

Team F - ETERNITY Calculator

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1 A section

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

1.1 poop

2 Smoothie

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

3 Perfect Meal Recipe

4 Appendices

4.1 Appendix A - Interview Questionnaire

Suggested Interview Questions ETERNITY Calculator - Team F

Name: _____

Occupation: _____

Suggested Interview Questions

1. What do you use a calculator for?
2. What would you like your calculator to do? Or what is the ideal calculator for you?
3. What kinds of calculators have you used? (physical, apps, online, etc.). Hardware or Software?
4. What functions do you use most often? Which ones do you use the least?
5. What features did you like most about your calculator. What do you not like about your calculator?
6. Is the aesthetics of your calculator important? What matters most (shape, color, personalized themes, etc.)?
7. If you're using a keyboard, how would you map the keys to functions, numbers, etc. ergonomics?

4.2 Appendix B - Interview transcripts

Interview Q&A - 1st year HR student

What do you use a calculator for?

- Almost exclusively for her accounting and finance classes
- Most of her usage of the calculator is for simple lightweight math used in accounting and finance.
- She does not use it extensively, mostly for exams and homework.

What would you like your calculator to do? Or what is the ideal calculator for you?

- She likes her calculator to be simple
- Prefers a calculator that has its function symbols identical to the ones in the books
- She would like her calculator to display the answers in a human readable form (5x7 Matrix numeric representation), and not the digital form (7-segment numeric representation)
- In the future she would like to see a calculator network system, similar to that of the iclicker, where the professor would give you a password, which after inputting it into the calculator, downloads a custom function from the professor's base station, or unlocks/locks some of the pre programmed functions in the calculator.

What kinds of calculators have you used? (physical, apps, online, etc.). Hardware or Software?

- Uses both a physical calculator as well as a calculator app on her phone.
- Mainly uses the calculator application because it's always available.
- Prefers the physical calculator since she enjoys the tactile feel of the buttons and because phones are not allowed during exam time.

What functions do you use most often? Which ones do you use the least?

- Most of the time she uses functions such as: addition, subtraction, delete (backspace) , 10^x , Ans function for retrieving the previous answer , exponential and square root.
- Rarely, if ever, uses logarithms or any of the trigonometric functions.

What features did you like most about your calculator. What do you not like about your calculator?

- She feels indifferent about what she likes in her calculator. All she cares about is that the calculator gives the right answer.
- The only thing she does not like about her calculator is that it displays numbers in a digital format (7 segment numeric representation)

Are the aesthetics of your calculator important? What matters most (shape, color, personalized themes, etc.)?

- Most of the physical aesthetics are of little importance to her. What matters the most is that the calculator gives an answer.
- She claims that the physical aesthetics would be merely a perk and would not pay extra for them.

If you're using a keyboard, how would you map the keys to functions, numbers, etc. ergonomics?

- She would like her calculator to have some shortcuts to common functions such as percentage
- Prefers the shortcuts to have their own dedicated buttons on the calculator instead of having to press multiple buttons at once.

Thoughts on making a calculator that has customizable capabilities?

- She would like to have the ability to program functions into the calculator, but only if academic establishments would allow it.

Interview Q&A - 3rd year mechanical engineering student

What do you use a calculator for?

- University studies
- Mostly finds himself using it for mathematical purposes.

What would you like your calculator to do? Or what is the ideal calculator for you?

- His ideal calculator would not be missing essential functions like plus, minus, multiplication, exponents, and the basics. Other common functions he mentioned from University, include logs, derivatives, e, integrals, roots, square roots, and more. He believes it's a must to have the ANS (answer button), and calculation history included too.
- The calculator should be lightweight and portable.
- In the future he would like to see more calculators that provide more support for polar coordinates. Lastly he would like to have access to shorter readable manuals or video content to quickly go over all of the calculator's features and how to implement them.
- Believes It would be great to have the answer button, calculation history, polar capability and a shorter readable manual!

What kinds of calculators have you used? (physical, apps, online, etc.). Hardware or Software?

