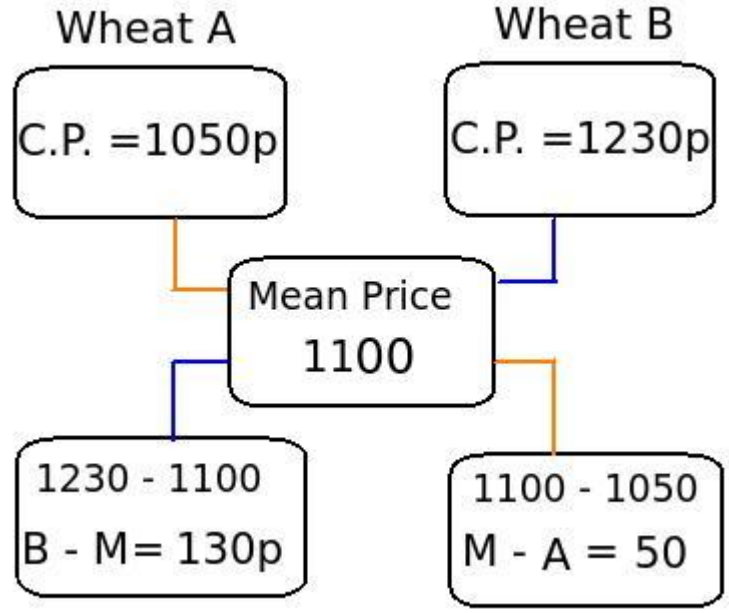
BHARAT SCHOOL OF BANKING
MIXTURE /ALLIGATION

Q 1. In what ratio must wheat A at Rs. 10.50 per kg be mixed with wheat B at Rs. 12.30 per kg, so that the mixture be worth of Rs. 11 per kg?

a. 13 : 5
b. 18 : 3
c. 17 : 5
d. 11 : 5
View solution
Correct option :(a)

Convert Rs into paise, to make the calculation easy



$$\text{Ratio} = \frac{(B - M)}{(M - A)}$$

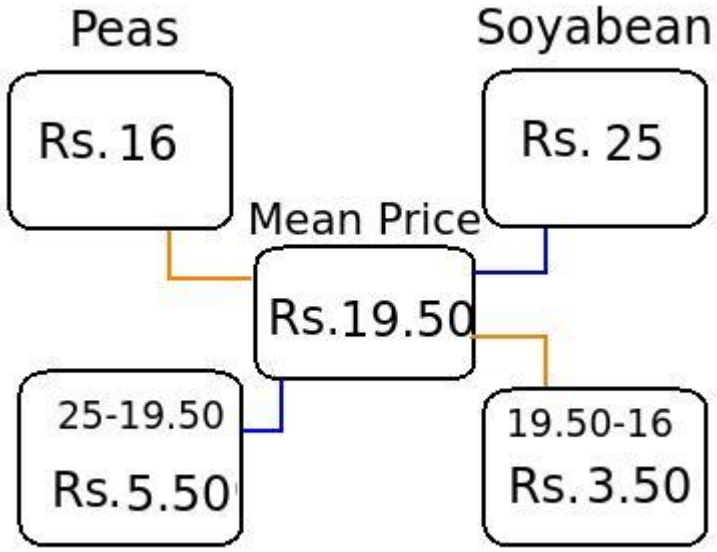
The required ratio = 130 : 50 = 13 : 5

Q 2. In what ratio must a shopkeeper mix Peas and Soybean of Rs. 16 and Rs. 25 per kg respectively, so as to obtain a mixture of Rs. 19.50 ?

a. 9 : 5
b. 7 : 5

c. 11 : 7
d. 12 : 8
View solution
Correct option: (c)

Use rule of alligation, to determine the ratio



The required ratio of Soybean and Peas = 5.50 : 3.50 = 11 : 7

Type 2: Calculate quantity of milk/alcohol left after nth operation = $[A(1 - (B/A))^n]$

Examples:

Q 3. 10 gallons are drawn from a container full of alcohol and filled with water again. 10 gallons of mixture are again drawn and the container is filled with water again. If the ratio of alcohol and water left in the container is 49 : 32, then find how much quantity does the container hold?

a. 35 gallons
b. 45 gallons
c. 55 gallons
d. 60 gallons
View solution
Correct option : (b)

