Affiliated to CBSE, New Delhi (Affiliation No. 1030642)

GNPS

GOMTI NANDAN PUBLIC SCHOOL

Gandhi Ward, Bina (M.P.) 470113. | 9165 609 333. | info@mygnps.com | www.mygnps.com

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

CHAPTER 5 BASIC

Arithmetic Progressions

3, 7, 11, 15, …

d = 4

$a_n = 4n - 1$

Answer Booklet · Full worked solutions with CBSE-style step marks

Every question of the Basic booklet | Step marks shown line by line | MCQ keys with working

INSIDE THIS BOOKLET

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HOW TO USE THE ANSWERS

1. Solve the question in your notebook **first**. Open this booklet only to check.
2. The orange number beside each line is the **step mark** an examiner gives for that line, as in the CBSE marking scheme.
3. Give yourself marks line by line. A right final answer without the working can lose step marks.
4. Check a term by counting on from the first term with d, and check that every n is a positive whole number.
5. Copy every wrong answer to the My Mistakes page of your booklet.

READ THIS FIRST

Marking Guide

Full worked solutions to every question in the chapter booklet, set out the way a CBSE examiner marks them.

HOW MARKS ARE GIVEN IN ARITHMETIC PROGRESSIONS ANSWERS

1. **1-mark MCQ / assertion–reason:** only the correct option scores. The working here is for your understanding.
2. **nth term (2 marks):** formula with the values put in 1 · answer 1.
3. **a and d from two facts (3 marks):** two equations 1 · a and d 1 · the term or sum asked for 1.
4. **Sum (2–3 marks):** number of terms 1 · formula with values 1 · answer 1.
5. **Word problem or case (4–5 marks):** a, d, n identified · formula · working · answer in words with units.
6. Lines with no number are working that earns no separate mark but must be shown.

PART A · SOLUTIONS

A Guided Practice – Solutions

Worked solutions with step marks for every question in Part A.

AP and the nth term

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

(i) 6, 6, 6: an AP with $d = 6$ — 1

(ii) 2, 4, 8: not an AP — 1

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

$a = 3, d = 5$ — 1

$a_{15} = 3 + 14 \times 5 = 73$ — 1

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

$7 + (n-1)4 = 87 \rightarrow n - 1 = 20$ — 1

$n = 21$: the 21st term — 1

Number of terms and sum

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

$n = \dfrac{98 - 10}{4} + 1$ — 1

$= 22 + 1 = 23$ — 1

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

$S_{12} = \dfrac{12}{2}[8 + 11 \times 3]$ — 1

$= 6 \times 41 = 246$ — 1

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. [3]

$a = 10, d = 2$: $a_{20} = 10 + 19 \times 2 = ₹48$ — 1

$S_{20} = \frac{20}{2}(10 + 48)$ — 1

$= ₹580$ — 1

B PART B · SOLUTIONS

NCERT Practice – Solutions

Worked solutions with step marks for every question in Part B.

Is it an AP?

B1. Which of these are APs? For each AP, write the common difference. **(i)** 3, 7, 11, 15, … **(ii)** 1, 4, 9, 16, … **(iii)** $-6,\ -2.5,\ 1,\ 4.5,\ \ldots$ [3]

(i) differences $4, 4, 4$: an AP, $d = 4$ — 1

(ii) differences $3, 5, 7$: **not** an AP — 1

(iii) differences $3.5, 3.5, 3.5$: an AP, $d = 3.5$ — 1

B2. Write the first four terms of the AP: **(i)** $a = 5, d = -3$ **(ii)** $a = -1.5, d = 0.5$ [2]

(i) $5,\ 2,\ -1,\ -4$ — 1

(ii) $-1.5,\ -1,\ -0.5,\ 0$ — 1

B3. Write the first term and the common difference: **(i)** $\frac{1}{4}, \frac{3}{4}, \frac{5}{4}, \frac{7}{4}, \ldots$ **(ii)** $0.7,\ 0.3,\ -0.1,\ -0.5,\ \ldots$ [2]

(i) $a = \frac{1}{4}, d = \frac{3}{4} - \frac{1}{4} = \frac{1}{2}$ — 1

(ii) $a = 0.7, d = 0.3 - 0.7 = -0.4$ — 1

Q	Answer	Working / reason
B4	**(c)** a, 2a, 3a, …	$a, 2a, 3a$ has the same difference a each time. The others have unequal differences.

