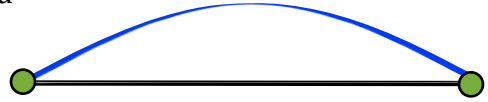


**PM Quiz practice problems. Section 4-3, 2-11-09**

1. Consider a string whose fundamental frequency is 100 Hz. Draw what the string would look like vibrating in its first four harmonics and label each corresponding frequency. The first one is done for you

a) 1st harmonic: (fundamental)  $f = \underline{100 \text{ Hz}}$



b) 2nd harmonic:  $f = \underline{\hspace{2cm}}$



c) 3rd harmonic:  $f = \underline{\hspace{2cm}}$



d) 4th harmonic:  $f = \underline{\hspace{2cm}}$



2. A particular instrument has a resonant frequency of 150 Hz in its 3rd harmonic. List the first 5 resonant frequencies of this instrument:

3. If you are given a resonant frequency of a string and the harmonic that it corresponds to, is that enough information to know ALL of the resonant frequencies of the string?  
Explain:

4. Recall that two pitches are separated by an octave if their corresponding frequencies differ by a factor of 2, i.e. a pitch is an octave higher than another pitch if its frequency is twice as great. Orchestras tune their instruments to the note A3, which corresponds to a frequency of 440 Hz.

a) What would be the frequency of A5, which is TWO octaves higher?

b) If an instrument's fundamental frequency is an A3, what harmonic corresponds to A5 (the note two octaves above)?

**Bonus question (if you have time):**

a) Shown below are two strings. The first has a fundamental frequency of 80 Hz. The second has a fundamental frequency of 60 Hz. What is the lowest frequency that could be used to cause both strings to resonate (hint: it may help to list the first few resonances of each string)?

b) What harmonic does this frequency correspond to on each of the two strings?

c) Draw the resonance pattern that this frequency would make on each of the two strings. Do you notice something peculiar about the relationship of these patterns to each other? Explain.

