Math 208, Section 3

Exam number 1 practice problems

3. Find a vector of length 2 which is perpendicular to both

(1,1,1) amd (2,1,2).

4. Find the equation of the plane through the point

(1,2,3) which is parallel to the plane $2x - y + z = 1$.

5. Show that if the vectors $\vec{\mathbf{v}}=(a_1, a_2)$ and $\vec{\mathbf{w}}=(b_1, b_2)$ have the same length, then the vectors

$$\vec{\mathbf{v}} + \vec{\mathbf{w}} \text{ and } \vec{\mathbf{v}} - \vec{\mathbf{w}}$$

are perpendicular to one another.

1. Find the partial derivatives of the function

$$f(x, y, z) = \sin(xy) - (xy - yz)^3$$

2. Find the equation of the tangent plane to the graph of the function

$$f(x, y) = x^2 - 2xy - y^3$$

at the point (2,1,-1).

3. Find the rate of change of the function $f(x, y, z) = xy - yz + xz$, in the direction of the vector $(1/3, 2/3, -2/3)$, at the point (2,1,-2). In what direction is the function f increasing the fastest, at the point (2,1,-2)?

1. (20 pts.) Find the equation of the plane passing through the points

(1,1,1), (3,1,2), and (-1,2,1)

2. (20 pts.) Sketch the level curves of the function

$$f(x, y) = 2y + x^3 - 1$$

In what direction is f increasing the fastest at the point (2,5) ?

3. Find the partial derivatives of the following functions:

(a) (5 pts.) $f(x, y) = (x + 2y)\cos(xy)$

(b) (5 pts.) $g(u, v) = \dfrac{u^2v - 3u + 1}{u - v}$

4. (25 pts.) Find the directional derivative of the function

$$f(x, y, z) = x^2z - 3yz^3 + 2y - 1$$

along the vector $\mathbf{v}$ = (1,-1,2), at the point $\mathbf{x_0}$ = (1,0,2).

Find the equation of the plane tangent to the level surface of f passing through the point $\mathbf{x_0}$ above.

5. (15 pts.) Calculate the first and second partial derivatives of the function

$$\frac{\sin(x + y)}{y}$$