7. (26 pts) Determine if the telescoping series diverges or converges. (To what?)

\[ \sum_{n=1}^{\infty} \frac{1}{n^2 + 2n} \]

8. (39 pts) Show convergence or divergence. You must show all details and explain each conclusion for credit.

a. \[ \sum_{n=1}^{\infty} \frac{n}{6n+1} \]

b. \[ 1 + \frac{1}{\sqrt{14}} + \frac{1}{\sqrt{9}} + \frac{1}{\sqrt{16}} + \cdots \]

c. \[ \sum_{n=1}^{\infty} \frac{1}{4^n} \]

9. (35 pts)

A. Suppose you know that \( a_n \to 0 \) as \( n \to \infty \). Of the following four statements, only one is true. Which is it?
(a) The series definitely converges, but we need more information to determine its sum.
(b) The series definitely converges, and \( \sum_{n=1}^{\infty} a_n = 0 \).
(c) The series definitely diverges.
(d) There is not enough information to decide whether the series converges or diverges.

B. Suppose you know that \( a_n \to 6 \) as \( n \to \infty \). Identify the one true statement:
(a) The series definitely converges, but we need more information to determine its sum.
(b) The series definitely converges, and its sum is 6.
(c) The series definitely diverges.
(d) There is not enough information to decide whether the series converges or diverges.

C. Suppose you know that \( S_n \to 3 \) as \( n \to \infty \). Which of the following statements are true? (More than one may be true.)
(a) The series definitely diverges.

D. For \( \sum_{k=1}^{\infty} 5 \left( -\frac{1}{2} \right)^k \), write down:
(a) the 3rd term of the series
(b) the 3rd term of the partial sum seq.
(c) find \( \lim_{n \to \infty} \) of the \( n \)th term of the series
(d) find \( \lim_{n \to \infty} \) of the \( n \)th partial sum