

UNIVERSITY OF SWAZILAND

FINAL EXAMINATIONS 2007

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

i.  $y = \sin^{-1}(2x^2)$  [6]

ii.  $x^3 + y^3 + 3xy^2 = 3$  [6]

(b) Given that  $f(x, y) = xye^{xy}$ , find  $f_{xy}$ . [8]

QUESTION 2

2. (a) Find the inverse of the following matrix

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

[10]

(b) Solve the following matrix system using Gaussian elimination with back substitution

$$2x + 4y + 6z = 2$$

$$4x + 5y + 6z = 1$$

$$3x + y - 2z = 1$$

[10]

QUESTION 3

3. (a)  $\int \frac{x}{1+x} dx$  [5]  
(b)  $\int \ln(x+1) dx$  [5]  
(c)  $\int \frac{x}{1+9x^4} dx$  [5]  
(d)  $\int_0^2 \int_{-1}^1 (1-6x^2y) dx dy$  [5]

QUESTION 4

4. (a) Use Newton's method with four (4) iterations and  $x_0 = 1$  to calculate the square root of 2. [7]  
(b) Find eigenvalues and eigenvectors for the matrix

$$A = \begin{pmatrix} 2 & -1 \\ -4 & 2 \end{pmatrix}$$

[7]

- (c) Reduce the following matrix to row echelon form

$$A = \begin{pmatrix} 1 & 1 & 4 & 4 \\ 0 & -1 & -2 & -3 \\ 1 & 3 & 7 & 9 \end{pmatrix}$$

[6]

QUESTION 5

5. (a) Given the function  $f(x) = x^3 - 3x + 2$ , find

(i) relative maximum and minimum [4]

(ii) intervals of increase and decrease [4]

(iii) inflection points [2]

(b) Solve the following system using Gauss-Jordan elimination method.

$$2x - y + 3z + 4w = 9$$

$$x - 2z + 7w = 11$$

$$3x - 3y + z + 5w = 8$$

$$2x + y + 4z + 4w = 10$$

[10]