PHYS 160 - Homework #3

Make sure your name is listed as a comment at the beginning of all your work.

Research:

Lookup Fourier Series online. They are sums of $sin()$ and $cos()$ with ever increasing frequencies that are integer multiples of a fundamental frequency. They are widely used to represent sound, electronic signals, ... Fourier proved that these series can represent any repetitive functions (with some constraints on discontinuities).

Consider the Fourier series

$$sound(t) = \sum_{n=1}^{N} term(n,t) \tag{1}$$

$$term(n,t) = \frac{1}{n} sin(nt) \tag{2}$$

where t is the time and n labels the harmonics, $n = 1$ being the fundamental frequency.

Using Maple:

- Plot the first five terms in the series, namely $term(1,t)$, $term(2,t)$, $term(3,t)$, ..., in a single graph over the time interval $t = [0, 20]$
- Plot the summed-up series with N=5 terms over the time interval $t = [0, 20]$.
- Plot the summed-up series with N=50 terms over the time interval $t = [0, 20]$.
- Comment on what produces the periodicity of this sound signal
- What is the period and why?

Using Excel

- Answer the first two questions above.
- Comment on the quality of the graphs as obtained in Maple and Excel.