LF LearnFrenzy

QUANTITATIVE APTITUDE · FREE STUDY MATERIAL

Average

Formulas & Shortcut Tricks

Every important formula, shortcut and exam trick for Average in one place – with solved examples, common mistakes and a one-page revision sheet.

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USEFUL FOR

- SSC CGL / CHSL / MTS
- Bank PO & Clerk (IBPS, SBI, RBI)
- Railways (RRB NTPC, Group D)
- Campus placements (TCS, Infosys, Wipro, Accenture)
- UPSC CSAT & state PSC exams

Practise Average free on LearnFrenzy – questions with instant explanations →

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1 Topic introduction

What it is, why it matters and how it is asked

An average (arithmetic mean) is the single value that could replace every item of a group without changing the total: Average = Sum/Number of items. If five friends have ₹100, ₹120, ₹90, ₹150 and ₹140, the average is ₹600/5 = ₹120 – share the money equally and each holds ₹120.

Almost every average question is really a question about totals. Convert averages to sums, see how the sum changes, and convert back. The shortcuts in this PDF simply skip writing those sums.

Why it matters in exams

- SSC and Railway papers ask 2–3 average questions every time – replacements, wrong entries and ages are favourites.
- Bank exams use averages in data interpretation and in short arithmetic questions.
- Placement tests like weighted averages, cricket averages and average speed traps.

Where it is used

- Marks, salaries, runs, rainfall, sales – any “typical value” is an average.
- Weighted averages give CGPA, combined class results and mixture prices.
- Average speed for journeys at different speeds.

Common question patterns

Basic
Find the average, the sum or a missing value.

Sequences
Average of consecutive, odd, even numbers or an AP.

Join / leave
A member joins or leaves and the average changes.

Replacement
One person is replaced and the average rises or falls.

Wrong entry
A value was misread – find the correct average.

Combined groups
Two sections or groups put together (weighted average).

Ages
Averages some years ago or later, babies born, members replaced.

Speed and cricket
Average speed; runs needed to raise a batting average.

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2 Important formulas

Cards marked MOST USED are the ones to revise first

The basics

Average and sum

MOST USED

> **Average = Sum of values/Number of values; Sum = Average × Number**

Turn every average into a sum first – sums can be added and subtracted, averages cannot.

EXAMPLE Marks 72, 85, 64, 91, 78 → sum 390 → average 390/5 = **78**.

Assumed-mean (deviation) method

MOST USED

> **Average = Assumed value + (sum of deviations from it)/n**

Pick a round number near the data and add only the small differences.

EXAMPLE 47, 52, 49, 55, 57: assume 50 → deviations −3, +2, −1, +5, +7 = +10 → 50 + 10/5 = **52**.

Changing every value

> **Add k to every value → average + k. Multiply every value by k → average × k**

The same change to every item moves the average by exactly that change.

EXAMPLE Average 40; every value is doubled and then increased by 5 → 2 × 40 + 5 = **85**.

Averages of standard sequences

Sequence	Average	Example
First n natural numbers	(n + 1)/2	1 to 50 → 25.5
First n odd numbers	n	1, 3, …, 39 (20 terms) → 20
First n even numbers	n + 1	2, 4, …, 40 (20 terms) → 21
Squares of first n numbers	(n + 1)(2n + 1)/6	n = 10 → 38.5
Cubes of first n numbers	$n(n + 1)^2/4$	n = 10 → 302.5
Any AP (evenly spaced)	(first + last)/2	14, 21, …, 98 → 56

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Average of an AP

MOST USED

> **Average = (first term + last term)/2 = middle term (odd count)**

In evenly spaced data the average sits exactly in the middle.

EXAMPLE All two-digit multiples of 7 run from 14 to 98 → average (14 + 98)/2 = **56**.

When the group changes

A new member joins

MOST USED

> **New member = old average + (new count) × (change in average)**

The newcomer brings the old average plus enough to lift everyone (including themselves) by the change.

change – positive if the average rises, negative if it falls

EXAMPLE 24 students average 40 kg; with the teacher the average rises by 1 kg → teacher = 40 + 25 × 1 = **65 kg**.

A member leaves

> **Leaving member = old average − (remaining count) × (change in average)**

If the average falls when someone leaves, that person was above average.

EXAMPLE 30 members average 50; one leaves and the average becomes 49.5 → 50 + 29 × 0.5 = **64.5**.

Replacement

MOST USED

> **New person − old person = (count) × (change in average)**

The group size stays the same, so the whole change in total comes from the swap.

EXAMPLE The average weight of 8 men rises by 2.5 kg when a man of 65 kg is replaced → new man = 65 + 8 × 2.5 = **85 kg**.

