

Chapter - 8

Comparing Quantities



8.1 You have already learnt about ratio in Class VI.

Look at the following example –

Find the ratio between ₹ 50 and 7500 paise.

We know that ₹ 1 = 100 paise.

∴ ₹ 50 = 5000 paise.

∴ The required ratio is = 5000 : 7500
= 2 : 3

To compare the quantity of two numbers, the unit must be, the same.

8.2 Equivalent Ratios :

To know whether different ratios are equivalent or not they may be compared among each others. To do these we have to express the ratios in fraction and change them into like fraction. If these like fractions are equal, then we say that the fractions are equivalent and these equivalent ratios are said to be in proportion.

Look at the following examples :

Example 1 : Are the ratios 3 : 4 and 4 : 5 equivalent?

Solution : First we have to examine whether the two ratios are equal or not.

$$\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20}, \quad \frac{4}{5} = \frac{4 \times 4}{5 \times 4} = \frac{16}{20}$$

We have seen that $\frac{15}{20} < \frac{16}{20}$

i.e $\frac{3}{4} < \frac{4}{5}$

∴ 3 : 4 is not equivalent to 4 : 5.

Example 2 : The medal tally of a district in Inter District Sports Meet in the year 2016 and 2017 is given below. Can you tell in which year the performance was better?

Year	Gold	Silver
2016	5	7
2017	3	8

Comparing Quantities

Solution : In the year 2016, Gold : Silver = 5 : 7

In the year 2017, Gold : Silver = 3 : 8

Now we have to compare the two ratios.

$$\frac{5}{7} = \frac{5 \times 8}{7 \times 8} = \frac{40}{56}, \quad \frac{3}{8} = \frac{3 \times 7}{8 \times 7} = \frac{21}{56}$$

Definitely $\frac{40}{56} > \frac{21}{56}$

ie $5 : 7 > 3 : 8$

Therefore we can say that the team performed better in the year 2016.

In our previous class we have learnt about Unitary Method. In this method first we find value of one unit and then the value of required number of units.

Example 3 : In a grocery shop, the weight of 15 rice bags, is found to be 90 kgs. If each bag contains equal amount of rice, then what will be the weight of rice in 45 rice bags?

Solution : 1st method :

$$\text{Weight of 15 rice bags} = 90\text{kg}$$

$$\text{Weight of 1 rice bag} = \frac{90}{15} \text{ kg}$$

$$\begin{aligned} \therefore \text{Weight of 45 rice bags} &= \left(\frac{90}{15} \times 45 \right) \text{kg} \\ &= 270 \text{ kg} \end{aligned}$$

2nd method :

$$\text{Let, that the weight of rice in 45 bags} = x \text{ kg}$$

$$\therefore 45 : x = 15 : 90$$

$$\text{Or } \frac{45}{x} = \frac{15}{90}$$

$$\text{Or } x = \frac{45 \times 90}{15} = 270$$

$$\therefore \text{The weight of 45 rice bags, is 270 kg}$$

In the 1st method, weight of 1 rice bag is determined first and then using this, weight of 45 rice bags is calculated. This is unitary method. In the 2nd method, the ratios are transferred into proportion and then the equation obtained has been solved.

Example 4 : If the price of 22.5 meter cloth is ₹ 1350 then how many meters of cloth you can buy with ₹ 765.

Solution :

With ₹ 1350, one can buy cloth = 22.5 m

∴ With ₹ 1, one can buy cloth = $\frac{22.5}{1350}$ m

∴ With ₹ 765, one can buy cloth $\left(\frac{22.5}{1350} \times 765 \right)$ m

$$= \frac{51}{4} \text{ m}$$

$$= 12.75 \text{ m}$$

Exercise - 8.1

- Find the ratios –
 - 5 km and 500 m
 - 6 week and 21 days
 - 30 days and 210 hours
 - 12 meter and 100 centimeter
 - 7 years and 18 months
- Examine whether the following ratios are equivalent or not
 - 4:5 and 2:3
 - 7:15 and 21:45
 - 6:8 and 54:72
 - 13:14 and 14:13
- The price of three geometry boxes is ₹ 33. How many geometry boxes can be bought with ₹ 286 ?
- Kalpna has bought 10 balls with ₹ 160 and Jaymati has bought 8 balls with ₹ 128. Find if both of them have purchased at an equal price ?
- Jenelia needs to pay 66,000/- as house rent for the whole year. If she wants to pay house rent in every three months then how much will she need to pay each time ?

