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# AVERAGES

- KOUSTAV



[www.linkedin.com/in/KoustavNandi](https://www.linkedin.com/in/KoustavNandi)



[www.youtube.com/TheAptitudeGuy](https://www.youtube.com/TheAptitudeGuy)

## CONCEPT - AVERAGES

$$\textit{Average} = \frac{\textit{Sum of the Terms}}{\textit{No. of Terms}}$$

1. 2 dragons and 8 unicorns are bought at an average of Rs.140. If the average price of a unicorn is Rs.60. What is the average price of a dragon?

A) Rs.480

B) Rs.920

☒ C) Rs.460

D) Rs.980

$$\frac{2D + 8U}{10} = 140$$

$$2D + 8 \times 60 = 1400$$

$$2D = 1400 - 480 = 920$$

$$D = \frac{920}{2} = \underline{\underline{460}}$$

2. A family consists of two grandparents, two parents and three grandchildren. The average age of the grandparents is 67 years, that of the parents is 35 years and that of the grandchildren is 6 years. What is the average age of the family?

A)  $28\frac{4}{9}$

✓ B)  $31\frac{5}{7}$

C)  $32\frac{1}{6}$

D)  $31\frac{2}{3}$

$$\frac{2 \times 67 + 2 \times 35 + 3 \times 6}{2 + 2 + 3} = \frac{222}{7} = \underline{\underline{31\frac{5}{7}}}$$

3. The average weight of 15 students in a group is 26kg. When the teacher's weight is included it becomes 30kg. What is the weight of the teacher?

A) 78

B) 86

C) 62

✓ D) 90

$$\frac{15 \times 26 + T}{16} = 30$$

$$T = 30 \times 16 - 15 \times 26$$
$$= \underline{\underline{90}}$$

$$T = 26 + 4 \times 16$$
$$= 26 + 64$$
$$= \underline{\underline{90}}$$

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$$25$$
$$T = 26 - 1 \times 16$$
$$= 10$$

4. The average age of a class of 19 students is 15 years. If the age of the teacher be included, then the average increases by 9 months. Find the age of the teacher.

A) 40

B) 25

✓ C) 30

D) 35

$$\frac{19 \times 15 + T}{20} = 15 + \frac{9}{12}$$

$$\begin{aligned} 19 \times 15 + T &= 15 \times 20 + \frac{9}{12} \times 20 \\ &= 15 \times 20 + 15 \times 1 \\ &= 15 \times 21 \end{aligned}$$

$$\begin{aligned} T &= 15(21 - 19) = 15 \times 2 \\ &= 30 \end{aligned}$$

$$\begin{aligned} T &= 15 + \frac{9}{12} \times 20 \\ &= 15 + 15 \\ &= 30 \end{aligned}$$

5. The average age of 6 members of a family is 40 years. If the grandfather is excluded, the average age decreases by 25%. What is the age of the grandfather?

A) 65 years

B) 75 years

C) 80 years

✓ D) 90 years

$$\frac{6 \times 40 - G_1}{5} = 30$$

$$6 \times 40 - G_1 = 30 \times 5$$

$$\begin{aligned} G_1 &= 240 - 150 \\ &= \underline{\underline{90}} \end{aligned}$$

$$40 \times 25\% = 10$$

$$40 - 10 = 30$$

6. The average age of 5 members of a family is 30 years. If the head of the family is excluded from this group, then the average age decreases by 16.67%. Find out the age of the head.

- A) 30 years      B) 35 years      C) 45 years      ✓ D) 50 years

$$\frac{5 \times 30 - H}{4} = 25$$

$$30 \times \frac{1}{6} = 5$$

$$\begin{aligned} H &= 5 \times 30 - 4 \times 25 \\ &= 150 - 100 \\ &= \underline{\underline{50}} \end{aligned}$$



7. If the average weight of 4 men increases by 3kg when one of them weighing 90kg is replaced by another man, then the weight of the new man is?

A) 80kg

B) 112kg

C) 78kg

✓ D) 102kg

$$\text{Old Avg} = A$$

$$\text{Old} = 90$$

$$\text{New Avg} = A + 3$$

$$\text{New} = N$$

$$\frac{4A - 90 + N}{4} = A + 3$$

$$\cancel{4A} - 90 + N = \cancel{4A} + 12$$

$$N = 12 + 90$$

$$= \underline{\underline{102}}$$

$$\begin{aligned} \text{Diff } |N - \theta| &= \text{Diff b/w avg} \times \text{No.} \\ &= 3 \times 4 = 12 \end{aligned}$$

$$\theta = 90$$

$$N = 90 + 12 = \underline{\underline{102}}$$

8. If the average weight of 4 men increases by 3kg when one of them is replaced by another man weighing 90kg, then the weight of the replaced man is?

