



ALUPE UNIVERSITY
COLLEGE
Pursuing the Frontiers of Knowledge

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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2017 /2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION



**FOR THE DEGREE OF BACHELOR OF
EDUCATION SCIENCE & ARTS**

COURSE CODE: MAT 114e
COURSE TITLE: INTEGRAL CALCULUS

DATE: 18TH APRIL, 2018

TIME: 9AM – 12.00 NOON

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 6 PRINTED PAGES

PLEASE TURN OVER

MAT 114e: INTEGRAL CALCULUS

STREAM: Bed(Sc/Arts)

DURATION: 3 Hours

INSTRUCTION TO CANDIDATES

- i. Answer *ALL* questions from *section A* and any *THREE* from *section B*
- ii. Do not write on the question paper.

SECTION A [31 Marks] ANSWER ALL QUESTIONS

Question one (16 marks)

a) Evaluate the following integral calculus

(i) (3mks)

$$\int_{-1}^1 (2x^2 - x^3) dx$$

(ii) (3mks)

$$\int_3^{11} \sqrt{2x+3} dx$$

(iii) (4mks)

$$\int \frac{x+3}{(x^2+6x)^{1/3}} dx$$

(iv) (3mks)

$$\int \frac{1}{2} \sin^2 x dx$$

b) Find the arc length of the curve $y = x^{3/2}$ from $x = 0$ to $x = \frac{4}{3}$ (3mks)

Question two (15 marks)

a) Use the method of integration by parts to evaluate the following integrals.

(i) (4mks)

$$\int x^2 e^{-x} dx$$

(ii) (4mks)

$$\int e^x \cos x dx$$

b) Find the area of the region bounded above by $y = x + 6$ bounded below by $g = x^2$ and bounded on the sides by lines $x = 0$ and $x = 2$ (3mks)

c) Evaluate (4mks)

$$\int \sin^2 x \cos^3 x dx$$

SECTION B (39 MARKS) [Answer **Any** Three Questions]

Question three (13 marks)

a) Calculate $\int_1^2 \frac{1}{x} dx$ using

i. trapezoidal rule with five intervals to four decimals (3mks)

ii. Assume $\int \frac{1}{x} dx = \ln x$ to four decimals (2mks)

Hence, calculate the percentage error (3mks)

b) Evaluate the integrals;



(i) (2mks)

$$\int_0^2 x(x^2 + 1)^3 dx$$

(ii) (3mks)

$$\int 8x^2(x^3 + 2)^{-3} dx$$

Question four (13 marks)

a) Evaluate(3mks)

$$\int \frac{3x^2}{x^3 + 5} dx$$

b) Find the area of the region that is between the curves $g = x^2$ and $y = x + 6$ hence sketch the graph. (4mks)

c) Evaluate

(i) (4mks)

$$\int \tan^{-1}x dx$$

(ii) (2mks)

$$\int \ln x dx$$

Question five (13 marks)

(a) Use the method of substitution to evaluate the following integrals

(i) (3mks)

$$\int \frac{x}{\sqrt{9x^2 - 4}} dx$$

(ii) (3mks)

$$\int \frac{x^2}{\sqrt[4]{x^3 + 2}} dx$$

(b) Evaluate the following definite integral

(i) (3mks)

$$\int_0^2 (2 - x)^2 dx$$

(ii) (4mks)

$$\int_{-1}^4 x(5+x)^{-1/2} dx$$

Question six (13 marks)

- a) Solve the integral $\int \frac{3x+7}{(x-1)(x^2+1)} dx$ (4mks)
- b) Evaluate the integral by completing the square (4mks)

$$\int \frac{dx}{\sqrt{5-4x-2x^2}}$$

- c) Show that the improper integral $\int_1^{\infty} \frac{1}{x^2} dx$ is convergent (5mks)

Question seven (13 marks)



- a) The curve $y = x^2 - 1$ is rotated about the x-axis through 360° . Find the volume of the solid generated when the area contained between the curve and the x-axis is rotated about the x-axis by 360° . (3mks)
- b) Determine the number c that satisfies the MVT for integrals for the function $f(x) = x^2 + 3x + 2$ on the interval $[1,4]$ (4mks)
- c) By application of definite integrals show that a cone of height h and radius r has volume (3mks)

$$\frac{1}{3} \pi r^2 h$$

- d) Evaluate the integral (3mks)

$$\int_0^{1.2} e^x dx$$

Taking six intervals by using trapezoidal rule up to 3 significant figures