Chapter 8

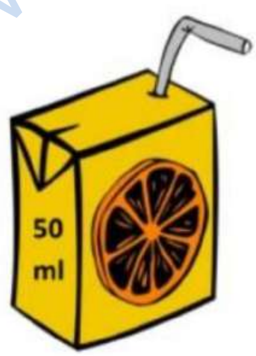
Comparing Quantities

Introduction to Comparing Quantities

In our daily life, there are many occasions when we compare two quantities. But what exactly quantity is? The amount or number of a material is called quantity. Now let's see some examples of quantity.

The number of apples in the basket is called quantity.

The volume of an orange juice in a packet is a quantity.

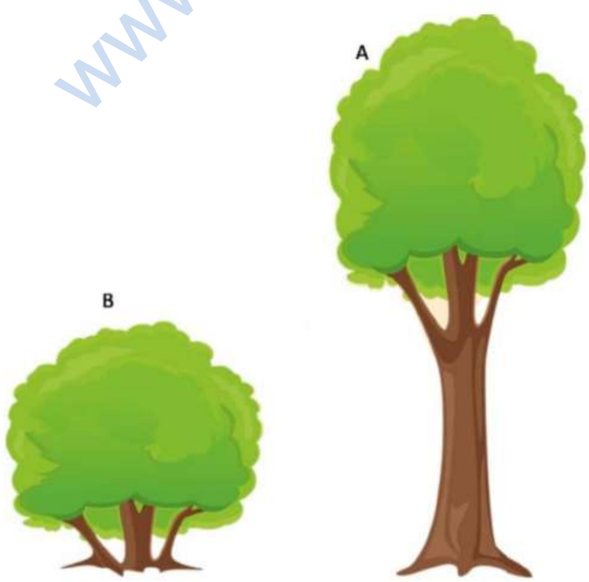


The number of students in class VII is a quantity.

The number of gulab jamun in a bowl is a quantity.

So we see each quantity around us has different attributes. Now we see how to compare quantities?

Look at the picture of trees can you tell which tree is smaller and which one is taller? By looking at the picture we say yes because we see the height of tree A is more than the height of tree B. Hence, the height of tree A is greater than tree B.



Now we take another example in which we compare the height of Harsha and Amit in which we find

1. Harsha is two times taller than Amit.
Or
2. Amit's height is half of Harsha's height.
In this way, we compare two quantities.

Ratio

A ratio is a simple mathematical term used for comparing two or more quantities that are measured in the same units.
In general, we express the ratio as a fraction. Suppose the ratio of A is to B is the fraction $\frac{A}{B}$, written as A: B

The maximum speed of a cheetah is 90 km/h. This is how fast he runs and we represent these two quantities by division as $\frac{90}{1}$ Cheetah runs 90 km in 1 hour.

Here, we relate distance with time in terms of division.

Hence, the ratio $\frac{90}{1}$ written as 90:1

Now we see what is the difference between ratio and fraction?

Suppose, Nobita went to the fruit market to buy certain fruit. She bought 1 kg of apples and 2 kg of papaya and $\frac{1}{2}$kg of mango.

If we compare the weight of apples to the weight of papaya we get1:2 or ($\frac{1}{2}$).

Here, ($\frac{1}{2}$) is a ratio.

Also, Nobita has $\frac{1}{2}$kg of mango. Here, ($\frac{1}{2}$) is a fraction.

Now we see, in both cases, the numbers are the same. But in the first case ($\frac{1}{2}$) is called a ratio and in the second case ($\frac{1}{2}$) is called a fraction because in the first case we compare two quantities. In the second case, we are talking about only one quantity (Mango).

Example:
(i) What is the ratio of pens to pencils?
(ii)What is the ratio of pens to the total number of pens and pencils?

(i) Total number of pens and pencils = 8
Number of pens = 3
Number of pencils = 5

So, the ratio of pens to pencils = 3:5 = $\frac{3}{5}$

(ii) Total number of pens and pencils = 8
Number of pens = 3

So, the ratio of pens to total number of pens and pencils = 3:8 = $\frac{3}{8}$

Example: Find the ratio of 10 km to 500 m.
First, convert both the distances to the same unit.
So, 10 km = 10 × 1000 m = 10000 m.
Thus, the required ratio, 10 km: 500 m is 10000: 500
HCF of 10000 and 500 is 500

Ratio is A:B = $\frac{10000 \div 500}{500 \div 500}$ = 20:1

Example: Find the ratio of Rs 4 to 500 Paisa

First, convert both the quantities in the same unit.

