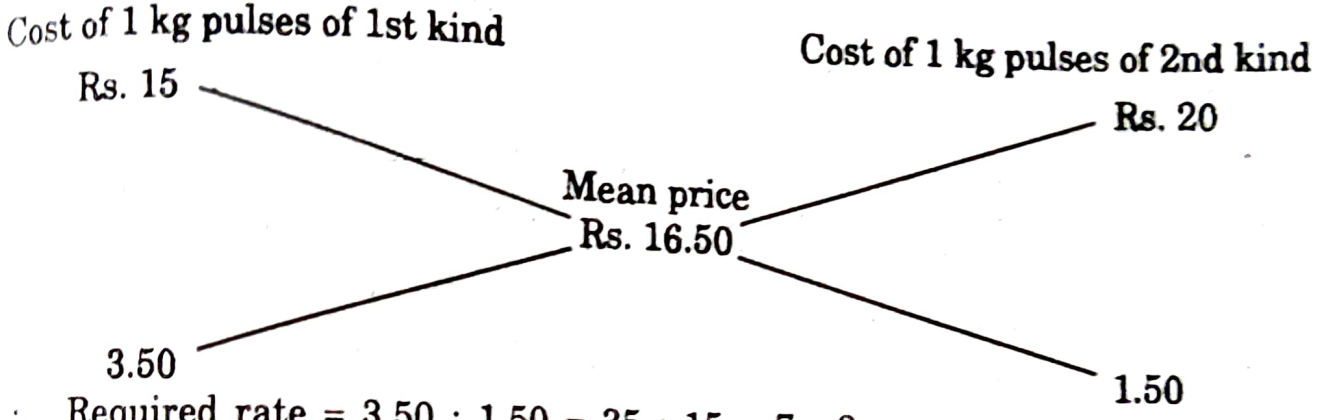
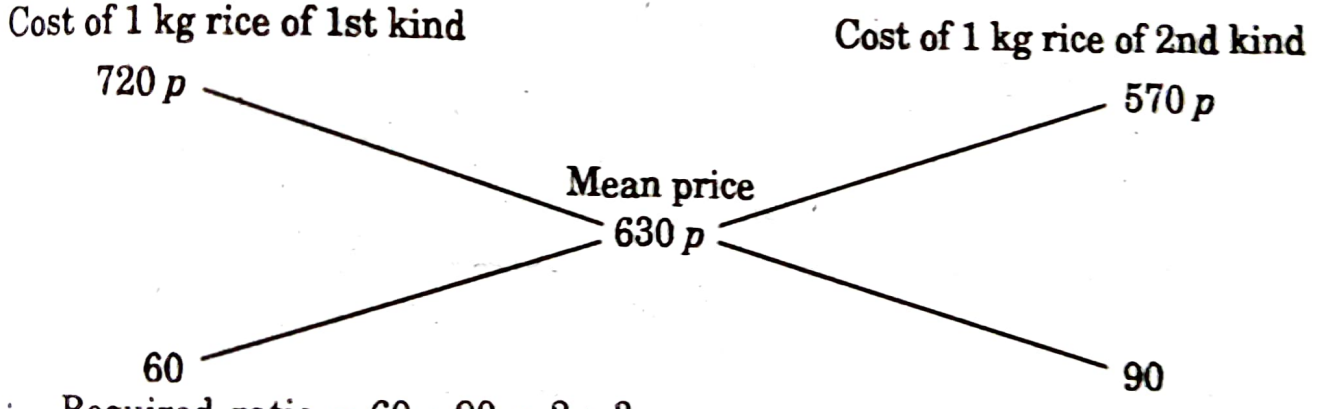
SOLUTIONS

