# Exam #4 Physics 152

1) a) $T = \frac{1}{f}$ $\omega = 2\pi f$

b) $k = 2\pi/\lambda$

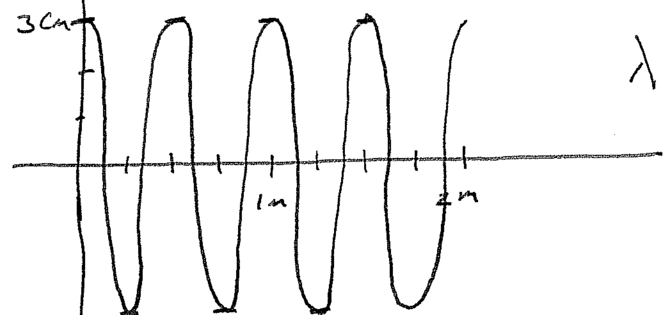
c) the angle of the pendulum string w/ the vertical is the variable that oscillates as a S.H.O.

2) $y(x,t) = 3cm \cos(4\pi x + 5\pi t)$

@ $t=0$

$y(x,0) = 3cm \cos(4\pi x)$

a)

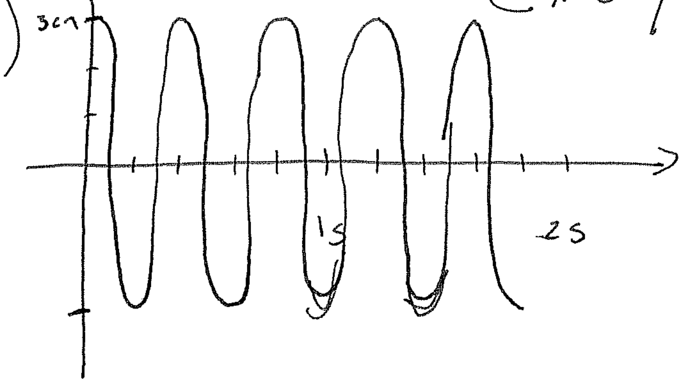



$\lambda = \frac{1}{2} m$

b) $k = 4\pi \frac{rad}{m} \Rightarrow \lambda = \frac{1}{2} m$

@ $x=0$ $y(0,t) = 3cm \cos(5\pi t)$

c)

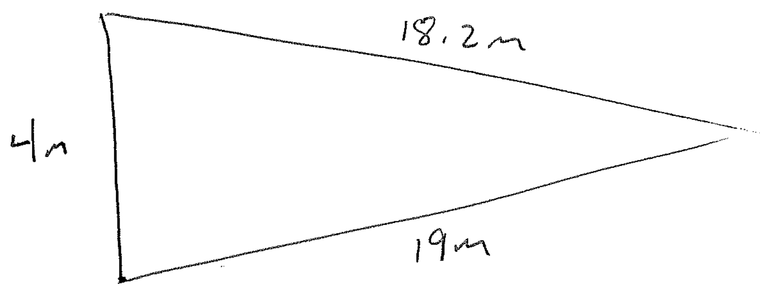



d) $\omega = \frac{2\pi}{T} = 5\pi \frac{rad}{s} \Rightarrow T = \frac{2}{5} s$

e) $v = \frac{\omega}{k} = \frac{5\pi \frac{rad}{s}}{4\pi \frac{rad}{m}}$ $1.25 m/s$

3)

a)




Destructive interference happens when the path length for the two waves differs by a half wave length so

$$\left(n+\tfrac{1}{2}\right)\lambda = \Delta X$$

$$= 19m - 18.2m = 0.8m$$

$$\lambda = \frac{0.8m}{n + 1/2}$$

so for $n = 0, 1, 2$

$$\lambda = 1.6m, \quad \frac{1.6m}{3}, \quad \frac{1.6m}{5}$$

these are the largest wave lengths, the frequency can be found through the speed of the wave

$$v = \lambda f$$

or

$$f_0 = \frac{V}{\lambda_0} = \frac{330\ m/s}{1.6m} \sim 205\,Hz$$

$$f_1 = \frac{V}{\lambda_1} = \frac{330\ m/s}{\frac{1.6m}{3}} \sim 615\,Hz$$

$$f_2 = \frac{V}{\lambda_2} = \frac{330\ m/s}{\frac{1.6\ m/s}{5}} \sim 1025\,Hz$$

