King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
MATH 201- Calculus-III (041)
Major Examination I (Sections 8 and 11)
October 16,2004

Time: 90 Minutes Grade: 60

Instructor : Dr. Abdul Rahim Khan

SHOW COMPLETE AND NEAT WORK FOR FULL CREDIT.

1. Find area of:

   (i) one loop of the graph of r=3 cos5θ.

   (ii) the region inside the circle $r = 1$ and outside the cardioid $r = 1 - \cos\theta$. (5+5)

2. On the cardioid r=1+$sin\theta$, find points where tangent line is vertical. (5)

3. Include all details to sketch the graph of r^2=4cosθ (5)

4. Calculate area of the surface generated by revolving the graph of $r^2 = 2\cos2\theta$ about the polar axis where $0 \leq\theta\leq\pi$. (10)

5. (i) Two spheres S_1 and S_2 are centered at the origin and are tangent to the sphere of radius 1 centered at (5,-2,3). Write equations of S_1 and S_2.

   (ii) Find 2 unit vectors that are perpendicular to the line y=-3x+1. (5+5)

6. (i) Do the vectors

$$\begin{aligned} \vec{U} &= \langle 1, -2, 1\rangle \\ \vec{V} &= \langle 3, 0, -2\rangle \\ \vec{W} &= \langle 5, -4, 0\rangle \end{aligned}$$

   lie in the same plane ? Justify.

(ii) Show that $\|\vec{U} \times \vec{V}\|^2 = \|\vec{U}\|^2\|\vec{V}\|^2 - (\vec{U}.\vec{V})^2$ (5+5)

7. Check whether the lines are parallel or skew lines:

$$L_1: \quad x = 1 + t, \quad y = -2 + 3t, \quad z = 4 - t$$
$$L_2: \quad x = 2t, \quad y = 3 + t, \quad z = -3 + 4t$$

(5)

8 Find the distance between lines.

$$L_1: \quad x = 2t, \quad y = 3 + 4t, \quad z = 2 - 6t$$
$$L_2: \quad x = 1 + 3t, \quad y = 6t, \quad z = -9t$$

(5)