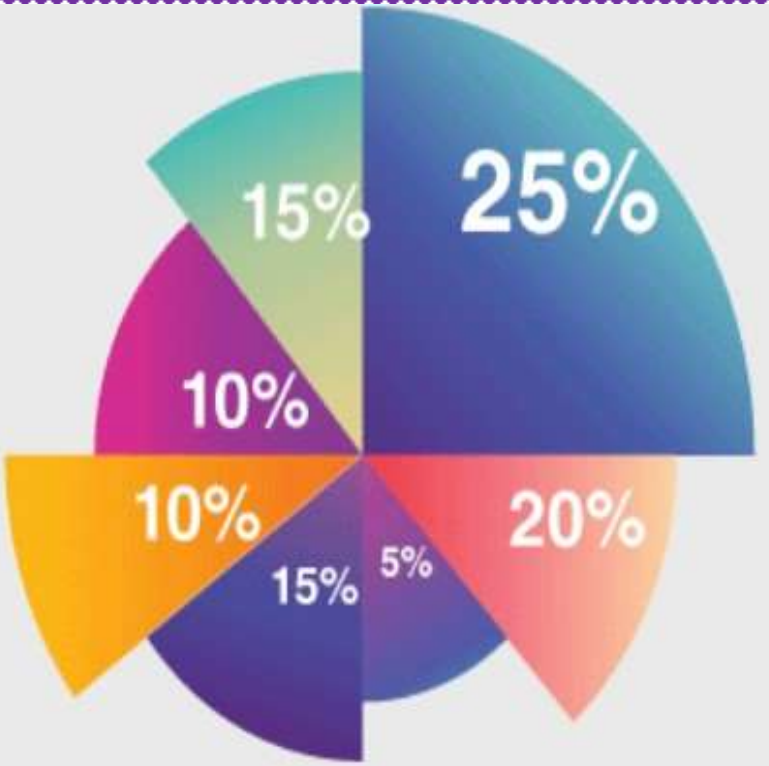
RATIOS AND PROPORTION



In the ratio a : b, we call a as the first term or **antecedent** and b, the second term or **consequent**.

E.g. The ratio 5 : 9 represents with antecedent = 5, consequent = 9

Rule: The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio

Proportion:

The equality of two ratios is called proportion.
If $a : b = c : d$, we write $a : b :: c : d$ and we say that a, b, c, d are in proportion. Then,

$$a/b=c/d$$

Here a and d are called **extremes**, while b and c are called **mean terms**.

Product of means = Product of extremes.

Thus, $a : b :: c : d$ $(b \times c) = (a \times d)$

Question: If $0.75 : x :: 5 : 8$, then x is equal to:

[A] 1.12

[B] 1.2

[C] 1.25

[D] 1.30

Fourth Proportional:
If $a : b :: c : d$, then d is called the fourth proportional to a, b, c.

Third Proportional:
$a : b :: b : c$, then c is called the third proportion to a and b.

Mean Proportional:
Mean proportional between a and b is $(ab)^{1/2}$.

Question: The fourth proportional to 5, 8, 15 is:

[A] 18

[B] 24

[C] 19

[D] 20

Question: The third proportional to 9 and 12 is:

[A] 18

[B] 16

[C] 15

[D] 20

Question: The mean proportional to 36 and 25 is:

[A] 35

[B] 20

[C] 30

[D] 32

Duplicate Ratios:

Duplicate ratio of $(a : b)$ is $(a^2 : b^2)$.

Sub-duplicate ratio of $(a : b)$ is $(a^{1/2} : b^{1/2})$.

Triplicate ratio of $(a : b)$ is $(a^3 : b^3)$.

Sub-triplicate ratio of $(a : b)$ is $(a^{1/3} : b^{1/3})$.

Question: Find the duplicate ratio of 3:4?

[A] 3:4 [B] 4:3 [C] 9:16 [D] 27:64

Question: Find the sub-triplicate ratio of 64:125?