- Both softwares and physical.
- Prefers physical calculator more than software-based because he has become used to it since his High School years.
- He doesn't mind using software calculators as long as it has useful shortcuts. He defined a simple software calculator as something that can open and run quickly on a computer or any other device.
- Kevin also mentioned he uses software calculators mostly for basic problems but not derivations and more advanced operations because it becomes too tedious to work with. He would much rather use the physical one.

What functions do you use most often? Which ones do you use the least?

- Addition, subtraction, multiplication, division, exponents, roots, converting to fractions, sin, cos, tan, exponents, logs, and mod.

What features did you like most about your calculator. What do you not like about your calculator?

- He liked Hexadecimal conversion, octa, binary conversions, derivations, and integration functions because they're relevant to his engineering courses. .
- Kevin doesn't like using the mouse pointer on his computer to input the values and functions on his software-based calculator. He would much rather use the computer keyboard. He mentioned the clicking option should be removed completely to encourage others to use the keyboard.

Are the aesthetics of your calculator important? What matters most (shape, color, personalized themes, etc.)?

- Easy to fit in your palm, portable, not too colourful (greyish, black). It should also be key mappable if it is a software-based calculator.

If you're using a keyboard, how would you map the keys to functions, numbers, etc. ergonomics?

- He would use the numbered keypad for inputting numbers
- Any symbols that are already commonly found (+, -, etc.) on both computers and physical calculators should be included.
- Assign important features and functions to large buttons, like the space bar or return key.
- Include a shortcut to quit
- Use the first letter of functions to input them into calculator. Ex: C for cos, S for sin, T for Tan, etc.

Thoughts on making a calculator that has customizable capabilities?

- Doesn't think it is necessary. He usually uses google to help solve complex problems and inputs the simple calculations on the calculator to double check his work and find the final answer.
- He believes it would be great to include physical skins to personalize the calculator but it is not a must.
- In the future he would like to make it customizable by being able to download packages for calculator functions that can easily be added or removed to the device.

Interview Q&A - 3rd year electrical engineering student

What do you use a calculator for?

- Any mathematics courses in his degree
- Almost all Engineering courses.
- Counting money at his job

What would you like your calculator to do? Or what is the ideal calculator for you?

- It should have the basic, essential functions such as square root, exponential, logarithms, and trigonometric functions.
- His ideal calculator would also have the ability to find variable unknowns (system of equations)
- He believes that a calculator that can plot and display graphs would be very beneficial
- Another feature he would like to see in calculators is the ability to calculate indefinite integrals.
- One of the main features he really wants to see is the ability to save/transfer his work (Graphs, functions, answers) from his calculator to his mobile phone.

What kinds of calculators have you used? (physical, apps, online, etc.). Hardware or Software?

- He has used all kinds of calculators, physical ones, apps, software. . .
- Prefers a physical calculator since he's used to its layout and buttons
- For quick calculations, he uses any calculator closest to him.

What functions do you use most often? Which ones do you use the least?

- Frequently uses functions such as trigonometric functions, exponential, logarithms, and root
- Hardly ever uses the modulus or absolute value functions.

What features did you like most about your calculator. What do you not like about your calculator?

- He dislikes that his calculator does not support finding unknown variables in equations.
- Claims that the few functions his calculator has for Radians and polar equations have been very helpful.

Are the aesthetics of your calculator important? What matters most (shape, color, personalized themes, etc.)?

- Aesthetics of his calculator are important to him.
- He prefers his calculator to be comfortable to hold
- Personalized themes on his calculator have little importance to him
- Prefers to buy a nice looking calculator that he likes and sticking with it instead of buying a customizable one.

If you're using a keyboard, how would you map the keys to functions, numbers, etc. ergonomics?

- He has no preference for key mapping, instead he would like his calculator to be set up in a way such that when he types the first few letters of the function name, it would show him function suggestions of which he can chose one.

Thoughts on making a calculator that has customizable capabilities?

