

Mathematics

Class VI



Rajasthan State Institute of Educational Research and Training, Udaipur



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Foreword

The Changes in scenario of the Society and the nation entail the changes in the system of education which determines and accelerate the process of development in them. Education, beside other factors, is an important factor, responsible for the development of the society and the nation. To make School education, effective, useful and interesting, the changes in the curriculum from time to time is an essential step. The national curriculum framework 2005 and right to Free and Compulsory Child Education Act, 2009 in the present time make it evident that a child occupies a pivotal place in all the teaching-learning activities, conducted in any educational institution. Keeping this view in mind, our process of causing learning amongst the students should be such that they construct knowledge on their own on the basis of the knowledge acquired through their experiences. A child should be allowed maximum freedom in the process of learning and for that – teacher should act as a guide and helper rather than a preacher to make the curriculum easily accessible to children/students, a text book is an important means. That is why the government of Rajasthan has got the new text book written by making necessary changes in them in the light of the changes made in the curriculum.

While writing a text book it has been kept in view that the text book should be easy and comprehensible, with the help of simple language and interesting and attractive with the inclusion of pictures and varied activities through which the learners may not only imbibe the knowledge and information, contained in them but also associate themselves with the social, neighbourhood and local environment along with the development of and adherence to the knowledge about the historical, cultural glory and democratic values of the country so as to establish themselves as sincere, good and worthy citizens of our country, India.

I very humbly request the teachers that they should not only confine themselves to the completion of the teaching of the text book but also to present it in such a manner that a child gets ample opportunities of learning and accomplishing the objectives of teaching-learning on the basis of the curriculum and his/her experiences.

The state Institute of Educational Research and Training (SIERT), Udaipur acknowledges its thankfulness to all those government and private institutions viz. National Council of Educational Research and Training, New Delhi, State and National Census Departments, Ahad Museum, Udaipur. Directorate of Public Relations, Jaipur, Rajasthan, Rajasthan Text Book Board, Jaipur, Vidya Bharati, All India Educational Institute, Jaipur, Vidya Bhawan Reference Library, Udaipur, different writers, newspapers and magazines, publishers and websites that have

cooperated with us in choosing and making the required material available for writing and developing the text book.

In spite of best efforts, if the name of any writer, publisher, institution, organization and website has not been included here, we apologize for that and extend our thankfulness to them. In this connection, their names will be incorporated in the next editions of this book in future. It (SIERT) also extends thanks to Mr. Damodar Lal Kabra, Retd. Principal, Chittorgarh for cooperation with us in the translation work of this book.

To enhance the quality of the text books, we have received timely guidance and precious suggestions from Shri Kunji Lal Meena Secretary, Elementary Education, Govt. of Rajasthan, Shri Naresh Pal Gangwar Secretary, Secondary Education Govt. of Rajasthan, and Commissioner National Secondary Education Council, Shri Suwa Lal Meena, Director Secondary Education, Govt. of Rajasthan, Shri Babulal Meena, Director Elementary Education, Govt. of Rajasthan and Shri B.L. Jatawat, Commissioner Elementary Education, Govt. of Rajasthan Jaipur, and as such the institute (SIERT) expresses its heartiest gratefulness to all of them.

This book has been prepared with the financial and the technical support of UNICEF. In this connection we are grateful to Mr. Samuel M, Chief, UNICEF Jaipur, Sulgana Roy, Education Specialist and all the related officers of UNICEF for their timely support and cooperation. Besides them the institute appreciates the efforts of all those officers and other members of the staff who have directly or indirectly cooperated with us in accomplishing the task of book writing and publishing it.

I am highly delighted to submit this book to you all with this belief in mind that it will not only prove beneficial to the teachers and the students but also serve as an effective link in the teaching-learning process and the personality development of the students.

To value thoughts and suggestions is a specific feature of a democracy; therefore the SIERT, Udaipur will always welcome your precious thoughts and suggestions for improving the quality of this book and thus make it better in every respect.

Director
SIERT, Udaipur

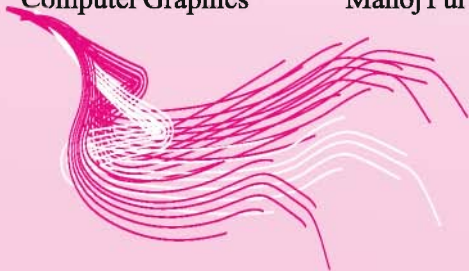


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For the Teachers

The new curriculum and the text book(s) in Mathematics have been prepared with a view to developing the teachers' competencies in the teaching process and methodology in this subject (Mathematics) in the light of the present changing global scenario.

This curriculum and text book in Mathematics have been prepared with a view to developing the child's understanding regarding the world of education along with the development of his/her latent capacities, enhancement of humane and moral values in dedicated, sincere citizen as well a patriot.

It is expected of a teacher of Mathematics to imbibe the main guiding principles of teaching. Stated in N.C.F., 2005 and in the light of them make the learners not only understand the subject matter of the book but also to imbibe it for their benefit in future.

The text book contains the following main features in it viz. the students have been made aware of the subject matter of the lessons the help of examples from their neighbourhood. In doing so it has been kept in mind that the teaching-learning material is available to the learners at low cost in their surroundings so that the teachers may use it in their day-today teaching by conducting different activities in the class room with a view to ensuring the learners maximum participation in the teaching-learning process and thereby making his/her teaching effective, useful and purposeful.

Considering the child as the center of the teaching-learning process, the teachers of learning by doing and correcting their mistakes an their own so as to develop insight in them for grasping and imbibing the subject matter of the mathematical lessons properly.

In the light of the provision of the Act of the Right to free and Compulsory Education, 2009, the subject matter has been prepared according to the spirit of the 'Continuous and Comprehensive Evaluation'. Therefore students should be imparted instructions dividing them into groups, according to their standards for inculcating the mathematical competencies in them.

The concepts of Mathematics have been delineated in detail along with pertinent pictures and diagrams for them. Examples and exercise have been combined so that the learners may understand the concepts and thus there by develop the capacity to solve the mathematical problems with maximum participation.

Under the heading 'Learning by Doing' enough activities for the development of the skills of mathematical thinking. Researching of the mathematical facts drawing, lining and measuring have been given for practice. All these activities are to be accomplished by the students with the spirit of cooperation, tolerance and responsibility.

The topics of national concerns viz - Environmental protection. Road safety, Gender Sensitivity, Beti Bachao; Bati Padhao and uprooting of Social evils, etc – have been included at proper places in the text book which the teachers should pay heed to and the same should be conveyed to the learners through the mathematical problems and mathematical solution and other glossary. The learners should be brought home to these national concerns along with the development of the sense of understanding them.

The teacher should judiciously divide the class into groups and sub-groups in order to generate the skill of self learning amongst the learners through various activities given in the text book of Mathematics. At the end of every lesson in the text book the mathematical concepts, definitions and results have been given under the title 'We have Learnt' according to learners capacities and maturity of minds.

At proper places the life history of Indian mathematicians and their contribution to Mathematics have been given in order to make the learners understand and appreciate such great personalities.

The curriculum and the book of Mathematics have been prepared, keeping the child at the center of the teaching-learning process reposing great faith in the teacher who with their great devotion and sincere efforts will work with children to make them understand the mathematical problems, definition, concepts and solutions well with this very belief in mind. The group of writers presents this book of Mathematics to the teachers of Rajasthan.

In India Mathematics has had rich tradition(s). Since times immemorial Indian Scholars and mathematicians have done excellent work in this area. In order to use the old knowledge in modern Mathematics and to establish its harmony with a view to enriching it (modern Mathematics), the Indian numerical system (Devnagari) and Vedic Mathematics have been incorporated in this text book - Efforts have been made to make calculations easier through Vedic Mathematics.



Contents

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1.1 We count objects according to our requirement. For example number of students in the school, number of people living in the village, number of books kept in the library, number of tiles placed on the floor etc. We can represent these numbers by proper number digits. Now look around and find out how many objects can you count?

Thousands years ago people knew only about small numbers. Gradually they learned to work with large numbers and also learned to express those numbers by symbols. Numbers help us to decide which group of objects is larger and which is smaller? With the help of numbers we can arrange the objects in a proper sequence.

Think about the situations where we use numbers.



We have played with four digit numbers in previous class. In this chapter we will learn about some more numbers.

1.1.1 Making numbers

Ramesh and Afsana are trying to form a four digit number. Ramesh made a number using digits 3, 5, 7, 8.

5378



Wow this is five thousand three hundred and seventy eight.

Afsana got another number using same digits.

8753

Your number is Eight thousand seven hundred and fifty three, which is greater than my number. Amazing! This is the largest number made by using these four digits.



You can also form different numbers using these digits. Ask your friend to arrange them in ascending and descending order.



Which is the smallest number among the numbers you made?

1.1.2 Comparison of numbers

Devika is playing a game. She asks her friends to form numbers using digits 2, 0, 1. Rohit made the number 210 and Mamta 21. Then Devika asks whose number is greater. Rohit says –Mine because there are more digits in my number. Now Devika says let's try to form another number of five digits using 4,5,2,6.

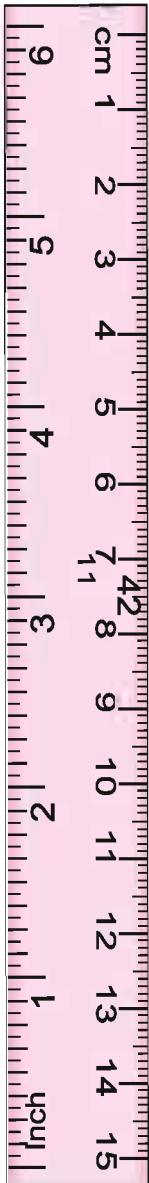
52643	Fifty two thousand six hundred forty three.
65234	Sixty five thousand two hundred thirty four.
64532	.....
23456	.....
65432	.....
64352	.....
.....
.....
.....

Looking at these numbers, Rohit said 65432 is the greatest and 23456 is the smallest number.

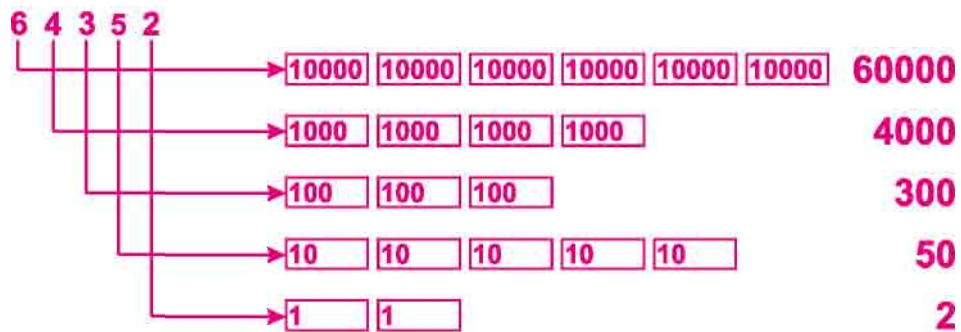
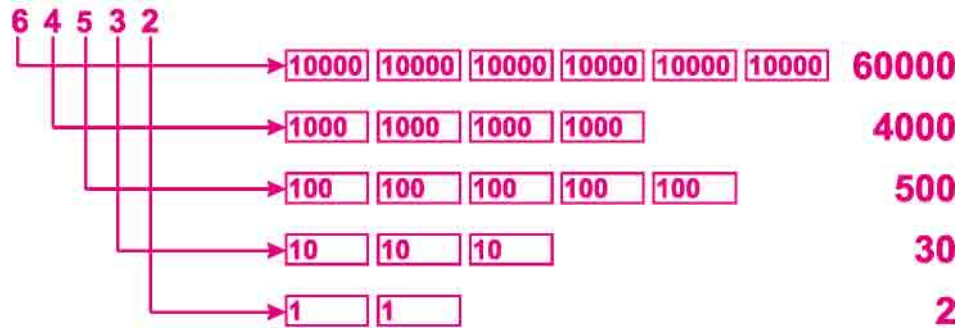
64352 is greater than 64532.

No, 64532 is greater.

Tell me, How?



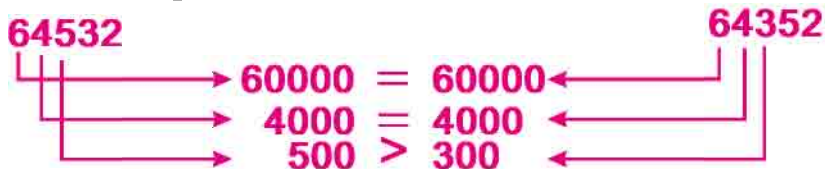
Rohit compared the number as follow:



can I compare these numbers even without place value of each?

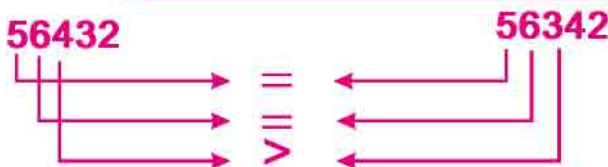
Ten thousand's and thousand place value digits are same in both of the above numbers. 5 is at the hundredreth places in 64532 and 3 is at the hundredreth places in 64352. Therefore 64532 is greater.

We can compare like this as well.



Number 64532 is greater than 64352 i.e. $64532 > 64352$.
Now compare 56432 and 56342.

Compare the numbers 56432 and 56342 from left to right and see which is the bigger number.



Can you tell us which number is greater?



Do and learn

1. In the following group of numbers; Circle (o) the greatest number and put a cross (x) on the smallest number.

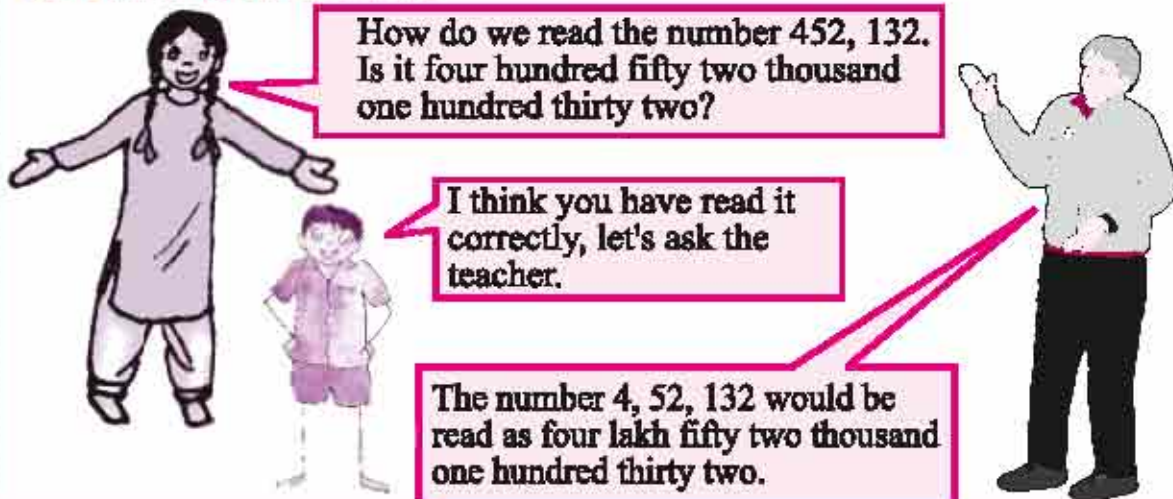
- (i) 4536, 4892, 4370, 4452
- (ii) 15623, 15073, 15189, 15800
- (iii) 25286, 25245, 25270, 25210
- (iv) 6895, 23787, 24569, 24659
- (v) 4685, 4444, 3847, 9071

2. Complete the following table

52,132	5 ten thousands, 2 thousands, 1 hundred, 3 tens, 2 ones $50,000+2,000+100+30+2$	Fifty two thousands one hundred thirty two.
45,471		
98,453		
67,309		
70,058		
12,345		
29,761		
33,333		
81,427		

Draw o (circle) on the greatest number and on the smallest number given in above table.

1.1.3 Reading the Numbers



Now take six digits of your choice and form different numbers. Ask your friend to read those and compare.

Complete the following table

Number (In digits.)	Lac	Ten Thou- sand	Thou- sand	Hun- dred	Tent- hs	Units	Number in words
3,52,027	3	5	2	0	2	7	Three lakh fifty two thousand twenty seven.
2,43,596							
7,00,295							
9,99,999							
1,00,000							
5,67,890							
6,04,307							
.....							

Discuss with your friends and arrange the above numbers given in the table in ascending order.



Can you tell us, if we add 1 to the largest number of six digits, what number will we get?

I know the largest number of six digits is 9, 99,999. So adding 1 to it we get 10, 00,000. This is the smallest seven digit number. How do we read it?



Maybe ten lakhs. Let's talk to teacher.



Yes we will read it ten lakhs. Now tell me how you will read 15, 40,400?



Do and learn

1. Write the number names for the following digits.

- (I) Five thousand five - 5005
- (ii) Five thousand four hundred thirty eight -
- (iii) Thirty eight thousand four hundred -
- (iv) Sixty five thousand seven hundred forty -
- (v) Eighty nine thousand three hundred twenty four -
- (vi) Twenty lakh five thousand two -
- (vii) Eighty five lakh eight hundred one -
- (viii) Seven lakh seven thousand seven -

2. Keeping the place value of number six at the same place and jumbling the digits of number 6350947; the smallest number shall be;

- (i) 6975430 (ii) 6043579 (iii) 6034579 (iv) 6034759 ()

3. The largest five digit number using digits 7, 8 and 9 is

- (i) 98978 (ii) 99897 (iii) 99987 (iv) 98799 ()

4. Complete the following table -

Number (In digits.)	Ten Lac	Lac	Ten Thou- sand	Thou- sand	Hun- dred	Tent- hs	Units	Number in words
57,68,423	5	7	6	8	4	2	3	Fifty seven lakh sixty eight thousand four hundred twenty three
99,99,999								
40,50,607								
32,05,004								
10,00,000								
98,76,543								

Discuss with your friends and write the numbers in descending order.

Can you tell us which number you shall get if you add 1 to the largest number of seven digits.



Why not if I add 1 to the seven digit number 99, 99,999, I get the number 1, 00, 00,000. How do we read it?





Even I don't know. Let's ask the teacher.

We read it one crore, this is also the smallest number of 8 digits.



It means we will read the number 2,20,51,965 as two crore, twenty lakhs, fifty one thousand nine hundred sixty five.



Do and learn

Complete the following table.

Number (In digits.)	Crores	Ten Lac	Lac	Ten Thousand	Thousand	Hundred	Tenths	Units	Number in words
4,53,10,670	4	5	3	1	0	6	7	0	Four crores, fifty three lakhs ten thousand six hundred seventy
4,35,01,076									
7,65,43,201									
1,00,00,000									
9,09,09,009									
6,50,41,300									

Discuss with your friends and write the numbers given in the table in ascending and descending order.

Exercise 1.1

1. Write the following numbers in words.

(i) 5782

(ii) 75,879

(iii) 3,89,087

(iv) 21,32,452

(v) 7,68,92,479

(vi) 50,60,798



2. Write the following in form of numbers.
- Sixty eight thousand five hundred twenty nine
 - Eighty nine thousand seventy nine
 - Five lakh seventy two thousand fifty seven
 - ninety lakh ninety thousand nine hundred ninety
 - One crore, twenty one lakh, thirty one thousand forty one.
3. Given the numbers 5,7,0,6,1,3 and 4. Form five numbers of seven digits using these.
4. Put the symbols $<$, $>$ and $=$ in the boxes given between the following numbers.
- (I) 1403789 140378 (ii) 560325 560326
 (iii) 732108 732208 (iv) 32872015 32852017
 (v) 612345 611345
5. Write the following numbers in ascending order.
- 8435, 4835, 13584, 5348, 25843
 - 1100, 1001, 1011, 1010
 - 50500, 50050, 55555, 50505
 - 58695376, 58685376, 58695306, 58685378
6. Write the following numbers in descending order.
- 847, 9754, 8320, 571
 - 4060, 6040, 4600, 4646
 - 9801, 25751, 36501, 38802
 - 10001, 11001, 10101, 10011

1.2 Number System

1.2.1 Indian number system

In Indian static method, we use units, tens, hundred, thousand, and further lakhs and crores. We use comma to display thousand, lakh and crore digit numbers. First comma is used in the place of hundred (third from right to left) and represents thousand, second comma is used after next two digits (fifth digit from right) to represent lakh and third comma is used further next two digits which represents crore.

1 Ten	= 10 units	
1 Hundred	= 10 tens	= 100 units
1 Thousand	= 10 hundreds	= 100 tens
1 Lakh	= 100 thousand	= 1000 hundreds
1 crore	= 100 lakh	= 10,000 thousands

1.2.2 International number system

In international static method unit, ten, hundred, thousand and million is used further. Commas are used to differentiate the period of hundred, thousands and millions.

For example number 22,051,965 is read as twenty two million fifty one thousand nine hundred sixty five.

Think about it

How many lakhs is equal to one million?

How many millions is equal to one crore?

Choose any five large numbers and write those numbers in national and international both statics methods.

1.3 Numbers in various scripts

Hindu arabic digits	Devnagri digits	Roman digits
1	१	I
2	२	II
3	३	III
4	४	IV
5	५	V
6	६	VI
7	७	VII
8	८	VIII
9	९	IX
10	१०	X
11	११	XI
12	१२	XII
13	१३	XIII
14	१४	XIV
15	१५	XV

In Roman method we write big numbers as follows

Numbers	20	30	50	100	500	1000
Roman	XX	XXX	L	C	D	M



- (i) If a symbol is repeated, its value is added on every repetition.
- (ii) No symbol is repeated more than three times. Symbols V, L, and D are never repeated.
- (iii) If a symbol with lesser value is to the right side of a symbol of greater value, then it is added to the greater number.
- (iv) If a symbol with lesser value is placed to the left side of symbol with greater value then it is subtracted from the greater number.
- (v) Value of symbols V, L and D is never subtracted. Symbol I can only be subtracted only from V and X. Symbol X can only be subtracted from L, M and C.

1.4 Understanding Units

We used centimeters, meters and kilometer as units of length in previous class.



When I measure my pencil, its length falls between 17 cm and 18 cm. What is its right measurement?

Even I don't know.



Look there are ten marks between 17cm and 18 cm. Each of these marks represent millimeter. Length of your pencil is up to 8 marks after 17cm. So its measurement would be 17.8(seventeen point 8) cm.

let's learn about relations between units.



10 millimeter = 1 centimeter (1cm)
 100 centimeter = 1 Meter (1m)
 1000 Meter = 1 kilometer (1Km)





Do you know how many centimeters make 1 Kilometer

Look, like this:

$$\begin{aligned} 1 \text{ Kilometer} &= 1000 \text{ meter} \\ &= 1000 \times 100 \text{ Centimeters} \\ &= 1,00,000 \text{ cm} \end{aligned}$$



We did use kilogram and grams weight to weigh in previous class.



Do you know how many grams make 1 kilogram?

Why not, 1000 gms make 1 kilogram.

$$1 \text{ kilogram} = 1000 \text{ gram}$$



You must have seen weights in the shop of a jeweller. There are some very smaller weights less than gram. These are used to weight milligram.

$$1 \text{ Gram} = 1000 \text{ miligram}$$



In the previous class we learned about litre and mililitre for measuring liquids and also learned about the relation between these two:

$$1 \text{ litre} = 1000 \text{ mililitre}$$

Look carefully we have used words mili, centi and kilo. Kilo means thousand and it is the greatest. Centi is used for 100'th and mili is used for 1000'th. And it is the smallest unit.



1.2 Bigger numbers for practical use

Detail of One month's purchase from khichdi kirana store is as follows:

Kirana store

Rate List

Sugar	-	Rs. 35 per kg
Gur	-	Rs 40 per kg
Salt	-	Rs. 7 per kg
Pure ghee	-	Rs. 395 per Kg
Tea leaves	-	Rs. 175 per Kg
Chilli powder-		Rs. 180 per kg
Coriander powder-		Rs 170 per kg
turmeric powder -		Rs.170 Per kg.
Seeng dana	-	Rs. 90 per kg.
Oil	-	Rs. 85 per lit.
Chana Dal	-	Rs. 65 per kg
Tuar Dal	-	Rs. 115 per kg
Rice basmati-		Rs. 65 per kg.
Besan	-	Rs. 70 per kg
Moong	-	Rs. 60 per kg
Soap cake(75gm)-		Rs.13 per piece

Purchase Details

Gur	325 Kg
Sugar	3837 Kg
Rice basmati	906 Kg
Seeng dana	164 Kg
Pure ghee	500 Kg
Tuar dal	1369 Kg
Tea leaves	188 Kg
Salt	234 Kg
Chilli powder	93 Kg
Coriander powder	147 kg
Turmeric Powder	189 kg
Chana Dal	3273 kg
Soap cake (75 gm.)	13048 pieces



1. Can you find out the total weight of things sold by khichdi kirana store last month?(excluding the weight of soapcake.)
2. What is the total weight of soap cake in kilogram sold last month?
3. How much amount of money did kirana store get by selling sugar and tea?
4. How much amount did Kirana store get by selling salt and chilli?

Example 1 The population of Talwara city was 3, 38,401 in 2001. It was increased by 88765 upto year 2011. What was the population of the city in the year 2011?

Solution The population of Talwara in the year 2011 = Population in 2001 + increase in population

$$\begin{array}{r}
 = 3,38,401 + 88,765 = \begin{array}{r} 3,38,401 \\ + 88,765 \\ \hline 4,27,166 \end{array} \\
 = 4,27,166
 \end{array}$$

Example 2 One newspaper contains 18 pages. 10,03,912 copies are printed daily. Find out how many pages are printed every day?

Solution Number of copies printed everyday = 10,03,912 Therefore number of pages printed daily would be

$$\begin{array}{r}
 = 10,03,912 \times 18 \\
 = 1,80,70,416
 \end{array}
 \quad
 \begin{array}{r}
 10,03,912 \\
 \times 18 \\
 \hline
 8031296 \\
 1003912X \\
 \hline
 18070416
 \end{array}$$

Example 3 In the state, scholarships were given to 12,38,792 students for session 2014-15. 17,92,304 students got scholarships for the session 2015-16. Find out in which year more scholarships were given and by how much?

Solution Scholarships provided in session 2015-16
(The number 12,38,792 is greater than the number 17, 92, 304)
Increase in scholarships in 2015-16

$$\begin{array}{r}
 = (\text{Scholarships given in 2015-16}) - (\text{Scholarships given in 2014-15}) \\
 = 17,92,304 - 12,38,792 = 5,53,512
 \end{array}
 \quad
 \begin{array}{r}
 17,92,304 \\
 - 12,38,792 \\
 \hline
 5,53,512
 \end{array}$$

Therefore there was an increase of 5,53,512 students getting scholarships in session 2015-16.

Example 4 There are 15,07,150 matchsticks made daily in a matchsticks company. If there are 50 matchsticks in a matchbox, find out how many matchboxes will be required for 15,07,150 matchsticks?

Solution There are 50 matchsticks in a matchbox
Therefore matchboxes required for 15,07,150 matchsticks.
= 15,07,150 ÷ 50
= 30143



$$\begin{array}{r}
 30143 \\
 50 \overline{) 1507150} \\
 \underline{-150} \\
 00071 \\
 \underline{-50} \\
 215 \\
 \underline{-200} \\
 0150 \\
 \underline{-150} \\
 000
 \end{array}$$

Therefore for keeping 15,07,150 matchsticks we need 30143 matchboxes.

Exercise 1.2

- Fill in the blanks:
 - 1 thousand = tens
 - 100 lakhs = crore
 - 1 kg = grams
 - 100 cm = meter
 - 1 km = meter
 - 1 litre = millilitre
- The winning candidate got 6,42,312 votes in Loksabha elections. He beat his nearest rival by 65,318 votes. Find out how many votes did the nearest rival get.
- In the first four days, the Dashehra Mela was visited by 3079, 5768, 9014 and 12,306 people respectively. Find out how many people in all turned up to visit the Mela in the four days.
- A cricketer made 15030 runs in Test Cricket and 18999 runs in One day Cricket. How many runs were made in both types of games?
- Find the difference between the biggest and smallest numbers obtained by using all the digits 5, 3, 9, 7, 4 once.
- Members of a self-employment group make 1385 Papads daily. How many Papads would they make in August?
- An airplane travels 685 kilometers in an hour. How much distance would it cover in 36 hours?
- A trader paid Rs. 18,57,750 for buying 150 television sets. Find out the cost of one television set.
- A student multiplied 5068 with 36 instead of 63. Find out the difference in both answers.
- 75000 sheets of paper are available for making Practice books. From every sheet, 8 pages of Practice book are made. Every Practice book has 200 pages. How many Practice books can be made from the available sheets of paper?

11. There are 15 litre of milk available in a hotel. If 25 ml milk is required for making a cup of tea, how many cups of tea can be made from 15 litre of milk?

1.6 Estimation

Mitesh, Manali, Devansh and Charvi are playing gilli-danda. Mitesh and Manali are in one team, and Devansh and Charvi are in the other team. Mitesh hit the gilli by danda. Mitesh and his friend estimated the distance between gilli and the gachh (guppi).



I should ask for 110 dandas, which should be enough.

110 are more than enough. Let us measure with the danda.



It is 115 dandas after measurement. Wow, your estimate was right.

Ok, tell us when and where else you estimate like this.



Do and learn:

Take various kinds of things in your hand (wheat, corn, soyabean, pebbles etc) and ask your friend to estimate the number. Now count it. Divide into groups of 4 in your class, and estimate their weights and fill it in the following

S.N.	Name of Student	Estimated Weight	Actual Weight
1			
2			
3			
4			

Now weigh the children on weighing machines and find out

- How many of you guessed the correct weight?
- How many of you guessed the weight close to the actual weight?
- How many of you guessed the weight not close to the actual weight?

Like this discuss with your friends and guess the:

- Estimated distance of the school from your house ism/km
- Estimated length of classroom is..... feet, width is.....feet.
- Estimated number of books in the library is

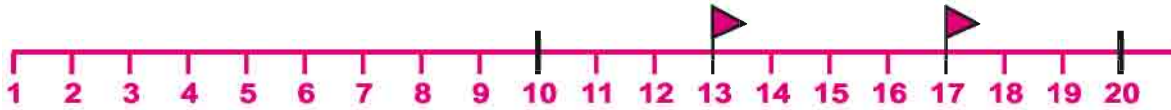
1.7 Rounding Numbers

Imagine that there is the wedding of your elder brother or sister in your home. Now we would try to find out how many guests would come. Can we find out the exact number of guests? It is not practically possible.

Think about the situations where we work with the rounded off number and when we need the exact number.



1.7.1 Rounding numbers to the nearest tens



Which flag is closer to 10?

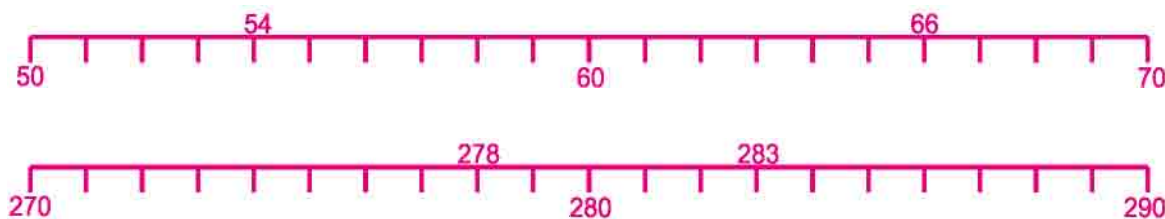
Which flag is closer to 20?

Number 13 is between number 10 and 20 but 13 is closer to number 10. Therefore we round off 13 to 10 to the nearest tens.

While rounding numbers we observe that numbers 1, 2, 3, 4 are closer to the number 0, as compared to the number 10. Hence we round them off to number 0. And 6, 7, 8, 9 are closer to the number 10 so we round them to number 10.

Number 5 is equidistant to number 0 and 10. Generally number 5 is rounded off to number 10.

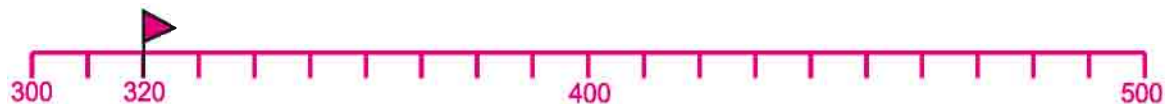
How do we round off the numbers written on the number line?



Are 278 and 283 both rounded off to 280? Why?

1.7.2 Rounding to the nearest hundreds

Think about the number 320 on the number line. It is close to which number?



Number 320 is closer to number 300, hence number 320 is rounded off to 300 as the nearest hundreds.

To round off number 5437 to the nearest tens, observe its units place. It is greater than 5 hence number 5437 is rounded to 5440 to the nearest tens. Likewise number 5437 would be rounded to the nearest hundreds as 5400 because when we focus on its tens place, we have number 3 which is less than 5. Therefore it is closer to number 400. Hence its nearest rounding to hundred is 5400.

Let's understand

48 upto tens	=	50
682 upto hundreds	=	700
335 upto hundreds	=	300
2907 upto hundreds	=	2900

1.8 Understanding brackets

Jagrati bought 5 copies from the market of price value Rs. 10 each. Her friend Himani bought 9 copies of same price. Find out the total cost of the copies paid by both of them?

$$\begin{aligned} \text{Jagrati said} &= 5 \times 10 + 9 \times 10 \\ &= 50 + 90 \\ &= 140 \text{ Rs.} \end{aligned}$$

$$\begin{aligned} \text{Himani said} &= 5 + 9 \times 10 \\ &= 5 + 90 \\ &= 95 \text{ Rs.} \end{aligned}$$

Can you tell us whose calculation is wrong?

Teacher: For this kind of problem we use brackets.

What Himani calculated is wrong.

We write $5+9$ in one bracket and then calculate it. Like this:

$$\begin{aligned} (5+9) &= 14 \\ 14 \times 10 &= 140 \end{aligned}$$

use of brackets tell us that those quantities which are inside the brackets are solved first and then we perform outer operations.

Learn these

$9 + 1 = 10$	$10 \times 10 = 100$
$99 + 1 = 100$	$100 \times 10 = 1000$
$999 + 1 = \dots\dots\dots$	$1000 \times 10 = 10,000$
$9999 + 1 = \dots\dots\dots$	$10,000 \times 10 = 1,00,000$
$99999 + 1 = \dots\dots\dots$	$1,00,000 \times 10 = 10,00,000$
$999999 + 1 = \dots\dots\dots$	$10,00,000 \times 10 = 1,00,00,000$
$9999999 + 1 = 1,00,00,000$	



Identify the pattern

$$\begin{aligned} 0 \times 9 + 1 &= 1 \\ 1 \times 9 + 2 &= 11 \\ 12 \times 9 + 3 &= 111 \\ 123 \times 9 + 4 &= 1111 \\ 1234 \times 9 + 5 &= \dots\dots\dots \end{aligned}$$

$$\begin{aligned} 9 \times 9 + 7 &= 88 \\ 98 \times 9 + 6 &= 888 \\ 987 \times 9 + 5 &= 8888 \\ 9876 \times 9 + 4 &= 88888 \\ 98765 \times 9 + \dots &= \dots\dots\dots \end{aligned}$$

Exercise 1.3

- Replace each number to the nearest hundred of the following and calculate the answer again in the nearest hundred.
(I) $247+691$ (ii) $4316+1567$ (iii) $7122-3565$ (iv) $4543-2036$
- Multiply the nearest tens numbers of the following:
(I) 34×57 (ii) 294×72 (iii) 869×675
- In the school library, there are 2541 books of stories, 1017 subject books and other books are 857. Find out the approximate number of books in the school. (Rounding the number to 100.)
- 8596 cows and 7015 buffaloes are there in a village. Find out which cattle is more than the other and how much? (Rounding the number to 100.)
- A car runs 15 kilometer with 1 litre petrol. How much petrol does it need to go 100 kms? (Find out the value rounding the number to 10)

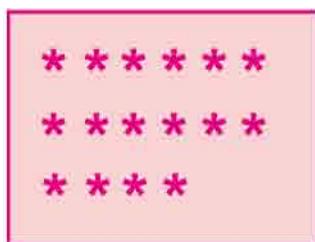
We learnt

- Between two numbers..., the number which has more digits is greater. If number of digits is same in the both, then we compare the first digit on the left of both numbers. In which number this digit is greater, that will be the greater number. If this digit is also same then we compare further digits from left to right.
- While forming of a greatest number, we write digits in descending order from left to right and for smallest number we write digits in ascending order from left.
- The largest number of four digit is 9999 and the smallest number of five digit is 10,000.
- Use of commas helps in writing and reading numbers. In Indian statics, first comma is used after the third digit from right, then others after the gap of two-two digits. In international method of statics, comma is used after every three digit from the right.
- Several times we do not need the exact numbers, only estimated numbers are enough.
- Likewise several times estimation of the calculation is also enough useful. For this, we first round off the number to its nearest and then get a quick result.

2.1 Rimjhim and Mukul are practising factors learned in previous classes. According to Rimjhim, the factors of 16 are 2, 4, 6 and 8.

Mukul– Rimjhim how can you say that 6 is a factor of 16? Can you divide 16 into groups of 6-6?

Rimjhim– Let me do it.



Oh! Two groups of 6-6 were formed but 2 remained the third time.

Mukul– This means that 6 is not a factor of 16, because 16 cannot be divided completely into groups of 6-6.

Rimjhim– Dividing equally means division, so can we say that all numbers which perfectly divide 16 are factors of 16?

2.2 Factors and Multiples

Rimjhim wants to find out those numbers which perfectly divide 8. She divides 8 by 8 and smaller numbers like this:

$\begin{array}{r} 1) 8 (8 \\ - 8 \\ \hline 0 \end{array}$	$\begin{array}{r} 2) 8 (4 \\ - 8 \\ \hline 0 \end{array}$	$\begin{array}{r} 3) 8 (2 \\ - 6 \\ \hline 2 \end{array}$	$\begin{array}{r} 4) 8 (2 \\ - 8 \\ \hline 0 \end{array}$
Quotient is 8 Remainder is 0	Quotient is 4 Remainder is 0	Quotient is 2 Remainder is 2	Quotient is 2 Remainder is 0
$\begin{array}{r} 5) 8 (1 \\ - 5 \\ \hline 3 \end{array}$	$\begin{array}{r} 6) 8 (1 \\ - 6 \\ \hline 2 \end{array}$	$\begin{array}{r} 7) 8 (1 \\ - 7 \\ \hline 1 \end{array}$	$\begin{array}{r} 8) 8 (1 \\ - 8 \\ \hline 0 \end{array}$
Quotient is 1 Remainder is 3	Quotient is 1 Remainder is 2	Quotient is 1 Remainder is 1	Quotient is 1 Remainder is 0



Rimjhim – 1, 2, 4 and 8 are numbers which perfectly divides 8. Hence 1, 2, 4 and 8 are factors of the number 8. So 8 can also be written as 1×8 , 2×4 . Factors are also known as “Upvartak”.

Mukul – Rimjhim, we can also say that 8 is one multiple of 1, 2, 4, 8. (Hence ‘8’ appears in the tables of 1, 2, 4, 8.)

Do and Learn ◆

In the following table, write the factors against the numbers given:

Number	Factors
12	1, 2, 3, 4, 6, 12
24
27
17
15
7

From the table above, can you say that '1' is the factor of every number?

.....

Every number is a factor of itself.



2.3 Prime and Non-prime numbers

Look at the factors of the numbers given below:

Number	Factors	Number of Factors
1	1	1
2	1,2	2
3	1,3	2
4	1,2,4	3
5	1,5	2
6	1,2,3,6	4
7	1,7	2
8	1,2,4,8	4

Table 2.1



In the table, 1 is the only number whose number of factors is 1, therefore 1 is neither Prime nor Non-prime.

Looking at the table, find out which numbers have only two factors?...

Those numbers which have only two factors (1 and the number itself) are known as Prime numbers, such as 2,3,5,7 etc.

Numbers with more than 2 factors are known as Non-prime or Composite numbers, such as 4, 6, 8, 9, 10 etc.

Number Game – Let us play a game where we can tell if a number is prime or not without factorization. First write the numbers 1-100 as shown below:

Step 1: Make a box on the number 1 as it is neither prime nor non-prime.

Step 2: Encircle number 2, and cross all its multiples such as 4, 6, 8 etc (except 2).

Step 3: The next number not crossed is 3. Encircle 3 and cross all its remaining multiples.

Step 4: Continue this process until all numbers have either been encircled or crossed. All encircled numbers are Prime numbers. After this game, how many Prime numbers did you get between 1–100? Write these numbers in sequence and match them with your friends.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

2.4 Odd-Even Numbers

Kanak and Pritam were playing marbles.

Kanak – Look Pritam, let me teach you a game. Take any number of marbles in your hand and close your fist. Now, I have to tell if the marbles in your hand are in pairs or not. This game is also called Eki or Beki. Eki means that when you make pairs of marbles in your hand and if one marble is left without a pair then it is Eki, if all marbles are in pairs then it is called Beki. Kanak and Pritam played this game and wrote it in a table.

Play this game with your friends and decide which numbers should be called Eki and which ones Beki?



Were you able to frame any rule? Numbers with 2, 4, 6, 8, 0 in units place are known as Even numbers. If 1, 3, 5, 7, 9, are in units place then the numbers are known as Odd numbers.

Score Card		
Kanak	Pritam	
15 marbles	Beki	Wrong
19 marbles	Eki	Right
24 marbles	Beki	Right
-----	-----	-----

Table 2.2

All those numbers which are perfectly divisible by 2 or are multiples of 2 are known as Even numbers.



Do and Learn

Write Even and Odd numbers separately.

- (i) 357 (ii) 436 (iii) 77 (iv) 1900 (v) 5001

Even numbers.....Odd numbers.....

Exercise 2.1

- Write all the factors of the following numbers:
(i) 48 (ii) 36 (iii) 28 (iv) 100 (v) 125
- Write the first five multiples of the following numbers:
(i) 7 (ii) 12 (iii) 17 (iv) 15 (v) 18
- Write all prime numbers between 10 and 30.
- Write the smallest prime number.
- Which of the following numbers have 6 as a factor?
6, 10, 12, 15, 18, 25, 30, 38, 46
- Write 3 numbers which are multiples of 4 and 6
- State whether True or False
 - 108 is a multiple of 9
 - 7 is a factor of 27
 - The sum of two prime numbers is an even number
 - Every prime number is odd
 - 1 is a factor of every number
 - Multiple of each number is less than the number itself
 - Factor of each number is less than the number itself

2.5 Rules of Divisibility

2.5.1 On the basis of the units digit

(I) Divisibility by 2

We have learned about odd and even numbers. Now can you tell if every even number is divisible by 2? Take some odd and even numbers like 24, 15, 48, 26, 13, 11 and find their factors.

Factors of 24 are 1, 2, 3, 4, 6, 8, 12, 24.

Factors of 15 are 1, 3, 5, 15.

Likewise find out factors of 26, 48, 13, 11.

Write the unit digit of those numbers whose one factor is 2.

Numbers		Numbers	
Even	Divisible by 2	Odd	Divisible by 2
22	Yes	11	No
28		51	
50		57	
36		23	
---		---	
---		---	

Table 2.3

Hence now we can say, all numbers which have unit digits as 0, 2, 4, 6, 8, are divisible by 2, and 2 is a factor of these numbers.

(i) Divisibility by 10

Numbers	Divisible by 10 Yes/No
20	
22	
120	
50	
17	
19	

Table 2.4

Write some more numbers in the table. Do you find any pattern in the numbers divisible by 10 at its units place?

All those numbers which have 0 at units place, or which have 10 as one of their factors, are divisible by 10.



(i) Divisibility by 5

Numbers	Factors
45	1,3,5,9,45
40	1,2,4,5,8,10,20,40
32	.....
18	.....
25	.....

Now look at the unit digit of every number, which has 5 as one of the factors. Hence we can say that all numbers having their unit digits 0 or 5 are divisible by 5.

Do and Learn ◆

1. Do all the numbers which have 0 and 5 at their units place, have 5 as one of their factors?
2. Are all these numbers divisible by 5?
3. Does any number not having 0 or 5 at its units place, have 5 as a factor?

2.5.2 On the basis of addition of digits

(i) Divisibility by 3

Teacher will arrange a game in the class.

1. Think about a number.
2. Add the digits of that number.
3. Divide the sum by 3.
4. Was it perfectly divided?
5. Divide the number by 3 directly.
6. Could it be divided perfectly.

Teacher will write the result on blackboard.

Numbers	Sum of Digit	Divisible by 3
39	$3 + 9 = 12 ; 1 + 2 = 3$	Yes
109	$1 + 0 + 9 = 10 ; 1 + 0 = 1$	No
507		
1008		
.....		

Table 2.5



Complete the table above –

Reena tried this rule on number 321 for divisibility by 3.

Sum of digits of 321 = $3+2+1=6$

6 is divisible by 3.

$$\begin{array}{r} 3 \overline{) 321} \quad (107 \\ \underline{- 3} \\ 021 \\ \underline{- 21} \\ 00 \end{array}$$

Hence we can say that any number with the sum of digits divisible by 3 is also divisible by 3.

(ii) Divisibility by 9

Numbers	Sum of Digit	Divisible by 9
1827	$1 + 8 + 2 + 7 = 18$	Yes
1227		
3395		
145		
.....		

Table 2.6

Complete the table above. On the basis of this can you find any pattern for the divisibility by 9?

If sum of digits of any number is divisible by 9 then that number is also divisible by 9.

Do and Learn

Sum of digits of 3672: $3+6+7+2=18$

Is it divisible by 9?

Find out $3672 \div 9$

(iii) Divisibility by 6

Check the divisibility by 2 and 3 on the number 216.

Numbers	Divisible by 2	Divisible by 3	Divisible by 6
216	Yes	Yes	Yes
58	Yes	No	No
108			
103			
.....			

Table 2.7

Write some more numbers in the table above and complete the table.

Do you see any pattern of divisibility by 6?

If any number is divisible by 2 and 3 separately, then it is also divisible by 6.

Do and Learn

Find out the divisibility by 6 for the numbers 336, 123, 1002, 4236.

(iv) Divisibility by 4

If a number has its last two digits divisible by 4 or if its tens and units digits are 0, then it is divisible by 4. Take some numbers and check this pattern.

Meena took one number 9212. Its last two digits are 12 which is divisible by 4. Now you try to divide it.

(v) Divisibility by 8

If the number framed by last three digits i.e. units, tens and hundred is divisible by 8 or if any number has 0 as its units, tens and hundreds digits, then the number is divisible by 8. Test this pattern in the table below:

Numbers	Number formed by hundreds, tens and units	Divisible by 8 Yes/No
1. 30480	$480 \div 8 = 60$	Yes
2. 42108	$108 \div 8 = \dots\dots\dots$	$\dots\dots\dots$
3. 1324	$324 \div 8 = \dots\dots\dots$	$\dots\dots\dots$
4. $\dots\dots\dots$	$\dots\dots\dots = \dots\dots\dots$	$\dots\dots\dots$
5. $\dots\dots\dots$	$\dots\dots\dots = \dots\dots\dots$	$\dots\dots\dots$

Table 2.8

(vi) Divisibility by 11

Is the number 72325 divisible by 11? The odd place digits in the number 72325 are 7, 3, 5.

Sum of these digits equals $7+3+5=15$.

Likewise sum of the even placed digits are $2+2=4$. Now (sum of odd placed digits - sum of even placed digits) = $15-4=11$, which is divisible by 11.

Hence the number 72325 is also divisible by 11.

Likewise you also fill in the table and find out which other numbers are divisible by 11?

$$\begin{array}{r}
 11) 72325 \text{ (} 6575 \\
 \underline{- 66} \\
 63 \\
 \underline{- 55} \\
 82 \\
 \underline{- 77} \\
 55 \\
 \underline{- 55} \\
 0
 \end{array}$$

S.N.	Numbers	Sum of even-placed digits	Sum of odd-placed digits	Difference divisible by 11 or not
1	3333			
2	15708			
3	12345			
4	130303			

Table 2.9

Can you define a rule for divisibility by 11 on the basis of the above table? All those numbers which have the difference between sum of its odd place digits and even place digits as zero (0) or multiple of 11 is divisible by 11.

2.6 Common multiple and prime factor

Common multiple

What are the multiple of 3 and 4?

Multiple of 3= 3, 6, 9, 12, 15, 18, 21, 24.....(write some more multiples)

Multiple of 4= 4, 8, 12, 16, 20, 24, 28, 36.....(write some more multiples)

Now select the common multiple of 3 and 4.

12, 24, 36...are those numbers which are multiple of both 3 and 4. These are called common multiple of 3 and 4.

Prime factor

We learnt finding out factors of numbers. Observe the factors of number 18.

$$18 = 2 \times 9 \quad \text{and} \quad 18 = 3 \times 6$$

$$= 2 \times 3 \times 3 \quad \quad \quad = 3 \times 2 \times 3$$

Now we can see that the factors of 18 done by above methods are prime numbers. These types of factors of any number are called prime factors. We can obtain factors of any number like this as well:

$$\begin{array}{r|l} 2 & 24 \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

Exercise 2.2

- Find out the prime factors of following numbers
 (i) 28 (ii) 54 (iii) 96 (iv) 148 (v) 156
- Write the prime factors of the smallest number of four digits.
- Find out common factors of the following:
 (i) 24, 36 (ii) 35, 40 (iii) 12, 18, 30 (iv) 14, 25, 35
- Find out first 3 common multiple of the following
 (i) 4 and 5 (ii) 8 and 12 (iii) 2, 4, 10 (iv) 3, 9, 15
- Write all the numbers smaller than 50, which are common multiple of 2 and 3



2.7 Highest Common factor(HCF)

2.7.1 By method of prime factorisation

We have learned about factors. Let's learn about properties of factors.

Most possible factors of 30,36 and 42 are

$$\begin{array}{r}
 30 = \boxed{1} \quad \boxed{2} \quad \boxed{3} \quad 5 \quad \boxed{6} \quad 10 \quad 15 \quad 30 \\
 36 = \boxed{1} \quad \boxed{2} \quad \boxed{3} \quad 4 \quad \boxed{6} \quad 9 \quad 12 \quad 18 \quad 36 \\
 42 = \boxed{1} \quad \boxed{2} \quad \boxed{3} \quad \boxed{6} \quad 7 \quad 14 \quad 21 \quad 42
 \end{array}$$

Hence we see 1, 2, 3 and 6 are common factors of 30, 36 and 42. 6 is the largest number and all 30, 36, 42 are divisible by 6. These kinds of numbers are called HCF. Let's understand its use in daily life.

Example 1 Asha, Nisha and Shyam have roll of ribbons 14 meter, 35 meter and 21 meter respectively. All of three want to cut the ribbon in equal largest pieces so that no ribbon must be left. Then how much long pieces of ribbon will they cut equal in length?

Solution Asha, Nisha and Shyam can respectively cut ribbons with the following measurement:

$$\begin{array}{r}
 14 = 1 \quad 2 \quad 7 \quad 14 \\
 35 = 1 \quad 5 \quad 7 \quad 35 \\
 21 = 1 \quad 3 \quad 7 \quad 21
 \end{array}$$

7 is the greatest common factor of 14,35 and 21. Therefore 7 meter is the greatest measurement for cutting the ribbons of length 14,35 and 21 and equal as well for cutting the equal ribbons in the above example. It is also HCF.

Example 2 Find out the HCF of 24,36 and 60 by the method of prime factor.

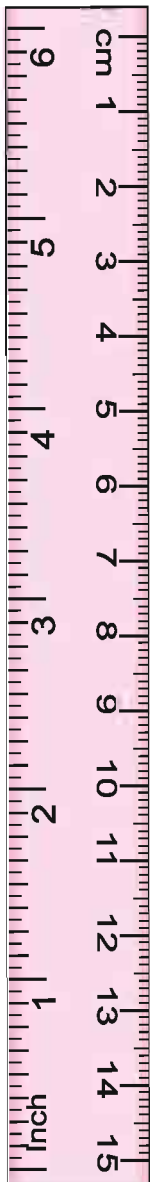
Solution

$$\begin{array}{r|l}
 2 & 24 \\
 \hline
 2 & 12 \\
 \hline
 2 & 6 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}
 \quad
 \begin{array}{r|l}
 2 & 36 \\
 \hline
 2 & 18 \\
 \hline
 3 & 9 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}
 \quad
 \begin{array}{r|l}
 2 & 60 \\
 \hline
 2 & 30 \\
 \hline
 3 & 15 \\
 \hline
 5 & 5 \\
 \hline
 & 1
 \end{array}$$

$$\begin{array}{r}
 24 = \boxed{2} \times \boxed{2} \times 2 \times \boxed{3} \\
 36 = \boxed{2} \times \boxed{2} \times \boxed{3} \times 3 \\
 60 = \boxed{2} \times \boxed{2} \times \boxed{3} \times 5
 \end{array}$$

Common Factors of 24, 36 and 60 = $2 \times 2 \times 3$

Hence HCF of 24, 36, 60 = $2 \times 2 \times 3 = 12$



Do and Learn

Raju's Cow Gives 15 litres and buffalo give 20 litres milk. Find out The maximum measurement for measuring pot for both type of milk exactly.

2.7.2 Vedic Method

In Vedic method the formula (Addition – Subtraction) is used to find out H.C.F, let's Practice It

Example 3 Find out H.C.F of 24 and 36

Solution First difference of numbers = $36 - 24 = 12$

Therefore possible H.C.F = 12

Second Difference $24 - 12 = 12$, First difference = Second difference. Hence H.C.F of 24 and 36 = 12

Example 4 Find out H.C.F of 145 And 232

Solution First difference $232 - 145 = 87$ therefore possible H.C.F is 87

Second difference $145 - 87 = 58$ therefore possible H.C.F is 58

Third difference $87 - 58 = 29$ therefore possible H.C.F is 29

Fourth difference $58 - 29 = 29$ therefore H.C.F is 29

H.C.F of 145 and 232 = 29

Example 5 Find out H.C.F of 18, 54, 81

Solution Addition Of two numbers $18 + 81 = 99$

First difference $18 + 81 - 54 = 45$ therefore possible H.C.F is 45

Second difference $54 - 45 = 9$ therefore possible H.C.F is 9

Possible H.C.F 9 is a factor of 45.

Hence H.C.F 18, 54, 81 = 9

Do and Learn

Find out H.C.F by Vedic method

(i) 8, 12

(ii) 38, 57

(iii) 117, 195

(iv) 99, 165, 231

Exercise 2.3

- Find out H.C.F of the following numbers
(I) 36, 84 (ii) 28, 42 (iii) 13, 26, 52 (iv) 15, 35, 40 (v) 23, 31, 93
- Find out H.C.F of the following
 - Two successive numbers
 - Two successive even numbers
 - Two successive odd numbers

3. Width and length of the floor is 25meters and 30meters respectively. Find out the length of the longest rope which can be use to measure length and width of the room exactly.
4. Three oil tankers are of capacity 96liters, 100liters and 144liters. Find out maximum measurements to measure the oil of all three tankers exactly.
5. Find out the length of the longest rope to measure distances of 36meters, 54meters, 90meters?

2.8 Lowest common multiple (L.C.M)

Teacher asks students a puzzle in the class.

If i make a pile of "4-4 or 5-5 berries

How many minimum berries would be distributed equally both the time"

Leela- It means that each pile must have equal berries and both of the piles must be distributed so that nothing left, nothing less

Teacher- Yes, now tell us that how many minimum berries are there in each pile?



Kamal- If berries are in the numbers 4, 8, 12, 16, 20, 24, 28, 32, 36, 40 etc then these berries can be divided into the groups of 4-4



Leela- If berries are in the number 5, 10, 15, 20, 25, 30, 35, 45 then we can distribute it in the groups of 5-5

The smallest number which is divisible by two or more than two numbers wholly, is called lowest common multiple of those numbers.



Do and Learn

Two bells start ringing together. First bell rings after every three minutes and second bell rings after every five minutes then after how much time both bells will ring together?

2.8.1 Methods of finding out lowest common multiple

1. Prime Factor Method

L.C.M. of 48 and 30 can be found out by prime factor method

Step 1 Find out prime factors of each number

$$48 = 2 \times 2 \times 2 \times 2 \times 3$$

$$30 = 2 \times 3 \times 5$$

2	48
2	24
2	12
2	6
3	3
	1

2	30
3	15
5	5
	1

Step 2 In these prime factors the prime factor 2 appears the maximum of four times (that is in 48) and 3 and 5 appear maximum 1-1 times each.

$$\text{Therefore the desired L.C.M} = 2 \times 2 \times 2 \times 2 \times 3 \times 5 = 240$$

2. Method of division

Let's find out the L.C.M of 18, 24, 30 by division method.

Step 1 Write the numbers in series as shown below:

2	18, 24, 30
2	9, 12, 15
2	9, 6, 15
3	9, 3, 15
3	3, 1, 5
5	1, 1, 5
	1, 1, 1

Step 2 Divide by the smallest possible numbers. Numbers which cannot be divided by that number are written as it is in the next line.

Step 3 This is continued till the numbers are divided. Then the division is repeated with the next prime number till all the numbers have been divided completely.

Step 4 The multiplication of divisors from each row is the L.C.M. Therefore the L.C.M of 18, 24, 30 is $2 \times 2 \times 2 \times 3 \times 3 \times 5 = 360$

3. Vedic method

Let's find the L.C.M of 12 and 16 by Vedic method.

Step 1 12 and 16 can be written in different form as $\frac{12}{16}$. (According to formula)

Step 2 Do prime factorization of 12 and 16. $\frac{12}{16} = \frac{2 \times 2 \times 3}{2 \times 2 \times 2 \times 2}$

Step 3 Now remove the common numbers from numerator and denominator. $\frac{12}{16} = \frac{3}{4}$

Step 4 By the method of cross multiplication $12 \times 4 = 16 \times 3 = 48$.
Hence L.C.M of 12 and 16 is 48.



Do and Learn

1. Find out the L.C.M of 48,64 and 80 by division method.
2. Find out the L.C.M of 24 and 30 by Vedic method.

Exercise 2.4

1. Find out L.C.M of the following.
 - (i) 10,15
 - (ii) 14,28
 - (iii) 12,18 and 27
 - (iv) 48, 56 and 72
2. Minimum how many mangoes can be divided into the group of 5 and 6 completely?
3. Sneha and Vansh go to market every 3rd and 5th day. They went to market today. After how many days will they go to market together?
4. Harish, kareem and rakesh take a round of the ground respectively in 6,8 and 12 minutes. If all of three start at 6'O clock then after how long time they will be together?
5. Find out the smallest number which is divisible by 16,20 and 24 completely.
6. A blue bulb keeps flashing on the interval of every 60 second and a red bulb keeps flashing on the interval of every 90 seconds. If both the bulbs are switched on at 5'o clock together then after how much time both will flash together?

We learnt

1. (i) One factor of a number is a whole divisor of that number.
 (ii) Each number is a factor of itself. 1 is a factor of every number.
 (iii) Every factor of a given number is smaller or equivalent to the number.
 (iv) Each number is a multiple of its each factor.
 (v) Every multiple of a given number is greater than the number or equivalent to the number.
 (vi) Every number is a multiple of itself.
2. (i) The number which has only two factors (The number itself and 1) is called a prime number.

- (ii) 2 is the smallest prime number which is also an even number. All the prime numbers are odd numbers.
3. We can check the divisibility of any number by 2, 3, 4, 5, 8, 9, 10 and 11.
- (i) Divisibility by 2, 5 and 10 can be checked by observing the digit at units place of the given number.
- (ii) Divisibility by 3 and 9 can be checked by adding the digits of the given number.
- (iii) Divisibility by 4 can be checked by the digits at tens and units place and divisibility by 8 can be checked by the digits at the unit, tens and hundreds place.
- (iv) Divisibility by 11 can be checked by the sum of the digits at the odd and even places.
4. If two numbers can be divided by a number, then the sum and difference of those numbers can also be divided by that same number.
5. The HCF of two or more numbers, is biggest among all its common factors.
6. The L.C.M. of two or more number is the smallest common among its all multiples through vedic method we can also find the LCM and HCF of numbers.



3.1 We count several things daily, like you have 3 friends, 6 cows are grazing in the field, 25 students in the class etc.

Man has started counting thousands years ago. We always start counting by number 1. We can count up to how much?

Ramesh said: up to 100.

Seema - why, we have the number 101 after 100.
(Ramesh was counting himself and thought that there are 200, 300...) after 100.

Then he said up to 1000.

Seema - but we have 2000, 3000, 4000.....after 1000.
(Ramesh starts thinking again about the greatest number but then gets puzzled)

Ramesh - Ok. Please you tell us up to which number can we count.

Seema - Yes , I am also thinking but even I don't know the last greatest number. We start counting from the number 1. Hence 1 is the first natural number.

Next natural number is 2 which we get as a result of adding 1 to 1, 3 when we add 1 to 2. This is the third natural number. Actually by adding 1 we get the next natural number, which is called successor of the previous number. Thus $99+1=100$ is the successor of 99. Hence the group of natural numbers is a group which is increased by 1 by 1.

If someone asks you that how many natural numbers are there? Can you tell us by counting? Perhaps no.

If we count 1, 2, 3....100, 101....999...1001. Then where will it end? No... Natural numbers are infinite, which is represented by ... Group of natural numbers is denoted by N.

Therefore $N = \{1, 2, 3, \dots\}$

3.1.1 Properties of natural numbers

1. The smallest natural number is 1
2. We get next natural number by adding 1 to the natural number. Such as $18+1=19$
3. Except 1, Subtracting 1 from each natural number we get its predecessor. Such as $18-1=17$
4. Natural numbers are infinite. Therefore we cannot write the largest natural number.

5. Subtracting 1 from the smallest natural number 1, we get zero (0), which is not a natural number.

3.2 Whole numbers

Fill in the blanks with suitable numbers :-

Predecessor natural number	Natural Number	Successor (Next natural number)
$13-1=12$	13	$13+1=14$
—	55	—
99	100	101
—	200	—
—	10	11
—	1	—

Table 3.1

Which number does not have any natural Predecessor natural number?

There is no natural predecessor of number 1. We take zero as the predecessor of 1. When we add it to the group of natural numbers, it becomes a new group.

(0,1,2,3...)

This is called a group of Whole numbers. It is denoted by W. Hence

$$W = \{0, 1, 2, 3, \dots\}$$

Your Father brought 6 bananas. There are six members in the family. Everyone ate 1 banana each. Now how many bananas are left?

you will say none.

Five birds were sitting on a tree. All birds flew one by one. So now how many are left.

You will say none.

Think about it:

$$6-6 = \dots \text{ or } 5-5 = \dots \text{ or } 10-10 = \dots$$

What is the answer?

3.2.1 Representing whole numbers on the number line.

To represent whole numbers on the number line draw a straight line which has many marks on equal distances.



Show the initial point by 0. Write 1,2,3 etc on the right side of 0. Looking at the number line can you tell which number is bigger? For this think whether a number on the left side of another number will be greater or smaller?



3.2.2 Properties of whole numbers

1. All the properties of natural numbers are true for whole numbers as well.
2. The smallest whole number is zero.
3. On the number line numbers are written in ascending order from zero towards right. i.e
 $0+1=1, 1+1=2, \dots, 101+1=102, 102+1=103, \dots, 103+1=104$ etc.

Looking at the following table find out true or false.

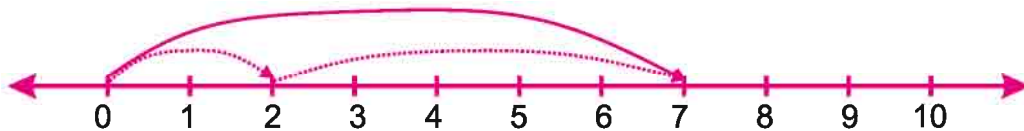
S.N.	Numbers	Position on number line	Relation between numbers	True/false
1	12,8	12 is on the right side of 8	$12 > 8$	
2	3,10	3 is on the left side of 10	$10 < 3$	
3	66,45	66 is on the right side of 45	$66 > 45$	
4	236,190	190 is on the left side of 236	$190 < 236$	
5	1001,1010	1010 is on the right side of 1001	$1010 > 1001$	

Table 3.2

3.2.3 Operations of whole numbers on the number line.

Practise the operations of simple addition, subtraction, multiplication and division on the number line.

Addition on the number line - Let us add 2 and 5.

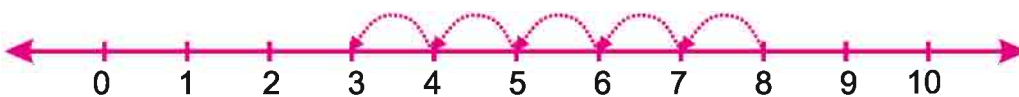


Starting from 2 on the number line we move 5 steps to the right and reach 7. Hence $2+5=7$ (Do practice with different numbers.)

When two numbers are added on the number line, we start with one number and move the number of steps equal to the other number. This gives us the desired sum.

Subtraction on the number line

This operation will be done in the opposite direction to the addition operation. If 5 is to be subtracted from 8. then –

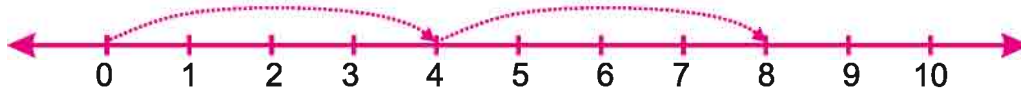


$8 - 5 = 3$. Practise with different numbers.

Multiplication on the number line.

Now we will multiply whole numbers on the number line .

