MA 127 A1 **Midterm Exam #2**
October 30, 1998

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

1. Find the intervals on which $f(x) = x^2e^x$ is **increasing**. Show your work. (12 points)

2. Consider the function $f(x) = x^3 - 12x + 1$ on the interval $[-3, 5]$. Find the absolute maximum and absolute minimum value of $f(x)$ on this interval. Show your work – just entering the values from your calculator will not be accepted. (12 points)

3. Compute the general anti-derivative of the following function. (12 points)

$$f(x) = \frac{x^2 + x + 1}{x}, x > 0.$$

4. Determine whether or not the following limit exists. If it does compute it. If not, explain why it does not exist. Show your work – a "calculator proof" is not sufficient here. (12 points)

$$\lim_{x \to 0}(\frac{1}{x} - \csc x) \ .$$

5. Use the evaluation theorem to compute the following definite integral. (12 points)

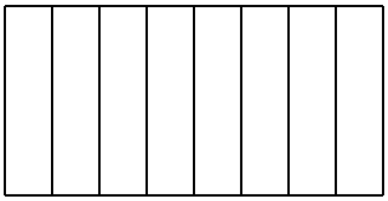
$$\int_{\ln 3}^{\ln 6} 8e^x dx \ .$$

6. Water is leaking out of a tank at a rate of $r(t)$ gallons per hour. The tank begins leaking at noon, and is not repaired until 4 pm. While it is leaking, measurements of the rate at which it is leaking (in gallons/minute) were made at half-hour intervals and recorded in the table below.

- (a) Write an expression for the total amount of water that leaks out as a definite integral.
- (b) Estimate the total amount of water that leaks out by approximating the integral in part (a) by using the Midpoint Rule with 4 subintervals.

Time	12:00	12:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00
r(t)	0.4	1.2	1.6	2.1	2.0	2.4	1.8	0.6	0.0

7. An agronomist wishes to completely fence eight rectangular plots for experimentation as shown in the figure below. If each plot must contain 90 m^2, find the minimum amount of fencing that must be used. (13 points)



8. A spotlight on the ground shines on a wall 12 m away. If a man 2 m tall walks from the spotlight toward the buildingat a speed of 1.6 m/s how fast is the height of his shadow on the building decreasing when he is 4 m from the building. (13 points)