**Chapter -9**

**Ratio and proportion**

**What is Ratio?**  
A ratio is a relationship between two numbers by division of the same kind. The ration of a to b is written as a : b = a / b In ratio a : b , we can say that a as the **first term** or **antecedent** and b, the**second term** or **consequent**.

**What is Proportion?**  
The idea of proportions is that two ratio are equal.  
If a: b = c: d, we write a: b: : c: d,

**Example:** 3 / 15 = 1 / 5  
**a** and **d** called **extremes,** where as **b** and**c** called **mean terms**

**Example:**  
If P : Q : R = 2 : 3 : 4 , Then P / Q : Q / R : R / P = ?  
**Answer:**  
P : Q : R = 2 : 3 : 4 . Let P = 2k, Q = 3k, R = 4k. Then,  
 = =,  = = and = =.

SO, : : = : : = 8 : 9 : 24 .

**Example:**  
If a : b = 3 : 7 and b : c = 5 : 9, find a : b : c .

**Answer:** A : B = 3 : 7, B : C = 5 : 9  
= ( 5 x 7 / 5 ) : ( 9 x 7 / 5 ) = 7 : 63 / 5 .  
= A : B : C = 3 : 7 : 63 / 5 = 15 : 35 : 63 .

**Example:**  
If 75 is divided into three parts proportional to 3, 5, 8, 9 then the smallest part is :  
**Answer:**  
ratio is = 3 : 5 : 8 : 9, sum of ratio terms is = 25.  
So the smallest part is = ( 75 x 3 / 25 ) = 9 .

**Example:**  
The Salary of Three friend A, B, C are divided into ratio 5 : 6 : 8.If the increment has given of 10%, 20%, 25%, Find the new ratio of three friend salary ?  
**Answer:**  
**Step 1:** We assume ration as 5x, 6x, 8x  
now the increment of new salary is A = 110 / 100, B = 120 / 100, C = 125 / 100.

**Step 2:** A,s new salary is 110 X 5x / 100 = 55x / 10.  
B,s new salary is 120 X 6x / 100 = 36x / 5.  
C,s new salary is 125 X 8x / 100 = 10.

**Step 3:**New ratio is 55x /10: 36x / 5 : 10.

**Example:**  
Find the mean proportional between given two number that is 64 and 49.  
**Answer:**  
The mean proportion of two numbers is  
Root of 64 and 49 is √8 x √ 7 = 8 x 7 = 56.  
**So, the mean proportional is 56.**

**Example:**  
Which of the following ratio is the greatest ?  
7 : 15 , 15 : 23 , 17 : 25 , 21 : 29  
**Answer:**  
7 / 15 = 0.466  
15 / 23 = 0.652  
17 / 25 = 0.68  
21 / 29 = 0.724  
**So, 0.724 is greatest and therefore, 21 : 29**

**Example:**  
What number has to be added to each term of 3 : 5 to make the ratio 5 : 6 :  
**Answer :**  
Let the number to be added x , Then  
3 + x / 5 + x = 5 / 6  
6 ( 3 + x ) = 5 ( 5 + x )  
x = ( 25 – 18 ) = 7  
**So , the number to be added is 7 .**

**Example:**  
A money bag contains 50 p, 25 p, and 10 p coins in the ratio 5 : 9 : 4, and the total amounting to Rs.206.  
Find the individual number of coins of each type.  
**Answer:**

**Step 1:** Let the number of 50 p,25 p, and 10 p coins be 5x, 9x, 4x respectively.

Then, 5x / 2 + 9x / 4 + 4x / 10 = 206  
= 50x + 45x + 8x = 4120= 103x = 4120  
= x = 40.

**Step 2:** Number of 50 p coins is **( 5 x 40 = 200 ),**  
Number of 25 p coins is**( 9 x 40 = 360 ),**  
Number of 10 p coins **( 4 x 40 = 160 ),**

**Example:**  
In a bottle mixture of 80 liters and the ratio of milk and water is 3 : 2. If this mixture ratio is to be 2 : 3.  What the quantity of water to be further added?  
**Answer:**  
**Step 1:** Quantity of Milk ( 80 x 3 / 5 ) = 48 liters, So Quantity of water in it  ( 80 – 48 ) = 32 liters.  
**Step 2:** New Ratio required 2: 3, Let x water to be added, Then Milk: Water is = 48: (32+x)  
=48 / (32 + x).  
Step 3: Now 48 / (32 + x) = 2: 3  
48 / (32 + x) = 2 / 3  
2x = 144 – 64  
x = 80/2  
=40 liters.

**Example:**  
The ratio of copper and zinc is 9 : 3 in an alloy . If quantity of zinc is 24 kg. The quantity of copper is would be?

**Answer:**  
ratio of copper and zinc is 9 : 3  
Let the required quantity of copper be x kg.  
So, 9: 3: 24: x  
9x = 24 x 3  
x = 72 / 9  
x = 8 kg

**Example:** In a liquid mixture of 60 liters, the ratio of milk and water is 2:1. If this ratio is to be 1: 2, then the quantity of water to be further added is:

**Answer:**  
So Quantity of milk = (60 x 2 / 3) = 40 liters.  
Water in it = (60 – 40) = 20 liters.  
New ratio required = 1: 2.  
Let quantity of water to be added further be x liters  
milk: water = 40 / (20 + x)  
Now,  
40 / ( 20 + x ) = 1 / 2  
20 + x = 80  
x = 60 litres  
So, 60 litres of water to be added further.

**Example:**  
20% alcohol present in a 15 litres mixture and rest of water  . If 3 litres of water be mixed with it , the percentage of alcohol in the new mixture would be  ?

**Answer:**  
20% present in a 15 litres mixture  
So, 20 x 15 / 100 = 3 litres .  
Water in it = (15 – 3) 12 liters.  
New quantity of mixture = (15 + 3) = 18 liters.  
Percentage of alcohol in new mix is = (3 x 100 / 18) % = 50 / 3.