MATH LOVE INSTITUTE

Education as a Service (EaaS)

Quality Education | Affordable Prices | Holistic Development

+91-7869553517 | www.mathlove.in

ARITHMETIC PROGRESSIONS

Complete Study Material for CBSE Class 10 (2025-26)

🌟 FASCINATING FACTS ABOUT ARITHMETIC

PROGRESSIONS

Did You Know?

🧮 **Gauss's Genius:** At age 10, Carl Friedrich Gauss instantly found the sum of numbers from 1 to 100 (which is 5050) using AP concepts! His teacher asked the class to add all numbers from 1 to 100, expecting them to be busy for hours. Gauss noticed that pairing numbers (1+100, 2+99, 3+98...) always gave 101, and there were 50 such pairs. Result: 50 × 101 = 5050!

🏛️ **Ancient Mathematics:** The concept of AP was known to ancient civilizations. Babylonians (around 2000 BCE) used AP in their astronomical calculations and tax records.

🇮🇳 **Indian Heritage:** Ancient Indian mathematicians like Aryabhata (476-550 CE) and Brahmagupta (598-665 CE) extensively studied arithmetic progressions and derived formulas for sum of first n natural numbers, sum of squares, and sum of cubes!

🎯 **Real-Life Applications:** APs are everywhere - salary increments, loan repayments (EMI), stacking objects, seating arrangements in stadiums, depreciation of assets, and even in nature (petals arrangement in some flowers)!

🎭 **Theatre Design:** Ancient Greek and Roman amphitheatres were designed using AP concepts - each row had more seats than the previous one by a fixed number to ensure everyone could see the stage!

💰 **Banking & Finance:** Simple interest calculations follow AP! The interest amount for consecutive years forms an arithmetic progression.

📐 **Architecture:** Staircases, pyramids, and many architectural wonders use AP in their design - each step or layer follows a pattern!

📋 CHAPTER OVERVIEW

Chapter	Arithmetic Progressions (Chapter 5)
Weightage	6 marks (As per CBSE marking scheme 2025-26)
Difficulty Level	Medium
Expected Questions	1-2 questions (2 marks, 3 marks, or 5 marks)
Time Required	10-15 minutes in exam

Topics Covered:

1. **Introduction to Arithmetic Progressions**
2. **Definition and General Form**
3. **Common Difference (d)**
4. **nth Term of an AP: $a_n = a + (n-1)d$**
5. **Sum of First n Terms: $S_n = n/2[2a + (n-1)d]$**
6. **Sum Formula using Last Term: $S_n = n/2(a + l)$**
7. **Real-Life Applications**

🎯 SECTION 1: WHAT IS AN ARITHMETIC PROGRESSION?

Definition:

An Arithmetic Progression (AP) is a sequence of numbers in which each term (except the first) is obtained by adding a fixed number to the preceding term.

General Form: a, a+d, a+2d, a+3d, ...

where:

a = first term

d = common difference

Real-Life Examples of AP

Example 1: Salary Increment

Reena gets a starting salary of ₹8000 with an annual increment of ₹500.

```
Year 1: ₹8000
Year 2: ₹8500
Year 3: ₹9000
Year 4: ₹9500
...

This forms an AP: 8000, 8500, 9000, 9500, ...
First term (a) = 8000
Common difference (d) = 500
```

Example 2: Ladder Rungs

A ladder has rungs that decrease uniformly by 2 cm from bottom to top. Bottom rung is 45 cm.

```
Length of rungs (in cm): 45, 43, 41, 39, 37, 35, 33,
31

This is an AP with:
a = 45 cm
d = -2 cm (negative because decreasing)
```

Example 3: Savings Scheme

Shakila puts ₹100 in her daughter's money box on 1st birthday, ₹150 on 2nd, ₹200 on 3rd...

```
Amount saved: 100, 150, 200, 250, ...

This is an AP with:
a = 100
d = 50
```

Understanding Common Difference (d)

How to Find Common Difference:

$d = a_2 - a_1 = a_3 - a_2 = a_4 - a_3 = ...$

Key Points:

- ✓ **d can be positive, negative, or zero**
- ✓ If d > 0, the AP is **increasing**
- ✓ If d < 0, the AP is **decreasing**
- ✓ If d = 0, all terms are **equal**
- ✓ Subtract any term from the **next** term to get d

Example 4: Identify if the following form an AP. If yes, find a and d.

(i) 3, 1, -1, -3, ...

$a_2 - a_1 = 1 - 3 = -2$
$a_3 - a_2 = -1 - 1 = -2$
$a_4 - a_3 = -3 - (-1) = -2$

Since differences are equal: **YES, it's an AP**
$a = 3, d = -2$

(ii) -5, -1, 3, 7, ...

