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CLASS X · MATHEMATICS BASIC (241) · CBSE BOARD EXAMINATION 2027

CHAPTER 5 BASIC

Arithmetic Progressions

3, 7, 11, 15, ... d = 4 $a_n = 4n - 1$

Chapter Practice Booklet · Questions only · Answers in the separate Answer Booklet

6 guided method questions | 37 practice questions | 3 case studies

Basic (430 series) board question index

INSIDE THIS BOOKLET

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STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

BOOKLET STARTED ON _____

CHAPTER TEST SCORE _____ / 20

1

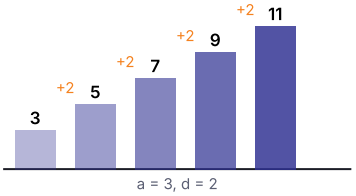
READ THIS FIRST · MATHEMATICS BASIC

Chapter Notes

The whole chapter in short-note form: every definition, formula, method and model answer. Revise from here – you should not need the textbook again.

1 What is an arithmetic progression?

An **arithmetic progression (AP)** is a list of numbers in which each term after the first is got by adding a fixed number d to the term before it. d is the **common difference**: $d = a_2 - a_1 = a_3 - a_2 = \ldots$



- General form: $a,\ a+d,\ a+2d,\ a+3d,\ \ldots$ (a = first term).
- d can be positive (3, 7, 11, …), negative (10, 7, 4, …; $d = -3$) or zero (5, 5, 5, …). Surds are fine too: $\sqrt{2},\ 2\sqrt{2},\ 3\sqrt{2}$ has $d = \sqrt{2}$.
- An AP is **finite** if it has a last term, otherwise **infinite**.

EXAMPLE
1, 4, 9, 16, …: differences 3, 5, 7 are not equal, so it is **not** an AP.

2 Three terms in AP

a, b, c are in AP if and only if $b - a = c - b$, i.e. $2b = a + c$. (b is the **arithmetic mean** of a and c.)

EXAMPLE
For what k are $k+2,\ 4k-6,\ 3k-2$ in AP?
$2(4k-6) = (k+2) + (3k-2) \rightarrow 8k - 12 = 4k \rightarrow k = 3$. The terms are 5, 6, 7 ✓

When a question says "three numbers in AP", take them as $a-d,\ a,\ a+d$: their sum is $3a$, which gives a at once.

3 The nth term

$a_n = a + (n-1)d$ (the nth term, also called the general term)

EXAMPLE
20th term of 4, 9, 14, …: $a = 4,\ d = 5,\ a_{20} = 4 + 19 \times 5 = 99$.

EXAMPLE
Which term of 4, 9, 14, … is 154? $4 + (n-1)5 = 154 \rightarrow n - 1 = 30 \rightarrow n = 31$: the 31st term.

EXAMPLE
Is 300 a term? $4 + (n-1)5 = 300 \rightarrow n - 1 = 59.2$, not a whole number, so **no**.

n is a term number, so it must be a positive whole number.

4 Number of terms · from the end · middle term

- **Number of terms** in $a, \ldots, l$: $n = \dfrac{l-a}{d} + 1$.
- **nth term from the end** (last term l): $l - (n-1)d$.
- **Middle term:** if n is odd, it is the $\left(\dfrac{n+1}{2}\right)$th term; if n is even, there are two middle terms, the $\dfrac{n}{2}$th and $\left(\dfrac{n}{2}+1\right)$th.

EXAMPLE
3, 8, 13, …, 253: $n = \dfrac{250}{5} + 1 = 51$. 20th term from the end $= 253 - 19 \times 5 = 158$.

EXAMPLE
Middle term of 7, 11, 15, …, 87: $n = \dfrac{80}{4} + 1 = 21$ (odd), so the 11th term: $7 + 10 \times 4 = 47$.

5 Finding a and d from two facts

1. Write each fact as an equation in a and d, using $a_n = a + (n-1)d$.
2. Subtract the equations to get d, then find a.
3. Write the AP or the term asked for.

EXAMPLE
$a_3 = 12$ and $a_{10} = 47$: $a + 2d = 12$, $a + 9d = 47 \rightarrow 7d = 35$, $d = 5$, $a = 2$. AP: 2, 7, 12, …

EXAMPLE
"The 7th term exceeds the 5th by 8": $a_7 - a_5 = 2d = 8 \rightarrow d = 4$.

