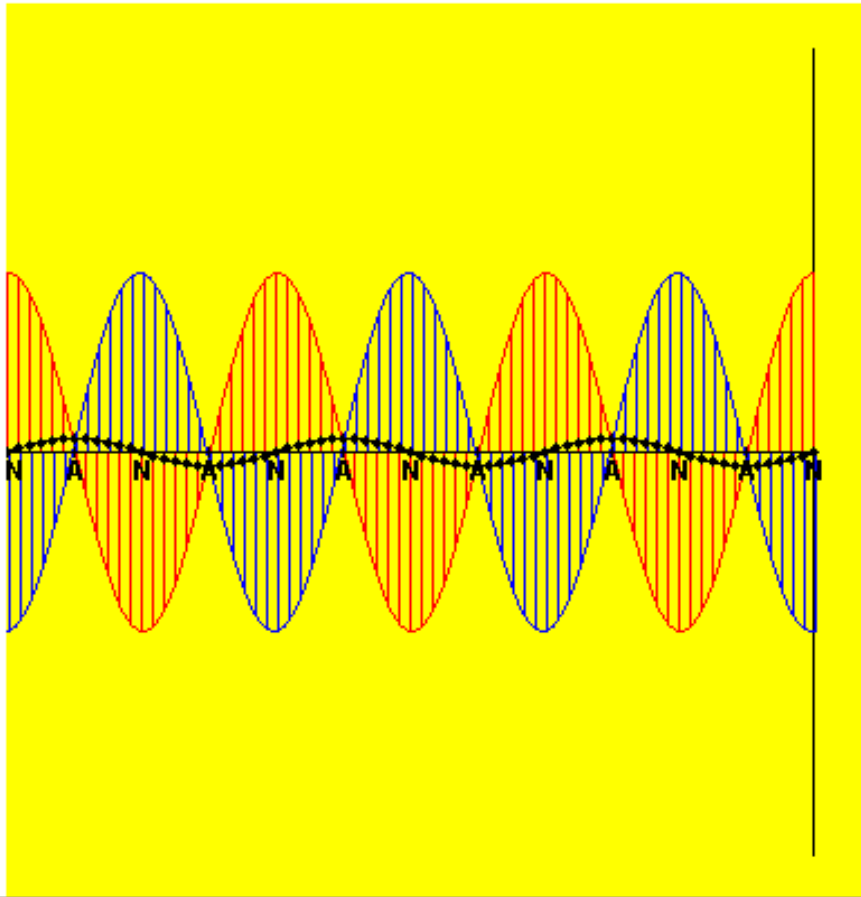
Standing wave
Loop



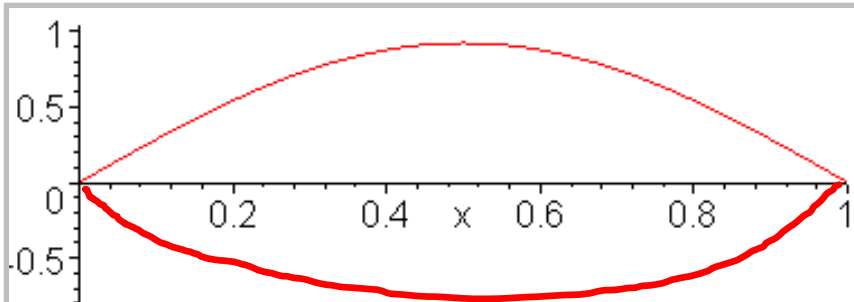
N = Node - no displacement
 A = antinode - max. displacement



