## Calculus III, Mathematics 2210-90

## Examination 2, Mar 11,13, 2004: Answers

You may use graphing calculators and a Table of Integrals. Each problem is worth 20 points. You MUST show your work. Just the correct answer is not sufficient for any points.

1. Consider the line L in the plane given by the equation 2x + 5y + 10 = 0. a) Find a base  $\{\mathbf{U}, \mathbf{V}\}$  with **U** parallel to L, and **V** counterclockwise to **U**. By "base" we mean that **U** and **V** are orthogonal unit vectors.

b) Find the equation of the line in coordinates  $\{u, v\}$  relative to the base  $\{\mathbf{U}, \mathbf{V}\}$ .

2. Write down the equations of the paraboloid of revolution  $z = x^2 + y^2$  in cylindrical and spherical coordinates.

3. a) Find the unit vector **U** in the direction of maximal change for the function  $w = x^3y^2z + xyz^2$  at the point (2,-1,2).

- b) What is  $D_{\mathbf{U}}w$  at this point?
- 4. Find the equation of the tangent plane to the surface

$$x^{1/2} + y^{1/2} - z^{1/2} = 0$$

at the point (4,9,25).

- 5. Let  $f(x, y) = x^2y^2 + x + y$ . a) Find the critical points of f.
- b) What kind of critical points are they? (maximum, minimum, saddle?)