[A] 8:25 [B] 4:5 [C] 5:4 [D] 4:25

Compound Ratio:

- ✓ If the ratios are-- 4:3, 9:13, 26:5, 2:15

Then Ratio compounded = (4*9*26*2)/(3*13*5*15) = 16:25;

Combined Ratio:

- ✓ If the ratios are- A:B= 1:2, B:C= 3:4, C:D= 6:9, and D:E= 12:16

Then A:B:C:D:E = 3:6:8:12:16

- ✓ Speed ratio – A:B:C:D then Time ratio- (1/A): (1/B) : (1/C) : (1/D)

Question: If x:y = 5:4 and x+y = 135, find “y”?

[A] 75

[B] 60

[C] 50

[D] 90

Question: If p:q = 9:7 and p -q = 40, then find value of “p”?

A. 90
B. 140
C. 180
D. 320

Question: If p:q = 2:3, q:r = 2:3 then find p:q:r ?

A. 2:3:3
B. 2:2:3
C. 2:6:3
D. 4:6:9

Question: If p:q = 1:2 r:q = 2:3 then find q:r:p?

A. 1:2:3
B. 3:1:2
C. 6:4:3
D. 4:3:6

Question: If x:y = 3:4 and y:z = 8:9, z:a is 15:16, find x:y:z:a?

A. 78:82:65:45
B. 30:40:45: 48
C. 76:90:56:80
D. None of these

Question: If p:r=3:5 the which of the following is the possible value of “p”?

A. 10

B. 11

C. 12

D. 13

Question: If a:b=2:3, b:c=4:5 and c:d=3:2 then find a:d.

A. 5:4
B. 4:5
C. 24:45
D. None

Question: If A is 60% of B and B is 40% of C then find A:C.

A. 2:5

B. 5:2

C. 6:25

D. 3:2

Question: If x:y is 2:3, find the value of (3x + 2 y) :(2x+5y)

A. 12/25
B. 11/27
C. 12/19
D. 11/23

Question: If 2A = 3B = 4C, then A : B : C is equal to:

A. 2:3:4

B. 3:4:6

C. 4:3:2

D. 6:4:3

Question: If Rs.2000 is divided among three person x, y and z in the ratio x:y:z= 2:3:5, then find the share of y.

A. Rs.400

B. Rs.600

C. Rs.800

D. Rs.1000

Question: A sum of money is to be distributed among A, B, C and D in the proportion of 5:2:4:3. If C gets Rs.1000 more than D then find the share of B.

A. Rs.500

B. Rs.1500

C. Rs.2000

D. None

Question: If Rs.782 be divided into three parts, proportional to (1/2: 2/3 : 3/4), then the first part is:

A. Rs.182

B. Rs.190

C. Rs.196

D. Rs.204

Question: A sum of Rs.1240 is distributed among A, B and C such that the ratio of amount received by A and B is 6:5 and that of B and C is 10:9 respectively. Find the share of C.

A. Rs.480

B. Rs.360

C. Rs.400

D. Rs.630

Question: A sum of money is to be divided among A, B, C such that A's share is equal to twice B's share and B's share is 4 times C's share then their share are in the ratio:

A. 1:2:4

B. 1:4:1

C. 8:4:1

D. 2:4:1

Question: The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase in the number of boys and girls be 20% and 10% respectively, what will be the new ratio?

A. 8 : 9

B. 17 : 18

C. 21 : 22

D. Cannot be determined

Question: The ratio of Boys & Girls is 10:3, when 36 girl more joined the ratio becomes 10:7. Find the no. of boys?

A. 90

B. 60

C. 100

D. None

Question: The income ratio of A & B is 5:8, if income of A increases by 60000, then the new ratio is 5:4, Find current income of A.

