Class 9 Maths Chapter 8 ‘Predicting What Comes Next - Exploring Sequences and Progressions’ Notes

Class 9 Maths Chapter 8 What Come Next Exploring Sequences and Progressions Notes Free PDF Download is made according to the latest CBSE and NCERT syllabus. These notes will be helpful in school exams, board exams and quick revisions. They help students to understand the chapter clearly, revise faster, and prepare for exams with confidence.

What Is a Sequence?

A sequence is an ordered list of numbers arranged according to a specific rule. Each number in the list is called a term. The position of every term is fixed the first term, the second term, the third term, and so on. Change the rule and you get an entirely different sequence.

For example: 2, 5, 8, 11, 14… is a sequence where each term is 3 more than the one before it.

Key Terms to Remember

- **Sequence:** An ordered list of numbers following a fixed rule. Example: 3, 6, 9, 12…
- **Pattern:** A regular and predictable arrangement the underlying rule that keeps the sequence consistent.
- **Arithmetic Progression (AP):** A sequence where the difference between any two consecutive terms is always the same fixed number.
- **Common Difference (d):** The fixed value added (or subtracted) to get from one term to the next in an arithmetic progression. d = second term − first term.
- **Term of a Sequence:** Each individual number in the sequence. The nth term is the term at position n. Written as a□ or T□.

Understanding Sequences

Number Sequences

A number sequence is simply a list of numbers in a specific order. Each number follows the previous one according to a clear rule. The rule might be "add 4 each time," "multiply by 2 each time," or "subtract 3 each time."

Examples:

- 1, 4, 7, 10, 13… (add 3 each time)
- 2, 4, 8, 16, 32… (multiply by 2 each time)
- 50, 45, 40, 35, 30… (subtract 5 each time)

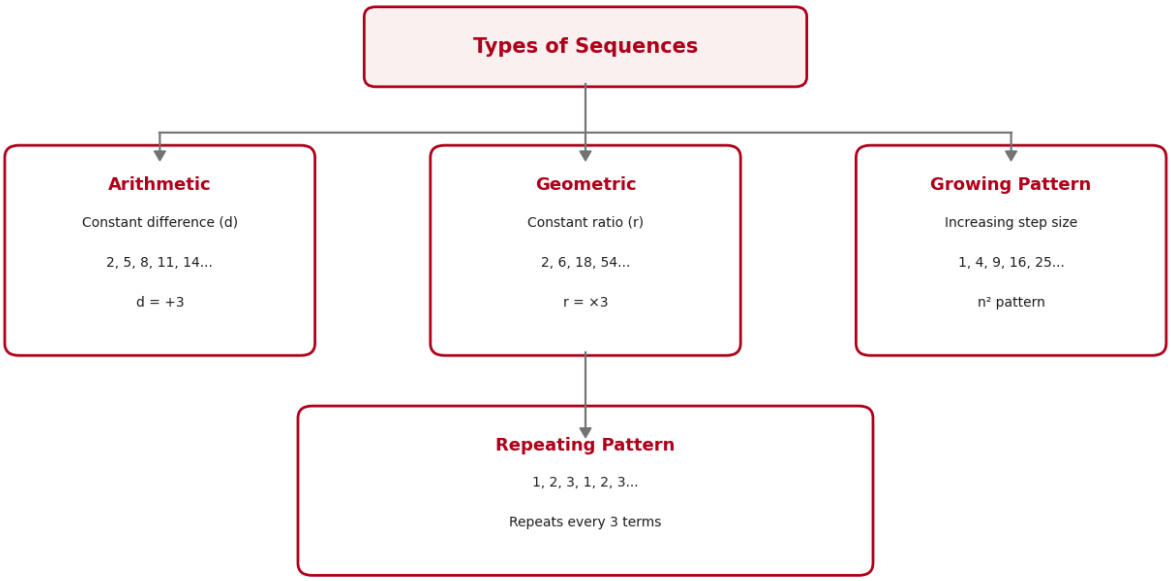
Visual and Shape Based Sequences

Not all sequences are made of numbers alone. Some sequences are made of shapes or dots arranged in growing patterns. For example, a sequence of triangles made from matchsticks where each new triangle adds two more sticks is a visual sequence. The number of sticks forms a number sequence: 3, 5, 7, 9…