8.3 Percentage : An easy method to compare quantities :

Tikhar's father is very satisfied with the result of the high school final examination of two schools locality. From Jamuguri School, 36 students got 1st division out of 48 students who appeared in the examination and the rest passed in 2nd division. On

Comparing Quantities

the other hand from Amguri school 42 students got 1st division out of 60 students who appeared and the rest of the students passed in 2nd division. A question came to the mind of Tikhar's father which of the two schools, performed comparatively better?

If we see, it seems that the result of Amguri school is better as 42 numbers of students got 1st division while from Jamuguri School 36 students got 1st division. However, seeing this it can't be said the result of which school is better. Cannot be determined only on this basis. In situation such as this the total number of students appearing from a school should also be observed. Now let us compare this by another method.

Result of Jamuguri school–

Out of 48 no. of students, 1st division holder = 36 nos.

∴ Out of 1 no. of students, 1st division holder = $\frac{36}{48}$ nos.

∴ Out of 100 no. of students, 1st division holder = $\frac{36 \times 100}{48}$ nos.
= 75 nos.

That is 75% students from Jamuguri school, got 1st division.

Result of Amguri School–

Out of 60 no. of students, 1st division holder = 42 nos.

∴ Out of 1 no. of students, 1st division holder = $\frac{42}{60}$ nos.

∴ Out of 100 no. of students, 1st division holder = $\frac{42 \times 100}{60}$ nos.
= 70 nos.

That is 70% students of Amguri school, got 1st division.

Therefore, comparing the result of both the schools with 100, it is seen that in fact the result of Jamuguri School is better than Amguri School. The process of comparing with 100 is said to be percentage or rate of percentage. Percentage or rate of percentage is an easy method to compare any quantity.

Keep in mind :

Percentage is a numerator of a fraction, the denominator of which is 100 and it is used to compare quantities. The word percent is derived from a Latin word (Per centum). The meaning is 'per hundred'.

The symbol of percentage is ' % '. That is 1% means 1 part of one hundred. It is written as –

$$1\% = \frac{1}{100} = 0.01$$

$$\text{Similarly, } 5\% = \frac{5}{100} = 0.05$$

$$20\% = \frac{20}{100} = 0.20,$$

$$72\% = \frac{72}{100} = 0.72 \text{ etc.}$$

Observe the following examples –

Look at the table below showing favourite games of 100 students of a School. Observe the table and fill up the blanks.

Name of games	Name of Students	Fraction	Rate of percentage	Style of writing	Style of reading
Football	40	$\frac{40}{100}$	40	40%	40 percent
Volleyball	20	$\frac{20}{100}$	20	20%	
Cricket	30				
Kabadi	10				
Total	100				

8.3.1 Different Methods to find out Percentage

In filling the above table you expressed fractions with denominator 100 as percentage. The value of the numerator was the value of the percentage. But, if the table of a quantity or the denominator of a fraction is not 100, then such quantities or fractions can be expressed in percentage in the following way.

Observe the following example – In a test Rasmita secured 18 marks out of 20. What percentage of marks was secured by her ?

Solution :

$$\text{Total marks} = 20$$

$$\text{Rasmita secured} = 18$$

$$\therefore \text{Value of fraction} = \frac{18}{20}$$

Comparing Quantities

1st Method : Using unitary method–

Out of 20 marks Rasmita secured = 18 marks

∴ Out of 1 marks Rasmita secured = $\frac{18}{20}$ marks

∴ Out of 100 marks Rasmita secured = $\left(\frac{18}{20} \times 100\right)$ marks

$$= (18 \times 5) \text{ marks}$$

$$= 90 \text{ marks}$$

∴ Percentage will be = 90%

2nd Method : Multiplying by 100%

$$\frac{18}{20} \times 100\% = 90\%$$

3rd Method : By making denominator 100 –

$$\begin{aligned}\frac{18}{20} &= \frac{18 \times 5}{20 \times 5} \\ &= \frac{90}{100} = 90\%\end{aligned}$$

4rd Method : Multiplying $\frac{100}{100}$

$$\begin{aligned}\frac{18}{20} \times \frac{100}{100} &= \frac{18 \times 5}{100} \\ &= \frac{90}{100} = 90\%\end{aligned}$$

Discuss in group and write :

Observe the following examples and write which will be more comfortable to compare in every case.

