Math 2263	**Name (Print):** ____________
Fall 2014	**Student ID:** ____________
Midterm 2	**Section Number: 001** ______
November 6, 2014	**Teaching Assistant:** ____________
Time Limit: 50 minutes	**Signature:** ____________

This exam contains 6 problems. Answer all of them. Point values are in parentheses. You must show your work to get credit for your solutions - correct answers without work will not be awarded points.

Do not give numerical approximations to quantities such as $\sin 5$, π, $\ln(3)$ or $\sqrt{2}$. However, you should simplify $\cos \frac{\pi}{2} = 0$, $e^0 = 1$, and so on.

1	20 pts	
2	15 pts	
3	20 pts	
4	20 pts	
5	10 pts	
6	15 pts	
TOTAL	100 pts	

1. (20 points) Use the method of Lagrange multipliers to find the extreme values of the function $f(x, y) = xy$ on the ellipse $\frac{x^2}{4} + y^2 = 1$.

2. (15 points) Transform the following integral into **polar coordinates** with appropriate limits for r and θ where D is a disk enclosed by the circle $x^2 + y^2 = 4x$:

$$\iint_D f(x, y)dA.$$

[Note that you cannot evaluate the integral since the function f is unknown.]

3. (20 points) Find the x-**component** of the center of mass of a triangular lamina D with vertices at $(0, 0)$, $(1, 0)$ and $(0, 1)$ if the density of mass function is $\rho(x, y) = y$.

4. (20 points) Consider the solid region E which lies within the cylinder $x^2 + y^2 = 1$, above the xy-plane and below the paraboloid $z = 1 + x^2 + y^2$.

   (a) (5 points) Sketch the solid region E.

   (b) (15 points) Use cylindrical coordinates to compute the volume of E.

5. (10 points) Let E be the portion of the ball $x^2 + y^2 + z^2 \leq 4$ that lies in the octant $x \leq 0, y \geq 0, z \geq 0$. Express the solid region E in terms of spherical coordinates.

6. (15 points) Sketch the region of integration and evaluate the integral

$$\int_0^1 \int_{x^{1/3}}^1 \frac{1}{y^4+1}\,dy\,dx.$$

[Hint: Switch the order of integration.]