

**4th Problem Set Phy132**  
**Due Wednesday, May 6**

**Problem 1.**

The net amplitude at a point in space is equal to the sum of the following two amplitudes:

$$d_1(t) = 4\sin(\omega t) \quad (1)$$

and

$$d_2(t) = 4\cos(\omega t) \quad (2)$$

Determine the resultant amplitude,  $d(t) = d_1(t) + d_2(t)$ . Hint: write the cosine function as a sine function with a phase and add the two sine functions.

**Problem 2.**

Two small speakers emit sound waves of different frequencies, that is, they are incoherent sources. Speaker A has an output of 10 milli-watts, and speaker B has an output of 20 milli-watts. You are located a distance of 5 meters away from speaker B, and 4 meters away from speaker A. What sound intensity level (in dB) do you hear if

- a) only speaker A is on
- b) only speaker B is on
- c) both speakers are on

**Problem 3.**

Luis is standing on the sidewalk when a police car drives by with its siren on. As the car approaches, Luis notices that the frequency of the siren is 560 Hz. As the car drives away, he notices that the frequency of the siren is 480 Hz. How fast was the police car going?

**Problem 4.**

Joan goes skydiving. As she is falling at terminal velocity, she screams very loudly with a frequency of 1500 Hz.

- a) If her friend on the ground directly below her measures the frequency of her scream to be 2000 Hz, how fast is she falling?

b) Joan hears the echo of her scream as it bounces off the ground below her. What frequency does Joan measure the echo to have?

**Problem 5.**

You need to design an organ pipe. You want the frequency to be 55 Hz, a low A note. How long should the pipe be if it is

- a) open-open
- b) open-closed?

**Problem 6.**

Two speakers are driven by the same oscillator of frequency 200 Hz. They are located horizontally a distance of 6 meters from each other. Barbara stands in front of one speaker very far away, and walks towards the speaker as shown in the figure on the figures page.

- a) How many times will she hear a minimum in intensity as she walks from far away towards the speaker?
- b) How far is she from the speaker when she hears these minima?

Take the speed of sound to be 340 m/sec.

**Problem 7.**

Jonathan cuts a pipe into two pieces. The lowest resonant frequency for one of the pieces is 256 Hz, and the lowest resonant frequency for the other piece is 440 Hz. How long was the original piece?

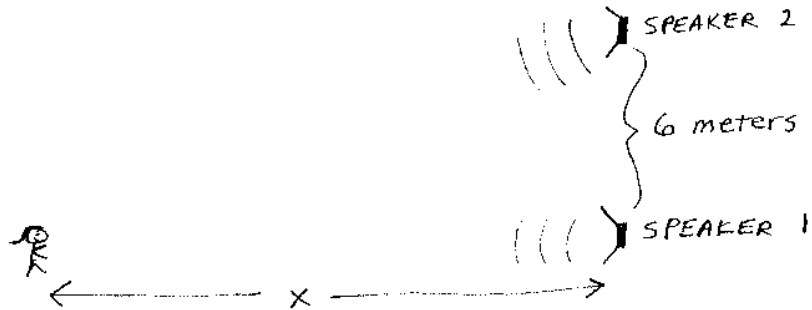
**Problem 8.**

Pascal wants to talk with Julia. They are 12 meters apart. A long wall is located 8 meters to the side of them. When Pascal talks, Julia hears the sound coming directly from Pascal, and the sound that reflects off the wall. See the figure on the figures page.

What is the lowest frequency that Pascal should talk so that when the two waves reach Julia they are in phase? Take the speed of sound to be 340 m/sec.

FIGURES FOR HOMEWORK 4

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