ICS4U7 IA Proposal

1. Problem Description

Math calculators are very useful to help calculate expressions and to take advantage of a computer's processing power as opposed to evaluating by hand. However, non-online calculators are often very expensive and require unnecessary precision in the inputs, leading to slow inputs. For example, the T1-84 graphing calculator which is used by many IB HL Math students will sometimes output an error when a subtraction sign is used as opposed to a negative sign. As for online calculators, many specialize in a certain strand of math such as graphing, statistics, vectors, etc. However, it can be very cumbersome to have several tabs open and not have them all on the same screen. Additionally, these calculators tend to be useful for strands that they do not specialize in, such as Desmos subpar statistics calculator. The website that efficiently performs math calculations for all strands is Wolfram Alpha, but many features require a paid subscription. All these problems do not agree with many HL IB Math students' values of both low costs and efficiency.

2. Proposed Solution

A math calculator will be created that is tailored specifically for HL Math students. This will specifically have functionalities for strands from the HL syllabus (which also encapsulates the SL syllabus). Also, the calculator will be free and efficient. Additionally, many of these math students tend to take other courses that require math such as ICS, Physics, Chemistry, and some basic functionalities for those courses will be added as well.

3. Functionality

Basic Scientific Mode

- Have all the normal features
- May have profiles, allowing for many different users to use it

Vectors Mode

- Allows users to input vectors
- Cross and dot product for vectors
- Adding and subtracting vectors

Functions and Calculus

- Allows users to input functions
- System of equations
- Quadratics: Solving x-int, y-int, min/max, axis of symmetry
- Solving f(x)=g(x)
- Graph f(x), f'(x), F(x), limits

Sequences and Series

- Solve sum, and a specific term for a given series
- Can find sum of infinite series

Statistics Mode

- Store sets of values
- Can determine mean, variance, standard deviation, sort, IQR, linear regression
- Discrete Binomial Distribution: Expected value, Variance P(X=x) and P(X<=x)
- Discrete Normal Distribution: Standardized normal variable, Inverse
- Can graph the data in bar graphs

Trigonometry Mode

- Find area of any triangle
- Solve sine and cosine law given certain values
- Unit circle that shows the angle, and their trigonometric values

Mastery Factors	**Sample use in the Solution**
Arrays	Statistics, storing values
OOP	Class for each profile, stores their inputted equations and values and saves them
Sorting	Sorting values in arrays for statistics
Searching	Binary for guessing values of x such that f(x)=g(x)
File I/O	Stores the equations and setting for each profile
Loops	Used to draw graphs by doing many small lines

Success Criteria

- Evaluate math string expressions entered through buttons
- Easy editing of math string expressions with many features - Easy switching between panels that save the data
- Easy addition and removal of data for statistics panel with statistics constantly refreshed and backed up
- Graphing Calculator displays accurate graphs
- Easy addition and removal of functions
- Evaluation of f(x), f’(x), F(x), and f(x) = g(x)

- Trig panels should display proper unit circle with rotating triangle
- Proper error handling