

Sum of n Terms of an AP

Two formulas, one idea — pick the right one, keep the $\frac{1}{2}$, keep the signs.

$$S_n = n/2 [2a + (n-1)d] \text{ or } S_n = n/2 (a + l) \cdot \text{pair the first term with the last: every pair adds to } a + l$$

Every symbol — and the trap beside it

Symbol	Means	The trap
S_n	sum of the first n terms	not the nth term a_n — one is a total, one is a single value
a	first term	read it off the list, including its sign
d	common difference: later term minus earlier	for 8, 3, -2, ... d is -5, not 5
l	last term of a finite AP	in "5, 8, ..., 50" l is 50 — never put n in its place
n	number of terms added	a positive whole number that makes sense in the question

Why it works (the derivation CBSE names): write S_n forwards and backwards, then add. Each of the n pairs adds to $a + l$, so $2S_n = n(a + l)$. Put $l = a + (n-1)d$ to get the other form.

Which formula? Let the question decide

The question gives you	Reach for	What comes out
a, d and n	$S_n = n/2 [2a + (n-1)d]$	the sum
a, the last term l and n	$S_n = n/2 (a + l)$	the sum, no d needed
a target sum; n unknown	the d-formula, set equal to the sum	a quadratic in n
a formula for S_n	$a_n = S_n - S_{n-1}$	any single term
"first n positive integers"	$S_n = n(n+1)/2$	$1 + 2 + \dots + n$

Worked on the card's AP: 8, 3, -2, ... to 22 terms $\Rightarrow S_{22} = 11 [16 + 21(-5)] = 11 [16 - 105] = 11 \times (-89) = -979$. Simplify the bracket fully before multiplying by n/2.

Where this sits in NCERT and CBSE

Question	Answer
Which NCERT section?	Chapter 5, Section 5.4 Sum of First n Terms of an AP
Which exercise?	Exercise 5.3, 20 questions — one behind the section number
Anything to skip?	Exercise 5.4 is marked optional — not examinable
How many marks?	Unit II Algebra = 20 of 80 ; CBSE sets marks by unit, not chapter

CBSE scope, verbatim: "Motivation for studying Arithmetic Progression Derivation of the nth term and sum of the first n terms of A.P. and their application in solving daily life problems."

Key takeaways

- $S_n = n/2 [2a + (n-1)d]$ when d is known; $n/2 (a + l)$ when the last term is known.
- Forgetting the $\frac{1}{2}$ doubles the answer — the formula is half of n times the bracket.
- With a negative d, keep the minus sign inside $(n-1)d$ and simplify before multiplying.
- A target sum gives a **quadratic in n**: keep every positive whole n that makes sense.
- $a_n = S_n - S_{n-1}$ pulls any single term out of a sum formula.
- NCERT **Section 5.4** → **Exercise 5.3**; six of its 20 questions are daily-life stories.

Three board-style questions, worked

Write the formula, substitute, simplify — and say why you reject a value.

EX 5.3 Q4 · TARGET SUM

How many terms of the AP 9, 17, 25, ... must be taken to give a sum of 636?

Step 1. $a = 9$, $d = 17 - 9 = 8$, $S_n = 636$.

Step 2. $636 = n/2 [18 + (n-1)8] = n/2 (8n+10) = n(4n+5)$.

Step 3. $4n^2 + 5n - 636 = 0 \Rightarrow (n-12)(4n+53) = 0 \Rightarrow n = 12$ or $n = -53/4$.

$n = -53/4$ is negative and not whole, so it is rejected. Answer: 12 terms.

✓ Check: $S_{12} = 6 [18 + 11 \times 8] = 6 \times 106 = 636$.

EX 5.3 Q19 · DAILY-LIFE STORY

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

Step 1. $a = 20$, $d = -1$, $S_n = 200$.

Step 2. $200 = n/2 [40 + (n-1)(-1)] = n(41-n)/2 \Rightarrow n^2 - 41n + 400 = 0$.

Step 3. $(n-16)(n-25) = 0 \Rightarrow n = 16$ or $n = 25$ — both positive whole numbers.

Reject $n = 25$: row 25 would hold $a_{25} = 20 + 24(-1) = -4$ logs, which is impossible.

16 rows; top row $a_{16} = 20 + 15(-1) = 5$ logs.

✓ Check: $S_{16} = 16/2 (20 + 5) = 8 \times 25 = 200$. Compare 24, 21, 18, ... summing to 78, where $n = 4$ and $n = 13$ both stand — a negative term is fine in a number list.

EX 5.3 Q11 · TERM FROM A SUM

The sum of the first n terms of an AP is $4n - n^2$. Find S_1 , S_2 , the 2nd, 3rd and 10th terms, and the n th term.

$S_1 = 4 - 1 = 3 = a_1$; $S_2 = 8 - 4 = 4$

$a_2 = S_2 - S_1 = 1$; $a_3 = S_3 - S_2 = 3 - 4 = -1$

$a_{10} = S_{10} - S_9 = -60 - (-45) = -15$

$a_n = (4n - n^2) - [4(n-1) - (n-1)^2]$

$= 4n - n^2 - 4n + 4 + n^2 - 2n + 1 = 5 - 2n$

✓ $n = 10$ gives $5 - 20 = -15$, matching the line on the left.

WHERE THE MARKS GO

What the student did	What it costs
Wrote $S_n = n[2a + (n-1)d]$	every line after it — the answer is doubled
Used $d = 5$ for 8, 3, -2, ...	the substitution mark and the answer
Kept $n = 25$ rows of logs	the final mark — the rejection line is part of the answer
Stopped at the sum when asked for a term	the last step: finish with a_n or $S_n - S_{n-1}$

NOW TRY THESE TWO

Ex 5.3 Q6. The first and last terms of an AP are 17 and 350, and $d = 9$. How many terms, and what is their sum?

Ex 5.3 Q16. Rs 700 is given as seven cash prizes, each Rs 20 less than the one before. Find each prize.

Answers: 38 terms, sum 6973 · Rs 160, 140, 120, 100, 80, 60, 40.

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