A. 120000

B. 240000

C. 360000

D. None

Question: In an alloy ratio of Cu and Zn is 4:3. when 4 kg Zn is mixed into that alloy then the ratio of Cu and Zn becomes 6:5. Find the initial amount of Zn.

A. 50 kg

B. 36 kg

C. 48 kg

D. None

Question: In an alloy ratio of Cu and Zn is 5:2. when 15 kg Cu is extracted from the alloy then the ratio of Cu and Zn becomes 5:3. Find the initial amount of Zn.

A. 18 kg

B. 6 kg

C. 45 kg

D. None

Question: In a bag, there are coins of 25 p, 10 p and 5 p in the ratio of 1 : 2 : 3. If there is Rs. 30 in all, how many 5 p coins are there?

A. 50

B. 100

C. 150

D. 200

Question: A bag contains Rs. 600 in the form of one-rupee, 50 paisa and 25 paisa coins in the ratio 3 : 4 : 12. The number of 25 paisa coins is

A. 600

B. 900

C. 1200

D. 1400

Question: The ratio of income of A and B is 5:6 and their expenditure is 3:4. If their savings are 1800 and 1600 then find income of A.

A. 5000

B. 7200

C. 6000

D. 5400

Question: In 28 liter mixture of milk and water the ratio of Milk and water is 5:2. How much quantity of water is to be added so that the ratio of milk and water becomes 2:5.

A. 60

B. 42

C. 40

D. 36

Question: In a mixture of 25 L the ratio of acid to water is 4:1. Another 3 L of water is added to the mixture. The ratio of acid to water in the new mixture is:

A. 5:2

B. 2:5

C. 3:5

D. 5:3

Question: Time taken by A to take 5 steps is equal to time by B to take 6 steps and by C to take 7 steps. But distance covered in 6 steps of A are equal to 7 steps of B and 8 steps of C. Ratio of their speeds is?

A. 77: 144: 156

B. 9: 14: 11

C. 140: 144: 147

D. 15: 21: 28

Question: By mistake instead of dividing RS. 117 among A, B and C in the ratio 1/2 :1/3: 1/4 it was divided in the ratio of 2:3:4. Who gains the most and by how much.

A. A, Rs.28

B. B, Rs.3

C. C, Rs.20

D. C, Rs.25

Question: The milk and water in a mixture are in the ratio 7:5. When 15 L of water are added to it, the ratio of milk and water in the new mixture becomes 7:8. The total quantity of water in new mixture is:

A. 35 L

B. 40 L

C. 60 L

D. 96 L

Q. The students in three classes are in the ratio 4 : 6 : 9. If 12 students are increased in each class, the ratio changes to 7 : 9 : 12. Then the total number of students in the three classes before the increase is:

A. 95

B. 76

C. 100

D. 114

Q. A sum of money is divided among A, B, C and D in the ratio 3 : 5 : 8 : 9 respectively. If the share of D Rs. 1,872 more than the share of A, then what is the total amount of money of B & C together?

A. Rs. 4,156

B. Rs. 4,165

C. Rs.4,056

D. Rs. 4,065

Q. Amit, Sumit and Vinit Divide an amount of Rs. 2,800 amongst themselves in the ratio of 5 : 6 : 3 respectively. If an amount of Rs. 200 is added to each of their shares. What will be the new ratio of their shares of the amount?

A. 8 : 9 : 6

B. 6 : 7 : 4

C. 7 : 8 : 5

D. 4 : 5 : 2

Q. Two numbers A and B are such that the sum of 5% of A and 4% of B is two-third of the sum of 6% of A and 8% of B. Find the ratio of A : B is

A. 4 : 3

B. 3 : 4

C. 1 : 1

D. 2 : 3

Partnership and Problems on ages

What is Partnership?

Important Concepts

Ratio of Divisions of Gains:

Suppose A and B invest Rs. x and Rs. y respectively for a year in a business, then at the end of the year:

(A's share of profit) : (B's share of profit) = x : y.

.

