



Kasarani Campus
Off Thika Road
P. O. Box 49274, 00101
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212
Fax: 4444175

KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF EDUCATION
(ARTS)

KMA 2201- INTERGRAL CALCULUS

Date: 10th August 2023
Time: 8.30am-10.30am

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- a) i) State the Mean Value Theorem. (2 Marks)
- ii) Verify the *Mean Value Theorem* for $f(x) = x^3 - 3x^2 - 10x + 20$ on the interval $[-1, 5]$. (4 Marks)
- b) Find the value of C in the function $f(x) = x^3 - 12x$ prescribed in the Rolle's theorem on the interval $0 \leq x \leq 2\sqrt{3}$. (3 Marks)
- c) Calculate the second Taylor Polynomial of $f(x) = \sqrt{x}$ at $x = 1$ and use this polynomial to estimate $\sqrt{1.02}$. (6 Marks)
- d) Evaluate the following integrals;
- i) $\int x^2 e^{x^3} dx$ (3 Marks)
- ii) $\int \cos 3x \cos 4x dx$ (4 Marks)
- iii) $\int \frac{x^3}{\sqrt{1-x^2}} dx$ (4 Marks)
- e) Using cylindrical shells, find the volume of the solid generated when the region endorsed between $y = \sqrt{x}$, $x = 1$, $x = 4$ is revolved about the y -axis. (4 Marks)

QUESTION TWO (20 MARKS)

- a) Find the area of the region bounded by the curve $y = xe^{-x}$ and the x -axis $x = 0$ to $x = 4$. (6 Marks)
- b) Evaluate $\int \frac{2x^3 - 4x^2 - x - 3}{x^2 - 2x - 3} dx$ using partial fractions method. (7 Marks)
- c) Find the length of the cardioid $r = 1 - \cos\phi$ (7 Marks)

QUESTION THREE (20 MARKS)

- a) Find the Taylor Polynomials $f_{1,\pi}(x)$, $f_{3,\pi}(x)$ and $f_{5,\pi}(x)$ for $f(x) = \sin x$. (7 Marks)
- b) Evaluate the integrals;
- i) $\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx$ (3 Marks)
- ii) $\int 3x \sqrt{1-2x^2} dx$ (5 Marks)

$$\text{iii) } \int \frac{dx}{(9-x^2)^{\frac{3}{2}}} \quad (5)$$

Marks)

QUESTION FOUR (20 MARKS)

a) Evaluate the integral;

i) $\int e^x \cos x \, dx$ (6 Marks)

ii) $\int \sin^5 x \, dx$ (3 Marks)

iii) $\int \sin^4 x \cos^4 x \, dx$ (6 Marks)

b) Use Partial fractions to evaluate;

$$\int \frac{-2x+4}{(x^2+1)^2} \, dx \quad (5)$$

Marks)

QUESTION FIVE (20 MARKS)

a) Use substitution method to evaluate;

i) $\int \frac{x}{\sqrt{1-x^2}} \, dx$ (5

Marks)

ii) $\int x^2 \sin(x^3) \, dx$ (4

Marks)

iii) $\int \sqrt{x} \sin^2(x-1) \, dx$. (5 Marks)

b) Determine the third Taylor polynomial of the function;

$$f(x) = \cos(\pi - 5x) \text{ at } x=0 \quad (6 \text{ Marks})$$