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“Score High with **Score-Up** PDF Series”

We **Dream Big Institution** Team have started a New Series “**Score- Up PDF**”. This will be like a one-stop solution for High Standard Practice Questions on all Topics. Here we have Given the **Quantitative Aptitude “Score-Up PDF” – Mixture and Alligation**, Candidates can download it now. Kindly share this to all your friends.

Important Formulas - Mixture and Alligation

1. Alligation

Alligation is the rule which 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 specified price.

2. Mean Price

Mean price is the cost price of a unit quantity of the mixture

3. Rule of Alligation

If two ingredients are mixed, then

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

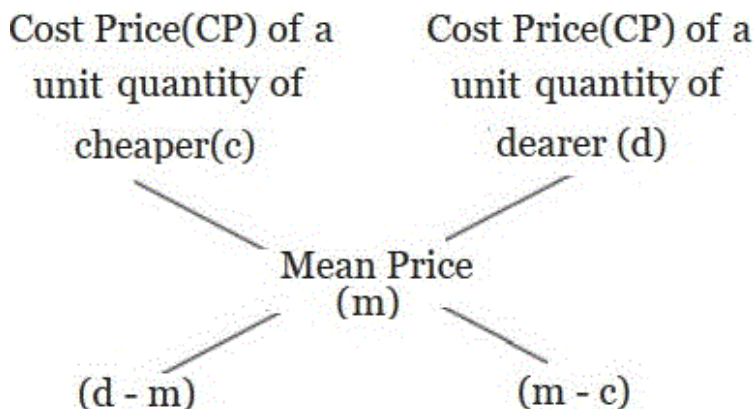
The above formula can be represented with the help of the following diagram which is easier to understand.



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

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 = $\left[x \left(1 - \frac{y}{x} \right)^n \right]$ units.

Type of Mixtures and Alligations Questions

The various types of questions based on Mixtures and Alligations concept are listed below.

- **Type 1:** You will receive the **quantity of ingredients and their price**, you will be asked to find the average price of the resulting mixture.
- **Type 2:** You will receive a **desired quantity/price of the mixture as well** as the price of the ingredients. You need to know in what ratio/percentage of ingredients to mix to get the desired amount.
- **Type 3:** Find the resulting amount when **concentrating/diluting** the mixture.
- **Type 4:** **Determine the ratio in which** 2 quantities should be mixed so that the resulting mixture can be sold. The mixture can be sold for a profit $x\%$.

Tips and Tricks To Solve Questions

Time management plays a very important role in the Government exams and candidates cannot afford to lose much time while solving any of the given questions. Thus, a few



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simple tricks and tips will also prove to be helpful for the candidates to solve the mixture alligation questions easily:

- ✓ The rule of alligation can also be used to solve questions based **partnerships, time and work and wages**
- ✓ Read a question and try placing the values in the alligation rule mentioned above to solve the question
- ✓ Questions from this topic may sound a bit tricky but are easy to solve if once a candidate get familiar with the concept and the important formulas used
- ✓ You cannot just find the ratio between the quantity of two elements but also the rate at which the article can be sold using the alligation rule

Topic Name: Mixture and Alligation Score-Up PDF for SSC Exam

Easy Level Questions:

Q.1 A jar had 330-liter mixture of Milk and water in the respective ratio of 2 : 1.60 liters of this mixture is taken out and 'x' liter each of milk and water is added to the jar (remaining mixture). The respective ratio between milk and water was 8 :5 respectively. What was the total quantity of both milk and water added to the jar?

- a) 90 liter
- b) 170 liter
- c) 160 liter
- d) 120 liter

Answer: d

Solution:

Given

Total mixture = 330 liter

Ratio of milk and water = 2 : 1

Calculation

Mixture left in jar after 60 liters taken out = $330 - 60 = 270$ liters

Milk = $(\frac{2}{3}) \times 270 = 180$ liter

Water = $(\frac{1}{3}) \times 270 = 90$ liter

Now according to question



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$$(180 + x)/(90 + x) = 8/5$$

$$\Rightarrow 900 + 5x = 720 + 8x$$

$$\Rightarrow 3x = 180$$

$$\Rightarrow x = 60$$

∴ Quantity that was added = $2 \times 60 = 120$ liter

Q2. A cistern contains 100 liters of water. 10 liters of water is taken out of it and replaced by the same quantity of soda. This process is repeated one more time. After that 20 liters of the solution is replaced by the same quantity of whiskey. Find the proportion of soda, water, and whiskey in the final mixture?

