

Homework 8, HONS 280 (Physics of Sound and Music)
Spring 2020
DUE Friday, February 28th, 2020

1. Two sounds are heard by the same listener. Sound 1 had a loudness level of 40 sones. Sound 2 had a loudness level of 60 sones. If the listener has an “average” perception of sound, how would the listener rate the ratio $\left(\frac{\text{loudness of sound 2}}{\text{loudness of sound 1}}\right)$?
2. Two sounds are heard by the same listener. Sound 1 had a loudness level of 80 phons. Sound 2 had a loudness level of 90 phons. If the listener has an “average” perception of sound, how would the listener rate the ratio $\left(\frac{\text{loudness of sound 2}}{\text{loudness of sound 1}}\right)$?
3. Find the jnd at frequencies of 100 Hz and 10 kHz.
4. Let us say you desire to play a musical piece in 4/4 time with a tempo of 120 bpm. (This means that a quarter note – which could also be labeled as a 4th note – lasts 0.5 second, an 8th lasts a quarter of a second, a 16th lasts an eighth of a second, etc. – you don’t need to read music to answer this, just extrapolate the relationship given here to determine what an “nth” note would last via ratios). Based on your answer to the previous question, what is the shortest note that it would even make sense to write down at this tempo, since a note any shorter could not be perceived? Your answer should be something like “a 64th note”, except with the number 64 replaced with an appropriate power of 2.
5. What is vibrato, and how does it influence our interpretation of pitch?
6. If you play (pure) tones of 750 Hz, 1000 Hz, and 1250 Hz simultaneously, what pitch will generally be heard?
7. If you instead play pure tones of 800 Hz, 1000 Hz, and 1400 Hz simultaneously, what pitch will generally be heard?
8. We’re getting pretty close to the point where you’re going to have to choose a project. At this point you aren’t committing to anything, but briefly describe at least 2 different questions you are thinking of trying to answer with your project.