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Initially the container contains only wine. 10 gallons of alcohol was removed and same quantity of water was added.
This process is again repeated by replacing the mixture(alcohol + water) of 10 gallons with same quantity of water. Hence, the initial quantity of wine and the final quantity of water and alcohol is the same.
1) First assume that the initial quantity of alcohol is 'A' .
2) We are given that, the ratio of alcohol and water is 49 : 32
3) Assume initial quantity of alcohol in the container = 49 + 32 = 81 ----- **(This is because we have assumed that initial quantity of alcohol = final quantity of water and alcohol)**
4) Subtract the quantity of alcohol replaced by water from the initial quantity of alcohol (A – B). As this operation is repeated n times, therefore $(A - B)^n$

Therefore,

$$\frac{\text{(Quantity of alcohol left after } n^{th} \text{ operation)}}{\text{(Initial quantity of alcohol) or (Volume of flask)}} = \left[\frac{(A-B)^n}{A}\right]$$

$$\frac{49}{81} = \frac{(A-10)^2}{A}$$

Solving, we can find the value of A (initial quantity of alcohol)
A = 45 gallons

Q 4. A container is filled with a mixture of water and milk in the ratio of 3 : 5. Find the quantity of mixture to be drawn off and replaced with water, in order to get the mixture as half milk and half water.

a. 2 : 3
b. 1 : 1
c. 1 : 5
d. 1 : 4
View solution

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Correct option : (c)

A container contains milk and water in the ratio of 3 : 5. This means that the vessel contains 8 litres of mixture.

Assume that x litres of this mixture is replaced with water.

From the mixture containing water and milk of 3 : 5, x quantity of mixture is withdrawn and is replaced by water of the same quantity in the mixture. From the mixture (3x)/(8) part of water is removed and x quantity of water is added.

1) Quantity of water in the newly formed mixture = $[3 - (\frac{3x}{8}) + x]$

---- (**3 is the quantity of water, x is the quantity of mixture replaced by water**)

2) Similarly, quantity of milk in the newly formed mixture = $[5 - (\frac{5x}{8})]$

---- (**Here x is not added because only water was added in the mixture and not the syrup**)

Therefore,

$[3 - (\frac{3x}{8}) + x] = [5 - (\frac{5x}{8})]$

Solving 1 and 2, we get

$5x + 24 = 40 - 5x$

$x = 8 / 5$

So the part of mixture replaced from 8 litres = $\frac{8}{5} \times \frac{1}{8} = \frac{1}{5}$

Type 3: Given : Profit and Loss obtained,
1) When S.P. = C.P.

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2) Find quantity added to gain profit

Examples:

Q 5. Find in what ratio must water be mixed with alcohol to gain 10% profit by selling the mixture at cost price.

a. 1 : 5
b. 1 : 10
c. 1 : 15
d. 1 : 20
View solution
Correct option : (b)

Assume, C.P. and S.P. of alcohol = Re. 1 per litre

The general formula to calculate C.P. in case of profit = $\frac{100}{(100 + \text{Gain}\%)} \times \text{S.P.}$

Here, 10 % profit is gained, therefore

Cost price of 1 litre of mixture = Rs. $\frac{100}{(100 + 10)} \times 1$ = Rs. $\frac{100}{110} = \frac{10}{11}$

Rs. 10 / 11 is the cost price of mixture.

Now, use the rule of alligation to determine the ratio of water and alcohol.

Water is free of cost, hence C.P. of water is zero.

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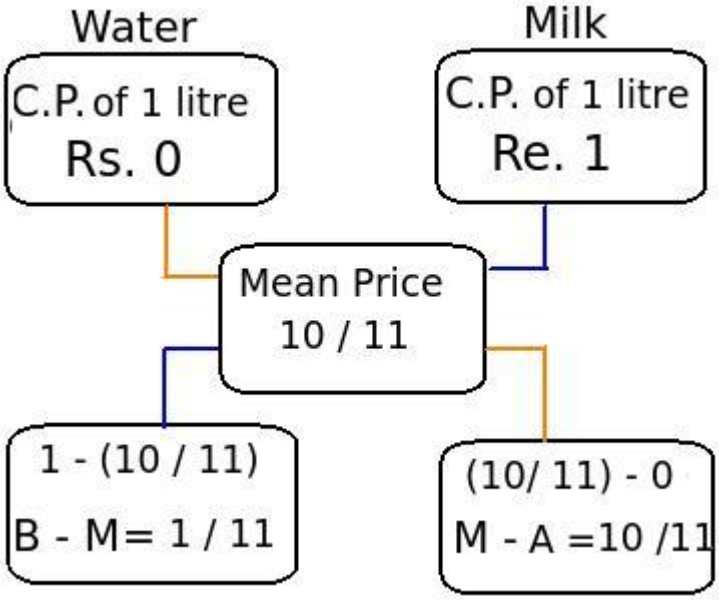

