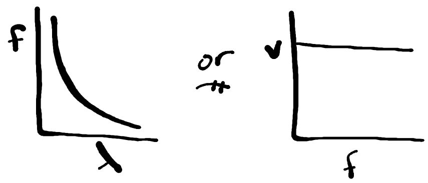
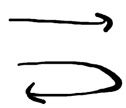
Part 1: Mechanical Waves

$v = f\lambda$

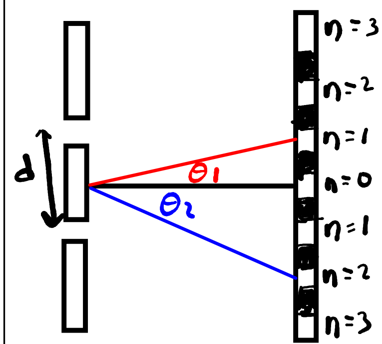


$v = \frac{d}{t}$



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

Part 2: Two Source Interference + Doppler



$\lambda = \frac{d\sin\theta_1}{1}$

$\lambda = \frac{d\sin\theta_2}{2}$

$\lambda = \frac{d\sin\theta_n}{n}$

Doppler Shift

v_s = speed of source

f_s = frequency of source

v = speed of wave

f = doppler shifted freq

$$f = \left(\frac{v}{v \pm v_s}\right) f_s$$

Towards us? Bad! Negative

$$f = \left(\frac{v}{v - v_s}\right) f_s$$

Away? Good! Positive

$$f = \left(\frac{v}{v + v_s}\right) f_s$$

freq of car horn: 400 Hz — $f_s = 400\ Hz$

Speed of car: 40 m/s — $v_s = 40\ m/s$

v of sound: 343 m/s — $v = 343\ m/s$

freq before and after?

Towards?

$$f = \left(\frac{v}{v - v_s}\right) f_s$$

$$f = \left(\frac{343}{303}\right) 400$$

$f = 452.8\ Hz$

Away?

$$f = \left(\frac{v}{v + v_s}\right) f_s$$

$$f = \left(\frac{343}{383}\right) 400$$

$f = 358.2\ Hz$

Bad numbers !! :(

$v_s = 20\,m/s$

$f_s = 500\,Hz$

$f = 490\,Hz$

v of wave?

$$f = \left(\frac{v}{v \pm v_s}\right) f_s$$

Plus or Minus?

Moving away → lower freq.

$$490 = \frac{v}{(v+20)} \cdot 500$$

$\div 500 \quad \div 500$

$$0.98 = \frac{v}{(v+20)}$$

$\cdot (v+20) \quad \cdot (v+20)$

$$0.98(v+20) = v$$

$$0.98v + 19.6 = v$$

$-0.98v \quad -0.98v$

$$19.6 = 0.02v$$

$\div 0.02 \quad \div 0.02$

$$\boxed{980\,m/s = v}$$

Mag

$4x + 10 = 6x$

$-4x \quad -4x$