$a_2 - a_1 = -1 - (-5) = -1 + 5 = 4$
$a_3 - a_2 = 3 - (-1) = 3 + 1 = 4$
$a_4 - a_3 = 7 - 3 = 4$

YES, it's an AP
$a = -5, d = 4$

(iii) 1, 1, 2, 3, 5, 8, ... (Fibonacci sequence)

$a_2 - a_1 = 1 - 1 = 0$
$a_3 - a_2 = 2 - 1 = 1$
$a_4 - a_3 = 3 - 2 = 1$
$a_5 - a_4 = 5 - 3 = 2$

Differences are NOT equal: **NO, it's NOT an AP**

(iv) 2, 4, 8, 16, ... (Geometric sequence)

$a_2 - a_1 = 4 - 2 = 2$

$a_3 - a_2 = 8 - 4 = 4$

$a_4 - a_3 = 16 - 8 = 8$

Differences are NOT equal: **NO, it's NOT an AP**

⚠️ COMMON MISTAKES IN IDENTIFYING AP:

❌ **Mistake 1:** Not checking all consecutive differences

- Wrong: Checking only first two terms
- Correct: Check at least 3-4 consecutive differences

❌ **Mistake 2:** Sign errors in negative numbers

- Example: For -3, -2, -1, 0...
- d = -2 - (-3) = -2 + 3 = 1 (NOT -5)

❌ **Mistake 3:** Confusing AP with GP

- AP: Same difference (add fixed number)
- GP: Same ratio (multiply by fixed number)
- Example: 2, 4, 8, 16 is GP (×2), NOT AP

Writing AP when a and d are Given

Example 5: Write the first 4 terms of AP when:

(i) a = 10, d = 10

```
First term = a = 10
Second term = a + d = 10 + 10 = 20
Third term = a + 2d = 10 + 2(10) = 30
Fourth term = a + 3d = 10 + 3(10) = 40

AP: 10, 20, 30, 40
```

(ii) a = -2, d = 0

```
First term = -2
Second term = -2 + 0 = -2
Third term = -2 + 0 = -2
Fourth term = -2 + 0 = -2

AP: -2, -2, -2, -2 (all terms equal)
```

(iii) a = 4, d = -3

```
First term = 4
Second term = 4 + (-3) = 1
Third term = 4 + 2(-3) = 4 - 6 = -2
Fourth term = 4 + 3(-3) = 4 - 9 = -5

AP: 4, 1, -2, -5
```

(iv) a = -1, d = 1/2

```
First term = -1
Second term = -1 + 1/2 = -1/2
Third term = -1 + 2(1/2) = -1 + 1 = 0
Fourth term = -1 + 3(1/2) = -1 + 3/2 = 1/2
```

AP: -1, -1/2, 0, 1/2

🎯 SECTION 2: nth TERM OF AN AP

FORMULA FOR nth TERM

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

where:

a_n = nth term (term at position n)

a = first term

d = common difference

n = position of term

Derivation of the Formula

Let's understand how this formula comes:

```
Given AP: a, a+d, a+2d, a+3d, a+4d, ...

1st term (n=1): a = a + 0×d = a + (1-1)d
2nd term (n=2): a+d = a + 1×d = a + (2-1)d
3rd term (n=3): a+2d = a + 2×d = a + (3-1)d
4th term (n=4): a+3d = a + 3×d = a + (4-1)d
...
nth term: a_n = a + (n-1)×d

Pattern: To reach nth term, we add d exactly (n-1) times!
```

Types of Problems on nth Term

📌 Four Types of nth Term Problems:

1. **Type 1:** Find nth term when a, d, n are given
2. **Type 2:** Find which term is a given value
3. **Type 3:** Find a or d when some terms are given
4. **Type 4:** Check if a number is a term of given AP

TYPE 1: Finding nth Term

Example 6: Find the 10th term of AP: 2, 7, 12, 17, ...

Step 1: Identify a, d, n

$a = 2$

$d = 7 - 2 = 5$

$n = 10$

Step 2: Apply formula

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

$a_{10} = 2 + (10-1) \times 5$

$a_{10} = 2 + 9 \times 5$

$a_{10} = 2 + 45$

$a_{10} = 47$

Answer: 10th term = 47

Example 7: Find the 20th term of AP: -5, -1, 3, 7, ...

$a = -5$

$d = -1 - (-5) = -1 + 5 = 4$

$n = 20$

$a_{20} = a + (n-1)d$

$a_{20} = -5 + (20-1) \times 4$

$a_{20} = -5 + 19 \times 4$

$a_{20} = -5 + 76$

$a_{20} = 71$

Answer: 20th term = 71

Example 8: Find the 11th term from the last of AP: 10, 7, 4, ..., -62

Method 1: Find total terms, then find 11th from last

Given: a = 10, d = 7-10 = -3, last term = -62

First find total number of terms:

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

$-62 = 10 + (n-1)(-3)$

$-62 = 10 - 3n + 3$

$-62 = 13 - 3n$

$-75 = -3n$

$n = 25$

So there are 25 terms.

11th from last = (25-11+1)th from start = 15th term

$a_{15} = 10 + (15-1)(-3)$

$a_{15} = 10 + 14(-3)$

$a_{15} = 10 - 42$

$a_{15} = -32$

Method 2: Reverse the AP

Reverse AP: -62, -59, -56, ..., 10

Now a = -62, d = -59-(-62) = 3

11th term of reversed AP:

$a_{11} = -62 + (11-1)\times 3$

$a_{11} = -62 + 30$

$a_{11} = -32$

Answer: 11th term from last = -32

TYPE 2: Which Term has a Given Value?