6 Sum of the first n terms

$$S_n = \frac{n}{2}[2a + (n-1)d] \quad \text{or} \quad S_n = \frac{n}{2}(a + l),$$
where $l = a_n$ is the last term.

- Idea: write the sum forwards and backwards and add. Each pair adds to $a + l$, and there are n pairs, so $2S_n = n(a + l)$.
- Sum of the first n natural numbers: $1 + 2 + \cdots + n = \frac{n(n+1)}{2}$. So $1 + 2 + \cdots + 100 = 5050$.
- Sum of the first n odd numbers: $1 + 3 + 5 + \cdots = n^2$.

EXAMPLE
First 20 terms of 3, 7, 11, …: $S_{20} = 10[6 + 19 \times 4] = 10 \times 82 = 820$.

7 Using S_n

- **Term from the sum:** $a_n = S_n - S_{n-1}$; in particular $a_1 = S_1$.
- **How many terms give a sum:** put S_n equal to the sum. This gives a quadratic in n; keep only a positive whole number.

EXAMPLE
$S_n = 3n^2 + 2n$: $a_1 = S_1 = 5$, $S_2 = 16$, so $a_2 = 11$, $d = 6$, $a_n = 6n - 1$.

EXAMPLE
How many terms of 9, 17, 25, … make 636?
$\frac{n}{2}[18 + 8(n-1)] = 636 \rightarrow 4n^2 + 5n - 636 = 0 \rightarrow n = \frac{-5 + 101}{8} = 12$ (the other root is negative).

8 Multiples and number problems

1. Find the first and the last number that fit (careful with "between": the end numbers are left out).
2. Count the terms: $n = \frac{l - a}{d} + 1$.
3. Add them: $S_n = \frac{n}{2}(a + l)$.

EXAMPLE
Multiples of 7 between 100 and 300: 105, 112, …, 294. $n = \frac{189}{7} + 1 = 28$; $S = 14 \times (105 + 294) = 5586$.

EXAMPLE
Two-digit numbers divisible by 3: 12, 15, …, 99. $n = \frac{87}{3} + 1 = 30$.

9 Model answer: two terms given (3 marks)

The 7th term of an AP is 32 and its 13th term is 62. Find the AP and the sum of its first 20 terms.

1. $a + 6d = 32$ and $a + 12d = 62$ 1
2. Subtracting: $6d = 30 \rightarrow d = 5$, $a = 2$. The AP is 2, 7, 12, 17, … 1
3. $S_{20} = \frac{20}{2}[2 \times 2 + 19 \times 5] = 10 \times 99 = 990$ 1

10 Model answer: savings (5 marks)

A family saves ₹800 in the first month and ₹150 more every month than in the month before. How much do they save in the 12th month? In which month do they save ₹3,050? How much do they save in the first year?

1. Savings form an AP with $a = 800$, $d = 150$. ½
2. $a_{12} = 800 + 11 \times 150 = ₹2{,}450$ 1
3. $800 + (n-1)150 = 3050 \rightarrow n - 1 = 15$ 1
4. $n = 16$: in the 16th month ½
5. $S_{12} = \frac{12}{2}[1600 + 11 \times 150] = 6 \times 3250$ 1
6. $= ₹19{,}500$ 1

11 Checks that save marks

- Use $n - 1$, not n: the 20th term is $a + 19d$.
- $d = a_2 - a_1$ (second minus first). For 10, 7, 4, … $d = -3$.
- "Between 1 and 300" leaves out 1 and 300.
- A value of n must be a positive whole number. If two values come out, check both against the story (a row cannot have a negative number of bricks).
- Do not divide the sum by n to get a term: use $a_n = S_n - S_{n-1}$.

Exam snapshot

What the board asks, and how to prepare

SYLLABUS 2026–27

- Motivation for studying arithmetic progressions.
- Derivation of the nth term and of the sum of the first n terms of an AP.
- Using them to solve daily-life problems.

Note: the sum of n terms is asked every year, usually as a 3- to 5-mark word problem or a case study.

BOARD WEIGHTAGE

20 / 80

Unit II Algebra together. Basic papers usually give one or two 1-mark questions (nth term, which term, d) and a 4-mark case study from this chapter.

