



KISII UNIVERSITY
UNIVERSITY EXAMINATIONS
SPECIAL EXAMINATION
FIRST YEAR EXAMINATION FOR THE AWARD OF
DEGREE IN BACHELOR OF EDUCATION SCIENCE
SECOND SEMESTER 2021/2022
(JULY, 2022)

MATH 114: GEOMETRY AND LINEAR ALGEBRA

STREAM: Y1 S2

TIME: 2 HOURS

DAY: WEDNESDAY, 11.30 AM – 1.30 PM

DATE: 20/07/2022

INSTRUCTIONS:

- 1. Do not write anything on this question paper.**
- 2. Answer ALL Questions in section A (Compulsory) and any other TWO Questions in section B.**

SECTION A (30 MARKS)

1.
 - a. Show that lines $4x + 6y = 2$ and $6x = 4y + 1$ are perpendicular (4marks)
 - b. Find the scalar of $\vec{A} = 14i + 12j - 8k$ and $\vec{B} = 6i + 4j - 8k$ and the angle θ between them. (6 marks)
 - c. Simplify $(4 + 3i)^3$ (3 marks)
 - d. Differentiate between standard and general forms of a circle (4 marks)
 - e. Express $r = 1 - 3\cos\theta$ in rectangular coordinates (3 marks)
 - f. Find the polar equation of the circle whose Cartesian equation is $2x^2 + 2y^2 = 8x$ (6 marks)
 - g. Find the equation of hyperbola having foci at $F1(-5,0)$ and $F2(5,0)$ and the difference of the total radii 6. (4 marks)

SECTION B (20 MARKS)

2.

- a. A line passes through points $A(2, -1, 5)$ and $B(3, 6, -4)$.
- Write a vector equation of the line. (5marks)
 - Write parametric equations for the line. (5marks)
 - Determine if the point $C(0, -15, 9)$ lies on the line. (5marks)
- b. Find the foci, vertices and asymptotes of a hyperbola with equation
- $$\frac{(x+2)^2}{9} = 1 + \frac{(y-1)^2}{4} \quad (5\text{marks})$$

3.

- a. Find the axis, vertex, focus and directrix of the parabola
- $$2y^2 + 16x - 12y + 2 = 0 \quad (6 \text{ mark})$$
- b. Let $z_1 = 2 + 2\sqrt{3}i$ and $z_2 = -1 - \sqrt{3}i$, Evaluate $3(z_1 z_2)$ (4 marks)
- c. Given that $\vec{A} = i - 3j + 2k$ and $\vec{B} = 2i + 6j$ find
- $\vec{A} \times 3\vec{B}$ (5 marks)
 - $\vec{B} \times \vec{A}$ (5 marks)

4.

- a. Check if the two line $3x - 5 = 2y$ and $4x + 5y = 1$ are parallel (4 marks)
- b. Find the foci, vertices and asymptotes of a hyperbola with equation
- $$\frac{(x+2)^2}{9} - 1 = -\frac{(y-1)^2}{4} \quad (6 \text{ marks})$$
- c. Find a unit vector that is perpendicular to both $\vec{A} = 2i - 2j - k$ and $\vec{B} = i + j + k$. What is the area of the parallelogram with \vec{A} and \vec{B} as its sides? (5 marks)
- d. Find the axis, vertex, focus and directrix of the parabola
- $$y^2 + 8x - 6y + 1 = 0 \quad (5 \text{ marks})$$

5.

- a. Write the equation of the circle $6x^2 + 6y^2 - 24x + 36y + 30 = 0$ in standard form (4 marks)
- b. Derive the equation of an ellipse and use it to find the foci and vertices of the ellipse $\frac{x^2}{16} = 1 - \frac{y^2}{25}$ (10 marks)
- c. Given $\vec{A} = 3i - 2j - 5k$ and $\vec{B} = 2i + j + k$. Find;
- $||-7\vec{A}||$ (2 marks)
 - $||2\vec{A} - 3\vec{B}||$ (2 marks)
 - $\vec{A} \cdot \vec{B}$ (2 marks)