b) Maxima occur at differences of 1 wave that

$$n\lambda = \Delta x$$

$$\lambda = \frac{\Delta x}{n}$$

$$f = \frac{v}{\lambda} = \frac{nv}{\Delta x}$$

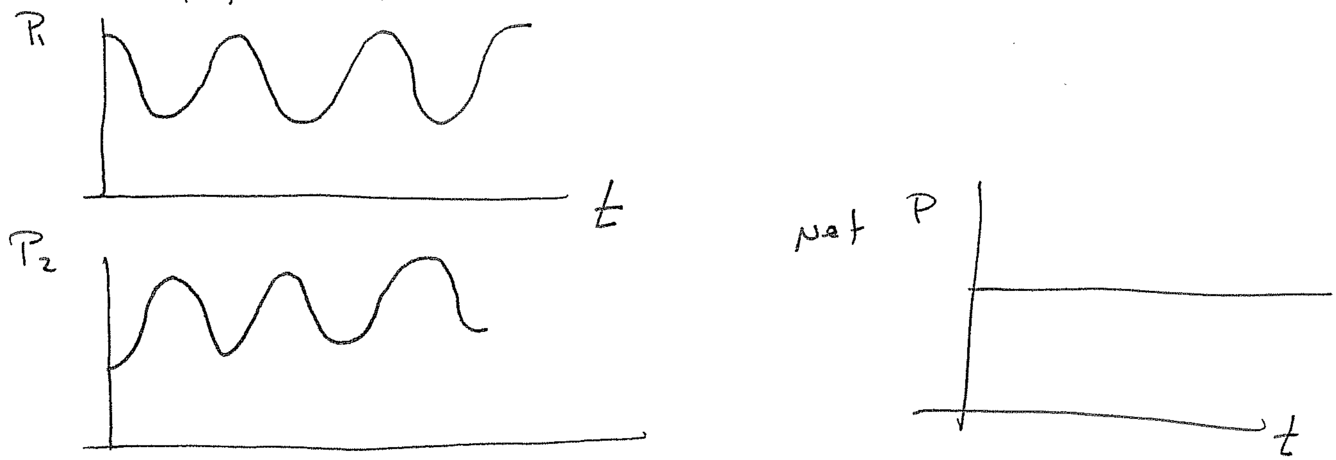
so

$$f_1 = \frac{330\,m/s}{0.8\,m} \sim 412\ Hz$$

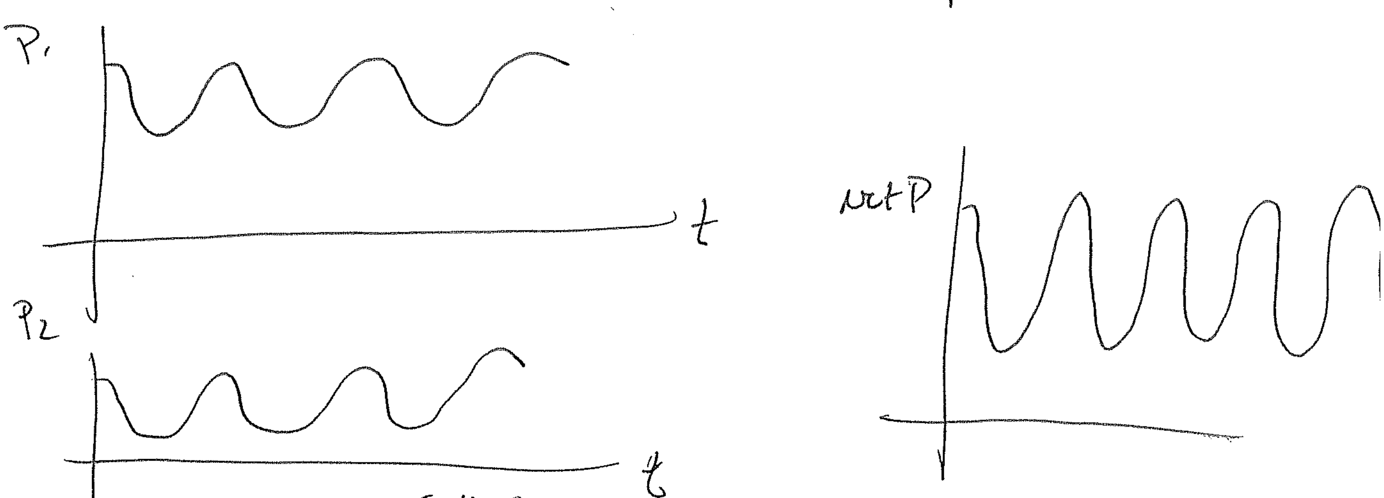
$$f_2 = 825\ Hz$$

$$f_3 = 1237\ Hz$$

c) with destructive interference the sound is reaching the observer out of phase w/ each other



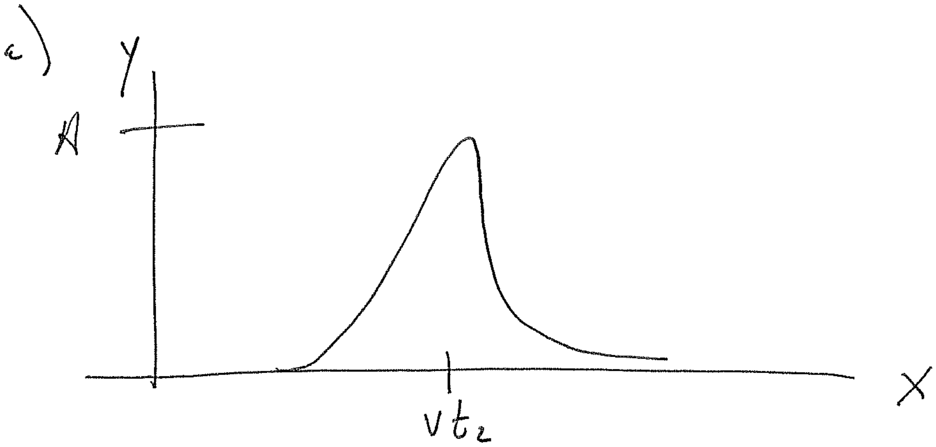

