

Math 5: Music and Sound. Quiz 1

30 mins (4 questions, Qu 3 worth less than the others)

Please write on this paper, show your working. The last page has useful information.

1. Consider the signal $2 \sin(400\pi t - \pi/4)$

(a) What is the period?

(b) Rewrite it in the form $A \sin(\omega t) + B \cos(\omega t)$.

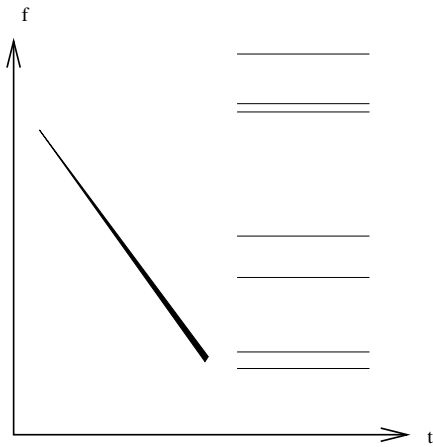
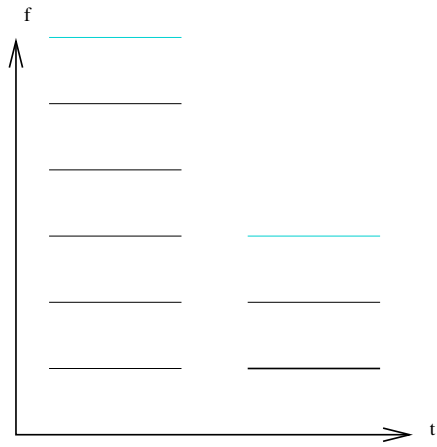
2. (a) What musical pitch (give name and octave, *e.g.* D#3) is nearest the frequency 1109 Hz?

(b) Find the frequency ratio of the *whole tone* interval in the Pythagorean scale.

(c) Find the frequency ratio between this whole tone and the equal-tempered whole tone in cents

3. What would you hear if two pure tones at frequencies 2000 Hz and 2008 Hz were played together? (For full points you must give all relevant new frequencies of phenomena which occur)

4. Describe in as much detail as you can what sounds these two spectrograms correspond to. For full points you must address: periodicity, pitch, timbre, loudness, and explain which sounds have these various aspects in common.



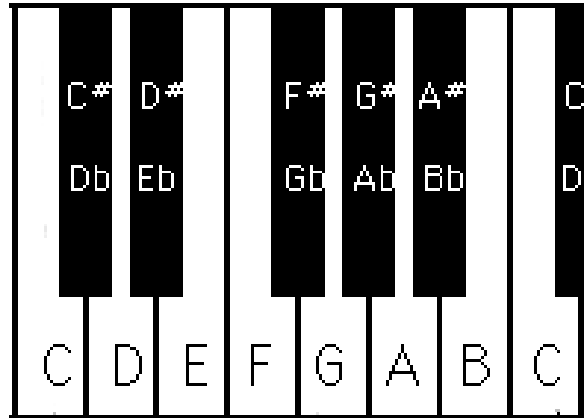
Useful information

$$\sin(a + b) = \sin a \cos b + \cos a \sin b$$

$$\sin a + \sin b = 2 \cos\left(\frac{a - b}{2}\right) \sin\left(\frac{a + b}{2}\right)$$

Intervals by number of semitones:

1. minor second
2. whole tone (major second)
3. minor third
4. major third
5. perfect fourth
6. tritone (augmented fourth)
7. perfect fifth
8. minor sixth
9. major sixth
10. minor seventh
11. major seventh
12. octave



The standard musical pitch A4 is 440 Hz