The ratio of milk and water = $\frac{1}{11} : \frac{10}{11}$ = 1 : 10

Q 6. A shopkeeper has 100 kg of salt. He sells part of the total quantity A at 7% profit and the rest B at 17 % profit. If he gains 10 % profit on the whole quantity, then find how much is sold at 7 % profit?

a. 30 kg
b. 35 kg
c. 40 kg
d. 45 kg
View solution
Correct option : (a)

Assume that A and B are two parts of the mixture. To determine the quantity A and B, first calculate ratio of A : B.

Given:
1) Selling price of mixture with 10% profit = Rs. 110
2) With 17 % profit, the selling price of A = Rs. 117
3) With 7 % profit, the selling price of B = Rs. 107

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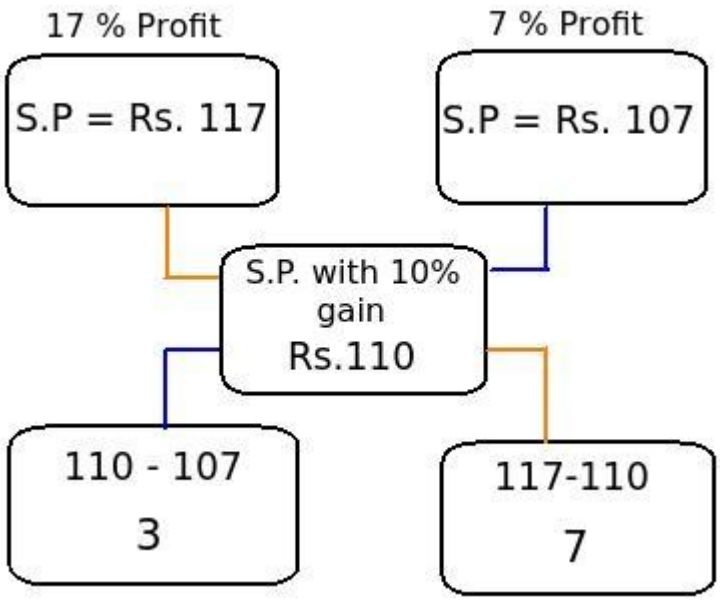
Now, this question can be easily solved by using the rule of alligation



Now, the ratio of A : B = 3 : 7

Let the quantity of part A be 3x and part B be 7x in the total quantity of 100 kg.

Therefore, 3x + 7x = 100
10x = 100
x = 10

Quantity of part A = 3x = 3 x 10 = 30 kg
Quantity of part B = 7x = 7 x 10 = 70 kg

Type 4 : If three types of mixtures are given. Find
1) Price of third variety when first two mixtures are mixed.
2) Ratio of quantities in newly formed mixture.

Examples:

Q 7. Sugar A worth Rs. 130/kg and B of Rs. 120/kg are mixed with a third variety C in the ratio of 1 : 1 : 2. If the mixture is worth Rs. 160, then find the price of third variety of

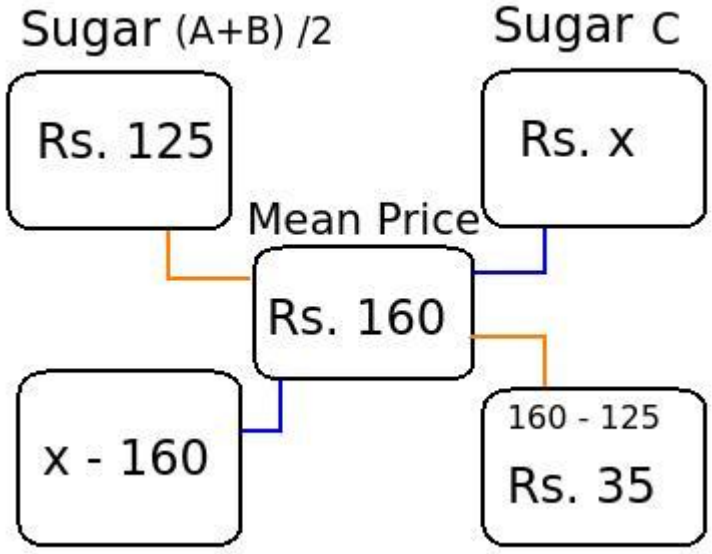
sugar.

a. Rs. 195
b. Rs. 200
c. Rs. 225
d. Rs. 230
View solution
Correct option: (a)

1) First calculate the average of A and B variety of sugar: $\frac{(120 + 130)}{2}$ = Rs. 125

2) Now, the mixture is formed by two varieties of sugar, one at Rs. 125 /kg and assume the cost of type C Rs. x. It is formed in the ratio of 2 : 2, i.e 1 : 1

Use the **rule of alligation,** to easily determine the unknown quantity.