(a) Minu's shirt $\frac{4}{5}$ part is cotton
 $\frac{1}{5}$ part is polyster

Or

80% Cotton

20% Polyster

(b) Earth's surface $\frac{71}{100}$ part is water
 $\frac{29}{100}$ part is soil

Or

71% Water

29% Soil

8.4 Convert fraction to percentages :

Let us observe some example :

Example 1 : Express $\frac{3}{4}$ in percentage.

Solution : $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$

Alternately $\frac{3}{4} = \frac{3}{4} \times 100\% = 75\%$

Example 2 : Express $\frac{6}{5}$ in percentage.

Solution : $\frac{6}{5} = \frac{6 \times 20}{5 \times 20} = \frac{120}{100} = 120 \times \frac{1}{100} = 120\%$ Alternately, $\frac{6}{5} = \frac{6}{5} \times 100\% = 120\%$

Example 3 : In a school there are 16 girls out of 40 students in Class VII. Express the number of girls in percentage.

Solution : Total no. of students in class = 40

Number of girl students in class = 16

\therefore The percentage of girls = $\frac{16}{40} \times 100\% = 40\%$

8.5 Conversion of decimal fraction into percentage :

We have discussed how fraction and decimal fraction can be converted to percentage. We have seen that first we have to express the decimals into fraction.

Example 1 : Express the following decimals in to percentage –

(a) 0.75

(b) 1.07

(c) 0.3

Solution : (a) 0.75

$$= 0.75 \times 100\%$$

$$= \frac{75}{100} \times 100\%$$

$$= 75\%$$

(b) 1.07

$$= 1.07 \times 100\%$$

$$= \frac{107}{100} \times 100\%$$

$$= 107\%$$

(c) 0.3

$$= 0.3 \times 100\%$$

$$= \frac{3}{10} \times 100\%$$

$$= 30\%$$

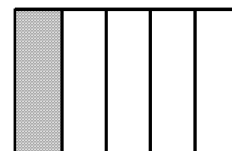
8.6 Conversion of percentage into fraction :

We have discussed the conversion of fraction and decimal fraction in to percentage. In our daily life we have to do just the opposite, that is – conversion of percentage into fraction or decimal fraction. Observe the following example –

Example 1 : If you are asked to colour 20% of the adjacent diagram, what will you do?

First you have to find out the value of 20% in fraction.

$$\text{That is } 20\% = \frac{20}{100} = \frac{1}{5}$$



$$20\% = \frac{1}{5} \text{ part}$$

Therefore you have to divide the diagram into 5 equal parts then have to colour one part.

Comparing Quantities

Example 2 : Express the following percentage values into fraction.

(i) 32%

(ii) 125%

Solution : (i) $32\% = \frac{32}{100} = \frac{8}{25}$

(ii) $125\% = \frac{125}{100} = \frac{5}{4}$

8.7 Conversion percentage into decimal fraction :

The process of converting percentage into decimal fraction is similar with conversion in to fraction. Here, you have to express only the last value in decimal.

Example 3 : Convert the following percentage into decimal fraction.

(i) 46%

(ii) 125%

(iii) 2.84%

Solution : (i) $46\% = \frac{46}{100} = 0.46$

(ii) $125\% = \frac{125}{100} = 1.25$

(iii) $2.84\% = \frac{284}{100}\% = \frac{284}{100} \times \frac{1}{100} = \frac{284}{10000} = 0.0284$

8.8 Conversion of Ratio into percentage :

You know that ratio is unitless fraction. Therefore to convert ratio into percentage first we have convert ratio into fraction then fraction into percentage.

Example 4 : Express the following ratios in percentage .

(i) 1:2

(ii) 5:4

(iii) 15:25

Solution : (i) $1:2 = \frac{1}{2} = \frac{1}{2} \times 100\% = 50\%$

(ii) $5:4 = \frac{5}{4} = \frac{5}{4} \times 100\% = 125\%$

(iii) $15:25 = \frac{15}{25} = \frac{15}{25} \times 100\% = 60\%$

8.9 Conversion of percentage into Ratio :

In this case first you have to convert the percentage into fraction and then write the fraction in ratio.