1. By the rule of alligation :



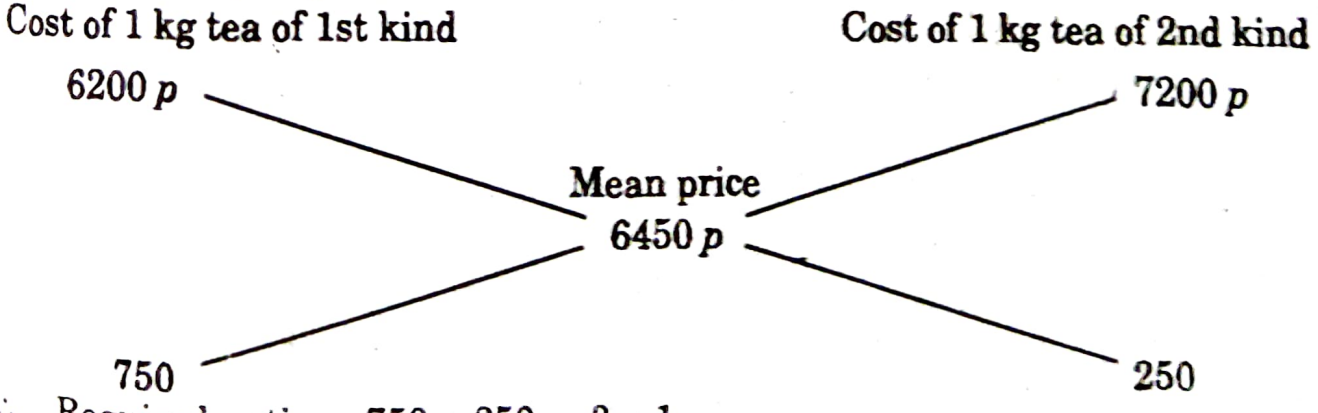
$\therefore$ Required rate = 3.50 : 1.50 = 35 : 15 = 7 : 3.

2. By the rule of alligation :



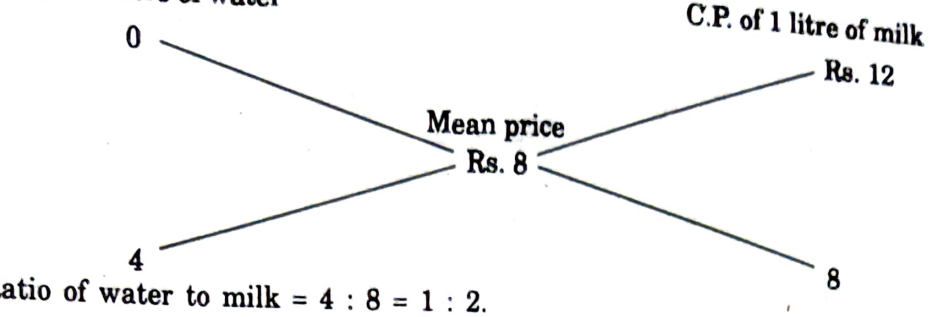
$\therefore$ Required ratio = 60 : 90 = 2 : 3.

3. By the rule of alligation :



$\therefore$ Required ratio = 750 : 250 = 3 : 1.

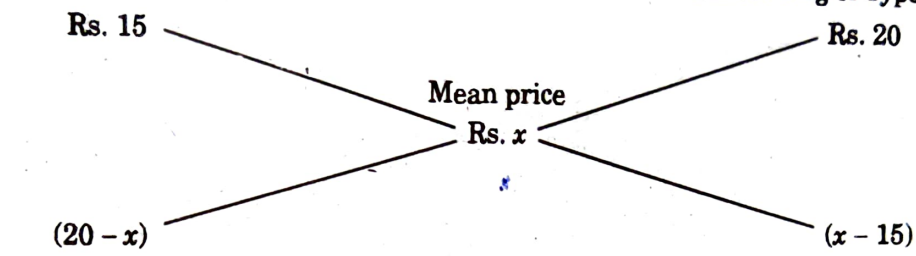
4. By the rule of alligation :



Ratio of water to milk = 4 : 8 = 1 : 2.

