QUIZ#1- CHAPTER 16 DATE: 30/01/20

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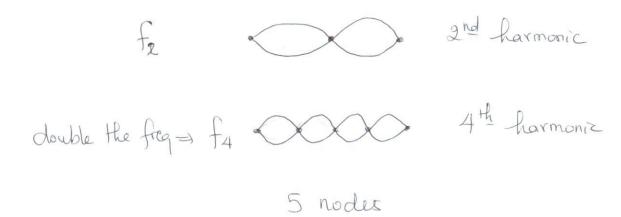
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- 1. Two identical sinusoidal transverse waves travel in the same direction along a stretched string. Each wave has an amplitude $y_m = 2.0$ cm and wavelength λ . The phase difference between the two waves is $0.20 \ \lambda$.
- (a) What is the phase difference in radian?

$$\phi = \left(0.2X\right)\left(\frac{2\pi \text{ rad}}{1}\right) = \left[1.257 \text{ rad}\right]$$

(b) What is the amplitude of the resultant?

2. A standing wave, having three nodes, is set up on a string fixed at both ends. If the frequency of the wave is doubled, how many antinodes will there be?



4 antinodes

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A wave on a stretched string is described by the displacement wave:

$$y(x,t) = 0.400 \sin (300t - 15.0x)$$

where x and y are in meters and t is in seconds.

(a) What is the speed of the wave?

(b) What is the maximum transverse velocity?

(c) What is the tension in the string if the linear mass density is 60 g/m?

$$v = \sqrt{\frac{1}{p}} \Rightarrow t = pv' = (60x10^3)(20)^2 = 24N$$

(d) What is the phase difference between two points on the string 21.0 cm apart?

$$\chi = \frac{\lambda}{2\pi} + \Rightarrow \Phi = \frac{2\pi}{\lambda} \times \frac{2\pi}{0.42} \times 0.21 = \boxed{\pi \text{ rad}}$$

$$\lambda = 2\pi - \frac{2\pi}{15} = 0.42m$$

(e) What is the average power transmitted by this wave?

$$P = \frac{1}{2} P v w^{2} y_{m}^{2} = \frac{1}{2} (60 \times 10^{3}) \times 20 \times (300)^{2} \times (0.4)^{2}$$

$$P = 8640 W$$

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1. Two sinusoidal waves travel simultaneously through the same medium. The first wave is described by $y_1(x,t) = y_m \cos(kx - \omega t)$ and the second wave by $y_2(x,t) = y_m \cos(kx - \omega t + \varphi)$. If the amplitude of the resulting superposition is $y_m/2$, what is the value of φ in wavelength?

$$y'_{m} = 2y_{m} \cos \frac{1}{2} = \frac{1}{2}$$

$$\cos \frac{1}{2} = \frac{1}{4} \Rightarrow \frac{1}{2} = \cos^{-1}(\frac{1}{4})$$

$$\Phi = 2 \cos^{-1}(\frac{1}{4}) = 151^{\circ} = 2.63 \text{ rad}$$

$$= 2.63 \text{ rad} \left(\frac{1}{2\pi}\right) = 0.42 \lambda$$

2. A string, fixed at both ends, has a fundamental frequency $f_a = 248$ Hz. The tension τ in the same string is changed so that the new fundamental frequency is $f_b = 496$ Hz. What is the value of the ratio τ_b/τ_a ?

$$f_{a} = \frac{v_{a}}{2L}$$

$$f_{b} = \frac{v_{b}}{2L}$$

$$f_{b} = \frac{v_{b}}{v_{a}} = \frac{v_{b}}{v_{a}} = \sqrt{\frac{t_{b}}{t_{a}}} = \sqrt{\frac{t_{b}}{t_{a}}}$$

$$f_{a} = \frac{v_{b}}{v_{a}} = \frac{v_{b}}{v_{a}} = \sqrt{\frac{t_{b}}{t_{a}}} = \sqrt{\frac{t_{b}}{t_{a}}} = \sqrt{\frac{t_{b}}{t_{a}}}$$

$$\frac{t_{b}}{t_{a}} = \left(\frac{f_{b}}{f_{a}}\right)^{2} = \left(\frac{496}{248}\right)^{2} = (2)^{2} = 4$$