1. Consider the following series and determine if they converge or diverge. In case of an alternating series specify if the convergence is absolute or conditional.

   (a) $\sum_{n=1}^{\infty} \frac{2^n (n!)}{n^n}$

   (b) $\sum_{n=1}^{\infty} (-1)^n \frac{\ln(n)}{n^2}$

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

   (d) $\sum_{n=1}^{\infty} \frac{\sqrt[n]{n}}{n^2}$

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

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

   (g) $\sum_{n=2}^{\infty} (-1)^n \frac{1}{n(\ln n)^2}$

2. Give examples of two series $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ that both converge but such that the series $\sum_{n=1}^{\infty} a_n b_n$ diverges.

3. For what values of x does the power series $\sum \frac{(4x-5)^n}{n^{3/2}}$ converge? Explain

4. (a) Find the McLaurin series for $f(x) = \ln(1+x)$ and determine for what values of x the series converges.

   (b) Deduce $\lim_{x \to 0} \frac{\ln(1+x)}{x}$

   (c) Using the Mclaurin polynomial of degree 4, find an approximation for $\ln(2)$

5. Find the Taylor series for $f(x) = x^3 - 2x^2 + x + 1$ with $a = 1$

6. (a) Using the series for e^x, find the series for e^{x^2}.

   (b) Using the result in part a,express the integral $\int e^{x^2} dx$ as an infinite series.