

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: MATH 314

COURSE TITLE: NUMERICAL ANALYSIS

STREAM: Y431

DAY: TUESDAY

TIME: 9.00 – 11.00 A.M.

DATE: 08/12/2009

INSTRUCTIONS:

Attempt question ONE and any other TWO questions

PLEASE TURN OVER

QUESTION ONE (30 MARKS)

(a) Evaluate

$$(\Delta + \nabla)^2 (x^2 + 2x - 1) \text{ given that } n = 1 \quad (5 \text{ marks})$$

(b) Use the Newton divided interpolation Formulae to find a polynomial that interpolates the points,

$$f(0) = 5 \quad f(2) = 13 \quad f(3) = 26 \quad (5 \text{ marks})$$

(c) Apply Simpsons $\frac{1}{3}$ rule to evaluate the approximate value of;

$$\int_0^1 \frac{dx}{1+x^2} \text{ using 4 intervals.} \quad (5 \text{ marks})$$

(d) Use Picard's method to find the power series solution for

$$y' = y - x^2 \quad y(0) = 1 \quad (5 \text{ marks})$$

(e) Locate and correct the error in the following data;

$$-5, -4, 1, 10, 28, 40, 61, 86, 115 \quad (5 \text{ marks})$$

(f) Find the Eigen values and vectors of, $A = \begin{bmatrix} 5 & -2 \\ -2 & 2 \end{bmatrix}$ (5 marks)

QUESTION TWO (20 MARKS)

(a) Show that;

$$(i) \Delta[f(x)g(x)] = f(x+n) \Delta g(x) + g(x) \Delta f(x)$$

$$(ii) \Delta \left[\frac{-f(x)}{g(x)} \right] = \frac{g(x) \Delta f(x) - f(x) \Delta g(x)}{g(x+n)g(x)}$$

Hence solve,

$$(iii) \Delta[x \cos x]$$

$$(iv) \Delta \left[\frac{\log x}{x^2} \right] \quad (10 \text{ marks})$$

(b) Prove the following;

(i) $1 - \nabla = E^{-1}$

(ii) $\nabla = \Delta E^{-1}$

Hence find;

$\left(\frac{\Delta^2}{E}\right) x^4$ and $E^{-1} \Delta[x^3 + x^2]$ **(10 marks)**

QUESTION THREE (20 MARKS)

(a) Derive the Newton Forward Interpolation Formulae and use it to find $f(5)$ given that

$f(0) = 1 \quad f(2) = 1 \quad f(4) = 65 \quad \text{and} \quad f(6) = 289$ **(10 marks)**

(b) Use Lagrange method to find a polynomial that interpolates, the points.

$[-4, 1245], [-1, 33] [0, 5] [2, 9]$ and $[5, 1335]$ **(10 marks)**

QUESTION FOUR (20 MARKS)

(a) Given the following Data;

x	3	5	11	27	34
$f(x)$	-13	23	899	17315	35606

Find $f^1(10)$ **(7 marks)**

(b) Derive the Simpsons $\frac{3^{th}}{8}$ rule hence use it to evaluate;

$\int_0^6 \frac{dx}{1+x^2}$ using 6 sub-intervals.

(c)

(d) **(13 marks)**

QUESTION FIVE (20 MARKS)

(a) Determine the value of y when $x = 0.1$ given that $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$, $n = 0.05$
using the modified Euler Formulae. **(10 marks)**

(b) Find all the Eigen values and vectors of the matrix defined by;

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

(10 marks)