NAME____

I____II_____III____IV____V____VI____VII____VIII____IX___TOTAL _________

March 6 2006	Mathematics 206a Multivariable Calculus Examination #2	Mr. Haines

(15) I. Suppose R is the region in the xy-plane bounded by x = 0, x = 2, y = 0, and y = x^2 .

Suppose $f(x) = x^2 + y^2$.

Set up and evaluate <u>two</u> iterated integrals which give the volume of the solid above the region R and under the surface z = f(x, y) :

A. Integrate first with respect to *y* and then with respect to *x*.

B. Integrate first with respect to *x* and then with respect to *y*.

(10) II. Suppose $\mathbf{f}(x, y, z) = (x^2 y^5, xyz)$ and $\mathbf{a}$ = (1, 1, 1)

A) Calculate the Jacobian matrix of $\mathbf{f}$ at $\mathbf{a}$.

B) Calculate the total derivative of $\mathbf{f}$ at $\mathbf{a}$

(10) III. Suppose $\mathbf{F} : \Re^2 \to \Re^3$ with rule $\mathbf{F}(x, y) = (xy, y, x)$
and $\mathbf{G} : \Re^3 \to \Re^1$ with rule $\mathbf{G}(x, y, z) = x^3 + y^3$.

A. Calculate the Jacobian matrix of the function **F** at the point (1, 1).

B. Calculate **F** (1, 1) .

C. Calculate the Jacobian matrix of the function **G** at the point **F** (1, 1).

D. Calculate the Jacobian matrix of the function $\mathbf{G} \circ \mathbf{F}$ at the point (1, 1).

(10) IV. Suppose $f:\Re^3 \to \Re$ with rule $f(x,y,z) = x + y + z^5$

A) Calculate the gradient of f at (1, 1, 1).

B) Calculate the directional derivative of f at (1, 1, 1) in the direction parallel to the vector (1, 2, 3).

(10) V. For the vector field $\mathbf{F}(x,y,z) = (yz, xz, xy)$

A) div **(F) =**

B) curl **(F) =**

(15) VI. For the function $f(x, y, z) = x^3 + y^2 + z$ at the point (0, 0, 0) compute:

A) The Hessian matrix.

B) The Hessian form.

C) The second-degree Taylor polynomial.

(10) VII. Compute the critical points, if any, or the function $f:\Re^2 \to \Re$ with rule $f(x,y)=(x^2-1)e^y$. If there are any, test them for local extrema. If there are none, state why.

(10) VIII. C is a curve in Euclidean 3-space connecting the points (0, 0, 0) and (1, 1, 1) parametrized by $\mathbf{f} : [0,1] \to \Re^3$ with rule $\mathbf{f}(t) = (t^2, t^2, t^2)$.

A. Compute $\mathbf{f}(0)$.

B. Compute $\mathbf{f}(1)$.

C. Compute the length of the curve C parametrized by $\mathbf{f}$.

(10) IX. C is the straight line segment in Euclidean 3-space that connects the points (1, 2, 0) and (2, 3, 2)

$\mathbf{F}:\Re^3 \to \Re^3$ has rule $\mathbf{F}(x, y, z) = (-x + y + z, x - y + z, x + y - z)$.

Compute $\int_C \mathbf{F} \bullet d\mathbf{x}$.