Therefore S_n and $\overline{S}_n$ converge.

(ii) Since $\overline{S}_n$ diverges.

Then $\infty = \lim_{n\to\infty} \overline{S}_n \le \lim_{n\to\infty} T_n$

so $\{T_n\}$ diverges.

For series $s_n = \sum_{j=1}^{n} a_j$ whose terms decrease "like" a geometric series there are a couple of methods of testing for convergence-divergence.