Solution to HW 6

1. i) first find the amplitude of y_m. total oscillation distance is 4.0 mm, (from lowest point to highest), so $y_m = \frac{4.00}{2} = 2.00$ mm.

ii) find the angular wave number k: $k = 2\pi/\lambda$ so we should determine λ from the figure. The grid lines are 1.00 cm apart, four grid lines span one complete wave, so $\lambda = 4 \cdot 1.0 = 4.0$ cm

$$\therefore k = 2\pi/\lambda = \frac{2\pi}{0.04\text{m}} = 157\text{m}^{-1} \approx 160\text{ m}^{-1}$$

iii) find angular frequency ω: $\omega = kv$. v is velocity of wave: $v = \frac{\Delta d}{\Delta t}$

$\Delta d = d = 3.16$ m. $\Delta t = 1.0$ ms $= 0.0010$ s

$$\therefore \omega = k\frac{d}{\Delta t} = (157\text{ m}^{-1})\,\frac{0.0316\text{m}}{0.0010\text{s}} = 4961\text{ s}^{-1} \doteq 5000\text{ s}^{-1}$$

iv) wave move along positive x axis. we must use the minus sign in $kx - \omega t$.

$$\therefore y(x, t) = (2.00\text{mm}) \sin[(160\text{m}^{-1})x - (5000\text{ s}^{-1})t]$$

2. From the figure, we see that the resultant wave is a sinusoidal wave that moves in the positive direction of the x axis. A first key idea here is that the interfering waves must both move in that direction, and then we can write them as:

$$y_1(x,t) = y_m \sin(kx - \omega t)$$
$$y_2(x,t) = y_m \sin(kx - \omega t + \varphi)$$

where $y_m = 4.0$ m.