=1440

Midterm for Calculus III(Fall 2002)
November 13, 2002

minutes total; PICK AND MARK CLEARLY 5 out of 6 problems – 150 points total with 30 points each. ***Problems NOT ordered according to difficulty!**

1. Use Lagrange multipliers to find the maximum and minimum values of

$$f(x, y) = x^2 y,$$

subject to the constraint

$$x^2 + y^2 = 1.$$

2. Find the volume of thesolid enclosed by the paraboloids

$$z = x^2 + y^2 \quad \text{and} \quad \mathrm{z = 16 - x^2 - y^2}.$$

3. Find the total mass of the solid tetrahedron with vertices $(0, 0, 0)$, $(1, 0, 0)$, $(0, 2, 0)$, $(0, 0, 3)$ and density function $\rho(x, y, z) = x^2 + y^2$.

4. Find the area of the surface defined by

$$z = x^2 + \frac{3}{2}y^2,$$

and bounded by $4x^2 + 9y^2 = 36$.

5. Compute the triple integral

$$\int_{x^2+y^2+z^2 \leq 1} (x - z)^2 \; dV.$$

6. For a rectangular region $\{0 \leq x \leq 2, 0 \leq y \leq 1\}$, a point P is radomly marked. The probability desnity function is proportional to $y^2 e^x$. Find this density function. Find the probability that P falls into the left half ($\{0 \leq x, y \leq 1\}$).

GOOD LUCK!