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

(a) \( a_n = \frac{\sin^2 n}{\sqrt{n}} \)

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

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

(a) \( \sum_{n=1}^{\infty} \frac{3^n}{2^n + 4^n} \)
3. Find the Taylor Series expansion of
   (a) \( f(x) = \frac{1}{1 - x}, \ a = 0 \)

   (b) \( \sum_{n=1}^{\infty} \frac{(-2)^n}{3^n + 1} \)

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) \( f(x) = \ln(1 + x), \ n = 4 \)
(b) \( f(x) = \sqrt{x}, \ n = 3 \)

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

\[
\sum_{n=1}^{\infty} \frac{1}{n(\ln n)^p}
\]

converges.

(b) Determine whether the series

\[
\sum_{n=1}^{\infty} (-1)^{n+1} \frac{n!}{n^n}
\]

converges absolutely, converges conditionally, or diverges.