Mixture

Mixtures / Allegation

Mean price

Introduction: **It is rule to find the ratio of two or more ingredients at the given price must be mixed to produce a mixture of desire price.**

Definition: Suppose, the items of different quality or quantity are mixed together. The cost price of the unit quantity of mixture is called Mean price .

Formula:
Method 1:

$$\frac{(Quantity\ of\ cheaper)}{(Quantity\ of\ costlier)} = \frac{(C.P.\ of\ costlier) - (Mean\ price)}{(Mean\ price) - (C.P.\ of\ cheaper)}$$

**Method 2:** Here we have given the concept which can be use for many cases

Cost of Cheaper (c)   **Cost of costlier (d)**

Cost of Mixture (m)
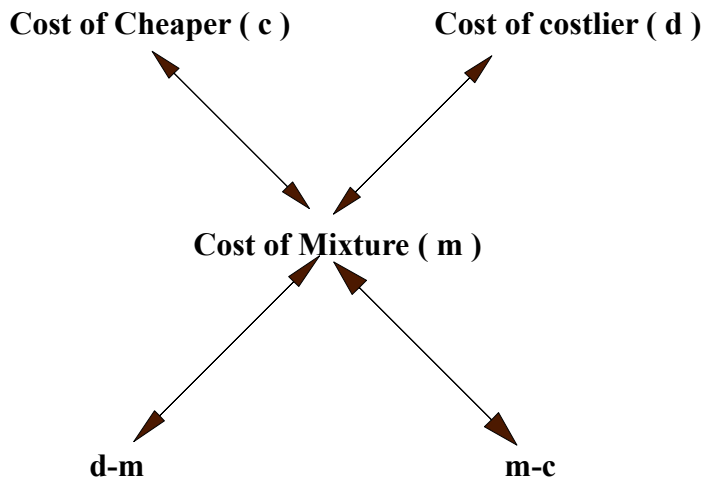
d-m   **m-c**

(Cheaper quantity) : (Costlier quantity) = (d – m) : (m – c)

Quiz Time

1) A merchant has 100 kg of salt, part of which he sells at 7% profit and the rest at 17% profit. He gains 10% on the whole. Find the quantity sold at 17% profit?

Explanation:

Less profit
7%

More profit
17%

Whole profit
10%

$17 - 10 = 7\%$ $10 - 7 = 3\%$
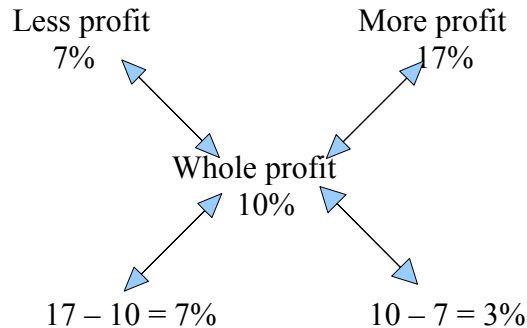
Ratio of less profit quantity and more profit quantity = 7 : 3

Given that total quantity of salt = 100 kg

Quantity of salt of more profit = $100 \, X \, \dfrac{3}{3+7}$ = 30 kg

Hence quantity of the 2nd kind is 30kg

2) Milk and water are in the ratio of 3:2 in a mixture of 80 liters. How much water should be added so that the ratio of milk and water becomes 2:3 ?

Explanation: Given that ratio of milk and water 3:2 in mixture of 80 liters
Quantity of milk = 80 X 3 over 5 = 48 liters
Quantity of water = 80 – 48 = 32 liters

Lets consider that the x quantity of water should add to make ratio of milk and water 2:3
48 : 32 + x = 2 :3
144 = 64 + 2x
2x = 80
x = 40

Hence the quantity of water added is 40 liters.

3) In two varieties of tea, one costing Rs. 25/kg. and the other costing RS. 30/kg are blended to produce blended variety of tea in ratio 2:3. find the cost price of the mixture per kg?
(A) 24 / kg
(b) 28 / kg
© 32/kg
d) 26 / kg
Explanation : Lets consider that cost price of the mixture is x .

