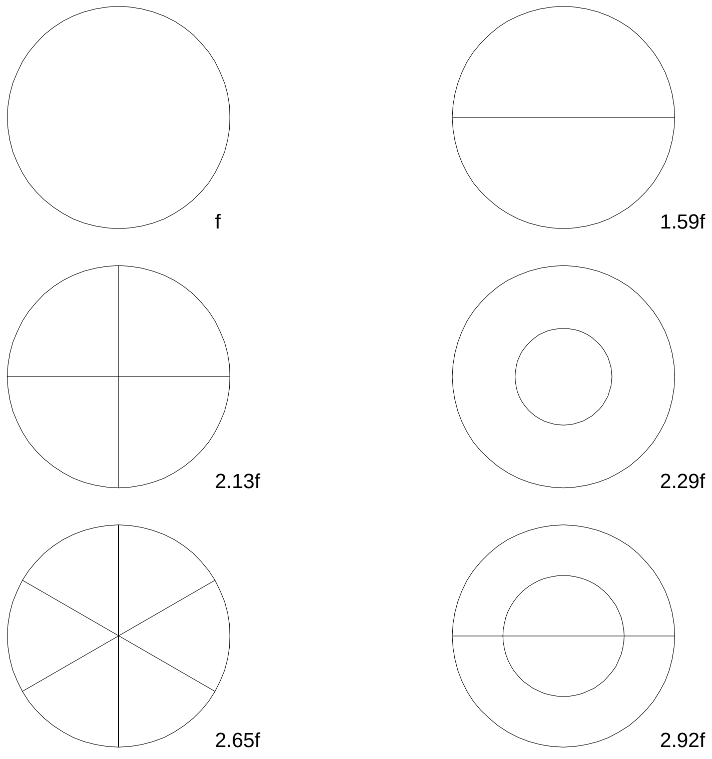
Physics of Music
Physics 341
Assignment 2

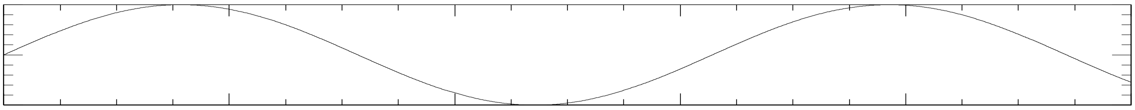
1) Figure 1 shows the nodes of the first 6 distinct modes of a drum head with their frequencies compared to that of the lowest mode. (The modes are numbered according to frequency, from the lowest frequency to the highest) Where would you lightly rest your finger(s) to damp out the second mode but not the third . Where to damp out the second and first but not the fourth.

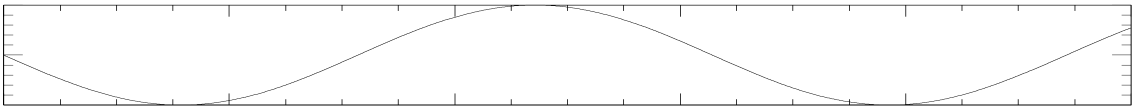


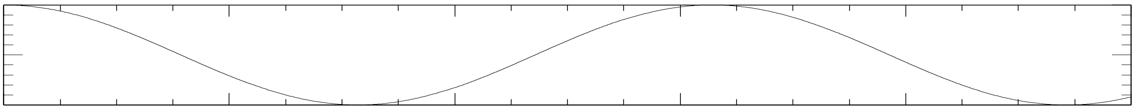

2) A uniform pipe is open at both ends. Where would you drill a small hole to damp out the first mode, but not the second. ( For a small hole, the difference in pressure in the pipe vs outside forces air through the small hole with a lot of friction.)

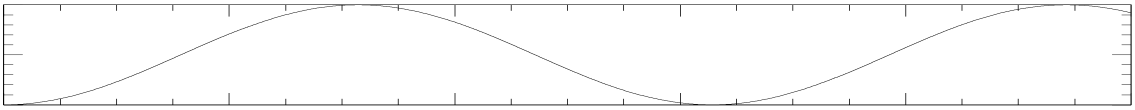
Where would you insert a piece of gauze into the pipe to damp out the second but not the third mode? (How would the guaze work in damping the mode?)

3) In the following set of four graphs, what is the phase shift of each of the graphs 2, 3, and 4 with respect to the graph 1? (Numbering starts from the top graph down)









4) The statement has been made (in many undergraduate physics text books) that the Tacoma Narrows bridge fell in 1940 due to resonance. The bridge, built just south of Seattle in the late '30s fell in a wind storm (40 mph winds), and its amplitude of vibration was over 100 times its amplitude in lower winds (the bridge deck tilted back and forth by over 40 degrees from the horizontal). Do you find this explanation convincing? Why (or why not)? (Hints: What would the Q of the bridge have to be got it to have such a large response? What would the frequency of pushing of the wind on the bridge have to be in order that the brige oscillated with such a large amplitude?)

For a video of the bridge see www.youtube.com/watch?v=j-zczJXSxnw

During the oscillation phase before the breakup, where are the nodes of oscillation?

5) A small lump of tape is placed on a guitar string exactly at a point 1/2 of the length from the end of the string. What effect would this have on the frequencies of the various modes of the string? (Consider the lowest 4 modes).