Gajendra Purohit

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Necessary condition for the convergence of series – Let $\sum u_n$ be a series of real number and this series is convergent then $\lim_{n\to\infty} u_n = 0$ but the converge of this theorem may not be true.

$\sum \frac{1}{n}$

$\lim_{n\to\infty} \frac{1}{n} = 0$

Q.1 Which of the following is/are not convergent

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

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

$\lim_{n \to \infty} n^{1/n} \neq 1$

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

(d) $\sum_{n=1}^{\infty} \sin\left(\frac{1}{n^2}\right)$

Test for convergence of a series of positive terms:

P – test $\Rightarrow$ A series of the form $\sum_{n=1}^{\infty} \frac{1}{n^p}$ is caued a p- series

Case-1 This series is convergent if $P > 1$

Case-2 This series is divergent if $P \leq 1$

Q.2 WOTF is/are convergent series

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

(b) $\sum_{n=1}^{\infty} \frac{1}{(n)^{1/3}}$

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

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

Q.3 For $a > 0$, the series $\sum_{n=1}^{\infty} a^{\log n}$ is convergent if f.

(a) $0 < a < e$

(b) $0 < a \leq e$

(c) $0 < a < \frac{1}{e}$

(d) $0 < a \leq \frac{1}{e}$

$a^{\log n} = n^{\log a}$

$n^{-(\text{or } 2)}$

$\sum n^{\log a}$

$\sum n^{\log \frac{1}{e}}$

$\sum \frac{1}{n^{-\log e}}$

$\sum \frac{1}{n}$

$-\log a > 1$

$\log a < 1$

$a < e^1$

$a < \frac{1}{e}$

$a = 1/e$

2. Comparision test –

Let $\sum u_n$ and $\sum u_n$ be two series of positive term and there exist a natural number m. Such that $un \leq kv_n$ for all $n \geq m$, k being a fixed positive number.

(i) $\sum u_n$ is convergent if $\sum v_n$ is convergent.

(ii) $\sum v_n$ is divergent if $\sum u_n$ is divergent.

$\sum \frac{\delta_{nn}}{n^2}$

$\sum \frac{c_{sn}}{n^2}$

$\sum \frac{|a_{ij}|}{n^2}$

$\left|\frac{\delta_{n2}}{n^2}\right| \leq \frac{1}{n^2}$

$\left|\frac{c_{sn}}{n^2}\right| \leq \frac{1}{n^2}$

$\left|\frac{c_{sn}}{n^2}\right| \leq \frac{1}{n^2}$

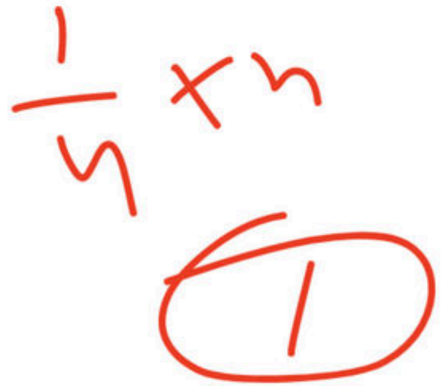
Q.4 Given $< a_n >$, $< b_n >$ be two monotonic sequence of real number and that $\sum a_n b_n$ is convergent WOTF is true.

(a) $\sum a_n$ is convergent and $\sum b_n$ is convergent

(b) at least one $\sum a_n$, $\sum b_n$ is convergent

(c) $< a_n >$ is bounded and $< b_n >$ is bounded

(d) At least one of $\sum a_n$, $\sum b_n$ is bounded.



