NAME______________________________________

I_____II_____III_____IV_____V_____VI_____VII_____VIII_____ TOTAL ___________

January 31 2008 | Mathematics 206a Multivariable Calculus Examination #1 | Mr. Haines

(10) I. Give a parametric equation of the line segment connecting the point (1, 2, 3) and the point (2, 3, 4) . This is a line segment of finite length, so be sure to put the proper limits on the parameter.

(10) II. Give a coordinate equation for the plane containing the point (1, 2, 5) which is perpendicular to the cross product of the vectors $\mathbf{v}_1 = \mathbf{i} + \mathbf{j} + \mathbf{k}$ and $\mathbf{v}_2 = \mathbf{i}$.

(20) III. Let the function $f : \Re^2 \to \Re$ be given by the rule $f(x, y) = \sqrt{x^2 + y^2}$.

A. Sketch a graph or describe the graph of $z = f(x, y)$ in words, mentioning what the surface looks like near the point (0, 0, 0).

B. $\dfrac{\partial f}{\partial x}(x, y) =$

C. $\dfrac{\partial f}{\partial y}(x, y) =$

D. Explain why $\dfrac{\partial f}{\partial x}(0,0)$ and $\dfrac{\partial f}{\partial y}(0,0)$ are not defined.

E. Sketch the graph of the intersection of the graph of f with the plane $x = 0$.

F. Show that $\lim\limits_{(x,y)\to(0,0)} \dfrac{\partial f}{\partial y}(x, y)$ does not exist by computing the limit from both directions along the line $x = 0$.

(16) IV. The plane P has equation $x + y + z = 0$.

A. Give a unit vector that is perpendicular to P .

B. Give a point that is in P .

C. Give the components of two non-parallel vectors which are perpendicular to the normal to P .

D. Give a parametrization of P.

(10) V. The points (1, 1), (2, 3), (5, 4), and (6, 6) are the four corners of a parallelogram in $\Re^2$. What is the area of that parallelogram?

(15) VI. Give examples of:

A. The equation of any line in $\Re^4$.

B. Two orthogonal vectors in $\Re^5$.

C. A negative definite quadratic form in three variables.

(10) VII. Suppose $\mathbf{A} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}$ and $\mathbf{T} : \Re^2 \to \Re^2$ is a linear transformation with the formula **T** (**x**) = **Ax .** Suppose **a** = 3**i** + 2**j** .

A) $\mathbf{T}^{-1}(\mathbf{a}) =$

B) $\mathbf{T}(\mathbf{T}^{-1}(\mathbf{a})) =$

(9) VIII. The graphs of the level surfaces for the function $f : \Re^3 \to \Re$ with rule $f(x, y, z) = x^2 + y^2 - z$ are in $\Re^3$. Try as best you can to describe in words or pictures the level surfaces for c = -1, c = 0, and c = 1.