

QUANTITATIVE APTITUDE

MIXTURE/ALLIGATION

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INTRODUCTION

- RULE OF ALLIGATION:
- IF THE GRADIENTS ARE MIXED IN A RATIO, THEN

C.P. OF UNIT QUANTITY OF
CHEAPER PRICE (C)

C.P. OF UNIT QUANTITY OF DEARER
PRICE (D)

MEAN PRICE
(M)

D – M

M – C

CHEAPER QUANTITY : DEARER QUANTITY
= (D – M) : (M – C)

EXAMPLE 01

- IN WHAT PROPORTION MUST RICE AT Rs. 3.10 / KG BE MIXED WITH RICE AT Rs. 3.60 / KG SO THAT MIXTURE BE WORTH Rs. 3.25 / KG?

C.P. OF UNIT QUANTITY OF
CHEAPER PRICE (C) 310

C.P. OF UNIT QUANTITY OF DEARER
PRICE (D) 360

MEAN P PRICE
(M) 325

$$(D - M) \ 360 - 325 = 35$$

$$(M - C) \ 325 - 310 = 15$$

$$\begin{aligned} \text{CHEAPER QUANTITY : DEARER QUANTITY} \\ &= (D - M) : (M - C) \\ &= \underline{35 : 15 = 7 : 3} \end{aligned}$$

EXAMPLE 02

- IN WHAT PROPORTION MUST TEA AT Rs. 62 / KG BE MIXED WITH RICE AT Rs. 72 / KG SO THAT MIXTURE BE WORTH Rs. 64.50 / KG?

C.P. OF UNIT QUANTITY OF
CHEAPER PRICE (C) 62

C.P. OF UNIT QUANTITY OF DEARER
PRICE (D) 72

MEAN PRICE
(M) 64.50

$$(D - M) \ 72 - 64.50 = 7.50$$

$$(M - C) \ 64.50 - 62 = 2.50$$

$$\begin{aligned} \text{CHEAPER QUANTITY : DEARER QUANTITY} \\ &= (D - M) : (M - C) \\ &= \underline{7.50 : 2.50 = 3 : 1} \end{aligned}$$

EXAMPLE 03

- IN WHAT PROPORTION MUST TEA AT Rs. 60 / KG BE MIXED WITH TEA AT Rs. 65 / KG SO THAT BY SELLING THE MIXTURE AT Rs. 68.20 / KG, HE MAY GAIN 10%?

C.P. OF UNIT QUANTITY OF
CHEAPER PRICE (C) 60

C.P. OF UNIT QUANTITY OF DEARER
PRICE (D) 65

68.20 IS S.P.
WITH
10% GAIN SO
NEED TO FIND
C.P.

MEAN PRICE (M)
 $68.20 \times (100/110) =$
62

$$(D - M) \quad 65 - 62 = 3$$

$$(M - C) \quad 62 - 60 = 2$$

CHEAPER QUANTITY : DEARER QUANTITY
= $(D - M) : (M - C)$
= 3 : 2

EXAMPLE 04

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

C.P. OF UNIT QUANTITY OF
CHEAPER PRICE (C) 130.5

C.P. OF UNIT QUANTITY OF DEARER
PRICE (D) X

Tea worth Rs. 126
per kg and Rs. 135
per kg are mixed in
the ratio 1 : 1

So their average
price

$$= (126+135)/2=130.5$$

5

$$(D - M) X - 153$$

MEAN PRICE (M)
153

Hence let's consider that
the mixture is formed by
mixing two varieties of
tea.

one at Rs. 130.50 per kg
and the other at Rs. x per
kg in the ratio 2 : 2, i.e., 1 :

1. Now let's find out x.

$$(M - C) 153 - 130.5 =$$

CHEAPER QUANTITY : DEARER QUANTITY

$$= (D - M) : (M - C)$$

$$= X - 153 : 22.50 = 1 : 1$$

$$\underline{X = 175.5}$$

EXAMPLE 05

- The cost of Type 1 material is Rs. 15 per kg and Type 2 material is Rs.20 per kg. If both Type 1 and Type 2 are mixed in the ratio of 2 : 3, then what is the price per kg of the mixed variety of material?

