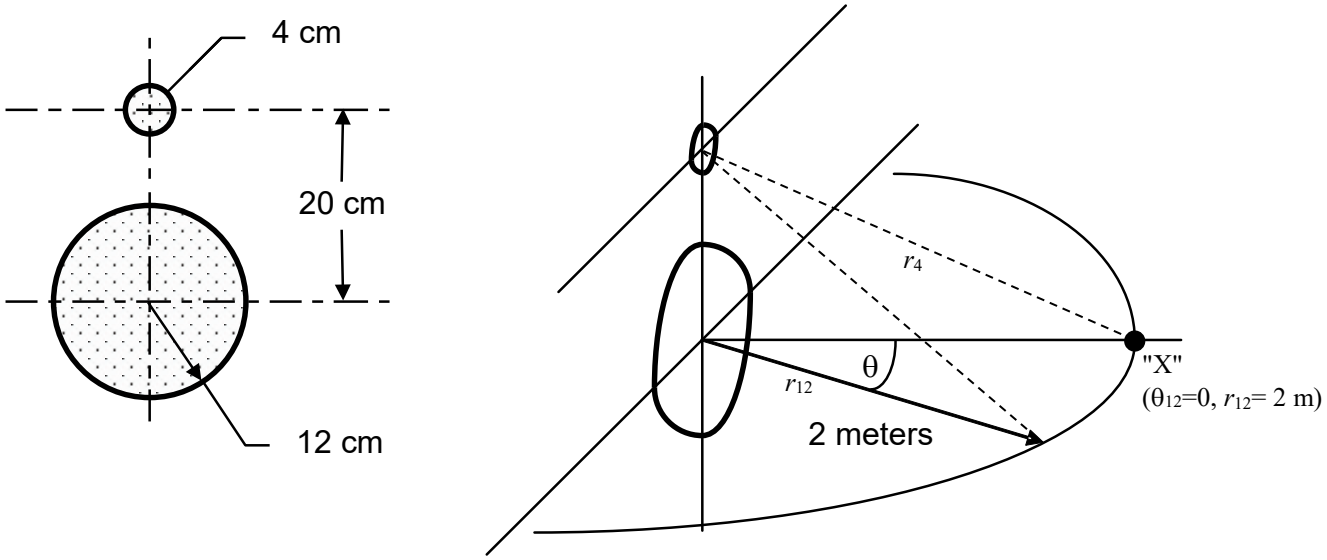
EELE 417/517 **Fall 2018**
Computer Problem
Assigned Monday, October 8, 2018
Due at the start of class on Monday, October 15, 2018

A loudspeaker system with two drivers is described by the following geometry:



Front View *Oblique View*

Each driver is modeled as a baffled piston radiator (far field case, K&F eqn. 7.4.17). Both drivers are operated at **f = 5 kHz** into air at 20°C. The observation point is "X", located in the plane of the 12 cm driver.

When the 12 cm radius driver is operated *alone*, the SPL measured for $\theta_{12} = 0°$ at "X" is found to be 100 dB re 20μPa.

When the 4 cm radius driver is operated *alone*, the SPL at "X" is also measured to be 100 dB re 20 μPa, but NOTE that at "X", $\theta_4 = 5.7°$ for the 4 cm driver because "X" is not in the same plane as the 4 cm driver.

(a) Under these operating conditions, first determine and plot the *pressure amplitude in the plane of the 12 cm driver's principal axis* as a function of the angle θ for each driver acting alone. Be careful, because $\theta = \theta_{12}$, BUT $\theta \neq \theta_4$ because the off-axis angle of the 4 cm driver is skew to the observation plane. MATLAB or Excel would be a useful way to do this. Comment on the results.
{ Bessel functions: Excel: `besselj(x,1)` MATLAB: `besselj(1,x)` }

(b) Finally, calculate the far field pressure amplitude as a function of θ when the two drivers operate at the same time, driven electrically in-phase with each other. Again, NOTE that $\theta = \theta_{12}$, BUT $\theta \neq \theta_4$. Also note that r_{12} and r_4 are not the same, so the arrival phase will differ in the receiver plane of "X". You need to take all of these factors into account in your calculation formulas. Comment on the results.

Submit hardcopy of your "computer code" and the three plots: pressure amplitude of 12 cm driver acting alone, pressure amplitude of 4 cm driver acting alone, and pressure amplitude of both drivers operating at the same time (taking into account the change in pressure amplitude *and phase* with respect to the two drivers), along with your comments.