Lesson-13

C3H2W3

Ratio and Proportion

Sandhya, Lalita and Kanta who are students of class VI, VII and VIII respectively of Basistha Vidyalaya are very intimate friends.

One day, they decided to find out, which category of student is more in their respective class- boy or girl.With this objective they counted the number of boy and girl students present in their classes on a certain day and three of them together during leisure prepared a table as shown here.

Class	Boy student	Girl student
VI	30	30
VII	40	20
VIII	10	30

They found the difference between boy student and girl students as follows,

In class VI number of boy students present equal to girl students present.

In class VII number of boys is more than girls by 20.

In class VIII number of boys is less than girls by 20.

We can compare two numbers by finding the difference between two numbers (by subtracting the smaller number from the larger.)

We can also state the above table in this way- number of boys present in class VII is twice the number of girls. On the other hand in class VIII number of girls in

three times the number of boys. Therefore, we can compare number in two ways- by subtracting one from the other or by expressing how many times one number is greater than other.

In class VI $\frac{\text{Number of boy students}}{\text{Number of girls students}} = \frac{30}{30} = \frac{1}{1}$ (Number of boys and girls is equal)

In class VII $\frac{\text{Number of boy students}}{\text{Number of girls students}} = \frac{40}{20} = \frac{2}{1}$ (Number of boys is twice that of girls)

In class VIII $\frac{\text{Number of boy students}}{\text{Number of girls students}} = \frac{10}{30} = \frac{1}{3}$ (Number of boys is one third of girls)

Let us take another example

Cost of one bicycle is Rs. 4,000

Cost of one motor cycle is Rs. 60,000

To compare the cost of these two vehicles it will be convenient for us to do the comparison by division than comparison by taking the difference.

This means $\frac{\text{Cost of the motor cycle}}{\text{Cost of the bicycle}} = \frac{60,000}{4,000} = \frac{15}{1}$

Which means, the cost of the motor cycle is 15 times more than the cost of the bicycle.

or, $\frac{\text{Cost of the bicycle}}{\text{Cost of the motor bicycle}} = \frac{4,000}{60,000} = \frac{1}{15}$

This means, the cost of the bicycle is one fifteenth of the cost of the motor cycle.

Here instead of telling that the cost of the motor cycle is more than the cost of the bicycle by Rs. 56,000 is not it more convenient to say that the cost of the motor cycle is 15 times more than the cost of the bicycle?

Comparison of two quantities by division is called ratio. If the two quantities are represented by a and b then their ratio is written as a : b (a is to b) and read as a is to b.

In the first example, in Basistha Vidyalaya

The ratio of boy students to girl students present in the class VI $= \frac{30}{30} = \frac{1}{1} = 1:1$

The ratio of boy students to girl students present in calss VII $= \frac{40}{20} = \frac{2}{1} = 2:1$

The ratio of boy students to girl students present in class VIII $= \frac{10}{30} = \frac{1}{3} = 1:3$

In the second example

The ratio of cost of the motor cycle and cost of bicycle $\frac{60000}{4000} = \frac{15}{1} = 15:1$

This means, cost of motor cycle : cost of bicycle $= 15:1$

(Number of boys are girls is equal)

Let us take another example

Suppose, weight of two friends Sandhya and Lalita is respectively 40 kg and 50 kg. What is the ratio of their weights?

The ratio of $\frac{\text{Weight of Sandhya}}{\text{Weight of Lalita}} = \frac{40}{50} = \frac{4}{5} =$ 4 : 5 (Lowest form of the ratio)

From this it is clear that ratio express a comparison and it has no unit.

In addition, we express the ratio in its lowest form.

Again, in determining the ratio of weight of the two friends we may reverse the order of division, this means we may divide Lalita's weight by Sandhya's weight. Then the ratio will be the ratio of Lalita's weight to Sandhya's weight.

That means, $\frac{\text{Lalita's weight}}{\text{Sandhya's weight}} = \frac{50}{40} = \frac{5}{4} = 5 : 4$

So, we have found that in doing comparison of two number by division we may get two ratios by changing the order of division. To understand the order of division, we may denote the two numbers as first term and second term. In ratio the first term is called Antecedent and Second term as Consequent.

