CHAPTER

13 Comparison of Quantities

13.1 Percentage

We have read in previous class that ratio means comparison between two or more similar quantities.

If Luv has Rs. 5 and Kush has Rs. 10 then ratio of their Rs. will be

5 : 10

means 1:2 in simple form.

This can be written as $\frac{1}{2}$ in form of fraction.

This can be expressed in form of percentage as we know percentage means how much out of 100?

If 1 is out of 2 then

50 out of 100 will be-

Means $1 : 2 = \frac{1}{2} = \frac{1 \times 50}{2 \times 50} = \frac{50}{100} = 50\%$

50% is read as 50 percent

Let us understand it by taking some more example-

Harmeet and Neelam picked some tindi and kachri in basket from the field. When they came back home and counted there were 14 tindi and 6 kachri. Can you compare number of tindis and kachris? There are two types of vegetables in basket. Their comparison is 14 : 6 or 7 : 3.

Number of tidis are $\frac{7}{3}$ of number of kachris. In this way number of kachris is $\frac{3}{7}$ th of number of tindis.

See this comparison in form of percentage:

Method of Harmeet -
Total items of vegetables- 20. There are 6 kachris in 20 vegetable items % of kachris

$\frac{6}{20} \times \frac{5}{5} = \frac{30}{100} = 30\%$

(Denominator is made as 100)

Method of Neelam (by unitary method)-
Out of 20 items of vegetables number of kachris are 6
If the total items of vegetables are 1 then
Number of kachris is $= \frac{6}{20}$
if total number of vegetables are 100 then number of kachris would be $= \frac{6}{20} \times 100 = 30\%$

There are tindis and kachris in basket

So % of tindis + % of kachris = 100

% of tindis + 30 = 100

or % of tindis = 100 - 30 = 70

So there are 70 % tindis and 30 % kachris.

Example 1 In a school of Jhalawar in Rajasthan 25% Neem, 15% Peepal plants were sown during environment pakwara (fortnight).

If there are 160 plants in total then-

(i) How many Neem plants are there?

(ii) How many Peepal plants are there?

(iii) Find the ratio of Neem and berries plants.

(iv) Determine number and percentage of Peepal plants.

(v) Number of Neem plants is less than Peepal plants by how much percentage?

Solution Total number of plants = 160

(i) Number of Neem plants is 25% of 160

$$= 160 \times \frac{25}{100}$$

$$= 40 \text{ plants}$$

(ii) Number of Peepal plants is 15% of 160

$$= 160 \times \frac{15}{100}$$

$$= 24 \text{ plants}$$

(iii) Neem plants: Peepal plants

40 : 24

5 : 3

(iv) Number of Peepal plants =

total number of plants shown - (Neem plants + Peepal plants)

= 160 - (40 + 24)

$= 160 - 64$
$= 94$ plants

Percentage of Peepal plants

$\because$ Peepal plants out of total 160 plants = 96 plants

$\therefore$ Peepal plants out of 100 plants $= \frac{96}{160} \times 100$

$= 60\%$

(v) Percentage difference between Neem plant and Peepal plant is

$= 60\% - 25\%$
$= 35\%$

Example 2 A students has got 10 marks in mathematics. If it is 40% then find total maximum marks of mathematics examination.

Solution Marks obtained in mathematics = 10
As 40 % of total marks are 10
Let total marks = x marks
So, 40 % of $x = 10$
Or $x \times \frac{40}{100} = 10$

Or $40x = 1000$

Or $x = \frac{1000}{40}$

Or $x = 25$ marks

Do and learn

Rashmi and Rehana picked flowers in basket from garden. In which there were 30% rose, 10% jasmine and rest ware marigold. If there were 120 flowers in basket then –

(i) What was the number of marigold flowers?
(ii) What was the number of jasmine flowers?
(iii) By what percentage were rose flowers less than jasmine flowers?

