



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY
FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES**

SCHOOL OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

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| QUALIFICATION: Bachelor of science in Applied Mathematics and Statistics | |
| QUALIFICATION CODE: 07BSAM | LEVEL: 6 |
| COURSE CODE: CLS601S | COURSE NAME: CALCULUS 2 |
| SESSION: JUNE 2023 | PAPER: THEORY |
| DURATION: 180 MINUTES | MARKS: 100 |

| FIRST OPPORTUNITY QUESTION PAPER | |
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| EXAMINERS | MR BENSON OBABUEKI DR SERGE NEOSSI-NGUETCHUE |
| MODERATOR: | DR DAVID IYAMBO |

| INSTRUCTIONS |
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| <ol style="list-style-type: none">1. Answer ALL 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 2 PAGES (excluding this front page)

Question 1 (35 marks)

Determine the following indefinite integrals using the indicated techniques:

1.1 $\int 3xe^{x^2} dx$ by substitution. (5)

1.2 $\int e^{3x} \sin 2x dx$ by parts. Start with $u = \sin 2x$. (9)

1.3 $\int \frac{dx}{36x^2 + 1}$ by trigonometric substitution. (5)

1.4 $\int \sin^4 y \cos^3 y dy$ by any (simple) method. (7)

1.5 $\int \frac{dx}{\sin x}$ using the t-formula. (9)

Question 2 (14 marks)

2.1 Determine the area enclosed by $y = x^2 - 9$ and $y = 9 - x^2$. (5)

2.2 What is the arc length of $y = \ln \sec x$ in the interval $0 \leq x \leq \frac{\pi}{4}$? (Hint: $\sec x$ is positive in the given interval) (5)

2.3 Calculate the volume of the solid generated if $y = 2x$ is rotated about the x -axis through a complete revolution, $0 \leq x \leq 4$. (4)

Question 3 (16 marks)

The definite integral $\int_0^1 e^{x^2+3} dx$ is to be estimated using the Simpson Rule, correct to within an error of 0.7%.

3.1 Determine the number of subintervals needed. (8)

3.2 Use $n = 8$ to estimate the given definite integral to within an error of 0.7%. (8)

Question 4 (13 marks)

4.1 Given that $f(x) = \sum_{n=1}^{\infty} \frac{n+1}{4^{n+1}} x^n$, determine the definite integral $\int_0^1 f(x) dx$. (6)

4.2 Use Taylor series to approximate $\int_0^{0.1} \sin(x^4) dx$ to within an error of 10^{-20} . (Hints: (1)

$\sin u = \sum_{n=0}^{\infty} \frac{(-1)^n u^{2n+1}}{(2n+1)!}$; (2) The alternating series error estimation rule allows you to truncate from the first term that has an absolute value less than the error limit.) (7)

Question 5 (11 marks)

The curve $y = x - x^2$, between $x = 0$ and $x = 2$, rotates about the x -axis through a complete revolution. Determine the centre of gravity of the solid so formed. (11)

Question 6 (11 marks)

A curve is defined by the parametric equations $x = \theta - \sin \theta$ and $y = 1 - \cos \theta$. Determine the area generated by the curve between $\theta = 0$ and $\theta = 2\pi$, when rotated completely about the x -axis. (11)

End of Paper

Total marks: 100%