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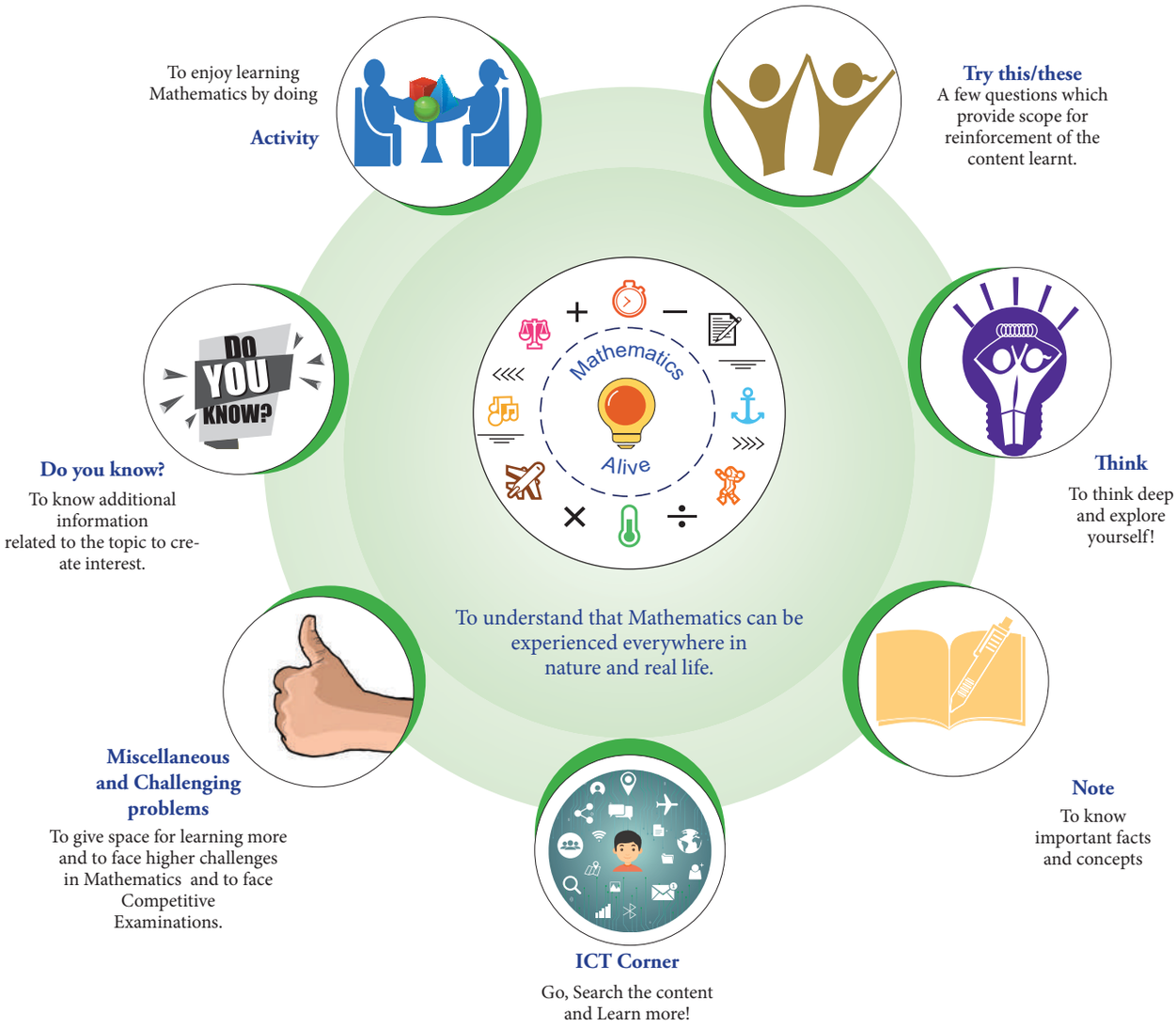
Mathematics is a unique symbolic language in which the whole world works and acts accordingly. This text book is an attempt to make learning of Mathematics easy for the students community.

Mathematics is not about numbers, equations, computations or algorithms; it is about understanding

— William Paul Thurston



To enjoy learning Mathematics by doing

Activity

Try this/these
A few questions which provide scope for reinforcement of the content learnt.

Do you know?
To know additional information related to the topic to create interest.

Think
To think deep and explore yourself!

To understand that Mathematics can be experienced everywhere in nature and real life.

Miscellaneous and Challenging problems
To give space for learning more and to face higher challenges in Mathematics and to face Competitive Examinations.

Note
To know important facts and concepts

ICT Corner
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Chapter 1

NUMBERS

9YQVCL

Learning Objectives

- To understand large numbers and the terms used to represent them.
- To compare large numbers and order them.
- To employ estimation for large numbers.
- To solve word problems involving four fundamental operations.
- To understand and use the properties of Whole Numbers.

1.1 Introduction

Read the following conversation between two classmates.

Mani : (Reading Newspaper Headlines)
"Ten thousand people visited the trade fair yesterday".

Mallika : Wow! That's a lot of people.

Mani : Thank goodness, I went to the trade fair exactly yesterday!

Mallika : Why… what is so important about it?

Mani : Don't you see? If I had not gone, they would have written "Nine thousand nine hundred and ninety-nine people only visited the trade fair yesterday". It would have been difficult to read and understand!

What do you think about this conversation? Was Mani right?

No! it would still be "Ten thousand people visited!". Newspapers give (and readers want) a sense of the size, NOT exact values when numbers are large.

You have probably heard names like 'lakhs' and 'crores' used by elders.

We often come across situations that involve large numbers in real life, like the number of people living in a district, the budget of the Government, the distance of stars or the number of bicycles sold in a year and so on. In all these situations, we look for names that convey the "size" of these numbers.

MATHEMATICS ALIVE - LARGE NUMBERS IN REAL LIFE

	
Tamil Nadu has about 26,345 square kilometre of forest land.	The number of stars in the Milky way galaxy is about 20,000 crore

Let us understand the large numbers in detail, and the way they are connected to the numbers learnt earlier.

Recap of Successor and Predecessor

- When 1 is added to a number we get its Successor.
- When 1 is subtracted from a number we get its Predecessor.

TRY THESE

- The Successor of 4576 is _____.
- The Predecessor of 8970 is _____.
- 999 + 1 = _____.
- 10000 – 1 = _____.
- The predecessor of the smallest 5 digit number is _____.

1.2 Formation of large numbers

Now, we learn the formation of large numbers. Let us build and complete the number tower by observing the pattern of numbers.

Greatest number	Add	Equals	Smallest number	Number Name
Greatest 1 digit number 9	+ 1	=	Smallest 2 digit number 10	Ten
Greatest 2 digit number 99	+ 1	=	Smallest 3 digit number 100	Hundred
Greatest 3 digit number 999	+ 1	=	Smallest 4 digit number _____	Thousand

Greatest 4 digit number _____	+ 1	=	Smallest 5 digit number 10000	Ten Thousand
Greatest 5 digit number _____	+ 1	=	Smallest 6 digit number _____	Lakhs
Greatest 6 digit number _____	+ 1	=	Smallest 7 digit number _____	Ten Lakhs
Greatest 7 digit number 9999999	+ 1	=	Smallest 8 digit number 10000000	Crores

We can observe that in every row the smallest number column has an additional zero compared to the previous row. You have read in lower classes about place value system. In this system (which was invented in India and spread to other countries!), the number 10 plays a very important role. It is shown in the following table.

1 × 10	=	10	(Ten)
10 × 10	=	100	(Hundred)
100 × 10	=	1000	(Thousand)
1000 × 10	=	10000	(Ten Thousand)
10000 × 10	=	100000	(Lakhs)
100000 × 10	=	1000000	(Ten Lakhs)

While each new row gives a number 10 times bigger, what happens if we skip and go 2 rows below. Numbers would be 100 times bigger.

For example, 1000 = 100 times 10, or Thousand has "hundred tens" in it.

NOTE

As the numbers get large, it is difficult to keep track of the number of digits and the place value for each digit. Wherever possible, we use names like lakh and crore instead of writing so many zeros. However, we can write exact values of large numbers too, if needed.

TRY THESE

1. Give 3 examples where the number of things counted by you would be a 5 digit number or more.
2. There are ten lakh people in a district. What would be the population of 10 such districts?
3. The Government spends rupees 2 crores for education in a particular district every month. What would be its expenditure over 10 months?

1.3 Place Value Chart

1.3.1 Indian Method

Periods	Crores		Lakhs		Thousands		Ones		
	TC	C	TL	L	T Th	Th	H	T	O
Place Value	Ten Crores	Crores	Ten Lakhs	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones

When we write large numbers we make use of place value chart to ensure that we do not miss any digit in between, while writing it. In a given number, starting from the right, the first three places make the ones period, the next two places make the thousands period, the next two places make the lakhs period and the next places make the crores period.

Try to read the number 359468421. Is it difficult? Yes. It is not easy. But by using the indicators or the periods, it is easy to read and write 359468421 as under.

Periods	Crores		Lakhs		Thousands		Ones		
Place Value	TC	C	TL	L	T Th	Th	H	T	O
Number	3	5	9	4	6	8	4	2	1
Number Name	35 Crores		94 Lakhs		68 Thousands		421 Ones		
	Thirty five crore ninety four lakh sixty eight thousand four hundred and twenty one.								

Use of comma

In any given number, we separate the periods by using commas. In our Indian System of Numeration, we use commas from the right. The first comma comes before Hundreds place (3 digits from the right). The second comma comes before Ten Thousands place (5 digits from the right). The third comma comes before Ten Lakhs place (7 digits from the right) and the digits next to it represents crore.

Example 1.1

The distance between the Sun and the Earth is about 92900000 miles. Read and write the number in the Indian method.

Solution

Periods	Crores	Lakhs		Thousands		Ones		
Place Value	C	TL	L	T Th	Th	H	T	O
Number	9	2	9	0	0	0	0	0
Using Commas	9,29,00,000							
Number Name	Nine crores and twenty nine lakhs.							

TRY THESE

Complete the table

Place Value / Number	TC	C	TL	L	T Th	Th	H	T	O	Number name
1670										
47684										
120001										
7800500			7	8	0	0	5	0	0	Seventy Eight Lakhs Five Hundred
53409098										
198765912										

Note: When we write numbers, the place value increases from right to left.

1.3.2 International Method

This system is followed by many countries in the world.

Periods	Billions			Millions			Thousands			Ones		
	HB	TB	B	HM	TM	M	HT	T Th	Th	H	T	O
Place Value	Hundred Billions	Ten Billions	Billions	Hundred Millions	Ten Millions	Millions	Hundred thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

In a given number, starting from the right, the first three places make the ones period, the next three places make the thousands period, the next three places make the million period and the next three places make the billion period etc.

Read and write 35694568421 in the international method

Periods	Billions			Millions			Thousands			Ones		
Place Value	HB	TB	B	HM	TM	M	HT	T Th	Th	H	T	O
Number		3	5	6	9	4	5	6	8	4	2	1
Number Name	35 Billions			694 Millions			568 Thousands			421 Ones		
	Thirty five billion six hundred and ninety four million five hundred and sixty eight thousand four hundred and twenty one.											

Use of commas

In the International System of Numeration, we use Ones, Tens, Hundreds, Thousands, Ten Thousands, Hundred Thousands, Million, Ten Million, Hundred Million and Billion, Ten Billion, Hundred Billion. Commas are used to mark Thousands, Millions and Billions.

Example 1.2

The distance between the Sun and the Earth is about 92900000 miles. Read and write the number in the International Method.

Solution

Periods	Billions			Millions			Thousands			Ones		
Place Value	HB	TB	B	HM	TM	M	HT	T Th	Th	H	T	O
Number					9	2	9	0	0	0	0	0
Using Commas	92,900,000											
Number Name	Ninety two million and nine hundred thousands.											

