Assignment 3

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2019-02-20, 23:59 IST.

Problem 1: Numerical Differentiation – Forward and Central Differences

Consider function \( f(x) = x^2 \cos(x) \). The true value of first derivative is \( f'(x) = 2x\cos(x) - x^2\sin(x) \). Let us represent the true value as \( f'_{true} \). We will calculate numerical derivative and errors at \( x = 0.5 \).

For a given value of step-size, \( h \), compute the derivative using forward and central difference formula. Let \( f'_{ fwd} \) and \( f'_{ cent} \) represent the two numerical differences. Let us calculate the absolute difference between the two as: \( \Delta = |f'_{ cent} - f'_{ fwd}| \) . Also calculate the error in using the forward difference formula: \( \text{err} = |f'_{ true} - f'_{ fwd}| \).

1) With step-size \( h=0.001 \), please report the value of delta (i.e., absolute value of difference between central and forward differences).

No, the answer is incorrect.
Score: 0
Accepted Answers: 
(Type: Range) 2.85e-4,2.90e-4

1 point

2) With step-size \( h=0.001 \), please report the value of error, err, for forward difference formula.

No, the answer is incorrect.
Score: 0
Accepted Answers: 
(Type: Range) 2.85e-4,2.90e-4
Score: 0
Accepted Answers:
(Type: Range) 2.85e-6-6.290e-6

4) With step-size \( h = 0.00001 \), please report the value of error, \( err \), for forward difference formula.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 2.85e-6-6.290e-6

1 point

Problem 2: Faraday's Law (Physics / Electrical Engineering)

The Faraday's Law is given as:

\[ V = L \frac{di}{dt} \]

where, \( V \) is the voltage and \( i \) is the current. The following data is obtained:

<table>
<thead>
<tr>
<th>t(s)</th>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>i(A)</td>
<td>0</td>
<td>0.16</td>
<td>0.32</td>
<td>0.56</td>
<td>0.72</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Given that the inductance is \( L = 4 \) (V/s)/A, compute the voltage computed using central difference formula as required below.

5) Please report the voltage at 0.2 seconds.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 7.99,8.01

1 point

6) Please report the voltage at 0.4 seconds.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 5.59,5.61

1 point

Problem 3: Multiple Applications of Simpson's 1/3rd Rule

In this problem, you will compute \( \int_0^2 (5 + 3 \cos(x)) \, dx \) using multiple applications of Simpson's 1/3rd rule. For the step-size given below, report the integral computed.

7) Report the numerical integral obtained using Simpson's 1/3 rule with \( h = 1 \). This is single application of Simpson's 1/3 rule. Please report the answer correct to three digits after the decimal.

No, the answer is incorrect.
Score: 0
8) Report the numerical integral obtained using Simpson's 1/3 rule with \( h=0.1 \). Please report the answer correct to three digits after the decimal.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 12.7445, 12.7456

Problem 4: Numerical Integration using quad

Please use the function `hw3fun.m` uploaded on the course website for this problem.

In this problem, please use MATLAB function `quad` to compute the integral:

\[
I = \int_0^{1.2} x^a \tan(x) \, dx
\]

for different values of \( a \). A function `fval=hw3fun(x,a)` is uploaded on the course website. Please use this file and compute the integral using `quad` for the following cases.

9) Compute the integral using `quad` for \( a=2 \)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.81, 0.83

10) Compute the integral using `quad` for \( a=-0.5 \)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1.16, 1.19