In the ratio of Sandhya's weight to Lalita's weight which is 4:5, the antecedent is 4 and the consequent is 5. On the other hand, ratio of Lalita's weight to Sandhya's weight is 5:4, the antecedent is 5 and the consequent is 4.

In general ratio of two quantities a and b is expressed as a:b, here 'a' is a called the antecedent and 'b' is the consequent.

Sandhya and Lalita mentioned their weights in the same unit that is kilogram, But if Sandhya would have expressed her weight as 400 Hectogram instead of 40 kilogram and Lalita as 5000 decagram instead of 50 kilogram than the ratio of their weight would have been-

Sandhya's weight : Lalita's weight $\frac{400}{5000} = \frac{2}{25} = 2 : 25$

Similarly, if their weights are expressed in units different from each other then we will find ratios which will be different from each other.

In this way, if the ratio of two definite quantities varies then it will not be meaningful. So, it is necessary that the two quantities be expressed in the same unit.

Generally speaking to find the ratio of two quantities a and b the two quantities must be in the same unit.

Example : Length of two bridges A and B on the National Hightway is 150 meter and 750 decimeter find the ratio of A and B.

Length of A is150 meter

Length of B is 700 decimeter =75 meter (The two quantities are expressed in the same unit)

$\therefore$ A's length : B's length $= \frac{150}{75} = \frac{2}{1} = 2:1$

That means A's length is twice of B's length.

Try these

1. Height of two memorial pillars P and Q is 30 decimeter and 150 centimeter respectively. Find P's height: Q's height and Q's height : P's height.
2. Weight of Ikbal's and Rantu's school bags is respectively 12 Hectogram and 1500 gram. Find the ratio of their school bags.

Proportionate Share

Shrawanti and Ahalya's mother invested Rs. 500 and Rs 1000 respectively in a stall at the Bihu function and at the end of the function they made a profit of Rs. 1200. Now, how much each of them will get?

Here,

Shrawantis mother's investment is Rs. 500

Ahalya's mother's investment is Rs. 1000

Total investment Rs =1500

Therefore, Shrawanti's mother's investment : total investment $= \frac{500}{1500} = \frac{1}{3}$

Ahalya's mother's investment : total investment $= \frac{1000}{1500} = \frac{2}{3}$

Shrawanti's mother's investment $= \frac{1}{3}$ times of total investment

Ahalya's mother's investment $= \frac{2}{3}$ times of total investment

So, Shrawanti's mother will get $\frac{1}{3}$ times of total profit

That means Shrawanti's mother will get $\frac{1}{3}$ of Rs 1200

$= 1200 \times \frac{1}{3} =$ Rs 400

Similarly, Ahalya's mother will get $\frac{2}{3}$ times of total profit.

That means $\frac{2}{3}$ of Rs 1200

$= 1200 \times \frac{2}{3}$ = Rs 800

Alternative method

The profit will be divided according to the ratio of Shrawanti's and Ahalya's mother's investment.

Ratio of their investment, $\frac{500}{1000} = \frac{1}{2} = 1 : 2$

That means if Shrawanti's mother gets 1 part, Ahalya's mother will get 2 parts.
So, the total profit will be divided equally into 3 parts and

Shrawanti's mother will get $\frac{1}{3}$ of Rs.1200 = Rs 400

Ahalya's mother will get $\frac{2}{3}$ of Rs.1200 = Rs 800

Equivalent ratio

Example (a)

(i) The length of a garden is 40 meter and breadth 30 meter.

The ratio of the garden's length to breadth, $\frac{\text{length}}{\text{breadth}} = \frac{40}{30} = \frac{4}{3} = 4 : 3$

(ii) The number of boy students and girl students in calss VI are respectively 36 and 27.

