SEQUENCES AND SERIES

Class XI

Sequence

A sequence is a function from natural number N (domain) to real numbers (codomain)



If $a_1, a_2, ..., a_n$ is a sequence, then the expansion $a_1 + a_2 +$ + a_n is called the series.

Sum of n terms of Special Series



- Sum of n natural numbers $\sum n = \frac{n(n+1)}{2}$
- Sum of squares of n natural numbers $\sum n^2 = \frac{n(n+1)(2n+1)}{6}$
- Sum of cubes of n natural numbers $\sum n^3 = \frac{n^2(n+1)^2}{4} = (\sum n)^2$
- $\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$
- $1 \cdot 2 + 2 \cdot 3 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$

Progression

If the terms of a sequence are written under specific conditions, then the sequence is called progression.

Types of Progression

Arithmetic Progression (A.P.)

A sequence whose terms increases or decreases by a fixed number.

 n^{th} term : $T_n = a + (n-1)d$ where d (common difference) = $T_n - T_{n-1}$, a =first term,

n'a term from end

 $T_n' = l - (n-1)d$, where l = last term

Sum of a terms

$$S_m = \frac{n}{2}[2\alpha + (n-1)d] = \frac{n}{2}[\alpha + I]$$

Note

- 3 terms in an A.P. a d, a, a + d, a + 2d
- 4 terms in an A.P. a 2d, a d, a, a + d, a + 2d

Basic Properties

- If a_i, a_j, a_j,, a_n are in A.P. with common difference d, then
 - a₁ ± x, a₂ ± x, ..., a_n ± x are also in A.P. where x is constant.
 - ka_j, ka_j, ..., ka_z are also in A.P. with common difference kd.
 - \(\frac{a_1}{k}\), \(\frac{a_2}{k}\), \(\frac{a_1}{k}\), \(\frac{a_1}{k}\), \(\frac{a_n}{k}\) are also in A.P. with common difference, \(\frac{d}{k}\), \(\frac{k}{\pi}\) = 0.

Geometric Progression (G.P.)

A sequence of non-zero numbers for which the ratio of a term to its just preceding term is always constant.

 u^{th} term : $T_a = ar^{a-1}$, where $r(\text{common ratio}) = T_a/T_{a-1}$, a = first term

 m^{th} term from end : $T'_n = l/r^{n-1}$, l = last term Sum of m terms

$$S_{tr} = \begin{cases} \frac{\alpha(r^{tr} - 1)}{r - 1}, r > 1 \\ \frac{\alpha(1 - r^{tr})}{1 - r}, r < 1 \end{cases} ; S_{to} = \frac{\alpha}{1 - r}, |r| < 1 \\ \alpha r, r = 1 \end{cases}$$

Note

- 3 terms in G.P. a/r, a, ar.
- 4 terms in G.P. a/r¹, a/r, a, ar.

Basic Properties

- If a₁, a₂, a₃, ..., a_n are in G.P. with common ratio r then
- $-\frac{1}{a_1}, \frac{1}{a_2}, \frac{1}{a_3}, \dots, \frac{1}{a_n}$ also in G.P., with common ratio 1/r.
- ka₁, ka₂, ka₃, ..., ka_n or a₁/k, a₂/k, a₃/k,....
 (k≠0) also in G.P., with common ratio r.
- a₁", a₂", a₃", a_n" also in G.P. with common ratio r*.
- a₁a₂ = a₄ · a₂ · ₁ ∀ k = 1, 2, 3, ..., n 1

~

Maria Santa

Arithmetic mean (A.M.)

- For two numbers a and b, A.M. is
 a+b
 .
- $A_r = a + r \left(\frac{b-a}{n+1} \right)$, $\forall r = 1, 2, ..., n$

where A, A are n arithmetic means inserted between two numbers a and b.

Geometric mean (G.M.)

- For two numbers a and b, G.M. is
 √ab.
- $G_k = a \left(\frac{b}{a}\right)^{\frac{k}{m+1}} \forall k = 1, 2, 3, ..., n$

where $G_p = ..., G_n$ are n geometric means inserted between two numbers a and b.

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- 1. Understanding the eBook Sequences And Series Problems Unit 12 Lesson Key
 - The Rise of Digital Reading Sequences And Series Problems Unit 12 Lesson Key
 - Advantages of eBooks Over Traditional Books
- 2. Identifying Sequences And Series Problems Unit 12 Lesson Key
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Sequences And Series Problems Unit 12 Lesson Key
 - User-Friendly Interface

- 4. Exploring eBook Recommendations from Sequences And Series Problems Unit 12 Lesson Key
 - Personalized Recommendations
 - Sequences And Series Problems Unit 12 Lesson Key User Reviews and Ratings
 - Sequences And Series Problems Unit 12 Lesson Key and Bestseller Lists
- 5. Accessing Sequences And Series Problems Unit 12 Lesson Key Free and Paid eBooks
 - o Sequences And Series Problems Unit 12 Lesson Key Public Domain eBooks
 - Sequences And Series Problems Unit 12 Lesson Key eBook Subscription Services
 - Sequences And Series Problems Unit 12 Lesson Key Budget-Friendly Options
- 6. Navigating Sequences And Series Problems Unit 12 Lesson Key eBook Formats
 - o ePub, PDF, MOBI, and More
 - Sequences And Series Problems Unit 12 Lesson Key Compatibility with Devices
 - Sequences And Series Problems Unit 12 Lesson Key Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - o Adjustable Fonts and Text Sizes of Sequences And Series Problems Unit 12 Lesson Key
 - Highlighting and Note-Taking Sequences And Series Problems Unit 12 Lesson Key
 - Interactive Elements Sequences And Series Problems Unit 12 Lesson Key
- 8. Staying Engaged with Sequences And Series Problems Unit 12 Lesson Key
 - o Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Sequences And Series Problems Unit 12 Lesson Key
- 9. Balancing eBooks and Physical Books Sequences And Series Problems Unit 12 Lesson Key
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Sequences And Series Problems Unit 12 Lesson Key
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Sequences And Series Problems Unit 12 Lesson Key
 - Setting Reading Goals Sequences And Series Problems Unit 12 Lesson Key
 - Carving Out Dedicated Reading Time

- 12. Sourcing Reliable Information of Sequences And Series Problems Unit 12 Lesson Key
 - Fact-Checking eBook Content of Sequences And Series Problems Unit 12 Lesson Key
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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