Homework Assignment 14: Due at the beginning of class 3/20/02

This homework is intended to be a set of fairly straight-forward exercises on calculating antiderivatives by the technique of u-substitution. The technique of u-substitution is the algorithm for calculating antiderivatives described below.

- Identify the "inside function."
- Set the inside function equal to *u*.
- Calculate the derivative $\frac{du}{dx}$.
- Re-arrange the derivative to make *dx* the subject of the expression.
- Substitute *u* for the "inside function" and the expression that you have just created for *dx* into the indefinite integral.
- You should now have an indefinite integral expressed entirely in terms of *u* with no *x*'s left in it.
- Find the antiderivatve.
- Substitute the "inside function" for *u* in the antiderivative.

NOTE: Your written answers to Questions 1-5 should include (at the very least):

- An explicit statement of the "inside function."
- An explicit calculation of the derivative $\frac{du}{dx}$.
- The steps that you used to re-arrange the derivative.
- The indefinite integral expressed entirely in terms of *u*.
- Your final answer expressed entirely in terms of *x*.

1. Find a formula for the antiderivative (indefinite integral):

$$\int 4\cdot\left[9\cdot e^x+\ln(x)\right]^3\cdot\left(9\cdot e^x+\tfrac{1}{x}\right)\cdot dx$$

2. Find a formula for the antiderivative (indefinite integral):

$$\int \tfrac{1}{2}\cdot\left[x^{10}+\ln(x)\right]^{\frac{-1}{2}}\cdot\left(10\cdot x^9+\tfrac{1}{x}\right)\cdot dx$$

3. Find a formula for the antiderivative (indefinite integral):

$$\int \frac{1}{\left[\frac{1}{x}+\frac{1}{x^2}\right]}\cdot\left(\tfrac{-1}{x^2}+\tfrac{-2}{x^3}\right)\cdot dx$$

4. Find a formula for the antiderivative (indefinite integral):

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

5. Find a formula for the antiderivative (indefinite integral):

$$\int x\cdot e^{x^2}\cdot dx$$