- a) 19 : 71 : 25
- b) 38 : 72 : 50
- c) 19 : 81 : 25
- d) 29 : 71 : 25

Answer: c

Solution:

Given

A cistern contains 100 liters of water.

Calculation

Initially

Water = 100 lit

After 1st replacement

Water : Soda = $90 : 10 = 9 : 1$

After 2nd replacement

Water = $90 - (10 \times 9/10) = 81$ lit

Soda = $10 - (10 \times 1/10) + 10 = 19$ lit

After 3rd replacement

Water = $81 - (20 \times 81/100) = 64.8$ lit

Soda = $19 - (20 \times 19/100) = 15.2$ lit

Whiskey = 20 lit

∴ Required ratio = $15.2 : 64.8 : 20$

$\Rightarrow 19 : 81 : 25$

Q.3) Ratio of Milk and water in Vessel A is 7:4 and same mixture in the ratio of 5:3, 22 liters mixture from vessel A taken out and poured in vessel B new ratio of milk to water is 27:16. If new quantity of mixture in vessel B is equal to initial quantity of



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mixture in vessel A, then find quantity of Milk after 8 liters of mixture has been taken out from Vessel A?

- A) 200/29 liters
- B) 546 / 11 liters
- C) 120/13 liters
- D) 220/19 liters

Answer: b

Let Ratio of Milk and water in Vessel A is 7x and 4y

Let ratio of milk and water in vessel B is 5y and 3y

Now according to question.

$$(5y + 22 * 7 / 11) / (3y + 22 * 4 / 11) = 27 / 16$$

$$(5y + 14) / (3y + 8) = 27 / 16$$

$$80y + 224 = 81y + 216$$

$$Y = 8$$

New quantity of mixture in vessel B

$$=> (8 * 5 + 14) + (8 * 3 + 8)$$

$$=> 54 + 32$$

$$=> 86$$

Therefore initial quantity of vessel A = 86 liters

Quantity of milk remaining in Vessel A

$$86 * 7 / 11 - 8 * 7 / 11$$

$$=> 546 / 11 \text{ litres}$$



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Q4. X and Y two alloys are made by mixing aluminum and magnesium metals in the ratio of 8: 5 and 9:16 respectively. If equal amounts of alloys are melted to form a new alloy Z, what will be the ratio of aluminum and magnesium in Z?

- a) 317:333
- b) 316:319
- c) 314:333
- d) 313:317

Answer: a

Solution:

The ratio of aluminum and magnesium in Z = $[8/13+9/25] : [5/13+16/25]$
= $317/325 : 333/325$
= 317:333

Q5. How many kilograms of sugar of Rs.5.4 per kg should be mixed with 10 kg of sugar of Rs.4.5 per kg, such that there may be gain of 20% by selling the mixture at Rs.5.94 per kg.

- a) 10 kg
- b) 12 kg
- c) 15 kg
- d) 8 kg

Answer: A

Solution:

Let, the amount of rice of Rs.5.4 per kg = x kg
According to the question,
 $x \times 5.4 + 4.5 \times 10 = 5.94 \times (10 + x) \div 120 \times 100$
 $= 5.4x + 45 = 4.95 \times (10 + x)$
 $= 5.4x + 45 = 49.5 + 4.95x$
 $= 5.4x - 4.95x = 49.5 - 45$
 $= 0.45x = 4.5$
 $= x = 10 \text{ kg}$



Moderate Level Questions:

Q.6. A mixture contains 40% milk and another mixture contains milk and water in the ratio of 1 : 5. How many litres of the latter must be mixed with 6 litres of the former so that the resulting mixture may contain milk and water in the ratio of 1 : 2.

