

UNIVERSITY OF ELDORET

UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF

COURSE CODE: MAT 121

COURSE TITLE: MATHEMATICS FOR BIOSCIENCES.

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INSTRUCTION TO CANDIDATES

Answer **ALL** questions from section A and any **THREE** from section B.

Duration of the examination: 3 hours

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SECTION A (31 MARKS): ANSWER ALL QUESTIONS

QUESTION ONE

a) Define a function. *- done* (1 Mark)

b) Simplify the following and give your answer without negative exponents,
 $(2x^2)^{-3} y^4 \div (x^{-1}y)^2$ (2 marks)

c) Obtain the limits

(i) $\lim_{n \rightarrow \infty} \frac{3n^2 - 4000}{2n^2 - 10000}$ (2 marks)

(ii) $\lim_{x \rightarrow 4} \frac{\sqrt{x} - 2}{x - 4}$ (2 marks)

d) Solve the equation

(i) $\log_2 x = 5 - \log_2 (x + 4)$ (3 marks)

(ii) $e^x = 5678$ *$e^x = 5678$* (2 marks)

e) Perform the following integration

(i) $\int (2e^x + \cos x) dx$ (2 marks)

(ii) $\int x^2 e^{x^3} dx$ (3 marks)

QUESTION TWO

- a) Differentiate between sequence and series. (2 marks)
- b) Solve $3 \cos 2x - \sin x + 2 = 0$ for $0 \leq x \leq 360$. (4 marks)
- c) Consider the matrix $A = \begin{bmatrix} 3 & 1 \\ 1 & 5 \end{bmatrix}$, find A^{-1} . (2 marks)
- d) Differentiate $y = 2e^{2x} \cos 3x$ (4 marks)

SECTION B – attempt only three questions in this section

QUESTION THREE

- a) Convert $\log_9 27 = \frac{3}{2}$ into equivalent index form. (1 mark)
- b) Solve $\sin 3x + \sin x = 0$ (3 marks)
- c) Consider the systems of equations $\begin{cases} 3x + y = 2 \\ 5y + x = 1 \end{cases}$, express it on matrix form hence solve it using matrix method. (6 marks)
- d) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be the function given by $f(x) = \begin{cases} |x| & : -1 \leq x \leq 1, \\ -1 & : elsewhere \end{cases}$ Discuss whether f is continuous on $[-1, 1]$. (3 marks)

QUESTION FOUR

- a) Perform the integration $\int \sin(2x - 3) dx$ (3 marks)
- b) Evaluate $\int_0^1 (x+1)e^{(x^2+2x)} dx$ (4 marks)
- c) Differentiate
- (i) $y = (2x - x^2)^3 \sqrt{x^2}$ (3 marks)
- (ii) $y = \frac{\sin x}{1 + \cos x}$ (3 marks)

QUESTION FIVE

- a) Simplify the following
- i) $\frac{2}{x^2 + 2x + 1} - \frac{1}{x^2 - x - 2}$ (2 marks)
- ii) Simplify $\frac{\frac{2}{3} \log 8 + \frac{1}{2} \log 9}{\log 6 + \log 2}$ (3 marks)

b) Solve $x^2 + 2x - 15 > 0$

(3 marks)

c) Let $f(x) = \frac{x}{x+1}$ and $g(x) = \sqrt{x-1}$. Find

(i) $f(2)g(2)$

(2 marks)

(ii) $f \circ g(2)$

(3 marks)

QUESTION SIX

a) Find the domain and range of the function $h(x) = \sqrt{1+5x}$.

(3 marks)

b) Let $f(x) = \begin{cases} x^2 & \text{if } x < 1, \\ 1 & \text{if } 1 \leq x < 2, \\ 1/x & \text{if } x \geq 2 \end{cases}$

(i) Sketch the graph of f for $x \in [0, 5]$.

(3 marks)

(ii) Discuss the continuity of f .

(3 marks)

c) Let $U = \{1, 2, 3, \dots, 12\}$

$A = \{x \in U : x \text{ is a prime number}\}$

$B = \{x \in U : x \text{ is an even number}\}$

$C = \{x \in U : x \text{ is divisible by 3}\}$

Find the following sets

(i) $(A \cap B) \cup C$

(2 marks)

(ii) $(A \cup C) \cap (B \cup C)$

(2 marks)

QUESTION SEVEN

a) The third and fourth terms of a geometric progression are 12 and 6 respectively. Write down the first five terms.

(4 marks)

b) Solve $\frac{dy}{dx} + \frac{1}{2}y = \frac{3}{2}$ with $y(0) = 2$.

(6 marks)

c) Evaluate ${}^nC_2 = 1$

(3 marks)

~~7(6)FD~~

d(u)

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25678