MATH10001 Mathematical Workshop

MATLAB Coursework

1. (4 marks) Write a script M-file to plot the equations below on the same axes for x between -1 and 1. Your code should generate a title and label the axes.

$$y = \cos^2(x)$$

$$y = e^x - 2\sin^2(2x)$$

2. (6 marks) Write a script M-file to implement the Newton-Raphson method with $x_0 = 1$ to find a solution of the equation below. Your solution should be correct to 5 decimal places and your code must not do more iterations than necessary to achieve this. Your code must output the result of each iteration until the required solution is reached.

$$\cos^2(x) = e^x - 2\sin^2(2x)$$

3. (a) (4 marks) Write a script M-file to implement the central difference method to find the gradient of $y = e^x - 2\sin^2(2x)$ at the point where $x = 1$. Write your code so that it produces estimates using $h = 0.1, h = 0.01$, $h = 0.001$ and $h = 0.0001$

   (b) (2 marks) Differentiate $y = e^x - 2\sin^2(2x)$ (by hand) and use your answer find to 7 decimal places the actual gradient when $x = 1$.

4. (6 marks) Write a script M-file to implement the mid-point rule to find the area bounded by the curve $y = e^x - 2\sin^2(2x)$, the x and y axes and the line $x = 0.3$. Use strips of width 0.02.

Project Report

This project is worth 25% of the marks for MATH10001. The project report should be word-processed using LaTeX and include the M-files and their outputs. There are 3 marks available for accurate LaTeX. To gain all the marks, **your M-files must contain comments to explain their structure** and the report must be clearly presented. To gain all the marks, **your code should be as efficient as possible.**

The project and report must be **all your own work**. Anyone suspected of sharing M-files or copying another student's work will be dealt with by the Academic Malpractice Panel.

You should submit your report through Blackboard by **4pm on Monday 16th November 2020**.

Presenting your answers

Upload a single pdf document via Blackboard and four M-files. The pdf should be generated using LaTeXand have the following form;

1. The name of the M-file for this question followed by the graph it outputs

2. Show how you derived your Newton-Raphson iteration formula for this question.
   The name of the M-file for this question followed by the output

3. a) The name of the M-file for this question followed by the output.
   b) Show how you did the differentiation by hand and what the gradient is correct to 7 d.p..

4. The name of the M-file for this question followed by the output