Exercise 13.1

1. Convert following ratios into percentages.
   (i) 1 : 4 (ii) 3 : 4
2. Himi travelled 240 km by bus and 360 km by train then determine,
   (i) Ratio of travelling by train and travelling by bus.
   (ii) Ratio of travelling by bus and by train.
   (iii) Ratio of travelling by train and total travelling.
   (iv) Ratio of travelling by bus and total travelling
3. In class VIII 68% students obtained grade A out of 75 students. How many students obtainable grade A?
4. A Kabaddi team of school has won 15 matches out of total matches played this year. If winning percentage was 75 then how many matches were played by the team?
5. There are 1275 trees in total in the field of Mohan. There are 36% trees that have fruits. Determine number of trees having fruits in the field.
6. Kamli spent 75% of the amount deposited in her account under Pradhan Mantri Jan Dhan Yojana. Now the amount left in her account is Rs. 600. Determine what was the amount deposited in here account?
7. According to a survey of 50,000 students under mid day meal in five districts of Rajasthan, 60% students like Pulses– Chapati, 25% like vegetable and chapatti and rest like khichdi. Determine percentage of students who like khichdi?

13.2 Profit – loss(Mark up price, Commission, VAT, discount, miscellaneous expenses, subsidy, service tax etc.)

Neelam started a lorry of readymade clothes, in which she is selling dresses of kids. She is selling a dress at Rs. 100 by purchasing it at Rs. 50 then her profit is 100 %.

After some days she started selling embroidered dresses after packing. Due to which extra expenses on each dress is Rs. 10. In this way her profit per dress is $100 - (50 + 10) = \text{Rs. } 40$ then profit percentage is $\frac{40}{60} \times 100 = 66\frac{2}{3}\%$.

Some extra money is spent while purchasing or selling things. This is added in purchase price which is called miscellaneous price. Like carriage, transportation, agent fees, go down rent etc. are miscellaneous expenses. After some experience Neelam thought of selling clothes after getting stitched from tailor instead of purchasing and then selling. If after purchasing cloth costing Rs. 2000 if discount received is 10% then purchase price will be Rs. 2000 - 200 = Rs. 1800.

If 25 dresses are made by spending Rs. 950 on its stitching, weaving etc. then what will be the cost price of 25 dresses?

$$\text{Rs.}\,(1800+950)=\text{Rs.}\,2750$$

Cost of one dress is Rs. $\frac{2750}{25}$ = Rs. 110. If each dress is sold at profit of 20% then what will be the selling price?

Selling price at 20% profit = (100 + 20) % of cost price

$$= \frac{110\times 120}{100}$$

$$= \frac{13200}{100} = \text{Rs.}\,132$$

After observing increased sales in business she opened a shop. If she put on 15 % VAT (Value Added Tax) on goods sold. Then at what price customer will purchase a dress?

> VAT is tax assessed on buyer on goods / objects sold

VAT of 15% on each dress = 15 % of selling price

$$= 132\times 15\% = \frac{132\times 15}{100}$$

$$= \text{Rs.}\,19.80$$

Selling price of a dress including VAT = Rs. 132 + 19.80

= Rs. 151.80

This type of problem can be solved in the following manner

Neelam bought a needle work (kashida) machine for Rs. 17280 including VAT of 8% then what was the price of machine (Original Price) before adding VAT? Think and tell.

Let price of machine excluding VAT	Price of machine including VAT
100	108
x	17280

First method (by ratio)

$100 : x :: 108 : 17280$

Product of extremes = product of middle terms

$100\times 17280 = 108x$

$$\frac{100\times 17280}{108} = x$$

$100\times 160 = x$

Or x = Rs. 16000

Value of machine excluding VAT = Rs. 16000

Another method (By Unitary Method)

If S.P. of machine including VAT is Rs. 108 then Price excluding VAT will be Rs 100

If S.P. of machine including VAT is Rs. 1 then Price excluding VAT will be Rs $\frac{100}{108}$

Then for S.P. of machine including VAT as Rs. 17280 Price excluding VAT will be

$$= \frac{100}{108} \times 17280$$

$$= 100 \times 160 = \text{Rs. } 16000$$

Do and Learn

1. Reena obtained a bill of goods purchased from Khadi Bhandar. Looking at the bill answer the following questions.

Azad Khadi Bhandar

Bill number 1501 Date 5-10-2015

Mr.----------

S.No.	Goods/ things	Quantity	Rate	Amount
1.	Bed sheet	4	80	320 = 00
2.	Kes	4	120	480 = 00
3.	Carpet	2	200	400 = 00
				1200 = 00
	Subsidy 15%			-180 = 00
				1020 = 00
	VAT 10%			102 = 00
	One thousand one hundred and twenty two only			1122 = 00
E & O.E.			Signature	

- What is the mark up price of goods purchased?
- Subsidy is calculated on which price?
- VAT is calculated on which price?

