Math 303, Worksheet #4 **Name:** ________________________
Fall 2008

1. Find the equation of the plane containing the points (1,1,1), (2,0,-1) and (-1,2,3).

Given a function $g(x, y)$, of two variable, the function $g_x(x, y)$ is the derivative of g as a function of x, where y is treated as a constant. Similarly $g_y(x, y)$ is the derivative of g as a function of y, where x is treated as a constant.

2. Let $g(x, y) = x^2 - 2xy - y^2$.

a. Compute $g_x(x, y)$ and $g_y(x, y)$.

b. Compute $g_x(1, 2)$ and $g_y(1, 2)$.

c. Describe in words the significance of $g_x(1, 2)$ and $g_y(1, 2)$.

d. Graph the function $g(x, y)$, and check that your values for $g_x(1, 2)$ and $g_y(1, 2)$ are reasonable.

3. Compute $g_x(x,y)$, $g_y(x,y)$, $g_x(2,-2)$, $g_y(2,-2)$ for each of the following.

a. $g(x,y) = x^2y^3$

b. $g(x,y) = xe^{y^2}$

4. Given a function $f(x,y)$ a point (a,b) and a 2 dimensional vector $\vec{v} = a\vec{i} + b\vec{j}$, the *directional derivative* of f in the direction of $\vec{v}$, $f_{\vec{v}}(a,b)$, is the slope of $f(x,y)$ at the point $(a,b,f(a,b))$ in the direction of $\vec{v}$. We'll see how to compute this on Friday. Use the graph of the function $f(x,y)$ to determine whether each of the following directional derivatives is positive, negative or approximately 0.

a. $f_{\vec{v}}(2,2)$, where $f(x,y) = -3y + 2y^2 - xy$, and $\vec{v} = -\vec{i} + \vec{j}$

b. $f_{\vec{v}}(2,2)$, where $f(x,y) = -3y + 2y^2 - xy$, and $\vec{v} = -\vec{i}$

c. $f_{\vec{v}}(2,2)$, where $f(x,y) = -3y + 2y^2 - xy$, and $\vec{v} = 2\vec{i} + \vec{j}$

d. $f_{\vec{v}}(0,2)$, where $f(x,y) = -3y + 2y^2 - xy$, and $\vec{v} = -\vec{i} - \vec{j}$

e. $f_{\vec{v}}(0,2)$, where $f(x,y) = -3y + 2y^2 - xy$, and $\vec{v} = -\vec{j}$

f. $f_{\vec{v}}(0,2)$, where $f(x,y) = -3y + 2y^2 - xy$, and $\vec{v} = \vec{i} + \vec{j}$