- a) 10 L
- b) 15 L
- c) 18 L
- d) 20 L

Ans: b

Sol:

Given,

Ratio of milk and water in 1st mixture = 40 : 60 or 2 : 3

Ratio of milk and water in 2nd mixture = 1 : 5

Quantity of 1st mixture = 6 L

Ratio of milk and water in final mixture = 1 : 2

Formula used,

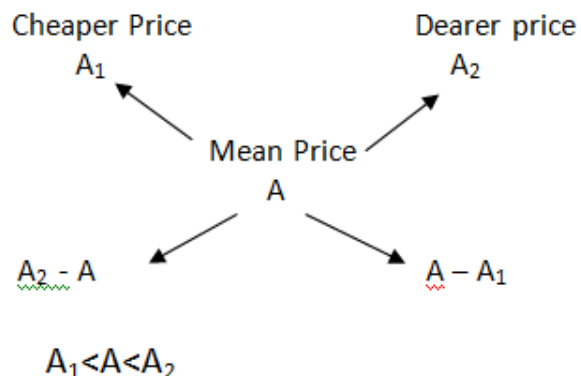
To find the ratio in which two quantities are mixed to form a new mixture is as shown below.

Where A_1 , A_2 and A are the cheaper price, Dearer price and Mean price, respectively.

Then ratio of cheaper quantity to Dearer quantity is calculated as ($n_1 : n_2$)

$$n_1 : n_2 = (A_2 - A) / (A - A_1)$$

Also the Mean value should lie between Cheaper price and Dearer price



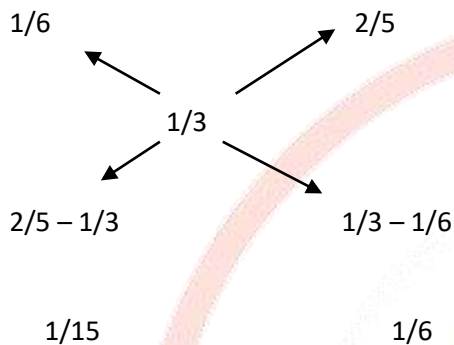


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Proportion of milk in 1st mixture = $\frac{2}{5}$ (Dearer value)
Proportion of milk in 2nd mixture = $\frac{1}{6}$ (Cheaper value)
Proportion of milk in final mixture = $\frac{1}{3}$ (Mean value)
Applying Alligation rule,



Cheaper : Dearer = $\frac{1}{15} : \frac{1}{6} = 2 : 5$
2R refers to former quantity of mixture
3R refers to latter quantity of mixture
 $\therefore 2R = 6 \text{ L}$
 $\therefore 5R = 15 \text{ L}$
Therefore, Quantity of latter mixture = 15 L

Q.7. Three containers of equal capacity are containing a mixture of wine and water in the ratio of 2 : 1, 5 : 4 and 3 : 4 respectively. These three containers are emptied into a 4th container. What is the approximate percentage of wine in 4th container?

- a) 50%
- b) 60%
- c) 45%
- d) 55%

Ans: d

Sol:

Given,

Ratio of wine and water in 1st container = 2 : 1

Ratio of wine and water in 2nd container = 5 : 4

Ratio of wine and water in 3rd container = 3 : 4



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Proportion of wine in 1st container = $\frac{2}{3}$ and proportion of water = $\frac{1}{3}$

Proportion of wine in 2nd container = $\frac{5}{9}$ and proportion of water = $\frac{4}{9}$

Proportion of wine in 3rd container = $\frac{3}{7}$ and proportion of water = $\frac{4}{7}$

Required ratio of wine and water in 4th container is

$(\frac{2}{3} + \frac{5}{9} + \frac{3}{7}) : (\frac{1}{3} + \frac{4}{9} + \frac{4}{7})$

104 : 85

Percentage of wine = $\frac{104}{189} \times 100 = 55\%$

Q.8. A container contains two liquids A and B in the ratio of 3 : 2. When 8 L of liquid B is added to X L of the mixture, the ratio of liquid A to liquid B becomes 1 : 1. What is the value of X?