Wrong entry corrected

MOST USED

> **Correct average = recorded average + (correct value − wrong value)/n**

Only the difference between the right and wrong value matters.

EXAMPLE 40 values average 36; 64 was read as 46 → 36 + 18/40 = **36.45**.

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Combined and overlapping groups

Weighted (combined) average

MOST USED

$$A = (n_1A_1 + n_2A_2 + \ldots)/(n_1 + n_2 + \ldots)$$

Never average the averages unless the groups are the same size.

n_i – size of group i A_i – its average

EXAMPLE 30 students average 72 and 45 students average 62 → (2,160 + 2,790)/75 = **66**.

Group sizes from averages (alligation)

$$n_1 : n_2 = (A_2 - A) : (A - A_1)$$

The combined average sits closer to the bigger group.

EXAMPLE Above: (66 – 62) : (72 – 66) = 4 : 6 = **2 : 3** = 30 : 45 ✓

Overlapping groups (common middle value)

MOST USED

Common value = (sum of first group) + (sum of last group) – (sum of all)

The shared middle item is counted twice when the two group sums are added.

EXAMPLE 11 numbers average 50; the first 6 average 48 and the last 6 average 53 → 288 + 318 – 550 = **56**.

Ages, speed and cricket

Average age over time

After t years every age rises by t, so the average rises by t (if the members are unchanged)

Move all ages to the same year before comparing groups.

EXAMPLE Average age of 6 people is 24 today → in 5 years it will be **29**.

Average speed

MOST USED

Total distance/total time. Equal distances at x and y: 2xy/(x + y). Equal times: (x + y)/2

For equal distances the answer is always below the simple average of the speeds.

EXAMPLE Equal distances at 40 and 60 km/h → 2 × 40 × 60/100 = **48 km/h** (not 50).

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Batting and bowling averages

> **Batting = runs/times out. Runs needed to lift the average by d next innings = new average + (old innings) × d**

Bowling average = runs conceded/wickets – lower is better.

EXAMPLE Average 42 after 15 innings; to reach 45 after the 16th he needs 45 + 15 × 3 = **90** runs.

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3 Shortcut tricks & smart techniques

Each trick says when to use it – that matters as much as the trick

Balance above and below the average

MOST USED

USE WHEN One value is missing and the average is known.

1. Write each known value as average ± difference.
2. The differences of all values add up to zero.
3. The missing value balances what is left.

EXAMPLE Average of 4 numbers is 25; three are 20, 28, 31 (−5, +3, +6 = +4) → fourth = 25 − 4 = **21**.

Consecutive numbers: start from the middle

MOST USED

USE WHEN Sums or averages of consecutive, odd or even numbers.

1. Average = middle term (odd count).
2. Step out by 1 (consecutive) or 2 (odd / even) to reach the end.

EXAMPLE 7 consecutive even numbers add to 434 → middle 434/7 = 62 → largest 62 + 6 = **68**.

Score that changes an average

USE WHEN A new test, innings or member shifts the average.

1. New value = new average + (old count) × change.
2. Equivalently: old average + (new count) × change.

EXAMPLE After the 11th test the average rises from 64 to 66 → 11th score = 66 + 10 × 2 = **86**.

Combined average by alligation

USE WHEN Two groups, two averages and the combined average – find the ratio or the size of a group.

1. Write the two averages at the ends and the combined one in the middle.
2. Cross-subtract to get the ratio of group sizes.

EXAMPLE Boys average 70, girls 80, class 76 → boys : girls = (80 − 76) : (76 − 70) = **2 : 3**.

Extreme values

USE WHEN “Maximum possible” or “minimum possible” value with a fixed average.

1. Fix the sum = average × count.
2. Make all the other values as small (or large) as the conditions allow.

EXAMPLE 5 distinct positive integers average 20 → largest can be 100 − (1 + 2 + 3 + 4) = **90**.

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Ready-made average speeds

USE WHEN Equal distances at two common speeds.

1. Use $2xy/(x + y)$ once and remember the pairs below.
2. The answer is always closer to the slower speed.

EXAMPLE 30 and 60 → **40**; 40 and 60 → 48; 60 and 90 → 72; 20 and 30 → 24.

Change the whole group at once

USE WHEN Every member's value is increased, decreased or scaled.

1. Apply the same change to the average.
2. No need to touch the individual values.

EXAMPLE Average salary ₹25,000; everyone gets a 10% rise and then ₹1,000 bonus → 27,500 + 1,000 = **₹28,500**.

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4 Solved examples

The full method on the left, the exam shortcut on the right

1 SEQUENCE

Find the average of all three-digit numbers divisible by 9.

STEP BY STEP

1. They run 108, 117, ..., 999 – an AP with difference 9.
2. Number of terms = (999 – 108)/9 + 1 = 100.
3. Sum = 100 × (108 + 999)/2 = 55,350; average = 553.5.