1.3.3 Comparison of Number Systems

We can easily understand both the Indian and the International Number Systems from the following table.

Indian Number System			International Number System		
Period	Name	Numeral	Name	Numeral	Period
Ones	One	1	One	1	Ones
	Ten	10	Ten	10	
	Hundred	100	Hundred	100	
Thousands	Thousand	1,000	Thousand	1,000	Thousands
	Ten thousand	10,000	Ten thousand	10,000	
Lakhs	Lakhs	1,00,000	Hundred thousand	100,000	
	Ten Lakhs	10,00,000	Million	1,000,000	Millions
Crores	Crores	1,00,00,000	Ten Million	10,000,000	
	Ten crores	10,00,00,000	Hundred Million	100,000,000	
	Hundred crores	100,00,00,000	Billion	1,000,000,000	Billions
	Thousand crores	1000,00,00,000	Ten Billion	10,000,000,000	

With the help of the above table, we can read the number 57340000 as 5,73,40,000 (Five Crore Seventy Three Lakh Forty Thousand) in the Indian System and as 57,340,000 (Fifty Seven Million Three Hundred Forty Thousand) in the International System.

TRY THESE

Identify the incorrectly placed comma and rewrite correctly.

Indian System : (i) 56,12,34,0,1,5 (ii) 9,90,03,2245

International System : (i) 7,5613,4534 (ii) 30,30,304,040

ACTIVITY

Take a white chart and cut into 9 equal pieces. Write different numbers on each piece. Arrange the pieces, as many times, horizontally which form different numbers. Write any five different numbers and express them in the Indian and the International System.

1.3.4 Place Value of digits in Large Numbers

Every digit of a number has a place value which gives the value of the digit.

Write the number 676097 in expanded form:

Number : 6,76,097

Expanded form : 6 lakhs + 7 ten thousands + 6 thousands + 0 hundreds + 9 tens + 7 ones

: $6 \times 100000 + 7 \times 10000 + 6 \times 1000 + 0 \times 100 + 9 \times 10 + 7 \times 1$

: $600000 + 70000 + 6000 + 90 + 7$

Finding the place value of all the digits in 9847056:

The Place value of 6 is	=	6 Ones	=	6×1	=	6
The Place value of 5 is	=	5 Tens	=	5×10	=	50
The Place value of 0 is	=	0 Hundreds	=	0×100	=	0
The Place value of 7 is	=	7 Thousands	=	7×1000	=	7,000
The Place value of 4 is	=	4 Ten Thousands	=	4×10000	=	40,000
The Place value of 8 is	=	8 Lakhs	=	8×100000	=	8,00,000
The Place value of 9 is	=	9 Ten Lakhs	=	9×1000000	=	90,00,000

Hence, the number 98,47,056 is read as Ninety Eight Lakhs Forty Seven Thousand Fifty Six.

TRY THESE

1. Expand the following numbers:
   (i) 2304567 (ii) 4509888 (iii) 9553556
2. Find the place value of underlined digits.
   (i) 3<u>8</u>41567 (ii) 94<u>4</u>3810
3. Write down the numerals and place value of 5 in the numbers represented by the following number names.
   (i) Forty Seven Lakhs Thirty Eight Thousand Five Hundred Sixty One.
   (ii) Nine Crores Eighty Two Lakhs Fifty Thousand Two Hundred Forty One.
   (iii) Nineteen Crores Fifty Seven Lakhs Sixty Thousand Three Hundred Seventy.

Example 1.3

How many thousands are there in 1 lakh?

Solution

Place Value	L	T Th	Th	H	T	O	
1 lakh	1	0	0	0	0	0	$\frac{1\text{lakh}}{1\text{thousand}} = \frac{100\cancel{000}}{1\cancel{000}} = 100$
1 thousand			1	0	0	0	

Lakh is 2 places to the left of thousand. So, it is 10 × 10 = 100 times thousand.
Hence, 1 lakh = 100 thousands.

Example 1.4

How many thousands are there in 1 million?

Solution

Place Value	M	H Th	T Th	Th	H	T	O	
1 million	1	0	0	0	0	0	0	$\frac{1\text{ million}}{1\text{ thousand}} = \frac{1000\cancel{000}}{1\cancel{000}} = 1000$
1 thousand				1	0	0	0	

Million is 3 places to the left of Thousand.
1000 Thousands (1000x1000 = 1,000,000) are in a million.

TRY THESE

1. How many hundreds are there in 10 lakh?
2. How many lakhs are there in a million?
3. 10 lakh candidates write the Public Exam this year. If each exam centre is allotted with 1000 candidates. How many exam centres would be needed?

Exercise 1.1

A7QM6R

1. Fill in the blanks.
   (i) The smallest 7 digit number is _____.
   (ii) The largest 8 digit number is _____.
   (iii) The place value of 5 in 7005380 is _____.
   (iv) The expanded form of the number 76,70,905 is _____.
2. Say True or False.
   (i) Successor of a one digit number is always a one digit number
   (ii) Predecessor of a 3-digit number is always a 3 or 4-digit number
   (iii) In the Indian System of Numeration the number 67999037 is written as 6,79,99,037.
   (iv) 88,888 = 8 × 10000 + 8 × 100 + 8 × 10 + 8 × 1

3. How many ten thousands are there in the smallest 6 digit number?

4. Observe the commas and write down the place value of 7.

   (i) 56,74,56,345 (ii) 567,456,345

5. Write the following numbers in the International System by using commas.

   (i) 347056 (ii) 7345671 (iii) 634567105 (iv) 1234567890

6. Write the largest six digit number and put commas in the Indian and the International Systems.

7. Write the number names of the following numerals in the Indian System.

   (i) 75,32,105 (ii) 9,75,63,453

8. Write the number names in words using the International System.

   (i) 345,678 (ii) 8,343,710 (iii) 103,456,789

9. Write the number name in numerals.

   (i) Two crores thirty lakhs fifty one thousand nine hundred eighty.

   (ii) Sixty six millions three hundred forty five thousand twenty seven.

   (iii) Seven hundred eighty nine millions, two hundred thirteen thousand four hundred fifty six.

10. Tamil Nadu has about twenty six thousand three hundred forty five square kilometre of Forest land. Write the number mentioned in the statement in Indian System and International System.

11. The number of employees in the Indian Railways is about ten lakhs. Write this in the International System of numeration.

Objective Type Questions

12. The successor of 10 million is

    (a) 1000001 (b) 10000001 (c) 9999999 (d) 100001

13. The difference between the successor and the predecessor of 99999 is

    (a) 90000 (b) 1 (c) 2 (d) 99001

14. 1 billion is equal to

    (a) 100 crore (b) 100 million (c) 100 lakh (d) 10000 lakh

15. The expanded form of the number 6,70,905 is

    (a) $6 \times 10000 + 7 \times 1000 + 9 \times 100 + 5 \times 1$

    (b) $6 \times 10000 + 7 \times 1000 + 0 \times 100 + 9 \times 100 + 0 \times 10 + 5 \times 1$

    (c) $6 \times 1000000 + 7 \times 10000 + 0 \times 1000 + 9 \times 100 + 0 \times 10 + 5 \times 1$

    (d) $6 \times 100000 + 7 \times 10000 + 0 \times 1000 + 9 \times 100 + 0 \times 10 + 5 \times 1$

1.4 Comparison of Numbers

We are familiar with the concept of comparing numbers and finding the biggest among them. We use symbols <, > and = to compare any two numbers.

1.4.1 Comparing numbers with unequal number of digits

1. When we compare the numbers 16090 and 100616, we have already learnt that the number with more digits is greater.

   Hence, 1,00,616 (6 digit number) > 16,090 (5 digit number).

2. Suppose we are given more than two numbers say 1468, 5, 201, 69 and 70000. Then among these, we can immediately say that the number 70000 is the greatest and 5 is the least, based on the number of digits.

TRY THESE

1. Write the numbers in the ascending order: 688, 9, 23005, 50, 7500.
2. Find the least and the greatest among the numbers: 478, 98, 6348, 3, 6007, 50935.

1.4.2 Comparing numbers with equal number of digits

Think about the situation

In a distance analysis chart, the distance between Chennai and New Delhi is 2180 k.m. and Chennai to Noida is 2158 k.m. respectively. Which city is farther from Chennai?

Step 1	Step 2	Step 3	
Compare the thousands place of two numbers 2 1 8 0 2 1 5 8 Here digit at the thousands place of both numbers are the same. We can't arrive at any conclusion. So, we move on to the next step.	Compare the hundreds place of two numbers 2 1 8 0 2 1 5 8 Here digit at the hundreds place of both numbers are the same. We can't arrive at any conclusion. So, we move on to the next step.	Compare the tens place of two numbers 2 1 8 0 2 1 5 8 Here digit at the tens place of both numbers are different, So, the number with the greatest tenth place will be the greater. Therefore, 2180 > 2158	Think! Why we need not compare the one's place?

Compare the given numbers 2180 and 2158 using the above mentioned steps.

2 = 2	1 = 1	8 > 5

Hence, 2180 > 2158. So, New Delhi is farther from chennai.

Example 1.5

Compare 59283746 and 59283748 using place value chart.

Solution

Step 1: Number of digits in the two given numbers are equal.

Step 2: Compare the place values using the place value chart.

Place Value	C	T L	L	T Th	Th	H	T	O
First Number	5	9	2	8	3	7	4	6
Second Number	5	9	2	8	3	7	4	8

Compare the digits of the two numbers from the highest place value as noted below.

5 = 5	9 = 9	2 = 2	8 = 8	3 = 3	7 = 7	4 = 4	6 < 8

Here only the digits in the ones place are not equal and 6 < 8.

Hence, 59283746 < 59283748.

TRY THESE

Compare the two numbers and put <, > and = using place value chart.

15475		3214
73204		973561
8975430		8975430
1899799		1899799

1.4.3 Arranging the numbers in ascending and descending order

The heights of five different apartments named as A, B, C, D and E in a locality are 985 feet, 1245 feet, 1865 feet, 355 feet and 585 feet respectively. They are shown according to their heights as shown in Fig. 1.1.

Can you arrange them in the ascending order of their heights?

Yes, We can arrange the numbers by comparing them based on the place values.

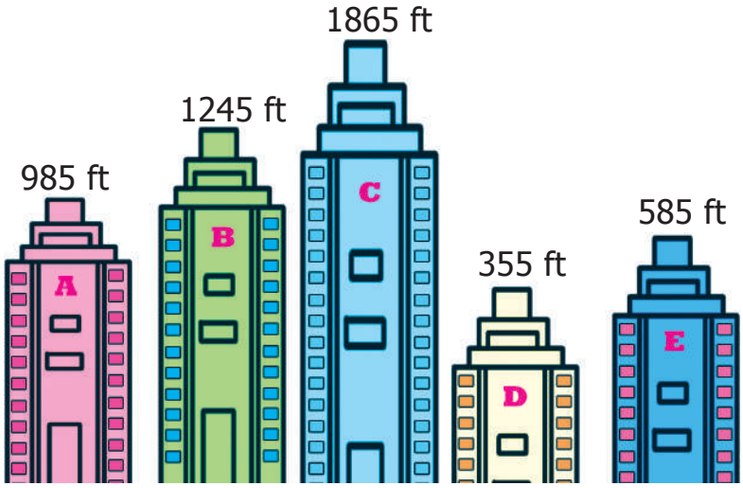


Fig. 1.1

Step 1

Compare the 4 digit numbers 1245 and 1865. By following the steps mentioned for comparing the numbers having same number of digits, we get 1865 > 1245.

The tallest apartment is 'C' (1865 feet).

The next tallest apartment is 'B' (1245 feet).