Identifying Patterns in a Sequence

To identify the pattern in any sequence, look at the differences between consecutive terms. If the difference is constant, it is an arithmetic progression. If the ratio between terms is constant, it is a geometric sequence. If neither is constant, look for a different relationship such as squares or cubes of natural numbers.

Types of Sequences



Arithmetic Sequence

An arithmetic sequence has a constant difference between consecutive terms. This difference can be positive (increasing sequence) or negative (decreasing sequence). Example: 10, 7, 4, 1, −2… has a common difference of −3.

Geometric Sequence

A geometric sequence has a constant ratio between consecutive terms. Each term is obtained by multiplying the previous term by a fixed number. Example: 3, 6, 12, 24, 48… has a common ratio of 2. Note: the Class 9 Chapter 8 curriculum focuses primarily on arithmetic progressions.

Growing Patterns

A growing pattern increases with each step but the difference between consecutive terms may not be constant. The sequence 1, 3, 6, 10, 15… (triangular numbers) grows but the differences increase: 2, 3, 4, 5…

Repeating Patterns

A repeating pattern cycles through the same set of values over and over. Example: Red, Blue, Green, Red, Blue, Green… The rule is a repeating block of three.

Arithmetic Progression (AP)

Definition of Arithmetic Progression

An Arithmetic Progression is a sequence of numbers in which the difference between every two successive terms is the same fixed value. This fixed value is called the common difference (d). If the terms of an AP are a_1, a_2, a_3…, then $a_2 - a_1 = a_3 - a_2 = d$ for all terms.

Components of an Arithmetic Progression

An AP has three essential components: the first term (a or a_1), the common difference (d), and the number of terms (n). Once you know these three things, you can find any term in the progression.

Finding the Common Difference

d = any term − the term just before it

For the AP 7, 11, 15, 19, 23: d = 11 − 7 = 4.

Check: 15 − 11 = 4, 19 − 15 = 4

For a decreasing AP like 20, 15, 10, 5: d = 15 − 20 = −5.

Examples of Arithmetic Progressions

Sequence	First term (a)	Common difference (d)
1, 3, 5, 7, 9…	1	+2
10, 7, 4, 1, −2…	10	−3
0, 0.5, 1, 1.5, 2…	0	+0.5
100, 95, 90, 85…	100	−5