Find out 2×4 . We can write it as (2 times 4)



Starting from 0 on the number line we reach till 4 once. Moving 4 steps again we reach 8 the second time. i.e $2 \times 4 = 8$

Exercise 3.1

1. Fill in the blanks

- (i) Predecessor of 55 is....
- (ii) Predecessor of 100 is.....
- (iii) Predecessor of 305 isand its successor is
- (iv) Whole numbers are formed by includingin natural numbers.
- (v) Predecessor of 1 is.....

2. Write the predecessors of the following numbers

- (i) 1203 (ii) 2406 (iii) 3555 (iv) 4444

3. Write the successors of the following numbers

- (i) 2304 (ii) 3611 (iii) 4000 (iv) 5060

4. Write the successors and predecessors of the following numbers

- (i) 189 (ii) 199 (iii) 209 (iv) 300

5. Which is the smallest whole number?

6. Mark right or wrong in front of the following statements :

- (i) All natural numbers are whole numbers.
- (ii) 1 is the smallest whole number.
- (iii) The sum of two whole numbers is always a whole number.



- iv. $245 + 450 = 450 + 245$
- v. $1124 + 0 = 0$
- vi. The operation of subtraction is reciprocal to the operation of addition.
- vii. $4 - 4 = 0$ (is a whole number)
- viii. $7 - 7 \neq 0$
- ix. The product of any two whole numbers is a whole number.
- x. When we multiply a whole number by 0 the product is the number itself.
- xi. When we multiply a whole number by 1 the product is the number itself.

3.3 Properties of whole numbers

3.3.1 Closure property

Look at the following numbers carefully and think

$$6 + 2 = 8, \text{ a whole number}$$

$$2 + 8 = 10, \text{ a whole number}$$

$$0 + 5 = 5, \text{ a whole number}$$

$$12 + 0 = 12, \text{ a whole number}$$

$$7 + 6 = 13, \text{ a whole number}$$

We can see from the above examples that the sum of two whole numbers is a whole number. Take some more pairs of whole numbers.

Are their sums also a whole number?

Did you find any pair whose sum is not a whole number? You will find that sum of whole numbers is always a whole number.

Therefore whole numbers are closed under addition.

Are the whole numbers closed for subtraction?

Consider the following

$$8 - 5 = 3 \quad \text{is whole number}$$

$$10 - 9 = 1 \text{ is a whole number}$$

$$0 - 5 = (-5) \quad \text{is not a whole number}$$

$$6 - 0 = 6 \quad \text{is a whole number}$$

$$13 - 17 = (-4) \text{ is not a whole number}$$

Subtraction of any two whole number may or may not be a whole number.

Thus whole number are not closed under subtraction.

Look at the following :

$$6 \times 2 = 12 \text{ a whole number}$$

$$4 \times 5 = 20 \text{ a whole number}$$

$$10 \times 0 = 0 \text{ a whole number}$$



$$0 \times 8 = 0 \text{ a whole number}$$

Therefore the product of two whole numbers is also a whole number.

Therefore whole numbers are closed under multiplication.

Think about the operation of division.

$$12 \div 4 = 3, \text{ a whole number}$$

$$7 \div 8 = \frac{7}{8}, \text{ not a whole number}$$

$$0 \div 5 = 0, \text{ a whole number}$$

$$20 \div 25 = \frac{4}{5}, \text{ not a whole number}$$

The quotient of two whole numbers may or may not be a whole number.

Therefore whole numbers are not closed under Division.

Do and learn		Closure property	
Whole numbers	Operations	Result	Conclusion
6 and 2	Addition		
0 and 5	Addition		
8 and 5	Subtraction		
13 and 17	Subtraction		
6 and 2	Multiplication		
0 and 8	Multiplication		
8 and 2	Division		
7 and 9	Division		

Table 3.3

3.3.2 Division by zero

Meaning of dividing a number by any number is subtracting that number again and again from the first number.

After subtracting 5 three times from the number 15 we will get 0.

$$\text{Hence } 15 \div 5 = 3$$

Let's try to find out the solution of $4 \div 0$

(i) Every time after subtraction of zero we are getting the number 4 only.

(ii) Will this procedure ever end or not?

Hence $4 \div 0$ is not explained in mathematical language. Therefore we will say that this is undefined.

Conclusion: Division of whole numbers by 0 is not defined.



3.3.3 Commutative property

Think about the following

$$8 + 7 = 15,$$

$$7 + 8 = 15$$

Likewise

$$19 + 15 = 34,$$

$$15 + 19 = 34$$

Hence adding two numbers in any order we get the same number as answer.

Now take five more pairs of numbers and test the above fact.

Does sum of any pair changed after changing their order? no.

Therefore we can say that whole numbers follow the property of commutativity for addition operation.

$$8 \times 5 = 40$$

$$5 \times 8 = 40$$

$$25 \times 10 = 250$$

$$10 \times 25 = 250$$

Hence multiplying two numbers by exchanging orders we get the same product.

$$8 - 3 = 5$$

$$10 - 7 = 3$$

$$3 - 8 = ?$$

$$7 - 10 = ?$$

We do not get same answer while subtraction on interchanging the place of numbers.

So as:

$$8 \div 2 = 4$$

$$25 \div 5 = 5$$

$$2 \div 8 = \dots?$$

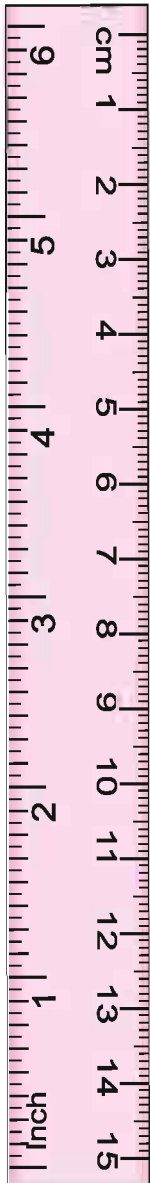
$$5 \div 25 = \dots?$$

We also do not get the same answer after interchanging the numbers of a division.

Conclusion Hence we can say

Whole numbers have a property of commutativity for addition and multiplication.

For subtraction and division whole numbers, property of commutativity is not applicable.



Whole numbers	Operations	Result	Conclusion
7 and 8	$7 + 8 = 15$	We get same sum after changing the order of numbers.	Is commutative is there
8 and 7	$8 + 7 = 15$		
9 and 6	$9 - 6 = 3$	We do not get same difference after changing the order of numbers.	Not commutative.
6 and 9	$6 - 9 = ?$		
5 and 4	$5 \times 4 = 20$	Product is always same after changing the order of numbers.	Is commutative.
4 and 5	$4 \times 5 = 20$		
10 and 2	$10 \div 2 = 5$	When we interchange the numbers we do not get the same quotient.	Not commutative.
2 and 10	$2 \div 10 = ?$		

3.3.4 Property of associativity

$$\begin{aligned} (5+2)+4 &= 7+4=11 \\ 5+(2+4) &= 5+6=11 \\ (7+9)+1 &= 16+1=17 \\ 7+(9+1) &= 7+10=17 \\ (5+8)+7 &= 13+7=20 \\ 5+(8+7) &= 5+15=20 \end{aligned}$$

Look at the above operations of addition. This property of whole numbers is known as associativity.

Will property of associativity also apply on subtraction?

One other example:

$$\begin{aligned} (6 \times 3) \times 2 &= 18 \times 2 = 36 \\ 6 \times (3 \times 2) &= 6 \times 6 = 36 \end{aligned}$$

Hence we see in the operation of multiplication as well there is no difference in the answer when we multiply first two numbers and then the third number. Let's see the rule of the associativity for division

$$\begin{aligned} (24 \div 6) \div 2 &= 2 \\ 24 \div (6 \div 2) &= 8 \end{aligned}$$



Hence we get different results on division of three whole numbers.

Conclusion (i) Property of associativity is applied on the operation of addition and multiplication.

(ii) Property of associativity is not applied on operations of subtraction and division.

Do and learn

Now take set of 3-3 numbers and test properties of associativity on the operations of addition and multiplication respectively.

3.3.5 Distribution of multiplication on addition

$4 \times 6 = 24$ can also be written as

$$4 \times (4 + 2) = 24$$

$$(4 \times 4) + (4 \times 2) = 24 \text{ or } 4 \times (4 + 2) = 24$$

Look at the following numbers carefully:

$$8 \times (3 + 9) = (8 \times 3) + (8 \times 9)$$

This is called distributive property of multiplication on addition.

3.3.6 Identity element

For addition and multiplication

Look at the following table

8	+	0	=	8
4	+	0	=	4
0	+	5	=	5
0	+	24	=	24
0	+	....	=	...

Hence it is clear from the table above that when we add 0 to any whole number, the answer is whole number itself. Therefore 0 is known as an identity element for whole numbers. Zero is an additive identity for whole numbers.

7	x	1	=	7
8	x	1	=	8
15	x	1	=	15
18	x	1	=	18
....	x	1	=	.....

Hence it is clear from the table above that when we multiply any number by 1 then we get the number itself. Therefore 1 is the identity element for multiplication of whole numbers. 1 is known as the multiplicative identity of whole numbers.


Exercise 3.2


1. Add the following by arranging in proper order.

(i) $85 + 186 + 15$ (ii) $175 + 96 + 25$ (iii) $65 + 75 + 35$ (iv) $55 + 86 + 45$

2. Find out the multiplication by proper order.

(i) $4 \times 1225 \times 25$ (ii) $4 \times 158 \times 125$ (iii) $4 \times 85 \times 25$ (iv) $8 \times 20 \times 125$

3. Find out the value of each of the following by distributive property.

(i) $185 \times 25 + 185 \times 75$

(ii) $4 \times 18 + 4 \times 12$

(iii) $54279 \times 92 + 8 \times 54279$

(iv) $12 \times 8 + 12 \times 2$

4. Find out the multiplication by using proper property.

(i) 185×106

(ii) 208×185

(iii) 54×102

(iv) 158×1008

5. Match the following

(i) $2 + 8 = 8 + 2$

(a) commutativity of multiplication

(ii) $8 \times 90 = 90 \times 8$

(b) commutativity of addition

(iii) $885 \times (100 + 45) = 885 \times 100 + 885 \times 45$

(c) Associative property of multiplication

(iv) $5 \times (4 \times 28) = (5 \times 4) \times 28$

(d) Multiplicative distribution on addition

6. If the multiplication of any two whole numbers is zero, can we say that one or both of the numbers must be zero? Give an example to prove it.

7. If the multiplication of two whole numbers is 1, then can we say that one or both of the numbers are equal to 1? Prove your answer with example.

8. Find out the following by distributive method.

(i) 138×101

(ii) 125×400

(iii) 608×35

9. Which of the following will not result in zero.

(i) $1 + 0$

(ii) 0×0

(iii) $\frac{0}{2}$

(iv) $10 - \frac{10}{2}$



10. Choose a, b, c... and write in the bracket.

(i) Which of the following has the commutative property of addition?

(a) $5 \times 8 = 8 \times 5$

(b) $(2 \times 3) \times 5 = 2 \times (3 \times 5)$

(c) $(12+8)+10 = (2+8)+10$

(d) $15+8 = 8+15$

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(ii) Which of the following has commutative property of multiplication.

(a) $10 \times 20 = 20 \times 10$

(b) $10 \times 10 = 20 \times 20$

(c) $(10 \times 20) = 10 \times 1$

(d) $10+20 = 10 \times 20$

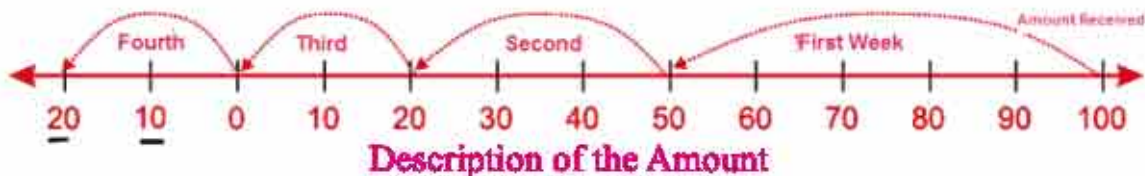
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We learnt

- Natural numbers are used for counting such as 1,2,3...
- If we add 1 to natural number we get the successive natural number. If we subtract 1 from any natural number, we get its predecessor.
- Every natural number has its successor.
- Except 1 every natural number has its predecessor again a natural number.
- If we include 0 in the group of natural numbers 1,2,3..., then we get a group of whole numbers.
- Every whole number has a predecessor except 0. Every whole number has a predecessor which is again a whole number.
- All whole numbers are not natural numbers but all the natural numbers are whole numbers.
- Take a line and mark a zero on it. On the right side mark more points on equal distances. Now write 1,2,3... on these marks. This line is called number line. Operations like addition, subtraction, multiplication can be easily performed on the number line.
- Moving towards right side of number line we get addition and towards left subtraction. Beginning from 0 and moving on equal distance on number line gives the multiplication.
- Whole numbers are closed under addition and multiplication.
- Division by 0 is not defined.
- For addition of whole numbers identity element or identity is zero and whole number 1 is the identity element for multiplication.
- Addition and multiplication are commutative for whole numbers.
- Addition and multiplication are associative for whole numbers.

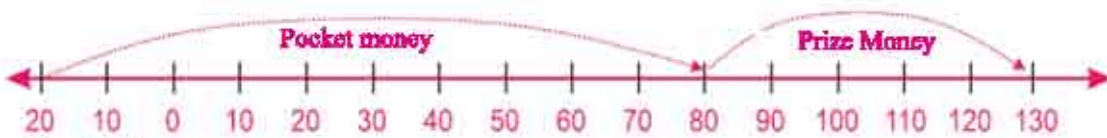
4.1 Mahesh is studying and he is staying in a tribal hostel. His father gives him Rs. 100 every month as pocket money which he deposits with his warden. He transacts the money according to his needs which is recorded on a paper by the warden.

Mahesh took Rs.50 in the first week, Rs. 30 in the second week, Rs. 20 in the third week and asked for Rs. 20 in the fourth week. The warden says that he has returned the complete amount. Ramesh tells him to deduct it in the next month. The warden gives him Rs. 20 and denotes in on the number-line as follows:



Mahesh got Rs.100 on the first day of the second month, which he deposited to the warden. Can you tell how much of Mahesh's money is now left deposited with the warden?

The same day he got prize of Rs 50 for essay writing, now how much total money of Mahesh is deposited with the warden?



Look at the number-line and answer the following questions:

1. How much money did Mahesh spend in the first month?
2. How much money did the warden give him in the fourth week?
3. In which direction has the warden shown above amount on the number-line?
4. What is the difference between the Rs. 20 written on the right side and the Rs.20 written on the left side of the zero?
5. On Which side of the number-line Rs. 100 and Rs.50 received in the second month is denoted?
6. If Mahesh has to spend Rs. 200 due to illness in the second month, how much money will remain with the warden and where on the number-line will it be denoted?

Let us play a game. Draw a number-line shown below:



Material : Red and blue colored dices, a cloth bag, differently colored pieces for all players

Rules of the game

1. Put both the dices in the bag.
2. Player has to select a dice without looking at the bag.
3. If the dice is red then it will move towards the right on the number line.
4. In case of the blue dice, the move is towards the left.
5. The player reaching 25 first will win

Sanju and kapil are playing the same game.

Sanju gets 4 on his red dice and he places his piece to the fourth place on the right. Kapil get 3 on his red dice and he places his piece on 3 on the right.



In the second chance, Sanju gets 3 on his red dice and Kapil gets 4 on his blue dice. Can you tell where the pieces would be kept?



Kapil puts his piece on the left on 1 and Sanju reaches on 7, and the game continues. Kapil reaches 25 on the left and Sanju reaches 10 on right. Kapil says he has won but Sanju says he is ahead. The mathematics teacher arrives and she explains:

Teacher : Kapil you have not won and as per rules Sanju needs 15 more points to win. You should continue playing.

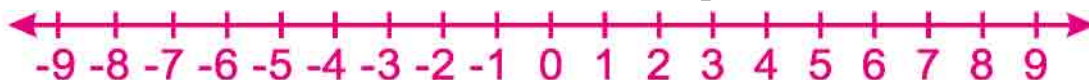
Kapil : Ma'am, I have reached on 25.

Teacher : Look carefully, the 25 on the left and 25 on the right represent two different numbers. Just as 10 is on the right side of 5 and so it is bigger than 5, every number is smaller than the number on its right.

Sanju : Hence your 25 being on the left are smaller than my 10.

Teacher : Numbers increase towards the right on the number-line. Every number is bigger than the number on its left and smaller than the number on its right. The numbers on the left of zero are called Negative numbers and are denoted as -1, -2, -3...to differentiate them from numbers on the right.

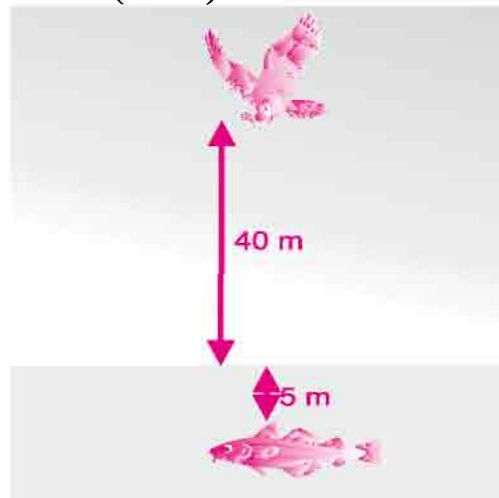
The number next to each number is called its Successor number. And the number before it is called Predecessor. Write the predecessor and successor of



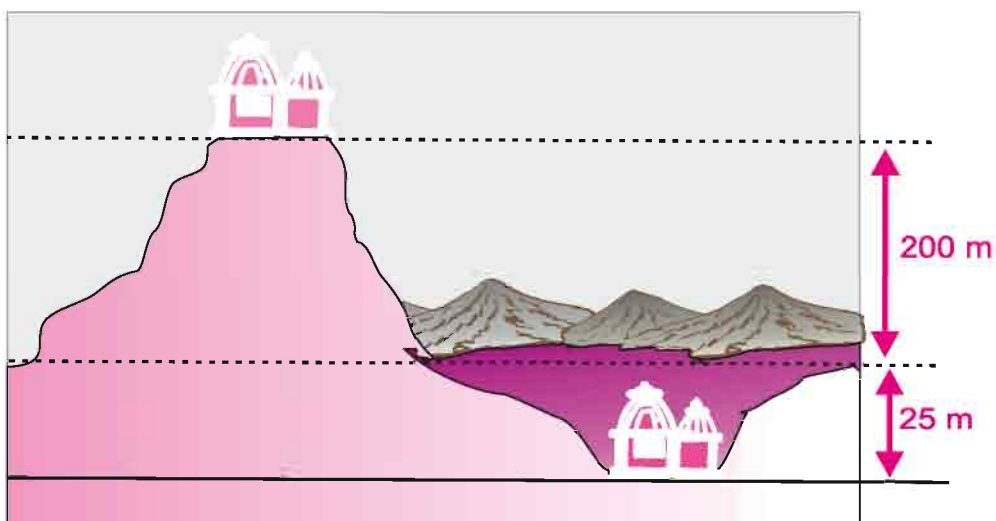
Numbers	Successor	Predecessor
-5		
6		
0		
25		
-10		

4.2 Use of Negative numbers

1. An eagle is flying at 40 meters above sea-level and just below it a fish is swimming at 5 meters below (i.e. -5) sea level.



2. A temple is on a hill at the height of 200 meters above the ground level, and there is another temple in a valley at 25 meters below (i.e. -25) ground level.



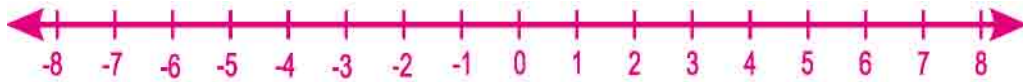
Do and Learn

Write using appropriate symbols

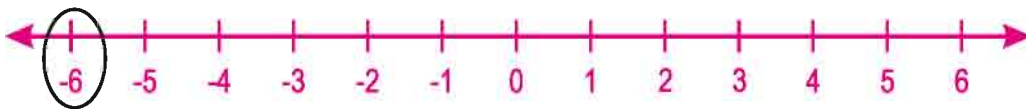
- | | |
|---|---|
| 1. Any 2 numbers smaller than 0 | 2. 50 meters below sea level |
| 3. 10°C Temperature below 0°C | 4. 15°C Temperature above 0°C |

4.3 Integers

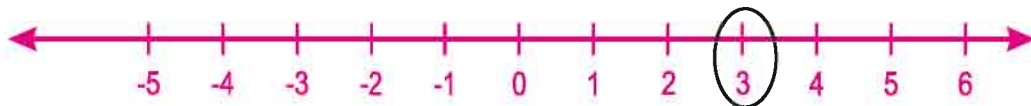
Natural numbers 1, 2, 3... were the first to be discovered, after that 0 added to the group of numbers is called Whole numbers 0, 1, 2, 3... Now we know that numbers are also Negative such as -1, -2, -3.... If we include negative numbers to the group of Whole numbers then the new group is called Integers. It is denoted by I.

Representing Integers on the Number line

Integers are represented in the same way as Natural and whole numbers on the number line. The only difference is that integers also include Negative numbers which are represented on the left side of 0 by points at equal distances between each other. For example to represent -6 it is denoted 6 points from 0 on the left.



If we want to represent +3 then it is represented on the third point towards the right.

**Do and Learn**

Mark -3, 5, -1, 0, -5, 6 on the number line.

4.4 Order relation in Integers

We know that $5 > 3$ and we can see that 5 is located towards the right of 3.



Similarly $3 > 0$, 3 is to the right of 0. Because the number 0 is to the right of -3 so $0 > -3$. Again -3 is to the right of -8 hence $-3 > -8$.

So we can see that as we move towards the right, the value of numbers increases and it decreases as we go to the left.

Exercise 4.1

1. Write the appropriate integer according to the following:

- The temperature of hot water is 45°C
- A matter freezes at 10°C below 0°C .
- Reena earned a profit of Rs 300 by selling book.
- Withdraw Rs. 500 from the bank account.

2. Represent the following on the number line.

- +5
- 4
- 0
- 2

3. Denote the bigger and smaller numbers using signs ($<$, $>$, $=$)

- $3 \square - 5$
- $-2 \square - 4$
- $7 \square - 7$
- $0 \square - 3$
- $0 \square 3$
- $1 \square - 50$

4. Write true or false for the following statements:

- 4 is located to the right side of -3 on the number line. ()
- Zero is a negative number. ()
- The smallest negative Integer is -1. ()
- 0 is located between -1 and 1 on number line. ()

5. Write the integers in ascending order between the pair of numbers given below.

- 0 and -4
- 3 and -5
- 2 and 2
- 10 and -6

6. Write the following integers in ascending and descending order.

- 7, 5, -3, 3
- 1, 3, 0, -2
- 1, 3, -6
- 5, 4, -1, 2

4.5 Addition of integers

Game of tamarind seeds.

Material : Seeds of tamarind cut half in the middle. (10), one number line for every player, one bowl and a plastic coin.

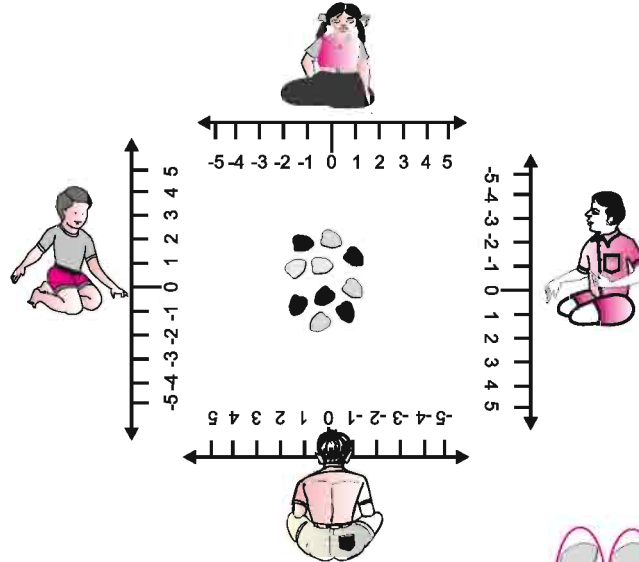
Rules of the game

- White part of every seed will represent +1 and black part of every seed -1.
- All the players will throw the seeds upwards turn wise. After falling on the ground a black part of seed will cancel a white part of seeds and shall be collected in the bowl in pairs.

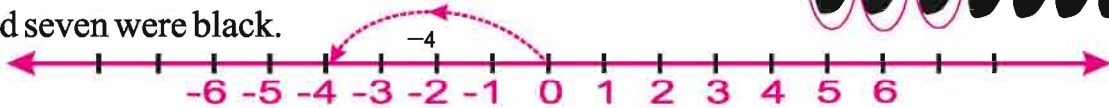
Now according to the colour of remaining seeds players will put their plastic coin on the number line and the game goes on...



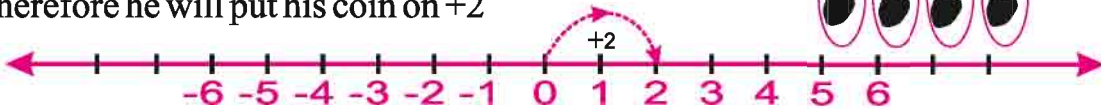
3. The player reaching on Ten first of all, will be the winner of the game.
Pragya and Dheeraj are playing the same game.



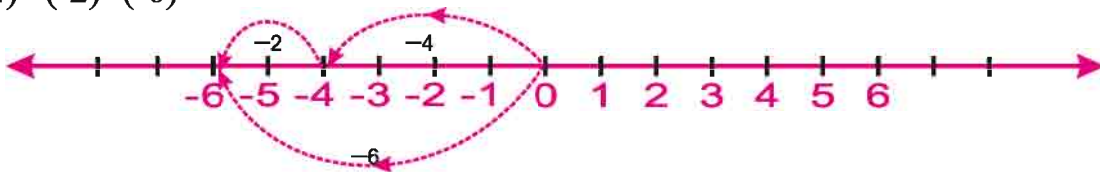
Pragya threw seeds. In those seeds three seeds were white and seven were black.



She has 4 black seeds after cancellation and she puts her coin on -4.
Now Dheeraj threw seeds he got 4 black and 6 white seeds.
Therefore he will put his coin on +2



Again Pragya got 2 black seeds in her second chance. Now in which direction her coin will move forward?
 $(-4) + (-2) = (-6)$



Addition of two positive integers is done like this

$$(+4) + (+2) = (+6)$$

Addition of two negative integers is

$$\text{done like this } (-3) + (-2) = -5$$

Do and Learn ♦ Solve the following-

(i) $(-7) + (+8)$

(ii) $-3 + (5)$

(iii) $(-3) + (-2)$

(iv) $(+7) + (-2)$

Note that we are using positive and negative symbols in reference of addition and subtraction and for showing the direction as well. Hence $7-3$ and $(+7)+(-3)$ are totally different, though the result of both is same.

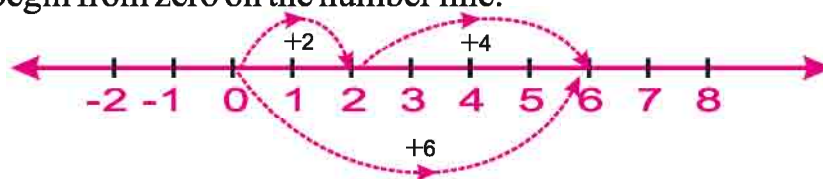
$7-3$ is the difference of two integers while $(+7)+(-3)$ is a sum of two integers. Following this $(+7)-(+3)$ is a subtraction of two integers.

4.5.1 Addition of integers on number line

It is not always possible for us to add integers by black and white seeds. Let us learn the addition of integers on number line.

(i) $(+2)+(+4)$

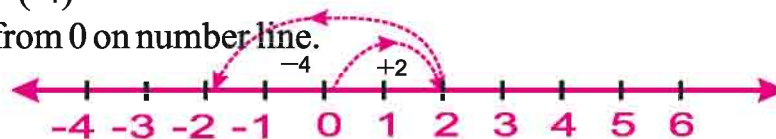
We begin from zero on the number line.



And $(+2)$ i.e we move 2 steps towards right side. Then $(+4)$ i.e 4 steps towards right. Addition of both means first moving 2 steps towards right and taking 4 more steps forward by this we took total six steps towards right. Hence we get $+6$ as answer.

(ii) $(+2)+(-4)$

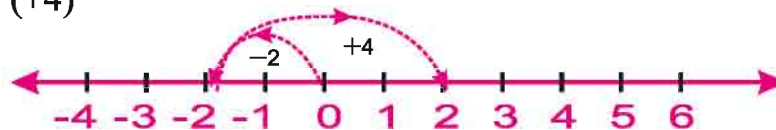
We begin from 0 on number line.



$(+2)$ i.e 2 steps towards right. Then (-4) means 4 steps towards left. Hence we will reach at (-2) crossing 1, 0, -1.

Therefore $(+2)+(-4)=-2$

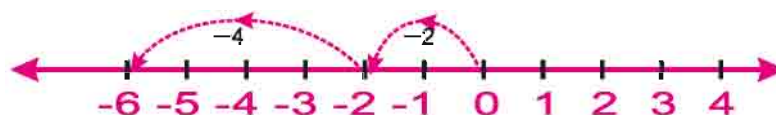
(iii) $(-2)+(+4)$



As before start with zero and move towards 2 steps to left (-2) and then 4 steps to right for $+4$. Hence crossing $-1, 0, 1$ we reach $+2$.

Thus $(-2)+(+4)=2$

(iv) $(-2)+(-4)$



Likewise starting from zero move 2 steps to left (-2) and 4 steps further to left (-4). As result we reach (-6) crossing -3, -4, -5.

$$\text{Therefore } (-2) + (-4) = -6$$

We saw when we add positive integers then we move towards right side both the time. As a result we reach towards the right only and we get the positive result.

What will be the sum of 2 positive integers? Positive/negative/zero

Similarly in the sum of two negative integers both the time we move to the left and reach on the left side. Hence the result is negative.

What is the result of addition for more than two negative integers? Positive, negative or zero But when adding a negative and a positive integer we have to move to left and right both. The result depends on the direction we move

Do and Learn

Complete the following table

S.N.	Addition	Result Positive/Negative	Sum
1.	$(-6) + (+7)$		
2.	$(-9) + (-1)$		
3.	$(+3) + (+5)$		
4.	$(+12) + (-7)$		

Example 1 Find the sum of $(-8) + (+4) + (-5) + (+2)$

Solution

$$\begin{aligned} & \text{Rearranging the negative and positive integers} \\ & = (-8) + (-5) + (+4) + (+2) \\ & = (-13) + (+6) \\ & = (-7) \end{aligned}$$

Example 2 Find the solution of $(+30) + (-20) + (-70) + (+65)$

Solution

$$\begin{aligned} & (+30) + (-20) + (-70) + (+65) \\ & = (+30) + (+65) + (-20) + (-70) \\ & = (+95) + (-90) \\ & = 5 \end{aligned}$$

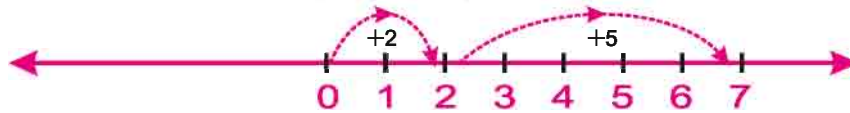
Exercise 4.2

- Using the number line find the integer which is.
 - 4 more than 5
 - + 4 more than (-4)
 - 5 less than 3
 - + 4 less than (-1)
- Find the value of the following using the number line.
 - $9 + (-3)$
 - $(-4) + (-3)$
 - $(-2) + 5$
 - $(-1) + 3 + (-2)$

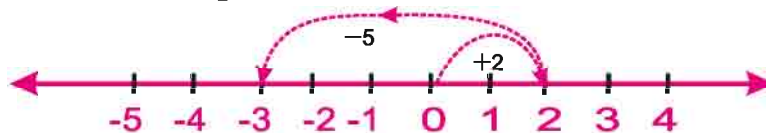
3. Without using the number line find the sum of the following
- (i) $11+(-2)$ (ii) $(-4)+(-6)$
 (iii) $(-250)+150$ (iv) $(-380)+(-270)$
 (v) $(-14)+4$ (vi) $(-180)+(-80)$
4. Find the value of the following
- (i) $137+(-354)+125$ (ii) $(-312)+39+192$
 (iii) $37+(-3)+24+(-8)$ (iv) $102+(-24)+(24)+(-11)$

4.6 Subtraction of integers using the number line.

We have added two positive integers on the number line. Think about $(+2)$ and $(+5)$. $(+2)$ i.e starting with zero and moving two steps to right we reach $+2$ and to add $(+5)$ we move five steps to the right and reach 7.



We have also seen that on the number line for addition of $(+2)+(-5)$, we start from $(+2)$ and move 5 steps to left

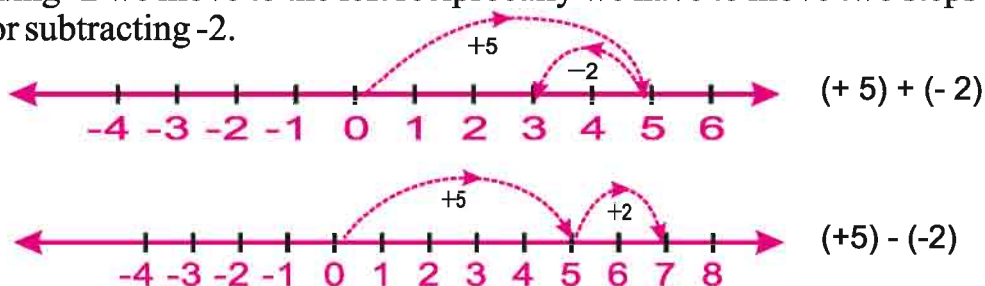


Therefore we see that for adding positive integers we move to the right and for adding negative integers we move to the left. Do we have to move to the left for subtraction as well? Let us look at the case of $5-2$.

$$5-2 = (+5) - (+2)$$

Since subtraction is reciprocal operation of addition, for subtraction of $+2$ we have to move two steps left from 5 (while we move to the right for addition).

Likewise for $(+5) - (-2)$ what will we do? Will we move to the right or left? For adding -2 we move to the left reciprocally we have to move two steps to the right for subtracting -2 .

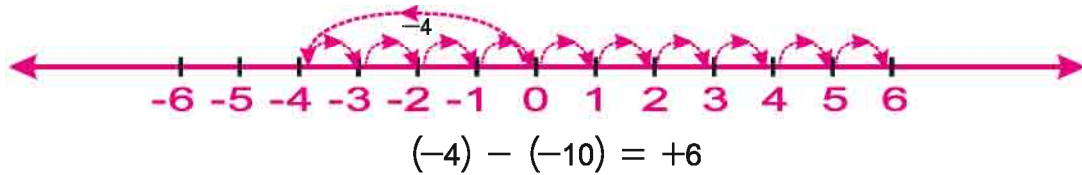


Do and Learn

Subtract the following with the number line

- (i) $(+7) - (+3)$ (ii) $(+3) - (+7)$
 (iii) $(+7) - (-3)$ (iv) $(-7) - (-3)$

Example 3 Find the value of $(-4) - (-10)$ with the help of number line.



4.7 Additive Identity

You know that $5+0=5$, $-8+0=-8$

i.e. 0 is a number in the operation of addition that gives the same number as the result.

Here 0 is an Additive Identity.

We have also read this Additive Identity in the chapter of Whole numbers.

4.8 Additive Inverse

Additive Inverse of any number is the number which when added to the number gives zero as result (additive identity)

Like, what should we add to 5 to get 0. Clearly, -5.

$(5) + (-5) = 0$ Similarly additive inverse of -5 is +5.

Likewise additive inverse of 8 is -8 and additive inverse of -13 is +13 because $(-13) + (+13) = 0$, $8 + (-8) = 0$.

The meaning of subtracting second number from the first number is adding its additive inverse to the first number. Do you think it is right?

Like $(+12) - (+5) = 12 + (\text{additive inverse of } +5)$

$= 12 + (-5) = 12 - 5 = 7$

Similarly $12 - (-5) = 12 + (\text{additive inverse of } -5)$

$= 12 + (+5) = 12 + 5 = 17$

Therefore we saw that subtracting positive integers the value of number reduces. While subtracting negative integers the value of the number increases.

4.9 Absolute Value of Integers

Represent the integers on a number line. Look at it and say at how much distance from 0 are the numbers +5 and -5. What is the relationship between these numbers?

The measure of distance in both cases is 5. In this way the value of +5 and -5 is 5 which is called absolute value

We write absolute value of -5 is $| -5 |$ and that of +5 is $| +5 |$. In this way

$| -5 | = 5 = | +5 |$ $| -7 | = 7 = | +7 |$ $| 0 | = 0$


Exercise 4.3


- Subtract the following

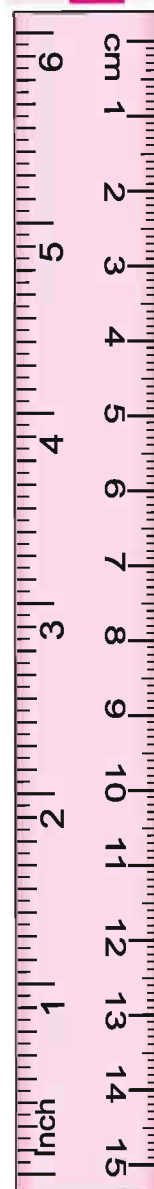
(i) $+32 - (+12)$	(ii) $+7 - (+15)$
(iii) $(-14) - (-20)$	(iv) $(-30) - (-15)$
(v) $23 - (-10)$	(vi) $(-27) - 22$
- Fill in the blanks

(i) $-5 + \dots = 0$	(ii) $7 + \dots = 0$
(iii) $11 + (-11) = \dots$	(iv) $-3 + \dots = -7$
(v) $14 - \dots = 16$	(vi) $-4 + \dots = -8$
- Fill in the blanks with the signs $<$, $>$, or $=$
 - $(-2) + (-9) \dots (-2) + (-4)$
 - $(-21) + (-10) \dots (-10) + (-21)$
 - $45 - (-12) \dots (-12) + (45)$
 - $(-14) + (14) \dots (-7) + (1)$
- Find the value of the following

(i) $(-7) + (-4) + 11$	(ii) $(-12) + (-3) - (-4)$
(iii) $14 - 8 - (-2)$	(iv) $(-24) + (-12) - (-8)$


We learnt


- Sometimes we need negative numbers in our daily life. Then we have to go down from 0 on the numberline. These numbers are called Negative numbers.
- $\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4 \dots$ group of numbers are called Integers in which $\dots -4, -3, -2, -1$ are Negative integers and $1, 2, 3, 4 \dots$ are Positive integers.
- Predecessors and Successors of any number can be got by subtracting 1 and adding 1 to the number respectively.
- When signs of numbers are same then add them and put the same sign with the result.
 - When we have numbers with different signs then subtract them and put the sign of the greater number with the answer.
- We learnt addition and subtraction of integers on the number line.
- 0 is known as additive identity.
- Additive inverse for any number is a number which when added to the number gives 0.



5.1 We have read about fractions as equal divisions in primary classes. Let us revise that. When we distribute one Roti among 3 kids equally then every child will get $\frac{1}{3}$ of it and this is called one-third.

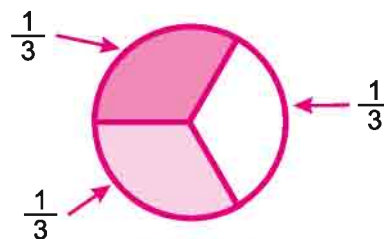


Fig. 5.1

Do and Learn

Match the following images (coloured parts) with fractions:



$\frac{1}{5}$



$\frac{1}{4}$



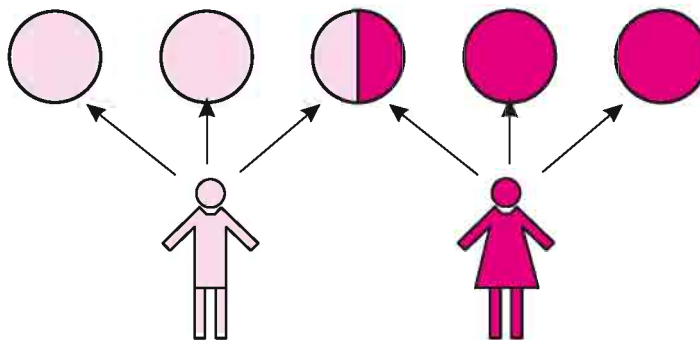
$\frac{1}{8}$



$1 + \frac{1}{2}$

Try to read these fractions.

Similarly when we distribute 5 chapatis between 2 children equally then we write like this.



$2 + \frac{1}{2}$ (Two and one upon two)

Also understand the following

Right now we showed $\frac{3}{5}$ in a chapatti. Think if we had three chapattis and we divide each of them into 5 parts, we take one divided part each then how much chapattis do the coloured parts represent? All of the three $\frac{1}{5}$ parts together represent $\frac{3}{5}$ parts of one chapatti.

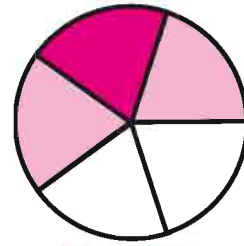


Fig. 5.2

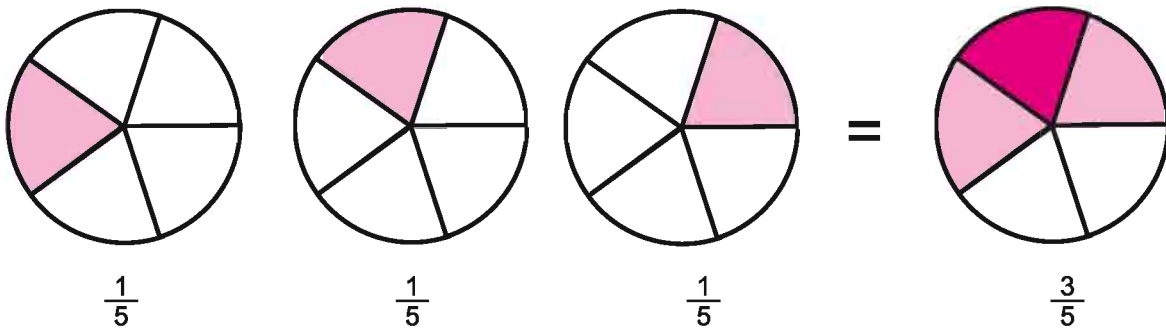


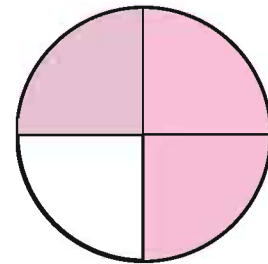
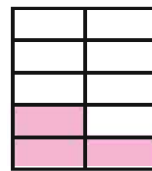
Fig. 5.3

But it should be kept in mind that as far as parts of the three chapattis are concerned, the coloured parts represent $\frac{1}{5}$ part of the three chapattis taken together.

We have learned about fractions in the form of equally divided parts. Now we try to understand the fraction in the form of parts of a Unit.

Lali had one big toffee on which there were marks of ten equal parts. In the school interval, Lali ate 3 equal parts of it. Think how much of the toffee Lali ate?

Equal parts of toffee eaten = 3
 Total equal parts of toffee = 10
 Toffee Lali ate = $\frac{3}{10}$ (Three upon Ten)



Similarly Vikram ate three equal parts of a chapatti, which was divided into 4 total equal parts in Mid Day Meal Programme. Then Roti eaten by Vikram

$$= \frac{\text{Parts of Roti eaten by Vikram}}{\text{Total parts of chapatti}}$$

$$= \frac{3}{4}$$

The total number of divisions of a unit is called Denominator and some parts taken from that are called Numerator.

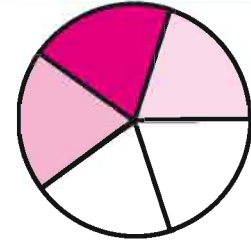


It is read as three upon Four or Three Fourths.

Thus think and tell if we take three out of five equal parts of a chapatti then it will represent how much parts of that unit?



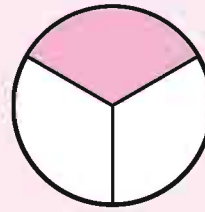
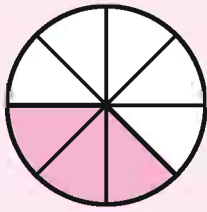
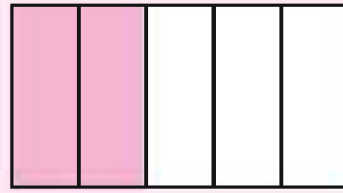
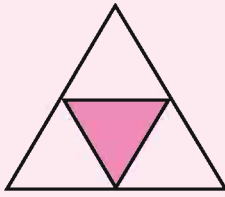
Yes! You got it right! = $\frac{3}{5}$ $\frac{\text{Numerator}}{\text{Denominator}}$



It is read as 3 upon 5. Here 3 is the numerator and 5 is the denominator.

Do and Learn

Write the shaded part of the following figures in the form of fractions:

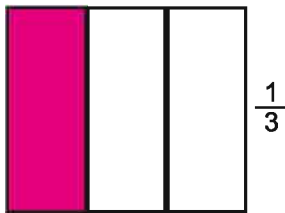


5.2 Explaining Fractions with the help of diagrams

Till now we have learned about dividing fractions in equal parts and as parts of a unit. Now we will show fractions in figures/pictures/diagrams.

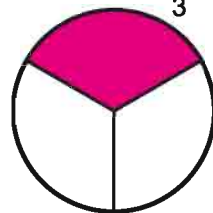
Representing $\frac{1}{3}$ with a diagram: Here 1 is numerator and 3 is denominator. Denominator shows in how many parts we have to divide unit. Here denominator is 3 then we will divide the unit in three equal parts.

Seema drew a diagram and divided it in three equal parts.



$\frac{1}{3}$

John drew a circle and divided it into three equal parts.

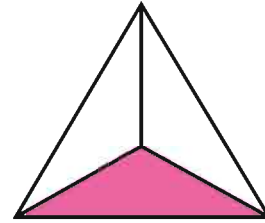


Fazloo made 1 inch long line and divided it into three equal parts.



In numerator 1 represent the taken or colored parts of the unit. You can show $\frac{1}{3}$ by any diagrams provided that all three parts must be equal.

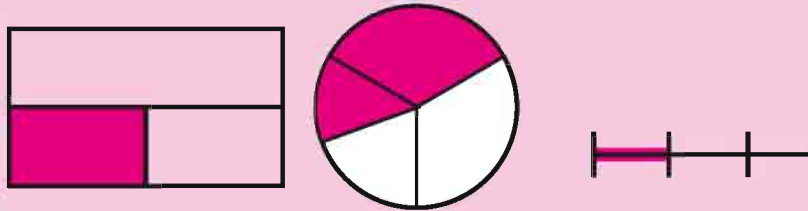
Look chanda showed $\frac{1}{3}$ in triangle.



Seema, John and Fazloo showed $\frac{1}{3}$ through different diagrams but one thing is common that in all three diagrams unit is divided into three equal parts and one of it is shaded.

Do and Learn

1. Which of the following diagram is right for $\frac{1}{3}$ and which is not. State the reason as well.



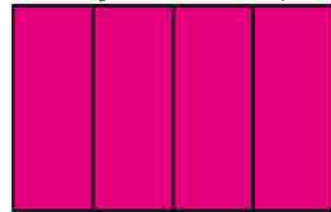
2. Show the following fractions by proper diagrams

(i) $\frac{2}{3}$ (ii) $\frac{3}{4}$ (iii) $\frac{1}{5}$

5.3 Proper, Improper and mixed fractions

We have learned showing fractions by diagrams. Now can you show $\frac{5}{4}$ by diagram? In $\frac{5}{4}$, 5 is a numerator and 4 is denominator.

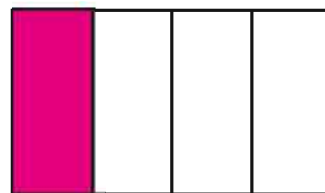
We know denominator shows the total equal parts of a unit. Therefore we draw a rectangle and divide it into 4 equal parts. Now In $\frac{5}{4}$ 5 is numerator and tells us that



how many parts we have to take. But can we take 5 parts out of the 4 equal parts. No, therefore we have to make one more unit and divide it again into 4 equal parts. Now we take all four parts from the first diagram and one from this another unit. Hence we take 5 coloured parts. This shows $\frac{5}{4}$, $\frac{5}{4}$ is also called an improper fraction. A fraction in which numerator is greater than or equal to denominator is called improper fraction.



+



$$\frac{5}{4} = 1 + \frac{1}{4}$$



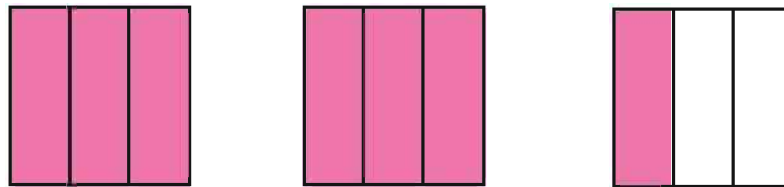
Proper fraction shows parts of a unit. Can you define proper fraction? Discuss with your friends about it.

5.3.1 Showing improper fraction in form of mixed fraction

Improper fractions can be shown in form of addition of units and proper fraction. This is called mixed fraction. Like $\frac{5}{4} = 1 + \frac{1}{4}$ or $1\frac{1}{4}$ It is read as a one and one upon four.

Example 1 show the improper fraction $\frac{7}{3}$ diagram and write it in the form of mixed fraction.

Solution In $\frac{7}{3}$ denominator is 3. Therefore we have to divide the unit into three equal parts. Numerator is 7 therefore we have to color 7 such parts. For it we will take three units and color total seven parts.



$$\frac{7}{3} = 2 + \frac{1}{3}$$

therefore mixed form of $\frac{7}{3}$

$$\frac{7}{3} = 2\frac{1}{3}$$

It is read as seven upon three or two and one upon three. Rashmi has put some pieces of khakhre. Looking at these write them in the fractions and tell us which is proper and improper fraction.

Converting improper fraction to mixed fraction

$$\begin{array}{r} 3 \overline{) 7(2} \\ -6 \\ \hline 1 \end{array} = 2\frac{1}{3}$$

= Quotient $\frac{\text{Reminder}}{\text{Divisor}}$

	$\frac{1}{4}$	Proper



Example 2 Express the following in the form of mixed fractions.

(i) $\frac{19}{4}$

(ii) $\frac{23}{6}$

Solution (i) $\frac{19}{4}$ $\begin{array}{r} 4)19(4 \\ -16 \\ \hline 3 \end{array}$ Divisor = 4
 Hence $\frac{19}{4} = 4$ unit and $\frac{3}{4}$ or $4 \frac{3}{4}$
 Quotient = 4
 Remainder = 3

Solution (ii) $\frac{23}{6}$ $\begin{array}{r} 6)23(3 \\ -18 \\ \hline 5 \end{array}$ Divisor = 6
 Hence $\frac{23}{6} = 3$ unit and $\frac{5}{6}$ or $3 \frac{5}{6}$
 Quotient = 3
 Remainder = 5

Do and Learn

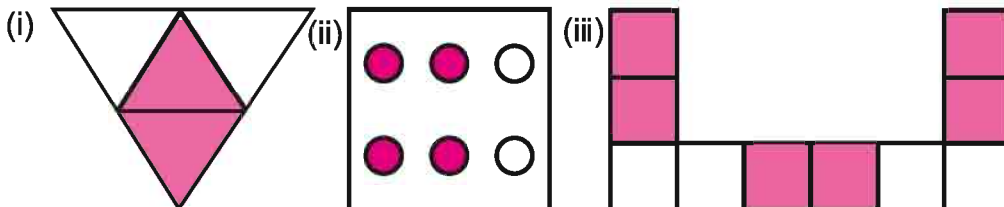
Express the following mixed fractions into improper fractions

(i) $3 \frac{2}{3}$

(ii) $7 \frac{1}{9}$

Exercise 5.1

1. Write the fractions to represent shaded parts of the following:



2. Show the following fractions by diagrams:

(i) $\frac{3}{5}$

(ii) $\frac{5}{4}$

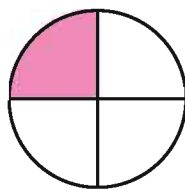
(iii) $\frac{3}{6}$

(iv) $2 \frac{2}{5}$

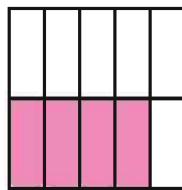
3. What is the fraction for 35 minutes to 1 hour?

4. Write the fraction for even numbers 1 to 15 to number 1 to 15?

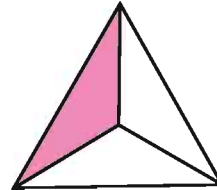
5. Look at the following figures and write the fraction for its uncolored parts.



(i)



(ii)



(iii)

6. Show the following fractions on number line.

(i) $\frac{3}{5}$ (ii) $\frac{3}{7}$ (iii) $\frac{8}{3}$

Example



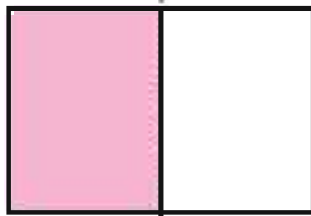
7. Express the following in mixed fractions.

(i) $\frac{20}{3}$ (ii) $\frac{11}{5}$ (iii) $\frac{19}{6}$

8. Express the following in improper fractions.

(i) $7\frac{2}{3}$ (ii) $5\frac{3}{4}$ (iii) $4\frac{1}{2}$

5.4 Like Fractions

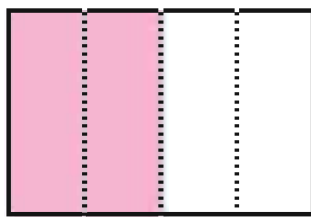


Janhawi and Devansh learned how to show fraction by diagrams. Then their teacher took one paper and fold it by half and asked

Teacher : one part of it shows which fraction?

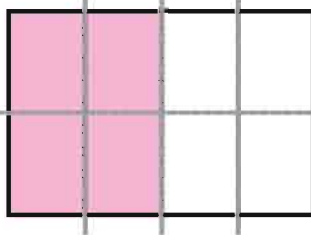
Janhvi: $\frac{1}{2}$ (one upon two)

Teacher: Let's color one part of it. Now play with it , folding it two more times. Now what will be the fraction for is colored part?



Devansh: Paper is divided into 4 equal parts and its color parts are 2. So it shows $\frac{2}{4}$

Janhvi: Here $\frac{1}{2}$ and $\frac{2}{4}$ showing equally colored parts of the same original part.



Teacher: You are right Janhvi. Fractions which show Equal parts are called like fractions. We write it like this:

$$\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$$

Folding this paper three times shows $\frac{4}{8}$

Activity: Take a paper with your friend and color it half. Fold it differently and write the respective fraction. But be aware that all parts should be equal while folding.

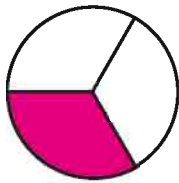
Devansh: I can make equivalent fractions even without folding the paper.

$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4} \quad , \quad \frac{1}{2} \times \frac{3}{3} = \frac{3}{6} \quad , \quad \frac{1}{2} \times \frac{4}{4} = \frac{4}{8}$$

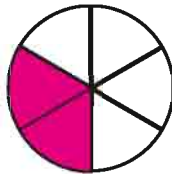
Teacher: Devansh you got the right pattern. Multiplying numerator and denominator of a fraction by same number we will get the equivalent fraction. In some cases, we can also get equal fractions by division, like $\frac{12}{16}$

Understand like fractions by diagrams.

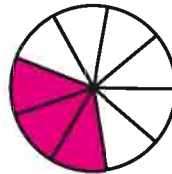
Are all the colored parts of unit in following diagrams equal? Then it is also a like fraction.



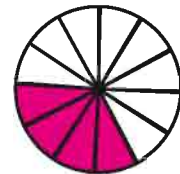
$$\frac{1}{3}$$



$$\frac{2}{6}$$



$$\frac{3}{9}$$



$$\frac{4}{12}$$

Example 3 Make equivalent fractions of $\frac{1}{4}$

Solution $\frac{1}{4} \times \frac{2}{2} = \frac{2}{8}$, $\frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$

Hence equivalent fraction of $\frac{1}{4}$

$$\frac{1}{4} = \frac{2}{8} = \frac{3}{12}$$

Example 4 Make equivalent fractions of $\frac{3}{6}$

Solution $\frac{3}{6} \div \frac{3}{3} = \frac{1}{2}$, $\frac{3}{6} \times \frac{2}{2} = \frac{6}{12}$, $\frac{3 \times 3}{6 \times 3} = \frac{9}{18}$

We can make more like fractions of $\frac{3}{6}$ by its like fraction $\frac{1}{2}$

Simplified form of equivalent fractions are those in which numerator and denominator are co-prime numbers for example $\frac{8}{14}$ can be simplified as $\frac{4}{7}$ in which 4 and 7 are mutually indivisible.



Example 5 $\frac{3}{4}$ are $\frac{6}{9}$ and like fractions, find out ?

Solution **Method 1:** $\frac{3}{4}$ is a simple fraction since 3 and 4 both are only divisible by 1. Simple form of $\frac{6}{9}$ is $\frac{2}{3}$ (dividing numerator and denominator by 3) Hence $\frac{3}{4}$ and $\frac{2}{3}$ are not like fractions.

Hence $\frac{3}{4}$ and $\frac{6}{9}$ are not equivalent fractions.

Method 2:

$$\frac{3}{4} \times \frac{2}{2} = \frac{6}{8}$$

$$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$$

Hence $\frac{3}{4}$ and $\frac{6}{9}$ are not equivalent fractions. Therefore $\frac{3}{4}$ and $\frac{6}{9}$ are not equivalent fractions.



Do and Learn

1. Make three equivalent fractions of the following:

(i) $\frac{3}{4}$

(ii) $\frac{1}{3}$

(iii) $\frac{2}{7}$

2. Check which are the equivalent fractions of the following?

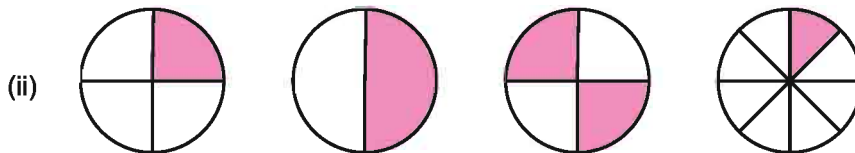
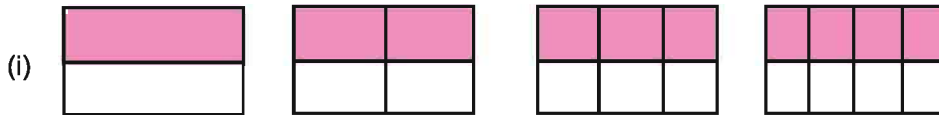
(i) $\frac{5}{10}$ and $\frac{1}{2}$

(ii) $\frac{3}{7}$ and $\frac{11}{13}$

All those fractions which have same denominators are called like fractions. Such as $\frac{1}{5}, \frac{3}{5}, \frac{6}{5}$. Do remember no equivalent fraction is like fraction. Think why?

**Exercise 5.2**

1. Write fraction for shaded part of each diagram are the equivalent fraction?



2. Replace the following each empty box with proper number

(i) $\frac{3}{7} = \frac{6}{\square}$ (ii) $\frac{8}{6} = \frac{4}{\square}$ (iii) $\frac{3}{5} = \frac{\square}{20}$ (iv) $\frac{100}{10} = \frac{10}{\square}$ (v) $\frac{18}{24} = \frac{\square}{4}$

3. Find the equivalent fraction of $\frac{3}{4}$ whose

(i) Denominator 24 (ii) Numerator 15 (iii) Denominator 32 (iv) Numerator 9

4. Convert the following fractions into simplified form

(i) $\frac{15}{27}$ (ii) $\frac{84}{98}$ (iii) $\frac{21}{49}$ (iv) $\frac{6}{72}$

5. Match the equivalent fractions

- | | |
|-------------------------|-----------------------|
| (i) $\frac{25}{40}$ | (a) $\frac{30}{36}$ |
| (ii) $\frac{250}{100}$ | (b) $\frac{8}{7}$ |
| (iii) $\frac{180}{200}$ | (c) $\frac{25}{5}$ |
| (iv) $\frac{2}{3}$ | (d) $\frac{5}{8}$ |
| (v) $\frac{9}{13}$ | (e) $\frac{27}{39}$ |
| (vi) $\frac{500}{100}$ | (f) $\frac{5}{2}$ |
| (vii) $\frac{3}{4}$ | (g) $\frac{100}{150}$ |
| (viii) $\frac{16}{14}$ | (h) $\frac{9}{10}$ |
| (ix) $\frac{1}{2}$ | (i) $\frac{600}{800}$ |
| (x) $\frac{5}{6}$ | (j) $\frac{3}{6}$ |

5.5 Comparison of fractions

Can you compare fractions like numbers 18,28,81...etc?

In comparison of numbers you have to find out smaller, greater numbers, such as 526 is smaller than 702. For comparison of fraction what rules can be followed? Let's see.

5.5.1 Comparison of fraction with same numerator

Look at the following fractions

$$\frac{1}{3}, \frac{4}{5}, \frac{7}{3}, \frac{8}{5}, 2\frac{1}{4}, 3\frac{3}{4}, \frac{1}{5}$$

$\frac{1}{3}, \frac{1}{5}$ are called unit fractions because it shows only one of the total parts of the unit.



Look at the above diagram and state which fraction is smaller $\frac{1}{3}$ or $\frac{1}{5}$

Similarly which is greater in $\frac{1}{4}$ and $\frac{1}{7}$



$\frac{1}{4}$ means one of the four parts of a unit.

$\frac{1}{7}$ means one of the 7 parts of a unit. Hence $\frac{1}{7}$ is smaller than $\frac{1}{4}$

Can you really make rules for comparisons of fractions.

If numerators of two fractions are same then fraction with smaller denominator is greater.



Example 6 Which is greater in $\frac{3}{5}$ and $\frac{3}{7}$

Solution Here unit fraction of $\frac{3}{5}$ is $\frac{1}{5}$

and $\frac{1}{7}$ is unit fraction of $\frac{3}{7}$

We know that $\frac{1}{5}$ is greater than $\frac{1}{7}$

Hence $\frac{3}{5} > \frac{3}{7}$

Do and Learn

1. Dolly get a $\frac{1}{5}$ of the cake and teenu gets $\frac{1}{7}$ of the cake. Then who got the more cake.
2. Which fraction is greater?
 - (i) $\frac{1}{3}$ and $\frac{1}{5}$
 - (ii) $\frac{2}{5}$ and $\frac{2}{7}$

5.5.2 Comparison of fractions with same denominators.

$\frac{1}{5}$, $\frac{4}{5}$, $\frac{8}{5}$ are different fractions with the same denominator. The smallest part of these fractions are equivalent.



Looking at the diagrams above we can say that among fractions with the same denominator, that fraction is greatest which has the greatest numerator.

Hence $\frac{8}{5} > \frac{4}{5}$ and $\frac{1}{5}$, Similarly $\frac{4}{5} > \frac{1}{5}$

Writing from greater to smaller like this $\frac{8}{5} > \frac{4}{5} > \frac{1}{5}$ is known as decending order.

Writing from smaller to greater like this $\frac{1}{5} < \frac{4}{5} < \frac{8}{5}$ is known as ascending order.

Do and Learn

Write the following in ascending and descending order

(i) $\frac{3}{7}, \frac{1}{7}, \frac{4}{7}, \frac{8}{7}, \frac{6}{7}$

(ii) $\frac{4}{13}, \frac{12}{13}, \frac{8}{13}$

5.5.3 Comparison of fractions with different numerators and denominators.

Let's assume that you want to compare $\frac{2}{3}$ and $\frac{3}{4}$. Then we will first make its like fractions

$$\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15} \quad \text{and} \quad \frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{12}{16}$$

Hence between $\frac{2}{3}$ and $\frac{3}{4}$ Like fractions with common denominator are $\frac{8}{12}$ and $\frac{9}{12}$

Hence between $\frac{2}{3} = \frac{8}{12}$ and $\frac{3}{4} = \frac{9}{12}$ we see $\frac{8}{12} < \frac{9}{12}$ or $\frac{2}{3} < \frac{3}{4}$

Example 7 Which fraction is greater between $\frac{3}{4}$ and $\frac{5}{8}$

Solution These are fractions with different numerators and denominators.

Let's find out like fractions of these

$$\frac{3}{5} = \frac{6}{10} = \frac{9}{15} = \frac{12}{20} = \frac{15}{25} = \frac{18}{30} = \frac{21}{35} = \frac{24}{40} = \frac{27}{45}$$

$$\text{and } \frac{5}{8} = \frac{10}{16} = \frac{15}{24} = \frac{20}{32} = \frac{25}{40} = \frac{30}{48} = \frac{35}{56}$$

Like fractions with common denominators are:

$$\frac{3}{5} = \frac{24}{40} \quad \text{and} \quad \frac{5}{8} = \frac{25}{40}$$

$$\text{Since } \frac{25}{40} > \frac{24}{40} \quad \text{Therefore } \frac{5}{8} > \frac{3}{5}$$

Think if we have to compare bigger unlike fraction then it will be complicated to solve. In this case, we have to compare by like fraction with the help of common multiple.



Example 8 compare $\frac{7}{8}$ and $\frac{7}{10}$

Solution These fractions have different denominators.

In $\frac{7}{8}$ and $\frac{7}{10}$ multiple of denominator 8 are 8, 16, ...

And similarly multiple of 10 are 10, 20, ... Hence 40 is the common multiple.

