(Knowledge for Development)

KIBABII UNIVERSITY

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UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COMPUTER SCIENCE

COURSE CODE: **MAT 110**

COURSE TITLE: **BASIC CALCULUS**

DATE: 27/01/2022 **TIME:** 2:00 PM - 4:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE COMPULSORY (30 MARKS)

(a) Define the following terms

(i) A function (2 mks)

(ii) An even function (2 mks)

(iii) An odd function (2 mks)

(b) If $h(x) = \frac{\sqrt{x}}{sinx}$ and $g(x) = 3x^2 + x^3 - 2$ find

(i) goh (2 mks)

(ii) hog (2 mks)

(c) Find the domain and the range of the function $f(x) = \sqrt{3 - x}$ (2 mks)

(d) Evaluate the following limits;

(i) $\lim_{x \to 3} \frac{\frac{1}{3} - \frac{1}{x}}{x^3 - 27}$ (4 mks)

(ii) $\lim_{x \to \infty} \frac{4x^3 - 2x - 1}{\sqrt{x^6 + \frac{4}{x}}}$ (3 mks)

(e) Given the function $y = \ln(2x^3 + x^2 - x)$, determine y^{II} (4 mks)

(f) Prove that $\lim_{\theta \to 0} \frac{sin\theta}{\theta} = 1$ (7 mks)

QUESTION TWO (20 MARKS

(a) Find the equation of the tangent and normal to the curve $x^2y + 2xy - 3x = 8$ At $(1, -1)$ (7 mks)

(b) Determine if the following function is continuous at $x = 3$

$$f(x) = \begin{cases} x^2 + 1 & x < 3 \\ 10 & x = 3 \\ \frac{5x+9}{2} - 2 & x > 3 \end{cases}$$ (5 mks)

(c) A particle moves in the OX so that it is S metres from O t seconds after passing O is given by $S = 6t^2 - t^3$ find;

(i) The distance when the particle is momentarily at rest (5 mks)

(ii) The greatest velocity in the direction of OX (3 mks)

QUESTION THREE (20 MARKS)

(a) Given $y = -3cosecx^4$ find $\frac{dy}{dx}$ (4 mks)

(b) Prove that $\lim_{x \to 2}(2x - 6) = -2$ (5 mks)

(c) Find $\frac{d^2y}{dx^2}$ given that $x(t) = t^2 + \frac{1}{2}t^3 - 3t + 6,\ y(t) = 3t^3 + 2$ (5 mks)

(d) A rectangular land is to be enclosed with 180M of barbed wire of which one of the shortest side is a wall. Find the maximize area enclosed. (6 mks)

QUESTION FOUR (20 MARKS)

(a) Determine whether each of the following functions is even, odd or neither

(i) $g(x) = 2 + x^2$ (2 mks)

(ii) $f(x) = x - x^2$ (2 mks)

(iii) $h(x) = 3x + 5x^3$ (2 mks)

(b) Given the equation of the curve $y = x^4 + x^3 - \frac{x^2}{2}$

(i) Find all the turning points (5 mks)

(ii) The nature of the turning points (5 mks)

(iii) Sketch the graph (4 mks)

QUESTION FIVE (20 MARKS)

(a) State the Rolle's theorem (2 mks)

(b) Find from the 1st principles the differential coefficient of y with respect to x given that $y = 2x^3 - 3x^2 + 4$ (4 mks)

(c) Find the derivative of Differentiate $y = \frac{(x^2-3)^3 sin2x}{ln4x}$ (4 mks)

(d) Evaluate the following

(i) $\int \frac{3}{(2-5x)^2} dx$ (5 mks)

(ii) $\int 2x^3 cos2x dx$ (5 mks)