



EMBU UNIVERSITY COLLEGE
(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

FIRST SEMESTER EXAMINATIONS 2014/2015

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELORS OF SCIENCE IN
MANAGEMENT OF AGROECOSYSTEMS, AGRICULTURE, HORTICULTURE,
WATER RESOURCES MANAGEMENT, AGRIBUSINESS, AGRICULTURAL
EDUCATION AND EXTENSION, AND RANGE MANAGEMENT

ACS 103/AEB 107: MATHEMATICS

DATE: DECEMBER 15, 2014

TIME: 13:30 – 15:30

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE

- a) Let $U = \{1, 3, 5, 7, 9, 11, 15\}$ be a universal set, $A = \{1, 5, 9, 13\}$ and $B = \{3, 9, 15\}$. Determine the following:
- i) $A \cup B$ (1 mark)
 - ii) $A \cap B$ (1 mark)
 - iii) A^c (1 mark)
 - iv) $B - A$ (2 marks)
- b) Let $D = \{k \in \mathbb{Z} : 2 \leq |k| < 4\}$. Describe the set D by listing its elements (2 marks)
- c) Convert 0.6% into fraction in its simplest form (3 marks)
- d) Round off 84.009974 to four decimal places (1 mark)
- e) Solve the following equations for x :

- (i) $2 \log(3x) = 2 + \log(9x)$ (4 marks)
- (ii) $2x^2 + 11x + 12 = 0$ (3 marks)
- f) If $f(x) = 3x^2 - 2x + 7$, determine the value of $f(-3)$ (2 marks)
- g) Evaluate $\lim_{x \rightarrow 2} \frac{x^2 + 2x - 8}{x - 2}$ (3 marks)
- h) If $y = 3x^2 - 2xe^x$, find $\frac{dy}{dx}$ (2 marks)
- i) Evaluate $\int (3x^2 - 2xe^x) dx$ (5 marks)

QUESTION TWO

- a) Solve the following inequality and show the solution on the number line:

$$-2 \leq \frac{1}{2}x - 3 < 1, x \in \mathbb{N} \quad (5 \text{ marks})$$

- b) Let $A = \begin{bmatrix} 3 & 4 & -1 \\ 2 & 0 & 7 \\ 1 & -3 & -2 \end{bmatrix}$. Evaluate

i) the adjoint of A (11 marks)

ii) the inverse of A (4 marks)

QUESTION THREE

- a) Determine the derivatives with respect to x of the following functions:

i) $y = 2\sqrt{x} - \sqrt[3]{x} + \frac{1}{x^3}$ (3 marks)

ii) $y = 5^x$ (3 marks)

iii) $y = \cos(3x^2)$ (2 marks)

- b) Sketch and find the area of the region bounded by the curves:

$$y = x^2 - 2x \text{ and } y = 6x - x^2 \quad (12 \text{ marks})$$

QUESTION FOUR

a) If $a_n = 3 + n(n - 1)^2$, show that $a_{n+1} - a_n = 3n^2 - n$ (4 marks)

b) The sum of the first n terms of an arithmetic series is given by $S_n = 4n - n^2$

- i) Give the formula for the n^{th} term in terms of n (3 marks)
- ii) Find the value of the 18th term (1 mark)
- iii) If $S_n = -60$, find the value of n . (5 marks)
- c) Determine the derivative of $y = \ln(x^{2/3})$ and simplify the final answer (3 marks)
- d) Find the local maximum and local minimum of $f(x) = 2x^3 - 3x^2 - 12x + 1$ (4 marks)

QUESTION FIVE

a) Evaluate the following integrals:

i) $\int_1^8 \left(x^{2/3} - \frac{4}{x}\right) \sqrt[3]{x} dx$ (4 marks)

ii) $\int \frac{(\ln x)^3}{x} dx$ (4 marks)

iii) $\int x^2 \ln x dx$ (4 marks)

b) Find the equation of the normal line to the curve $y^3 = 4x^2 + 2y + 2x - 2$ at the point (1,2) (6 marks)

c) Evaluate $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x - 2}$ (2 marks)

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