

The
Management
University
of Africa



Sponsored by the Kenya Institute of Management

UNDERGRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DEGREE OF BACHELOR OF EDUCATION ARTS

MTH 121: CALCULUS 1-DIFFERENTIAL

DATE: 30TH MARCH 2026

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION ONE

- a) Evaluate $\lim_{x \rightarrow \infty} \frac{x^2 - 5x^5}{2x^5 - x^2 + 7}$ (5 marks)
- b) Differentiate $y = \frac{x^4 - 2x^3 + 3x^2 + 2x - 5}{x^3}$ (5 marks)
- c) Find the equation of the normal to the curve $y = x^3 + 2x + 1$ at point (1, 4) (6 marks)
- d) Use Chain rule to differentiate $y = (3x + 2)^4$ (4 marks)
- e) If $f(x) = 2x^3 + 3x^2 - 12x + 4$, determine the absolute minimum and maximum points on the interval $[-4, 2]$ (5 marks)

QUESTION TWO

- a) Evaluate $\lim_{x \rightarrow \infty} \frac{x^2 - 4x - 21}{3x^2 - 17x - 28}$, if it exists (7 marks)
- b) If $f(x) = \frac{x+1}{3}$ and $g(x) = 3x - 1$, verify that f and g are inverse functions (5 marks)
- c) Find the values of x for which $\lim_{x \rightarrow \infty} \frac{2x+5}{x^2-x-6}$ is discontinuous (3 marks)

QUESTION THREE

- a) Differentiate $y = x^3$ from the first principles (5 marks)
- b) Find the derivatives of the function $f: x \rightarrow \frac{(x^2 + 2x + 3)(x - 1)}{3}$ (4 marks)
- c) Find the coordinates of the points on the curve $f(x) = x^3 - 6x^2 + 4$ whose gradient is -12 (6 marks)

QUESTION FOUR

- a) Identify the stationary points on the curve $y = x^3 - 3x + 2$. Determine the nature of each stationary points **(10 marks)**
- b) A farmer has 240 metres of wire-mesh to fence a rectangular enclosure. Find the greatest area he can enclose with the wire-mesh. **(5 marks)**

QUESTION FIVE

- a) Use product Rule to differentiate $f(x) = (x^2 + 3)(x^3 + 5)$ **(3 marks)**
- b) Use quotient Rule to differentiate $f(x) = \frac{(x+3)^3}{(x-2)^5}$ by Quotient Rule **(5 marks)**
- c) Differentiate implicitly the function $y^2 + 5x^2y^3 + x^4 = 9$ **(7 marks)**

QUESTION SIX

Sketch the curve $y = (x+1)(x+3)^2$. **(15 marks)**