# **Ratio and Proportion**

#### Ratio:

The ratio of two quantities a and b of same units is the fraction x/y, where  $b \neq 0$ 

- The fraction x/y can be represented as x:y

#### Different types of ratios are:

Duplicate ratio of (a : b) is  $(a^2 : b^2)$ . Sub-duplicate ratio of (a : b) is (a : b). Triplicate ratio of (a : b) is  $(a^3 : b^3)$ . Sub-triplicate ratio of (a : b) is  $(a^{1/3} : b^{1/3})$ .

**Compound ratio:** Compound ratio of (a : x), (b : y), (c : z) is (abc : xyz)

6) Inverse ratio: The inverse ratio of 5:8 is 8:5.

## **Proportion:**

1) Proportion is the equality of two ratios.

When (a : b = x : y) is represented as (a : b :: x : y), then a, b, x, y are said to be in proportion.

In (a : b :: x : y), a and y are called as extremes and b and x are called as mean terms.

## Product of means = Product of extremes

**2)** Mean proportion: Mean proportion between x and y is given as xy

**3)** Third proportion: If p : q = q : s, then s is called as third proportional to p and q.

**4)** Fourth proportion: If u : v = x : y, then y is the fourth proportional of u, v and x.

# **Quick Tips and Tricks**

#### 1) Comparison of ratios:

If  $(x:y) > (a:b) \rightarrow \frac{x}{y} > \frac{a}{b}$ 

5) If a number a is divided in the ratio x: y,

1) First part: 
$$\frac{ax}{(x + y)}$$

2) Second part: (x+

# 2) Proportion

- For four numbers a, b, c, d if a : b = c : d,
  - 1. Product of Mean(bc) = Product of Extremes(ad)

- 2. **Invertendo Property:** Then b : a = d : c; that is, if two ratios are equal, then their inverse ratios are also equal.
- 3. Alternendo Property: then a : c = b : d; that is, if the second and third term interchange their places, then also the four terms are in proportion.
- 4. **Componendo Property:** For four numbers a, b, c, d if a : b = c : d then (a + b) : b :: (c + d) : d.
- Dividendo Property: If a : b :: c : d then (a b) : b :: (c - d) : d.
- Convertendo Property: If a : b :: c : d then a : (a b) :: c : (c d)
- Componendo-Dividendo Property: If a : b :: c : d then (a + b) : (a - b) :: (c + d) : (c - d).
- 8. Addendo Property: If a : b = c : d = e : f, value of each ratio is (a + c + e) : (b + d + f)
- 9. Note: If a : b = c : d = e : f, then the value of each ratio will be (am+cn+ep)/(bm+dn+fp), where m, n, p may be non zero number.]

## Q1. Arrange the following ratios in descending order.

#### 4) ariation:

- If a = kb for some constant k, then we can say that a is **directly proportional** to b.

- If ba =k for some constant k, then we can say that a is **inversely proportional** to b.

#### Examples of Direct Proportion:

- 1. Cost of an Object vs the Number of Objects Purchased
- 2. Number of Visitors and Earnings of a Restaurant/business
- 3. Time taken and Distance covered by a Vehicle

Examples of Indirect Proportion:

- 1. Speed of object and time taken
- 2. Number of workers and time taken to finish the work:

As the number of people or workers **increases**, the time it takes to finish a task **decreases**.

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**3.** The number of goods you can buy is inversely related to the price of each item.

# Type 1:

#### Q1. Basic ratio's and Proportion

- a. 2:3,
- b. 3:4,
- c. 5:6,
- d. 1:5

**Q2.** If x: y = 1: 2, find the value of (2x + 3y): (x + 4y)

**Q 3.** If a : b = 2 : 3 and b : c = 5 : 7, then find a : b : c.

**Q 4.** If A : B : C = 3 : 4 : 7, then what is the ratio of (A / B) : (B / C) : (C / A)?

**Q5.** The length of the ribbon was originally 30 cm. It was reduced in the ratio 5:3. What is its length now?

**Q6.** The radius of the ribbon was originally 10 cm. It was increased in the ratio 2:1. What is its radius now?

**Q7.** The first, second and third terms of the proportion are 42, 36, 35. Find the fourth term.

Type 2: Division and Distribution of objects into ratios In this type of numerical, given amount or quantity is divided among two or more persons and amount or quantity retained by each person is calculated.

