

ALLIGATION OR MIXTURE

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 desired price.

2. Mean Price

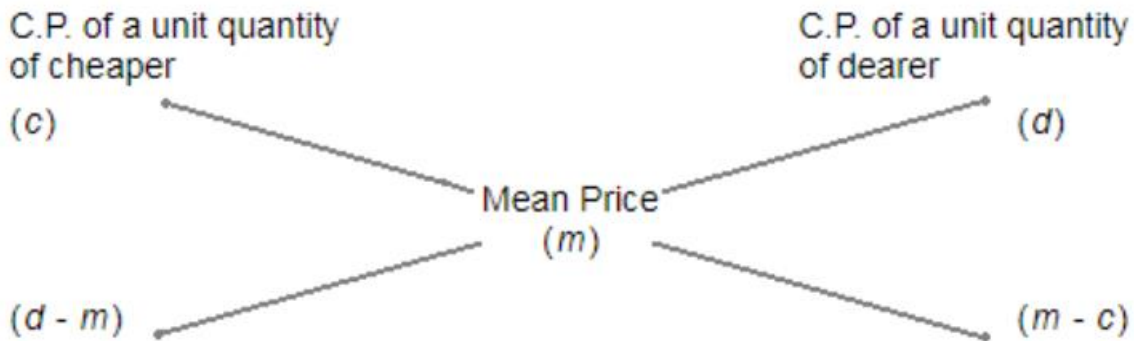
The cost of a unit quantity of the mixture is called the mean price.

3. Rule of Alligation

If two ingredients are mixed, then

Quantity of cheaper / Quantity of dearer = (C.P. of dearer - Mean Price) / (Mean price - C.P. of cheaper)

We present as under:



$$\therefore (\text{Cheaper quantity}) : (\text{Dearer quantity}) = (d - m) : (m - c).$$

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4. 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 = $x (1 - y/x)^n$ Units

Problems with solutions

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 kg?

Solution

By the rule of alligation:

Cost of 1 kg pulses of 1 st kind	Cost of 1 kg pulses of 2 nd kind	
Rs. 15	Mean Price	Rs. 20
3.50	Rs. 16.50	1.50

Required rate = 3.50: 1.50 = 7: 3.

2. 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?

Solution

$$\begin{aligned} \text{Amount of milk left after 3 operations} &= \left[40 \left(1 - \frac{4}{40} \right)^3 \right] \text{ litres} \\ &= \left(40 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} \right) = 29.16 \text{ litres.} \end{aligned}$$

3. A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is:

Solution

By the rule of alligation, we have:

Strength of first jar	Strength of 2 nd jar	
40%	Mean	19%
7	Strength	14
	26%	

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

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

4. Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg.

Solution

By the rule of alligation:

Cost of 1 kg of 1 st kind	Cost of 1 kg of 2 nd kind	
720 p		570 p
	Mean Price	
60	630 p	90

∴ Required ratio = 60 : 90 = 2 : 3.

5. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of water is 16 : 65. How much wine did the cask hold originally?

Solution

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.

$$\left(\frac{x(1 - (8/x))^4}{x} \right) = \frac{16}{81}$$

$$\left(1 - \frac{8}{x} \right)^4 = \left(\frac{2}{3} \right)^4$$

$$\left(\frac{x - 8}{x} \right) = \frac{2}{3}$$

$$3x - 24 = 2x$$

$$x = 24.$$