Place Value / Apartments	Th	H	T	O
A		9	8	5
B	1	2	4	5
C	1	8	6	5
D		3	5	5
E		5	8	5

Step 2

Compare the three digit numbers 985, 585 and 355. Using the above table, we get, 985 > 585 > 355. The smallest among them is 355.

Hence we write the heights of the apartments in ascending order as,

355	<	585	<	985	<	1245	<	1865
D		E		A		B		C

TRY THESE

The area in sq. k.m. of four Indian states are given below

States	Area (Sq.k.m.)
Tamil Nadu	1,30,058
Kerala	38,863
Karnataka	1,91,791
Andhra Pradesh	1,62,968

List the areas of the above four Indian States in the ascending and the descending order.

DO YOU KNOW?

Thomas Harriot
(1560 - 1621)
A famous mathematician, was the first to use "<" (less than) and ">" (greater than) symbols.

1.5 Creating New Numbers

Using the four digits 9, 4, 8 and 5 we need to make different 4-digit numbers in such a way that the digits are not repeated. We get the following arrangement of different 4-digit numbers.

Th	H	T	O
9	4	8	5
9	4	5	8
9	8	4	5
9	8	5	4
9	5	4	8
9	5	8	4

TRY THESE

In the same way, try placing the digit 4 in thousands place and get six different 4-digit numbers. Also make different 4-digit numbers by fixing 8 and 5 in the thousands place.

ACTIVITY

Divide a chart paper into eight equal parts. Write different 1-digit numbers on it. List out the possible 8 digit numbers and also find the largest and the smallest numbers among them.

Impact of Place Value

Consider the 4-digit number 3795. When we exchange the digits of two places, the number either becomes larger or smaller. For example, the given number is 3795. If the digits 9 and 5 are exchanged, then the number is 3759. This number is less than the given number. It makes a great impact in the situations like handling currencies.

TRY THESE

- In the same way, make different 4-digit numbers by exchanging the digits and check every time whether the number made is small or big.
- Pedometer used in walking practice contains 5 digit number. What could be the largest measure?

Exercise 1.2

1. Fill in the blanks with > or < or =.
   (i) 48792 _____ 48972
   (ii) 1248654 _____ 1246854
   (iii) 658794 _____ 658794
2. Say True or False.
   (i) The difference between the smallest number of seven digits and the largest number of six digits is 10.
   (ii) The largest 4-digit number formed by the digits 8, 6, 0, 9 using each digit only once is 9086.
   (iii) The total number of 4 digit numbers is 9000.
3. Of the numbers 1386787215, 137698890, 86720560, which one is the largest? Which one is the smallest ?
4. Arrange the following numbers in the descending order:
   128435, 10835, 21354, 6348, 25840
5. Write any eight digit number with 6 in ten lakhs place and 9 in ten thousandth place.
6. Rajan writes a 3-digit number, using the digits 4, 7 and 9. What are the possible numbers he can write?
7. The password to access my ATM card includes the digits 9,4,6 and 8. It is the smallest 4 digit even number. Find the password of my ATM Card.
8. Postal Index Number consists of six digits. The first three digits are 6, 3, and 1. Make the largest and the smallest Postal Index Number by using the digits 0,3 and 6, each only once.

9. The heights (in metres) of the mountains in Tamil Nadu are as follows:

Sl. No	Mountains	Height (in metres)
1	Doddabetta	2637
2	Mahendragiri	1647
3	Aanaimudi	2695
4	Velliangiri	1778

(i) Which is the highest mountain listed above?

(ii) Order the mountains from the highest to the lowest.

(iii) What is the difference between the heights of the mountains Aanaimudi and Mahendragiri?

Objective Type Questions

10. Which list of numbers is in order from the smallest to the largest?

(a) 1468, 1486, 1484 (b) 2345, 2435, 2235

(c) 134205, 134208, 154203 (d) 383553, 383548, 383642

11. The Arabian Sea has an area of 1491000 square miles. This area lies between which two numbers?

(a) 1489000 and 1492540 (b) 1489000 and 1490540

(c) 1490000 and 1490100 (d) 1480000 and 1490000

12. The chart below shows the number of newspapers sold as per Indian Readership Survey in 2018. Which could be the missing number in the table?

Name of the Newspaper	Ranking	Sold (in Lakh)
A	1	70
B	2	50
C	3	?
D	4	10

(a) 8 (b) 52 (c) 77 (d) 26

1.6 Use of Large Numbers in Daily Life Situations

We know to apply four basic operations on numbers. We will see a few more examples which deal with the four operations such as addition, subtraction, multiplication and division.

Example 1.6

In an exhibition, the number of tickets sold on the first, second, third and fourth days are 1,10,000, 75,060, 25,700 and 30,606 respectively. Find the total number of tickets sold on all the 4 days.

Solution

Number of tickets sold on the first day	=	1,10,000
Number of tickets sold on the second day	=	75,060
Number of tickets sold on the third day	=	25,700
Number of tickets sold on the fourth day	=	30,606
Adding all the above, the total number of tickets sold on all the 4 days	=	2,41,366

Example 1.7

In a year, a whole-sale paper firm sold 6,25,600 notebooks out of 7,50,000 notebooks. Find the number of notebooks left unsold.

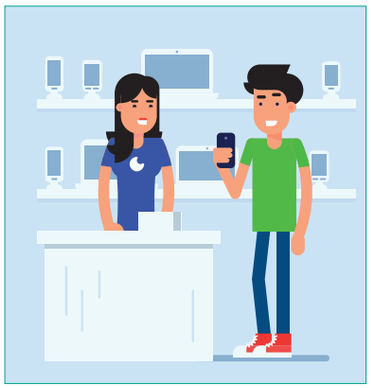
Solution

Number of notebooks in the store	=	7,50,000
Number of notebooks sold	=	6,25,600
Number of notebooks unsold	=	1,24,400

Example 1.8

In a mobile store, the number of mobiles sold during a month is 1250. Assuming that the same number of mobiles are sold every month, find the number of mobiles sold in 2 years.

Solution



Number of mobiles sold in 1 month = 1250

1 year = 12 months

2 years = 2 × 12

= 24 months

Number of mobiles sold in 24 months = 1250 × 24 = 30,000

Number of mobiles sold in 2 years = 30,000

Example 1.9

If ₹10,00,000 was distributed in a Government scheme to 500 women in the Self Help Groups, then find the amount given to each woman.

Solution

Amount to be given to 500 women = ₹10,00,000

Amount given to each woman = 10,00,000 ÷ 500 = ₹2000

Each woman in the Self Help Group was given ₹2000.

1.7 Order of Operations

Think about the situation

Valli and her four friends went to a butter milk shop. Each had a cup of butter milk and paid ₹30, assuming that the cost of one cup of butter milk to be ₹6. But the shop keeper told that the cost of butter milk had increased by ₹2. Then, Valli decided to give ₹2 more and paid ₹32. But the shop keeper claimed that she had to pay ₹40. Who is correct?

Valli calculated as,	Shop keeper calculated as,
$= (5 \times 6) + 2$	$= 5 \times (6 + 2)$
$= 30 + 2$	$= 5 \times 8$
$= 32$	$= 40$

The amount ₹40 claimed by the Shop keeper is correct. This confusion can be avoided by using the brackets in the correct places like $5 \times (6 + 2)$.

The rule of order of operations is called as BIDMAS. In BIDMAS the operations done from left to right.

Expansion of BIDMAS	
B	Bracket ( )
I	Indices (you will learn it later)
D	Division ÷ or /
M	Multiplication ×
A	Addition +
S	Subtraction –

Now, we try to solve $9 + 5 \times 2$ by using BIDMAS,

$$9 + (5 \times 2) = 9 + 10$$
$$= 19$$

Example 1.10

Simplify : $24 + 2 \times 8 \div 2 - 1$

Solution

$24 + 2 \times 8 \div 2 - 1$	(given question)
$= 24 + 2 \times 4 - 1$	(÷ operation, completed first)
$= 24 + 8 - 1$	(× operation, completed second)
$= 32 - 1$	(+ operation, completed third)
$= 31$	(– operation , completed last)

Example 1.11

Simplify : $20 + [8 \times 2 + \{(6 \times 3) - (10 \div 5)\}]$

Solution

Given,

$20 + [8 \times 2 + \{(6 \times 3) - (10 \div 5)\}]$

$= 20 + [8 \times 2 + \{(6 \times 3) - 2\}]$ (÷ completed first)

$= 20 + [8 \times 2 + \{18 - 2\}]$ (× completed second)

$= 20 + [8 \times 2 + 16]$ ({ } completed third)

$= 20 + [16 + 16]$ (× completed fourth)

$= 20 + 32$ ([ ] operation completed fifth)

$= 52$ (+ completed last)

Exercise 1.3

1. Fill in the blanks.
   (i) If Arulmozhi saves ₹ 12 per day, then she saves ₹ _____ in 30 days.
   (ii) If a person 'A' earns ₹ 1800 in 12 days, then he earns ₹ _____ in a day.
   (iii) $45 \div (7 + 8) - 2 =$ _____.
2. Say True or False.
   (i) $3 + 9 \times 8 = 96$ (ii) $7 \times 20 - 4 = 136$ (iii) $40 + (56 - 6) \div 2 = 45$
3. The number of people who visited the Public Library for the past 5 months were 1200, 2000, 2450, 3060 and 3200 respectively. How many people visited the library in the last 5 months.
4. Cheran had a bank savings of ₹ 7,50,250. He withdrew ₹ 5,34,500 for educational purpose. Find the balance amount in his account.
5. In a cycle factory, 1560 bicycles were manufactured every day. Find the number of bicycles manufactured in 25 days.
6. ₹ 62500 was equally distributed as a New Year bonus for 25 employees of a company. How much did each receive?
7. Simplify the following numerical expressions:
   (i) $(10 + 17) \div 3$ (ii) $12 - [3 - \{6 - (5 - 1)\}]$
   (iii) $100 + 8 \div 2 + \{(3 \times 2) - 6 \div 2\}$

Objective Type Questions

8. The value of $3 + 5 - 7 \times 1$ is _____.
   (a) 5 (b) 7 (c) 8 (d) 1

9. The value of 24 ÷ {8 – (3 x 2)} is _____

(a) 0 (b) 12 (c) 3 (d) 4

10. Use BIDMAS and put the correct operator in the box.

2 ☐ 6 –12 ÷ (4 + 2) = 10

(a) + (b) – (c) × (d) ÷

1.8 Estimation of numbers

Let us see few examples now,

(ix) Nearly 60,000 people watched the Republic day parade at Rajpath, New Delhi.

(x) About 2,80,000 people of various countries died due to earthquake and Tsunami on 26th December 2004 in the Indian ocean.

(xi) The India-Pakistan cricket match was viewed by about 30 million cricket fans in the Television all over the world.

We often come across statements like these in TV channels and dailies. Do these news items, give the exact numbers? No. The numbers mentioned are not accurate. They are only the approximate or closer values to the actual ones. This is the reason, why we generally use words like "about", "nearly" and "approximately". These numbers are only the estimation of the actual value. The word 'about' denotes the number not exactly, but a little more or less. This value is called the estimated value.

The actual figure, though not exactly possible, could have been 59,853 or 61,142 for the first example and it could have been 2,78,955 or 2,80,984 for the second example. Imagine and write about, what could have been the exact number for the third example given above? Similarly, there are many more possible numbers. Thus,

- to get a rough idea we need estimation.
- to get the estimated value, we generally round off the numbers to their nearest tens, hundreds or thousands.

Some real life situations where we use estimates are

(a) Cost of a Television, Refrigerator, Mixer Grinder etc., are usually expressed in thousands of rupees.

(b) The Voters population in an Assembly Constituency in a state is often stated in lakhs.

(c) The Central or State Government's Annual Budget is usually given in lakh crore.

When an exact answer is not necessary, estimation strategies can be used to determine a reasonably close answer.