500 Paisa = ₹$\frac{500}{100}$=₹ 5

Hence, the required ratio is 4: 5

Equivalent Ratios

Two ratios can be compared by converting them into like fractions.If the two fractions are equal, then the given two ratios are called equivalent ratios.

We can get an equivalent ratio by multiplying or by dividing the numerator and denominator of a given ratio by the same number.

Example: In a class test Pranav scored 150 marks in 4 subjects and for the same Nisha scored 225 marks in 6 subjects.
Here, the ratios of their scores to the number of subjects are 150:4 and 225:6

To convert these ratios into like fraction we divide numerator and denominator of the first ratio by 2 and numerator and denominator of the second ratio by 3 we get

$\frac{150}{4} = \frac{150 \div 2}{4 \div 2} = \frac{75}{2}$ and $\frac{225}{6} = \frac{225 \div 3}{6 \div 3} = \frac{75}{2}$

We see after simplifying both the fractions are the same.

Hence, 150:4 = 225:6

Example: Are the ratios 2:5 and 12: 30 equivalent?

To check this we need to know whether $\frac{2}{5} = \frac{12}{30}$

We have, $\frac{2}{5}$

To convert these ratios into like fraction we multiply numerator and denominator by 6

$\frac{2}{5} = \frac{2X6}{5X6} = \frac{12}{30}$

Here we find that both the fractions are the same $\frac{12}{30} = \frac{12}{30}$

Hence, the ratios 2:5 and 12: 30 are equivalent.

Proportion:

If the two ratios are equal, we say that they are in proportion and the symbol use '::' or '=' to equate the two ratios.
Example: Consider the two ratios 5:15 and 7:21.
Here we find that,
5:15 = 1:3 and 7:21 = 1: 3
∴ 5:15 =7:21

After simplifying both the ratios are the same.
Thus, $5:15 = 7:21$ are in proportion.

The scale of proportionality in maps or models:

Suppose Sheldon made a sketch of his uncle's house as shown in the figure. To draw a sketch the scale chosen by Sheldon is 100 cm = 1 cm. This is because of the lack of space.

In this case, the ratio of heights in the drawing should be the same as the ratio of actual heights i.e.,

$$\frac{Actual\ height\ of\ house}{Actual\ height\ of\ Car} = \frac{Height\ of\ house\ in\ drawing}{Height\ of\ car\ in\ drawing}$$

If these ratios are equal then they are said to be in proportion.

Example: The scale of a map is 2 cm: 30 km. What is the actual distance between the two towns if they are 10 cm apart on the map?

Here we cannot draw 30 km distance on a paper so, we are chosen 2 cm for 30 km.

Thus, if the distance on the map is 2 cm, the actual distance is 30km.

We have 2 cm: 30 km
Let the actual distance between the two towns be x km when the two towns are 10 cm apart. Thus, we have the following information.

$$\text{Distance on the map} = \text{Actual distance}$$

$$2 \text{ cm} = 30 \text{ km}$$

10 cm = x km

2: 10 = 30: x

(Since the distance on the map is proportional with the actual distance)

$$\frac{2}{10} = \frac{30}{x}$$

(Reciprocal both side)

$$\frac{10}{2} = \frac{x}{30}$$

$$x = \frac{10}{2} \times 30$$

x = 150 k

Important Points

If A:B::C:D, then

1. A, B, C, D are respectively known as the first, second, third, and fourth term.
2. A and D are called extremes while B and C are called means.
3. Product of extremes = Product of means i.e., (A × D = B × C)

If A:B::B:C, then
1. A, B, Care said to be in continued proportion.
2. C is called third proportional to A and B and fourth proportional to A, B, B.

3. $\frac{A}{B} = \frac{B}{C} \Rightarrow$ B × B = A × C

B is called the mean proportional or geometrical mean between A and C.

