Name:

Problem 1: Jacobians. Find the determinant of the Jacobian for switching from cylindrical to spherical coordinates.

Problem 2: Jacobians. Let $s(x, y)$ and $t(x, y)$ describe a change of coordinates. Let $x(u, v)$ and $y(u, v)$ describe a change of coordinates. Prove the following identity:

$$\left|\frac{\partial(s, t)}{\partial(x, y)}\right|\left|\frac{\partial(x, y)}{\partial(u, v)}\right| = \left|\frac{\partial(s, t)}{\partial(u, v)}\right|$$

Problem 3: Line integrals. Compute the line integral of the vector field
$$F(x, y, z) = \langle 3x^2 + 2yz + 3y^2, 2xz + 6xy, 2xy + 4 \rangle$$
along the curve parameterized by
$$\gamma(t) = \langle \sin(t), \cos^2(t), \sin^3(t) \rangle$$
where $0 \in [0, \pi]$.

Interesting Puzzle, will not be graded. 8 math graduate students and their advisors are at a party. Many handshakes took place, but no one shook the hand of their own advisor. I asked everybody how many hands they had shaken, and everybody gave a different answer. How many hands did my advisor shake?