You have 50 minutes to complete this test. You must show all work to receive full credit. Work any 7 of the following 8 problems. Clearly CROSS OUT the problem you do not wish me to grade. Each problem is worth 14 points, and you get 2 points for free, for a total of 100 points. The answers will be posted on the electronic reserves later today.

1. Solve $y^{\prime}=y^{2} e^{3 x}$ if $y=1$ when $x=0$.
2. Find $y^{\prime}$ :
(a) $y=\sqrt{x \ln \left(x^{2}+1\right)}$
(b) $y=x^{2} e^{3 x-2}$
3. Which is the better investment option, (A) an account earning annual interest of $8 \%$ compounded quarterly, or (B) an account earning annual interest of $7.5 \%$ compounded continuously?
4. A fossil is found to contain $1 / 6$ of its original ${ }^{14} C$. The half-life of ${ }^{14} C$ is 5730 years. How old is the fossil?
5. Solve the following for $x$ :
a) $\quad 3^{x^{2}-4 x}=\left(\frac{1}{81}\right)^{x-4}$
b) $\quad \log _{3}(x-2)+\log _{3}(x+6)=2$
c) $\quad \log _{x}(2 x-3)=1$
6. Evaluate the following integrals:
a) $\int \frac{1}{x \ln x} d x$
b) $\quad \int \frac{2 x^{2}+x-5 \sqrt{x}}{3 x^{2}} d x$
7. For the function $f(x)=x e^{x}$, list all intervals of increase and decrease, all maximum and minimum points, intervals where the function is concave up and concave down, all inflection points, and all asymptotes (or say there are none). Then sketch the graph of the function.
8. Evaluate $\int x^{3} \ln x d x$.