MOST ASKED IN BASIC BOARD PAPERS + SAMPLE PAPER 2026–27 (3 PAPERS CHECKED)

How often	Question type	Marks	Papers
★★☆	nth term, which term, common difference	1	2 of 3
★★☆	Case study: trees planted, a spiral of semicircles	4	2 of 3

MISTAKES THAT COST MARKS

- Using n in place of $n - 1$ in $a_n = a + (n - 1)d$.
- Getting the sign of d wrong when the terms decrease.
- Forgetting the $+1$ in $n = \dfrac{l - a}{d} + 1$.
- Forgetting to halve: $S_n = \dfrac{n}{2}[\ldots]$.
- Saying a number is a term when n comes out as a fraction.
- Arithmetic slips with negative d: $10 + (n - 1)(-3)$ is $13 - 3n$.

HOW TO USE THIS BOOKLET

1. **Day 1:** Notes, then Part A (guided methods) – fill every blank.
2. **Day 2:** Part B (NCERT practice). Do every MUST DO question first.
3. **Day 3:** Part C (board pattern), Part D (case studies) and the real board questions in Part E.
4. **Sun 20 Dec: Sunday chapter test – 20 marks in 40 minutes, without the booklet.**
5. Check every answer in the Answer Booklet. Write each mistake on the My Mistakes page.

RULES AT A GLANCE

Common difference	$d = a_2 - a_1$
nth term	$a_n = a + (n-1)d$
nth from the end	$l - (n-1)d$
Number of terms	$n = \dfrac{l-a}{d} + 1$
Three terms in AP	$2b = a + c$; take $a-d$, a, $a+d$
Sum	$S_n = \dfrac{n}{2}[2a + (n-1)d] = \dfrac{n}{2}(a+l)$
Term from sum	$a_n = S_n - S_{n-1}$

A

PART A · LEARN THE METHODS

Guided Practice

Fill in the blanks to learn each board method step by step. Then use the same steps on your own in Part B.

AP and the nth term

A1. Find the differences and decide whether each list is an AP. MUST DO [2]

(i) 4, 10, 16, 22: $10-4 =$ ___, $16-10 =$ ___, $22-16 =$ ___. AP? ___ $d =$ ___

(ii) 2, 4, 8, 16: ___, ___, ___. AP? ___

A2. Complete the steps to find the 15th term of 3, 8, 13, … MUST DO [2]

$a =$ ___, $d =$ ___. $a_{15} = a + (\ ___\ )d = 3 +$ ___ $\times$ ___ $=$ ___

A3. Complete the steps: which term of 7, 11, 15, … is 87? [2]

$a =$ ___, $d =$ ___. $a + (n-1)d = 87 \rightarrow$ ___ $+(n-1)\times$ ___ $= 87$

$(n-1) \times 4 =$ ___ $\rightarrow n - 1 =$ ___ $\rightarrow n =$ ___

Number of terms and sum

A4. Complete the steps: how many terms are there in 10, 14, 18, …, 98? [2]

$a =$ ___, $l =$ ___, $d =$ ___. $n = \dfrac{l-a}{d} + 1 = \dfrac{\quad - \quad}{\quad\quad} + 1 =$ ___

A5. Complete the steps to find the sum of the first 12 terms of 4, 7, 10, … MUST DO [2]

$a =$ ___, $d =$ ___, $n =$ ___

$S_n = \dfrac{n}{2}[2a + (n-1)d] = \dfrac{12}{2}[$ ___ $+$ ___ $\times$ ___ $] = 6 \times$ ___ $=$ ___

Word problem

A6. Sara saves ₹10 on the first day, ₹12 on the second, ₹14 on the third, and so on. Complete the steps to find how much she saves on the 20th day and in all 20 days. MUST DO [3]

$a =$ ___, $d =$ ___. 20th day: $a_{20} =$ ___ $+19\times$ ___ $=$ ₹____

Total: $S_{20} = \frac{20}{2}(a + l) = 10\,(\,$ ___ $+$ ___ $\,) =$ ₹____

B PART B · NCERT PRACTICE — NCERT Practice

The same skills as the NCERT examples and exercises, with new numbers. Basic papers are built on NCERT, so finish every question.

Is it an AP?

