

UNIVERSITY OF SWAZILAND

FINAL EXAMINATIONS

B.A.S.S. II

TITLE OF PAPER : MATHEMATICS FOR STATISTICIANS

COURSE NUMBER : ST 202

TIME ALLOWED : TWO (2) HOURS

INSTRUCTIONS : 1. THIS PAPER CONSISTS OF
FIVE QUESTIONS.
2. ANSWER ANY THREE QUESTIONS

SPECIAL REQUIREMENTS : NONE

THIS EXAMINATION PAPER SHOULD NOT BE OPENED UNTIL
PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

QUESTION 1

1. (a) Use any method to find the inverse of the following Matrix (if it exists)

$$A = \begin{pmatrix} 1 & -1 & -2 \\ 2 & -3 & -5 \\ -1 & 3 & 5 \end{pmatrix}$$

[8]

- (b) Given the function $f(x) = x^4 - 8x^2 + 3$, find

- (i) relative maximum and minimum [4]
(ii) intervals of increase and decrease [4]
(iii) inflection points [4]

QUESTION 2

2. Find the derivative, $\frac{dy}{dx}$ of the following functions

- (a) $y = x^{\frac{1}{2}}$ [5]
(b) $x^3 + 3x^2y^2 + y^3 = 2$ [5]
(c) $x \ln(x + y) + x = 2$ [5]
(d) $y = \sin^{-1} 2x^2$ (N.B: $\sin^{-1} = \arcsin$) [5]

QUESTION 3

3. (a) Find the slope of the curve $x^2 + xy + y^2 = 7$ at the point (1,2) [4]
- (b) If $f(x, y) = x^2y^2 + y \sin x + yxe^x$, find
- (i) f_x [3]
- (ii) f_y [3]
- (iii) f_{xx} [3]
- (c) Use Newton's iteration method to find the positive root of the equation $f(x) = x^4 - 2$ using $x_0 = 1$ and FOUR iterations. [7]

QUESTION 4

- (a) Evaluate the following integrals
- i. $\int x \ln(x + 1) dx$ [7]
- ii. $\int \frac{dx}{1 + 4x^2}$ [6]
- (b) Evaluate the following limits
- i. $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$ [4]
- ii. $\lim_{x \rightarrow \infty} \frac{x^2 + 3x - 6}{2x^2 - x + 9}$ [3]

QUESTION 5

4. (a) Use Gaussian elimination method to solve the system

$$x + 2y + z = 1$$

$$x - y - z = 0$$

$$2x + y + z = 3$$

[8]

(b) Find the eigenvalues and eigenvectors of the matrix

$$A = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 3 & -2 \\ 0 & -2 & 3 \end{pmatrix}$$

[12]

END OF EXAMINATION