



**ALUPE UNIVERSITY**  
COLLEGE  
*...Bastion of Knowledge...*

P. O.Box 845-50400 Busia(K)  
principal@auc.ac.ke  
Tel: +254 741 217 185  
+254 736 044 469  
off Busia-Malaba road

OFFICE OF THE DEPUTY PRINCIPAL  
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

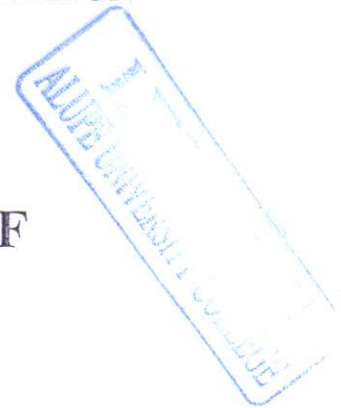
---

# UNIVERSITY EXAMINATIONS

## 2019 /2020 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

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



COURSE CODE: MAT 114

COURSE TITLE: INTEGRAL CALCULUS

DATE: 16<sup>TH</sup> OCTOBER, 2020 TIME: 0900 – 1200 HRS

---

### INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 3 PRINTED PAGES

PLEASE TURN OVER

REGULAR – MAIN EXAM

**MAT 114: INTEGRAL CALCULUS**

**STREAM: EDS, EDB, EDA**

**DURATION: 3 Hour**

**INSTRUCTION TO CANDIDATES**

Answer **ALL** questions from section A and any **THREE** from section B.

No sharing of scientific calculators.

Do not write on this question paper.

Duration of the examination: 3 hours

**SECTION A (31 MARKS): ANSWER ALL QUESTIONS**

**QUESTION ONE (16 MARKS)**

- a) Differentiate between definite and indefinite integrals (2 marks)
- b) Find the values of  $c$  which satisfy the mean-value theorem for  $f(x) = 3x^2 + 5x - 2$  on the interval  $[-1,1]$ . (3 Marks)
- c) Find
  - i)  $\int \frac{v}{1-v} dv$  (3 marks)
  - ii)  $\int \frac{1}{1 + \sin x} dx$  (5 marks)
- d) Water flows from the bottom of a storage tank at a rate of  $r(t) = 150 - 5t$  litres per minute. Find the amount of water that flows from the tank during the first 15 minutes. (3 marks)

**QUESTION TWO (15 MARKS)**

- a) Evaluate
  - i)  $\int (x + 1)e^{x^2+2x} dx$  (3 marks)
  - ii) Evaluate  $\int_0^{\frac{\pi}{2}} \sin x \cos x dx$  (3 marks)
- b) Find  $\int \frac{x}{x^2 - 2x - 3} dx$  (4 marks)

- c) Find the surface area of the portion of the sphere generated by revolving the curve

$$y = \sqrt{1-x^2}, \quad 0 \leq x \leq \frac{1}{2}. \quad (5 \text{ marks})$$

**SECTION B (39 MARKS): ANSWER ANY THREE QUESTIONS**

**QUESTION THREE(13 MARKS)**

- a) Find the area of the region enclosed by  $x = y^2$  and  $y = x - 2$  (4 marks)  
b) Derive the volume of a sphere of radius  $r$ . (5 marks)  
c) Find  $\int \tan^2 x \sec^4 x dx$  (4 marks)

**QUESTION FOUR(13 MARKS)**

- a) Find  $\int \cos^5 x dx$  (3 marks)  
b) Find the volume of the solid generated when the region between the graphs  $f(x) = \frac{1}{2} + x^2$  and  $g(x) = x$  over the interval  $[1,2]$  is revolved about the  $x$ - axis. (4 marks)  
c) Sketch the curve  $y = x^2 + 2$  for  $0 \leq x \leq 3$ . Approximate the area under this curve using the trapezium rule with three trapezia. Find exact area and find the percentage error in using trapezium rule. (6 marks)

**QUESTION FIVE(13 MARKS)**

- a) Use the cylindrical shell to find the volume of the solid generated when the region enclosed between  $y = \sqrt{x}$ ,  $x = 1$ , and  $x = 4$  and the  $x$ - axis is revolved about the  $y$ -axis. (4 marks)  
b) Find the length of the curve  $y = x^{\frac{3}{2}}$  form the point  $(1,1)$  to  $(2,2\sqrt{2})$ . (5 marks)  
c) Obtain the integral,  $\int \ln x dx$  (4 marks)

**QUESTION SIX(13 MARKS)**

- a) Use Simpson's rule to evaluate the integral  $\int_b^1 \frac{1}{1+x^2} dx$  using 10 strips of equal width. (5 marks)

- b) Find the volume of the solid that is obtained when the region under the curve  $y = \sqrt{x}$  over the interval (1,4) is revolved about the x-axis. (4 marks)
- c) Find  $\int \frac{1}{\sqrt{a^2 + x^2}} dx$  for all  $a \neq 0$  (4 marks)

**QUESTION SEVEN(13 MARKS)**

a) Obtain the following integrals

i)  $\int \frac{x^3 + x}{(x^4 + 2x^2 + 3)^{11}} dx$  (3 marks)

ii)  $\int \frac{\ln(x+1)}{(x+1)} dx$  (3 marks)

b) Evaluate the following integrals

i)  $\int_b^6 \frac{x}{\sqrt{x+1}} dx$  (4 marks)

ii)  $\int_0^1 x^2 \cos x^3 dx$  (3 marks)