B1. Which of these are APs? For each AP, write the common difference. MUST DO [3]

(i) $3, 7, 11, 15, \ldots$ (ii) $1, 4, 9, 16, \ldots$ (iii) $-6, -2.5, 1, 4.5, \ldots$

B2. Write the first four terms of the AP: [2]

(i) $a = 5, d = -3$ (ii) $a = -1.5, d = 0.5$

B3. Write the first term and the common difference: [2]

(i) $\frac{1}{4}, \frac{3}{4}, \frac{5}{4}, \frac{7}{4}, \ldots$

(ii) $0.7, 0.3, -0.1, -0.5, \ldots$

B4. Which of these lists is an AP? [1]

(a) $\sqrt{3}, \sqrt{6}, \sqrt{9}, \ldots$ (b) $1, 1, 2, 2, \ldots$ (c) $a, 2a, 3a, \ldots$ (d) $2, 4, 8, 16, \ldots$

The nth term

B5. Find: MUST DO [2]

(i) the 25th term of 7, 11, 15, …

(ii) the 15th term of $12, 7, 2, \ldots$

B6. Which term of the AP 5, 11, 17, … is 251? MUST DO [2]

B7. Is 184 a term of the AP 3, 7, 11, …? Justify. [2]

B8. The 5th term of an AP is 23 and its 12th term is 51. Find its 30th term. MUST DO [3]

B9. How many two-digit numbers are divisible by 6? [2]

B10. Find the 12th term from the end of the AP 4, 9, 14, …, 254. [2]

B11. For what value of n are the nth terms of the APs 50, 53, 56, … and 2, 9, 16, … equal? [3]

B12. Two APs have the same common difference. The difference between their 100th terms is 80. What is the difference between their 1000th terms? [2]

Sum of n terms

B13. Find the sum: MUST DO [2]

(i) of the first 18 terms of 3, 8, 13, …

(ii) $7 + 10.5 + 14 + \cdots + 84$

B14. How many terms of the AP 30, 27, 24, … must be taken so that their sum is 165? Explain the double answer. [3]

B15. In an AP, $a = 5$, $d = 3$ and $a_n = 50$. Find n and S_n. [2]

B16. Find the sum of the first 30 positive multiples of 7. [2]

B17. The sum of the first n terms of an AP is $3n^2 + 5n$. Find the first term, the common difference and the nth term. MUST DO [3]

Word problems

B18. ₹1,600 is to be given as 8 prizes for punctuality. Each prize is ₹20 less than the one before it. Find the value of each prize. MUST DO [3]

C

PART C · BOARD PATTERN (BASIC)

Board Pattern Practice

Question types from real Mathematics Basic papers (430 series) and the 2026–27 Sample Paper. ★★★ = asked in all 3 papers checked · ★★ = 2 papers · ★ = 1 paper.

ASSERTION–REASON: HOW TO ANSWER

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Common difference · nth term · middle term

★★☆ 2 of 3 papers · 1 mark

C1. The common difference of the AP $\sqrt{5},\ 3\sqrt{5},\ 5\sqrt{5},\ \ldots$ is: MUST DO [1]

(a) $\sqrt{5}$ (b) $2\sqrt{5}$ (c) $3\sqrt{5}$ (d) 2

C2. The 10th term of an AP with first term x and common difference y is: [1]

(a) $x + 10y$ (b) $10x + y$ (c) $x + 9y$ (d) $9x + y$

C3. Which term of the AP 18, 36, 54, … is 270? MUST DO [1]

(a) 15th (b) 14th (c) 16th (d) 18th

C4. If $3k - 1$, $4k + 1$, $5k + 3$ are consecutive terms of an AP, the common difference is: [1]

(a) $k - 2$ (b) $2k + 1$ (c) 2 (d) $k + 2$

C5. The middle term of the AP 6, 10, 14, …, 86 is: [1]

(a) 42 (b) 46 (c) 50 (d) 44

C6. If the nth term of an AP is $5 - 3n$, its common difference is: [1]

(a) -3 (b) 3 (c) 5 (d) 2

C7. ASSERTION–REASON [1]

Assertion (A): The list 2, 5, 9, 14, … is not an AP.

Reason (R): In an AP, the difference between consecutive terms is the same throughout.

