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Sequences

IGCSE Mathematics

The Panda Math Tutor

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1 Introduction

Note

Sequences are one of the fundamental topics in IGCSE Mathematics. A sequence is an ordered list of numbers that follows a particular pattern or rule. Understanding sequences helps develop pattern recognition and algebraic thinking, and appears in contexts ranging from saving plans to population growth.
In this chapter, we will explore:

- The language and key definitions of sequences
- Term-to-term rules and position-to-term rules
- Linear (arithmetic) sequences
- Finding the nth term of a linear sequence
- Quadratic sequences
- Finding the nth term of a quadratic sequence
- Geometric sequences
- Other special sequences (triangular, Fibonacci, cube, etc.)
- Using the nth term to solve problems

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2 Key Definitions

Definition

A **sequence** is an ordered list of numbers that follows a particular rule or pattern. Each number in the sequence is called a **term**.

Definition

The **terms** of a sequence are the individual values in the list. The first term is often written as a_1 (or simply a), the second term as a_2, and so on. The nth term is written as a_n.
For example, in the sequence $3, 7, 11, 15, 19, \ldots$

- $a_1 = 3$ (the first term)

- $a_2 = 7$ (the second term)
- $a_5 = 19$ (the fifth term)

Definition

The n**th term** (or **general term**) of a sequence is a formula that allows you to calculate any term directly from its **position number** n. It is written as a_n or sometimes as $T(n)$ or u_n.

Definition

The **common difference** (denoted d) of an arithmetic (linear) sequence is the constant value added to each term to get the next term:

$$d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = \cdots$$

Definition

The **common ratio** (denoted r) of a geometric sequence is the constant value multiplied by each term to get the next term:

$$r = \frac{a_2}{a_1} = \frac{a_3}{a_2} = \frac{a_4}{a_3} = \cdots$$

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Note

Two types of rules describe sequences:

- A **term-to-term rule** tells you how to get the next term from the current term. For example: "start at 5 and add 3 each time" gives $5, 8, 11, 14, \ldots$
- A **position-to-term rule** (the nth term formula) tells you how to calculate any term directly from its position n. For example: $a_n = 3n + 2$ gives $5, 8, 11, 14, \ldots$

The position-to-term rule is far more powerful because it lets you find **any** term without listing all the terms before it.

Preview ends here

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