Instructor: Dr. A. Mekki

Name: _____ Key _____ Id: _____

The resultant wave of two equal waves traveling in the same medium is given by
$y(x,t) = (1.5cm)\sin[\pi(2x - 5t + 0.4)]$, where x is in meters and t in seconds.
(a) Write the displacements y_1 and y_2 of the two original waves.

The resultant wave has the form:

$$y(x,t) = 2y_m \cos\frac{\phi}{2} \sin\left(kx - \omega t + \frac{\phi}{2}\right)$$

$$\Rightarrow \quad \frac{\phi}{2} = 0.4\,\pi$$

and $\quad 2y_m \cos\frac{\phi}{2} = 1.5\,cm \Rightarrow \quad 2y_m \cos(0.4\pi) = 1.5\,cm$

$$\Rightarrow y_m = 2.43\,cm$$

$$\Rightarrow \quad \boxed{\begin{aligned} y_1 &= (2.43\,cm)\,\sin\left(2\pi x - 5\pi t\right) \\ y_2 &= (2.43\,cm)\,\sin\left(2\pi x - 5\pi t + 0.8\pi\right) \end{aligned}}$$

(b) What is the displacement of a particle in the medium at position x = 0.5 m and t = 1.0 s.

We use the displacement of the resultant wave

$$y(0.5, 1) = (1.5\,cm)\,\sin\underbrace{\left(2\pi \times 0.5 - 5\pi + 0.4\pi\right)}_{rad}$$

$$= (1.5\,cm) \times 0.951$$

$$= \boxed{1.43\,cm}$$