5. Let the price of the mixed variety be Rs. x per kg.

By the rule of alligation, we have :



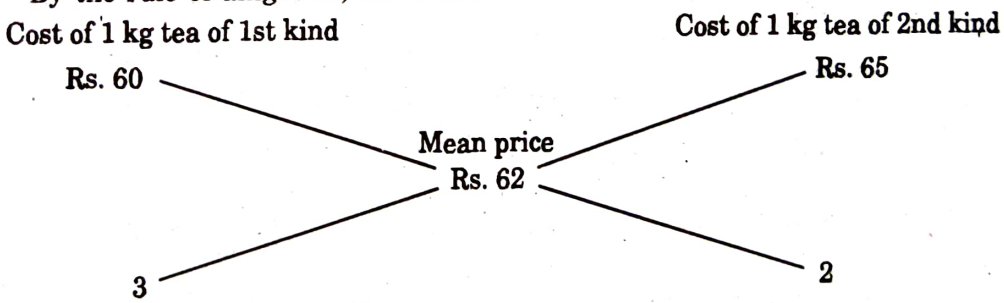
$$\therefore \quad \frac{(20-x)}{(x-15)} = \frac{2}{3} \Rightarrow 60 - 3x = 2x - 30 \Rightarrow 5x = 90 \Rightarrow x = 18.$$

So, price of the mixture is Rs. 18 per kg.

6. S.P. of 1 kg of the mixture = Rs. 68.20, Gain = 10 %.

C.P. of 1 kg of the mixture = Rs. $\left(\frac{100}{110} \times 68.20\right)$ = Rs. 62.

By the rule of alligation, we have :

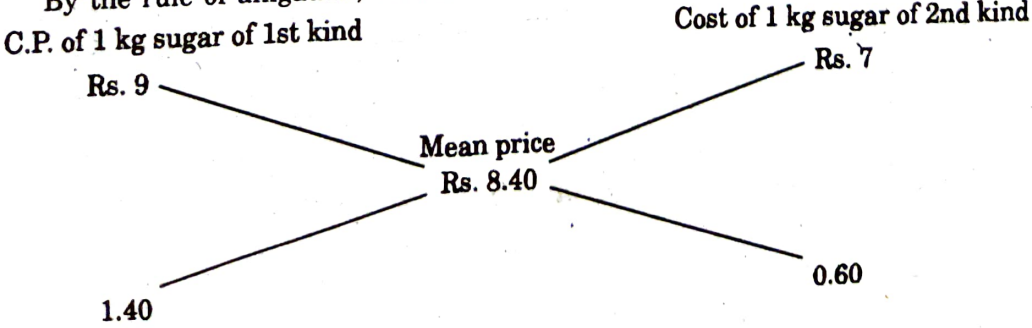


$\therefore$ Required ratio = 3 : 2.

7. S.P. of 1 kg of mixture = Rs. 9.24, Gain = 10%.

$\therefore$ C.P. of 1 kg of mixture = Rs. $\left(\frac{100}{110} \times 9.24\right)$ = Rs. 8.40.

By the rule of alligation, we have :



$\therefore$ Ratio of quantities of 1st and 2nd kind = 14 : 6 = 7 : 3.

Let x kg of sugar of 1st kind be mixed with 27 kg of 2nd kind.

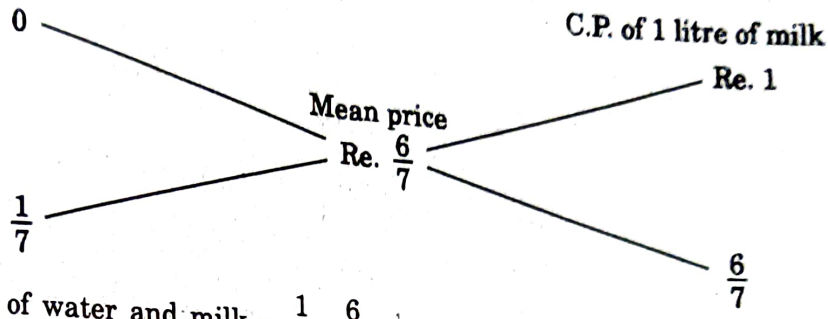
Then, $7 : 3 = x : 27$ or $x = \left(\frac{7 \times 27}{3}\right) = 63$ kg.

