Gajendra Purohit

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Series of real numbers

D'Alembert Ratio test – Let $\sum u_n$ be a positive terms series such that

(A) $\lim_{n\to\infty} \frac{u_{n+1}}{u_n} = l$ Then the series is

(i) Convergent if $l < 1$
(ii) Divergent if $l > 1$
(iii) Test fails for $l = 1$

(B) $\lim_{n\to\infty} \frac{u_{n+1}}{u_n} = \infty$ then $\sum u_n$ is divergent.

Q.1. Suppose

$a_n = \frac{3^n + 3}{5^n - 5}$ *and* $b_n = \frac{1}{(1+n^2)^{1/4}}$ *for* $n = 2, 3, 4....$ Then which of the following is true

(a) Both $\sum_{n=2}^{\infty} a_n$ and $\sum_{n=2}^{\infty} b_n$ are convergent

(b) Both $\sum_{n=2}^{\infty} a_n$ and $\sum_{n=2}^{\infty} b_n$ are divergent

(c) $\sum_{n=2}^{\infty} a_n$ is convergent and $\sum_{n=2}^{\infty} b_n$ are divergent

(d) $\sum_{n=2}^{\infty} a_n$ is divergent and $\sum_{n=2}^{\infty} b_n$ are convergent

Q2. Let $<a_n>$ be a sequence of positive real numbers, the series $\sum_{n=1}^{\infty} a_n$ converges if the series

(a) $\sum_{n=1}^{\infty} a_n^{\,2}$ converges

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

(c) $\sum_{n=1}^{\infty} \frac{a_{n+1}}{a_n}$ converges

(d) $\sum_{n=1}^{\infty} \frac{a_n}{a_{n+1}}$ converges

Q6. The series $x+\frac{2^2x^2}{2!}+\frac{3^3x^3}{3!}+.....$ is convergent if x belong to the interval

(a) $\left(0,\frac{1}{e}\right)$

(b) $\left(\frac{1}{e},\infty\right)$

(c) $\left(\frac{2}{e},\frac{3}{e}\right)$

(d) $\left(\frac{3}{e},\frac{4}{e}\right)$

Q3. What value of x, the series $\sum_{n=1}^{\infty} \frac{x^n}{n^2+1}$ is divergent?

(a) (0, 1)

(b) (2, ∞)

(c) (1, ∞)

(d) (0, 2)

Cauchy's condensation test :

If f(n) is a positive monotonically decreasing function of n, then the two infinite series $\sum f(n)$ and $\sum a^n f(a^n)$ converge or diverge together, where $a > 1$, $a \in Z$.

Q4. For which value of 'p' the series $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^p}$ is convergent?

(a) 1

(b) 2

(c) 1/2

(d) 1/3

Q5. Which of the following series is Divergent

(a) $\sum_{n=1}^{\infty} \frac{1}{n} \sin^2 \frac{1}{n}$

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

(c) $\sum_{n=1}^{\infty} \frac{1}{n^2} \sin \frac{1}{n}$

(d) $\sum_{n=1}^{\infty} \frac{1}{n} \tan \frac{1}{n}$

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Cauchy's nth root test : Let $\sum u_n$ be a positive terms series and let $\lim_{n\to\infty}(u_n)^{1/n} = l$.

Then the series is

(a) Convergent if $l < 1$
(b) Divergent if $l > 1$
(c) Test fails if $l = 1$

Note : If nth term of series is in the power of n then we can use Cauchy's nth root test.

Q1. Which of the following series is/are convergent?

(a) $\sum_{n=1}^{\infty}\left(\frac{5n+1}{4n+1}\right)^{n}$

(b) $\sum_{n=1}^{\infty}\frac{\sin\frac{1}{n}}{n^{1/n}}$

(c) $\sum_{n=1}^{\infty}\left(1-\frac{1}{n}\right)^{n}$

(d) $\sum_{n=1}^{\infty}\sqrt{n}\left(1-\cos\left(\frac{1}{n}\right)\right)$

Q2. For n ≥ 1, let $a_n = \begin{cases} n2^{-n} & if \quad n\ is\ odd \\ 3^{-n} & if \quad n\ is\ even \end{cases}$. Which of the following statements is/are convergent?

(a) The sequence $\langle a_n \rangle$ is convergent

(b) The sequence $\langle a_n \rangle$ is divergent

(c) The series $\sum_{n=1}^{\infty} a_n$ is convergent

(d) The series $\sum_{n=1}^{\infty} a_n$ is divergent

Cauchy's integral test :

If u(x) is non-negative decreasing integrable function such that u(n) = u_n then $\sum_{n=1}^{\infty} u_n$ is convergent iff the value of $\int_1^{\infty} u(x)dx$ is finite.

Q3 . The convergence for series $\sum_{n=1}^{\infty} \frac{1}{n(\log n)}$. is

(a) Convergent
(b) Divergent
(b) Oscillatory
(d) None of these

Q4 . Which of the following series is divergent?

(a) $\sum_{n=1}^{\infty} \frac{1}{n} \sin^2 \frac{1}{n}$

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

(c) $\sum_{n=1}^{\infty} \frac{1}{n^2} \sin \frac{1}{n}$

(d) $\sum_{n=1}^{\infty} \frac{1}{n} \tan \frac{1}{n}$

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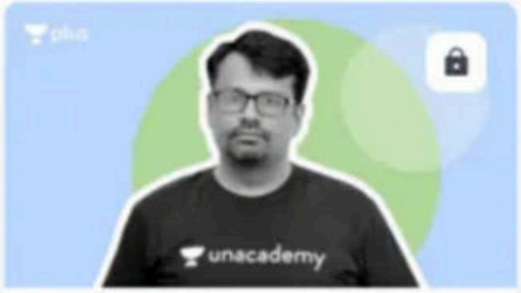

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Educator highlights

- Works at **Pacific Science College**
- Studied at **M.Sc., NET, PhD(Algebra), MBA(Finance), BEd**
- PhD, NET | Plus Educator For CSIR NET | Youtuber (260K+Subs.) | Director Pacific Science College |
- Lives in **Udaipur, Rajasthan, India**
- Unacademy Educator since

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