SOEN 6011: Project Team C

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1 Function Description

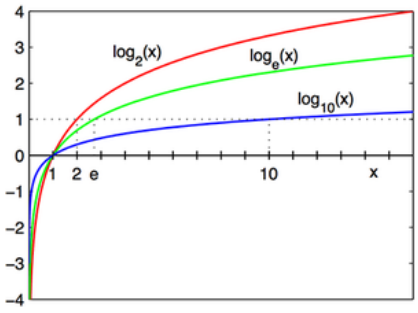
1.1 Logarithmic Function

$$\log_b(x)$$

The **logarithmic** function is the **inverse** of the exponential function, since it is a one-to-one function. The graph of an inverse function is the reflection of the original function, using the line y = x as reflection axis. John Napier expressed y as a function of x for the logarithm in 1614 resulting in:

$$\log_b(x) = y$$

which can be read: “x is equal to b (base) to the power y”, which is equivalent to "y is the base-b logarithm of x."



Domain: x > 0 (set of positive real numbers)

Co-domain: Set of real numbers **R**

Specificity of the base: b ≠ 1 and b > 0

1.2 Unique characteristics

Exponential expressions can be written as logarithmic expressions and logarithmic expressions can be written as exponential expressions. ex: $3^2=9 \Rightarrow \log_3(9) = 2$

- when b = 10 the function is called common logarithm and denoted log(x)
- when b = *e* = 2.7182818… the function is called natural logarithm and denoted ln(x)

Logarithmic identities:

- Product: $log_b(x * y) = log_b x + log_b y$
- Quotient: $log_b(x/y) = log_b x - log_b y$
- Power: $log_b(x^p) = p\, log_b x$
- Root: $log_b \sqrt[p]{x} = \frac{log_b x}{p}$

2. Assumptions

Assumption 1
As of version 0, we assume that the user interface will be text based relying on console input-output.

Assumption 2
The ‘system’ refers to the scientific calculator, Eternity: Functions

3. Functional requirements

F4.0.v1 Function Selection
When the system starts, the interface should display the function name and allow the user to select the logarithmic function.

F4.1.v1 Logarithm Base Initialization
When the user selects the logarithmic function, the system should ask the user which base *b* he wishes to use and set the base value.

F4.2.v1 Logarithm Base Validation
After the user inputs the base value *b*, the system should validate that *b* is a real positive number not equal to 1.

F4.3.v1 Logarithm Variable Initialization
If the base *b* is valid, the system should ask the user to input the value for variable *x* and set it.

F4.4.v1 Logarithm Variable Validation
After the user inputs the variable *x* value, the system should validate that the variable *x* is a real positive number.

F4.5.v1 Logarithm Calculation
If the variable *x* is valid, the system should calculate the logarithm of *x* in base *b*, without relying on java built-in functions, and store the result.

F4.6.v1 Result Display
After the calculation completes, the system should display the result on the user interface.

4. References

[1] https://en.wikipedia.org/wiki/Logarithm

[2] http://dwb4.unl.edu/Chem/CHEM869R/CHEM869RMats/Logs/Logs.html