2. As compared to Rs. 5000, Rs. 4000 are less by what percentage? Is that percentage similar to percentage by which Rs. 5000 are more than Rs. 4000?

Example 3 An object marked Rs. 960 is sold for Rs. 672. What is discount percentage?

Solution Mark up price = Rs. 960
Selling price of object= Rs. 672
Discount = Mark up price – selling price
= 960 – 672
Discount = Rs. 288
Discount obtained on mark up price Rs. 960 = Rs. 288
Discount on mark up price Rs. 1 = Rs. $\frac{288}{960}$
Discount on mark up price Rs. 100 = Rs. $\frac{288}{960} \times 100$

Discount = 30%

Example 4 After giving discount of 20% on mark up price, a trouser was sold for Rs. 560. Determine mark up price of trouser.

Solution Selling Price = Rs. 560
20% discount means there is discount of Rs. 20 on mark up price Rs. 100
So selling price = Rs. 100 - 20
= Rs. 80
If selling price is Rs. 80 then mark up price of trouser is Rs. 100

If selling price is Rs. 1 then mark up price = $\frac{100}{80}$

If selling price is Rs. 560 then mark up price = $\frac{100}{80} \times 560 = 700$

Mark up price of trouser is Rs 700

Example 5 Sukhveer Singh bought a spray instrument in Rs. 4400 including 10% tax. What was the price of spray pump before including tax?

Solution Let Price excluding tax is Rs. 100
Then price including tax is Rs. 100 + 10 = Rs. 110

∵ If price including tax is Rs 110 then original price is Rs 100
∴ If price including tax is Rs 1 then original price is $\frac{100}{110}$

∴ If price including tax is Rs 4400 then original price is $\frac{100}{110} \times 4400$

$= \text{Rs. } 4000$

So price of spray pump including tax is Rs. 4000

Example 6 Ramu purchase two ceiling fans @ Rs. 1800 each. Out of which one fan was sold at 5% loss and other is sold at 12% profit. Find selling price of each fan. Tell total profit or loss.

Solution Purchase price of each fan = Rs. 1800
One fan is sold at 5% loss then
Purchase price is Rs. 100 then selling price of fan = Rs. 95
Purchase price is Rs. 1800 then selling price of fan = Rs. $\frac{95}{100} \times 1800$
$= \text{Rs. } 1710$

Another fan is sold at 12 % so

∵ If purchase price is Rs. 100 then selling price of fan is Rs 112
∴ If purchase price is Rs. 1 then selling price is Rs. $\frac{112}{100}$

∴ If purchase price is Rs. 1800 then selling price is Rs. $\frac{112}{100} \times 1800$
$= \text{Rs. } 2016$

Total purchase price = Rs. 1800 + Rs. 1800
$= \text{Rs. } 3600$

Total selling price = Rs. 1710 + Rs. 2016 = Rs. 3726

Total purchase price < total selling price so there will be profit

Profit = Rs. 3726 - Rs. 3600
= profit of Rs. 126

13.3 Simple Interest

Umesh took Rs. 2400 as loan @ 9%. If he wishes to repay loan in 3 years and 6 months then what interest he is supposed to pay?
He went to teacher. He asked how I would calculate interest for 3 years and 6 months.
Teacher said convert time duration in months to years.
One year has 12 months.

Amount taken as loan = Rs. 2400
Rate of interest = 9 % annually
Time = 3 years 6 months
Time = 3 years + $\frac{6}{12}$ years
= (3 + ½) years
= $\frac{7}{2}$ years

$$\text{Simple interest} = \frac{\text{principal} \times \text{rate} \times \text{time}}{100}$$

$$= 2400 \times \frac{7}{2} \times \frac{9}{100}$$
$$= \text{Rs. } 756$$

Amount = Principal + Interest
= Rs. 2400 + 756
= Rs. 3156

Example 7 what amount should be lent by Eeshwar so that amount obtained as interest will be Rs. 1831.50 after 2 years and 9 months?