Example: If 6:4 = x : 12, find the value of x.
We have,
6 : 4 = x : 12

$$\frac{6}{4} = \frac{x}{12}$$

$\frac{6}{4} \times 12 = x$

$x = 18$

Alternate method

We have,

6: 4= x : 12

We know that

Product of Extremes = Product of Means

$$6 \times 12 = 4 \times x$$

$$72 = 4x$$

$$\frac{4x}{4} = \frac{72}{4}$$

$$x = 18$$

Example: If the 6 chapattis are consumed by 3 peoples, how many people will consume 100 chapattis?

Suppose x people will consume 100 chapattis.

We have,

x = 100

∴ 3: x = 6: 100

We know that

Product of Extremes = Product of Means

$$3 \times 100 = 6 \times x$$

$$300 = 6x$$

$$\frac{6x}{6} = \frac{300}{6}$$

$$x = 50$$

So, 50 peoples will consume 100 chapattis.

Unitary Method

A method in which the value of the unit (one) quantity is first obtained to find the value of any required quantity is called the unitary method.

Example: Rakesh went to the stationery shop and bought 6 erasers for ₹60. What was the cost of 3 erasers?

According to the definition of the unitary method first, we need to find out the cost of 1 eraser.

So, the cost of 6 erasers = ₹60

∴ The cost of 1 eraser = $\frac{Total\ cost\ of\ erasers}{Total\ number\ of\ erasers}$

= $\frac{60}{6}$ = ₹10

∴ The cost of 1 eraser = ₹10

Hence, the cost of 3 erasers = 3× Cost of 1 eraser

3× 10 = ₹30

So, in the unitary method,
⟹First we found the cost of 1 eraser.
⟹Then we found the cost of 3 erasers by cost of 1eraser by multiplying 3.

Example: If the cost of 25 lunch boxes is ₹ 1575, what was the cost of 15 lunch boxes?

According to the definition of the unitary method first, we need to find out the cost of 1 lunch box.

So, the cost of 25 lunch box= ₹1575

∴The cost of 1 lunch box = $\frac{Total\ cost\ of\ lunch\ boxes}{Total\ number\ of\ lunch\ boxes}$

$= \frac{1575}{25}$ = ₹63

∴The cost of 1 lunch box = ₹63

Hence, the cost of 15 lunch boxes = ₹ 63 ×15=₹945

Percentage

Percentages are an important part of our everyday lives. We use percentages in different areas. Such as % discount in shopping malls, % rainfall of the year, bank interest rates, % housing loan, % of the girl passed in 10th class, % rate of petrol and diesel. Percentages are a useful way of comparing fractions with different denominators. Percentages give information which is often easier to understand than fractions.

Example: $\frac{45}{100}$ of the total number of students in the class are male, is quite difficult to interpret, while the statement 45% of the total number of students in the class are male is easier to understand

Meaning of Percentage:

Percent: The word percent is derived from the Latin word 'percentum' which means 'per hundred'.

Percentage: Percentage are numerators of fractions with denominator 100. The percentage is denoted by the symbol '%' i.e., 1 % means 1 out of 100. It can be written as 1%= 1/100=0.01

Example: When we say Rakesh gives 20% of his income as income tax, this means that he gives ₹ 20 out of every hundred rupees of his income.

To understand this let us consider the following example.

Aniket is fond of collecting souvenirs. He collected 100 souvenirs from different countries. From the table can you tell the percentage of souvenirs of any country?

Name of the country	No. of souvenir (per hundred)	Fraction	Written as
India	12	$\frac{12}{100}$	12%
India U.K.	20	$\frac{20}{100}$	20%
Germany	15	$\frac{15}{100}$	15%
China	23	$\frac{23}{100}$	23%
Canada	30	$\frac{30}{100}$	30%
	100		

Percentages when the total is not a hundred
In such cases, we need to convert the fractions to an equivalent fraction with denominator 100.
Any fraction can be expressed into a percentage by multiplying it by 100.

$$\frac{A}{B} \times \frac{100}{100} = \frac{(A \times 100)}{B}\%$$

We multiply the fraction by 100/100. This does not change the value of the fraction.

