



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR
SECONDYEAR FIRST SEMESTER
SPECIAL/ SUPPLEMENTARY EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAT 210

COURSE TITLE: CALCULUS II

DATE: 12/02/2021 **TIME: 8 AM -10 AM**

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

Question One (30 Marks)

- a. Evaluate the integral $\int \left(6e^x - \frac{3}{1+x^2}\right) dx$ (3 Marks)
- b. Find $\int \frac{4x^2+13x-9}{x^3+2x^2-3x} dx$ (5 Marks)
- c. Evaluate $\int (1 - \sin^3 3x) \cos 3x dx$ (3 Marks)
- d. The region enclosed by the curves $y = x$ and $y = x^2$ is rotated about the x axis. Find the volume of the resulting solid (5 Marks)
- e. Evaluate $\iint (x - 3y^2) dy dx$ for the region $\{(x, y): 0 \leq x \leq 2, 1 \leq y \leq 2\}$ (5 Marks)
- f. Evaluate $\int x^2 \sin x dx$ (4 Marks)
- g. Find the Riemann sum for $f(x) = x^2 + 1$ taking the sample points to be the right endpoints and $a = 0, b = 2$ and $n = 5$ (5 Marks)

Question Two (20 Marks)

- a. Evaluate the integrals
- i. $\int t^2 e^t dt$ (4 Marks)
- ii. $\int \tan^3 x \sec^2 x dx$ (4 Marks)
- iii. $\int \sin^2 x \cos^2 x dx$ (4 Marks)
- b. Determine the position function $s(t)$ of an object if its velocity is $v(t) = 3 - 12t$ and the initial position is $s(0) = 3$ (3 marks)
- c. Use partial fractions to evaluate $\int \frac{x^4}{x^2 - 1} dx$ (5 marks)

Question Three (20 Marks)

- a. Find the average value of the function $f(x) = x^2 + 3x - 1$ on the interval $[-1, 3]$ (3 Marks)
- b. Evaluate the following integrals
- i. $\int_0^2 \sqrt{x^2 + 9} dx$ (4 Marks)
- ii. $\int \frac{dx}{\sqrt{4-x^2}}$ (3 Marks)
- iii. $\int \frac{x dx}{\sqrt{1-4x^2}}$ (4 Marks)
- iv. $\int_0^1 \int_1^x e^y dy dx$ (2 Marks)
- v. Find the area of the region bounded above by $y = x^2 + 1$, bounded below by $y = x$ and bounded on the sides by $x = 0$ and $x = 1$ (4 Marks)

Question Four (20 Marks)

- a. Define $I_n = \int \tan^n x dx$. Show that $I_n = \frac{\tan^{n-1} x}{n-1} - I_{n-2}$. Hence evaluate $\int \tan^7 x dx$ (10 Marks)
- b. Find the value of c that satisfies the conclusion of the integral Mean Value Theorem in the function below (3 Marks)

$$f(x) = x^2, 0 \leq x \leq 2$$

- c. The arc of the parabola $y = x^2$ from $(1,1)$ to $(2,4)$ is rotated about the x axis. Find the area of the resulting surface (4 Marks)
- d. Find the arc length of the curve $y = e^{2x}$ from $x = 0$ to $x = 2$ (3 Marks)

Question Five (20 Marks)

- a. Decompose $\frac{x^3+2}{(x-1)(x+2)(x+3)}$ into partial fractions. Hence or otherwise evaluate $\int \frac{x^3+2}{(x-1)(x+2)(x+3)} dx$ (10 Marks)
- b. Evaluate $\int_1^3 \frac{x+2}{x+1} dx$ (5 Marks)
- c. Find $\frac{d}{dx} \int_{x^2}^1 \frac{1}{\sqrt{t^4+2}} dt$ (5 Marks)