Solution Amount of Interest = Rs. 1831.50
Rate = 12%
Time = 2 years + $\frac{9}{12}$ months
= 2 years + $\frac{3}{4}$ = $\frac{11}{4}$

$$\text{Simple interest} = \text{Principal} \times \text{rate} \times \frac{\text{time}}{100}$$

$$1831.50 = \text{Principal} \times \frac{11}{4} \times \frac{12}{100}$$

$$1831.50 \times 100 \times 4 = \text{Principal} \times 11 \times 12$$

$$\text{Principal} \times 11 \times 12 = 1831.50 \times 100 \times 4$$

$$\text{Principal} = \frac{1831.50 \times 4 \times 100}{11 \times 12}$$

$$\text{Principal} = \frac{183150 \times 4 \times 100}{11 \times 12 \times 100}$$

$$= \text{Rs. } 5550$$

So amount given on credit by Eeshwar is Rs. 5550

Exercise 13.2

1. Mohan purchases some mattresses for Rs. 7250. After some time he sold them for Rs. 6090. Find out loss percentage.

2. Due to increase in salary of Ajit Singh by 12 % new salary becomes Rs. 25760. Find his previous salary.

3. Manjeet mark up price on a pump by increasing 40%. If he wishes to sell it after providing subsidy of 40% then find out profit or loss percentage.

4. Cost of a moped is Rs. 54000. Now price increased by 14% then tell the price to be paid for moped.

5. A businessman purchased goods for Rs. 14000. He paid Rs. 350 as auto rent and Rs. 150 as wages. For earning 5% profit, at what price he should sell goods.

6. A furniture seller sold two dressing tables at the rate of Rs. 7200. Out of them 20% profit obtained on one table and 20% loss on another. How much profit or gain percentage is obtained in whole transaction?

7. Manoj paid Rs. 6500 as interest on loan of Rs. 52000 after two years. Find percentage interest paid by Manoj.

8. In what time will principal of Rs. 3200 at rate of 8% become Rs3840?

9. Bhupendra took loan of Rs 6300 at rate of 7% for 2 years and 8 months then tell what amount will be paid by him.

13.4 Compound Interest

Bank Pass Book

Date	Description	Deposit	Withdrawal	Balance
1.4.13	Cash	2000	-	2000
1.4.14	Interest	140	-	2140
1.4.15	Interest	149.80	-	229.80

From entry of pass book tell-
- Interest is added after what period?
- How much interest is added for the first period?
- How much interest is added for the second period?
- Whether amount of interest is same for every year?

Suman after looking at bank pass book asked her mother-

Suman - Mom, Papa deposited Rs 2000 two years back in saving account. But why interest given by bank on this account increases every year?

Mother - Yes, interest received or paid normally is not simple interest. In definite period three months, six months or one year; interest is added to principal. After this definite period a new principal is obtained on adding this principal and interest. That is why every time amount of interest seems to be increased.

Suman - Then this is not called as simple interest. Then how it is calculated?

Mother - Yes this is called as compound interest. Come let us learn how to calculate compound interest.

Suman - Interest for every year is calculated separately.

Mother - See, your father has deposited Rs 2000 in bank. Compound interest rate is 7 %.

Simple interest for first year is $SI = \frac{P \times R \times T}{100}$

$$SI = \frac{2000 \times 7 \times 1}{100} = \text{Rs } 140$$

Amount at the end of one year is $P_1 + SI$

$$= \text{Rs}(2000 + 140)$$

$$= \text{Rs } 2140 = P_2$$

Simple interest for second year

$$SI_2 = \frac{P_2 \times T \times R}{100} = \frac{2140 \times 7 \times 1}{100} = \text{Rs } 149.80$$

Amount received / paid at the end of second year

Means amount at the end of second year $= P_2 + SI_2$

$= 2140 + 149.80$

$=$ Rs. 2289.80

Suman - Mom, total Interest in two years

$= (149.80 + 140)$

$=$ Rs 289.80

This is more than simple interest.

