Math 174 Exam II Name:

1. (10) Find the directional derivative of $f(x, y, z) = z\ln(x^2 + y^2 - 3)$ at $(2, 2, 5)$ in the direction of $3\mathbf{j} + 4\mathbf{k}$.

2. (10) Let (x, y) be rectangular coordinates and (r, θ) be polar coordinates. Compute $(\partial r/\partial x)_y$ when $x = 3$ and $y = 4$.

3. (10) Find the equation of the tangent plane to the surface given by $x^2 + 3xy^3z = 1$ at $(x, y, z) = (1, 0, 1)$.

4. (10) Find the equation of the tangent plane to the surface given by $z = x^2 + 3xy^3 - 1$ at $(x, y, z) = (1, 0, 0)$.

5. (20) For the function $f(x, y) = x^3 - 6xy + y^3$, find and classify all relative maxima, minima, and saddle points.

6. (20) For the function $f(x, y) = x + 2xy + y^2$, find the points in the rectangle $\{(x, y) : -1 \leq x \leq 1, 0 \leq y \leq 2\}$ where f has its absolute maximum and absolute minimum.

7. (20) Use the linear approximation at $(1, 0)$ to estimate $f(x, y) = x + \ln(x^2 + \tan y)$ at $(x, y) = (3/4, 1/4)$. Do not estimate the error.