FACULTY OF HEALTH AND APPLIED SCIENCES

NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND STATISTICS

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| **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:** JANUARY 2020 | **PAPER:** THEORY |
| **DURATION:** 3 HOURS | **MARKS: 100** |

| SECOND OPPORTUNITY EXAMINATION QUESTION PAPER | |
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| **EXAMINER** | Dr N. Chere and Mrs Y.Shaanika-Nkalle |
| **MODERATOR:** | Prof Gunter Heimbeck |

## 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]**

1.1. Suppose that $\lim_{x\to -2} f(x) = 12$, $\lim_{x\to -2} g(x) = -3$. Then find

1.1.1. $\lim_{x\to -2}\left(\sqrt{3f(x)} + g(x)\right)$ = --------------------

1.1.2. $\lim_{x\to -2}\left((g(x))^2 + x\right)$ = ------------------

1.1.3. $\lim_{x\to -2}\left(\frac{x^2+xg(x)}{f(x)}\right)$ = ------------------

1.1.4. $\lim_{x\to -2}(2x + (f(x))^2)$ = ------------------

1.2. Determine the following derivatives.

1.2.1. $\frac{d}{dx}\left(\sin\left(\frac{1}{x}\right)\right)$ =-----------------------

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

1.2.3. If y = ln(sinx), then $\left.\frac{dy}{dx}\right|_{x=\frac{\pi}{4}}$ = -----------------------

1.3. Suppose that f and g are continuous functions such that g (4) = 2

and $\lim_{x\to 4}(2f(x) + 3g(x)) = 20$. Then the value of f (4) = ---------------------

1.4. The domain of the function f(x) = $\sqrt{4 - 9x^2}$ is equal to --------------------

1.5. Suppose a function f has the property that for all real numbers x, $1-x^2 \le f(x) \le \cos x$. Then $\lim_{x\to 0} f(x)$ = ----------------

**SECTION B [Workout Problems]**

**QUESTION 2 [75]**

2.1. Let f(x) = $\sqrt{2x + 2}$. Then

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

2.1.2. state the range of $f^{-1}$. [2]

2.2. Evaluate the following limits if it exists.

2.2.1. $\lim_{x\to -\infty} \frac{2x^4+4x^2+3}{x^2+2x^3+1}$ [4]

2.2.2. $\lim_{x\to -1} \frac{\ln(x^3+2)}{x+1}$ [6]

2.2.3. $\lim_{x \to 2} \frac{\sqrt{2x+4}-\sqrt{8}}{x-2}$ [5]

2.2.4. $\lim_{x \to 2} \frac{x^2-2x}{x^3-8}$ [5]

2.3. Let $f(x) = x^2 - x$. Find $f'(x)$ by using the limit definition of derivative. [5]

2.4. Use the precise definition of limit to prove that $\lim_{x \to 3}(2x+3) = 9$. [7]

2.5. Use chain rule to find $\frac{dy}{dx}$ if $y = \sin(\ln 2x)$ [5]

2.6. If $x+y = 2xy^2$ Then

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

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

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

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

2.7.2. use (3.6.2) to find $(f^{-1})'(0)$ [3]

2.8. Let $f(x) = 2x^3 - 3x^2 - 12x$.

2.8.1. find 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 when where it is decreasing. [4]

2.8.3. the open intervals on which the graph of f is concave upward and on which the graph of f is concave down ward. [4]

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

**END OF EXAMINATION**