# Criterion C: Development

1. Regular expressions
2. Stacks
3. String looping
4. ScriptEngineManager
5. DecimalFormat

1. Initially, I thought that I would be able to just loop through the input string and find the coefficients and exponents of each function by finding their exponent. This did not work once i started testing strings that were 3 or more functions long. So, I had to research another way to do it. I came across Regular expressions quickly, but pushed them aside due to complexity. Eventually, I broke down and got to work implementing Regular expressions from my parsing. This allowed me to easily break up user input into separate functions which would make it easier to loop through to find the coefficient and exponent.

2. In my program, I collect all of my separated functions and operators in two stacks. I chose to use a stack, because I need the output to be in a specific order. Stacks allow me to do this. When i reassemble the answer string I pop the top function off the stack, find the derivative, and add the newfound derivative to the front of the answer String. Then I pop the top operator from the operator stack and add it to the front of the answer String. This ensures that the order of the user input will be kept in tact through calculation. Also, while doing this, the FunctionProperties are put in a FunctionProperties ArrayList for the details of how the derivative was found.

3. To find the coefficient and the exponent, I simply loop through the Strings that have been parsed by my Regular Expression. Because I know what my Regular Expression will accept as input, I can make assumptions about where the coefficient will be and where the exponent will be. The coefficient will be everything before the variable and the exponent will be everything after the “^” symbol. Using this assumption, I am able to find both the coefficient and the exponent by looping through the parsed String.

4. I wanted to be able to take in an input such as (10/5)x^(10/5) and get the correct derivative of 4x^1. However I did not know how to do this on my own. Through my separation of coefficient and exponent, i already had the String of “(10/5)” ready to go. I then came across ScriptEngineManager. This is a little ScriptManager that when given an input like “(10/5)”, it will evaluate it, in this case evaluating to 2.

5. I wanted my program to be able to deal with double values. Eventually I ran into the classic floating point roundoff error. To solve this i used DecimalFormat to limit my output to a maximum of 3 decimal places and a minimum of none for whole numbers.