Midterm Exam - 11AM Mar 5, 2010
Physics of Music– Phys 341
Time 50min

Do as many problems as you can in the time. After I have marked the exam, you will be given a chance to hand in revised answers to the questions you got wrong. Your midterm mark will be the average of the total marks obtained the first and second time. Note that the questions will be marked somewhat more strictly the second time, but you cannot get less than you got the first time.

The exam will be marked out of 21. There are 25 marks altogether on this exam. Do all questions. If you get more than 20 you will keep the extra marks for your midterm mark. The marks for each question are given in square brackets at the beginning of the question. There are eight questions.

At the end of the questions and in the last graphs is some information which you may find useful.

Answer the questions in the Answer booklets, but if you do any work on the exam sheets, make sure you include them with the booklets.

There are seven(7) pages altogether, three pages of exam questions and four of graphs.

Calculators (unprogrammed) are allowed in the exam room.

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1. [2] In figure 1 is the plot of a recording of a sound. What is the period of the sound? What is the frequency of the sound? What is the amplitude of the sound? What is the wavelength of the sound in air?

2. [3] Compare the two waveforms in figure 2, which have the same period. Which do you think contains the highest component harmonics (giving reasons)? What would you estimate that highest harmonic number to be?

3. [4](a) At an outdoor rock concert, one fan sits near the stage about 10 meters from the speakers, while the second sits at the back 100 meters

from the speakers. The second fan has along his sound level meter, and measures the intensity to be 100dB. How loud would it be for the person 10 meters from the stage?

b) In figure 3 are plotted the first three vibration of modes of a bar of metal as seen from the side. The player sticks his piece of gum onto the center of the bar. What would happen to the frequencies of the first three modes. What would happen to the Q of the first three modes?

4. [4](a) While playing the piano, if I held down the sustaining pedal (this lifts a set of damping pads from the strings of the piano) and sing a note, the piano would sing back to me. What is happening?

   b) If I hold down a note on the piano (which also lifts the damping pad on that note) name three notes I could sing which would cause that string to sing back to me.

   (b) On the airplane I put earplugs in to my ears. Now when I open and close my mouth or move my tongue around in my mouth I hear the noise as though it had a pitch, which changes as I change my mouth. What do you think it happening?

5. [4] (a)Briefly describe the main components of the ear and their importance to the hearing of sound.

   (b)What is the name of the note a (perfect) fourth above G_3? What is its frequency?

6. [4] A worker is subject to a sound of 80dB for 4 hours, and 120dB for 1 hour. What is the average intensity in watts/m^2 and in dB during the 5 hours? [Remember that the standard for such dB ratings is that 0dB correspondes to 10^{-12} watts/m^2. Be careful in computing the average intensity, and recall that intensity is what is being averaged.]

7. [2] What happens to the frequency of the "popping sound" of a wine bottle as you gradually drink the wine? (Popping sound= sound produced as you pop your finger out of the opening of the bottle). What would happen to the pitch of the sound if you took the bottle into a Uranium hexaflouride atmosphere (which is about 5 times the density

of air but has the same compressibility) (numerical answers not needed but reasons for the answer are needed).

8. [2] What will be the topic of your term paper for this course? Why?

$2^{1/12} = 1.0595$ $2^{2/12} = 1.122$ $2^{3/12} = 1.189$ $2^{4/12} = 1.2599$
$2^{5/12} = 1.3348$ $2^{6/12} = 1.414$ $2^{7/12} = 1.498$ $2^{8/12} = 1.587$
$2^{9/12} = 1.682$ $2^{10/12} = 1.782$ $2^{11/12} = 1.888$

Velocity of sound in air= 340 m/sec.