- Would only buy it if it comes at no extra cost, otherwise he would prefer to buy a cheaper calculator with the pre-programmed functions that he knows he needs.

Interview Q&A - 2nd year avionics student

What do you use a calculator for?

- He uses it to solve his math and physics problems most of the times.
- He also uses it to keep track of his finances and plan his spending accordingly.

What would you like your calculator to do? Or what is the ideal calculator for you?

- In addition to basic functions he would like it to be able to calculate more complex functions such as e^x , log, roots, derivatives, integrals and so on.
- His ideal calculator is the one that has specific button for each function while it is portable.
- Maybe a folding calculator.

What kinds of calculators have you used? (physical, apps, online, etc.). Hardware or Software?

- He has used both hardware and software.
- He prefers using his engineering calculator app on his cellphone but since he is not allowed to use it in the exams he has to use his regular calculator most of the times.

What functions do you use most often? Which ones do you use the least?

- These days in addition to basic functions like multiplication and division, he mostly uses functions such as power, exp, root, log, trigonometric, derivative and integral.
- The factorial function might be one of those that he used the least recently.

What features did you like most about your calculator. What do you not like about your calculator?

- Since it is a pretty simple calculator, it is simple to use for the fundamental functions.
- The things that he doesn't like about it is that it cannot convert decimals into fraction and also it can't calculate derivative and integral.

Are the aesthetics of your calculator important? What matters most (shape, color, personalized themes, etc.)?

- He doesn't care about the aesthetic of calculator.
- Its simplicity of use, accuracy and portability have higher importance to him.

If you're using a keyboard, how would you map the keys to functions, numbers, etc. ergonomics?

- He would assign each function to a specific button.
- For inverse functions such as arcsin or nth root he would assign shift + the key for original function.
- He would make sure that his calculator has the ability to represent numbers in different formats. For instance, he would assign the key "H" for Hexadecimal and "R" for radian.

Interview Q&A - Entrepreneur

What do you use a calculator for?

- She mostly uses it to calculate the price of services and products for the clients.
- Calculate her employees' salary based on the hours they work.
- She also uses it to keep track of her personal finances.

What would you like your calculator to do? Or what is the ideal calculator for you?

- Since most of the times she uses it to calculate the amount of money, she prefers her calculator to round the amount to 2 decimals.
- She would also like to have a button to calculate the tax so it would save her time and prevent making mistakes.

What kinds of calculators have you used? (physical, apps, online, etc.). Hardware or Software?

- She generally uses a physical calculator because she is used to it.
- When she does not have her calculator with her, she uses apps and/or online calculators.

What functions do you use most often? Which ones do you use the least?

- Most often she uses multiplication, addition, subtraction, division and percentage.
- She rarely uses other functions such as sin, cos or log.

What features did you like most about your calculator. What do you not like about your calculator?

- She likes that its screen is large in size and that it has soft buttons.
- Its simplicity to work with.
- Since it is rather large, it is not very portable. She can only use it in her work place.

Are the aesthetics of your calculator important? What matters most (shape, color, personalized themes, etc.)?

- Not that much. As long as it has a decent look and is easy to work with, it would be OK.

If you're using a keyboard, how would you map the keys to functions, numbers, etc. ergonomics?

- She would map the numbers and basic functions to their associated keys in keyboard.
- She would also like to have some shortcut keys for instance "t" for calculating tax and "s" for total sum.
- She believes it would be interesting to have a calculator that can be customized by the user. For example since the tax rates, products price and employees' salaries are subject to change, it would be cool if it had a shortcut for each of them to be able to modify the amount when the change happens.

4.3 Appendix C - Personas

Sarah Garrell (20)

Job Title: 1st year HR student

Education: High School + CEGEP

Experience:

- Starbucks Barista
- Summer camp counselor

Goals:

- Get her degree and work in recruiting
- Pass accounting and finance

Goals and Tasks user accomplishes

Mostly she is worried about her finance class so anything that would help her with that would be appreciated.



