NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science	
QUALIFICATION CODE: 07BSOC	**LEVEL: 5**
COURSE CODE: CLS502S	**COURSE NAME:** CALCULUS 1
SESSION: JULY 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS: 77**

SUPPLEMENTARY/ SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	Dr A. S. EEGUNJOBI
MODERATOR:	Prof G. 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)

PART A [32 marks]

1. If $x^2 - 2xy + 3y^2 = 8$, then $\frac{dy}{dx}$ at $(x = 1, y = 2)$ is
   A. 1 B. 5 C. $\frac{1}{3}$ D. 3 E. $\frac{1}{5}$ (3)

2. If $h(x) = \frac{5}{x^2+1}$ and $p(x) = 3x$, then $p(h(2))$ is
   A. $\frac{5}{37}$ B. 3 C. -5 D. 5 E. $\frac{37}{5}$ (3)

3. If $f(x) = \ln(\ln(1-x))$, then $f'(x)$ is
   A. $-\frac{1}{\ln(1-x)}$ B. $\frac{1}{(1-x)\ln(1-x)}$ C. $\frac{1}{(1-x)^2}$ D. $-\frac{1}{(1-x)\ln(1-x)}$ E. $\frac{1}{\ln(1-x)}$ (3)

4. $$\lim_{x\to 0} \frac{3^{\sin x} - 1}{x}$$
   is
   A. 0 B. 1 C. $\ln 3$ D. 3 E. -1 (3)

5. If $y = \sin^{-1}\sqrt{x}$, the $\frac{dy}{dx}$ is
   A. $\frac{2}{\sqrt{x}\sqrt{1-x}}$ B. $\frac{-2}{\sqrt{x}\sqrt{1-x}}$ C. $\frac{1}{2\sqrt{x}\sqrt{1-x}}$ D. $\frac{1}{\sqrt{1-x}}$ E. $\frac{\sqrt{x}}{\sqrt{1-x}}$ (3)

6. If $y = \sin(2\sin^{-1}x)$ then $\frac{dy}{dx}$ is
   A. $\frac{2-4x^2}{\sqrt{1-x^2}}$ B. $\frac{2+4x^2}{\sqrt{1-x^2}}$ C. $\frac{2-4x^2}{\sqrt{1+x^2}}$ D. $\frac{2+4x^2}{\sqrt{1+x^2}}$ E. $\frac{2-4x^2}{\sqrt{x^2-1}}$ (3)

7. The slope of the normal to the curve $y = \cos 2x$ at $\frac{\pi}{6}$ is
   A. $\sqrt{3}$ B. $-\frac{1}{\sqrt{3}}$ C. $\frac{2}{\sqrt{3}}$ D. $\frac{1}{\sqrt{3}}$ E. None (3)

8. Given $x(t) = 3t - 1$ and $y(t) = 3t(t-1)$, then $\frac{dy}{dx}$ is
   A. $2t - 1$ B. $9(2t - 1)$ C. $\frac{1}{2}$ D. $2t + 1$ E. $\frac{1}{2t-1}$ (3)

9. Compute the partial derivative of the function $f(x, y, z) = e^{1-x\cos y} + ze^{-\frac{1}{1+y^2}}$ with respect to x at the point $(1, 0, \pi)$
   A. -1 B. $-\frac{1}{e}$ C. $\frac{\pi}{e}$ D. π E. 0 (3)

10. The radius of a cylinder is increasing at the rate of $3m/sec$ and its altitude is decreasing at the rate of $4m/sec$. The rate of change of volume when radius is 4 meters and altitude

is 6 meters is

A. $80\pi m^3/sec$ B. $144\pi m^3/sec$ C. $80m^3/sec$ D. $64\pi m^3/sec$ E. $64m^3/sec$ (5)

PART B [45 marks]

1. If a rock is thrown vertically upward from the surface of Mars with velocity $15m/s$, its height after t seconds is $h = 15t - 1.86t^2$.
   (a) What is the velocity of the rock after $2s$? (5)
   (b) What is the velocity of the rock when its height is $25m$ on its way up? and on its way down? (8)
2. Find the critical numbers of the function. $f(y) = \frac{y-1}{y^2-y+1}$ (5)
3. (a) Verify that the function $f(x) = 2x^2 - 4x + 5$ satisfies the three hypotheses of Rolle's Theorem on the interval $[-1, 3]$. (5)
   (b) Then find all numbers c that satisfy the conclusion of Rolle's Theorem. (5)
4. Find the value(s) of k for which

$$f(x) = \begin{cases} -6x - 12, & x < -3 \\ k^2 - 5k, & x = -3 \\ 6, x > -3 \end{cases}$$

   continuous at $x = -3$ (9)
5. Air is being pumped into a spherical balloon such that its radius increases at a rate of $.75in/min$. Find the rate of change of its volume when the radius is 5 inches. (8)

End of Exam!