The ratio of boy students to girl students $\frac{\text{Number of boys}}{\text{Number of girls}} = \frac{36}{27} = \frac{4}{3} = 4 : 3$

(iii) Cost of one Rosogulla is Rs12 and Cost of one pedah is Rs 9

Therefore ratio of the cost of Rosogulla to pedah

$\frac{\text{Cost of Rosogulla}}{\text{Cost of Pedha}} = \frac{12}{9} = \frac{4}{3} = 4 : 3$

From the above examples we have seen that $\frac{40}{30} = \frac{36}{27} = \frac{12}{9} = \frac{4}{3} = 4 : 3$

or $40 : 30 = 36 : 27, \quad 12 : 9 = 4 : 3$

That means the lowest common form of $40 : 30 = 36 : 27, 12 : 9$ is same and it is $4 : 3$

That is why $40 : 30, 36 : 27, 12 : 9$ are called equivalent ratio.

As we express a fraction in its lowest form in the same way we can find the greatest common factor of the antecedent and consequent of a ratio and dividing them by the greatest common factor we can express it in its lowest form.

In the given, examples note how we got the lowest form of the ratio as 4 : 3

$$\frac{\text{Length of the garden}}{\text{Breadth of the garden}} = \frac{40}{30}$$

The greatest common factor of 40 and 30 =2×5=10

Therefore, $\frac{\text{Length of the garden}}{\text{Breadth of the garden}} = \frac{40 \div 10}{30 \div 10} = \frac{4}{3} = 4:3$

$$\begin{array}{r|l} 2 & 40,\ 30 \\ \hline 5 & 20,\ 15 \\ \hline & 4,\ 5 \end{array}$$

In the same way, $\frac{\text{Number of boy students}}{\text{Number of girl students}} = \frac{36}{27}$

The greatest common factor of 36 and 27 =3×3=9

Therefore, $\frac{\text{Number of boy students}}{\text{Number of girl students}} = \frac{36 \div 9}{27 \div 9} = \frac{4}{3} = 4:3$

$$\begin{array}{r|l} 3 & 36,\ 27 \\ \hline 3 & 12,\ 9 \\ \hline & 4,\ 3 \end{array}$$

Similarly, $\frac{\text{Cost of rosogulla}}{\text{Cost of pedah}} = \frac{12}{9}$

The greatest common factor of 12 and 9 =3

Therefore, $\frac{\text{Cost of rosogulla}}{\text{Cost of pedah}} = \frac{12 \div 3}{9 \div 3} = \frac{4}{3} = 4:3$

$$\begin{array}{r|l} 3 & 12,\ 9 \\ \hline & 4,\ 3 \end{array}$$

Example (b).

Let us write the ratio 4 : 6 in its different form.

$$4:6 = \frac{4}{6} = \frac{4 \div 2}{6 \div 2} = \frac{2}{3} = 2:3$$

$$4:6 = \frac{4}{6} = \frac{4 \times 2}{6 \times 2} = \frac{8}{12} = 8:12$$

$$4:6 = \frac{4}{6} = \frac{4 \times 3}{6 \times .....} = \frac{12}{.....} = 12:18$$

$$4:6 = \frac{4}{6} = \frac{4 \times .....}{6 \times .....} = \frac{.....}{.....} = 16:.....$$

Note that

2 : 3 = 8 : 12 = 12 : 18 = 16 : 24 ..... (= 4 : 6)

That means 2 : 3 = 8 : 12 = 12 : 18 = 16 : 24, ... although they are in different forms they mean the same ratio.

They are called Equivalent Ratio.

Write the lowest form of these equivalent ratio.

Note to teacher : The teacher will drive in the concept of equivalent ratio by giving them example of equivalent ratio and non equivalent ratio.

What we have learnt-

If we multiply or divide the antecedent and consequent of a given ratio by the same number then the resulting ratios are equivalent to the given ratio.

Try these

(i) Each student will take a ratio and write five of its equivalent ratios. A student will interchange his or her note book with the student sitting next to him/her and will ascertain the correctness of the same. If necessary he/she will take help of the teacher.

(ii) Match the following ratios on the left hand side with the equialent ratios given a the right hand side.

