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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, SEMESTER TWO EXAMINATION
BACHELOR OF EDUCATION (ARTS)
KMA 2201: INTEGRAL CALCULUS

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS
QUESTION ONE (30 MARKS)

a) Evaluate the following integrals:

   i) $\int x^2\sqrt{x^3 + 5}\, dx$ (4 marks)

   ii) $\int_1^4 (5x - 2\sqrt{x} + \frac{32}{x^3})\, dx$ (4 marks)

   iii) $\int \frac{x\, dx}{(x-1)(x+1)^2}\, dx$ (3 marks)

b) The parabola $y = 2 - x^2$ and the line $y = -x$ enclose an area. Use integration methods to find the size of the area enclosed.   (5 marks)

c) The region bounded by the graph

   $x^2 = y - 2, 2y - x^2 - 2 = 0, x = 0, x = 1$ is rotated 360°about the x −axis.

   Find the volume of the resulting solid   (4 marks)

d) A stone falls freely from the top of a cliff and its velocity v, after t seconds is given by $10t\, m/s$. Find

   the distance S if it falls in 5 seconds   (5 marks)

e) Obtain the reduction formulae for $l_n = \int x^n e^x\, dx$.
   Hence evaluate $\int x^4 e^x\, dx$ (5 marks)

QUESTION TWO (20 MARKS)

a) Use Simpson's rule with 9 ordinates correct to 4 decimal places to estimate   (7 marks)

$$\int_2^4 \frac{5\ln 2x}{5 + \ln 2x}\, dx$$

b) Show that the improper integral $\int_1^\infty \frac{1}{x^2}\, dx$ is convergent   (4 marks)

c) Evaluate $\int x^3 \sqrt{1 - x^2}\, dx$ using Integration by parts.   (4 marks)

d) Obtain the reduction formulae for $l_n = \int \sin^n x\, dx$.

   Hence evaluate $\int \sin^4 x\, dx$ (5 marks)

QUESTION THREE (20 MARKS)

a) Find the integral $\int \sin^3 x \, dx$ (5 marks)

b) Find $\int \frac{1+x^2}{\sqrt[4]{3x+x^3}} \, dx$ (6 marks)

c) Find the area enclosed by the curves $y=2x-x^2$ and $y = 2x^2 - 4x$ (5marks)

d) Verify the fundamental theorem of calculus using the equation

$2x^3 - 3x^2 + x - 2$ on $[2, 5]$. (4 marks)

QUESTION FOUR (20 MARKS)

a) Find $\int \frac{dx}{\sqrt{1+x^2}} \, dx$ (5 marks)

b) Use partial fractions to evaluate

$\int \frac{2x^2-11x+5}{(x^2+2x-5)(x-3)} \, dx$ (6 marks)

c) i) Evaluate $\int_0^4 \frac{1}{\sqrt{1+x^3}} dx$ using **Simpsons Rule** $with\ n = 3$ (5 marks)
ii) Estimate the error involved in this approximation (4 marks)

QUESTION FIVE (20 MARKS)

a) Find $\int 2x^2 \sec(4\pi x^3 + 6) \, dx$ (5 marks)

b) Evaluate the integral $\mathbf{I} = \int_1^2 \frac{1}{x} \, dx$ using trapezoidal rule using 4 equal sub intervals . (7 marks)

c) Evaluate the following definite integrals

$\int_0^\pi (x + 1) \sin x \, dx$ (4 marks)

d) Using for integration find
$\int \cos 5 x \cos 3 x \, dx$ (4 marks)