1. Consider $\sum_{n=2}^{\infty} \frac{(\ln(n))^2}{n^2}$

(a) Show that the series converges.

(b) Find an upper bound for the error in approximating the sum $S$ by the partial sum $S_N$.

(c) Determine how many terms are required to make the error $|S - S_N| < 0.005$.

2. For each of the following, determine if the series converges or diverges. In each case, note the test used, and check all conditions.

(a) $\sum_{n=1}^{\infty} \frac{1}{n^2 - 4n + 5}$

(b) $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^3 + 1}}$

(c) $\sum_{n=1}^{\infty} \frac{1 + 2^n}{1 + 3^n}$

3. Find the values of $p$ for which $\sum_{n=2}^{\infty} \frac{(-1)^n (\ln(n))^p}{n}$ converges.

4. For each of the following, determine if the series converges absolutely, converges conditionally, or diverges.

(a) $\sum_{n=1}^{\infty} \frac{\sin(4n)}{4^n}$

(b) $\sum_{n=1}^{\infty} \frac{(-1)^n}{(\tan^{-1}(n))^n}$