Ratio	Equivalent ratio
3:7	1:2
10:15	99:63
99:999	9:21
1000:2000	2:3
11:7	11:111

Let us try

Example 1 : Cost of 1 pair of shoe and 1 pair of sandal is in the ratio 5 : 2. Let us write its 5 equivalent ratios.

$$5:2 = \frac{5}{2} = \frac{5\times2}{2\times2} = \frac{10}{4} = 10:4 \qquad \text{(Multiplying both terms by 2)}$$

$$\text{or, } 5:2 = \frac{5}{2} = \frac{5\times3}{2\times3} = \frac{15}{6} = 15:6 \qquad \text{(Multiplying both terms by 3)}$$

$$\text{or, } 5:2 = \frac{5}{2} = \frac{5\times100}{2\times100} = \frac{1500}{200} = 1500:200 \qquad \text{(Multiplying both terms by 100)}$$

$$\text{or, } 5:2 = \frac{5}{2} = \frac{5\times500}{2\times500} = \frac{2500}{1000} = 2500:1000 \qquad \text{(Multiplying both terms by 500)}$$

Example 2 : The ratio of cost of 1 trouser and cost of 1 shirt is 5 : 2. If the cost of the shirt is Rs 1200.00 then what is the cost of the trouser?

Here, $\frac{\text{Cost of trouser}}{\text{Cost of shirt}} = \frac{5}{2}$

Cost of the shirt = Rs 1200

But $1200 = 2 \times 600$

So, if we multiply both the terms by 600 we will get the equivalent fraction of the ratio $\frac{5}{2}$

Here, $\frac{\text{Cost of trouser}}{\text{Cost of shirt}} = \frac{5}{2} = \frac{5 \times 600}{2 \times 600} = \frac{3000}{1200}$

Therefore cost of the trouser = Rs 3000

Example 3 : The length of the main door of a house is 180 cm and its breadth 110 cm. What is the ratio of the length to breadth.

Solution : Length of the door : Breadth of the door = 180 : 110

$$= \frac{180}{110}$$

$$= \frac{180 \div 10}{110 \div 10} = \frac{18}{11}$$

2	180, 110
5	90, 55
	18, 11

$\therefore$ The HCF of 180 and 110 $= 2 \times 5 = 10$

Length of the door : Breadth of the door = 18 : 11

Example 4 : What is the ratio of 1 quintal to 60 kilograms?

1 Quintal = 100 kilogram

Therefore 1 Quintal : 60 kilogram

= 100 kilogram : 60 kilogram

$$= \frac{100}{60} = \frac{100 \div 20}{60 \div 20}$$

$$= \frac{5}{3} = 5 : 3$$

2	100, 60
2	50, 30
5	25, 15
	5, 3

$\therefore$ HCF of 100 and 60 $= 2 \times 2 \times 5 = 20$

Example 5 : The total population in a village is 340. If the number of women is 160 What is the ratio of men to women?

Solution : Total population = 340

Number of women = 160

That means, number of men = 340 – 160 = 180

Therefore, number of men : Number of women

= 180 : 160

$= \frac{180}{160}$

$= \frac{9}{8} = 9 : 8$

Example 6 : Find any four equivalent ratios of 7 : 4

Solution : $7 : 4 \quad = \frac{7}{4} = \frac{7\times2}{4\times2} = \frac{14}{8} \quad = 14 : 8$

$7 : 4 \quad = \frac{7}{4} = \frac{7\times3}{4\times3} = \frac{21}{12} \quad = 21 : 12$

$7 : 4 \quad = \frac{7}{4} = \frac{7\times4}{4\times4} = \frac{28}{16} \quad = 28 : 16$

$7 : 4 \quad = \frac{7}{4} = \frac{7\times5}{4\times5} = \frac{35}{20} = 35 : 20$

That means, four equivalent ratios are 14 : 8, 21 : 12, 28 : 16 and 35 : 20

Example 7 : Fill in the blanks with suitable number.

$$\frac{120}{360} = \frac{\square}{60} = \frac{12}{\square} = \frac{30}{\square} = \frac{\square}{72}$$

Solution :