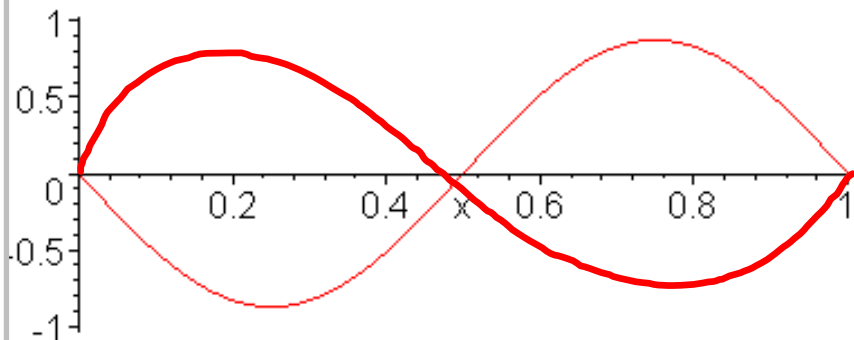
inlet SWelleRefl started



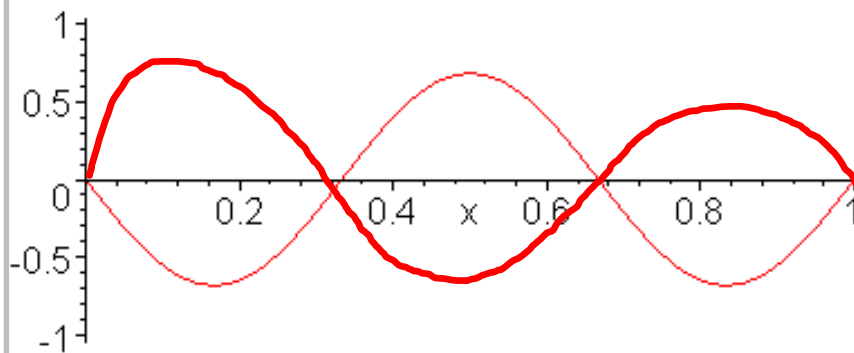
StWelleRefI started



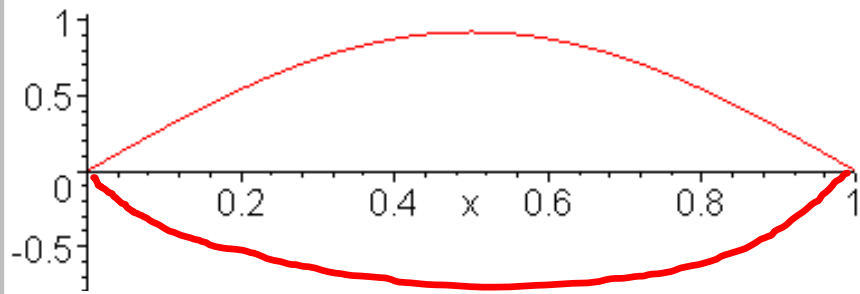
Fundamental Frequency
first harmonic



second harmonic

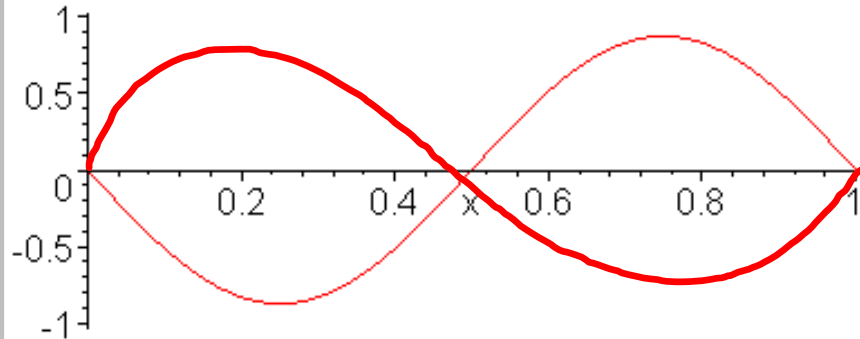


third harmonic

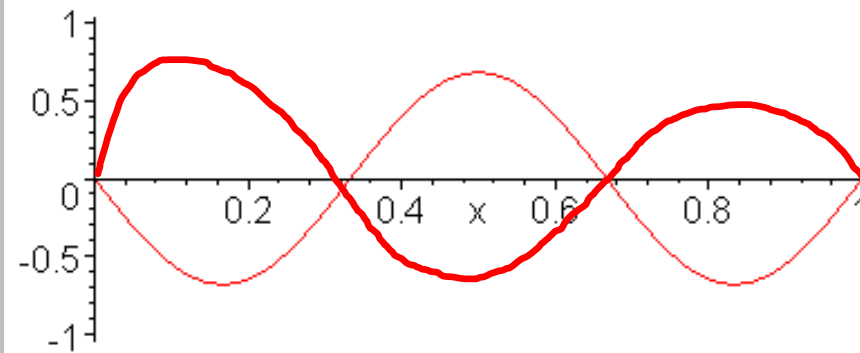


What part of the wave is in each medium?

