

Problem I.4

Partial Product

Learning Objectives

- Programming Skills – For loops
- Importing packages
- Using numpy arrays

Due Date:

Folder: IntroToProgramming

File Name: PartialProd_LastName.py

Problem Background

We now take the idea of partial sums and modify it slightly to consider partial products. In the same way we can consider an infinite sum of numbers, we can also consider an infinite product of numbers. The notation is written as,

$$\prod_{i=1}^{\infty} a_i.$$

We can also talk about a sequence of partial products, defined by,

$$p_n = \prod_{i=1}^n a_i.$$

In this problem, we will be looking at sequences of partial products to determine which infinite products converge and which diverge. We will also use these sequences to attempt to estimate what the infinite products converge to, when they converge.

Programming Reminders

- Syntax for a for loop: `for ii in range(N):`
- Import numpy with `import numpy as np`
- Create a numpy array of zeros with `x = np.zeros((10))`

Program Criteria

Write a program that does the following:

- Create an input variable N for the total number of terms in the partial product sequence.
- Generate the first N terms for the following partial product sequences using a `for` loop, not a built-in function,

$$- p_n = \prod_{i=2}^n \frac{i^3 - 1}{i^3 + 1}$$

$$- q_n = \prod_{i=1}^n \frac{e^{i/100}}{i^{10}}$$

– A partial sum of your creation

- Print out the first 15 terms and the last 15 terms in each sequence, with an appropriate description.

Deliverables

Place the following in a folder named `IntroToProgramming` in your repository:

- A Python file `PartialProd.LastName.py` that satisfies the program criteria.
- A Latex document `PartialSum.LastName.pdf` with the following information:
 - Write down the partial sum terms that you created
 - State whether you think each series will converge or diverge and explain why.
 - If you think the series will converge, give an estimate of what it will converge to.