MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2015/2016

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION WITH INFORMATION TECHNOLOGY

MAIN CAMPUS

MMA 101: ANALYTIC GEOMETRY

Date: 29th April, 2016 Time: 2.30 - 4.30pm

INSTRUCTIONS:

- **Answer Question ONE and any other TWO Questions.**
- **Start each question on a fresh page**
- **Indicate question numbers clearly at the top of each page.**
- **Scientific calculators may be used**
- **Observe further instructions from the booklet**

Question 1 [30 Marks]

(a) Show that

$$\sin 3x = 3\sin x - 4\sin^3 x$$

[6 Marks]

(b) Find the equation of a line given by the coordinate (x,y) where

$$x = 3(t - \sin t) \qquad y = 3(1 - \cos t) \quad \text{for all } t = \frac{\pi}{2}$$

[6 Marks]

(c) Identify the centre,foci and vertices of the ellipse given

$$\frac{(x-2)^2}{4} + \frac{(y+1)^2}{25} = 1$$

[4 Marks]

(d) Express the equation $xy = 1$ interms of x'y' coordinates by rotating the axes through 45° angle. Discuss the new equation [6 Marks]

(e) Complete the square and and describe the geometric shape

$$x^2 + y^2 + z^2 - 4x + 8y - 10z + 36 = 0$$

[4 Marks]

(f) Find the polar coordinate equation corresponding to conic section given below

$$x^2 - y^2 = 9$$

[4 Marks]

Question 2 [20 Marks]

(a) Derive the formula for choosing an appropriate angle θ through which to rotate the axes [10 Marks]

(b) Show that the equation

$$x^2 - 4y^2 + 2x + 8y - 7 = 0$$

represents a hyperbola. Find its center, asymptotes and foci [6 Marks]

(c) Find an equation of a parabola with focus at the point (0,2) and whose directrix is the line y=-2 [4 Marks]

Question 3 [20 Marks]

(a) Show that the points

$$\left[\left(\frac{3+t^2}{1+t^2}\right), -\left(\frac{t-1}{1+t^2}\right)\right] \quad t \in \mathbb{R}$$

[10 Marks]

(b) Derive the standard form equation of a hyperbola [10 Marks]

20

Question 4 [~~18~~ Marks]

(a) Show that

$$\cos\alpha\cos\beta = \frac{1}{2}[\cos(\alpha - \beta) + \cos(\alpha + \beta)]$$

Hence solve

$$\cos 3\theta \cos\theta$$

[5 Marks]

(b) Using rotation of axes, analyze the given equation

$$3x^2 + 2xy + 3y^2 = 16$$

[10 Marks]

(c) Transform the equation

$$r = 10\cos\theta$$

into rectangular coordinate hence, find its area [5 Marks]

Question 5 [20 Marks]

(a) Solve the given quadrate polynomial

$$10\cos^2 x - 12\cos x - 7 = 0$$

[5 Marks]

(b) Find the rectangular equation of the curve whose parametric equations are given as

$$x = a\cos t, \quad y = a\sin t \qquad -\infty < t < \infty$$

where $a > 0$ is a constant [5 Marks]

(c) In 2008 the cost of an average home in Maseno was Kshs 251,364. In 2009 the cost was Kshs 222,960. Assuming the relationship between time and cost is linear, develop a formula for predicting the cost of average home in 2010 and hence find the cost in 2010. [5 Marks]

(d) A new car dealer offers three options to his customers: power steering, high performance engines and air conditioning. The dealer lister the following information in his early tax records.
200 cars sold
75 without any options
10 with three options
40 included high performance engines and air conditioning
30included power steering and and air conditioning
20 included power steering and and high perfomance
80 included power steering
60 included high performance engines
70 included air conditioning
Explain why the Buraeu of Internal revenue orderd a complete audit of the dealers records [5 Marks]

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