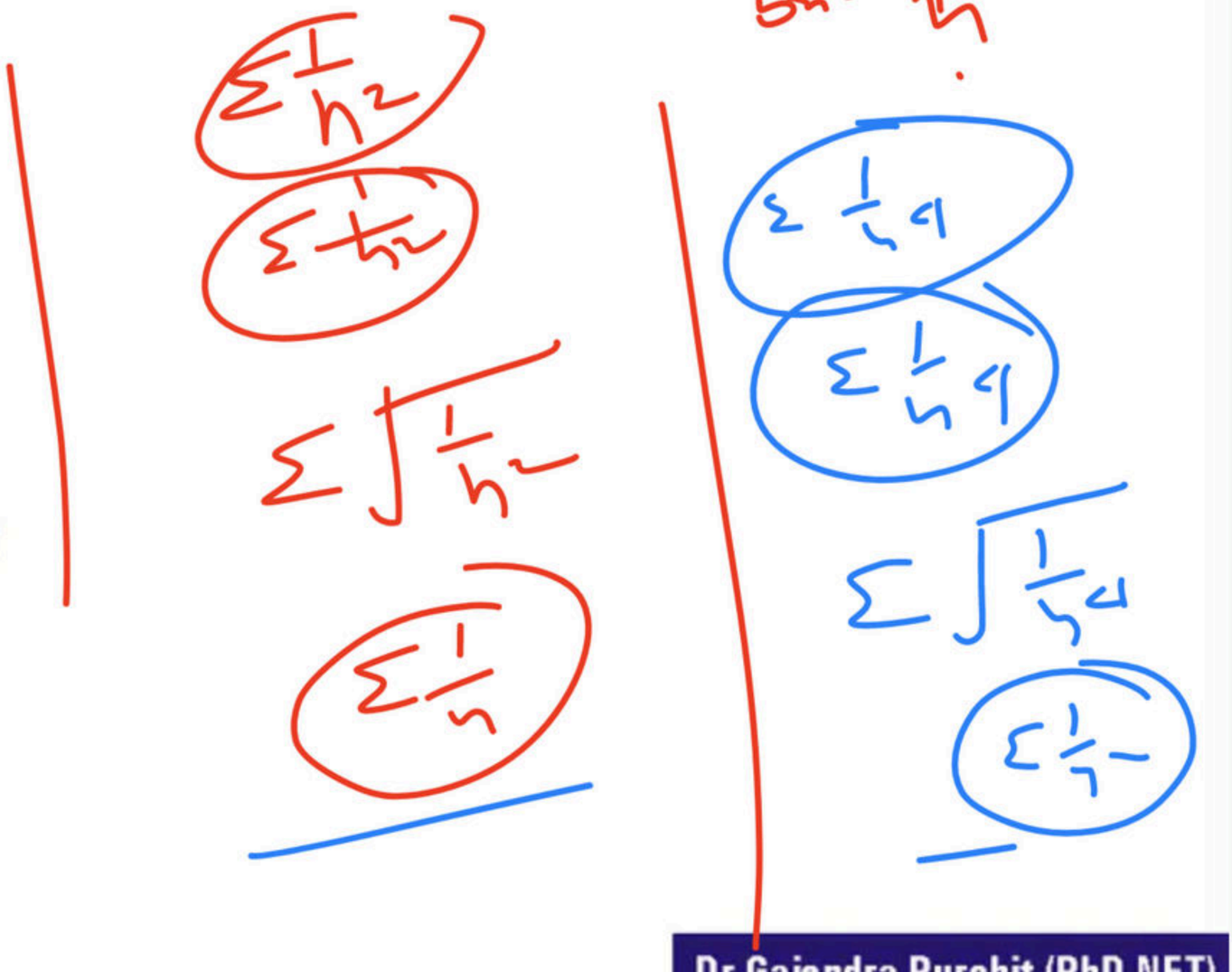
Q.5 If $\sum a_n^2$ and $\sum b_n^2$ are convergent series at positive real number then $\sum \sqrt{a_n b_n}$

(a) must be convergent

(b) must be divergent

(c) may be convergent

(d) may or may not be convergent



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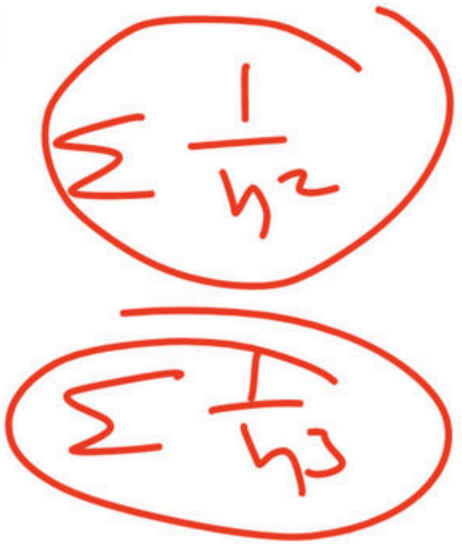
Q.6 If $\sum a_n$ is a convergent series of positive real number then $\sum \frac{a_n}{n}$

