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March 6, 2008

Mathematics 206a
Multivariable Calculus
Examination #2

Mr. Haines

(10)I. Derivatives

A. Suppose $\mathbf{f}(x, y, z) = (x + e^z + y, yx^2)$ and $\mathbf{a} = (1, 1, 0)$. Calculate the total derivative of $\mathbf{f}$ at $\mathbf{a}$.

B. Suppose $\mathbf{g} : \Re \to \Re^3$ with rule $\mathbf{g}(t) = (6t, 3t^2, t^3)$ and f:$\Re^3 \to \Re$ with rule $f(x, y, z) = e^{xyz}$. Use the Chain Rule to calculate $(f \circ \boldsymbol{g})'(1)$ **.**

(10)II. If $f:\Re^2 \to \Re$ has rule $f(x, y) = \ln\sqrt{x^2 + y^2}$, calculate the directional derivative of f at (2, 0) in the direction parallel to the vector 2**i** + **j**.

(10) III. For the vector field $\mathbf{F}(x, y, z) = \left(x^2 y, z, xyz\right)$

A. div (**F**) =

B. curl (**F**) =

(10) IV. Find the equation of the tangent plane to the surface $x^2 + 2y^2 + 3xz = 10$ at the point (1, 2, 1/3).

(10) V. Suppose that a mountain has the shape of an elliptic paraboloid with equation $z = 4 - x^2 - 2y^2$. If a marble were released at (1, 1), 1), in what direction in the xy-plane would it begin to roll?

(10) VI. Find the critical points of $f(x,y)=e^{1+x^2-y^2}$ and determine whether they are local maxima, local minima, or saddle points.

(10) VII. Let C be the path in $\Re^4$ parametrized by $\boldsymbol{f}\,(t)=(\cos t,\sin t,\cos 2t,\sin 2t)$ starting at t = 0 and ending at t = π . Compute the length of C.

(10) VIII. Suppose C is the helical path parametrized by $\boldsymbol{f}(t) = (\cos t, \sin t, t)$ starting at t = 0 and ending at t = 2π.

A. If $F : \Re^3 \to \Re$ with $F(x, y, z)$ = x + y + z^2 , Compute $\int_C F dL$.

B. If $\mathbf{F} : \Re^3 \to \Re^3$ with $\mathbf{F}(x, y, z)$ = x**i** + y**j** + z^2 **k** . Compute $\int_C \vec{F} \bullet d\vec{x}$.

(10) IX. If S is the solid bounded below by the paraboloid $z = x^2 + y^2$ and above by the plane $z = 1$, set up but do not evaluate an iterated integral whose value is the triple integral $\iiint_S f(x, y, z)dV$.

(10) X. Compute the value of the triple integral of $f(x, y, z) = xyz$ over the box $[0,1]\times[0,1]\times[0,1]$.