1. Prove or disprove that any power series does not converge uniformly on a unbounded domain, unless \( a_1 = a_2 = \cdots = 0. \)

2. Give an example of sequence \( \{f_n(x)\} \) that converges uniformly to 0 on a certain domain \( D \), such that \( \sum f_n(x) \) converges only pointwise on the same domain \( D \).

3. Disprove that if \( f_n \geq 0 \) and \( f_n(x) \) converges to 0 uniformly, then \( f_n^2(x) \) converges to 0 uniformly.

4. Prove or disprove that if \( \sum_{n=1}^{\infty} f_n \) converges uniformly, then \( \sum_{n=1}^{\infty} f_n^2(x) \) converges uniformly.

5. Show that \( \sum_{n=1}^{\infty} x^n/(1 + x^n) \) converges pointwise, but not uniformly, on \( (0, 1) \).

6. Find the Taylor series expansion of \( \ln(1 + x^2) \) at \( x_0 = 0 \). Find the intervals where the series converges, where the series converges uniformly, and where \( \ln(1 + x^2) \) equals the series.

7. Suppose \( f(x) = |x| \) if \( x \in (-1, 1] \), and \( f(x+2) = f(x) \). Find the Fourier series of \( f(x) \), and indicate on which interval \( f(x) \) equals the Fourier series.