Calculus for Applications, MAT 3243
Midterm, October 16, 1996
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Name: _____

Show all work. Box your answers.

1. For the following functions f compute $f(\hat{\imath})$, $f(\hat{\jmath})$, and $f(2\hat{\imath} - 3\hat{\jmath})$:
   (a) $f\colon \mathbf{R}^2 \to \mathbf{R}$ is orthogonal projection to $u = (2, -1)$, i.e. $f(v) = \mathrm{comp}_u v$.
   (b) $f\colon \mathbf{R}^2 \to \mathbf{R}^2$ is clockwise rotation by $\dfrac{\pi}{2}$.
2. For the following functions f compute the derivative matrix $D(f)$.
   (a) $f(x, y, z) = (x + y^2 + z^3, xy^2z^3)$
   (b) $f(x, y) = (\cos(xy), ye^x, x + y)$
3. Let $f\colon \mathbf{R}^2 \to \mathbf{R}$ be given by $f(x, y) = xy^2$.
   (a) Find the equation of the plane tangent to the graph of $z = f(x, y)$ at $(1, -1, f(1, -1))$.
   (b) Find the slope of this plane in the direction of $(2, 1)$, i.e. the directional derivative of f at $(1, -1)$ along $(2, 1)$.
4. Evaluate the following path integrals after parametrizing the given path.
   (a) $\int 2x^2y\,dx - xy^2\,dy$ along the straight line segment from $(0, 0)$ to $(-1, 2)$.
   (b) $\int y\,dx - x\,dy$ once around the unit circle counterclockwise.

1	2	3	4	total