Example: Write $\frac{3}{25}$ as a percent.

$$\frac{3}{25}=\frac{3}{25}\times\frac{100}{100}=\left(\frac{3}{25}\times 100\right)\% = \left(\frac{300}{25}\right)\%=12\%$$

Example: Write $\frac{1}{20}$ as a percent.

$$\frac{1}{20}=\frac{1}{20}\text{ x }\frac{100}{100}=\left(\frac{1}{20}\times 100\right)\% = \left(\frac{100}{20}\right)\%=5\%$$

Example: There are 50 students in class VII, and 35 go to the picnic. Calculate the percentage of the number of students who go to the picnic?
35 students of the 50 go to the picnic.

Percentage of the number of students in class VII = $\frac{35}{50}\times\frac{100}{100}$

$$=\left(\frac{35}{50}\times 100\right)\% = \frac{350}{50} = 70\%$$

So, 70% of the students go to the picnic

Converting fractional numbers to Percentage

To convert a fractional number into percentages, multiply the fraction by 100 and put the % sign.

$$\frac{A}{B}\times\frac{100}{100}=\frac{(A\times 100)}{B}\%$$

Example: Convert the fractional number $\frac{3}{50}$ into percent.

$$\frac{3}{50}=\frac{3}{50}\times\frac{100}{100}=\left(\frac{3}{50}\times 100\right)\%=\left(\frac{300}{50}\right)\%=6\%$$

Example: Convert the fractional number $\frac{5}{40}$ into percent.

$\frac{5}{40} = \frac{5}{40} \times \frac{100}{100} = (\frac{5}{40} \times 100)\%= (\frac{500}{40})\%=12.5\%$

Converting Decimals to Percentage

To convert a decimal number into a percentage, multiply the decimal number by 100 and put the % sign.

Decimal number × 100 = Number in %

Express each of the following decimal number into percent.

(i) 0.55 (ii) 0.07 (iii) 2.2

(i) $0.55 = 0.55 \times 100\% = \frac{55}{100} \times 100\% = 55\ \%$

(ii) $0.07 = 0.07 \times 100\% = \frac{7}{100} \times 100\% = 7\%$

(iii) $2.2 = 2.2 \times 100\% = \frac{22}{10} \times 100\% = 220\%$

Converting Percentages to fraction or decimals

To convert a percentage into a fraction or a decimal, divide it by 100%.

$$A\% = \frac{A}{100}$$

Express 140 % percentage into a fraction.

$140\ \% = \frac{140}{100} = \frac{14}{10} = \frac{7}{5}$

Express 140 % percentage into a decimal.

$140\ \% = \frac{140}{100} = 1.40$

Express 3 % percentage into a decimal.

$3\ \% = \frac{3}{100} = 0.03$

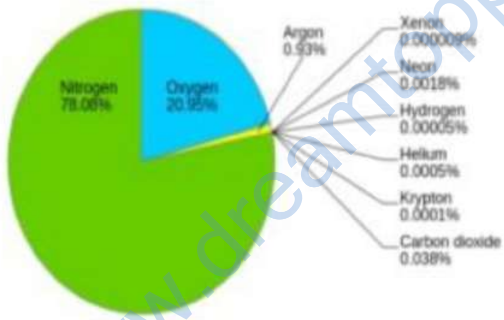
Express 20 % percentage into a fraction.

$20\ \% = \frac{20}{100} = \frac{1}{5}$

Percentage - Concept of Whole

The percentage is also used as the concept of the whole. Suppose if we add parts together it always gives a whole (100%). Similarly, if the whole is divided into parts it combines and gives you a whole or 100%.

Example: As we know the air is a mixture of gases and that gases are present in the atmosphere in different percentages. When we add the percentage of different gases in the atmosphere we get 100%



So, if we are given one part, we can always find out the other part. Suppose Rashmi has 1 whole pizza, it consists of 8 parts out of these Rashmi gives 4 parts to her brother, we can always find out the remaining parts of the pizza.

Example: In a school, 30% students are girls, find the percentage of boys.

Total number of students in the school = 100%

Percentage of girls in a school = 30%

The percentage of boys in a school = Total number of students in the school (100%) - Percentage of girls in a school

The percentage of boys in a school = 100% - 30% = 70%

Example: 68% candidates appear for the JEE exam. What percent of candidates not appear for the exam?