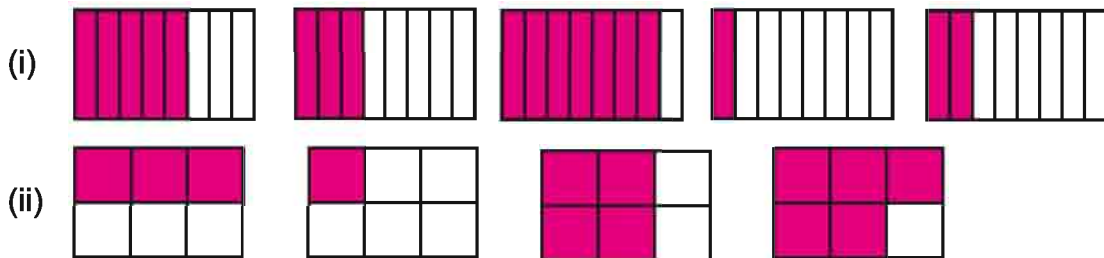
$$\frac{7}{8} \times \frac{5}{5} = \frac{35}{40} \quad ; \quad \frac{7}{10} \times \frac{4}{4} = \frac{28}{40}$$

$$\text{Hence } \frac{7}{8} = \frac{35}{40} \quad \text{and} \quad \frac{7}{10} = \frac{28}{40}$$

$$\text{Since } \frac{35}{40} > \frac{28}{40} \quad \text{Therefore } \frac{7}{8} > \frac{7}{10}$$

Exercise 5.3

1. Write fractions for each of the following diagram and then arrange them in ascending and descending order.



2. Compare the two fractions and put a sign (<, > or =)

(i) $\frac{5}{6} \square \frac{9}{11}$ (ii) $\frac{3}{4} \square \frac{1}{5}$ (iii) $\frac{3}{5} \square \frac{3}{7}$

3. All the following fraction represent three different numbers. Convert these in simple form and write these in groups of those three.

(i) $\frac{2}{12}$	(ii) $\frac{3}{15}$	(iii) $\frac{8}{50}$	(iv) $\frac{16}{100}$
(v) $\frac{10}{60}$	(vi) $\frac{15}{75}$	(vii) $\frac{18}{90}$	(viii) $\frac{16}{96}$
(ix) $\frac{12}{75}$	(x) $\frac{12}{72}$	(xi) $\frac{10}{50}$	(xii) $\frac{4}{25}$

4. Answer the following and show how did you solve these ?

(i) are $\frac{12}{15}$ & $\frac{15}{30}$ equal ?

(iii) are $\frac{3}{5}$ & $\frac{9}{15}$ equal ?

(ii) are $\frac{4}{5}$ & $\frac{5}{6}$ equal ?

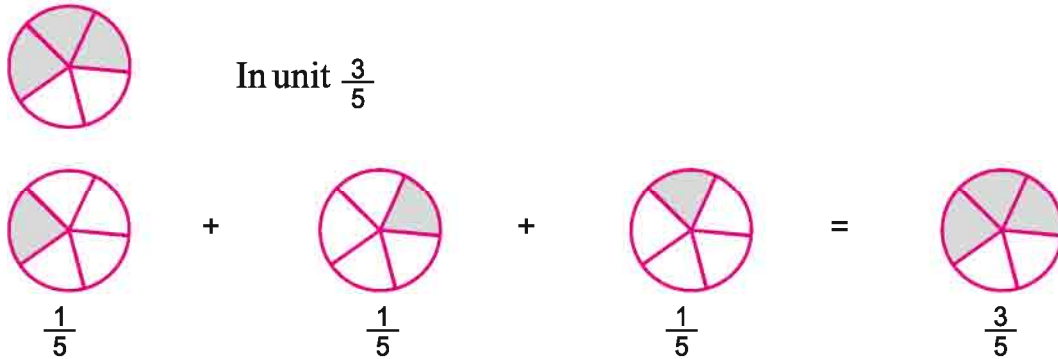
(iv) are $\frac{9}{16}$ & $\frac{5}{9}$ equal ?

5. 20 Students passed with first division in the class A of 25 students. In class B, 24 students passed with first division out of 30 student? From which class more part of students passed with first division?

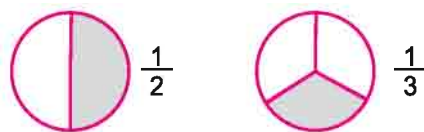
6. Rohit eats 4 chapatis out of total 8. Rohini eats $\frac{1}{4}$ of total 8 chapatis. Who ate less?

5.6 Addition of fractions

While representing fractions, we have learned that we can write $\frac{3}{5}$ in two ways.



In form of addition of different units $\frac{3}{5}$ Can we add $\frac{1}{2}$ and $\frac{1}{3}$ like this.



As we have seen in addition of numbers, example $333+40 = 373$. Here 1 is the smallest unit of 333 and of 40 as well (add 1 up to 40 times). Therefore we can add all those numbers which have same smallest unit.

Units are different in $\frac{1}{2}$ and $\frac{1}{3}$ making equivalent fractions of these fractions.

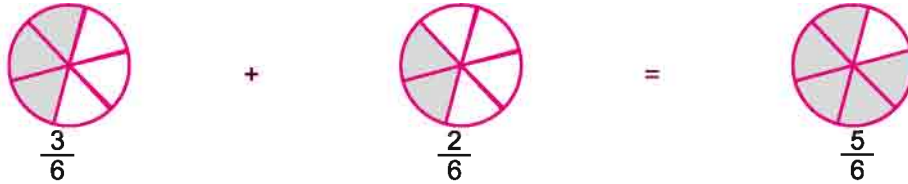
$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} \quad \text{and} \quad \frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12} = \frac{1}{3}$$

$$\text{Therefore } \frac{1}{2} = \frac{3}{6} \text{ and } \frac{1}{3} = \frac{2}{6}$$



Shows fractions with similar units, where $\frac{1}{6}$ is like and smallest unit.

Representing $\frac{3}{6}$ and $\frac{2}{6}$ by diagrams



One more method for adding fractions with different denominators is L.C.M

$$\begin{array}{r} \frac{1}{2} + \frac{1}{3} \\ (1 \times 3) + (1 \times 2) \\ \hline \frac{3+2}{6} = \frac{5}{6} \end{array}$$

Step 1 : Take L.C.M of 2 and 3 which is 6.

Step 2 : Divide L.C.M 6 by denominator of $\frac{1}{2}$ i.e 2 we will get quotient 3, now multiply 3 by numerator 1. Similarly for fraction $\frac{1}{3}$ divide L.C.M 6 by denominator 3. We will get quotient 2, multiply it with 1 the numerator.

Step 3 : Add the products.

Do and Learn

Solve the following:

(i) $\frac{1}{3} + \frac{2}{3}$ (ii) $\frac{3}{5} + \frac{2}{7}$ (iii) $\frac{4}{5} + \frac{7}{15}$

5.6.1 Addition of mixed fractions

Mixed fractions can be added by two methods.

1. Add whole parts of mixed fraction and improper parts of mixed fraction separately.
2. Add mixed fractions after converting them to improper fractions.

$$2\frac{3}{4} + 5\frac{4}{5}$$

$$2 + 5 + \frac{3}{4} + \frac{4}{5}$$

$$7 + \frac{3}{4} + \frac{4}{5}$$

$$\frac{3}{4} + \frac{4}{5} = \frac{3 \times 5}{4 \times 5} + \frac{4 \times 4}{5 \times 4} \quad (\text{L.C.M of 4 and 5} = 20)$$

$$= \frac{15}{20} + \frac{16}{20} = \frac{31}{20}$$

$$= 1 + \frac{11}{20} \left(\text{converting } \frac{31}{20} \text{ into mixed fraction} \right)$$

$$\text{Again } 7 + \frac{3}{4} + \frac{4}{5} = 7 + 1 + \frac{11}{20}$$

$$= 8 + \frac{11}{20} = 8\frac{11}{20}$$

$$\therefore 2\frac{3}{4} + 5\frac{4}{5} = 8\frac{11}{20}$$

Addition of mixed fraction after converting into improper fraction.

$$2\frac{3}{4} + 5\frac{4}{5}$$

$$= \frac{11}{4} + \frac{29}{5}$$

$$= \frac{11 \times 5}{4 \times 5} + \frac{29 \times 4}{5 \times 4}$$

$$= \frac{55}{20} + \frac{116}{20} = \frac{171}{20} = 8\frac{11}{20}$$

Exercise 5.4

1. Solve the following:

(i) $\frac{5}{19} + \frac{2}{19}$ (ii) $\frac{1}{6} + \frac{1}{6} + \frac{1}{6}$ (iii) $\frac{12}{23} + \frac{27}{23} + \frac{10}{23}$

(iv) $\frac{4}{7} + \frac{3}{14}$ (v) $\frac{2}{5} + \frac{3}{4} + \frac{5}{3}$ (vi) $\frac{17}{6} + \frac{18}{5}$

(vii) $4\frac{1}{3} + 3\frac{1}{3}$ (viii) $5\frac{3}{5} + 3\frac{5}{7}$

- Sunita got $\frac{1}{4}$ part and marry got $\frac{1}{4}$ arts of a mango. Both will get how much part of mango all together.
- Reshma purchased $\frac{1}{3}$ meter and jaya purchased $\frac{3}{5}$ meter of ribbon. Find out the total length of ribbon they purchased.
- Ramesh covered $4\frac{1}{4}$ km of distance by bus and he walked $\frac{3}{4}$ km distance to reach school from home. How much total distance he covered to reach school.
- Amit took $\frac{1}{2}$ litre milk first day, $\frac{3}{4}$ litre second day and $1\frac{1}{4}$ litre third day. Find out how much total milk he took in these three days.
- Devansh painted the $\frac{2}{3}$ part of a wall of his room. His sister Janhvi helped him and painted $\frac{1}{3}$ part of the same wall. Find out how much part of the room they painted altogether.

5.7 Subtraction of fractions

For subtraction of fractions we will use the same method as we used for addition of fractions.

(i) Subtract $\frac{5}{8}$ from $\frac{7}{8}$

Here denominators of $\frac{7}{8}$ and $\frac{5}{8}$ are equal. Therefore we will just subtract numerator without doing anything with denominator.

$$\text{Hence } \frac{7}{8} - \frac{5}{8} = \frac{7-5}{8} = \frac{2}{8} = \frac{1}{4}$$

(ii) Subtract $\frac{2}{5}$ from $\frac{8}{6}$

Now denominators are different here. So we will find out like fractions of these with the same denominator.

$$\frac{8}{6} = \frac{8 \times 5}{6 \times 5} = \frac{40}{30}, \quad \frac{2}{5} = \frac{2 \times 6}{5 \times 6} = \frac{12}{30}$$

$$\frac{40}{30} - \frac{12}{30} = \frac{28}{30} = \frac{14}{15}$$

$$\text{Hence } \frac{8}{6} - \frac{2}{5} = \frac{14}{15}$$

(iii) Solve $7\frac{1}{6} - 5\frac{2}{5}$

LCM Method

$$\frac{8}{6} - \frac{2}{5} \quad \text{Here LCM of 6 \& 5 is 30}$$

$$= \frac{(8 \times 5) - (2 \times 6)}{30}$$

$$= \frac{40 - 12}{30} = \frac{28}{30}$$

$$\frac{28}{30} \quad \text{Simplifying } \frac{14}{15}$$



Subtraction in mixed fraction is easy by converting them to improper fractions. Therefore we will here study only these type of subtractions.

$$7\frac{1}{6} = \frac{43}{6}, 5\frac{1}{4} = \frac{21}{4}$$

$$\therefore 7\frac{1}{6} - 5\frac{1}{4} = \frac{43}{6} - \frac{21}{4}$$

Now we will find out like fractions of both fractions and will subtract them.

$$\frac{43 \times 2}{6 \times 2} - \frac{21 \times 3}{4 \times 3}$$

$$\frac{86}{12} - \frac{63}{12}$$

$$= \frac{86-63}{12} = \frac{23}{12} = 1\frac{11}{12}$$

$$\text{Therefore } 7\frac{1}{6} - 5\frac{1}{4} = 1\frac{11}{12}$$

First of all, we will convert mixed fraction into improper fraction. Then will find out like fractions of these and subtract.

Exercise 5.5

1. Solve the following

(i) $\frac{6}{5} - \frac{2}{5}$

(ii) $\frac{4}{5} - \frac{3}{7}$

(iii) $5\frac{1}{2} - 2\frac{1}{5}$

(iv) $8\frac{1}{4} - 2\frac{5}{6}$

(v) $\frac{17}{6} - \frac{9}{4}$

(vi) $\frac{3}{4} - \left(\frac{2}{5} + \frac{1}{4}\right)$

2. Heera gave $\frac{3}{7}$ litre milk to Bhavna out of her $\frac{1}{4}$ liter milk. How much of milk is now left with her.

3. A wooden piece is $\frac{9}{10}$ meter long and a $\frac{2}{5}$ meter long piece has been cut from it. What is the length of the remaining piece.

4. Anshul drink $\frac{2}{3}$ of one glass water. Find out how much water is left in the glass?

5. Sunil purchased $5\frac{1}{2}$ kg and Vijay purchased $3\frac{4}{5}$ kg mangoes. Find how much more mangoes did sunil purchased?

6. Neha finished one race in $3\frac{1}{2}$ minute and Geeta in $\frac{13}{4}$ minutes. Find out who finished the race in lesser time and how much time?

7. Complete the following addition and subtraction table:

		+	→
(i)	$\frac{2}{5}$	$\frac{4}{5}$	
	$\frac{1}{5}$	$\frac{2}{5}$	

		+	→
(ii)	$\frac{1}{3}$	$\frac{1}{5}$	
	$\frac{1}{5}$	$\frac{1}{6}$	

We learnt

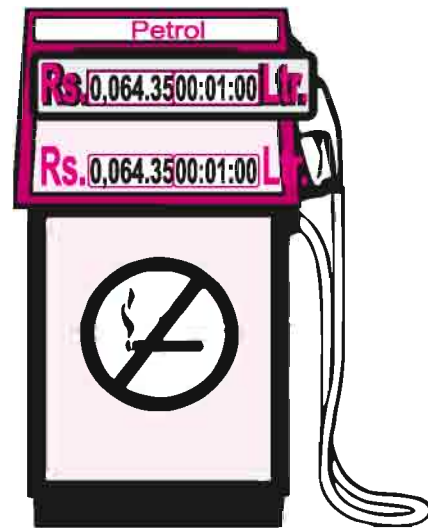
1. Fraction is a number that represent part of a whole unit all. Whole can be only one object or can also be a group of objects. In any case, to express counted parts of a unit into fraction, it is necessary that all parts must be equal.
2. In Fraction $\frac{5}{7}$, 5 is numerator and 7 is denominator.
3. In a proper fraction numerator is smaller than denominator and in improper fraction numerator is always greater than denominator. Improper fraction can also be written as whole units and one part. In this case it gets converted into mixed fraction.
4. Two fractions are called like fractions if both of these represent same quantity. There are many like fractions of each proper or improper fraction. To find out a like fraction, we can multiply or divide numerator and denominator both with any number except zero.
5. Simple form of a fraction is that, when its numerator and denominator both does not have any common factor except 1.



Chapter 6

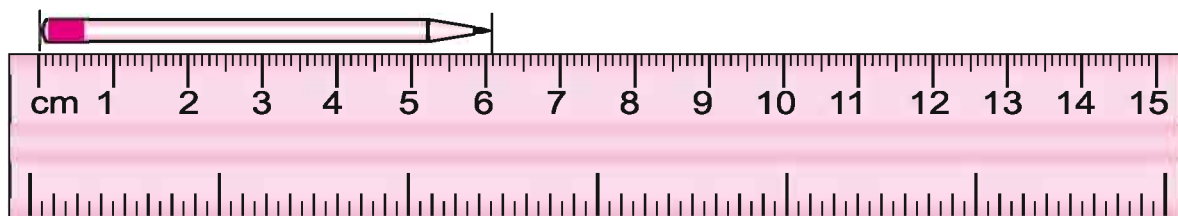
Decimal Numbers

6.1 You must have observed the prices of medicine, Petrol and LPG. In the given diagram price of medicine is shown Rs.35.75 i.e Rs.35 and 75 paise. Similarly price of petrol is Rs.64.35. i.e Rs 64 and 35 paise. In Rs 64.35 and 35.75 , The dot (.) represent decimal. We will discuss about decimal in detail.

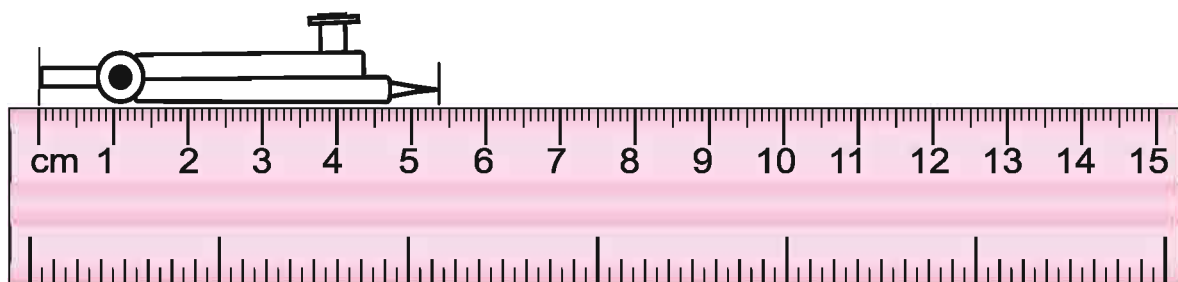


6.1.1 Decimal numbers

Say how much is the length of the Ram's pencil?
..... cm.?



How much is the length of Rehman's Compasses?



In the diagram above the length of a compasses is a little more than 5 and a little less from 6cm. How will you find out the length of the compasses by this diagram?

Do and learn

You too measure pencil, rubber and other things from your bag by scale and fill in the table.

S.n.	Objects	Length
1		
2		
3		
4		
5		
6		

You must have noticed when we measure the compass, we saw its length was a bit more than 5. For it we divided 1 cm into 10 equal parts and its one part is 1 mm. Now if we have to show mm into cm, then we write it to the right side of decimal. Value of first place to the right side of decimal is one tenth of a unit. i.e $\frac{1}{10}$. It is also called 10th part. While measuring compass 3 parts are being equal of 10th. Therefore we will write it as 5.3 cm.

6.2 Place value of decimal

In any number, value of its digits depends on its place value. Such as in the number 325. 3 is on the place of 100th. therefore $3 \times 100 = 300$

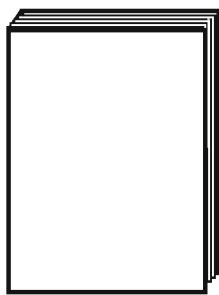
In any number, value of its digits depends on its place value. Such as in the number 325. 2 is on the place of 10th. therefore $2 \times 10 = 20$

And 5 is at the unit place. Therefore $5 \times 1 = 5$

Similarly in the number 523

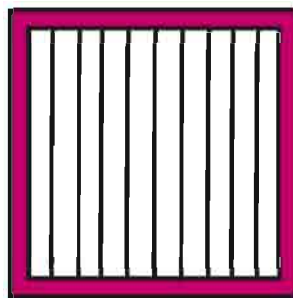
Place value of 5 =

When we look at any number from left to right its place value becomes $\frac{1}{10}$



100

(Hundred)



10

(tens)



1

(unit)



$\frac{1}{10}$

one tenth

Now write place values of some decimal numbers.

Decimal number	Hundred	Tens	Unit	One tenth
124.5	1	2	4	5
315.5	.....	.....	.....	.....
402.1	.....	.....	.....	.....



Do and learn ◆

Write the place value of digits in the following number.

- (i) 123.4 (ii) 111

6.3 Expanded form of decimal numbers

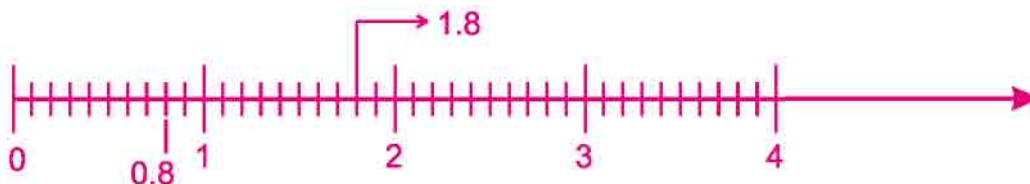
$$325.4 = 300 + 20 + 5 + \frac{4}{10}$$

$$34.7 = 30 + 4 + \frac{7}{10}$$

In decimal numbers point is always placed between unit and one tenth.

6.4 Representation on number line

We have learned about representation of fractions on a number line. Now we will learn to represent decimal numbers on number line. 0.8 means 8 tenths of 1 or $\frac{8}{10}$. Hence it will be between 0 and 1. We also know that right side of a decimal number shows $\frac{1}{10}$ place. Therefore we will divide number line in 10 parts from 0 to 1.

**Do and learn** ◆

Show the decimal numbers 0.6, 1.3 and 2.5 on number line

Example 1 Write in the decimal form

- (i) 5 units and 2 one-tenths
(ii) 5 tens, 3 units and 4 one tenths.

Solution

- (i) 5 units and 2 one-tenths
i.e. $5 + \frac{2}{10} = 5.2$
(ii) 5 tens, 3 units and 4 one-tenth
i.e. $50 + 3 + \frac{4}{10} = 53.4$

One Tenth means tenth part of one
i.e. 1 One tenth = $\frac{1}{10}$
2 one tenth = $\frac{2}{10}$

Example 2 Write in the decimal form

(i) $40 + \frac{3}{10}$ (ii) $500 + 70 + 4 + \frac{7}{10}$

Solution (i) $40 + \frac{3}{10} = 40.3$

(ii) $500 + 70 + 4 + \frac{7}{10} = 574.7$

We can also understand like this

$$\frac{40}{1} + \frac{3}{10} = \frac{40 \times 10 + 3 \times 1}{10}$$

$$\frac{400 + 3}{10} = \frac{403}{10} = 40.3$$

A fraction which has 10 as a denominator can easily be written in decimal form.

6.5 Converting decimal numbers into fractions

Example 3 Write decimal numbers in simple form after converting into fractions

(i) 24.4 (ii) 10.5

Solution (i) $\frac{24.4}{10}$

$$= \frac{2 \times 122}{2 \times 5}$$

$$= \frac{122}{5} \text{ (simplest form.)}$$

Hence 24.4 can be written as $24 + \frac{4}{10}$ or $\frac{244}{10}$
Hence for converting decimal number into fraction we remove point and divide it by 1 and put such number of zeros which the number after the decimal place.

We have learned that if numerator and denominator are mutually indivisible then it is the simple form of division.

(ii) $10.5 = \frac{105}{10} = \frac{21}{2}$ (Simplest Form)

6.6 Converting fractions into decimal

Try to write fraction in the decimal form, which has denominator other than 10.

Example 4 Convert the following fractions in the form of decimals:

(i) $\frac{9}{5}$

(ii) $\frac{1}{2}$

For these type of fractions, we find out like fraction for converting denominator in the form of multiple of 10. Then like we have done already if denominator is 10 then we put point in numerator from right after first digit and if it is hundred then after two digits from right side.

(i) equivalent fraction of $\frac{9}{5} = \frac{9}{5} \times \frac{2}{2} = \frac{18}{10} = 1.8$

(ii) equivalent fraction of $\frac{1}{2} = \frac{1}{2} \times \frac{5}{5} = \frac{5}{10} = 0.5$



Exercise 6.1

1. Write the numbers for the following in the table given below:

- | | | |
|------------------|---------|--------------|
| (i) 1 tens | 2 units | 3 one-tenths |
| (ii) 1 hundreds | 3 tens | 7 one-tenths |
| (iii) 2 hundreds | 5 tens | 1 unit |
| | | 2 one tenths |

Hundred	Tens	Units	One-tenths	The number
(100)	(10)	(1)	(1/10)	

2. Write the place value of following decimal numbers in a table

- | | | | |
|----------|----------|------------|------------|
| (i) 19.4 | (ii) 0.5 | (iii) 10.9 | (iv) 205.9 |
|----------|----------|------------|------------|

3. Write each of the following in form of decimal

- | | |
|---------------------------|-------------------------------|
| (i) 7 one-tenths | (ii) 2 tens 4 one-tenths |
| (iii) fourteen point nine | (iv) six hundred point three. |

4. Represent the following in form of decimal fractions

- | | | | |
|--------------------------|-------------------------|-------------------------------------|------------------------|
| (i) $\frac{3}{10}$ | (ii) $4 + \frac{8}{10}$ | (iii) $300 + 50 + 8 + \frac{1}{10}$ | |
| (iv) $90 + \frac{3}{10}$ | (v) $\frac{3}{2}$ | (vi) $\frac{2}{5}$ | (vii) $4 \frac{1}{2}$ |
| | | | (viii) $3 \frac{3}{5}$ |

5. Write fractions for the following decimal numbers and convert in the simplest form.

- | | | | |
|-----------|----------|-----------|-----------|
| (i) 0.6 | (ii) 2.5 | (iii) 2.8 | |
| (iv) 13.7 | (v) 21.2 | (vi) 1.0 | (vii) 6.4 |

6. Using cms convert the following into decimal form

- | | | |
|----------------|------------|---------------|
| (i) 2mm | (ii) 30 mm | (iii) 116 mm |
| (iv) 5 cm 2 mm | (v) 95 mm | (vi) 19cm 1mm |

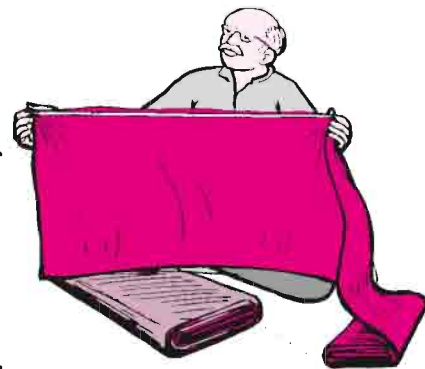
7. On the number line between which two whole numbers, the following numbers are marked? Which whole number of these is closer to the decimal number.

- | | | | | |
|---------|----------|-----------|----------|---------|
| (i) 0.5 | (ii) 5.3 | (iii) 9.0 | (iv) 4.9 | (v) 3.8 |
|---------|----------|-----------|----------|---------|

8. Show the following on number line.
 (i) 0.3 (ii) 1.7 (iii) 3.4 (iv) 2.5
9. The length of tulsi's hand grip is 95 mm. Write it in cm form.
10. Deepu has a 6 cm long scale. It has been broken at 4.4 cm .what is the length of the left piece of scale?

6.7 One hundredths

As we measure small objects and distances in cm and mm. so we measure bigger objects in meter and cm. You have read about meter scale in previous classes. There are hundred cms in one meter. Therefore 1 cm is the one-hundredth part of 1 meter. There are marks at hundred equal points between 0 to 1 meter and distance of every part is called 1 cm or hundredth part of 1 meter i.e One-hundredth. (If you find meter scale some where , try it.) Neelu measured the board on the wall of class room. She found that it is 2 meters and 15 small points i.e 15 cm. So it is 2meter 15 cm and 2 meters $\frac{15}{100}$ we will write it as 2.15 meter. Therefore the length of the board is 2m15 cm 2.15 meter. Similarly we can show 5 cm as $\frac{5}{100}$ m. or 0.05 m.



$1 \text{ cm} = \frac{1}{100} \text{ m}$ or
one hundredths of meter



6.8 One-thousandth

As second place towards right side of the decimal point is one-hundredth. Next after it is 10th part of one-hundredth. This is called one-thousandth. Such as 43.125. Forty three point one two five here 5 is at one tenth part ($\frac{1}{10}$) of hundredth place.

$$\frac{1}{100} \times \frac{1}{10} = \frac{1}{1000} \text{ (One thousandth part.)}$$

6.9 Reading decimal numbers

Prices of medicine, petrol and dollar in rupee and in similar situation. We have seen use of decimals. Do you know how it is read?

We will read 34.25 rs. as rs. Thirty four point two five. So as indian value of 1 dollar is Rs64.025 and we will read it as sixty four point zero two five.

Now write the following numbers in words

1. 45.36 cm =

2. 325.25rs. =



numbers written on the right side of decimal are never read together. As 35.75 shall be read as thirty five point seven five, not thirty five point seventy five.



Example 5 Write in decimal form

(i) $\frac{3}{5}$

(ii) $\frac{3}{4}$

(iii) $\frac{1}{25}$

(iv) $\frac{8}{1000}$

Solution (i) We know that on the left side of the decimal numbers is unit and on the right side is one-tenth and one-hundredth parts. Therefore for converting into decimal numbers, we have to multiply it by any like fraction which has its denominator 10 or 100. Therefore

$$\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10} = 0.6$$

Similarly

(ii) $\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 0.75$

(iii) $\frac{1}{25} = \frac{1 \times 4}{25 \times 4} = \frac{4}{100} = 0.04$

(iv) $\frac{8}{1000}$ Here place value of one-tenth and one-hundredth is 0. Therefore $\frac{8}{1000}$ shall be written as 0.008. Here in denominator; three 0 after 1.

So we have to write three digits after decimal point.

Example 6 Write decimal numbers in form of fractions.

(i) 0.07 (ii) 12.34 (iii) 0.407

Solution (i) $0.07 = \frac{7}{100}$

(ii) $12.34 = 12 + \frac{34}{100}$ Here simple form of $\frac{34}{100}$ is $\frac{17}{50}$ therefore $12 \frac{17}{50}$

(iii) $0.407 = \frac{407}{1000}$

Example 7 Write in the decimal form

(i) $500 + 5 + \frac{2}{10} + \frac{9}{100}$

(ii) $7 + \frac{4}{10} + \frac{6}{1000}$

Solution

(i) $500 + 5 + \frac{2}{10} + \frac{9}{100}$

$500 + 5 + \frac{29}{100}$

$= 505.29$

By converting denominator in similar number and then addition;

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

$\frac{20}{100} + \frac{9}{100} = \frac{29}{100}$

$$(ii) 7 + \frac{4}{10} + \frac{6}{1000} \quad \left\{ \begin{array}{l} \frac{4}{10} \times \frac{100}{100} = \frac{400}{1000} \\ \frac{400}{1000} + \frac{6}{1000} = \frac{406}{1000} \end{array} \right.$$

$$7 + \frac{406}{1000} \quad (\text{Here is a zero on hundredth place})$$

$$= 7.406$$

6.10 Comparison of decimals

Which number is greater 2.5 or 2.09?

Here digits at the unit's place are similar therefore we compare the numbers on right side of the decimal.

For 2.5 we have 5 at the One-tenth place. Therefore $\frac{5}{10}$ And in 2.09, we have 0 on the One-tenth place and 9 at the One-hundredth place. Therefore $\frac{9}{100}$

First method For comparison we make like fractions

$$\frac{5}{10} = \frac{5 \times 10}{10 \times 10} = \frac{50}{100}$$

Now compare $\frac{50}{100}$ and $\frac{9}{100}$ $\frac{50}{100}$ is greater. Therefore $2.5 > 2.09$

Second method As in case of other numbers, we compare those from left to right. Similarly in decimal numbers we compare first one-tenth and then one hundredth.

In 2.5 and 2.09 We have 5 as one-tenth and in 2.09 we have 0. Now one-tenth $5 > 0$ therefore $2.5 > 2.09$

Example 8 Which number is greater?

(i) 1 or 0.99

since it has 1 at units place in 1 and 0 as units place in 0.99.

(ii) 3.090 or 3.093

$$3.090 = 3 + \frac{0}{10} + \frac{9}{100} + \frac{0}{1000}$$

$$3.093 = 3 + \frac{0}{10} + \frac{9}{100} + \frac{3}{1000}$$

Both the numbers 3.09 and 3.093 are similar upto one-hundredth place. But 3 is at one-thousandth in 3.093.

Do and learn

Which number is greater in the following:

(i) 3.07 & 3.89 (ii) 0.57 & 0.05 (iii) 147.8 & 147.08 (iv) 9.5 & 5.92



6.11 Use of decimals

Example 9 Mahesh has 500 gram potatoes, 500 gram tomatoes, 250 gram capsicum and 100 gram ginger. Then how much is the total weight of vegetables in kg.

Solution We know that 1000 gram = 1 kilogram. Therefore 500 gram potatoes + 500 grams tomatoes + 250 gram capsicum + 100 gram ginger = 1350 gram. Now we will convert it into kilogram as follows:

$$1000 \text{ gram} + 350 \text{ gram} = \frac{1000}{1000} + \frac{350}{1000}$$

i.e 1350 gram = 1 kg, 350 gram = 1.350 Kg.

Example 10 Add 0.38 and 0.45

Solution:

unit	one tenths	one-hundredth
0	3	8
+	4	5
0	8	3

$$\frac{8}{100} + \frac{5}{100} = 13 \text{ hundredth}$$

$$\frac{13}{100} = \frac{10+3}{100} = \frac{10}{100} + \frac{3}{100} = \frac{1}{10} + \frac{3}{100}$$

$$= 1 \text{ tenths} + 3 \text{ hundredth}$$

$$\therefore \text{tenths} = \frac{1}{10} + \frac{3}{100} + \frac{4}{100} = \frac{8}{10} = 8 \text{ tenths}$$

Do and learn

Add the following

(i) $1.54 + 1.80$

(ii) $2.75 + .08$

Example 11 (i) Subtract 1.78 from 4.34 (ii) Subtract 0.78 from 2

Solution

unit	tenths	one-hundredth
4	3	4
-	7	8
2	5	6

unit	tenths	one-hundredth
2	0	0
-	7	8
1	2	2

For adding or subtracting decimal number to the whole number, we write same numbers of 0 after it with the symbol of decimal as the other number has the digits after decimal. Note putting 0 after decimal in whole numbers does not change its value.

Do and learn

(i) Subtract 1.67 from 5.47

(ii) Subtract 4.07 from 8.90

Example 12 The distance of school from papu's home is 8 kilometer 850 meters. He goes to school by bus up to 6 kilometer 500 meter and covers the rest distance by walking. How much distance he covers by walking?

Solution Distance of school form home = 8.850 km.

Distance covered by bus = 6.500 km. Hence the distance covered by pappu by walking = $8.850 - 6.500 = 2.350 = 2 \text{ km } 350 \text{ meters}$.

Exercise 6.2

1. Write the decimal numbers for the place value of digits given in the table.

S.N.	Hundreds 100	Tens 10	Units 1	One-tenth $\frac{1}{10}$	One-hundredth $\frac{1}{100}$	One-thousandth $\frac{1}{1000}$
(i)	2	3	0	0	5	7
(ii)	0	0	1	3	0	5
(iii)	2	5	3	5	0	5
(iv)	3	4	0	1	2	0
(v)	0	1	3	0	3	0

2. Write the following in decimal numbers.

(i) $23 + \frac{3}{10} + \frac{6}{1000}$

(ii) $\frac{7}{10} + \frac{3}{100} + \frac{6}{1000}$

(iii) $137 + \frac{6}{100}$

(iv) $700 + 3 + \frac{5}{100} + \frac{3}{1000}$

(v) $\frac{3}{10} + \frac{7}{1000}$

(vi) $\frac{1}{10} + \frac{9}{100}$

3. Write the following decimal numbers in words.

(i) 1.20

(ii) 108.56

(iii) 10.756

(iv) 6.01

4. Convert in fraction and write in simple form.

(i) 0.18

(ii) 0.25

(iii) 0.066

(iv) 0.40

5. Which number is greater? Write the reason as well.

(i) 0.4 or 0.04

(ii) 3 or 0.7

(iii) 0.999 or 0.19

(iv) 5.64 or 5.603

6. Use decimal and convert into rupees.

(i) 5 paise

(ii) 75 paise

(iii) 80 paise

(iv) 50 paise

7. Use decimal and convert into kilometres.

(i) 70 Km 5 m

(ii) 88 m

(iii) 800m

8. Solve the following:

(i) $0.007 + 8.5 + .008$

(ii) $280.69 + 25.8 + 8.80$

(iii) $0.75 + 10.425 + 2$

(iv) $32.52 + 36.60$

(v) $8.28 - 5.25$

(vi) $2.29 - 0.9$



9. Ravi weigh 15 kg 400 gm rice, 2kg 20 gm sugar, 100kg 850 gm flour. How much total did ramesh weigh?
10. Lily goes for evening walk. She walked 2km 100 meter on Monday, 3 km,500 m on Tuesday and 2 km 700 m on Wednesday, then how much in total she walked?
11. Teena has 20 m 50 cm long cloth. She had cut 4m, 25 cm cloth out of it. How much cloth is left with teena now?
12. Akash bought 12 kg vegetable. It include 4kg 150 gm tomatoes, 5kg 750 gram onions and rest are potatoes. Tell the weight of potatoes?

We learnt

1. For knowing parts of a whole unit, we will show it in parts. when a section is divided into 10 equal parts. Each part of it shall be $\frac{1}{10}$ (one-tenth). We can write it as 0.1, this is a decimal representation. This dot (.) is called decimal and used between unit and one tenths digits.
2. Every fraction can be written as decimal number and vice versa every decimal number can be written as fraction.
3. When a unit is divided into 100 equal parts then each part of it is We can write it as 0.01 in decimal form.
4. As we move from left to right on a place value table, place value of numbers is reduced to
5. Decimal numbers can also be shown on number lines.
6. Two decimal numbers can be compared . It begins with the whole number on left side of the decimal. If this is similar then we compare the digits on the place of One-tenth and again if these are also similar then look at the next digit one hundredth and goes on...



Chapter 7

Vedic Mathematics

7.1 Till now we have learned addition, subtraction, multiplication by Vedic maths. In this chapter we will study about these in detail. It includes; one more (Ekadhiken), one less (eknunen), absolute, deviation, absolute friend digit, inverse numbers, Addition of inverse numbers, subtraction, multiplication etc. except this we shall know about base of formula and shall learn about multiplication and division by 10 and 100

7.2 Next (One more) Ekadhiken

Chandra Shekhar has a magic box. If anyone speaks any number in front of this box. Then this box shows one more than the spoken number. When Anand speaks 8, this box says 9.

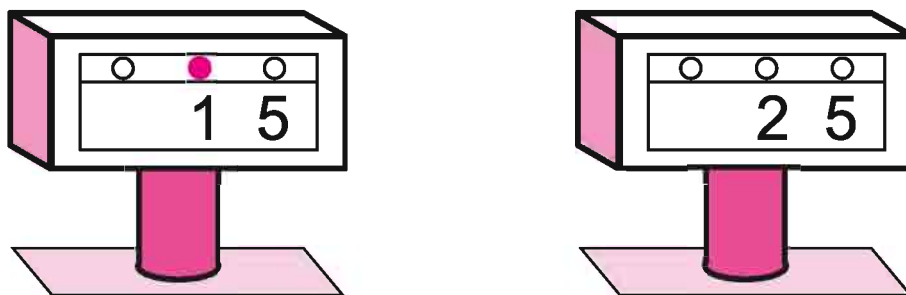
When Karan says 6, this box says 7. So box was telling the next number but when Leelavati told 15, this box said 25.

All the children started to think why this time box said 25? When next number after 15 is 16.

Similarly whenever a two digit number was spoken the box said next number for only the digit at the place of tens. Now children understood that at which number the point on the box get darker, shows the one more number.

i.e It shows the next one number for darker point.

Thus we have to show this special number a bit darker.



In the above diagram if the darker point would be on 5. The box would have shown the next one more number as 16. But it is on 1 therefore it showed 25. Practice these with more examples and fill in the blanks:



Ekadhik = Find out one more

One more = One more than the previous

$$\text{One more of } 3 = \overset{\cdot}{3} = 4$$

$$\text{One more of } 7 = \overset{\cdot}{7} = 8$$

$$\text{One more of } 9 = \overset{\cdot}{9} = 10$$

$$\text{One more of } 12 = \overset{\cdot}{12} = 13$$

$$\text{One more of } 28 = \overset{\cdot}{28} = 29$$

$$\text{One more of } 32 = \overset{\cdot}{32} = 33 \text{ (one more of unit digit 2)}$$

$$\text{One more of digit 1 in number } 14 = \overset{\cdot}{14} = 24 \text{ (one more of the digit at tens place i.e one more of } 1=2)$$

$$\text{One more of 2 for number } 25 = \overset{\cdot}{25} = 35$$

$$\text{One more of digit 9 for } 98 = \overset{\cdot}{98} = 108 \text{ (one more of } 9 = \overset{\cdot}{9} = 10)$$

Number	One more hint	New number
4	4	5
6	.....	.....
11	1 ¹	12
18	.....	.....
96	.....	.....
In 125 of digit 2	1 ² 5	135
In 354 of digit 3	.....	.....
In 648 of digit 8	.....	.....
In 985 of digit 9	.....	.....
In 1459 of digit 1	.....	.....

7.2.1 (Poorven)Before

In vedic maths ekadhiken poorven (before) word is also in trend with ekadhiken (one more). Thus meaning of poorven is prior means the just one digit before ...

In 13, the poorven digit of 3 = 1 The number before 3(at the place of tens)-1

In 59, poorven digit of 9 = 5 The number before 9(at the place of tens)-5

In 286, poorven digit of 8 = 2 The number before 8(at the place of hundreds) -2

In 435, poorven digit of 4 = 0 The number before 4 (at the place of thousands)-0

Therefore for which digit poorven is asked, we just take its just previous digit Such as ekadhiken poorven of 6 is 0 6 and new number is 16. Poorven digit of 6 will be 0. The number without any poorven digit is supposed to have '0' as its poorven.

Number	Ekadhiken poorven	New number
7	07	17
9	.....
In 16 of digit 6	16	26
In 42 of digit 2	.....	.....
In 96 of digit 9	096	196
In 87, of digit 8	.....	.....
In 134, of digit 3	134	.....
In 273, of digit 7	.....	.....
In 819, of digit 1	.....	.....
In 827, of digit 8	.....	.....

7.3 Addition by Ekadhikenpoorven

We will learn addition using Ekadhiken poorven.

Example 1

$$\begin{array}{r} 78 \\ 065 \\ \hline 143 \end{array}$$

Hints

- 1) Addition of digits at unit's place $8+5=13$. Thus we will mark the one more sign on poorven digit of 6
- 2) And we will put 3 below whole sum (at the place of unit)
- 3) In the addition digits at tens place $7 + \overset{\cdot}{6} = 14$ (where $\overset{\cdot}{6} = 7$)
- 4) Therefore mark one more sign on poorven digit of 6 i.e 0 (the number without any poorven digit is supposed to have 0 as its poorven)
- 5) Write the remainder 4 at the place of addition (tens place)
- 6) $\overset{\cdot}{0} = 1$ shall be written at hundreds place.



Example-2

$$\begin{array}{r} 98 \\ \overset{\circ}{0}\overset{\circ}{6}9 \\ \overset{\circ}{0}\overset{\circ}{8}5 \\ \hline 252 \end{array}$$

Hints

- 1) Addition of digits at the units place $8+9=17$ therefore one more sign at poorven digit of 9 i.e. 6
- 2) Left $7+5=12$ therefore one more sign would be at poorven digit of 5 i.e. 8
- 3) Remainder 2 shall be at the place of addition (in unit)
- 4) In the addition of tens place $9+\overset{\circ}{6}=16$ therefore one more sign is on the poorven of 6 i.e. 0
- 5) Remainder $6+\overset{\circ}{8}=15$ therefore put one more sign on poorven of 8 i. e. 0 and write remainder 5 in place of addition.
- 6) At the end $\overset{\circ}{0}+\overset{\circ}{0}=2$ at the place of hundreds.

Example-3

$$\begin{array}{r} 7 \quad 60 \\ \overset{\circ}{1}\overset{\circ}{3} \quad 45 \\ 38 \quad 50 \\ \hline 59 \quad 55 \end{array}$$

Hints

- 1) $0+5=5$ written at unit's place below
- 2) $6+4=10$ therefore we mark the sign of one more on 3 (Poorven of 4)
- 3) Remainder $0+5=5$ wrote in the sum at the place of tens.
- 4) $7+\overset{\circ}{3}=11$ Therefore one more sign will be on 1 (poorven of 3)
- 5) Remainder $1+8=9$ written below in sum at the place of hundreds.
- 6) $\overset{\circ}{1}+3=5$ Written below at the place of addition.

Example-4

$$\begin{array}{r} 26 \quad 386 \\ \overset{\circ}{0}\overset{\circ}{9}\overset{\circ}{7} \quad \overset{\circ}{8}\overset{\circ}{6}\overset{\circ}{5} \\ \hline 124 \quad 251 \end{array}$$

Hints

- 1) $6+5=11$ Therefore one more sign on poorven digit of 5 i.e 6; remainder 1 in meter in the addition at the place of unit
- 2) $8+\overset{\circ}{6}=15$ Therefore one more sign will be on the poorven digit of 6 i.e 8. Remainder 5 in addition under meter at the place of tens.
- 3) $3+\overset{\circ}{8}=12$ therefore one more sign will be on poorven digit of 8 i.e 7 remainder 2 in addition under meter at the place of addition.
- 4) $6+\overset{\circ}{7}=14$. Therefore one more sign on 9 the poorven digit of 7
- 5) Remainder 4 in the addition under kilometer
- 6) $2+\overset{\circ}{9}=12$ therefore one more sign on 0 i.e poorven of digit 9.
- 7) $\overset{\circ}{0}=1$ at the place sum.

Exercise 7.1

1. Find out the addition by formula of Ekadhiken poorven-

$$\begin{array}{r} \text{(i) } 96 \\ + 68 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(ii) } 98 \\ 49 \\ + 35 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(iii) } 327 \\ 496 \\ + 528 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(iv) } \text{RS} \quad \text{P} \\ 418 \quad 75 \\ + 395 \quad 36 \\ \hline \end{array}$$

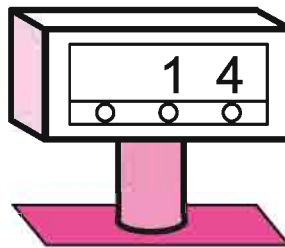
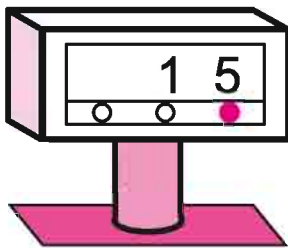
$$\begin{array}{r} \text{(v) } \text{Km} \quad \text{M} \\ 86 \quad 786 \\ + 75 \quad 345 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(vi) } \text{Kg} \quad \text{gm} \\ 139 \quad 65 \\ + 87 \quad 83 \\ \hline \end{array}$$

7.4 Eknunen (one less than previous)

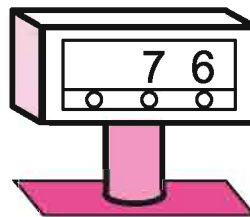
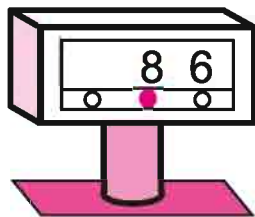
Didi as we were learning to find out the number written on box by the method of one more, then why not we make a box which can tell us the number less than 1. Let us see by subtracting 1 number.

If we speak 15 on the box, the box tells us the number 14



Less than one means to subtract 1. For showing less 1 we denote it by (•)

Similarly Pushkar spoke the number 86 then box told 76 by formula of less 1



Thus it shows less than one digit of the darker dotted number. In the second box darker dot is below 8 of 86. Therefore the box shows number 76. Therefore eknunen poorven is one less than of the previous digit. Thus in 19 one less than previous is 09.

Some more examples are given below. Fill in the blanks:



Do and learn

Number	Ekadhiken poorven sign	New number
In 15, of digit 5	1̇5	05
In 23, of digit 3	.....	.....
In 47, of digit 4	.....	.....
In 159, of digit 9	15̇9	149
In 351, of digit 1	.....	.....
In 524, of digit 2	.....	.....
In 1675, of digit 6	.....	.....
In 8963, of digit 9	.....	.....

7.5 Complementary Digit (Parammitra ank)

Sulochna didi brings a box in the class. There are 10 marbels in the box. didi asks to take out marble from the box then tej singh takes out 9 marbels. Then didi asks about remaining marbles in the box. The answer is 1.

Similarly other children also take out marbles from the box. One student took out 6 marbles then ;how many marbles left in the box. The answer is 4 marbles. Thus sum of taken out and left over marbles is 10 therefore we get the amount of left marbles by subtracting the number of marbles taken out. Thus if base number is 10 and one number is given then remainder is the parammitra of that number.

Complementary digit of 1 (Parammitra ank)	= 9	(10-1=9)
Complementary digit of 2 Parammitra ank)	= 8	(10-8=2)
Complementary digit of 3 (Parammitra ank	= 7	
Complementary digit of 4 (Parammitra ank)	= 6	
Complementary digit of 5 (Parammitra ank)	= 5	
Complementary digit of 9	= 0	
(9̇ = ekadhik of 9)		

Therefore the sum of both numbers is 10.

Formula: Subtraction from sum of eknunen + prammitra ank**Example 5** Solve 52-27

$$\begin{array}{r} 52 \\ - 27 \\ \hline 25 \end{array}$$

Hint

- (i) 7 can not be subtracted from 2. Therefore we add the Complementary digit of 7, the digit 3 to 2
 $2+3=5$ write below the sum.
- (ii) Put a sign of less than on the poorven digit of 2 i.e 5 such as $\bar{5} = 4$
- (iii) subtract 2 from $\bar{5}$ ($4-2=2$) and write remainder 2 below.
 Thus $52-27=25$ is the answer.

Example 6 subtract 359 from 643

$$\begin{array}{r} 643 \\ - 359 \\ \hline 284 \end{array}$$

Hint

1. 9 can not be subtracted from 3. Therefore we will add Complementary digit of 9 i.e 1 to 3. Then sum $3+1=4$
2. we put sign of one lesser on the poorven of 3 i.e $\bar{4}$
3. 5 can not be subtracted from $\bar{4} = 3$. Therefore we added Complementary digit of 5 i.e 5 to the digit 3. Hence sum is $5+3=8$
4. Put a sign of one lesser with the poorven number of 4. i.e $\bar{6}$
5. $\bar{6} = 5$, $5-3=2$.
 Hence $643-359=284$ answer.

Example 6 subtract

Rs.	Paisa
81	85
- 24	96
56	89

Hint

- (1) 6 Can not be subtracted from 5. Therefore 4, the Complementary digit of 6 would be add to 5. Then write $5+4=9$
- (2) put -sign with the poorven ank of 5 i.e $\bar{8}$
- (3) 9 can not be subtracted from $\bar{8} = 7$. Therefore we add digit 1 (param mitra of 9) to the sum $\bar{8} + 1 = 8$
- (4) Put the one lesser sign with 1 (Poorven ank of $\bar{8}$) such as $\bar{1}$
- (5) 4 can not be subtracted from $\bar{1} = 0$. Therefore we add 6 to the number $\bar{1}$ i.e $6+\bar{1} = 6$
- (6) Put one lesser sign with 8 (The poorven of $\bar{1}$) such as $\bar{8}$
- (7) Subtracting 2 from $\bar{8} = 7$ then $\bar{8} - 2 = 5$
 Thus subtracting Rs 24.96 from 81.25= Rs 56 and 89 p.



Example 8

Kms.	Metre
37	670
28	890
<hr/> 08	<hr/> 780

Hint

- (1) Subtracting 0 from 0=0
- (2) 9 can not be subtracted from 7. We add parammitra digit of 9 i.e 1 to 7. Hence $7+1=8$
- (3) Put one lesser sign on the poorven of 7 i.e 6 Such as 6
- (4) 8 can not be subtracted from 6, Therefore we add param mitra digit of 8 i.e 2 to 6. Hence $6 + 2 = 7$
- (5) We put one lesser sign with the poorven digit of 6 i.e 7
- (6) 8 can not be subtracted from 7 = 6, Complementri digit of 8 is 2 and adding 2 to 7 i.e $7+2=8$
- (7) put one lesser sign with poorven digit of 7 i.e 3 such as 3
- (8) Subtracting 2 from 3 = 2 Write $2-2=0$

Exercise 7.2

1. Subtract by the formula of eknunen poorven & "Parammitra ank".

(i) 75	(ii) 84	(iii) 435	(iv) 840
$- 27$	$- 56$	$- 146$	$- 573$
<hr/>	<hr/>	<hr/>	<hr/>

(v)		(vi)		(vii)	
Rs	P	M	Cm	Kg	gm
75	40	134	40	235	125
$- 56$	73	$- 65$	85	$- 79$	238
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

7.6 Deviation

Chetan went to a shop to bring packet of match boxes. Shop keeper told its price Rs 7. Chetan gave rs. 10 to shop keeper. Then shopkeeper returns Rs 3 to him. Shiva reached at shop, takes a packet of salt and its price is Rs 15. Shiva gave one note of rs10 and one of Rs 5.

In the above two examples transaction was based on digit 10.

Kapil bought a packet of 200 ml of milk for Rs 8. Durga bought a coco nut for Rs 12. Therefore the shop keeper returned Rs 2 to Kapil and durga gave Rs. 2 more to the shop keeper. If Kapil would have purchased both the things, then how much of money he had given to the shop keeper. Must be Rs. 20. In vedic maths calculation are generally done on the base of number 10, its multiple and raised power.

Therefore the value more or less than the base is called deviation. Lesser value than base is called negative deviation and more value than base is called positive deviation.

Do and learn

Number 9	How much less than 10 ...(-1)
Number 6	Deviation from 10.....
Number 14	How much more than 10
Number 85	How much less then 100
Number 89	How much more than 100
Number 94	Deviation from 100
Number 102	How much more than 100.....+2
Number 105	How much more than 100.....
Number 113	Deviation from 100

7.7 Inverse “Vinkulum”

We learned about Param mitra where sum of 2 digits is equal to 10. Then these digits are param mitra of each other. How much the number is smaller than the base. To show negative form of it we put a line over the number and it is called Vinkulum. Here we will convert number greater than 5.

$$\begin{aligned}
 8 &= 10 - 2 \\
 &= 10 + \bar{2} \quad \text{We write -2 as inverse i.e } \bar{2} \\
 &= 1\bar{2}
 \end{aligned}$$

Example 9 Convert 7 into its Vinkulum.

$$\begin{aligned} & 7 \\ = & \overset{\cdot}{0}\bar{3} \\ = & \bar{1}\bar{3} \end{aligned}$$

Hint

1. Vinkulum line on the param mitra digit of 7 i.e 3
2. one more sign on poorven digit of 7 i.e 0
3. $\overset{\cdot}{0} = 1$

Example 10 convert 9 into its vinkulum

$$\begin{aligned} & 9 \\ = & \overset{\cdot}{0}\bar{1} \\ = & \bar{1}\bar{1} \end{aligned}$$

Hint

- (1) Vinkulum line on the Param mitra digit of 9 i.e 1
- (2) one more sign on the poorven of 9 i.e. 0
- (3) Write $\overset{\cdot}{0} = 1$

Example 11 convert 64 into its vinkulum

$$\begin{aligned} & 6 \ 4 \\ = & \overset{\cdot}{0} \ \bar{4} \ 4 \\ = & \bar{1} \ \bar{4} \ 4 \end{aligned}$$

Hint

- (1) digit 4 would be as it is and Vinkulum line would be on 4, the Param mitra digit of 6
- (2) one more sign on 0, the poorven digit of 4
- (3) Write $\overset{\cdot}{0} = 1$

Example 12 convert 079 into its vinkulum

$$\begin{aligned} & 079 \\ = & \overset{\cdot}{7}\bar{1} \\ = & \bar{8}\bar{1} \\ = & \overset{\cdot}{0}\bar{2}\bar{1} \\ = & \bar{1}\bar{2}\bar{1} \end{aligned}$$

Hint

- 1) Inverse line on 1, the param mitra digit of 9.
- 2) One more sign on poorven digit of 7= $\overset{\cdot}{7}$
- 3) Hence vinkulum line on 2, the param mitra digit of 8.
- 4) One more sign on poorven digit of 8. i.e 0
- 5) Write $\overset{\cdot}{0} = 1$



Exercise 7.3

1. Convert the general numbers into its vinkulum.

(i) 8

(ii) 27

(iii) 82

(iv) 78

(v) 96

7.7.1 Convert the Vinkulum number into the general number

(i) To convert inverse into general number. Assume that number is a positive number.

(ii) Write the Param mitra of this assumed number.

(iii) Put a one lesser sign with poorven digit of the vinkulum number.

(iv) If there are three digits in vinkulum number, then we will first convert the digit at tens place and then units place.

Example 13 Convert $2\bar{4}$ into general numbers.

 $2\bar{4}$ **Hint**

(1) Write the param mitra digit 6 of the positive value of $\bar{4}$ i.e 4

 $\bar{2}6$

(2) Put one less than sign on 2 i.e poorven of $\bar{4}$

 16

(3) Write $2=1$

Example 14 Convert $5\bar{3}\bar{2}$ into general numbers

Hint $5\bar{3}\bar{2}$

(1) write param mitra digit of positive value 3 of $\bar{3}$ (at the tens place) i.e 7

 $= 5\bar{7}\bar{2}$

(2) Put a one less than sign on poorven digit of $\bar{3}$ i.e 5. Such as $\bar{5}=4$

 $= 4\bar{7}\bar{2}$

(3) Write the param mitra digit of positive value of $\bar{2}$ i.e. 8 on units place.

 $= 4\bar{7}8$

(4) put one less than sign on 7 (poorven of $\bar{2}$) = 7

 $= 468$

(5) Write $7=6$

Exercise 7.4

1. Convert the vinkulum number into general number.

(i) $3\bar{5}$ (ii) $5\bar{4}$ (iii) $13\bar{2}$ (iv) $5\bar{4}\bar{2}$ (v) $6\bar{2}\bar{3}$

7.7.2 Addition by vinkulam

Addition of vinkulam numbers is done like general numbers. In vinkoolam addition we write addition of units at the place of unit and sum of the tens digit is written at the place of tens.

Add the following:

$$(i) \quad \bar{2} + \bar{3} = \bar{5}$$

$$(ii) \quad \bar{1} \bar{3} + \bar{2} \bar{4} = \bar{3} \bar{7}$$

$$(iii) \quad 2 + \bar{2} = 0$$

$$(iv) \quad 8 + \bar{3} = 5 + 3 + \bar{3} = 5 \quad (8=5+3 \text{ and } 3+\bar{3}=0)$$

$$(v) \quad \bar{6} + 2 = \bar{4} + \bar{2} + 2 = \bar{4}$$

It is clear from the above example that addition of vinkulam numbers is vinkulam number. Addition of a number with its inverse = 0. Addition shall be in the form of a number which is greater.

Example 15 Add by vinkulam method

$$\begin{array}{r} \bar{1} \bar{2} \\ \bar{1} \bar{2} \\ \hline 00 \end{array}$$

Hint

$$(1) \text{ In the unit number } 2 + \bar{2} = 0$$

$$(2) 1 + 1 = 0$$

Example 16 Add by vinkulam method

$$\begin{array}{r} \bar{6} \bar{4} \\ \bar{3} \bar{2} \\ \hline \bar{3} \bar{6} \\ = \bar{3} \bar{4} \\ = \bar{2} \bar{4} \end{array}$$

Hint

$$(i) \text{ in the unit digit } \bar{4} + \bar{2} = \bar{6}$$

$$(ii) \text{ in the digit at tens } \bar{6} + \bar{3} = \bar{3}$$

$$(iii) \text{ convert } \bar{3} \bar{6} \text{ into general number.}$$

$$(iv) \text{ Param mitra of } \bar{6} \text{ is } 4 \text{ and digit } 3 \text{ is here with one lesser sign. Such as } \bar{3}$$

$$(v) \text{ Write } \bar{3} = 2$$

Exercise 7.5

1. Find the sum of vinkulam numbers.

$$(i) \quad \begin{array}{r} \bar{6} \bar{3} \\ \bar{4} \bar{3} \\ \hline \\ \hline \end{array}$$

$$(ii) \quad \begin{array}{r} \bar{7} \bar{3} \\ \bar{4} \bar{2} \\ \hline \\ \hline \end{array}$$

$$(iii) \quad \begin{array}{r} \bar{8} \bar{2} \\ \bar{5} \bar{5} \\ \hline \\ \hline \end{array}$$

$$(iv) \quad \begin{array}{r} \bar{8} \bar{9} \\ \bar{7} \bar{8} \\ \hline \\ \hline \end{array}$$

$$(v) \quad \begin{array}{r} \bar{5} \bar{3} \\ \bar{2} \bar{1} \\ \hline \\ \hline \end{array}$$

7.7.3 Subtraction using vinkoolam numbers

Subtraction is done using vinkulam numbers like we do with general numbers. Write the subtraction of unit digit at the place of unit. Similarly subtraction of tens digit is written below the tens place. As well as the digits which are subtracted again added with its vinkulum to the above numbers.

Subtract the following:

$$(i) \quad \bar{2} - 3 = \bar{2} + \bar{3} = \bar{5}$$

$$(ii) \quad \bar{1} \bar{3} - 24 = \bar{1} \bar{3} + \bar{2} \bar{4} = \bar{3} \bar{7}$$

In the above example we see subtraction of vinkulam numbers is vinkoolam.

Example 17 Subtract 45 from 83

$$\begin{array}{r} 83 \\ - 45 \\ \hline \end{array}$$

$$\begin{array}{r} 83 \\ + \bar{4}\bar{5} \\ \hline 4\bar{2} \\ = 48 \\ = 38 \end{array}$$

Hint

- (1) Changing the sign of -45 into + write 4 and 5 with their vinkulam lines.
- (2) Write $3 + \bar{5} = \bar{2}$ in the units place.
- (3) Write $8 + \bar{4} = 4$ on tens place.
- (4) Convert $4\bar{2}$ into general number.

Example 18 Subtract 426 from 793

$$\begin{array}{r} 793 \\ - 426 \\ \hline \end{array}$$

$$\begin{array}{r} 793 \\ + \bar{4}\bar{2}\bar{6} \\ \hline 3\bar{7}\bar{3} \\ = 377 \\ = 367 \end{array}$$

Hints

- (i) Changing the signs -426 into + and draw vinkulam line over 4,2 and 6
- (ii) Write $3 + \bar{6} = \bar{3}$
- (iii) Write $9 + \bar{2} = 7$
- (iv) Write $7 + \bar{4} = 3$
- (v) Convert $3\bar{7}\bar{3}$ into general number.



Exercise 7.6

1. Find out difference using vinkulam:

$$\begin{array}{r} \text{(i) } 96 \\ - 49 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} \text{(ii) } 932 \\ - 245 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} \text{(iii) } 952 \\ - 788 \\ \hline \\ \hline \end{array}$$

$$\begin{array}{r} \text{(iv) } 834 \\ - 547 \\ \hline \\ \hline \end{array}$$

7.8 Write mathematical table using vedic maths method.

- (1) Change the number into vinkulam to write table
- (2) Identify the digits at units and tens place in vinkulam.
- (3) according to instruction given keep adding to vinkulam digits.

Example 19. Write table of 9

$$\text{Vinkulam of } 09 = 10 - 1 = 1\bar{1}$$

Here in $1\bar{1}$ unit digit is one less i.e. $\bar{1}$ thus one lesser and tens digit is one more

$$\begin{array}{r} 09 \\ 1\bar{1} \\ \hline 09 \\ \left(\begin{array}{l} 0 + 1 \\ 1 + 1 \\ 2 + 1 \\ 3 + 1 \end{array} \right) \longrightarrow \begin{array}{l} 18 \\ 27 \\ 36 \\ 45 \end{array} \longleftarrow \left(\begin{array}{l} 9 - 1 \\ 8 - 1 \\ 7 - 1 \\ 6 - 1 \end{array} \right) \\ 54 \\ 63 \\ 72 \\ 81 \\ 90 \end{array}$$

and so on.

Example 20. Write table of 8.

Since Inverse of 08 is $\bar{12}$ Therefore here unit digit would be reduced by 2 and tens digit would be increased by 1

$$\begin{array}{r}
 08 \\
 \bar{12} \\
 \hline
 08 \\
 \left(\begin{array}{l} 0 + 1 \\ 1 + 1 \\ 2 + 1 \\ 3 + 1 \\ 4 + 1 \\ 4 + 1 \end{array} \right) \longrightarrow \begin{array}{l} 16 \\ 24 \\ 32 \\ 40 \\ 5\bar{2} = 48 \\ 56 \end{array} \longleftarrow \left(\begin{array}{l} 8 - 2 \\ 6 - 2 \\ 4 - 2 \\ 2 - 2 \\ 0 - 2 = \bar{2} \\ 8 - 2 = 6 \end{array} \right) \\
 \begin{array}{l} 64 \\ 72 \\ 80 \end{array}
 \end{array}$$

and so on.

General form of 5 2 is 48.

Now we can make tables of many numbers.

Do and learn

Make table of following tables.

(i) 99

(ii) 98

(iii) 89

(vi) 999

7.9 Multiplication calculation (By formula of nikhilam) When base is 10 or 100.

We have learned about deviation, which was in the form of base 10 or power of 10. If a deviation is calculated by subtracting base from a number, that deviation is positive or negative.

Lets look at the method of formula of nikhilam for multiplication.

1. Take nearest base of given two numbers which are to be multiplied either 10 or 100
2. Now write respective deviations from base in front of those numbers.
3. Now divide the multiplication product place into two parts by a slanting line.
4. Multiply deviation in right side .
5. In left side calculate deviation of any given number +another number
6. In right side multiplication of deviation:
 - (i) If base is 10 then there will be one digit in the right side. If there are two digits then add digits at tens place to the left side.

