Mixture and Alligation

~ Quantitative Aptitude · SSC Exams ~

← the "cross" rule solves half of these in seconds!

This chapter blends two or more ingredients and asks for the ratio, mean value or strength of the result. One tool — the **alligation cross** — runs through it all.

① Mean Price / Mean Value

When quantities are mixed, the **mean price** is the cost price of **one unit** (1 kg, 1 L...) of the final mixture.

Mean price = (Total cost of all ingredients) / (Total quantity)

Each ingredient's cost = its rate × its quantity. Add them, then divide by the total quantity.

Worked example — mixing two sugars

Given — 3 kg sugar at ₹40/kg mixed with 2 kg at ₹50/kg.

Total cost → 3×40 + 2×50 = 120 + 100 = ₹220.

Total quantity → 3 + 2 = 5 kg.

Mean price → 220 ÷ 5 = **₹44/kg**. ✅

Worked example — three-item mixture

5 L oil at ₹90 + 3 L at ₹100 + 2 L at ₹120.

Cost = 450 + 300 + 240 = ₹990; quantity = 10 L ∴ mean = 990 ÷ 10 = **₹99/L**.

Try these

2 kg @ ₹30 + 3 kg @ ₹40 → **₹36**

4 L @ ₹25 + 1 L @ ₹50 → **₹30**

1 kg @ ₹60 + 1 kg @ ₹80 → **₹70**

6 kg @ ₹15 + 4 kg @ ₹20 → **₹17**

✓ The mean price always lies **between** the cheapest and dearest rate — if your answer falls outside that band, something is wrong.

② The Rule of Alligation

Alligation reverses the mean-price idea: given the two rates and the mean, it finds the **ratio** in which they must be mixed.

