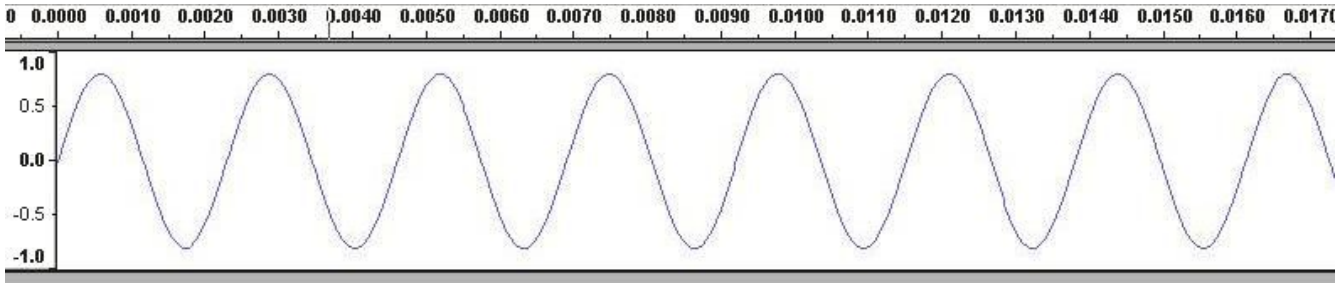
Project 4F: Sound Wave Lab

Math Studies 1

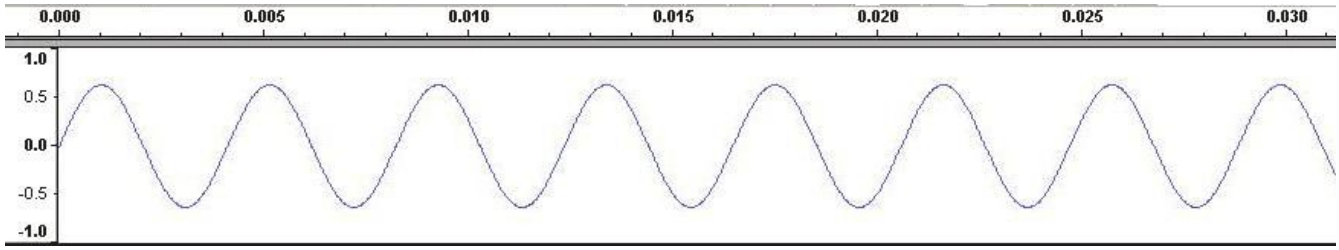
Purpose: The purpose of this investigation is to analyze a sound wave to determine its frequency (pitch) and decide whether the tuning fork is actually "in tune."

1. Choose one of these sound waves and download it from ManageBAC.

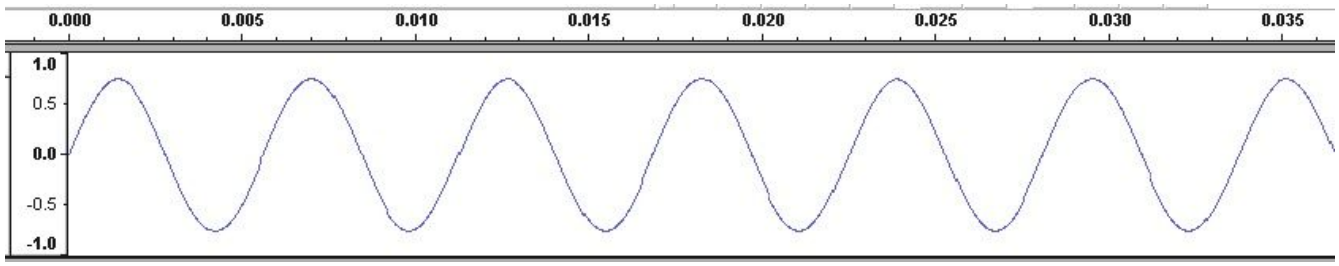
A440:



Bb233:



F175:



2. Import the sound wave to Geogebra and match up the scales. [Hint: Set properties to "Backround Image" and "Absolute Position on Screen."]
3. Decide whether this is a sine or cosine wave.
4. Make sliders for a, b, and c, and graph

   $f(x) = a \cdot sin(b \cdot x°) + c$ OR

   $f(x) = a \cdot cos(b \cdot x°) + c$
5. Find values of a, b, and c to match the sound wave. [Hint: You may need to change the limits of the sliders. Double-click a slider to change its properties.]
6. Write down the equation here: _____

7. Calculate the period of the wave: _____.
8. Calculate the *frequency* of the wave using the formula *frequency* = 1/*period*. (The units of frequency are Hertz (Hz).) _____
9. Use the table below to determine the closest *pitch* (musical note) to this frequency. _____
10. The sound wave you have analyzed came from a tuning fork that was labeled with its intended pitch and frequency. This information is given in the filename of the graphic you downloaded. Write down the intended frequency: _____ Hz, and the intended pitch: _____.
11. Calculate the percent error of the tuning fork's frequency:

    _____
12. A tuning fork will sound out of tune if it deviates 3% or more from its intended frequency. Is this tuning fork in tune or out of tune? _____

Percentage error	$\varepsilon = \frac{v_A - v_E}{v_E} \times 100\%$, where v_E is the exact value and v_A is the approximate value of v

Octave 3	Octave 4	Octave 5
C 131	C 262	C 523
C# 139	C# 278	C# 554
D 147	D 294	D 587
D# 156	D# 311	D# 622
E 165	E 330	E 659
F 175	F 349	F 699
F# 185	F# 370	F# 740
G 196	G 392	G 784
G# 208	G# 415	G# 831
A 220	A 440	A 880
A# 233	A# 466	A# 932
B 247	B 494	B 988

Project: Write a paper that explains the mathematics you did and the results. The paper should include the following:

I. Introduction with statement of task, and description of plan (how you will accomplish the task).

II. A copy of the graph pasted from geogebra, with an explanation of how you generated the graph and what it means.

III. All of the above mathematics, incorporated into paragraph form, with explanations of the calculations you did and what each one calculates.

IV. A paragraph that *interprets* the results: this paragraph must connect the answers to the calculations with the original purpose of the project.

V. A summarizing paragraph that wraps up the project.

Requirements

- This project must be typed in MS Word;
- All equations and calculations must be typed using the equation editor.
- This will be graded according to the Math Studies project rubric.
- It is due _____ and is worth _____ points.