UNIVERSITY OF SWAZILAND

DEPARTMENT OF STATISTICS AND DEMOGRAPHY

MAIN EXAMINATION PAPER, 2006

COURSE TITLE: Mathematics for Statisticians

COURSE CODE: ST 202

TIME ALLOWED: 2 HOURS

INSTRUCTIONS: This paper consists of five questions, answer any three questions

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Question 1

Find the derivative $\dfrac{dy}{dx}$ of the following functions:

(a) $f(x) = \dfrac{5}{2x^3}$ (5)

(b) $y = (3x - 2x^2)(5 + 4x)$ (5)

(c) $y = \dfrac{x-1}{2x+3}$ (5)

(d) $f(x) = e^{-3x^2}$ (5)

Question 2

Evaluate the following integrals:

(a) $\displaystyle\int e^{3x+1}dx$ (5)

(b) $\displaystyle\int (3x^3 - 4x)dx$ (5)

(c) $\displaystyle\int e^{-2x}dx$ (5)

(d) Given that $F(x, y) = 10x^2 y$, Find (5)

    (i) F_x
    (ii) F_y

Question 3

Evaluate the following:

(a) $\int_{1}^{2}\int_{o}^{x}(2xy+3)dydx$ (10)

(b) $\int_{y}^{5y}\sqrt{x-y}\,dx$ (10)

Question 4

Use Newton's method to find the positive root of the following equations:

(a) $f(x) = x^2 - 8$ using $x = 1$ as the initial guess (use up to 6 decimal places and three iterations)   (10)

(b) $f(x) = 2x^3 + x^2 - x + 1$ (10)

Question 5

(a) Solve the following system of equations using the method of determinants

$$5x + 2y = 8$$
$$23x + 7y = 28$$

          (5)

(b) Find the eigenvalues and eigenvectors of the matrix:

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

          (7)

(c) Find the adjoint of the matrix A below and use the adjoint to find the inverse of the matrix:

$$A = \begin{pmatrix} 4 & 3 & 2 \\ 6 & 5 & 10 \\ 10 & 1 & 6 \end{pmatrix}$$

          (8)

END OF EXAM.