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

2021 /2022 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE/ARTS

COURSE CODE: **MAT 104e**

COURSE TITLE: **BASIC MATHEMATICS AND ANALYTIC GEOMETRY**

DATE: 20th JANUARY 2022 **TIME:** 9:00AM-12:00PM

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF 3 PRINTED PAGES **PLEASE TURN OVER**

REGULAR – MAIN EXAM

MAT 104e: BASIC MATHEMATICS AND ANALYTIC GEOMETRY

STREAM: BED **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)

QESTION ONE (16 MARKS)

a) Define the following terms [2mks]
   i. Conic
   ii. combination

b) solve the equation $sin\vartheta = -\frac{1}{2}$ for values from $-180°$ to $180°$ [2mks]

c) Using an appropriate triangle show that $cos^2x + sin^2x = 1$ [3mks]

d) State and prove the t-formulae for $sinx$ [3mks]

e) Change the equation $r^2 = a^2\cos 2\theta$ into Cartesian coordinates [2mks]

f) Convert the following polar coordinates to the Cartesian system $(2, 120^0)$ [2mks]

g) Show that the circles $x^2 + y^2 - 6x + 4y + 2 = 0$ and $x^2 + y^2 + 8x + 2y - 22 = 0$ are orthogonal [2mks]

QESTION TWO (15 MARKS)

a) Find the tangents common to $x^2 + y^2 = 8$ and $y^2 = 16x$ [4mks]

b) Show that $Tan(A + B) = \frac{tanA+tanB}{1-tanAtanB}$ [3mks]

c) A committee of 6 is to be formed from a group of seven engineers and four mathematicians. How many different committees can be formed if at most 3 mathematicians are always to be included [3mks]

d) State and prove the cosine rule [3mks]

e) If $y = sh^{-1}(\frac{3}{4})$ show that $shy + chy = 2$ [2mks]

SECTION B: ANSWER ANY THREE QUESTIONS IT CARRIES EQUAL MARKS

QUESTION THREE (13 MARKS)

a) Solve the following quadratic equation by factorization method $2x^2 + 3x+1 = 0$ [4mks]

b) Using parametric representation find the equation of the tangent and the normal at the point T on $y^2 = 4px$ [3mks]

c) Show that $shAchB + chAshB = sh(A + B)$ [3mks]

d) Solve $3cos\vartheta + 4sin\vartheta = 2$ for values of ϑ from 0° to 180° [3mks]

QUESTION FOUR (13MARKS)

a) State the vertex and focus of the parabola having the equation; $(y - 3)^2 = 8(x - 5)$ [4mks]

b) Prove from the definition that $4sh^3x = sh3x - 3shx$ [4mks]

c) Prove that $y = 2x + 2$ touches $y^2 = 16x$ [5mks]

QUESTION FIVE (13MARKS)

a) Find the distance from the point $(1,4)$ to the line $3x - 5y + 2 = 0$ [3mks]

b) Obtain the acute angle between $x - y + 1 = 0$ and $x + 5y + 1 = 0$ [3mks]

c) Find the vertex, focus, axis and directrix of the following parabola [3mks]

$x^2 - 4x - 8y + 28 = 0$

d) Solve the equation $3cos2\vartheta + sin\vartheta = 1$ for values of ϑ from 0° to 180° [4mks]

QUESTION SIX (13MARKS)

a) Using the remainder theorem factorize the expression $2x^3 + 3x^2 - 32x + 15$ [3mks]

b) Find the equation of a circle through points (1,5) (-2,3) (2,-1) [6mks]

c) Consider a curve $y = x^2 + 2x + 6$ find the equation of the tangent at x = 0 and the normal line [4mks]

QUESTION SEVEN (13MARKS)

a) Find the slope of the line bisecting the angle from L_1 with slope 7 to L_2 with slope 1 [4mks]

b) In triangle PQR, r = 5.75 and the sizes of angle P and Q are 42° and 65° respectively calculate the lengths of the remaining sides [3mks]

c) Using the standard formulae of a circle show the gradient at the point where tangent meets the circle is $-(\frac{x_1+g}{y_1+f})$ [4mks]

d) Calculate the length of the tangent from the point (10,3) to the circle [2mks]
$2x^2 + 2y^2 - 4x + 8y - 2 = 0$