C8. The 3rd term of an AP is 11 and its 7th term exceeds its 5th term by 8. Find its 20th term. [2] MUST DO

C9. How many terms are there in the AP 7, 13, 19, …, 205? [2]

C10. Which term of the AP 3, 15, 27, 39, … is 120 more than its 21st term? [2]

Sum of n terms

practice · 2–3 marks

C11. If the sum of the first n terms of an AP is $2n^2 + 5n$, its second term is: [1] MUST DO

(a) 7 (b) 11 (c) 18 (d) 4

C12. In an AP, $a = 5$, $a_n = 95$ and $S_n = 1000$. Then n is: [1]

(a) 20 (b) 18 (c) 19 (d) 25

C13. The sum of the first 20 odd natural numbers is: [1]

(a) 200 (b) 420 (c) 380 (d) 400

C14. Find the sum of the first 22 terms of the AP $8,\ 3,\ -2,\ \ldots$ [2] MUST DO

C15. Find the sum of all multiples of 15 between 1 and 300. [3] MUST DO

C16. How many terms of the AP 5, 9, 13, … must be taken to give a sum of 275? [3]

Word problems

practice · 3 marks

C17. Priya saves ₹50 in the first week, ₹60 in the second, ₹70 in the third, and so on. In how many weeks will her total savings be ₹2,000? [3] MUST DO

C18. A library charges a fine of ₹5 for the first day a book is late, ₹7 for the second day, ₹9 for the third, and so on. (i) What is the total fine for a book returned 15 days late? (ii) On which day is the day's fine ₹41? [3]

C19. A gardener plants 3 saplings in the first row, 5 in the second, 7 in the third, and so on. He plants 120 saplings in all. How many rows are there, and how many saplings are in the last row? [3]

D

PART D · SECTION E STYLE

Case-Based Questions

Each case carries 4 marks (1 + 1 + 2), as in Section E of the board paper. Underline the numbers in the passage before you start.

D1. Case Study · Savings Jar [4]

Arjun puts ₹20 into his savings jar in the first week, ₹25 in the second week, ₹30 in the third week, and so on, adding ₹5 more each week.

(i) How much does he put in during the 10th week? [1]

(ii) In which week does he put in ₹100? [1]

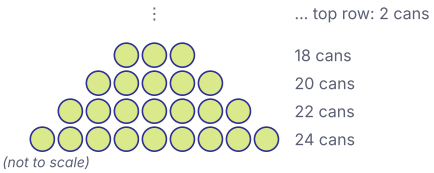
(iii) How much is in the jar after 20 weeks? [2]

OR

(iii) In how many weeks will the jar hold ₹825? [2]

D2. Case Study · Supermarket Display [4]

A supermarket stacks cans in rows for a display. The bottom row has 24 cans, and each row has 2 cans fewer than the row below it. The top row has 2 cans.



(i) How many cans are in the 5th row from the bottom? [1]

(ii) How many rows are there? [1]

(iii) How many cans are there in the display? [2]

OR

(iii) If the display is stopped after 8 rows, how many cans does it use? [2]

D3. Case Study · Cycling Training [4]

Meera is training for a cycle rally. She rides 12 km on the first day and 2 km more each day than the day before.

(i) How far does she ride on the 8th day? [1]

(ii) On which day does she ride 40 km? [1]

(iii) Find the total distance she rides in the first two weeks. [2]

OR

(iii) In how many days will her total distance be 210 km? [2]

PART E · REAL BOARD QUESTIONS

E Board PYQ Index (Basic)

Real questions from the Mathematics Basic (430 series) papers and the 2026–27 Sample Paper, by type. Open the official paper and solve the listed questions.

Frequency	Question type	Marks	Where asked (year: paper code, question number)	Practise here
★★☆	**nth term, which term, common difference**	1	**2026:** 430/1/2 Q8 · **SQP 2026–27:** Q6, Q7	A1–A4, B1–B12, C1–C10
★★☆	**Case study**	4	**2025:** 430/1/1 Q37 · **SQP 2026–27:** Q37	A6, B18, C17–C19, D1–D3

Papers checked (3): 2026 – 430/1/2 (Section A only could be read online) · 2025 – 430/1/1 · CBSE Sample Paper 2026–27 (Mathematics Basic). Sets of one code family share most questions, so they count as one paper. Download the official papers from cbse.gov.in → Previous Year Question Papers → Mathematics Basic.

F

PART F · YOUR RECORD

My Mistakes

Write down each mistake from this chapter, including the chapter test.

Every wrong answer is a free lesson. Write it here, find the rule you missed, and redo the question after three days. Bring this page to class before the next test.

Date	Part & Q No.	What went wrong	Correct rule or method	Redone ✓