

1. . **Answer the following questions, giving some valid reasons to support your answer**

(a) For $a_n = 1 - \frac{1}{n}$, find $\lim_{n \rightarrow \infty} a_n$?

(b) For $a_n = (-1)^n$, find $\lim_{n \rightarrow \infty} a_n$?

(c) Find $\lim_{n \rightarrow \infty} \frac{1 + 2^n}{1 - 3^n}$

(d) Find $\lim_{n \rightarrow \infty} (1/3)^n$?

2. If $\lim_{n \rightarrow \infty} a_n = 0$, what can you say about the convergence of $\sum_{n=1}^{+\infty} a_n$?
Give an example to illustrate your point.

3. If $\lim_{n \rightarrow \infty} a_n = 1$, what can you say about the convergence of $\sum_{n=1}^{+\infty} a_n$?
Give an example to illustrate your point.

4. If $\lim_{n \rightarrow \infty} \frac{a_n}{b_n} = 0$, and $\sum_{n=1}^{+\infty} b_n$ diverges, what can you say about the convergence of $\sum_{n=1}^{+\infty} a_n$?

5. If $\lim_{n \rightarrow \infty} \frac{a_n}{b_n} = 10$, and $\sum_{n=1}^{+\infty} b_n$ diverges, what can you say about the convergence of $\sum_{n=1}^{+\infty} a_n$?

6. $\lim_{n \rightarrow \infty} a^n = ?$ (list all possible cases for values of a)

7. **For each of the following series determine if the series converges conditionally, converges absolutely or diverges.**

(a) $\sum_{n=1}^{+\infty} (-1)^n \frac{\ln(n)}{n}$

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

- (c) $\sum_{n=1}^{+\infty} \frac{n}{\sqrt{4+n^5}}$
- (d) $\sum_{n=1}^{+\infty} \left(\frac{1-3n}{3+4n}\right)^n$
- (e) $\sum_{n=1}^{+\infty} \frac{2^n}{n!}$
- (f) $\sum_{n=0}^{\infty} \frac{2}{4n^2-1}$
- (g) $\sum_{n=0}^{\infty} \frac{2^{2n}}{5^n}$
- (h) $\sum_{n=2}^{\infty} \frac{1}{n(\ln n)}$
- (i) $\sum_{n=0}^{+\infty} (-1)^n \frac{\ln(n)}{n^3}$
- (j) $\sum_{n=1}^{+\infty} \frac{(-1)^n n}{3^n}$
- (k) $\sum_{n=1}^{+\infty} (-1)^n \frac{1}{\ln(n)}$

8. For each of the following power series determine where the series converges or diverges, and determine the radius of convergence, also decide if the series converges at the ends and what type.

- (a) $\sum_{n=1}^{+\infty} x^n$
- (b) $\sum_{n=1}^{+\infty} \frac{(-1)^n (x^n)}{n^2}$
- (c) $\sum_{n=1}^{+\infty} \frac{(-1)^n (2x-1)^n}{n^3}$
- (d) $\sum_{n=1}^{+\infty} \frac{(-1)^n x^{(2n+1)}}{n!(n+1)!2^{(2n+1)}}$