Example 5 : Express the following percentage in the lowest form of ratio.

(i) 12%

(ii) 50%

(iii) 12.5%

Solution : (i) $12\% = \frac{12}{100} = \frac{3}{25} = 3:25$

(ii) $50\% = \frac{50}{100} = \frac{1}{2} = 1:2$

$$(iii) 12\frac{5}{10}\% = \frac{125}{10} \times \frac{1}{100} = \frac{1}{8} = 1:8$$

8.10 Use of percentage :

In our day to day life percentage is used in almost every aspect. Let us see the following examples –

- (i) The rate of pass percentage in the HSLC examination in the year 2019 is 60.23 %
- (ii) In the last election, 79% voters cast their votes.
- (iii) Eva has bought a set of dress at 15% discount.
- (iv) Diganta is taking a loan at the rate of 8.75% from bank.
- (v) 18% GST (Goods and Services Tax) is implemented.

Activity : After discussing in group give five examples where percentage is used.

Example 6 : Determine the value –

- (i) 15 % of ₹ 500 (ii) 25% of 1 hour (in minute) (iii) 1% of 1234
- (iv) 12.5% of ₹ 640

Solution : (i) 15 % of ₹ 500

$$= ₹ \left(500 \times \frac{15}{100} \right)$$

$$= ₹ 75$$

(iii) 1% of 1234

$$= 1234 \times \frac{1}{100}$$

$$= 12.34$$

(ii) 25% of 1 hour

$$= \left(60 \times \frac{25}{100} \right) \text{Minute (1 hour = 60 minute)}$$

$$= 15 \text{ minute}$$

(iv) 12.5% of ₹ 640

$$= 640 \times \frac{125}{10} \times \frac{1}{100}$$

$$= \frac{8000}{100} = 80$$

Example 7 : If the value of 10% of a number is 40, then find out the number.

Solution :

Let the number be 'x'

Given that, 10% of x = 40

$$\text{Or } x \times \frac{10}{100} = 40$$

Comparing Quantities

$$\text{Or } \frac{x}{10} = 40$$

$$\therefore x = 40 \times 10 = 400$$

Hence the determined number is 400

Example 8 : What percentage of 64 is 16 ?

Solution : Let the percentage be $x\%$

$$\therefore x\% \text{ of } 64 = 16$$

$$\text{Or } 64 \times \frac{x}{100} = 16$$

$$\text{Or } 64x = 16 \times 100$$

$$\text{Or } x = \frac{16 \times 100}{64}$$

$$\text{Or } x = 25$$

\therefore The percentage is $= 25\%$

Exercise - 8.2

1. Express the following fraction in percentage –

$$(i) \frac{3}{5} \quad (ii) \frac{7}{12} \quad (iii) \frac{15}{32} \quad (iv) \frac{91}{175} \quad (v) \frac{21}{40}$$

