Phys102 (Sec # 41) Quiz # 1 (Ch.16)

Name: Key ID #

The equation of a transverse wave on a string is:

$$Y = (3.0\ \text{mm}) \sin[(30\ \text{m}^{-1})\, x - (500\ \text{s}^{-1})\, t]$$

The linear mass density of the string is 0.02 kg/m.

a- Calculate the speed of the wave.

$$v = \frac{\omega}{k} = \frac{500}{30} = \boxed{16.7\ \text{m/s}}$$

b- Find the tension in this string (in N).

$$v = \sqrt{\frac{\tau}{\mu}} \Rightarrow \tau = \mu v^2 = 0.02\,(16.7)^2$$

$$\boxed{\tau = 5.6\ \text{N}}$$

c- Calculate the average power transmitted by the wave.

$$P_{avg} = \frac{1}{2}\mu v (\omega y_m)^2 = \frac{1}{2}(0.02)(16.7)(500)^2 (3\times10^{-3})^2$$

$$= \boxed{0.38\ \text{W}}$$

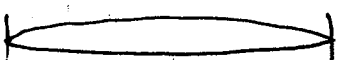
d- Calculate the magnitude of the transverse speed at x = 1.0 m and t = 2.0 s.

$$u = \frac{dy}{dt} = -\omega y_m \cos(30x - 500t)$$

magnitude $= |u| = \left|-500\,(3)\cos(30 - 500(2))\right| = 1095\ \frac{\text{mm}}{\text{s}} = \boxed{1.1\ \frac{\text{m}}{\text{s}}}$ (rad)

2- A 2.0 m long string with a mass of 0.04 kg is stretched with a tension of 30 N between two fixed supports. What is the resonant frequency of the longest wavelength on this string?

$n = 1$



$L = \frac{\lambda}{2} \Rightarrow \lambda = 2L \Rightarrow$ the longest wavelength.

$$f_1 = \frac{v}{2L} = \frac{\sqrt{\frac{\tau}{\mu}}}{2L} = \frac{\sqrt{\frac{\tau L}{m}}}{2L}$$

$$f_1 = \frac{\sqrt{\frac{30(2)}{0.04}}}{2(2)} = \boxed{9.7\ \text{Hz}}$$