Cost price of two varieties of tea are Rs 25 and Rs 30.
We know that,

$$\frac{Quantity\ of\ cheaper}{Quantity\ of\ costlier} = \frac{cost\ price\ of\ costlier - Mean\ price}{Mean\ price - Cost\ price\ of\ cheaper}$$
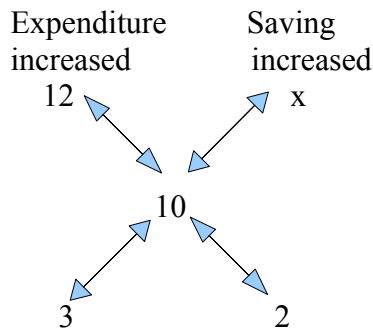
$$\frac{2}{3} = \frac{30 - x}{x - 25}$$

2x – 50 = 90 – 3x

5x = 140

$x = \dfrac{140}{5} = 28$

Hence the cost price of the mixture is Rs.28/kg

4) Jessi's expenditure and savings are in the ratio 3 : 2. Her income increases by 10% and her expenditure also increases by 12% .By how many percent does her savings increase ?

Explanation :

We get two values of x,7 and 13 .
But x should be 7 not 13.

Required % increase = 7%.

5) Two vessels A and B contain milk and water mixed in the ratio 4:3 and 2:3. In what ratio must these mixtures be mixed to form a new mixture containing half milk and half water?
Explanation :
Given that ratio of milk and water in vessel A = 4 : 3
and vessel B = 2 : 3

Quantity of milk in Vessel A = $\dfrac{4}{7}$

Quantity of water in vessel A = $\dfrac{3}{7}$

Quantity of milk in vessel B = $\dfrac{2}{5}$

Quantity of water in vessel B = $\dfrac{3}{5}$

Lets consider that the x and y quantities of vessels A and B are mixed to get ratio of milk and water 1 : 1.

$$\frac{\frac{4x}{7}+\frac{2y}{5}}{\frac{3x}{7}+\frac{3y}{5}}=\frac{1}{1}$$

$$\frac{4x}{7}+\frac{2y}{5}=\frac{3x}{7}+\frac{3y}{5}$$

$$\frac{x}{7}=\frac{y}{5}$$

$$\frac{x}{y}=\frac{7}{5}$$

Hence the answer is 7 : 5 .

Solved Examples :

1) Chris has 5 gallons of a solution that is 30 percent antifreeze, which he wants to use to winterize his car. How much pure antifreeze should he add to this solution so that the new solution will be 65 percent antifreeze?

Solution: Let x gallons of antifreeze be mixed with y gallons of water to get 5 gallons of solution.
$\rightarrow$ x + y = 5 ----------(1)

Given the solution is 30 percent antifreeze,

Which means, $\dfrac{x}{(x+y)} = \dfrac{30}{100}$.

100 x = 30 x + 30 y
70 x = 30 y
7x = 3y -------------(2)

Multiplying equation (1) with 3 3
3x + 3y = 15
Substitute 3y = 7x in above equation
3x + 7x = 15
10 x = 15

x = $\dfrac{15}{10} = \dfrac{3}{2}$ = 1.5

and y = $\dfrac{35}{10}$ = 3.5

Chris add some more pure antifreeze to the solution so that he gets new solution of 65 percent antifreeze.
Lets considers he added z gallons.

$\dfrac{(x+z)}{(x+y+z)} = \dfrac{65}{100}$

100 x + 100 z = 65 x + 65y + 65z
35z = 65y − 35x
7z = 13y − 7x = 45.5 − 10.5 = 35

z = $\dfrac{35}{7}$ = 5 gallons

Hence Chris has added 5 more gallons of pure antifreeze to get 65% solution.

