KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN EDUCATION
SECOND SEMESTER 2022/2023
[JANUARY-APRIL, 2023]

MATH 114: GEOMETRY AND LINEAR ALGEBRA

STREAM: Y1S2 **TIME: 2 HOURS**

DAY: MONDAY, 12:00 – 2:00 PM **DATE: 03/04/2023**

INSTRUCTIONS

1. **Do not write anything on this question paper.**
2. ***Answer question ONE and any other TWO questions.***

QUESTION ONE (30 MARKS)

a. Find the equation of a line through the point (5, -3) which is inclined at $\frac{\pi}{3}$ to the positive direction of the x-axis. (3marks)

b. Find the rectangular co-ordinates of a point B(4, $\frac{\pi}{2}$). (3marks)

c. Change $x^2 + y^2 - 4y = 0$ to polar form. (3marks)

d. Find a vector equation and the cartesian equation of the perpendicular bisectors of PQ, where P and Q are the points with position vectors;

i) -3**i** – **j** and 7**i** + **j** (4marks)

ii) a**i** + b**j** and 2a**i** + 3b**j** (3marks)

e. If z_1 = 2(cos320^0 + jsin320^0) and z_2 = 2(cos120^0 + jsin120^0). Determine modulus and argument of z_2z_1 (6marks)

f. Given $A = \begin{pmatrix} 1 & 1 & 1 \\ 3 & 4 & 5 \\ 3 & 6 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 4 & -1 \\ 2 & 0 & 8 \\ 3 & -3 & 5 \end{pmatrix}$. Find

i) $|B - A|$ (4marks)

ii) A X B (4marks)

QUESTION TWO (20 MARKS)

a. Find an equation of the line parallel to the line with equation 6x – 2y = 8 and which passes through the point (2, -3) (3marks)

b. i) Find a vector equation of the line passing through the points A(2, -2, -1) and B(4, -3, 1) (4marks)

ii) Hence find the Cartesian equation of the line AB. (3marks)

c. Find the vector (parametric form) and Cartesian equation of the plane through the points A(2, 0, -2), B(-1, 1, 3) and C(2, 1, -1). (4marks)

d. Find the vector equation of the line of intersection of the planes;

r = 3**i** – **j** – **k** + λ(**i** + 2**j**) + μ(**i** - **k**) and **r** = 2**i** + **k** +s(3**i** -5**k**) +t(**j** + **k**) (4marks)

e. Find the angle between **a** and **b** given that **a** = **i** + 2**j** +**k** and **b** = 3**i** +**j** –**k** (2marks)

QUESTION THREE (20 MARKS)

a. Find the distance of the line L with equation 3x – 4y +8 =0 from the point (-2, 3) (2marks)

b. Four vectors of magnitude 2, $4\sqrt{2}$, 6 and 8 units are inclined at angles of 30^0, 45^0, 60^0 and 120^0 to the x- axis respectively. Find magnitude and direction of the resultant vector R. (6marks)

c. Given A = **i** -2**j** -3**k**, B = 2**i** + **j** – **k** and **C** = **i** +3**j** – 2**k**. Find

i) A ● (B X C) (2marks)

ii) B ● (C X A) (2marks)

d. Given the points A(1, 3, 5), B(4, 12, 20) and C(3, 9, 15).

Find; i) **AB** (2marks)

ii) |**AC**| (2marks)

iii) **BC** (2marks)

iv) Show that **AB** is collinear to **AC** (2marks)

QUESTION FOUR (20 MARKS)

a. Solve i) (2 + 3i)(4 -5i) = x +yi (2marks)

ii) (a - 2bi) + (b -3ai) = 5 +2i (2marks)

b. Express with real denominator:

i) $\frac{5+4i}{5-4i}$ (2marks)

ii) $\frac{3i-2}{1+2i}$ (2marks)

c. Simplify $\frac{1}{(1+i)^3}$ a(2rmks)

d. Find the modulus and argument of $\frac{7-i}{3-4i}$ and express in the form r(cos$\emptyset + isin\emptyset$) (3marks)

e. If $z_1 = 1 + i$ and $z_2 = 7 - i$, find modulus of $\frac{z_1-z_2}{z_1z_2}$ (4marks)

f. If z = x + yi find the real and the imaginary part of z - $\frac{1}{z}$ (3marks)

QUESTION FIVE (20 MARKS)

a. Find the angle ∅ between the lines 3x – 4y + 8 = 0 and x +y – 3 =0 (3marks)

b. Find the equation of the perpendicular bisector of the line segment RS warith (4, -5) and S(-2, -3). (4marks)

c. Find the distance between the points A(3, -1) and B (-7, 5) (2marks)

d. Simplify $\frac{4-2i}{3-5i}$ and hence calculate the value of $\left[\frac{4-2i}{3-5i}\right]^6$ using Demoirves theorem. (4marks)

e. Determine the centre and radius of the circle $x^2 + y^2 - 4x + 10y + 13 = 0$ (4marks)

f. Convert into Cartesian the following equation r = $\frac{4}{sin\emptyset+2cos\emptyset}$ (3marks)