Mathematics 181A **Fall 2008**

Exam 3

November 13, 2008

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Name

Technology used: ______________________________ **Only write on one side of each page.**

- Show all of your work. Calculators may be used for numerical calculations and answer checking only.

1. [12 points] Find the sum of the converging geometric series $\sum_{n=3}^{\infty} 4\left(\frac{2^{n=1}}{5^n}\right)$.

2. [10 points] Use the table of integrals to help evaluate one (1) of the following. Specify which formula(s) you use from the table.

1. $\int \frac{3dz}{z[\ln z]^2\left([\ln z]^2+16\right)}$
2. $\int (e^x)^3 \cos(e^x)\, dx$

3. [15 points each] Do **two** (2) of the following.

1. Use the definition of limit of a sequence (this requires you use "ε") to prove that $\lim_{n\to\infty} \frac{n+2}{n+1} = 1$.

2. Use the error bound formula $E_n \leq \frac{1}{180} M \frac{(b-a)^5}{n^4}$ to find the smallest value of n so that the error in using Simpson's Rule to approximate $\int_1^5 \frac{1}{x} dx = \ln(5)$ is less than 10^{-6}.

3. Use integration, the Direct Comparison Test for improper integrals or the Limit Comparison Test for improper integrals to determine if the improper integral $\int_0^1 \frac{1}{x(x+1)} dx$ converges or diverges. Why?

4. [12 points each] For **four** (4) of the following. Determine if the following the infinite series converge or diverge? Give reasons and show your work. Use both sides of this sheet.

1. $\sum_{k=1000}^{\infty} \frac{\ln(n)}{\ln(2n)}$
2. $\sum_{n=1}^{\infty} \frac{[\ln n]^5}{n^3}$
3. $\sum_{n=1}^{\infty} \frac{3^{n-1}+2}{3^n}$
4. $\sum_{n=1}^{\infty} \frac{n+4}{3^{n-1}}$
5. $\sum_{n=1}^{\infty} \frac{n^2+10n}{n^4\sqrt{n+2}}$