

**King Fahd University of Petroleum and Minerals**  
**Department of Mathematical Sciences**  
**Semester I, 2006-2007(061)**  
**MATH 201**  
**Major Exam I**

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

Student ID: \_\_\_\_\_

Section: \_\_\_\_\_

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**Note:**

FOR ALL PROBLEMS, SHOW WORK. NO CREDIT FOR ANSWERS NOT SUPPORTED BY WORK.

1. Identify the curves by transforming the given polar equation to rectangular coordinates

(a)  $r = \frac{6}{3 \cos \theta + 2 \sin \theta}$ .

(b)  $r = 5 \sec \theta$ .

2. (a) Identify the curve

$$r = \cos \theta + \sin \theta$$

by changing the equation to rectangular coordinates.

- (b) Sketch the curve.
- (c) Set up an integral for the area inside the curve  $r = \cos \theta + \sin \theta$ . (Hint: Find  $\theta$  for which  $r = 0$ ).

3. The distance between a point  $P(x, y)$  and the point  $A(1, -2)$  is two times the distance between  $P(x, y)$  and  $B(0, 1)$ . Show that the set of all such points is a circle.

4. Find all values of  $t$  for which the parametric curve has (a) a horizontal tangent line  
(b) a vertical tangent line

$$x = 2t^3 - 15t^2 + 24t + 7$$

$$y = t^2 + t + 1$$

5. (a) Let  $\vec{u} = [1, 1, 1]$  and  $\vec{v} = [1, -1, -1]$ . Find the (i) component of  $\vec{u}$  along  $\vec{v}$ , (ii) component of  $\vec{u}$  orthogonal to  $\vec{v}$ .
- (b) Draw a cube and find the cosine of the angle between  $d_1$  and  $d_2$  where  $d_1$  is a diagonal of the cube and  $d_2$  is a diagonal of a face.