1. Show that the series \( \sum_{n=1}^{\infty} (-1)^n \frac{\cos n}{2^n} \) is absolutely convergent.

2. For each of the following series, determine whether the series is absolutely convergent, conditionally convergent or divergent. Justify your answers.
   
   (a) \( \sum_{n=1}^{\infty} (-1)^n \frac{3}{2n+1} \).
   
   (b) \( \sum_{n=1}^{\infty} (-1)^n \frac{n}{4n+3} \).
   
   (c) \( \sum_{n=1}^{\infty} (-1)^n \left( \frac{1+2n}{3+4n} \right)^n \).
   
   (d) \( \sum_{n=2}^{\infty} (-1)^{n+1} \frac{\cos n}{n(\ln n)^2} \).

3. Estimate the infinite sum \( \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{n^5} \) such that the error is within 0.001.

4. For each of the following sequence of functions, determine whether or converges pointwise to a function, and find the limiting function if it exists. Justify your answers.
   
   (a) \( \left\{ \left( 1 + \frac{x}{n} \right)^{nx} \right\} \), \( x \in (-\infty, +\infty) \).
   
   (b) \( \{ x^{n+1} \} \), \( x \in [-1, 1] \).
   
   (c) \( \left\{ \frac{x^{2n}}{1 + x^{2n}} \right\} \), \( x \in [0, 1] \).

5. Let \( \{ F_n \} \) be a sequence of functions on an interval \( I \). It is given that \( \{ F_n \} \) converges uniformly on some function \( F \) on \( I \). Suppose also that for each \( n \in \mathbb{Z}^+ \), there exists a real number \( M_n > 0 \) such that
   
   \[ |F_n(x)| \leq M_n \quad \text{for all} \ x \in I. \]

   Show that there exists a real number \( M \) such that \( |F(x)| \leq M \) for all \( x \in I \).