You have 60 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 $\dfrac{dy}{dx} = \dfrac{1}{y(3x+1)}$.

2.   Evaluate $\int 5xe^{3x}\,dx$.

3.   Find all maxima, minima and inflection points of $f(x) = \ln(x^2 + 1)$. Also give the intervals where f is increasing, decreasing, concave up, and concave down. Then carefully sketch the graph of f.

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

(a) $f(x) = \dfrac{e^{-3x}}{x^2 + 1}$

(b) $f(x) = x \ln \sqrt{x}$

5. Suppose you are offered two investment options. Option A offers a rate of return of 8.25% per year compounded quarterly. Option B offers a rate of 8.2% compounded continuously. Which option will give a better return on your investment? (Hint: Find the ending balance for a sample investment amount for one year).

6. The rate at which a student employee can file papers is a function of the employee's experience. It is estimated that after t weeks on the job, the average student employee can file $Q(t) = 700 - 400e^{-0.5t}$ papers per hour.

    a) How many papers can a new employee file per hour?

    b) How many papers can a student employee with 6 weeks experience file per hour?

    c) Approximately how many papers will a student employee be able to file per hour after an extended period of employment? (Show work and explain!)

7. a) If $\log_3 (x-5) = 2$, find x.

    b) If $\log_2 a = 4$, $\log_2 b = 3$, and $\log_2 c = 6$, calculate $\log_2 \dfrac{a^3}{\sqrt{bc}}$.

8. Evaluate the following integrals:

    a) $\int (2x+6)^5 \, dx$

    b) $\int \left(3\sqrt{x} - \dfrac{2}{x^3} + \dfrac{1}{x} \right) dx$