

GWANDA STATE UNIVERSITY



FACULTY OF NATURAL RESOURCES MANAGEMENT AND AGRICULTURE

DEPARTMENT OF HORTICULTURE AND CROP PRODUCTION

PROGRAMME: BSc AGRICULTURAL ECONOMICS

LAE1205 MATHEMATICS FOR AGRICULTURAL ECONOMICS

FINAL EXAMINATION

JUNE 2024

This examination paper consists of 4 pages,

Time Allowed: Three (3) Hours
Total Marks: 100
Special Requirements: pen, calculator, ruler.
Examiner's Name: Mr. S. Werengani

Instructions

1. Answer **ALL** questions in Section A
2. Answer any **TWO (2)** questions in Section B

Mark allocation

Question	Marks
Section A	60
Section B	40
Total attainable marks	100

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SECTION A: Answer ALL questions.

Question 1 (20 Marks)

(a) Given $4x^3 - 2x^2 - x - 22 = 0$

(i) Prove whether $(x-2)$ is a factor of the polynomial. [2 marks]

(ii) Hence or otherwise find the solution of $4x^3 - 2x^2 - x - 22 = 0$. [3 marks]

(b) A known function $2x^3 - 4x^2 + 5x - 8$ is identical to $ax^3 - bx^2 + cx - d$.

State the values of a, b, c, and d. [4 marks]

(c) Find the first derivative of the following functions:

(i) $(2x+4)(3x-5)$. [2 mark]

(ii) $(x^6+3)(x^4+6)$. [3 marks]

(d) Find the partial derivative of the following functions:

(i) $y = 2a^3 - 5ab + 3b^3$. [3 marks]

(ii) $y = a^4 - ab + b^5$. [3 marks]

Question 2 (20 Marks)

(a) Find the partial derivative of the following functions:

(i) $y = 2a^3 - 3ab + b^3$. [3 marks]

(ii) $y = a^2 - ab + b^2$. [3 marks]

(b) Simplify the following:

(i) $\int x^2$ [2 marks]

(ii) $\int 8x^4$ [2 marks]

(iii) $\int 4x^2 + 3x^3 - 3x - 4$. [3 marks]

(iv) $\int 4e^{2x} + 3e^{3x} - 4$. [3 marks]

(c) The marginal revenue of a firm is $MR = 100 - 5Q + Q^2$ where Q represents

quantity produced. Find the total revenue and the average revenue of the firm. [4 marks]

Question 3 (20 Marks)

(a) Integrate

(i) $\int 4 + 3x^2$ [2 mark]

(ii) $\int 8x^2 + 3e^{3x}$ [2 mark]

(b) Given that the average revenue function is given by $AR = 10 - Q^2$ for quantity Q of goods produced. Derive:

(i) The total revenue function. [2 mark]

(ii) The marginal revenue function. [2 marks]

(b) Find the second derivative of the following:

(i) x^4 [2 marks]

(ii) $10x^5$ [2 marks]

(iii) $x^3 + 3x^2 - 3x - 4$ [2 marks]

(iv) $4x + 2$ [2 marks]

SECTION B: Answer any **two** questions.

Question 4 (20 Marks)

(a). The Cobb Douglas production function is given by $16K^{1/2}L^{1/2}$. Derive:

(i) The marginal product of labour (MP_L). [3 marks]

(ii) The marginal product of capital (MP_K). [3 marks]

(b) Solve the following matrices:

(i) $\begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 5 \\ 3 & 2 & 1 \end{bmatrix} + \begin{bmatrix} 2 & 3 & 1 \\ 0 & 2 & 3 \\ 2 & 1 & 4 \end{bmatrix}$ [3 marks]

(ii) $\begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 5 \\ 3 & 2 & 1 \end{bmatrix} - \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 5 \\ 3 & 2 & 1 \end{bmatrix}$ [3 marks]

(iii) $\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$ [3 marks]

(c) Solve the following differential equations

(i) $dy/dx = x^2y + y.$

(ii) $dy/dx + 2xy^2 = 0.$

Question 5 (20 Marks)

(a) Differentiate the following functions in respect of x:

(i) $y = 2x^3 - 5x.$ [3 marks]

(ii) $y = x^4 - x^2 + 4.$ [3 marks]

(b) Solve the following:

(i) $\int 100x^2 + e^x$ [3 marks]

(ii) $\int 3x^3 - 3x - 4$ [3 marks]

(iii) $\int_0^4 4x + x^4 + 2$ [4 marks]

(c) The matrix of a credit demand function is given by $A = \begin{bmatrix} 2 & 3 \\ 1 & 5 \end{bmatrix}$

Find the inverse of the matrix. [4marks]

Question 6 (20 Marks)

(a). The Cobb Douglas production function is given by $Q = K^{0.5} L^{0.5}.$

Derive $\frac{dQ}{dL}$ and $\frac{dQ}{dK}$ [4 marks]

(b) Consider two points, A and B, where $A = (1, 2, 3)$ and $B = (6, 5, 4)$

Calculate the position vector of AB [2 marks]

(c). Derive the polynomial function from the following factors: $(x+1)(x+2)(x+3).$ [4 marks]

(d). Differentiate:

(i) $12x$ [1 mark]

(ii) $2x^3 + 6x^2 + 6$ [2 marks]

(iii) $e^{3x} + 4x^3 + 9$ [2 marks]

(e) Integrate:

(i) $115x$ [2marks]

(ii) $x^3 - 5x^2 - 1$ [2 marks]

(iii) x [1 mark]