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March 12 2010

Mathematics 206
Multivariable Calculus
Examination #2

Mr. Haines

(10)I. Suppose $F : \mathbf{R}^2 \to \mathbf{R}$ with rule $F(x, y) = xy$
and that $\boldsymbol{G} : \mathbb{R} \to \mathbf{R}^2$ with rule $G(t) = (t, t^2)$. Use the chain rule to:

A. calculate the Jacobian matrix of the function ***G*** o *F* at the point (2, 1).

B. calculate the derivative of the function ***G*** o *F* at the point (2, 1).

C. calculate the Jacobian matrix of the function *F* o ***G*** at 1.

D. calculate the derivative of the function *F* o ***G*** at 1.

(10) II. Find the equation of the tangent plane at the point (0, -1, 2) to the surface whose equation is $x^3 + 12y + 3z^2 = 0$.

(10) III. Suppose that $\boldsymbol{F} : \mathbf{R}^3 \to \mathbf{R}^3$ with rule $F(x, y, z) = (x^3, x^2y^2, xz^2)$.

A. Calculate div ***F***

B. Calculate **curl *F***

(10) IV. Consider the path $\boldsymbol{f}: \mathbb{R} \to \mathbf{R}^2$ with $\boldsymbol{f}(t) = (e^{-t}cost, e^{-t}sint)$ for $0 \leq t \leq 1$.

A. Give an integral that computes the total length of this path.

B. Calculate the value of this integral.

(10) V. Let $f(x, y) = x^2 + y^3$.

A. Calculate the First Taylor polynomial for f at $\mathbf{a} = (1, 2)$.

B. Calculate the Second Taylor polynomial for f at $\mathbf{a} = (1, 2)$.

(10) VI. Evaluate: $\int_0^1 \int_0^z \int_0^y z \, dx dy dz$.

(10) VII. Suppose $f(x, y, z) = x^2 y^3 + xy - z - 3y$ and **a** = (1, 1, 1).

Calculate the directional derivative of f at **a** in the direction parallel to **x** = (1, 2, 2)

(10) VIII. Set up but **do not evaluate** an iterated integral that gives the volume of the solid below the surface $x^3 + y^3 + z = 9$ and above the right triangle with vertices (0, 0), (1, 0), and (1, 2)

(10) IX. The point (0, 2) is a critical point of $f(x, y) = 2x^2 + x^2 y + y^2 - 4y$. Use the Second Derivative Test to determine whether (0, 2) is a local minimum, a local maximum, a saddle point, or none of these.

(10) X. Evaluate the line integral $\int_C \boldsymbol{F}(x, y, z) \cdot d\boldsymbol{x}$ where $\boldsymbol{F}(x, y, z) = (y, z, x)$ if

A) C is the straight line segment from (0,0,0) to (1,1,1) .

B) C is the straight line segment from (1,1,1) to (0,0,0) .