2. Express the decimal fraction in percentage –

$$(i) 0.8 \quad (ii) 5.75 \quad (iii) 0.08 \quad (iv) 32.1 \quad (v) 0.004$$

3. Express in fraction –

$$(i) 20\% \quad (ii) 32\% \quad (iii) 0.5\% \quad (iv) 7.25\% \quad (v) 180\%$$

4. Convert the percentages into decimal fraction and express the fraction in lowest form of the following–

$$(i) 18\% \quad (ii) 0.25\% \quad (iii) 60\% \quad (iv) 42.5\% \quad (v) 56\%$$

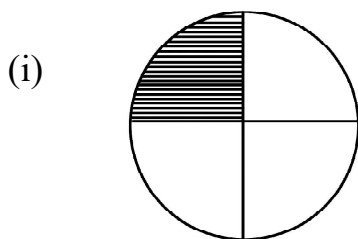
5. Express in percentage –

$$(i) 4:10 \quad (ii) 11:20 \quad (iii) 19:50 \quad (iv) 3:25 \quad (v) 9:4$$

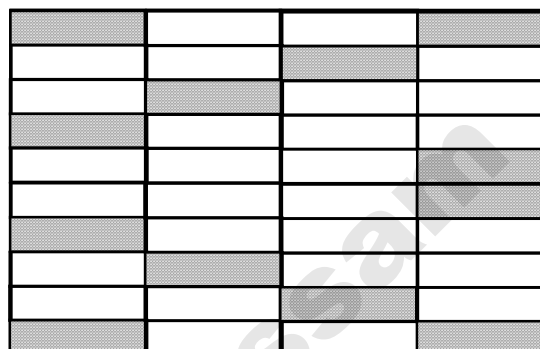
6. Express in ratio —

$$(i) 72\% \quad (ii) \frac{15}{4}\% \quad (iii) 0.14\% \quad (iv) 6\frac{2}{5}\% \quad (v) 4.6\%$$

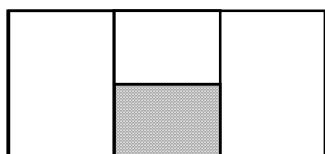
7. Express the coloured portion of the following figures in percentage —



(iii)



(ii)



8. Express in percentage

(i) 8 hours of day

(ii) 72 persons out of 80

(iii) 25 paise of ₹ 5

9. Determine the value —

(i) 20% of 50

(ii) 30% of 600

(iii) 20% of 5 kms

(iv) 30% of 1 hour

10. If value of 20% of a number is 50, determine the number.

11. 13% of which number is 91 ?

12. What percentage of ₹ 40 is ₹ 16 ?

13. Express '30 out of 40' and '40 out of 50', both in percentage. Which is greater?

14. The area of a garden is 400 square meter. The garden is arranged in the following manner.

i) 30% space of the garden is reserved for flowers. Find the area of the space for flowers.

ii) The area of a pond in the garden is 80 square meter. What percentage of the garden is covered by the pond ?

8.11 Increase or decrease in percentage :

Sometimes, it is necessary to know the rate of percentage in the increase or decrease of any quantity. For example the increase of population in a decade of a district is 2,50,000 to 3,50,000. Instead of numbers if it is said that the increase is 40% then it is easier to understand. Let us see how to convert the given decrease or increase into rate of percentage.

Comparing Quantities

$$\begin{aligned}\text{Rate of percentage of increase} &= \frac{\text{change in quantity}}{\text{original quantity}} \times 100\% \\ &= \frac{\text{increase of quantity}}{\text{the quantity with which compared}} \times 100\% \\ &= \frac{(3,50,000 - 2,50,000)}{2,50,000} \times 100\% \\ &= \frac{1,00,000}{2,50,000} \times 100\% \\ &= 40\%\end{aligned}$$

Example 1 : Royal has started a business with ₹ 80,000. After one year, it becomes ₹ 1,20,000. What is the rate of percentage of increased amount?

$$\begin{aligned}\text{Solution : Rate of percentage of increase} &= \frac{\text{change in amount}}{\text{total amount}} \times 100\% \\ &= \frac{\text{increase in amount}}{\text{the amount of which is compared with}} \times 100\% \\ &= \frac{(1,20,000 - 80,000)}{80,000} \times 100\% \\ &= \frac{40,000}{80,000} \times 100\% \\ &= 50\%\end{aligned}$$

Example 2 : (i) By what percentage ₹ 2400 is more than ₹ 2000 ?

(ii) By what percentage ₹ 2000 is less than ₹ 2400 ?

Solution : (i) Increased amount

$$= \text{Rupees } 2400 - ₹ 2000$$

$$= ₹ 400$$

$$\begin{aligned}\therefore \text{percentage of increase} &= \frac{\text{increased amount}}{\text{total amount}} \times 100\% \\ &= \frac{400}{2000} \times 100\% \\ &= 20\%\end{aligned}$$

$$\begin{aligned} \text{(ii) Decreased amount} &= ₹ 2400 - ₹ 2000 \\ &= ₹ 400 \end{aligned}$$

$$\begin{aligned} \therefore \text{percentage of decreased} &= \frac{\text{decreased amount}}{\text{original amount}} \times 100\% \\ &= \frac{400}{2400} \times 100\% \\ &= \frac{50}{3}\% = 16.67\% \end{aligned}$$

Example 3 : In the last 5 years, the population of illiterate people in a country has decreased from 180 lakhs to 130 lakhs. What is the rate of percentage of decrease?