Example 9: Which term of AP: 21, 18, 15, ... is -81?

Given: $a = 21$, $d = 18-21 = -3$

Find: n such that $a_n = -81$

Using formula:

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

$-81 = 21 + (n-1)(-3)$

$-81 = 21 - 3n + 3$

$-81 = 24 - 3n$

$-81 - 24 = -3n$

$-105 = -3n$

$n = 35$

Answer: -81 is the 35th term

Verification:

$a_{35} = 21 + (35-1)(-3) = 21 + 34(-3) = 21 - 102 = -81$ ✓

Example 10: Which term of AP: 3, 8, 13, 18, ... is 78?

$a = 3,\ d = 8-3 = 5$

Find n when $a_n = 78$

$78 = 3 + (n-1)\times 5$

$78 = 3 + 5n - 5$

$78 = -2 + 5n$

$80 = 5n$

$n = 16$

Answer: 78 is the 16th term

TYPE 3: Finding a or d

Example 11: Determine the AP whose 3rd term is 16 and 7th term exceeds 5th term by 12.

Given:

$a_3 = 16$

$a_7 - a_5 = 12$

Step 1: Write equations using formula

$a_3 = a + 2d = 16$ ... (1)

$a_7 = a + 6d$

$a_5 = a + 4d$

$a_7 - a_5 = (a + 6d) - (a + 4d) = 2d = 12$

So, $d = 6$ ... (2)

Step 2: Find a using equation (1)

$a + 2d = 16$

$a + 2(6) = 16$

$a + 12 = 16$

$a = 4$

Step 3: Write the AP

$a = 4$, $d = 6$

AP: 4, 10, 16, 22, 28, ...

Answer: The AP is 4, 10, 16, 22, 28, ...

Example 12: The 17th term of an AP exceeds its 10th term by 7. Find the common difference.

Given: $a_{17} - a_{10} = 7$

$a_{17} = a + 16d$

$a_{10} = a + 9d$

$a_{17} - a_{10} = (a + 16d) - (a + 9d) = 7$

$a + 16d - a - 9d = 7$

$7d = 7$

$d = 1$

Answer: Common difference = 1

TYPE 4: Checking if a Number is a Term

Example 13: Check whether 301 is a term of AP: 5, 11, 17, 23, ...

$a = 5,\ d = 11-5 = 6$

If 301 is a term, then:

$a_n = 301$

$a + (n-1)d = 301$

$5 + (n-1)\times 6 = 301$

$5 + 6n - 6 = 301$

$6n - 1 = 301$

$6n = 302$

$n = 302/6 = 50.33...$

Since n is NOT a positive integer (whole number)

Answer: 301 is NOT a term of this AP

Example 14: Check whether -150 is a term of AP: 11, 8, 5, 2, ...

```
a = 11, d = 8-11 = -3

If -150 is a term:
11 + (n-1)(-3) = -150
11 - 3n + 3 = -150
14 - 3n = -150
-3n = -164
n = 164/3 = 54.67...
```

n is NOT a positive integer

Answer: -150 is NOT a term of this AP

Special Applications

Example 15: How many two-digit numbers are divisible by 3?

Two-digit numbers divisible by 3:
12, 15, 18, 21, ..., 99

This is an AP with:
a = 12, d = 3, last term = 99

Find n:
$a_n = 99$
$12 + (n-1) \times 3 = 99$
$12 + 3n - 3 = 99$
$9 + 3n = 99$
$3n = 90$
$n = 30$

Answer: There are 30 two-digit numbers divisible by 3

Example 16: How many multiples of 4 lie between 10 and 250?

Multiples of 4 between 10 and 250:
12, 16, 20, 24, ..., 248

First multiple after 10: 12
Last multiple before 250: 248

a = 12, d = 4, last term = 248

$248 = 12 + (n-1)\times 4$
$248 = 12 + 4n - 4$
$248 = 8 + 4n$
$240 = 4n$
$n = 60$

Answer: There are 60 multiples of 4 between 10 and 250

⚠️ COMMON MISTAKES IN nth TERM PROBLEMS:

❌ **Mistake 1:** Using n instead of (n-1)

- Wrong: $a_n = a + nd$
- Correct: $a_n = a + (n-1)d$
- Remember: We add d exactly (n-1) times!

