NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Health, Natural Resources and Applied Sciences

School of Natural and Applied Sciences

Department of Mathematics, Statistics and Actuarial Science

13 Jackson Kaujeua Street
Private Bag 13388
Windhoek
NAMIBIA

T: +264 61 207 2913
E: msas@nust.na
W: www.nust.na

QUALIFICATION : **BACHELOR of SCIENCE**	
QUALIFICATION CODE: **07BSOC**	LEVEL: **5**
COURSE: **CALCULUS 1 FOR NATURAL SCIENCE**	COURSE CODE: **CNS512S**
DATE: **NOVEMBER 2024**	SESSION: **1**
DURATION: **3 HOURS**	MARKS: **100**

FIRST OPPORTUNITY: EXAMINATION QUESTION PAPER

EXAMINER: ***Mrs. Hilma Yvonne Nkalle***

MODERATOR: ***Dr. Nega Chere***

INSTRUCTIONS:

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS:

1. Non-Programmable Calculator

This paper consists of 3 pages including this front page

Question 1 [2 Marks]

Find the domain and the range of the given relation.

$R = \{(1,4), (2,8), (3,12), (4,16), (5,20\}$.

Question 2 [2 Marks]

Given $f(x) = 2x^2 - x + 3$, find $f(-1)$.

Question 3 [6 Marks]

Given $f(x) = \sqrt{x+4}$ and $g(x) = 2x^2 - 3$, find $f(g(x)) = 17$.

Question 4 [5;4 Marks]

Find the following limits

(a) $\lim_{x\to 0} \frac{\tan x}{x}$.

(b) $\lim_{x\to 0} \frac{e^x - 1}{x}$.

Question 5 [6 Marks]

Given $f(x) = \begin{cases} kx^2 & if\ x \leq 2 \\ 3 & if\ x > 2 \end{cases}$. Find the value of "k" so that the function f is continuous.

Question 6 [5 Marks]

If $y = 5\cos x - 3\sin x$, prove that $\frac{d^2y}{dx^2} + y = 0$.

Question 7 [7 Marks]

Given $x = 2at^2$; $y = at^4$. Find $\frac{dy}{dx}$

Question 8 [5 Marks]

Find the derivative of $\log(\log x)$, $x > 0$.

Question 9 [8 Marks]

Let $x^2 + xy + y^2 = 100$. Find $\frac{dy}{dx}$ by using implicit differentiation.

Question 10 [5 Marks]

Let g be the function defined by $g(x) = x^3 + x$, if $f(x) = g^{-1}(x)$ and $f(2) = 1$, what is the value of $f(2)$?

Question 11 [10 Marks]

Find the stationary points of the function $f(x) = x^3 - 6x^2 + 9x - 2$.

Question 12 [9;5 Marks]

Let $f(x) = x(x+1)^3$. Use detailed sign table in answering the following questions.

(a) Find the intervals in which f is increasing or decreasing.
(b) Find the intervals in which the graph of $y = f(x)$ is concave upward or downward.

Question 13 [11 Marks]

Prove that the function $f: \mathbb{R}\backslash\{2\} \rightarrow \mathbb{R}\backslash\{5\}$ defined by $f(x) = (5x+1)/(x-2)$ is bijective.

Question 14 [4 Marks]

Given the function below, determine whether it is odd, even or neither. Show your working.

$f(x) = 4x^3 - 9$

Question 15 [6 Marks]

Given $z = f(x,y) = x^2y + 2y^4e^x$, find $\partial f/\partial x$; $\partial f/\partial y$; $(\partial \hat{}\, 2\ f)/(\partial x \hat{}\, 2\ )$