Math 212 Spring 2005 **Exam #2**

Instructions: You have **two hours** to complete this exam. You should work alone, without access to the textbook or class notes. You may not use a calculator. Do not discuss this exam with anyone except your instructor.

This exam consists of 7 questions. You must show your work to receive full credit. Be sure to **indicate your final answer clearly** for each question. Pledge your exam when finished, and include your name and section number on the front of the exam. The exam is due by **Friday, 5 p.m.** Good luck!

1. Find and classify the critical points of $f(x, y) = 3xy - x^2y - xy^2$.

2. Find the extreme values of

$$f(x, y) = 2x^2 + 3y^2 - 4x - 5$$

on the region described by $x^2 + y^2 \leq 16$.

3. Compute the average of the function $f(x, y) = xe^{y^5}$ over the region

$$D = \{(x, y) | \, 0 \leq x \leq 3; \sqrt{x/3} \leq y \leq 1\}.$$

4. Find the volume enclosed by the sphere $x^2 + y^2 + z^2 = 1$ and the cylinder $x^2 + y^2 = \frac{1}{2}$.

5. Let S be the solid body bounded by $x^2 + y^2 = 2, z = -\sqrt{x}, z = \sqrt{y}$ with $x \geq 0, y \geq 0$. Compute

$$\int\int\int_S z \; dx\, dy\, dz.$$

6. Let S be the solid body to the right of the yz–plane which is bounded by the planes $y = x$, $y = -x$ and by $x^2 + y^2 + z^2 = 1$, and $x^2 + y^2 + z^2 = 9$. Compute

$$\int\int\int_S \frac{z^2}{x^2 + y^2 + z^2} \, dx\, dy\, dz.$$

7. Let $\mathbf{c}(t) = \left(2t, \frac{4}{3}t^{\frac{3}{2}}, \frac{1}{2}t^2\right)$. Compute the arc length of the path $\mathbf{c}$ between the points $(0, 0, 0)$ and $(2, \frac{4}{3}, \frac{1}{2})$.