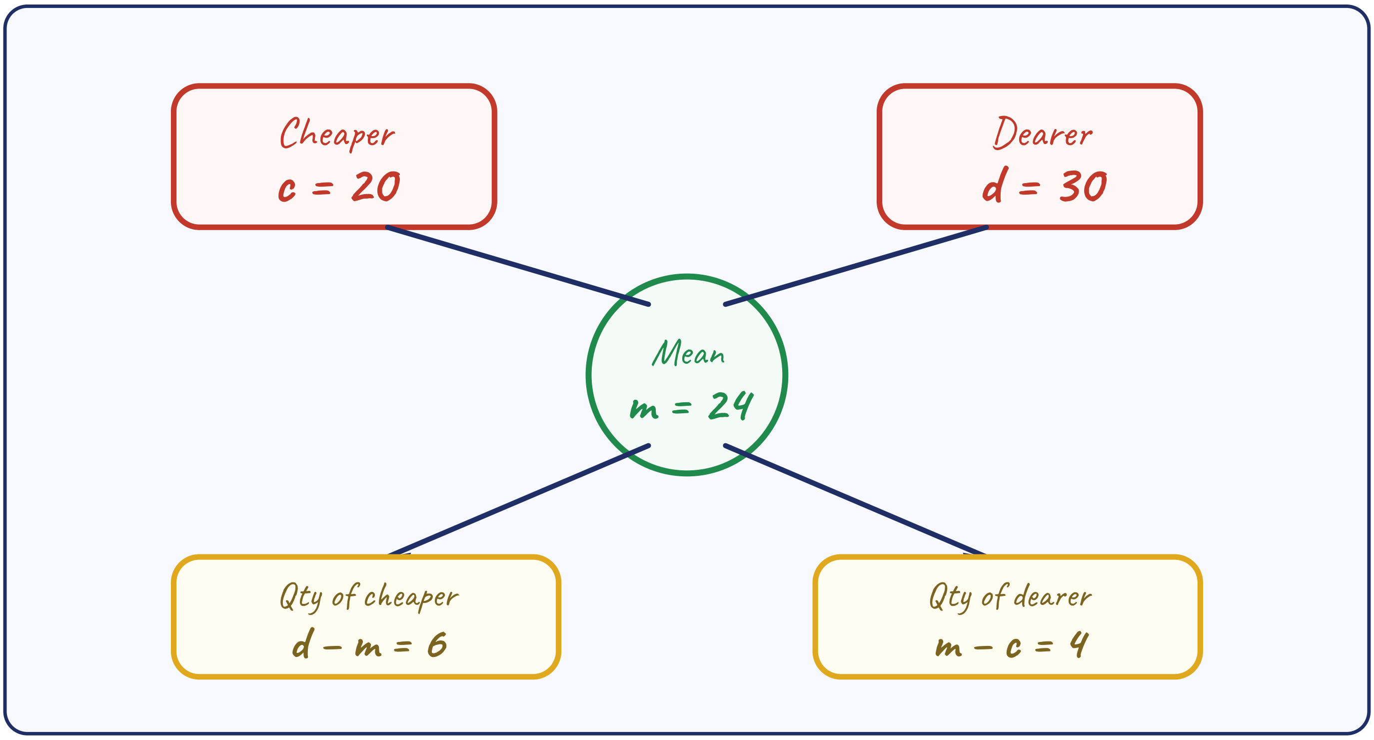
Rule of Alligation

If ingredients of value **c** (cheaper) and **d** (dearer) are mixed to a mean value **m**, then

$$\textbf{(Qty of cheaper) : (Qty of dearer)} = (d - m) : (m - c)$$

Each ratio-part is the **difference across the diagonal** — hence the "cross".

The cross — how to draw it



- Put **c** and **d** at the two **top** corners, the mean **m** in the **middle**.
- Subtract **diagonally**: $d - m$ sits under **c**, and $m - c$ sits under **d**.
- Read the bottom row: cheaper : dearer = **(d−m) : (m−c)**. Always keep the answer positive.

The part written **under** an ingredient is **its own** share. Under the cheaper you get $(d-m)$ — the quantity of the **cheaper**.

Alligation — Worked Examples

Worked example 1 — the rice mix

Given — rice at ₹20/kg and ₹30/kg mixed to cost ₹24/kg.

Cross → $c = 20$, $d = 30$, $m = 24$.

Cheaper = $d - m = 30 - 24 =$ **6**; **Dearer** = $m - c = 24 - 20 =$ **4**.

Ratio → 6 : 4 = **3 : 2** (cheaper : dearer). ✅

Worked example 2 — two teas

Tea at ₹18 and ₹24 mixed to sell (mean) at ₹20/kg. $c = 18$, $d = 24$, $m = 20$.

Cheaper : Dearer = (24−20) : (20−18) = 4 : 2 = **2 : 1**.

So for every 2 kg of the ₹18 tea, take 1 kg of the ₹24 tea.

Worked example 3 — find the quantity

In what quantity must ₹16 wheat be mixed with 12 kg of ₹24 wheat to make the mean ₹18/kg?

Ratio = (24−18):(18−16) = 6:2 = 3:1 (cheaper:dearer).

Dearer = 12 kg is the "1" part → cheaper = 3 parts = **36 kg**. ✅

Worked example 4 — ratio to percentage

Two salts at ₹12 and ₹18 give a mean of ₹14. Ratio = (18−14):(14−12) = 4:2 = 2:1.

Cheaper is 2 of 3 parts → it forms **66⅔%** of the mixture, dearer 33⅓%.

Try these (cheaper : dearer)

₹10, ₹15, mean ₹12 → **3 : 2**

₹25, ₹40, mean ₹30 → **2 : 1**

₹8, ₹12, mean ₹9 → **3 : 1**

₹50, ₹70, mean ₹65 → **1 : 3**

✓ The bigger the gap between the mean and a rate, the **less** of that ingredient you need — the diagonal difference is small on the near side.

③ Reverse Alligation

The same cross runs **backwards**: if the **ratio** is known you can find the **mean**, or if the mean and one rate are known you can find the **missing rate**.

Mean from a known ratio

Mean value $m = (c \cdot q_c + d \cdot q_d) / (q_c + q_d)$ — the weighted average of the two rates.

Worked example 1 — find the mean

Given — mix ₹25 and ₹30 sugar in the ratio 2 : 3.

Mean → $(25 \times 2 + 30 \times 3) / (2+3) = (50 + 90) / 5 = 140 / 5 =$ **₹28/kg**. ✅

Worked example 2 — find the missing rate

A ₹30 variety mixed with an unknown ₹c variety in ratio 3 : 2 (cheaper : dearer) gives mean ₹28.