The nth term

B5. Find: **(i)** the 25th term of 7, 11, 15, … **(ii)** the 15th term of $12,\ 7,\ 2,\ \ldots$ [2]

(i) $a = 7, d = 4$: $a_{25} = 7 + 24 \times 4 = 103$ — 1

(ii) $a = 12, d = -5$: $a_{15} = 12 + 14(-5) = -58$ — 1

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

$5 + (n - 1)6 = 251 \rightarrow n - 1 = 41$ — 1

$n = 42$: the 42nd term — 1

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

$3 + (n-1)4 = 184 \to n - 1 = 45.25$ 1

n is not a whole number, so 184 is **not** a term 1

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

$a + 4d = 23$, $a + 11d = 51$ 1

Subtract: $7d = 28 \to d = 4$, $a = 7$ 1

$a_{30} = 7 + 29 \times 4 = 123$ 1

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

12, 18, …, 96: $96 = 12 + (n-1)6$ 1

$n - 1 = 14 \to n = 15$ 1

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

$l = 254$, $d = 5$: 12th from the end $= l - 11d$ 1

$= 254 - 55 = 199$ 1

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

$50 + 3(n-1) = 2 + 7(n-1)$ 1

$48 = 4(n-1) \to n = 13$ 1

The 13th terms are equal (both are 86) 1

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]

$(a + 99d) - (b + 99d) = a - b = 80$ 1

$(a + 999d) - (b + 999d) = a - b = 80$ 1

Sum of n terms

B13. Find the sum: **(i)** of the first 18 terms of 3, 8, 13, … **(ii)** $7 + 10.5 + 14 + \cdots + 84$ [2]

(i) $S_{18} = 9[6 + 17 \times 5] = 9 \times 91 = 819$ 1

(ii) $d = 3.5$, $n = \dfrac{84 - 7}{3.5} + 1 = 23$; $S = \dfrac{23}{2}(7 + 84) = 1046.5$ 1

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

$\dfrac{n}{2}[60 - 3(n-1)] = 165 \to n(63 - 3n) = 330 \to n^2 - 21n + 110 = 0$ 1

$(n - 10)(n - 11) = 0 \to n = 10$ or 11 1

Both work: the 11th term is $30 - 30 = 0$, so adding it does not change the sum 1

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

$5 + 3(n-1) = 50 \rightarrow n = 16$ 1

$S_{16} = 8(5 + 50) = 440$ 1

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

$7 + 14 + \cdots + 210 = 7(1 + 2 + \cdots + 30)$ 1

$= 7 \times \dfrac{30 \times 31}{2} = 3255$ 1

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

$a_1 = S_1 = 8$; $S_2 = 22$, so $a_2 = 14$ 1

$d = 14 - 8 = 6$ 1

$a_n = 8 + (n-1)6 = 6n + 2$ 1

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. [3]

$S_8 = \dfrac{8}{2}[2a + 7(-20)] = 1600 \rightarrow 2a - 140 = 400$ 1

$a = 270$ 1

Prizes: ₹270, 250, 230, 210, 190, 170, 150, 130 1

C

PART C · SOLUTIONS

Board Pattern Practice – Solutions

Worked solutions with step marks for every question in Part C.

Common difference · nth term · middle term

Q	Answer	Working / reason
C1	**(b)** $2\sqrt{5}$	$3\sqrt{5} - \sqrt{5} = 2\sqrt{5}$.
C2	**(c)** x + 9y	$a_{10} = a + 9d = x + 9y$.
C3	**(a)** 15th	$18 + (n-1)18 = 270 \rightarrow 18n = 270 \rightarrow n = 15$.
C4	**(d)** k + 2	$(4k+1) - (3k-1) = k + 2$ and $(5k+3) - (4k+1) = k + 2$.
C5	**(b)** 46	$n = \dfrac{80}{4} + 1 = 21$, so the 11th term: $6 + 10 \times 4 = 46$.
C6	**(a)** –3	$a_{n+1} - a_n = (5 - 3n - 3) - (5 - 3n) = -3$.
C7	**(a)**	The differences are 3, 4, 5. Both are true and R explains A.