Solution : Total quantity = Total numbers of illiterate people in the beginning
= 180 lakhs

$$\begin{aligned} \text{Change in quantity} &= \text{Decreased number of illiterate people} \\ &= (180 - 130) \text{ lakhs} = 50 \text{ lakhs} \end{aligned}$$

$$\begin{aligned} \therefore \text{Rate of percentage of decreased} &= \frac{\text{change of quantity}}{\text{original quantity}} \times 100\% \\ &= \frac{50}{180} \times 100\% = 27.77\% \end{aligned}$$

8.12 Uses of percentage in profit-loss

The purchasing of any commodity is called its cost price. It is written as CP (Cost Price). The price in which the commodity is sold is called its selling price. It is written as SP (Selling Price).

If a shopkeeper buys any commodity for 100 Rupees and sell it for ₹ 120 then the shopkeeper will get a profit of ₹ 20. It means that the selling price is more than cost price then the difference ie 'selling price – cost price' is called profit.

Likewise if a shopkeeper buys any commodity for ₹ 100 and sells it for ₹ 70 then the shopkeeper will get a loss of ₹ 30. It means if selling price is lower than cost price then the difference 'cost price – selling price' is called as loss.

If cost price < selling price. Then profit = SP – CP

If cost price = selling price. Then no profit or loss

If cost price > selling price, then loss = Cost price – Selling price

Comparing Quantities

Let us complete the following table now–

Sl. No.	Cost Price (₹) (CP)	Selling Price(₹) (SP)	Profit (₹)	Loss (₹)
(i)	375	325	----	----
(ii)	1200	1325	----	----
(iii)	430	----	25	----
(iv)	430	----	----	25
(v)	----	140	----	20
(vi)	----	140	20	----

Profit or loss can be converted to rate of percentage. Profit or loss are always determined on the basis of cost price. Let us observe the following example.

If the cost price of a pen is ₹ 50 and selling price is ₹ 60, then profit will be $60 - 50 = ₹ 10$

∴ Rate of percentage of profit

$$= \frac{\text{Profit}}{\text{Cost price}} \times 100\%$$

$$= \frac{10}{50} \times 100\% = 20\%$$

Always keep in mind :

$$\text{Percentage of profit} = \frac{\text{Profit}}{\text{Cost price}} \times 100\%$$

$$\text{Percentage of profit} = \frac{\text{selling price} - \text{cost price}}{\text{cost price}} \times 100\%. \text{ SP} > \text{CP}$$

Likewise –

$$\text{Percentage of Loss} = \frac{\text{Loss}}{\text{cost price}} \times 100\%$$

$$\text{Percentage of Loss} = \frac{\text{cost price} - \text{selling price}}{\text{cost price}} \times 100\% , \text{ CP} > \text{SP}$$

Observe the following example :

Example 1 : A watch is bought for ₹ 800 and is sold for ₹ 952.

- (i) What is the profit?
- (ii) What is the percentage of profit?

Solution :

$$\begin{aligned} \text{(i) Profit} &= \text{Selling price} - \text{Cost Price} \\ &= (952 - 800) \text{ Rupees} \\ &= 152 \text{ ₹} \end{aligned}$$

$$\text{(ii) \% of Profit} = \frac{152}{800} \times 100\% = \frac{152}{8}\% = 19\%$$

Example 2 : Cost price of a ball is Rs.150. If the shopkeeper sells the ball with a loss of 10% then what is the selling price of it ?

Solution :

$$\text{Given, Cost price} = 150 \text{ Rupees}$$

$$\text{Percentage of loss} = 10\%$$

We have to find out selling price

10% loss against cost price

$$\text{i.e. 10\% of 150 Rupees} = \left(150 \times \frac{10}{100}\right) \text{ Rupees} = ₹ 15$$

$$\begin{aligned} \therefore \text{Selling price} &= \text{Cost price} - \text{Loss} \quad (\text{Loss} = \text{CP} - \text{SP}) \\ &= (150 - 15) ₹ = ₹ 135 \end{aligned}$$

Example 3 : Selling price of a toy is ₹ 480. If the shopkeeper get a profit of 20% then what is the cost price of the toy?