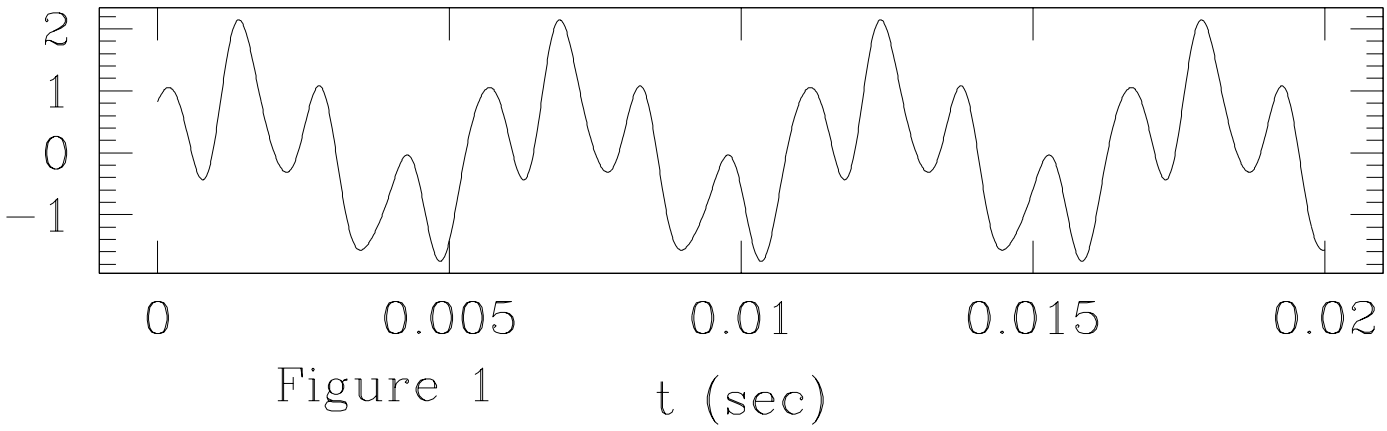
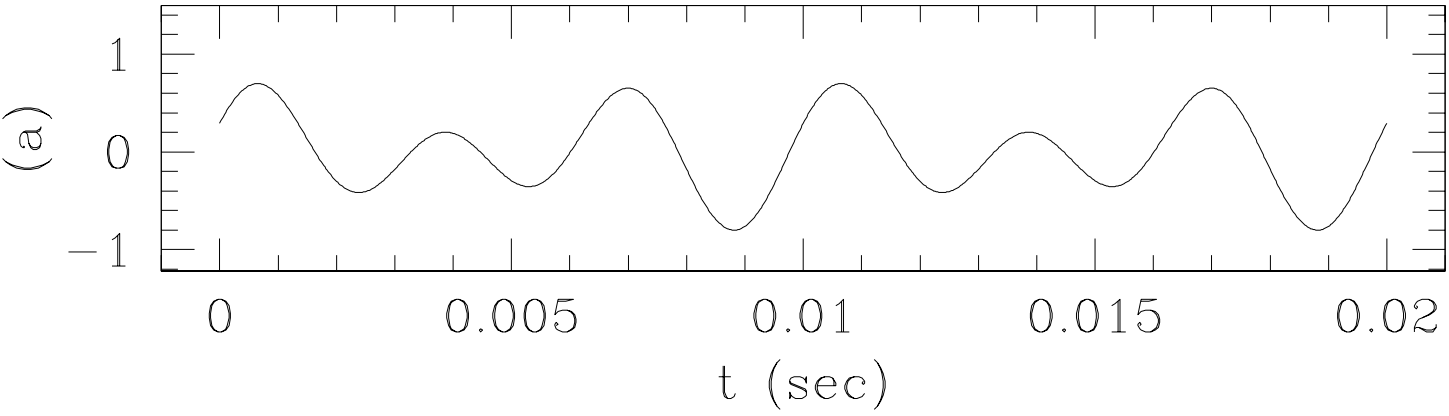


Figure 1



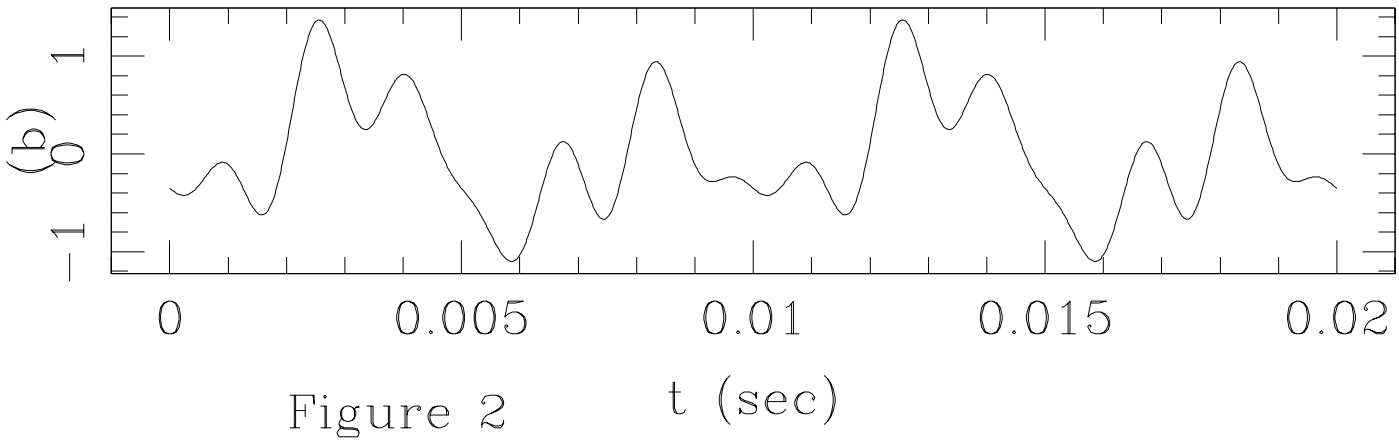
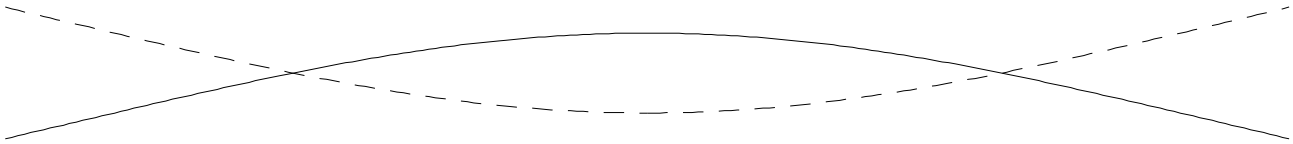