First of all, let us take $\frac{120}{360} = \frac{\square}{60}$

Here, $360 = 60\times6$

That means $360 \div 6 = 60$

Therefore to find the missing number, that is $\square$ we will have to divide 120 by 6

$\therefore$ The required number to be filled in $\square$ is $120 \div 6 = 20$

Similarly, $\frac{120}{360} = \frac{12}{\square}$

Here $120 = 12 \times 10$

That means $120 \div 10 = 12$

Therefore, to find the missing number we will have to divide 360 by 10

That means the missing number = $\square = 360 \div 10 = 36$

In the same way, $\frac{120}{360} = \frac{30}{\square}$ the missing number at $\square$ is 90

Lastly, $\frac{120}{360} = \frac{\square}{72}$, The number at $\square$ is 24.

Example 8 : Divide Rs 180 between Montu and Rantu in the ratio 2:3

Solution : To divide between Montu and Rantu in the ratio 2:3 means if Montu gets Rs 2, Rantu will get Rs. 3

That means Montu will get Rs 2 and Rantu will get Rs.3

That means from 2+3 = 5 rupees, Montu will get Rs.2 and Rantu will get Rs.3

In other words Montu will get $\frac{2}{5}$ parts and

Rontu will get $\frac{3}{5}$ Parts of rupees 5.

Therefore, of Rs.180 Montu will get $\frac{2}{5} \times 180 = \text{Rs.}72$

and Rantu will get $\frac{2}{5} \times 180 = \text{Rs.}108$

Try these

1. The ratio of the cost of one mathematics book to one English book is 5 : 3. If the price of the Mathematics book is Rs.125 what is the cost of the English book?
2. The ratio of the length of the door to the window of your room is 7 : 4 ; if the length of the window is 120 centimeter what is the length of the door?
3. Find three equivalent ratios to 2 : 3

Proportion

Example (a)

Sabita bought 4 pencils from a shop for Rs. 20 and Nayan bought from another shop 6 pencils of same type for Rs. 30. The question that came to their mind is whether they have bought the pencils at the same rate or one of the shop has sold them at a higher rate. At last Sabita claimed that she has bought the pencils at a lower rate because she has spent less amount of money than Nayan. On the otherhand Nayan claimed that he has bought the pencils at a lower rate because he has got more number of pencils than Sabita. As they could not come to a clear decision they went to Sabita's sister Reema who is a student of class X.

Let us see how Reema solved the problem. Reema first calculated the ratio of the money spent by Sabita and Nayan. Then she calculated the ratio of the pencils bought

So, Rs.20 : Rs. 30 = $\frac{20}{30} = \frac{2}{3} = 2 : 3$

Ratio of the pencils bought, 4 pencils : 6 pencils = $\frac{4}{6} = \frac{2}{3} = 2:3$

Reema proved that Rs. 20 : Rs. 30 = 4 pencils : 6 pencils (= 2 : 3)

As the ratio of the money spent by them and number of pencils they got is same.

therefore they have bought the pencils at the same rate. And Reema also explained that

as Rs. 20: Rs.30 = 4 pencils : 6 pencils

the four quantities Rs. 20, Rs. 30, Rs. 4 pencils , 6 pencils are in proportion.

Note the four quantities that are in proportion. Are their units same? The units of the four quantities are not same. The unit of the first two quantities is 'rupees' and the units of the other two quantities is 'number' of pencils. That means, when four quantities are in proportion, their units may not be same.

Example (b)

Kuhiram worked for 3 days for a family and earned Rs.1050 and Bolaram worked for another family for 5 days and earned Rs. 1750. Will their daily wage be same? Let us examine this with the idea of proportion.

The ratio of their earning, Rs.1050 : Rs.1750 $= \frac{1050}{1750}$

$= \frac{3\times350}{5\times350} = \frac{3}{5} = 3:5$

Again the ratio of the number of days they worked, 3days : 5 days $= \frac{3}{5} = 3:5$

That means, Rs.1050 : Rs. 1750 = 3 days : 5 days (= 3 : 5)

The ratio of their earnings and the ratio of the days they worked are same.

