1) Does the sequence \( \left\{ \frac{1}{n} \right\} \) converge or diverge?

2) Does the series \( \sum_{n=1}^{\infty} \frac{1}{n} \) converge or diverge?

4) Find the sum of the series (if it converges), or show that it diverges:

\[
\sum_{n=1}^{\infty} \frac{(-1)^{n+1} 7(3n+1)}{2^{2n+1}}
\]

\[
\sum_{n=0}^{\infty} \frac{(-1)^n 5^n}{6(4n+1)}
\]

5) Let \( \sum_{n=1}^{\infty} a_n \) be a series whose sequence of partial sums \( \{S_n\} \) is given by \( S_n = \frac{5n+3}{n+1} \).

a) Determine if \( \sum_{n=1}^{\infty} a_n \) converges or diverges.

b) Find \( a_1 \), and a formula for \( a_n \) for \( n \geq 2 \).

6) Determine in each of the following series converges or diverges, and justify your answers.

a) \[ \sum_{n=1}^{\infty} \left( \frac{n}{3n+2} \right)^k \]

b) \[ \sum_{n=1}^{\infty} \frac{n+1}{n^3+4} \]

c) \[ \sum_{n=1}^{\infty} \frac{n^5}{n^k} \]

7) Find an example of two series \( \sum_{n=1}^{\infty} a_n \) and \( \sum_{n=1}^{\infty} b_n \) such that

a) \( \sum_{n=1}^{\infty} b_n \) diverges, but \( \sum_{n=1}^{\infty} (a_n + b_n) \) converges.

b) \( a_n < b_n \) for all \( n \), \( \sum_{n=1}^{\infty} b_n \) converges, and \( \sum_{n=1}^{\infty} a_n \) diverges.