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OF SCIENCE AND TECHNOLOGY**

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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:	JANUARY 2025	SESSION:	2
DURATION:	3 HOURS	MARKS:	100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION: QUESTION PAPER

EXAMINER: *Dr. David Iiyambo*

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 3 pages including this front page

Question 1.

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

a) Find the domain of f . [6]

b) Given that $(g \circ h)(x) = 4x^2 - 8x + 7$, where $x \neq 0$, calculate the value of a . [5]

Question 2.

2.1 Find the following limits, if they exist.

a) $\lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h}$. [7]

b) $\lim_{x \rightarrow 2^-} \frac{x^2 - 4}{|x - 2|}$ [6]

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

d) $\lim_{x \rightarrow 3} \frac{1}{(3-x)^2}$. [4]

2.2 Using the Precise definition (the $\varepsilon - \delta$ method), prove that $\lim_{x \rightarrow -3} (14 - 5x) = 29$. [9]

Question 3.

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

b) Find the equation of the tangent line to the graph of f at the point where $x = 3$. [5]

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

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

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

Question 4.

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

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

b) With the value of m you found in a), is f differentiable at $x = 3$ or not? Justify your answer. [5]

Question 5.

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

- a) Find the intervals on which f is increasing and on which it is decreasing, and hence state the local extreme values of f . If your answer is not a whole number, round it correct to 2 decimal places.
[10]
- b) Find the intervals on which the graph of $y = g(x)$ is concave upwards and on which it is concave downwards.
[7]

END OF EXAMINATION QUESTION PAPER