- a) 50 L
- b) 45 L
- c) 40 L
- d) None of these

Ans: c)

Sol:

Given,

Ratio of A and B in the mixture 3 : 2

Volume of B added = 8 L

Final ratio of A and B in the mixture = 1 : 1

Formula used,

To find the ratio in which two Quantities are mixed to formed a new mixture is as shown below.

Where A_1 , A_2 and A are the cheaper price, Dearer price and Mean price, respectively.

Then ratio of cheaper Quantity to Dearer quantity is calculated as $(n_1 : n_2)$

$n_1 : n_2 = (A_2 - A) / (A - A_1)$

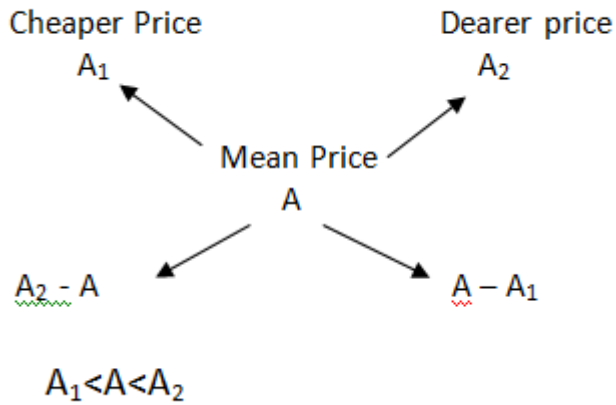
Also the Mean value should lie between Cheaper price and Dearer price



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applying Alligation concept

Proportion B in the mixture = $\frac{2}{5}$ (cheaper)

Pure liquid B = 1 (dearer)

Proportion of B in final mixture = $\frac{1}{2}$ (mean)

Using Alligation concept

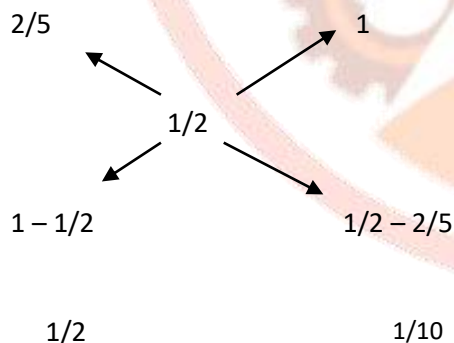
Ratio of cheaper to dearer = $\frac{1}{2} : \frac{1}{10} = 5 : 1$

1R refers to pure liquid of B = 8 L

$\therefore 1R = 8 \text{ L}$

$\therefore 5R = 40 \text{ L}$

Therefore, $X = 40 \text{ L}$



Q.9. In what proportion a milkman must mixed water with milk, so that after selling the mixture at half the cost of milk, gains 40%

a) 9 : 5

b) 5 : 9



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- c) 4 : 5
d) 3 : 5

Ans: a)

Sol:

Given,

Cost of mixture = $1/2 \times$ cost of milk

Percentage profit = 40%

Formula used,

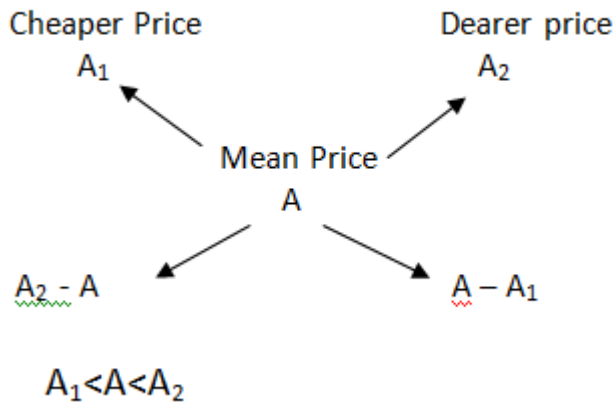
To find the ratio in which two Quantities are mixed to form a new mixture is as shown below.

Where A_1 , A_2 and A are the cheaper price, Dearer price and Mean price, respectively.

