

waves, problem set #2

1) A pipe closed at one end, playing in the fundamental, resonates with a string with length l , mass m , and tension T , in 4th overtone. Call sound velocity in the air v_{air} . If we open both ends of the same pipe, and play it in its 3rd overtone what is the wavelength and frequency of the sound wave it produces?

2) A wire has length 0.50 m and mass 0.020 kg. A transverse wave in the wire is described by $y(x, t) = 0.2 \cos(2x - 5t)$ where y and x are in meters, and t in seconds.

a) What is the tension on the wire?

b) If we fix both ends and make standing waves in this wire with same tension, what is the fundamental resonance frequency of the string?

c) What is the resonance frequency if there are two nodes, in addition to the two nodes at the end?

3) Two loudspeakers, A and B, are driven by the same amplifier and emit sinusoidal waves in phase with amplitude A . Speaker B is $L = 2.0$ m to the right of speaker A. The frequency of the sound waves produced by the loudspeakers is $f = 440$ Hz. Consider point P along the line connecting them at a distance x to the right of speaker A. Take all three cases, $x < 0$, $0 < x < L$, and $L < x$. Both speakers emit sound waves that travel directly from the speaker to point P. Although the amplitude of the wave is inversely proportional to distance from source, but take it to be constant for both speakers at any x . Find the interference pattern (the amplitude) at x .