SPRING 2008 — MA 227 — TEST 4
APRIL 21, 2008

Name: ______________________________

1. Part I

There are 6 problems in Part 1, each worth 4 points. Place your answer on the line to the right of the question. Only your answer on the answer line will be graded.

(1) Compute div $\mathbf{F}$ when $\mathbf{F}(x, y, z) = \langle \sin(xz), e^{xy}, yz \rangle$.

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(2) Find the curl of the vector field $\mathbf{F}(x, y, z) = \langle xyz, \sin(xz), z \rangle$.

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(3) Compute ∇f when $f = 2x^2 - xy + z^2$.

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(4) Argue if the vector field $F(x, y) = \langle 2x, -xy \rangle$ is conservative.

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(5) Find a function f such that $\nabla f = \langle 4xy^{\frac{5}{2}}, 5x^2y^{\frac{3}{2}} \rangle$.

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(6) Evaluate the line integral $\int_C 3ds$ where C is a segment of the straight line connecting the points (-1,1) and (1,3).

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2. Part II

There are 3 problems in Part 2, each worth 12 points. On Part 2 problems partial credit is awarded where appropriate. Your solution must include enough detail to justify any conclusions you reach in answering the question.

(1) Let C be the boundary of the unit square (with vertices at $(0,0)$, $(1,0)$, $(1,1)$, and $(0,1)$) oriented counterclockwise. Evaluate

$$\int_C (y^2\,dx - xy\,dy)$$

by two methods: directly as a line integral and using Green's Theorem.

(2) Find the work done by the force field $\mathbf{F} = 2x\,\mathbf{i} + 3y\,\mathbf{j}$ on a particle that moves along a line segment from the point $(1,1)$ to the point $(3,5)$.

(3) Find the surface area of that part of the surface $\mathbf{r}(u,v) = \langle u, u+2v, v^2\rangle$ where $0 \le u \le 2,\ 0 \le v \le 1$.