



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES  
DEPARTMENT OF MATHEMATICS AND STATISTICS**

<b>QUALIFICATION:</b> Bachelor of Science; Bachelor of Science in Applied Mathematics and Statistics	
<b>QUALIFICATION CODE:</b> 07BOSC; 07BSAM	<b>LEVEL:</b> 5
<b>COURSE CODE:</b> CLS502S	<b>COURSE CODE:</b> CALCULUS 1
<b>SESSION:</b> JANUARY 2023	<b>PAPER:</b> THEORY
<b>DURATION:</b> 3 HOURS	<b>MARKS:</b> 100

<b>SUPPLEMENTARY / SECOND OPPORTUNITY EXAMINATION QUESTION PAPER</b>	
<b>EXAMINER:</b>	DR. DSI IYAMBO
<b>MODERATOR:</b>	DR. N CHERE

**INSTRUCTIONS**

1. Attempt all the questions in the booklet provided.
2. Show clearly all the steps used in the calculations.
3. All written work must be done in black or blue ink, and sketches must be done in pencil.

**PERMISSIBLE MATERIALS**

1. Non-programmable calculator without a cover.

**THIS QUESTION 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**

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