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). Working from first principles, find the derivative of $y = \frac{1}{x-2}$ at $x = 1$ and $x = 4$. **(6 Marks)**

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

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

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

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

(c). A cylindrical container has a volume of 64cm^3. 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 $\frac{dy}{dx}$ given $x = \theta - \sin\theta,\ y = 1 - \cos\theta.$ **(3 Marks)**

Question TWO

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

(10 Marks)

(b). Find the curvature of a parabola $y^2 = 12x$ at the point (3, 6).

Question THREE

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

Question FOUR

(a). A car starts from rest and moves a distance, S meters in t seconds where $s = \frac{1}{6}t^3 + \frac{1}{4}t^2$. Find:

(i). The initial acceleration.
(ii). The acceleration after two seconds.

(4 Marks)

(b). Find the first derivatives for:

(i). $y = arc\ \cot\dfrac{1+x}{1-x}$

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

(iii). $y = e^{-2x}\sin 3x$

(16 Marks)

Question FIVE

(a). Find the equations of the tangent and normal to $y = x^3 - 2x^2 + 4$ at (2, 4).

(8 Marks)

(b). Water is running out of a conical funnel at the rate of $1cm^3/sec$. If the radius of the top of the funnel is 4cm and the height is 8cm, find the rate at which the radius of the water surface is decreasing when it is 2cm from the top. **(10 Marks)**

(c). Find $\dfrac{dy}{dx}$ given $y = \cosh^{-1} e^x$. **(2 Marks)**