You have 50 minutes to complete this test. You must show all work to receive full credit. Work any 6 of the following 7 problems. Clearly CROSS OUT the problem you do not wish me to grade. Each problem is worth 16 points, and you get 4 points for free, for a total of 100 points. The answers will be posted on the electronic reserves tomorrow.

1. Solve \( y' = \frac{xy}{\sqrt{1-x^2}} \) if \( y = 2 \) when \( x = 0 \).

2. Find \( f'(x) \) for the following functions. DO NOT simplify!

   (a) \( f(x) = \frac{e^x + x}{\ln x} \)

   (b) \( f(x) = \ln \left( \frac{e^{2x}}{x^2 + 1} \right) \)
3. The undergraduate enrollment at S&T was 5155 in the Fall of 2009. In the Fall of 2011, it was 5501. Assuming enrollment grows exponentially, what is the expected enrollment in Fall 2012?

4. a) Simplify \( \log_{25} \frac{1}{125} \).

b) Simplify \( 2e^{3\ln 2} \).

c) Solve for \( x \): \( \ln(3-x) - \ln(2x-1) = \ln 2 \).
5. For the function \( f(x) = \frac{6}{1 + e^{-x}} \), 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, being sure to label appropriately.
6. Evaluate the following integrals:

a) \[ \int x^3 (x^2 - 1)^8 \, dx \]

b) \[ \int \frac{1}{3x - 5} \, dx \]

c) \[ \int \left( \frac{1}{2x} - \frac{2}{x^2} + \frac{3}{\sqrt{x}} \right) \, dx \]

7. Solve \[ \int (x+1)(x+2)^6 \, dx \]