Therefore,

$\frac{(x - 160)}{35} = 1$

x = 35 + 160 = Rs. 195

The cost of third variety of sugar C = Rs. 195

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Q 8. Two containers P and Q contain milk and water in the ratio of 5 : 2 and 7 : 6 respectively. Find the ratio in which these two mixtures can be mixed so that a new mixture formed in the container R is in the ratio of 8 : 5.

a. 5 : 6
b. 4 : 9
c. 7 : 9
d. 9 : 7
View solution
Correct Option:(c)

Let the cost price of milk be **Re. 1 per litre.**

Therefore, **cost of milk in 1 litre of mixture in**

Container A (Milk : Water = 5 : 2) = $\frac{5}{7}$ x Re. 1 = Re. $\frac{5}{7}$

Container B (Milk : Water = 7 : 6) = $\frac{7}{13}$ x Re. 1 = Re. $\frac{7}{13}$

Container C (Milk : Water = 8 : 5) = $\frac{8}{13}$ x Re. 1 = Re. $\frac{8}{13}$

Now use the rule of alligation, to find the required ratio

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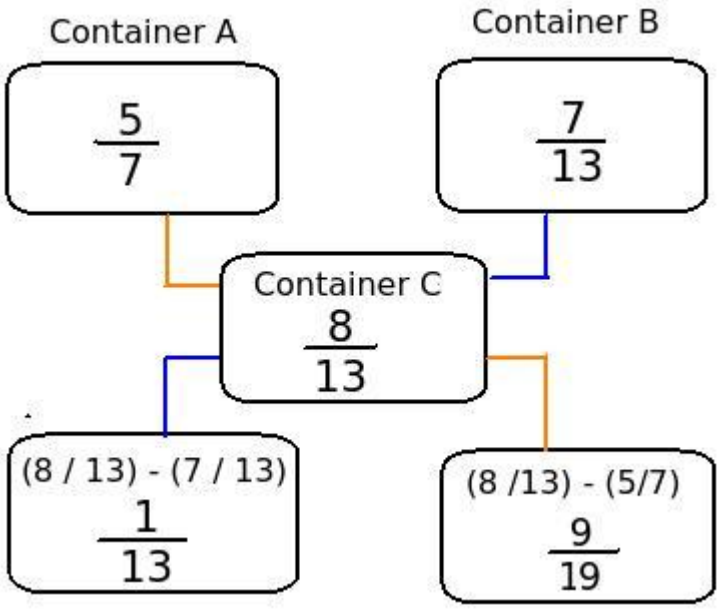

The required ratio of milk and water:

$$\frac{1}{13} : \frac{9}{91}$$

Simplifying, we get 7 : 9

Q.9) A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?

A. $\frac{1}{3}$

B. $\frac{1}{4}$

C. $\frac{1}{5}$

D. $\frac{1}{7}$

Answer: Option **C**
Explanation:

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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

$\therefore \left(3 - \frac{3x}{8} + x\right) = \left(5 - \frac{5x}{8}\right)$

$\Rightarrow 5x + 24 = 40 - 5x$

$\Rightarrow 10x = 16$

$\Rightarrow x = \frac{8}{5}$.

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

Tea worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs. 153 per kg, the price of the third variety per kg will be:

A. Rs. 169.50

B. Rs. 170

C. Rs. 175.50

D. Rs. 180

Answer: Option **C**
Explanation:

Since first and second varieties are mixed in equal proportions.

So, their average price = Rs. $\left(\frac{126 + 135}{2}\right)$ = 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 of 1st kind		Cost of 1 kg tea of 2nd kind
Rs. 130.50	Mean Price Rs. 153	Rs. x
$(x - 153)$		22.50

$\therefore \frac{x - 153}{22.50} = 1$

$\Rightarrow x - 153 = 22.50$

$\Rightarrow x = 175.50$

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