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. Since we are doing Basic Skills tomorrow, exams will be returned on Wednesday.

1. Solve \( \frac{dy}{dx} = 4x^3 y^2 \) if \( y = 2 \) when \( x = 1 \).

2. Evaluate the following.

   a) \( \int (4x + 2) e^{3x^2 + x - 1} \, dx \)

   b) \( \int \frac{1}{x(\ln x)^2} \, dx \)
3. Find all maxima, minima and inflection points of $f(x) = x \ln x$ for $x > 0$. Also give the intervals where $f$ is increasing, decreasing, concave up, and concave down. Find all vertical and horizontal asymptotes, or state that none exist. Then carefully sketch the graph of $f$.

4. Find $f'(x)$ for the following functions. DO NOT simplify!

(a) $f(x) = x^2 \ln \sqrt{x^2 + 1}$

(b) $f(x) = \frac{e^{-3x}}{x^2 + 1}$
5. Which account will earn more money, Account A, earning 6% annual interest compounded monthly, or Account B, earning 5.5% interest compounded continuously?

6. A family of rabbits has taken up residence under the azalea in my backyard. Currently there are 5 rabbits, and a month from now there will be 8 rabbits. Assuming that rabbits multiply exponentially, and that I keep my cat indoors, how long will it be until there are 100 rabbits?
7. a) If \( 5 = 1 + 4e^{6x} \), solve for \( x \).

b) If \( \log_3 x = \frac{1}{3} (\log_3 16 + 2 \log_3 2) \), solve for \( x \).

8. Evaluate \( \int \frac{\ln 3x}{x^2} \, dx \).