20. ALLIGATION OR MIXTURE

IMPORTANT FACTS AND FORMULA

1. **Alligation**: It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.
2. **Mean Price**: The cost price of a unit quantity of the mixture is called the mean price.
3. **Rule of Alligation**: If two ingredients are mixed, then

$$\frac{\text{(Quantity of cheaper)}}{\text{(Quantity of dearer)}} = \frac{\text{(C.P. of dearer) - (Mean price)}}{\text{(Mean price) - (C.P. of cheaper)}}$$

We present as under:

C.P. of a unit quantity of cheaper (c) — C.P. of a unit quantity of dearer (d)

(m)

(d-m) — *(m-c)*

∴ (Cheaper quantity) : (Dearer quantity) = (d - m) : (m - *c*).

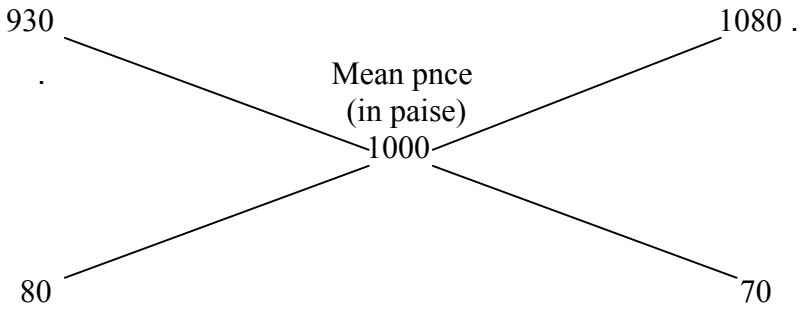
4. Suppose a container contains x units of liquid from which y units are taken out and replaced by water. After n operations the quantity of pure liquid=[x(1-y/x)^n]units.

SOLVED EXAMPLES

Ex. 1. In what ratio must rice at Rs. 9.30 per kg be mixed with rice at Rs. 10.80 per kg so that the mixture be worth Rs. 10 per kg ?

Sol. By the rule of alligation, we have:

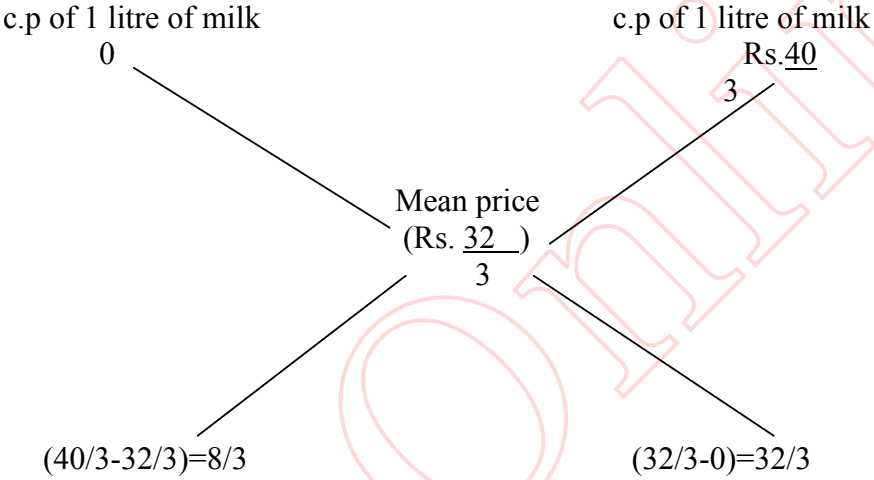
C.P. of 1 kg rice of 1st kind (in paise) C.P. of 1 kg rice of 2nd kind (in paise)



:.' Required ratio = 80 : 70 = 8 : 7.

Ex. 2. How much water must be added to 60 litres of milk at 1 ½ litres for Rs. 2 So as to have a mixture worth Rs.10 2/3 a litre ?

