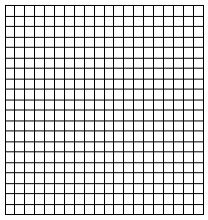
MAT 261 Exam III **Name** _____

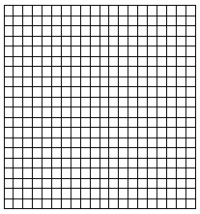
Problem	Score
1 (20 pts)	
2 (30 pts)	
3 (25 pts)	
4 (25 pts)	
Total (100 pts)	

1. Functions (20 pts)

a. State and sketch the domain of the function $f(x,y) = \sqrt{x+y}$.



b.Sketch and label at least 5 level curves for the function $f(x,y) = 1 - x^2$.



c. Sketch the function in part b.

d. Show that $\lim_{(x,y)\to(0,0)} \frac{x^2 y}{x^3+y^3}$ does not exist.

2. Partial Derivatives (30 pts)

a. Let $g(x,y) = x^5 + 3x^3y^2 + 3xy^4$.

i) Find $\frac{\partial g}{\partial x}$.

ii) Find $\frac{\partial^3 g}{\partial x^2 \partial y}$.

b) For $x^2 + y^2 + z^2 = xz$ determine $\frac{\partial z}{\partial x}$.

c) Find $\frac{\partial z}{\partial t}$ for $z = x^2 + xy + y^2$, $x = s + 2t,\ y = st$.

d) Draw a tree diagram for the chain rule for $u = u(x,y,z),\ x = x(s,t),\ y = y(s,t),\ z = z(s,t)$. Label <u>one</u> branch involving derivatives of u with respect to t.

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3.Miscellaneous (25 pts) Let $f(x,y) = xe^y$.

a. Find the gradient of $f(x,y)$.

b. Find the directional derivative of $f(x,y)$ at (2,0) in the direction $< 2, 1 >$.

c. What is the maximum rate of change of *f(x,y)* at (2,0)?

d. Linearize the given function at (2,0).

e. Express *df* in terms of *dx* and *dy*.

4.Maxima and Minima (25 pts)

a. State the Second Derivative Test for classifying critical points.

b. Determine the nature of the critical points for the function $f(x,y) = x^3 + y^2 - 12x + 2y.$.

c. Use Lagrange multipliers to find the maximum and minimum values of $f(x,y) = x^2 y$ subject to the constraint $x^2 + y^2 = 5$.