Then ratio of cheaper Quantity to Dearer quantity is calculated as $(n_1 : n_2)$

$$n_1 : n_2 = (A_2 - A) / (A - A_1)$$

Also the Mean value should lie between Cheaper price and Dearer price



Let cost of milk = Rs. X per litre

\therefore Selling price of mixture of milk and water = Rs. $X/2$ per litre (dearer)

Cost of water = Rs. 0 per litre (cheaper)

Percentage profit after selling the mixture = 40%

\therefore Cost price of the mixture = $X/2 \times 100/140 = 5X/14$ (mean)

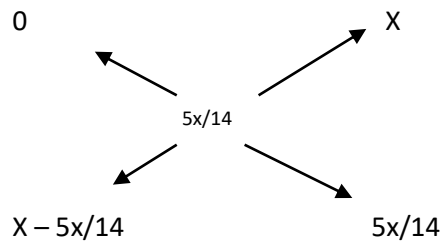
Applying Alligation rule



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Ratio of cheaper to dearer = $9X/14 : 5X/14 = 9 : 5$

Therefore, ratio of water and milk = $9 : 5$

Q.10. Two liquids A and B are mixed in the ratio of 1 : 4 and the mixture is sold at Rs.46 per litre at a profit of 15%. If the liquid A costs Rs. 10 less than the cost of B. cost of B is (In Rs.)

- a) 40
- b) 42
- c) 50
- d) 32

Ans: b)

Sol:

Ratio of liquid A and B in the mixture is 1 : 4

Selling price of the mixture = 46 per litre

Percentage profit = 15%

Cost of A = cost of B - 10

Formula used,

To find the ratio in which two Quantities are mixed to formed a new mixture is as shown below.

Where A_1 , A_2 and A are the cheaper price, Dearer price and Mean price, respectively.

Then ratio of cheaper Quantity to Dearer quantity is calculated as $(n_1 : n_2)$

$$n_1 : n_2 = (A_2 - A) / (A - A_1)$$

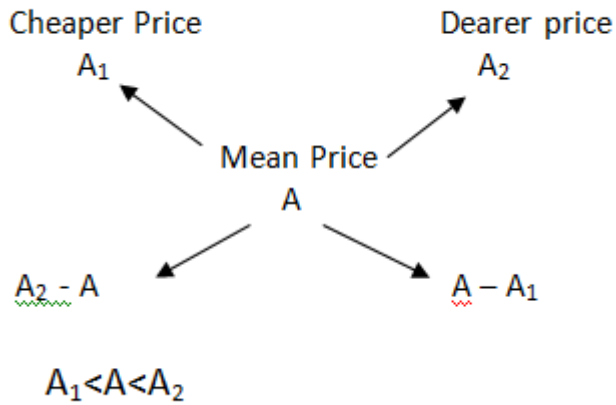
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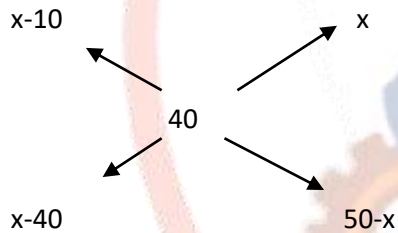
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Let the cost of B = X per litre (dearer)
Cost of A = X - 10 (cheaper)
Selling price of the mixture = 46 per litre
Cost price of the mixture = $46 \times 100/115 = 40$ (mean)
Applying Alligation rule



Ratio of cheaper to dearer = $(X - 40) : (50 - X) = 1 : 4$ (Given)

$$\therefore (X - 40) / (50 - X) = 1 / 4$$

$$X = 42$$

Therefore, cost of B = Rs. 42 per litre



High Level Questions:

Q.11. A can contains a mixture of two liquids A and B in the ratio of 7 : 9. When X litres of mixture is removed and is replaced by B. The ratio of A and B becomes 21 : 43. Find X is how much percent of the initial mixture.

