PROBLEM I.3: PARTIAL SUM

ROSIE KEY

1. Equations Used

Series 1:

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

Series 2:

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

Series 3:

$$\prod_{i=1}^{n} \frac{1}{i}$$

2. Terms Created

Using anaconda, a program was created to to make a list containing the partial partial products of three different equations at a length given by user input. Then, the first 15 and last 15 terms of the list would be printed. Below are the outputs for the input N=1000:

First 15

Series 1	Series 2	Series 3
0.77777778	1.01005017e+000	1.00000000e+00
0.72222222	1.00630326e-003	5.00000000e-01
0.7	1.75608351e-008	1.66666667e-01
0.68888889	1.74307884e-014	4.16666667e-02
0.68253968	1.87642717e-021	8.33333333e-03
0.67857143	3.29516281e-029	1.38888889e-03
0.67592593	1.25111460e-037	1.98412698e-04
0.67407407	1.26223663e-046	2.48015873e-05
0.67272727	3.96097579e-056	2.75573192e-06
0.67171717	4.37755525e-066	2.75573192e-07
0.67094017	1.88398386e-076	2.50521084e-08
0.67032967	3.43067877e-087	2.08767570e-09
0.66984127	2.83403242e-098	1.60590438e-10
0.66944444	1.12700459e-109	1.14707456e-11
0.66911765	2.27068697e-121	7.64716373e-13

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Last 15

Series 1	Series 2	Series 3
0.66666735	0.	0.
0.66666735	0.	0.
0.66666735	0.	0.
0.66666735	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666734	0.	0.
0.66666733	0.	0.
0.66666733	0.	0.
0.66666733	0.	0.

3. Conclusion

Given the results above, Series 2 and Series 3 converge at 0.. Series 1, however, diverges. All series were tested with 1000 terms, and Series 1 was tested again with 3000 and 6000 terms. In order to determine where a partial product series converges, there needed to be a large enough input that did not overwork the program, so 1000 was an ideal choice.