By cross: cheaper : dearer = $(30 - 28) : (28 - c) = 2 : (28 - c)$.

Set equal to 3 : 2 → $2 / (28-c) = 3 / 2 \rightarrow 28 - c = 4/3$... re-check with parts below.

Cleaner: cheaper is 3 parts, so $(30-28)=2$ matches the **dearer** "2" part → each part = 1; cheaper part $(28-c)=3 \rightarrow c =$ **₹25**. ✅

Worked example 3 — ratio to hit a target price

At what ratio must ₹9 and ₹12 rice be mixed to sell at ₹10/kg?

$(12-10):(10-9) = 2 : 1$ → **₹9 rice : ₹12 rice = 2 : 1**.

Quick table — mean of a 1 : 1 mix

Rate 1	Rate 2	Ratio	Mean
₹20	₹30	1 : 1	**₹25**
₹20	₹30	3 : 1	**₹22.5**
₹20	₹30	1 : 3	**₹27.5**

💡 Whichever ingredient has the **larger share** pulls the mean **towards its own rate** — a handy sanity check.

④ Milk & Water Problems 🥛

A dealer stretches milk by adding water. Treat **water as the free (₹0) ingredient** and everything becomes alligation.

Key relations

- Water % = (water / total mixture) × 100.
- Milk : Water is just the quantity ratio in the vessel.
- Selling a milk–water mix at the **cost price of milk** → Gain % = (water / milk) × 100.

Worked example 1 — water added

Given — 20 L of milk, then 5 L of water is added.

Milk : Water → 20 : 5 = **4 : 1**.

Water % → 5 / 25 × 100 = **20%**. ✅

Worked example 2 — sell at cost price of milk

A milkman mixes 2 L water in 10 L milk and sells at the **cost price of milk**.

He sells 12 L at the value of milk but paid for only 10 L. Gain = 2 L of milk-value on 10 L cost.

Gain % = (2 / 10) × 100 = **20%**. ✅

Worked example 3 — alligation for strength

How much water be mixed with 60 L pure milk so that water is 25% of the new mixture?

Water : Milk = 25 : 75 = 1 : 3. Milk (3 parts) = 60 L → 1 part = 20 L ∴ water = **20 L**.

Milk : Water → Water %

4 : 1 → water = **20%**

3 : 1 → water = **25%**

3 : 2 → water = **40%**

5 : 3 → water = **37.5%**

💡 Selling at cost price with water added → gain is measured **on the milk** (water / milk), **not** on the whole mixture.

Milk & Water — more work

Worked example 4 — find profit from a ratio

Milk : water in a can is 5 : 1 and the seller sells it at the cost price of milk.

Water : milk = 1 : 5 → Gain % = (1/5) × 100 = **20%**. ✅

Worked example 5 — water to reach a target gain

A trader has 40 L pure milk. How much water gives a 25% profit when sold at milk's cost price?

Gain% = water/milk ×100 = 25 → water = 25% of 40 = **10 L**. Mixture = 50 L.

Worked example 6 — two cans, one target

Can A has milk : water = 4 : 1; can B has 2 : 3. In what ratio to mix for milk : water = 1 : 1?

Milk fraction: A = 4/5 = 0.8, B = 2/5 = 0.4, target m = 0.5.

A : B = (0.5−0.4) : (0.8−0.5) = 0.1 : 0.3 = **1 : 3**. ✅

Check → milk = 0.8×1 + 0.4×3 = 2.0 over 4 L = 0.5 ✓.

Worked example 7 — add milk to change ratio

A 40 L mix has milk : water = 3 : 1. How much milk to make it 4 : 1?

Milk = 30 L, water = 10 L (water stays fixed). For 4 : 1 with 10 L water → milk = 40 L.

Extra milk needed = 40 − 30 = **10 L**. ✅

Try these

Milk:water 6:1, sold at CP → gain **16⅔%**

Milk:water 9:1, sold at CP → gain **11&frac19;%**

50 L milk, 10% profit → add **5 L** water

25 L milk + 5 L water → water **16⅔%**

✓ When you only **add water**, the milk stays constant; when you only **add milk**, the water stays constant. Anchor on the unchanged part.

