ALLIGATION OR MIXTURE

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 desired price.

MEAN PRICE:

- The cost of a unit quantity of the mixture is called the mean price.
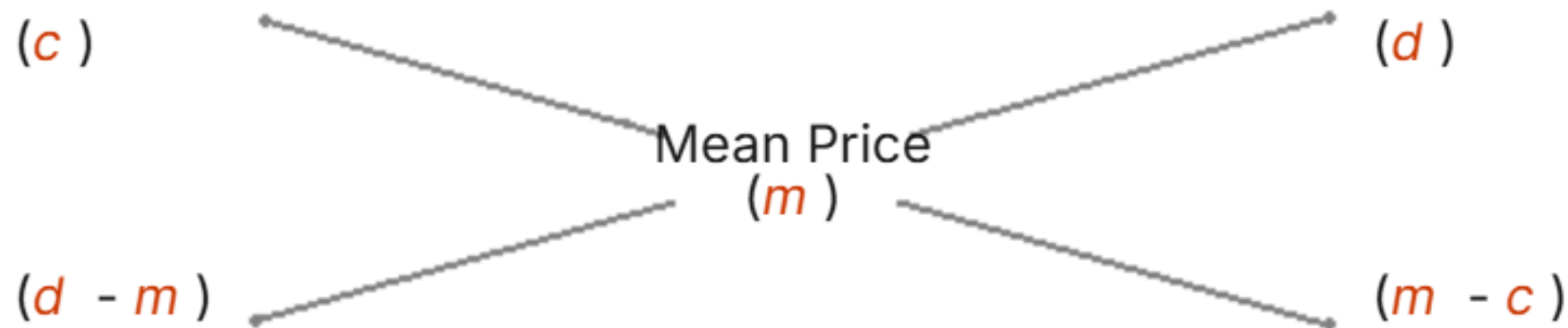
Rule of Alligation:

If two ingredients are mixed, then

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

We present as under:

C.P. of a unit quantity of cheaper

(*c*)

C.P. of a unit quantity of dearer

(*d*)

Mean Price
(*m*)

(*d* - *m*)

(*m* - *c*)

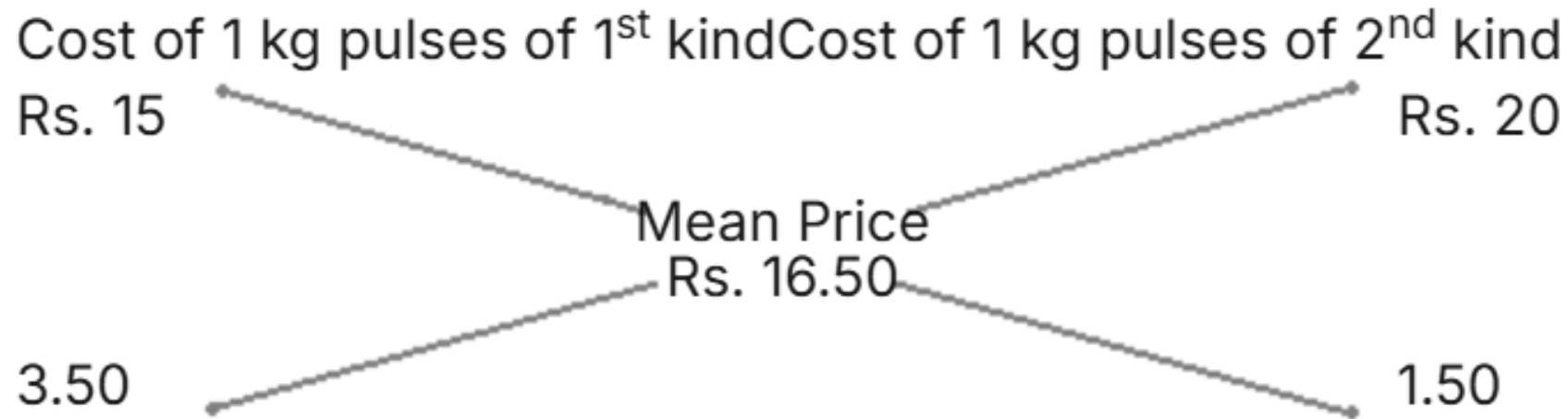∴ (Cheaper quantity) : (Dearer quantity) = (*d* - *m*) : (*m* - *c*).

Suppose a container contains x of liquid from which y units are taken out and replaced by water.

