Mathematics 126 **Midterm 1**
Sept. 19, 2003

● Calculators are allowed *only* for numerical calculations.

● There are three sheets of scratch paper attached at the end of the exam. Use them and but do not tear them off the exam in doing so, and hand them in together with the exam.

● Show your work; write each step down clearly in your calculations/reasonings.

1(70 pts) Evaluate the following definite and indifinite integrals.

a)

$$\int_0^1 x^2(1+x^3)^4 \, dx$$

b)

$$\int \frac{x^3}{x^2+1} \, dx$$

c)

$$\int_0^{1/\sqrt{2}} 2x \arctan x \; dx$$

d)

$$\int \frac{1}{x^2\sqrt{x^2+4}} \; dx$$

(Hint: Set $u = 2\tan t$.)

e)

$$\int \frac{x + 4}{x^2 + 2x - 3} \, dx$$

f)

$$\int_1^2 \frac{(\ln x)^3}{x} \, dx$$

g)

$$\int (\ln x)^2 \; dx$$

2.(10 pts) From the chain rule $(fg)' = f'g + fg'$, deduce the formula for integration by parts; $\int u\,dv = uv - \int v\,du$ where $u = f(x)$ and $v = g(x)$.

3.(20 pts) Below is the graph of velocity $v(t)$ of a car. Let

$$d(t) = \int_0^t v(s)ds.$$

a) Find the values of $d(2)$ and $d(4)$. Explain.

b) Find the values of $d'(1)$ and $d'(3)$. Explain.

c) When is the car furthest from the starting point at $t = 0$? Explain.

d) Draw a rough sketch of the grapf $y = d(t)$.

.