8. Let C.P. of 1 litre milk be Re. 1.

S.P. of 1 litre of mixture = Re. 1, Gain $= \frac{50}{3}\%$.

$\therefore$ C.P. of 1 litre of mixture $= \left(100 \times \frac{3}{350} \times 1\right) = \text{Re. } \frac{6}{7}$.

By the rule of alligation, we have :

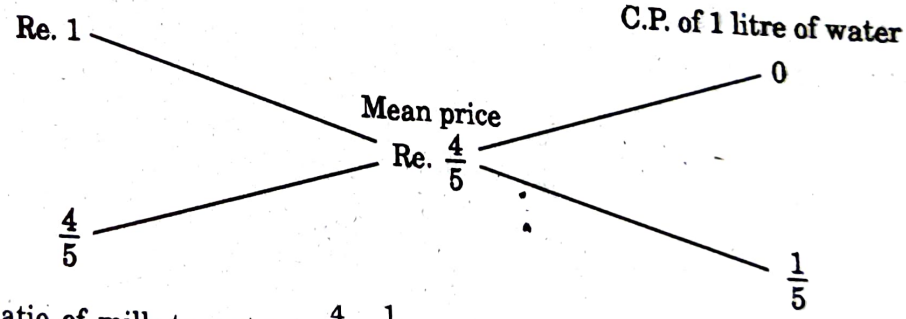


$\therefore$ Ratio of water and milk $= \frac{1}{7} : \frac{6}{7} = 1 : 6$.

9. Let C.P. of 1 litre milk be Re. 1.

Then, S.P. of 1 litre of mixture = Re. 1, Gain = 25%.

C.P. of 1 litre mixture $= \text{Re. } \left(\frac{100}{125} \times 1\right) = \text{Re. } \frac{4}{5}$.



$\therefore$ Ratio of milk to water $= \frac{4}{5} : \frac{1}{5} = 4 : 1$.

Hence, percentage of water in the mixture $= \left(\frac{1}{5} \times 100\right)\% = 20\%$.

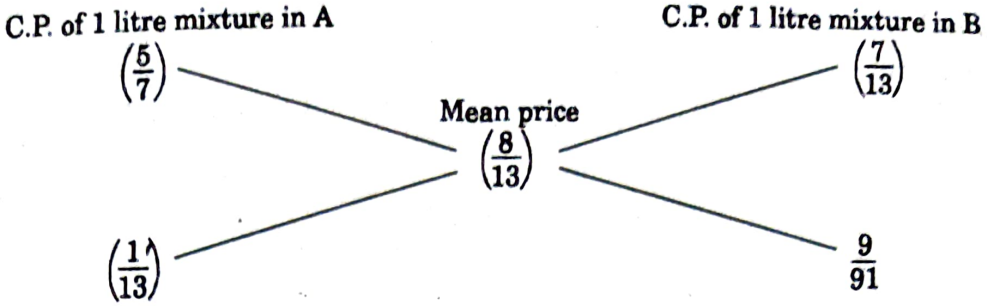
10. Let the C.P. of spirit be Re. 1 per litre.

Spirit in 1 litre mix. of A $= \frac{5}{7}$ litre; C.P. of 1 litre mix. in A $= \text{Re. } \frac{5}{7}$.

Spirit in 1 litre mix. of B $= \frac{7}{13}$ litre; C.P. of 1 litre mix. in B $= \text{Re. } \frac{7}{13}$.

Spirit in 1 litre mix. of C $= \frac{8}{13}$ litre; Mean price $= \text{Re. } \frac{8}{13}$.

