

MACHAKOS UNIVERSITY
University Examinations 2022/2023
SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS AND STATISTICS
FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF
BACHELOR OF EDUCATION SCIENCE
BACHELOR OF EDUCATION ARTS

SMA 103: ANALYTICAL GEOMETRY

DATE:..... TIME:.....

INSTRUCTIONS: Answer QUESTION ONE and any other TWO QUESTIONS

QUESTION ONE 30 MARKS

- a) Find the y and the x intercepts for the line through points (- 3, - 28) and (7,52) (5 marks)
- b) Find the equation of the line perpendicular to the line $y = 5x - 9$ and passes through point (1,14). (5 marks)
- c) Determine the parametric equation of the parabola $y^2 - 12y - 20x + 76 = 0$ (5marks).
- d) Calculate the focus, equation of directrix and length of latus rectum of the parabola $5y^2 = 24x$ (5 marks)
- e) Convert the Cartesian coordinates of the point (- 4, 3) into Polar coordinates (4 marks)
- f) Find the equation of the circle with center $C(2,0)$ and radius $r = 7$. (3 marks)
- g) Calculate the eccentricity of the hyperbola $\frac{x^2}{25} - \frac{y^2}{9} = 1$ (3 marks)

QUESTION TWO (20 MARKS)

- a) Determine whether the point $P(4,5)$ lies on, inside or outside the circle $x^2 + y^2 = 35$. (5mks)

b) Find the tangent to the circle at the point $P(7,12)$ if the equation has center $C(4,8)$.
(5marks)

c) Determine the angle between the lines $y = 2x + 5$ and $y = 12x - 1$ (5 marks)

d) Find the point of intersection of the lines

$$y + x - 3 = 0$$

$$x - 3y + 6 = 0 \quad (5mks)$$

QUESTION THREE (20 MARKS)

a) Determine the polar equation of the parabola $x^2 = -12(y - 3)$ (5 marks)

b) Determine the vertex, the axis of symmetry, the focus, the equation of the directrix and the length of the latus of the parabola $y^2 - 6y - 12x + 9 = 0$ (5marks)

c) Find the equation of the tangent to the parabola $y^2 - 2y - 12x - 23 = 0$ at the point

$$p\left(-\frac{7}{4}, 10\right) \quad (5mks)$$

d) Find the parametric equation of the parabola $y^2 - 12y - 20x + 76 = 0$ (5mks)

QUESTION FOUR (20 MARKS)

a) Find the equation of and sketch the ellipse whose eccentricity is $\frac{3}{2}$ center at origin, directrix $x = 6$ and focus $(1,0)$ (10mks)

b) Find the equation of the tangent and equation of the normal at point $P(-1,2)$ of the ellipse

$$x^2 + 4y^2 + 2x - 8y + 1 = 0 \quad (10mks)$$

QUESTION FIVE (20 MARKS)

a) Consider the hyperbola whose equation is given as $y^2 - x^2 - 2y + 4x - 7 = 0$. Sketch the hyperbola labelling foci and vertices. (10marks).

b) Find the coordinates of the foci, the eccentricity, the length of the latus rectum and the

$$\text{directrix of the hyperbola } \frac{x^2}{36} - \frac{y^2}{4} = 1 \quad (5mks)$$

c) Write in Cartesian form the equation $r = 9 \csc \theta$ (5mks)