MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE, BACHELOR OF EDUCATION AND BACHELOR OF ARTS WITH INFORMATION TECHNOLOGY

MAIN CAMPUS

MMA 101: ANALYTIC GEOMETRY

Date: 8th December, 2016   Time: 8.30 - 11.30 am

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 on the answer booklet.

Question 1   [30 Marks]

(a) Show that the root of the quadratic equation

$$ax^2 + bx + c \quad \text{is} \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

[5 Marks]

(b) Transform the polar equation

$$r = 2\sin\theta$$

to rectangular form and identify the graph.   [5 Marks]

(c) Mercedes wants to invest long term, the Kshs 30,000 she got from her sponsor. Over the next 10 years she hopes to get an income of Kshs 2000 per year based on yearly average return for 10 years. Her financial advisor recommended three funds, Elite Total Return at 5%, Elite Strategic Return at 6% and Elite High Income at 7% that would allow Mercedes to achieve her goal while providing diversification. If she chooses to invest a sum of Kshs 2,000 under Elite Total income, how much should she invest under Elite High income   [5 marks]

(d) Find the equation of an ellipse with a foci$(0, \pm 8)$ and eccentricity of $e = \frac{4}{5}$ [5 Marks]

(e) Express the equation $xy = 1$ interms of $x'y'$ coordinates by rotating the axes through $45°$ angle. Discuss the new equation.   [5 marks]

(f) Simplify the function

$$\frac{\sin 3x}{\sin x \cos x}$$

[5 Marks]

Question 2   [20 Marks]

(a) Derive the equation of an ellipse with the center at the origin[10 Marks]

(b) Analyze the equation

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

[7 Marks]

(c) Identify the conic given by the polar equation

$$r = \frac{10}{3 - 2\cos\theta}$$

[3 Marks]

Question 3   [20 Marks]

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

(b) Solve the equation

$$x^2 + \sqrt{3}xy + 2y^2 + 10 = 0$$

[10 Marks]

Question 4   **[20 Marks]**

(a) Show that the points $P(3,3)$, $Q(8,17)$ and $R(11,5)$ are vertices of a right angled triangle   [4 Marks]

(b) Evaluate

$$\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta}$$

[5 Marks]

(c) A group of people came forward to claim Kshs 1,000,000 from Pambazuka National Lottery Jackpot which the winners were to share equally. Before the Jackpot was divided, three more ticket holders showed up. As a result, the share of each of the original ticket holders was reduced by Kshs 75,000. How many ticket holders must have been in the original group   [5 Marks]

(d) Find the polar equation of the circle

$$x^2 + (y-3)^2 = 9$$

[4 Marks]

(e) Identify the equation without rotation of axes

$$8x^2 - 12xy + 17y^2 - 4\sqrt{5}x - 2\sqrt{5}y - 15 = 0$$

[2 Marks]

Question 5   **[20 Marks]**

(a) Determine the locus of a point $P(x,y)$ if its distance $|AP|$ from $A(7,1)$ is twice the distance $|BP|$ from $B(1,4)$ [5 Marks]

(b) Analyze the equation

$$4x^2 - 24xy - 3y^2 - 156 = 0$$

[10 Marks]

(c) Identify the equation

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

[5 Marks]

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