Total number of candidates= 100%

Candidates appear for the JEE exam = 68%

Percent of candidate did not appear for the exam = Total number of candidates (100%) - Candidates appearing for the JEE exam

Percent of candidate did not appear for the exam = 100% - 68% = 32%

Estimation

Fun with Estimation

Percentages help us to estimate the parts of an area.

Example: What percent of the adjoining figure is shaded

We first find the fraction of the figure that is shaded. From this fraction, the percentage of the shaded part can be found.

Now, in the figure, we see that

Total number of petals in the flower = 4

Shaded petals = 3

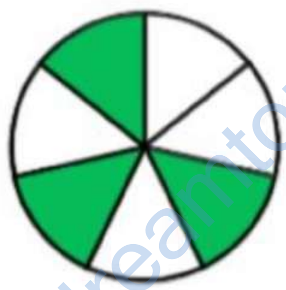
Therefore, the shaded portion in the flower = $\frac{3}{4}$

Now,
We know that to convert a fractional number into percentage we multiply the fraction by 100 and put % sign

$$\frac{3}{4} \times \frac{100}{100} = \left(\frac{3}{4} \times 100\right) \% = \frac{300}{4} = 75\%$$

Hence, in the above figure 75% part of the figure is shaded.

Example: In the given figure:
(i) Estimate what part of the figure is coloured?
(ii) Find the percent which is coloured



In the given figure,
Total number of parts in the circle = 7
Total number of coloured parts in the circle = 3

(i) Therefore, the coloured parts in the circle = $\frac{3}{7}$

Now,
We know that to convert a fractional number into percentage we multiply the fraction by 100 and put % sign

(ii) $\frac{3}{7} \times \frac{100}{100} = \left(\frac{3}{7} \times 100\right) \% = \frac{300}{7} = 42.85\%$

Hence, 42.85% part of the figure is coloured.

Use of Percentages

Interpreting percentages

As we know a percentage is a number without having any unit. It is denoted by a % symbol. So, 30 % is nothing but 30 parts per 100 which can also be written as $\frac{30}{100}=\frac{3}{10}$

. Therefore, the percentage value can be interpreted as a fraction by dividing the value by 100.

Example: Shree is spending 60% part of his salary.

60% means 60 parts out of 100 or $\frac{60}{100}$.

This means Shree is spending ₹ 60 out of every ₹ 100

Example: In a city 30% population are children.

30% means 30 parts out of 100 or $\frac{30}{100}$.

This means in a city there are 30 children out of 100 peoples.

Converting percentages to "How Many"

By using the given percentage, we calculate exactly what the amount or what quantity one is talking about.

Example: Sani is saving 50% of his salary it means Ravi is saving ₹ 50 for every ₹ 100 he has been earning. So, how much Ravi is saving if the salary is ₹ 50000 per month?

We know that,

Ravi saves 50% of his salary.

Replacing 50% by $\frac{50}{100}$ for calculating the amount,

Therefore, the total amount Ravi is saving

$= \frac{50}{100} \times 50,000 = ₹25,000$

Example: Find the whole quantity if

30% of it is 600

Let the whole quantity be x

30% of x = 600

$\frac{30}{100}$ of x = 600

x = $\frac{100}{30} \times 600$

x = $\frac{600}{3}$

x = 2000

Example: There are 500 strawberries in a box. If 20% of strawberries are rotten, find the number of rotten strawberries?

Total number of strawberries in the box = 500
Out of these 20% strawberries are rotten
So,

Number of rotten strawberries in the box
20% of 500
= $\frac{20}{100} \times 500 = 100$
Hence, the total number of rotten strawberries in the box is 100

Ratio to Percent

Sometimes parts are given to us in the form of ratios and we need to convert those to percentages. We know ratios are expressed in the form m:n or m/n. To convert a ratio into percent, we write it as a fraction then multiply it by 100 and put percent sign %. Suppose we have the ratio of two quantities i.e., m: n and we have to calculate the % of m.
For that first, we need to calculate total quantity i.e., m + n.

Then we find % of m = $\frac{m}{m+n}$.

This same procedure is used to calculate % n i.e., % of n = $\frac{m}{m+n}$

We can solve the same for more than two quantities also.