SHORTCUT

AP → average = (first + last)/2 = (108 + 999)/2 = 553.5.

Why it works: In an evenly spaced list, the count cancels out of the average.

Answer: 553.5

2 WRONG ENTRIES

The average of 25 observations is 44. Later it was found that 72 was copied as 27 and 18 was copied as 81. Find the correct average.

STEP BY STEP

1. Recorded sum = 25 × 44 = 1,100.
2. Correct sum = 1,100 – 27 – 81 + 72 + 18 = 1,082.
3. Correct average = 1,082/25 = 43.28.

SHORTCUT

Net error = (72 – 27) + (18 – 81) = –18 → 44 – 18/25 = 43.28.

Why it works: Each wrong entry changes the sum by (correct – wrong); add all such changes.

Answer: 43.28

3 REPLACEMENT

The average age of a team of 10 players rises by 1.5 years when two players aged 22 and 26 are replaced by two new players. Find the average age of the new players.

STEP BY STEP

1. Increase in total = 10 × 1.5 = 15 years.
2. New pair total = 22 + 26 + 15 = 63.
3. Their average = 63/2 = 31.5 years.

SHORTCUT

(Old pair + count × change)/2 = (48 + 15)/2 = 31.5.

Why it works: The team size is unchanged, so the rise in total comes only from the swap.

Answer: 31.5 years

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4 COMBINED

The average salary of all workers in a workshop is ₹18,000. The 8 technicians average ₹30,000 and the rest average ₹15,000. How many workers are there?

STEP BY STEP

1. Let the total be n: 18,000n = 8 × 30,000 + (n − 8) × 15,000.
2. 18,000n = 2,40,000 + 15,000n − 1,20,000.
3. 3,000n = 1,20,000 → n = 40.

SHORTCUT

Technicians are 12,000 above, others 3,000 below → ratio 3,000 : 12,000 = 1 : 4 → 8 : 32 → 40.

Why it works: Alligation balances the amounts above and below the overall average.

Answer: 40

5 OVERLAP

The average of 13 results is 60. The average of the first 7 is 57 and of the last 7 is 64. Find the 7th result.

STEP BY STEP

1. Sum of all 13 = 780.
2. First 7 = 399; last 7 = 448.
3. The 7th is counted in both: 399 + 448 − 780 = 67.

SHORTCUT

Common term = 7 × 57 + 7 × 64 − 13 × 60 = 67.

Why it works: Adding the two group sums counts the shared middle result twice.

Answer: 67

6 AVERAGE SPEED

A man covers three equal distances at 10, 20 and 60 km/h. Find his average speed for the whole journey.

STEP BY STEP

1. Take each part as 60 km (LCM of speeds).
2. Times: 6 h + 3 h + 1 h = 10 h.
3. Average speed = 180/10 = 18 km/h.

SHORTCUT

3xyz/(xy + yz + zx) = 3 × 10 × 20 × 60/(200 + 1,200 + 600) = 18.

Why it works: Average speed is total distance over total time, not the mean of the speeds (30).

Answer: 18 km/h

7 CRICKET

A batsman scores 122 runs in his 21st innings and his average rises by 4. What is his average after the 21st innings?

STEP BY STEP

1. Let the old average be A: 20A + 122 = 21(A + 4).
2. 20A + 122 = 21A + 84 → A = 38.
3. New average = 38 + 4 = 42.

SHORTCUT

New average = score − (old innings) × rise = 122 − 20 × 4 = 42.

Why it works: The score above the new average must lift each of the 20 earlier innings by 4.

Answer: 42

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8 AGES

Three years ago the average age of a family of 5 was 16 years. A baby has since been born, and today the average age of the family is still 16. How old is the baby?

STEP BY STEP

1. Three years ago the total was 5 × 16 = 80; today the same 5 total 80 + 15 = 95.
2. With the baby: 6 × 16 = 96.
3. Baby = 96 − 95 = 1 year.

SHORTCUT

Baby = 16 − 5 × 3 = 1 (the average must absorb 15 extra years).

Why it works: Move every age to today before comparing totals.

Answer: 1 year

9 CONSECUTIVE

The average of 7 consecutive numbers is 33. What is the average of the next 5 consecutive numbers?

STEP BY STEP

1. The 7 numbers are 30 to 36 (33 is the middle).
2. The next 5 are 37 to 41.
3. Their average = 39.

SHORTCUT

Last of the 7 = 33 + 3 = 36; middle of the next 5 = 36 + 3 = 39.

Why it works: For consecutive numbers the average is always the middle term.