Suppose A invests Rs. x for p months and B invests Rs. y for q months then,

(A's share of profit) : (B's share of profit)= xp : yq

Question: A and B started a business with Rs.20000 and Rs.30000 respectively for 1 year. If they had profit of Rs.4000. What is the ratio of A in this profit?

A. Rs.800

B. Rs.1600

C. Rs.2400

D. Rs.1200

Question: A and B started a business with Rs.60000 and Rs.80000 respectively. What is the ratio of their profits after 3 years?

A. 1:2

B. 1:1

C. 4:3

D. 3:4

Question: A, B, C Started a business with capitals Rs.60,000, Rs.50,000 and Rs.40,000 respectively. After 9 months C left them. If profit after one year is Rs.14,000 then profit of C is:

A. Rs.5000
B. Rs.4000
C. Rs.6000
D. Rs.3000

Question: A, B, C subscribe Rs. 50,000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35,000, A receives:

A. Rs.8400

B. Rs.11900

C. Rs.13600

D. Rs.14700

Question: Pradeep opened a shop investing Rs.30,000. Priyanka joined him 2 months later, investing Rs.45,000. They earned a profit of Rs.76,000 after completion of 2 year. What will be Priyanka's share of profit? :

A. Rs.27000

B. Rs.44000

C. Rs.32000

D. Rs.40000

Question: A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is:

A. Rs.500
B. Rs.1000
C. Rs.1500
D. Rs.2000

Question: Kiran is younger than Bineesh by 7 years and their ages are in the respective ratio of 7 : 9, how old is Kiran?

A. 25

B. 24.5

C. 26

D. 26.5

Question: The Ratio of Mona and Vikas's present age is 9:10. After 4years the ratio will become 11:12. What is the present age of mona?

A. 20
B. 18
C. 15
D. 24

Question: The Ratio of Ram and Shyam's present age is 2:1. After 5years the ratio will become 3:2. What is the present age of both?

A. 10, 5
B. 12, 8
C. 15, 18
D. 15, 10

Question: At present age of father is 5 times the age of the son. 3years hence the father would be 4 times that of the son. What is present age of father?

A. 40
B. 45
C. 50
D. 35

Mixture and Alligation

Mixture: Mixing of two or more than two type of quantities gives us a mixture.

Example:

Quantities of these elements can be expressed as percentage or ratio.(20% of sugar in water)