2) Suppose 30 liters of a solution with an unknown percentage of alcohol is mixed with 5 liters of a 90% alcohol solution. If the resulting mixture is a 62% alcohol solution, what is the percentage of alcohol in the first solution?
Solution:

In the first solution ,

amount of alcohol = $30 X \dfrac{x}{100}$ liters.

In the second solution

amount of alcohol = $5 X \dfrac{90}{100}.$

In the last solution ,

amount of alcohol = $35 X \dfrac{62}{100}$

When first two solutions are mixed,
the total amount of alcohol is the sum of the amounts in the two ingredients,

so $30 X \dfrac{x}{100} + 5 X \dfrac{90}{100} = 35 X \dfrac{62}{100}$.

0.3x + 0.45 = 21.7
0.3 x = 21.25
x = 7.08

Hence the first solution has 7.08 % of alcohol.

3) A group of chemists are conducting an experiment to produce a new liquid material. One chemical contains 15% sodium (Na) and the other chemical contains 30% sodium (Na). Once they mix the two samples the resulting chemical contains 22% sodium (Na). How many milliliters (ml) of each sample must be mixed to obtain 600 ml of the new chemical?

Solution: Since the first material is 15% sodium,
It means that, if we have some amount, A, of the material,
We can determine the amount of sodium it contains by taking 15% of that.
Amount of sodium from first material = 0.15 X A

Similarly, if B is the amount of the second material,
Amount of sodium from second material = 0.30 X B

Now, if we combine the two chemicals to get a new chemical, which is 22% sodium,
The total amount of combined sodium is amount of sodium from both sources = 0.22 X (A + B)

Sodium from first material + second material = Sodium from both materials
 0.15X A + 0.30X B = 0.22X(A+B)
Multiply by 100 in above equation
15A + 30B = 22 A + 22B
  8B = 7A

We know that A + B = 600
7A + 7B = 4200
8B + 7B = 4200
15B = 4200
B = 280
A = 320

Hence 320ml of first chemical is added with 280ml of second chemical to form 600ml of new solution.

4) An advertisement for an orange drink claims that the drink contains 10% orange juice. How much pure orange juice would have to be added to 5 quarts of the drink to obtain a mixture containing 40% orange juice?

Solution: Given that there are 5 quarts of "drink" that is 10% orange juice.
Thus the 5 quarts of drink contain 5 X 10% = 5 X 0.1 = 0.5 quarts of orange juice,
and hence must contain 4.5 quarts of other stuff.

If we add x quarts of pure orange juice to the original mixture that contains 0.5 quarts of OJ and 4.5 quarts of something else,
Then what we have is a mixture of 5 + x quarts that contains 0.5 + x quarts of OJ.

So after we've added x quarts of pure OJ, the concentration of OJ will be $\dfrac{(0.5+x)}{(5+x)}$

We want to know when this will be equal to 0.4

So solve for x: $\dfrac{(0.5+x)}{(5+x)} = 0.4$

0.5 + x = 2 + 0.4x
0.6x = 1.5
x = $\dfrac{1.5}{0.6}$ = 2.5

Thus you should add 2.5 quarts of pure OJ to make the concentration of the new mixture 40% OJ.

5) A petroleum distributor has two gasohol storage tanks, the first containing 9 percent alcohol and the second containing 12 percent alcohol. They receive an order for 300,000 gallons of 10 percent alcohol. How can they mix alcohol from the two tanks to fill this order?

Solution:

We need to prepare the alcohol of 300, 000 gallons with 10 percent alcohol.
Suppose in the 100 gallons of mixture, we add x gallons of 9% alcohol and (100 - x) of 12% alcohol.
Now, (9% of x) + (12% of (100 – x)) = 10% of 100
→ 0.09x + 0.12(100 – x) = 10
→ 12 – 0.03x = 10
→ 0.03x = 2
→ x = 200/3   = 66.66 gallons
So we use 66.66 gallons type (1) and 33.33 gallons type (2) per 100 gallons of mixture.

