GSU Mathematics Problem Competition, Fall 2005
Problem Set 1
Due Date: Monday, Sept. 19
Instructions: Do any or all of these problems, and submit to the Mathematics main office by 5:00 pm on the due date. All GSU undergraduate students are eligible. Please include your name and e-mail address with your solutions. Have fun! For more information, see:
http://www.cs.georgiasouthern.edu/faculty/kersey_s/private/competition/competitionS2005.html

---

1. (Maymeskul) Level: Elementary
If $\left(x + \frac{1}{x}\right)^2 = 3$, find $x^3 + \frac{1}{x^3}$.

2. (Wu) Level: Calculus
Evaluate the following integral by hand without using Integration by Parts:

$$\int xe^x \sin(x)\, dx.$$

(Hint: Begin with an educated guess of the form of the solution.)

3. (Champ) Level: Linear Algebra
Let M be a nonsingular real matrix that has been partitioned as

$$M = \begin{bmatrix} A & B \\ C & D \end{bmatrix}.$$

Assume also that A and D are invertible. Express M^{-1} in terms of A, B, C and D.