Figure 2



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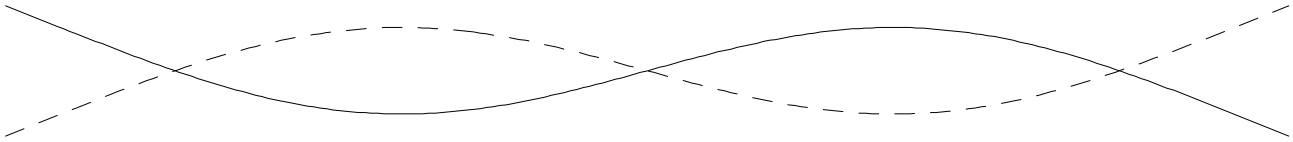

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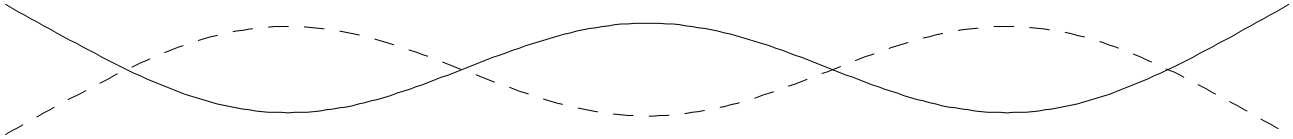
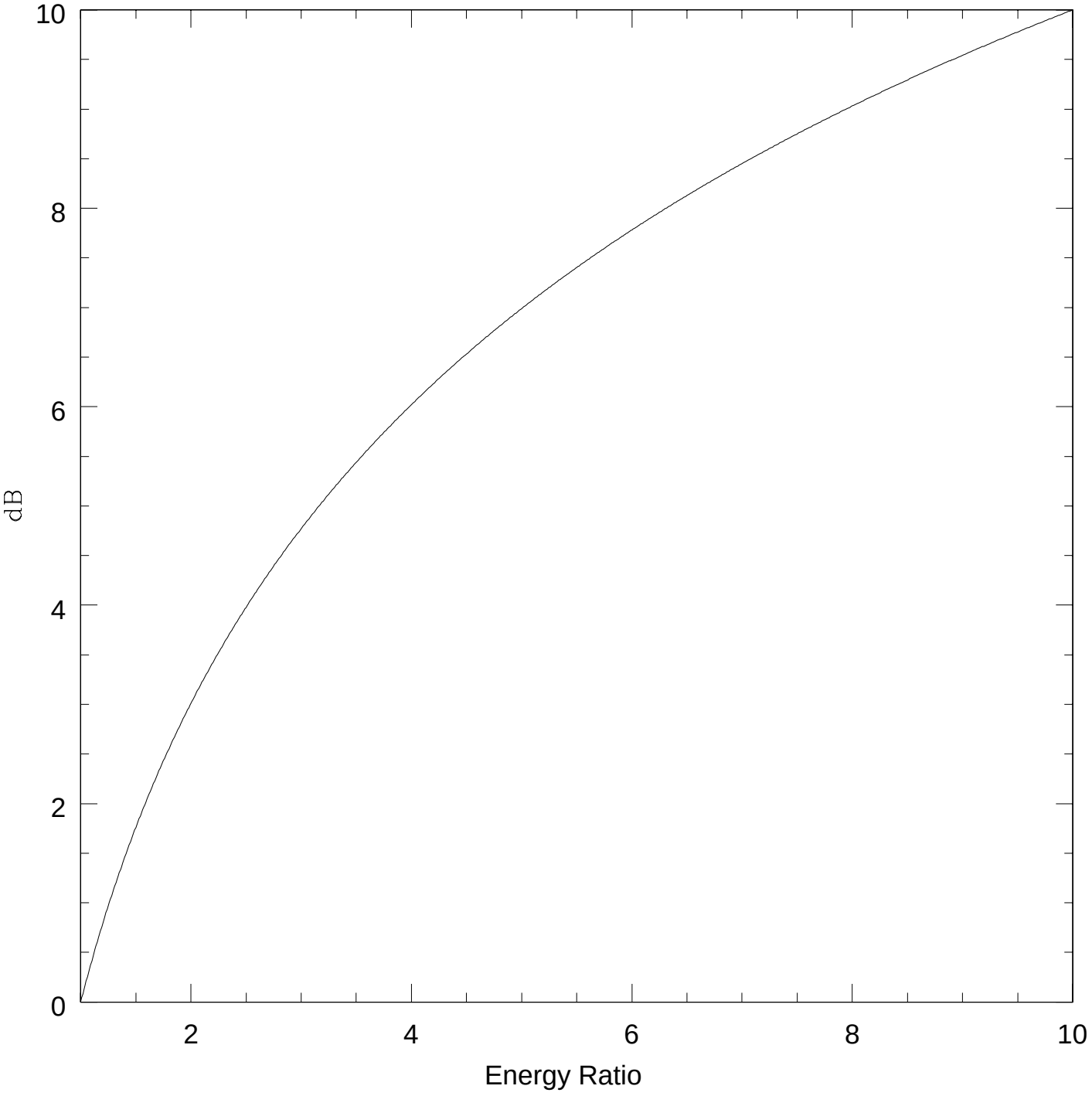
