Problem 1. What does the Leibnitz Alternating Series Test state?

Problem 2 (Spivak 23-1)**.** Determine whether the following converge:

1. $\sum_{n=1}^{\infty} \frac{\sin n\theta}{n^2}$
2. $\sum_{n=1}^{\infty} (-1)^n \frac{\log n}{n}$
3. $\frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \frac{1}{11^2} + \frac{1}{13^2} + \cdots$
4. $\sum_{n=1}^{\infty} \frac{2^n n!}{n^n}$
5. $\sum_{n=1}^{\infty} \frac{1}{n^2 \log n}$
6. $\sum_{n=2}^{\infty} \frac{1}{(\log n)^k}$
7. $\sum_{n=2}^{\infty} \frac{1}{(\log n)^n}$
8. $\sum_{n=1}^{\infty} \frac{n^2}{n^3 + 1}$

Problem 3 (Spivak 23-15)**.**

1. Prove if $\sum a_n$ converges absolutely, then for any subsequence a_{n_k}, $\sum a_{n_k}$ also converges absolutely.
2. Prove if $\sum a_n$ converges absolutely, then

$$\sum_{n \in \mathbb{N}} a_n = (a_0 + a_2 + a_4 + \cdots) + (a_1 + a_3 + a_5 + \cdots) \tag{1}$$

Problem 4 (Spivak 23-16)**.** Prove if $\sum a_k$ is absolutely convergent, then $\left|\sum a_k\right| \leq \sum |a_k|$.