

**UNIVERSITY OF SWAZILAND**

**FINAL EXAMINATIONS 2008/9**

**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) Given that  $f(x, y) = x \ln(x + y)$ , find  $f_x$ ,  $f_y$ ,  $f_{xx}$ ,  $f_{xy}$  and  $f_{yy}$ . [8]

(b) Find the derivatives  $\frac{dy}{dx}$  of the following functions

i.  $x^3 + y^3 + 3xy^2 = 3$  [4]

ii.  $y = \cos^{-1}(2x^2)$  [4]

iii.  $y = x^{\frac{1}{2}}$  [4]

QUESTION 2

2. (a) Use Newton's method with four (4) iterations and five decimal places to find the root of

$$f(x) = x^3 - x + 1$$

given that  $x_0 = -1$  [10]

(b) Find all the local maximum, minimum and saddle points of the following function

$$f(x, y) = 2x^3 - 6xy + 3y^2 + 6x - 18y$$

[10]

### QUESTION 3

3. (a) Use Gauss-Jordan reduction (elementary row operations) method to find the inverse of the following matrix

$$\begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 2 & 7 & 7 \end{pmatrix}$$

[10]

- (b) Find eigenvalues and eigenvectors for the matrix  $A = \begin{pmatrix} 2 & -1 \\ -4 & 2 \end{pmatrix}$  [10]

### QUESTION 4

4. (a) Evaluate the following integrals

i.  $\int \tan^{-1} x \, dx$  [5]

ii.  $\int \frac{x^2 - 3x + 2}{x(x+1)(x-3)} \, dx$  [5]

iii.  $\int_0^2 \int_{-1}^1 (1 - 6x^2y) \, dx \, dy$  [5]

- (b) Evaluate the following limits

i.  $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$  [3]

ii.  $\lim_{x \rightarrow \infty} \frac{x^2 + 3x - 6}{2x^2 - x + 9}$  [2]

QUESTION 5

5. (a) Use Gauss-Jordan method to solve the system

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

$$x - y - z = 0$$

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

[10]

- (b) Transform the following determinant to triangular form, and evaluate the determinant:

$$\begin{vmatrix} 1 & 3 & 5 & 2 \\ 0 & -1 & 3 & 4 \\ 2 & 1 & 9 & 6 \\ 3 & 2 & 4 & 8 \end{vmatrix}$$

[10]

END OF EXAMINATION