Example: Convert each part of the ratio into a percentage.
(i) 1:3:4

Total parts = 1 + 3 + 4 = 8

% of first part = $\frac{1}{8}$ × 100=12.5%

% of second part = $\frac{2}{8}$ × 100 = $\frac{200}{8}$ = 25%

% of third part = $\frac{4}{8}$ × 100 = $\frac{400}{8}$ =50%

Example: To make a chakli Sara's mother takes three parts of rice and one part urad dal. What percentage of rice and urad dal in a mixture?

We have:

The ratio of Rice: Urad dal = 3: 1
Total rice and Urad dal take to make chakli = 3 + 1 = 4

So, total rice taken to make chakli = $\frac{3}{4}$

∴Percentage of rice in the mixture = ($\frac{3}{4}$× 100) % = 75%

Now, as we know
The ratio of Rice: urad dal = 3:1

So, total Urad dal taken to make chakli = $\frac{1}{4}$

Hence,

Percentage of Urad dal in the mixture = ($\frac{1}{4}$× 100) % = 25%

Hence, the percentage of rice and Urad dal in the given mixture is 75% and 25%

Increase or decrease as a percent

Suppose you bought a plant of height 30 cm, after 1 year the height of the plant is increased by 15 cm. So, by how much percent the height of the plant has increased in one year? To find out this we use the following formula

$$\text{Increase \%} = \left(\frac{\text{Increase in value}}{\text{Original value}} \times 100\right)\%$$

Now, suppose you bought a pencil of length 20 cm after some use the length of the plant is decreased by 15 cm. So, by how much percent the length of the pencil has decreased? To find out this we use the following formula

$$\text{Decrease \%} = \left(\frac{\text{Decrease in value}}{\text{Original value}} \times 100\right)\%$$

Example: Prachi read 15 books this month and 10 books last month.

What is the percent increase?

The increase in the number of books = 15 – 10 = 5 books

$$\text{Increase \%} = \left(\frac{Increase\ in\ value}{Original\ value} \times 100\right)\%$$

$$\text{Increase \%} = \left(\frac{Increase\ in\ the\ number\ of\ books\ read}{Original\ number\ of\ books} \times 100\right)\%$$

$$\text{Increase \%} = \left(\frac{5}{10} \times 100\right)\% = 50\%$$

50% is the percentage increase in the number of books read by Prachi

Example: In a city, the population of the children decreased from 75,000 to 50,000. Find the percentage decrease.

Initial population of the children in the city = 75,000
Final population of the children in the city = 50,000
Decrease in population of the children in the city
= 75,000 - 50,000
= 25,000

$$\text{Decrease \%} = \left(\frac{Decrease\ in\ value}{Original\ value} \times 100\right)\%$$

Decrease % = $\left(\frac{Decrease\ in\ population\ of\ the\ children\ in\ the\ city}{Original\ number\ of\ children\ in\ the\ city} \times 100\right)$ %

Decrease % = $\left(\frac{25000}{50000} \times 100\right)$ % = 50%

Hence, the percentage decrease in children in the city is 50%.

Example: The income of Ashish increases by 10% annually. If his present income is ₹33,000, what was it a year ago?

One year ago, let the income be x

Annual increase = 10%

∴Present income = x + 10% of x

$= x + \frac{10x}{100}$

$x + \frac{10x}{100} = 33,000$

$\frac{100x + 10x}{100} = 33,000$

$\frac{110x}{100} = 33,000$

$x = 33,000 \times \frac{100x}{110}$

$x = 30,000$

So, one year ago the income of the Ashish was ₹ 30,000

Example: In the last year the price of a TV was ₹10,000. This year the price has increased by 20%. So, what is the price of TV now?

Let the original price of TV be ₹ 100

Increase in price of TV= ₹ 20

So, increased price of TV = 100 + 20 = ₹ 120

If the original price of the TV is ₹ 100 then the increased price of

TV = ₹ 120

If the Original price of TV is ₹ 10,000

Then

Now the increase in the price of TV = $\frac{120x}{110} \times 10,000$ = ₹ 12,000

Profit and Loss

Prices Related To an Item or Buying and Selling

Suppose Rakesh bought a Kite for ₹ 10 from the shopkeeper and sell it to his friend for ₹ 20. So, here the price at which Rakesh bought a kite is called cost price, and the price at which he sells the kite to his friend is called selling price.

