# University Physics 1A

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## Waves

$$v = \frac{\omega}{k} = f\lambda$$

$$\text{speed of wave} = v = \sqrt{\frac{elastic\ property}{inertial\ property}}$$

$$\text{for a string(spring) v} = \sqrt{\frac{tension}{mass\ density}} = \sqrt{\frac{F_{tension}}{\lambda}}$$

$$\text{for air(sound) v} = \sqrt{\frac{bulk\ modulus\ of\ air}{volume\ mass\ density}} = \sqrt{\frac{B}{\rho}}$$

Principle of superposition: two waves at the same point just add their values. While this does not hold for other concepts, it holds for most of the mediums that we will work with.

### Interference

Two waves going in the same direction with the same amplitude:

$$\begin{aligned} y &= y_{max}\sin(kx - \omega t) + y_{max}\sin(kx - \omega t + \phi) \\ &= 2y_{max}\cos(\frac{\phi}{2})\sin(kx - \omega t + \frac{\phi}{2}) \end{aligned}$$

If $\phi = \pi$ and the two waves are half a wavelength apart, then the two waves are destructive and cancel each other out. If $\phi = 0$, then the two are constructive and amplify each other. Any other values of $\phi$ are partially constructive. This is an example of wave interference.

Two waves travelling in the opposite direction:

$$\begin{aligned} y &= y_{max}\sin(kx - \omega t) - y_{max}\sin(kx - \omega t) \\ &= 2y_{max}\cos(\omega t)\sin(kx) \end{aligned}$$

This forms a standing wave.

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