Math 212 Spring 2006

BONUS Quiz **8** **Multivariable Calculus**

Name: ________________________

Date: ________________ **Friday March 31**
Time Begun: ________________ Ron Buckmire
Time Ended: ________________

Topic : Method of Lagrange

The idea behind this quiz is to provide you with an opportunity to illustrate your understanding of the Method of Lagrange for constrained multivariable optimization.

Reality Check:

EXPECTED SCORE : __________**/10** ACTUAL SCORE : __________**/10**

Instructions:

0. Please look for a hint on this quiz posted to `faculty.oxy.edu/ron/math/212/06/`.
1. Once you open the quiz, you have as much time as you like to complete it, please record your start time and end time at the top of this sheet.
2. You may use the book or any of your class notes. You must work alone.
3. If you use your own paper, please staple it to the quiz before coming to class. If you don't have a stapler, buy one. **Quizzes with loose sheets will not be graded.**
4. After completing the quiz, sign the pledge below stating on your honor that you have adhered to these rules.
5. Your solutions must have enough details such that an impartial observer can read your work and determine HOW you came up with your solution.
6. Relax and enjoy...
7. **This quiz is due on Monday April 3**, in class. NO LATE QUIZZES WILL BE ACCEPTED.

Pledge: I, ________________, pledge my honor as a human being and Occidental student, that I have followed all the rules above to the letter and in spirit.

1. A solid circular cylinder of height H and radius R has volume $V(r,h) = \pi r^2 h$ and surface area $A(r,h) = 2\pi rh + 2\pi r^2$.

(a) (*4 points.*) An old standard Calculus problem is to maximize the volume $V(r,h)$ subject to the "fixed-area constraint" $A(r,h) = A_0$, where A_0 is some positive constant. Use Lagrange multipliers to show that the constrained maximum occurs when $h = 2r$.

(b) (*4 points.*) Another old standard Calculus problem is to maximize the surface area $A(r,h)$ subject to the "fixed-volume constraint" $V(r,h) = V_0$, where V_0 is some positive constant. Use Lagrange multipliers to show that the constrained maximum occurs when $h = 2r$.

(c) (*2 points.*) Use your answers from part (a) and part (b) to obtain expressions for the Volume V and Surface Area A of the objects in terms of the fixed parameters V_0 and A_0 (where $V = V(A_0)$ and $A = A(V_))$ which satisfy the "fixed-volume" and "fixed-area" constraints. What is the connection between your answers?