- (ii) If base is 100. Then product shall be of digit two as well. If it is only one than write zero before it.
7. If product of the deviation is negative then take one number from Left side (the base) and convert it into positive form.
Let's multiply by Nikhilam formula

Example 21

$$\begin{array}{r}
 13 \times 12 \\
 \text{Number} \quad \text{Deviation} \\
 13 \quad \quad + 3 \\
 \times 12 \quad \quad + 2 \\
 \hline
 = (13 + 2) \quad / \quad (+3 \times +2) \\
 (12 + 3) \\
 \hline
 = 15 \quad / \quad 6 \\
 = 156
 \end{array}$$

Hint

1. Multiple number $13=10+3$ which is 3 more than 10 and $12=10+2$, 2 more than 10. we will write it as +2, +3 in form of deviation.
2. Write the numbers up and down and deviation in front of them.
3. Product of deviations $(+2) \times (+3) = +6$ is written on the right side of the diagonal line.
4. Write in the left side $13+2$ or $12+3=15$
5. Product is 156 after removing the diagonal line.

Example 22

$$\begin{array}{r}
 15 \times 17 \\
 \text{Number} \quad \text{Deviation} \\
 15 \quad \quad + 5 \\
 \times 17 \quad \quad + 7 \\
 \hline
 = (15 + 7) \quad / \quad (+5 \times +7) \\
 (17 + 5) \\
 \hline
 = 22 \quad / \quad 35 \\
 = 22 \quad / \quad 35 \\
 = 25 \quad / \quad 5 \\
 = 255
 \end{array}$$

Hint

1. Multiplier $15=10+5$, which is 5 more than 10 and $17=10+7$, seven more than 10, we write it as +5 and +7
2. Write the numbers up and down and deviation in front of them.
3. Product of the deviation $(+5) \times (+7) = +35$ would be written on the right side of slanted line.
4. Write $15+7$ or $17+5=22$
5. There will be only one number on the right hand side because in base 10, there is one zero.
6. In the product of deviation (35) unit digit 5 on R.H.S and add 3 on the left side. (In form of base 10)
7. on L.H.S $22+3=25$
8. on removing slanted line product is 255.

Example 23

$$8 \times 7$$

Number	Deviation
8	- 2
x 7	- 3
= (8 - 3) / (7 - 2) / (-2 x - 3)	
= 5 / 6	
= 56	

Hint

1. Multipliers $8 = 10 - 2$ which is 2 less than 10, and $7 = 10 - 3$ which is 3 less than 10, are written in the form of deviation as -2 and -3.
2. Write the numbers one below the other and the deviations opposite to them.
3. The product of the deviations $(-2) \times (-3) = +6$ is written on the right side of the slanted line.
4. On the left hand side write $8 - 3$ or $7 - 2 = 5$.
5. On removing the slanted line, the product is 56.

Example 24

$$6 \times 9$$

Number	Deviation
6	- 4
x 9	- 1
= (6 - 1) / (9 - 4) / (-4 x - 1)	
= 5 / 4	
= 54	

Hint

1. Multipliers $6 = 10 - 4$ which is 4 less than 10, and $9 = 10 - 1$ which is 1 less than 10, are written in the form of deviation as -4 and -1.
2. Write the numbers one below the other and the deviations opposite to them.
3. The product of the deviations $(-4) \times (-1) = +4$ is written on the right side of the slanted line.
4. On the left hand side write $6 - 1$ or $9 - 4 = 5$.
5. On removing the slanted line, the product is 54.



Example 25

$$\begin{array}{r}
 6 \times 7 \\
 \begin{array}{r}
 \text{Number} \quad \text{Deviation} \\
 6 \qquad \qquad -4 \\
 \times 7 \qquad \qquad -3 \\
 \hline
 = (6 - 3) \quad / \quad (-4 \times -3) \\
 (7 - 4) \\
 = 3 \quad / \quad 12 \\
 = 3 \quad / \quad 2 \\
 = 4 \quad / \quad 2 \\
 = 42
 \end{array}
 \end{array}$$

Hint

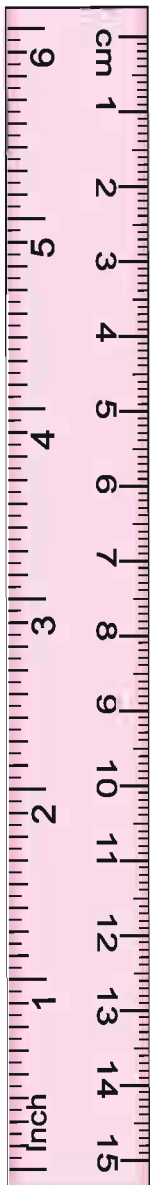
1. Multipliers $6 = 10 - 4$ which is 4 less than 10, and $7 = 10 - 3$, are written in the form of deviation as -4 and -3.
2. Write the numbers one below the other and the deviations opposite to them.
3. The product of the deviations $(-4) \times (-3) = +12$ is written on the right side of the slanted line.
4. On the left hand side write $6-3$ or $7-4 = 3$.
5. One number will remain on the right hand side because the base number 10 has one zero.
6. The units digit of the product of deviations i.e. 12 is written in the right hand side while the tens digit i.e. 1 is added to the left hand side.
7. There is 3 on the left hand side
8. $3+1=4$. On the left hand side.
9. Product is 12 on removing diagonal line.

Example 26

$$\begin{array}{r}
 8 \times 13 \\
 \begin{array}{r}
 \text{Number} \quad \text{Deviation} \\
 8 \qquad \qquad -2 \\
 \times 13 \qquad \qquad +3 \\
 \hline
 = (8 + 3) \quad / \quad (-2 \times +3) \\
 (13 - 2) \\
 = 11 \quad / \quad -6 \\
 = 10 \quad / \quad -6 \\
 = 10 \quad / \quad 10 - 6 \\
 = 10 \quad / \quad 4 \\
 = 104
 \end{array}
 \end{array}$$

Hint

1. Multiplication number $8=10-2$, which is 2 less than 10. And $13 = 13-10=3$ which is 3 more than 10. So it would be written as $-2+3$ as deviation
2. Write the numbers up and down and their deviations in front of them
3. Write the multiplication $-2 \times +3 = -6$ would be written on the right side of the diagonal line
4. on left side write $8+3$ OR $13-2=11$
5. The multiplication product of deviation is negative on the right hand side. for converting it into positive take 1 as 1×10 towards right hand side.
6. there would be $11-1=10$ on the left hand side.
7. on right hand side $10-6=4$
8. Multiplication product on removing diagonal line is 104



Example 29

$$101 \times 108$$

Number	Deviation
101	+01
x 108	+08
$= \frac{(101 + 08) \quad (108 + 01)}{(101 \times 08) \quad (108 \times 01)}$	
$= 109 \quad / \quad 08$	
$= 10908$	

Hint

1. Multiplication number $101=100+1$ which is 1 more than 100 and $108=100+8$ which is 8 more than 100. We write it as +01 and +08 as deviation
2. Write the numbers up and down and their deviations in front of them.
3. Write the multiplication of $+01 \times +08 = +8$ on the right side of diagonal line.
4. Write $101+08$ or $108 + 01 = 109$ on the left side.
5. Multiplication of deviation is +8 on the right hand side (two zeroes in 100. Therefore there must be 2 digits on right side) So write 08 instead of +8
6. Multiplication on removing diagonal line is 10908

Example 30

$$92 \times 87$$

Number	Deviation
92	-08
x 87	-13
$= \frac{(92 - 13) \quad (87 - 08)}{(92 \times -13) \quad (87 \times -08)}$	
$= 79 \quad / \quad 104$	
$= 79 \quad / \quad 04$	
$= 80 \quad / \quad 04$	
$= 8004$	

Hint

1. Multiplication number $92=100-8$. which is 8 less than 100 and $87=100-13$ which is 13 less than 100. Write the numbers up and down and their deviation in front of them.
2. Multiplication of deviation $-08 \times -13 = +104$ would be written on the right side of diagonal line.
3. On left side write $92-13$ or $87-08=79$
4. On the right side multiplication of deviation is 104 (two zeroes in base 100) therefore there will be two digits in right side. i.e 04. Add 1 to the left side.
5. Now on left side $79+1=80$
6. On removing diagonal line multiplication product 8004




Exercise 7.7

1. Multiply (Using formula of nikhilam)

- (i) 12×13
- (ii) 11×19
- (iii) 13×15
- (iv) 8×7
- (v) 6×9
- (vi) 8×12
- (vii) 102×104
- (viii) 106×107
- (ix) 112×109
- (x) 91×98
- (xi) 96×94
- (xii) 98×104
- (xiii) 85×93

7.10 Division by nikhilam

Previously we multiplied by nikhilam which is easier than the general method. Similarly division by nikhilam is also very simple.

Repeated subtraction is done till we get 0 as answer. How many times subtraction is done? This is a long procedure. Today division is done by a certain method or by cramed mathematical tables. But in Vedic maths, division can also be done as in multiplication by assuming 10 or 100 as base

Method

1. Decide nearest base number of divisibility, Then find out its complementary number (Param Mitra).
2. In the procedure of division on a certain point divide into three section by two vertical lines.
3. Write divisor and its complementary number below it in the first section on left side.
4. Write the last digits of divisible in the same numbers equal to the number of zeroes in the base.
5. Remainder of divisible would be written in the middle section.



Example 31

$$124 \div 9$$

Here Divisor = nearest base of nine = 10

Complementary number = 1

Here in base 10. There is only a single 0. Therefore write 4 of divisor in the third section. In the middle section digit of divisible is 12.

First Section Number	Middle Section	Third Section
9	1	2 4
Complementary Number	1	1 -
	→ 1	↓ 3 3
		↓ 7

Hint

1. We write 1 at the place of sum below in middle section.
2. This digit 1 x complementary 1 = 1 is written below 2 and - in the third section
3. Sum 2 + 1 = 3 at the place of sum below.
4. Again product 3 x complementary number 1 = 3.
5. Write product 3 in third section below 4, sum 4 + 3 = 7.
6. Hence divisor = 9, quotient = 13 and remainder = 7.

Similarly taking 100. Let us practise.

Example 32

$$123 \div 98$$

Divisor = 98, complementary number = 100 - 98 = 02

Again distribute in three sections

First Section Number	Middle Section	Third Section
9 8	1	2 3
Complementary Number	0 2	

Taking base 100 there are two zeroes in base number. Therefore remainder should also be of maximum two digits. For this we drew a straight line from right side leaving 2 digits. We drew one more straight line on the left side. Now divisor 98 on the left side of this line and write complementary number 02 below this. process of solution is like this:

	First Section	Middle Section	Third Section
Number	9 8	1	2 3
Complementary Number	0 2	↓ 1	0 2
		1	2 5

First of all write divisor, then digit 1 under middle section. Then after multiplying this by complementary number, write below the divisor. Now add the digits on right side. Middle section is quotient and third section is remainder. We repeat the process till we get smaller number than divisor in the third section.

Note: In this procedure we do not have to subtract, in fact we get the answers by addition only.

Example 33

$$1004 \div 87$$

	First Section	Middle Section	Third Section
Number	8 7	1 0	0 4
Complementary Number	1 3	↓ 1	3 -
		↓ 1	1 3
		1 1	4 7

Hints

1. If base is 100 means there are two digits written on the right side.
2. Complementary number of 87 on the base is 13
3. Wrote 1 below and multiply 1 by complementary.
4. After addition, again received 1. Therefore again multiplied 1 by complementary number
5. After addition we got quotient 11 and remainder 47

Example 34

$199 \div 97$

	First Section	Middle Section	Third Section
Number	9 7	1	9 9
Complementary Number	0 3	↓	0 3
		1	10 2
			0 2
			1
		1	0 3
		2	0 5

Hints

1. Base is 100. Therefore there are written two digits on right side.
2. Complementary number of 97 on the base 100 is 03
3. Write 1 and multiplied it by complementary number.
4. Remainder was 102 but here shall be two digits in the third section. (Since base = 100). Therefore we will add 102 and 02 in third section, add 1 in middle section and multiply 1 with the complementary number and write it in the third section and add the numbers in middle section and third section.
5. Hence quotient and remainder are 2 and 5 respectively.

Example 35

$2345 \div 78$

	First Section	Middle Section	Third Section
Number	7 8	2 3	4 5
Complementary Number	2 2	↓	4 -
		↓	5 4
			1
		2	3 9
			2
		2	4 4
		2	8 3
		+1	-7 8
		3	0 5

Hint

1. Complementary of 78 on base 100 is 22
2. Wrote 2 below multiply it with complementary number and add.
3. We got 7 below. Then multiply it by complementary number and we got 239 after addition.
4. After adding 2 to the numbers written below we get quotient 29 and remainder 83.
5. Remainder 83 which is greater than divisor 78. Therefore quotient = $29 + 1 = 30$
Remainder = $83 - 78 = 5$

Exercise 7.8

1. Divide by formula of nikhilam

- (i) $124 \div 89$
- (ii) $406 \div 9$
- (iii) $298 \div 96$
- (iv) $1358 \div 113$
- (v) $1234 \div 112$
- (vi) $306 \div 8$

We Learnt

1. Ekadhiken (one more) means +1
2. Eknunen (one less) means -1.
3. EKadhik poorven means one more than the previous
4. Eknunen poorven means one less than the previous.
5. Complementary digit - Two numbers whose addition is 10 are complementary to each other.
6. Deviation = Number - base
7. Inverse - To write negative numbers into positive numbers.
8. Addition of a number and its inverse is always 0.
9. Addition of two inverse numbers is again an inverse number.
10. Inverse application is the simplest method of Subtraction.
11. Write tables using inverse.
12. Multiply and divide by formula of nikhilam.



8.1 We see many things in our surrounding like buildings, utensils, furniture, painting etc. You must have seen mehandi design, these are made using shapes like round, square, triangle, lines etc. These shapes are called geometrical shapes.

Now try to find out these kind of shapes in things around you.

In india geometry is used in making several things since Vedic kal, whether its 'Havankundmandap' or temple. These geometrical shapes are also used in houses, palaces and other buildings. Originally the word geomatri is a combination of geo and matri. Here geo means land ad metri means measurement.



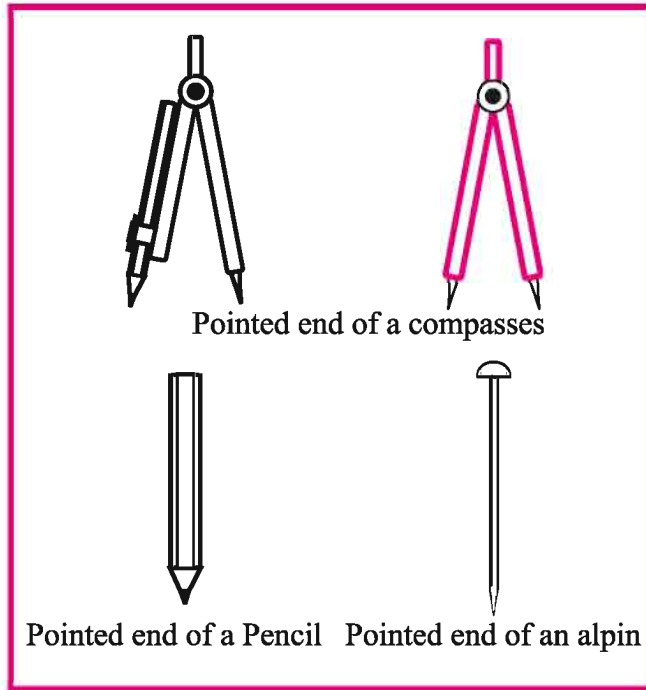
8.2 Basic geometrical shapes

In this chapter we will learn about geometrical shapes. Some diagrams of different things are given below with their geometrical shapes. Tell us which object shows the shape in its surface.

1				
2				
3				
4				
5				

8.2.1 Point

Mark a point on a paper by pencil.



Sharper the tip smaller will be the point. Almost invisible minute sign look like a dot. This dot decides a location.



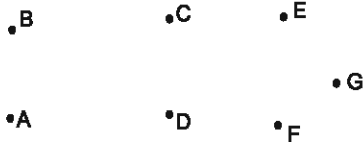
Map of Rajasthan



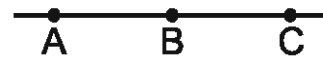
In this map some dots are showing the location of some cities of Rajasthan. (The map is not based on measurement)



If you mark some dots on a paper, you need to differentiate these. For it we denote these by using capital letters of English...like A,B,C etc.



If three and more points fall on a same line. These are called linear points.



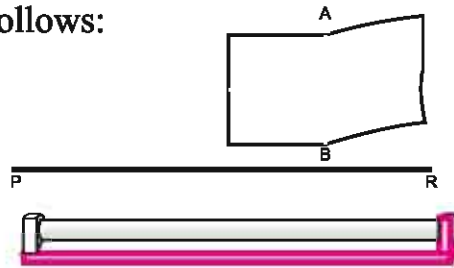
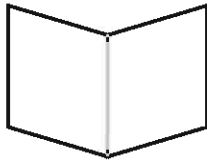
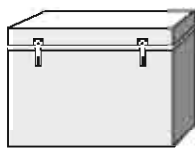
Do and learn

Mention some places where you notice dots/points in your daily life.

8.2.2 Line segment

Take a piece of paper. Now fold it and unfold it again as shown in the diagram. Do you see any mark of fold? This mark of fold shows you the line segment. It has two ending points...A and B

Some examples of line segment are as follows:

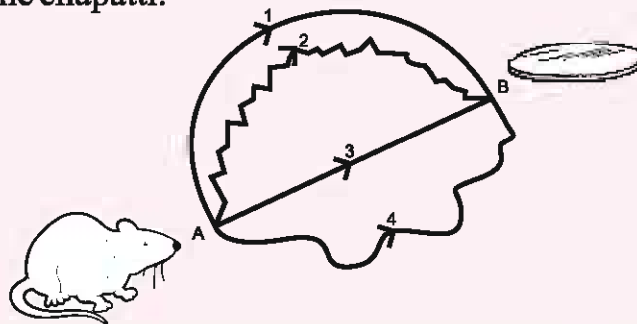


Do and learn

1. Find out some examples of line segments around you and write their names. Such as corners of wall...

2. Look at the diagram below

A rat is on point A and a piece of chapatti is on point B. Which is the shortest way to reach the chapatti.



8.2.3 Line

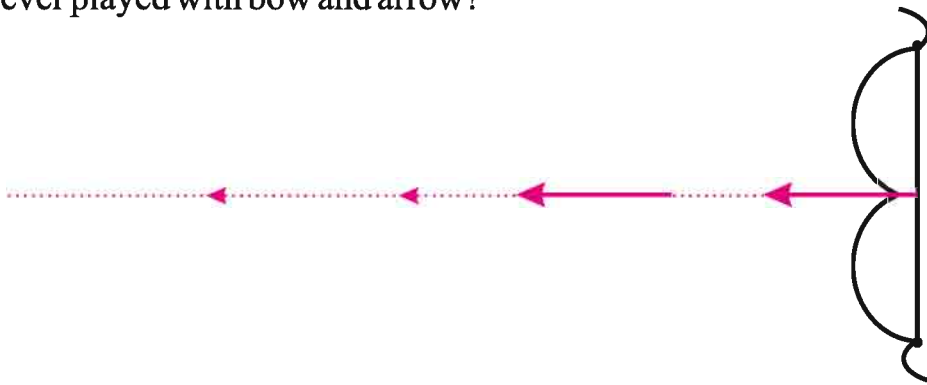
Imagine if we increase the line segment from A and B point in their respective direction then what will happen?



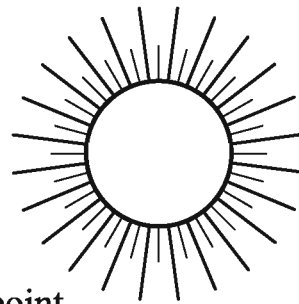
By doing this we get a symbolic line because we cannot draw the infinite long line on the paper. Therefore to represent it we mark arrow on both the ends. As shown above. It is denoted by arrows \overleftrightarrow{AB}

8.2.4 Ray

Have you ever played with bow and arrow?



The arrow which you use to play just falls down after a distance. If we imagine that an arrow goes up to infinity distance in the direction we threw it, then the path made by it is known as Ray path. Thus Ray starts from a point and then goes to infinity in the same direction. Here are some more examples of rays or kiran.

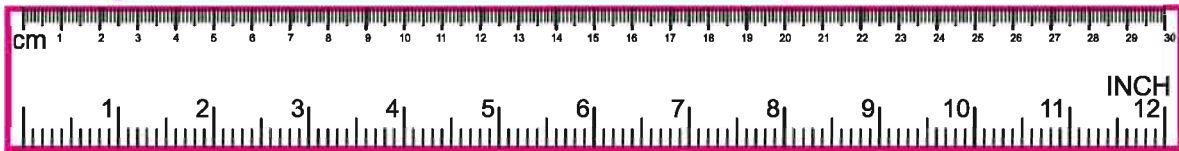


The point on which the kiran starts is called initial point.



In the above diagram A is an initial point of the Ray and P is another point on it. We denote it by \overrightarrow{AP}

8.3 Scale (Introduction of scale)



You have learned measuring object's length and student's height by meter scale. Above is a diagram of a scale. Now look at the above diagram or any scale you have and answer the following:

1. How many numbers are marked on downside of it?

.....

2. How many numbers are marked on upside?

.....

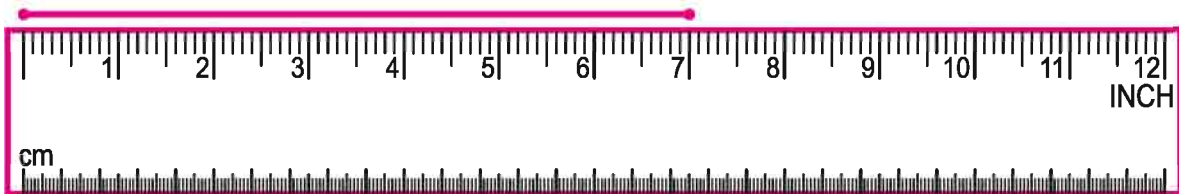
3. How many small marks are there between two consecutive numbers.

.....

The marks up to 30 on the above side represent cm. and 10 equally marked parts show 1mm(milimeter). Therefore $1\text{ cm} = 10\text{mm}$.

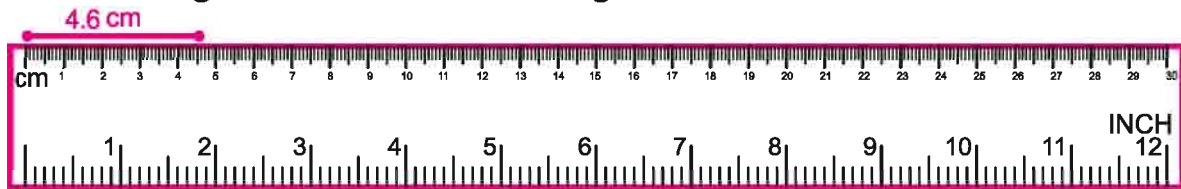
The 12 numbers marked below denotes an inch each. Generally we use scale to draw line, line segment and Ray etc.

Ajay and vijay used 12 inch scale for measuring line segment.

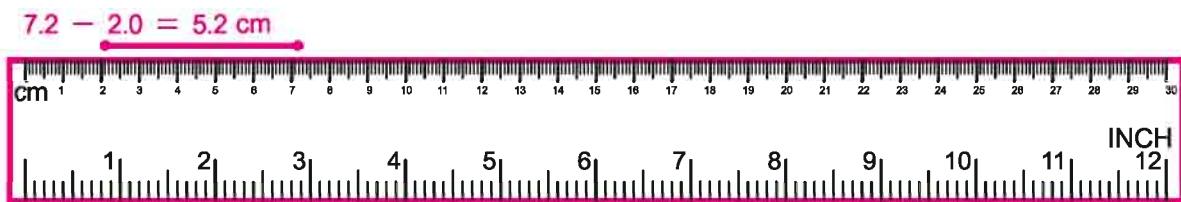


Ajay and vijay measured line segment as shown in the diagram. Can you tell us whose answer is right. Should we measure a line segment by putting zero on the scale at the initial point of line?

Some line segments are shown in the diagrams below:



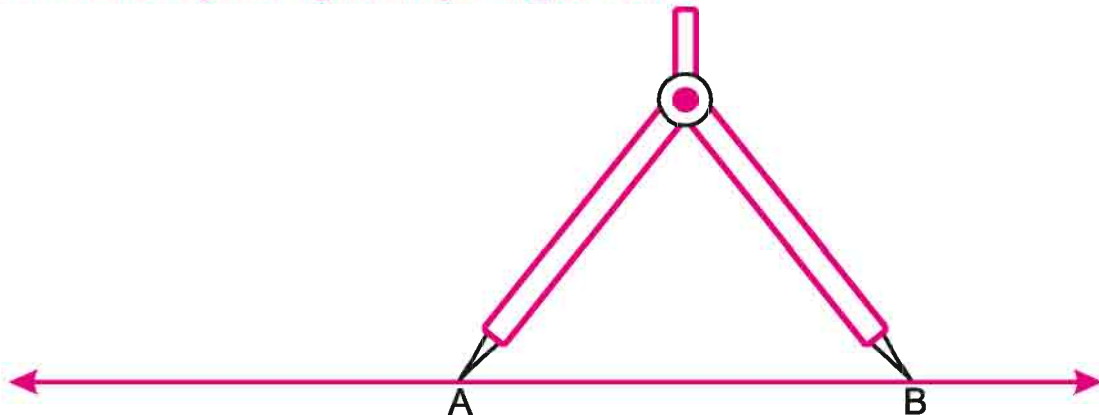
$4.6 \text{ cm} = 4 \text{ cm and } 6 \text{ mm.}$



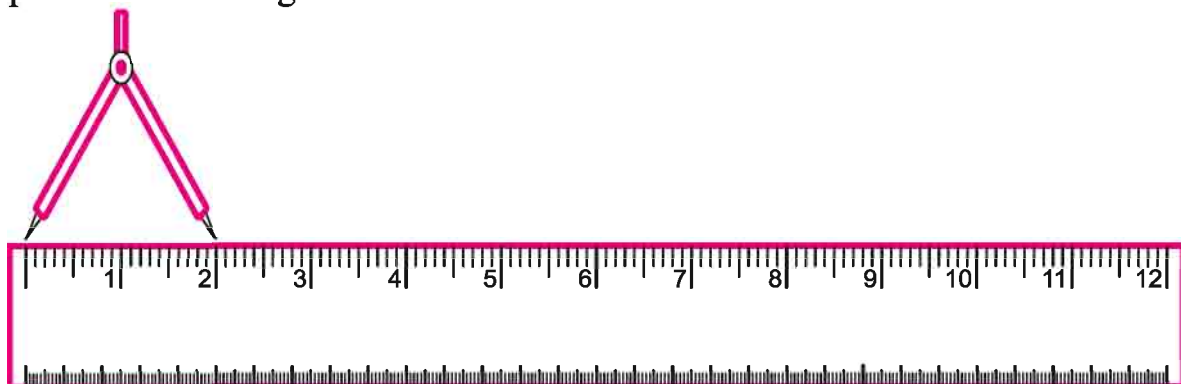
$5.2 \text{ cm} = 5 \text{ cm and } 2 \text{ mm.}$

Draw line segments of different lengths and measure them.

8.4 Measuring line segment by using divider.



For measuring line segment by the divider, open the divider wide as shown in the figure above. Put its one arm at initial point A and another at the last point B, Then put the divider on scale with its one point on 0 and the other on whatever point shows its length.

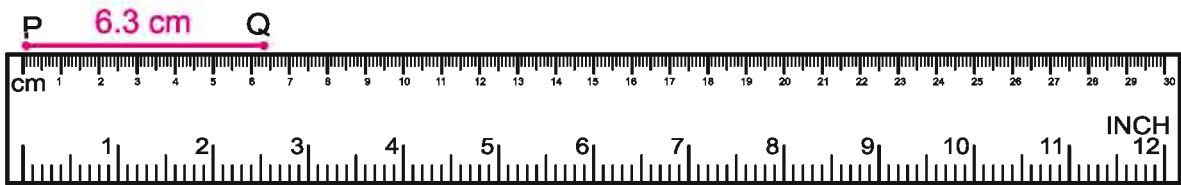


Do and Learn

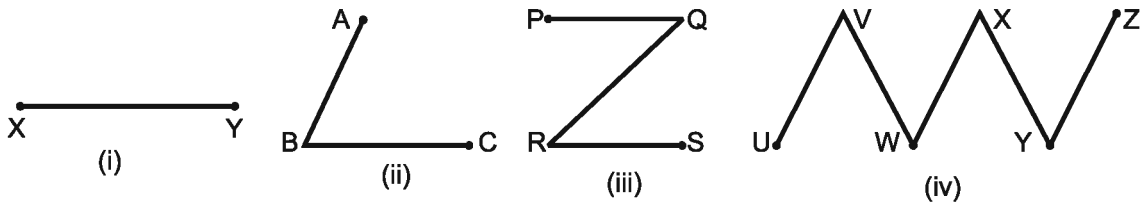
Kanku says it is more accurate to measure the line by divider than the scale. Do you agree with her. Give a logic to support your answer. (use maths kit available in the school.)

8.5 Drawing a line segment

Draw a line segment using a scale. For it, we mark a point for 0 on the scale and mark another point on scale according to the length we want to draw line. Now draw a line between these two points. In the diagram below PQ is a 6.3 cm line segment.

**Exercise 8.1**

1. Write the name of the line segments shown in the diagrams below:



2. Draw a line segments by using scale :

- (i) 4.0 cm (ii) 3.7 cm (iii) 7.5 cm (iv) 5.1 cm

3. Draw a line of the length of your pen. Write the right length of the pen.

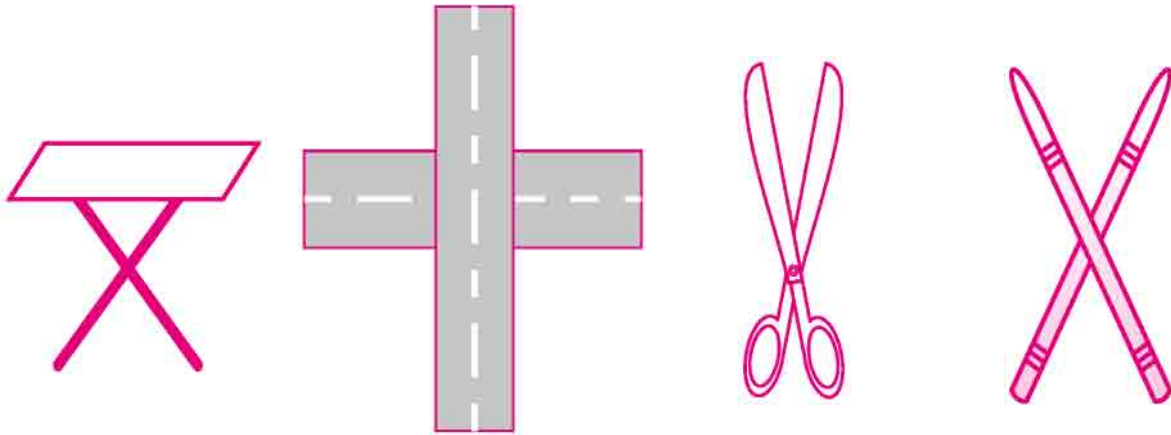
4. Draw a line of 3.2 cm using scale. Draw another line of the double length of it.

5. Draw any line AB and again draw a line of equal length without measuring it. (Hint: Use divider)

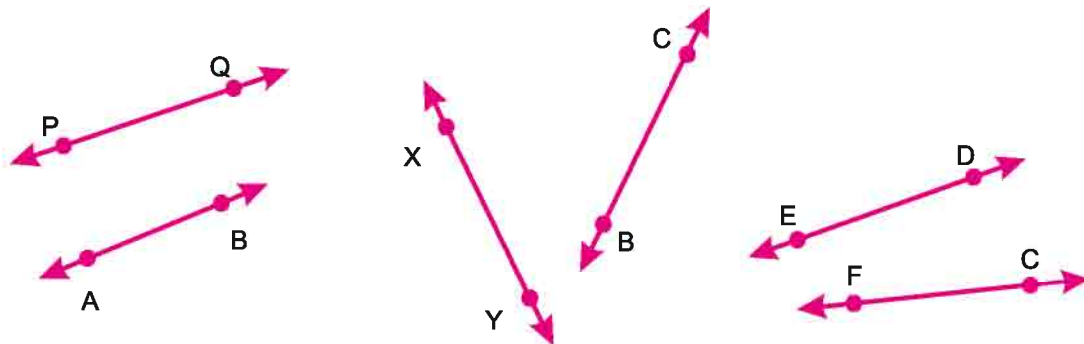
6. Measure the lines below using divider on scale and write its measurement.



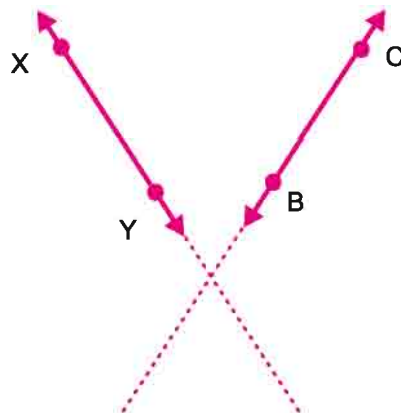
8.6 Intersecting Lines



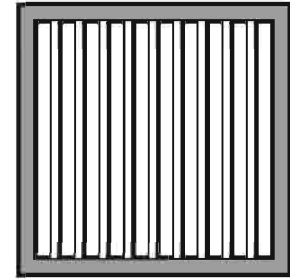
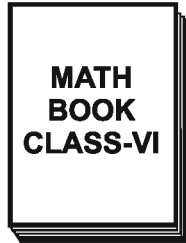
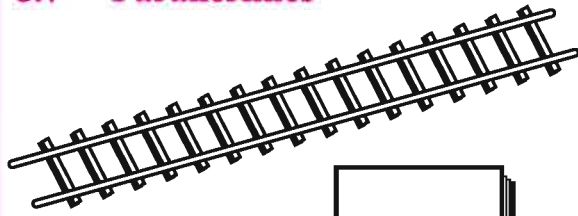
Look at the diagrams above. We see roads and dandia can be represented by one line and lines in the diagram are intersecting each other. So the lines which cut or intersect each other on a point are known as Intersecting Lines and the point on which it intersects each other is called point of intersection.



In the diagrams shown above. Are these pair of lines intersecting? Though these lines are not cutting each other. But if we extend their length these will intersect each other.



8.7 Parallel lines

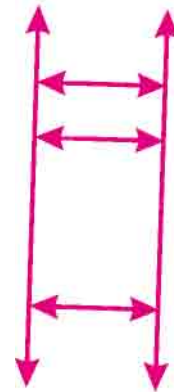
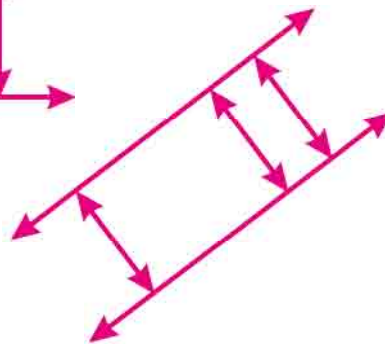
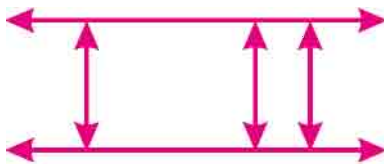


Raman look, rail lines, grill of windows or zebra lines. These are having same gap between two lines.

Therefore ends of these lines never meet.



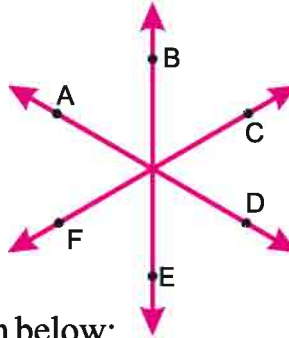
When the perpendicular distance between the two lines remains the same; such lines are called parallel lines.

**Do and Learn** ◆

Find out some more examples of parallel lines like this in your daily life and write about these.

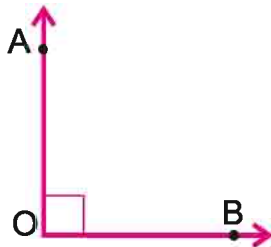
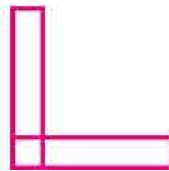
8.8 Concurrent Lines

When two or more than two lines pass through same point, they are called Concurrent Lines. Each intersecting lines is also Concurrent. AD, BE and CF are Concurrent lines.



8.9 Perpendicular lines

Look at the diagrams given below:

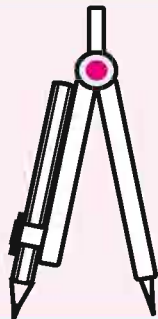


Observe the lines in the diagram. Can you see any right angle? Are they intersecting?

When two lines meet each other at right angle, then these are called perpendicular lines. Like in the diagram OA and OB are perpendicular to each other. We write it as $OA \perp OB$

Do and Learn

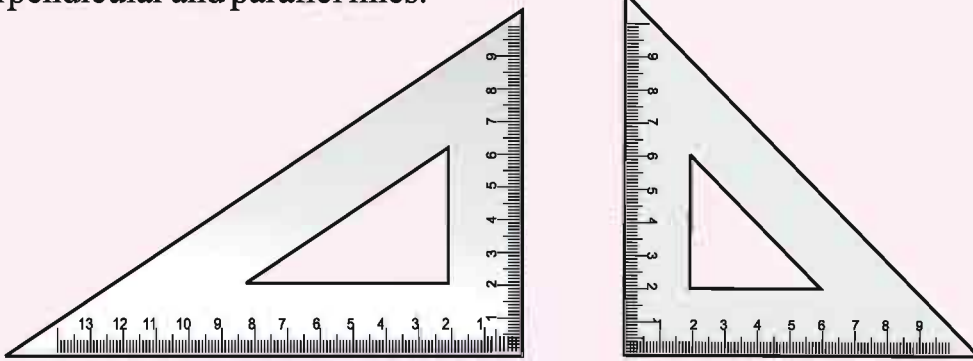
1. If line $L \perp M$ then is $M \perp L$.
2. How many lines can be perpendicular to any line?
3. Look at the letters of English alphabet L, N, X, Y, T and suggest which of these can be examples of perpendicular lines.



Compasses: There are two ends in a compasses. One end is pointed and other has a pencil holder. It is used to draw a circle and cut an arch. It is also used to mark equal lengths.



Set squares: These are two triangular equipments. One has the top angles 45° , 45° and 90° and the other has 30° , 60° and 90° . These are used to make perpendicular and parallel lines.



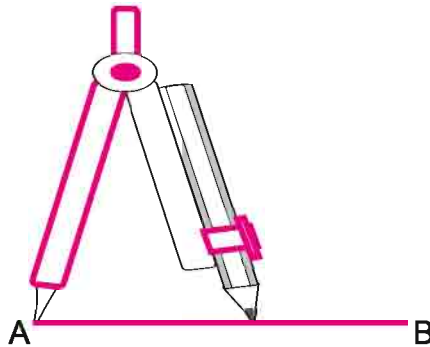
8.10 Perpendicular Bisector

AB is a line segment. Now for bisecting with the help of scale and compasses (divide into two equal parts). We will follow the steps below:

Step 1 Draw a line AB



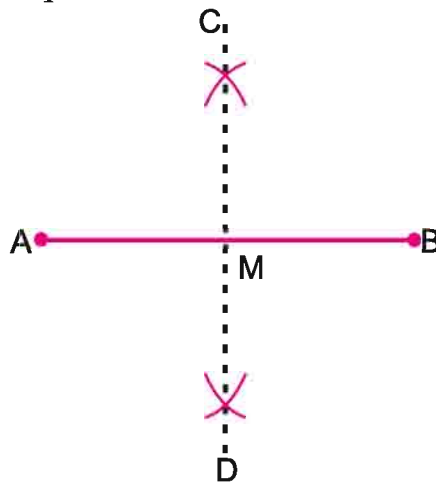
Step 2 Put pointed end of compasses on point A of AB. Now open the compass more than half and cut an arch on both side.



Step 3 Now keeping the compasses open to the same extent, keep the pointed end on point B, cut two arcs on both sides which will intersect the arcs drawn previously. Label the two points of intersection C and D respectively.



Step 4 Draw a line joining the point C and D which bisects the line AB at point M.



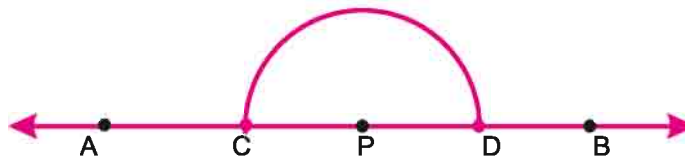
Thus CD is perpendicular bisector of AB and M is the middle point.

8.10.1 Drawing a perpendicular on given point on a line.

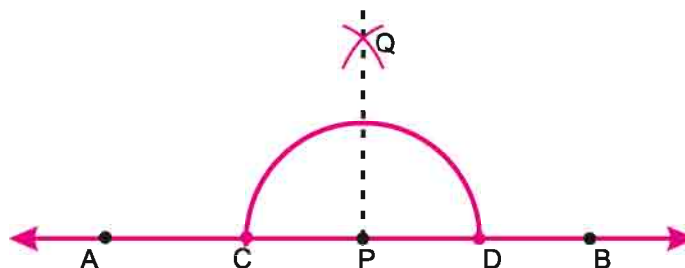
Step 1 Point P is given on the line AB.



Step 2 Assume P as a center and take a convenient radius draw an arc which will intersect line AB at points C and D.

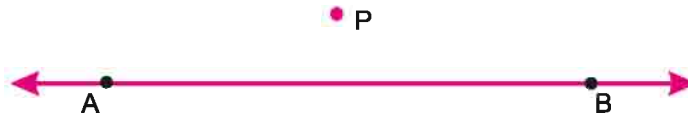
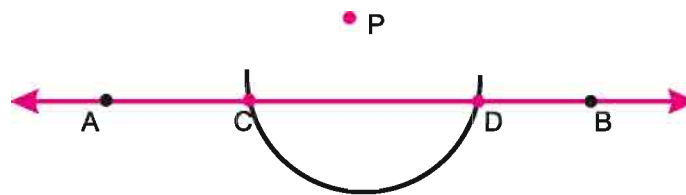
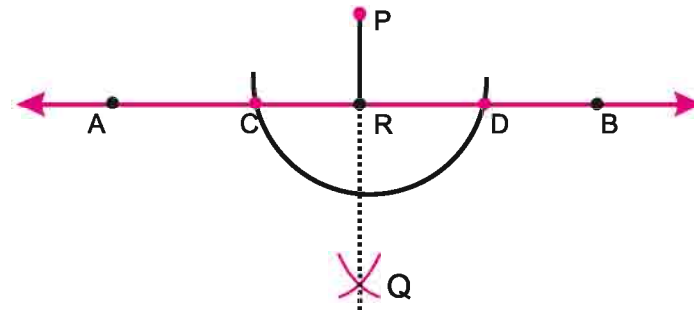


Step 3 Keeping the pointed tip of the compasses on point C. Draw an arc above the line. Keeping the radius same, draw another arc while the tip of the compass is at D. The point of intersection of two arcs is labeled as Q. Join Q and P.

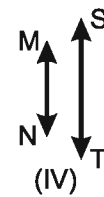
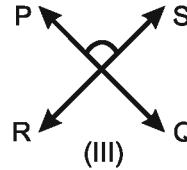
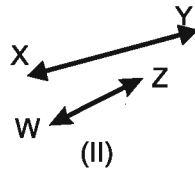
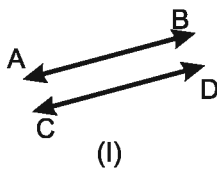


Step 4 In this way QP is perpendicular to AB.



8.10.2 Drawing a perpendicular on a line from a given point.**Step 1** Point p is situated externally to line AB **Step 2** Taking a suitable radius draw an arc from point P using compass. This arc intersects the line AB . At point C and D .**Step 3** Keeping the tip of compass on c , draw an arc at the bottom. With the same radius and the tip of compass on D . Draw an arc intersecting the previous arc. Thus point Q obtained and is joined with P . Line PR is perpendicular to AB from point P .**Exercise 8.2**

1. Write the names of parallel and intersecting lines in the figures below:



2. If five lines of different lengths pass through a point, then what are the lines called?

3. Bisect the line segments of the following lengths and write the length of each part.

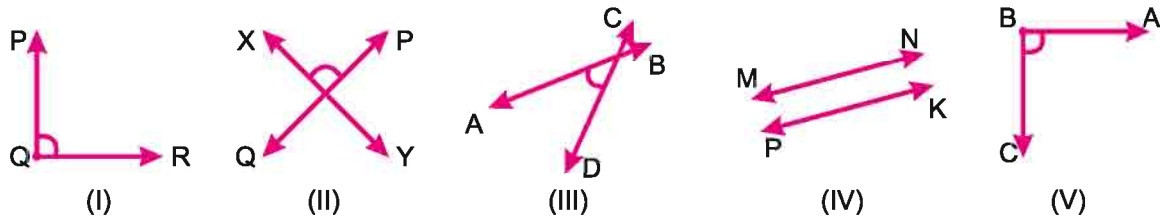
(i) 8 cm

(ii) 7.6 cm

(iii) 5.8 cm.

(iv) 6.4 cm

4. Identify and name the perpendicular lines from the figures below;



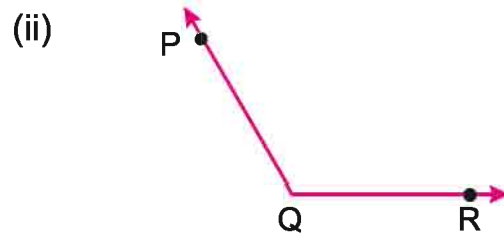
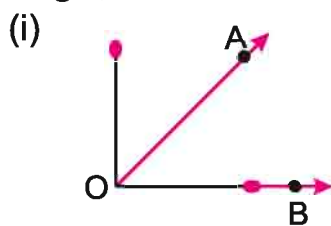
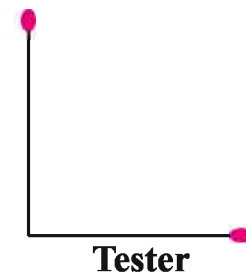
5. Draw a line segment \overline{MN} and mark a point L on it. With a ruler and compass, draw a perpendicular to MN through the point L.
6. Draw a line segment AB. Taking a point R not on the line AB, draw a perpendicular to AB from R.

8.11 Angles

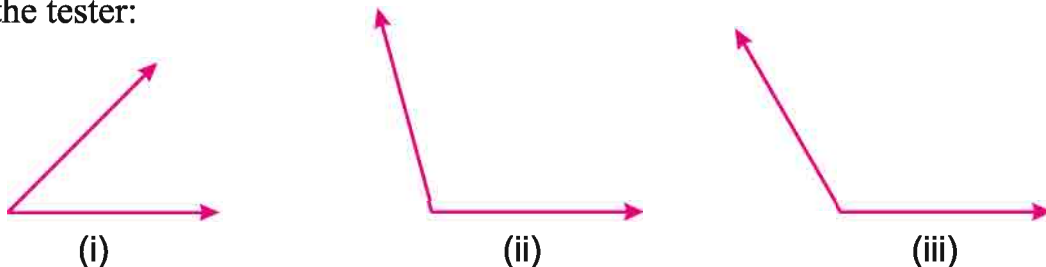
You have studied about angles in Class 5 such as acute, right angle and obtuse angles.

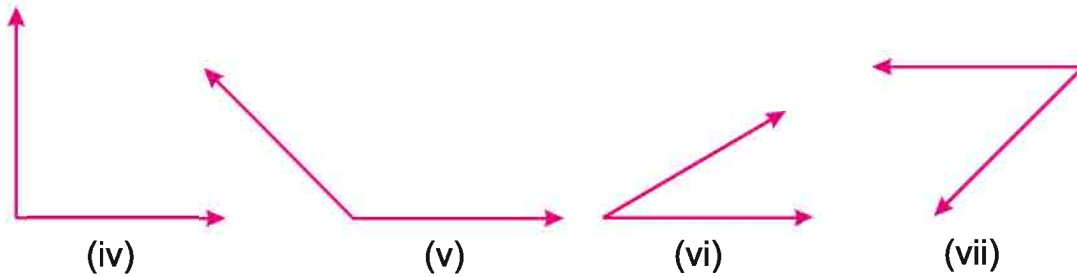
Activity 1

Take two matchsticks and join them together at one end to create an L-shape. This is equal to a right angle. We will use it as a tester. As shown in Figure keep the tester on the side AB of angle $\angle AOB$. Since angle $\angle AOB$ is smaller than right angle, it is acute angle. Again keep the tester on side QR of $\angle PQR$ such that the corner of the tester coincides with point Q. Since $\angle PQR$ is bigger than right angle, it is an obtuse angle.



Whether the following angles are acute, right or obtuse by measuring them with the tester:





The students observe these angles and discuss.

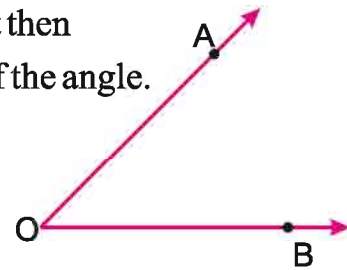
Ayush : How many rays are there in each angle?

Ramesh : Every angle has two rays.

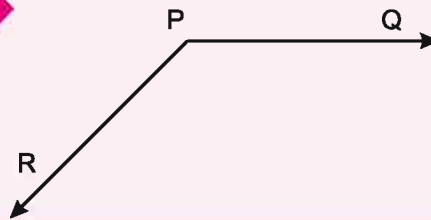
Ayush : But it has only one starting point.

Teacher : Yes children, if two rays emerge from a point then an angle is formed, and the point is called the Vertex of the angle.

OA and OB are the sides in the figure and O is the Vertex.



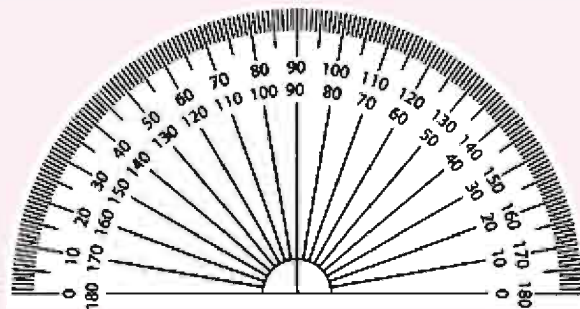
Do and Learn



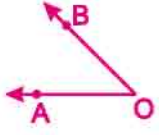
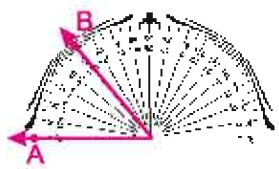
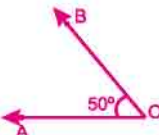
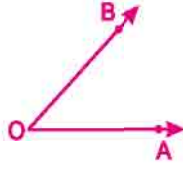
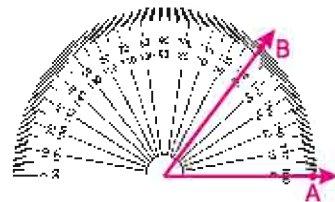
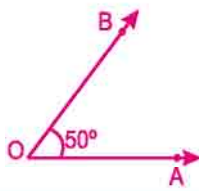
In the figure above
Sides.....
Vertex.....

Introduction to the Protractor (D)

An instrument called the Protractor or 'D' is required for the precise comparison and measurement of angles. You can see it in your geometry box. Observe carefully the Protractor shown in the figure and



you will see two measurements – the Inner and Outer measurements. The line representing right angle is marked as 90° . There are two types of angles on its two sides, angles formed clockwise and anti-clockwise. 0° to 180° are marked on both the sides and each part is called a Degree. Now we will learn to measure angles by using the Protractor.

clockwise angles	Steps	Anti-clockwise angles
  	<ol style="list-style-type: none"> 1. Identify whether these are acute or obtuse angles. 2. Keep the mid-point of the 'D' on the vertex of the angle. 3. Without removing the mid-point of the 'D' from the vertex of the angle, align it with the side of the angle. 4. Observe the measurement lines, where the base line shows 0°. 5. Read this angle, its other side crosses the measuring line forming $AOB = 50^\circ$. 	  

8.11.1 Classification based on measurement of angle

Attempt the following.

You measured and classified angles using the Right Angle Tester in Activity 1, into Acute angle, Right angle and obtuse angles. With a Protractor, measure and write the angles in the following table.

Measurements of Acute angles					
Measurements of Right angles					
Measurements of Obtuse angles					

With this activity we found out that all acute angles are less than 90° and all obtuse angles are more than 90° and less than 180° .

Ayush – This means that angles between 0° to 90° are known as Acute angles.

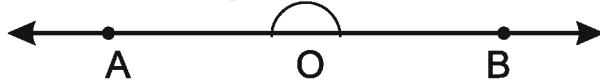
Manan – And 90° angle is called as Right angle.

Teacher – Yes, and angle between 90° to 180° are called as Obtuse angles.



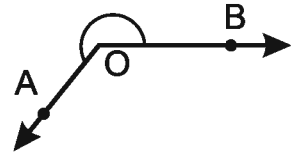
Ayush – What is the 180° angle called?

Teacher – The angle of 180° is called as Straight angle.



Ayush – This is even bigger than a Straight angle.

Teacher – Angles bigger than 180° are called as Reflex angles.



8.11.2 Drawing Angles

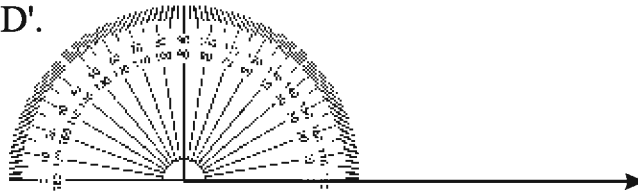
(i) Drawing an angle of given measurement with a Protractor:

For drawing a 70° angle



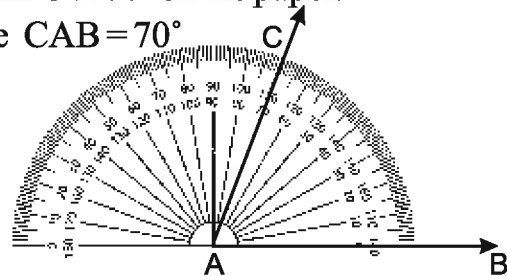
Step 1 Draw a ray AB

Step 2 Keep the midpoint of the 'D' on point A such that its base line coincides with the angle 0° on the 'D'.



Step 3 Starting with 0° near point B, mark point C at 70° on the paper.

Step 4 Join points A to C, this forms the angle $CAB = 70^\circ$



Do and Learn

Now draw angles with the following measurements:

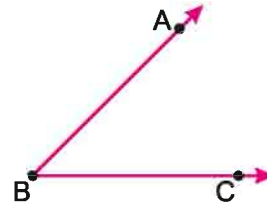
(i) $\angle ABC = 110^\circ$

(ii) $\angle PQR = 40^\circ$

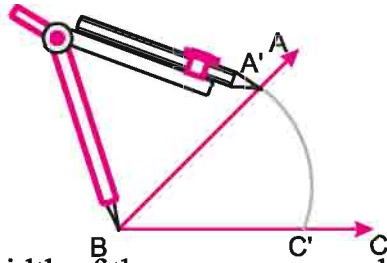
(ii) Drawing an angle equal to a given angle with a compasses

$\angle ABC$ is given whose measurement is unknown.

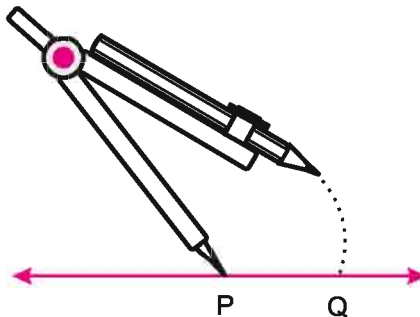
Step 1 Draw a line land mark a point P on it



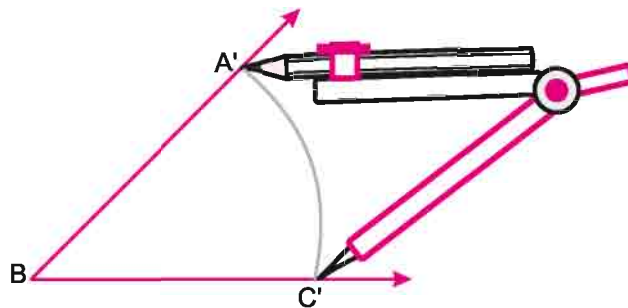
Step 2 Keeping the tip of the compasses on vertex B of angle $\angle ABC$, draw an arc which intersects the sides of $\angle ABC$, and name them A' and C' .



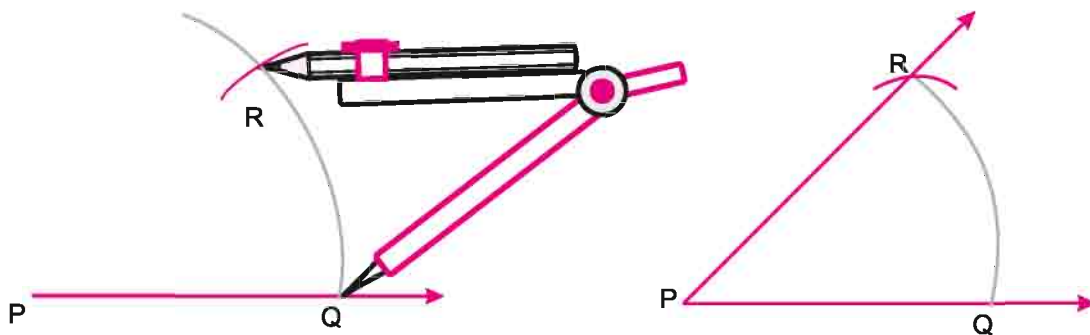
Step 3 With the same width of the compasses and its tip at P, draw an arc which intersects the line at point Q.



Step 4 Open the compasses with the width of $A'C'$ in $\angle ABC$.



Step 5 With Q as the centre, place the tip of compasses at Q and draw same arch which intersects the previous arc at point R. Joining P and R gives the desired angle $\angle PQR$.



Hence $\angle ABC$ and $\angle PQR$ are equal angles.



8.11.3 Bisecting a given angle with the help of compasses

P is given in Figure (i).

Step 1 With point P as centre draw an arc with compasses which intersects the sides of angle P at Q and R.

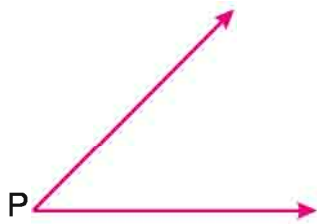


Fig. (i)

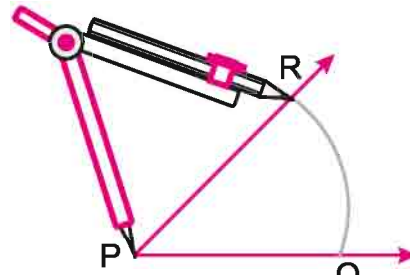


Fig. (ii)

Step 2 With Q as centre, keeping the same width of compasses draw an arc within the area of the angle (Figure iii)

Step 3 Similarly with R as centre and the width of compasses as before, draw an arc intersecting the previous arc. Label the intersection as point T. (Figure iv)

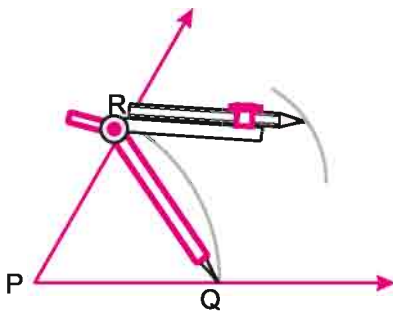


Fig. (iii)

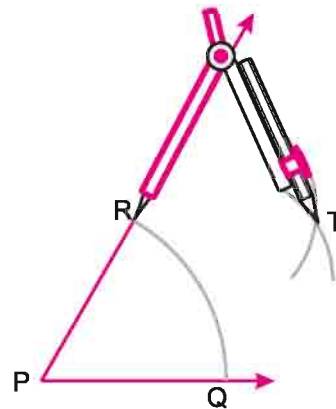
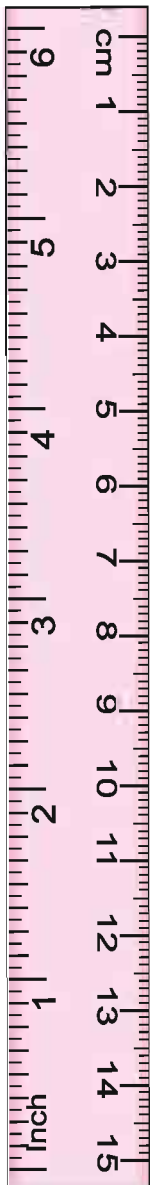
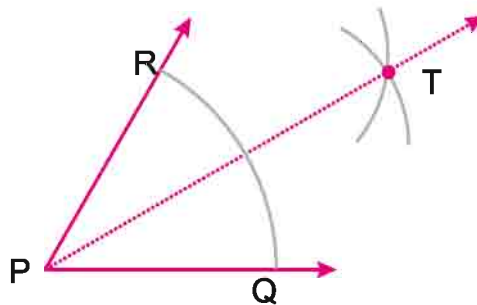


Fig. (iv)

Step 4 Joining T and P gives the bisector TP of angle P. (Figure v)

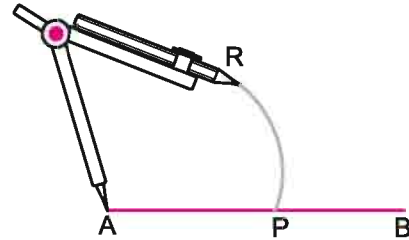


8.11.4 Drawing angles with compass

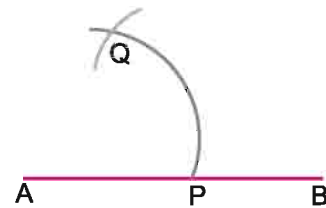
8.11.4 (i) Drawing 60° , 120° and 180°

(A) Drawing 60° angle

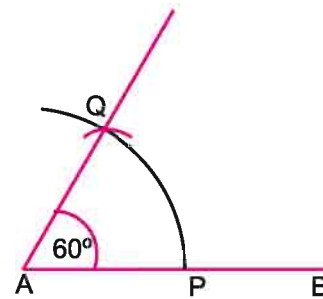
Step 1 Draw a line segment AB. Now taking a suitable radius put the tip of compasses on A and draw an arc cutting AB at point P.



Step 2 Put the tip on P and draw another arc of same radius intersecting the previous arc. Mark Q on the pointed intersection.

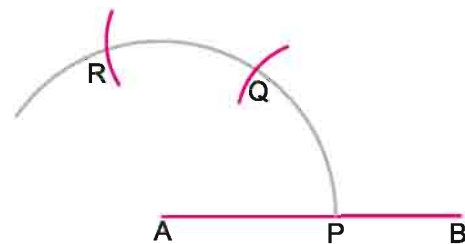


Step 3 Joining A and Q, we have $\angle QAB = 60^\circ$.

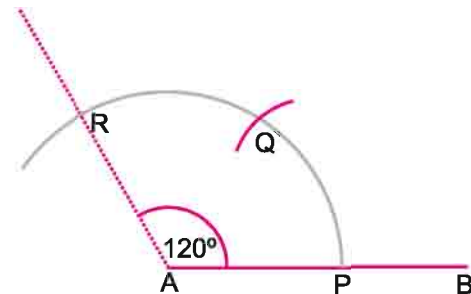


(B) Draw an angle of 120° .

Step 1 Continuing with the previous steps, put the tip of compasses on Q and draw one more arc of the same radius, which intersects the previous arc at point R.



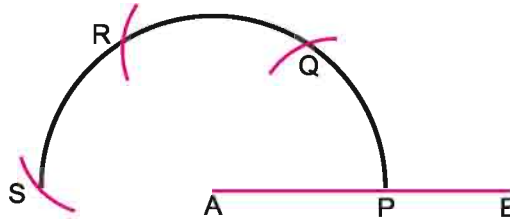
Step 2 Joining AR we get $\angle RAB = 120^\circ$.



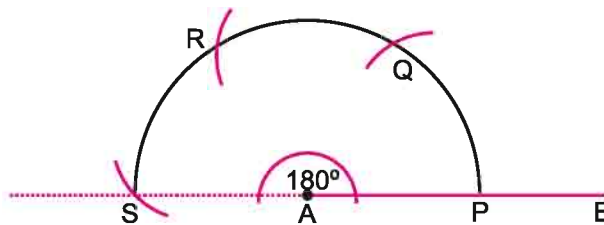
(C) Drawing angle of 180°

Continuing the steps of the previous figure

Step 1 Draw an arc of the same radius with the tip of compasses on R which intersects the previous arc at point S.



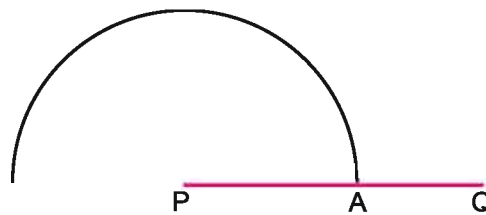
Step 2 Joining SA we get $\angle SAB = 180^\circ$.

**8.11.4 (ii) Drawing angles of 30°, 45° and 90°**

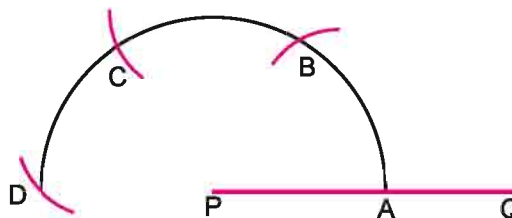
Based on the construction of 60°, 120° and 180° you can draw 30° with bisection of 60°, 90° with bisecting 60° and 120° and 45° with the bisection of 30° and 60°.

