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UNIVERSITY REGUALR EXAMINATIONS

2nd SEMESTER 2012 /2013 ACADEMIC YEAR

FOR THE DEGREE

OF

BACHELOR OF SCIENCE

(MATHEMATICS)

COURSE CODE: MAT 224

COURSE TITLE: ANALYTIC GEOMETRY

DATE: 26th August, 2013 **TIME:** 9.00am – Noon

INSTRUCTIONS TO CANDIDATES:

- Answer **ALL** questions in section A and any THREE questions from section B.

This paper consists of 3 printed pages. Please turn over.

SECTION A: COMPULSORY

QUESTION 1 (15 MARKS)

a. Determine the parametric equation of the line through the points A(1,2,-1) and B(4,3,5) (3mks)
b. Determine the x-y coordinates of the points where the following parametric equations will have horizontal or vertical tangents $x = t^3 - 3t, y = 3t^2 - 9$ (5mks)
c. Analyse the equation $9x^2 + 4y^2 + 36x - 8y + 4 = 0$ (7mks)

QUESTION 2 (16 MARKS)

a. Determine the length of the parametric curve given by the following parametric equations $x = 3\sin t, y = 3\cos t,\ 0 \le t \le 2\pi$ (4mks)
b. Convert the rectangular equation $x^2 + y^2 + 8x = 0$ in polar form and identify the graph (4mks)
c. Derive the arc length formula of the polar curve define by $r = f(\theta), \alpha \le \theta \le \beta$ (8mks)

SECTION B: ANSWER ANY THREE QUESTIONS

QUESTION 3 (13 MARKS)

a. Determine the Cartesian coordinate representation of the polar point $\left(\sqrt{3}, \pi/6\right)$ (3mks)
b. Determine the area of the region within the entire cardiod $r = 1 - \cos\theta$ (4mks)
c. Calculate the arc length of the spiral $r = e^{\theta}$ between $\theta = 0$, and $\theta = 1$ (4mks)
d. Convert the polar equation $r + 5\sin\theta = 0$ into rectangular form (2mks)

QUESTION 4 (13 MARKS)

a. i. Define a hyperbola (1mk)

ii. Draw a sketch of a hyperbola and use it to derive the equation $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$

(9mks)

b. Find the distance, to 3.d.p. between the points $P_1\left(4, \pi/4\right)$, $P_2\left(1, \pi/2\right)$

(3mks)

QUESTION 5 (13 MARKS)

a. Derive the equation of the place through the points, A, B and C whose position vectors are **a**, **b**, and **c** respectively.
(5mks)

b. Determine the equation of the plane through the points A(1, 0, 1) , b(2, 2, 0) and C(3,1,4)
(4mks)

c. Sketch the parametric curve for the following set of equations $x=t^2+t, y=2t-1, \quad -2 \le t \le 1$ (4mks)

QUESTION 6 (13 MARKS)

a. Convert $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 5\right)$ to cylindrical coordinates
(4mks)

b. Find a rectangular equation for the surface whose spherical equation is $\rho = \sin\theta \sin\phi$. Identify the surface.
(3mks)

c. Given the plane $x+y-z=1$, a point $A(1,2,-3)$ and a line L whose parametric equation is $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + t\begin{pmatrix} 3 \\ -1 \\ 4 \end{pmatrix}$. Determine the coordinates of a point B on line L such that AB is parallel to the plane.
(6mks)

QUESTION 7 (13 MARKS)

a. Find the polar equation for the path of a point P which moves in such a way that the product of its distances from the two fixed points $F_1(a, \pi)$ and $F_2(a, 0)$ is a constant say b^2.
(8mks)

b. Find an equation in rectangular coordinates of a surface whose cylindrical coordinates is $r = 4Cos\theta$. Identify the surface
(5mks)