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

(a) Show that the series converges.
   \textit{Answer:} Use the Integral Test.

(b) Find an upper bound for the error in approximating the sum \( S \) by the partial sum \( S_N \).
   \textit{Answer:} The upper bound from the Integral Test is \( \frac{(\ln(N))^2 + 2 \ln(N) + 2}{N} \)

(c) Determine how many terms are required to make the error \( |S - S_N| < 0.005 \)
   \textit{Answer:} \( N \geq 24,952 \)

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) \( \sum_{n=1}^{\infty} \frac{1 + 2^n}{1 + 3^n} \)
   \textit{Answer:} They all converge by the Limit Comparison Test.

3. Find the values of \( p \) for which \( \sum_{n=2}^{\infty} (-1)^n \frac{(\ln(n))^p}{n} \) converges.
   \textit{Answer:} The series converges for all \( p \) by the Alternating Series Test. It converges absolutely for \( p < -1 \)

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) \( \sum_{n=1}^{\infty} \frac{(-1)^n}{(\tan^{-1}(n))^n} \)
   \textit{Answer:} Both series converge absolutely by the Comparison Test and Limit Comparison Tests respectively.