ACTIVITY

1. Fill in the jar with some items like Tamarind seeds. Let each student give an estimate of the number of items. Make a table of the result by finding the difference of the estimate and the actual amount.
2. Get a large jar and a bag of Tamarind seeds and put 30 seeds in the jar. Observing the contents, estimate how many seeds roughly will fill the whole jar. Continue to fill the jar to check your estimate.

Rounding off is one way to find a number for estimation that is quite convenient. It gives us the closest suitable number according to a given place value. There are four steps involved in the rounding process. Let us illustrate this with an example.

Example 1.12

Round off the number 8,436 to the nearest hundreds.

Step	To do	8,436 to hundreds
Step 1	Find the digit in hundreds place	8,436
Step 2	Look at the digit to its right	8,436
Step 3	If this digit is 5 or greater, add 1 to it. If it is less than 5, leave it unchanged	8,436 (3 < 5) Leave 4 unchanged
Step 4	Change the digits to the right of 4 to zeros	8,400

Example 1.13

Round off the number 78,794 to the nearest thousands.

Step	To do	78,794 to thousands
Step 1	Find the digit in thousands place	78,794
Step 2	Look at the digit to its right	78,794
Step 3	If this digit is 5 or greater, add 1 to it. If it is less than 5, leave it unchanged	78,794 (7 > 5) Add 1 to 8 and Change 8 to 9
Step 4	Change the digits to the right of 79 to zeros	79,000

TRY THESE

1. Round off the following numbers to the nearest ten.

   (i) 57 (ii) 189 (iii) 3,956 (iv) 57,312

2. Round off the following numbers to the nearest ten, hundred and thousand.

   (i) 9,34,678 (ii) 73,43,489 (iii) 17,98,45,673

3. The tallest mountain in the world Mount Everest, located in Nepal is 8,848 m high. Its height can be rounded to the nearest thousand as _____.

1.8.1 Estimation of Sum and Difference

Example 1.14

The amount deposited by a Gold merchant in his bank account in the month of January is ₹17,53,740 and in the month of February is ₹15,34,300. Estimate the sum and difference of the amount deposited to the nearest thousand.

Solution

Rounding off to the nearest thousand is as follows.

	Actual Amount	Estimated Amount
Amount deposited in January	₹ 17,53,740	₹ 17,54,000
Amount deposited in February	₹ 15,34,300	₹ 15,34,000
Total amount deposited	₹ 32,88,040	₹ 32,88,000
Difference between the amounts deposited	₹ 2,19,440	₹ 2,20,000

THINK

Is 2,19,440 is rounded off to its nearest thousand as 2,19,000. Why?

1.8.2 Estimation of Product and Quotient

Example 1.15

If the cost of a copy of Thirukkural book is ₹ 188, then find the estimated cost of 31 copies of such books. (Note : Find the rounded values of 188 to hundreds and 31 to tens and then find the result)

DO YOU KNOW?

The number $\mathbf{10^{100}}$ is called **googol** (this is, 10 multiplied 100 times)

The number $\mathbf{10^{googol} = 10^{(10^{100})}}$ is called **googolplex**

Solution

Here, 188 is nearer to 200 and 31 is nearer to 30.

The exact cost of 31 copies is 188 × 31 = ₹ 5828 whereas,

The estimated cost of 31 copies = 200 × 30 = ₹ 6000

Therefore, the estimated cost of 31 copies of Thirukkural books is ₹ 6000.

Example 1.16

Find the estimated value of 5598 ÷ 689.

Solution

Actual value		Estimated value	
	8		8
689	5598	700	5600
	5512		5600
	86		0

Hence, the estimated value of 5598 ÷ 689 is 8

Round of the numbers 5598 and 689 to the nearest hundreds are 5600 and 700

TRY THESE

- Estimate the sum and the difference rounding off to nearest thousands: 8457 and 4573.
- Estimate the product : 39 × 53
- Estimate the quotient : 6845 ÷ 395

Exercise 1.4

1. Fill in the blanks.
   (i) The nearest 100 of 843 is _____.
   (ii) The nearest 1000 of 756 is _____.
   (iii) The nearest 10000 of 85654 is _____.

A7ZI8E

2. Say True or False.
   (i) 8567 is rounded off as 8600 to the nearest 10.
   (ii) 139 is rounded off as 100 to the nearest 100.
   (iii) 1,70,51,972 is rounded off as 1,70,00,000 to the nearest lakh.

3. Round off the following to the given nearest place.
   (i) 4,065; hundred (ii) 44,555; thousand
   (iii) 86,943; ten thousand (iv) 50,81,739; lakh
   (v) 33,75,98,482; ten crore

4. Estimate the sum of 157826 and 32469 rounded off to the nearest ten thousand.

5. Estimate by rounding off each number to the nearest hundred.
   (i) 8074 + 4178 (ii) 1768977 + 130589

6. The population of a city was 43,43,645 in the year 2001 and 46,81,087 in the year 2011. Estimate the increase in population by rounding off to the nearest thousand.

Objective Type Questions

7. The number which on rounding off to the nearest thousand gives 11000 is

   (a) 10345 (b) 10855 (c) 11799 (d) 10056

8. The estimation to the nearest hundred of 76812 is

   (a) 77000 (b) 76000 (c) 76800 (d) 76900

9. The number 9785764 is rounded off to the nearest lakh as

   (a) 9800000 (b) 9786000 (c) 9795600 (d) 9795000

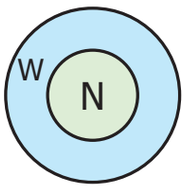
10. The estimated difference of 167826 and 2765 rounded off to the nearest thousand is

    (a) 180000 (b) 165000 (c) 140000 (d) 155000

1.9 Whole Numbers

What is Mathematics about? It is about numbers, perhaps about shapes as well. It is true that people usually count 1,2,3... on various situations. This collection of counting numbers {1,2,3,...} is called Natural numbers, denoted by N. If this collection includes 0 as well, then the collection {0,1,2,3,...} is called Whole numebrs, denoted by W.

1.9.1 Recall the facts on Natural and Whole Numbers



- The smallest natural number is 1.
- The smallest whole number is 0.
- Every number has a successor. The number that comes just after the given number is its successor.
- Every number has a predecessor. The number 1 has a predecessor in W namely '0', but it has no predecessor in N. The number '0' has no predecessor in W.
- There is an order to numbers. By comparing the two given numbers the larger of the two can be identified.
- Numbers are endless. By adding 1 to any chosen large number, the next number can be found.

Logical and Mathematical operations of numbers are used in everyday arithmetic of numbers. These operations can be made easier using properties. Certain properties of numbers are already used without actually knowing them. For example, while adding 8 + 2 + 7, one way of adding is, 8 and 2 are added first to get 10 and then 7 is added to it. The other way of adding this is, 2 and 7 added first to get 9 of then 8 is added to 9 to get 17 which is same as the are about in first way

TRY THESE

- Find the value of 6 + 3 + 8 and 3 + 6 + 8
  i) Are they same?
  ii) Is there any other way of arranging these three numbers?
- Find the value of 5 × 2 × 6 and 2 × 5 × 6
  i) Are they same?
  ii) Is there any other way of arranging these three numbers?
- Is 7 – 5, the same as 5 – 7? Why?
- What is the value of (15 – 8) – 6? Is it the same as 15 – (8 – 6)? Why?
- What is 15 ÷ 5? Is it the same as 5 ÷ 15? Why?
- What is the value of (100 ÷ 10) ÷ 5? Is it the same as 100 ÷ (10 ÷ 5)? Why?

1.10 Properties of Whole Numbers

The properties of numbers are important facts to be remembered,which helps to do arithmetic calculations more precisely and to avoid mistakes.

1.10.1 Commutativity of addition and multiplication

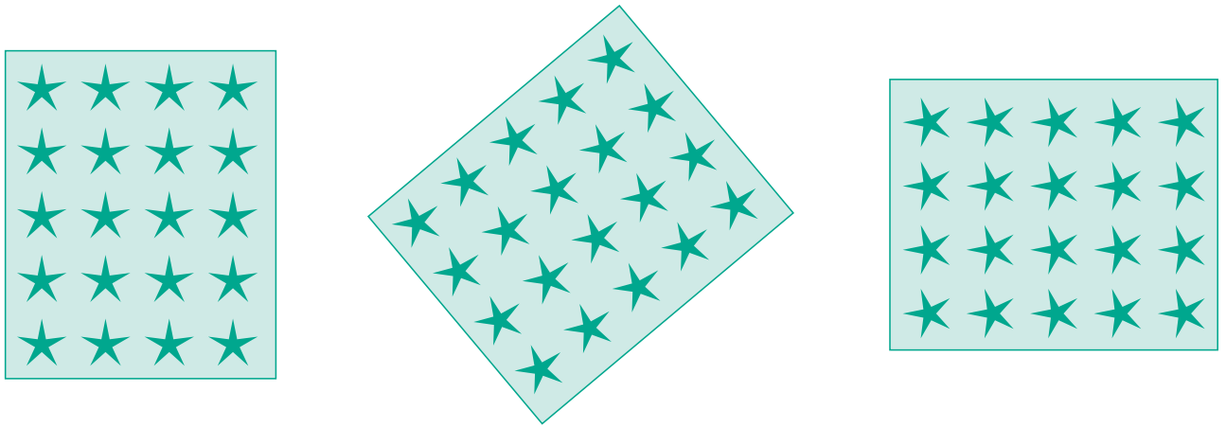
When two numbers are added (or multiplied), the order of the numbers does not affect the sum (or the product). This is called commutativity of addition (or multiplication).

Observe the given facts:

(i)	43 + 57	=	57 + 43
(ii)	12 × 15	=	15 × 12
(iii)	35,784 + 48,12,69,841	=	48,12,69,841 + 35,784
(iv)	39,458 × 84,321	=	84,321 × 39,458

Such facts are called as equations. In each of the above equations, the answers on both the sides are same. Finding the answer for the third and fourth equations takes more time. But, these equations are meant to convey the properties of numbers. The third equation is correct by commutativity of addition and the fourth equation is correct by commutativity of multiplication.

There is a nice pictorial way of understanding commutativity of multiplication. If we have 5 rows of stars, each with 4 stars, we can draw the total of 20 stars as a rectangle (5 × 4 = 20). See Fig.1.2 below. Now rotate the rectangle given in Fig.1.2 (a) to get the Fig.1.2(c) as given below. It is the same rectangle. It has exactly the same total number of stars, 20. But now we have 4 rows of stars, each with 5 stars! That is, 5 × 4 = 4 × 5.



(a) (b) (c)

Fig. 1.2

Now, look at the following example.

$7 - 3 = 4$ but $3 - 7$ will not give the same answer. Similarly, the answers of $12 \div 6$ and $6 \div 12$ are not equal.

That is, $7 - 3 \neq 3 - 7$ and $12 \div 6 \neq 6 \div 12$

Hence, In whole numbers subtraction and division are not commutative.

TRY THESE

- Use atleast three different pairs of whole numbers to verify that subtraction is not commutative.
- Is $10 \div 5$, the same as $5 \div 10$? Justify it by taking two more combinations of numbers.

1.10.2 Associativity of addition and multiplication

When several numbers are added, the order in which the numbers are added does not matter. This is called associativity of addition. Similarly, when several numbers are to be multiplied, the order in which the numbers are multiplied does not matter. This is called associativity of multiplication.

It can be said that the following equations are correct, without actually doing any addition or multiplication, but by using the property of associativity. A few examples are given below:

$$(43 + 57) + 25 = 43 + (57 + 25)$$
$$12 \times (15 \times 7) = (12 \times 15) \times 7$$
$$35{,}784 + (48{,}12{,}69{,}841 + 3) = (35{,}784 + 48{,}12{,}69{,}841) + 3$$
$$(39{,}458 \times 84{,}321) \times 17 = 39{,}458 \times (84{,}321 \times 17)$$

It is to be noted that here too, subtraction and division are not associative.