for constructive interference the sound arrives in phase



4| straight from HW

$$F(x) = A e^{-(x/b)^2}$$

a)

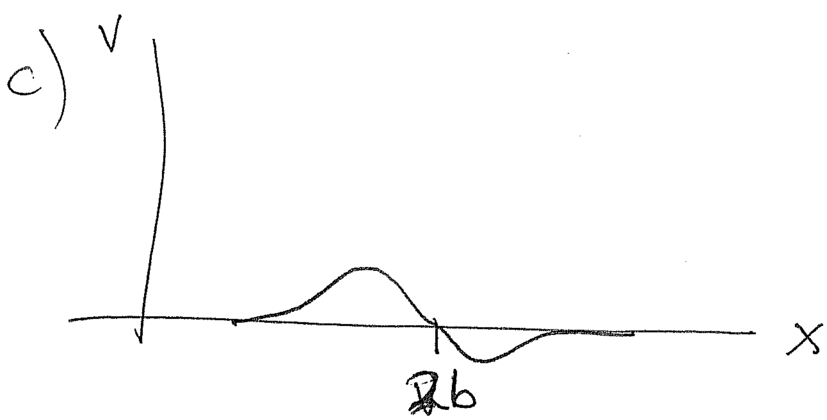



b)

$$F(x,t) = A e^{-\left[\frac{(x-vt)}{b}\right]^2}$$

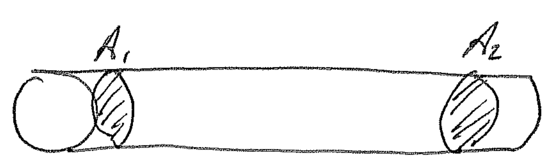
makes the wave move in +x-direction

c)




5 In a tube the sound cannot spread out so the intensity will stay the same as the wave propagates down the tube.

$$I = \frac{P}{A}$$




power is constant so

$$I_1 = \frac{P}{A_1} = \frac{P}{A_2} = I_2 \qquad I_1 = I_2$$