A) 80kg

B) 112kg

☒ C) 78kg

D) 102kg

$$\text{Old Avg} = A$$

$$\text{New Avg} = A + 3$$

$$\text{Old} = \theta$$

$$\text{New} = 90$$

$$\frac{4A - \theta + 90}{4} = A + 3$$

$$4A - \theta + 90 = 4A + 12$$

$$\theta = 90 - 12 = \underline{\underline{78}}$$

$$\text{Diff} = 3 \times 4 = 12$$

$$\uparrow N = 90$$

$$\downarrow \theta = 90 + 12$$

$$90 - 12 = \underline{\underline{78}}$$

9. The average age of 8 men is decreased by 2 years when one of them is replaced by a 40-year-old woman. What is the age of the man who was replaced?

☒ A) 56 years

B) 48 years

C) 32 years

D) 24 years

$$\text{Diff} = 2 \times 8 = 16$$

$$\downarrow N = 40$$

$$\uparrow \theta = 40 + 16 = \underline{\underline{56}}$$

$40 - 16$

$$\frac{8A - \theta + 40}{8} = A - 2$$

$$\cancel{8A} - \theta + 40 = \cancel{8A} - 16$$

$$\theta = 40 + 16 = \underline{\underline{56}}$$

10. Ross Geller finds the average of 10 two-digit positive integers. By mistake, he interchanges the digits of one number, say AB. Due to this, the average becomes 1.8 less than the correct one. Find the value of  $|A-B|$ .

A) 3

B) 6

☒ C) 2

D) 4

$$\text{Diff} = 1.8 \times 10 = 18$$

$$AB - BA = 18$$

$$10A + B - (10B + A) = 18$$

$$10A + B - 10B - A = 18$$

$$9A - 9B = 18$$

$$A - B = \frac{18}{9} = \underline{\underline{2}}$$

11. The average weight of three men A, B and C is 84kg. Another man D joins the group and the average now becomes 80kg. If another man E, whose weight is 3kg more than that of D, replaces A, then the average weight of B, C, D and E becomes 79kg. The weight of A is:

A) 67kg

B) 72kg

✓ C) 75kg

D) 80kg

$$A + B + C = 84 \times 3 \quad \text{--- (1)}$$

$$A + B + C + D = 80 \times 4 \quad \text{--- (2)}$$

$$D = 84 - 4 \times 4 = 84 - 16 = 68$$

$$E = 68 + 3 = 71$$

$$B + C + D + E = 79 \times 4 \quad \text{--- (3)}$$

$$\text{(2)} - \text{(3)}$$

$$A - E = 80 \times 4 - 79 \times 4$$

$$= 4$$

$$A - 71 = 4$$

$$A = 4 + 71$$

$$= \underline{\underline{75}}$$

12. The average wages of a worker during a fortnight comprising 15 consecutive working days was Rs.90 per day. During the first 7 days, his average wages was Rs.87/day and the average wages during the last 7 days was Rs.92 /day. What was his wage on the 8th day?

A) 83

B) 92

C) 90

✓ ~~D) 97~~

Diagram illustrating the sequence of days and averages:

- Days 1 to 7: Average wage = 87 (labeled as  $90 - 3$ )
- Day 8: Wage =  $x$  (labeled with a downward arrow from 90)
- Days 9 to 15: Average wage = 92 (labeled as  $90 + 2$ )

