

## Homework #3

Assigned Wednesday, October 20, 2010

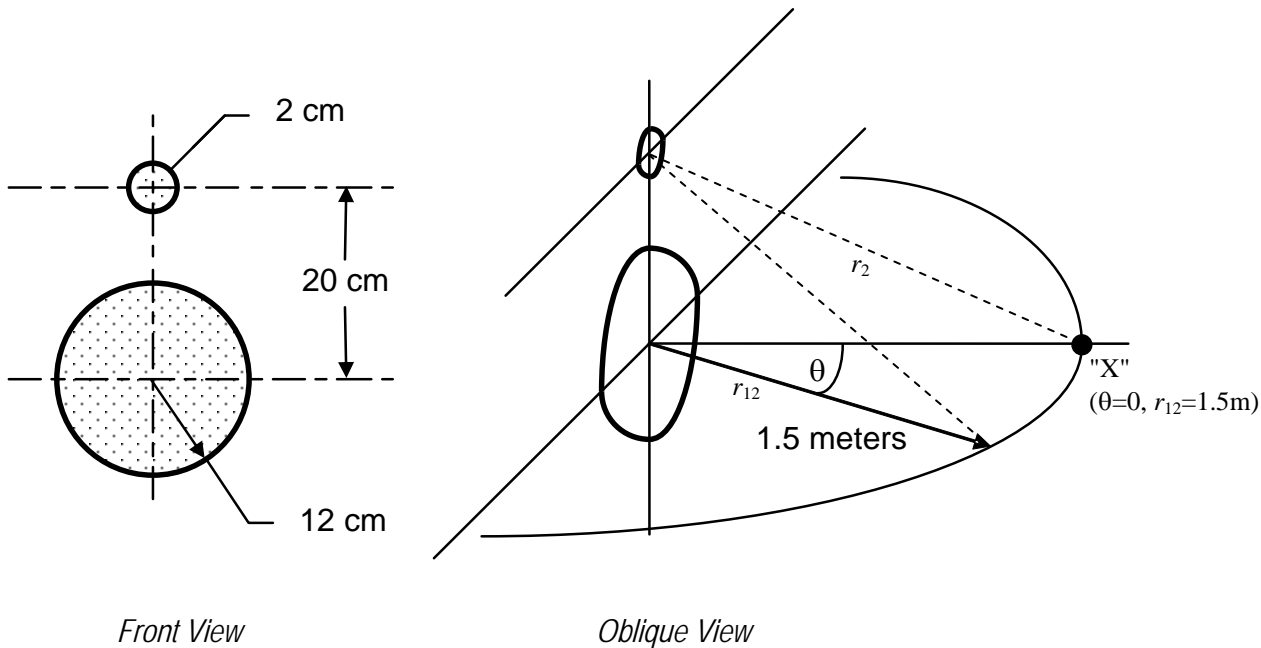
Due at the start of class on Friday, October 29, 2010

- (1) From the K&F textbook: **7.6.6**
- (2) A heavy equipment operator sustains the following noise exposure:

3 hours at 92 dBA  
1 hour at 95 dBA

Assuming she has additional work hours available, how many hours can she now be allowed to spend in a 90 dBA noise field without exceeding the OSHA industrial noise guidelines (Table 13.11.2)? Explain.

- (3) A loudspeaker system with two drivers is described by the following geometry:



Each driver is modeled as a baffled piston radiator (far field case, K&F §7.4b, pp. 181-184). Both drivers are operated at  $f = 5 \text{ kHz}$  into air at  $20^\circ\text{C}$ .

The receiver position "X" is in the plane of the 12 cm radius driver at a distance of 1.5 meters from the center of that driver. Use the far field pressure relationship (eqn. 7.4.17).

- (a) When the 2 cm radius driver is operated *alone*, the SPL measured for  $\theta = 0^\circ$  at "X" is found to be 100 dB re  $20\mu\text{Pa}$ . When the 12 cm radius driver is operated *alone*, the SPL at "X" is also measured to be 100 dB re  $20\mu\text{Pa}$ . Determine the displacement amplitude of each driver.
- (b) Under the same operating conditions, determine and plot the pressure amplitude *in the plane of the 12 cm driver's principal axis* as a function of the angle  $\theta$  for each of the drivers acting alone. NOTE that the actual angle and distance from the 2cm driver will be different because the measurement is being made in the plane of the 12cm driver. MATLAB would be a useful way to do this. Comment on the results.
- (c) Finally, calculate the far field pressure amplitude as a function of  $\theta$  when the two drivers operate at the same time. Note that the precise distance and angle from the two drivers differs when making the observation from the plane of the 12 cm driver: take the resulting phase and amplitude differences into account when summing the response. Comment on the results.