MT 135-56/8 **Integration with *Derive*^{TM} *6*, Part III** **Fall, 2004**

The purpose of these exercises is to gain more experience with antiderivatives.

Recall the Procedure for Substituting Values into Expressions:
Highlight the expression, and choose “Variable Substitution” from the Simplify menu. Highlight the variable you’ll be replacing, and type the replacement value in the “New Value” field. Then click “OK,” followed by a “Basic” simplification from the Simplify menu.

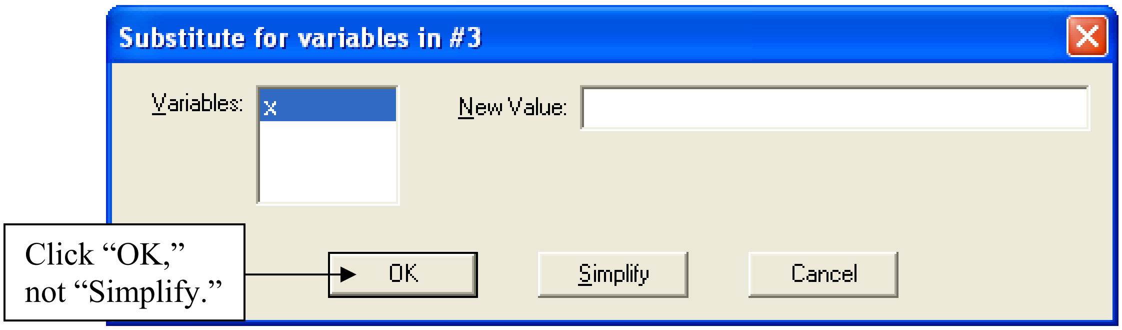

Figure 1: Substitute Dialog Box

Copying Results from Derive onto Your Homework Paper:
Recall that when you compute an indefinite integral, you’re finding the most general antiderivative for the function involved. So your answer should include an arbitrary constant. When Derive returns $\frac{\left(3x^2+4x\right)^{3/2}}{9}$ as a result, you should write $\frac{\left(3x^2+4x\right)^{3/2}}{9}+C$ on your paper. But do not include a constant of integration for a definite integral.

Also, when Derive antidifferentiates $\frac{1}{x}$, the result is $\ln x$. You’ll need to include the absolute value symbol when you copy this onto your paper: $\ln|x|+C$.

Finally, remember that you should write $(\ln x)^2$ when Derive writes $\ln(x)^2$.

Exercises:
Use *Derive*[TM] *6* for the following exercises. Use standard mathematical notation to record the results ***on a separate sheet of notebook paper.*** Do not turn in a print-out of your Derive session.

1. For each function $f(x)$ below, find the most general antiderivative $F(x)$. Then have Derive compute $F'(x)$, and show that $F'(x) = f(x)$. You may have to do some algebra for this last step.

> Example:
>
> $f(x) = \dfrac{4x^2 + 4x + 5}{2x - 1}$
>
> $F(x) = 4\ln|2x - 1| + x^2 + 3x + C$ (from Derive)
>
> So $F'(x) = \dfrac{8}{2x-1} + 2x + 3$ (from Derive).
>
> Since $\dfrac{8}{2x-1} + 2x + 3 = \dfrac{8}{2x-1} + \dfrac{(2x+3)(2x-1)}{2x-1} = \dfrac{8 + 4x^2 + 4x - 3}{2x-1} = \dfrac{4x^2 + 4x + 5}{2x-1}$,
> we see that $F'(x) = f(x)$.

(a) $f(x) = (\ln x)^2$

(b) $f(x) = \left(1 + xe^x\right)^2$

2. An object is moving in a straight line with velocity $v(t) = \frac{175}{192} t \sqrt[3]{5t+9}$ feet per second. When $t = 11$ seconds, the object is 100 feet to the left of the origin. Find the position function $s(t)$.

3. Water flows from a garden hose at a rate of $W(t) = \dfrac{t+3}{\sqrt{t+1}}$ gallons per minute, *t* minutes after the faucet is turned on. What size container is needed to contain all of the water that flows from the hose in the first 8 minutes?

I will have office hours in the computer lab in Dolan E223 on Friday, December 3, from 2:00 until 3:00 p.m., and on Sunday, December 5, from 1:00 until 2:00 p.m. I will have office hours in my office on Sunday, December 5, from 2:00 p.m. until 4:00 p.m.