Cost price: The price at which an item is bought is known as its cost price. The cost price is denoted by C.P

Selling price: The price at which an item sold is known as the selling price. The selling price is denoted by S.P

Profit and Loss

Profit and Loss depend upon the cost price and selling price of the item.

Profit: If the selling price of an item is greater than the cost price, then the difference between the selling price and cost price is of an item is called profit. Thus if S.P. >C.P.

Profit=S.P.–C.P.

S.P.=C.P.+ Profit

C.P.=S.P.–Profit

In the above example, we see, S.P of the kite > C.P of the kite
i.e., Profit =₹20 – ₹10 = ₹10
So, Rakesh incurred a profit in this deal.

Example: An water heater was bought for ₹ 1200 and sold for ₹1350. Find Profit or gain.

Cost price of the water heater = ₹ 1200
Selling price of the water heater = ₹ 1350
Here,
S.P. of the water heater > C.P. of the water heater
Hence, Profit = S.P - C.P
Profit = (1350 – 1200) = ₹ 150
Hence, the profit is ₹ 150.

Example: Rani buys bangles for ₹ 125 her overhead expense is ₹ 15. if she sells the bangles for ₹ 200, determine her profit.

We have,
Cost of the bangles = ₹ 125
Overhead expenses = ₹ 15
So, total expenses = ₹ (125 + 15) = ₹ 140
S.P = ₹ 200
Here, S.P. > C.P.
Profit = SP - CP
= ₹ (200 - 140)
= ₹ 60
Hence, the profit is ₹ 60.

Loss: If the selling price of an item is less than the cost price, then the difference between the cost price and selling price is of an item is called profit. Thus if S.P.

Loss =C.P.–S.P.

S.P.=C.P.- Loss

C.P.=S.P.+ Loss

Example: Meena bought a pen for ₹ 50 from a shopkeeper and sell

it to his friend for ₹ 30.
In this example, we see, S.P of the pen< C.P of the pen

Loss = C.P – S.P

i.e.,

Loss =₹50 – ₹30 = ₹20

So, Meena incurred a loss in this deal.

Example: On selling a pressure cooker of ₹ 1250, Nilesh gets a loss of ₹ 35.
Find the cost price of the raincoat.

The selling price of a raincoat = ₹ 1250

Loss = ₹ 35

We know,

Loss = C.P – S.P

₹ 35 = C.P – ₹ 1254

C.P = ₹ 1250 + 35

C.P = ₹ 1285

Hence, the cost price of the pressure cooker is ₹ 1285

Example: Ben bought a hair straightener for ₹ 940 and sold it for ₹ 547. Find his loss.

We have,

C.P of hair straightener = ₹ 940

S.P of hair straightener = ₹ 547

We know, C.P. > S.P.

∴ Loss = C.P - S.P

= ₹ 940 - ₹ 547

$= ₹\ 93$

Hence, Ben incurred a loss of ₹ 93.

Note: If S.P. = C.P. ⟹ No Profit no Loss

Profit and Loss as a Percentage

Now, in order to compare the profit and loss in two or more sales, we express profit and loss as a profit % and loss %. The profit or loss is always calculated on the CP. Thus,

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

Example: If the profit made on a juice bottle is ₹ 4 and the cost price of a juice bottle is ₹20 then how much is the profit percentage?

We have,
C.P. = ₹ 20 and profit = ₹ 4

$$\text{Profit \%} = \frac{Profit}{Costprice} \times 100$$

$$\text{Profit \%} = \frac{4}{20} \times 100 = 20\%$$

Hence, the profit on the juice bottle is 20%.

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Hence, the profit on the juice bottle is 20%.

Example: At 6% profit, a farmer sold 30 quintals of wheat. If a quintal of wheat cost him ₹ 2,000 and his total overhead charges were ₹ 1000. Find his total profit

Cost of 1 quintal of wheat= ₹ 2,000

The cost of 30 quintals of wheat = 30×2,000 = ₹ 60,000

Overhead expenses = ₹ 1,000

Total cost price = ₹ (60,000 + 1,000)

= ₹ 61,000

Now, we know

Profit % = $\frac{Profit}{Costprice} \times 100$

$6 = \frac{P}{61,000} \times 100$

$6 = \frac{P}{610}$

P = 610 × 6

P = 3660

Hence, the farmer gets a profit of ₹ 3660.

