University Physics 1A

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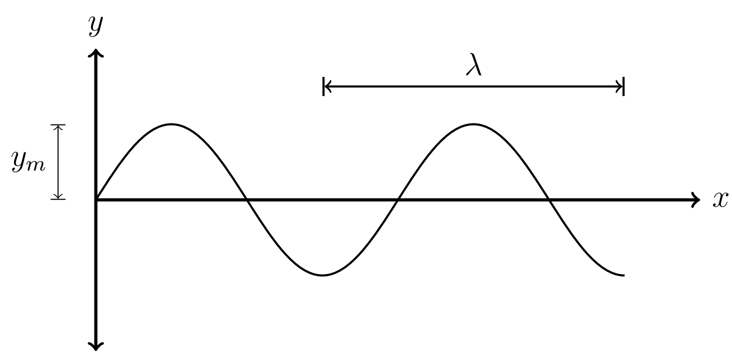
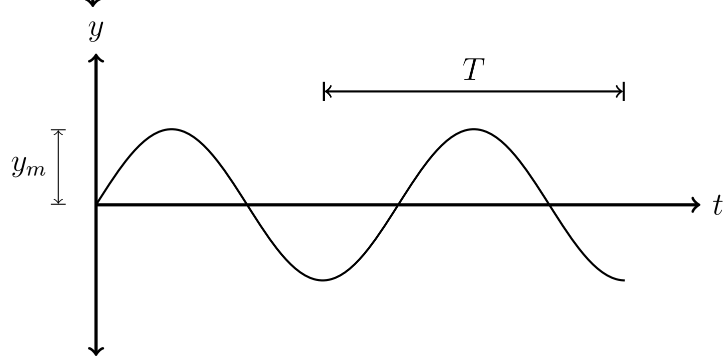
Waves





A wave pattern moves λ in T.

$$T = \frac{1}{f}$$

$$v = \frac{\text{how far it goes}}{\text{how long it takes}} = \frac{\lambda}{T} = \lambda f = \frac{\omega}{k}$$

The wave equation is of the form:

$$y = y_m \cos(kx - \omega t)$$

with k the angular wave number in radians per meter and ω the angular frequency in radians per second.

$$\omega = 2\pi f$$

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

For a wave moving through a string, the speed of the wave is:

$$v = \sqrt{\frac{tension}{mass\ density}} = \sqrt{\frac{F_{tension}}{\lambda}}$$

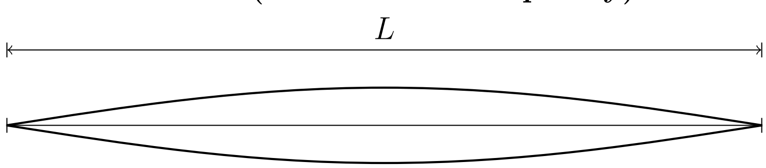
Note that the lambda above represents mass density in kilograms per meter.

Wave Interference

Two waves travelling in opposite directions with the same amplitude can be represented as:

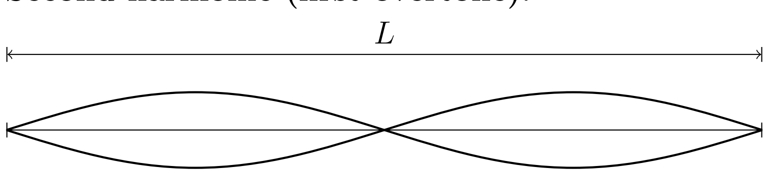
$$y = 2y_m \sin(kx)\cos(\omega t)$$

First harmonic (fundamental frequency):



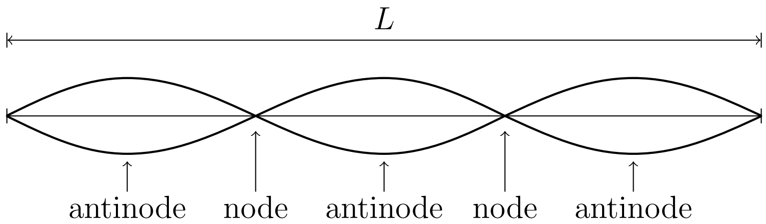
$\lambda = 2L \quad f = \frac{v}{2L}$

Second harmonic (first overtone):



$\lambda = L \quad f = \frac{v}{L}$

Third harmonic (second overtone):



$\lambda = \frac{2L}{3} \quad f = \frac{3v}{2L}$

You can find all my notes at `http://omgimanerd.tech/notes`. If you have any questions, comments, or concerns, please contact me at alvin@omgimanerd.tech