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

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION: QUESTION PAPER

EXAMINER:	***Dr. David Iiyambo and Mrs. Yvonne Nkalle***
MODERATOR:	***Dr. Nega Chere***

INSTRUCTIONS (add other relevant 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 3 pages including this front page

Question 1.

The functions f, g and h are defined by, $f(x) = \dfrac{2x+1}{\sqrt{x^2+5x+4}}$, $g(x) = x^2+3$, $h(x) = 2x+a$ and $k(x) = 4x^2-3;\ x \geq 0$.

1.1 Find the domain of f. [6]

1.2 Given that $(g \circ h)(x) = 4x^2 - 8x + 7$, where $x \neq 0$, calculate the value of a [4]

1.3 Determine whether k^{-1} exists. If it does, find it. [9]

Question 2.

Find the following limits, if they exist.

2.1 $\lim\limits_{h \to 0} \dfrac{\sqrt{4+h}-2}{h}$. [6]

2.2 $\lim\limits_{x \to 2^-} \dfrac{x^2-4}{|x-2|}$ [6]

2.3 $\lim\limits_{x \to 3} \dfrac{1}{(3-x)^2}$. [4]

2.4 $\lim\limits_{x \to \infty} x^2 \sin\left(\dfrac{1}{4x^2}\right)$. [8]

Question 3.

3.1 Use the definition (first principle) to find the derivative of $f(x) = \sqrt{x+1}$. [8]

3.2 Find the equation of the tangent line to the graph of f at the point where $x = 3$. [4]

3.3 Find $g'(x)$ for each of the following functions.

a) $g(x) = \cos^2(\cos x)$ [5]

b) $g(x) = 3^x e^x$ [4]

c) $g(x) = \sin\left(\tan^{-1}(\ln x)\right)$ [5]

3.4 If the equation $x^2y + xy^2 = 6$ determines a differentiable function f such that $y = f(x)$, find the equation of the normal line to the graph of this equation at the point $P(2, 1)$. [7]

Question 4.

Consider the function $f(x) = \begin{cases} x - m & \text{if } x < 3; \\ 1 - mx & \text{if } x \geq 3. \end{cases}$

Find the value of m for which f is a continuous function at $x = 3$. [9]

Question 5.

Let $f(x) = x^{\frac{1}{3}}(2x+7)$ and $g(x) = 2x - 3x^{\frac{2}{3}}$.

5.1 Find the intervals on which f is increasing and on which it is decreasing, and hence state the local extreme values of f. If you answer is not a whole number, round it correct to 2 decimal places.

[9]

5.2 Find the intervals on which the graph of $y = g(x)$ is concave upwards and on which it is concave downwards. [6]