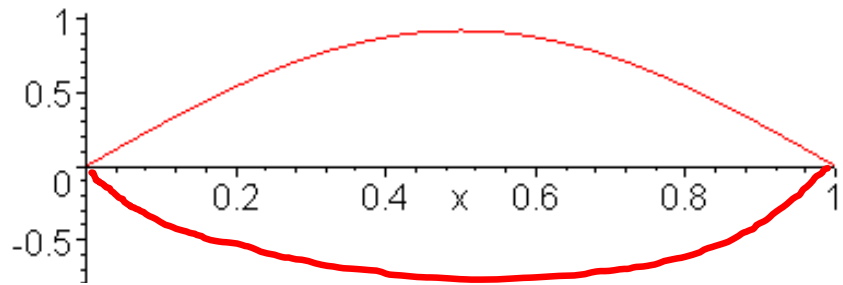
$$\frac{1}{2} \lambda = L$$



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

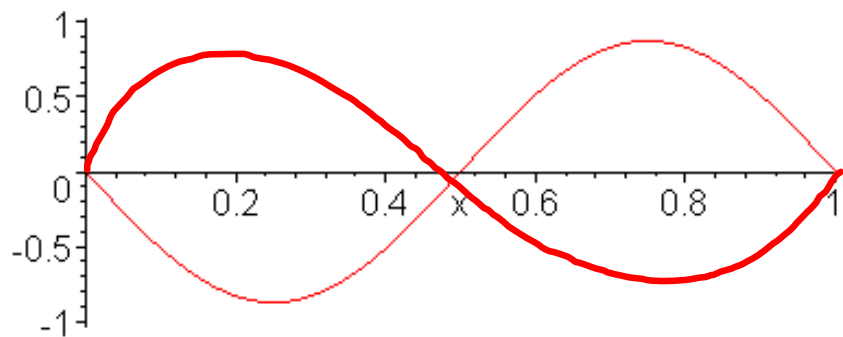


$$\frac{3}{2} \lambda = L$$



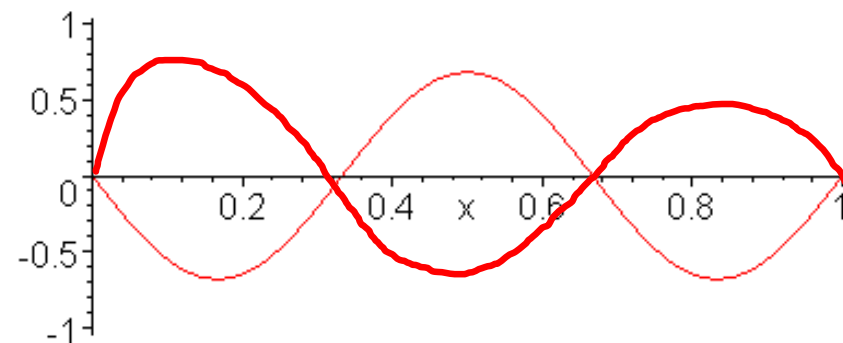
$$L = 1/2 \lambda \quad \text{or, } \lambda = 2/1 L$$

$$\lambda = 2/1 (1\text{m}) = 2\text{m}$$



$$L = 2/2 \lambda \quad \text{or, } \lambda = 2/2 L$$

$$\lambda = 2/2 (1.0\text{m}) = 1\text{m}$$

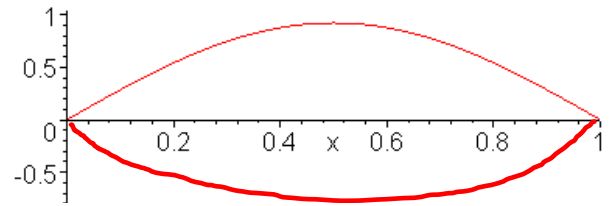


$$L = 3/2 \lambda \quad \text{or, } \lambda = 2/3 L$$

$$\lambda = 2/3 (1\text{m}) = 0.6\bar{6}\text{m}$$

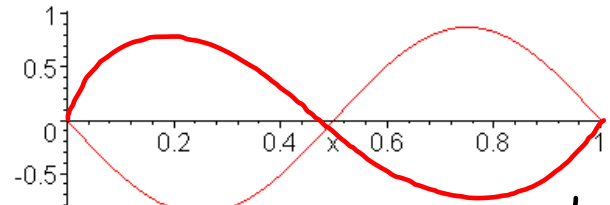
What do all the " λ " equations have in common?