❌ **Mistake 2:** Sign errors with negative d

- When d is negative, be careful with signs
- Example: $a + (n-1)(-3) = a - 3(n-1) = a - 3n + 3$

❌ **Mistake 3:** Not checking if n is a positive integer

- When checking if a number is a term, n MUST be a positive whole number
- If n comes out as fraction or negative, that number is NOT a term

❌ **Mistake 4:** Confusion in "nth from last" problems

- Either reverse the AP and find nth term
- OR find total terms first, then: nth from last = (total - n + 1)th from start

🎯 SECTION 3: SUM OF FIRST n TERMS OF AN AP

FORMULA FOR SUM OF n TERMS

$$S_n = n/2\,[2a + (n-1)d]$$

OR

$$S_n = n/2\,(a + l)$$

where:

S_n = sum of first n terms

a = first term

d = common difference

n = number of terms

l = last term = a_n

Derivation: Gauss's Method

How young Gauss found sum of 1 to 100:

Let S = 1 + 2 + 3 + 4 + ... + 98 + 99 + 100

Write it in reverse:

S = 100 + 99 + 98 + 97 + ... + 3 + 2 + 1

Add both equations term by term:

2S = 101 + 101 + 101 + ... + 101 + 101 + 101

2S = 101 × 100 (100 times)

2S = 10100

S = 5050

General Formula Derivation:

For AP: a, a+d, a+2d, ..., a+(n-1)d

S_n = a + (a+d) + (a+2d) + ... + [a+(n-2)d] + [a+(n-1)d] ... (1)

Write in reverse:

S_n = [a+(n-1)d] + [a+(n-2)d] + ... + (a+2d) + (a+d) + a ... (2)

Add (1) and (2):

$2S_n$ = [2a+(n-1)d] + [2a+(n-1)d] + ... + [2a+(n-1)d] (n times)

$2S_n$ = n[2a + (n-1)d]

S_n = n/2 [2a + (n-1)d]

Also, since last term l = a + (n-1)d:

S_n = n/2 [a + a+(n-1)d] = n/2 (a + l)

When to Use Which Formula?

📌 Choosing the Right Formula:

- **Use $S_n = n/2[2a + (n-1)d]$** when you know:
  - First term (a), common difference (d), and number of terms (n)
- **Use $S_n = n/2(a + l)$** when you know:
  - First term (a), last term (l), and number of terms (n)
  - This is easier and faster when last term is given!

Finding Sum of First n Terms

Example 17: Find the sum of first 22 terms of AP: 8, 3, -2, ...

Given: $a = 8$, $d = 3-8 = -5$, $n = 22$

Using formula: $S_n = n/2[2a + (n-1)d]$

$S_{22} = 22/2\ [2\times8 + (22-1)(-5)]$
$S_{22} = 11\ [16 + 21(-5)]$
$S_{22} = 11\ [16 - 105]$
$S_{22} = 11 \times (-89)$
$S_{22} = -979$

Answer: Sum of first 22 terms = -979

Example 18: Find sum: 7 + 10½ + 14 + ... + 84

First find number of terms:

a = 7, d = 10½ - 7 = 3½ = 7/2, last term = 84

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

$84 = 7 + (n-1)\times 7/2$

$84 - 7 = (n-1)\times 7/2$

$77 = (n-1)\times 7/2$

$77 \times 2/7 = n-1$

$22 = n-1$

$n = 23$

Now find sum using $S_n = n/2(a + l)$:

$S_{23} = 23/2\ (7 + 84)$

$S_{23} = 23/2 \times 91$

$S_{23} = 23 \times 91/2$

$S_{23} = 2093/2$

$S_{23} = 1046.5$

Answer: Sum = 1046.5

Example 19: Find sum of first 1000 positive integers

Numbers: 1, 2, 3, 4, ..., 1000
This is an AP with a = 1, l = 1000, n = 1000

$S_{1000} = n/2(a + l)$
$S_{1000} = 1000/2\ (1 + 1000)$
$S_{1000} = 500 \times 1001$
$S_{1000} = 500500$

Answer: Sum = 500,500

General Formula: Sum of first n natural numbers = n(n+1)/2

Finding n when Sum is Given

Example 20: How many terms of AP: 24, 21, 18, ... must be taken so that their sum is 78?

Given: $a = 24$, $d = 21-24 = -3$, $S_n = 78$

Using $S_n = n/2[2a + (n-1)d]$:

$78 = n/2[2\times24 + (n-1)(-3)]$

$78 = n/2[48 - 3n + 3]$

$78 = n/2[51 - 3n]$

$156 = n(51 - 3n)$

$156 = 51n - 3n^2$

$3n^2 - 51n + 156 = 0$

$n^2 - 17n + 52 = 0$ (dividing by 3)

$(n - 4)(n - 13) = 0$

$n = 4$ or $n = 13$

Both values are valid!

Answer: Either 4 terms or 13 terms

Why two answers?

Sum of first 4 terms = Sum of first 13 terms = 78

This happens because some middle terms are negative, canceling each other out!

Example 21: Find the sum of first 51 terms of an AP whose 2nd and 3rd terms are 14 and 18 respectively.

Given: $a_2 = 14$, $a_3 = 18$, $n = 51$

Step 1: Find a and d

$a_2 = a + d = 14$ ... (1)

$a_3 = a + 2d = 18$ ... (2)

Subtract (1) from (2):

$(a + 2d) - (a + d) = 18 - 14$

$d = 4$

Substitute in (1):

$a + 4 = 14$

$a = 10$

Step 2: Find S_{51}

$S_{51} = 51/2[2\times10 + (51-1)\times4]$

$S_{51} = 51/2[20 + 50\times4]$

$S_{51} = 51/2[20 + 200]$

$S_{51} = 51/2 \times 220$

$S_{51} = 51 \times 110$

$S_{51} = 5610$

Answer: Sum of first 51 terms = 5610

Finding a or d when Sum is Given

Example 22: If sum of first 14 terms of an AP is 1050 and its first term is 10, find the 20th term.