- a) 25%
- b) 20%
- c) 35%
- d) 30%

Ans: a)

Sol:

Given,

Ratio of A and B in the given mixture = 7 : 9

Removed quantity = X L

Final ratio of A and B = 21 : 43

Let liquid A and B in the mixture be 7Y and 9Y, respectively

Quantity of A after removal of X L of the mixture = $7Y - 7/16 \times X = 7Y - 7X/16$

Similarly, quantity of B left = $9Y - 9X/16$

Mixture is replaced by X L of B

∴ Final quantity of B = $9Y - 9X/16 + X$

Given, ratio of A and B = 21 : 43

∴ $(7Y - 7X/16) : (9Y - 9X/16 + X) = 21 : 43$

⇒ $(16Y - X) / (144Y + 7X) = 3/43$

⇒ $256Y = 64X$

$X = 4Y$

Required percentage = $4Y/16Y \times 100 = 25\%$

Therefore, Percentage of X in initial mixture = 25%

Q.12. There is 128 L of pure acid in a container. $1/4^{\text{th}}$ of acid is removed and replaced by water. This process is repeated further 2 more times. Find the difference of acid and water in the final mixture.

- a) 40 L
- b) 20 L
- c) 30 L
- d) Can't be determined



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Ans: b)

Sol:

Quantity of pure acid in the container = 128 L

Removed quantity = $1/4 \times 128 = 32$ L

Formula used,

Quantity of pure liquid (A) left after "n" removal and replacements = $X (1 - Y/X)^n$

Where, X = pure liquid (Initially)

Y = replaced quantity

n = total no. of operations performed

Quantity of liquid B after "n" removal and replacements = $[X - X (1 - Y/X)^n]$

Quantity of acid after "3" removal and replacements = $128 (1 - 32/128)^3 = 128 \times 3/4 \times 3/4 \times 3/4 = 54$ L

Quantity of water (say B) = $128 - 54 = 74$ L

Required, difference between acid and water in the final mixture = $74 - 54 = 20$ L

Q.13. Two containers A and B contains milk and water in the ratio of 2 : X and 4 : 1. These two containers are mixed in the ratio of 3 : 1, making mixture half milk and half water. Find X

- a) 5
- b) 7
- c) 3
- d) None of these

Ans: c)

Sol:

Given,

Ratio of milk and water in A = 2 : X

Ratio of milk and water in B = 4 : 1

A and B are mixed in the ratio = 3 : 1

Final ratio of milk and water = 1 : 1

Formula used,

To find the ratio in which two Quantities are mixed to formed a new mixture is as shown below.

Where A_1 , A_2 and A are the cheaper price, Dearer price and Mean price, respectively.

Then ratio of cheaper Quantity to Dearer quantity is calculated as $(n_1 : n_2)$



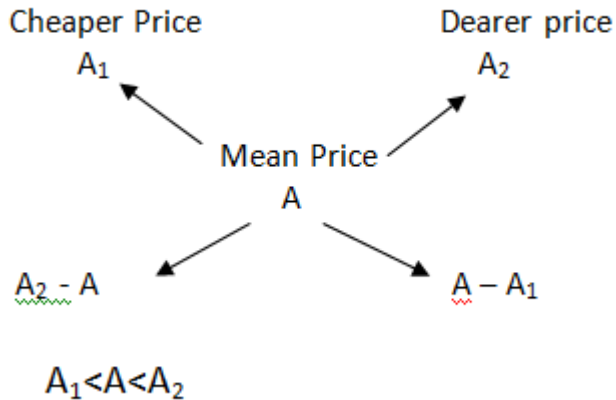
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$$n_1 : n_2 = (A_2 - A) / (A - A_1)$$

Also the Mean value should lie between Cheaper price and Dearer price

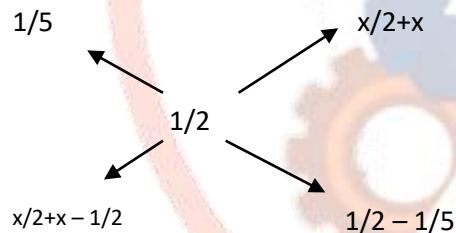


Proportion of water in A = $X / (2 + X)$ (dearer)

Proportion of water in B = $1/5$ (cheaper)

Proportion of water in final mixture = $1/2$ (mean)

Using Alligation concept,



Ratio of cheaper to dearer = $[X / (2 + X) - 1/2] : 3/10 = 1:3$ (Given)

$$\Rightarrow (X - 2) \times 10 = (X + 2) \times 2$$

$$\Rightarrow 10X - 20 = 2X + 4$$

$$\Rightarrow 8X = 24$$

$$X = 3$$

Therefore $X = 3$



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Q.14. Two containers whose capacities are in the ratio of 1 : 2, completely filled with milk and water. Ratio of milk and water in the container are in the ratio of 4 : 1 and 2 : 3, respectively. Taking $\frac{1}{4}$ th of the first and $\frac{1}{5}$ th of the second, a new mixture is formed. Find percentage of milk in the new mixture?

