

MATHEMATICS • CLASS 11

CHAPTER 8

Sequences and Series

CHAPTER NOTES



SEQUENCES: TERMS AND ORDER

A sequence is a collection of numbers arranged in a definite order. Each number is called a term. The subscript tells us the position of a term.

$$a_1, a_2, a_3, \dots, a_n, \dots$$

The term at a stated position is also called the general term.

$$a_n: \text{nth term}$$

Population counts, bank deposits and depreciating values can form sequences.

Finite sequence

A finite sequence has a fixed, finite number of terms. In the chapter's generation model, the number of ancestors doubles at each generation.

$$300 \text{ years} \div 30 \text{ years} = 10 \text{ generations}$$

$$2, 4, 8, 16, \dots, 1024$$

$$a_1 = 2, a_2 = 4, a_{10} = 1024$$

Infinite sequence

An infinite sequence does not end. Successive quotients in division provide an illustration.

$$10 \div 3: \quad 3, 3.3, 3.33, 3.333, \dots$$

RULES FOR GENERATING SEQUENCE TERMS

A sequence can be viewed as a function. Its domain is the natural numbers or an appropriate subset of them.

$$a: \mathbb{N} \rightarrow \mathbb{R}, \quad a(n) = a_n$$

For a finite sequence: domain = $\{1, 2, \dots, k\}$

An algebraic rule

A formula may give a term directly from its position.

Even natural numbers

2, 4, 6, 8, ...

$$a_n = 2n$$

$$a_1 = 2, \quad a_2 = 4, \quad a_{23} = 46, \quad a_{24} = 48$$

Odd natural numbers

1, 3, 5, 7, ...

$$a_n = 2n - 1$$

A rule in words

A sequence need not be presented by an algebraic formula. It can also be described by a rule in words.

Prime numbers in increasing order:

2, 3, 5, 7, ...

THE FIBONACCI SEQUENCE

A recurrence relation gives a new term using earlier terms. The Fibonacci sequence starts with two terms equal to unity.

$$a_1 = a_2 = 1$$

$$a_n = a_{n-2} + a_{n-1}, \quad n > 2$$

Each new term is the sum of the previous two terms.

The resulting sequence

1, 1, 2, 3, 5, 8, ...

The starting terms and the recurrence rule together determine the sequence.

Build the terms in order

$$a_3 = a_1 + a_2 = 1 + 1 = 2$$

$$a_4 = a_2 + a_3 = 1 + 2 = 3$$

$$a_5 = a_3 + a_4 = 2 + 3 = 5$$

$$a_6 = a_4 + a_5 = 3 + 5 = 8$$

SERIES AND SIGMA NOTATION

A series is the expression formed by adding the terms of a sequence. It is finite or infinite according to the sequence.

Sequence

$$a_1, a_2, a_3, \dots, a_n$$

Associated finite series

$$a_1 + a_2 + a_3 + \dots + a_n$$

An infinite series

$$a_1 + a_2 + a_3 + \dots$$

Sigma notation

$$a_1 + a_2 + \dots + a_n = \sum_{k=1}^n a_k$$

The sigma sign indicates addition. Add the indexed terms from the lower limit to the upper limit.

Series and sum are different

The series is the indicated addition. Its sum is the number obtained after adding.

Series: $1 + 3 + 5 + 7$

Sum: 16

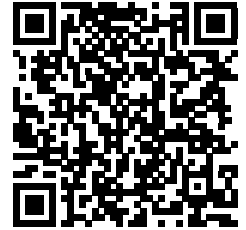


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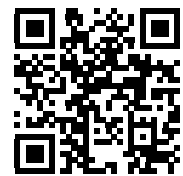


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