C.P. OF UNIT QUANTITY OF
CHEAPER PRICE (C) 15

C.P. OF UNIT QUANTITY OF DEARER
PRICE (D) 20

Cost Price(CP) of
Type 1 material is
Rs. 15 per kg

Cost Price(CP) of
Type 2 material is
Rs. 20 per kg

Let Cost Price(CP) of
resultant mixture be
Rs. x per kg

MEAN PRICE (M) x

$(D - M)$ 20 - x

$(M - C)$ x - 15

CHEAPER QUANTITY : DEARER QUANTITY

$$= (D - M) : (M - C)$$

$$= 20 - x : x - 15 = 2 : 3$$

$$\underline{x = 18}$$

EXAMPLE 06

- A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk should he mix from each of the containers so as to get 12 litres of milk such that the ratio of water to milk is 3 : 5?

QUANTITY OF MILK IN CAN A (C)
 $\frac{3}{4}$

QUANTITY OF MILK IN CAN B (D) **$\frac{1}{2}$**

MEAN (M) **$\frac{5}{8}$**

$$(M - D) \frac{5}{8} - \frac{1}{2} = \frac{1}{8}$$

$$(C - M) \frac{3}{4} - \frac{5}{8} = \frac{1}{8}$$

$$\begin{aligned} \text{QUANTITY OF CAN A : QUANTITY OF CAN B} \\ &= (M - D) : (C - M) \\ &= \frac{1}{8} : \frac{1}{8} = \underline{1 : 1} \end{aligned}$$

SO 6 LITRES FROM EACH CAN NEEDED.

EXAMPLE 07

- How many litres of water must be added to 16 liters of milk and water contains 10% water to make it 20% water in it?

**% CONCENTRATION OF WATER IN
WATER (C) 100**

**% CONCENTRATION OF WATER IN
MILK SOLUTION (D) 10**

MEAN (M) 20

$$(M - D) \ 20 - 10 = 10$$

$$(C - M) \ 100 - 20 = 80$$

**QUANTITY OF WATER: QUANTITY OF MILK
SOLUTION**

$$\begin{aligned} &= (M - D) : (C - M) \\ &= 10 : 80 = 1 : 8 = X / 16 \end{aligned}$$

QUANTITY OF WATER X = 2 LITRES

EXAMPLE 08

- 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?
- **Assume that 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**
 $= x(1-y/x)^n$

Hence milk now contained by the container

$$\begin{aligned} &= 40(1-4/40)^3 \\ &= 40(1-1/10)^3 \\ &= 40 \times (9/10) \times (9/10) \times (9/10) \\ &= (4 \times 9 \times 9 \times 9)/100 \\ &= \underline{29.16} \end{aligned}$$

EXAMPLE 09

- 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 the water is 16 : 65. How much wine did the cask originally hold?
- Let initial quantity of wine = x litre

**After a total of 4 operations, quantity of wine = $x(1-y/x)^n$
= $x(1-8/x)^4$**

Given that after a total of 4 operations, the ratio of the quantity of wine left in cask to that of water = 16 : 65

Hence we can write as $x(1-8/x)^4 / x = 16 / 81$

$$\Rightarrow (1-8/x)^4 = (2/3)^4$$

$$\Rightarrow (1-8/x) = 2/3$$

$$\Rightarrow (x-8x)/x = 2/3$$

$$\Rightarrow 3x-24=2x$$

$$\Rightarrow \underline{x=24}$$

EXAMPLE 10

- 3 litre of water is added to 11 litre of a solution containing 42% of alcohol in the water. The percentage of alcohol in the new mixture is
- We have a 11 litre solution containing 42% of alcohol in the water

=> Quantity of alcohol in the solution = $(11 \times 42)/100$

Now 3 litre of water is added to the solution

=> Total Quantity of the new solution = $11 + 3 = 14$

Percentage of alcohol in the new

solution = $\left[\frac{(11 \times 42)/100}{14} \right] \times 100$

= $(11 \times 3)/100$

= 33%

THANK YOU