



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science ; Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BSOC; 07BAMS	LEVEL: 5
COURSE CODE: CLS502S	COURSE NAME: CALCULUS 1
SESSION: NOVEMBER 2019	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER

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INSTRUCTIONS

1. Answer 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 blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

SECTION A [Short answer questions] [$2\frac{1}{2}$ marks for each question]

QUESTION 1 [25 marks]

1. 1. Suppose that $\lim_{x \rightarrow 5} f(x) = 2$, $\lim_{x \rightarrow 5} g(x) = 6$. Then

1.1.1. $\lim_{x \rightarrow 5} (2f(x) - g(x)) = \text{-----}$

1.1.2. $\lim_{x \rightarrow 5} \sqrt{(f(x))^4} = \text{-----}$

1.1.3. $\lim_{x \rightarrow 5} \left(\frac{g(x)}{3f(x)} \right) = \text{-----}$

1.1.4. $\lim_{x \rightarrow 5} (x^2 - 5(f(x))^2) = \text{-----}$

1.2. Determine the following derivatives.

1.2.1. $\frac{d}{dx} (\ln(\sin x)) = \text{-----}$

1.2.2. $\frac{d}{dx} (e^{\sqrt{x}}) = \text{-----}$

1.2.3. If $y = \sin(\sin x)$, then $\left. \frac{dy}{dx} \right|_{x=\frac{\pi}{2}} = \text{-----}$

1.3. Suppose that f and g are continuous functions such that $f(3) = 4$ and

$\lim_{x \rightarrow 3} (f(x) - 3g(x)) = 16$. Then the value of $g(3) = \text{-----}$

1.4. The domain of the function $f(x) = \sqrt{x^2 + x} = \text{-----}$

1.5. Suppose a function f has the property that for all real numbers x , $3 - |x| \leq f(x) \leq 3 + |x|$.

Then $\lim_{x \rightarrow 0} f(x) = \text{-----}$

SECTION B [Workout Problems]

QUESTION 2 [75]

2.1. Let $f(x) = -\sqrt{1 - 3x}$. Then

2.1.1. find a formula for $f^{-1}(x)$. [5]

2.1.2. state the domain of f^{-1} . [3]

2.2. Evaluate the following limits if it exists.

2.2.1. $\lim_{x \rightarrow -1^-} \left(\frac{1}{x+1} - \frac{1}{|x+1|} \right)$ [4]

2.2.2. $\lim_{x \rightarrow 0} \frac{2x + \tan 10x}{x}$ [6]

2.2.3. $\lim_{x \rightarrow 1} \frac{x-1}{\sqrt{x+3}-2}$ [5]

2.2.4. $\lim_{x \rightarrow -3} \frac{x^3+27}{x^2+3x}$ [5]

2.3. Let $f(x) = \frac{1}{x+2}$. Find $f'(x)$ by using the limit definition of derivative. [5]

2.4. Use the precise definition of limit to prove that $\lim_{x \rightarrow 2} (4 - 6x) = -8$. [7]

2.5. Use the chain rule to find $\frac{dy}{dx}$ if $y = \left(\frac{x^2}{x+1}\right)^3$ [5]

2.6. If $x+y+xy^2=3$, then

2.6.1. Use implicit differentiation to solve and express $\frac{dy}{dx}$ in terms of x and y . [5]

2.6.2. use the result in (2.6.1) to find an equation of a tangent line to the curve $x+y+xy^2=3$ at $(1,1)$. [3]

2.7. Suppose $f(x) = 2x^5 + x^3 + 1$. Then

2.7.1. find $(f^{-1})'(x)$ [5]

2.7.2. use (2.7.1) to find $(f^{-1})'(4)$ [2]

2.8. Let $f(x) = 3x^4 - 4x^3$. Then find

2.8.1. the local maximum and local minimum value of f if there are any. [5]

2.8.2. the intervals on which f is increasing and on which f is decreasing. [4]

2.8.3. the open intervals on which f is concave upward and on which it is concave downward. [4]

2.8.4. the inflection point(s). [2]

END OF EXAMINATION