THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**DIPLOMA IN BUILDING & CIVIL ENGINEERING
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE**

AMA 2108: CALCULUS I

SPECIAL/SUPPLEMENTARY EXAMINATON

SERIES: OCTOBER 2011

TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer booklet*
- *Pocket/Scientific Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** 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) Working from first principles, find the derivative of $y = \dfrac{1}{x-8}$ at $x = 2$ and $x = 4$ (6 marks)

b) Find $\dfrac{dy}{dx}$ given

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

(ii) $y = 1_n(x+3)^2$

(iii) $y = \frac{1}{4}\sinh 2x - \frac{1}{2}x$ (12 marks)

c) A cylindrical container has a volume of 64cm³. Find the dimensions so that the amount (surface area) of the container is a minimum where:
The container is an open cup (9 marks)

d) Find $\dfrac{dy}{dx}$ given $x = \theta,\ y = 1 - \cos\theta.$ (3 marks)

SECTION B (Answer *any TWO questions from this section*)

Question 2

a) A curve is expressed parametrically as $c = \sqrt{t},\ y = t - \dfrac{1}{\sqrt{t}}$. Find the equation of the tangent to the curve at the point where t = 4. (10 marks)

b) Find the curvature of a parbola $y^2 = 11x$ at the point (3, 6).

Question 3

Determine the turning points for the curve $y = 2x^3 - 9x^2 + 12x$. Hence sketch the graph of the curve. (20 marks)

Question 4

a) A car starts from rest and moves a distance, S meters in t seconds where $s = \dfrac{1}{8}t^3 + \dfrac{1}{2t^2}.$

Find:

    (i)   The initial acceleration

    (ii)   The acceleration after two seconds.   (6 marks)

b) Find $\dfrac{dy^2}{dx^2}$ for the following

(i) $y = e^x \sin 3x$ (14 marks)

(ii) $y = arc \, \sin(1+x)$

Question 5

a) Find $\dfrac{dy}{dx}$ given $y = \tan^{-1} e^x$ (5 marks)

b) Find the equation for the normal to $y - x^3 - 4x^2 + 10$ at (2, 2)   (7 marks)

c) Water is running out of a conical funnel at a rate of $1\text{cm}^3/\text{sec}$. The radius of the top of the funnel is 4cm and height of the funnel is 10cm. Determine the rate at which the radius of the water surface is decreasing when it is 3cm from the top of funnel.   (8 marks)