Answer: 39

10 MISSING VALUES

The average of 6 numbers is 45. The average of the first four is 40, and the 5th number is 12 less than the 6th. Find the 6th number.

STEP BY STEP

1. Sum of 6 = 270; sum of first 4 = 160.
2. 5th + 6th = 110, and 6th − 5th = 12.
3. 6th = (110 + 12)/2 = 61.

SHORTCUT

Sum and difference → larger = (110 + 12)/2 = 61.

Why it works: Two unknowns with a known sum and difference: add and halve.

Answer: 61

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11 REMOVING MEMBERS

The average of a class of 42 students is 60. Two students who scored 76 and 84 leave. Find the new average.

STEP BY STEP

1. Total = 42 × 60 = 2,520.
2. Remove 76 + 84 = 160 → 2,360.
3. New average = 2,360⁄40 = 59.

SHORTCUT

The two average 80, i.e. 20 above 60 each → total excess 40 spread over 40 → average falls by 1.

Why it works: Removing above-average members lowers the average by their total excess ÷ remaining count.

Answer: 59

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5 Important exam tips

Patterns, traps and habits that save marks

Frequently asked question patterns

- Replacement of one or two members, with weights or ages.
- Wrong entries – one or several values misread.
- New member joins or leaves; teacher or captain included.
- Combined average of sections or groups; number of workers from averages.
- Overlapping groups with a common middle value.
- Average age with time shifts and babies born.
- Average speed and cricket batting averages.

Common mistakes to avoid

- Averaging two averages when the groups are different sizes.
- Taking $(x + y)/2$ as the average speed for equal distances.
- Using the old count instead of the new count when a member joins.
- Forgetting to move ages to the same year.
- Ignoring the sign of the change (a fall is negative).
- Counting the common middle value only once in overlap questions.

Points to remember

- Sum = average × number – work with sums.
- Differences from the average always add to zero.
- Average of an AP = (first + last)/2.
- Replacement: new – old = n × change.
- Equal-distance average speed = $2xy/(x + y)$.

Speed and accuracy

- Use an assumed mean for lists of close numbers.
- Write the replacement or join formula directly – no full equation.
- Use alligation for any two-group question.
- Check answers: a group average must lie between its smallest and largest values.

Preparation strategy

- Learn the four change formulas (join, leave, replace, wrong entry) until they are automatic.
- Practise on LearnFrenzy in order: Easy → Medium → Hard → Exam Pattern Mix → Data Sufficiency.
- Most average questions should take 30–45 seconds.
- Keep an error log – note whether you used the old or new count.
- Read the Quick Revision Sheet (next page) the night before the exam.

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6 Quick revision sheet

Everything on one page for the night before the exam

Formulas

Average	**sum/number**	Assumed mean	**A + Σd/n**
First n natural	**(n + 1)/2**	First n odd / even	**n / n + 1**
AP	**(first + last)/2**	Joins	**old avg + (new n) × change**
Leaves	**old avg − (remaining n) × change**	Replacement	**new − old = n × change**
Wrong entry	**avg + (correct − wrong)/n**	Combined	**Σ nA/Σ n**
Group ratio	**$(A_2 - A) : (A - A_1)$**	Overlap	**$sum_1 + sum_2$ − total**
Speed (equal dist.)	**2xy/(x + y)**	Speed (3 equal dist.)	**3xyz/(xy + yz + zx)**
Speed (equal time)	**(x + y)/2**	Runs needed	**new avg + n × rise**

Shortcut tricks

- Differences from the average sum to 0.
- Consecutive → average is the middle.
- Combined average leans to bigger group.
- Every value + k → average + k.
- Ages: shift everyone to the same year.
- Max one value → minimise the rest.

Must-know numbers

Average speeds	30 & 60 → 40 · 40 & 60 → 48 · 60 & 90 → 72 · 20 & 30 → 24 · 50 & 75 → 60
Sequences	Avg 1-10 = 5.5 · 1-50 = 25.5 · 1-100 = 50.5 · first 20 odd = 20 · first 20 even = 21
Squares / cubes	Avg of first 10 squares = 38.5 · avg of first 10 cubes = 302.5

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7 A message from LearnFrenzy

For everyone preparing for placements, competitive and government exams

Keep going – you are closer than you think

Success in examinations is not just about how many hours you study. It is about how effectively you understand concepts, practise questions, and improve yourself every day.

Every formula you learn, every problem you solve, and every mistake you correct brings you one step closer to your goal.

Whether you are preparing for campus placements, competitive examinations, or government jobs, remember that consistency, confidence, and smart preparation make a real difference.

Don’t just memorize formulas. Understand the concepts, practise smart techniques, and develop the confidence to solve problems independently.

Your hard work today can create the opportunities you dream of tomorrow.

— Team LearnFrenzy

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