we can write the resultant wave as

$$y'(x,t) = [2y_m \cos\tfrac{1}{2}\phi] \sin(kx - \omega t + \tfrac{1}{2}\phi)$$

1) The amplitude $2y_m \cos\frac{1}{2}\phi$ of the resultant wave is half the total oscillation distance of 6.0 mm, so we have

$$2y_m \cos\tfrac{1}{2}\phi = 3.0 \text{ mm}$$

$$y_m = 4.0 \text{ mm} \Rightarrow \phi = 2\cos^{-1}\frac{3.0 \text{ mm}}{2(4.0 \text{ mm})} = 2.4 \text{ rad}$$

2) to find the angular wave number k, two key ideas:

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

ii) λ can be measured as the distance between repetition of the wave shape.

let's use the solid curve and pick any point at which it crosses the x axis. That curve makes an identical crossing 3.0 cm to the right (or left) from the first point. Thus, $\lambda = 3.0$ cm, and

$$k = 2\pi/\lambda = 2\pi/0.030\text{m} = 209 \text{ m}^{-1} \approx 210 \text{ m}^{-1}$$

3) to find ω, $\omega = kv$. v is the ratio of distance d traveled by the resultant wave to the time interval Δt required for that travel.

Thus, we have $\omega = kv = k\frac{d}{\Delta t} = (209 \text{ m}^{-1}) \frac{0.0420 \text{ m}}{0.0010 \text{ s}} = 8778 \text{ s}^{-1} \doteq 8800 \text{ s}^{-1}$

we can now write for the interfering waves as

$$y_1(x,t) = (4.0 \text{ mm}) \sin(210x - 8800t)$$

$$y_2(x,t) = (4.0 \text{ mm}) \sin(210x - 8800t + 2.4 \text{ rad})$$

$$y'(x,t) = (3.00 \text{ mm}) \sin(210x - 8800t + 1.2 \text{ rad})$$

with x in meters and t in seconds ..