Mother - Simple interest for two years $= \frac{P \times T \times R}{100}$

$= \frac{2000 \times 2 \times 7}{100}$

$=$ Rs. 280

Yes, Mom due to compound interest we received Rs. 289.80 - 280 = 9.80 more

Suman to teacher-Teacher, which is simple method to calculate simple interest?

Teacher- You have learnt how to calculate simple interest. Let us learn how to calculate compound interest.

Let principal amount for first year = P1 and Interest rate is R% then interest is calculated as follows.

Interest at the end of one year $SI_1 = \frac{P_1 \times T \times R}{100}$

$= \frac{P_1 \times 1 \times R}{100}$

$= \frac{P_1 R}{100}$

$\therefore$ Amount $A_1 = P_1 + \frac{P_1 R}{100}$

$= P_1\left[1 + \frac{R}{100}\right] = P_2$ (Principal of second year)

$Si_2 = \frac{P_2 \times T \times R}{100} = \frac{P_2 R}{100}$

$SI_2 = \frac{P_2 R}{100}$

$= P_1\left(1 + \frac{R}{100}\right)\frac{R}{100}$

$SI_2 = \frac{P_1 R}{100}\left(1 + \frac{R}{100}\right)$

Amount at the end of second year

$A_2 = P_2 + SI_2$

$= P_1\left(1 + \frac{R}{100}\right) + \frac{P_1 R}{100}\left(1 + \frac{R}{100}\right)$

$= P_1\left[1 + \left(\frac{R}{100}\right)\right]\left[1 + \left(\frac{R}{100}\right)\right]$

$= P_1\left(1 + \frac{R}{100}\right)^2 = P_3$

(P_3 Principal of third year)

In this way for third year

$$SI_3 = \frac{P_3 \times T \times R}{100}$$

$$= \frac{P_3 \times 1 \times R}{100}$$

$$= \frac{P_3 R}{100}$$

$$A_3 = P_3 + SI_3$$

$$= P_3 + \frac{P_3 R}{100}$$

$$= P_3 \left(1 + \frac{R}{100}\right)$$

$$= P_1 \left(1 + \frac{R}{100}\right)\left(1 + \frac{R}{100}\right)\left(1 + \frac{R}{100}\right)$$

$$= P_1 \left(1 + \frac{R}{100}\right)^3$$

After n years with R % annual compound interest rate

Amount $= P_1 \left(1 + \frac{R}{100}\right)^n$

Compound Interest $CI = A - P$

Means compound interest with R & annual compound interest rate for n years

$$CI = P_1 \left(1 + \frac{R}{100}\right)^n - P_1$$

Do and learn

Sandeep borrowed Rs 3000 for 2 years at 8% annual compound interest rate from bank for establishing a biogas plant. if interest is accumulated annually then determine

(i) What amount has to be repaid with 8% annual compound interest rate?

(ii) How much Compound interest is there?

(iii) If this money was borrowed with simple interest then less or more interest was to be paid and how much?

Suman - Sir, it is written in question that if rate of interest is accumulated annually. What does it mean?

Teacher - Yes, this mean, you have looked into different pass books (bank, saving bank pass book of post office) and experienced that rate is accumulated as quarterly, half yearly and annually. This is called transformation method.

Suman - Sir, What is transformation period?

Teacher - The time period after which interest is added to get new principal is called transformation period.

Suman - Sir, when interest is added half yearly then there will be two transformation period and when interest is added quarterly then there will be four transformation period.

Teacher - Yes, in this condition there will be change in rate also.

Suman - Sir, Why?

Teacher - If interest on Rs. 100 for one year is Rs. 8 then what will be interest half yearly, quarterly? Think.

Suman - I got it. In six months it will be half means Rs. 4 and in three months it will be one fourth means Rs. 2.

Do and learn

Complete the following blanks given in the table.

Condition of accumulation of interest	Time in years	Annual Rate	Transform-ation period	Transformed Rate
Annual	2	10%	2	10%
Half yearly	$1\frac{1}{2}$	6%	- - -	3%
Quarterly	$1\frac{1}{4}$	8%	5	- - -
Half yearly	2	14%	4	- - -
Annual	1	7%	- - -	- - -
Quarterly	Six months	16%	- - -	- - -

Suman - This means formula for compound interest will be

$$CI = P\left(1+\frac{R}{100}\right)^n - p$$

CI = Compound Interest
P = principal
R = Transformation rate
n = transformation period

Teacher - Very true, but if interest accumulation rate is annual then there will be no change in rate and time.