Given: $S_{14} = 1050$, $a = 10$, $n = 14$

Step 1: Find d

$S_{14} = 14/2[2\times10 + (14-1)d]$

$1050 = 7[20 + 13d]$

$1050/7 = 20 + 13d$

$150 = 20 + 13d$

$130 = 13d$

$d = 10$

Step 2: Find a_{20}

$a_{20} = a + 19d$

$a_{20} = 10 + 19\times10$

$a_{20} = 10 + 190$

$a_{20} = 200$

Answer: 20th term = 200

Example 23: If sum of first 7 terms is 49 and sum of first 17 terms is 289, find sum of first n terms.

Given: $S_7 = 49$, $S_{17} = 289$

Using $S_n = n/2[2a + (n-1)d]$:

For n = 7:

$49 = 7/2[2a + 6d]$

$49 \times 2/7 = 2a + 6d$

$14 = 2a + 6d$

$7 = a + 3d$ ... (1)

For n = 17:

$289 = 17/2[2a + 16d]$

$289 \times 2/17 = 2a + 16d$

$34 = 2a + 16d$

$17 = a + 8d$ ... (2)

Subtract (1) from (2):

$(a + 8d) - (a + 3d) = 17 - 7$

$5d = 10$

$d = 2$

From (1): $a + 3(2) = 7$

$a = 7 - 6 = 1$

General formula for S_n:

$S_n = n/2[2(1) + (n-1)(2)]$

$S_n = n/2[2 + 2n - 2]$

$S_n = n/2 \times 2n$

$S_n = n^2$

Answer: $S_n = n^2$

🎯 SECTION 4: REAL-LIFE APPLICATIONS (WORD PROBLEMS)

📝 Steps to Solve Word Problems:

1. **Read carefully:** Identify what forms the AP
2. **Find a, d, n:** Determine the first term, common difference, and number of terms
3. **Choose formula:** nth term or sum formula as needed
4. **Solve:** Apply the formula and calculate
5. **Verify:** Check if answer makes sense
6. **State answer:** Write complete answer with units

Example 24: Ramkali saved ₹5 in first week and increased her savings by ₹1.75 each week. In which week will her savings be ₹20.75?

Weekly savings form an AP:
Week 1: ₹5
Week 2: ₹5 + ₹1.75 = ₹6.75
Week 3: ₹8.50
...

a = 5, d = 1.75
Find n when a_n = 20.75

$a_n = a + (n-1)d$
$20.75 = 5 + (n-1)\times 1.75$
$20.75 - 5 = (n-1)\times 1.75$
$15.75 = (n-1)\times 1.75$
$n-1 = 15.75/1.75$
$n-1 = 9$
$n = 10$

Answer: In the 10th week, her savings will be ₹20.75

Example 25: A contract specifies penalty of ₹200 for 1st day, ₹250 for 2nd day, ₹300 for 3rd day and so on. How much will contractor pay if delayed by 30 days?

Penalty per day forms AP:
200, 250, 300, 350, ...

a = 200, d = 50, n = 30

Find total penalty = S_{30}

$S_{30} = 30/2[2\times200 + (30-1)\times50]$
$S_{30} = 15[400 + 29\times50]$
$S_{30} = 15[400 + 1450]$
$S_{30} = 15 \times 1850$
$S_{30} = 27,750$

Answer: Contractor will pay ₹27,750 as penalty

Example 26: A sum of ₹1000 is invested at 8% simple interest per year. Find interest at end of 30 years using AP.

Interest for each year forms AP:
Year 1: 1000×8×1/100 = ₹80
Year 2: 1000×8×2/100 = ₹160
Year 3: 1000×8×3/100 = ₹240
...

This is AP: 80, 160, 240, ...
a = 80, d = 80, n = 30

Find a_{30}:
a_{30} = 80 + (30−1)×80
a_{30} = 80 + 29×80
a_{30} = 80 + 2320
a_{30} = 2400

Answer: Interest at end of 30 years = ₹2400

Example 27: In a flower bed, 23 rose plants in 1st row, 21 in 2nd, 19 in 3rd, and so on. Last row has 5 plants. How many rows?

Number of plants per row: 23, 21, 19, ..., 5

a = 23, d = 21-23 = -2, last term = 5

Find n:

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

$5 = 23 + (n-1)(-2)$

$5 = 23 - 2n + 2$

$5 = 25 - 2n$

$2n = 20$

$n = 10$

Answer: There are 10 rows in the flower bed

Example 28: ₹700 is to be divided among 7 students as prizes. Each prize is ₹20 less than preceding one. Find value of each prize.

Let first prize = a
Then prizes are: a, a-20, a-40, a-60, ...