Formula for the nth Term of an Arithmetic Progression

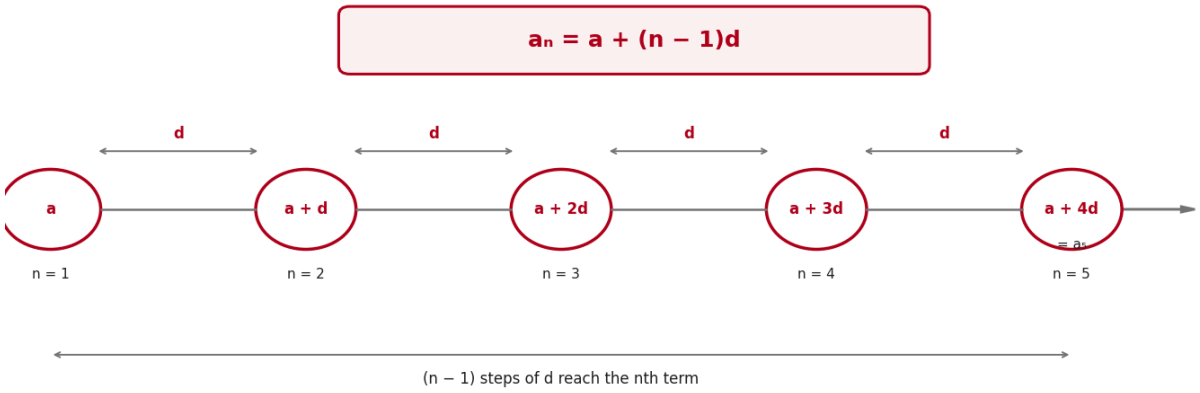
Understanding the nth Term Formula

The nth term formula lets you find any term directly without listing all the terms before it. The formula is: $a_n = a + (n - 1)d$

Where: a = first term, n = position of the term you want, d = common difference, a_n = the value of the nth term.

The logic: to reach the nth term, you start at a and take (n − 1) steps of size d.

Arithmetic Sequence Formula



How to Apply the Formula

Step 1: Identify a (first term) and d (common difference).

Step 2: Identify n (the position of the term you want).

Step 3: Substitute into $a_n = a + (n - 1)d$.

Step 4: Simplify.

Solved Example Using the nth Term Formula

Question: Find the 15th term of the AP: 4, 7, 10, 13…

First term a = 4, common difference d = 7 − 4 = 3, n = 15.

$a_{15} = 4 + (15 - 1) \times 3 = 4 + 14 \times 3 = 4 + 42 = 46$

How to Predict the Next Term in a Sequence

Finding a Common Difference

To find the next term in an arithmetic sequence, calculate the common difference d by subtracting any term from the one that follows it. Then add d to the last known term.

Example: 11, 16, 21, 26, ?

d = 16 − 11 = 5

next term = 26 + 5 = 31

Finding a Common Ratio

For a geometric sequence, divide any term by the one before it to find the common ratio r. Multiply the last known term by r to get the next.

Example: 3, 6, 12, 24, ?

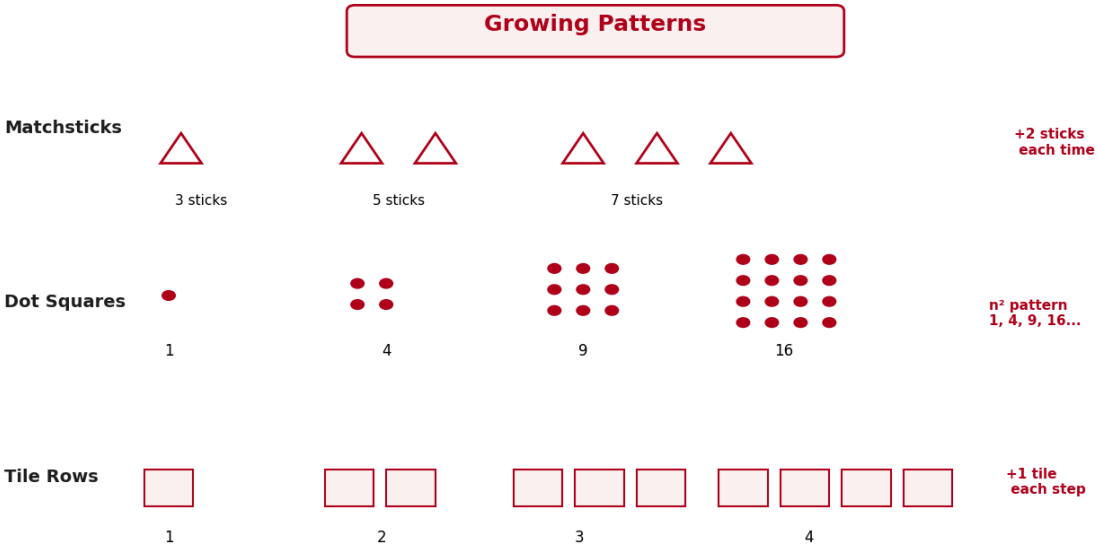
r = 6 ÷ 3 = 2

next term = 24 × 2 = 48

Recognising Number Patterns

Not every sequence fits the arithmetic or geometric pattern. Look at the differences between terms, or the differences of the differences. If those second differences are constant, the sequence follows a quadratic rule (like n^2). If you see a pattern of squares, cubes, or alternating signs, identify that rule directly.