After n operations, the quantity of pure liquid $= \left[x \left(1 - \dfrac{y}{x} \right)^n \right]$ units.

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

By the rule of alligation:

Cost of 1 kg pulses of 1st kind Cost of 1 kg pulses of 2nd kind

Rs. 15   Rs. 20

Mean Price
Rs. 16.50

3.50   1.50

∴ Required rate = 3.50 : 1.50 = 7 : 3.

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

Price
9.30/kg

Price
10.80/kg

Mean price
10/kg

(10 - 10.80) : (9.30-10)
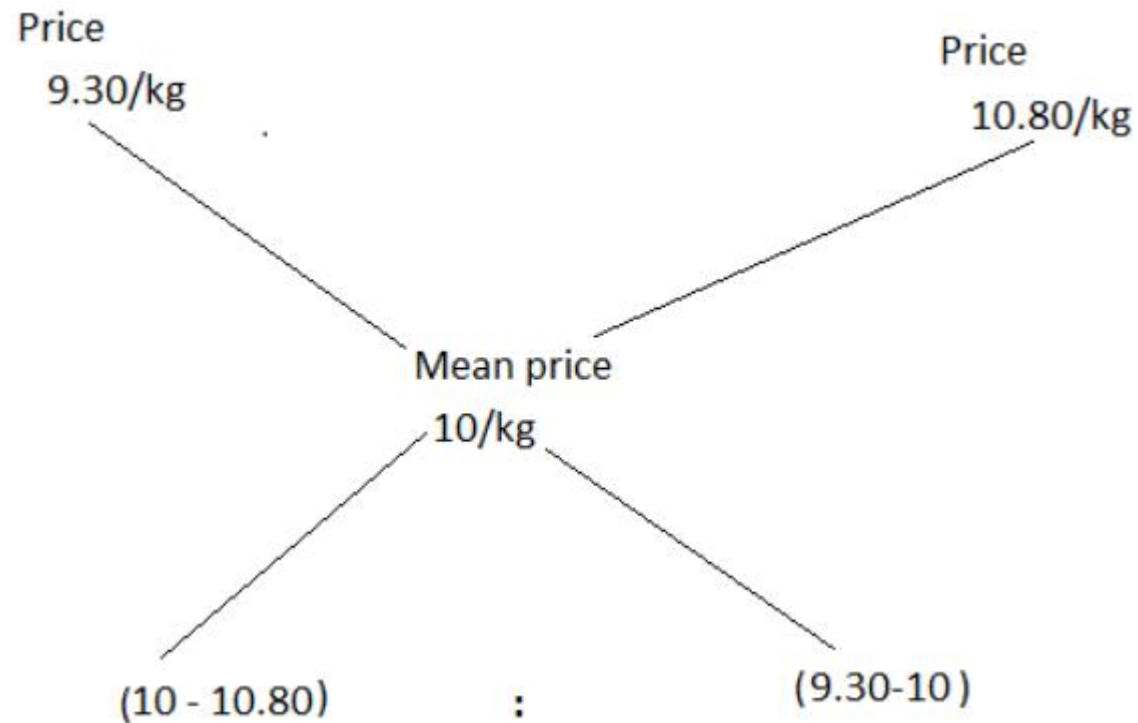
x:y = 8:7.

How much water must be added to 60 litres of milk at 1.5 litres for ₹ 20 so as to have a mixture worth ₹ 10 2/3 a litre?

C.p of 1.5 =3/2 litre of milk= rs 20

C.p of 1 Litre of milk = rs 20×2/3=rs40/3

C.p of 1 Litre of water =0

Mean price rs 10 2/3=rs 32/3

Ratio of water and milk.
= 8/3:32/3
=8:32
=1:4
*Quantity of milk to be added to 60 litre of milk.
=>(1/4×60)litre
=>15 Litre

