

Name:

Math Questions - Partial credit will be given. If you can't find the number, give the method. If you don't know the method, give your thoughts. (Note: Be sure to answer everything asked.)

1. (16 pts) A loudspeaker 20 cm in diameter is mounted at the center of a one-meter square baffle board.
 - (a) Determine the path length from the center of the front side to the center of the back side of the speaker.
 - (b) At what frequency will this path be equal to one-half wavelength of sound?
2. (16 pts) A certain loudspeaker has a compliance of $10^{-4} \frac{\text{m}}{\text{N}}$ and a mass (cone plus voice coil) of 71 g. Estimate its resonance frequency. (See section 2.1; the compliance is the reciprocal of stiffness or spring constant: $C = \frac{1}{K}$.)
3. (16 pts) Express each of the following dimensions on a CD as numbers of wavelengths of the laser light:
 - pit width
 - pit depth
 - diameter of the focused laser spot
4. (16 pts) Specify reasonable values for the reverberation times for the following frequencies for a 2000 m³ concert hall to be used primarily for orchestral music.
 - 100 Hz
 - 200 Hz
 - 500 Hz
 - 1000 Hz
5. (20 pts) Repeat a historic experiment done by Joseph Henry over 130 years ago. Clap your hands periodically as you move away from a large flat wall. Determine how far away you have to be in order to distinguish the echo from the original sound. Divide twice this distance by the speed of sound to obtain the "limit of perceptibility," as Henry called it. Be sure to tell me where the wall was.
6. (16 pts) If two hard parallel walls are spaced 30 m apart, calculate the repetition rate for the flutter echo that might result. What efforts might be made to prevent its occurrence?