Problem 1  (5 points)

Imagine a vocal tract with a zero-flow termination (hard wall) at $x = -L_b$, a zero-pressure termination (open lips) at $x = L_f$, and an area change at $x = 0$ with reflection coefficient $\gamma$. Pressure in the front tube is given by

$$p_2(x, \omega) = p_2^+ e^{-j\omega x} + p_2^- e^{j\omega x}$$

and pressure in the back tube is given by

$$p_1(x, \omega) = p_1^+ e^{-j\omega x} + p_1^- e^{j\omega x}$$

Write (DO NOT SOLVE!) four equations, based on the boundary conditions, that would let you solve for the four unknowns $p_2^+, p_2^-, p_1^+$, and $p_1^-$.  

Problem 2  (5 points)

Imagine a two-tube vocal tract with a back-cavity area of $A_1 = 8\text{cm}^2$ and length of $L_1 = 11\text{cm}$, and a front-cavity area of $A_2 = 1\text{cm}^2$ and length of $L_2 = 6\text{cm}$. Find the first three formant frequencies. You may assume that $8 \gg 1$. 