



**PAMIBIA 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>	NOVEMBER 2022	<b>PAPER:</b>	THEORY
<b>DURATION:</b>	3 HOURS	<b>MARKS:</b>	100

<b>FIRST OPPORTUNITY EXAMINATION QUESTION PAPER</b>	
<b>EXAMINER:</b>	DR. DSI IIYAMBO
<b>MODERATOR:</b>	DR. N CHERE

<b>INSTRUCTIONS</b>
<ol style="list-style-type: none"><li>1. Attempt all the questions in the booklet provided.</li><li>2. Show clearly all the steps used in the calculations.</li><li>3. All written work must be done in black or blue ink, and sketches must be done in pencil.</li></ol>

**PERMISSIBLE MATERIALS**

1. Non-programmable calculator without a cover.

**THIS QUESTION 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**

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