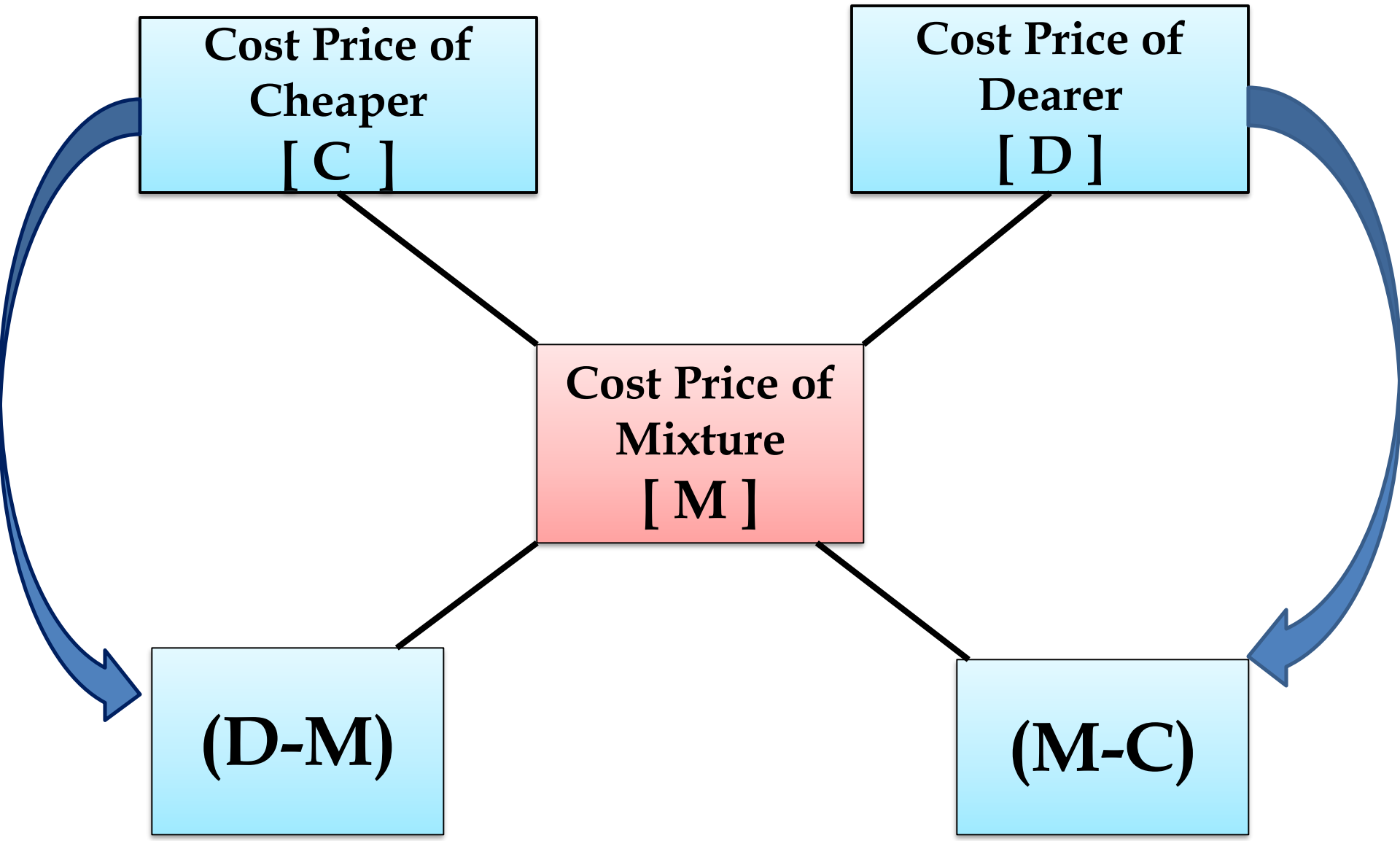
Fraction (A solution of sugar and water such that sugar : water = 1:4)

Alligation : Alligation is a rule which is used to solve the problems related to mixture and its ingredient.

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.

Alligation Rule : When two elements are mixed to make a mixture and one of the elements is cheaper and other one is costlier then,

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Costlier}} = \frac{\text{CP of Costlier} - \text{Mean Price}}{\text{Mean Price} - \text{CP of Cheaper}}$$


Cost Price of Cheaper [C]
Cost Price of Dearer [D]
Cost Price of Mixture [M]
(D-M)
(M-C)

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of dearer}} = \frac{(D-M)}{(M-C)}$$

Note: (1) Mean value lies between cheaper Value and dearer value.

(2) All the three values in alligation rule should be same type having same unit. For e.g. Cost price.

1. In what ratio must a grocer should mix two varieties of pulses costing Rs.15 /Kg and Rs.20/Kg respectively so as to get a mixture worth Rs.16.50/Kg?

[A] 7 : 3

[B] 4 : 5

[C] 6 : 4

[D] None of the above

2. 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?

[A] 1 : 3

[B] 2 : 3

[C] 3 : 4

[D] 4 : 5

3. In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg and Rs. 65 a kg so that by selling the mixture at Rs. 68.20 a kg he may gain 10%?

[A] 3 : 2

[B] 3 : 5

[C] 3 : 6

[D] None of the above

4. How many kg of tea worth Rs. 25/kg must be blended with 30 kg of tea worth Rs. 30/kg so that by selling the blended variety at Rs. 30/kg there should be a gain of 10%?