Visual Patterns and Their Extensions



Matchstick Patterns

In matchstick patterns, shapes are built from sticks and each new shape in the sequence adds a fixed number of sticks. For equilateral triangles arranged in a row, the first triangle uses 3 sticks and each new triangle added shares one side with the previous one, adding 2 sticks. The number of sticks follows the AP: 3, 5, 7, 9… with d = 2.

Dot Patterns

Dot patterns arrange dots in shapes. Square dot patterns grow as 1, 4, 9, 16… (perfect squares). Triangular dot patterns grow as 1, 3, 6, 10… These sequences are not arithmetic progressions but recognising their visual structure helps identify the rule.

Tile Patterns

Tile patterns grow by adding one or more tiles at each step. A single row of tiles growing by one tile at each step gives the natural number sequence 1, 2, 3, 4… itself the simplest arithmetic progression with a = 1 and d = 1.

Predicting Future Shapes in a Pattern

To predict the 10th shape in a matchstick pattern where d = 2 and a = 3: $a_{10} = 3 + (10 - 1) \times 2 = 3 + 18 = 21$ sticks. The nth term formula works for visual patterns exactly the same way it works for number sequences.

Important Concepts from the Chapter

Extending a Sequence

To extend any sequence, identify the rule (add d, multiply by r, or follow another pattern) and apply it to the last known term to generate the next terms.

Finding Missing Terms

If a term in the middle of a sequence is missing, use the fact that consecutive terms must maintain a constant difference. Example: 5, ?, 17, 23 the difference should be constant. From 17 to 23 is +6, so from 5 to the missing term is also +6. Missing term = 5 + 6 = 11.

Generalising a Pattern

Generalising means writing the nth term as a formula. For the tile pattern 2, 5, 8, 11…: a = 2, d = 3, so the nth term = $2 + (n - 1) \times 3 = 3n - 1$. This single expression generates every term.

Writing Rules for Sequences

A rule for a sequence is a mathematical expression that gives the value of any term from its position number. For the sequence 4, 7, 10, 13…, the rule is $a_n = 3n + 1$. Plug in n = 1: $a_1 = 4$. Plug in n = 5: $a_5 = 16$.

Solved Examples for Quick Revision

Example on Arithmetic Sequence

Question: Check whether 5, 11, 17, 23, 29 is an AP. If yes, find the common difference.

Solution: Differences: 11 − 5 = 6

17 − 11 = 6,

23 − 17 = 6,

29 − 23 = 6.

The difference is constant. Yes, it is an AP with d = 6.

Example on Finding the Next Term

Question: Find the next two terms of the AP: 13, 9, 5, 1…

Solution: d = 9 − 13 = −4.

Next term = 1 + (−4) = −3.

Term after that = −3 + (−4) = −7.

The sequence continues: 13, 9, 5, 1, −3, −7…

Example on Finding the nth Term

Question: Find the 20th term of the AP: 3, 8, 13, 18…

Solution: a = 3, d = 8 − 3 = 5, n = 20.

$a_{20} = 3 + (20 - 1) \times 5 = 3 + 19 \times 5 = 3 + 95 = 98$

Formula Sheet for Class 9 Maths Chapter 8

Arithmetic Progression Formula

nth Term of AP

$a_n = a + (n - 1)d$

a = first term

d = common difference

n = position of term

a_n = value at position n

Common Difference

$d = a_2 - a_1$

$d = a_3 - a_2$

Any term − Previous term

Positive d → Increasing

Negative d → Decreasing

Is x a Term in the AP?

Set $a_n = x$

Solve for n

If n is a positive

whole number → Yes

Otherwise → No

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