(A) Drawing angle of 30°

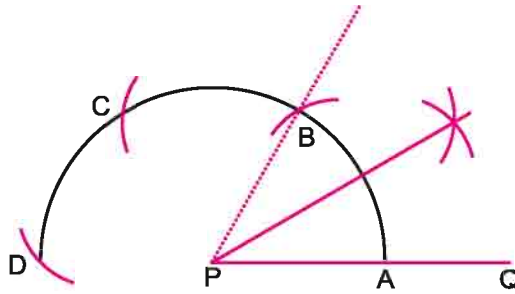
Step 1 Draw line segment PQ. With suitable radius draw an arc with the tip of compass at P.



Step 2 With the same radius and tip of compass at A, B, C draw arcs which intersect the previous ones at B, C, D.



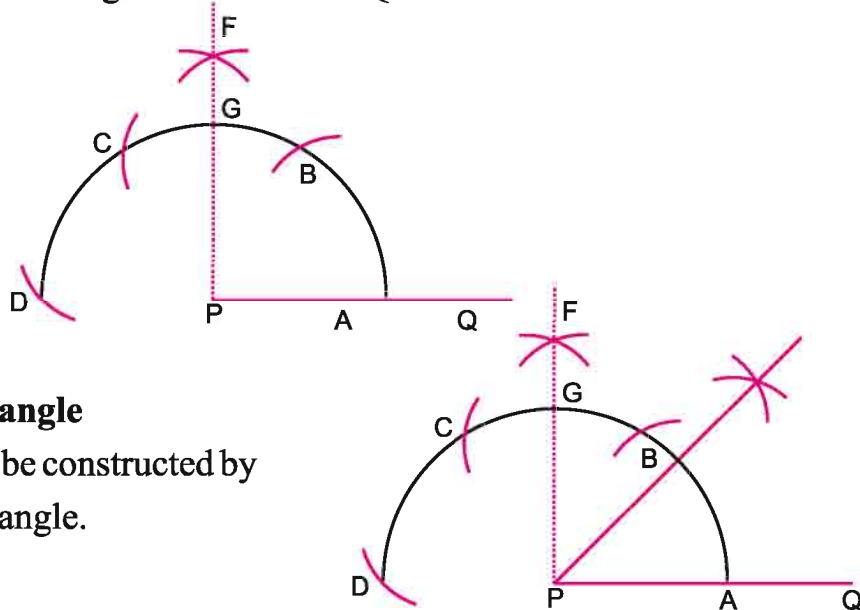
Step 3 Joining PB we get $\angle BPA = 60^\circ$. Bisecting it gives angle of 30° .



(B) Drawing 90° angle

90° can also be obtained by bisecting 180° .

Similarly bisecting $\angle BPC$ gives 90° i.e. $\angle FPQ = 90^\circ$.

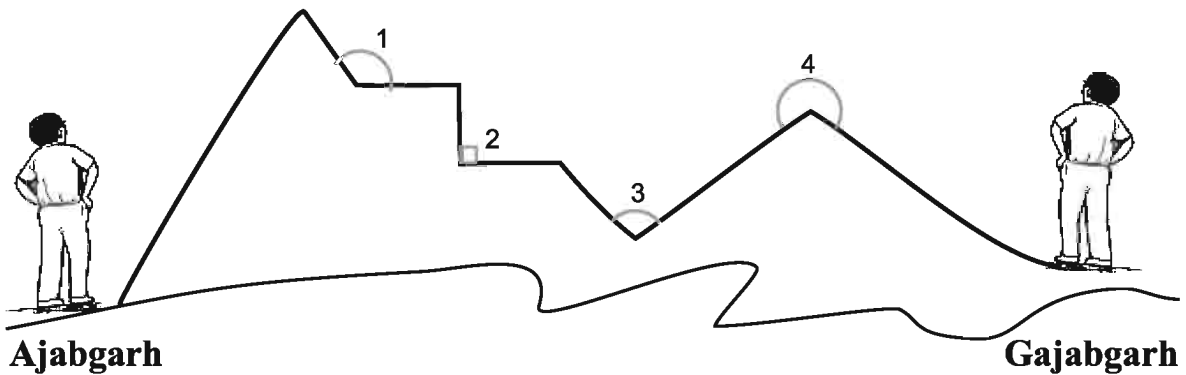


(C) Drawing 45° angle

45° angle can be constructed by bisecting 90° angle.

Exercise 8.3

- The road from villages Ajabgarh to Gajabgarh is drawn below. Write the names of the $\angle 1, \angle 2, \angle 3, \angle 4$.



2. Draw the following angles in your copy Arbitrarily and write their measurements with a protractor.

(i) Obtuse angle (ii) Straight angle (iii) Acute angle (iv) Right angle

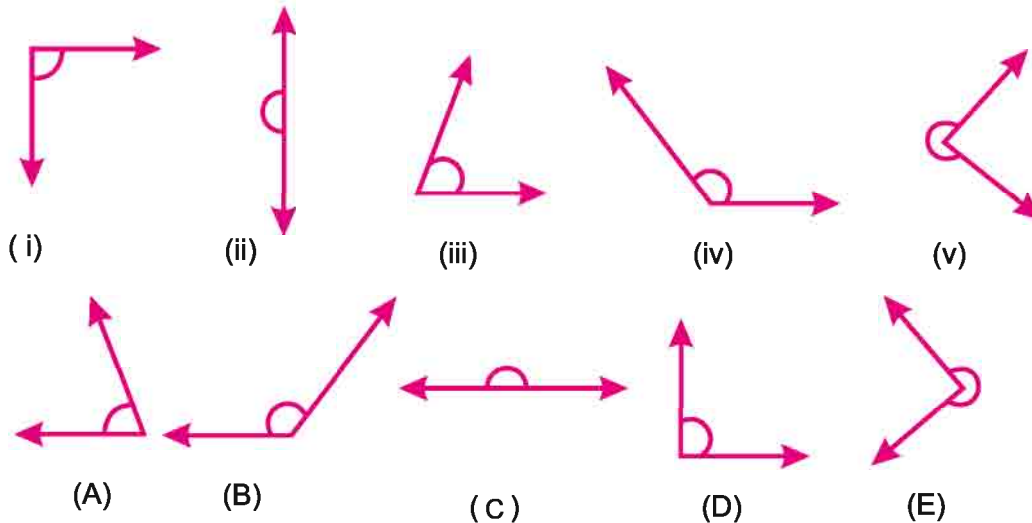
3. Draw the following angles using protractor

(i) 45° (ii) 90° (iii) 72° (iv) 105°
 (v) 134° (vi) 180° (vii) 20° (viii) 21°

4. With the help of the compass and ruler draw the following angles:

(i) 60° (ii) 120° (iii) 180° (iv) 90° (v) 45°

5. Observe and find out the similar figures in the following:

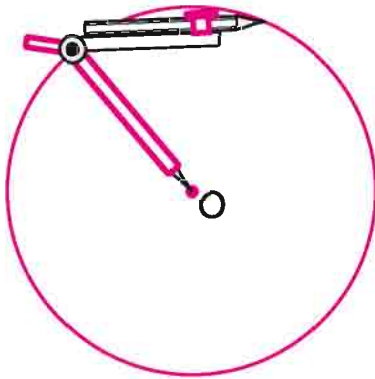


8.12 Circle

You must have seen many shapes in your home and surroundings like bangle, wheel tyre, plate etc. Now take a bangle put it on the copy and draw its outline by moving a pencil along it outside. Observe this shape. How is it?

8.12.1 Drawing a Circle

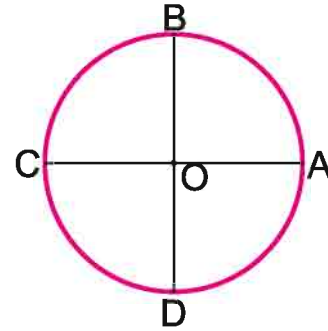
Open the compass to a suitable width and put its tip on the copy and make one complete rotation of the end with pencil.



Such a shape is called a Circle.

The point at the tip is marked by 'O'. The distance from any point on the circle to 'O' is the same.

$$OA=OB=OC=OD$$



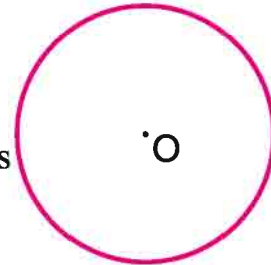
“Circle is the shape on which every point is at the same distance from a certain point at the centre.”



8.12.2 Parts of a Circle

Centre of Circle, Radius and Diameter

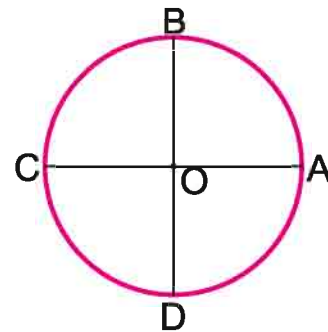
- (i) **Centre** - When we draw circle with a compasses, the point on which the tip of compasses is placed is called the Centre of Circle. In the given diagram point 'O' is the Centre of Circle.



The certain point on certain surface is called the centre of the circle, through which a circle is drawn surrounding it.

- (ii) **Radius** - In the diagram mark 'o' at the point, where the compasses pointed end was placed to draw a circle and mark 'A' at the point where the pencil's end was placed. Now join 'O' and 'A'. This 'OA' is called radius of the circle. Take some more points like 'B, C, D' on the circle, join 'OB, OC' and 'OD'. Now measure 'OB, OC' and 'OD'

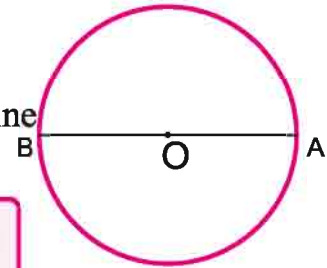
Here $OA = OB = OC = OD$. Thus the distance between centre and any point of the Circle is always same.



Hence, the length between centre and any point on the circle is called its radius.

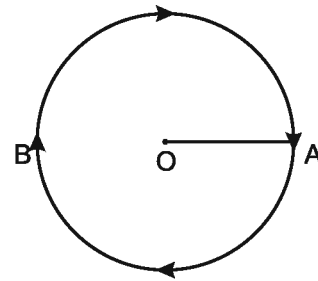
(iii) **Diameter**- Expanding the radius OA to OB, we get a line AB. This is just double of the radius of the circle.

The line segment passing through centre of the circle and cuts on 2 points on it is called its diameter.



(iv) **Circumference of a circle**

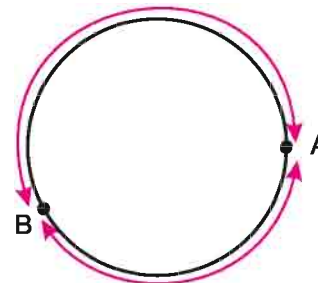
To draw a circle we have to start from a point. The distance covered between the initial point and coming back to the same point is called its circumference. Thus circumference of a circle is the distance of whole round.



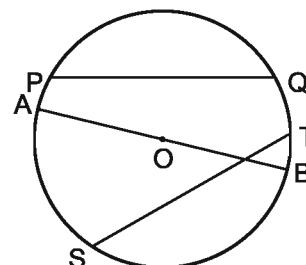
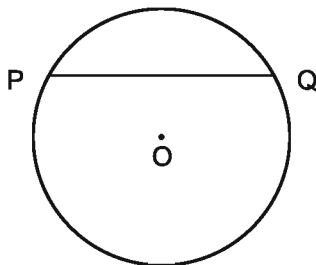
(v) **Arc of a Circle**

There are two points on a circle

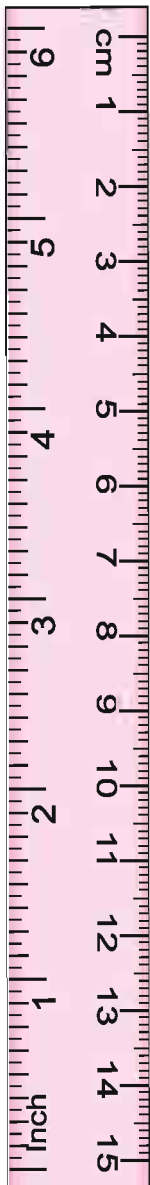
A and B. A and B divides the circumference of the circle into two parts. These two parts are called arcs of the circle.

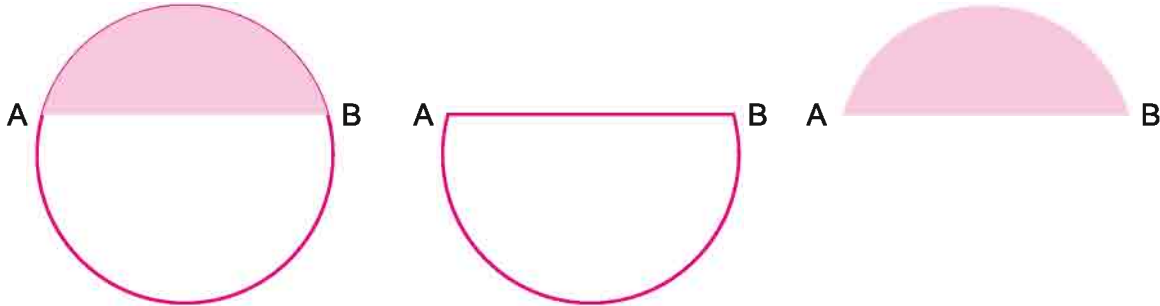


(vi) **Chord** - Take two points P and Q on circumference of the circle, join them, hence the line PQ divides the circle into two parts. This line is known as chord of the circle. There could be more than one chord in a circle, like AB, ST etc.

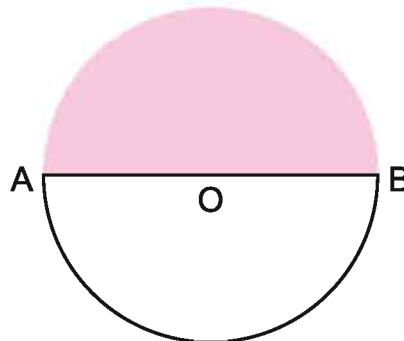


Diameter of a circle is its longest chord.

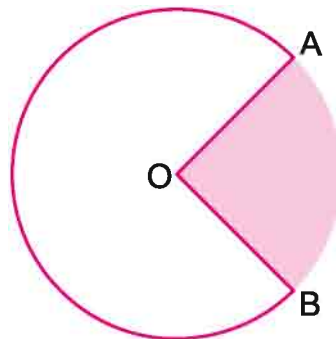


(vii) Segment

In the above diagram AB is a chord which divide the circle into two parts. These two parts are shown separately and are called circle segments. Diameter of a circle also divide it in two equal parts. Since circle segment made by this diameter is half of the circle. Therefore these two segments of the circle is known as semicircle.

**(viii) Sector**

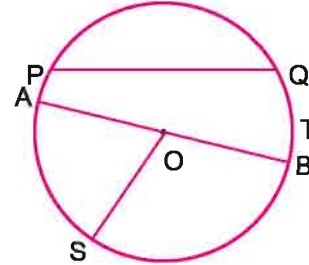
OA and OB are two radii of a circle given in the diagram. These radii make two parts of a circle. One is shaded and another is not. The unshaded part of it is shown as AOB. These are called sector of circle. Shaded part is called minor sector and unshaded part is called major sector.



Exercise 8.4

1. Looking at the diagram of the circle

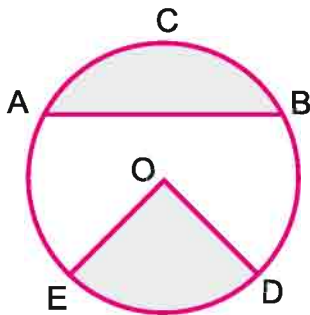
- (i) Radius =
- (ii) Diameter =
- (iii) Chord =
- (iv) Center =



2. Say true or false.

- (i) Each diameter of a circle is also a chord.
- (ii) every Chord of a circle is its diameter as well.
- (iii) Two diameters of a circle definitely intersect each other.
- (iv) Center of a circle is always at an equal distance from any point on the circumference.
- (v) Diameter of a circle is half of its radius.

3. Write the names of shaded parts of the following diagrams

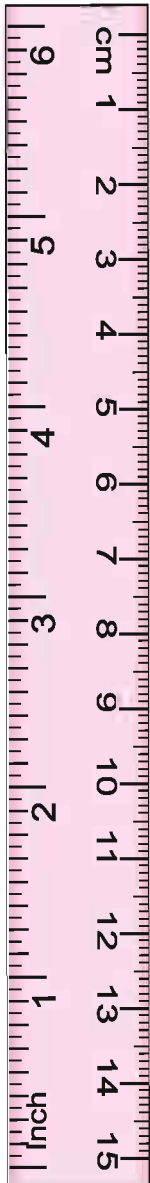


Shaded ACB =

Shaded EOD =

4. Draw a circle and mark the following

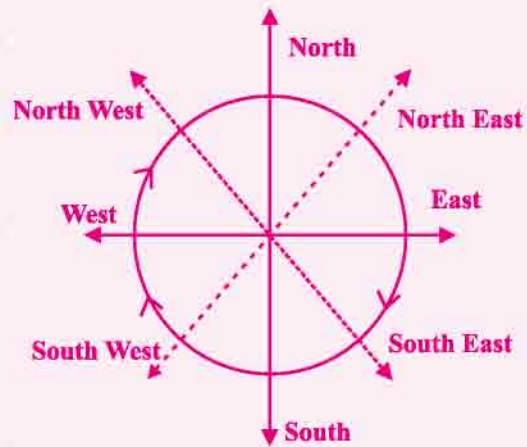
- | | | |
|-------------|--------------|-----------------------|
| (I) Center | (ii) Radius | (iii) Diameter |
| (iv) An arc | (v) a sector | (vi) A circle segment |



Do and Learn

Look at the diagram and follow the directions of the clock.

- (i) Value of an angle from East to South East
- (ii) Value of an angle from East to South West
- (iii) How many right angles are made from East to West.
- (iv) After taking three right angle turns from south in which direction we find ourselves?

**We Learnt**

1. Point is used to decide a location. It is generally denoted by a capital letter of English.
2. The smallest path joining two points shows the line segment. The line segment is shown by AB joining A to B. AB and BA both represent the same line segment.
3. When we extend a line segment AB on both sides without any end point, we get a line that is again represented by AB. Some time we denote it by l as well.
4. When two different lines meet or intersect at a point. These are called intersecting lines.
5. When two lines do not cut each other or intersect, these are called parallel lines.
6. Two lines or more than two lines passing through a common point are called concurrent lines.
7. Two rays drawn from a single common point. Makes an angle. Two lines OA and OB makes angle $\angle AOB$ or angle $\angle BOA$.
8. Circle is the shape, on which every point is at the equidistant from a certain point on its surface. This point is called its centre. The length from centre to any point on circle is called radius.
9. The line segment passing through its centre and cuts the circumference at two points is called diameter of the circle.
10. The distance covered by travelling a circle is called its circumference.

9.1 We observe a lot of objects around us. All such objects have different shapes, a few of them have plain surfaces while others don't have. Observe the figures given below (Fig.9.1)

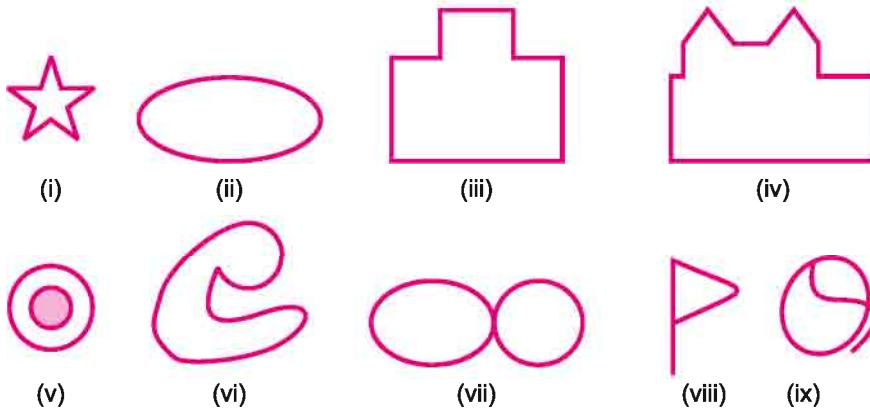


Fig. 9.1

You can draw some of these shapes without crossing over itself and without lifting the pencil from the paper. Such shapes are called simple figures. For example,

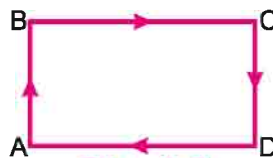


Fig. 9.2

To draw figure 9.2, you can start from point A, pass through points B, C and D and reach back the starting point A to complete the figure. You have drawn this shape without crossing over itself and without lifting the pencil from the paper. Hence Fig. 9.2 is a simple shape. Now, consider Figure 9.1 (v). It can't be drawn without lifting the pencil. Hence, it is a complex shape. Identify all the simple and complex shapes in Figure 9.1.

9.2. Closed and Open Curves

Some students are playing a game 'Lion and the Lamb' in the school playground. One student is playing the role of a lion and another student is playing the role of a lamb. 7 students are holding hands together to make a ring around the student playing lamb. This ring is a cage and the lamb is safe inside the cage. Lion is trying again and again to enter the cage but is unable to find the way inside. Why is it so?

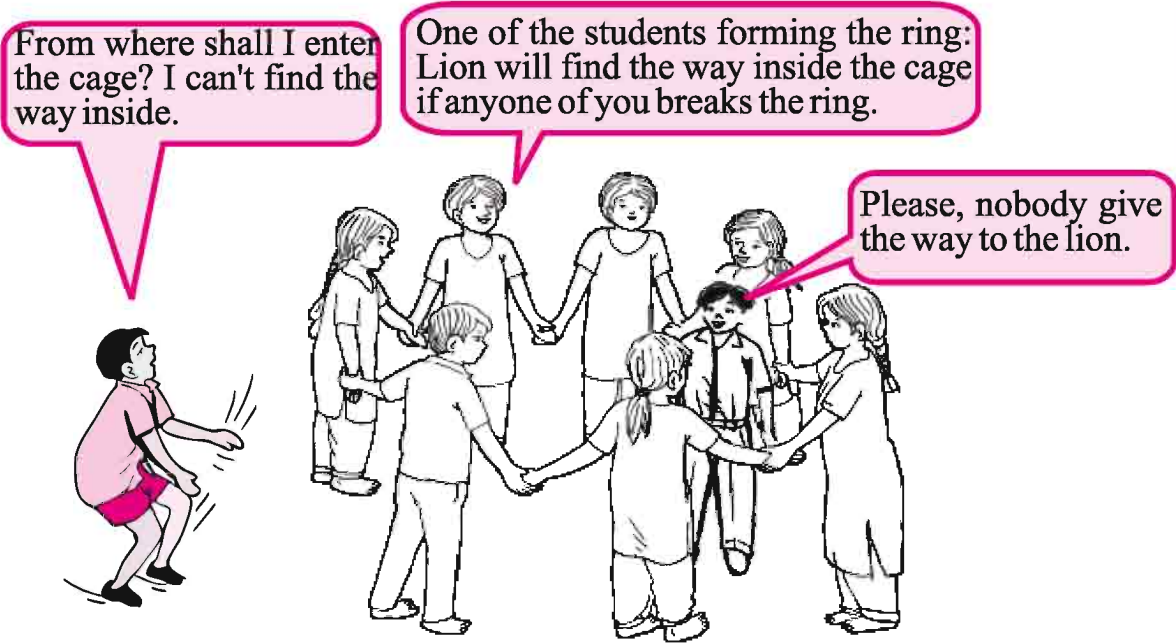


Fig. 9.3

In the figure 9.4, a rat is shown trapped inside many curves. In which of the following curves, the rat will be able to find its way out?

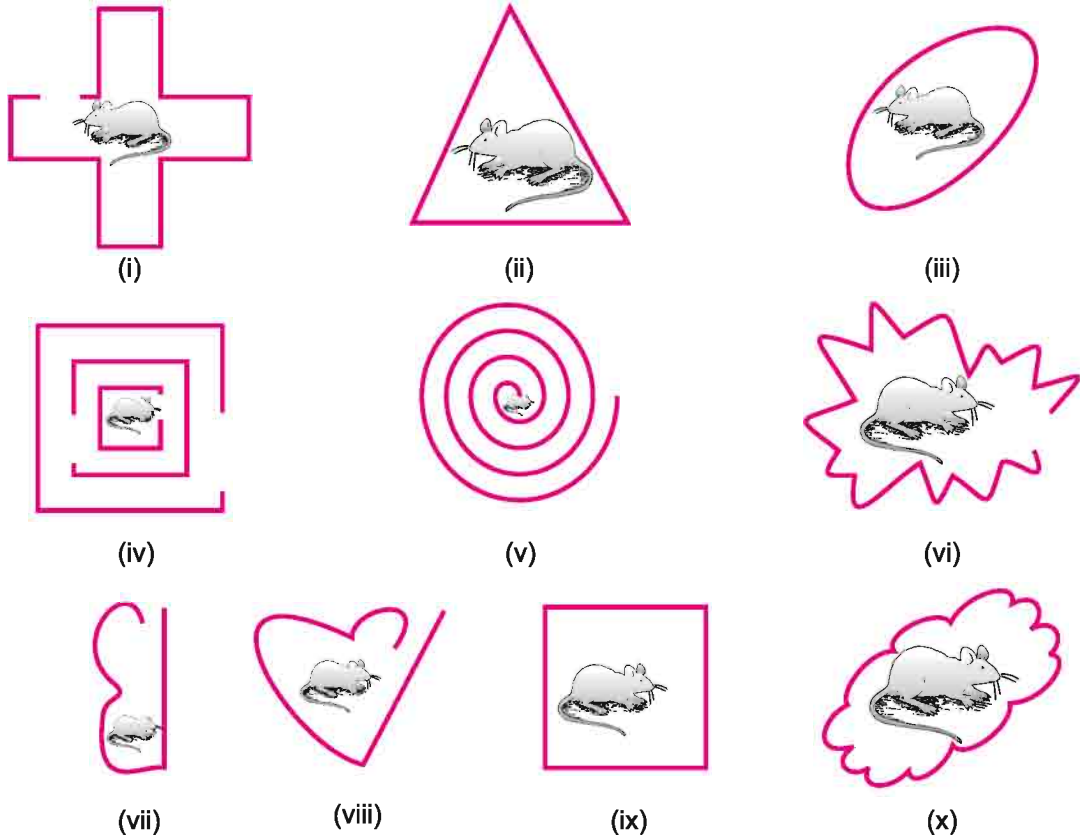


Fig. 9.4



The rat can't come out of the curves (ii), (iii), (ix) and (x). Hence these are closed curves. Those simple shapes which can be traced all the way around back to the starting point are called closed curves. Those shapes which can't be traced all the way around back to the starting point are called open curves.

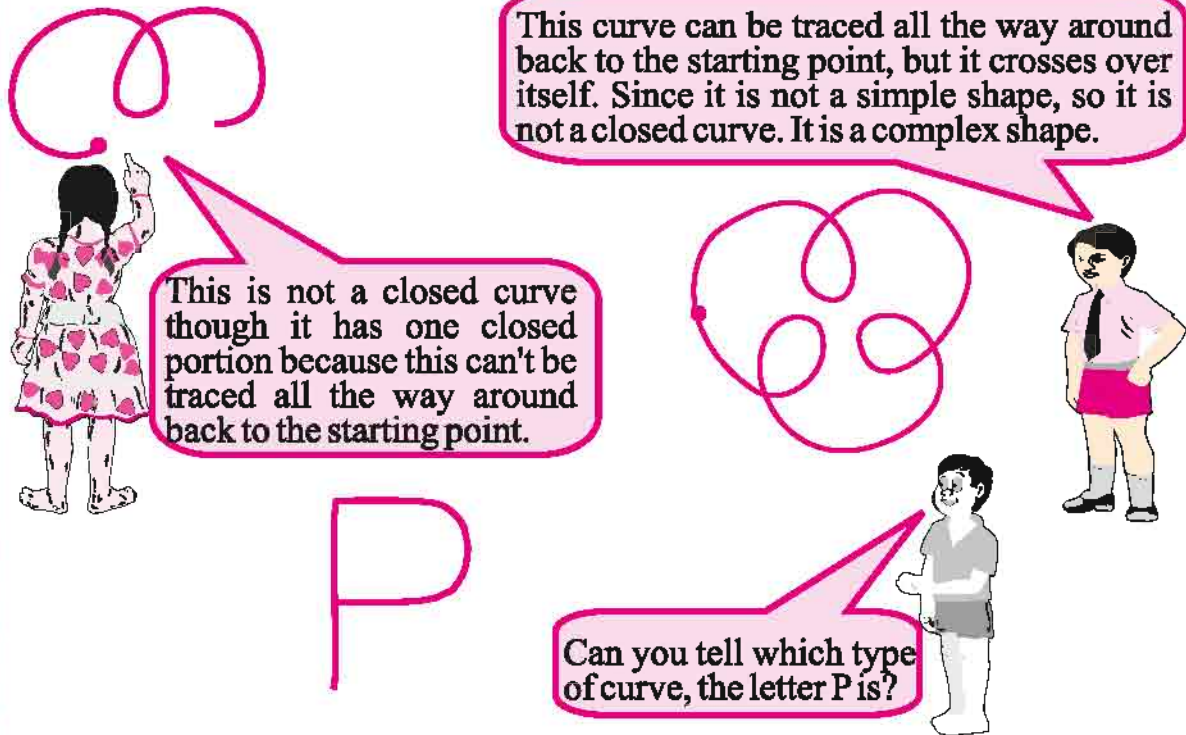


Fig. 9.5

The game of 'river and its bank'

Rules:

1. Using a chalk, draw a large ring on the floor.
2. When the instruction call is for river, participants need to jump inside the ring.
3. When the instruction call is for bank, participants need to jump outside the ring.
4. Participant is out of the game if above rules are not followed.

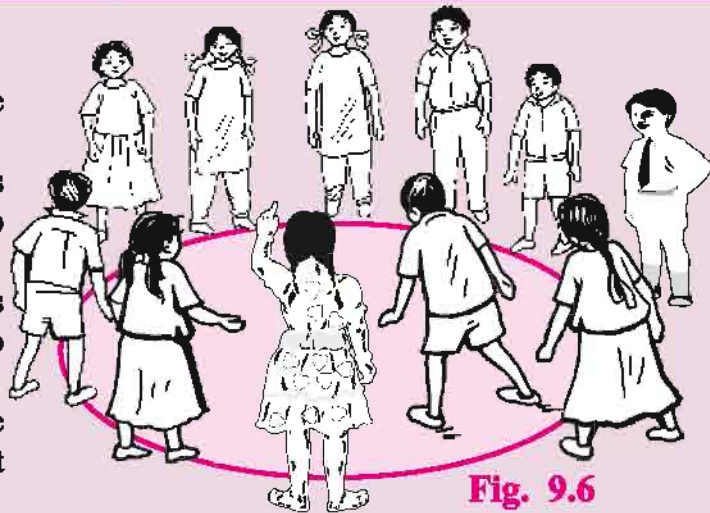


Fig. 9.6

In the above figure, children standing inside the ring are said to be in the interior part of the ring. Children standing outside of the ring are said to be in the exterior part of the ring. Children standing on the ring are said to be on the boundary of the ring.

In a closed curve, there are three parts.

- (i) interior ('inside') of the curve
- (ii) boundary ('on') of the curve and
- (iii) exterior ('outside') of the curve.

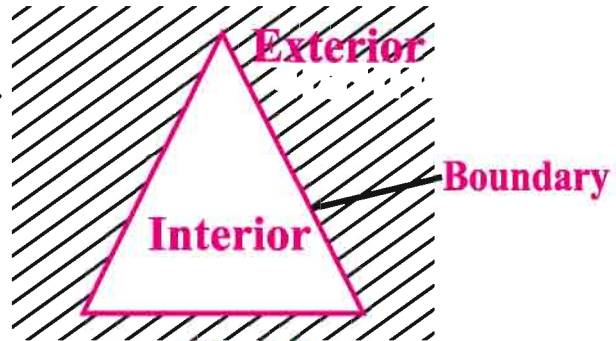
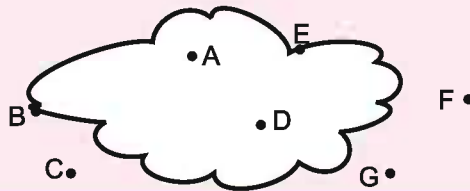


Fig. 9.7

Do and Learn. ◆

1. Draw three open and three closed curves.
2. In the given figure, which point lie in which part (interior, exterior or boundary) of the curve?



Exercise 9.1

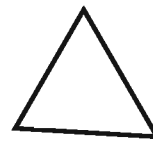
1. Classify the following curves as (i) Open or (ii) Closed.



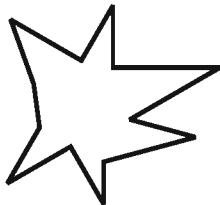
(i)



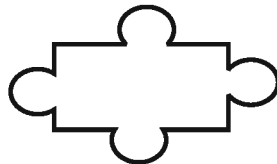
(ii)



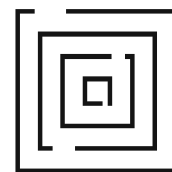
(iii)



(iv)



(v)

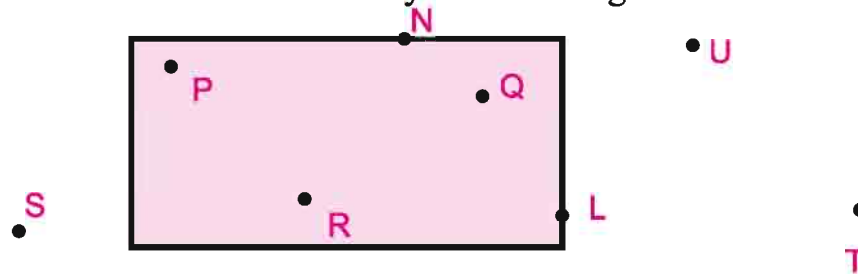


(vi)

2. Which all letters from A to Z are closed curves?



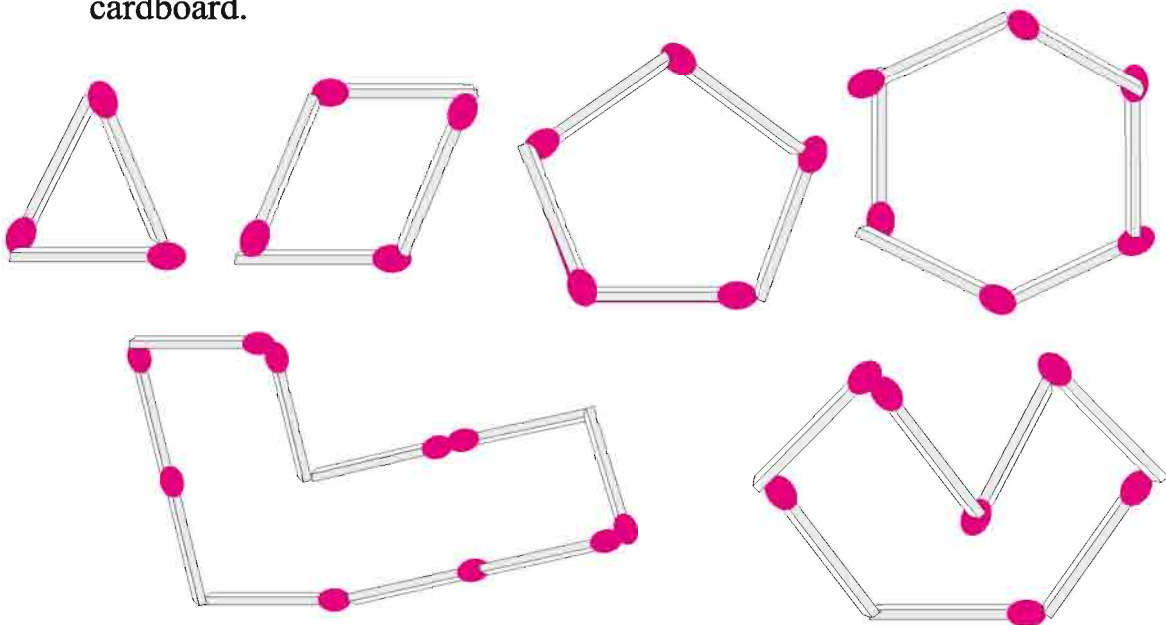
3. (i) Which points lie in the interior part of the rectangle?
 (ii) Which points lie in the exterior part of the rectangle?
 (iii) Are N and L lie on the boundary of the rectangle?

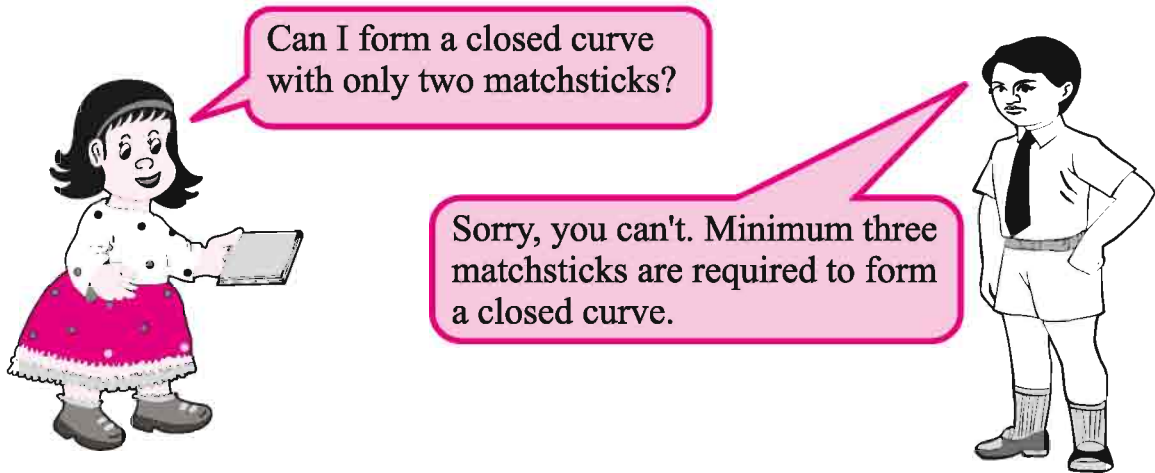


4. Draw, if possible, each one of the following with a rough diagram:-
 (i) A closed curve that is not a polygon.
 (ii) An open curve made up entirely of line segments.
 (iii) A polygon with two sides.
 (iv) A polygon with four sides.
5. Adjust five points A, B, C, D and E in a figure of a polygon such that-
 (i) Points A and C lie in the interior part of the polygon.
 (ii) Points B and D lie in the exterior part of the polygon.
 (iii) Point E lies on the boundary of the polygon.

9.3 Polygons

Try to form the following shapes with sticking matchsticks on the cardboard.

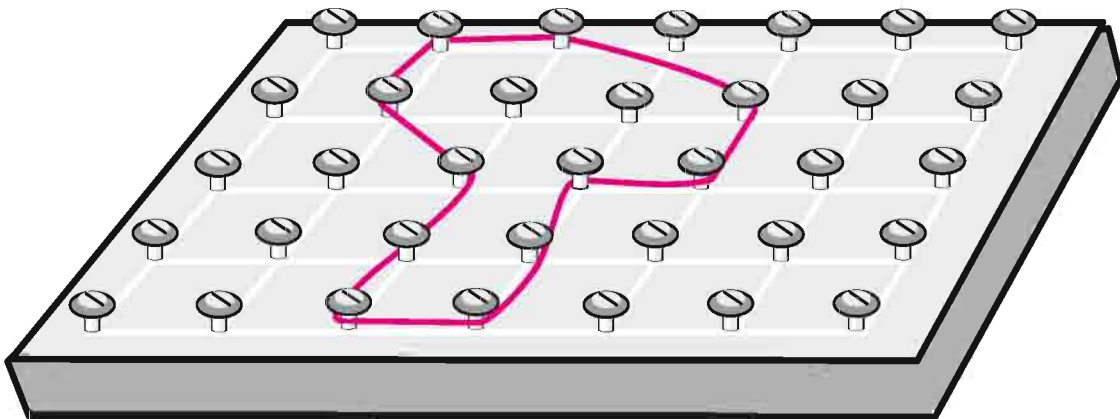




Simple closed figures made up entirely of three or more line segments are called polygons. Polygons can be made on geoboards.



Various polygons can be made on a geoboard by stretching rubber bands or tying threads around the pins of the geoboard.

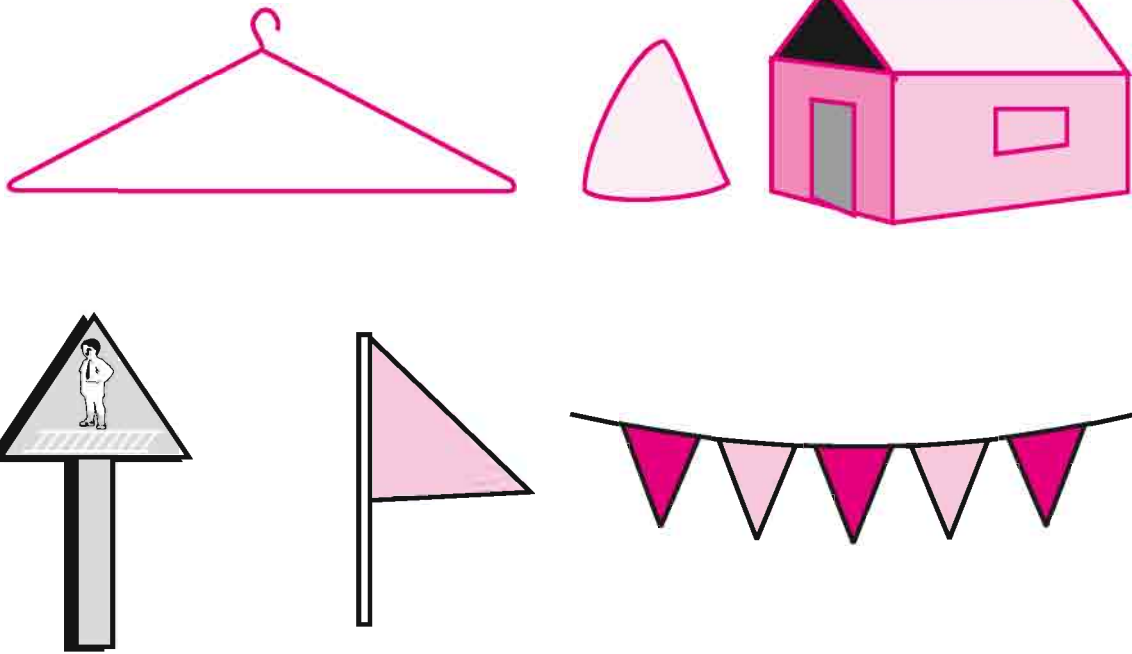


(A geoboard consists of a physical board with a certain number of nails half driven in it.) See the polygon made on the geoboard. How many sides does the polygon have? Try to make as many polygons as you can of different number of sides.

9.4 Triangle

We made various polygons with matchsticks. Carefully observe the polygon which was made up from three matchsticks. This is a triangle. Identify the triangles in the following figures.

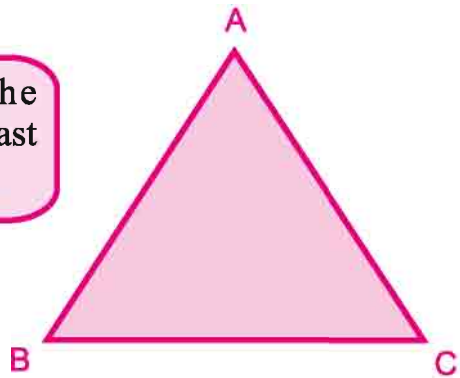




A triangle is a three-sided polygon. It has three corners called vertices (Plural of vertex) and three angles.



A triangle is the polygon with the least number of sides.

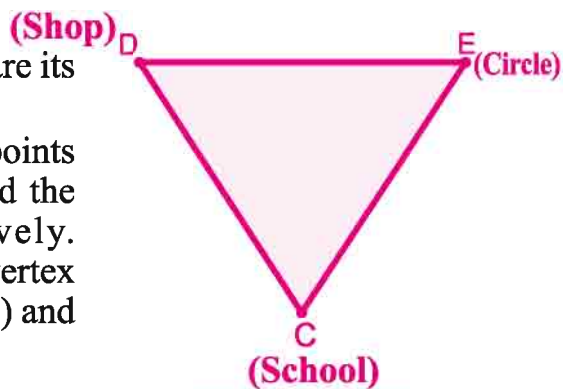


9.4.1 Elements of a triangle

Radha started walking from her school. She reached back her school after visiting a shop and crossing a square. Her path looked like the adjacent figure.

In this triangle, points C, D and E are its vertices (plural of vertex).

The distances between points C and D, points D and E, and points E and C, are called the sides CD, DE and EC respectively. Angles made on vertex C, vertex D and vertex E are called $\angle C$ ($\angle DCE$), $\angle D$ ($\angle CDE$) and $\angle E$ ($\angle CED$) respectively.

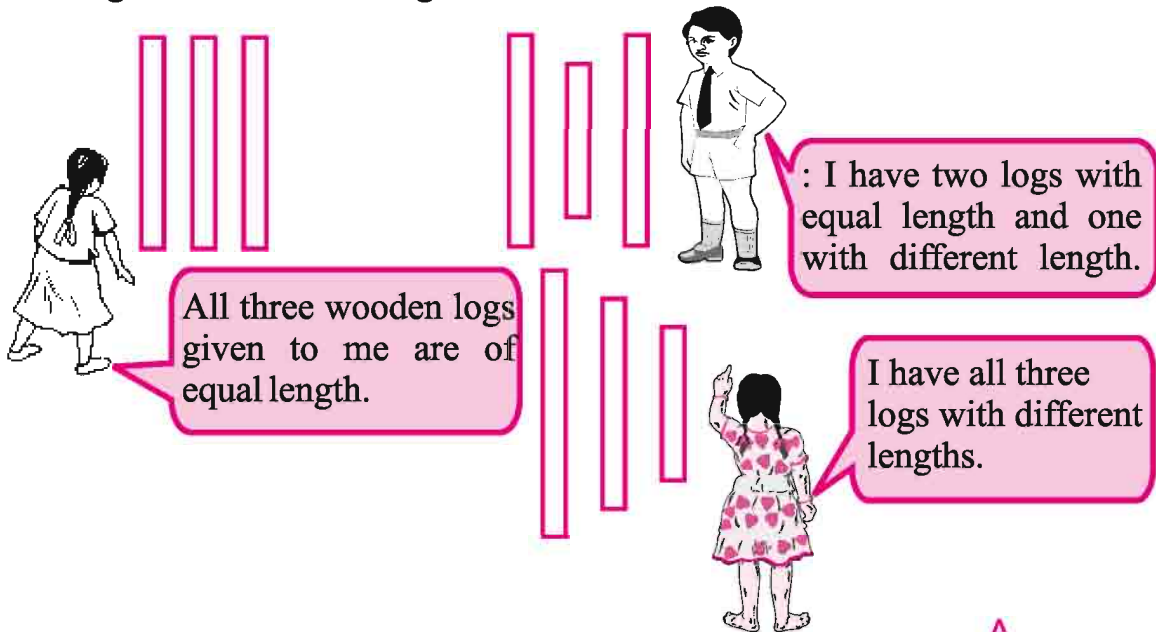


We know that the angle made on vertex D can be written as $\angle CDE$ as well as $\angle EDC$.

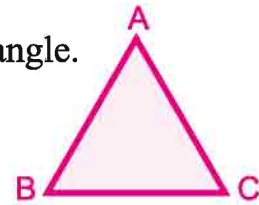
9.5 Classification of Triangles

9.5.1 On the basis of Side

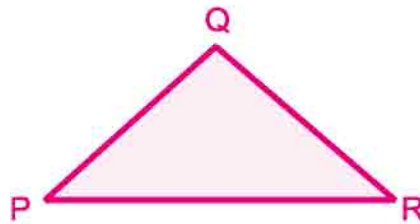
Teacher gave three wooden logs each to three students.



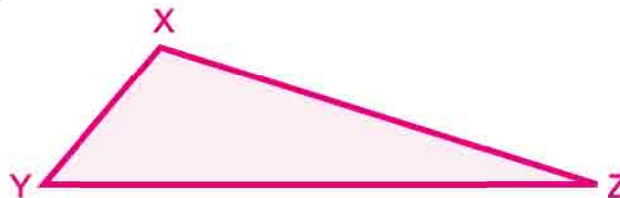
A triangle having three equal sides is called an equilateral triangle.
In the given figure, $AB = BC = CA$.



A triangle having two equal sides is called an isosceles triangle.
In the given figure, $PQ = QR \neq PR$



A triangle having all three unequal sides is called a scalene triangle.
In the given figure, $XY \neq YZ \neq ZX$



Do and Learn.

Try to construct equilateral triangles, isosceles triangles and scalene triangles using match sticks.

9.5.2 On the basis of angles

Students in the class are cutting off triangular shapes out of coloured paper sheet.

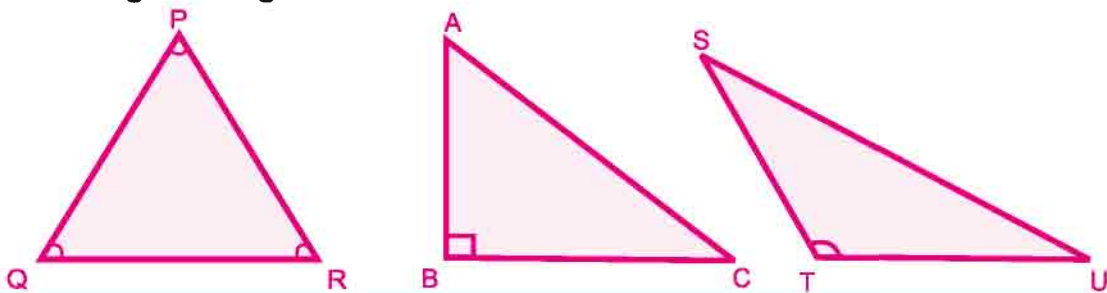
Each angle of my triangle is an acute angle.

In my triangle, one angle is obtuse angle and remaining two are acute angles.



In my triangle, one angle is right angle and remaining two are acute angles.

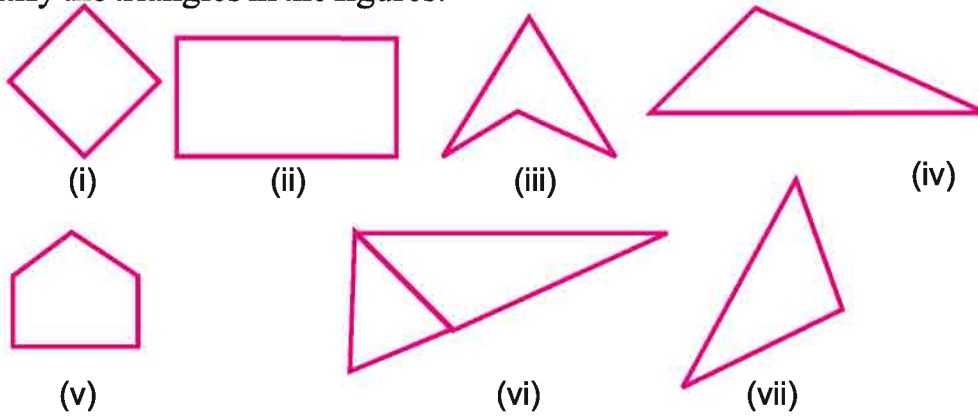
- (i) If each angle is less than 90° , then the triangle is called an acute angled triangle.
- (ii) If any one angle is a right angle then the triangle is called a right angled triangle.
- (iii) If any one angle is greater than 90° , then the triangle is called an obtuse angled triangle.

**Do and Learn.**

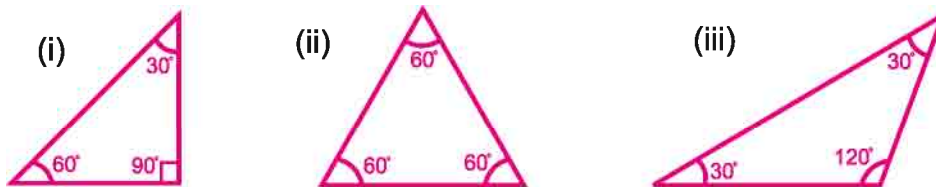
1. If all three sides of a triangle are equal, what can you say about the angles will they be acute angles?
2. Make a scalene triangle and write down measures of its angles.
3. Do you think it is possible to sketch a triangle with two right angles? If yes, sketch it in your notebook. If no, explain the reason.

Exercise 9.2

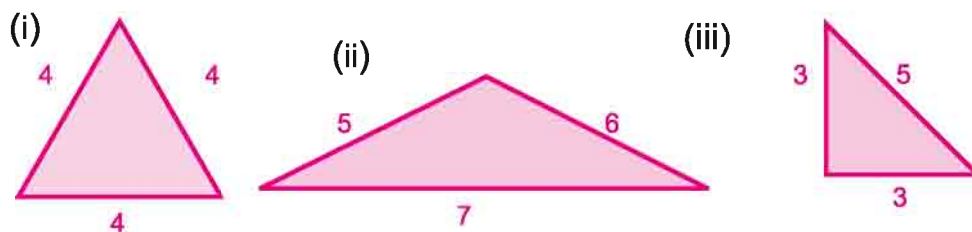
1. Identify the triangles in the figures.



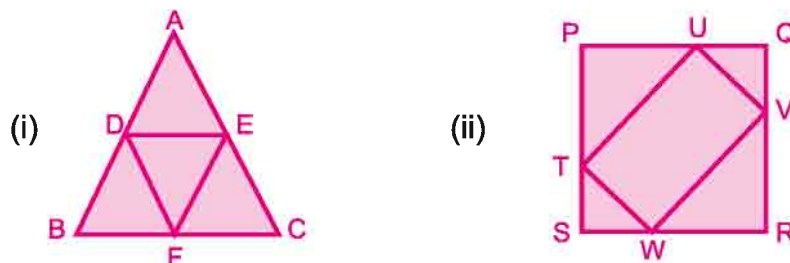
2. Identify each of the following triangles on the basis of angles.



3. Identify each of the following triangles on the basis of sides.



4. List the names of each of the triangles formed in each of the following figures.



5. Name the types of following triangles on the basis of given angles:

(i) $105^\circ, 46^\circ, 29^\circ$

(ii) $60^\circ, 60^\circ, 60^\circ$

(iii) $57^\circ, 33^\circ, 90^\circ$

6. Name the types of following triangles on the basis of given sides:

- (i) 3.5 cm, 3 cm, 1.8 cm (ii) 2.8 cm, 2 cm, 2cm (iii) 5.2 cm, 5.2 cm, 5.2 cm

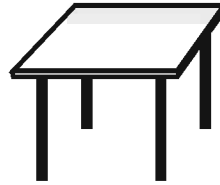
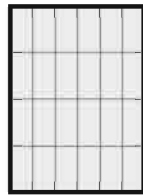
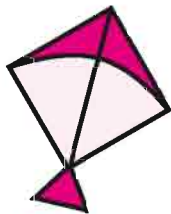
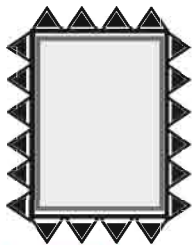
7. Mark True or False :

- (i) A triangle has three sides, three vertices and three angles. ()
 (ii) If all the angles of a triangle are less than a right angle, then such triangle is called a right angled triangle. ()
 (iii) A triangle having three unequal sides is called an equilateral triangle. ()
 (iv) A triangle having two equal sides is called an isosceles triangle. ()
 (v) In a triangle, if one angle is obtuse angle and two angles are acute angles, then the triangle is called an obtuse angled triangle. ()

9.6 Quadrilateral

You have seen blackboard in your class. How many edges (sides) does the blackboard have? Look around and see where you can find more shapes with four edges (sides). Table tops, currency notes, surface of a biscuit packet, etc are a few more examples of shapes with four edges (sides). A polygon which has four sides is called a quadrilateral.

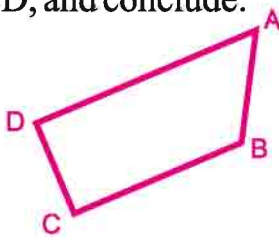
Identify all the quadrilaterals in the following figures.



Great! It means all the four sided fields in my village have quadrilateral shape.



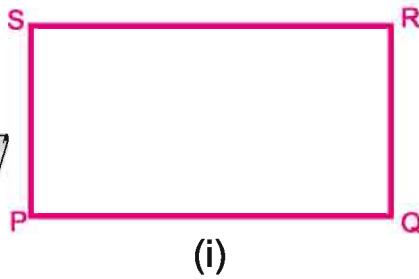
9.6.1 Elements of a Quadrilateral: Look at the following quadrilateral ABCD, and conclude:



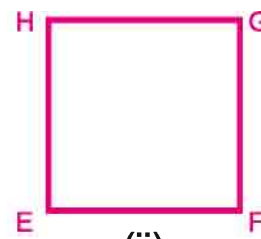
1. How many sides does it have?
2. How many vertices does it have?
3. How many angles does it have?

We find that the quadrilateral has four sides: AB, BC, CD, DA Four vertices of the quadrilateral are: A, B, C, D Four angles of the quadrilateral are: $\angle A$, $\angle B$, $\angle C$, $\angle D$. Pairs of sides facing each other are: AB and DC, BC and AD. These are called opposite sides. Sides adjacent to AB are: AD and BC (similarly, write adjacent sides for all the sides). Angle opposite to $\angle A$ is $\angle C$. Angles adjacent to $\angle A$ are $\angle B$ and $\angle D$ (similarly, write opposite angle and adjacent angles for each angle).

Salma and Pritam equated the sides and made two types of quadrilaterals.



(i)



(ii)



When I measured the sides and angles of quadrilateral PQRS, I found that its opposite sides are equal and all the four angles are equal to 90° .

When I measured the sides and angles of quadrilateral EFGH, I found that all of its sides are equal and all the four angles are equal to 90° .



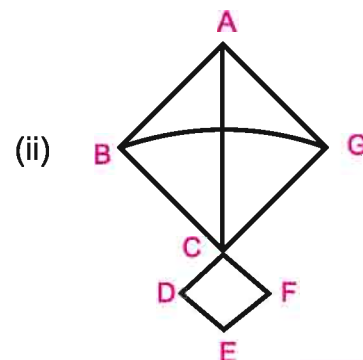
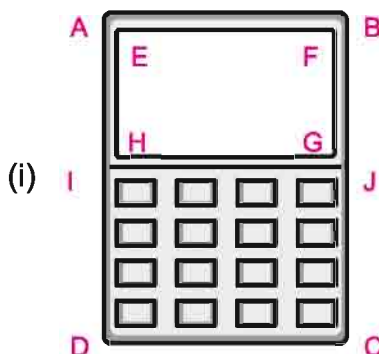
Yes, both of these shapes are quadrilaterals as each one has four sides and four angles. But, these are special types of quadrilaterals.

In Figure (i), $PQ = SR$, $SP = RQ$, and, $\angle P = \angle Q = \angle R = \angle S = 90^\circ$. A quadrilateral whose opposite sides are equal and all the four angles are equal to 90° , is called a Rectangle.

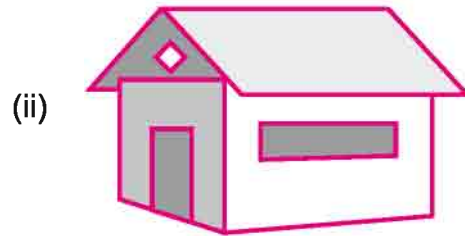
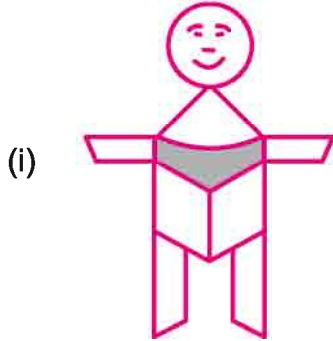
In Figure (ii), $EF = FG = GH = HE$, and, $\angle E = \angle F = \angle G = \angle H = 90^\circ$. A quadrilateral whose all four sides are equal and all the four angles are equal to 90° , is called a Square.

Exercise 9.3

1. Name the quadrilaterals formed in the following figures:



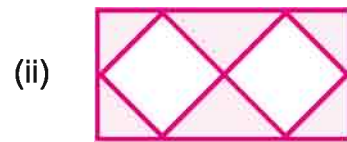
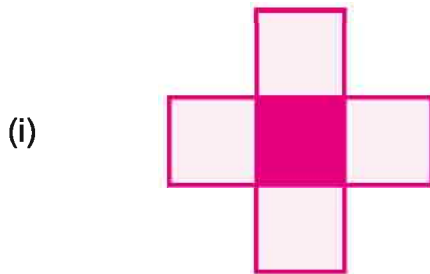
2. Write the number of quadrilaterals formed in the following figures:



3. Draw a rough sketch of a quadrilateral KLMN, and identify-

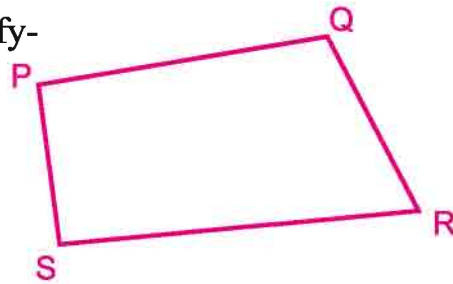
- Two pairs of opposite sides.
- Two pairs of adjacent sides.
- Two pairs of opposite angles.
- Two pairs of adjacent angles.

4. Write the numbers of rectangles and squares in the following figures:



5. In the given quadrilateral PQRS, identify-

- Angle opposite to $\angle P$
- Angles adjacent to $\angle R$
- Side opposite to QR
- Sides adjacent to PS.
- Name of all four angles.



6. Say True or False :

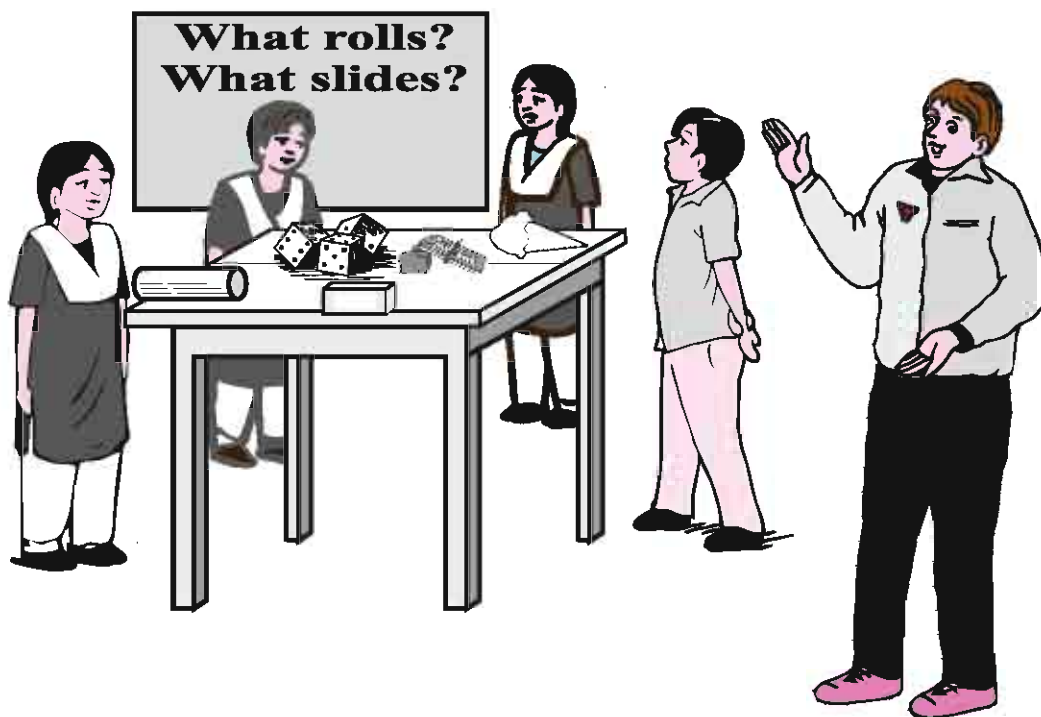
- All the sides of a rectangle are of equal length. ()
- Each angle of a square is a right angle. ()
- Opposite sides of a rectangle are unequal. ()
- A quadrilateral whose opposite sides are equal is called a rectangle. ()

We Learnt

1. Those simple shapes which can be traced all the way around back to the starting point are called closed curves. Those shapes which can't be traced all the way around back to the starting point are called open curves.
2. Parts which are inside, outside and on the closed curve are called interior, exterior and boundary of the closed curve respectively.
3. Simple closed figures made up entirely of three or more line segments are called polygons. A triangle is a three-sided polygon. A quadrilateral is a four-sided polygon.
4. Triangles can be classified as scalene (all unequal sides), isosceles (2 equal sides) or equilateral (all equal sides) based on the lengths of their sides.
5. Triangles can be classified as acute angled (all angles acute), right angled (one right angle) or obtuse angled (one obtuse angle) based on their angles.
6. A quadrilateral whose opposite sides are equal and all the four angles are equal to 90° , is called a rectangle.
7. A quadrilateral whose all four sides are equal and all the four angles are equal to 90° , is called a square.



10.1 Carefully observe the picture given below. The students are playing with a geometry box kept inclined on a table. They are sliding and rolling various objects like match box, marbles, dice, ball, a cylindrical wood piece, eraser, a joker's cap, etc. on the surface of the geometry box.



