

1. Determine if the following sequences converge or diverge:

(i). $\{\tan \frac{3}{n}\}$

(ii). $\{\frac{(\ln n)^2}{n}\}$

(iii). $\{(1 + \frac{2}{n})^n\}$

(iv). $\{\frac{\sin 3n}{2^n - 1}\}$

2. A sequence $\{a_n\}$ is given by $a_1 = \sqrt{2}$, $a_{n+1} = \sqrt{2 + a_n}$. Show that the sequence converges.

3. Show that if $\{a_n\}$ is bounded and $\lim_{n \rightarrow \infty} b_n = 0$, then $\lim_{n \rightarrow \infty} a_n b_n = 0$.

4. Determine if the following series converge or diverge:

(i). $\sum (-1)^n n$

(ii). $\sum \ln(1 + \frac{1}{n})$

(iii). $\sum \frac{1}{2n-1}$

(iv). $\sum \frac{2+(-1)^n}{n^2}$

(v). $\sum_{n=2}^{\infty} \frac{1}{n \ln n}$

(vi). $\sum_{n=2}^{\infty} \frac{(-1)^n}{\ln n}$