Midterm 3; Math 127 A1
November 19, 1999

This exam is a closed book, no notes, no "crib sheets" exam. Calculators are permitted. There are seven problems on this exam – don't overlook those on the back of the page. The number of points that each problem is worth is printed next to the problem. Good luck!

1. Evaluate the indefinite integral: (14 points)

$$\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx$$

(Please show your work – no credit for "calculator" answers.)

2. Evaluate the definite integral: (14 points)

$$\int_0^1 x e^{-x} dx$$

(Please show your work – no credit for "calculator" answers.)

3. Evaluate the derivative of the function: (14 points)

$$g(x) = \int_{-1}^{\sin(x)} \frac{1}{1+t^3} dt \ .$$

4. Find the area enclosed between the curves $y = x^4 - x^2$ and $y = 1 - x^2$. (14 points)

5. Consider the improper integral

$$\int_e^\infty \frac{1}{x(\ln x)^2} dx \ .$$

   (a) Explain how this integral is defined. (7 points)

   (b) Does the integral converge or diverge? If it converges, compute its value. If it diverges, explain why. (8 points)

6. The following table gives the power consumption, $P(t)$, in megawatts in the San Francisco Bay Area from midnight to 6 am on September 19, 1996. Use Simpson's Rule (with $n = 6$) to estimate the total energy use during this period. (The total energy use is the integral of the power consumption.) (14 points)

t	12	1	2	3	4	5	6
P(t)	4182	3856	3640	3558	3547	3679	4112

7. Consider a pyramid whose base is a square of side length 4 cm and whose height is 3 cm.

   (a) Explain how to approximate the volume of the pyramid by a Riemann sum. (7 points)

   (b) Take the limit of this Riemann sum to obtain an exact expression for the volume as an integral. Then evaluate this integral to find the volume of the pyramid. (8 points)