You too play and experiment with different objects and discover which objects can roll.

Shankar - Round objects like ball and marbles can roll.

Varsha - Yes! But match box, dice and eraser do slide.

Tahir - Joker's cap can roll as well as slide.

Teacher - Bingo! Those surfaces of the solid shapes which help them to slide are called flat surfaces and those surfaces which help the solid shapes to roll are called curved surfaces. For example, a ball has all over a curved surface. A cylinder has two bases which are flat surfaces and one curved surface between them.

Do and learn

Make a list of at least 20 objects around you and observe their surfaces. Categorize these objects in the table given below.

Objects having only curved surface	Objects having only flat surfaces	Objects having curved as well as flat surfaces
Orange	Box	Battery

10.2 Three Dimensional Shapes. In chapter 8, we had learnt about the shapes like circle, square, triangle, rectangle, etc which have length and breadth only. These are called two dimensional (2D) figures. We had also learnt about line segment which has only one measure which is its length. Hence, line and line segments are one dimensional figures. Instead the objects listed above in the table have three measures: length, breadth and height or depth. So, these are called three dimensional (3D) figures.

10.2.1 Cuboid

The shapes having only flat surfaces like trunk, brick, tea leaves packet, oil can, toothpaste tube box, etc are examples of cuboids. One such cuboid is a match box. Observe each of its surface and answer the following questions.

How many surfaces are there in a cuboid?

What is the shape of each surface?

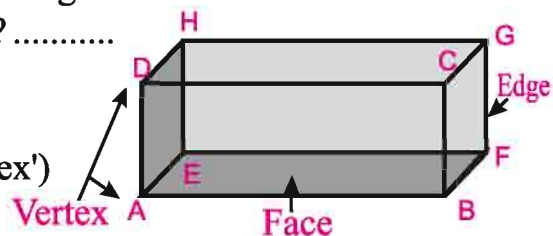
Two surfaces meet at a line segment called an edge.

How many edges are there in the match box?

Three edges meet at a point called a vertex.

How many vertices

(note that 'vertices' is the plural form of 'vertex') are there in a cuboid?



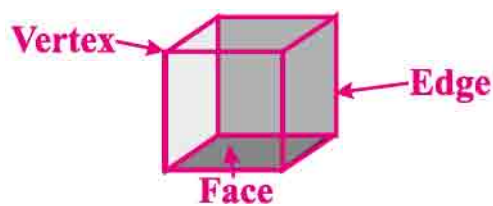
Each flat surface of a cuboid is a rectangle. It is called its face. A cuboid has six faces. Two faces of a cuboid meet at a line segment which is called an edge of the cuboid. A cuboid has 12 edges and 8 vertices.



In the above figure, 6 faces of the cuboid are ABCD, EFGH, BFGC, AEHD, ABFE and CGHD respectively. Similarly, 12 edges are AB, CD, EF, GH, BC, FG, AD, EH, BF, CG, AE and DH respectively. 8 vertices of the cuboid are A, B, C, D, E, F, G and H respectively.

10.2.2 Cube

The cuboids like chalk box, dice, etc have all the square faces, i.e, the length, breadth and height of such cuboids are all equal. Such specific cuboid is called a cube. Similar to a cuboid, a cube also has 6 faces, 8 vertices, and 12 edges.



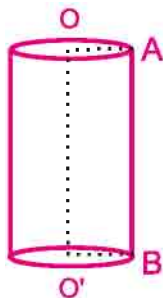
10.2.3 Cylinder

The shape like a wooden log which has two circular flat faces and one curved face is called a cylinder. Other examples of cylinders are grain storage drums, water pipes, etc.



Do and learn

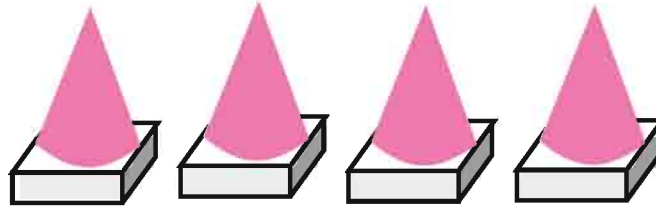
◆ Is a rolling pin (used to flatten dough to make chapatti) an example of a cylinder? Affirm your answer using proper logic.



The given figure of a cylinder has two circular flat surfaces and one curved surface between them. OA and O'B are radii of the circular surfaces and OO' is the height of the cylinder.

10.2.4 Cone

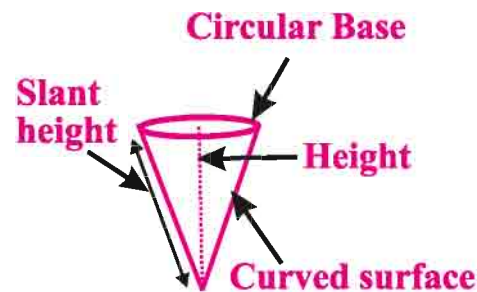
We have seen following shapes on road maintenance sites:



Apart from these, shapes like a joker's cap and an ice-cream cone also have a curved surface and a circular flat surface.



The shape which has a flat circular base and a curved surface is called a cone.



10.2.5 Sphere

A ball, a marble and a football have similar shapes. Whole of their surface is a curved surface. All of these are examples of spherical shapes. Is a coin a sphere? Can a coin roll on its entire surface? Is it possible with a bangle?

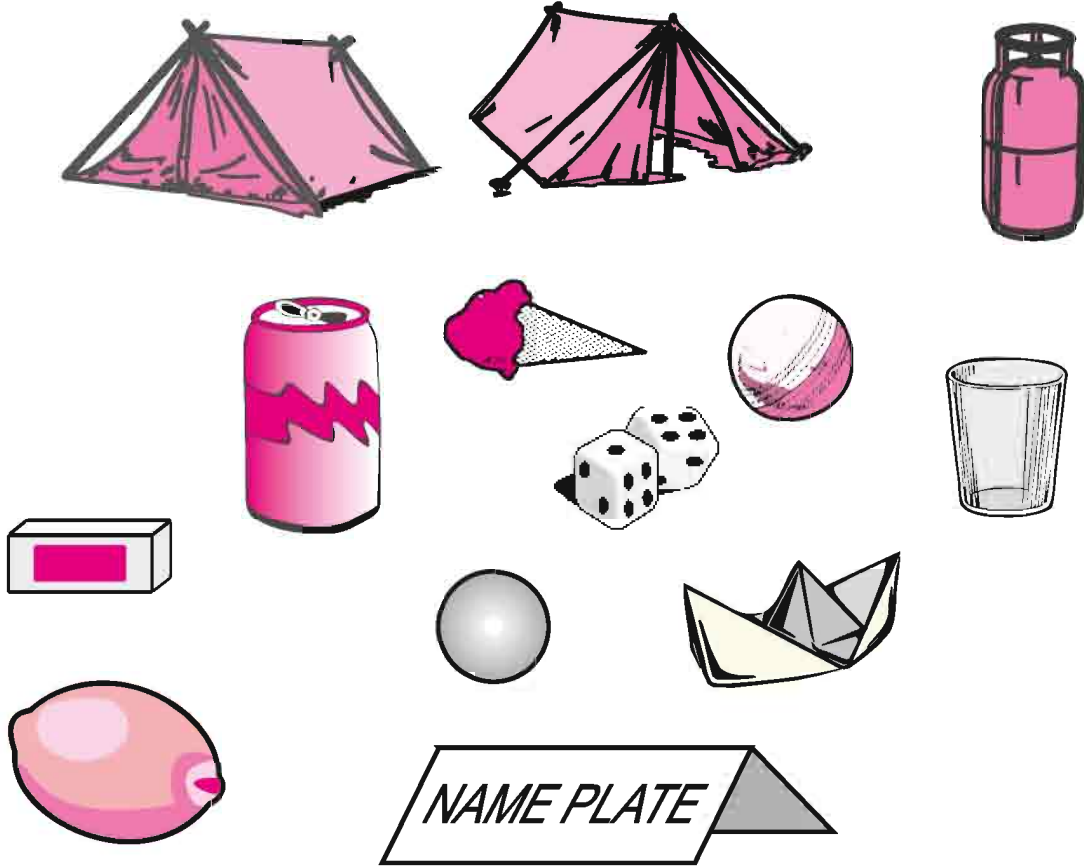
You must have observed that when a lemon is cut into two equal parts from the middle, we get two half spheres. A shape like a half sphere is called a hemisphere.



Think and discuss: What are the differences between a circle, a sphere and a cylinder?



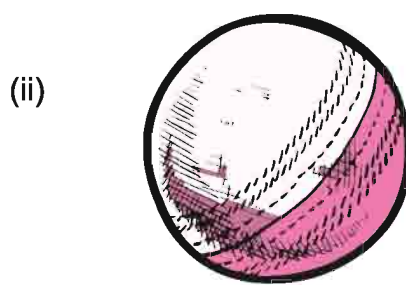
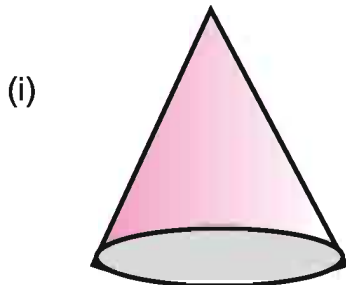
10.2.6 Polyhedron - Here are a few objects you see in your day to day life. Which of the following have all flat faces and no curved surface?

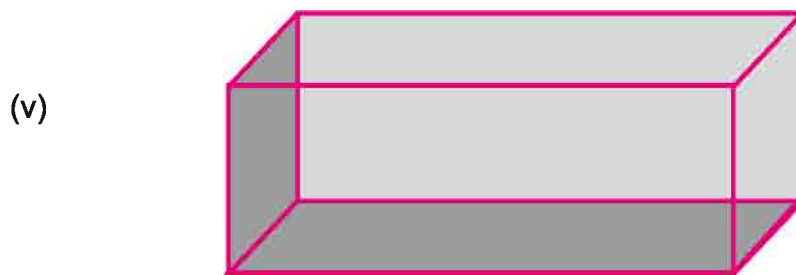
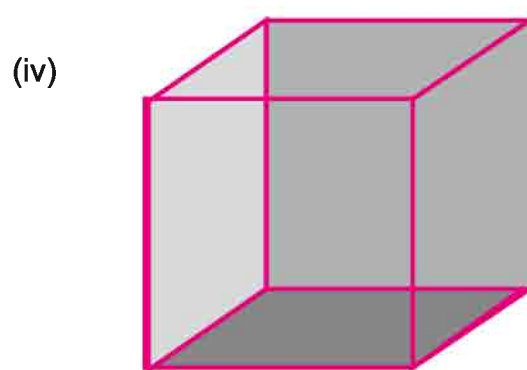
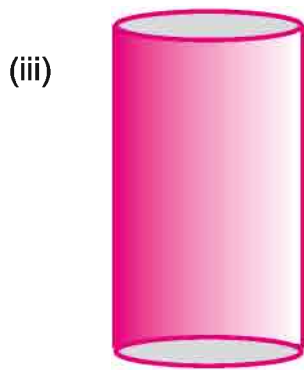


The solid shape which has all flat faces and each face is a polygon (triangle, quadrilateral, etc) is called a polyhedron.

Exercise 10

1. Identify the pictures given below and name each of them.





2. Think and write.

- (i) Name of any two spherical fruits.
- (ii) Name of two solid shapes made of fresh a redish.
- (iii) Name any two cylindrical shapes used in kitchen.
- (iv) Name any two cubical objects which you keep in your school bag.

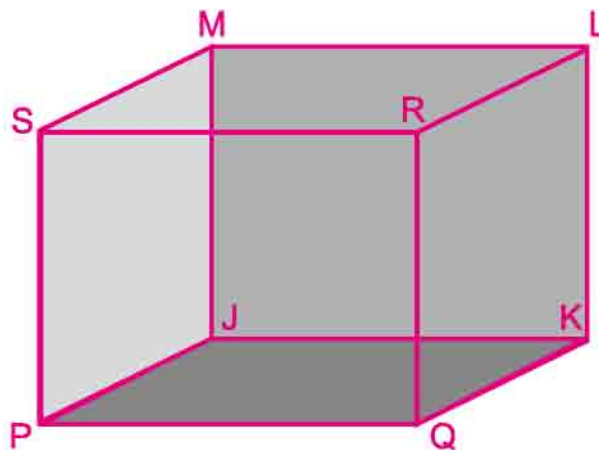
3. Say True or False:

- (i) A cube and a cuboid have 6 faces. ()
- (ii) All the edges of a cuboid are equal. ()
- (iii) If the lid of a cylindrical box is removed, the box is left with a circular face and a cylindrical face. ()



- (iv) Both the bases of a cone are circular. ()
- (v) A cube can be obtained by cutting a cuboid through its edges. ()
- (vi) Bangles are circular in shape. ()

4. Write down the names of the faces, edges and vertices of the cuboid given below.



We Learnt

1. Flat surfaces of the solids help them to slide. Curved surfaces of the solids help them to roll.
2. The solid shapes which have three measures namely length, breadth and height or depth are called three dimensional (3D) shapes.
3. Each surface of a cuboid is a rectangle. A cuboid has 6 faces, 8 vertices and 12 edges.
4. Each surface of a cube is a square. A cube has 6 faces, 8 vertices and 12 edges.
5. A cylinder is a solid shape which has two circular flat surfaces and one curved surface between them.
6. A cone is a solid shape which has one circular surface as its base and only one curved surface.
7. A sphere is a solid shape which has all over only one curved surface, for example, ball, marbles, football, etc.
8. The solid shape which has all flat faces and each face is a polygon (triangle, quadrilateral, etc) is called a polyhedron.

11.1 Carefully look at the pictures below.

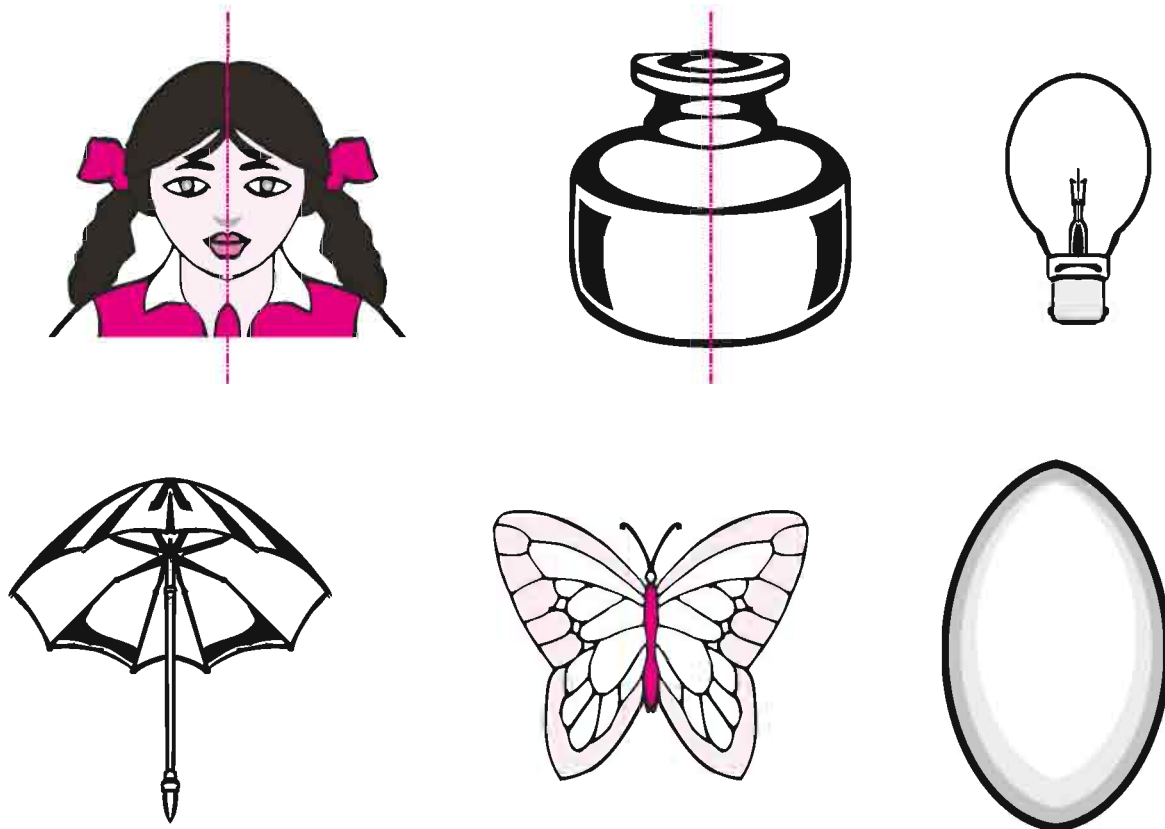


Fig. 11.1

Discuss with your friends and answer the following questions.

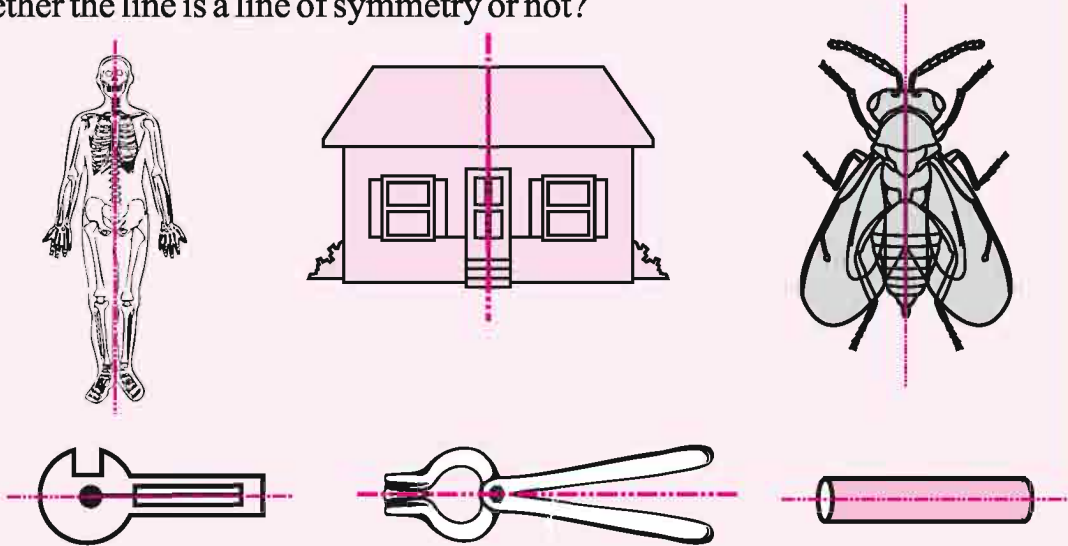
- (i) Two pictures are divided with dashed lines. The dashed line divides the picture in how many parts?
- (ii) Are these parts identical?
- (iii) Can we draw more lines like the one already drawn?
- (iv) Can we draw such line in all the pictures above? Do try and see.

You will find that the dashed line divides the picture in two equal halves. Imagine that you folded the picture along the dashed line such that the left and right halves match exactly. Or, if you placed a mirror along the dashed line, you would see the other half of the figure reflected in the mirror. Such lines are called the line or axis of symmetry and such figures are called symmetrical figures.

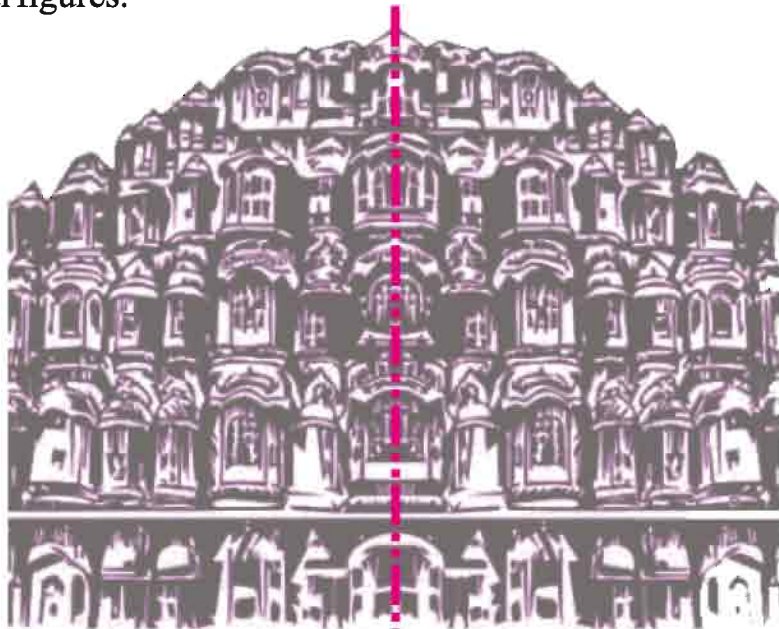


Do and Learn.

A dashed line is drawn in each of the following figures. Can you tell whether the line is a line of symmetry or not?

**Fig. 11.2**

A line of symmetry divides the figure in two equal halves which match exactly. It can be horizontal, vertical or inclined. When you fold the figure along the dotted line, one half of the figure would fit exactly over the other half. This line can be real or virtual. Generally, symmetrical figures look beautiful than asymmetrical figures.

**Fig. 11.3**

The symmetrical construction is one of the reasons which adds beauty to the world famous Hawa Mahal of Jaipur.

Do and Learn

Two lines of symmetry made in the figures below.

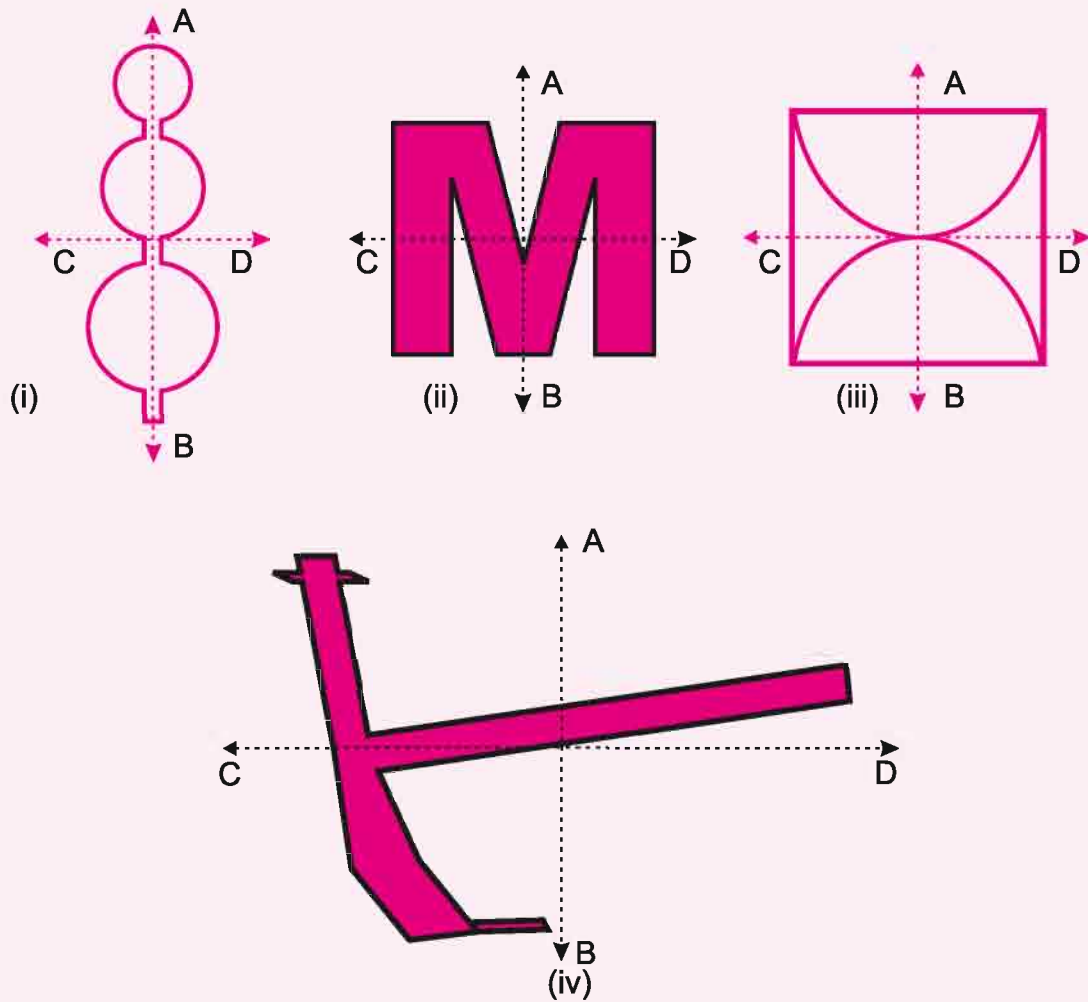


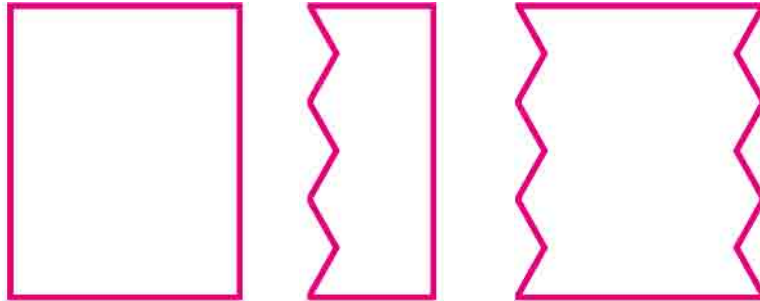
Fig. 11.4

- (i) Name the lines of symmetry in each figure.
- (ii) Is there a figure in which both the lines are lines of symmetry?
- (iii) Is AB (the vertical line) the line of symmetry in all the figures?
- (iv) Is there any figure in which none of the dashed lines are lines of symmetry?



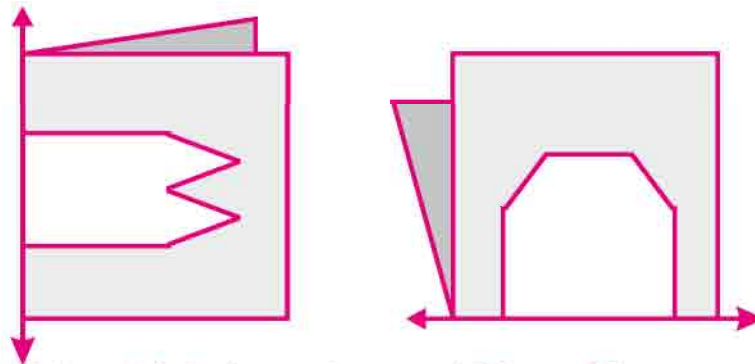
11.2 Explore Symmetry

Take a piece of coloured paper. Fold it in half. Draw the design as shown in the picture below. Cut the shape drawn and unfold the shape.



Repeat the same exercise by folding the paper more than once. You will get interesting figures.

Given here are figures of a few folded sheets and designs drawn about the fold. In each case, draw a rough diagram of the complete figure that would be seen when the design is cut off.



11.3 Figures with multiple (more than one) Lines of Symmetry

From the above examples, we found that lines of symmetry can be horizontal or vertical or diagonal or sidelong. Some shapes have only one line of symmetry; some have two lines of symmetry; and some have three or more.

Find the number of lines of symmetry for each of the following shapes:

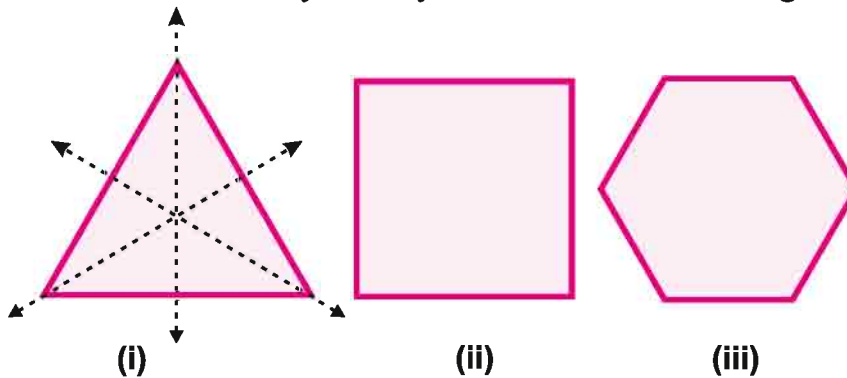


Fig. 11.5

It is now very clear that there can be multiple lines of symmetry in some figures. Number of lines of symmetry in an equilateral triangle, a square and a regular pentagon are three, four and five respectively. Very interesting! Similarly, lines of symmetry keep on increasing as the number of sides keeps on increasing in regular polygons. Now guess the number of lines of symmetry in a regular polygon of 12 sides. Building upon the same logic, we can say that since a circle is a polygon with infinite sides, it has infinite lines of symmetry.

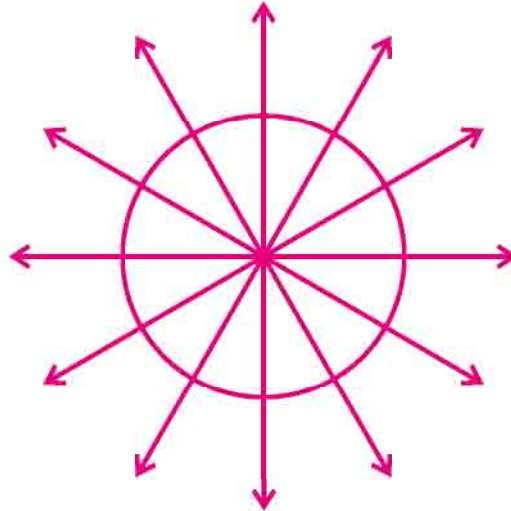


Fig. 11.6

Exercise 11

1. (a) Identify the shapes given below. Check whether they are symmetric or not.



(i)



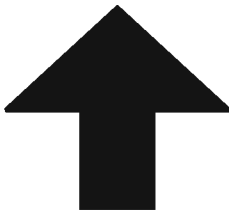
(ii)



(iii)



(iv)



(v)



(vi)



(vii)

(b) Which of the above shapes have more than one lines of symmetry?



2. Examine the alphabets given below for the existence of symmetry.

A B C E O G H K N W I Z

- Which of the above alphabets are not symmetrical?
 - Which of the above alphabets are symmetrical?
 - Which of the above alphabets have vertical line of symmetry?
 - Which of the above alphabets have horizontal line of symmetry?
 - Which of the above alphabets have vertical as well as horizontal lines of symmetry?
 - Which of the above alphabets have more than two line of symmetry?
3. Find the number of lines of symmetry for each of the following shapes:



(i)



(ii)



(iii)



(iv)



(v)



(vi)

4. Make different shapes having two lines of symmetry in each of them.

5. List ten objects you find in your home or school and draw their figures in your notebook. Which of them are symmetric and which are not? Can you identify the lines of symmetry for those objects which are symmetric?

we learnt

1. A figure has line symmetry if a line can be drawn dividing the figure into two identical parts. The line is called a line of symmetry.

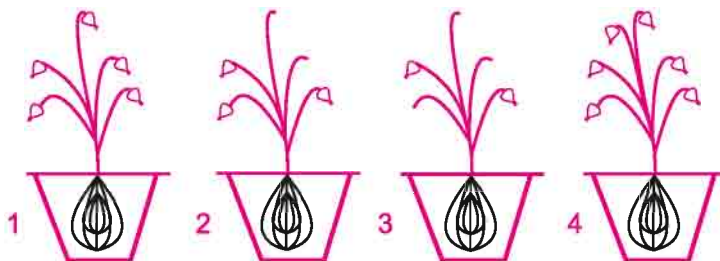
2. Number of lines of symmetry in a regular polygon will be equal to the number of sides in that polygon.

Regular Polygon	Number of lines of symmetry
Equilateral Triangle	3
Square	4
Regular Pentagon	5
Regular Hexagon	6

12.1 Our study so far has been with numbers made from the digits 0 to 9. We also learnt different operations on these numbers. We applied our knowledge of numbers to various problems in our day to day life. The branch of mathematics in which we studied numbers is arithmetic. Sometimes, arithmetic alone is not effective enough to solve complicated problems of numbers. Hence, we begin the study of another branch of mathematics to handle problems that we can't solve using just arithmetic. It is called algebra. In algebra, we often use letters like (a,b,c) to represent numbers. Letters are used as symbols for generalizing numbers. These letters are called literals.

By using letters, we can talk about any number and not just a particular number. Secondly, letters may stand for unknown quantities.

12.2 The Idea of a Variable See the figure below:



In the above figure, some seeds are sowed. Number of fruits obtained from each seed is as follows:

Seed 1	Number of fruits = 5
Seed 2	Number of fruits = 3
Seed 3	Number of fruits = 2
Seed 4	Number of fruits = 6

For convenience, let us write the letter 'x' for the number of fruits obtained from a seed. Then,

For seed 1	$x = 5$
For seed 2	$x = 3$
For seed 3	$x = 2$
For seed 4	$x = 6$

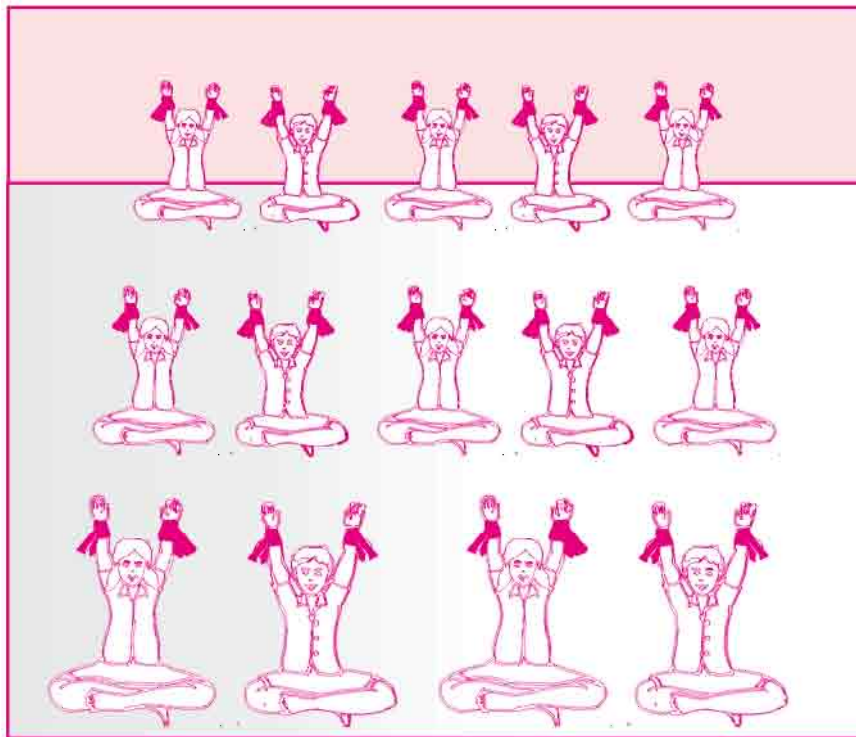
The value of x (number of fruits obtained) goes on changing for different seeds. x is an example of a variable. Its value is not fixed; it can take any value 1, 2, 3, 4, The word 'variable' means something that can vary, i.e. change. The value of a variable is not fixed. It can take different values. Thus, a Variable is a number which can take different values in different situations. Instead, the arithmetic numbers which have fixed values are called Constants.

Do and Learn. ◆

- Let y denote age in years. Write down the value of y for your 10 friends.

12.2.1 The Yoga Class

Let, the Yoga class is going on in your school. Students are doing Yoga with their hands up. Ribbons are tied in each hand of each student. Fill in the table below with the help of the figure given below.



Number of students	1	2	3	4	5					
Number of ribbons	2	4	6	8	10					

Table 12.1

How many ribbons are tied to 10 students?

As per the table, the answer is 2×10 .

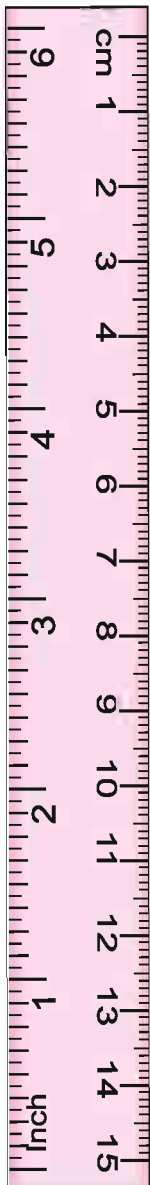
Hence, number of ribbons = $2 \times$ number of students

Let n denotes number of students. Then,

Number of ribbons = $2 \times n$

$n = 1, 2, 3, 4, \dots$

As per the table, number of ribbons keeps on increasing with increasing value of n .



12.2.2 Generalising with Matchstick Patterns

Chinu and Chotu are making patterns with matchsticks. They decide to make triangular patterns. They make 2 triangles. Their friend Ramu comes in. He looks at the pattern and forms one more triangle. Ramu always asks questions. He asks Chinu, “How many matchsticks will be required to make further triangles?” They go on forming the patterns and prepare a table.

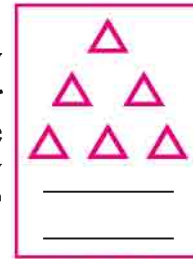


Fig. 12.1

Number of triangles formed	1	2	3	4	5	6
Number of matchsticks required	3	6	9	12	15	18

Table 12.2

How many matchsticks will be required to make 8 triangles?

Number of matchsticks required = $3 \times$ Number of triangles formed

If T denotes number of triangles formed, then,

number of matchsticks required = $3 \times T$

Here, T is an example of variable whose value is not fixed. $T = 1, 2, 3, 4, \dots$

12.3 Algebraic Expressions

Game of matchsticks – Raju and his friends are making patterns with matchsticks. Raju puts a matchstick on a table. Pappu takes two matchsticks and forms an open container. Then Kavita also picks two sticks, forms second open container adjacent to the one made by Pappu. Then Sanju also forms third open container adjacent to the one made by Kavita. Following the same pattern, how many matchsticks are required to form 8 containers? Let's make a table.

Number of containers formed	1	2	3	4	.....	n
Number of matchsticks required	3	5	7	.....	.....	.....

Table 12.3

While writing the table, Raju realises that 2 matchsticks are required to add one container.

Number of matchsticks required for 1 container = $1 + 2 \times 1$

Number of matchsticks required for 2 containers = $1 + 2 \times 2$

Number of matchsticks required for 3 containers = $1 + 2 \times 3$

Number of matchsticks required for n containers = $1 + 2 \times n$
 = $1 + 2n$, here n is a variable.

$(1 + 2n)$ is an example of an algebraic expression. An algebraic expression is an expression built up from constants, variables, and the algebraic operations like addition, subtraction, multiplication, division, etc. For example, in the algebraic expression $(1 + 2n)$, n is multiplied by 2 and then 1 is added to the product. Algebraic expression can be monomial (1 term), binomial (2 terms), or polynomial (more than 2 terms).



Now, we will learn to form more algebraic expressions.

Algebraic expression	How it is formed
(i) $2 + 7$	adding 7 in 2
(ii) $x + 9$	adding 9 in x
(iii) $p + q$	adding q in p
(iv) $a - 3$	subtracting 3 from a
(v) $3 - b$	subtracting b from 3
(vi) $x - y$	subtracting y from x
(vii) $3 \times x$	x is multiplied by 3
(viii) $\frac{13}{a}$	13 is divided by a
(ix) $\frac{x}{y}$	x is divided by y

Write 10 other such simple expressions and tell how they have been formed.

Do and Learn. ◆

- Write algebraic expressions through given instructions about how to form it.
 - Sum of 5 and a variable-----
 - Difference between 7 and a variable-----
 - 3 times of a variable-----
 - 12 less than 6 times of a variable-----
 - Half of a variable-----
 - 200 less than one third of a variable-----
- Shweta secured 75 marks in Mathematics. Her score in Science is not known. Let her Science score be x . What is her total score?
- Sakshi has some candies with her. Ashu has 4 times as many candies as Sakshi. How many candies are there in total?.....

Forming Algebraic expressions with given statements.

Statement	Algebraic expression
(i) Subtracting 7 from z	$z - 7$
(ii) Subtracting 4 from p	$p - 4$
(iii) Subtracting 16 from a	$a - 16$
(iv) y is divided by 3	$\frac{y}{3}$

- | | | |
|-------|----------------------|------|
| (v) | Multiplying m by 7 | $7m$ |
| (vi) | Multiplying x by 3 | $3x$ |
| (vii) | Multiplying x by 5 | $5x$ |

Do and Learn. ◆

Match the algebraic expressions with appropriate situations in the following:

- | | | |
|-------|---------------|---|
| (i) | $x + 4$ | (a) Prashant has 4 times as many wealth as Kamli. |
| (ii) | $x - 4$ | (b) Malti has Rs.4/- more than Seema. |
| (iii) | $4 - x$ | (c) My weight is 4 kgs less than Nancy. |
| (iv) | $4y$ | (d) I had Rs.4/- from which I spent some money. How much I am left with? |
| (v) | $\frac{y}{4}$ | (e) Banshi had some marbles. He distributed them between his 4 friends equally. How many marbles each friend get? |


Exercise 12.1


- Make the matchstick patterns of the letters given below. Draw the figures of the patterns in your notebook. Create rules to find out number of matchsticks required for each pattern. (You can use literals like a , b , x , y , etc to create rules.)
 - Pattern of T T, TT, TTT,.....
 - Pattern of N N, NN, NNN,...
 - Pattern of W W, WW, WWW,...
- Tree Plantation Program was held in a school. 4 Trees were planted in each row. Write the number of trees planted in terms of the number of rows.
- Ranu is 5 years younger than Leela.
 - Let Leela's age be x years. Write the age of Ranu in terms of x .
 - Let Ranu's age be P years. Write the age of Leela in terms of P .
- Cost of a pen is Rs.5/-. Madan has some money with him. He pays all of that money to buy those pens. Write the number of pens purchased in terms of the money he had.

5. Complete the table given below:

x	1	2	3	4	5	--	--
$2x + 3$	5	7	--	--	--	15	--

12.4 Rules for Algebraic Expressions

12.4.1 Commutativity

(i) For Addition – We know that interchanging the order of numbers in addition does not change the sum. For example, $2 + 5 = 5 + 2$.

This property of numbers is known as the commutativity of addition of numbers. Commuting means interchanging. So it means that if the order of numbers is commuted in addition, the sum will remain same. Similarly, if x and y are two variables, then, we can say that, $x + y = y + x$

(ii) For Multiplication – Similarly, for the product of two numbers, $5 \times 2 = 2 \times 5 = 10$. That is, for multiplication of two numbers, the order of the two numbers being multiplied does not matter. This property of numbers is known as commutativity of multiplication of numbers.

$$x \times y = y \times x$$

12.4.2 Distributivity - Suppose we are asked to calculate 8×35 . We obviously do not know the table of 35. So, we do the following-

$$\begin{aligned} 8 \times 35 &= 8 \times (30 + 5) \\ &= 8 \times 30 + 8 \times 5 \\ &= 240 + 40 \\ &= 280 \end{aligned}$$

By using variables, we can write this property of numbers also in a general and concise way. Let x , y and z be three variables, each of which can take any number. Then

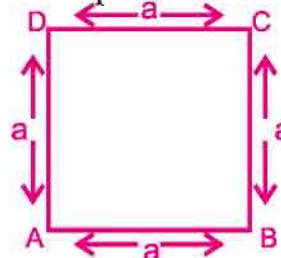
$$x \times (y + z) = x \times y + x \times z$$

This property is known as distributivity of multiplication over addition of numbers.

12.4.3 Rules from Geometry (in the form of algebraic expressions) We can write the perimeters of rectangle and square in the form of algebraic expressions. We know that perimeter of any polygon (a closed figure made up of 3 or more line segments) is the sum of the lengths of its sides

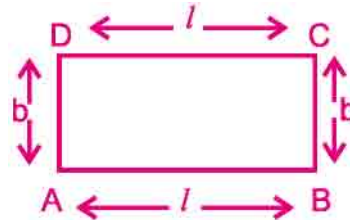
(i) Perimeter of a Square

$$\begin{aligned} \text{Perimeter of the square } ABCD &= AB + BC + CD + DA \\ &= a + a + a + a \\ &= 4a = 4 \times \text{side} \end{aligned}$$



(ii) Perimeter of a Rectangle- Opposite sides of a rectangle are equal. Thus, in the rectangle ABCD, let us denote by l , the length of the sides AB or CD and, by b , the breadth of the sides AD or BC.

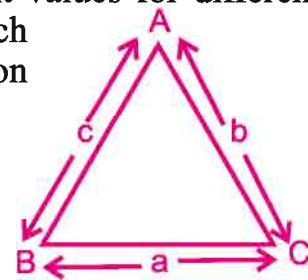
Therefore, Perimeter of a rectangle
 = length of AB + length of BC
 + length of CD + length of AD
 = $2 \times$ length of CD + $2 \times$ length of BC
 = $2l + 2b$
 = $2(l + b)$



Here, both l and b are variables. They take on different values for different rectangles. Also, they take on values independent of each other. i.e. the value one variable takes does not depend on what value the other variable has taken.

(iii) Perimeter of a triangle-

Perimeter of a triangle = sum of the lengths of its sides
 = BC + CA + AB
 = $a + b + c$



Exercise 12.2

- With the numbers 3, 7 and 4, form arithmetic expressions using-
 - Only addition and subtraction operations.
 - Only multiplication and addition operations.
- For each of the below expressions, mention whether it is an arithmetic expression or algebraic expression?

(i) $3x + 5$ (ii) $5 \times 4 + 7$ (iii) $3 + 4 \times 3 + 5$
 (iv) $2x + 1$ (v) $\frac{x}{2} + 5 - x$ (vi) $3x$
- Observe the expressions in the table carefully. Mention, what all operations are used to form that expression by putting the sign of Right/Wrong in the table.

S.No.	Expression	Addition	Subtraction	Multiplication	Division
1	$x + 5$				
2	$7m + 3$				
3	$y - 3x$				
4	$x - y - z$				
5	$3x - 10 - \frac{z}{5}$				
6	$\frac{y}{17}$				

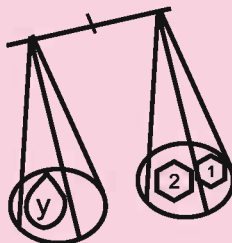


4. Write algebraic expressions for the following situations.
- (i) 7 added to a (ii) 10 subtracted from b (iii) x multiplied by 4
 (iv) x divided by 4 (v) x subtracted from 7 (vi) 10 divided by q
5. Give expressions for the following cases.
- (i) 15 added to $2n$ (ii) 15 subtracted from $2x$
 (iii) 3 added to twice of p (iv) 3 subtracted from twice of q
 (v) 11 subtracted from the product of y and 5
 (vi) 11 added to the product of z and -3
6. Form algebraic expressions using q , 5 and -3 .
7. Nathu has Rs $x/-$ with him. Then,
- (i) How much money do Bina have if she owns twice as much as Nathu does?
 (ii) How much money is Nathu left with after buying books worth Rs. 150/-?
 (iii) How much money do Seema have if she owns half as much as Nathu had initially?
 (iv) How much money do Milli have if she owns thrice as much as Nathu does?
8. The height of a triangle is 5 more than twice of its base. What is its height if base is b ?
9. The present age of Vimal is p years.
- (i) How old was he 10 years ago?
 (ii) How old will Vimal be 5 years from now?
 (iii) Vimal's aunt is thrice as old as Vimal. How old is Vimal's aunt?
 (iv) Age of Vimal's mother is 5 years less than twice of Vimal's age. How old is his mother?

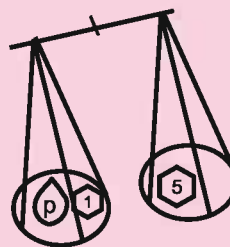
12.5 Introduction to Equations

Seema bought a papaya from a fruit seller. He measured the weight of the papaya in the weighing scale. He put the papaya on one pan. The scale was balanced when he put a 2 kgs weight on another pan of the scale. Denoting the weight of the papaya with a variable x , we can write it in a mathematical sentence as, $x = 2$.

Observe the mathematical sentence in the following conditions.



$$y = 2 + 1$$



$$p + 1 = 5$$

These mathematical sentences are called Equations.

12.5.1 Forming Equations from given Statements

Observe the equations formed from the statement given.

Twice of a number is 10.	$2n = 10$
5 more than thrice of a number is 17.	$3n + 5 = 17$
3 less than half of a number is 6.	$\frac{x}{2} - 3 = 6$
Adding 15 in twice of a number results in 51.	-----

12.5.2 Deriving Statements from given Equations

$3x = 21$	Thrice of a number is 21.
$2x - 7 = 19$	7 less than twice of a number is 19.
$23 = 4x + 3$	23 is 3 more than 4 times a number.
$3x - 7 = 11$	.....

Thus, a relation between some constants and variables in which mathematical operations are used along with the 'equal to' sign "=" is called an Equation. An equation has two sides: left hand side (L.H.S.) and right hand side (R.H.S.) which are separated with an 'equal to' sign.

12.5.3 Solution of an Equation

Let us take the equation:

$$x + 1 = 5$$

L.H.S. \curvearrowright \curvearrowleft R.H.S.

Let's try and find out the value of x in above equation which satisfies the equation.

Value of x	L.H.S.	R.H.S.	Result
0	$0 + 1 = 1$	5	Not equal
1	$1 + 1 = 2$	5	Not equal
2	$2 + 1 = 3$	5	Not equal
3	$3 + 1 = 4$	5	Not equal
4	$4 + 1 = 5$	5	Equal

Keeping the value of x as 4, L.H.S. of the equation becomes equal to R.H.S. of the equation. Hence, the equation is satisfied when x takes the value 4.

Let us take one more equation: $3x - 2 = 2x + 1$
 L.H.S. ↗ ↖ R.H.S.

Value of x	L.H.S.	R.H.S.	Result
0	$3 \times 0 - 2 = -2$	$2 \times 0 + 1 = 1$	Not equal
1	$3 \times 1 - 2 = 3 - 2 = 1$	$2 \times 1 + 1 = 2 + 1 = 3$	Not equal
2	$3 \times 2 - 2 = 6 - 2 = 4$	$2 \times 2 + 1 = 4 + 1 = 5$	Not equal
3	$3 \times 3 - 2 = 9 - 2 = 7$	$2 \times 3 + 1 = 6 + 1 = 7$	Equal

The value of the variable in an equation which satisfies the equation is called a solution to the equation. The method we used to find the solution is a trial and error method.

Exercise 12.3

1. State which of the following are equations (with a variable). Identify the variable from the equations with a variable.

- (i) $5x = 0$ (ii) $t - 7 > 5$ (iii) $4 \div 2 = 2$
 (iv) $2x - 1 < 5$ (v) $7 = 14 \times 2 + q$ (vi) $15000 = 2t + 3500$

2. For the equation, $10y = 50$, pick out the solution which satisfies the equation from the values $y = 10$, $y = 8$ and $y = 5$.

3. A possible solution is given with each of the equations given below. Put the value of the variable in the equation and show that the value satisfy / do not satisfy the equation.

- (i) $3x - 7 = 5$ $x = 5$ (ii) $3p + 2 = 8$ $p = 2$

4. Complete the table and by inspection of the table find the solution to the equation :

- (i) $3x = 15$

x	0	1	2	3	4	5	6	7
$3x$	0	3						

- (ii) $\frac{p}{3} = 4$

P	1	2	3	4	5	6	7	8	9	10	11	12
$\frac{P}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{3}{3}$									

(iii) $x - 3 = 5$

x	1	2	3	4	5	6	7	8	9	10	11
$x - 3$	-2	-1	0								

we learnt

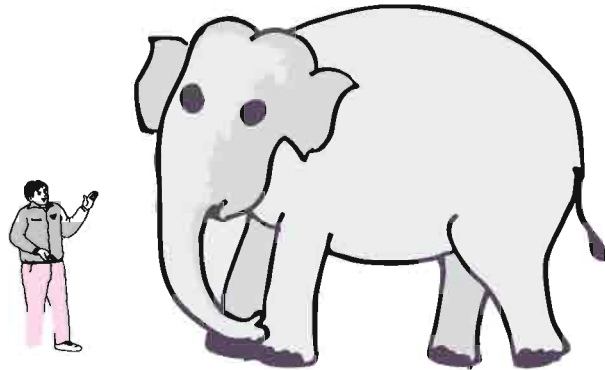
1. We learnt making patterns using matchsticks. We learnt how to write the general relation between the number of matchsticks required for repeating a given shape.
2. A variable takes on different values, its value is not fixed. For example, the radius of a circle can have any value. It is a variable. But the sum of the interior angles of a quadrilateral has a fixed value. It is not a variable.
3. We may use any letter x, y, z, p, q etc. to show a variable.
4. Using different operations we formed expressions with variables and constants like:
 $x + 4, x - 3, 3p, 4q$, etc.
5. Variables allow us to express many common rules in both algebra and arithmetic in a general way. For example, The commutative law of addition and the commutative law of multiplication can be expressed as
 $a + b = b + a$ and $a \times b = b \times a$ respectively.
6. An equation is a condition on a variable. It is expressed by saying that an expression with a variable is equal to a fixed number, e.g. $x + 4 = 8$.
7. We learnt trial and error method to get the solution of an equation. In this method, we give some value to the variable and check whether it satisfies the equation. We go on giving this way different values to the variable, until we find the right value which satisfies the equation.

13.1 Daljeet and Kanha are two cattle keepers. They own 50 cows and 200 cows respectively. If we compare the number of cows owned by them, we find Kanha has $200 - 50 = 150$ cows more than Daljeet. This is one way of comparison by the taking difference. Similarly, in our daily life, many a times we compare two quantities of the same type.

We know that weight of an adult elephant is generally in between 2000kgs to 5000kgs. Where as weight of an adult human is generally in between 50kgs to 100kgs.

In the given picture, weights of the elephant and the man are 2550kgs and 75kgs respectively. Now, let's compare the weights of the elephant and the man by the taking difference.

$$2550\text{kgs} - 75\text{kgs} = 2475\text{kgs}.$$



Here, we observe that there is much difference between their weights. In such situations, taking the difference does not express the comparison. The elephant's weight is too much as compared to the human weight. So, let's compare these weights by division.

$$\frac{\text{Elephant's weight}}{\text{Human's weight}} = \frac{2550}{75} = \frac{34}{1}$$

We can say that the elephant's weight is 34 times the human's weight. Thus, in certain situations, comparison by division makes better sense than comparison by taking the difference. The comparison by division is the Ratio. In the next section, we shall learn more about 'Ratios'.

13.2 The Concept of Ratio

Consider the following:

Hakim Khan's weight is 25 kg and his father's weight is 75 kg. How many times Father's weight is of Hakim Khan's weight?

$$\frac{75 \text{ Kg}}{25 \text{ Kg}} = \frac{3}{1}$$

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

Do and Learn

1. Cost of a pen is Rs 10 and cost of a pencil is Rs 2. What will be the ratio of a pen's cost to a pencil's cost?
2. Ravi walks 6 km in an hour while Suraj walks 4 km in an hour. What is the ratio of the distance covered by Ravi to the distance covered by Suraj?

Meena and Shehnaaz have Rs. 15/- and Rs. 30/- respectively.

1. How many times the money owned by Meena is the money owned by Shehnaaz?

$$\frac{\text{Money owned by Meena}}{\text{Money owned by Shehnaaz}} = \frac{15}{30} = \frac{1}{2} = \text{Half}$$

Or 1 : 2

Hence, Meena owns half the money as Shehnaaz.

2. How many times the money owned by Shehnaaz is the money owned by Meena?

$$\frac{\text{Money owned by Shehnaaz}}{\text{Money owned by Meena}} = \frac{30}{15} = \frac{2}{1} = \text{Twice}$$

Or 2 : 1

Hence, Shehnaaz owns twice the money as Meena.

Observe that the two ratios 1 : 2 and 2 : 1 are different from each other. Thus, the order in which quantities are taken to express their ratio is important. Read the table carefully and fill in the blanks:

1 st quantity	2 nd quantity	How many times 2 nd quantity is to 1 st quantity?	Ratio	How many times 1 st quantity is to 2 nd quantity?	Ratio
2 apples	6 apples	Three times	3 : 1	One third	1 : 3
500 gms Jaggery	1000gms Jaggery	.....	.....	.....	.....
T Shirt Rs.200/-	Jacket Rs.1000/-	.....	.....	.....	.....

Hamid has 5 goats and Kaalu has 8 bicycles. Can we express these quantities in ratio? Think about it.

Goats and bicycles are not of same category. Therefore we can't establish any relation between them. Goats and bicycles can't be compared to each other as they belong to different categories.



For establishing a relation or comparison by ratio, the two quantities must be of the same category and in the same unit. If they are not, they should be expressed in the same unit before the ratio is taken.



Example 1 Saurabh takes 15 minutes to reach school from his house and Sachin takes one hour to reach school from his house. Find the ratio of the time taken by Saurabh to the time taken by Sachin.

Solution Since the time taken by Saurabh and Sachin are given in different units, we first need to convert them into same unit.

Time taken by Saurabh = 15 minutes

Time taken by Sachin = 1 hour = 60 minutes

Hence, required ration is

$$15 \text{ minutes} : 60 \text{ minutes} = \frac{15}{60} = \frac{3}{12} = \frac{1}{4}$$

So, the ratio of time taken by Saurabh and Sachin is 1 : 4.

Example 2 Out of 45 students in 6th class, 25 are girls and remaining are boys.

- (a) What is the ratio of number of girls to the number of boys?
 (b) What is the ratio of number of boys to the number of girls?

Solution

Number of girls = 25

Number of boys = 45 - 25 = 20

(a) Ratio of number of girls to the number of boys = 25 : 20 = 5 : 4

(b) Ratio of number of boys to the number of girls = 20 : 25 = 4 : 5

Observe that the two ratios 5 : 4 and 4 : 5 are different from each other.

Do and Learn

The numbers of vehicles passing on the road between 9am to 10am are recorded in the table below.

Vehicle Type	Number of vehicles
Two wheeler	24
Car	60
Truck	40

- What is the ratio of number of two wheelers to the number of cars?
- What is the ratio of number of total vehicles to the number of trucks?
- Weight of a car is 3300 pounds and weight of abicycle is 22 pounds.
What is the ratio of the weight of bicycle to the weight of car?

13.2.1 Ratio in different situations

Rahul and Khushi started a business and invested money in the ratio 4 : 5. After one year the total profit was Rs 54,000.

Rahul said “we will divide it equally”, Khushi said “I should get more as I have invested more”. It was then decided that profit will be divided in the ratio of their investment.

Here, the two terms of the ratio 4 : 5 are 4 and 5. Sum of these terms = $4 + 5 = 9$

What does this mean?

This means if the profit is Rs 9 then Rahul should get Rs 4 and Khushi should get Rs 5.

Or, we can say that Rahul gets 4 parts and Khushi gets 5 parts out of the 9 parts, i.e., Rahul should get $\frac{4}{9}$ of the total profit and Khushi should get $\frac{5}{9}$ of the total profit.

If the total profit were Rs 54,000, could you find the share of each?

Here, total profit is Rs 54,000 which is divided into 9 parts = $\frac{54000}{9}$

$$\text{Rahul's share} = \frac{54000}{9} \times 4 = \text{Rs } 24000.$$

$$\text{Khushi's share} = \frac{54000}{9} \times 5 = \text{Rs } 30000.$$

Observe that 4 : 5 or $\frac{4}{5}$ and

$$24000 : 30000 \text{ or } \frac{24000}{30000} = \frac{4}{5} \text{ Why?}$$

Example 3 Divide Rs 45 in the ratio 1 : 2 between Riya and Kanchan.

Solution The two parts are 1 and 2.

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

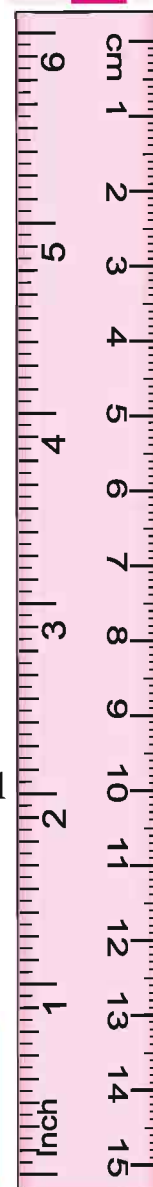
This means if there are Rs 3, Riya will get Re 1 and Kanchan will get Rs 2. Or, we can say that Riya gets 1 part and Kanchan gets 2 parts out of every 3 parts.

$$\text{Therefore, Riya's share} = \frac{1}{3} \times 45 = \text{Rs } 15.$$

$$\text{And Kanchan's share} = \frac{2}{3} \times 45 = \text{Rs } 30.$$

Do and Learn

- (1) Find the ratio of number of doors and the number of windows in your classroom.
- (2) Draw any rectangle and find the ratio of its length to its breadth.



13.2.2 Equivalent ratios:

Consider the following :

1. Length of a room is 30 m and its breadth is 20 m. So, the ratio of length of the room to the breadth of the room = $\frac{30}{20} = \frac{3}{2} = 3 : 2$
2. Length of a board in Gaurav's school is 360 cm and its breadth is 240 cm. So, the ratio of length of the board to the breadth of the board = $\frac{360}{240} = \frac{3}{2} = 3 : 2$

The ratio in both the examples is 3 : 2.

Note the ratios 30 : 20 and 360 : 240 in lowest form are same as 3 : 2.

These are **equivalent ratios** You have read about like fractions in the chapter of fractions.

Can you think of some more examples having the ratio 3 : 2?

Let's understand equivalent ratios with one more example.

Example 4 Give two equivalent ratios of 3 : 2.

Solution:

$$\text{Ratio } 3 : 2 = \frac{3}{2} = \frac{3 \times 2}{2 \times 2} = \frac{6}{4}$$

Therefore, 6 : 4 is an equivalent ratio of 3 : 2

$$\text{Similarly, the ratio } 9 : 6 = \frac{9 \div 3}{6 \div 3} = \frac{3}{2}$$

So, 9 : 6 is another equivalent ratio of 3 : 2.

Therefore, we can get equivalent ratios by multiplying or dividing the numerator and denominator by the same number.

Example 5 Fill in the missing numbers:

$$\frac{12}{18} = \frac{\square}{3} = \frac{6}{\square}$$

Solution In order to get the first missing number, we consider the fact that $18 = 3 \times 6$. i.e. when we divide 18 by 6 we get 3. This indicates that to get the missing number of second ratio, 12 must also be divided by 6.

When we divide, we have, $12 \div 6 = 2$

Hence, the second ratio is $\frac{2}{3}$.

Similarly, to get third ratio we multiply both terms of second ratio by 3. (Why?)

Hence, the third ratio is $\frac{6}{9}$.

Therefore, $\frac{12}{18} = \frac{2}{3} = \frac{6}{9}$ [These are all equivalent ratios.]



Do and Learn.

- The length and diameter of a straw are 12cm and 6 mm respectively. What is the ratio of its diameter to its length?
- Anand takes 25 minutes to reach school from his house and Anshul takes one hour to reach school from his house. Find the ratio of the time taken by Anand to the time taken by Anshul.

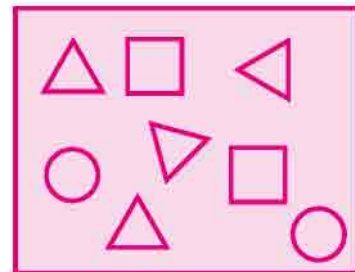
Exercise 13.1

- A social awareness camp was organized in the summer vacations this year. 25 girls and 15 boys participated in the camp and put water bowl for birds.
 - What is the ratio of number of girls to the number of boys?
 - What is the ratio of number of girls to the number of participants?
- During a Tree Plantation programme in a school, students of 6th class planted 8 Neem trees, 13 mango trees and 19 Guava trees.
 - What is the ratio of number of Neem trees planted to the number of Mango trees planted?
 - What is the ratio of total number of trees planted to the number of Neem trees planted?
- See the figure and find the ratio of.
 - Number of triangles to the number of circles.
 - Number of squares to all the figures.
 - Number of triangles to all the figures.
- Fill in the following blanks:

$$\frac{15}{21} = \frac{5}{\square} = \frac{\square}{14} = \frac{25}{\square}$$
- Find the ratio of the following :

(i) 25 to 150	(ii) 72 to 36
(iii) 55kms to 121kms	(iv) 35 minutes to 55 minutes
- Find the ratio of the following :

(i) 60 paisa and 3 Rupees	(ii) 800gms and 5kgs
(iii) 15 minutes and 1 hour	(iv) 1 liter and 750ml



7. During a year, a cowshed had received donations worth Rs.3,25,000 out of which Rs.3,00,000 were spent on the welfare of the cows. Find the ratio of donations received to the expenditure incurred.
8. Mahesh studies 4 hours daily and Laxmi studies 180 minutes daily. Find the ratio of study time of Mahesh to study time of Laxmi. (1 hour = 60 minutes)
9. Out of 720 students in a school, 360 students stay at a hostel. Find the ratio of number of students staying at the hostel to the total number of students.
10. Talisma and Gurumit started a business and invested money in the ratio 2 : 5. After one year the total profit was Rs 35,000. Find the shares of profit for Talisma and Gurumit.
11. Consider the statement: Ratio of breadth and length of a hall is 3 : 4. Complete the following table that shows some possible breadths and lengths of the hall.

Breadth of the hall (in meters)	6	.....	24	.....
Length of the hall (in meters)	8	16	.....	.....

12. Present age of father is 45 years and that of his son is 15 years. Find the ratio of
 - (a) Present age of father to the present age of son.
 - (b) Age of the father to the age of son, when son was 10 years old.
 - (c) Age of father after 5 years to the age of son after 5 years.
 - (d) Age of father to the age of son when father will be 60 years old.

