MACHAKOS UNIVERSITY

University Examinations for 2017/2018 academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR EXAMINATION FOR DEGREE IN BACHELOR OF EDUCATION (ARTS)

SMA 103: ANALYTICAL GEOMETRY

INSTRUCTIONS

ATTEMPT QUESTION ONE AND ANY TWO QUESTIONS

QUESTION ONE 30 MARKS

a) Convert the Cartesian coordinates of the point $(-4,3)$ into Polar coordinates (4 marks)

b) Prove that $\frac{1+\cot\theta}{1+\tan\theta} = \cot\theta$ (4 marks)

c) Find the distance between the points $(2,1)$ and $(-3,8)$. (2 marks)

d) Find the gradient of the line passing through the points $(3,7)$ and $(-1,23)$ (3 marks)

e) Find the distance from point P(-2, -3) to the line $8x + 15y - 24 = 0$. (4 marks)

f) Determine the radius and the coordinates of the circle given by the equation

$x^2 + y^2 - 8x - 2y + 8 = 0$ (5 marks)

g) Derive the equation of the parabola with its vertex at (3, 2) and its focus at (5, 2).

(3 marks)

h) Find the focus, the equation of the directrix, the length of the latus rectum for the parabola (5 marks)

QUESTION TWO

a) Find the general and normal equations to the line through points (2,5) and (3,7) (8 marks)

b) Determine the equation of the hyperbola whose eccentricity is $\frac{3}{2}$ and the foci are $f'(-2,0)$ and $f(2,0)$ (4 marks)

c) Prove that $\sqrt{\left(\frac{1-\sin x}{1+\sin x}\right)} = \sec x - \tan x$ (6 marks)

d) A triangle ABC has sides $a = 9.0cm$ $b = 7.5cm$ and c=6.5cm. Determine its three angles and its area (2 marks)

QUESTION THREE

a) Find the diretrix, eccentricity & foci of the ellipse $4x^2 + 9y^2 = 36$. Hence sketch a graph (8 marks)

b) Solve the equation in the range $-180^\circ \leq x \leq 360^\circ$ (6marks)

$$\cos\left(\frac{x}{2}\right) - 2\sin^2\left(\frac{x}{2}\right) = -1$$

c) Solve $6\cos^2\theta + 5\cos\theta - 6 = 0$ for values of A in the range $0^\circ \leq A \leq 360^\circ$ (6 marks)

QUESTION FOUR

a) Find the coordinate of the foci, the eccentricity, the length of the latus rectum and the direction of the hyperbola

$$\frac{x^2}{36} - \frac{y^2}{4} = 1$$ (8 marks)

b) Sketch the circle given by the equation $x^2 + y^2 - 4x + 6y - 3 = 0$ (6 marks)

c) Prove that $\frac{\tan x + \sec x}{\sec x(1 + \tan x / \sec x)} = 1$ (6 marks)

QUESTION FIVE

a) Find the angle between the lines $y = 2x + 5$ and $y = 12x - 1$ (4 marks)

b) Find the focus, the Centre, the eccentricity and diretrix of the ellipse whose equation is $x^2 + 4y^2 + 4x - 24y + 24 = 0$ (8 marks)

c) Find the normal equation of the line with $p = 6$ and $w = 30^\circ$ (3 marks)

d) A circle has the equation $x^2 + y^2 - 4x + 10y = 8$. Find the equation of the tangent and the normal at (3, 1). (5 marks)