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QUALIFICATION: BACHELOR OF SCIENCE IN APPLIED MATHEMATICS AND STATISTICS & BACHELOR OF SCIENCE			
QUALIFICATION CODE:	07BSAM, & 07BSOC	LEVEL:	5
COURSE:	CALCULUS 1	COURSE CODE:	CLS502S
DATE:	NOVEMBER 2024	SESSION:	1
DURATION:	3 HOURS	MARKS:	100

FIRST OPPORTUNITY EXAMINATION: QUESTION PAPER

EXAMINER: *Dr. David liyambo*

MODERATOR: *Dr. Nega Chere*

INSTRUCTIONS:

1. Attempt all the questions in the booklet provided.
2. Please write neatly and legibly using a black or blue inked pen, and sketches must be done in pencil.
3. Do not use the left side margin of the answer script. This must be allowed for the examiner.
4. No books, notes or other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.
6. Show clearly all the steps used in the calculations.

PERMISSIBLE MATERIALS:

1. Non-programmable calculator without a cover.

ATTACHMENTS:

None

This paper consists of 2 pages including this front page

Question 1.

Consider the functions $f(x) = 4x^2 + 9$, $g(x) = \sqrt{1 - x^2}$ and $h(x) = 4x^2 - 3$; $x \geq 0$.

- a) Find the sum of the smallest and the largest numbers in the domain of $\frac{g}{f}$. [9]
- b) Determine whether g is even, odd or neither. [4]
- c) Determine whether h^{-1} exists. If it does, find it. [10]

Question 2.

- a) Find the following limits, if they exist.

(i) $\lim_{x \rightarrow -3} \frac{4x + 12}{x^3 + 3x^2 - 4x - 12}$. [5]

(ii) $\lim_{x \rightarrow 0^+} (e^x + x)^{\frac{1}{x}}$ [8]

- b) Use the $\varepsilon - \delta$ method to show that $\lim_{x \rightarrow 2} (10x - 6) = 14$. [7]

Question 3.

- a) Use the definition (first principle) to find the derivative of $f(x) = \frac{1}{\pi^2} - \frac{x-1}{x+\sqrt{2}}$. [10]

- b) Differentiate the function $f(x) = (\ln 3)^{\sec x} + \tan^{-1}(\ln 4x)$. [6]

- c) If the equation $x^2y + \sin y = 2\pi$ determines a differentiable function f such that $y = f(x)$, find the equation of the tangent line to the graph of the given equation at the point $P(1, 2\pi)$. [8]

Question 4.

Let $f(x) = |2x - 10| + 2$.

- a) Show that f is continuous at $x = 5$. [7]
- b) Show that f is not differentiable at $x = 5$. [8]

Question 5.

Let $f(x) = \frac{x^4}{4} - 2x^2 + 4$ and $g(x) = 2x^4 - 8x^3 + 316x - 172$.

- a) Find the intervals on which f is increasing and on which it is decreasing. [9]
- b) Find the intervals on which the graph of $y = g(x)$ is concave upwards and on which it is concave downwards. [9]

END OF EXAMINATION QUESTION PAPER