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Fundamental Frequency
first harmonic

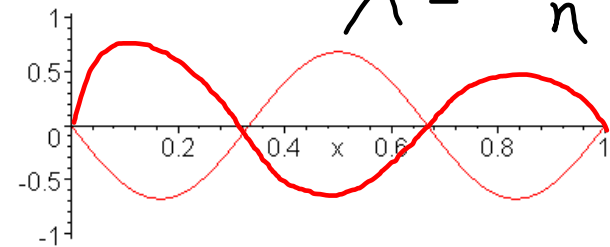
$$\lambda = 2/1 L$$



second harmonic

$$\lambda = 2/2 L$$

$$\lambda = \frac{2L}{n} = \frac{2(1.0m)}{2} = 1m$$



third harmonic

$$\lambda = 2/3 L$$

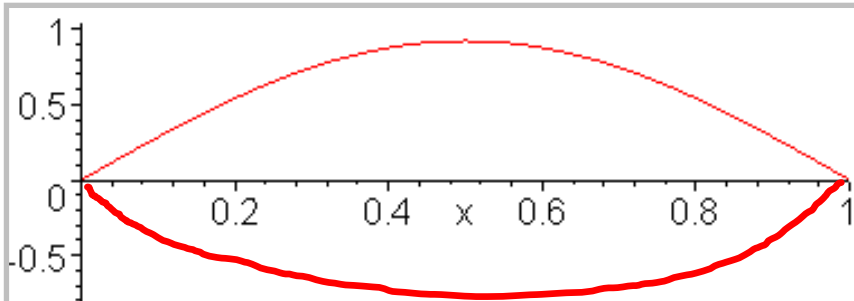


$$\lambda = 2L/n$$

"n" stands for the # harmonic you're dealing with

8th harmonic

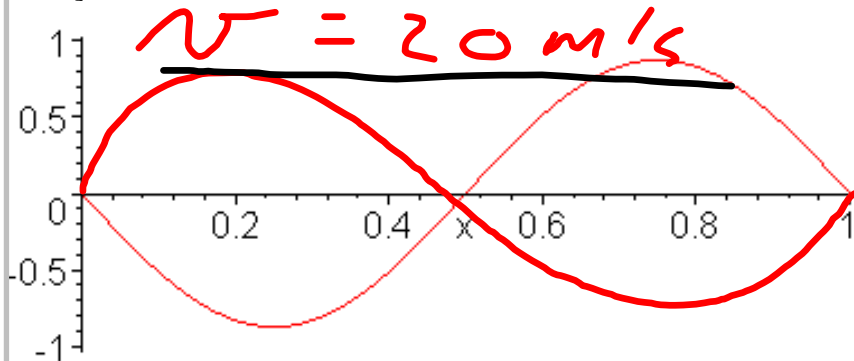
$$\lambda = \frac{2L}{n} = \frac{2(1.0m)}{8} = 25m$$



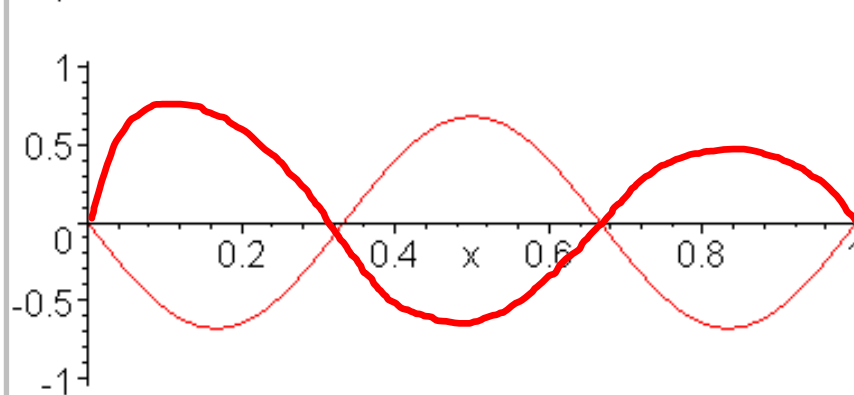
Velocity, Frequency, wavelength

$$f_1 = \frac{v}{\lambda} = \frac{20 \text{ m/s}}{2 \text{ m}} = 10 \text{ Hz}$$

$v = 20 \text{ m/s}$



$$f_2 = \frac{v}{\lambda} = \frac{20 \text{ m/s}}{1 \text{ m}} = 20 \text{ Hz}$$



$$f_3 = \frac{v}{\lambda} = \frac{20 \text{ m/s}}{0.667 \text{ m}} = 30 \text{ Hz}$$