MATH 234 (A. Assadi) **Spring 2009**
Practice Exam for Midterm II

Problem 1. Evaluate the iterated integral $\int_{-1}^{1} dx \int_{-x}^{x^2} (3+2y)dy$.

Problem 2. Change the order of integration in the double integral $\int_{0}^{1} dx \int_{x-1}^{x+1} e^{y+1}dy$.

Problem 3. Find the area of the surface $z = x^2 + y^2$ <u>BETWEEN</u> the planes $z=1$ $z=4$.

Problem 4. A spherical shell **S** is made of two spheres with center at origin, with the inner radius $R_1 = \sqrt{2}$ and the outer radius $R_2 = 2$. A solid **V** is the volume cut off from **S** by a cone **K**. The cone **K** is obtained from a 360 degree rotation about the z-axis of the triangle with vertices $(0,0,0)$, $(0,0,2)$, $(0,2,2)$. (a) Graph the intersection of **S, K** and the volume V with the three coordinate planes. (b) Outline the steps that you will take to find the volume of **V** in simple, short English sentences. (c) Outline the steps that you will take to find the mass of a substance contained in **V** with density given by the function $f(x,y,z)$ in simple, short English sentences.

Problem 5. Use the setup and the notation from **Problem (4).** You are <u>**NOT**</u> required to calculate the numerical integration answers to the following; rather, you must show the steps in your work carefully and do all the required computations to write the multiple integrals as ***iterated integrals*** with explicit bounds.
(i) Write down the region of integration for calculation of the volume in spherical coordinates, then set up the triple integral and its bounds.
(ii) Repeat part (i) above using cylindrical coordinates.
(iii) Repeat part (i) above using Cartesian coordinates.

Problem 6. Lagrange's Multiplier. Find all points $P = (x,y,z)$ at which the function $f(x,y,z) = 2x+3y+z+5$ attains a minimum subject to the constraint $g(x,y,z) = 4x^2 + 9y^2 - z = 0$.

NOTE: Problems 1 & 2 have 10 points each. Problems 3-6 have 20 points each.