MA 182, Honors Mathematical Analysis II, Fall '05.
Extra Homework Sheet # 5.

1. Differentiate the following functions:

   (a) $f(x) := \int_0^x \tan\alpha \, d\alpha$

   (b) $g(x) := \int_x^2 \tan\alpha \, d\alpha$

   (c) $h(y) := \int_2^y \sqrt{1+t^2} \, dt$

   (d) $k(x) := \int_{\sin x}^0 \ln(3+t^4) \, dt$

   (e) $A(x) := \int_{-x}^x e^{t^2} dt$

   [Hint: $\int_{-x}^x \cdots = \int_{-x}^0 \cdots + \int_0^x \cdots$*]*

   (f) $G(x) := \int_{x^2}^{x^4} \log_2 t \; dt$

   [Hint: Similar trick as above. It doesn't matter that 0 *is not between* x^2 *and* x^4*. Actually, one can use any* $c \in \mathbb{R}$ *to split the integral.]*

2. Consider the function $F : \mathbb{R} \longrightarrow \mathbb{R}$ defined by

   $$F(x) := \int_{10}^x \frac{t}{1+t^6} \, dt$$

   Find the intervals of increase and decrease of F. Determine all the relative minimum and maximum points.

   [Tip: Do not attempt to solve the integral.]

3. Evaluate the following definite integrals:

   (a) $\int_0^1 \cos(\pi t) \, dt$

   (b) $\int_0^{\pi/2} e^{\sin x} \cos x \, dx$

   (c) $\int_1^2 x\sqrt{x-1} \, dx$

   (d) $\int_e^{e^4} \frac{1}{x\sqrt{\ln x}} \, dx$

4. Evaluate $\int \tan x \, dx$

   [Hint: Rewrite $\tan x$ *as* $\frac{\sin x}{\cos x}$ *and use the substitution* $u = \cos x$*.]*