



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 ARTS

COURSE CODE: MAT 111

COURSE TITLE: GEOMETRY AND ELEMENTARY
APPLIED MATHEMATICS

DATE: TIME:

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVER



REGULAR –MAIN EXAM

MAT 111: GEOMETRY AND ELEMENTARY APPLIED MATHEMATICS

STREAM: BSc ASC

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.
- iii. Take $g = 9.8m/s^2$

No sharing of scientific calculators.

Do not write on this question paper.

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SECTION A (31 MARKS): ANSWER ALL QUESTIONS

QUESTION ONE (16 MARKS)

- a) Define a force. (2 marks)
- b) Show that the points $A(-1,-2)$, $B(4,-1)$, $C(5,4)$ and $D(0,3)$ are vertices of a rhombus. (3 marks)
- c) Find the equations of the lines that have the tangents to the curve $y = x^3 - 6x + 8$ and parallel to the line $y = 6x - 2$. (6 marks)
- d) Find the equation of the common cord of two circles given by
 $x^2 + y^2 - 4x - 2y + 1 = 0$
 $x^2 + y^2 + 4x - 6y + 10 = 0$. (2 marks)
- e) Find the parametric and Cartesian equation of $A(2,1,1)$ and $B(0,5,3)$. (3 marks)

QUESTION TWO (15 marks)

- a) Find the Cartesian equations for the line passing through $(2,-9,5)$ and parallel to the vector $\vec{V} = 3\hat{i} - \hat{j} + 4\hat{k}$ (2 marks)
- b) Find all asymptotes of the following function $y = \frac{x+3}{x^2+9}$. (2 marks)
- c) A motor car is uniformly retarded and brought to rest from a speed of $100km/h$ in 20 sec. find its acceleration. (3 marks)
- d) Express the following in rectangular coordinates, $r^2 = 1 + \sin \theta$ (2 marks)

- e) Find the area of the triangle whose vertices are $A(1,-1,0)$, $B(2,1,-1)$, and $C(-1,1,2)$.
(6 marks)

SECTION B – ATTEMPT THREE QUESTIONS IN THIS SECTION

QUESTION THREE (13 marks)

- a) Find the equation of the line perpendicular to the line $4x + 5y + 7 = 0$ and passing through the point $(6,-5)$. (3 marks)
- b) Find the distance of the point $(0,4)$ from the line $2x + y - 7 = 0$ (2 marks)
- c) Locate the Centre of mass of the system having the coordinates $(2m,0m)$, $(6m,0m)$ and $(6m,2m)$ with the masses $5kg$, $10kg$ and $15kg$ respectively. (5 marks)
- d) Find the distance between $(-3,2,4)$ and the plane $2x + y + 2z = 12$. (3 Marks)

QUESTION FOUR (13 marks)

- a) Write an equation of the tangent at the point $(2,2)$ to the curve $x^2 - 2xy + y^2 + 2x + y = 0$ (5 marks)
- b) Find the radius and the Centre of the circle with the equation $4x^2 + 4y^2 + 12x - 16y = 11$ (5 marks)
- c) Express the given equation in polar coordinates, $(x + y)^2 = x - y$ (3 marks)

QUESTION FIVE (13 marks)

- a) Find the unit vector perpendicular to the vectors $\vec{A} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$. (4 marks)
- b) Find the angle between the lines given by $\frac{x-4}{2} = \frac{y-1}{2} = \frac{z-1}{1}$ and $\frac{x-3}{3} = \frac{y+5}{-4} = \frac{z-6}{5}$ (5 marks)
- c) A stone is thrown vertically upwards with an initial speed of $16m/s$. Neglecting Air resistance, find,
(i) The maximum height reached, (2 marks)
(ii) The time taken before it reaches the ground. (2 marks)

QUESTION SIX (13 marks)

- a) Find the equation of the plane via the point $(2,1,7)$ and perpendicular to the line joining it at the point $(2,3,1)$. (3 Marks)
- b) Calculate the maximum height reached by a particle that has been fired with initial velocity 540km/h at an angle of elevation of 45° after 10sec. How far away will the projectile be above the land? (6 marks)
- c) A block of mass 50kg lies in a rough surface which is horizontal. The coefficient of friction being $\frac{1}{5}$ find,
- (i) The maximum horizontal force, (2 marks)
- (ii) The acceleration of the block if twice the minimum force is applied. (2 marks)

QUESTION SEVEN (13 marks)

- a) Find k to show that the planes $(k+1)x - y + (2-k)z = 0$ is perpendicular to the plane $2x + 6y - z + 13 = 0$ (4 marks)
- b) Find the points of intersection of the curve $r = 1$ and $r = 2\sin\theta$ (3 marks)
- c) Find the acute angle between the planes $2x - 4y + z = 5$ and $y + 3z = 2$ (3 marks)
- d) Show that $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$. (3 marks)