METU
Northern Cyprus Campus

MATH 210 Applied Mathematics for Engineers			Final Exam			02.06.2009
Last Name: Name: Student No:			Dept/Sec: Time: 13:00 Duration: 120 minutes		Signature:	
4 QUESTIONS ON 4 PAGES					TOTAL 100 POINTS	
1	2	3	4			

Q1. (25 pts.) If soccer team **A** wins the championship, 10% of the fans supporting team **B** and 10% of the fans supporting team **C** change their minds and support team **A**. 10% of the fans supporting team **A** change their minds (due to mismanagement) and equally choose teams **B** and **C** even though team **A** wins the championship. If team **A** wins the championship year after year for a long time, calculate the proportion of fans supporting teams **A**, **B** and **C**.

Q2. (25 pts.) a) For each of the following vector fields find whether vector field $\vec{F}$ can be expressed in terms of gradient of a scalar field f (i.e., $\vec{F} = \vec{\nabla} f$)

1. $\vec{F}_1 = (3x^2 y + e^x)\vec{i} + x^3 \vec{j}$

2. $\vec{F}_2 = ze^{xz}\vec{i} + \vec{j} + xe^{xz}\vec{k}$

3. $\vec{F}_3 = \sin(2x)\vec{i} + \cos(2y)\vec{j} + (e^x + z)\vec{k}$

b) For vector fields provided in (a), evaluate the following line integrals along $y = x^2$ from (0,0,0) to (1,1,0)

1. $\int \vec{F}_1 \cdot d\vec{r} =$

2. $\int \vec{F}_2 \cdot d\vec{r} =$

3. $\int \vec{F}_3 \cdot d\vec{r} =$

Q3. (25 pts.) Consider the nonlinear equation $f(x) = -x^2 + 3x - 2 = 0$ which can be written as $x = g(x) = -x^2 + 4x - 2$. Find the range of the initial guess that will result in

a) Divergent fixed point iteration
b) Convergent fixed point iteration (Also specify which root fixed point iterations converge as a function of the initial guess x_0).

Q4. (25 pts.) a) Let $z = \cos(x)(x^2 + y^2)$, find the equation for the tangent plane at $(\frac{\pi}{2},1,0)$

b) Find the volume of the tetrahedron with vertices (1,1,1),(2,2,2),(1,-1,4) and (-2,1,5)

c) Consider a triangle with vertices (1,1,1), (2,2,2), (4,1,5). There is a light source at a great distance from the triangle. If the light rays are traveling in $-\vec{k}$ direction, find the shadow area of the triangle on the x-y plane.

d) Find a vector field $\vec{F}$ in the x-y plane which satisfies the following equations:

$\vec{\nabla} \cdot \vec{F} > 0$

$\vec{\nabla} \times \vec{F} = -\vec{k}$