⑤ Repeated Replacement (Dilution)

Draw out some liquid, top up with water, repeat. Each round scales the pure liquid by the **same factor**.

Replacement formula

Vessel has **x** units of pure liquid; each time **y** units are drawn and replaced by water, done **n** times:

$$\text{Pure left} = \mathbf{x(1 - y/x)^n} \quad \text{and} \quad \text{Pure : Total} = \mathbf{(1 - y/x)^n}$$

Worked example 1 — the standard case

Given — $x = 40$ L pure milk, $y = 8$ L drawn & replaced with water, $n = 2$ times.

Factor → $1 - 8/40 = 1 - 1/5 = 4/5$.

Pure milk → $40 \times (4/5)^2 = 40 \times 16/25 = 640/25 =$ **25.6 L**.

Water → $40 - 25.6 =$ **14.4 L**. ✅

Worked example 2 — three rounds

100 L of wine; 20 L drawn & replaced with water, 3 times. Factor $= 1 - 20/100 = 4/5$.

Wine left $= 100 \times (4/5)^3 = 100 \times 64/125 =$ **51.2 L**. Water = 48.8 L.

Worked example 3 — find n

A vessel of 81 L milk becomes 16/81 pure after replacing water repeatedly, 8 L each time… use ratio form.

$(1 - y/x)^n = (2/3)^n = 16/81 = (2/3)^4 \rightarrow$ **$n = 4$** rounds.

Powers you'll reuse

$(4/5)^2 =$ **16/25**

$(4/5)^3 =$ **64/125**

$(3/4)^2 =$ **9/16**

$(2/3)^3 =$ **8/27**

💡 The **total** volume never changes (you draw y and pour back y). Only the **pure** fraction shrinks by (1−y/x) each round.

⑥ Mixing Two Mixtures

Two vessels already hold milk–water mixtures. To combine them, apply alligation to the **milk fractions** (or the water fractions).

Method

- Write each vessel's milk fraction: $a/(a+b)$ and $c/(c+d)$.
- Put them on the cross with the target fraction m in the middle.
- The cross gives the **ratio of the two vessels**.

Worked example 1 — equal quantities

Given — vessel A milk : water = 7 : 2, vessel B = 4 : 5; mixed in equal amounts.

Milk fractions → A = $7/9$, B = $4/9$.

Combined milk → $(7/9 + 4/9) \div 2 = (11/9)/2 = 11/18$; water = $7/18$.

Result → milk : water = **11 : 7**. ✅

Worked example 2 — find the mixing ratio

A is milk : water = 5 : 1, B is 3 : 5. In what ratio for a result of milk : water = 1 : 1?

Milk fractions: A = $5/6$, B = $3/8$, target = $1/2$.

A : B = $(1/2 - 3/8) : (5/6 - 1/2) = (1/8) : (1/3) = 3 : 8$ → **A : B = 3 : 8**.

Worked example 3 — combine given volumes

10 L of a 3 : 2 mix and 15 L of a 2 : 3 mix are poured together.

Milk = $3/5 \times 10 + 2/5 \times 15 = 6 + 6 = 12$ L; water = $4 + 9 = 13$ L.

Result milk : water = **12 : 13**. ✅

✓ Always convert each vessel to the **same yardstick** — the fraction of milk (or of water) — before you apply the cross.

If quantities are given, skip the cross — just add milk to milk and water to water, then take the ratio.

⑦ Alligation for Other Averages

The cross works for **any weighted average** split into two groups — ages, speeds, marks, profit %. The two "rates" are the group averages; the ratio is the group sizes (or times).

General cross

Group1 : Group2 = (avg2 − overall) : (overall − avg1) — weights nearest to the overall win the larger share.

Worked example 1 — average age

Given — boys average 12 yr, girls average 10 yr, class average 11.5 yr.
Cross → boys : girls = (11.5 − 10) : (12 − 11.5) = 1.5 : 0.5 = **3 : 1**.
Check → (12×3 + 10×1)/4 = 46/4 = 11.5 ✓. ✅

Worked example 2 — average speed (time ratio)

A car covers part of a trip at 30 km/h and part at 50 km/h, averaging 42 km/h.
Time at 30 : time at 50 = (50 − 42) : (42 − 30) = 8 : 12 = **2 : 3**.
Alligation on speeds gives the ratio of **times**, not distances.

