KING FAHD UNIVERSITY OF PERTOLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #1- CHAPTER 16

NAME: Key ID# SECTION# 16

When a wave travels through a medium, individual particles execute a periodic motion given by the equation: $y = 4.0 \sin\{\pi/4(2t+x/8)\}$ where x and y and are in meters and t is in seconds. Calculate

(a) The wavelength

$$k = \frac{\pi}{32} \text{ rad/m} \Rightarrow \lambda = \frac{2\pi}{k} = \frac{2\pi}{\frac{\pi}{32}} = \boxed{64 \text{ m}}$$

(b) The frequency

$$f = \frac{\omega}{2\pi} \qquad \omega = \frac{\pi}{2} \text{ rad/s} \Rightarrow f = \frac{\pi}{4\pi} = \boxed{\frac{1}{4} \text{ Hz}}$$

(c) The speed of the wave

$$v = \lambda f = \frac{64}{4} = \boxed{16 \text{ m/s}}$$

(d) The maximum transverse velocity

$$u_{max} = \omega y_m = \frac{\pi}{2} \times 4 = \boxed{6.28 \text{ m/s}}$$

(e) The phase difference at any given instant between two particles that are 20.0 m apart is

$$\phi = \frac{2\pi}{\lambda} \Delta x$$

$$= \frac{2\pi}{64} \times 20 = \boxed{0.6\pi \text{ rad}}$$

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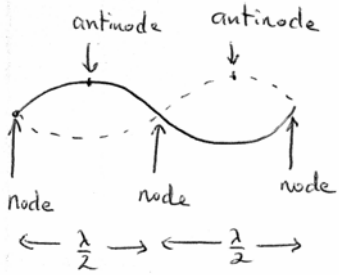
A string, fixed at its ends, vibrates according to the equation: $y = 0.5 \sin(1.5\pi x) \cos(40\pi t)$ where x and are in meters and t is in seconds.

(a) What are the positions of the first two antinodes?



$$x_1 = \frac{\lambda}{4} = \boxed{0.33\,m}$$

$$x_2 = \frac{3\lambda}{4} = \boxed{1\ m}$$

(b) What are the positions of the first two nodes?

$$\lambda = \frac{2\pi}{k} = \frac{2\pi}{1.5\pi} = 1.3\,m$$

$$x_1 = 0$$

$$x_2 = \frac{\lambda}{2} = \boxed{0.65\,m}$$

(c) What is the tension in the string if its mass per unit length is 10 g/m?

$$v = \lambda f = \frac{\omega}{k} = \frac{40\pi}{1.5\pi} = 26.7\ m/s$$

$$v = \sqrt{\frac{\tau}{\mu}} \Rightarrow \tau = v^2 \mu = (26.7)^2 \times 10^{-2}$$

$$= \boxed{7.1\,N}$$

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NAME: Key ID# SECTION# 18

Two identical waves moving in the same positive direction along a stretched string, interfere with each other. The amplitude, wavelength and frequency of each wave are 10.0 mm, 10 cm, and 150 Hz, respectively. The phase difference between them is 0.80 radian.

(a) Write the equation of the resultant wave.

$$y' = 2y_m \cos\frac{\phi}{2} \sin\left(kx - \omega t + \frac{\phi}{2}\right)$$

$$= 2\times10^{-3} \cos\left(\frac{0.8}{2}\right) \sin\left(\frac{2\pi}{0.1}x - (2\pi\times150)t + \frac{0.8}{2}\right)$$

$$\boxed{y' = 1.8\times10^{-2} \sin\left(62.8\,x - 942\,t + 0.4\right)}$$

(b) What is maximum transverse speed of the particles in the medium?

$$u = \omega y_m = 1.8\times10^{-2} * 942 = \boxed{17\ m/s}$$

(c) What the maximum transverse acceleration of the particles in the medium?

$$a = \omega^2 y_m = 1.8\times10^{-2} * (942)^2 = \boxed{15973\ m/s^2}$$