1.10.3 Distributivity of multiplication over addition or subtraction

An interesting fact relating to addition and multiplication comes from the following patterns:

$$(72 \times 13) + (28 \times 13) = (72 + 28) \times 13$$
$$37 \times 102 = (37 \times 100) + (37 \times 2)$$
$$37 \times 98 = (37 \times 100) - (37 \times 2)$$

From the last two cases, we are arriving at the following equations:

$$37 \times (100 + 2) = (37 \times 100) + (37 \times 2)$$
$$37 \times (100 - 2) = (37 \times 100) - (37 \times 2)$$

It can be noted that the product of a number and a sum of numbers can be written as the sum of two products. Similarly, the product of a number and a number got by subtraction can be written as the difference of two products. This property is called the property of distributivity of multiplication over addition or subtraction. It is a very useful property to group numbers in a convenient way. Now let us say $18 \times 6 = (10 + 8) \times 6$ in an easy way as shown in Fig.1.3.

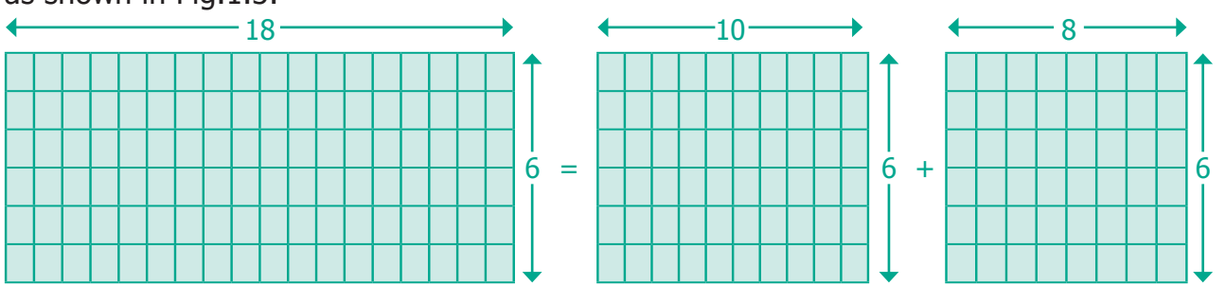


Fig.1.3

Thus, $18 \times 6 = (10 + 8) \times 6$ is shown clearly in the above figure.

It is to be noted that addition does not distribute over multiplication.

For example,

$10 + (10 \times 5) = 60$ and $(10 + 10) \times (10 + 5) = 300$ are not equal.

1.10.4 Identity for addition and multiplication

When zero is added to any number, we get the same number. Similarly, when we multiply any number by 1, we get the same number. So, zero is called the additive identity and one is called the multiplicative identity for whole numbers.

TRY THESE

Complete the following tables.

9	+	0	=	9
7	+	0	=	
0	+	17	=	17
0	+		=	37
0	+		=	

11	×	1	=	11
1	×	55	=	55
1	×	12	=	
1	×		=	100
1	×		=	

Finally, these are some simple observations that are important.

- When we add any two natural numbers, we get a natural number. Similarly when we multiply any two natural numbers, we get a natural number.
- When we add any two whole numbers, we get a whole number. Similarly when we multiply any two whole numbers, we get a whole number.
- When we add a natural number to a whole number, we get a natural number. When we multiply a natural number by a whole number, we get a whole number.

NOTE

- Any number multiplied by zero gives zero.
- Division by zero is not defined.

TRY THESE

Complete the table.

6	+	8	=	14, a natural number
4	+	5	=	9, a natural number
4	×	5	=	20, a natural number
6	×	8	=	48, a natural number
	+		=	
	+		=	
	×		=	
	×		=	
6	+	8	=	14 , a whole number
4	+	5	=	9, a whole number
15	×	0	=	0, a whole number
11	×	2	=	22, a whole number
	+		=	
	+		=	
	×		=	
	×		=	

All such properties together play a vital role in the Number System. When we learn Algebra, we can realise the usefulness of these properties of the Number System and we can find ways of extending it too.

DO YOU KNOW?

How will you read the large number given below?
731,687,303,715,884,105,727
This is read as 731 quintillion, 687 quadrillion, 303 trillion, 715 billion, 884 million, 105 thousand, 727 ones.

Exercise 1.5

A89EA2

1. Fill in the blanks.

   (i) The difference between the smallest natural number and the smallest whole number is _____.

   (ii) 17 × _____ = 34 × 17

   (iii) When _____ is added to a number, it remains the same.

   (iv) Division by _____ is not defined.

   (v) Multiplication by _____ leaves a number unchanged.

2. Say True or False.

   (i) 0 is the identity for multiplication of whole numbers.

   (ii) Sum of two whole numbers is always less than their product.

   (iii) Both addition and multiplication are associative for whole numbers.

   (iv) Both addition and multiplication are commutative for whole numbers.

   (v) Multiplication is distributive over addition for whole numbers.

3. Name the property being illustrated in each of the cases given below.

   (i) 75 + 34 = 34 + 75 (ii) (12 × 4) × 8 = 12 × (4 × 8)

   (iii) 50 + 0 = 50 (iv) 50 × 1 = 50

   (v) 50 × 42 = 50 × 40 + 50 × 2

4. Use the properties of whole numbers and simplify.

   (i) 50 × 102 (ii) 500 × 689 – 500 × 89

   (iii) 4 × 132 × 25 (iv) 196 + 34 + 104

Objective Type Questions

5. $(53 + 49) \times 0$ is

   (a) 102 (b) 0 (c) 1 (d) $53 + 49 \times 0$

6. $\frac{59}{1}$ is

   (a) 1 (b) 0 (c) $\frac{1}{59}$ (d) 59

7. The product of a non-zero whole number and its successor is always

   (a) an even number (b) an odd number

   (c) zero (d) none of these

8. The whole number that does not have a predecessor is

   (a) 10 (b) 0 (c) 1 (d) none of these

9. Which of the following expressions is not zero?

   (a) 0×0 (b) $0 + 0$ (c) $2 / 0$ (d) $0 / 2$

10. Which of the following is not true?

    (a) $(4237 + 5498) + 3439 = 4237 + (5498 + 3439)$

    (b) $(4237 \times 5498) \times 3439 = 4237 \times (5498 \times 3439)$

    (c) $4237 + 5498 \times 3439 = (4237 + 5498) \times 3439$

    (d) $4237 \times (5498 + 3439) = (4237 \times 5498) + (4237 \times 3439)$

Exercise 1.6

Miscellaneous Practice Problems

1. Try to open my locked suitcase which has the biggest 5 digit odd number as the password comprising the digits 7, 5, 4, 3 and 8. Find the password.
2. As per the census of 2001, the population of four states are given below. Arrange the states in ascending and descending order of their population.

State	Population
Tamil Nadu	72147030
Rajasthan	68548437
Madhya Pradesh	72626809
West Bengal	91276115

3. Study the following table and answer the questions.

Year	No. of Tigers
1990	3500
2008	1400
2011	1706
2014	2226

(i) How many tigers were there in 2011?

(ii) How many tigers were less in 2008 than in 1990?

(iii) Did the number of tigers increase or decrease between 2011 and 2014? If yes, by how much?

4. Mullaikodi has 25 bags of apples. In each bag there are 9 apples. She shares them equally amongst her 6 friends. How many apples do each get? Are there any apples left over?

5. A poultry has produced 15472 eggs and fits 30 eggs in a tray. How many trays do they need?

Challenging Problems

6. Read the table and answer the following questions.

Name of the Star	Diameter (in miles)
Sun	864730
Sirius	1556500
Canopus	25941900
Alpha Centauri	1037700
Arcturus	19888800
Vega	2594200

(i) Write the Canopus star's diameter in words, in the Indian and the International System.

(ii) Write the sum of the place values of 5 in Sirius star's diameter in the Indian System.

(iii) Eight hundred sixty four million seven hundred thirty. Write in Indian System.

(iv) Write the diameter in words of Arcturus star in the International System.

(v) Write the difference of the diameters of Canopus and Arcturus stars in the Indian and the International Systems.

7. Anbu asks Arivu Selvi to guess a five digit odd number. He gives the following hints.

   - The digit in the 1000s place is less than 5
   - The digit in the 100s place is greater than 6
   - The digit in the 10s place is 8

   What is Arivu Selvi answer? Does she give more than one answer?

8. A Music concert is taking place in a stadium. A total of 7,689 chairs are to be put in rows of 90. (i) How many rows will there be? (ii) Will there be any chairs left over?

9. Round off the seven digit number 29,75,842 to the nearest lakhs and ten lakhs. Are they the same?

10. Find the 5 or 6 or 7 digit numbers from a newspaper or a magazine to get a rounded number to the nearest ten thousand.

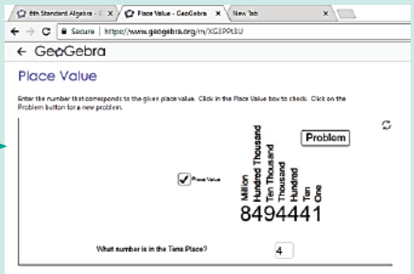
Summary

- Use of commas helps us in reading and writing large numbers.
- Use of commas differs in the Indian and the International Systems.
- Comparing any two numbers, the one with more digits is larger.
- Comparing any two numbers, if the digits are the same, the number that has a greater left most digit is larger.
- Using BIDMAS, we can avoid the common arithmetic mistakes.
- Large numbers are needed for various situations in our daily life.
- The situations where we do not need the exact quantity give rise to estimation or approximation.
- Estimation is approximating a quantity to a reasonable accuracy.
- Rounding of a number involves in getting a quick, desired and rough estimate of it.
- If zero is included in the collection of Natural numbers (N), we get the collection of Whole numbers (W), W = {0, 1, 2, ...}.
- '0' is the smallest whole number.
- '0' and '1' are the additive and multiplicative identities of whole numbers respectively.
- Whole numbers can be added or multiplied in any order and hence Commutative.
- Multiplication of Whole numbers is both Commutative and Associative.
- Multiplication is Distributive over addition for Whole numbers.
- Division by '0' is not defined.

ICT Corner

NUMBERS

Expected Result is shown in this picture



Step – 1

Open the Browser, Copy and paste the link given below (or) by type the URL given (or) Scan the QR Code.

Step - 2

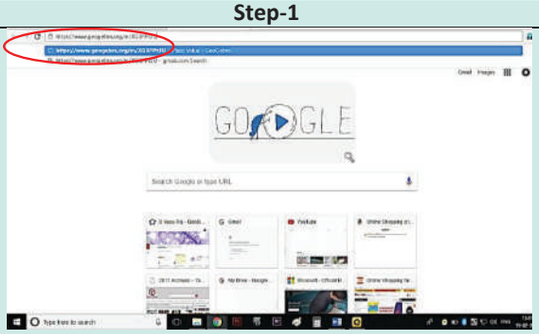
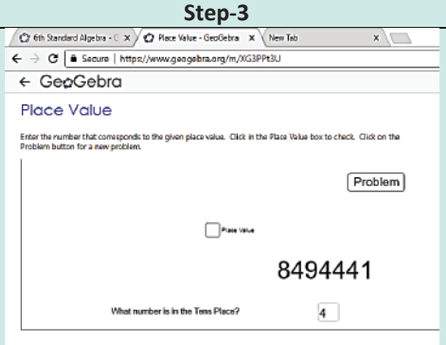
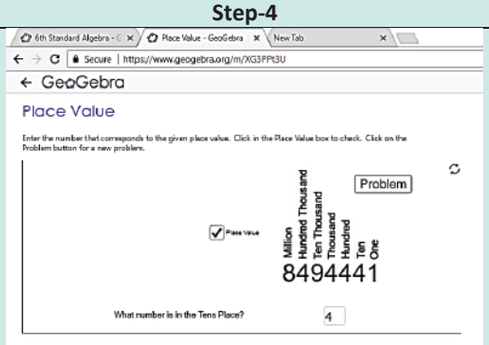
GeoGebra worksheet named “Place Value” will open. A Natural number is given. You can change the problem by clicking on “Problem” button.