Worked example 3 — average marks

Section X averages 75 marks, section Y averages 60, whole batch averages 69.
X : Y = (69 − 60) : (75 − 69) = 9 : 6 = **3 : 2** (number of students).

For **average speed** the weights are **times**; for classes/sections they are **head-counts**. Identify the weight before you cross.

Averages by Alligation — more

Worked example 4 — blended profit %

A man invests one part at 8% and another at 12%, earning 9% overall.

Part at 8% : part at 12% = (12 − 9) : (9 − 8) = 3 : 1 → **3 : 1**.

Worked example 5 — find the overall from a ratio

40 boys average 60 marks; 20 girls average 75. Batch average?

Overall = (60×40 + 75×20)/60 = (2400 + 1500)/60 = 3900/60 = **65 marks**. ✅

Worked example 6 — average speed both ways

Equal distances at 40 km/h and 60 km/h. Average speed = harmonic mean = 2ab/(a+b).

= (2×40×60)/(40+60) = 4800/100 = **48 km/h**.

Note — equal **distance** uses harmonic mean; equal **time** uses the simple average.

Worked example 7 — salary alligation

Average pay of officers ₹48000, of clerks ₹24000, of all staff ₹30000. Ratio of officers : clerks?

= (30000 − 24000) : (48000 − 30000) = 6000 : 18000 = **1 : 3**.

Try these (group ratio)

avg 40, 50, overall 44 → **3 : 2**

avg 20, 30, overall 26 → **2 : 3**

5%, 8%, overall 6% → **2 : 1**

avg 12, 18, overall 15 → **1 : 1**

✓ Alligation always gives a **ratio of weights**. To get actual counts you need one real number (total students, total investment...).

⑧ Adulteration & Gain %

A dealer sells at cost price but cheats on quality or quantity. The "free" adulterant (water, chalk) is pure profit.

Two standard results

- Adulterant added & sold at cost price → Gain % = (adulterant / genuine) × 100.
- False weight — sells at cost price but gives less: Gain % = (true − used) / used × 100.

Worked example 1 — water in milk

Given — 1 L water mixed into every 4 L milk, sold at milk's cost price.

Gain % → (1 / 4) × 100 = **25%**. ✅

Worked example 2 — false weight

A grocer sells at cost price but uses an 800 g weight for 1 kg.

Gain % = (1000 − 800) / 800 × 100 = 200 / 800 × 100 = **25%**. ✅

Worked example 3 — % of adulterant from gain

A trader mixes chalk in sugar and gains 20% selling at cost price. Find chalk : sugar.

20 = (chalk/ sugar)×100 → chalk : sugar = 1 : 5 → chalk = **$16\frac{2}{3}$%** of the mix.

Adulterant : genuine → gain

1 : 5 → gain **20%**

1 : 4 → gain **25%**

1 : 10 → gain **10%**

1 : 8 → gain **12.5%**

Gain is always measured **on the genuine part** (the cost he actually paid), never on the padded total.

Selling a Mixture at Profit / Loss

First find the **mean cost** of the mixture, then apply the ordinary profit–loss formula on that cost.

Profit on a mixture

Profit % = (SP − mean CP) / (mean CP) × 100. Selling price of the whole = SP / unit × total quantity.

Worked example 1 — rice blend sold for profit

Given — ₹30 and ₹40 rice mixed in ratio 2 : 3, sold at ₹42 / kg.
Mean CP → (30×2 + 40×3) / 5 = (60 + 120) / 5 = 180 / 5 = ₹36 / kg.
Profit % → (42 − 36) / 36 × 100 = 600 / 36 = **$16\frac{2}{3}$%**. ✅

Worked example 2 — find SP for a target profit

₹80 and ₹100 tea mixed 3 : 2; the trader wants 20% profit. Find the selling rate.
Mean CP = (80×3 + 100×2) / 5 = (240 + 200) / 5 = ₹88. SP = 88 × 1.20 = **₹105.60 / kg**.

