Traveling Sinusoidal Wave

- Mathematical form: $y(x,t) = A\sin(kx \pm \omega t + \phi)$
- Each point (x coordinate) is a harmonic oscillator
- Wave number: $k = \frac{2\pi}{\lambda}$

wavelength
(distance between identical-looking points on wave)

- Wave travels with speed $v = \omega/k = \lambda f$

Types of Waves

- Displacement (y) is amount by which medium is disturbed temporarily
  - Medium doesn’t keep traveling, it just oscillates back and forth
  - **Transverse wave**: medium oscillates perpendicular to wave travel
  - **Longitudinal wave**: medium oscillates along direction of travel
  - EM waves often don’t have a medium, it’s the electric field in space that oscillates, and this is perpendicular to wave travel

Speed of Waves on a Rope

- Wave speed depends on properties of medium
- Rope: $v = \sqrt{\frac{F_T}{\mu}}$
  - μ: mass/length of rope

Intensity & Decibels

- Waves carry energy and can transmit it (power)
- Intensity is power/area: $I = \frac{P}{A}$
- Intensity can vary a lot, so we usually report it on a log scale:

"Intensity level"
Unit: decibel

$$\beta = 10 \log\left(\frac{I}{I_0}\right)$$

  - I_0 is some reference intensity
    - Sound: $I_0 = 10^{-12}$ W/m^2
    - Can also use decibels to compare two intensities

Advice for Stretched Spring Problem

- Be careful how you write spring stretch in terms of lengths
- Speed of wave depends on *both* tension and mass/per length