Problem calculator solves

She needs a calculator to calculate the equations for finance class. Her school does not allow her a programmable calculator so she will need to memorize the equations. She would definitely appreciate it if she could enter the equation from left to right just like she memorized them.

Kevin Donnavan (23)

Job Title: Engineering Student

Education: 3rd Year Mechanical Engineering

Experience:

- 3rd Year Mechanical Engineering
- Summer internship as a junior structural engineer
- Army reserves - Infantry

Skills:

- Problem Solving, Mathematics
- Programming in Java, C#, and C++

Goals:

- Obtain a good GPA and find a job in his field.

Goals and Tasks user accomplishes

Kevin says he just wants to get through his classes and get a decent GPA. Like everyone, his hardest classes mostly have to do with math (although he feels he is better than average). Kevin will be happy with anything that can make his math calculations easier.



Problem calculator solves

The calculator helps Kevin get fast answers to difficult math problems he sees in class. Without a calculator, he is not sure how he would calculate the various functions that he sees on a daily basis. The calculator has to be precise enough so he can get the right answer to complex solutions of differential equations but he is not willing to wait - calculation must be near-instantaneous.

Tarek Ghamzi (23)

Job Title: Engineering Student

Job Title: 3rd year Electrical engineering student

Education: High School + CEGEP, currently in Electrical Engineering

Experience:

- Subway
- Pharmacist assistant

Skills:

- Problem Solving, Mathematics
- Programming in C++ , and arduino

Goals:

- Finish his degree with a good GPA
- Find a job in his field

Goals and Tasks user accomplishes

Tarek claims that his main priority in life at the moment is to get his degree in Electrical Engineering. He claims that his field is heavily based on math, which he struggles with. He aims to graduate with a higher than average GPA to gain an edge over others in his highly competitive field.



Problem calculator solves

His calculator helps him in computing the high level mathematical functions that would take hours to solve by himself. It also helps him double check his answers for simple calculations. Tarek claims that his calculator is with him at all times. Its accuracy, speed and comfort are of highest value to him.

Arash Mohajer (28)

Job Title: 2nd year Avionics Engineering student

Education: High School + CEGEP, currently in University

Experience:

- Completed two internships at a company that manufactures Flight Simulators
- Worked part time as a waiter

Skills:

- Mathematics, Physics
- Technical Writing
- Some experience programming in C# and Java

Goals:

- Find more internships during his degree
- Finish his degree in a reasonable amount of time
- Save money for his future (manage personal finance)

Goals and Tasks user accomplishes

Arash wants to finish his degree in Avionics as soon as possible so that he can get a good job in a field that he enjoys. He wants to continue taking part in engineering competitions and hackathons to learn more about his field and others and to meet other like-minded individuals. He wants to manage his personal finance in order to pay off the debt that he currently has from his university tuition.



Problem calculator solves While he is more focused on graduating than getting good grades in his classes, he has many math and physics intensive classes where he relies on a calculator. He uses a calculator at school for homework, projects and exams. He also uses a calculator for conversion between different units for engineering and physics problems. At home, he uses his calculator to manage his personal finances and to plan his future spending.

Victoria Benlolo (35)

Job Title: 1st year HR student

Education: High School + CEGEP

Experience:

- Has owned and managed a spa for 2 years
- Worked as a financial analyst for 7 years

Skills:

- Economics, Business, Finance
- Public Speaking
- Investing

Goals:

- Maximize the profit of her business
- Invest in new profitable endeavours
- She is interested in opening new spas around town once her business grows more
- Hire new employees and continue to manage the finances of her business



Goals and Tasks user accomplishes

Victoria wants to continue to grow her business and potentially start franchising her spa to open up new locations around the city. She wants to hire new talent in order to expand her finance team. Her day-to-day includes managing employees' pay, keeping inventory of products, paying bills and managing business income. Additionally, she wants to continue investing in the stock market.