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

$a_7 - a_5 = 2d = 8 \to d = 4$; $a + 2d = 11 \to a = 3$ 1

$a_{20} = 3 + 19 \times 4 = 79$ 1

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

$205 = 7 + (n-1)6 \to n - 1 = 33$ 1

$n = 34$ 1

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

$d = 12$; $a_{21} = 3 + 240 = 243$, so the term is 363 1

$3 + (n-1)12 = 363 \to n = 31$: the 31st term 1

Sum of n terms

Q	Answer	Working / reason
C11	**(b)** 11	$a_2 = S_2 - S_1 = 18 - 7 = 11$.
C12	**(a)** 20	$\frac{n}{2}(5 + 95) = 1000 \to 50n = 1000 \to n = 20$.
C13	**(d)** 400	$S_{20} = 10[2 + 19 \times 2] = 400$ (also $n^2 = 400$).

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

$a = 8, d = -5$: $S_{22} = 11[16 + 21(-5)]$ 1

$= 11 \times (-89) = -979$ 1

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

15, 30, …, 285 (300 is left out) 1

$n = \dfrac{285 - 15}{15} + 1 = 19$ 1

$S = \dfrac{19}{2}(15 + 285) = 2850$ 1

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

$\frac{n}{2}[10 + 4(n-1)] = 275 \to n(2n + 3) = 275 \to 2n^2 + 3n - 275 = 0$ 1

$D = 9 + 2200 = 2209 = 47^2 \to n = \dfrac{-3 + 47}{4}$ 1

$n = 11$ (the other root is negative) 1

Word problems

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]

$\frac{n}{2}[100 + 10(n-1)] = 2000 \rightarrow n^2 + 9n - 400 = 0$ 1

$D = 81 + 1600 = 1681 = 41^2 \rightarrow n = \frac{-9 + 41}{2}$ 1

$n = 16$ weeks 1

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]

(i) $S_{15} = \frac{15}{2}[10 + 14 \times 2] = \frac{15}{2} \times 38$ 1

$= ₹285$ 1

(ii) $5 + 2(n-1) = 41 \rightarrow n = 19$: the 19th day 1

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]

$\frac{n}{2}[6 + 2(n-1)] = n(n+2) = 120 \rightarrow n^2 + 2n - 120 = 0$ 1

$(n+12)(n-10) = 0 \rightarrow n = 10$ rows 1

Last row: $3 + 9 \times 2 = 21$ saplings 1

D

PART D · SOLUTIONS

Case-Based Questions – Solutions

Worked solutions with step marks for every question in Part D.

D1. Case Study · Savings Jar [4]

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

$a_{10} = 20 + 9 \times 5 = ₹65$ 1

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

$20 + 5(n-1) = 100 \rightarrow n = 17$: the 17th week 1

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

$S_{20} = 10[40 + 19 \times 5]$ 1

$= 10 \times 135 = ₹1,350$ 1

OR

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

$\frac{n}{2}[40 + 5(n-1)] = 825 \rightarrow n^2 + 7n - 330 = 0$ 1

$(n+22)(n-15) = 0 \rightarrow 15$ weeks 1

D2. Case Study · Supermarket Display [4]

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

$a_5 = 24 + 4(-2) = 16$ cans 1

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

$24 - 2(n-1) = 2 \rightarrow n = 12$ rows 1

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

$S_{12} = \frac{12}{2}(24 + 2)$ 1

$= 156$ cans 1

OR

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

$S_8 = 4[48 + 7(-2)]$ 1

$= 4 \times 34 = 136$ cans 1

D3. Case Study · Cycling Training [4]

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

$a_8 = 12 + 7 \times 2 = 26$ km 1

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

$12 + 2(n-1) = 40 \rightarrow n = 15$: the 15th day 1

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

$S_{14} = 7[24 + 13 \times 2]$ 1

$= 7 \times 50 = 350$ km 1

OR

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

$\frac{n}{2}[24 + 2(n-1)] = n(n+11) = 210 \rightarrow n^2 + 11n - 210 = 0$ 1

$(n+21)(n-10) = 0 \rightarrow 10$ days 1