**Q8.** Two numbers are in the ratio 3 : 4. If the sum of numbers is 63, find the numbers.

**Q9.** If Suresh distributes his pens in the ratio of 1/2 : 1/4 : 1/5 : 1/7 between his four friends A, B, C and D, then find the total number of pens Suresh should have?

**Q10.** If Rs 1050 is divided into three parts, proportional to (1/3) : (3/4) : (4/6), then what is the first part?

**Q11.** Divide \$370 into three parts such that second part is 1/4 of the third part and the ratio between the first and the third part is 3 : 5. Find each part.

**Q12.** The ratio of number of boys and girls is 4 : 3. If there are 18 girls in a class, find the number of boys in the class and the total number of students in the class.

**Q13.** Amit and Rajesh shared an amount in the ratio 5:7 if Rajesh recieved 45 more than Amit how much does each received?

#### Type 3: Mixture of different contents

**Q 14.** In a mixture of 13 litres, the ratio of milk and water is 3 : 2. If 3 liters of this mixture is replaced by 3 liters of milk, then what will be the ratio of milk and water in the newly formed mixture?

**Q 15.** A mixture contains alcohol and water in the ratio of 7 : 5. If 8 liters of water is added to the mixture, then the ratio becomes 7 : 9. Find the quantity of alcohol in the given mixture?

#### Type 4: Income/ Expenditure and Salary

These questions are related to annual savings or expenditure. We are asked to find the salaries in ratio form or vice-versa.

**Q 16.** The annual income of Puja, Hema and Jaya taken together is Rs. 46,000. Puja spends 70 % of income, Hema spends 80 % of her income and Jaya spends 92

% of her income. If their annual savings are 15 : 11 : 10, find the annual saving of Puja?

**Q 17.** A man, his wife and daughter worked in a graden. The man worked for 3 days, his wife for 2 days and daughter for 4 days. The ratio of daily wages for man to women is 5:4 and the ratio for man to daughter is 5:3. If their total earnings is mounted to Rs. 105, then find the daily wage of the daughter.

**Q** 18. Amit, Raju and Ram agree to pay their total electricity bill in the proportion 3 : 4 : 5. Amit pays first day's bill of Rs. 50, Raju pays second day's bill of Rs. 55 and Ram pays third day's bill of Rs. 75. How much amount should Amit pay to settle the accounts?

**Q 19.** Salaries of Ram and Sham are in the ratio of 4 : 5. If the salary of each is increased by Rs. 5000, then the new ratio becomes 50 : 60. What is Sham's present salary?

#### Type 5: Coins and Values

These are ratio based numerical, in which a bag containing different number of coins like 10 p, 50, 25 p are given along with the total amount and we are asked to find each type of coin in the bag or the value of coins.

**Q 20.** A bag contains equal number of 25 paise, 50 paise and one rupee coins respectively. If the total value is Rs 105, how many types of each type are present?

**Q 21.** A purse contains 342 coins consisting of one rupees, 50 paise and 25 paise coins. If their values are in the ratio of 11 : 9 : 5 then find the number of 50 paise coins?

**Q22.** A bag contains Rs. 510 in the form of 50 p, 25 p and 20 p coins in the ratio 2: 3: 4. Find the number of coins of each type.

#### Mixed Problem:

**Q1.** In a class of 60, where girls are twice that of boys, Amal ranked seventeenth from the top. If there are 9 girls ahead of Amal, how many boys are after him in rank?

**Q2.** Three numbers are in the ratio of 3:4:6 and their product is 1944. Find the largest of these numbers.

Q3. The sum of two numbers is 40 and their difference is 4. Find the ratio of the numbers.

**Q4.** If the area of a triangle is 1176 cm2. The base: corresponding altitude is 3:4, find the altitude of the triangle.

**Q5.** If in 3 kg of metal, which is one- third silver and the rest aluminium, is mixed with 7 kg of another metal,which is two-seventh silver and the rest is aluminum. What is the ratio of silver to aluminium in the mixture?