Worked example 3 — ratio for a target profit

In what ratio mix ₹60 and ₹65 pulses so that selling at ₹68.20 gives 10% profit?
Mean CP must be 68.20 / 1.10 = ₹62. Cross: (65−62):(62−60) = 3 : 2 → **₹60 : ₹65 = 3 : 2**.

Worked example 4 — a loss case

₹50 and ₹70 oil mixed 1 : 1, sold at ₹54 / L. Mean CP = ₹60.
Loss % = (60 − 54) / 60 × 100 = **10% loss**.

✓ Two-step drill → (1) mean CP by alligation / weighted average, (2) profit or loss on that CP. Never mix the two steps.

More Solved Examples – I

Q1 – In what ratio must ₹15 and ₹20 rice be mixed to get ₹16.50/kg?
(20 − 16.5) : (16.5 − 15) = 3.5 : 1.5 = **7 : 3**.

Q2 – 25% of a 40 L milk mix is water. How much milk to add to make water 20%?
Water = 10 L (stays fixed). For 20% water → total = 10/0.20 = 50 L → add 50 − 40 = **10 L milk**.

Q3 – From 20 L pure milk, 4 L is replaced by water twice. Pure milk left?
$20 \times (1 - 4/20)^2 = 20 \times (4/5)^2 = 20 \times 16/25 =$ **12.8 L**.

Q4 – Two alloys have gold : copper = 3 : 2 and 1 : 4. Mixed equally, gold : copper?
Gold = 3/5 + 1/5 = 4/5 over 2 = 2/5; copper = 3/5. Ratio = **2 : 3**.

Q5 – Sugar at ₹15 and ₹20 mixed 3 : 2; sold at ₹21/kg. Profit %?
Mean CP = (15×3 + 20×2)/5 = (45 + 40)/5 = ₹17. Profit = (21−17)/17 ×100 = **23 4/17 %** ≈ 23.53%.

Q6 – A shopkeeper adds water to milk and gains 25% at cost price. Water : milk?
25 = (water/milk)×100 → water : milk = **1 : 4**.

Spot the type first: replacement ⟶ use the power formula; simple blend ⟶ use the cross; sale ⟶ find mean CP then profit.

More Solved Examples – II

Q7 – 60 kg alloy A (lead : tin = 3 : 2) and 100 kg alloy B (lead : tin = 1 : 4). Tin in the new alloy?
Tin = $2/5 \times 60 + 4/5 \times 100 = 24 + 80 = 104$ kg out of 160 kg → **65%** tin.

Q8 – A vessel is full of milk. 10 L is drawn, replaced by water; done twice; now milk : water = 81 : 19. Capacity?
$(1 - 10/x)^2 = 81/100 = (9/10)^2 \rightarrow 1 - 10/x = 9/10 \rightarrow 10/x = 1/10 \rightarrow x =$ **100 L**.

Q9 – Tea worth ₹126 and ₹135 mixed with a third at ₹x, ratio 1 : 1 : 2, mean ₹153. Find x.
$126 + 135 + 2x = 153 \times 4 = 612 \rightarrow 2x = 612 - 261 = 351 \rightarrow x =$ **₹175.50**.

Q10 – How many kg of ₹9.60 sugar mixed with 24 kg of ₹14.40 to gain 20% by selling at ₹13.20?
Mean CP = 13.20/1.20 = ₹11. Cross: (14.4–11):(11–9.6) = 3.4 : 1.4 = 17 : 7. Cheaper = $(17/7) \times 24 =$ **58 2/7 kg**.

Q11 – A can has milk & water 5 : 3. 16 L of the mix is removed and replaced by 16 L water; now 5 : 7. Capacity?
Let capacity be x. Milk after = $5x/8 - 5/8 \times 16 = 5x/8 - 10$; total stays x. $5x/8 - 10 = 5x/12 \rightarrow x/24 = 2 \rightarrow x =$ **48 L**.

Q12 – Two vessels A & B have milk : water = 4 : 3 and 2 : 3. Mix to get 1 : 1. Ratio A : B?
Milk fractions: A = 4/7, B = 2/5, target 1/2. A : B = (1/2 – 2/5) : (4/7 – 1/2) = (1/10) : (1/14) = **7 : 5**.

