Problem Set 10

Friday, April 14

I. Problems to be graded on completion.

1. Evaluate the following indefinite integrals:
   a. $\displaystyle\int x^2\sqrt{x^3+1}\ dx$
   b. $\displaystyle\int e^x\cos(e^x)\ dx$
   c. $\displaystyle\int \frac{2x\ dx}{x^2+1}$
   d. $\displaystyle\int e^{\sin x}\cos x\ dx$
   e. $\displaystyle\int \frac{3x\ dx}{(x^2+1)^2}$
   f. $\displaystyle\int x^{-3/4}(x^{1/4}+1)^{-2}\ dx$
   g. $\displaystyle\int \frac{\tan(e^{-2x})}{e^{2x}}\ dx$
2. Evaluate the following definite integrals:
   a. $\displaystyle\int_0^{\sqrt{3}} x(x^2+1)^3\ dx$
   b. $\displaystyle\int_0^3 \frac{x\ dx}{\sqrt{x^2+16}}$
   c. $\displaystyle\int_{1/4}^{1/3} \sin(\pi x)\ dx$
   d. $\displaystyle\int_0^{\pi/2} (\cos x)^2\sin x\ dx$

II. Problems to be graded on correctness.

1. Evaluate the following indefinite integrals. Do not take any shortcuts.

   a. $\displaystyle\int (2x+3)^2 \, dx$

   b. $\displaystyle\int e^{-4x+2} \, dx$

   c. $\displaystyle\int \sin(x-7) \, dx$

   d. $\displaystyle\int \left(\sec(\tfrac{1}{6}x-1)\right)^2 \, dx$

   e. $\displaystyle\int \tan(17x) \, dx$

   f. $\displaystyle\int \sqrt{\tfrac{3}{2}x+5} \, dx$

   In each case, the thing you substituted was *linear*, meaning of the form $u = ax + b$. Now that you've done six linear substitutions the long way, describe a shortcut you can take for linear substitutions in general. You may use this from now on. Give an example of an integral that requires a non-linear substitution (e.g. $u = x^2 + 1$ or $u = \sin x$) for which your shortcut either doesn't make sense or gives the wrong answer.

2. Evaluate

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