Step-3

In the bottom page, Answer the question asked by typing the number related to the question.

Step-4

Now Click on the “Place Value” to see all the place values. Repeat the test by clicking on “Problem”.

Step-1	Step-2
	
Step-3	**Step-4**
	

Browse in the link

Place Value: - ***https://www.geogebra.org/m/XG3PPt3U***

Chapter 2

INTRODUCTION TO ALGEBRA

A8IABP

Learning Objectives

- To describe, extend, create numeric and geometric patterns.
- To make predictions related to the patterns and investigate repeating patterns.
- To understand the role of 'variables' in patterns.
- To use variables in simple algebraic expressions and equations to describe relationships.

2.1 Introduction

Are you ready for a number game? Follow the steps carefully:

Step 1	Step 2	Step 3	Step 4	Step 5
Think of any number	Multiply it by 2	Add 20	Divide by 2	Subtract the original number you had thought in step 1

Is your answer 10? Is it the same for all in the class? Verify it with your friend who might have started with a number other than your number. Surprised? What if you started with a fraction, say $\frac{1}{2}$ or $\frac{3}{4}$ or $\frac{4}{5}$? In this game, regardless of the number you started with, the answer will be 10.

Let us verify the game for two more numbers, say 4 and 9.

- If the initial number is 4,

Step 1	Step 2	Step 3	Step 4	Step 5
4	$4 \times 2 = 8$	$8 + 20 = 28$	$28 \div 2 = 14$	$14 - 4 = 10$

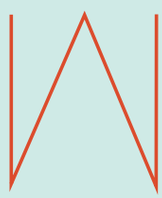
- If the initial number is 9,

Step 1	Step 2	Step 3	Step 4	Step 5
9	$9 \times 2 = 18$	$18 + 20 = 38$	$38 \div 2 = 19$	$19 - 9 = 10$

So, we can say that the same will happen for other numbers too.

You will find that Algebra is interesting and useful in solving problems in our daily life such as

- Finding the number of things to its cost.
- Expressing the distance covered, in terms of speed and time.
- Converting miles into kilometres, grams to kilograms etc.
- Finding the length of the barbed wire to fence a garden.
- Finding the area of a park.
- Finding the missing numbers in a sequence.

MATHEMATICS ALIVE – ALGEBRA IN REAL LIFE		
		
4 sticks	8 sticks	12 sticks
1 × 4 sticks	2 × 4 sticks	3 × 4 sticks

2.2 Patterns

Mathematics is easy when we look at it as a study of patterns. Patterns allow us to make reasonable guesses. Understanding patterns provide a clear basis for problem solving skills. In this chapter, we are going to look at patterns that deals with numbers. For example, let us list the numbers we know in order

1, 2, 3, 4, 5, 6, 7, 8, 9, 10...

We observe that 1 is odd, 2 is even, 3 is odd, 4 is even etc. Thus odd numbers and even numbers alternate with each other. If these is a sequence 12, 8, 4 ... can you find the next number? Easy, each number is obtained by subtracting 4 from the previous number. So the fourth number is 0.

The branch of Mathematics that deals with such patterns is called Algebra. Today Algebra is used widely in many fields that include banking, insurance, accounting, statistics, science, engineering, manufacturing and so on.

TRY THESE

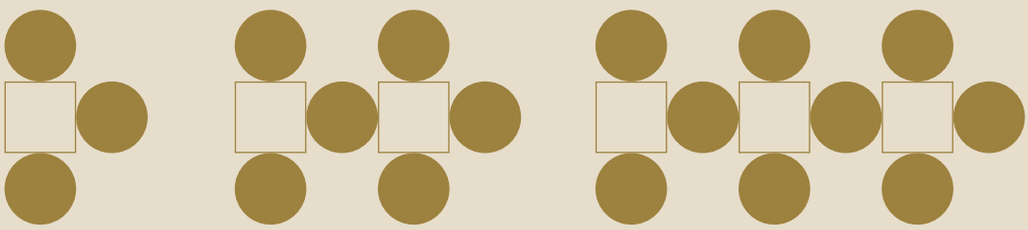
- Observe the following patterns and complete them.

  (i) 5, 8, 11, 14, ___ , ___ , ___

  (ii) If 15873 × 7 = 111111 and 15873 × 14 = 222222 then what is

  15873 × 21 =? and 15873 × 28 =?

- Draw the next two patterns and complete the table.



Pattern	1st	2nd	3rd	4th	5th
Squares	1	2	3		
Circles	3	6	9		

- Create your own pattern of shapes and prepare a table.

2.2.1 Patterns in Number Operations

In the first chapter on Whole Numbers, you have learnt about numbers that are multiplied by 1 or 0.

For example, we know, 57 × 1 = 57 and 43 × 0 = 0.

But we also know that this statement is true for all numbers (not just for the above two). So, can we say "any number" × 1 = "the same number" that we started with?

Algebra gives a way for writing such facts in a short and sweet way. We can write the above statement as $n \times 1 = n$, where n is a number. Here n on the left-hand side is just a letter that is used instead of saying "any number". The number on the right-hand side is the same n. This ensures that we get a correct statement!

In Algebra, we say that "n" is a *variable*. A variable is a symbol (usually an alphabet like n or x) that represents a number. Variables often help us to write briefly what we mean by a relation. In $n \times 1 = n$, left side number quantity 1 do not vary always. So we call it as *constant*.

For example, the following patterns such as,

$$7 + 9 = 9 + 7$$
$$57 + 43 = 43 + 57$$
$$123 + 456 = 456 + 123$$
$$7098 + 2018 = 2018 + 7098$$
$$35784 + 481269841 = 481269841 + 35784$$

can be simply summarized as $a + b = b + a$.

Here, we have two variables namely *"a"* and *"b"*. Each variable can take *"any value"*, but the value of *'a'* is the same on both sides, and the value of *'b'* is also the same on both sides. But, the values of *'a'* and *'b'* need not be equal to each other.

Can you give a similar intrepretation for $a \times b = b \times a$?

NOTE

Similar rules cannot be written for subtraction! We know what is '7 – 3', but not '3 – 7'. So *'a – b'* and *'b – a'* are not the same!

2.3 Understanding operations on Variables

Consider the following situations.

Situation 1:

Mathi is 3 years elder than his sister Nila. If we know Nila's age, can we find Mathi's?

If Nila's age is *'n'*, you can see that Mathi's age is always '$n + 3$'. This is the advantage of using variables. We do not need different statements for different values of the age! As we give different values for *'n'*, we get different values for '$n + 3$', here 3 is a *constant*. This is clear from the following table.

Nila's age 'n'	Mathi's age '$n + 3$'
If $n = 4$	7
If $n = 8$	11
If $n = 12$	15

Situation 2:

Patterns using Ice Candy Sticks

Pari and Manimegalai made some patterns with ice candy sticks.

To make one 'T', how many ice candy sticks are used by them? (Two sticks)

To make two 'T's, how many ice candy sticks are used by them? (Four sticks)

Continuing this, they prepared the following table to find the number of ice candy sticks used by them

Number of 'T's formed	1	2	3	4	. . .	k	. . .
Number of ice candy sticks used / required	2	4	6	8	. . .	2k	. . .
	2×1	2×2	2×3	2×4	. . .	$2 \times k$	. . .

From the above table, it is clear that if the number of 'T's required by them is 'k' then the number of ice candy sticks required by them will be $2 \times k = 2k$. Here 'k' is a variable.

TRY THESE

Use a variable to write the rule, which gives the number of ice candy sticks required to make the following patterns.

(i) a pattern of letter C as 

(ii) a pattern of letter M as 

2.4 Framing Algebraic Statements

Consider that there are 'n' number of apples in a basket. If 5 more apples are added, what will be the total number of apples in the basket now?

The total number of apples can be easily framed into an algebraic statement as '$n + 5$'. This algebraic statement '$n + 5$' tells that, whatever be the number of apples you had earlier, there are 5 more apples now in the basket.

- Suppose there are unknown number of people in a bus, say 'x' and if 2 more people get into the bus, then there will be '$x + 2$' people in the bus.

- There is a patty of butter which weighs 'w' grams. If you cut off 100 grams from it, you will have '$w - 100$' grams left.
- If you start with a number 'y' and then double it, you can write it as '$2y$' (you know, '$2y$' means 2 multiplied by y).

2.4.1 Converting Algebraic statements to Verbal statements

A few examples are given in the following table.

Sl. No	Algebraic statement	Verbal statement
1.	$m + 14$	14 more than 'm'
2.	$x - 6$	'x' is reduced by 6
3.	$3y$ (or) $3 \times y$	product of 3 and 'y'
4.	$5 \div z$ (or) $\frac{5}{z}$	5 divided by 'z'
5.	$2p - 5$	5 less to 2 times 'p'

Likewise, verbal statements can be converted to algebraic statements as follows.

TRY THESE

Sl. No	Algebraic statement	Verbal statement
1.	$a + 5$	
2.	$6z - 1$	
3.	$12y$	
4.	$\frac{x}{6}$	

2.4.2 Converting Verbal statements to Algebraic Statements

A few examples are given in the following table.

Sl. No	Verbal statement	Algebraic statement
1.	'x' is increased by 21	$x + 21$
2.	7 is taken away from 'a'	$a - 7$
3.	Twice 'p'	$2p$
4.	10 divided by 'm'	$10 \div m$
5.	The product of 7 and 'y' is divided by 2	$7y \div 2$

TRY THESE

Sl. No	Verbal statement	Algebraic statement
1.	Seven times of 'n' minus 5	
2.	The sum of 'x' and 4	
3.	3 times 'y' is divided by 8	
4.	11 is multiplied by 'm'	

2.5 Solving unknowns through examples

Let us fill in the empty boxes

(a) $\square + 3 = 8$ (b) $2 + \square = 9$ (c) $11 - 5 = \square$

The $\square$ stands for an unknown number.

To make the equations meaningful, we shall write 5 in the first box, we shall write 7 in the second box and we shall write 6 in the third box.

TRY THESE

Find the unknown.

(i) $37 + 43 = 43 + \square$ (ii) $(22 + 10) + 15 = \square + (10 + 15)$

(iii) If $7 \times 46 = 322$ then $46 \times 7 = \square$

Example 2.1

Suppose that there are some eggs in a tray. If 6 eggs are taken out from it and still 10 eggs are remaining, how many eggs are there in the tray?

According to the given statement,

Unknown number of eggs in the tray minus 6 eggs gives 10 eggs

This can be written as, $x - 6$ gives 10, where 'x' denotes the unknown number.

Now, we will find out for what value of 'x', $x - 6$ gives 10.

Value of 'x' Yes/No	$x - 6$	Result	Is it 10?
7	7 – 6	1	No
10	10 – 6	4	No
12	12 – 6	6	No
15	15 – 6	9	No
16	16 – 6	10	Yes
18	18 – 6	12	No

Hence, the unknown number (variable) 'x' takes the value 16.

TRY THIS

Find the suitable value of 'm', to get a sum of 9?

m	$m + 4$	Result	Is it 9? Yes / No
1	1+4	5	No
2	_____	_____	
3	_____	_____	
4	_____	_____	
5	_____	_____	

Example 2.2

Athiyan and Mugilan are brothers. Athiyan is 'p' years old and Mugilan is elder to Athiyan by 6 years. Write an algebraic statement for this and find the age of Mugilan if Athiyan is 20 years old.

Age of Athiyan = 'p' years

Age of Mugilan = '$p + 6$' years (algebraic statement)

If $p = 20$, then Mugilan's age is = 20 + 6

= 26 years.

