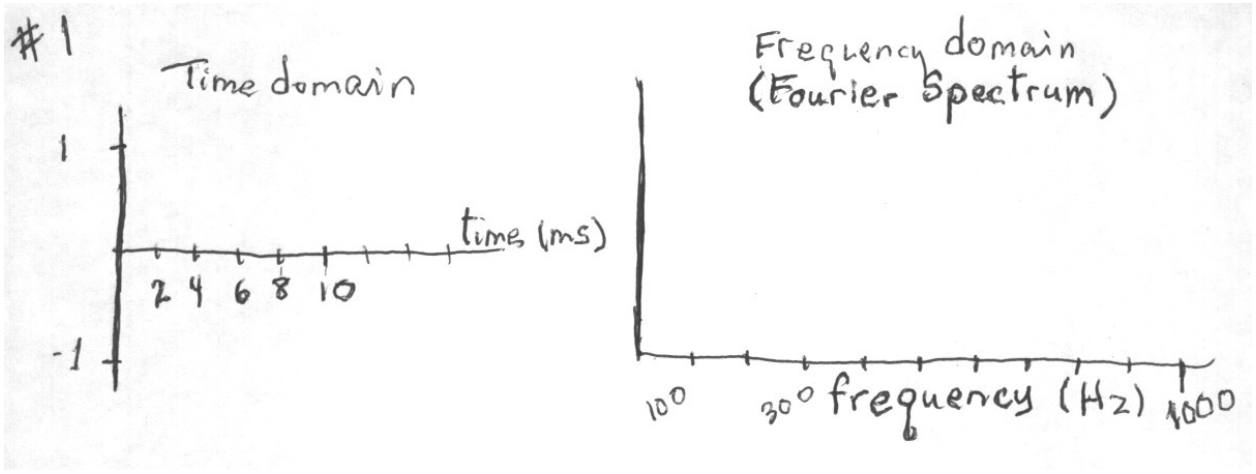
Homework #6 (chapter 4)

Question 1

Sketch the following five waveforms in both the time domain and the frequency domain. Assume that they all have an amplitude of 1 in the time domain and in the frequency domain the amplitudes can be plotted relative to the amplitude of the fundamental. (Hint, take a look at table 4-1 on page 96 of the text). You may want to use slightly different scales on the axis for the different wave forms.

#	waveform	description
1	Triangle	Period of 10 ms
2	Sine	Period of 5 ms
3	Square	Frequency of 300 Hz
4	Sawtooth	Frequency of 200 Hz
5	pulse	Period of 20 ms

Use pairs of graph axis numbered 1 to 5; an example pair of graph axis is shown below.

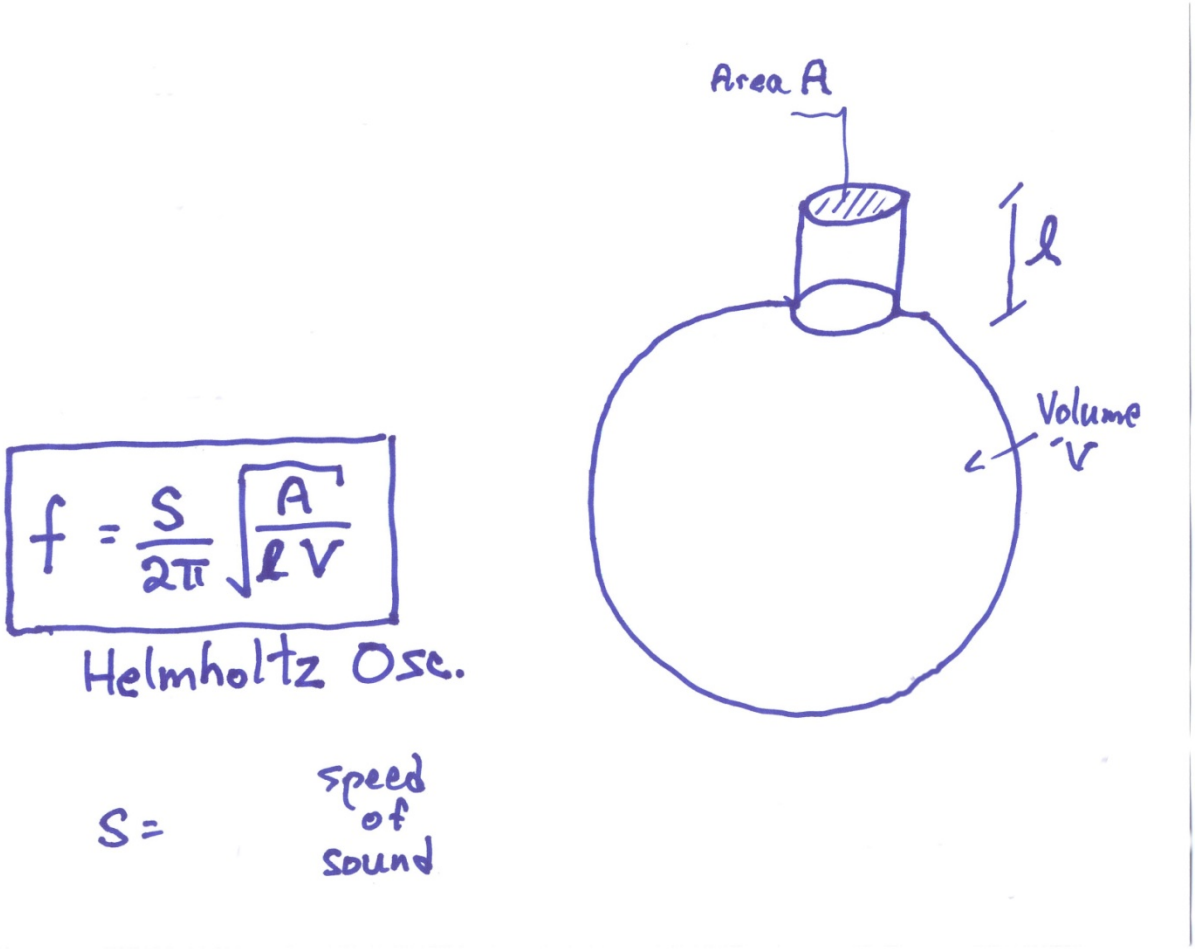


Question 2

List and define the 6 factors that affect tone quality (given in chapter 4 and in lecture).

Question 3

A Helmholtz oscillator is formed when an air-pocket (of volume V) is connected to the outside world through a tube with area A and length ℓ as shown in the sketch below.



Find the natural frequency of a pop bottle Helmholtz oscillator that has a neck of length of ℓ=2.5 cm and inside diameter of d=1.4 cm and the lower part of the bottle holds a volume of .30 liter (this is equal to a volume of V=300 cm^3). You can leave all the lengths in cm in the equation if you express the speed of sound as 34,500 cm/sec. Remember that the area of a circle is $A=\pi(d/2)^2$.