Higher-Level Solved Examples

H1 — 3 : 2 acid-water, part removed & replaced by water → 1 : 1. Fraction replaced?

Acid fraction 3/5 → 1/2. Removing fraction f: 3/5(1−f) = 1/2 → 1−f = 5/6 → f = **1/6** of the mixture.

H2 — ₹20 rice mixed with ₹24 rice, then whole sold at ₹27.50 for 25% profit. Ratio?

Mean CP = 27.50/1.25 = ₹22. Cross: (24−22):(22−20) = 2 : 2 = **1 : 1**.

H3 — A container has 40 L milk. 4 L drawn & replaced by water, 3 times. Milk : water now?

Milk = $40(1 - 4/40)^3 = 40(9/10)^3$ = 40 × 729/1000 = 29.16 L; water = 10.84 L → **729 : 271**.

H4 — Average of 30 students is 40. If 20 boys average 35, girls' average?

Total = 30×40 = 1200; boys = 20×35 = 700 → girls (10) = 500 → average = 500/10 = **50**.

H5 — Wine : water = 3 : 1 in a cask. How much of the mix be replaced by water to make it 1 : 1?

Wine fraction 3/4 → 1/2. 3/4(1−f) = 1/2 → 1−f = 2/3 → f = **1/3** of the mixture replaced.

H6 — ₹100 and ₹80 tea in ratio 3 : 2 is one blend; another is 1 : 1. Equal blends mixed → mean rate?

Blend-1 = (100×3+80×2)/5 = ₹92; blend-2 = ₹90. Equal amounts → (92+90)/2 = **₹91/kg**.

✓ "Replace a fraction once" → strength × (1−f). "Replace y units n times" → strength × $(1-y/x)^n$. Same idea, different bookkeeping.

Practice Set

1. Mix ₹18 & ₹24 for mean ₹20 → ratio?
2. Mix ₹10 & ₹15 in 3 : 2 → mean?
3. 25 L milk + 5 L water → water %?
4. Milk:water 4:1 sold at CP → gain %?
5. 50 L milk, 8 L replaced by water once → milk left?
6. x=40,y=10,n=2 → pure liquid left?
7. Vessels 7:2 & 4:5 equal mix → ratio?
8. Boys avg 15, girls 12, class 14 → ratio?
9. Invest 6% & 10%, overall 7% → ratio?
10. ₹30 & ₹36 in 1:1, sold ₹36 → profit %?
11. Water in milk, gain 20% at CP → water:milk?
12. 800 g weight for 1 kg at CP → gain %?
13. ₹9.6 & ₹14.4 for mean ₹12 → ratio?
14. 81 L, replace 27 L by water once → wine left?
15. Avg speed of equal distances 30 & 60 → ?

Answer Key — with working

1→ 2:1 ((24−20):(20−18)=4:2) · **2→ ₹12** ((10×3+15×2)/5) · **3→ 16⅔%** (5/30) · **4→ 25%** (water/milk=1/4) · **5→ 42 L** (50×42/50=50×21/25) · **6→ 22.5 L** ($40×(3/4)^2$=40×9/16) · **7→ 11:7** (milk 11/18) · **8→ 2:1** ((14−12):(15−14)) · **9→ 3:1** ((10−7):(7−6)) · **10→ 9 1/11 %** (CP 33, (36−33)/33) · **11→ 1:5** (20=w/m×100) · **12→ 25%** (200/800) · **13→ 2:1** ((14.4−12):(12−9.6)=2.4:2.4? → 1:1) · **14→ 54 L** (81×(1−27/81)=81×2/3) · **15→ 40 km/h** (2×30×60/90).

*Note Q13: (14.4−12):(12−9.6) = 2.4 : 2.4 = **1 : 1** (equal parts).

Quick Revision

- ✓ Cross → cheaper : dearer = (d−m) : (m−c). Mean price = total cost / total quantity.
- ✓ Replacement → pure left = $x(1-y/x)^n$. Sell at CP with water → gain = water/milk ×100.
- ✓ Same cross fits ages, speeds, marks & profit % — any two-group weighted average.

☆ *Mix it right — alligation makes it easy!* ☆