This is AP with d = -20, n = 7
Total sum = ₹700

$S_7 = 700$
$7/2[2a + (7-1)(-20)] = 700$
$7/2[2a + 6(-20)] = 700$
$7/2[2a - 120] = 700$
$7[2a - 120] = 1400$
$2a - 120 = 200$
$2a = 320$
$a = 160$

Prizes are:
1st: ₹160
2nd: ₹140
3rd: ₹120
4th: ₹100
5th: ₹80
6th: ₹60
7th: ₹40

Verification: 160+140+120+100+80+60+40 = 700 ✓

Example 29: A manufacturer produced 600 TV sets in 3rd year and 700 in 7th year. Find: (i) production in 1st year (ii) production in 10th year (iii) total production in first 7 years.

Production per year forms AP:
$a_3 = 600, a_7 = 700$

Step 1: Find a and d
$a_3 = a + 2d = 600 \ldots (1)$
$a_7 = a + 6d = 700 \ldots (2)$

Subtract (1) from (2):
$4d = 100$
$d = 25$

From (1): $a + 50 = 600$
$a = 550$

(i) Production in 1st year = a = 550 sets

(ii) Production in 10th year:
$a_{10} = a + 9d$
$a_{10} = 550 + 9 \times 25$
$a_{10} = 550 + 225$
$a_{10} = 775$ sets

(iii) Total production in first 7 years:
$S_7 = 7/2[2 \times 550 + (7-1) \times 25]$
$S_7 = 7/2[1100 + 150]$
$S_7 = 7/2 \times 1250$
$S_7 = 4375$ sets

Answers: (i) 550 sets (ii) 775 sets (iii) 4375 sets

Example 30: 200 logs are stacked: 20 in bottom row, 19 in next, 18 in next, and so on. In how many rows are logs placed and how many in top row?

Logs per row: 20, 19, 18, 17, ...

a = 20, d = -1, S_n = 200

Find n:

$S_n = n/2[2a + (n-1)d]$

$200 = n/2[2\times20 + (n-1)(-1)]$

$200 = n/2[40 - n + 1]$

$200 = n/2[41 - n]$

$400 = n(41 - n)$

$400 = 41n - n^2$

$n^2 - 41n + 400 = 0$

$(n - 25)(n - 16) = 0$

$n = 25$ or $n = 16$

Check which is valid:

If n = 25: $a_{25} = 20 + 24(-1) = -4$ (Negative! Not possible)

If n = 16: $a_{16} = 20 + 15(-1) = 5$ (Positive ✓)

Answer: Logs are in 16 rows, with 5 logs in top row

⚠️ COMMON MISTAKES IN WORD PROBLEMS:

❌ **Mistake 1:** Not identifying what forms the AP

- Read carefully to identify the sequence
- Is it savings per week, penalty per day, or plants per row?

❌ **Mistake 2:** Wrong units

- Always write answer with correct units
- ₹, cm, years, rows, etc.

❌ **Mistake 3:** Not verifying practical feasibility

- Negative values for quantities like logs, plants are not possible
- Check if answer makes sense in real context

❌ **Mistake 4:** Confusing sum with nth term

- Total penalty after 30 days = S_{30} (sum)
- Penalty on 30th day = a_{30} (nth term)

📝 PREVIOUS YEARS' BOARD QUESTIONS

2 MARK QUESTIONS

Q1. Find the 31st term of an AP whose 11th term is 38 and 16th term is 73. (2023)

Solution:

Given: $a_{11} = 38$, $a_{16} = 73$

$a_{11} = a + 10d = 38$ ... (1)

$a_{16} = a + 15d = 73$ ... (2)

Subtract (1) from (2):

$5d = 35$

$d = 7$

From (1): $a + 70 = 38$

$a = -32$

$a_{31} = a + 30d$

$a_{31} = -32 + 30 \times 7$

$a_{31} = -32 + 210$

$a_{31} = 178$

Answer: 31st term = 178

Q2. Which term of AP: 3, 15, 27, 39, ... will be 132 more than its 54th term? (2024)

Solution:

$a = 3,\ d = 15-3 = 12$

$a_{54} = 3 + 53\times12 = 3 + 636 = 639$

We need: $a_n = a_{54} + 132$

$a_n = 639 + 132 = 771$

$3 + (n-1)\times12 = 771$

$12(n-1) = 768$

$n-1 = 64$

$n = 65$

Answer: 65th term

3 MARK QUESTIONS

Q3. The sum of 4th and 8th terms of an AP is 24 and sum of 6th and 10th terms is 44. Find first three terms. (2022)

Solution:

Given:

$a_4 + a_8 = 24$

$(a+3d) + (a+7d) = 24$

$2a + 10d = 24$

$a + 5d = 12 \quad ... \quad (1)$

$a_6 + a_{10} = 44$

$(a+5d) + (a+9d) = 44$

$2a + 14d = 44$

$a + 7d = 22 \quad ... \quad (2)$

Subtract (1) from (2):

$2d = 10$

$d = 5$

From (1): $a + 25 = 12$

$a = -13$

First three terms:

$a_1 = -13$

$a_2 = -13 + 5 = -8$

$a_3 = -8 + 5 = -3$

Answer: -13, -8, -3

Q4. How many terms of AP: 9, 17, 25, ... must be taken to give a sum of 636? (2023)

Solution:

$a = 9,\ d = 17-9 = 8,\ S_n = 636$

$n/2[2\times9 + (n-1)\times8] = 636$

$n/2[18 + 8n - 8] = 636$

$n/2[10 + 8n] = 636$

$n(10 + 8n) = 1272$

$10n + 8n^2 = 1272$

$8n^2 + 10n - 1272 = 0$

$4n^2 + 5n - 636 = 0$

Using quadratic formula:

$n = [-5 \pm \sqrt{(25 + 10176)}]/8$

$n = [-5 \pm \sqrt{10201}]/8$

$n = [-5 \pm 101]/8$

$n = 96/8 = 12 \quad or \quad n = -106/8$ (reject)

Answer: 12 terms

Q5. First and last terms of an AP are 17 and 350. If common difference is 9, how many terms are there and what is their sum? (2024)

Solution:

$a = 17,\ l = 350,\ d = 9$

Find n:

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

$350 = 17 + (n-1)\times 9$

$333 = 9(n-1)$

$n-1 = 37$

$n = 38$

Find sum:

$S_n = n/2(a + l)$

$S_{38} = 38/2(17 + 350)$

$S_{38} = 19 \times 367$

$S_{38} = 6973$

Answer: 38 terms, Sum = 6973

5 MARK QUESTIONS

Q6. In a potato race, bucket is at starting point 5m from first potato. Other potatoes are 3m apart in a line. There are 10 potatoes. A competitor picks up nearest potato, runs back, drops it in bucket, runs back for next potato, and continues. What is total distance? (2023)

Solution:

For 1st potato: $2 \times 5 = 10$ m

For 2nd potato: $2 \times (5+3) = 16$ m

For 3rd potato: $2 \times (5+6) = 22$ m

For 4th potato: $2 \times (5+9) = 28$ m

...

For 10th potato: $2 \times (5+27) = 64$ m

Distances form AP: 10, 16, 22, 28, ..., 64

$a = 10$, $d = 6$, $n = 10$

Total distance = S_{10}

$S_{10} = 10/2(10 + 64)$

$S_{10} = 5 \times 74$

$S_{10} = 370$ m

Answer: Total distance = 370 meters

💯 EXAM STRATEGY & TIME MANAGEMENT

Question Type	Marks	Time	Strategy
Find nth term	2	2-3 min	Identify a, d, n. Apply formula. Show all steps.
Which term equals?	2-3	3-4 min	Set up equation. Solve for n. Check if n is positive integer.
Find sum	2-3	3-4 min	Choose correct formula. Calculate carefully. Verify if time permits.
Find a or d	3	4-5 min	Form two equations. Solve simultaneously. Find required value.
Word problems	3-5	5-7 min	Read twice. Identify AP. Form equation. Solve. State with units.

⏰ Time Allocation Tips:

- **Read question carefully:** Identify what is given and what to find (30 sec)
- **Choose formula wisely:** Use S_n = n/2(a+l) when last term given - it's faster!
- **Show all steps:** Write formula first, then substitute values
- **Box important formulas:** a_n = a+(n-1)d and S_n formulas
- **Verify if time permits:** Especially for 3-5 mark questions
- **Units are important:** Don't forget to write units in answers

⚠️ COMMON MISTAKES TO AVOID (CONSOLIDATED)

Top 15 Mistakes Students Make:

1. **Using n instead of (n-1):** Formula is $a_n = a+(n-1)d$, NOT a+nd
2. **Sign errors:** Be very careful with negative d or negative terms
3. **Wrong formula choice:** Know when to use which sum formula
4. **Not checking if sequence is AP:** Always verify d is constant
5. **Calculation errors:** 2×24 = 48, not 46! Double-check arithmetic
6. **Not simplifying:** Convert mixed fractions, simplify before solving
7. **Forgetting to find n first:** In problems asking for sum to specific term
8. **Accepting negative n:** Number of terms must be positive integer
9. **Forgetting units:** ₹, cm, meters - write appropriate units
10. **Not reading "from last":** 11th from last ≠ 11th from first!
11. **Confusing a_n with S_n:** nth term vs sum of n terms
12. **Wrong simultaneous equations:** Set up equations correctly
13. **Not verifying answer:** Check if n comes as fraction - invalid for terms!
14. **Incomplete word problem setup:** Identify what forms AP clearly
15. **Skipping steps:** Show complete working for full marks

📚 IMPORTANT FORMULAS - QUICK REFERENCE

1. General Form: a, a+d, a+2d, a+3d, ...

2. Common Difference: $d = a_{k+1} - a_k$

3. nth Term: $a_n = a + (n-1)d$

4. Sum of n Terms:

- $S_n = n/2[2a + (n-1)d]$
- $S_n = n/2(a + l)$ where l = last term

5. Special Sums:

- Sum of first n natural numbers: $n(n+1)/2$
- Sum of first n odd numbers: n^2
- Sum of first n even numbers: $n(n+1)$

