Directions: Answer these questions anywhere you like (here, another piece of paper, e-mail, tree bark, etc.). Use all forms of help, including friends, pets, me, and the Internet.

Some useful rules and relationships:

- Wavelength and frequency: $\lambda f = c$
- Speed of sound: $c = 343 \frac{m}{s}$
- Ohm's Law: $V = IR$ (or $I = \frac{V}{R}$)
- Series resistances: $R_{eq} = R_1 + R_2$
- Parallel resistances: $R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$
- To calculate power: $P = IV$

Problem 1

You've got a 100 W amplifier powering a subwoofer with 88 dB/W efficiency at 1 meter. A friend spends more to get a 200 W amplifier, and the efficiency of his subwoofer is 84 dB/W.

1. Which subwoofer is more powerful?
2. At 2 meters away, how loud will your subwoofer go before your amp starts clipping?
3. What might you have traded off in order to get a more efficient subwoofer?

Problem 2

An AC source of 20 V RMS drives an 8 Ω resistor.

1. How much current does the resistor draw?
2. How much power does the resistor dissipate?

Calculate the total current and power figures again when:

1. another resistor is added in series
2. another resistor is added in parallel

Problem 3

Two identical speakers are placed 1 meter apart in an open space. They each play a pure tone at 200 Hz that, in the absence of the other speaker, would be 80 dB at 1 meter away. Your couch is placed 1 meter back from the plane of the speakers.

1. Draw a little picture of this arrangement.
2. What is the sound level at the center of the couch?
3. What is the sound level at the right edge of the couch, directly in front of the right speaker but 45 degrees off axis from the left speaker?
4. Is there a spot where the two speakers cancel each other out completely? Find it or explain why not.

Problem 4

1. Why is it that the difference between 1 V and 2 V is 6 dB, but the difference between 1 W and 2 W is only 3 dB?
2. Compute $10 \log_{10} 2$. What is the significance of this number?