- a) $150/3$ %
- b) 75%
- c) $160/3$ %
- d) None of these

Ans: c)

Sol:

Given,

Volumes of the containers are in the ratio = 1 : 2

Ratio of milk and water in 1st container = 4 : 1

Ratio of milk and water in 2nd container = 2 : 3

Removed quantity = $\frac{1}{4}$ th of A and $\frac{1}{5}$ th of B

Let, Volume of 1st and 2nd container be X and 2X respectively

Quantity of milk after taking $\frac{1}{4}$ th of 1st container = $\frac{4}{5} \times X = \frac{4X}{5}$

Similarly, quantity of water = $\frac{1}{5} \times X = \frac{X}{5}$

Quantity of milk after taking $\frac{1}{5}$ th of 2nd container = $\frac{2}{5} \times 2X = \frac{4X}{5}$

Similarly, quantity of water = $\frac{3}{5} \times 2X = \frac{6X}{5}$

Total quantity of milk = $\frac{4X}{5} + \frac{4X}{5} = \frac{8X}{5}$

Total quantity of water = $\frac{X}{5} + \frac{6X}{5} = \frac{7X}{5}$

Therefore, ratio of milk and water = $\frac{8X}{5} : \frac{7X}{5} = 8 : 7$

Required, percentage of milk in the mixture = $\frac{8}{15} \times 100 = \frac{160}{3}$ %

Q.15. A milkman bought 20 L of milk and mixed 4 L water in it. If the cost of mixture becomes Rs. 30 per litre. What is the cost of milk per litre?

- a)Rs. 40
- b)Rs. 38
- c)Rs. 36
- d)Rs. 35

Ans: c)



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Sol:

Given,

Quantity of milk = 20 L

Quantity of water = 4 L

Ratio of milk and water = 5 : 1

Cost of mixture = 30 per litre

Formula used,

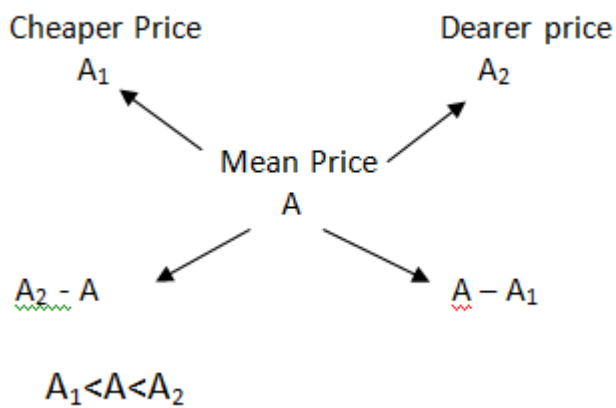
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Then ratio of cheaper Quantity to Dearer quantity is calculated as $(n_1 : n_2)$

$$n_1 : n_2 = (A_2 - A) / (A - A_1)$$

Also the Mean value should lie between Cheaper price and Dearer price



Let cost of milk = Rs. X per litre (dearer)

Cost of water = Rs. 0 per litre (cheaper)

Cost of mixture = Rs. 30 per litre (mean)

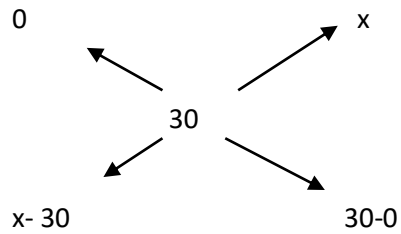
Using Alligation concept



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Ratio of cheaper to dearer = $(X - 30) : 30 = 1 : 5$ (Given)

$$\therefore (X - 30) / 30 = 1/5$$

$$\Rightarrow X - 30 = 6$$

$$X = 36$$

Therefore, cost of milk = Rs. 36 per litre