By the rule of alligation, we have :



$\therefore$ Required ratio $= \frac{1}{13} : \frac{9}{91} = 7 : 9.$

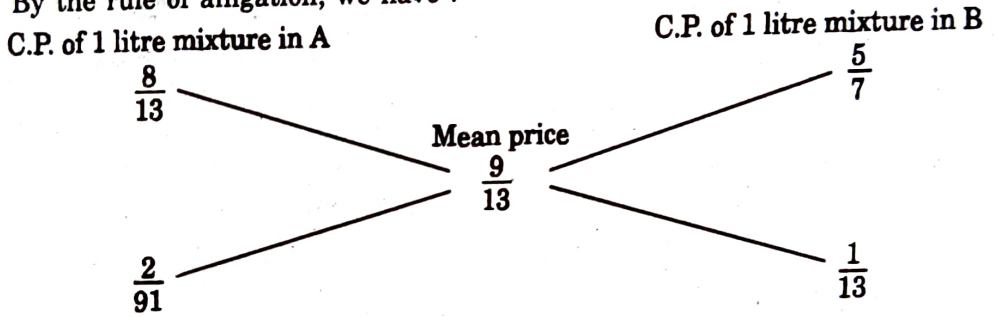
11. Let cost of 1 litre milk be Re. 1.

Milk in 1 litre mix. in A $= \frac{8}{13}$ litre, C.P. of 1 litre mix. in A = Re. $\frac{8}{13}$.

Milk in 1 litre mix. in B $= \frac{5}{7}$ litre, C.P. of 1 litre mix. in B = Re. $\frac{5}{7}$.

Milk in 1 litre of final mix. $= \left(\frac{900}{13} \times \frac{1}{100} \times 1\right) = \frac{9}{13}$ litre; Mean price = Re. $\frac{9}{13}$.

By the rule of alligation, we have :



$\therefore$ Required ratio $= \frac{2}{91} : \frac{1}{13} = 2 : 7.$

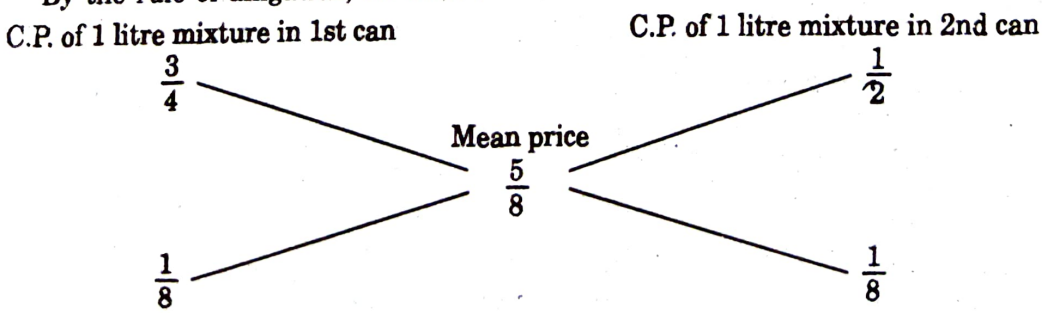
12. Let cost of 1 litre milk be Re. 1.

Milk in 1 litre mix. in 1st can $= \frac{3}{4}$ litre, C.P. of 1 litre mix. in 1st can = Re. $\frac{3}{4}$.

Milk in 1 litre mix. in 2nd can $= \frac{1}{2}$ litre, C.P. of 1 litre mix. in 2nd can = Re. $\frac{1}{2}$.

Milk in 1 litre of final mix. $= \frac{5}{8}$ litre, Mean price = Re. $\frac{5}{8}$.