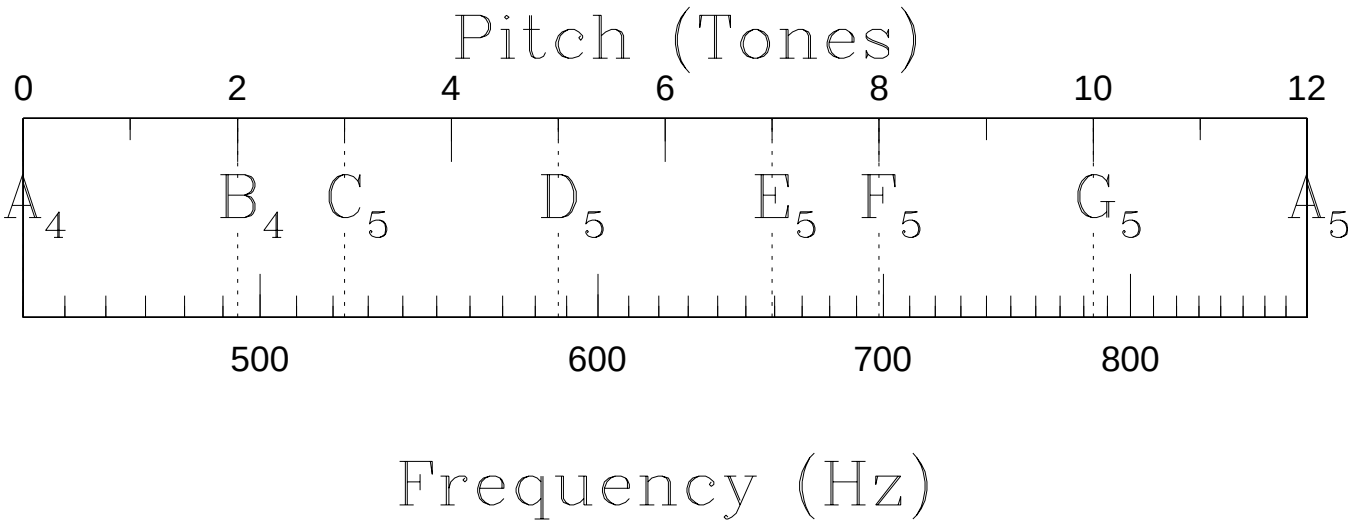


Mode 3 Freq= 5.402 f0

Figure 3


10
8
6
4
2
0
dB
2
4
6
8
10
Energy Ratio


Pitch (Tones)
0
2
4
6
8
10
12
A4
B4
C5
D5
E5
F5
G5
A5
500
600
700
800
Frequency (Hz)