Names: _____

Work in groups of five to complete the following problems. Each problem should be solved on a separate sheet of paper and each sheet of paper should have at least one group member's name on it. Algebraic support must be shown to receive full credit (i.e. show work!). Answers should be exact unless otherwise specified.

1. (5 pts.) Find and classify all extrema of the function $f(x, y) = x^2 + xy + y^2 + y$.

2. (5 pts.) Use Lagrange multipliers to find and classify the extrema of the function $f(x, y) = x^2 + 2y^2$ subject to the constraint $x^2 + y^2 = 1$.

3. (5 pts.) Evaluate the integral $\iint_R (6x^2 y^3 - 5y^4)\, dA$, where $R = \{(x, y) : 0 \le x \le 3, 0 \le y \le 1\}$.

4. (5 pts.) Evaluate the integral $\int_0^{\sqrt{\pi}} \int_y^{\sqrt{\pi}} \cos(x^2)\, dx\, dy$ by reversing the order of integration.

5. (5 pts.) Evaluate the integral $\int_{-3}^{3} \int_0^{\sqrt{9-x^2}} \sin(x^2 + y^2)\, dy\, dx$ by converting to polar coordinates.