This exam contains 6 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may not use your books, notes, or a calculator on this exam.

You are required to show your work on each problem on this exam.

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1. \( f(x, y) = x^2 + y \) is defined on the region \( D = \{(x, y) | x^2 + y^2 \leq 1\} \).

   (a) (6 points) Find the critical point(s) of \( f \) on the region \( D \).

   (b) (7 points) Use the method of \textbf{Lagrange multipliers} to find the extreme values of \( f \) on the circle \( x^2 + y^2 = 1 \) which is the boundary of \( D \).

   (c) (7 points) Find the extreme values of \( f \) on \( D \).
2. (20 points) Find the mass and center of mass of the lamina that occupies the region $D$ with density function $\rho(x, y) = x$. Here $D$ is bounded by the line $x + y = 2$, the line $y = 0$ and a part of the parabola $y = x^2, x \geq 0$. 
3. (20 points) Find the surface area of the part of the paraboloid $z = 1 - x^2 - y^2$ that lies above the $xy$-plane.
4. (20 points) Let $E$ be the solid bounded by $y = x^2$, $z = 0$, and $y + z = 1$. Express the triple integral $\iiint_E z \, dV$ as iterated integrals in two different orders $dxdydz$ and $dzdydx$. Then evaluate either of the two iterated integrals.
5. (20 points) Find the volume of the sphere $x^2 + y^2 + z^2 \leq 4$ using both cylindrical coordinates and spherical coordinates.