A8S6DC

Exercise 2.1

A922EZ

1. Fill in the blanks.

   (i) The letters $a, b, c, \ldots x, y, z$ are used to represent _____.

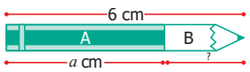
   (ii) The algebraic statement of 'f decreased by 5' is _____.

   (iii) The algebraic statement of 's divided by 5' is _____.

   (iv) If A's age is 'n' years now, 7 years ago A's age was _____.

   (v) If '$p - 5$' gives 12 then 'p' is _____.

2. Say True or False.

   (i) 

   The length of part B in the pencil shown is '$a - 6$'.

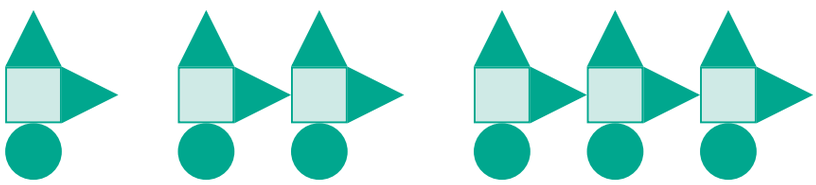
   (ii) If the cost of an  is 'x' and the cost of a  is ₹5, then the total cost of fruits is ₹ '$x + 5$'.

   (iii) 10 more to three times 'c' is '$10c + 3$'

   (iv) If the cost of 10 rice bags is ₹ 't', then the cost of 1 rice bag is ₹$\frac{t}{10}$.

   (v) The product of 'q' and 20 is '$20q$'.

3. Draw the next two patterns and complete the table.



Shapes	1st Pattern	2nd Pattern	3rd Pattern	4th Pattern	5th Pattern
Squares	1	2	3		
Circles	1	2	3		
Triangles	2	4	6		

4. Arivazhagan is 30 years younger to his father. Write Arivazhagan's age in terms of his father's age.

5. If 'u' is an even number, how would you represent

   (i) the next even number? (ii) the previous even number?

6. Express the following verbal statement to algebraic statement.

(i) 't' is added to 100. (ii) 4 times 'q'. (iii) 4 less to 9 times of 'y'.

7. Express the following algebraic statement to verbal statement.

(i) $x \div 3$ (ii) $11 + 10x$ (iii) $70s$

8. The teacher asked two students to write the algebraic statement for the verbal statement "8 more than a number". Vetri wrote '$8 + x$' but Maran wrote '$8x$'. Who gave the correct answer?

9. Answer the following questions.

(i) If 'g' is equal to 300 what is the value of '$g - 1$' and '$g + 1$' ?

(ii) What is the value of 's', if '$2s - 6$' gives 30?

10. Complete the table and find the value of 'k' for which $\frac{'k'}{3}$ gives 5.

k	3	6	9	12	15	18
$\frac{k}{3}$	1	2				

Objective Type Questions

11. Variable means that it

(a) can take only a few values (b) has a fixed value

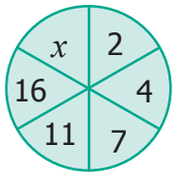
(c) can take different values (d) can take only 8 values

12. The number of days in 'w' weeks is

(a) $30 + w$ (b) $30w$ (c) $7 + w$ (d) $7w$

13. The value of 'x' in the circle is

(a) 6 (b) 8 (c) 21 (d) 22



14. The value of 'y' in $y + 7 = 13$ is

(a) $y = 5$ (b) $y = 6$ (c) $y = 7$ (d) $y = 8$

15. 6 less to 'n' gives 8 is represented as

(a) $n - 6 = 8$ (b) $6 - n = 8$ (c) $8 - n = 6$ (d) $n - 8 = 6$

Exercise 2.2

Miscellaneous Practice Problems

1. Complete the following pattern.

$9 - 1 =$

$98 - 21 =$

$987 - 321 =$

$9876 - 4321 =$

$98765 - 54321 =$

What comes next?

2. A piece of wire is '12*s*' cm long. What will be the length of the side, if it is formed as

   (i) an equilateral triangle

   (ii) a square

3. Identify the value of the shapes and figures in the table given below and verify their addition horizontally and vertically.

★	☺	☺	★	= 30
★	★	▲	▲	= 36
★	▲	☺	☺	=
★	☺	▲	☺	=
= 32	=	=	=	=

4. The table given below shows the results of the matches played by 8 teams in a Kabaddi championship tournament.

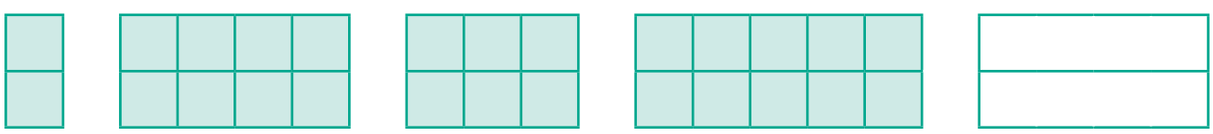
Teams	A	B	C	D	E	F	G	H
Total Matches played	8	7	n	a	9	10	8	y
Matches won	5	6	4	7	b	6	x	3
Matches lost	k	m	6	2	3	c	4	6

Find the value of all the variables in the table given above.

Challenging Problems

5. Gopal is 8 years younger to Karnan. If the sum of their ages is 30, how old is Karnan?

6. The rectangles made of identical square blocks with varying lengths but having only two square blocks as width are given below.



P Q R S T

(i) How many small size squares are there in each of the rectangles P, Q, R and S?

(ii) Fill in the boxes.

Rectangle	P	Q	R	S	T
Number of small size squares along the breadth	2	2	?	2	2
Number of squares along the length	1	4	3	?	x
Total number of squares in rectangle	?	8	?	10	?

7. Find the variables from the clues given below and solve the cross–word puzzle.

x			t		
		z			p
v				k	
			u		
		a			m
	s				

Across	Down
x + 40 gives 100	x is 1005 multiplied by 6
7 reduced from t gives 31	$t \div 7 = 5$
z is 5 added 5 times	p is the predecessor of first 3 digit number
v is the whole number zero plus number of days in a ordinary year	z is the number of weeks in a year (digits reversed)
k is 24 added to 25	k is 11 times 4
u is 2 added to two times 11 gives the number of hours in a day	u is product of 23 and 9
a is 20 more to 40	a is 4 added to the product of 12 and 5
s minus 1 gives 246 is the number of letters in Tamil language	m is the successor of 9

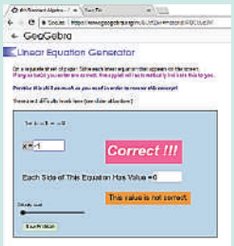
Summary

- Variables are quantities that can take any value and they are denoted by small alphabets $a, b, c, \ldots, x, y, z$.
- Constants are quantities whose value do not change always i.e. a fixed value.
- A Variable allows us to express relations easily in all practical situations.
- Variables are used to generalise and express many common rules of Geometry and Arithmetic.

ICT Corner

INTRODUCTION TO ALGEBRA

Expected Result is shown in this picture



Step – 1

Open the Browser, Copy and paste the link given below (or) by type the URL given (or) Scan the QR Code.

Step - 2

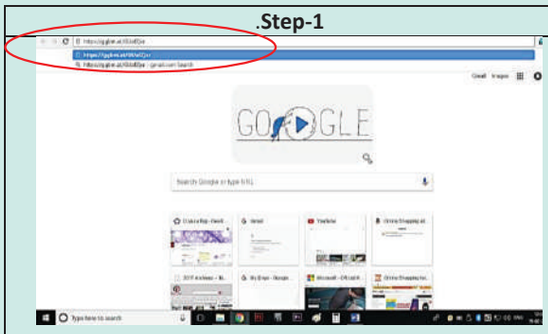
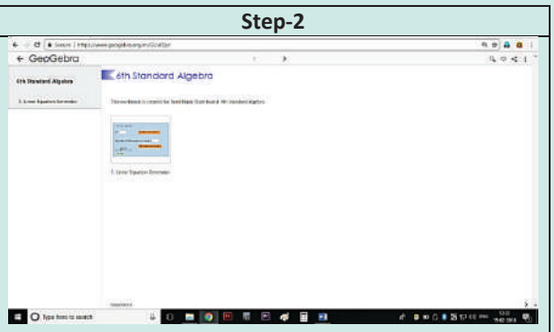
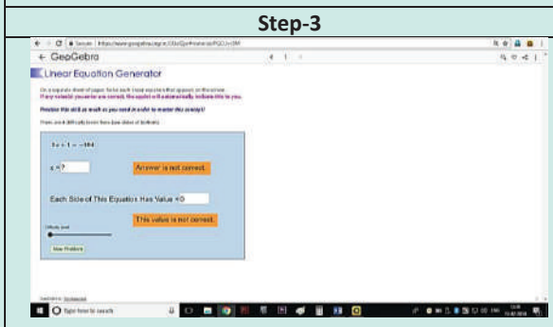
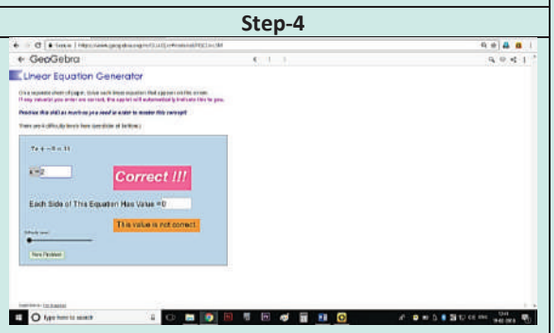
GeoGebra Work Book "**6th Standard Algebra**" will appear. There are several worksheets. In that open "**Linear Equation Generator**"

Step-3

In the page select the difficulty level by moving the slider. Linear equation will appear on the top solve it and enter your answer in the "**x**" box and hit enter.

Step-4

If your answer is correct "**Correct!!!**" menu will appear. Try more problems by clicking on "**New Problem**"

.Step-1	Step-2
	
Step-3	**Step-4**
	
Try the remaining worksheets given in this work book related to your lesson	

Browse in the link

Algebra: - https://ggbm.at/GUafZjxr

Chapter 3 RATIO AND PROPORTION

A9JTIA

Learning Objectives

- To understand the concept of ratio.
- To use ratio notation and simplify ratios.
- To divide a quantity into two parts for a given ratio.
- To recognise the relationship between ratio and proportion.
- To use the unitary method and solve simple ratio problems.

Recap

1. Which of the following fractions is not a proper fraction?

   (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{5}{10}$ (d) $\frac{10}{5}$

2. The equivalent fraction of $\frac{1}{7}$ is _____.

   (a) $\frac{2}{15}$ (b) $\frac{1}{49}$ (c) $\frac{7}{49}$ (d) $\frac{100}{7}$

3. Write > ,< or = in the box.

   (i) $\frac{5}{8}$ ☐ $\frac{1}{10}$ (ii) $\frac{9}{12}$ ☐ $\frac{3}{4}$

4. Anban says that $\frac{2}{6}$th of the group of triangles given below are blue. Is he correct?

5. Joseph has a flower garden. Draw a picture which shows that $\frac{2}{10}$ th of the flowers are red and the rest of them are yellow.

6. Malarkodi has 10 oranges. If she ate 4 oranges, what fraction of oranges was not eaten by her?

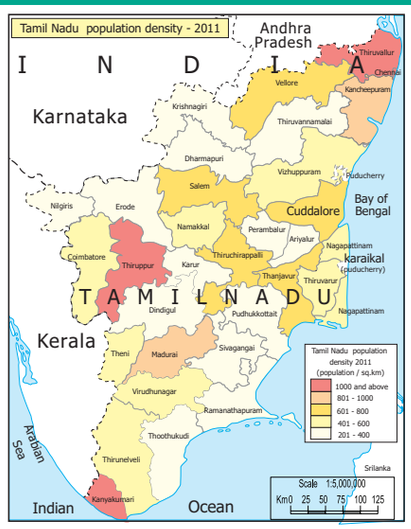
7. After sowing seeds on day one, Muthu observes the growth of two plants and records it. In 10 days, if the first plant grew $\frac{1}{4}$ th of an inch and the second plant grew $\frac{3}{8}$ th of an inch, then which plant grew more?

