



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**BRIDGING TO HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING
(BHD 011)
CERTIFICATE IN ARCHITECTURE (CA 10B)**

AMA 1208/2408 : CALCULUS I

END OF SEMESTER EXAMINATION

SERIES: AUGUST/SEPTEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*

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

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1

a) Find the derivative of the following function from first principle

$$f(x) = \frac{1}{x^3 + 7}$$

(6 marks)

$$\frac{dy}{dx}$$

b) Find for the following:

$$y = \log_{10} \left(\frac{4x^3 - 1}{\sin x} \right)$$

(i)

$$y = \sqrt[3]{4x^3 - \frac{5}{x^3} + 1}$$

(ii)

$$y = \frac{e^{4x} \tan x}{(x^2 + 10) \sinh x}$$

(iii)

(apply logarithmic method)

(15 marks)

$$x^2 + 8xy + y^2 = 10$$

c) Given a function of the form find at the following at point (-2,6)

(i) Equation of the tangent

(ii) Equation of the normal

(9 marks)

SECTION B (Answer any TWO questions from this section)

Question 2

a) Find first derivatives for the following

$$y = \sec^{\frac{2}{3}} 4x$$

(i)

$$y = \text{arc tan} \left(\frac{4-x}{e^{2x}} \right)$$

(ii)

$$y = \text{arc cosh} \left(\frac{5}{x^2} \right)$$

(iii)

(13 marks)

$$s = e^{-t} \ln t$$

b) Given a function of the form

Find: (i) $\frac{ds}{dt}$

(ii) $\frac{d^2s}{dt^2}$

(7 marks)

Question 3

a) A vehicle starts from rest and covers distance s meters in t seconds. The relationship between s

$$s = 3t^2 - 2t$$

and t is of the form:

find:

(i) Distance covered when the vehicle comes to rest

(ii) Acceleration after 5 seconds

(6 marks)

b) Find the angles of intersection between the two functions given as $x^2 + y^2 = 32$ and $y^2 = 4x$

(14 marks)

Question 4

a) Find the equations of the tangent and the normal to the curve at the point where $t = 0$ defined

$$x = 5e^{-t} \quad y = 3e^t$$

parametrically as:

(10 marks)

b) Find the radius of curvature at the point where $\theta = \frac{\pi}{4}$ for the function defined as:

$$x = \theta - \sin \theta \quad y = 1 - \cos \theta$$

and

(10 marks)

Question 5

a) A function is defined by the relationship:

$$y = x^2 + \frac{128}{x}$$

Find:

i) Critical points

ii) Nature of the critical points

(10 marks)

- b) Water flows at a rate of $1\text{cm}^3\text{s}^{-1}$ through the opening at the bottom of a conical funnel whose axis is perpendicular and sides slope at 30° to the vertical. Find the rate at which the water level falls when the depth of the water is 10cm (10 marks)