MACM 316 - Computing Assignment 1

- **Read the *Guidelines for Assignments* first.**
- Submit a one-page PDF report to Crowdmark and upload your Matlab scripts (as m-files) to Canvas. *Do not use any other file formats*.
- Keep in mind that Canvas discussions are open forums.
- You must acknowledge any collaborations/assistance from colleagues, TAs, instructors etc.

Consider the function

$$F(h) = \frac{e^h - e^{-h}}{h}$$

where h is a positive value. It is not possible to evaluate this function when $h = 0$ due to a division by zero error. In order to understand the behaviour of this function as h approaches zero, we can calculate $F(h)$ for a series of smaller and smaller values of h and observe the resulting output values.

(a) Write a Matlab code that computes the function $F(h)$.
Then, create a plot of $F(h)$ for a range of h values .
By using different values of h, estimate the limit of $F(h)$ as h approaches zero.
Consider the possibility that h may be chosen too small and explain what can happen in this scenario.
Explain your reasoning. Remember to choose appropriate scales for the axes in your plot.

(b) **Showing your work, find the limit $L = \lim_{h \to 0} F(h)$ analytically.**
Then, create a plot of $|F(h) - L|$ for various h.
We are interested in the largest value of p for which $F(h) = L + O(h^p)$. Using your plot, find p.

Explain your reasoning. Remember to choose appropriate scales for the axes in your plot.

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Your report cannot exceed one page. It should include at least one figure with proper labels. Make sure to choose axis scales appropriate for the data. Discussions should be kept brief and answer all questions asked.

Submit your 1 page report for this question to Crowdmark in .pdf format according the Assignment Guidelines described in the syllabus. Your grade is based on your Crowdmark submission. We ask that you do ***not*** *include identifying information (name, ID number, etc) on your submission.*

Submit your Matlab code to Canvas "Computing Assignment 1 - Matlab Code".

After marking, we will post a few exemplary reports as sample solutions. We appreciate your support on this. If you do not wish to have your report posted, please state so at the top of your report.

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Grades will be based on 5 criteria:

Figures/Quality of presentation:

2 marks: Well-presented

1 mark: Missing labels, figure is small, inappropriate axis scaling

0 marks: Figure does not present much useful information

Writing / Clarity and conciseness:

2 marks: Writing is clear and concise

1 mark: Contains minor spelling or grammatical errors, too brief or too long, does not convey the main ideas

0 marks: Writing quality is poor and cannot be understood

Data:

2 marks: Data is correct and relevant to the report

1 mark: some data is missing, unimportant data is included

0 marks: No data, data is incorrect, data is irrelevant

Limiting value (part (a)):

2 marks: Complete analysis and discussion

1 mark: Correct and complete response for either small h or limiting value, but not both

0 marks: Analysis and discussion missing

Round-off error (part (b)):

2 marks: Complete analysis and discussion

1 mark: Value of p is given but discussion missing or poor

0 marks: Analysis and discussion missing