Solution :

$$\text{Given, Selling price} = 480 \text{ Profit is and } 20\%$$

We have to find out cost price

$$\text{Profit} = 20\% \text{ of cost price} = \text{CP} \times \frac{20}{100} = \text{Cost price} \times \frac{1}{5}$$

We know,

$$\text{Selling price} - \text{Cost price} = \text{Profit}$$

$$\begin{aligned} \therefore \text{Selling price} &= \text{Profit} + \text{Cost Price} \\ &= 20\% \text{ of cost price} + \text{Cost price} \end{aligned}$$

$$= \text{Cost price} \times \frac{1}{5} + \text{Cost price}$$

$$= \text{Cost price} \left(1 + \frac{1}{5} \right)$$

$$\text{i.e., } 480 = \text{Cost price} \times \frac{6}{5}$$

$$\therefore \text{Cost price} = 480 \times \frac{5}{6} = 400$$

$$\therefore \text{Cost price of the toy} = ₹ 400.$$

8.13 Simple interest :

People borrow money from different sources or banks in various needs. At the time of refunding against any loan amount one has to pay an extra amount at a definite rate. This extra amount is known as interest.

Let us observe an example :

A man has deposited an amount of ₹ 50,000 in a bank for a period of one year. After one year the man has got an extra amount of ₹ 2000 in addition to ₹ 50,000 i.e. total amount received ₹ 52,000.

In this case, ₹ 50,000 is the principal and ₹ 2,000 is the interest against ₹ 50,000 for 1 year. Again ₹ 52,000 is known as amount in total. The period from taking a loan and repaying is called as the time of interest.

It is not like that interest should be paid only when money is borrowed, but also interest is received from bank for money deposited in it. Now-a-days people invest money in post office, mutual fund, fixed deposit of various banks to get profitable interest.

8.13.1 Rate of Interest :

At the time of taking loan or depositing money there is an agreement of interest. Generally this agreement is based on ₹ 100 and for a period of one year and interest is calculated based on principal and time of interest, at this rate. The interest of one year on ₹ 100 is called as rate of interest per annum or interest percentage.

By rate of interest ₹ 5 per annum we understand that interest of ₹ 100 in one year is ₹ 5 or we understand rate of interest = 5%.

In the above example, interest of ₹ 50,000 in 1 year was ₹ 2,000. Therefore interest of ₹ 100 in 1 year will be –

$$= \left(\frac{2000}{50000} \times 100 \right) = ₹ 4$$

Therefore, in that case rate of interest = 4%

Observe :

Sometimes, interest is calculated after 6 months or 3 months. If there is no mention of time like 3 or 6 months for calculation of interest, it is understood as annual.

Let us take an example :

Amal has borrowed ₹ 6,000 on 20% rate of interest per annum. Calculate the interest to be paid by Amal after one year.

Solution : Borrowed sum = ₹ 6000

Rate of interest per years = 20%

i.e. interest of ₹ 100 in 1 year = ₹ 20

$$\therefore \text{interest of ₹ 1 in 1 year} = ₹ \frac{20}{100}$$

$$\therefore \text{interest of ₹ 6000 in 1 year} = \frac{20}{100} \times 6000 ₹ = ₹ 1200$$

Therefore, after one year Amal has to Pay

$$= ₹ (6000 + 1200) = ₹ 7200$$

To find out the interest of one year we may calculate by using the following relationship

Let principal or sum borrowed is P and rate of interest per annum as R%

Interest of ₹ 100 in 1 year is ₹ R

$$\therefore \text{Interest of ₹ 1 in 1 year} = ₹ \frac{R}{100}$$

$$\begin{aligned} \therefore \text{Interest of ₹ P in 1 year} &= ₹ \frac{R}{100} \times P \\ &= ₹ \frac{P \times R}{100} \end{aligned}$$

Interest for multiple years :

In the above example, at the end of one year the amount of interest on Rs. 6000 borrowed by Amal at 20% rate of interest was –

Comparing Quantities

$$\frac{20}{100} \times 6000 = ₹ 1200$$

Now if Amal borrows that amount for 2 years then he has to pay interest –
 $= ₹ 2 \times 1200 = ₹ 2400$

Likewise the amount of interest he has to pay if he borrows for 3 years
 $= 3 \times 1200 = ₹ 3600$

This way of calculating interest where principal is not changed is known as simple interest. As the number of years increased the interest also increased.