Sol. C.P. of 1 litre of milk = Rs. (20 x 2/3) = Rs. 40/3



∴ Ratio of water and milk = 8/3 : 32/3 = 8 : 32 = 1 : 4

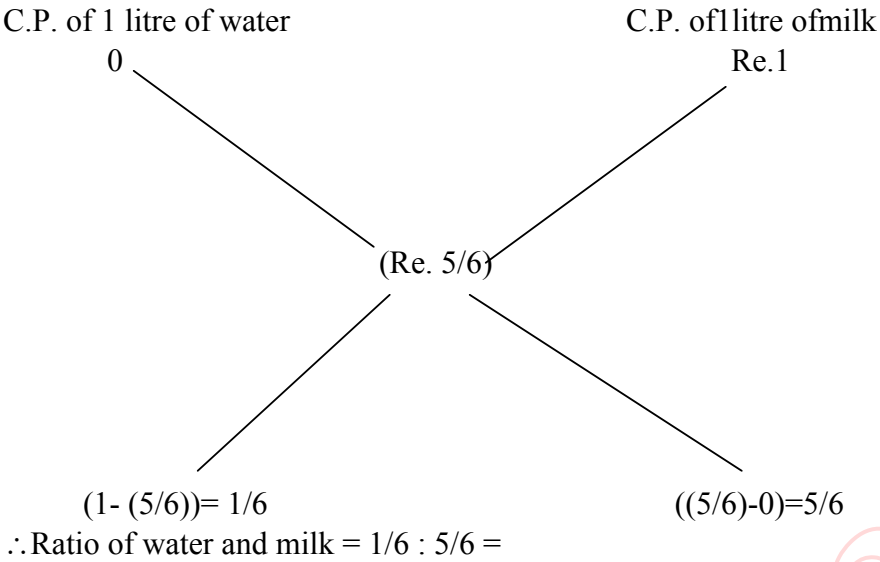
∴ Quantity of water to be added to 60 litres of milk = [1/4 X 60] litres =15 litre

Ex. 3. In what ratio must water be mixed with milk to gain 20 % by selling the mixture at cost price?

Sol. Let C.P. of milk be Re. 1 per litre.
Then, S.P. of 1 litre of mixture = Re. 1.
Gain obtained = 20%.

∴ C.P. of 1 litre of mixture = Rs.[(100/120)* 1]=Rs.5/6

By the rule of alligation, we have:



∴Ratio of water and milk = 1/6 : 5/6 =

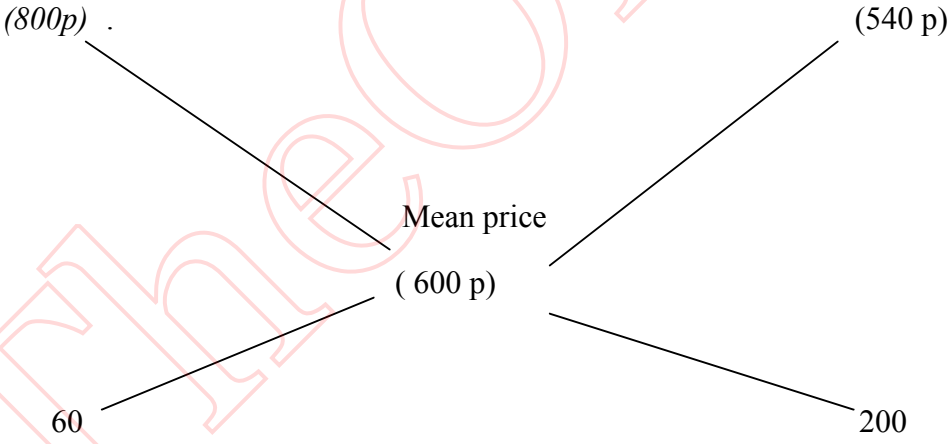
Ex. 4. .How many kgs. of wheat costing Rs. 8 per kg must be mixed with 86 kg of rice costing Rs. 6.40 per kg so that 20% gain may be obtained by Belling the mixture at Rs. 7.20 per kg ?

Sol. S.P. of 1 kg mixture = Rs. 7.20,Gain = 20%.

∴ C.P. of 1 kg mixture = Rs. $\left[(100/120)*7.20\right]$=Rs. 6.

By the rule of alligation, we have:

C_P. of 1 kg wheat of 1st kind C.P. of 1 kg wheat of 2nd kind



Wheat of 1st kind: Wheat of 2nd kind = 60 : 200 = 3 : 10.
Let x kg of wheat of 1st kind be mixed with 36 kg of wheat of 2nd kind.
Then, 3 : 10 = x : 36 or lOx = 3 * 36 or x = 10.8 kg.

Ex. 5. The milk and water in two vessels A and B are in the ratio 4 : 3 and 2: 3 respectively. In what ratio, the liquids in both the vessels be mixed to obtain a new mixture in vessel C containing half milk and half water?

Sol. Let the C.P. of milk be Re. 1 per litre

Milk in 1 litre mixture of A = 4/7litre; Milk in 1 litre mixture of B = 2/5 litre;
Milk in 1 litre mixture of C = ½ litre
C.P. of 1 litre mixture in A = Re .4/7; C.P. of 1 litre mixture in B = Re.2/5
Mean price = Re.1/2
By the rule of alligation, we have:

C.P. of 1 litre mix. in A (4/7) — C.P. of 1 litre mix. in B (2/5)

(1/2)

(1/10) — (1/14)

Required ratio = 1/10 : 1/14 = 7 : 5