4. You are standing at a distance d from a source that emits sound waves equally in all directions. You walk $50.0\,m$ toward the source and observe that the intensity of these waves has doubled. Calculate the distance d.

5. An ambulance with a siren emitting a whine at $1600\,Hz$ overtakes and passes a cyclist pedaling a bike at $8.00\,ft/s$. After being passed, the cyclist hears a frequency of $1590\,Hz$. How fast is the ambulance moving?

Chapter 18

1. A string under tension τ_i oscillates in the third harmonic at frequency f_3, and the waves on the string have wavelength λ_3. If the tension is increased to $\tau_f = 4\tau_i$ and the string is again made to oscillate in the third harmonic, what then are (a) the frequency of oscillation in terms of f_3 and (b) the wavelength of the waves in terms of λ_3.

2. In Figure 18.2 two loudspeakers, separated by a distance of $2.00\,m$ are in phase. Assume the amplitudes of the sound from the speakers are approximately the same at the position of a listener, who is $3.75\,m$ directly in front of one of the speakers. (a) For what frequencies in the audible range $(20 - 20.000\,Hz)$ does the listener hear a minimum signal? (b) For what frequencies is the signal a maximum?

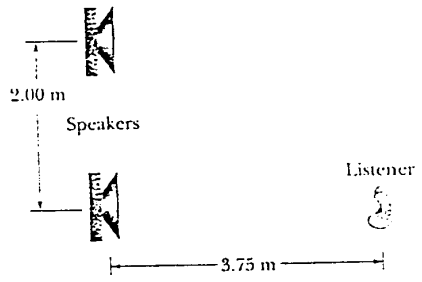

FIG. 18.2

3. Two waves are propagating on the same very long string. A generator at one end of the string creates a wave given by

$$y = (6.0\,cm)\cos\frac{\pi}{2}\left[(2.0\,m^{-1})\,x + (8.0\,s^{-1})t\right],$$

and one at the other end creates the wave

$$y = (6.0\,cm)\cos\frac{\pi}{2}\left[(2.0\,m^{-1})\,x - (8.0\,s^{-1})t\right].$$

(a) Calculate the frequency, wavelength, and speed of each wave. (b) Find the points on the string at which there is no motion (the nodes). (c) At which points is the motion of the string a maximum (the antidoes)?

4. A sound wave of 40.0 cm wavelength enters the tube shown in Figure 18.4 at the source end. What must be the smallest radius r such that a minimum will be heard at the detector end?

FIG. 18.4

5. Two sound waves, from two different sources with the same frequency, $540\,Hz$, travel at a speed of $330\,m/s$. The sources are in phase. What is the phase difference of the waves at a point that is $4.40\,m$ from one source and $4.00\,m$ from the other? The waves are traveling in the same direction.