



Kasarani Campus
Off Thika Road
Tel. 2042692 / 3
P. O. Box 49274, 00100
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212
Fax: 4444175

KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS AND COMPUTER SCIENCE)

Date: 9th April, 2024
Time: 8.30am – 10.30am

KMA 201 - CALCULUS 11

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Evaluate the following integrals;

i) $\int \frac{3x^2 + 2x}{(x^3 + x^2 + 4)^{10}} dx$ (2 Marks)

ii) $\int x(x + 1)^2 dx$ (2 Marks)

iii) $\int \sin^3 x \cos x dx$ (2 Marks)

iv) $\int x \tan x^2 dx$ (2 Marks)

v) $\int x \cos x dx$ (2 Marks)

vi) $\int \frac{2x+4}{x^2+4x+2} dx$ (2 Marks)

b) Determine the volume of the object generated when the area between $y = x^2$ and $y = x$ is rotated around the x -axis. (3 Marks)

c) The velocity of a moving point is given by the equation $v = (2t^3 + 4t + 2)m/s$. Find the path covered by the point after 5 seconds. (3 Marks)

d) Evaluate the following definite integrals

i) $\int_0^{\pi} \sec^2 x \tan^2 x dx$ (3 Marks)

ii) $\int_0^1 2 e^{4x^3+3} x^2 dx$ (3 Marks)

e) Determine the length of the arc represented by the equation $x = \frac{2}{3}(y - 1)^{\frac{3}{2}}$ on the interval (1, 4). (3 Marks)

f) Show that $\int \tan x = \ln|\sec x| + c$.

(3 Marks)

QUESTION TWO (20 MARKS)

a) Evaluate the following integrals:

i) $\int x(2x + 1)^4 dx$ (3 Marks)

ii) $\int \ln x dx$ (4 Marks)

iii) $\int x \sin x$ (4 Marks)

iv) $\int x e^{x^2} dx$ (3 Marks)

v) $\int \cos^4 x \sin^5 x dx$ (3 Marks)

b) Suppose a population of fruit flies increases at a rate of $g(t) = 2e^{0.02t}$ per day. If the initial population of fruit flies is 100 flies, how many flies are in the population after 10 days? (3 Marks)

QUESTION THREE (20 MARKS)

a) Given the function $f(x) = \frac{x^3 + 2x}{x + 3}$.

i) Express $f(x)$ as $p(x) + \frac{q(x)}{r(x)}$. (3 Marks)

ii) Evaluate $\int \frac{x^3 + 2x}{x + 3} dx$. (3 Marks)

b) If the motor on a motorboat is started at $t = 0$ and the boat consumes gasoline at the rate of $5t - t^2$ gal/hr, how much gasoline is used in the first 2 hours? (4 Marks)

c) The parabolas $y = x^2$ and $y = \sqrt{x}$ enclose an area. Use integration methods to find the size of the area enclosed. (5 Marks)

d) During a 9 hour work day, the production rate at time t hours was $r(t) = 5 + \sqrt{t}$ cars per hour.

Find the average hourly production rate. (5 marks)

QUESTION FOUR (20 MARKS)

a) Evaluate the following integrals:

i) $\int \frac{\sin^2 t}{1 - \cos t} dt$ (4 Marks)

ii) $\int \frac{x dx}{\sqrt{x-1}}$ (4 Marks)

b) Evaluate the following definite integrals:

i) $\int_0^3 e^{2x} dx$ (4 Marks)

ii) $\int_0^{\frac{\pi}{2}} \frac{\cos x}{1 + \sin x} dx$ (4 Marks)

- c) Find $\int_0^6 y dx$ using Simpsons Rule given the following data

x	0	1	2	3	4	5	6
y	4	10	12	16	6	2	1

(4 Marks)

QUESTION FIVE(20 MARKS)

- a) Find the integral of the following using trigonometric substitution:

i) $\int \frac{x^2 dx}{\sqrt{9-x^2}}$ (5 Marks)

ii) $\int \frac{\sqrt{x^2+1}}{x} dx$ (5 Marks)

- b) Use the slicing method to find the volume of the solid of revolution bounded by the graphs of $f(x) = \sqrt{4-x}$, $x = 0$ and $x = 4$, and rotated about the x -axis.

(5 Marks)

- c) Find the area of the region bounded by the parabolas $y = x^2 - 7x + 9$ and $y = -x^2 + 3x + 1$.

(5 Marks)