For 300,000 gallons, we mixed 200,000 and 100,000 of type (1) and type (2) respectively.

1) The proportion of milk and water in 3 samples is 2:1, 3:2 and 5:3. A mixture comprising of equal quantities of all 3 samples is made. The proportion of milk and water in the mixture is

      (a) 2 : 1

      (b) 5 :1

      (c) 96 : 61

      (d) 227 : 133   **Correct**

Explanation :

Proportion of milk in 3 samples is $\frac{2}{3}$, $\frac{3}{5}$, $\frac{5}{8}$.

Proportion of water in 3 samples is $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$.

Since equal quantities are taken,

Total proportion of milk is $\frac{2}{3}+\frac{3}{5}+\frac{5}{8}$ = $\frac{227}{120}$

Total proportion of water is $\frac{1}{3}+\frac{2}{5}+\frac{3}{8}=\frac{133}{120}$

Proportion of milk and water in the solution is = 227:133

2) The instructions for mixing a certain type of concrete, call for 1 part cement, 2 parts sand, and 3 parts gravel. You have four cubic feet of sand. How much cement and gravel should you mix with this sand to obtain the desire concrete?

Explanation : Since the sand is measured in cubic feet and the " recipe " is given in terms of " parts" .
Lets assumes that one cubic foot is one part. And c amount of cement , g amount of gravel required .
Given : one part of cement : 2 part of sand : 3 part of gravel

$\frac{1}{2}=\frac{c}{4}$

c = 2

and $\frac{2}{3}=\frac{4}{g}$

2 g = 12

g = 6

Hence answer is 2 cubic foot cement and 6 cubic gravel .

Question 3: **Sterling Silver is 92.5% pure silver. How many grams of pure silver and sterling silver must be mixed to obtain 100g of a 94% Silver alloy?**

Explanation : The amount of the output mixture is 100g.
Let x = grams of 92.5% silver alloy
Then, since the total weight is 100g, we have (100-x) = grams of 100% silver
 92.5% silver + (100 - x) grams at 100% = 100g at 94%
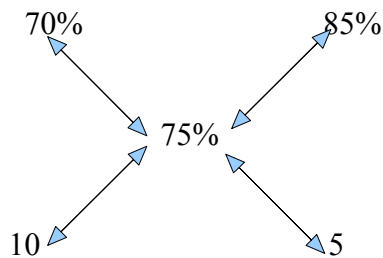 0.925x + 100 – x = 94
 0.925x + 100 – x = 94
0.075x = 6
x = 6 over 0.075 = 80
So to make 100g of an alloy of 94% silver,

You need to mix 80g of 92.5% alloy and 20g of pure silver.

Question 4: **In an examination out of 480 students, 85% of the girls and 70% of boys are passed. How many boys appeared in the examination if total pass percentage was 75% ?**

Explanation :

$$70\% \qquad\qquad 85\%$$

$$75\%$$

$$10 \qquad\qquad 5$$

Therefore boys : girls = 10 : 5 = 2 : 1 .

no .of boys = $480 \times \dfrac{2}{3}$ = 320.

5) In what ratio wheat at Rs.3.20 per kg be mixed with wheat at Rs. 2.90 per kg so that the mixture is worth Rs. 3.08 per Kg.

Explanation : $\dfrac{Quantity\ of\ cheaper}{Quantity\ of\ costlier} = \dfrac{Costlier\ Wheat - Mean\ price}{Mean\ price - cheaper\ wheat}$

$= \dfrac{3.2 - 3.08}{3.08 - 2.90}$

$= \dfrac{0.12}{0.18}$

$= \dfrac{2}{3}$

Hence in 2 : 3 ratio, the wheat at Rs 2.9 and at Rs 3.2 should mixed .

6) A person has \$5000. He invests a part of it at 3% per annum and the remainder at 8% per annum simple interest. His total income in 3 years is \$750. Find the amount invested at 8% interest.

