



Kasarani Campus  
Off Thika Road  
Tel. 2042692 / 3  
P. O. Box 49274, 00100  
NAIROBI  
Westlands Campus  
Pamstech House  
Woodvale Grove  
Tel. 4442212  
Fax: 4444175

**KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR**  
**FIRST YEAR, FIRST SEMESTER EXAMINATION**  
**FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**(MATHEMATICS)**

Date: 8<sup>th</sup> April, 2024  
Time: 2.30pm – 4.30pm

**KMA 101 – INTRODUCTION TO ANALYTICAL GEOMETRY**

**INSTRUCTIONS TO CANDIDATES**

**ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS**

**QUESTION ONE (30 MARKS)**

- a) Find the equation of the line that passes through the point  $(4, -1)$  and making an angle of  $30^\circ$  with the positive x-axis. (3 Marks)
- b) Find the equation of the ellipse with center at  $(2, 3)$ , focus at  $(5, 3)$  and corresponding vertex at  $(7, 3)$ . (4 Marks)
- c) Find the angle between the lines  $2x - 3y + 7 = 0$  and  $7x + 4y - 9 = 0$ . (3 Marks)
- d) Show that  $y^2 - 4x - 4y = 0$  is an equation of a parabola and sketch it. (4 Marks)
- e) Sketch the ellipse represented by the equation  $2x^2 + 2y^2 - 4x - 2y + 2 = 0$  (4 Marks)
- f) Determine the equation of the tangent to the circle  $x^2 + y^2 - 2y + 6x - 7 = 0$  at the point  $F(-2, 5)$  (4 Marks)
- g) A line passes through the points  $(-2, 6)$  and  $(4, 5)$ . Find the equation of a perpendicular line that passes through the point  $(4, 5)$ . (4 Marks)
- h) Find the ratio in which the point  $(-11, 16)$  divides the line segment joining the points  $(-1, 2)$  and  $(4, -5)$ . (4 Marks)

### **QUESTION TWO (20 MARKS)**

- a) Find the equation of the circle that passes through the points  $(2,1)$ ,  $(0, 5)$  and  $(-1, 2)$  and hence find the centre and radius of the circle. (6 Marks)
- b) Show that  $x^2 + y^2 + 6x + 8y + 9 = 0$  is an equation of a circle. Find the center and radius of the circle. (3 Marks)
- c) Find the equation of a line tangent to the circle whose equation is  $(x + 5)^2 + (y - 2)^2 = 36$  at the point  $(-2, 6)$  which lies on the circle. (5 Marks)
- d) Determine the equation of the tangent to the circle  $2x^2 + 2y^2 - 7x - 9y - 13 = 0$  at the point  $F(3,-4)$ . (6 Marks)

### **QUESTION THREE (20 MARKS)**

- a) Find the equation of the ellipse whose foci are  $(-2, -3)$  and  $(-2,7)$  and whose major axis has length 14. (4 Marks)
- b) i) Show that  $10x^2 - 20x + 18y^2 - 108y + 82 = 0$  is an equation of an ellipse. (3 Marks)
- Hence find:
- ii) the lengths of the semi-major and semi-minor and coordinates of the vertices. (2 Marks)
- iii) Coordinates of the foci. (2 Marks)
- iv) The length and coordinates of the latera recta. (3 Marks)
- v) The eccentricity. (1 Mark)
- vi) Sketch the ellipse. (2 Marks)
- c) An architectural design for the president's office calls for it to be an elliptical-shaped oval office a major axis of 140 feet and a minor axis of 60 feet. Write an equation that models the shape of the office. (3 Marks)

### **QUESTION FOUR (20 MARKS)**

- a) Show that  $x^2 + 4x + y^2 - 4y + z^2 - 8z = 0$  is an equation of a sphere and hence find its centre and radius. (5 Marks)
- b) Find the equation of line through point  $(3,2)$  and making angle  $45^\circ$  with the line  $x-2y = 3$  (6 Marks)
- c) A satellite dish in the shape of a paraboloid is 10ft. across and 3 ft. deep. How far from the vertex at the bottom of the dish should the receiver be placed? (4 Marks)
- d) Given the focus of a parabola is at  $F(2,3)$  and the directrix is the line  $y-5=0$ . Find the equation of the parabola. (5 Marks)

### **QUESTION FIVE( 20 MARKS)**

- a) Given the equation  $4y^2 + 40y - x^2 - 4x + 60 = 0$ . Find;
- i) the lengths of the semi-major and semi-minor and coordinates of the vertices. (4 Marks)
- ii) coordinates of the foci. (2 Marks)
- iii) the length and coordinates of the latera recta. (3 Marks)
- iv) the equations of the asymptotes. (2 Mark)
- v) Sketch the curve. (3 Marks)
- b) Given the points  $P(2,1)$ ,  $Q(2,3)$ , and  $R(2,4)$ , determine the angle between lines  $PQ$  and  $QR$ . (3 Marks)
- c) A point divides internally the line- segment joining the points  $(8,9)$  and  $(-7,4)$  in the ratio  $2 : 3$ . Find the co-ordinates of the point. (3 Marks)