



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

.....YEAR SEMESTER SPECIAL /SUPPLEMENTARY EXAMINATION FOR
BACHELOR OF

SMA 103: ANALYTICAL GEOMETRY

DATE:

TIME:

INSTRUCTIONS TO CANDIDATES

Attempt question *one (compulsory)* and any other *two questions*.

QUESTION ONE (30 MARKS)

- a) Show that every line has an equation of the form $Ax + By = C$ where A and B are not both 0, and that, conversely, every such equation is the equation of a line. (3 marks)
- b) Prove that the circle whose equation is $x^2 + y^2 - 4x + 10y - 2 = 0$, is a real circle (3 marks)
- c) Solve the equation $2\sin^2 \theta = \sin \theta$ for the values of θ from 0° to 360° (4 marks)
- d) Calculate the focus, equation of directrix and length of latus rectum of the parabola $5y^2 = 24x$ (5 marks)
- e) Calculate the eccentricity of the hyperbola $\frac{x^2}{25} - \frac{y^2}{9} = -1$ at the point $p(3, \frac{12}{5})$ (4 marks)
- f) Consider the polar equation $r = \frac{5}{4 - 3\cos \theta}$. Express the equation in its standard form and state the value of e (5 marks)
- g) Calculate the equation of the tangent to the parabola $y^2 + 14y - 12x + 13 = 0$ at the point $t = 2$ (3 marks)

QUESTION TWO (20 MARKS)

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

QUESTION THREE (20 MARKS)

- a) Determine the equation of the tangent to the circle $x^2 + y^2 = 5$ from the point (8,3) (10 marks)
- b) Calculate the distance from the point (5,8) to the circle $x^2 + y^2 + 2x + 6y + 3 = 0$ (5 marks)
- c) Determine the angle between the lines $y = 2x + 5$ and $y = 12x - 1$ (5 marks)

QUESTION FOUR (20 MARKS)

- a) Sketch the ellipse and label the axes, foci and vertices described by the equation $9y^2 + 4x^2 + 18y + 8x - 23 = 0$ (10 marks)
- b) Determine the polar equation of the parabola $x^2 = -12(y - 3)$ (10 marks)

QUESTION FIVE (20 MARKS)

- a) Calculate the general and normal equation of the line through the point (2,5) and (3,7) (6 marks)
- b) Prove that $\sin 4\theta = 4\cos^3 \theta \sin \theta - 4\sin^3 \theta \cos \theta$ (6 marks)
- c) Solve the equation $2\cos x - 2\sqrt{3}\sin x = 3$ (8 marks)