Explanation :

Average rate of interest = $\dfrac{100 \times 750}{5000 \times 3}$

$\qquad\qquad\qquad\qquad = 5\%$ per annum.

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3             8
  ↘        ↗
    ↘    ↗
       5
    ↗    ↘
  ↗        ↘
3             2
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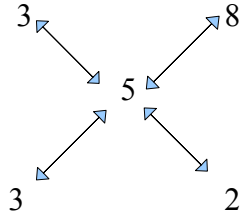
Investment at 3% per annum

$= \dfrac{3}{5} X 5000 = $ Rs.3000.

Investment at 8% per annum = $\dfrac{2}{5}$ X 5000 = \$ 2000.

7) In a class of 65 students, \$39 are distributed among them so that each boy gets 80 cents and girl gets 30 cents. Find the number of boys and girls in class.

Explanation :

Mean value of money per student = $\dfrac{3900}{65}$ = 60 cents.

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80              30
   ↘        ↗
      ↘  ↗
       60
      ↗  ↘
   ↗        ↘
30              20
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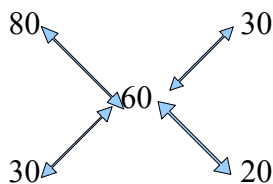
Boys : girls = 30 : 20 = 3 : 2

No. of boys = $\dfrac{3}{5} X 65 = 39.$

No. of girls = 65 – 39 = 26

Hence the number of boys and girls in the class 39 and 26

8)Two vessels A and B contain milk and water mixed in the ratio 8:5 and 5:2 respectively. The ratio in which these two mixtures be mixed to get a new mixture containing milk and water in the ratio 9:4?

Explanation :
Given that ratio of milk and water in vessel A = 8 : 5
and vessel B = 5 : 2

Quantity of milk in Vessel A = $\dfrac{8}{13}$

Quantity of water in vessel A = $\dfrac{5}{13}$

Quantity of milk in vessel B = $\dfrac{5}{7}$

Quantity of water in vessel B = $\dfrac{2}{7}$

Lets consider that the x and y quantities of vessels A and B are mixed to get ratio of milk and water 9 : 4 .

$$\dfrac{\dfrac{8}{13}x + \dfrac{5y}{7}}{\dfrac{5x}{13} + \dfrac{2y}{7}} = \dfrac{9}{4}$$

$$\dfrac{32x}{13} + \dfrac{20y}{7} = \dfrac{45x}{13} + \dfrac{18y}{7}$$
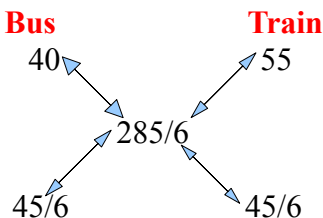
$$\dfrac{2y}{7} = x$$

7x = 2y

x : y = 2 : 7

Hence the answer is 2 : 7 .

9) A person travels 285 Km in 6 hours in two stages. In the first part of the journey, he travels by bus at the speed of 40 Km/hr. In second part of the journey, he travels by train at the speed of 55 Km/hr. How much distance did he travels by train ?

Explanation :

Time spent in bus : train = 1 : 1

Distance traveled = 55 X 3 = 165 Km.
Hence he has covered 165 Km by train.

10) 729 ml of mixture contains milk and water in the ratio 7:2. How much more water is added to get a new mixture containing milk and water in the ratio 7:3?

Explanation :
Given :   729 ml of mixture contains milk and water in the ratio 7:2

Amount of the milk = $\dfrac{7}{9} X\, 729$ = 567 ml

Amount of water = 729 – 567 = 162 ml

Lets consider that x amount of water should be added.
Total amount of water = 162 + x

After adding water ratio become 7 : 3

$$\Rightarrow \quad \frac{567}{162+x}=\frac{7}{3}$$

1701 = 1134 + 7x

7x = 567

 x = 81 ml

Hence 81ml water should add too get required mixture.