KIBABII UNIVERSITY COLLEGE

FIRST YEAR FIRST SEMESTER 2014 EXAMINATION FOR THE

DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS

COURSE CODE: **MAT 121**; TIME: 3 HOURS

COURSE TITLE: **CALCULUS I**

Attempt Question ONE and ANY Other TWO questions

QUESTION 1 (30MARKS)

(a) Obtain the derivatives of the function $f(x) = x^4 + 12x$

using delta method. **[6mks]**

(b) Find points where the curve $y = x^4 - 2x^2 + 2$ has a horizontal gradient.

[2mks]

(c) Given that $y = \frac{2x+3}{1-5x}$, find $\frac{dy}{dx}$. **[6mks]**

(d) Find $\frac{dy}{dx}$ given that $y^3 + 6x = x^2$. **[2mks]**

(e) Find $\frac{dy}{dx}$ if $y = ln(2x^2 + 3x)$. **[2mks]**

(f) Given that $y = \frac{1}{x}(x^2 + \frac{1}{x})$ find $\frac{dy}{dx}$. **[4mks]**

(g) Find y'' given that $y = 3x^3 - 4x + 4$. **[2mks]**

(h) Find the value of c satisfied by the conclusion of Rolle's Theorem for,

$f(x) = x^3 - 3x^2 + 2x + 2$ on the interval $[0, 1]$. **[6mks]**

QUESTION 2 (20MARKS)

(a) Differentiate the following w.r.t x

(i) $y = \frac{(3x+1)^4}{(5x-2)^3}$ **[4mks]**

(ii) $y = x(x+3)^4$ **[4mks]**

(iii) $y = \frac{1}{\sqrt{(x^2-2)}}$ **[4mks]**

(b) Water runs into a conical tank at the rate of $9\,ft^3/min$. The tank stands

point down and has a height of $10\,ft$ and a base radius of $5\,ft$. How fast is the

water level rising when the water is $6\,ft$ deep? **[8mks]**

QUESTION 3 (20MARKS)

(a) Investigate the stationary values of the function,

$y = x^3 - 2x^2 - 4x$. **[10mks]**

(b) Given that $x = \frac{1}{t}$; $y = 3t^2 + 2$ find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of t. **[10mks]**

QUESTION 4 (20MARKS)

(a) Sketch the curve given by $y = \frac{(x+3)}{(x-1)}$. **[10mks]**

(b) Find $\frac{dy}{dx}$ using first principles given that $y = cosx$. **[10mks]**

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QUESTION 5 (20MARKS)

(a) Calculate how rapidly the fluid level inside a vertical cylindrical tank drops if we pump the fluid out at the rate of 3000/L min. **[10mks]**

(b) Find $\frac{dy}{dx}$ if $y = cot^4(3x^2+2x-1)$. **[10mks]**