Calculus for Applications / MAT 3243
Midterm 2 / December 1, 1999 / Instructor: D. Gokhman

Name: _____

Please show all work and box the answers, where appropriate.

1. (10 pts.) Let $f(x, y, z) = xyz$, $a = (-1, 2, 0)$, $u = (1, 2, -2)$.
   Find $D_u(f)(a)$ — the directional derivative of f at a along u.

2. (10 pts.) Find an equation for the plane tangent to $yz - x^2 = 1$ at $(1, 2, 1)$.

3. (10 pts.) Let $g(x, y) = \cos(x^2) + xy^2$ and $f(u) = \begin{bmatrix} u^2 + 1 \\ e^u \end{bmatrix}$.
   Find $f \circ g$, $g \circ f$, $D(f)$, $D(g)$, $D(f \circ g)$, and $D(g \circ f)$.

4. (10 pts.) Consider a curved segment $s(t) = (t^{3/2}, t)$, $0 \le t \le 1$.

   (a) Find vectors tangent to the curve at each of the endpoints.
   (b) Sketch.
   (c) Find the arclength.

5. (10 pts.) Let $F(x, y) = (y^2, xy)$. Integrate $F \cdot ds$ along the straight line segment from $(1, 1)$ to $(3, 2)$.

6. (10 pts.) Let $F(x, y, z) = (x + z, z, x + y)$. Find a function $f(x, y, z)$ such that $D(f) = F$ and use it to integrate $F \cdot ds$ along an arbitrary path from the origin to $(1, -1, 2)$.

1	2	3	4	5	6	total (60)	%