



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2021/2022 ACADEMIC YEAR**  
**FIRST YEAR SECOND SEMESTER**  
**SPECIAL/SUPPLEMENTARY EXAMINATION**  
**FOR THE DEGREE OF BACHELOR OF SCIENCE**

**COURSE CODE: MAA123**

**COURSE TITLE: CALCULUS II**

**DATE: 25/07/2022**

**TIME: 08:00 AM - 10:00 AM**

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**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 COMPULSORY (30 MARKS)**

- a) Define the term integration. (1 mark)
- b) State the Fundamental theorem part II (Evaluation theorem) for integrals. (2 marks)
- c) Evaluate the following integrals by parts method.
- i.  $\int 4x \sec^2 x \, dx$  (4 marks)
- ii.  $\int t^3 \ln t \, dt$  (3 marks)
- d) A particle moves with velocity function  $\vec{v}(t) = \frac{4t^2+t-3}{t^3}$ , find its displacement function  $\vec{s}(t)$  at any time  $t$  where  $t$  is time seconds. (4 marks)
- e) Given  $f(x) = 1 + x^2$ , find the number  $C$  that satisfy the conditions of the mean value theorem on the interval  $[-1, 2]$ . (4 marks)
- f) Evaluate  $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \frac{\sin 2x}{\sqrt{1-\cos 2x}} \, dx$  (5 marks)
- g) Evaluate the following definite integral

$$\int_3^4 \frac{x^3 - x^2 - 5x}{x^2 - 3x + 2} \, dx \quad (7 \text{ marks})$$

**QUESTION TWO (20 MARKS)**

- a) Evaluate
- i.  $\int \frac{1}{4+3 \cos \theta} \, d\theta$  (5 marks)
- ii.  $\int x^2 \cos x \, dx$  (4 marks)
- iii.  $\int \frac{2+x+6x^2-2x^3}{x^2(x^2+1)} \, dx$  (8 marks)
- b) Evaluate the following integral by substitution,  
 $\int \cos x e^{\sin x} \, dx$  (3 marks)

**QUESTION THREE (20 MARKS)**

- a) Show that if  $u = g(x)$  is a continuous differentiable function whose range is an interval  $I$  and  $f$  is continuous on  $I$ , then  $\int f(g(x)) \cdot g'(x) \, dx = \int f(u) \, du$ . (2 marks)
- b) Evaluate the following integrals
- i.  $\int e^{3x} \sin 5x \, dx$  (7 marks)
- ii.  $\int \frac{x^2+4x+1}{(x-1)(x+1)(x+3)} \, dx$  (7 marks)
- c) Evaluate  $\int \frac{t}{\sqrt{2t^2+1}} \, dt$  (4 marks)

**QUESTION FOUR (20 MARKS)**

- a) Find the volume of the solid of revolution between  $x = 0$  and  $x = 2$  when the curve  $y = x^2$  is rotated about the
- i.  $x$  - axis (3 marks)
  - ii.  $y$  - axis (3 marks)
- b) Evaluate the following trigonometric integrals
- i.  $\int \sin^2 t \cos^3 t dt$  (4 marks)
  - ii.  $\int \sin 5x \cos 5x dx$  (3 marks)
  - iii.  $\int_0^{\frac{\pi}{2}} \frac{1}{1+\cos \theta} d\theta$  (4 marks)
- c) Evaluate  $\int x^2 \sin x^3 dx$  (3 marks)

**QUESTION FIVE (20 MARKS)**

- a) Define the term improper integrals. (1 mark)
- b) Evaluate the following improper integrals
- i.  $\int_{-\infty}^0 x e^x dx$  (3 marks)
  - ii.  $\int_2^5 \frac{1}{\sqrt{x-2}} dx$  (4 marks)
- c) Find the average value of  $f(x) = \sqrt{4-x^2}$  on the interval  $[-2,2]$ . (7 marks)
- d) Find the area of the region enclosed between the parabolas  $y = 4 - x^2$  and  $y = x^2 - 2x$ . (5 marks)