**Method 1 (Left):**

$$15 \times 90 = 7 \times 87 + x + 7 \times 92$$

$$x = 15 \times 90 - 7(87 + 92)$$

Units Place

$$10 - 7 \times 9$$

$$10 - 3 = \underline{\underline{7}}$$

**Method 2 (Right):**

$$90 = 7 \times (-3) + x + 7 \times (+2)$$

$$= 7(-3 + 2) + x = 7(-1) + x = x - 7$$

$$x = 90 + 7 = \underline{\underline{97}}$$

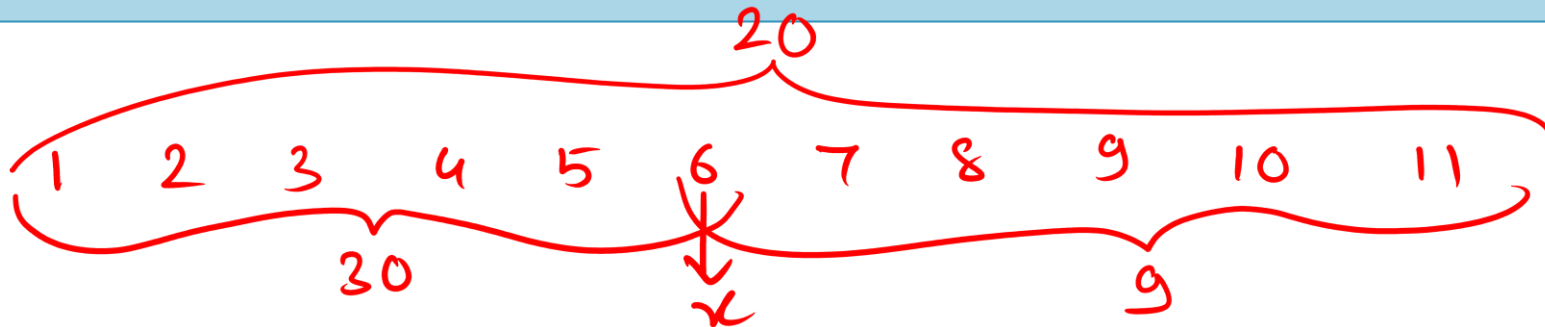
13. The average runs made by all the eleven batsmen of a cricket team in a match was 20 runs. The average runs made by the first six batsmen was 30 runs, and that of the last six batsmen was 9 runs. Find the number of runs made by the sixth batsman.

A) 28

☒ B) 14

C) 7

D) 19



$$11 \times 20 = 6 \times 30 + 6 \times 9 - x$$

$$x = 6(30 + 9) - 11 \times 20$$

$$= 6 \times 9 - 0$$

$$= 4$$

14. Ten years ago, the ages of the members of a joint family of eight people added up to 231 years. Three years later, one member died at the age of 60 years and a child was born during the same year. After another three years, one more member died, again at 60, and a child was born during the same year. The current average age of this eight-member joint family is nearest to:

A) 25

☒ B) 24

C) 26

D) 22

-10y	231
-7y	$231 + 3 \times 8 - 60 + 0 = 195$
-4y	$195 + 3 \times 8 - 60 + 0 = 159$
Present	$159 + 4 \times 8 = 191$

$$\frac{191}{8} \approx \underline{\underline{24}}$$



15. A vessel contains 36L of milk. 12L of milk is taken out and replaced by an equal amount of water. If this process is repeated once proportionally, what is the final quantity of milk in the vessel?

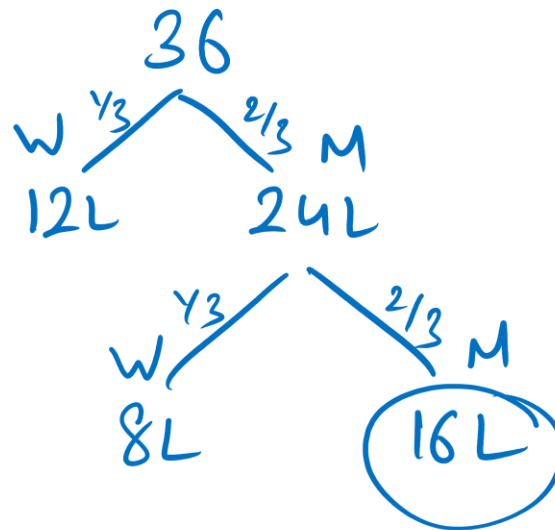
A) 10

B) 12

✓ C) 16

D) 24

$$36 \left(1 - \frac{12}{36}\right)^2$$
$$= 36 \times \frac{2}{3} \times \frac{2}{3}$$
$$= 16$$



