Spring 2015	**Quiz 2 (5)**	**Date:**
K.Yaghi	**Math 201- Section X**	**Duration: 1 hour**

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

Find the domain and the range of the function $f(x,y,z) = \sqrt[2]{-2[(x-1)^2 + y^2 + (z-3)^2 - 4]}$ 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, describe the level curves of f . (10 *pts*)

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

Consider the function $f(x,y,z) = x^3z + x^2y^2 + \sin(yz)$

(i) Find the tangent plane and normal line to the surface $f(x,y,z) = -3$ at the point $(-1,0,3)$.(10 *pts*)

(ii) Suppose that the equation $f(x,y,z) - xy = \ln(zy)$ defines z implicitly as a function of (x,y). Find $\frac{\partial z}{\partial x}$ at the point $(2,\pi,\pi)$ (4 *pts*)

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

Find all local maxima, local minima and saddle points for $f(x,y) = 2x^3 - 3y^3 + 6xy^2 - 150x$.(10 *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. (5 *pts each*)

a) $\lim_{(x,y)\to(0,0)} \cos(\frac{x^6y^5}{x^{10}+y^2})$ b) $\lim_{(x,y)\to(0,0)} \frac{x^6y^2}{x^{10}+y^5}$ c) $\lim_{(x,y)\to(0,0)} \frac{xy(e^x-1)}{y-x}$ d) $\lim_{(x,y)\to(0,0)} \frac{x^2y^2}{x^4+y^2}$

Problem 5 (*answer on page* 5 *of the booklet*)

Is $f(x,y) = \begin{cases} x\,sin\frac{1}{x^2+y^2} & (x,y) \neq (0,0) \\ 0 & (x,y) = (0,0) \end{cases}$ continous at (0,0) ? (5 *pts*)

Problem 6 (*answer on page* 6 and the last page *of the booklet*)

Suppose that the derivative of a function $f(x,y,z)$at the point (2,-3,1) decreases most rapidly in the direction of $A = 3i - 2j + k$, and that in this direction the value of the derivative is $-2\sqrt{14}$. Also suppose that $f(3,1,0) = 7$, $f(5,-2,4) = 20$, $\nabla f(3,1,0) = 3i - j$ and $\nabla f(5,2,-4) = 4i - 3j + k$.

$f(2,-3,1) = 4$.

Let $x = 3r - s$, $y = r - 4s$, $z = r^2s$ and $w = f(x,y,z)$

(i) Find the derivative of f at the point $(3,1,0)$ in the direction of $i + j + \sqrt{2}k$. (5 *pts*)

(ii) Is there a unit vector u such that $D_uf(3,1,0) = \sqrt{10}$? (3 *pts*)

(iii) Find $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial s}$ at $(r,s) = (1,0)$. (7 *pts*)

(iv) Find the directions of zero change in w at the point (r,s) = (1,0) (4 *pts*)

(v) Find a line normal to the surface $w(r,s) = 4$ in the $rs - plane$. (8 *pts*)

(vi) Find a plane tangent to the surface $w(r,s) = 7(r-s)$ in the $rs - plane$. (7 *pts*)

(vii) Find the normal line to the surface $w(r,s) = 7 - \frac{1}{t}$ in the $rst - space$. (7 *pts*)