(a) may not convergent

(b) divergent

(c) is convergent

(d) may or may not be convergent



Limit Comparison test – Let $\sum u_n$ and $\sum v_n$ be two series of positive real number and $\lim_{n\to\infty} \frac{u_v}{v_n} = \ell$ Where 1 is a non- zero finite number. Then the both series converges or diverges like together

$\sum \frac{1}{n^2}$

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

$u_n = \frac{1}{n^2+n+1}$

$v_n = \frac{1}{n^2}$

$\lim_{n\to\infty} \frac{u_n}{v_n}$

$\lim_{n\to\infty} \frac{n^2}{n^2+n+1} = 1$

$$\sum n^2 \Delta_n \frac{1}{n}$$

$$\zeta_n = n^{\frac{2}{3}} \Delta_n \frac{1}{n}$$

$$v_n = n^2$$

$$\lim_{n \to \infty} \frac{\zeta_n}{v_n} = \lim_{n \to \infty} \frac{n^{\frac{2}{3}} \Delta_n \frac{1}{n}}{n^2}$$

$$= \lim_{n \to \infty} \left(\Delta_n \frac{1}{n} \right) = 0$$

$$\sum \frac{n+1}{n^2+1}$$

$$a_n = \frac{n+1}{n^2+1}$$

$$b_n = \frac{n}{n^2} = \frac{1}{n}$$

$$\lim_{n\to\infty} \frac{a_n}{b_n} = \lim_{n\to\infty} \frac{\frac{n+1}{n^2+1}}{\frac{n}{1}} = 1$$

$$\sum y_n = \sum \left(\sqrt{n^4+1} - \sqrt{n^4-1}\right) \times \frac{\left(\sqrt{n^4+1} + \sqrt{n^4-1}\right)}{\left(\sqrt{n^4+1} + \sqrt{n^4-1}\right)}$$

$$= \sum \frac{2}{\sqrt{n^4+1} + \sqrt{n^4-1}}$$

$$y_n = \frac{1}{n^2}$$

$$= \lim_{n\to\infty} \frac{y_n}{y_n} = \lim_{n\to\infty} \frac{2n^2}{\sqrt{n^4+1} + \sqrt{n^4-1}} = 1$$

Q7. Which of the following series is/are convergent

(a) $\sum \frac{1}{n^2+a^2}$

(b) $\sum \frac{bn-a}{bn^2+a^2}$

(c) $\sum \frac{1}{\sqrt{n}+\sqrt{n+1}}$

(d) $\sum \sqrt{\frac{n}{n^4+2}}$

a c

b A

c b

d a

Q8. What value of α for which the series $\sum \frac{1}{n^{\alpha+\frac{1}{n}}}$ is convergent

(a) 2

(b) 1

(c) $\frac{1}{2}$

(d) 3

$\sum \frac{1}{n^{\alpha} n^{1/n}}$

$c_n = \frac{1}{n^{\alpha} n^{1/n}}$

$\lim_{n\to\infty} \frac{c_n}{v_n} = \lim_{n\to\infty} \frac{1}{n^{\alpha}} =$

$v_n = \frac{1}{n^{\alpha}}$

$\alpha > 1$

Q9. Consider the series $\sum_{n=1}^{\infty} \frac{x^{n-1}}{1+x^n}$; $x > 0$ i Which of the following is/ are correct

(a) convergent $x > 1$

(b) convergent $x < 1$

(c) divergent $x < 1$

(d) None of these

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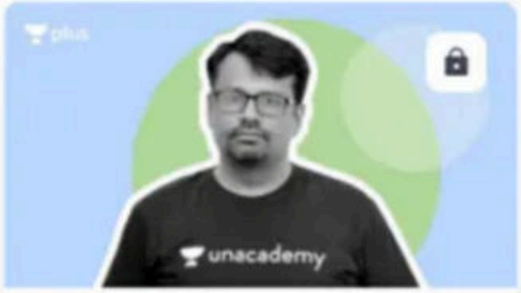

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Educator highlights

- 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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