Homework 7

This homework assignment is about polynomial interpolation (section 4.1) and numerical differentiation (section 4.3).

For the written exercises, you should upload a scanned PDF to Gradescope and then follow the prompts given by Gradescope to assign certain pages of your PDF document to the correct problems.

For the coding exercises, you will be prompted to upload your python file directly to Gradescope. Please make sure you submit only one file and that your variables are assigned to the correct variable names.

The course syllabus found on Canvas has information on how homework is graded and how homework should be presented and submitted. Please let me or the TAs know if you have any questions or concerns.

This assignment is due on Tuesday, February 20 at 11:59pm.

Written Assignment

- From section 4.1 (pg. 174) Complete problems: 1, 2, 5, 7a
- For 7a in section 4.1 you do not need to simplify the polynomial/put the polynomial in the most efficient form for computing.
- From section 4.3 (pg.198) Complete problem: 1, 3

Coding Assignment

Below is a table of a United States population (in millions) from the year 1800 to 1910.

Year	Population (in millions)
1800	5.308
1810	7.240
1820	9.638
1830	12.861
1840	17.064
1850	23.192
1860	31.443
1870	38.558
1880	50.189
1890	62.980
1900	76.212
1910	92.228

We will write a python script to approximate the population growth rate. You can follow the hw7_template.py on Canvas or write your own python script to complete the following coding problem. In the template, the code is written that approximate the population growth with the forward difference formula.

1. (a) Write a code to approximate the growth rate of the population using the backwards difference formula. This should be a 1D array of shape (12,) with the first element of the array being left as 0 after initialization (since the backward difference formula requires $f(t-h)$). Save this to the variable named forward_diff.

   (b) Write a code to approximate the growth rate of the population using the central difference formula. This should be a 1D array of shape (12,) with the first and last element of the array being left as 0 after initialization (since the backward difference formula requires both $f(t+h)$ and $f(t-h)$). Save this to the variable named forward_diff.