Example 8 If interest accumulation rate is half yearly and Rs 10,000 are borrowed for one year then with annual rate as 14 %. What amount is to be repaid?

Solution Interest accumulation is half yearly so time is doubled and rate is halved. Transformation period n=1×2 =2 and transformation rate = 14/2% =7% half yearly.

$$\text{Amount} = P\left(1+\frac{R}{100}\right)^n$$

$$= 10,000\left(1+\frac{7}{100}\right)^2 = 10,000\left(\frac{107}{100}\right)\left(\frac{107}{100}\right)$$

$$= \text{Rs. } 11449$$

So after one year Rs 11449 will be repaid.

Example 9 What amount will be received after investing Rs 20,000 for one year and 6 months at the rate of 8% when interest is accumulated annually.

Solution Converting time period into year = 1 year + 6 months

$$= 1 \text{ year} + \frac{6}{12} \text{ years} = 1\frac{1}{2} \text{ years}$$

Condition for Interest accumulation is annual so there will be no change in rate and time. Yaman put values in formula like this

$$A = 20000\left(1+\frac{8}{100}\right)^{1\frac{1}{2}}$$

Degree is in form of fraction, how will I solve it?

Teacher - For first year rate is 8% treat amount obtained as principal and for next half year rate will be halved means 4 %.

Yaman - Sir, like this.

$$A = 20000 \times \left(\frac{108}{100}\right) \times \left(\frac{104}{100}\right)$$

$$= 2 \times 108 \times 104 = \text{Rs. } 22464$$

13.5 Practical problems based on increasing rate

While solving questions, Suman started thinking whether she can solve problems

related to percentage increase rate through formula of compound interest. She asked this thing to her teacher. **Suman** - Can I solve problems related to percentage increase through formula of compound interest?

Teacher - Yes, you can apply this formula in following conditions-

(i) Increase (or decrease) in population

(ii) If rate of growth of bacteria is known, then to determine rate of increase.

(iii) To determine value of an object if in intermediary years there is increase or decrease in its value.

Example 10 There is a target of increase in number of students at Yoga centre by 20%. If in year 2014 this number is 300 then in year 2016 on completion of target how many students will be there in yoga centre.

Solution Initial number = 300

Rate of increase = 20%

Time period n = 2 years

Number of students after 2 years = initial value $\left(1+\frac{R}{100}\right)^n$

$$=300\times\left(1+\frac{20}{100}\right)^2$$

$$=300\times\frac{120}{100}\times\frac{120}{100}=432$$

Example 11 In a district number of road accidents in year 2014 is 3000. Due to awareness through road safety attempts there was 15 % decrease in road accidents then how many road accidents occurred in 2016.

Solution Initial value 8000 , rate = 15% (negative due to decrease in rate) time period = 2 years Value after two years?

Number of road accidents in year 2016 $= \text{Initial value}\left(1+\frac{-R}{100}\right)^n$

$$=8000\left(1+\frac{-15}{100}\right)^2$$

$$=8000\left(1-\frac{15}{100}\right)^2$$

$$=8000\times\frac{85}{100}\times\frac{85}{100}=\text{Rs. } 5780$$

Example 12 Malaria is spreading in a city. For its prevention fogging, spray of kerosene, removing water logging and applying cow dung, DDT spray used due to which number of malaria patients get reduced by 5%. If number of patients in this week is 6859 then what was the number of malaria patients three weeks back?

Solution Rate = -5% per week, assume initial value = x
Period n = 3 weeks, number of patients in last week = 6859

Final value = initial value $\left(1+\frac{R}{100}\right)^n$

$$6859 = x\left(1-\frac{5}{100}\right)$$

$$= x \times \frac{95}{100} \times \frac{95}{100} \times \frac{95}{100}$$

$$\frac{6859 \times 100 \times 100 \times 100}{95 \times 95 \times 95} = x$$

$$\frac{6859 \times 20 \times 20 \times 20}{19 \times 19 \times 19} = x$$

$$x = 8000$$

So, number of patients suffering from malaria three weeks back was 8000.

