



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF CIVIL AND BUILDING ENGINEERING

DCC/09, DBC/09, HDB 10

END OF SEMESTER EXAMINATIONS

MAY 2010 SERIES

AH 2103 - CALCULUS I

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination:

Answer booklet
Pocket calculator

This paper consists of **FIVE** Questions.
Answer Question **ONE** and any other **TWO** Questions.
Maximum marks for each part of a question are as shown.

Question ONE (COMPULSORY)

(a). Find the derivative of $y = \frac{1}{x+2}$ at $x=1$ and $x=3$ from first principles.

(6 Marks)

(b). Find $\frac{dy}{dx}$, given;

(i). $y = x^2 \cos x + 2x \sin x + 2 \cos x$

(ii). $y = \ln(x+2)^3$

(iii). $y = \cos 3x + \frac{1}{3}x$

(12 Marks)

(c). A closed cylindrical container has a volume of 64cm^3 . Find the dimensions such that the surface area of the container is a minimum. **(12 Marks)**

Question TWO

(a). Find the equations of the tangent and normal to $y = x^2 - 3xy + y^2 = 5$ at $(1, 1)$.

(10 Marks)

(b). Water is running out of a conical funnel at the rate of $1\text{cm}^3\text{sec}^{-1}$. The radius of the top of the funnel is 4cm and the sides slope at 60° to the horizontal. Find the rate at which height of the water surface is falling when it is 2cm from the top.

(10 Marks)

Question THREE

Find $\frac{dy}{dx}$, given;

(i). $y = \arctan \frac{1+x}{1-x}$

(7 Marks)

(ii). $y = \ln(x^2 + 3)(x^3 + 1)$

(6 Marks)

(iii). $y = e^{-2x} \sin 2x$

(7 Marks)

Question FOUR

- (a). Find the curvature of the parabola $y^2 = 4x$ at the point $(1, -2)$.
(8 Marks)
- (b). A curve is expressed parametrically as $x = e^{-t} \cos 2t$, $y = e^{-2t} \sin 2t$. Determine slope of the curve at the point $t=0$.
(12 Marks)

Question FIVE

Determine the turning points for the curve $y = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 6x + 8$. Hence sketch the curve in the range $-4 \leq x \leq 3$.
(20 Marks)