13.3 Proportion

Two friends Dinky and Priti went to market to purchase hair clips. They purchased 20 hair clips for Rs 30. Dinky gave Rs 18 and Priti gave Rs 12. After they came back home, Priti asked Dinky to give 10 hair clips to her. But Dinky said, "since I have given more money so I should get more clips. You should get 8 hair clips and I should get 12".

Can you tell who is correct, Dinky or Priti? Why?

Ratio of money given by Dinky to the money given by Priti = Rs 18 : Rs 12 = 3 : 2

According to Priti's suggestion, the ratio of the number of hair clips for Dinky to the number of hair clips for Priti = 10 : 10 = 1 : 1

According to Dinky's suggestion, the ratio of the number of hair clips for Dinky to the number of hair clips for Priti = 12 : 8 = 3 : 2

Now, notice that according to Priti's distribution, ratio of hair clips and the ratio of money given by them is not the same.

But according to the Dinky's distribution the two ratios are the same. Hence, we can say that Dinky's distribution is correct.

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

$$18 : 12 :: 12 : 8 \text{ or } 18 : 12 = 12 : 8$$

Meaning of Ratios in Proportion:

Consider the following examples:

1. Divakar purchased 3 pens for Rs 15 and Anu purchased 10 pens for Rs 50. Whose pens are more expensive?

Ratio of number of pens purchased by Divakar to the number of pens purchased by Anu = $3 : 10$. Ratio of their costs = $15 : 50 = 3 : 10$

Both the ratios $3 : 10$ and $15 : 50$ are equal, i.e., $15 : 50 = 3 : 10$

Therefore, the pens were purchased for the same price by both.

2. A man travels 35 km in 2 hours. Another man travels 70 km in 4 hours. Is the speed of first man is in proportion with the speed of second man?

The ratio of distances travelled by both = $35 : 70 = 1 : 2$

The ratio of time taken by both = $2 : 4 = 1 : 2$

Both ratios are equal.

i.e., $35 : 70 :: 2 : 4$

Or $35 : 70 = 2 : 4$

It is read as 35 is to 70 as 2 is to 4. And, we can say that the four numbers 35, 70, 2 and 4 are in proportion.

Let us consider another example.

3. Cost of 3 kg of apples is Rs 360 and 15 kg of watermelons cost Rs 90. Now, ratio of the weight of apples to the weight of watermelon is $3 : 15 = 1 : 5$. And ratio of the cost of apples to the cost of the watermelon is $360 : 90 = 4 : 1$. Here, the two ratios $3 : 15$ and $360 : 90$ are not equal, i.e. $3 : 15 \neq 360 : 90$. Therefore, the four quantities 3, 15, 360 and 90 are not in proportion.

Do and Learn.

Determine if the following are in proportion.

(i) $3 : 5$ and $1 : 15$

(ii) $4 : 12$ and $9 : 27$

(iii) Rs 10 is to Rs 15 and 4 is to 6

Example 6 Are the ratios $30 \text{ cm} : 36 \text{ cm}$ and $10 \text{ m} : 12 \text{ m}$ in proportion?

Solution

$$30 \text{ cm} : 36 \text{ cm} = 5 : 6$$

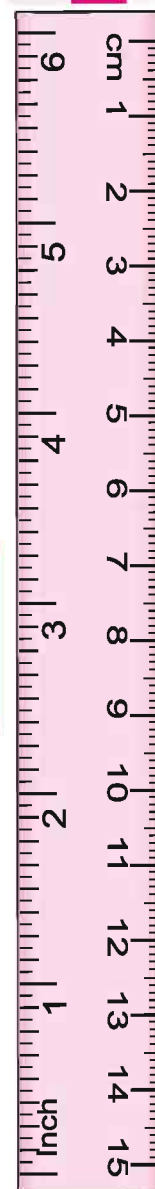
$$10 \text{ m} : 12 \text{ m} = 5 : 6$$

$$\text{So, } 30 : 36 = 10 : 12$$

Hence, the ratios $30 \text{ cm} : 36 \text{ cm}$ and $10 \text{ m} : 12 \text{ m}$ in proportion.

$$\text{i.e., } 30 : 36 :: 10 : 12$$

In a statement of proportion, the four quantities involved when taken in order are known as respective terms. First and fourth terms are known as **extreme terms**. Second and third terms are known as **middle terms**. In the above example, 30 and 12 are the extreme terms. 36 and 10 are the middle terms.



$$\begin{array}{c}
 \text{Extreme Terms} \\
 \downarrow \quad \downarrow \\
 30:36::10:12 \\
 \uparrow \quad \uparrow \\
 \text{Middle Terms}
 \end{array}$$

$$\begin{aligned}
 30 \times 12 &= 36 \times 10 \text{ i.e.,} \\
 360 &= 360.
 \end{aligned}$$

Therefore, the four quantities 30, 36, 10 and 12 are in proportion.

If any four quantities are in proportion, then product of extreme terms = product of middle terms

Example 7 Do the ratios 15 cm to 3 m and 10 sec to 2 minutes form a proportion?

Solution

$$\begin{aligned}
 \text{Ratio of 15 cm to 3 m} \\
 &= 15 : 3 \times 100 \text{ (1 m = 100 cm)} \\
 &= 1 : 20
 \end{aligned}$$

$$\begin{aligned}
 \text{Ratio of 10 sec to 2 min} \\
 &= 10 : 2 \times 60 \text{ (1 min = 60 sec)} \\
 &= 1 : 12
 \end{aligned}$$

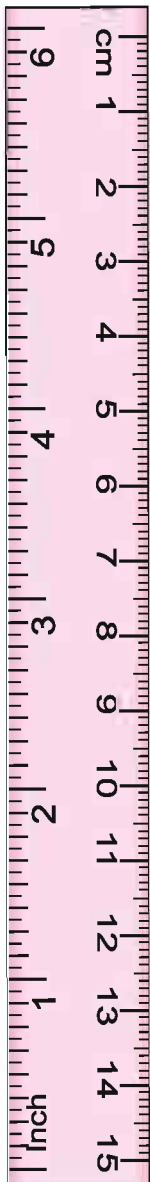
Since, $1 : 20 \neq 1 : 12$, therefore, the given ratios do not form a proportion.

Exercise 13.2

1. Determine if the following are in proportion.

(i) 8, 6, 48, 36	(ii) 12, 18, 20, 30
(iii) 14, 20, 26, 32	(iv) 26, 65, 32, 60
2. Write True (T) or False (F) against each of the following statements :

(i) $20 : 60 :: 15 : 45$	(ii) $20 : 22 :: 32 : 42$
(iii) $0.9 : 0.36 :: 10 : 4$	(iv) $5.2 : 26 :: 1.8 : 0.9$
3. Are the following statements true?
 - (i) $30 \text{ sec} : 1 \text{ min} :: 16 \text{ m} : 32 \text{ m}$
 - (ii) $2.5 \text{ litres} : 5 \text{ litres} :: 25 \text{ m} : 50 \text{ m}$
 - (iii) $\text{Rs } 44 : \text{Rs } 20 :: 66 \text{ litres} : 30 \text{ litres}$
 - (iv) $12 \text{ m} : 15 \text{ m} :: 48 \text{ kg} : 64 \text{ kg}$



4. Determine if the following ratios form a proportion. Also, write the middle terms and extreme terms where the ratios form a proportion.
- 200 cm : 2.5 m and Rs 40 : Rs 5
 - 1 kg : 250 g and Rs 40 : Rs 10
 - 4 kg : 16 kg and 20 g : 400 g
 - 39 persons : 65 persons and 9 litres : 15 litres

13.4 Unitary Method

Two friends Neelam and Punam went to market to purchase vegetables. Neelam purchased 2 kg potatoes for Rs 30. What is the price of 1 kg potatoes? Consider one more situation. Mohan travels 40 km in 4 hours. With the same speed how much distance would he be able to travel 5 hours?

These are examples of the kind of situations that we face in our daily life. How would you solve these?

Reconsider the first example:

Cost of 2 kg potatoes = Rs 30

Therefore, Cost of 1 kg potatoes = $\frac{30}{2} = \text{Rs } 15$

Now, if you were asked to find cost of 5 kg potatoes.

It would be = Rs $15 \times 5 = \text{Rs } 75$

Reconsider the second example:

Now, we want to know the distance travelled by Mohan in 1 hour.

Since, the distance travelled in 4 hours = 40 km

Therefore, the distance travelled in 1 hour = $\frac{40}{4} \text{ km} = 10 \text{ km}$

Therefore, the distance travelled in 5 hours = $10 \times 5 \text{ km} = 50 \text{ km}$

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



Do and Learn: ◆

Read the table and fill in the boxes.

Number of Books	Price paid by Reshma	Price paid by Seema
2 Books	Rs 50	Rs 70
1 Book	Rs 25	.....
5 books	.....	.....



Example 8 If the cost of a garland is Rs 7, what will be the cost of 8 such garlands?

Solution Since the cost of 1 garland = Rs. 7
Therefore, cost of 8 garlands = Rs. $7 \times 8 = \text{Rs } 56$

Example 9 A car travels 60 km in 3 litres of petrol. How much distance will it cover in 1 litre of petrol?

Solution Since the distance travelled in 3 litres of petrol = 60 km
Therefore, the distance travelled in 1 litre of petrol = $\frac{60}{3} \text{ km} = 20 \text{ km}$

Example 10 If the cost of a dozen soaps is Rs 174, what will be the cost of 8 such soaps?

Solution We know that 1 dozen = 12
Since, cost of 12 soaps = Rs 174
Therefore, cost of 1 soap = Rs $\frac{174}{12} = \text{Rs } 14.50$
Therefore, cost of 8 soaps = Rs $14.50 \times 8 = \text{Rs } 116$
Thus, cost of 8 such soaps is Rs 116.

Example 11 Cost of 10 scout badges is Rs 50. What will be the cost of 32 such scout badges?

Solution Since, Cost of 10 scout badges = Rs 50
Therefore, cost of 1 scout badge = Rs $\frac{50}{10} = \text{Rs } 5$
Therefore, cost of 32 scout badges = Rs $5 \times 32 = \text{Rs } 160$
Thus, cost of 32 scout badges is Rs 160.

Example 12 If the cost of 2.5 litres of milk is Rs 100.

- (i) What quantity of milk can be purchased in Rs 10?
- (ii) What will be the cost of 2 litres of milk?

Solution (i) In this case, quantity of milk is unknown and cost is known.
Therefore, we proceed as follows:

Since, quantity of milk which can be purchased in Rs 100 = 2500 ml

Therefore, quantity of milk which can be purchased in Rs 1 = $\frac{2500}{100} \text{ ml}$

Therefore, quantity of milk which can be purchased in Rs 10 = $\frac{2500}{100} \text{ ml} \times \text{Rs } 10$
= 250 ml

(ii) In this case, cost of milk is unknown and quantity is known. Therefore, we proceed as follows:

Since, cost of 2.5 litres of milk = Rs 100

Therefore, cost of 1 litre of milk = Rs $\frac{100}{2.5} = \text{Rs } 40$

Therefore, cost of 2 litres of milk = Rs $40 \times 2 = \text{Rs } 80$.



If the cost of one object is given, we can find out the cost of many objects by multiplying the cost of one object with the number of objects. If the cost of several objects are given, we can find out the cost of one object by dividing the cost of several objects by the number of objects.



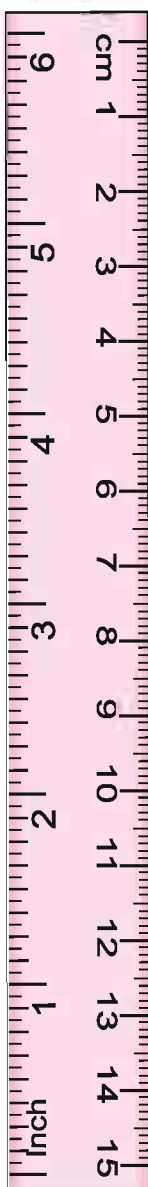
Exercise 13.3

1. If the cost of 1 quintal of sugar is Rs 2700, find the cost of 1 kg of sugar.
2. The bus fare for 200 km is Rs. 150. What will be the fare for 500 km?
3. If the interest on Rs 700 is Rs 168 for a certain amount of time. What will be the interest on Rs 1500 for the same time and same rate of interest?
4. In a day, 6 girls were able to fence 18 plants. Then 15 girls can fence how many plants in a day?
5. 5 persons can save 15 litres of water if they take bath using a bucket instead of shower. Then 25 persons can save how many litres of water?
6. A motorbike travels 120 km in 2 litres of petrol. How many litres of petrol will it require to travel 300 km?
7. A train travels 130 km in 2 hours. How much time is required to cover 520 km with the same speed?
8. Cost of 4 chairs is Rs 900. How many such chairs can be purchased for Rs 33750?
9. Geeta pays Rs 10500 as rent for 3 months. How much does she has to pay for a whole year, (if the rent per month remains same?)
10. Rahim made 48 runs in 8 overs and Kabir made 54 runs in 6 overs. Who made more runs per over?
11. Cost of 3 kg of millet is Rs 49.50.
 - (i) What will be the cost of 7 kg of millet?
 - (ii) What quantity of millet can be purchased in Rs 165?



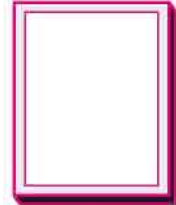
**We Learnt**

1. For comparing quantities of the same type, we commonly use the method of taking difference between the quantities.
2. In many situations, a more meaningful comparison between quantities is made by using division, i.e. by seeing how many times one quantity is to the other quantity. This method is known as comparison by ratio.
3. For comparison by ratio, the two quantities must be in the same unit. If they are not, they should be expressed in the same unit before the ratio is taken.
4. The same ratio may occur in different situations
5. Note that the ratio 3 : 5 is different from 5 : 3. Thus, the order in which quantities are taken to express their ratio is important.
6. A ratio may be treated as a fraction, thus the ratio 1 : 2 may be treated as $\frac{1}{2}$
7. Two ratios are equivalent, if the fractions corresponding to them are equivalent.
8. A ratio can be expressed in its lowest form.
9. Four quantities are said to be in proportion, if the ratio of the first and the second quantities is equal to the ratio of the third and the fourth quantities.
10. The order of terms in the proportion is important. 3, 10, 12 and 40 are in proportion, but 3, 10, 40 and 12 are not.
11. The method in which we first find the value of one unit and then the value of the required number of units is known as the unitary method.



14.1 Consider about following situations.

1. Neeta wants to put a lace border all around a rectangular picture.
2. An athlete is running on a circular track. He starts from a point A, completes one round and reaches back at the starting point A. What is the distance covered by him?
3. A farmer wants to fence his field. What is the total length of wire he must use?



In situations like this, we need to measure the length of the boundary of the closed figures. Perimeter is the measure of a closed figure when you go round the figure once.

In this chapter, we will learn about the concepts of perimeter and area.

14.2 Perimeter

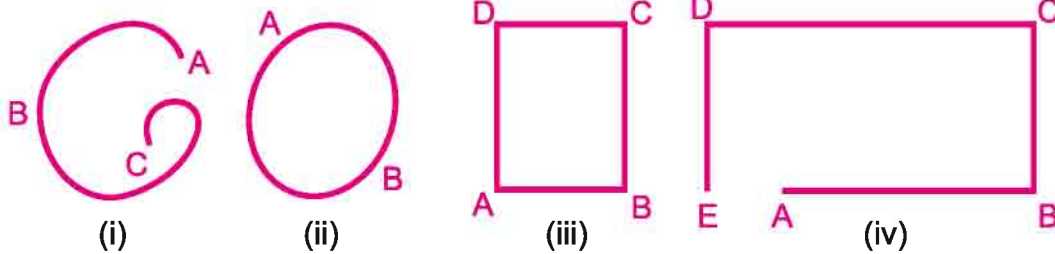


Fig. 14.1

Madhav and Ishan formed some figures as shown in figure 14.1. They observed that figures (i) and (iv) are open figures but figures (ii) and (iii) are closed figures. We can't measure perimeter of open figures. Hence, perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.

We measure perimeter and area only for closed figures. Think why?



14.2.1 Unit of measuring perimeter

Let's try to solve following problems-

1. Measure in centimeters and write the lengths of the four sides of a page of your notebook. Also find the sum of the lengths of the four sides.
2. Rashmi went to a park 120 m long and 80 m wide. She took one complete round on its boundary. What is the distance covered by her?

3. Figure 14.2 is a closed figure made of various line segments. Find the perimeter of the figure by adding the lengths of the line segments.
 $\text{Perimeter} = AB + BC + CD + DE + EF + FG + GH + HI + IJ + JK + KL + LA$
 $= \dots\dots\dots \text{ cm}$

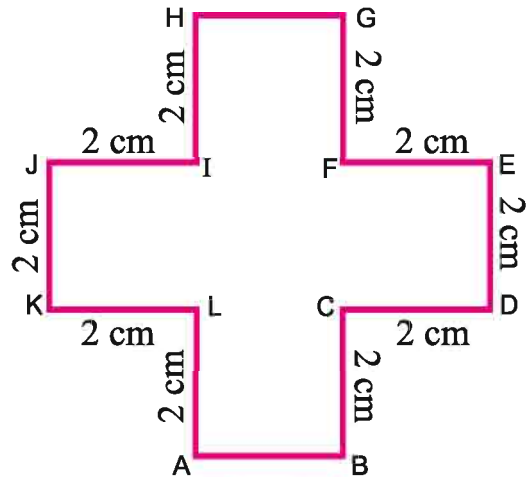


Fig. 14.2

4. Find the perimeter of the figure 14.3.
 $\text{Perimeter} = PQ + QR + RS + ST + TU + UP$
 $= \dots\dots\dots \text{ m}$

Remember that for measuring perimeter, units of measurement for concerned lengths should be same.

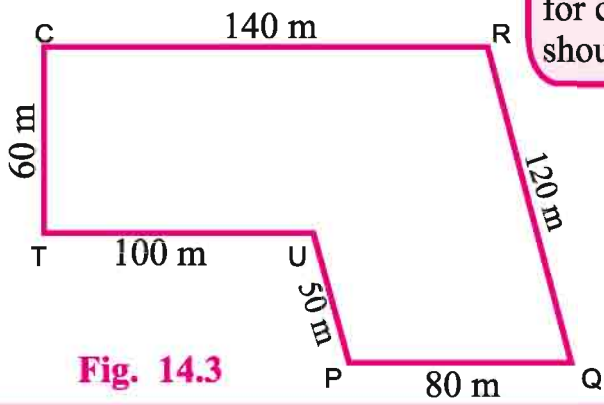
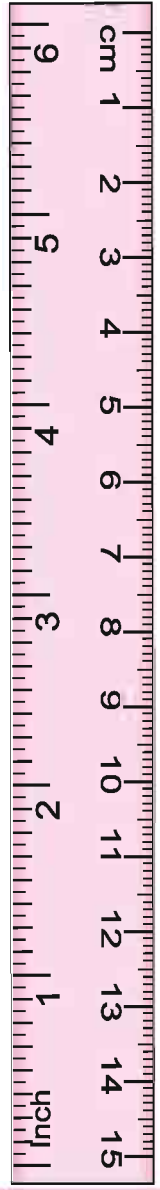


Fig. 14.3



14.2.2 Find the perimeter of the following rectangles. Which rectangle has the greatest perimeter?

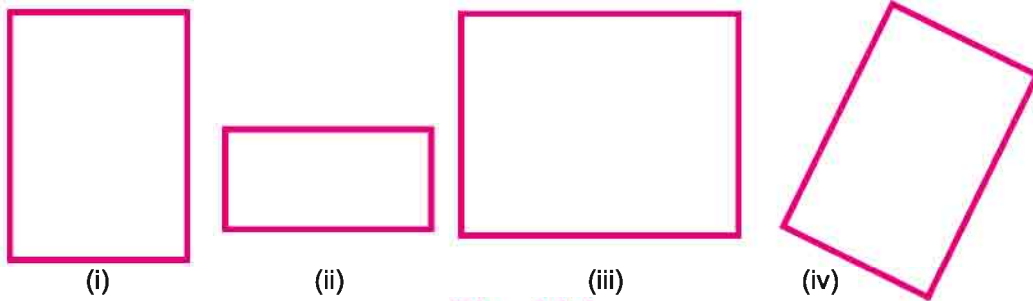


Fig. 14.4

Remember that opposite sides of a rectangle are equal. Perimeter of the rectangle = Sum of the lengths of its four sides = length + breadth + length + breadth

How many times length is added? Two times

How many times breadth is added? Two times

Therefore, Perimeter of the rectangle = Twice of length + Twice of breadth

$$= 2 \times \text{length} + 2 \times \text{breadth}$$

$$= 2 \times (\text{length} + \text{breadth})$$

$$\text{Perimeter of the rectangle} = 2 \times (\text{length} + \text{breadth})$$

Do and Learn: ◆

Find the perimeter of the following rectangles.

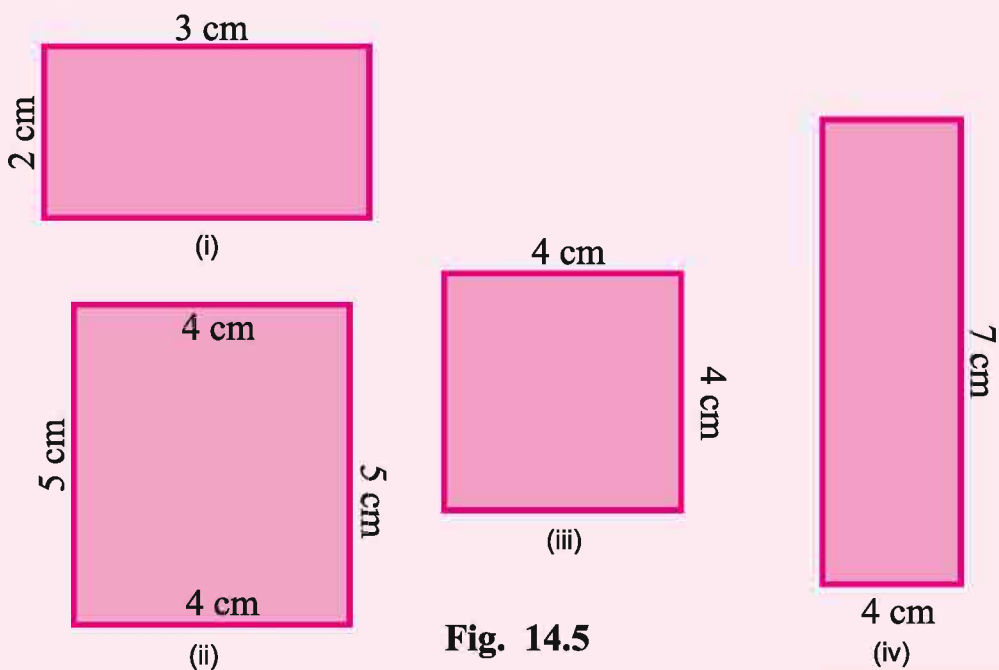


Fig. 14.5



Example 1 Find the perimeter of a rectangular mirror whose length is 25 cm and breadth is 14 cm

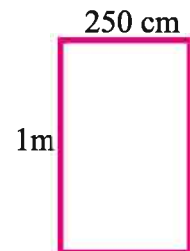
Solution

Length of the rectangular mirror	= 25 cm
Breadth of the rectangular mirror	= 14 cm
Therefore, Perimeter of the rectangle	= $2 \times (\text{length} + \text{breadth})$
	= $2 \times (25 \text{ cm} + 14 \text{ cm})$
	= $2 \times (39 \text{ cm})$
	= 78 cm

Example 2 Find the perimeter of a rectangle whose length and breadth are 250 cm and 1 m respectively.

Solution

Length of the rectangle	= 250 cm
Breadth of the rectangle	= 1 m
	= 100 cm (1 m = 100 cm)
Therefore, Perimeter of the rectangle	= $2 \times (\text{length} + \text{breadth})$
	= $2 \times (250 \text{ cm} + 100 \text{ cm})$
	= $2 \times (350 \text{ cm})$
	= 700 cm = 7 m



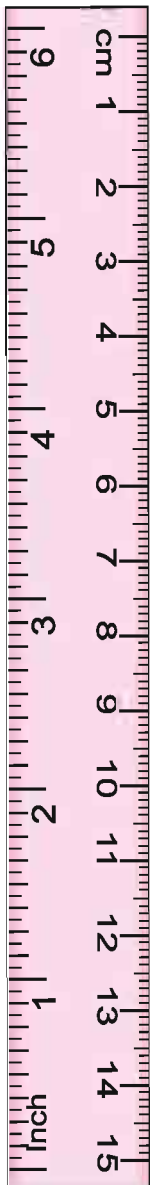
Example 3 A farmer has a rectangular field of length and breadth 415 m and 280 m respectively. He wants to fence it. Find the cost of fencing at the rate of Rs 10 per metre.

Solution

Length of the rectangular field	= 415 m
Breadth of the rectangular field	= 280 m
Therefore, Perimeter of the rectangular field	= $2 \times (\text{length} + \text{breadth})$
	= $2 \times (415 \text{ m} + 280 \text{ m})$
	= $2 \times (695 \text{ m})$
	= 1390 m

Cost of fencing per meter = Rs 10

Therefore, cost of fencing for 1390 m	= Rs 10 \times 1390
	= Rs 13900



14.2.3 Perimeter of Regular Polygons

Madhav and Ishaan are making different polygons with the help of similar straws. Following are a few of the shapes they made:

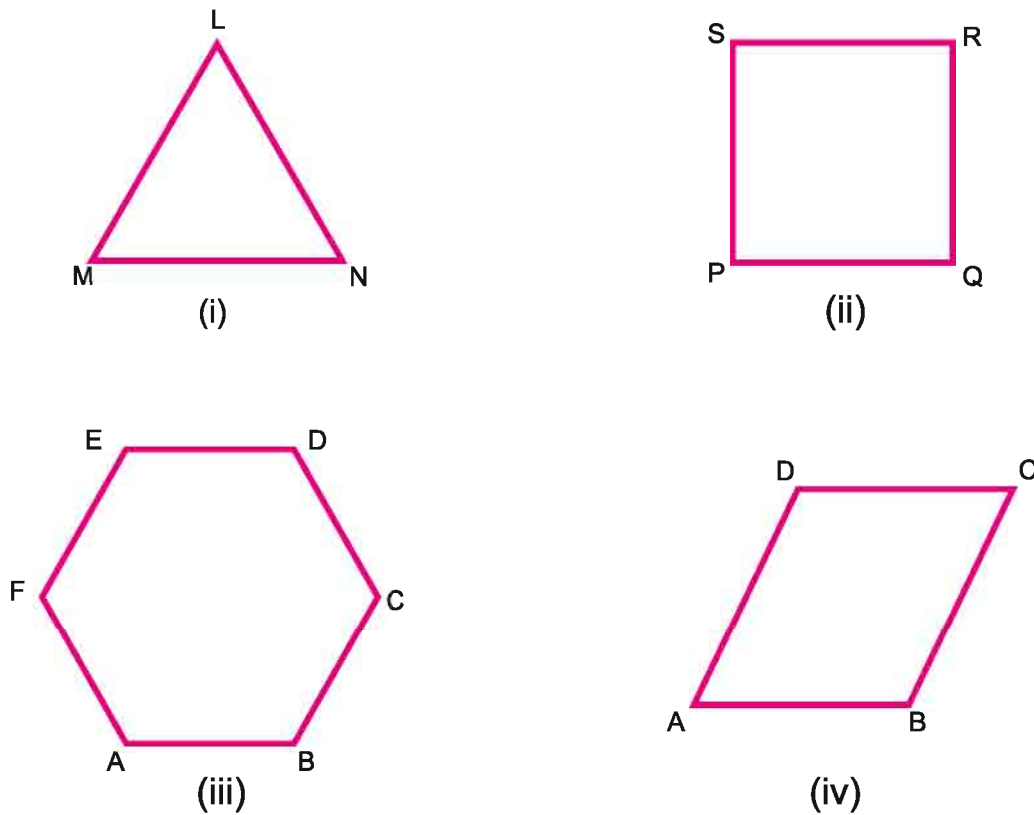


Fig. 14.6

Measure the lengths of the sides of these figures and fill in the table.

S.No. of the figure	Number of sides	Measure of length of one side	Sum of measure of lengths of all the sides	Product of number of sides and measure of length of one side
(i)				
(ii)				
(iii)				
(iv)				

Table 14.1

Observing table 14.1, you will find that in each figure, sum of measure of lengths of all the sides of that figure is equal to the product of number of sides of that figure and measure of length of one side of that figure.

$$\text{Perimeter of a regular polygon} = \text{Number of sides} \times \text{Length of one side}$$

Since a square is also a regular polygon, therefore,

$$\text{Perimeter of a square} = 4 \times \text{length of side}$$

Example 4 Find the distance travelled by Jyoti if she takes two rounds of a square park of side 90 m.

Solution Perimeter of the square park = $4 \times \text{length of side}$
 $= 4 \times 90 \text{ m}$
 $= 360 \text{ m}$

$$\text{Distance travelled by Jyoti in two rounds} = 2 \times 360 \text{ m}$$

$$= 720 \text{ m}$$

Example 5 Find the side of the square whose perimeter is 18 cm.

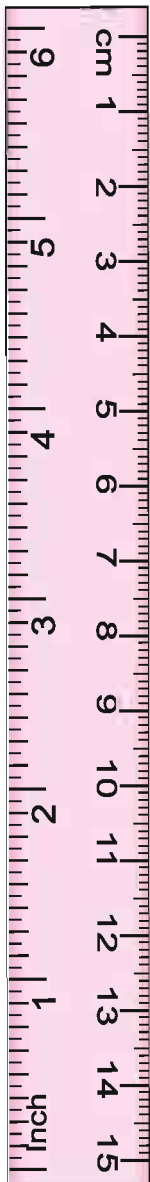
Solution Perimeter of the square = 18 cm
 We know that Perimeter of a square = $4 \times \text{side}$
 Therefore, $18 \text{ cm} = 4 \times \text{side}$
 Hence, $\text{side} = \frac{18}{4}$
 $= 4.5 \text{ cm}$

Example 6 Find the perimeter of an equilateral triangle whose side is 8.5 cm.

Solution All three sides in an equilateral triangle are equal
 So perimeter of triangle = $3 \times \text{side}$
 $= 3 \times 8.5$
 $= 25.5 \text{ cm}$

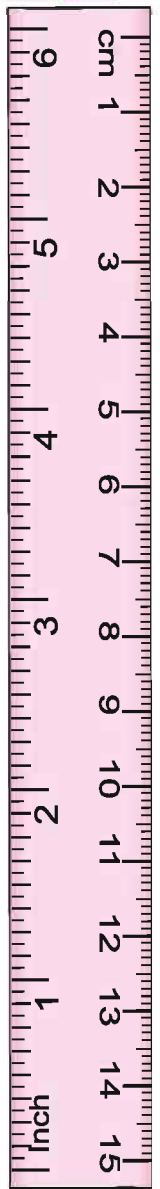
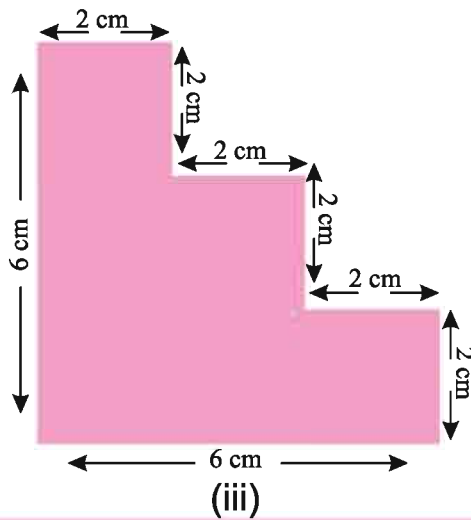
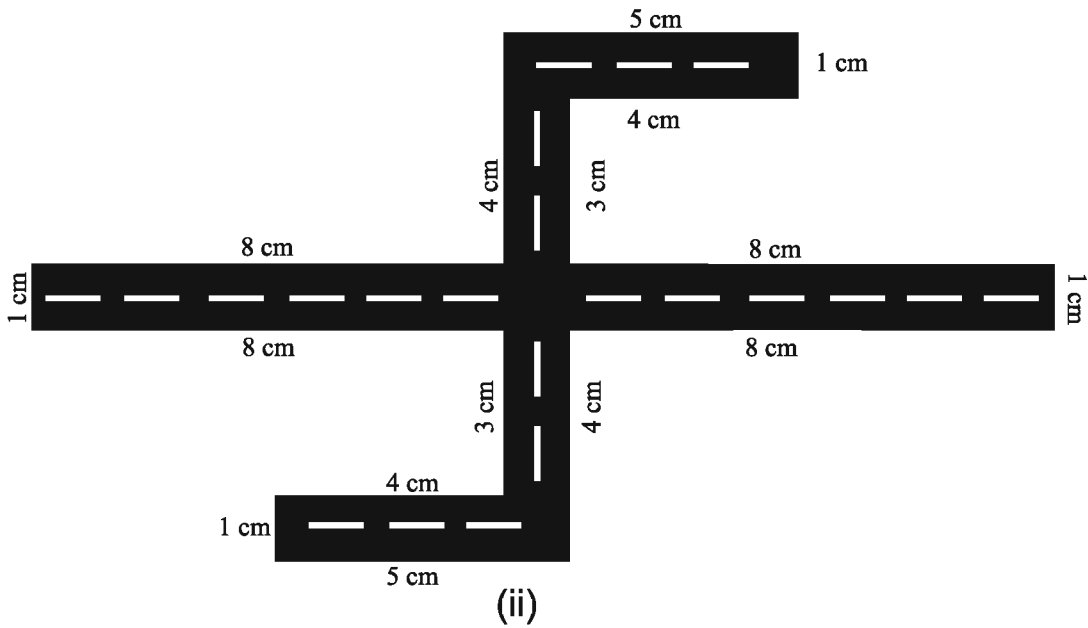
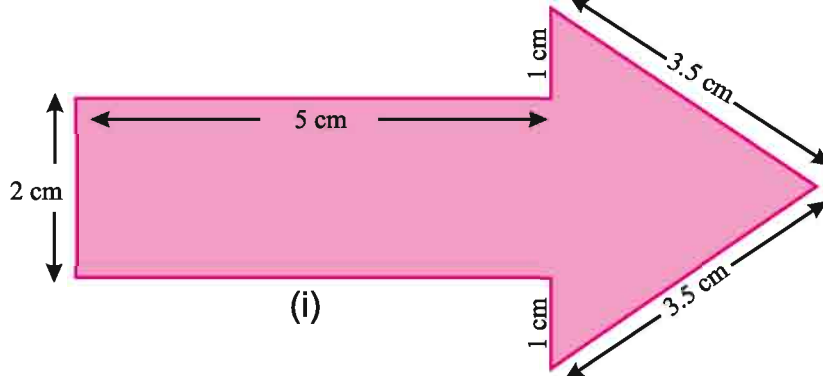
Do and Learn. ◆

1. Find the perimeter of a regular polygon with each side equal to 3.5 cm and number of sides equal to 3.
2. The perimeter of a regular polygon is 28 cm and its each side equal to 7 cm Find the number of sides of the polygon.
3. Find the perimeter of a square with each side equal to 4.5 cm.



Exercise 14.1

1. Find the perimeter of each of the following figures :



2. Find the perimeter of a regular pentagon with each side equal to 4 cm.
3. A piece of string is 36 cm long. What will be the length of each side if the string is used to form :
A piece of string is 36 cm long. What will be the length of each side if the string is used to form :
(i) a square? (ii) an equilateral triangle? (iii) a regular hexagon?
4. Geeta runs around a square field of side 50 m. Puja runs around a rectangular field with length 65 m and breadth 25 m. Who covers less distance?
5. Find the side of the regular pentagon whose perimeter is 30 cm.
6. Madhu has a rectangular field of length and breadth 23.5 m and 15.5 m respectively. He wants to fence his field with steel wire. What is the total length of steel wire he must use?
7. Perimeter of a football ground is 270 m. Find the breadth of the ground if the length of the ground is 90 m.

14.3 Area

Look at the closed figures (Fig 14.7) given below. All of them occupy some space of a flat surface. Can you tell which one occupies more space?

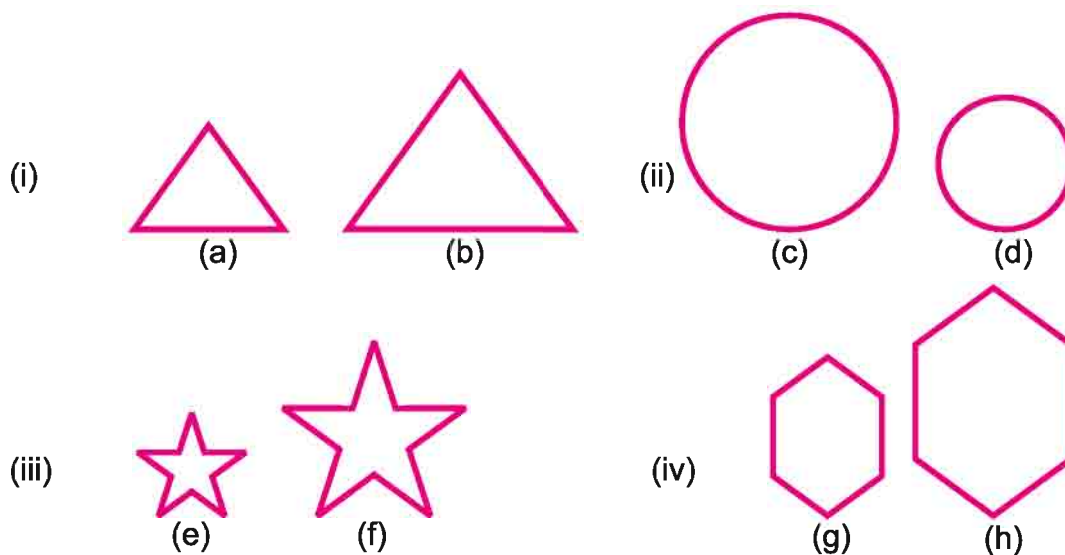


Fig. 14.7

Kusum—Smaller figures occupy less space and larger figures occupy more space.

The amount of surface enclosed by a closed figure is called its area.

Teacher - Now, look at the below figures of Fig 14.8. Which one of these has larger area?

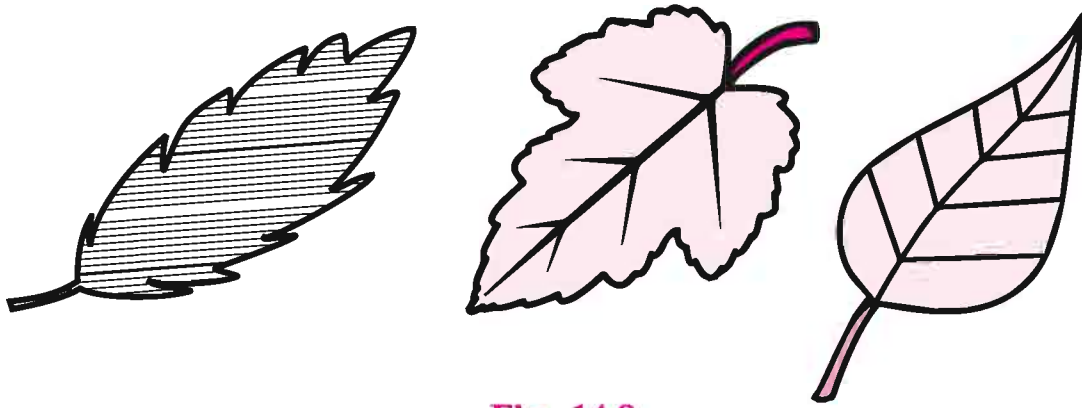


Fig. 14.8

All the students in the class are quiet.

Naresh - It is difficult to tell just by looking at these figures.

Teacher - So, what do we do? Let's try to estimate the area.

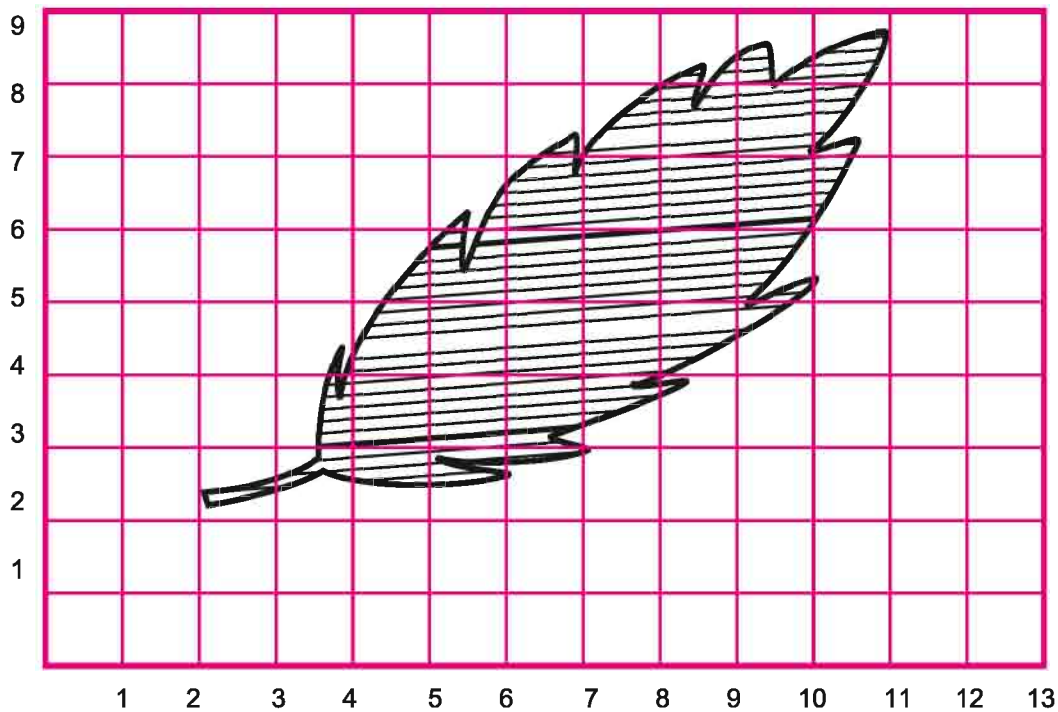
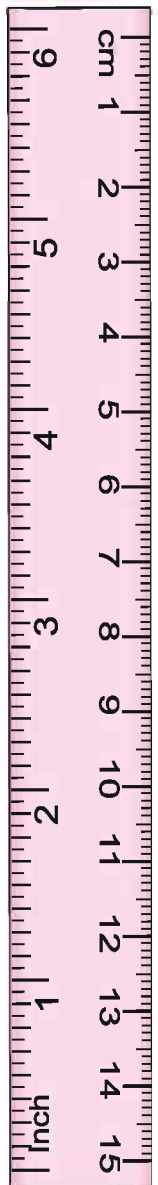


Fig. 14.9



If more than half of a square is enclosed by the figure, just count it as one square. Ignore portions of the figure that are less than half a square. If exactly half the square is enclosed, take its area as $1/2$ sq unit.



Fully-filled squares = 10

More than half-filled squares = 14

Less than half-filled squares = 06

If we ignore 'less than half-filled squares' and count 'more than half-filled squares' just as one square, then, Number of squares enclosed by the figure of the

leaf = $(10 + 14) = 24$ squares

Therefore, Estimated area of the leaf = 24 squares.

Do and Learn. ◆

Put a leaf of a china rose plant and a leaf of a pepal tree on grid papers. Find the estimated areas of both. Compare and tell which leaf has greater area?

14.4 Area of Rectangle

Place any one figure on a squared grid paper or graph paper where every square measures $1 \text{ cm} \times 1 \text{ cm}$ (i.e. 1 sq. unit). Make an outline of the figure. Look at the squares enclosed by the figure. Some of them are completely enclosed, some half, some less than half and some more than half.

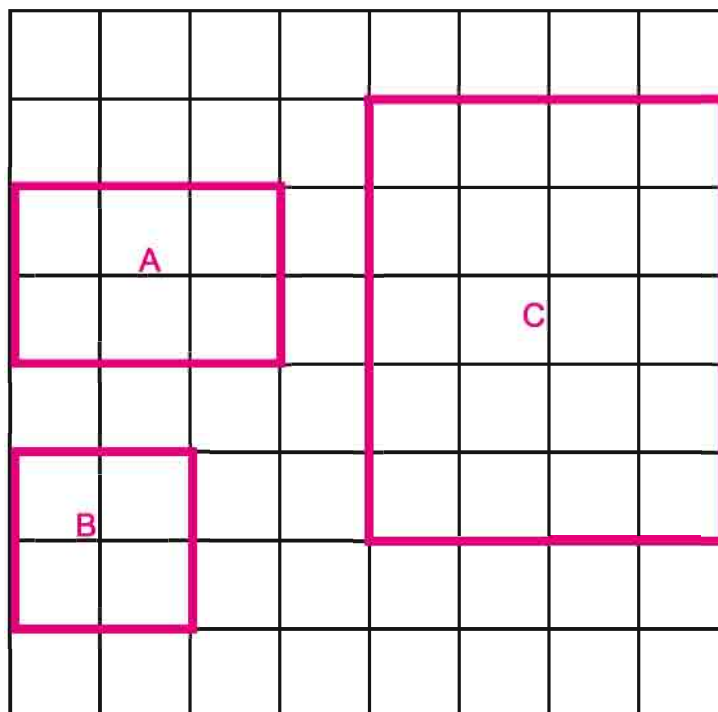
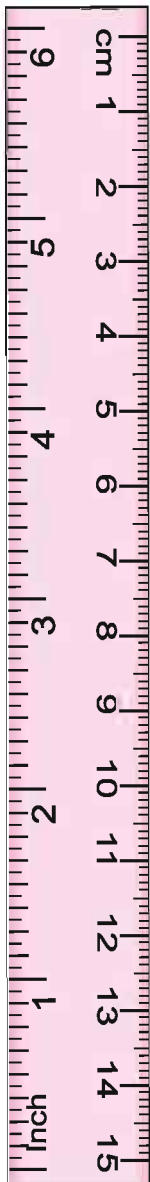


Fig. 14.10



Make some more rectangles on the grid paper and fill in the following table.

Rect-angle	Length	Breadth	Number of squares enclosed by the rectangle	Length \times Breadth
A	..... cm	..... cm	.....	.....
B	..... cm	..... cm	.....	.....
C	..... cm	..... cm	.....	.....
D	..... cm	..... cm	.....	.....

Table 14.2

From the table 14.2, we can infer that for each rectangle, number of squares enclosed by the rectangle is equal to the product of length and breadth of that rectangle.

$$\text{Hence, Area of a rectangle} = \text{Length} \times \text{Breadth}$$

14.5 Area of Square

We know that square is a rectangle whose length and breadth are equal. So, think, what should be the area of a square?

$$\text{Area of the square} = \text{side} \times \text{side}$$

14.6 Unit of Area

To find the area, two similar units are multiplied. Hence, the unit of area is written as square units or sq. units.

For e.g., $\text{cm} \times \text{cm} = \text{sq. cm} (\text{cm}^2)$

$$\text{m} \times \text{m} = \text{sq. m} (\text{m}^2)$$

Example 7 Find the area of the surface of a rectangular mobile phone whose length and breadth are 14 cm and 7 cm respectively.

Solution Length of mobile phone = 14 cm

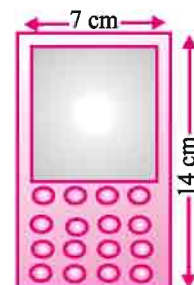
Breadth of mobile phone = 7 cm

Therefore, the area of the surface of the mobile phone

$$= \text{Length} \times \text{Breadth}$$

$$= 14 \text{ cm} \times 7 \text{ cm}$$

$$= 98 \text{ sq. cm}$$



Example 8 Find the area of a square field with each side equal to 15 m.

Solution Length of one side of the square field = 15 m

$$\begin{aligned}\text{Therefore, the area of the square field} &= \text{side} \times \text{side} \\ &= 15 \text{ m} \times 15 \text{ m} \\ &= 225 \text{ sq. m}\end{aligned}$$

Example 9 Area of a rectangular cardboard is 2.50 sq. m. Find the breadth of the cardboard if its length is 2 m.

Solution Area of the rectangular cardboard = 2.50 sq. m.

Length of the cardboard = 2 m

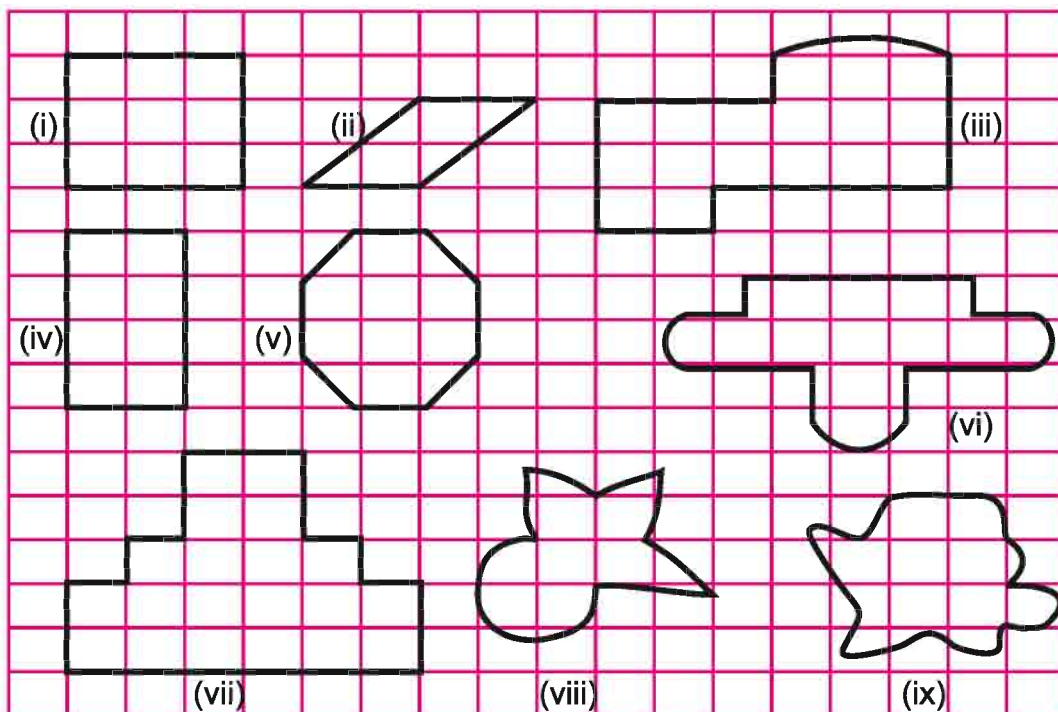
We know that, area of a rectangle = length \times breadth

$$\text{Therefore, breadth of the cardboard} = \frac{\text{Area}}{\text{Length}} = \frac{2.50 \text{ sq. m}}{2 \text{ m}} = 1.25 \text{ m}$$

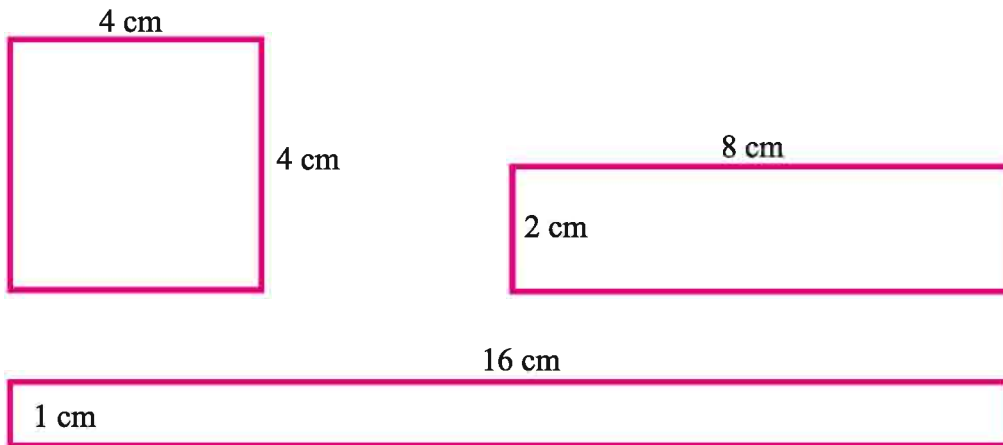
Exercise 14.2

1. By counting squares, estimate the areas of the figures.

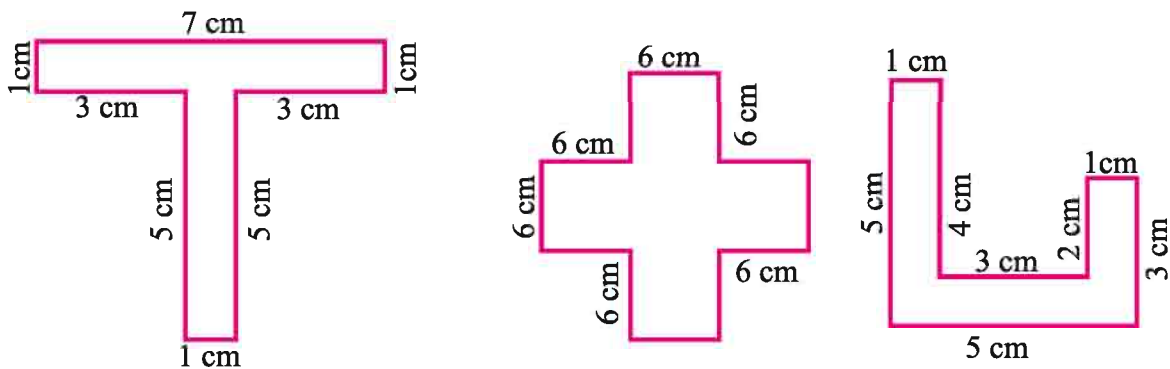
Given: 1 square cell = 1 cm \times 1 cm)



2. Find the areas of the following figures. What do you infer from this?



3. By splitting the following figures into rectangles, find their areas (The measures are given in centimeters).



4. A room is 10 m long and 8 m wide. How many square meters of carpet is required to cover the floor of the room?

5. Find the area of a square frame of side 9 cm.

6. Find the areas of the following rectangles. Which rectangle has least area and which one has greatest area?

(i) $l = 2 \text{ m}$
 $b = 80 \text{ cm}$

(ii) $l = 180 \text{ m}$
 $b = 70 \text{ cm}$

(iii) $l = 200 \text{ cm}$
 $b = 1 \text{ m}$

(iv) $l = 190 \text{ cm}$
 $b = 1 \text{ m}$

7. The area of a rectangular garden 50 m long is 300 sq m. Find the width of the garden.
8. Six square flower beds each of sides 1 m are dug on a piece of land 8 m long and 6 m wide. What is the area of the remaining part of the land?
9. What will be the change in the area of a rectangle if its-
 - (i) Length and breadth are both doubled?
 - (ii) Length is tripled and breadth is doubled twice?
10. What will be the change in the area of a square if its side is
 - (i) Halved?
 - (ii) Doubled?

14.7 Relation between Perimeter and Area of a Rectangle

1. When perimeter is equal:

Take a grid paper with every square measures $1\text{ cm} \times 1\text{ cm}$. Take 22 pieces of thin strings each 1 cm long. Place these strings on the grid paper and make different rectangles each with perimeter equal to 22 cm (as shown in the figure 14.11).

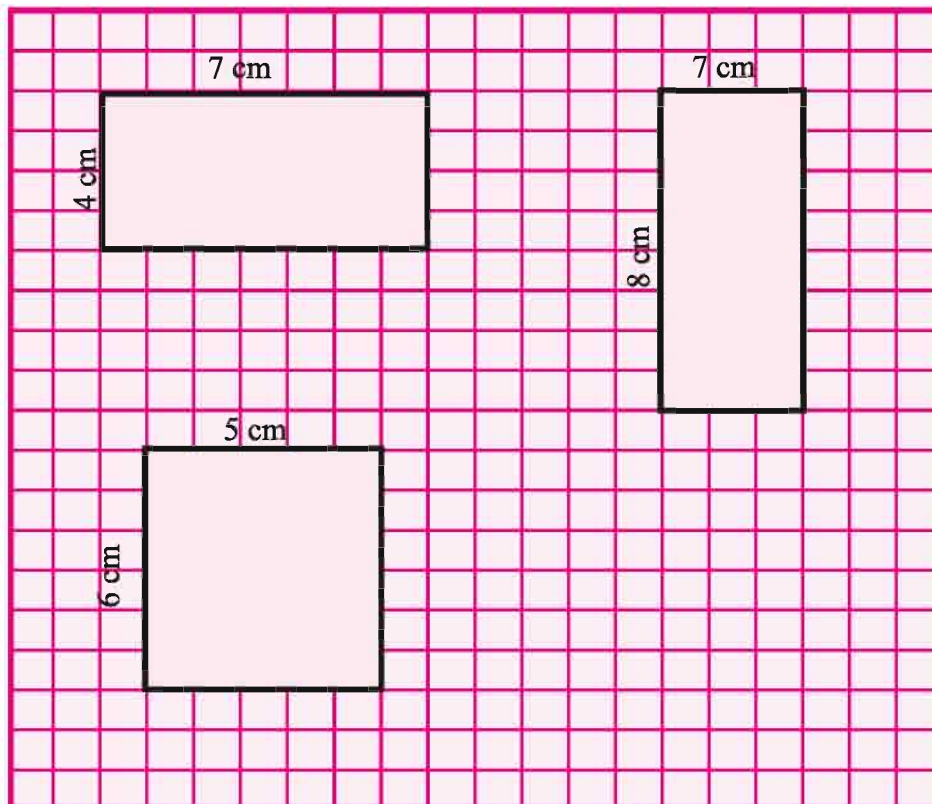


Fig. 14.11

Fill the details in the given table. For each figure, count the number of squares enclosed and fill in the table.

Length	Breadth	Length x Breadth	Area (sq. units)
..... cm	..... cm	.....	.....
..... cm	..... cm	.....	.....
..... cm	..... cm	.....	.....
..... cm	..... cm	.....	.....

Table 14.3

On similar grid papers, make some more rectangles with the same perimeter, and continue filling the above table with the details of those rectangles. What do you infer from Table 14.3?

1. Areas of rectangles with same perimeter may not be always equal.
2. Among the rectangles with same perimeter, the rectangle with smallest difference between its length and breadth, will have greatest area.

2. When area is equal

On a centimeter squared paper, make as many rectangles as you can, such that enclosed area of each rectangle is 24 squares. Fill the details about their length and breadth in a table with format similar to table 14.3. What do you infer from the table?

14.8. Comparison between a square's area and a rectangle's area with same perimeter:

Given below are figures of the plots of Punam and Puja (Figure 14.12). Whose plot has greater area?

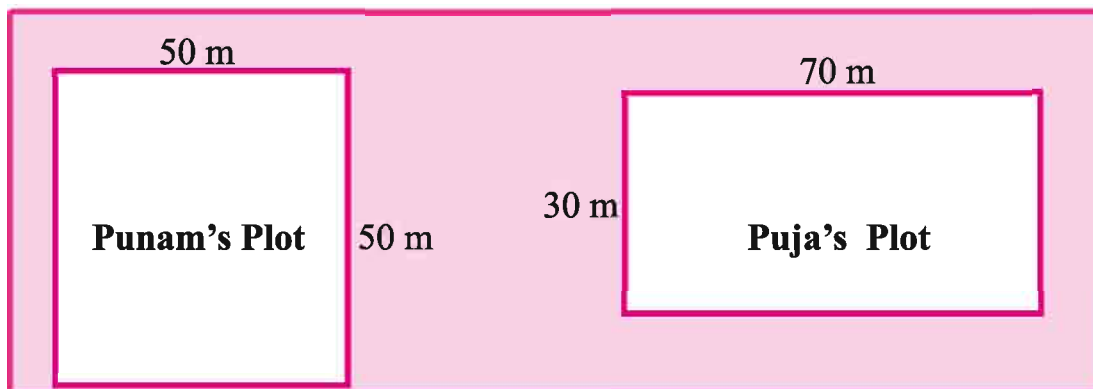


Fig. 14.12

Area of Punam's plot = sq. m

Area of Puja's plot = sq. m

Square and rectangle with same perimeter

Square's area is greater than rectangle's area when the perimeter is the same for both.

14.9 Change in perimeter when shape of the figure is reduced

A square handkerchief of width 20 cm is cut off from a piece of square cloth 80 cm wide. What will be the change in the perimeter of the cloth if-

- (i) The handkerchief is cut off from a corner of the cloth [Fig. 14.13(i)]?
- (ii) the handkerchief is cut off from the middle of a side [Fig. 14.13(ii)]?

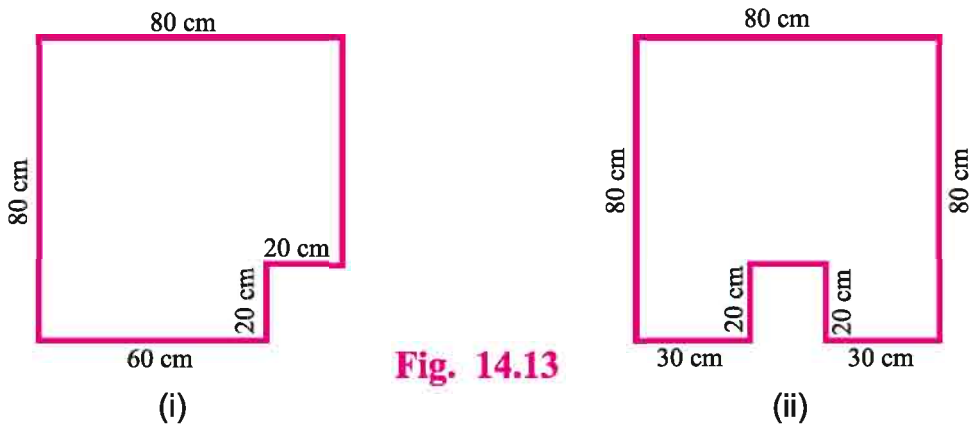


Fig. 14.13

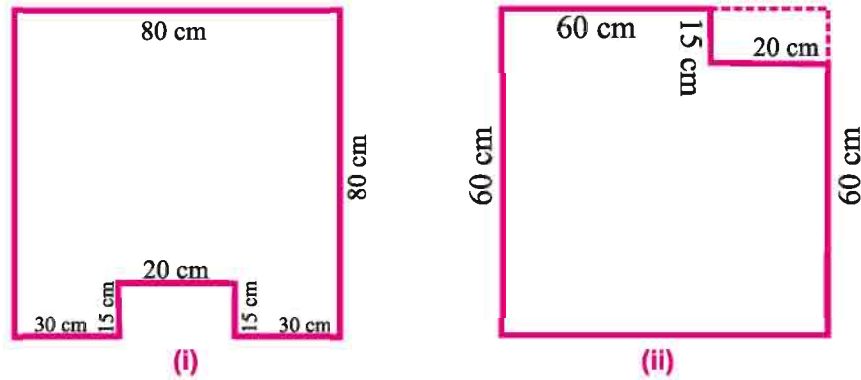
The changes in the perimeter of a figure may not be same when parts with equal area are removed from different places of the shape.

Exercise 14.3

1. Find the areas and perimeters of the following rectangular figures. Which of them have same perimeter but different area?



2. Gopi has a square field of side 75 m. Narayan has a rectangular field of length 85 m. If the perimeters of both the fields are same, whose field has greater area and by how much?
3. Area of a square is 64 sq. cm. Perimeter of a rectangle is equal to the perimeter of this square. Find the length of the rectangle if its breadth is 6.5 cm. Which figure has greater area?
4. A rectangular piece of 20 cm x 15 cm is cut off from a bigger rectangle as shown in the figures below. In each case, find the difference in perimeter before and after the piece is cut off.



5. On a centimeter squared paper, make as many rectangles as you can, such that the area of the rectangle is 64 sq. cm (consider only natural number lengths).
- Which rectangle has the greatest perimeter?
 - Which rectangle has the least perimeter?
 - Find the change in width of rectangle with decreasing perimeter of the rectangle.
6. On a centimeter squared paper, make as many rectangles as you can, such that the perimeter of the rectangle is 16 cm (consider only natural number lengths).
- Which rectangle has the greatest area?
 - Which rectangle has the least area?
 - Find the change in length of rectangle with increasing area of the rectangle.

We Learnt

- Perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.
- Perimeter of a rectangle = $2 \times (\text{length} + \text{breadth})$
 - Perimeter of a square = $4 \times \text{length of its side}$
 - Perimeter of an equilateral triangle = $3 \times \text{length of a side}$
 - Perimeter of a regular polygon = $\text{Number of sides} \times \text{Length of one side}$
- The amount of surface enclosed by a closed figure is called its area.
- To calculate the area of a figure using a squared paper, the following conventions are adopted :
 - Ignore portions of the area that are less than half a square.
 - If more than half a square is in a region. Count it as one square.
 - If exactly half the square is counted, take its area as $\frac{1}{2}$ sq units.
- Area of a rectangle = $\text{length} \times \text{breadth}$
 - Area of a square = $\text{side} \times \text{side}$

Chapter 15

Data Handling

15.1 In your previous class, you have learnt about the basic idea of 'Data'. We studied about tally marks, graphs and pictographs. In this chapter, we will take one more step towards learning how to organize data.

Take a coin and toss it 20 times. List the outcome so obtained (head or tail) in your notebook. Kishan writes down in his notebook:

T T H H T T T H T H H T T H T H H H T T

This data is obtained when Kishan tossed the coin 20 times.

Make a note of ages of your friends in your class.

.....Is it a kind of data?

Janaki's favourite dessert is jalebi. Is it a data too?

No, this is not a data because only Janaki's choice is asked.

