# namibia university
## OF SCIENCE AND TECHNOLOGY

### FACULTY OF HEALTH, APPLIED SCIENCES &NATURAL RESOURCES

### 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: JUNE 2022** | **PAPER:** THEORY |
| **DURATION:** 3 HOURS | **MARKS: 100** |

| FIRST OPPORTUNITY EXAMINATION QUESTION PAPER | |
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| **EXAMINER** | **Mrs. H. Y. Nkalle** |
| **MODERATOR:** | Dr. N. Chere |

| INSTRUCTIONS |
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| 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)

**Question 1**

Consider the relation $P = \{(1,7), (-1,7), (3,9), (1,3)\}$. Is $P$ a function? Justify your answer. [2]

**Question 2**

Show that $\lim\limits_{x \to 0} \dfrac{1-cosx}{x} = 0$. [6]

**Question 3**

Find $\lim\limits_{x \to a} \dfrac{\sqrt{a+2x}-\sqrt{3x}}{\sqrt{3a+x}-2\sqrt{x}}$. [8]

**Question 4**

Find the average rate of change of the function $f(x) = x^2 + 4x$ over the interval [-6, 4]. [5]

**Question 5**

Find the instantaneous rate of change at $x = b$ for the function $f(x) = x^2 + 2x$. [5]

**Question 6**

Consider the function $f(x) = e^{rx}$. Determine the values of $r$ so that $f$ satisfies the equation $f''(x) + f'(x) - 6f(x) = 0$. [8]

**Question 7**

Find the equation of the tangent line to the graph of the function $f(x) = \sqrt{x}$ at the point (1,1). [5]

**Question 8**

Differentiate $f(x) = \dfrac{24x}{6x+5}$ from first principle. [7]

**Question 9**

Let $f(x) = c$. Find $f'(x)$ using limit definition of derivative. [3]

**Question 10**

Find the range of $f(x) = \sqrt{1 - x^2}$. [5]

**Question 11**

Let $f(z) = \ln z$. Find $f'''(z)/z = 2$. [4]

**Question 12**

Find $\frac{dy}{dx}$ by using implicit differentiation of $xy = 1$. [4]

**Question 13**

Use logarithmic differentiation to find $\frac{d}{dx}\left(x^{\sqrt{3}}\right)$. [5]

**Question 14**

Investigate whether the following functions are odd or even.
   (a) $f(x) = x^3$. [2]
   (b) $f(x) = \cos x$. [2]

**Question 15**

Let $f(x) = \frac{1}{3}x^3 + x^2 - 15x - 9$. Use detailed sign tables in answering the following questions.

   (a) Find the intervals in which $f$ is increasing or decreasing. [9]
   (b) Find the intervals in which the graph of $y = f(x)$ is concave upward or downward. [6]

**Question 16**

Air is escaping from a spherical balloon at the rate of $2\text{cm}^3$ per minute. How fast is the radius shrinking when the volume is $36\pi$ cm$^3$ ? [8]

**Question 17**

Find the rate of change of the area $A$, of the circle with respect to its circumference $C$, i.e $\frac{dA}{dC}$. [6]

**End of paper**
**Total marks:100**