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# MIXTURES & ALLIGATION

- KOUSTAV

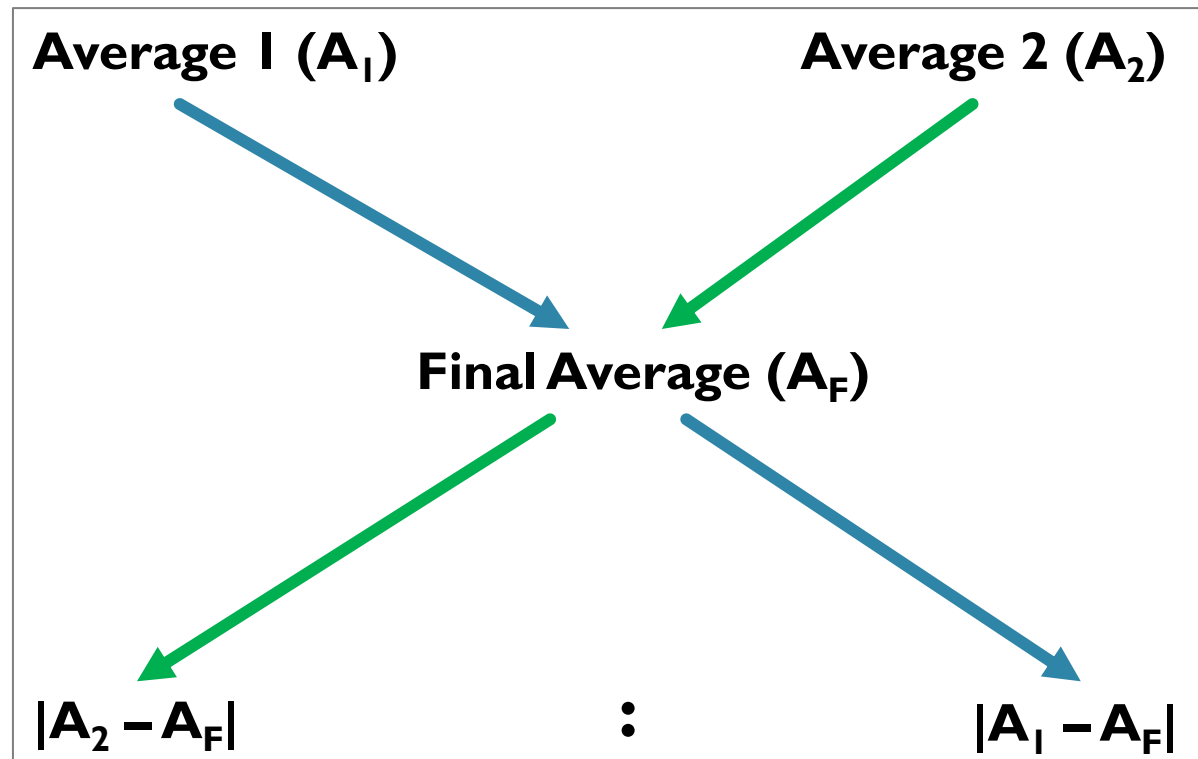


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# CONCEPT - ALLIGATION



1. In what ratio must a grocer mix two varieties of pulses costing Rs.15 and Rs.20 per kg respectively so as to get a mixture worth Rs.16.50 per kg?

A) 3 : 7

B) 5 : 7

✓ C) 7 : 3

D) 7 : 5

$$\begin{array}{l} 15 \quad 20 \\ x : y \\ \frac{15x + 20y}{x+y} = 16.5 \\ 15x + 20y = 16.5x + 16.5y \\ 16.5x - 15x = 20y - 16.5y \\ 1.5x = 3.5y \\ \frac{x}{y} = \frac{3.5}{1.5} = \frac{35}{15} = \frac{7}{3} \end{array}$$

$$\begin{array}{ccc} 15 & & 20 \\ & \searrow & \swarrow \\ & 16.5 & \\ & \swarrow & \searrow \\ 3.5 & : & 1.5 \\ 35 & : & 15 \\ 7 & : & 3 \end{array}$$

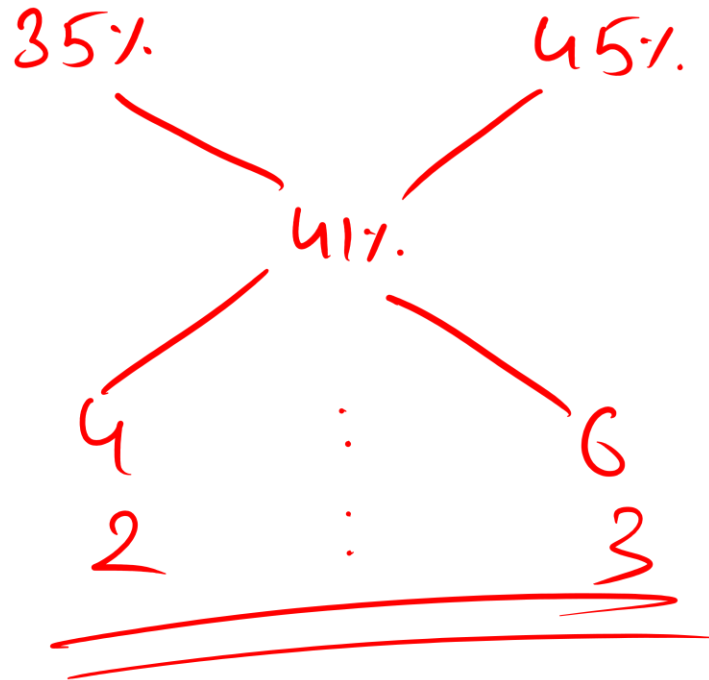
2. The ratio in which 35% alcohol solution should be mixed with 45% solution in order to get a 41% solution:

A) 2:1

B) 1:3

C) 3:1

✓ D) 2:3



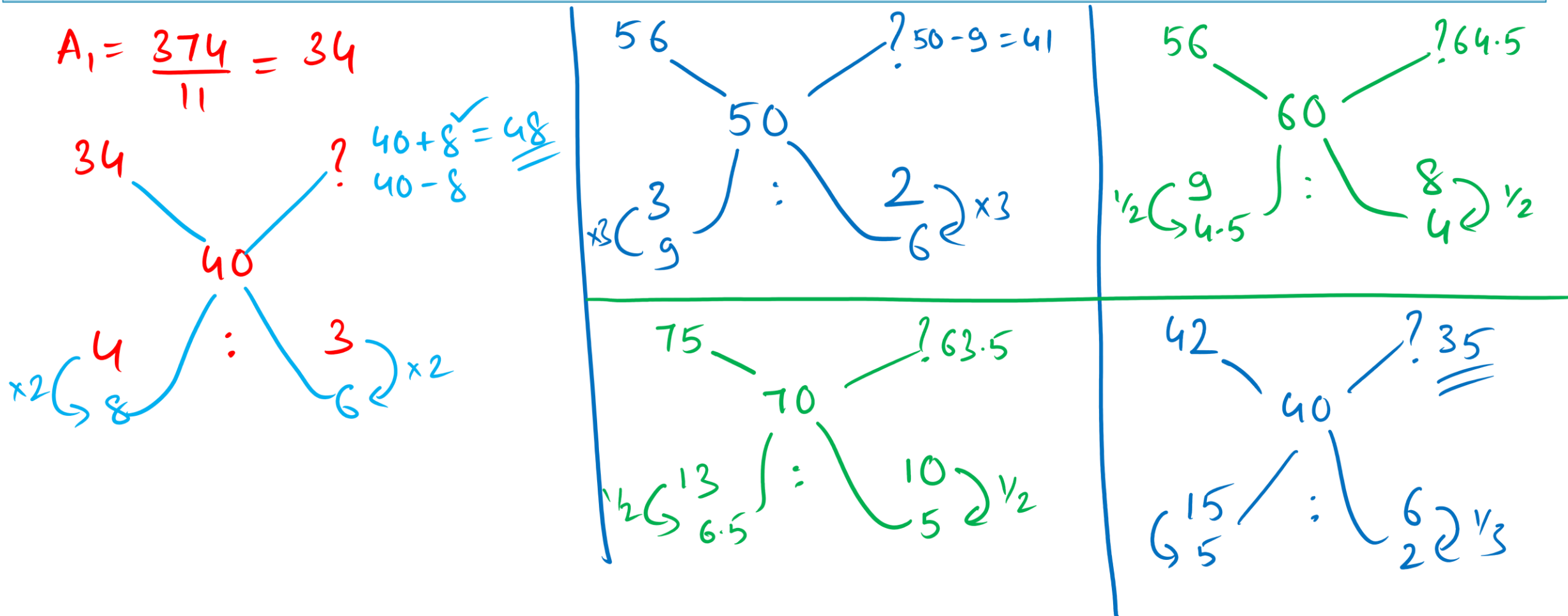
3. A dealer buys 11 kg of wheat at Rs.374 and mixes it with another quality of wheat in the ratio of 4:3. The price of the resulting mixture is Rs.40 per kg. The price of the other quality of wheat is \_\_\_\_\_?