6. Middle Term:

- If n is odd: Middle term = $a_{(n+1)/2}$
- If n is even: Two middle terms = $a_{n/2}$ and $a_{(n/2)+1}$

7. Important Result: $a_n = S_n - S_{n-1}$

🚀 LAST MINUTE REVISION CHECKLIST

☑ Theory to Remember:

- ☑ Definition of AP - each term obtained by adding fixed d
- ☑ General form: a, a+d, a+2d, a+3d, ...
- ☑ d can be positive, negative, or zero
- ☑ Formula for nth term (write it 5 times!)
- ☑ Both formulas for sum (know when to use which)

☑ Quick Checks:

- ☑ Is difference between consecutive terms constant?
- ☑ Did I use (n-1) and not n in nth term formula?
- ☑ Is my answer for n a positive integer?
- ☑ Did I write units in word problems?
- ☑ Have I shown all steps for full marks?

☑ Common Question Types:

- ☑ Find nth term given a, d, n
- ☑ Which term equals a given value?
- ☑ Find sum of first n terms
- ☑ Find a or d given certain terms
- ☑ How many terms for given sum?
- ☑ Word problems on savings, penalties, arrangements

☑ Before Exam:

- ☑ Practice at least 30 questions
- ☑ Solve last 3 years' board questions
- ☑ Time yourself - complete in allocated time
- ☑ Revise all formulas - write them 10 times

- ☑ Go through common mistakes list

💡 EXPERT TIPS FOR SCORING FULL MARKS

How to Score 100% in Arithmetic Progressions:

- **1. Master the formulas:** Write them from memory without looking
- **2. Show formula first:** Always write formula before substituting
- **3. Clear working:** One step per line, proper alignment
- **4. Box answers:** Final answer should be clearly visible
- **5. Include units:** Essential in word problems for full marks
- **6. Verify logically:** Does negative plants/people make sense? NO!
- **7. Check arithmetic:** Simple calculation errors cost marks
- **8. Use shortcuts wisely:** S_n = n/2(a+l) is often faster
- **9. Practice diverse problems:** Different types, not just easy ones
- **10. Time management:** Don't spend too long on one question

🎓 PRACTICE QUESTIONS FOR SELF-

ASSESSMENT

Section A: 2 Marks Questions

1. Find the 20th term of AP: 3, 8, 13, ...
2. Which term of AP: 21, 18, 15, ... is -81?
3. How many three-digit numbers are divisible by 7?
4. Find common difference if 17th term exceeds 10th term by 7
5. First term is 5, last term is 45, sum is 400. Find n and d

Section B: 3 Marks Questions

6. Find sum of first 22 terms of AP: 8, 3, -2, ...
7. Determine AP whose 3rd term is 16 and 7th term exceeds 5th by 12
8. How many terms of AP: 24, 21, 18, ... sum to 78?
9. Sum of 4th and 8th terms is 24, sum of 6th and 10th is 44. Find first three terms
10. Find sum of first 51 terms if 2nd term is 14 and 3rd is 18

Section C: 5 Marks Questions

11. A manufacturer produced 600 sets in 3rd year and 700 in 7th. Find production in 1st year, 10th year, and total in first 7 years
12. Contract specifies penalty: ₹200 for day 1, ₹250 for day 2, increasing by ₹50 each day. Find penalty for 30 days delay
13. In spiral of semicircles with radii 0.5, 1.0, 1.5, ..., find total length of 13 semicircles
14. 200 logs stacked: 20 in bottom, 19 next, 18 next. How many rows and logs in top row?
15. School plants trees: Class 1 plants 1 tree per section, Class 2 plants 2, up to Class 12. Three sections per class. Total trees planted?

📖 ADDITIONAL RESOURCES

Where to Practice More:

- **NCERT Textbook:** Exercise 5.1, 5.2, 5.3, 5.4 - Complete all questions
- **NCERT Exemplar:** More challenging problems for depth
- **Previous Years Papers:** Last 5 years (2020-2024)
- **Sample Papers 2025-26:** Released by CBSE
- **Math Love Institute:** Chapter-wise tests at ₹1 only!

Important Points for Board Exam:

- ✓ AP chapter carries 6 marks in board exam
- ✓ Usually 1-2 questions asked
- ✓ Can be combined with other chapters
- ✓ Word problems are very common
- ✓ Show complete working for full marks
- ✓ Practice both formula types for sum

📞 NEED HELP?

Math Love Institute - Your Success Partner

🏫 **Personalized Doubt Clearing Sessions**

📱 **Contact:** +91-7869553517

🌐 **Website:** www.mathlove.in

📧 **Email:** info@mathlove.in

Join our Board Exam Crash Course 2025-26:

- ✓ Complete syllabus coverage with expert faculty
- ✓ Chapter-wise tests @ ₹1 only!
- ✓ Full-length mock tests @ ₹10
- ✓ Small batches for individual attention
- ✓ Doubt clearing sessions included
- ✓ Previous years' papers solved with tips
- ✓ Shortcuts and tricks for scoring 100%
- ✓ Special focus on Arithmetic Progressions