Chapter 12

Ratio And Proportion

Ratio

Ratio

In our day to day life, we compare many things like

- Ria's height is 140 cm whereas her friend Sonia is 180 cm. If we calculate the difference it comes out to be 40 cm.
- Cost of pen is 5 rupees whereas cost of pencil is 3 Rupees. If we calculate the difference it comes out to be 2 Rupees.
- Consider another example, cost of car is 5,50,000 rupees whereas that of the bike is 50,000. If we calculate thedifference it comes out to be 5,00,000 and if we compare by division:

$$\frac{550000}{50000} = \frac{11}{1}.$$

This comparison by division is known as Ratio.

Ria's weight is 20 kg and her father's weight is 60 kg. How many times Father's weight is of Ria's weight?
It is three times.

In the above examples, we compared the two quantities in terms of 'how many times'. This comparison is known as the Ratio. We denote ratio using symbol ':'.

Two quantities can be compared only if they are in the same unit.

Example: Length and breadth of a rectangular field are 100 m and 30 m respectively. Find the ratio of the length to the breadth of the field.
Sol.
Length of the rectangular field = 100 m
Breadth of the rectangular field = 30 m

The ratio of the length to the breadth is 100: 30

The ratio can be written as = $\frac{100}{30} = \frac{10}{3}$

Thus, the required ratio is 10 : 3.

Example: 55 persons are working in an office. If the number of females is 25 and the remaining are males, find the ratio of:

(a) The number of females to the number of males.

(b) The number of males to the number of females.

Sol.

Number of females = 25

Total number of workers = 55

Number of males = 55 – 25 = 30

Therefore,

The ratio of number of females to the number of males = 25 : 30

= 5: 6

The ratio of number of males to the number of females = 30 : 25

= 6 : 5

We can get equivalent ratios by multiplying or dividing the numerator and denominator by the same number.

Example: Divide 90 chocolates in ratio 1 : 2 between Ria and Sonia.

Sol.

The two parts are 1 and 2.

Therefore, sum of the parts = 1 + 2 = 3.

This means if there are 3, Ria will get 1 and Sonia will get 2.

Or, we can say that Ria gets 1 part and Sonia gets 2 parts out of every 3 parts.

Therefore, Ria's share = $\frac{1}{3} \times 90 = 30$

And Sonia's share = $\frac{2}{3} \times 90 = 60$

Proportion

Proportion

Consider the following examples:-

- Ria purchased 2 pens for 10 and Sonia purchased 10 pens for 50. Whose pens are more expensive?

The ratio of number of pens purchased by Ria to the number of pens purchased by Sonia = 2 : 10 = 1:5
Ratio of their costs = 10 : 50 = 1:5
Both ratios 2 : 10 and 10 : 50 are equal.
Therefore, the pens were purchased for the same price by both.

- Roohi sells 4 kg of apples for 100 and Raman sells 8 kg of apples for 200. Whose apples are more expensive?

Ratio of the weight of apples = 4 kg: 8 kg = 1: 2
Ratio of their cost = 100: 200 = 1: 2
So, the ratio of the weight of apples = ratio of their cost.
Since both the ratios are equal.
Hence, we say that they are in proportion.
They are selling apples at the same rate.

If two ratios are equal, we say that they are in proportion and use the symbol '::' or '=' to equate the two ratios.

If two ratios are not equal, then we say that they are not in proportion.
In a statement of proportion, the four quantities involved when taken in order are known as respective terms.
The first and fourth terms are known as extreme terms.
Second and third terms are known as middle terms.

Example: Are the ratios 15g: 18g and 40 kg: 48 kg in proportion?

Sol.

15 g: 18 g = $\frac{15}{18}$ = 5: 6

40 kg: 48 kg = $\frac{40}{48}$ = 5: 6
So, 15: 18 = 40: 48.
Therefore, the ratios 15 g: 18 g and 40 kg: 48 kg are in proportion, i.e.
15 : 18 :: 40 : 48
The middle terms in this are 18, 40 and the extreme terms are 15, 48.

Example: Determine if 20 cm: 1 m and 40: 200 form a proportion.
Also, write the middle terms and extreme terms where the ratios form a proportion.

Sol.

20 cm: 1 m = 20 cm: 100 cm

20 cm: 100 cm = $\frac{20}{100}$ = 1: 5

40: 200 = $\frac{40}{200}$ = 1: 5

So, 20 cm: 1 m = 40: 200

Therefore, the ratios 20 cm: 1 m and 40: 200 are in proportion,

i.e.

20 cm: 1 m :: 40: 200

The middle terms in this are 1 m, 40 and the extreme terms are 20 cm, 200

Unitary Method

The method in which first we find the value of one unit and then the value of the required number of units is known as the Unitary Method.

Example: If the cost of 6 cans of juice is 300, then what will be the cost of 4 cans of juice?

Cost of 6 cans of juice = 300

Therefore, the cost of one can of juice = $\frac{300}{6}$ = 50

Therefore, cost of 4 cans of juice = 50 × 4 = 200.

Thus, the cost of 4 cans of juice is 200.

Example: If the cost of a dozen soaps is 156, what will be the cost of 18 such soaps?

We know that 1 dozen = 12

Since the cost of 12 soaps = 156

Therefore, the cost of 1 soap = $\frac{156}{12}$ = 13

Therefore, cost of 18 soaps = 13 × 18 = 234

Thus, the cost of 18 soaps is 234.

Example: The cost of 125 envelopes is 375. How many envelopes can be purchased for 120?

In 375, the number of envelopes that can be purchased = 125

Therefore, in 1, the number of envelopes that can be purchased = $\frac{125}{375}$

Therefore, in 120, the number of envelopes that can be purchased

$= \frac{125}{375} \times 120 = 40$

Thus, 40 envelopes can be purchased for 120.