We can find the following general relationship to determine interest for more than one years–

Interest to be paid on a principal of ₹ P at R % at T years–

Interest of ₹ 100 in 1 year is ₹ R

$$\therefore \text{Interest of ₹ 1 in 1 year} = ₹ \frac{R}{100}$$

$$\therefore \text{Interest of ₹ P in 1 year} = ₹ \frac{R}{100} \times P$$

$$\therefore \text{Interest of ₹ P in T year} = ₹ \frac{P \times R \times T}{100}$$

$$I = \frac{P \times R \times T}{100} \text{ or } I = \frac{PRT}{100}$$

Amount to be paid at the end of T years

$$\text{Amount } A = P + I$$

Interest is of two types. Simple Interest and compound interest. In this lesson we have discussed simple interest only. Here interest implies only simple interest. You will learn about compound interest in next class.

Example : Calculate the interest of ₹ 840 at ₹ 5 percentage per annum for 5 years.

Solution : Here principal (P) = ₹ 840

Rate of interest (R) = 5

Time for interest (T) = 5 years

$$\therefore \text{Required Simple Interest } I = \frac{P \times R \times T}{100} = \frac{840 \times 5 \times 5}{100} = ₹ 210$$

Example 2 : Calculate the interest and amount for a period of 2 years and 6 months on principal ₹ 4500. Rate of interest is 15%

Solution : Time of interest = 2 years 6 months

$$= \left(2 + \frac{6}{12} \right) \text{ years} = \frac{5}{2} \text{ years}$$

Principal P = ₹ 4500

Rate of interest R = 15

$$\begin{aligned} \therefore \text{Simple interest } I &= \frac{P \times R \times T}{100} \\ &= \frac{4500 \times 15 \times \frac{5}{2}}{100} = \frac{3375}{2} \\ &= ₹ 1687.50 \end{aligned}$$

$$\begin{aligned} \therefore \text{Amount } A &= P + I \\ &= ₹ (4500 + 1687.50) = ₹ 6187.50 \end{aligned}$$

Exercise - 8.3

- Find the profit or loss in the following transactions. Also find profit per cent or loss percent in each case.
 - A ball bought for ₹ 300 and sold for ₹ 450.
 - A TV bought for 10,000 and sold for ₹ 15,500.
 - A cupboard bought for ₹ 45,000 and sold for ₹ 3,500.
 - A shirt bought for ₹ 400 and sold for ₹ 280.
- Population of an area decreases from 45,000 to 42,000. Calculate percentage of decrease.
- A book bought for ₹ 250 and sold for ₹ 190. What is the profit or loss in percentage?
- Rohan has bought a TV for ₹ 10,500 and sold it at a profit of 30%. Calculate the selling price of the TV.
- Sumona has bought a car for ₹ 2,50,000 and sold for ₹ 2,30,000. What is the loss or profit in percentage?
- A motor cycle has been sold for ₹ 23,000 at a profit of 15%. What is the cost price of the motor cycle?
- Ratan has bought an almirah for ₹ 6,250 and sold at a loss of 24%. What is the selling price of the almirah?

Comparing Quantities

8. Determine the interest of ₹ 5000 at 8% rate of interest per annum for 3 years.
9. Dalimi pays ₹ 120 as interest for one year at a rate of interest of 5%. How much money did she borrow ?
10. Find out the interest of ₹ 1,25,000 at 10% rate of interest for a period of 1 year and 6 months.
11. Find out the interest and total amount of ₹ 1500 at rate of interest of ₹ 12 per annum for 2 years and 9 months.

What we have learnt

1. To compare two quantities (eg : height, weight, distance, number etc) the units of the quantities to be compared must be the same.
2. To make two ratios equivalent, they are compared by converting them to like fractions.
3. Another way of comparing quantities is percentage. Percentages are numerators of fractions with denominator 100.
4. Fractions can be converted to percentage and percentage can be converted to fractions.
5. Decimals can be converted to percentage and on the other hand percentage can be converted to decimals.
6. Percentage can be converted to ratios.
7. Percentage are widely used in our daily life.
 - ♦ Percentage is used in profit or loss.
 - ♦ Percentage is used in definite amount of decrease or increase.
 - ♦ Percentage is used to calculate interest on the borrowed amount.

