

Assignment IX, PHYS 150 (Physics of Sound and Music)
Combination Tones and Harmony
Due 3/14/14

1. What are beats?
2. According to your text, beats ceased to be perceived when Δf is greater than about what frequency difference?
3. What are second-order beats?
4. Explain how you can conceive of a musical staff as a semilogarithmic graph paper.
5. If you view a musical staff as a semilogarithmic graph paper, what are the variables along the two axes?
6. Redraw figure 8.9 in your text on lined or graph paper but using a linear frequency scale. Do this carefully, and make sure to include everything that the figure has. (This will be worth many points). Put this problem on its own page in your homework solutions, and do this with great care.
7. The lowest fifth on a piano is from A_0 (27.5 Hz) to E_1 (41.2 Hz). By applying the criteria for roughness of Plomp and Levelt, show why it sounds less pleasant than the fifth from A_4 (440 Hz) to E_5 (660 Hz).
8. What is a difference tone?
9. If we define the principle difference tone as $f_2 - f_1$ and the cubic difference tone as $2f_1 - f_2$, what is the relationship between f_1 and f_2 where the principle difference tone and the cubic difference tone are the same?
10. How does phase influence timbre? When are its effects largest?