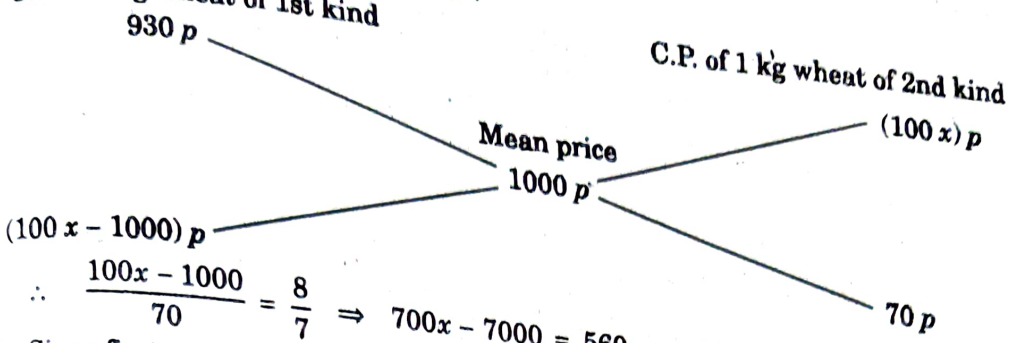
By the rule of alligation, we have :



$\therefore$ Ratio of two mixtures $= \frac{1}{8} : \frac{1}{8} = 1 : 1.$

So, quantity of mixture taken from each can $= \left(\frac{1}{2} \times 12\right) = 6$ litres.

13. Let the rate of the second quality be Rs. x per kg.
By the rule of alligation, we have :

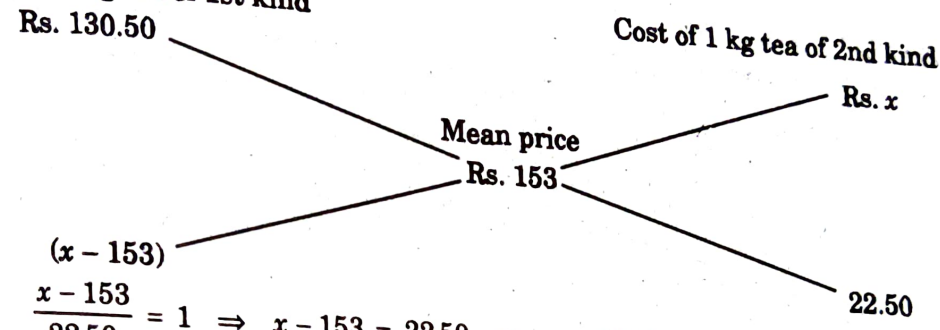


$\therefore \quad \frac{100x - 1000}{70} = \frac{8}{7} \Rightarrow 700x - 7000 = 560 \Rightarrow 700x = 7560 \Rightarrow x = \text{Rs. } 10.80.$

14. Since first and second varieties are mixed in equal proportions, so their average price

$= \text{Rs.} \left(\frac{126 + 135}{2}\right) = \text{Rs. } 130.50.$

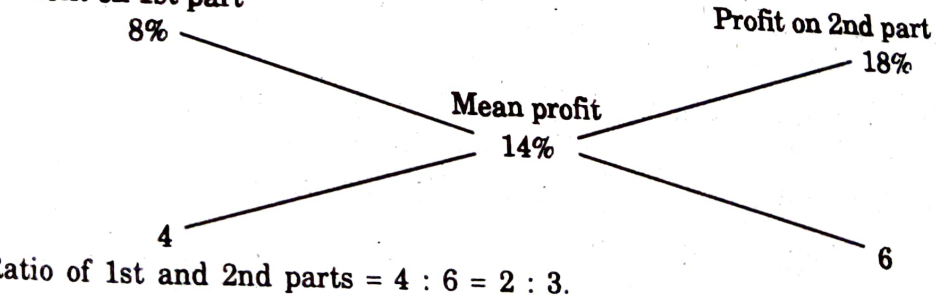
So, the mixture is formed by mixing two varieties, one at Rs. 130.50 per kg and the other at say, Rs. x per kg in the ratio 2 : 2, *i.e.*, 1 : 1. We have to find x.
By the rule of alligation, we have :
Cost of 1 kg tea of 1st kind



$\therefore \quad \frac{x - 153}{22.50} = 1 \Rightarrow x - 153 = 22.50 \Rightarrow x = 175.50.$

Hence, price of the third variety = Rs. 175.50 per kg.

