EXAM 3 - MATH 251
YOUR NAME:_____

Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Consider $f(x, y, z) = x^3 + yz^2$, where $x = u^2 + v$, $y = u + v^2$ and $z = uv$. Calculate $\dfrac{\partial f}{\partial u}$ and $\dfrac{\partial f}{\partial v}$ at $(u, v) = (-1, -1)$.

2. Find $\dfrac{\partial w}{\partial z}$ if w is defined implicitly as a function of x, y and z by

$$x^2 w + w^3 + wz^2 + 3yz = 0.$$

3. Calculate the directional derivative of $f(x, y, z) = xe^{-yz}$ in the direction of the vector $\mathbf{v} = \langle 1, 1, 1 \rangle$ at the point $P = (1, 2, 0)$.

4. Find the tangent plane and the normal line to the surface $3z^3 + x^2y - y^2x = 1$ at the point $P(1, -1, 1)$.

5. Find the local minima, local maxima and saddle points of the function

$$f(x, y) = x^3 + y^3 - 12xy.$$