Therefore their daily wage will be same.

Again as

Rs.1050 : Rs.1750 = 3 days : 5 days

Therefore, Rs.1050, Rs.1750, 3days, 5days these four quantities are in proportion.

Note the proportionate quantities in the above example (a) and (b)

(a) Rs. 20 : Rs. 30 = $= \frac{20}{30} = \frac{4\times5}{6\times5} = \frac{4}{6} = 4$ pencils : 6 pencils

(b) Rs.1050 : Rs. 1750 $= \frac{1050}{1750} = \frac{3\times350}{5\times350} = \frac{3}{5} = 3$ days : 5 days

Observe the relations among the proportionate quantities in the above examples and try if you can find (a) the price of each pencil and (b) daily wage.

What we have learnt

Four quantities a, b, c and d are said to be in proportion if a : b = c : d We use the Symbol : : (as) insted of '=' (equal) sign

That means a:b : : c : d implies a, b, c, d quantities are in proportion. First and fourth terms are known as extreme terms, second and third terms are known as middle terms.

Example 1: Let us examine if the terms below are in proportion.

(i) 10, 15, 14, 21

(ii) 33 cm, 39 cm, 44cm, 52cm

(iii) Rs. 5, Rs.7, Rs.15m, 20 m

(iv) 75 cm, 1m, Rs.60, Rs.80

(v) 20 sqm, 16 sqm, 25 sqm, 20 sqm

Solution :

(i) 10, 15, 14, 21

$$10 : 15 = \frac{10}{15} = \frac{2}{3} = 2:3$$

and $$14 : 21 = \frac{14}{21} = \frac{2}{3} = 2:3$$

That means, $10 : 15 = 14 : 21 \ (= 2 : 3)$

So, 10, 15, 14, 21 these four quantities are in proportion.

(ii) 33 cm, 39 cm, 44 cm, 52 cm

$$33 \text{ cm} : 39 \text{ cm} = \frac{33}{39} = \frac{11}{13} = 11:13$$

and $$44 \text{ cm} : 52 \text{ cm} = \frac{44}{52} = \frac{11}{13} = 11:13$$

That means, 33 cm : 39 cm = 44 cm : 52 cm (= 11 : 13)

So, 33 cm, 39 cm, 44 cm, 52 cm these four quantities are in proportion.

(iii) Rs. 5, Rs. 7, 15 m, 20 m

Rs. 5 : Rs. 7 = 5:7

and $$15 \text{ m} : 20 \text{ m} = \frac{15}{20} = \frac{3}{4} = 3:4$$

So, Rs. 5 : Rs. 7 $\neq$ 15 m : 20 m

So, Rs. 5 , Rs. 7, 15 m and 20 m these four quantities are not in proportion.

(iv) 75cm, 1 m, Rs. 60, Rs. 80

1 m = 100 cm

$$\text{Ratio of 75 cm and 1 m} = 75 \text{ cm} : 100 \text{ cm} = \frac{75}{100} = \frac{3}{4} = 3:4$$

$$\text{Ratio of Rs. 60 and Rs 80} = \text{Rs. 60} : \text{Rs. 80} = \frac{60}{80} = \frac{3}{4} = 3:4$$

That means, 75 cm : 100 cm = Rs. 60 : Rs. 80 (= 3 : 4)

Therefore, 75 cm, 1 m, Rs. 60 , Rs.80 these four quantities are in proportion.

(v) 20 sqm, 16 sqm, 25 sqm, 20 sqm

$$20 \text{ sqm} : 16 \text{ sqm} = \frac{20}{16} = \frac{5}{4} = 5:4$$

and $$25 \text{ sqm}, 20 \text{ sqm} = \frac{25}{20} = \frac{5}{4} = 5:4$$

That means 20 sqm : 16 sqm = 25 sqm : 20 sqm

So, 20 sqm, 16 sqm, 25 sqm, 20 sqm these four quantities are in proportion.

Example 2: Let us prove that 4 meter and 10 meter, 26 kilogram and 65 kilogram are in proportion.