C.P of 1 L water

C.P. of 1 L milk

0

$\frac{40}{3}$

₹ 32/3

$\left(\frac{40}{3} - \frac{32}{3}\right) = \frac{8}{3}$
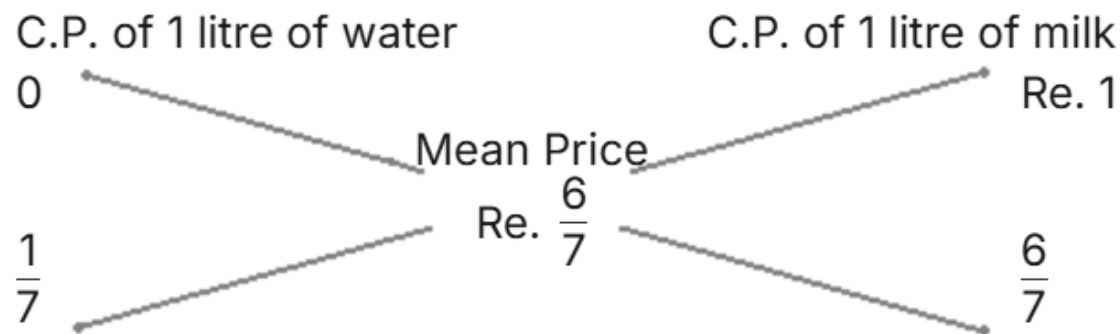
$\frac{32}{3} - 0 = \frac{32}{3}$

In what ratio must water be mixed with milk to gain $16\frac{2}{3}\%$ on selling the mixture at cost price?

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 = $\left(100 \times \frac{3}{350} \times 1\right)$ = $\frac{6}{7}$

By the rule of alligation, we have:

C.P. of 1 litre of water
0

C.P. of 1 litre of milk
Re. 1

Mean Price

Re. $\frac{6}{7}$

$\frac{1}{7}$

$\frac{6}{7}$

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

How many kilograms of wheat costing ₹ 8 per kg be mixed with 36kg of wheat costing ₹ 5.40 per kg so that 20% gain may be obtained by selling the mixture at 7.20 per kg.

SP of a mixture = 7.20/kg

CP of a mixture = 100/120 × 7.20

⇒ CP of a mixture = Rs. 6/kg

Now by using allegation,

8/kg   5.40/kg

6/kg

0.6/kg   2/kg

Now the ratio = 0.6 : 2

⇒ 8/kg : 5.40/kg = 3 : 10

According to the question,

⇒ 10 = 36kg

⇒ 1 = 3.6 kg

Now, 3 = 3 × 3.6 = 10.8 kg

∴ **Total quantity of Rs. 8/kg is 10.8kg.**

A container contains 40 litres of milk. From this container 4 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?
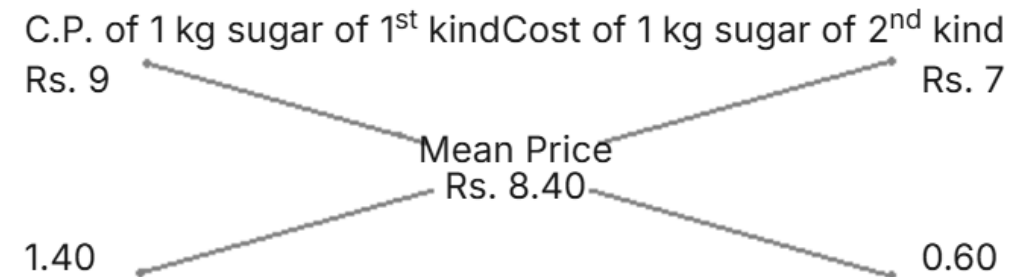
Amount of milk left after 3 operations $= \left[40 \left(1 - \dfrac{4}{40} \right)^3 \right]$ litres

$= \left(40 \times \dfrac{9}{10} \times \dfrac{9}{10} \times \dfrac{9}{10} \right) = 29.16$ litres.

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

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

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

By the rule of allilation, we have:

C.P. of 1 kg sugar of 1st kind   Cost of 1 kg sugar of 2nd kind
Rs. 9   Rs. 7

Mean Price
Rs. 8.40

1.40   0.60

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

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

Then, 7 : 3 = x : 27

$\Rightarrow x = \left(\dfrac{7 \times 27}{3} \right)$ = 63 kg.

Three equal glasses are filled with mixtures of spirit and water. The portion of spirit to water is 2:3 in the first glass, 3:4 in the second glass and 4:5 in the third glass. The contents of three glasses are emptied into a single vessel. Find the proportion of spirit and water in it

$$spirit = \frac{2}{2+3} + \frac{3}{3+4} + \frac{4}{4+5}$$

$$spirit = \frac{401}{315}$$

$$water = \frac{3}{2+3} + \frac{4}{3+4} + \frac{5}{4+5}$$

$$water = \frac{544}{315}$$

$$\frac{spriti}{water} = \frac{401}{315} \times \frac{315}{544}$$

$$\frac{spriti}{water} = \frac{401}{544}$$