Fall 2001, Exam 3, Math 142

PRINT Your Name:_____

There are 11 problems on 6 pages. Problem 1 is worth 10 points. Each of the other problems is worth 9 points. SHOW your work. $\boxed{CIRCLE}$ your answer. **NO CALCULATORS! CHECK** your answer whenever possible. If you want to pick up your exam before Monday, write a short note to that effect on the top of this page and I will leave your exam outside my office door, before I go home tonight.

1. Find $\int \sin^3 x dx$. Check your answer.

2. Find $\int \cos^4 x dx$.

3. Find the general solution of $\frac{dy}{dx} - 3y = xe^{3x}$. Check your answer.

4. Find $\int e^{-x} \cos x dx$. Check your answer.

5. Find $\int \frac{6x^2-3x+1}{(4x+1)(x^2+1)} dx$. Check your answer.

6. Consider the sequence whose n^{th} term is $a_n = \left(\frac{n-3}{n}\right)^n$. Find the limit of this sequence.

7. Find $\lim_{x \to 1^-} \frac{x-1}{\arctan x}$.

8. Find $\int_{-3}^{1} \frac{1}{x^2} dx$.

9. Find $\int_{1}^{\infty} \frac{x}{e^x} dx$.

10. Consider the series $\sum_{k=1}^{\infty} \ln(\frac{k}{k+1})$. Find a closed formula for the partial sum $s_n = \sum_{k=1}^{n} \ln(\frac{k}{k+1})$. (In other words, I want you to find a formula which is equal to s_n . Your formula is not allowed to contain any "dots" or any summation signs.) Does the original series converge or diverge? Find the limit of the series, if possible.

11. A ball is dropped from a height of 100 feet. Each time it hits the floor, it rebounds to $\frac{2}{3}$ its previous height. Find the total distance the ball travels before coming to rest.