✓ A) Rs.48/kg

B) Rs.50/kg

C) Rs.42/kg

D) Rs.32/kg



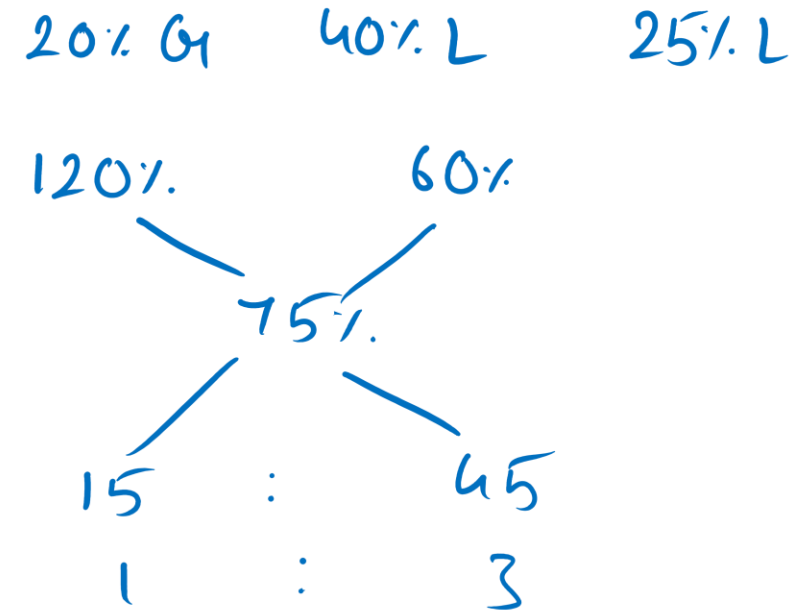
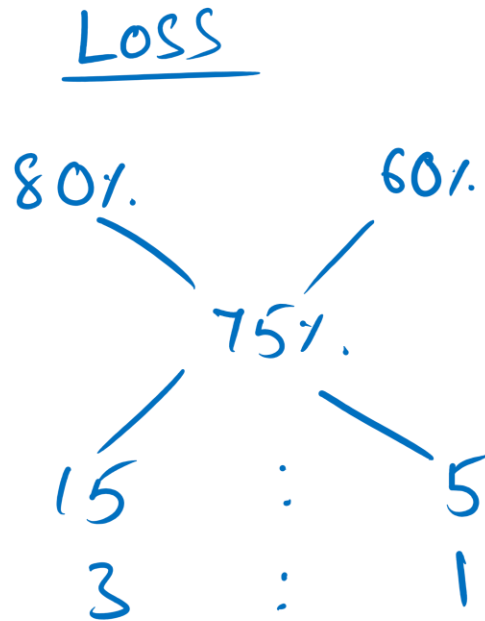
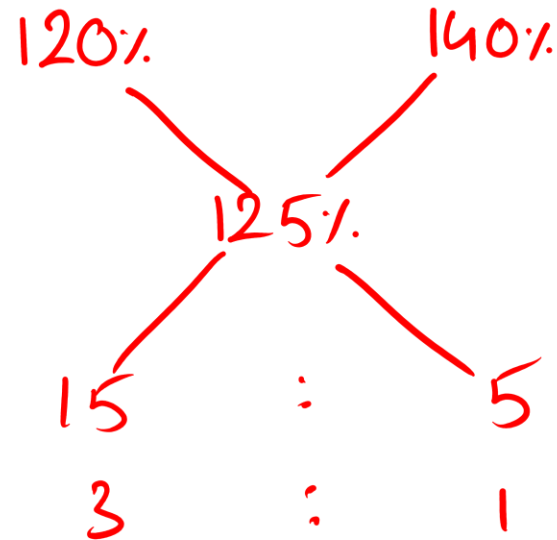
4. A shopkeeper has 50kg of rice. He sells a part of it at 20% profit and the rest at 40% profit. He gains 25% on the whole. Find the ratio of the two parts.

✓ A) 3 : 1

B) 2 : 1

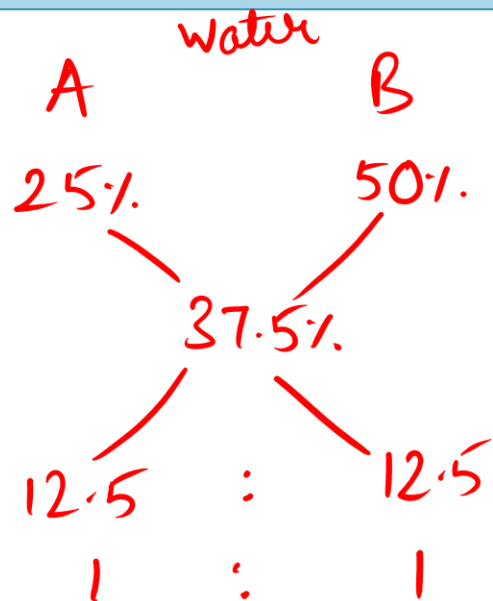
C) 1 : 3

D) 4 : 1



5. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk should he mix from each container so as to get 12 litres of milk such that the ratio of water to milk is 3:5?

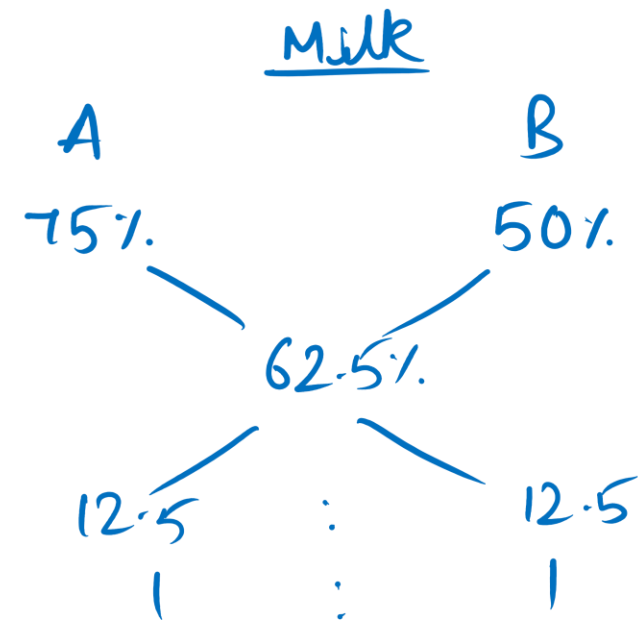
- A) 4 litres, 8 litres    ☒ B) 6 litres, 6 litres    C) 5 litres, 7 litres    D) 7 litres, 5 litres



