MA 241 - Exam 1 July 10, 2003
(Total = 100 points) Show all work!

1. (5 pts.) $\tan \frac{5}{3}\pi =$ (pick one):
   a) $\sqrt{3}$ b) $\frac{1}{\sqrt{3}}$ c) $-\sqrt{3}$ d) $-\frac{1}{\sqrt{3}}$ e) $-\frac{2}{\sqrt{3}}$.

2. (5 pts.) $(\sin x + \cos x)^2$=(pick one):
   a) $1 + \sin(2x)$ b) 1 c) 0 d) $1 + \sin x \cos x$ e) $\tan^2 x$.

3. (10 pts.) Use Part 1 of the Fundamental Theorem of Calculus to find the derivative of
$$g(x) = \int_1^{x^4} \sec t \, dt.$$

4. Use the Substitution Rule to find each of the following indefinite integrals (10 pts. each):
$$\text{a) } \int \frac{(\ln x)^2}{x} \, dx \qquad \text{b) } \int \cos^3 x \, dx.$$

5. Use integration by parts to find each of the following indefinite integrals (15 pts. each):
$$\text{a) } \int x \sin x \, dx \qquad \text{b) } \int \ln x \, dx.$$

6. (10 pts.) Write out the form of the partial fraction decomposition of the rational function
$$\frac{x^5 + 3x^2 + 4x}{(x^2 + 2x + 3)^2 (x + 7)(x - 4)^3}.$$
   Do *not* determine the numerical value of the coefficients.

7. (20 pts.) Evaluate the following definite integral:
$$\int_0^1 \frac{x^2 + x + 2}{(x + 1)(x^2 + 1)} \, dx.$$