Charge Given On Borrowed Money or Simple Interest

Suppose Farmer wants to buy a bullock cart but he has not enough money to buy a bullock cart. So, he decided to take a loan from the bank. So, he went to the bank and asks for the loan to the bank manager.

Bank manager: How much principal amount you need to buy a bullock cart?

Farmer: What is the principal?

Bank manager: The amount you want to borrow from the bank.

Farmer: I need 5,000.

Bank manager: For borrowing this money for some time the borrower needs to pay some charges to the bank and that is known as Interest.

Farmer: How much bank charges do I have to pay?

Bank manager: It depends upon the interest.

Farmer: If I return the money to the bank in 1 year, how much do I have to pay in total?

Bank manager: You have to pay principal plus interest.

Important Terms:

Principal: The money borrowed by a borrower from a lender is known as the principal.

Interest: The additional money paid by the borrower to the lender for having used his money is called the interest.

Amount: The total money which the borrower pays back to the lender at the end of the specified period is called the amount.
i.e., Amount = Principal + Interest
A = P + I
Where, A – Amount, P – Principal, and I – Interest

Simple Interest: If the interest is calculated uniformly on the original principal throughout the loan period, it is called simple interest.
Interest is generally given in % for a period of one year.
P – Principal
R% - Rate of interest per annum then
For every ₹ 100 borrowed the interest paid is ₹ R

$$I = ₹\ 1 \rightarrow ₹\ \frac{R}{100}$$

$$I = ₹\ P \rightarrow ₹\ \frac{PXR}{100}$$

So, Simple interest for 1 year = $\frac{PXR}{100}$

Simple interest for multiple years
P – Principal
R- Rate of interest per annum
T = Time (years)

Simple interest = $\frac{PXRXT}{100}$

$$I = \frac{PXRXT}{100}$$

Or

$$T = \frac{IX100}{PXR}$$

Or

$$P = \frac{Ix100}{TXR}$$

Or

$$R = \frac{Ix100}{TXP}$$

Example: Find the simple interest on ₹ 2500 at 10% per annum for 1 year

Principal amount (P) = ₹2500
Time period (T) = 1 year
Rate of interest (R) = 10% p.a.

Annual interest= $\frac{PXR}{100}$

Annual interest = $\frac{2500X10}{100}$

= ₹ 250

Example: Sagar borrowed ₹ 2000 from his uncle at the rate of 10% per annum for 2 years. Find interest.
We have,
(P) = ₹ 2000
Rate of interest (R) = 10% and
Time (T) = 2 year

$$S.I = \frac{PXRXT}{100}$$

$$S.I = \frac{2000X10X2}{100}$$

S.I = ₹ 400

Hence, the interest paid by Sagar is ₹ 400

Example: In what time will ₹ 7500 amount to be ₹ 9000 at 4% per annum?
(P) = ₹ 7500
Rate of interest (R) = 4% and
A = ₹ 9000
Time (T) =?
Interest = Amount – principal
Interest = ₹ 9000 - ₹ 7500
Interest = ₹ 1500

$$I = \frac{PXRXT}{100}$$

$$T = \frac{IX100}{PXR}$$

$$T = \frac{1500X10}{7500X4}$$

$$T = \frac{375}{4}$$

T = 5 years

Example: Rahul borrowed ₹ 1050 from her friend at 4% per annum. He returned the amount after six months. How much did he pay?

Principal amount (P) = ₹ 1050

Time period (T) = 6 months = $\frac{6}{12} = \frac{1}{2}$ year

As 1 year = 12 months
Rate of interest (R) = 4 % p.a.

$$I = \frac{PXRXT}{100}$$

$$I = \frac{1050X4X1/2}{100}$$

$$I = \frac{1050X4X1}{100X2}$$

$$I = \frac{1050X4}{200}$$

I =₹7

Total amount paid after 6 months = Principal amount + Interest
= ₹ 1050 + ₹7
= ₹ 1057
Hence, after 6 months he pays ₹ 1057