$$w:M = 3:5$$

$$w\% = \frac{3}{8} \times 100 = 37.5\%$$

$$\frac{5}{8} \times 100 = 62.5\%$$





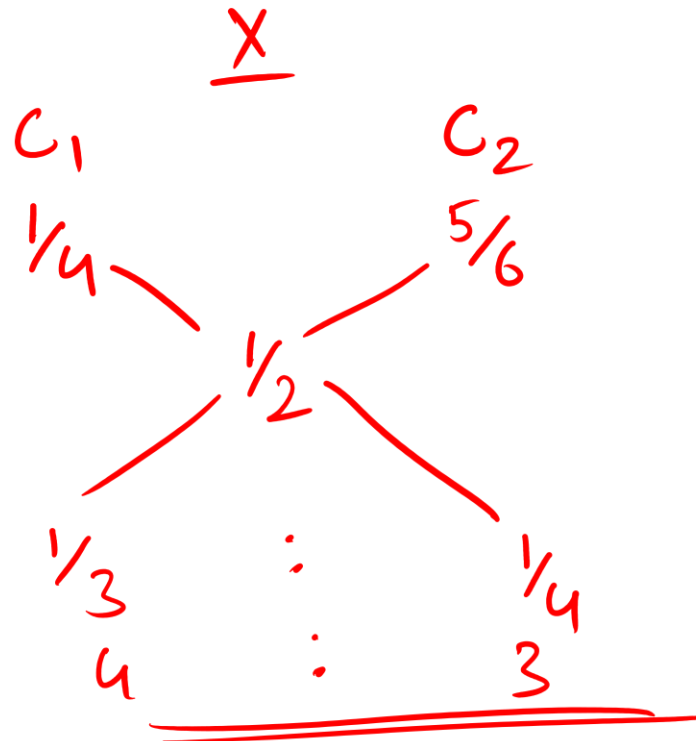
6. Two liquids X and Y are in the ratio 1 : 3 in container C1 and in the ratio 5 : 1 in container C2. In what ratio should the contents of the two containers be mixed so as to obtain a mixture of X and Y in the ratio 1 : 1?

A. 1 : 2

B. 3 : 2

C. 5 : 6

✓ D. 4 : 3



$$\frac{1}{4} - \frac{1}{2} = \frac{1-2}{4} = -\frac{1}{4}$$

$$\frac{5}{6} - \frac{1}{2} = \frac{5-3}{6} = \frac{2}{6} = \frac{1}{3}$$

7. How many kilogram of sugar costing Rs.9 per kg must be mixed with 27 kg of sugar costing Rs.7 per kg so that there may be a gain of 10% by selling the mixture at Rs.9.24 per kg?

A) 36kg

B) 42kg

C) 54kg

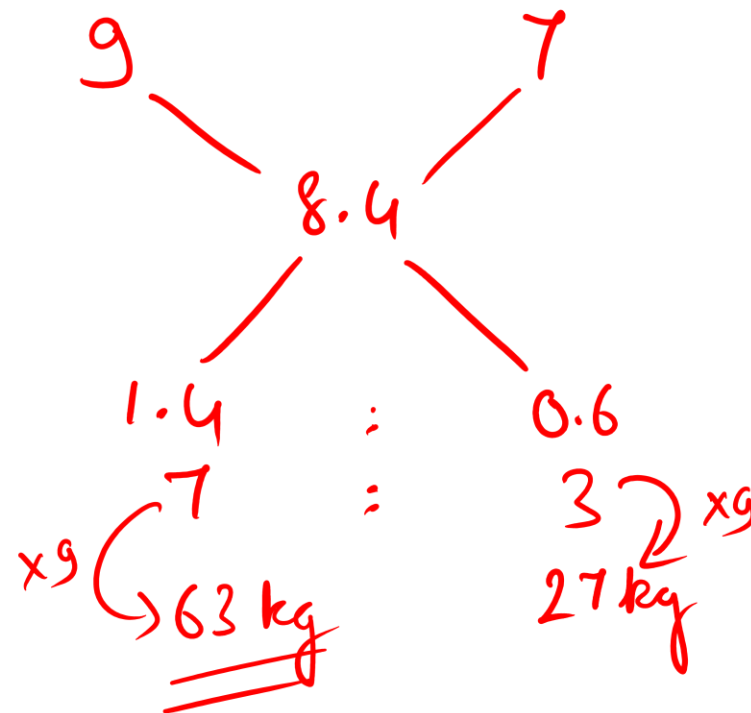
✓ D) 63kg

$$SP = 9.24$$

$$G = 10\%$$

$$SP = \frac{110}{100} CP$$

$$CP = \frac{9.24 \times 100}{110}$$
$$= 8.4$$



8. A dishonest milkman professes to sell his milk at cost price, but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is

