

Catholic University Institute of Buea (CUIB)

2019/2020 ACADEMIC YEAR



First Semester Examinations - MARCH 2020

School	ENGINEERING				
Course Code	EMA 201	Course Title ENGINEERING MATHEMATICS III			
Status	C	Credit Value	6	Dept	Engineering
Date 05	5/03/2020	Venue	LH 2, LH 11	Time	8:00 - 11:00
Course Master(s)	可,物质的 计控制	Dr. Patrice Ndambomve			1/3-1/3

INSTRUCTIONS

- Answer ALL questions
- Penalty will be given for poor presentation of answers
- Electronic Calculators are allowed.

Question 1 (5 marks)

What do you understand by the following terms as used in numerical analysis?

i. Relative error

(1 mark)

ii. Approximation error

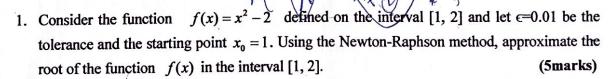
(1 mark)

((,2112;2)(21),

iii. $e = O(h^q), e = O(hlogh)$ for an error e depending on h.

(3 marks)

Ouestion 2 (15 marks)



2. Let
$$g(x) = x - \frac{1}{2}(x^2 - 2)$$

(i) Find the fixed points of g.

(2marks)

(ii) To which of the fixed points of g does the algorithm $x_{n+1} = x_n - \frac{1}{2}((x_n)^2 - 2)$ converge?

(4 marks)

(iii) Find the approximate value of the fixed point of g to which the algorithm converges using the starting point $x_0 = 1$. (4 marks)

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Question 3 (8 marks)

Given the four data points (-1, 1), (0, 1), (1, 2), (2, 0), determine the interpolating piece-wise linear function.

Question 4 (13 marks)

Let f be an arbitrary continuous function and a and b with a < b be two real numbers.

- 1. For the numerical integration of f from a to b, what is the formula for the:
 - Midpoint rule;
 - · Trapezoidal rule;
 - Simpson's rule.

(6 marks)

- 2. For $f(x) = xe^x$, a = 0, and b = 2, find the approximate values of $\int_0^2 xe^x dx$ for each of the rules above. (6 marks)
- 3. Which of the rules gives the best approximation?

(1 mark)

Question 5 (9 marks)

Consider the Initial Value Problem:

(IVP)
$$\begin{cases} y'(t) = 2ty(t) \\ y(0) = 1 \end{cases}$$

Where y'(t) is the derivative of y with respect to t.

1. Write out the formula for the Euler method for the above (IVP).

(1 mark)

- Use Euler method above to numerically solve (IVP) from t = 0 to t = 1.5 with a step size h = 0.5.(3 marks)
- 3. Calculate the error at each step, knowing that the exact solution obtained analytically is

$$y(t) = e^{t^2} ag{5 marks}$$

GOOD LUCK