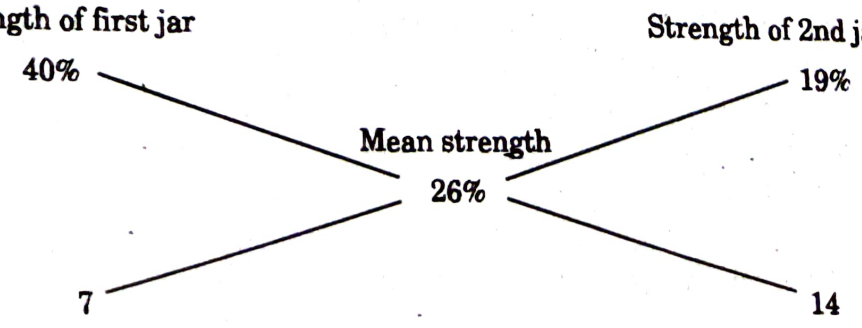
15. By the rule of alligation, we have :
Profit on 1st part



Ratio of 1st and 2nd parts = 4 : 6 = 2 : 3.

$\therefore$ Quantity of 2nd kind $= \left(\frac{3}{5} \times 1000\right)$ kg = 600 kg.

16. By the rule of alligation, we have :
Strength of first jar



So, ratio of 1st and 2nd quantities = 7 : 14 = 1 : 2.

$\therefore$ Required quantity replaced $= \frac{2}{3}$.

17. Amount of milk left after 3 operations

$$= \left[40\left(1-\frac{4}{40}\right)^3\right] \text{litres} = \left(40\times\frac{9}{10}\times\frac{9}{10}\times\frac{9}{10}\right) = 29.16 \text{ litres.}$$

18. Let the quantity of the wine in the cask originally be x litres.

Then, quantity of wine left in cask after 4 operations $= \left[x\left(1-\frac{8}{x}\right)^4\right]$ litres.

$$\therefore \quad \frac{x\left(1-\frac{8}{x}\right)^4}{x} = \frac{16}{81} \Rightarrow \left(1-\frac{8}{x}\right)^4 = \left(\frac{2}{3}\right)^2 \Rightarrow \left(\frac{x-8}{x}\right) = \frac{2}{3}$$

$$\Rightarrow 3x - 24 = 2x \Rightarrow x = 24.$$

19. Suppose the can initially contains $7x$ and $5x$ litres of mixtures A and B respectively.

Quantity of A in mixture left $= \left(7x - \frac{7}{12}\times 9\right)$ litres $= \left(7x - \frac{21}{4}\right)$ litres.

Quantity of B in mixture left $= \left(5x - \frac{5}{12}\times 9\right)$ litres $= \left(5x - \frac{15}{4}\right)$ litres.

$$\therefore \quad \frac{\left(7x-\frac{21}{4}\right)}{\left(5x-\frac{15}{4}\right)+9} = \frac{7}{9} \Rightarrow \frac{28x-21}{20x+21} = \frac{7}{9} \Rightarrow 252x - 189 = 140x + 147$$

$$\Rightarrow 112x = 336 \Rightarrow x = 3.$$

So, the can contained 21 litres of A.

20. Suppose the vessel initially contains 8 litres of liquid.

Let x litres of this liquid be replaced with water.

Quantity of water in new mixture $= \left(3 - \frac{3x}{8} + x\right)$ litres.

Quantity of syrup in new mixture $= \left(5 - \frac{5x}{8}\right)$ litres.

$$\therefore \quad \left(3-\frac{3x}{8}+x\right) = \left(5-\frac{5x}{8}\right) \Rightarrow 5x + 24 = 40 - 5x \Rightarrow 10x = 16 \Rightarrow x = \frac{8}{5}.$$

So, part of the mixture replaced $= \left(\frac{8}{5}\times\frac{1}{8}\right) = \frac{1}{5}$.