

King Fahd University of Petroleum and Minerals  
Department of Mathematical Sciences  
**Math 201 (Calculus III) (062)**  
**Major Examination I (Sec # 8)**  
**March 25, 2007**

**Time: 90 Minutes**

**Marks: \_\_\_\_\_/60**

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Name: \_\_\_\_\_

ID #: \_\_\_\_\_ Serial #: \_\_\_\_\_

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**Instructions:**

1. Show complete and neat work for full credit.
2. This exam consists of (9) pages.

1. The position of two particles at time  $t$  is given by:

$$x_1 = 3 \sin t, y_1 = 2 \cos t \quad (0 \leq t \leq 2\pi)$$

$$x_2 = 3 + \cos t, y_2 = 1 + \sin t \quad (0 \leq t \leq 2\pi).$$

Check whether or not the particles will collide.

(5 points)

2. Let  $r = 5 \cos 2\theta$ . Check symmetry of this curve about  $x$ -axis,  $y$ -axis and the origin. Sketch this curve by giving necessary details. (10 points)

3. Find arc length of the cardioid  $r = 3 + 3 \cos \theta$ .

(5 points)

4. Find area of the surface generated by revolving the curve

$$x = 4\sqrt{t}, y = \frac{t^2}{2} + \frac{1}{t} \quad (1 \leq t \leq 4) \text{ about } y\text{-axis.}$$

(10 points)

5. Find area of the region that lies inside the circle  $r = 3 \sin \theta$  and outside the cardioid  $r = 1 + \sin \theta$ . (10 points)

6. (a) Let  $\vec{a} = 3\vec{i} - 7\vec{j} + 2\vec{k}$ ,  $\vec{b} = \vec{i} - 2\vec{k}$ . Calculate  $\text{proj}_{\vec{b}} \vec{a}$ . (3 points)

(b) Find the equation of a sphere with center  $(-3, 2, 7)$  and it touches the  $yz$ -plane. (2 points)

7. (a) Do the following vectors lie in the same plane? Justify.

$$\vec{u} = \langle 1, -2, 1 \rangle$$

$$\vec{v} = \langle 3, 0, -2 \rangle$$

$$\vec{w} = \langle 5, -4, 0 \rangle$$

(2 points)

- (b) Find the distance between the planes

$$z = x + 2y + 1, \quad 3x + 6y - 3z = 4.$$

(3 points)

8. Determine whether the lines  $L_1$  and  $L_2$  are parallel or intersecting. If they intersect, find the point of intersection.

$$L_1 : x = 1 + 4t, y = 5 - 4t, z = -1 + 5t$$

$$L_2 : x = 2 + 8t, y = 4 - 3t, z = 5 + t.$$

(10 points)