Problem calculator solves At the Spa, Victoria uses a calculator to calculate all of her business expenses, profit/loss, employee salaries, etc. A reliable calculator is very important to her. She uses a calculator to plan expenses in her future business expansion plans. She also uses a calculator to keep track of how her personal accounts and investment portfolios are growing.

4.4 Appendix D - Use Case Descriptions

ID	UC 1
Name	Calculate result
Description	User wants the calculator to resolve his mathematical expression to a satisfactory level of precision near-instantaneously.
Pre-condition	<ul style="list-style-type: none">• Calculator is on
Post-condition	<ul style="list-style-type: none">• Calculator takes user input, parses, calculates, and arrives at a correct result.• Calculator saves the result of this operation for future use (UC 2).
Basic path	<ol style="list-style-type: none">1. This use case starts with the user entering a mathematical expression into the calculator.2. When satisfied with inputted expression user presses "=" button or "enter" on keyboard.3. Calculator performs resolution of the arithmetic expression.4. Calculator stores the result of the expression (UC 4).
Alternative Path	<ol style="list-style-type: none">1b. User enters a letter and number in order to store a variable (UC 3).3a. Calculator detects a syntax or arithmetic error in user's input.<ol style="list-style-type: none">1. Calculator detect the type of exception.2. Calculator displays this exception on screen (UC 4)3. User can clear exception and return to the offending arithmetic expression and attempt to correct the error (return to Basic Path 2).

Table 1: UC 1 - Calculate result

ID	UC 2
Name	Recover previous result
Description	User wants to recall the result of a previous calculation and be able use it in another calculation.
Pre-condition	<ul style="list-style-type: none"> • Calculator is on • A successful calculation has already taken place (UC 1)
Post-condition	<ul style="list-style-type: none"> • User sees result of previous calculation and can input it into another calculation.
Basic path	<ol style="list-style-type: none"> 1. User presses "Ans" button which will input result of the previous calculation into the current calculation. 2. User carries on with the rest of the calculation (UC 1).
Alternative Path	<ol style="list-style-type: none"> 1a. User can press "mem" button and see a list of previous results that can be chosen for the current calculation. <ol style="list-style-type: none"> 1. User presses "mem" button 2. User scrolls to the desired result 3. User presses "enter" button to insert select result into current calculation.

Table 2: UC 2 - Recover previous result

ID	UC 3
Name	Store variables
Description	User want to store values that can be recalled during calculations by referencing an alphabetical label.
Pre-condition	<ul style="list-style-type: none"> • Calculator is on
Post-condition	<ul style="list-style-type: none"> • A number is stored in the calculator's memory and is ready to be retrieved by invoking its alphabetical label. • User should be able to clear or overwrite a stored variable.
Basic path	<ol style="list-style-type: none"> 1. This use case starts with the user entering an alphabetical label that will eventually be used to recall the stored value. 2. The user then presses "equals" to indicate that a value is to be stored under the chosen label. 3. The user then presses "enter" which tells the calculator to store the variable under the aforementioned label. 4. At any point during a calculation (UC 1), the user can evoke the value stored in a variable by entering the corresponding alphabetic character. 5. The calculator substitutes the variables's value into the calculation.
Alternative Path	<ol style="list-style-type: none"> 1a. Clearing the variable <ol style="list-style-type: none"> 1. User enters the alphabetic label of the variable that requires clearing (value and label appear on display). 2. User presses "clear". 3. The calculator shows the variable is now cleared.

Table 3: UC 3 - Store variables

Glossary

Discord A communication software hosted on the web used for scheduling, discussion and sharing of files.

Eclipse A Java Integrated Development Environment.

Git An open source distributed version control software.

GitHub A web service that hosts git repositories for ease of use between developers.

IntelliJ A Java Integrated Development Environment.

Java A general purpose object-oriented programming language.

JavaDoc A code documentation generator for Java.

JavaFX A graphical user interface library for Java.

Junit A library in Java used for writing unit tests.

Latex A textual interface for writing technical and scientific documents.

Transcendental Function "A function that does not satisfy any single-variable polynomial equation whose coefficients are themselves roots of polynomials".