If instead, a group's choice would have been asked and recorded, would that be considered as a data?

S.No.	Statements	It is a data / It is not a data
1	Number of students in your class	Not a data
2	Class wise number of students from class VI to XII, who come to school by walking	
3	Number of schools in your town	
4	Number of animals in your neighbourhood	
5	Weight of your family members	
6	Number of brick houses and number of huts in your town	
7	Age of your class teacher	

Classify the following statements whether it is a data or not:

Make some more statements by yourself, and decide whether they are data or not.

(Questions and examples quoted in this chapter are only to create a base for teachers and students. Present some relevant and local situations, statements and questions to make the environment of the classroom lively.)

15.2 Types of data.

Shabnam and Sushil are student's forum's president and prime minister respectively. They required data regarding the number of students present in each class today. Shabnam went to each class of the school to collect the data. Instead, Sushil went to Headmaster's room and collected the data from the records there. Data collected by both of them were similar. Here, Shabnam collected the data by herself. Hence, this is called Primary Data for her. Instead, Sushil collected this information from the records maintained in the Headmaster's room. Hence, this is called Secondary Data for him. Government sends its representatives to each and every home to gather population data. Hence, this data is primary data for the government. But when the same population data is used by other organizations for other purposes, it becomes secondary data for them.

Gather the following data from each teacher of your school:

Name of the teacher:

Post

Educational Qualification:

Subject taught by him/ her:

Teaching Experience:.....

Age:

The data collected by you in this activity, is primary data for you. Can you tabulate this information?

If you collect some information regarding each student of your class through the students' reports section of students' attendance register of your class, then it becomes secondary data for you.

15.3 Organization of data

15.3.1 It was decided to distribute sweets of their own choice among the students on the eve of annual function. Information was gathered from each student about his or her choice of sweet.

Following symbols were used:

Jalebi—J Laddu—L Barfi—B Gulabjamun—G

Following is the choice of sweets of 20 students of Class VI:

G, J, J, L, J, G, B, B, J, L, J, B, B, L, J, B, J, G, G, B

Shashi used the following method to represent data:

J—7 L—3 B—6 G—4



Vikas used the following method to represent data:

Name of the sweet	Number of students who like it
<i>Jalebi</i> – J	✓✓✓✓✓✓✓✓
<i>Laddu</i> – L	✓✓✓
<i>Barfi</i> – B	✓✓✓✓✓✓
<i>Gulabjamun</i> – G	✓✓✓✓

Rohit used the following method to represent data:

Name of the sweet	Tally Marks	Number of students who like it
<i>Jalebi</i> – J	|| || || |	7
<i>Laddu</i> – L	|| |	3
<i>Barfi</i> – B	|| || ||	6
<i>Gulabjamun</i> – G	|| ||	4

Rajul used the following method to represent data:

Name of the sweet	Tally Marks	Number of students who like it
<i>Jalebi</i> – J	|||| ||	7
<i>Laddu</i> – L	|||	3
<i>Barfi</i> – B	|||| |	6
<i>Gulabjamun</i> – G	||||	4

Here, we see four different types of methods and conclude that Rajul's method is most appropriate because it is easier to count the groups of five.

15.3.2 Kareena threw a dice 30 times and noted the number appearing each time as shown below :

3, 6, 5, 4, 4, 3, 6, 5, 3, 6, 2, 3, 1, 6, 4, 1, 3, 6,
1, 1, 2, 4, 4, 3, 3, 4, 2, 1, 2, 1

Kareena wanted to extract following information:

1. The number that appeared the maximum number of times.
2. The number that appeared the minimum number of times.
3. Difference between the number of times odd numbers have appeared and number of times even numbers have appeared.

Kareena prepared the table using tally marks:

Digit of the dice occurred	Tally Marks	Frequency
1	|||| I	6
2	||||	4
3	|||| II	7
4	|||| I	6
5	||	2
6	||||	5

Now, the information can be easily interpreted from the above table. Do similar activities in your classroom.

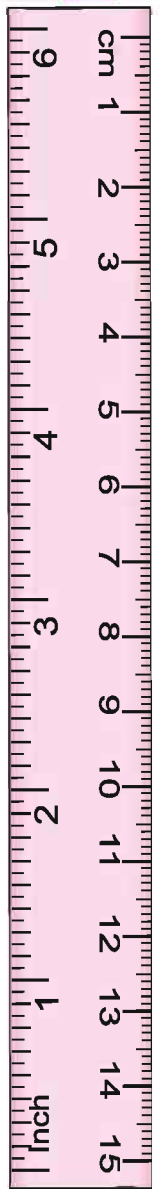
15.4 Pictograph

Students were sitting in five rows in a class.

Row No.	☺ = 1 student
1	☺ ☺ ☺ ☺
2	☺ ☺ ☺ ☺ ☺
3	☺ ☺ ☺
4	☺ ☺ ☺ ☺
5	☺ ☺

- (i) In which row, maximum number of students are sitting?
- (ii) In which row, minimum number of students are sitting?
- (iii) In which rows, equal number of students are sitting?

You can answer these questions by just studying above diagram. The picture visually helps you to understand the data. It is a pictograph. A pictograph represents data through pictures of objects. It helps answer the questions on the data at a glance.



Let's go through more examples:

The following pictograph shows the number of students who like to play different sports in a class of 40 students:

Favourite sport	Number of students who like it. ☺ = 1 student
Kho Kho	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺
Football	☺ ☺ ☺ ☺ ☺
Volleyball	☺ ☺ ☺ ☺ ☺ ☺ ☺
Badminton	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺
Hockey	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺

What can you conclude from the pictograph?

- 8 students like to play kho kho.
- Students' most favourite sport is badminton. 11 students like to play badminton.
- Least number of students like to play football.

The following pictograph shows number of various trees planted in a school. Observe the pictograph carefully and answer the following questions:







Type of tree planted	Number of trees planted 🌴 = 5 trees
Guava	🌴 🌴 🌴 🌴 🌴 🌴
Banana	🌴 🌴 🌴
Papaya	🌴 🌴 🌴 🌴 🌴
Orange	🌴 🌴 🌴 🌴

- Number of Guava trees planted.
- Number of Orange trees planted.
- 15 trees are planted of which fruit?
- What is the difference between number of papaya trees planted and number of banana trees planted?

Do and Learn. ◆

Divide the students into small groups in your class. One by one, each student will create a situation and will prepare a pictograph. Based on the pictograph, the student will ask a few questions and the group members will try to answer those questions.

Following pictograph shows the number of patients admitted in a hospital due to road accidents.

Type of road accident	Number of patients  = 100 patients
Collision between two vehicles	
Tyre burst	
Skidding of two wheelers	
Wrong lane/ way driving	
Crossing the road	

- (i) Which type of road accident resulted in maximum number of patients?
- (ii) Which type of road accident resulted in minimum number of patients?
- (iii) What is the total numbers of patients due to all of the road accidents?

Complete the table given below on the basis of above pictograph:

Type of road accident	Number of patients
Collision between two vehicles	
Tyre burst	More than 100 but less than 200
Skidding of two wheelers	
Wrong lane/ way driving	100
Crossing the road	

Do and Learn. ◆

Gather the information regarding the source of income of 200 persons in your town. Show the data in a pictograph.



Exercise 15.1





























- Identify the primary and secondary data from the following:
 - Numbers of students present from each class during Morning Prayer on a particular day.
 - Numbers of students from each caste gathered from the students' attendance register of class VI.
 - Number of vehicles passing through a road between 9 am to 11 am on a particular day.
 - Listing the distances of Jaipur from major towns of Rajasthan after looking at a map.
- Following is the data about the ages of 30 students of class VI. Prepare a table using tally marks.
 11, 12, 11, 13, 14, 11, 12, 13, 15, 13, 13, 16, 14, 13, 14,
 13, 12, 14, 13, 12, 14, 13, 13, 12, 14, 14, 13, 12, 13, 14
 - How many students have completed 13 years of age?
 - Maximum number of students are of which age?
 - How many students have not yet completed 14 years of age?
- 25 students participated in an Essay Competition on the topic 'Clean India - Healthy India'. Following is the data about their marks obtained out of maximum marks 10.
 6, 7, 7, 5, 8, 9, 8, 6, 7, 5, 8, 6, 6, 5, 4, 7, 6, 8, 8, 9, 7, 5, 9, 8, 10
 Prepare a table using tally marks and answer the below questions:
 - Number of students who obtained less than or equal to 6 marks.
 - Number of students who obtained more than 6 marks.
 - Number of students who obtained 8 marks.
- Number of members in five families are depicted by the following pictograph

Family	Symbol ☺ = 1 member
A	☺ ☺ ☺ ☺ ☺
B	☺ ☺ ☺ ☺
C	☺ ☺
D	☺ ☺ ☺ ☺ ☺ ☺
E	☺ ☺ ☺ ☺































Observe the pictograph and answer the following questions:

- (i) Which family has maximum members?
- (ii) Which family has minimum members?
- (iii) What is the difference between number of family members of families D and C?
- (iv) How many total number of members in all the five families?

5. The pictograph below shows how many envelopes were sold by a post office during a week. Use the pictograph to answer the questions.

Day	Symbol  = 5 envelopes
Monday	      
Tuesday	   
Wednesday	    
Thursday	     
Friday	  
Saturday	 

- (i) How many envelopes were sold on Wednesday?
 - (ii) On which day, maximum number of envelopes were sold?
 - (iii) If cost of one envelop is Rs. 5, find the revenue generated by selling envelopes on Monday.
 - (iv) How many envelopes were sold during the week? Find the revenue generated by selling envelopes during the week.
6. The following pictograph shows the number of students who like to play different sports in a class of 30 students:

Favourite sport	Number of students who play it.  = 1 student
Football	     
Kho Kho	       
Volleyball	    
Cricket	         


- (i) How many students play Kho-Kho?
- (ii) Which sport is played by maximum number of students?
- (iii) How many students play none of the sports?

5.4.1 Drawing a Pictograph.



Drawing a pictograph is interesting.


Let's take an example. Availability of drinking water is continuously decreasing. The government decided to identify those sources of drinking water which are getting polluted. The following table depicts the number of polluted sources in a district.

Source of drinking water getting polluted	Number
Wells	8
Ponds	4
Hand pump	5
Dam	3
Bore well	6

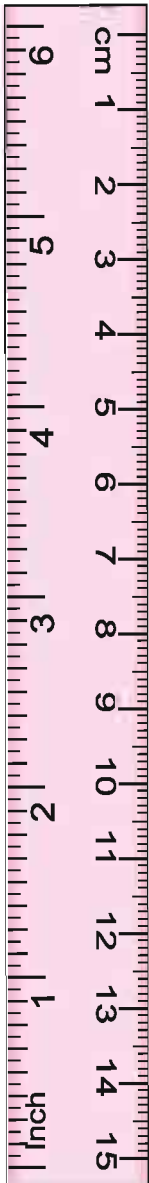
Prepare a pictograph of sources using one symbol  to represent 1 source.

Solution

Source of drinking water getting polluted	Number	Symbol  = 1 source
Wells		
.....		
Hand pump		
.....		
.....		

- (i) Radhika left the pictograph incomplete. Can you complete it?
- (ii) If symbol  would represent 10 sources, what would have been the data for the district? Show in a table.

Total number of students in a class is 40. The table below shows how many students of that class took mid day meal during a week. Represent it by a pictograph.



Day	Number of students who took mid day meal
Monday	35
Tuesday	31
Wednesday	37
Thursday	33
Friday	34
Saturday	36

Solution If we indicate 5 students with symbol $*$, then

Symbol for 4 students \oplus

Symbol for 3 students \oplus

Symbol for 2 students ∞

Symbol for 1 student \circ

So, we can represent the data in the following pictograph:

Day	Number of students who took mid day meal
Monday	$*$ $*$ $*$ $*$ $*$ $*$ $*$
Tuesday	$*$ $*$ $*$ $*$ $*$ $*$ \circ
Wednesday	$*$ $*$ $*$ $*$ $*$ $*$ $*$ \circ
Thursday	$*$ $*$ $*$ $*$ $*$ $*$ \oplus
Friday	$*$ $*$ $*$ $*$ $*$ $*$ \oplus
Saturday	$*$ $*$ $*$ $*$ $*$ $*$ $*$ \circ

Following table depicts number of bags of fortified wheat flour purchased for an 'Aangan Baadi Centre' in 8 months of a particular year.

Month	Number of bags
March	200
April	250
May	250
June	210
July	300
August	345
September	205
October	340



Represent the above data by a pictograph.

Symbol  = 100 bags

Month	Number of bags
March	
April	
May	
June	
July	
August	
September	
October	

Picturising for March, April, May and July is not difficult. But representing 210, 340, 345 and 205 with the pictures is not easy. We may round off 10 & 5 to 0 and 45 to 50.

Exercise 15.2

1. At a primary healthcare centre, numbers of patients treated for common flu during a week are recorded in the table given below. Prepare a pictograph indicating 5 patients with a symbol of 1 tablet.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
25	30	15	30	25	20	25

2. Following is the choice of subjects of 25 students of Class VI:

Hindi, Mathematics, English, Science, English, Hindi, Sanskrit, Mathematics, Computer Science, Social Studies, Science, Mathematics, Hindi, Mathematics, Science, Mathematics, English, Hindi, English, Hindi, Mathematics, Science, Mathematics, Computer Science, Mathematics.

Tabulate the above data in a frequency table with the help of tally marks. Which subject is most preferred?

Which subject is least preferred?

3. Number of votes secured by candidates contesting for Panchayat election under following election symbols are:

Election Symbol	Cycle	Television	Ball	Fan
Number of votes secured	250	300	350	250

Prepare a pictograph choosing the scale of your choice and answer the following questions:

- Which election symbol's candidate won the election?
- What is the difference between number of votes secured by winner candidate and first runner up candidate?

4. Following is the data regarding measures of heights of students (in cm) in a class: 148, 150, 152, 149, 151, 154, 153, 152, 150, 149, 148, 152, 153, 154, 152, 151, 152, 153, 152, 152, 153, 151, 152, 153

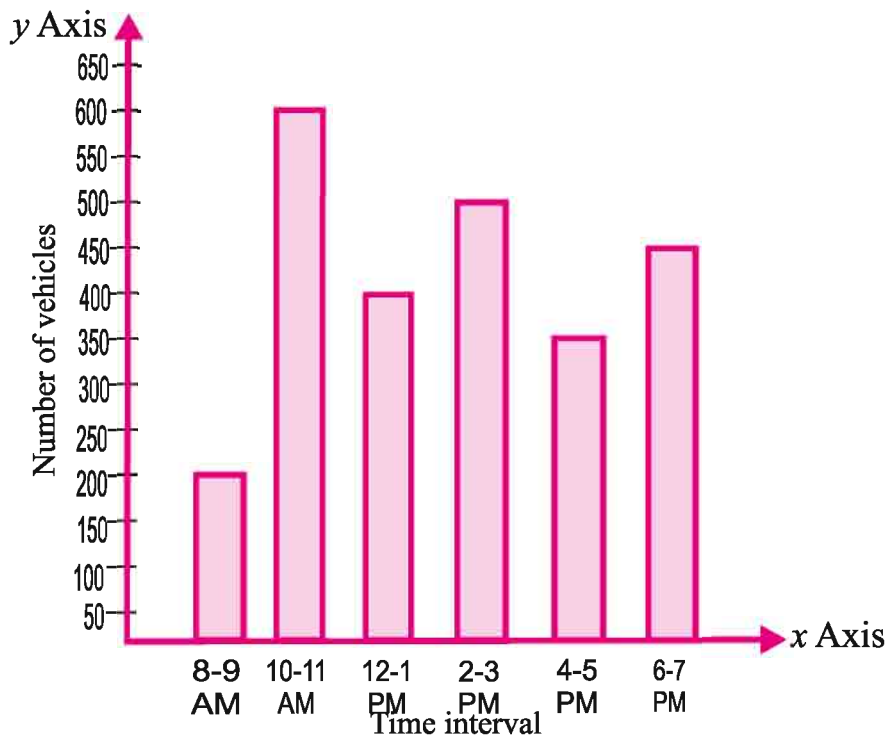
- Prepare a frequency table using tally marks for the above measures of heights.
- Prepare a pictograph choosing the scale of your choice.
- Find the measure of height of the tallest student.
- Find the difference between measures of heights of tallest student and shortest student.

15.5 Bar Graph.

Representing data by pictograph is not only time consuming but at times difficult too. Let us see some other way of representing data visually. Bars of uniform width can be drawn horizontally or vertically with equal spacing between them and then the length of each bar represents the given number. Such method of representing data is called a bar diagram or a bar graph.

15.5.1 Interpretation of a Bar Graph

Let us look at the example of vehicular traffic at a busy road crossing in Jaipur, which was studied by the traffic police on a particular day. The number of vehicles passing through the crossing every alternate hour from 8 a.m. to 7 p.m. is shown in the bar graph. Time intervals are shown on x axis and number of vehicles are shown on y axis. One unit of length stands for 50 vehicles.



Answer the following questions:

1. Is it a horizontal or vertical bar graph?
2. Which time interval records minimum traffic?
3. Which time interval records maximum traffic?
4. What is the number of vehicles on road during the time interval when traffic is the maximum?
5. What is the number of vehicles on road during the time interval when traffic is the minimum?
6. Which time intervals record equal traffic?

Solution

1. We can see that it is a horizontal bar graph.
2. We can see that minimum traffic is shown by the shortest bar for the time interval 8-9 a.m.
3. We can see that maximum traffic is shown by the longest bar for the time interval 10-11 a.m.
4. Maximum traffic shown by the longest bar is 600 vehicles.
5. Minimum traffic shown by the shortest bar is 200 vehicles.
6. Time intervals 12-1 p.m. and 6-7 p.m. have equal traffic.

Do and Learn.

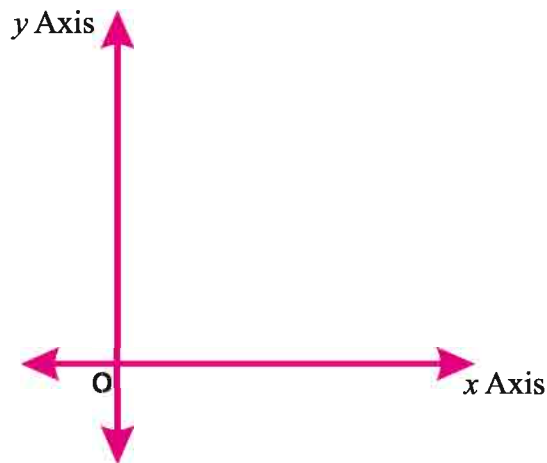
1. Represent the above bar graph by a pictograph.
2. Draw a bar graph taking time interval on y axis and number of vehicles on x axis.

In a model school, income from various paid facilities provided to townsfolk after school hours was presented in front of school management committee:

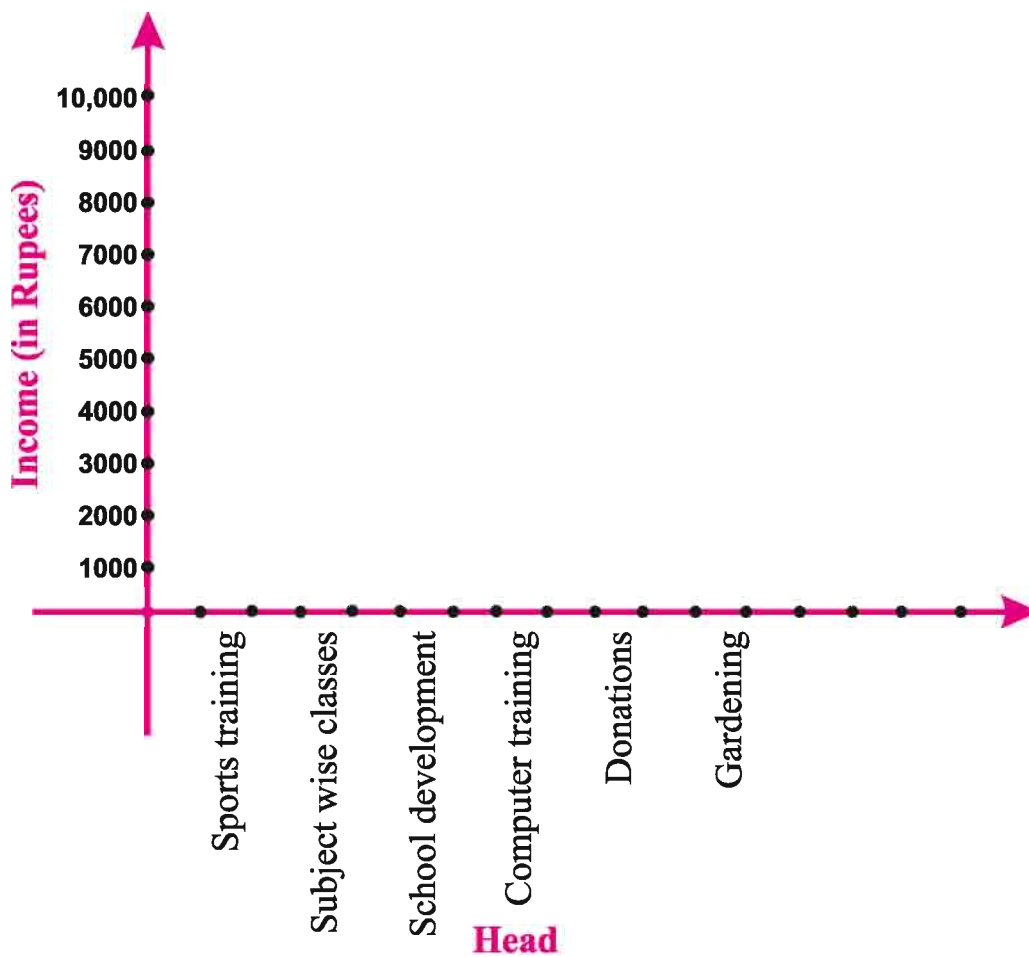
Paid Facility provided	Income (in Rupees)
Sports training	4,000
Subject wise classes	10,000
School development	3,000
Computer training	6,000
Donations	8,000
Gardening	7,000

School management committee appreciated the income and proposed to show it on the wall of headmaster's room in the form of a bar graph drawn on a chart. The bar graph was drawn in the following steps:

1. First of all, a horizontal line and a vertical line were drawn.



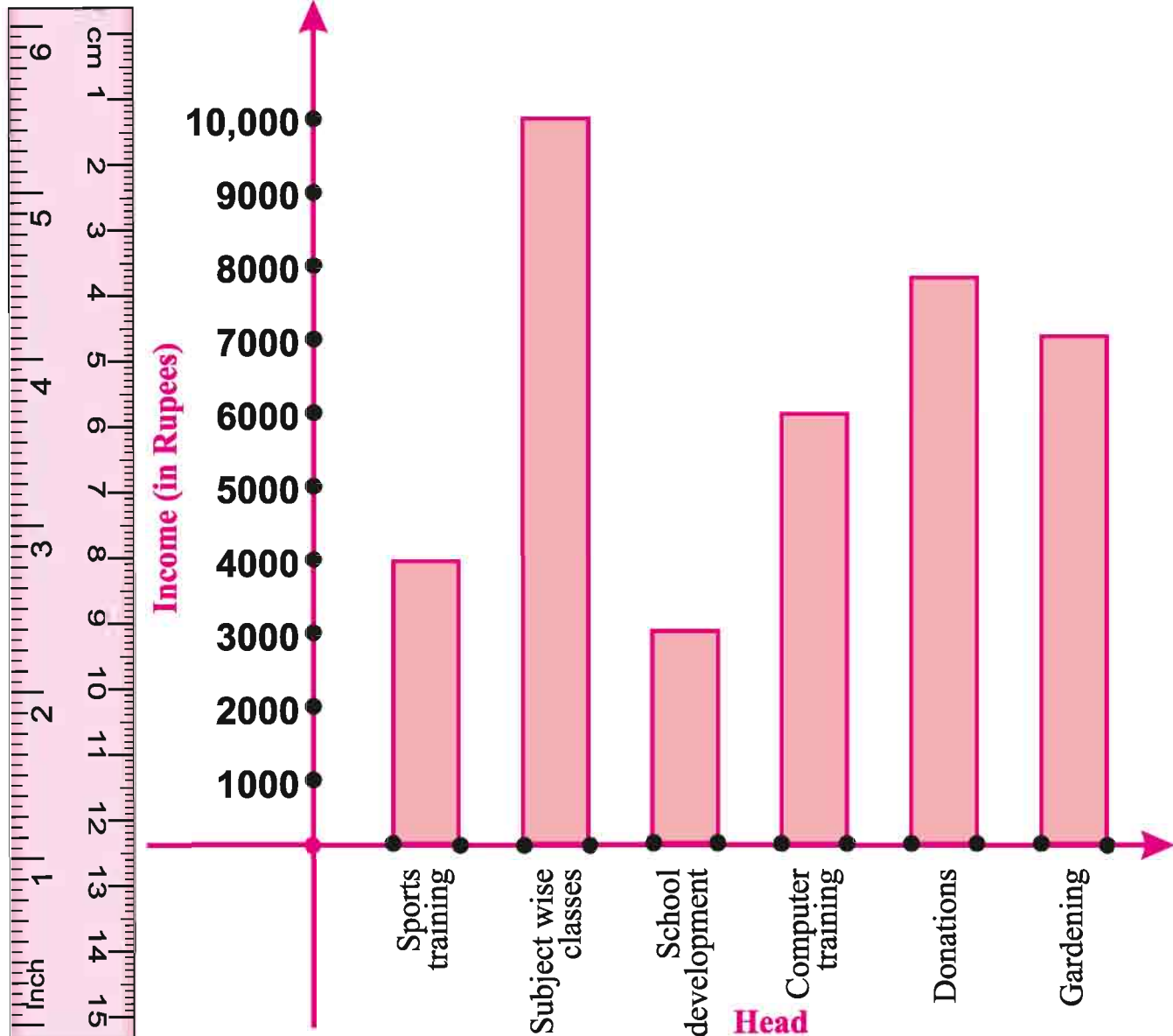
2. Along the horizontal line, Paid Facilities were marked. Along the vertical line, corresponding Income was marked. Bars of same width were taken keeping uniform gap between them.



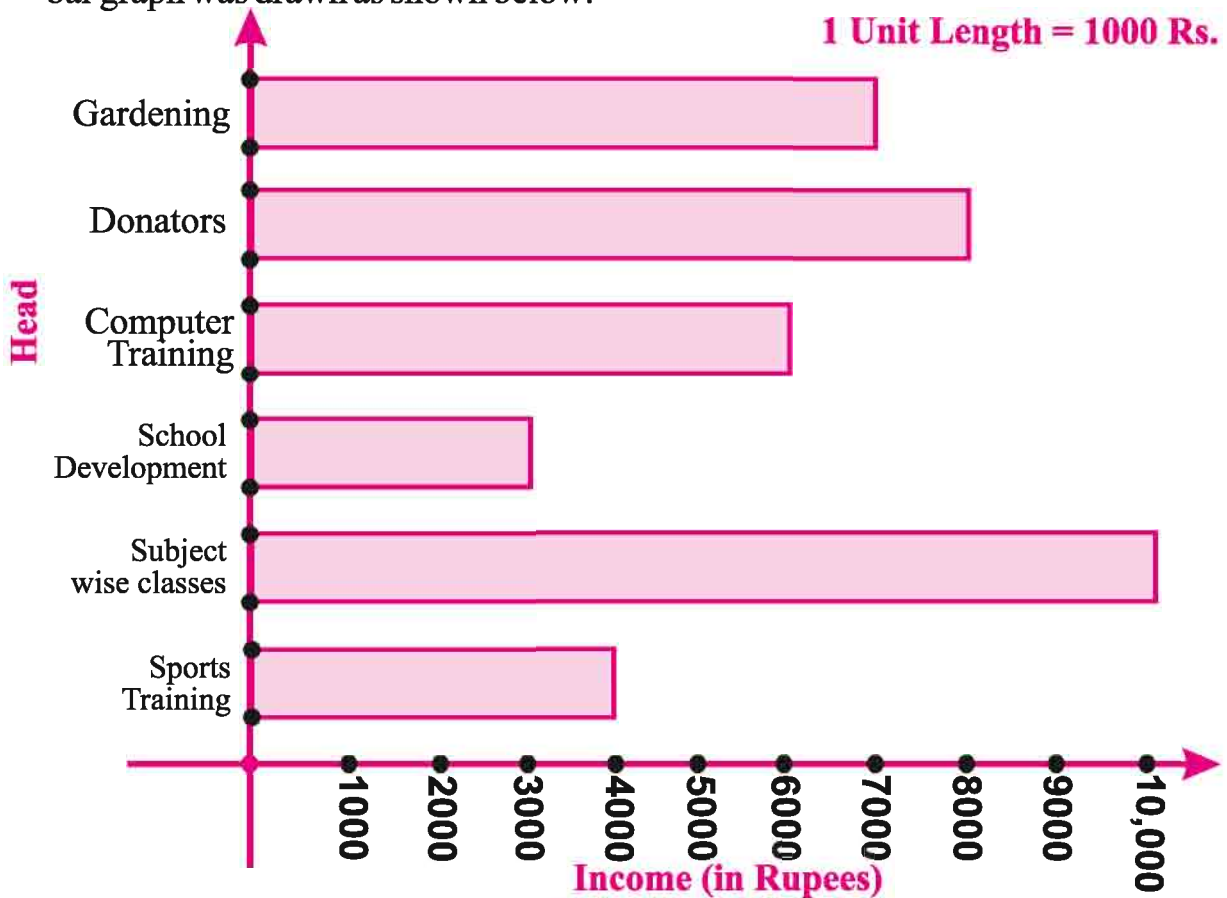
3. Suitable scale was chosen along the vertical line. Scale chosen: 1 unit length = Rs 1,000 and then the corresponding values were marked.

The heights of the bars were calculated for various facilities as shown below:

Sports training	:	$4000 \div 1000$	=	4 units
Subject wise classes	:	$10000 \div 1000$	=	10 units
School development	:	$3000 \div 1000$	=	3 units
Computer training	:	$6000 \div 1000$	=	6 units
Donations	:	$8000 \div 1000$	=	8 units
Gardening	:	$7000 \div 1000$	=	7 units



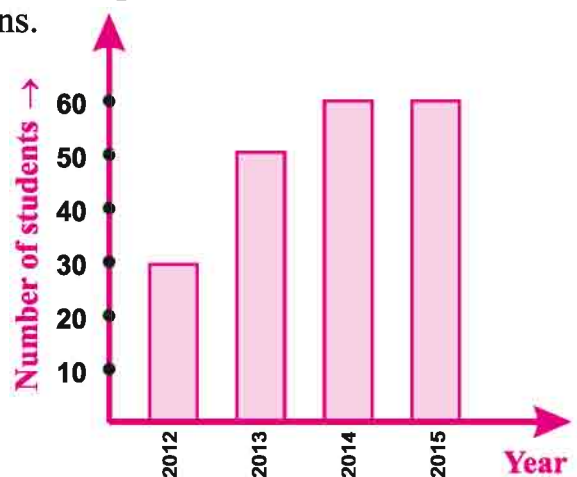
Seeing this bar graph, the headmaster suggested representing the data by interchanging positions of paid facilities and corresponding income. Then the bar graph was drawn as shown below:



Exercise 15.3

1. The bar graph given alongside shows the number of students awarded scholarships during the years 2012-2015 in a particular school. Read the bar graph and write down your observations.

- (i) What is the scale of this bar graph?
- (ii) How many students were awarded scholarships in the year 2014?
- (iii) In which year, minimum number of scholarships were awarded?



2. Given below is the data regarding average ages of some animals.

Elephant	70 years
Goat	15 years
Horse	50 years
Cow	22 years
Deer	40 years
Bull	28 years

Draw a bar graph to represent the above information and answer the following questions:

- Name the animal with highest average age.
 - Name the animal with least average age.
 - Find the difference between average ages of bull and cow.
3. Number of persons in various occupations in a colony is given in the following table.

Occupation	Teacher	Doctor	Shopkeeper	Daily Wager	Lawyer
Number of persons	22	8	19	26	10

To represent the above information, choose a scale of your choice and draw

- a vertical bar graph
 - a horizontal bar graph
4. Following table shows the yield of various crops in Harkhu's farm this year.

Name of the crop	Maize	Millet	Moth Bean	Guar	Soya bean
Yield (quantity in Kg)	12500	20600	13000	24000	18500

Take a scale of your choice and draw a horizontal bar graph to represent the above information and answer the following questions:

- Which crop has maximum yield and how much quantity?
- What is the total yield?
- Which crop yielded 20600 kg?

5. Following table shows the number of students who participated in various competitions in a camp:

Competition	Number of students participated
Drawing	34
Singing	12
Debate	18
Quiz	36

Take a scale of your choice and draw a horizontal bar graph and a vertical bar graph to represent the above information.

6. The following table shows marks obtained by 40 students in a Mathematics quiz competition:

Marks group	Number of students
0 – 20	3
20 – 40	6
40 – 60	12
60 – 80	14
80 – 100	5

Answer the following questions:

- Number of students who obtained marks in the group 40 – 60.
- The marks group having maximum number of students?
- Number of students who obtained more than 60 marks.

We Learnt

- Data is a collection of numbers gathered to give some information.
- There are two types of data: (i) primary data and (ii) secondary data.
- To get a particular information from the given data quickly, the data can be arranged in a tabular form using tally marks
- We learnt how a pictograph represents data in the form of pictures, objects or parts of objects. We have also seen how to interpret a pictograph and answer the related questions. We have drawn pictographs using symbols to represent a certain number of items or things. For example, = 5 students.
- We have discussed how to represent data by using a bar diagram or a bar graph. In a bar graph, bars of uniform width are drawn horizontally or vertically with equal spacing between them. The length of each bar gives the required information.
- To do this we also discussed the process of choosing a scale for the graph. For example, 1 unit = 100 bags. We have also practiced reading a given bar graph. We have seen how interpretations from the same can be made.



ANSWER SHEET

Exercise 1.1

- (i) Five thousand seven hundred eighty two.
(ii) Seventy five thousand eight hundred and seventy nine.
(iii) Three lac eighty nine thousand eighty seven.
(iv) Twenty one lac thirty two thousand four hundred fifty two.
(v) Seven crore sixty eight lac ninty two thousand seventy nine.
(vi) Fifty lac sixty thousand seven hundred ninty eight.
- (i) 68,529 (ii) 89,079 (iii) 5,72,057 (iv) 90,90,990 (v) 1,21,31,041
- Do your self.
- (i) > (ii) < (iii) < (iv) > (v) >
- (i) 4835 < 5348 < 8435 < 13584 < 25843 (ii) 1001 < 1010 < 1011 < 1100
(iii) 50,050 < 50,500 < 50,505 < 55,555
(iv) 5,86,85,376 < 5,86,85,378 < 5,86,95,306 < 5,86,95,376
- (i) 9,754 > 8,320 > 847 > 571 (ii) 6,040 > 4,646 > 4,600 > 4,060
(iii) 38,802 > 36,501 > 25,751 > 9,801 (iv) 11,001 > 10,101 > 10,011 > 10,001

Exercise 1.2

- (i) 100 (ii) 1 (iii) 1000
(iv) 1 (v) 1000 meter (vi) 1000
- 5,76,994 3. 30,167 4. 34,029 5. 62,964
- 42,935 7. 24,660 8. 12,385 9. 1,36,836
- 3,000 11. 600

Exercise 1.3

- (i) 900 (ii) 5,900 (iii) 3,500 (iv) 2,500
- (i) 1800 (ii) 20,300 (iii) 5,91,600
- 4,400 4. 1600 cows 5. 7 leter

Exercise 2.1

- (i) 1, 2, 3, 4, 6, 8, 12, 16, 24, 48 (ii) 1, 2, 3, 4, 6, 9, 12, 18, 36
(iii) 1, 2, 4, 7, 14, 28 (iv) 1, 2, 4, 5, 10, 20, 25, 50, 100
(v) 1, 5, 25, 125
- (i) 7, 14, 21, 28, 35 (ii) 12, 24, 36, 48, 60
(iii) 17, 34, 51, 68, 85 (iv) 15, 30, 45, 60, 75
(v) 18, 36, 54, 72, 90

3. 11, 13, 17, 19, 23, 29 4. 2 5. 6, 12, 18, 30 6. 12, 24, 36
 7. (i) True (ii) False (iii) False (iv) False (v) True (vi) False (vii) True

Exercise 2.2

1. (i) $2 \times 2 \times 7$ (ii) $2 \times 3 \times 3 \times 3$ (iii) $2 \times 2 \times 2 \times 2 \times 2 \times 3$ (iv) $2 \times 2 \times 37$
 (v) $2 \times 2 \times 3 \times 13$
 2. $2 \times 2 \times 2 \times 5 \times 5 \times 5$
 3. (i) 1, 2, 3, 4, 6, 12 (ii) 1, 5 (iii) 1, 2, 3, 6 (iv) 1
 4. (i) 20, 40, 60 (ii) 24, 48, 72 (iii) 20, 40, 60 (iv) 45, 90, 135
 5. 6, 12, 18, 24, 30, 36, 42, 48

Exercise 2.3

1. (i) 12 (ii) 14 (iii) 13 (iv) 5 (v) 1
 2. (i) 1 (ii) 2 (iii) 1
 3. 5 meter 4. 4 liter 5. 18 meter

Exercise 2.4

1. (i) 30 (ii) 28 (iii) 108 (iv) 1008
 2. 30 3. 15 4. 24 past 6 5. 240
 6. 3 past 5

Exercise 3.1

1. (i) 56 (ii) 99 (iii) 304, 306 (iv) 0 (v) 0
 2. (i) 1,202 (ii) 2,405 (iii) 3,554 (iv) 4,443
 3. (i) 2,305 (ii) 3,612 (iii) 4,001 (iv) 5,061
 4. (i) 188,190 (ii) 198, 200 (iii) 208, 210 (iv) 299, 301 5. 0
 6. (i) True (ii) False (iii) True (iv) True (v) False
 (vi) False (vii) True (viii) False (ix) True (x) False
 (xi) True

Exercise 3.2

1. (i) 286 (ii) 296 (iii) 175 (iv) 186
 2. (i) 1,22,500 (ii) 79,000 (iii) 8,500 (iv) 20,000
 3. (i) 18,500 (ii) 120 (iii) 54,27,900 (iv) 120
 4. (i) 19,610 (ii) 38,480 (iii) 5,508 (iv) 1,59,264
 5. (i) (b) (ii) (a) (iii) (d) (iv) (c)
 8. (i) 13,938 (ii) 50,000 (iii) 21,280
 9. (i), (iv) 10. (i) d (ii) a

Exercise 4.1

1. (i) $+45^{\circ}\text{C}$ (ii) -10°C (iii) $+300$ Rupees (iv) -500 Rupees
 3. (i) $>$ (ii) $>$ (iii) $>$ (iv) $>$ (v) $<$ (vi) $>$
 4. (i) False (ii) False (iii) False (iv) True
 5. (i) $-4, -3, -2, -1, 0$ (ii) $-5, -4, -3$
 (iii) $-2, -1, 0, 1, 2$ (iv) $-10, -9, -8, -7, -6$
 6. (i) Ascending = $-7, -3, 3, 5$ (ii) Ascending = $-2, -1, 0, 3$
 Descending = $5, 3, -3, -7$ Descending = $3, 0, -1, -2$
 (i) Ascending = $-6, 1, 3$ (iv) Ascending = $-5, -1, 2, 4$
 Descending = $3, 1, -6$ Descending = $4, 2, -1, -5$

Exercise 4.2


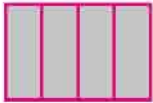





1. (i) 9 (ii) 0 (iii) -2 (iv) -5
 2. (i) 6 (ii) -7 (iii) $+3$ (iv) 0
 3. (i) 9 (ii) -10 (iii) -100 (iv) -650 (v) -10 (vi) -260
 4. (i) -92 (ii) -81 (iii) 50 (iv) 91

Exercise 4.3

1. (i) 20 (ii) -8 (iii) 6 (iv) -15 (v) 33 (vi) -49
 2. (i) 5 (ii) (-7) (iii) 0 (iv) (-4) (v) (-2) (vi) -4
 3. (i) $<$ (ii) $=$ (iii) $>$ (iv) $>$
 4. (i) 0 (ii) -11 (iii) 8 (iv) -28

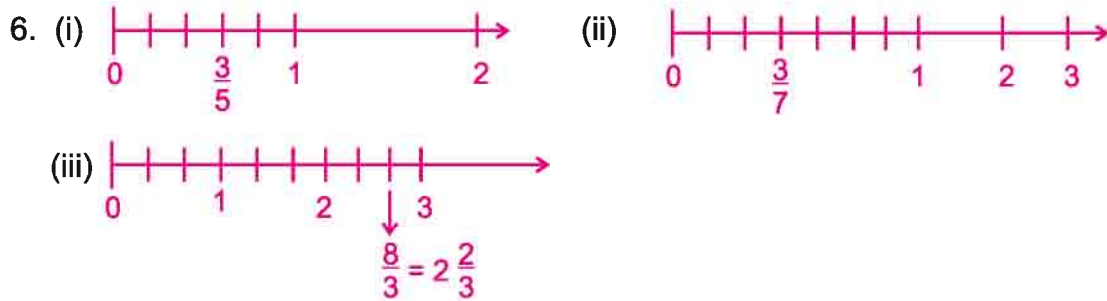
Exercise 5.1

1. (i) $\frac{2}{4} = \frac{1}{2}$ (ii) $\frac{2}{3}$ (iii) $\frac{3}{5}$

2. (i)  (ii)   (iii) 
  

(Through different figures one can represent fraction numbers.)

3. $\frac{7}{12}$ hours 4. $\frac{7}{15}$ 5. (i) $\frac{3}{4}$ (ii) $\frac{6}{10} = \frac{3}{5}$ (iii) $\frac{2}{3}$



7. (i) $6\frac{2}{3}$ (ii) $2\frac{1}{3}$ (iii) $3\frac{1}{6}$
 8. (i) $\frac{23}{3}$ (ii) $\frac{23}{4}$ (iii) $\frac{9}{2}$

Exercise 5.2

1. (i) Yes (ii) No 2. (i) **14** (ii) **3** (iii) **12** (iv) **1** (v) **3**
 3. (i) $\frac{18}{24}$ (ii) $\frac{15}{20}$ (iii) $\frac{24}{32}$ (iv) $\frac{9}{12}$
 4. (i) $\frac{5}{9}$ (ii) $\frac{6}{7}$ (iii) $\frac{3}{7}$ (iv) $\frac{1}{12}$
 5. (i) d (ii) f (iii) h (iv) g (v) e (vi) c (vii) i
 (viii) b (ix) j (x) a

Exercise 5.3

1. (i) Descending – $\frac{7}{8} > \frac{5}{8} > \frac{3}{8} > \frac{2}{8} > \frac{1}{8}$ Ascending – $\frac{1}{8} < \frac{2}{8} < \frac{3}{8} < \frac{5}{8} < \frac{7}{8}$
 (ii) Descending – $\frac{5}{6} > \frac{4}{6} > \frac{3}{6} > \frac{1}{6}$ Ascending – $\frac{1}{6} < \frac{3}{6} < \frac{4}{6} < \frac{5}{6}$
 2. (i) $\frac{5}{6} > \frac{9}{11}$ (ii) $\frac{3}{4} > \frac{1}{5}$ (iii) $\frac{3}{5} > \frac{3}{7}$
 3. **Group 1** $\frac{2}{12} = \frac{10}{60} = \frac{12}{72} = \frac{16}{96}$ **Group 2** $\frac{3}{15} = \frac{10}{50} = \frac{15}{75} = \frac{18}{90}$ **Group 3** $\frac{8}{50} = \frac{16}{100} = \frac{12}{75} = \frac{4}{25}$
 4. (i) No (ii) No (iii) Yes (iv) No
 5. Equal number students got first division in the both classes.
 6. Rohini

Exercise 5.4

1. (i) $\frac{7}{19}$ (ii) $\frac{1}{2}$ (iii) $\frac{49}{23}$ (iv) $\frac{11}{14}$ (v) $\frac{169}{60}$ (vi) $\frac{193}{30}$ (vii) $\frac{23}{3}$ (viii) $\frac{326}{35}$

2. $\frac{1}{2}$ 3. $\frac{14}{15}$ 4. 5 Km 5. $\frac{5}{2}$ Leter or $2\frac{1}{2}$ Leter 6. Completely in 1 wall

Exercise 5.5

1. (i) $\frac{4}{5}$ (ii) $\frac{13}{35}$ (iii) $\frac{33}{10}$ (iv) $\frac{65}{12}$ (v) $\frac{7}{12}$ (vi) $\frac{1}{10}$

2. $\frac{5}{28}$ leter 3. $\frac{1}{2}$ m 4. $\frac{1}{3}$ Part 5. $\frac{17}{10}$ Kg 6. Geeta, $\frac{1}{4}$ minute

7.(i)

	\oplus	\rightarrow
\downarrow	\ominus	
$\frac{2}{5}$	$\frac{4}{5}$	$\frac{6}{5}$
$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$
$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$
$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$

(ii)

	\oplus	\rightarrow
\downarrow	\ominus	
$\frac{1}{3}$	$\frac{1}{5}$	$\frac{8}{15}$
$\frac{1}{5}$	$\frac{1}{6}$	$\frac{11}{30}$
$\frac{2}{5}$	$\frac{1}{30}$	$\frac{1}{6}$
$\frac{2}{15}$	$\frac{1}{30}$	$\frac{1}{6}$

Exercise 6.1

1. (i) 12.3

(ii) 13.7

(iii) 251.2

2.

	H	T	U	O.T
(i)		1	9	4
(ii)			0	5
(iii)		1	0	9
(iv)	2	0	5	9

3. (i) 0.7 (ii) 20.4 (iii) 14.9 (iv) 600.3
4. (i) 0.3 (ii) 4.8 (iii) 358.1 (iv) 90.3 (v) 1.5 (vi) 0.4 (vii) 4.5 (viii) 3.6
5. (i) $\frac{3}{5}$ (ii) $\frac{5}{2}$ (iii) $\frac{14}{5}$ (iv) $\frac{137}{10}$ (v) $\frac{106}{5}$ (vi) 1 (vii) $\frac{32}{5}$
6. (i) 0.2 cm (ii) 3 cm (iii) 11.6 cm (iv) 5.2 cm (v) 9.5 cm (vi) 19.1 cm
7. (i) In between 0 and 1 (ii) In between 5 and 6 (iii) on 9 (iv) In between 4 and 5
(v) In between 3 and 4



9. 9.5 cm 10. 1.6 cm

Exercise 6.2

1. (i) 230.057 (ii) 1.305 (iii) 253.505 (iv) 340.120 (v) 13.030
2. (i) 23.306 (ii) 0.736 (iii) 137.06 (iv) 703.053 (v) 0.307 (vi) 0.19
3. (i) One decimal two zero (ii) One hundred eight decimal five six.
(iii) Ten decimal seven five six (iv) Six decimal zero one.
4. (i) $\frac{9}{50}$ (ii) $\frac{1}{4}$ (iii) $\frac{33}{500}$ (iv) $\frac{2}{5}$
5. (i) $0.4 > 0.04$ (ii) $3 > 0.7$ (iii) $0.999 > 0.19$ (iv) $5.64 > 5.603$
6. (i) 0.05 Rupees (ii) 0.75 Rupees (iii) 0.80 Rupees (iv) 0.50 Rupees
7. (i) 70.005 Km (ii) 0.088 Km (iii) 0.8 Km
8. (i) 8.515 (ii) 315.29 (iii) 13.175 (iv) 69.12 (v) 3.03 (vi) 1.34
9. 118.270 Kg
10. 8.300 Km
11. 16.25 m
12. 2 K 100 gram

Exercise 7.1

1. (i) 164 (ii) 182 (iii) 1351
 (iv) 814 Rupees 11 Paise (v) 162 km 131 meter (vi) 227 Kg 48 gram

Exercise 7.2

1. (i) 48 (ii) 28 (iii) 289
 (iv) 267 (v) 18 Rupees 67 Paise (vi) 68 meter 55 cm
 (vii) 155 kg 887 gram

Exercise 7.3

1. (i) $1\bar{2}$ (ii) $3\bar{3}$ (iii) 122 (iv) $1\bar{2}\bar{2}$ (v) $10\bar{4}$

Exercise 7.4

1. (i) 25 (ii) 46 (iii) 128 (iv) 458 (v) 577

Exercise 7.5

1. (i) 14 (ii) 31 (iii) 23 (iv) 09 (v) 28

Exercise 7.6

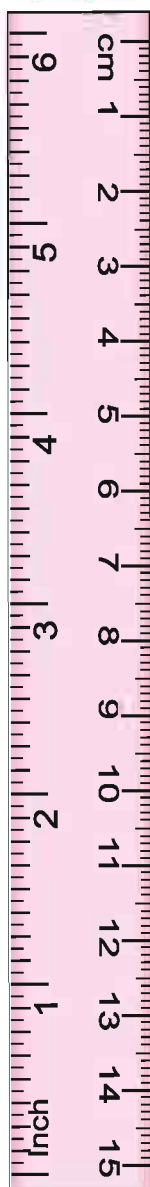
1. (i) 47 (ii) 687 (iii) 164 (iv) 287

Exercise 7.7

1. (i) 156 (ii) 209 (iii) 195 (iv) 56 (v) 54 (vi) 96
 (vii) 10608 (viii) 11342 (ix) 12208 (x) 8918 (xi) 9024
 (xii) 10192 (xiii) 7905

Exercise 7.8

1. (i) Quotient = 1, Remainder = 35 (ii) Quotient = 45, Remainder = 01
 (iii) Quotient = 3, Remainder = 10 (iv) Quotient = 12, Remainder = 02
 (v) Quotient = 11, Remainder = 02 (vi) Quotient = 38, Remainder = 02



Exercise 8.1

1. (i) XY (ii) AC, AB, BC (iii) PQ, QR, RS
 (iv) UV, VW, WX, XY, YZ

Exercise 8.2

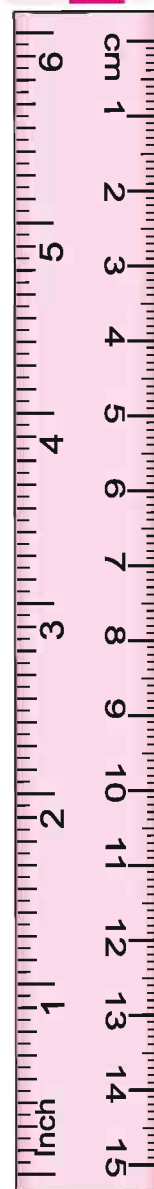
1. Parallel lines = AB, CD, and MN, SN
 Intersecting lines = XY, WZ and PQ, RS
2. Colinear lines 3. Do yourself
4. $PQ \perp QR$, $XY \perp PQ$, $AB \perp BC$

Exercise 8.3

1. (i) $\angle 1$ = obtuse angle (ii) $\angle 2$ = Right angle
 (iii) $\angle 3$ = Acute angle (iv) $\angle 4$ = Reflex angle
2. (i) d (ii) c (iii) a (iv) b (v) e

Exercise 8.4

1. Radius = OS
 Diameter = AB
 Chord = PR
 Center = O
2. (i) True (ii) False
 (iii) True (iv) True
 (v) False
3. Shaded ACB = Circle Segment
 Shaded EOD = Sector Segment



Exercise 9.1

- Open figure (i), (vi) and Close figure (ii), (iii), (iv), (v)
- O
- (i) PQR (ii) S,L,U,T (iii) Yes

Exercise 9.2

- Do your self
- (i) Right angle (ii) Acute Angle (iii) Obtuse Angle
- (i) Equilateral Triangle (ii) Scalene Triangle (iii) Isosceles Triangle
- (i) 5 triangle write the names your self (ii) 4 triangle write the names your self
- (i) Obtuse Angle (ii) Acute Angle (iii) Right angle
- (i) Scalene (ii) Isosceles (iii) Equilateral
- (i) Right (ii) Wrong (iii) Wrong (iv) Right (v) Right

Exercise 9.3

- (i) Write the names your self (ii) Write the names your self
- (i) 6 (ii) 5
- Do your self.
- (i) Square - 5, Rectangle - 6 (ii) Square - 2, Rectangle - 1
- (i) $\angle R$ (ii) $\angle Q, \angle S$ (iii) PS (iv) QP or RS (v) $\angle P, \angle Q, \angle R, \angle S$
- (i) Wrong (ii) Right (iii) Wrong (iv) Right

Exercise 10

- Cone, Sphere, Cube, Cuboid
- Do your self.
- (i) True (ii) False (iii) True (iv) False (v) True (vi) False
- Vertex of cuboid = P, Q, R, S, J, K, L, M
Edges of cuboid = PQ, QR, RS, SP, JK, KL, LM, MJ, PJ, QK, RL, SM
Faces of cuboid = PQRS, JKLM, PQKJ, SRLM, PJMS, QKLR

Exercise 11

- (a) (i), (ii), (iv), (v) (b) (iv)
- (i) Three alphabets (ii) Nine alphabets (iii) Five alphabets
(iv) Seven alphabets (v) Three alphabets (vi) One alphabets (do your self)
- (i) 1 (ii) 1 (iii) 2
(iv) 2 (v) 2 (vi) 3

Exercise 12.1

1. (i) $2a$ (ii) $3a$ (iii) $4a$ 2. $4x$
 3. (i) $(x-5)$ year (ii) $(P+5)$ year 4. $\frac{x}{5}$ or $x \div 5$
 5.

x	1	2	3	4	5	6	7
$2x+3$	5	7	9	11	13	15	17

Exercise 12.2

1. (i) $3 - 7 + 4$, $3 + 7 - 4$ (ii) $3 \times 7 + 4$, $3 + 7 \times 4$
 2. (i) Algebraic (ii) Numerical (iii) Numerical
 (iv) Algebraic (v) Algebraic (vi) Algebraic
 3.

S. No.	Expression	Addition	Subtraction	Multiplication	Division
1.	$x+5$	✓	-	-	-
2.	$7m+3$	✓	-	✓	-
3.	$y-3x$	-	✓	✓	-
4.	$x-y-z$	-	✓	-	-
5.	$3x-10-\frac{z}{5}$	-	✓	✓	✓
6.	$\frac{y}{17}$	-	-	-	✓

4. (i) $a+7$ (ii) $b-10$ (iii) $4x$ (iv) $\frac{x}{4}$ (v) $7-x$ (vi) $10 \div q$ or $\frac{10}{q}$
 5. (i) $2n+15$ (ii) $2x-15$ (iii) $2P+3$ (iv) $2q-3$ (v) $5y-11$ (vi) $-3z+11$
 6. For examples (do your self)

Exercise 12.3

1. (i) Variable x (ii) No (iii) No (iv) No (v) Variable q (vi) Variable t
 2. $y = 5$
 3. (i) No (ii) Yes
 4. (i) $x = 5$
 (ii) $P = 12$
 (iii) $x = 8$

Exercise 13.1

1. (i) 5 : 3 (ii) 5 : 8 2. (i) 8 : 13 (ii) 5 : 1
 3. (i) 2 : 1 (ii) 1 : 4 (iii) 1 : 2 4. 7, 10, 35, yes
 5. (i) 1 : 6 (ii) 2 : 1 (iii) 5 : 11 (iv) 7 : 11
 6. (i) 1 : 5 (ii) 4 : 25 (iii) 1 : 4 (iv) 4 : 3
 7. 13 : 12 8. 4 : 3 9. 1 : 2
 10. Talisma 10,000 Rs. Gurmeet 25,000 Rs. 11. Do your self.
 12. (i) 3 : 1 (ii) 4 : 1 (iii) 5 : 2 (iv) 2 : 1

Exercise 13.2

1. (i) Yes (ii) Yes (iii) No (iv) No
 2. (i) True (ii) False (iii) True (iv) False
 3. (i) Right (ii) Right (iii) Right (iv) Wrong
 4. (i) Not in proportion (ii) In proportion, Middle term - 250, 40 Extreme term - 10, 1
 (iii) Not in proportion (iv) In proportion, Middle term - 65, 9 Extreme term - 39, 15

Exercise 13.3

1. 27 2. 375 3. 360 4. 45
 5. 75 6. 5 7. 8 8. 150
 9. 42,000 10. 9
 11. (i) 115.50 (ii) 10

Exercise 14.1

1. (i) 21 cm (ii) 68 cm (iii) 24 cm
 2. 20 cm
 3. (i) 9 cm (ii) 12 cm (iii) 6 cm
 4. Pooja run less, 20 meter
 5. 6 m 6. 78 meter 7. 45 meter

Exercise 14.2

1. (i) 9 Sq. cm (ii) 4 Sq. cm (iii) 17 Sq. cm
 (iv) 8 Sq. cm (v) 10 Sq. cm (vi) 13 Sq. cm
 (vii) 20 Sq. cm (viii) 7 Sq. cm (ix) 9 Sq. cm
2. 16 Sq. cm, 16 Sq. cm, 16 Sq. cm
3. (i) 12 Sq. cm (ii) 180 Sq. cm (iii) 11 Sq. cm
4. 80 Sq. cm
5. 81 Sq. cm
6. (i) 16,000 Sq. cm (ii) 12,600 Sq. cm (iii) 20,000 Sq. cm
 (iv) 19, 0000 Sq. cm
7. 6 m
8. 42 Sq. m
9. (i) Four times (ii) Twelve times
10. (i) One Fourth (ii) Four times

Exercise 14.3

1. Perimeter of III & IV is same but the area is differ.
2. Field of gopi, 100 sq. m.
3. Area of a square greater by is 2.25 sq. cm.
4. (i) Perimeter increased by 30 cm.
 (ii) Perimeter increased by 15 cm.
5. (i) 130 cm
 (ii) 32 sq. cm
 (iii) increasing
6. (i) 16 sq. cm
 (ii) 7 sq. cm
 (iii) decreasing



Exercise 15.1

1. (i) Primary (ii) Secondary (iii) Primary (iv) Secondary

2.

Age	Tally marks	Number of student
11	|||	3
12	//// |	6
13	//// // |	11
14	//// |||	8
15	|	1
16	|	1
Addition		30

3. (i) 21 Students (ii) 11 Students (iii) 20 Students

Age	Tally marks	Number of student
4	|	1
5	||||	4
6	////	5
7	////	5
8	//// |	6
9	|||	3

- (i) 10 digits (ii) 15 Students (iii) 6 Students

4. (i) family D (ii) family C (iii) difference = $6-2 =$ member (iv) 21 members

5. (i) Envelope (ii) Monday (iii) Rs. 175 (iv) Envelop left 135 and the price = Rs. 675

6. (i) 8 (ii) Cricket (iii) 0

Exercise 15.2

1

Days	Indicator $\bigcirc = 5$ Patients
Monday	$\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$
Tuesday	$\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$
Wednesday	$\bigcirc \bigcirc \bigcirc$
Thursday	$\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$
Friday	$\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$
Saturday	$\bigcirc \bigcirc \bigcirc \bigcirc$
Sunday	$\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$

2.

Subject	Telly Mark	No. of students
Hindi	||||	5
Mathematics	|||| |||	8
English	||||	4
Science	||||	4
Sanskrit	|	1
Computer Education	||	2
Social Science	|	1

Mathematics is the most likely subject.
Sanskrit and social science is last likely subject.

3

Days	Indicator $\text{stick figure} = 5$ Voter
Cycle	$\text{stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure}$
T.V.	$\text{stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure}$
Ball	$\text{stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure}$
Fan	$\text{stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure} \text{ stick figure}$

(i) Ball

(ii) $350 - 300 = 50$ Vote

4 (i)

Height of the students (cm)	Telly Mark	No. of Students
148	||	2
149	||	2
150	||	2
151	|||	3
152	|||| |	9
153	||||	5
154	||	2

(ii)

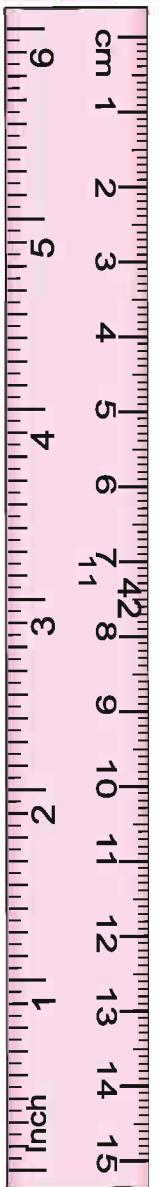
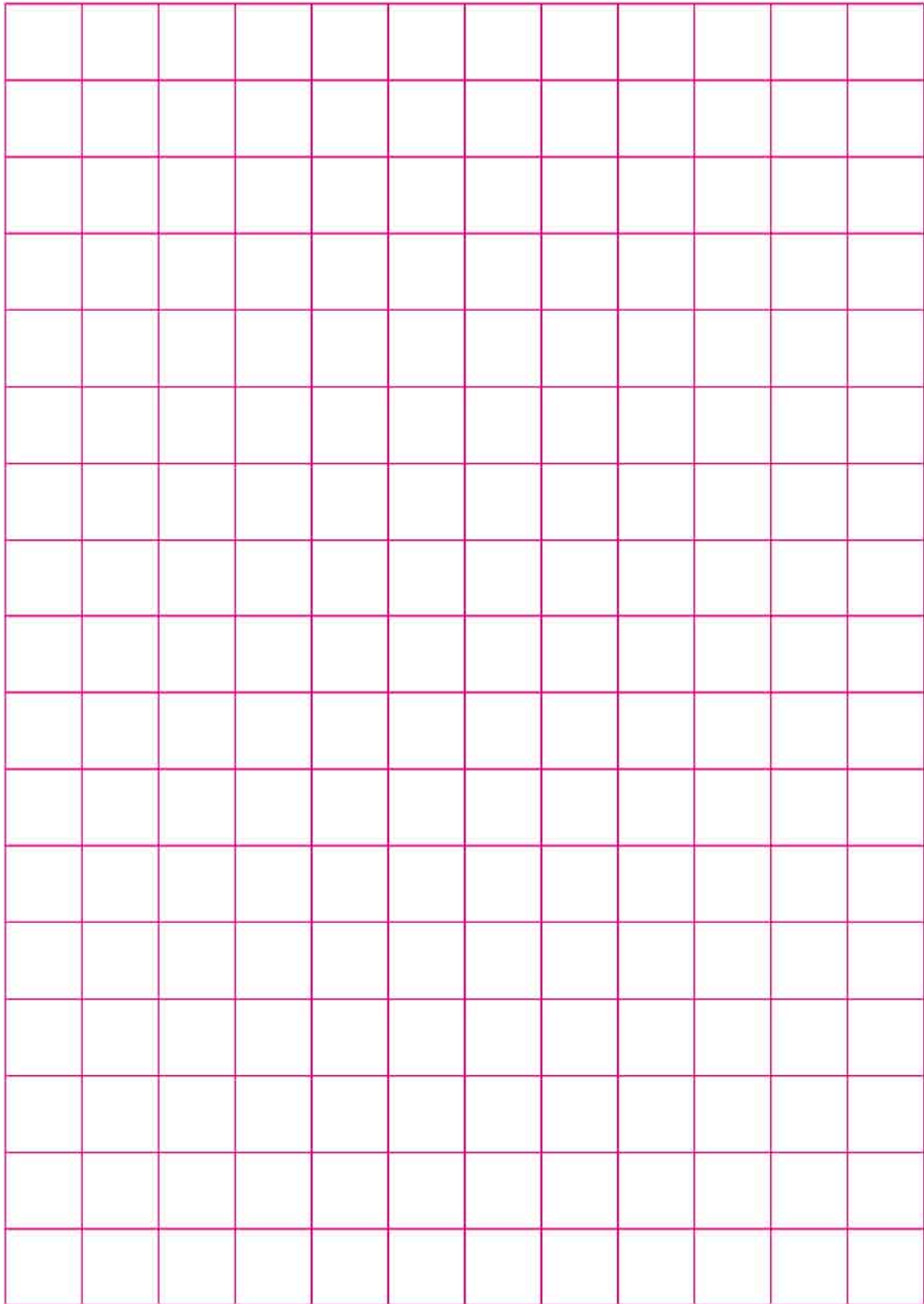
Height (cm)	Indicator ☺ = 1 Student
148	☺ ☺
149	☺ ☺
150	☺ ☺
151	☺ ☺ ☺
152	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺
153	☺ ☺ ☺ ☺ ☺
154	☺ ☺

(iii) 154 cm

(iv) 6 cm

Exercise 15.3

- (i) 1 cm = 10 student (ii) 60 student (iii) in 2012
- (i) Elephant (ii) Goat (iii) 28 year - 22 year = 6 year
- (i) Guar, 24,000 kg. (ii) 88600 kg. (iii) Millet
- (i) 12 (ii) 60-80 (iii) 19



THE GREAT MATHEMATICIAN ARYABHATTA

Aryabhatt was born in 475 AD at Kusumpur. Later Kusumpur was named Patliputra. At present it is called Patna, the capital of Bihar. In 499 AD, at the age of 23, he wrote Aryabhattiya. This has four sections

1. Gitika Pada
2. Ganita Pada
3. Kal Kriya Pada
4. Gol Pada

In Ganit Pada (37 verses), it covers place value, perimeter of square, square root, cube root, area of triangle, circle and Trapezium. There is also

description about the volume of sphere and pyramid and the value of π . Bhaskar-I (629 AD) has written Bhashya (commentary) on Aryabhattiya this Bhashya is very well known. Aryabhatta was the first mathematician who found out the relation between circumference and diameter in finite places. He was the first astronomer to declare that the earth is spherical, the sun is static and the earth and other planets revolve round the sun.

In the honour of Aryabhatta, India named its first Satellite after his name. Aryabhatta Satellite was launched on 19th April 1975.