Exercise 13.3

1. Number of visitors on the first day of book fair in the city was 3000 which increased to 3600 on next day. Determine increase in fare visitors.
2. Price of a television is Rs. 30,000. Value of object decreases (devaluates) by 20 % then determine its value after 2 years.
3. Kapil took a loan of Rs. 52800 at annual rate of 12% from a bank for purchasing a scooter when accumulated rate is annual. After one year and 6 months what amount is to be paid for repaying loan?
4. In year 2013 number of road accidents was 10,000.By traffic police awareness programs were run for avoiding road accidents due to which it decreases by 20% then what was the number of road accidents in 2015?
5. Determine compound interest on Rs. 10,000 for 2 years at 8% annual rate if interest is calculated at annual rate.
6. Payal took loan of Rs. 12,000 for parlour from a nationalized bank. How much amount she will repay after 2 years 6 months at annual rate of 8%. When interest is accumulated annually.
7. Calculate compound interest on Rs. 18,000 for $1\frac{1}{2}$ year @ 10% when interest is calculated half yearly.
8. Vishnu invested Rs. 80,000 at annual rate of 14% if interest accumulates half yearly then determines what amount he will receive? If time is (i) 6 months (ii) 1 year

9. Khushwant borrowed Rs. 12,500 for 3 years @ 5 % annually on simple interest. If same amount is borrowed @ 5% annually on compound interest then what extra amount Khushwant has to pay?

13.6 Understanding of direct and Inverse relationship and problems based on it

In a hostel varnishing was going on. In 2 days varnish of 3 rooms was done by two . In the hostel all 18 rooms are of equal measure. Students are discussing on varnishing work.

Mahaveer - Three rooms are painted in 2 days then calculate time required to paint all 18 rooms.

Gurumeet - Number of days Work done number of painted rooms

$$\begin{matrix} 2 \\ \downarrow \\ x \end{matrix} \qquad \begin{matrix} 3 \\ \downarrow \\ 18 \end{matrix}$$

There is direct relation between number of days and amount of work done means if number of workers is constant then on increasing number of days work done also increases.

$$2 : x :: 3 : 18$$

Product of extremes = product of middle terms

$$2 \times 18 = 3x$$

$$\frac{2 \times 18}{3} = x$$

$$12 = x$$

Mahaveer - Yes this is true they will paint the whole hostel (means all 18 rooms) in 12 days.

Gurumeet - Then is there any relationship between number of workers and work done.

Mahaveer - I think if there are large numbers of workers work will be done earlier. Let us ask teacher.

Gurumeet - Sir, there is direct relationship between number of workers and number of days.

Teacher - Yes, there is direct relation.

Direct relation between two variables is like this when one variable increases then the other also increases and when one decreases then other also decreases. But sometimes one variable decreases when another variable increases and when second variable is decreased then first increases. This relation is inverse relation.

Do and learn

1.Read following statements and find it is direct/ inverse relation.

1.	A ladder is slipping by the side of wall height of top of ladder from bottom and distance from bottom to top of wall	Inverse relation
2.	Between distance and time of car moving with uniform velocity.	....
3.	Between number of persons and sufficiency of food material in days (when quantity of food material is constant)	....
4.	Between water and tank and population of village(when amount of water and its distribution is same	....

2.Think about such examples about direct and inverse relationship and discuss them with friends.

Example 13 In a field 4 workers complete work of ploughing in 8 days. If this work has to be done in 2 days then how many workers will be required.

Solution Here there is inverse relation between number of workers and time required for completion of work

Number of workers	time required for completion of work (in days)
↓ 4	8 ↑
x	2

Assume x workers are required for the task.

$4 : x :: 2 : 8$ (due to inverse relation)

Product of extremes = product of middle terms

$$4 \times 8 = 2x$$

$$\frac{4 \times 8}{2} = x$$

$$16 = x$$

So to complete work in two days 16 workers will be required.

