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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS AND SCIENCE)

COURSE CODE: MAT 114

COURSE TITLE: INTEGRAL CALCULUS

DATE: 8TH JUNE, 2022 **TIME: 1400 – 1700 HRS**

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 2 PRINTED PAGES PLEASE TURN OVER

REGULAR – MAIN EXAM

MAT 114: INTEGRAL CALCULUS

STREAM: EDS, EDB, EDA **DURATION: 3 Hours**

INSTRUCTION TO CANDIDATES

Answer **ALL** questions from section A and **ANY THREE** Questions in section B.
All questions in section B carry Equal Marks
No sharing of scientific calculators.
Do not write on this question paper

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SECTION A (31 MARKS): ANSWER ALL QUESTIONS

QUESTION ONE (16 MARKS)

a) Evaluate $\int (5x^2 + 2\cos x)dx$ (3 marks)

b) Using appropriate substitution evaluate $\int_0^{\pi/4}(1 + \sin 2x)^3 \cos 2x\, dx$ (7 marks)

c) Evaluate $\int_0^{\pi/3} x\, sec^2\, x\, dx$ using integration by parts (6 marks)

QUESTION TWO (15 MARKS)

a) The region bounded by the graphs of the equations $x^2 = y - 2$ and $2y - x - 2 = 0$ and by the vertical lines $x = 0$ and $x = 1$ is revolved about the x-axis. Find the volume of the washer (5 marks)

b) Evaluate $\int \frac{1}{x^2\sqrt{16-x^2}}\, dx$ (5 marks)

c) Show that $\int \frac{dx}{\sqrt{x^2-a^2}} = \ln\left(x + \sqrt{x^2 - a^2}\right) + c$ (5 marks)

SECTION B (39 MARKS): ANSWER ANY THREE QUESTIONS

QUESTION THREE (13 MARKS)

a) Find the area of the region bounded by the graphs of $y + x^2 = 6$ and $y + 2x - 3 = 0$ (8 marks)

b) Evaluate $\int sin^5 x\, dx$ (5 marks)

QUESTION FOUR (13 MARKS)

a) The region bounded by the y-axis and the graphs of $y = x^3$, $y = 1$ and $y = 8$ is revolved about the y-axis . Find the volume of the resulting solid. (5 marks)

b) Evaluate $\int \frac{4x^2+13x-9}{x^3+2x^2-3}\, dx$ (8 marks)

QUESTION FIVE (13 MARKS)

a) Set up an integral for finding the arc length of the graph of the equation $y^3 - y - x = 0$ from $A(0,-1) to\ B(6,2)$ and approximate the integral by using Simpson's rule with $n = 6$ and round the answer to one decimal place. (7 marks)

b) Evaluate $\int \frac{2x-1}{x^2-6x+13}\,dx$ (6 marks)

QUESTION SIX (13 MARKS)

a) Evaluate $\int_1^4 \left(5x - 2\sqrt{x} + \frac{32}{x^2}\right) dx$ (4 marks)

b) Using Trapezoidal rule, solve the integral, $\int_0^1 \frac{1}{x^2+6x+10}\,dx$ (5 marks)

c) Evaluate $\int (2x^3 + 1)^7\, x^2\, dx$ (4 marks)

QUESTION SEVEN (13 MARKS)

a) Find $\int_0^{10} \frac{1}{1+x^2}\,dx$ using Simpson`s one third rule (5 marks)

b) If $f(x) = 3x^{2/3} - 10$ find the arclength of the graph of f from the point $A(8,2)$ to $B(27,17)$ (8 marks)