Solution : $4 \text{ meter} : 10 \text{ meter} = \frac{4}{10} = \frac{2}{5}$

$$26 \text{ kilogram} : 65 \text{ kilogram} = \frac{26}{65} = \frac{2}{5}$$

Therefore, 4 meter and 10 meter, 26 kilogram and 65 kilogram these quantities are in proportion.

Example 3 : Let us find out if 4 days, 18 days, Rs. 250 and Rs.1125 are in proportion.

Solution : Here $4 \text{ days} : 18 \text{ days} = \frac{4}{18} = \frac{2}{9}$

$$\text{Rs. 250} : \text{Rs. 1125} = \frac{250}{1125} = \frac{2}{9}$$

So, $\frac{4}{18} = \frac{250}{1125} \left(= \frac{2}{9} \right)$

Therefore, 4 days, 18 days, Rs. 250 and Rs.1125 terms are in proportion.

Exercise

1. Find the ratios (where possible, if not state reason)
   (i) 55 m to 11 m
   (ii) 55 cm to 11 m
   (iii) 750 gram to 35 gram
   (iv) 750 gram to 1.5 kilogram
   (v) Rs. 2 to Re.1
   (vi) Rs. 2 to 10 paise
   (vii) 5 kilogram to 50 gm
   (viii) 5 kilogram to 5 meter
   (ix) Rs. 200 to 200 people
   (x) 10 elephants to 5 horses
   (xi) 100 ampere to 10 ampere
   (xii) 10 kilogram to 10 kilometer
2. Are the following terms in proportion
   (a) 1, 3, 5, 7 (b) 2, 6, 9, 27 (c) 8, 6, 18, 16 (d) 3, 8, 15, 40
3. State whether right/wrong-
   (a) 12 : 18 : : 28 : 12
   (b) 16 : 24 : : 20 : 30
   (c) 8 : 7 : : 16 : 14
   (d) 99 kg : 45 kg = Rs. 44 : Rs. 20
   (e) 7.5 litre : 15 litre = 5 kg : 10 kg
   (f) 45 km : 60 km = 12 hours : 15 hours
   (g) 2 hours : 5 hours = 8 litre : 20 litre
4. Express in lowest form (wherever possible)
   (i) 500 : 50 (ii) 50 : 500 (iii) 100 : 400
   (iv) 5 : 17 (v) 819 : 126 (vi) 128 : 8
5. Find three equivalent ratio to the ratios given below.
   (i) 500 : 50 (ii) 50 : 500 (iii) 15 : 20 (iv) 5 : 17
6. Present age of A and B is 15 years and 25 years respectively. What will be the ratio of their age after 45 years.
7. Ratio of two numbers is 7 : 12. What will be the new ratio if its antecedent is doubled and consequent is increased by 2.
8. Find the ratio of the total even numbers to the total odd numbers of the serial number from 1 to 20.

9. In each of the following ratios considering the consequent of the ratio as 100 find the equivalent ratios.

   1 : 4 ; 2 : 5 ; 5 : 2 ; 7 : 20

10. **Find the ratios**

    (i) Multiples of 5 to the multiples of 10 of the numbers from 1 to 100

    (ii) The total number with 5 in the units place of the numbers from 1 to 100 to the total number (100)

    (iii) The total number with 0 in the units place of the numbers from 1 to 100 to the total number.

11. **Draw figures with ruler and pencil and find the ratio**

    (i) The number of diagonal of a quadrilateral to the number of its sides.

    (ii) The number of diagonals of a pentagon and to the number of its sides.

    (iii) The number of hypotenuse of a right angled triangle to its number of sides.

    (iv) The number of diagonals of a hexagon to its number of sides (Note the number of diagonals and sides)

12. Present age of Tagor is 10 years. Her sister Maloti's age is two times of her age. What is the ratio of their age ? What was the ratio of their age 5 years ago and what will be the ratio 5 years after?

    Arrange the ratios in ascending order.