[A] 36 Kg

[B] 40 Kg

[C] 32 Kg

[D] None of the above

5. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is:

[A] 20%

[B] 10 %

[C] 11 %

[D] None of the above

6. In what ratio must water be added to spirit to gain 10% by selling it at the cost price?

[A] 1 : 11

[B] 1 : 5

[C] 1 : 10

[D] 1 : 9

7. Sea water contains 5% salt by weight. How many kilograms of fresh water must be added to 40kg of sea water for the salt content of the solution to be 2%?

[A] 50

[B] 60

[C] 65

[D] 70

8. A mixture of 45 L of spirit and water contains 20% of water in it. How much water must be added to it to make the water 25% in the new mixture?

[A] 3 L

[B] 4 L

[C] 5 L

[D] 6 L

9. In a zoo, there are rabbits and pigeons. If head are counted, there are 200 and legs are 580. How many rabbits are there ?

[A] 110

[B] 90

[C] 80

[D] 120

10. A man has 90 pens. He sells some of these at profit of 15 % and rest at 9% profit. On the whole transaction he gets a profit of 11%.How many pens did he sell at 9% profit.

[A] 60

[B] 50

[C] 40

[D] 70

11. A trader has 25 kg of rice. A part of which he sold at 4% profit and rest at 9% profit. His overall gain is 7%. What is the quantity he sold at 9% profit?

[A] 9 Kg

[B] 10 Kg

[C] 12 Kg

[D] 15 Kg

12. A man buys two cows for Rs. 1350 and sells one for loss of 6% and the other for gain of 7.5% and on the whole he neither gains nor loses. What does each cow cost?

[A] Rs. 850, Rs.500

[B] Rs. 650, Rs. 700

[C] Rs. 750, Rs. 600

[D] Rs. 550, Rs. 800

13. There are 50 students in a class, Rs. 320 are distributed among them so that each boy get 10 Rs. and each girl get 5 Rs. Find no. of girls.?

[A] 36

[B] 18

[C] 14

[D] 7

14. A merchant borrowed Rs.3500 from two money lenders. For one loan he paid 14% p.a. and for other 18% p.a. Total interest paid for one year was Rs.525. How much did he borrow at 18% p.a.

[A] Rs.875

[B] Rs.625

[C] Rs.750

[D] Rs.1000

15. A man travels 80 km in 7 hrs. Some part on foot with 8kmph and rest on cycle with 16kmph. Find the distance covered by cycle.

[A] 16 Km

[B] 32 Km

[C] 24 Km

[D] 48 Km

16. In what ratio must a person mix three kinds of tea costing Rs.60/kg, Rs.75/kg and Rs.100 /kg so that the resultant mixture when sold at Rs.96/kg yields a profit of 20%?

[A] 1 : 2 : 4

[B] 3 : 7 : 6

[C] 1 : 4 : 2

[D] None of these

17. Find out the ratio of new mixture so that it will cost Rs 1.40 per kg from the given three kinds of rice costing Rs 1.20, Rs 1.45 and Rs 1.74.

[A] 39 : 20 : 20

[B] 30 : 20 : 30

[C] 30 : 29 : 29

[D] None of these

Mixture Questions

18. In 28L mixture of milk and water the ratio of milk and water is 5:2. How much quantity of water is to be added so that the milk and water becomes 2:5

[A] 60 L

[B] 42 L

[C] 40 L

[D] 36 L

19. A mixture consist Milk and water in 5:1. On adding 5 L water, the ratio becomes 5:2. Find quantity of milk in original mixture.

[A] 5 L

[B] 10 L

[C] 15 L

[D] 25 L

20. Mixture consist Milk and water in 4:3. On adding 2 L of water, ratio becomes 8:7. find total quantity of final mixture.