Example 14 Dharmesh wishes to move from Dungarpur to Jalore by car

(i) If car requires 5 litre petrol for moving a distance of 90 km then what distance it will travel in 20 litres.

(ii) While reaching Jalore from Dungarpur after travelling 6 hours with an average speed of 60 km/hr. What will be average speed while returning if it takes $4\frac{1}{2}$ hours?

Solution There is direct relation between distance (km) travelled by vehicle and amount of fuel (litre).

Distance travelled (km)	Amount of fuel (in litres)
90 ↓	5 ↓
x	20

Let it will travel a distance of x km.

$$90 : x :: 5 : 20$$

Product of extremes = product of middle values

$$90 \times 20 = 5x$$

$$\frac{90 \times 20}{5} = x$$

$$360\text{ km} = x$$

So, with 20 litres of petrol that car will travel a distance of 360 km.

(iii) There is inverse relation between average speed and time

Average speed of vehicle (Km per hour)	Time required to travel a definite distance (hour)
60 ↓	6 ↑
x	$4\frac{1}{2}$

Assume while returning average speed of car is x km/hr.

$$60 : x :: 4\frac{1}{2} : 6$$

$$60 : x :: \frac{9}{2} : 6$$

Product of extremes = product of middle values

$$60 \times 6 = \frac{9}{2} x$$

$$\frac{\overset{20}{\cancel{60}} \times 6 \times \overset{2}{\cancel{2}}}{\underset{3}{\cancel{9}}} = x \qquad x = 80$$

While returning average speed of car is 80 km per hour.

Exercise 13.4

1. Vimla travelled 200 km distance by bus and she gave fare of Rs. 180. What rent she has to pay for travelling a distance of 500 km.
2. Shadow of a 10 metre long tree is 18m in morning. What will be height of shadow of 120 m high tower at same time?
3. If weight of 5 books is 2.5 kg then 30 kg will be weight of how many books?
4. A bus is moving with a uniform speed of 45 km per hour then what time bus will take to travel a distance of 225km.
5. Mamta can fill 30 parindahs with 15 litres of water then tell how many liters of water will be required for filling 120 such parindahs.
6. 100 liters of water can be saved by washing 5 cars with jug and buckets instead of tap. In this way how many liters of water can be saved by washing 20 such cars?
7. 9 workers took 16 days to complete pucca boundary walls of school. If number of workers is 12 then wall can be prepared in how many days?
8. A camp has food for 40 soldiers for 20 days. After 5 days 10 more soldiers joined then rest of the food will be sufficient for how many days?
9. Under Swachh Bharat Mission 15 volunteers clean their village in 4 days. I village needs to be cleaned in 3 days then how many workers will be required?
10. In a school under shramdan 2 students clean for 5 hours. If same part needs to be cleaned in 3 days then how many workers will be required?
11. Madhu prepares food for 12 days from biogas plant by putting on 80 kilograms of cowdung. Then to prepare food for 60 days how much cow dung will be required?

We learnt

1. Subsidy on mark up price is called discount.
   Discount = Mark up price – selling price

2. $$\text{Percentage discount} = \frac{\text{Discount}}{\text{Mark up price}} \times 100$$

3. Extra expenses on any object after purchasing are added to purchase is called miscellaneous expense.
   Actual purchase price = buying price + miscellaneous price
4. On selling an object VAT (Value - added Tax) is charged by government. This is included in amount of bill.
5. Simple Interest = Principal $\times$ Rate $\times \frac{\text{Time}}{100}$
   Amount = Principal + Interest
6. Interest calculated on total Amount of last year (A = P + I) is called compound interest.
7. (i) When interest is accumulated annually then

   Total amount (A) = $P\left(1+\frac{R}{100}\right)^n$ where P = principal, R = Rate, n = time period

   (ii) When interest is accumulated half yearly then

   Total Amount = $P\left(1+\frac{R}{200}\right)^{2n}$

   Where $\frac{R}{2}$ is half year rate of interest and 2n = number of half years.

8. When two quantities are related such that by increase or decrease of one quantity another quantity increase or decrease in same ratio then they are called directly proportional.
9. When two quantities are related such that by increase or decrease of one quantity another quantity decrease or increase in same ratio then they are called inversely proportional.