ENS 1300
Numerical Differentiation and Integration
Coding Practice

Problem 1 (20 points) Numerical Differentiation and Integration

In lab 6, you used curve to determine the best fit polynomial for the following data:
X=[0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20];
Y= [-4 -3 8 47 132 281 512 843 1292 1877 2616 3527 4628 5937 7472 9251 11292 13613 16232 19167 22436];

PART 1

1. Numerically differentiate the data points.
2. In the same window, plot the numerical derivative using forward difference (green line) backward difference (blue line), and central difference (red line).
   NOTE: Refer to the following link to see how to map the values of x:
   https://efcms.engr.utk.edu/ef230-2019-01/modules/matlab-integration/
3. Use the curve fitting tool to determine the best fit polynomial equation for this data.
4. Determine the equation for the derivative of this polynomial equation.
5. From this equation, determine values of the derivative for 500 values of x from 0 to 20
6. Also in the same window as step 2, plot the values of the derivate generated from the polynomial (black line).
7. In all, there should be four curves on the same plot, although the curve generated by the derivative of the polynomial and the central difference derivative are almost the exact same line.

PART 2

1. Numerically integrate these data points from 0 to 20.
2. Using the best fit polynomial equation found for the data in part 1, integrate the best fit polynomial equation.
3. Determine the value of this integrated equation at x = 20.
4. Compare this value to the numerical integrated value (No code needed).

Problem 2 Machine Parts (15 points)

A machine cuts N pieces of a pipe. After each cut, each piece of pipe is weighed and its length is measured. These two values are then stored in a n by 2 matrix that has weight in the first column and length in the second column. The weight is supposed to be between 1.9 and 2.1 and the length is supposed to be between 9.9 and 10.1. Any pipe that is outside of either or both parameters is considered a reject.

Write code that will check each piece of pipe to determine whether it is a reject. **Write the program so that the number of pieces can be varied.** The script should keep track of the number of acceptable pieces of pipe and the number of rejects. These values should be displayed in the command window using a single fprintf statement.

Use the following values to test the code:

Sample	Weight	Length
1	2.14	10.04
2	1.97	9.98
3	2.06	10.05
4	1.93	9.92
5	1.89	10.04
6	2.08	10.16
7	1.94	10.03
8	2.12	10.15
9	1.96	9.94
10	1.99	10.02
11	2.07	9.96
12	2.11	10.14
13	1.91	9.97
14	1.95	10.06
15	2.05	9.93
16	2.03	10.14
17	2.15	9.97
18	1.92	10.06
19	2.04	9.93
20	2.16	9.89

NOTE: A different data set will be used to grade your code!