King Fahd University of Petroleum & Minerals

Department of Mathematics & Statistics
MATH 201 – Calculus III
EXAM I
Semester 082

March 30, 2009 **Duration: 120 minutes**

Student Name : ________________________________
ID Number : ________________________________
Section Number : ________________________________

Instructions

- Write neatly and eligibly. You may lose points for messy work.
- Show all your work.
- All types of calculators and mobiles are not allowed.

Question #	Student Grade	Maximum Points
Q.1		17
Q.2		17
Q.3		17
Q.4		17
Q.5		16
Q.6		16
TOTAL		100

Good Luck

Q.1 a) i) Find the Cartesian equation of the curve whose parametric equations are given by $x = 2\cot t$, $y = 2\sin^2 t$.

ii) Find the point where the curve intersects the y-axis.

b) Find the points on the curve $x = 6t - t^3$, $y = 3t^2$ where the tangent is parallel to the line with equation $y = 5 - 2x$.

Q.2 Consider the polar equation $r = 2 + 2\cos 2\theta$.

i) Sketch the curve of the given polar equation

ii) Find the slope of the tangent line to the polar curve at $\theta = \pi/4$

Q.3 a) Find the area of the region inside the polar curve $r = 2 + 2\sin\theta$ and outside the curve $r = 3$.

b) Set up an integral to find the area of one loop of the rose $r = 3\cos 6\theta$. (**Do Not Evaluate the Integral**)

Q.4 A sphere has equation $x^2+y^2+z^2 = 10y-16z+C$, where C is a constant.

i) Find the center of the sphere

ii) Find the radius of the sphere in terms of C.

iii) If the radius of the sphere is equal to 10, find the points where the sphere intersects the y-axis.

Q.5 Let $\vec{a} = \langle \sqrt{2}, 1, 1 \rangle$ and $\vec{b} = \langle -\sqrt{2}, 4, -1 \rangle$ be two vectors in $\mathbb{R}^3$.

i) Find the scalar projection and vector projection of $\vec{b}$ onto $\vec{a}$.

ii) Find the angle between the vectors $\vec{a}$ and $\vec{a} + \vec{b}$.

iii) If $\vec{r} = \langle x, y, z \rangle$, show that the vector equation $(\vec{r} - \vec{a}) \cdot (\vec{r} - \vec{b}) = 0$ represents a sphere.

Q.6 Find the area of the triangle with vertices $P(1,4,6)$, $Q(-2,5,-1)$ and $R(1,-1,1)$.