Fall 2012-2013	**Quiz 2**	**Date: Nov. 22-2012**
K.Yaghi	**Math 201- Sections 9-13**	**Duration: 1 hour**

Problem 1 *(answer on page* **1** *of the booklet)*

Find the domain of the function $f(x,y,z) = \sqrt{x^2+y^2+z^2-1} + \ln(4-x^2-y^2-z^2)$. Determine if the domain of f is an open region, a closed region or neither? Also, determine if the domain is bounded or unbounded. Also find the equation of the level curve through the point $(1,1,0)$. (8 *pts*)

Problem 2 (*answer on page* **2** *of the booklet*)

Find the equations of the tangent plane and normal line to the surface $e^{xy} + \cos(xz) - \arctan(yz) + \frac{\pi}{4} = 2$ at the point $(0,1,1)$. (20 *pts*)

Problem 3 (*answer on page* **3** *of the booklet*)

Use the method of Lagrange multipliers to find the absolute maximum and minimum values of $f(x,y,z) = z - x^2 - y^2$ subject to the constraints $x+y+z=1$ and $x^2+y^2=4$. (20 *pts*)

Problem 4 (*answer on page* **4** *of the booklet*)

For each of the following limits, say if it exists or no, justifying your answer. (7+8+8 *pts)*

a) $\lim\limits_{(x,y)\to(1,0)} \frac{(x-1)^2 \ln x}{(x-1)^2+y^2}$ b) $\lim\limits_{(x,y)\to(0,0)} \frac{\sin x \sin y}{\sin^2 x + \sin^2 y}$ c) $\lim\limits_{(x,y)\to(0,0)} \frac{x^2y^2}{x^4+3y^4}$

Problem 5 (*answer on pages* ***5 and 6*** *of the booklet*)

Suppose that the directions of zero change of a function $f(x,y,z)$ at the point (1,1,0) are $\vec{i} - \vec{j}$ and $-\vec{i} + \vec{j}$. Suppose also that the derivative of the function $f(x,y,z)$ increases most rapidly at the point (2,0,1) in the direction of $A = 2i + j - k$ and the value of derivative at this point is $2\sqrt{6}$. Also suppose that

$f(1,1,0) = 3$, $f(3,1,4) = 2$, $f(2,0,1) = 6$ and $\nabla f(3,1,4) = 3i - 2j + k$.

Let $x = r + s$, $y = r - s$, $z = r^2 s$ and $w = f(x,y,z)$

(i) Find $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ at $(r,s) = (1,0)$ then estimate $w(1.1, -0.05)$. (8 *pts*)

(ii) Find the derivative of f at $(3,1,4)$ in the direction of $i + j - 4k$. (4 *pts*)

(iii) Find a line normal to the surface $w(r,s) = 3e^{rs} + \ln r$ in the $rs-plane$. (8 *pts*)

(iv) Find a plane tangent to the surface $w(r,s) = 5 + e^{t}$ in the $rst-plane$. (9 *pts*)