1. Determine whether or not the sequence \( \{a_n\} \) converges, and find its limit if it does converge.

(a) \( a_n = \frac{\ln n}{\sqrt{n}} \)

(b) \( a_n = \left(1 + \frac{2}{n}\right)^{2n} \)

2. Determine whether the following infinite series converges or diverges.

(a) \[ \sum_{n=1}^{\infty} \frac{(-1)^{n+1} \ln n}{n} \]
3. Find the Taylor Series expansion of
   (a) \( f(x) = \sqrt{1 + x}, \ a = 0 \)

   (b) \( \sum_{n=1}^{\infty} \frac{n!}{e^{n^2}} \)

4. Find Taylor’s formula for the given function \( f \) at \( a = 0 \). Find both the Taylor polynomial \( P_n(x) \) of the indicated degree \( n \) and the remainder \( R_n(x) \).
   (a) \( f(x) = \tan x, \ n = 3 \)

   (b) \( f(x) = \cos x, \ a = \frac{\pi}{4} \)
(b) $f(x) = e^{-x}$, $n = 5$

5. (a) Determine the value of $p$ for which the series

$$\sum_{n=1}^{\infty} \frac{n}{(n^2 + 1)^p}$$

converges.

(b) Determine whether the series

$$\sum_{n=1}^{\infty} \frac{(-10)^n}{n!}$$

converges absolutely, converges conditionally, or diverges.