King Fahd University of Petroleum & Minerals
Department of Mathematics & Statistics
Math 201 Major Exam I
The Third Semester of 2014-2015 (143)
Time Allowed: 120 Minutes

Name: _____ ID#: _____

Section/Instructor: _____ Serial #: _____

- Mobiles and calculators are not allowed in this exam.
- Provide all necessary steps required in the solution.

Question #	Marks	Maximum Marks
1		10
2		14
3		12
4		14
5		14
6		12
7		14
8		10
Total		100

Q:1 Consider the parametric equations $x = 2 + \sin t,\ y = \cos t + 1$.

(a) (5 points) Eliminate the parameter to find a cartesian equation.

(b) (5 points) Sketch the curve for $0 \leq t \leq \pi$ and mark the direction in which the curve is traced as t increases.

Q:2 (a)(7 points) Find the equation of tangent line to the curve $t = ln\ (x - t), \quad y = t\ e^t$ at $t = 0$.

(b) (7 points) Find the length of the curve

$$x = 2t - 2\sin t, \quad y = 2 - 2\cos t, \quad 0 \leq t \leq 2\pi.$$

Q:3 (a)(6 points) Write the polar equation $r = (ln\ r - ln\cos\theta)\ csc\theta$ in cartesian coordinates.

(b) (6 points) Graph the sets of points whose polar coordinates satisfy the following conditions

$$1 \leq r \leq 2 \text{ and } \frac{2\pi}{3} \leq \theta \leq \frac{5\pi}{6}.$$

Q:4 (a)(6 points) Identify the symmetries of the curve $r^2 = 4\cos\theta$.

(b) (6 points) Find the slope of the curve $r = 1 + \sin\theta$ at $\theta = \frac{\pi}{3}$.

Q:5 (14 points) Find the area of the region that lies inside both curves $r = \cos 2\theta$ and $r = \sqrt{3}\ \sin 2\theta$ for $0 \leq \theta \leq \frac{\pi}{2}$.

Q:6 (a) (6 points) Find an equation of the sphere that passes through the point $(2, -4, 3)$ and has center $(1, 2, 5)$. Describe the intersection of this sphere with the xz-plane.

(b) (6 points) If the angle between two unit vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ is $\frac{\pi}{3}$, then find the value of $|3\overrightarrow{a} - 2\overrightarrow{b}|$.

Q:7 (6 points) Find the vector projection of $\overrightarrow{a} =< 1, 1, 1 >$ onto $\overrightarrow{b} =< 2, 3, 4 >$ and the scalar component of $\overrightarrow{a}$ in the direction of $\overrightarrow{b}$.

(b) (8 points) Find a unit vector perpendicular to the plane P(1, -1, 0), Q(2, 1, -1) and R(- 1, 1, 2).

Q:8 (10 points) Find the volume of the parallelepiped determined by the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$,, and $\overrightarrow{AD}$ where

$$A(1,0,0),\ B(0,2,0),\ C(0,0,3),\ D(0,1,3).$$