A) 4%

B) 6%

✓ C) 20%

D) 25%

$$\text{Milk} = 100 \text{ L}$$

$$\text{Milk} + \text{water} = 125 \text{ L}$$

$$\text{water} = 25 \text{ L}$$

$$\% \text{ W} = \frac{25}{125} \times 100 = \underline{\underline{20\%}}$$

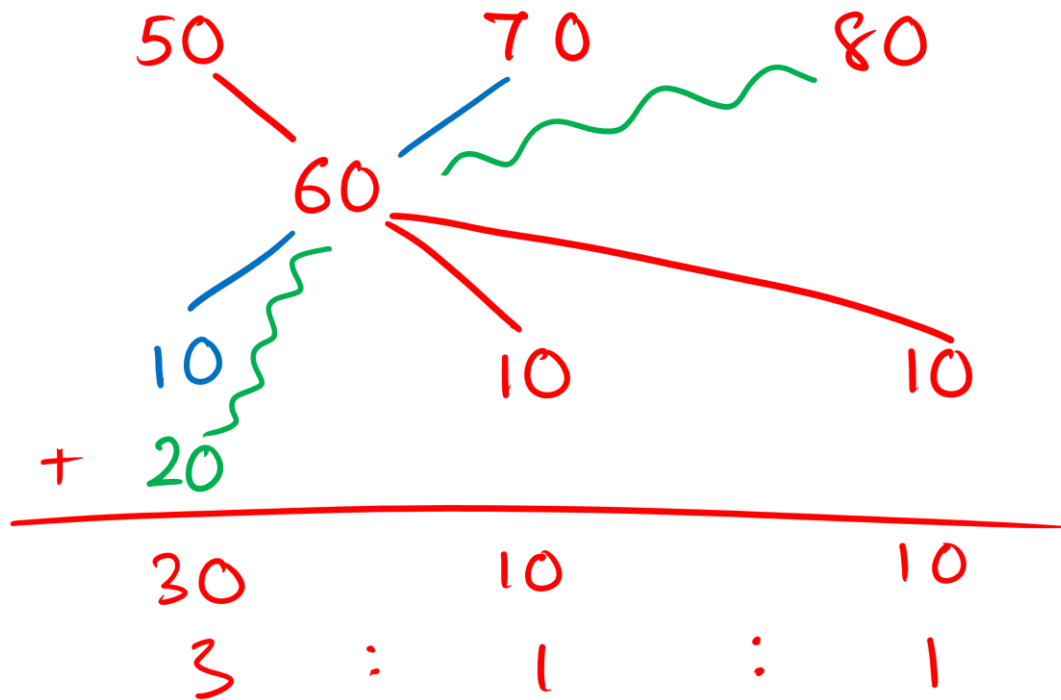
9. In what ratio must a grocer mix three varieties of sugar costing Rs.50, Rs.70 and Rs.80 per kg respectively so as to get a mixture worth Rs.60 per kg?

A) 2 : 1 : 1

B) 2 : 2 : 1

✓ C) 3 : 1 : 1

D) 3 : 2 : 1



**10. Brass is an alloy of copper and zinc only. Bronze is an alloy containing 80% copper, 4% zinc and 16% tin. A fused mass of both the alloys is made to contain 74% copper, 16% zinc & 10% tin. The ratio of copper to zinc in brass is?**

**A) 12:16**

**B) 16:9**

**C) 3:4**

**D) 12:5**

## EXTRA QUESTIONS:

- 1. The average monthly salary of 12 workers and 3 managers in a factory was Rs.600. When one of the managers whose salary was Rs.720, was replaced with a new manager, the average salary of the team went down to Rs.580. What is the salary of the new manager? (Cisco-2018)**

A. Rs.420                      B. Rs.690                      C. Rs.640                      D. Rs.610
- 2. The average salary of all the employees in the company is 8000. The average salary of 7 designers is 12000 and the average salary of the rest is 6000. The total number of employees in the company is**

A. 23                      B. 22                      C. 21                      D. 20
- 3. The average age of eight men got increased by 2 years when 2 of them whose ages are 21 years and 23 years are replaced by two new men. The average age of the two new men is:**

A. 22                      B. 28                      C. 30                      D. 34
- 4. A dealer buys wheat at Rs.46 per kg and mixes it with another quality of wheat in the ratio of 4:3. The price of the resulting mixture is Rs.40 per kg. The price of the other quality of wheat is \_\_\_\_\_?**

A) Rs.48/kg                      B) Rs.50/kg                      C) Rs.42/kg                      D) Rs.32/kg
- 5. Two liquids X and Y are in the ratio 1 : 3 in container  $C_1$  and in 5 : 1 in container  $C_2$ . In what ratio should the contents of the two containers be mixed so as to obtain a mixture of X and Y in the ratio 1:1?**

A. 1 : 2                      B. 3 : 2                      C. 5 : 6                      D. 4 : 3