[A] 15 L

[B] 30 L

[C] 45 L

[D] 60 L

21. Two bucket contains same amount of mixture of Milk and water in 9:5 and 4:3 resp. If these buckets are further mixed, find the ratio of milk and water in final mixture.

[A] 11 : 17

[B] 17 : 11

[C] 9 : 8

[D] 8 : 9

22. Two bucket contains same amount of mixture of Milk and water in 9:5 and 4:3 resp. If these buckets are further mixed in 1:2, find the ratio of milk and water in final mixture.

[A] 17 : 25

[B] 25 : 17

[C] 9 : 16

[D] 8 : 18

23. Three equal glasses are filled with mixture of Milk and water in 3 : 1, 5 : 3 and 9 : 7 resp. If these glasses are further mixed, find the ratio of milk and water in final mixture.

[A] 11:17

[B] 17:11

[C] 31 : 17

[D] 17 : 31

24. Mixture consist 80% Acid and rest water. A part of this mixture is replaced with same amount of water and new ratio becomes 4:3. find part of mixture which is replaced.

[A] 1/5

[B] 2/5

[C] 1/7

[D] 2/7

25. A tank is filled with mixture consist 3 part water & 5 part alcohol. A part of this mixture is drawn off and replaced with same amount of water. New mixture contains half water and half alcohol. find part of mixture which is replaced.

[A] 1/5

[B] 2/5

[C] 1/7

[D] 2/7

26. A bucket contains two liquids A and B in 5:3. If 16 L of mixture is drawn off and replaced with same amount of liquid B, the ratio becomes 3:5. How much Liter bucket holds?

[A] 40 L

[B] 24 L

[C] 26 L

[D] 80 L

27. Two vessels A and B contain M and W in 4:3 and 2:3 resp. In what ratio the liquids may be mix to obtain a new mixture containing half milk and half water ?

[A] 7 : 5

[B] 5 : 7

[C] 1 : 4

[D] 1 : 2

28. Two vessels A and B contain M and W in 8:5 and 5:2 resp. In what ratio the liquids may be mix to obtain a new mixture containing 69and(3/13) % milk ?

[A] 2 : 7

[B] 7 : 2

[C] 5 : 6

[D] 6 : 5

Removal and Replacement

If a vessel contains "x" liters of liquid A and if "y" liters be withdrawn and replaced by liquid B, then if "y" liters of the mixture be withdrawn and replaced by liquid B, and the operation is repeated 'n' times in all, then :

$$\frac{\text{Quantity of liquid A after } n^{th} \text{ operation}}{\text{Initial quantity of liquid of A}} = \left[\frac{x-y}{x}\right]^n = \left[1-\frac{y}{x}\right]^n$$

$$\mathbf{F.C = I.C(1-y/x)^n}$$

FC= Final concentration

IC= Initial concentration

y = no. of liters replaced

x = Total concentration

n = total number of iterations

29. A container contains 40 L milk. 4 L was taken out and replaced with water. This process is repeated further 2 times. Now how much milk is there in the mixture?

[A] 28 L

[B] 29.16 L

[C] 27.16 L

[D] 30 L

30. A vessel contains 125 liters of wine. 25 liters of wine was taken out of the vessel and replaced by water. Then, 25 liters of mixture was withdrawn and again replaced by water. The operation was repeated for third time. How much wine is now left in the vessel?

[A] 49 L

[B] 64 L

[C] 72 L

[D] 56 L

31. 8 L was taken out from a cask full of wine and replaced with water. This operation is performed 3 more times. The ratio of quantity of wine left in the cask to that of water is 16:65. how much wine did the cask hold initially?

[A] 12 L

[B] 18 L

[C] 24 L

[D] 30 L

32. A jar full of whisky contains 40% alcohol. A part of this is replaced with another containing 19% alcohol. Now there is 26% alcohol. Find the quantity of whisky which is replaced.

[A] 1/2

[B] 1/3

[C] 1/5

[D] 2/3