Gajendra Purohit

Legend in CSIR-UGC NET & IIT-JAM

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Power series : A series of the form $\sum_{n=0}^{\infty} a_n (x - x_0)^n$ is known as real infinite power series where a_n are constant.

i.e. $\sum_{n=0}^{\infty} a_n (x - x_0)^n = a_0 + a_1 (x - x_0) + a_2 (x - x_0)^2 + ...$

Some important facts of power series when $x_0 = 0$:

(1) Every power series converges for $x = 0$, for all value of coefficient a_n. i.e. if power series is not convergent other than $x = 0$, then this series is called nowhere convergent.

(2) If a given series converge for all value of x, then we say that the given power series every where convergent.

Region of convergence :

(3) If the given power series converges for some value of x and diverge for other value of x then the set of all value of x for which it is convergent is known as region of convergence.

Radius of convergence :

Let $\sum a_n x^n$ is a power series and |x| < R is region of convergence then R is called radius of convergence.

Formula for finding radius of convergence

$$\frac{1}{R} = \overline{\lim_{n\to\infty}} \left| \frac{a_{n+1}}{a_n} \right| = \overline{\lim_{n\to\infty}} |a_n|^{1/n}$$

Some useful results :

(1) The radius of convergence of $\sum a_n x^n$ is equal to $\sum n a_n x^{n-1}$.

(2) The radius of convergence of $\sum a_n x^n$ is equal to $\sum \frac{a_n}{(n+1)} x^{n+1}$.

(3) If R is the radius of convergence of $\sum a_n x^n$ then radius of convergence of $\sum a_n x^{pm}$ and $\sum a_n x^{pm+k}$; $k \in N$ is $(R)^{1/p}$; $p > 0$.

(4) If R and R_1 are the radius of convergence of $\sum a_n x^n$ and $\sum b_n x^n$ then radius of convergence of $\sum (a_n x^n + b_n x^n)$ is $\min\{R, R_1\}$

Q1. The radius of convergence of the power series $\sum_{n=0}^{\infty}\left(\frac{n^2}{4^n}\right)x^{5n}$ is **IIT JAM 2022**

(a) 4

(b) $\sqrt[5]{4}$

(c) $\frac{1}{4}$

(d) $\frac{1}{\sqrt[5]{4}}$

Q2. Let r be the radius of convergence of the power series

$$\frac{1}{3}+\frac{x}{5}+\frac{x^2}{3^2}+\frac{x^3}{5^2}+\frac{x^4}{3^3}+\frac{x^5}{5^3}+\ldots\ldots\text{then the value of } r^2$$

is **IIT JAM 2022**

(a) 1 (b) 3

(c) 5 (d) 7

Q3. The radius of convergence of the power series $\sum_{n1}^{\infty}\left(\frac{n+2}{n}\right)^{n^2} x^n$ is **IIT-JAM 2020**

(a) e^2

(b) $\frac{1}{\sqrt{e}}$

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

(d) $\frac{1}{e^2}$

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Q4. Let $a_n = \frac{(1+(-1)^n)}{2^n} + \frac{(1+(-1)^{n-1})}{3^n}$ then the radius of convergence of the power series $\sum_{n=0}^{\infty} a_n x^n$ about $x = 0$

IIT JAM 2018

(a) 1 (b) 2

(c) 3 (d) 4

Q5. Let k be a positive integer. The radius of convergence of the series $\sum_{n=0}^{\infty} \frac{(n!)^k}{(kn)!} z^n$ is **[CSIR NET 2014]**

(a) k (b) k^{-k}

(c) k^k (d) ∞

Q6. The sum of the finite series

$$S=\frac{1}{2}-\frac{1}{3\times 1!}+\frac{1}{4\times 2!}-\frac{1}{5\times 3!}+\ldots\ldots \text{is equal to}$$

[CSIR-NET Nov. 2020]

(A) $2-\frac{1}{e}$ (B) $1-\frac{2}{e}$

(C) $\frac{2}{e}-1$ (D) $\frac{1}{e}-2$

Q7. Let $S_1 = \frac{1}{3} - \frac{1}{2} \times \frac{1}{3^2} + \frac{1}{3} \times \frac{1}{3^3} - \frac{1}{4} \times \frac{1}{3^4} + \ldots\ldots$ and $S_2 = \frac{1}{4} + \frac{1}{2} \times \frac{1}{4^2} + \frac{1}{3} \times \frac{1}{4^3} + \frac{1}{4} \times \frac{1}{4^4} + \ldots\ldots$ Which of the following identities is true?

[CSIR-NET Feb. 2022]

(A) $3S_1 = 4S_2$ (B) $4S_1 = 3S_2$

(C) $S_1 + S_2 = 0$ (D) $S_1 = S_2$

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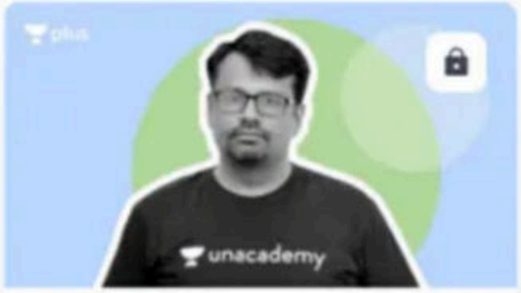

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Educator highlights

- 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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