13. The ratio of two numbers is 7 : 12; If the larger number is 84 what is the smaller number?

14. If we melt two metals at a certain temperature, we may get a new metal. This type of metal is called an alloy. The ratio of copper and lead in such an alloy is 9 : 7. If the alloy contains 117 kilogram of copper what is the amount of lead in it?

15. Lai and Lessai are two brothers. Present age of Lessai is 29 years and Lai is 3 years older to him. What is the ratio of their age?

16. The ratio of monthly income of Padum's mother and father is 4 : 5; If his father's income is Rs.50,000, what is the monthly income of his mother?

17. Divide Rs.145 in the ratio 1 : 4.

18. Rs.145 is divided into two parts in a certain ratio One of the part is Rs. 27. Find the ratio taking Rs. 27 as the antecedent of the ratio.

Answers

1. (i) 11 : 1 (ii) 1 : 20 (iii) 150 : 7 (iv) 1 : 2 (v) 2 : 1 (vi) 20 : 1 (vii) 100 : 1 (viii) No, because the two quantities cannot be expressed in same units (ix) No, because the two quantities cannot be expressed in the same unit. (x) 2 : 1 (xi) 10 : 1 (xii) No, because the two quantities cannot be expressed in the same unit.
2. (a) No (b) Yes (c) No (d) Yes
3. (a) Wrong (b) Correct (c) Correct (d) Correct (e) Correct (f)Wrong (g) Correct
4. (i) 10 : 1 (ii) 1 : 10 (iii) 1 : 4 (iv) 5 : 17 is in the lowest form (v) 13 : 2 (vi) 16 :1
6. 6 : 7 7. 1 : 1 8. 1 : 1
9. 25 : 100; 40 : 100; 250 : 100, 35 : 100
10. (i) 1 : 2 (ii) 1 : 1 (iii) 1 : 3 (iv) diagonals 9 , sides 6; ratio 3 : 2
12. 1 : 2, 1:3, 3: 5 13. 28 14. 91 kilogram 15. 29 : 32 16. Rs. 40,000
17. Rs. 29, Rs.116, 18. 27 : 118

Unitary method : The word 'Unitary' has come from the word 'Unit' which means one. If we know the unitary method it becomes easier for us to find the value of required number of units in many cases. Let us understand with examples.

6 ball pens cost Rs. 42, Price of each ball pen being same. What will be the cost of 9 such ball pens.

Solution : Cost of 6 ballpens is Rs. 42. To find the price of 1 ballpen we will have to divide Rs. 42 by 6. That means,

Cost of 1 ball pen = 42 ÷ 6 = Rs. 7

∴ Cost of 9 ball pens = 7 × 9 = Rs. 63

We can do this in a shorter method.

Number of pens	Cost in Rs.	Reason
6	42	Given
1	42 ÷6 = 7	Decrease, divide
9	9×7 = 63	Increase, multiply

Cost of 6 bananas is Rs. 48 and Cost of 8 pears is Rs.56 Which fruit is costlier?

Solution : (a) Cost of 6 banans Rs. 48

∴ Cost of 1 banana $= \frac{48}{6}$ = Rs. 8

(b) Cost of 8 pears Rs. 56

∴ Cost of 1 pear = $\frac{56}{8}$ = Rs. 7

In short

	Number of Fruits	Cost (In Rs)
(a)	6 bananas	48
	1 bananas	48 ÷ 6 = 8
(b)	8 Pears	56
	1 Pear	56 ÷ 8 = 7

Therefore banana is costlier

Exercise

1. Cost of 1 Mathematics book is Rs. 45.00. What is the cost of 10 books?
2. Cost of 12 story books is Rs. 300, what is the cost of 3 story books?
3. Cost of 1 dozen (12) of eggs is Rs.60, What is the cost of one and half dozen of eggs?
4. One packet of Gelpen contains 5 pens. The maximum retail price of a packet is Rs. 30. The shop keeper sells it for Rs. 25. What is the cost of 24 pens?
5. 600 men can complete a work in 40 days. In how many days the work will be completed by 400 men?

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Answers

1. Rs. 450.00 2. Rs.75.00
3. Rs. 90.00 4. Rs. 120.00 5. 60 days