Menofia University
Faculty of Engineering
Shebien El-koum
Academic Year : 2015- 2016
Date : 13 / 6/ 2016

Department: Basic Engg. Science
Year : 2_nd Elect.
Subject : Engg. Mathematics (1-B)
Code: BES 011
Time Allowed : 3 hours

Answer all the following questions: [100 Marks]

Q1: [50 Marks]

(a) If the origin translated to the point $(1,-2)$ and the axes are rotated by an angle $\tan^{-1}(-0.5)$, find the new equation of the equation $14x^2-4xy+11y^2-36x+48y+41=0$. (8Marks)

(b) Prove that the equation $6x^2+7xy+2y^2-11x-7y+3=0$ represents two straight lines and then find the point of intersection, the angle between them and the bisector equations. (8 Marks)

(c) Find the vertex, focus, directrix and the latus rectum of the parabola $3x^2+12x-8y=0$, then find the equation of tangent at the point $(1,4.5)$. (8 Marks)

(d) Discuss and sketch the hyperbola $9x^2-4y^2-36x+32y+8=0$, then find the foci, directrices, asymptotes equations and the length of the latus rectum. (8 Marks)

(e) Describe the locus of the point of intersection of two perpendicular tangents to the circle $x^2+y^2=r^2$. (8 Marks)

(f) Find the common tangents drawn of the ellipses $\frac{x^2}{13}+\frac{y^2}{4}=1$ and $\frac{x^2}{9}+\frac{y^2}{13}=1$. (4 Marks)

(g) Transform the following equations: (6 Marks)

(i) $(x^2+y^2)^2=a^2(x^2-y^2)$ to polar coordinates.

(ii) $r=\frac{2a}{1-\cos\theta}$ to cartesian coordinates and then classify it.

Q2: **[28 Marks]**

Find the following integrals:

(i) $\int x^4(1+x^{5/2})^{1/2}\,dx$

(ii) $\int \frac{dx}{2+3\tan x}$

(iii) $\int_0^{\pi/4} \ln(1+\tan\theta)\,d\theta$

(iv) $\int \frac{dx}{(x^2-6x+13)^2}$

(v) $\int \tan^3 x \sec^3 x\ dx$

(vi) $\int \frac{dx}{\sqrt{\sqrt{x}+1}}$

(vii) $\int \frac{x}{\sqrt{5x^2-4x}}\,dx$

Q3: **[22 Marks]**

(a) Find the area bounded by the curves $x = 1+y^2$ and $y = x-7$. (5 Marks)

(b) Find the volume generated by revolving about the x-axis, the area bounded by the curves $x^2+y^2=25$, $3x-4y=0$ and $y=0$ lying in the first quadrant. (5 Marks)

(c) Find the length of the curve $x^{2/3}+y^{2/3}=1$. If the curve is rotated about the x-axis in the first quadrant, then find the surface area of the solid generated. (7 Marks)

(d) Applying Simpson's rule, obtain an approximate value of $\int_0^1 \frac{dx}{1+x^2}$, taking four equal intervals and hence obtain an approximate value of π, correct to four decimal places. (5 Marks)

Good Luck