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. \( \int \frac{3dz}{z[\ln z]^2([\ln z]^2+16)} \)
   
   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 \( E_n \leq \frac{1}{180} M \left( \frac{b-a}{n} \right)^5 \) 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. \[ \sum_{n=1}^{\infty} \frac{n^2+10n}{n^3\sqrt{n+2}} \]