3.1 Introduction

In our daily life, we handle lots of situations where we compare quantities. Comparison of our heights, weights, marks secured in examinations, speeds of vehicles, distances travelled, auto fare to taxi fare, bank balances at different periods of time and many more things are done. Comparison is usually between quantities of the same kind and not of different kind. It will not be meaningful to compare the height of a person with the age of another person. Also, we need a standard measure for comparison.

This sort of comparison by expressing one quantity as the number of times the other is called a '*Ratio*'.

MATHEMATICS ALIVE – RATIO IN REAL LIFE



Male		Female	
Height	Ideal Weight	Height	Ideal Weight
4' 6"	28 - 35 Kg.	4' 6"	28 - 35 Kg.
4' 7"	30 - 39 Kg.	4' 7"	30 - 37 Kg.
4' 8"	33 - 40 Kg.	4' 8"	32 - 40 Kg.
4' 9"	35 - 44 Kg.	4' 9"	35 - 42 Kg.
4' 10"	38 - 46 Kg.	4' 10"	36 - 45 Kg.
4' 11"	40 - 50 Kg.	4' 11"	39 - 47 Kg.
5' 0"	43 - 53 Kg.	5' 0"	40 - 50 Kg.
5' 1"	45 - 55 Kg.	5' 1"	43 - 52 Kg.
5' 2"	48 - 59 Kg.	5' 2"	45 - 55 Kg.
5' 3"	50 - 61 Kg.	5' 3"	47 - 57 Kg.
5' 4"	53 - 65 Kg.	5' 4"	49 - 60 Kg.
5' 5"	55 - 68 Kg.	5' 5"	51 - 62 Kg.
5' 6"	58 - 70 Kg.	5' 6"	53 - 65 Kg.
5' 7"	60 - 74 Kg.	5' 7"	55 - 67 Kg.
5' 8"	63 - 76 Kg.	5' 8"	57 - 70 Kg.
5' 9"	65 - 80 Kg.	5' 9"	59 - 72 Kg.
5' 10"	67 - 83 Kg.	5' 10"	61 - 75 Kg.
5' 11"	70 - 85 Kg.	5' 11"	63 - 77 Kg.
6' 0"	72 - 89 Kg.	6' 0"	65 - 80 Kg.

555 persons to one square k.m.

Comparison of Height and Weight by using ratio

3.2 Ratio

Think about this Situation

Let us consider a situation of cooking rice for two persons. The quantity of rice required for two persons is one cup. To cook every one cup of rice, we need to add two cups of water. Assuming that 8 more guests join for lunch, will the use of ratio help us in handing this situation?

The number of cups of rice and water required are given below.

DO YOU KNOW?

It is possible to trace the origin of the word "ratio" to the Ancient Greek Medieval. Writers used the word proprotio ("proportion") to indicate ratio and proportionalities ("proprotionality") for the equality of ratios. Early translators rendered this into Latin as ratio ("reason"; as in the word "rational")

Number of cups of rice	1	2	3	4	5
Number of cups of water (or) No. of persons	2	4	6	8	10

In all the cases, the number of cups of water (or) the number of persons is 2 times the number of cups of rice. So, we write

Number of cups of rice : Number of cups of water (or) the number of persons = 1 : 2

Such comparison is called as a Ratio.

NOTE

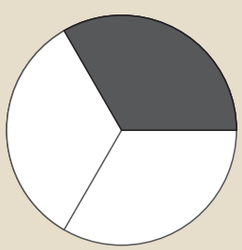
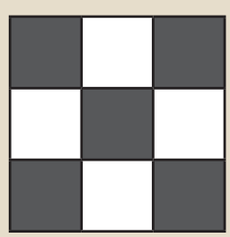
- A ratio is a comparison of two quantities with same units.
- If 'a' and 'b' are two different quantities with same unit then, we can write the ratio as a:b (read as a is to b).
- A ratio can be written as a fraction; ratios are mostly written in the simplest form.
- In the above example, the ratio of rice to water in terms of the number of cups can be written in three different ways as 1 : 2 or $\frac{1}{2}$ or 1 to 2 .

TRY THESE

1. Write the ratio of red tiles to blue tiles and yellow tiles to red tiles.

2. Write the ratio of blue tiles to that of red tiles and red tiles to that of total tiles.

3. Write the ratio of shaded portion to the unshaded portions in the following shapes.

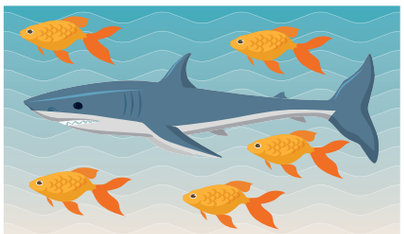
	
Ratio:_____	Ratio:_____

3.2.1 Properties of Ratio

- A ratio has no unit. It is a number. For example, the ratio of 8 k.m. to 4 k.m. is written as 8 : 4 = 2 : 1 and not 2 k.m. : 1 k.m.
- The two quantities in a ratio should be of the *same* unit. The ratio of 4 k.m. to 400 m is expressed as (4 × 1000) : 400 = 4000 : 400 = 10 : 1

- Each number of the ratio is called *a term*.
- Order of the terms in a ratio cannot be reversed.

A few examples are given below.

 (a)	 (b)
Ratio of the number of small fish to the number of big fish is 5 : 1	Ratio of the number of boys to girls in above figure 5 : 4

In the above example, the ratio of the number of small fish to the number of big fish is 5 : 1. The same information cannot be written as 1 : 5 and so, 5 : 1 and 1 : 5 are not the same.

Similarly, if in a class, there are 12 boys and 12 girls, then the ratio of number of boys to the number of girls is expressed as 12 : 12 which is the same as 1 : 1.

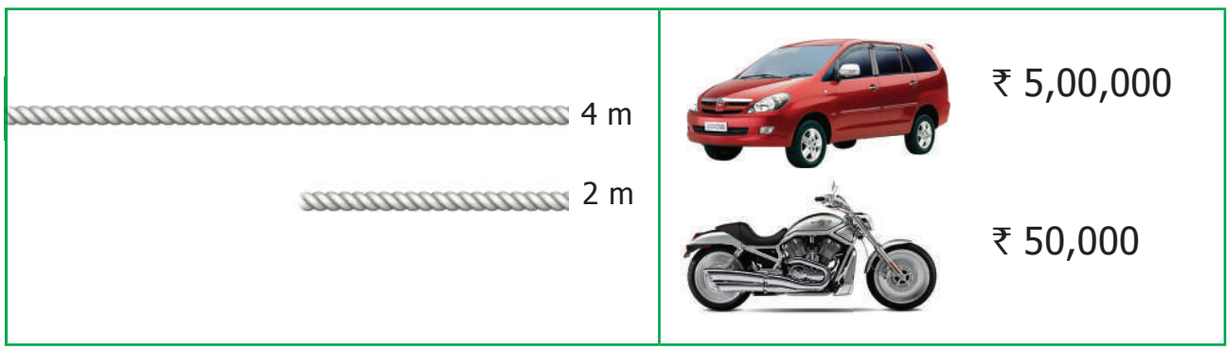
TRY THESE

If the given quantity is in the same unit, put ✓ otherwise put X in the table below.

Sl.No	Quantity	Put ✓ or X
1	5 c.m and 100 c.m	
2	₹ 5 and 50 oranges	
3	2 m and 75 ml	
4	7 k.m and 700 m	
5	3 k.g of potatoes and 2 k.g onions	
6	10 c.m and 32 pencils	

3.2.2 Ratios in simplest form

Think about these situations



(a) Fig. 3.1 (b)

1. The larger rope is 4 m long and the smaller rope is 2 m long. This is expressed in the form of ratio as 4 : 2 and the simplest form of ratio of the larger rope to the smaller rope is 2 : 1 (See Fig. 3.1 (a))
2. The cost of a car is ₹ 5,00,000 and the cost of a motorbike is ₹ 50,000. This is expressed as 500000 : 50000 = 50 : 5 and the simplest form of ratio of the car to the motorbike is 10 : 1 (See Fig. 3.1 (b))

3.2.3 Simplifying ratios of same unit

5 x 1 = 5

5 x 2 = 10

5 x 3 = 15

5 x 4 = 20

Example 3.1

Simplify the ratio 20 : 5.

Solution

Step 1 : Write the ratio in fraction form as $\frac{20}{5}$.

Step 2 : Divide numerator and denominator by 5. That is, $\frac{20 \div 5}{5 \div 5} = \frac{4}{1} = 4 : 1$

This is the ratio in the simplest form.

Example 3.2

Find the ratio of 500 g to 250 g.

Solution

500 g to 250 g = 500 : 250 $\Rightarrow \frac{500}{250} = \frac{500 \div 250}{250 \div 250} = \frac{2}{1} = 2 : 1$

This is the ratio in the simplest form.

Example 3.3

Madhavi and Anbu bought two tables for ₹ 750 and ₹ 900 respectively. What is the ratio of the prices of tables bought by Anbu and Madhavi?

Solution

The ratio of the price of tables bought by Anbu and Madhavi

$= 900:750 = \frac{900}{750} \Rightarrow \frac{900 \div 150}{750 \div 150} = \frac{6}{5} = 6:5$. This is the ratio in the simplest form.

3.2.4 Simplifying ratios of different units

1 hour = 60 minutes

20 x 1 = 20

20 x 2 = 40

20 x 3 = 60

Example 3.4

What is the ratio of 40 minutes to 1 hour?

Solution

Step 1 : Express the quantity in the same unit. (Hint : 1 Hour = 60 minutes)

Step 2 : Now, the ratio of 40 minutes to 60 minutes is $40:60 \Rightarrow \frac{40}{60} = \frac{40 \div 20}{60 \div 20} = \frac{2}{3} = 2:3$

This is the ratio in the simplest form.

TRY THESE

Write the ratios in the simplest form and fill in the table.

Sl. No.	Quantity	Ratio Form	Fraction Form	Dividing by a common number	Simplest form of Ratio
1	Ratio of 15 girls to 10 boys	15 : 10	$\frac{15}{10}$	$\frac{15 \div 5}{10 \div 5} = \frac{3}{2}$	3 : 2
2	Ratio of 1m 25 cm to 2 m	125 : 200 (1m=100cm)	$\frac{125}{200}$		
3	Ratio of 3 Kg to 750 g	3000 : 750 (1Kg=1000g)			
4	Ratio of 70 minutes to 30 minutes				

Exercise 3.1

A9TPJX

1. Fill in the blanks.
   (i) Ratio of ₹3 to ₹5 = _____.
   (ii) Ratio of 3 m to 200 c.m = _____.
   (iii) Ratio of 5 k.m 400 m to 6 k.m = _____.
   (iv) Ratio of 75 paise to ₹2 = _____.
2. Say whether the following statements are True or False.
   (i) The ratio of 130 c.m to 1 m is 13 : 10.
   (ii) One of the terms in a ratio cannot be 1.
3. Find the simplified form of the following ratios.
   (i) 15 : 20 (ii) 32 : 24 (iii) 7 : 15 (iv) 12 : 27 (v) 75 : 100
4. Akilan walks 10 k.m in an hour while Selvi walks 6 km in an hour. Find the simplest ratio of the distance covered by Akilan to that of Selvi.
5. The cost of parking a bicycle is ₹5 and the cost of parking a scooter is ₹15. Find the simplest ratio of the parking cost of a bicycle to that of a scooter.
6. Out of 50 students in a class, 30 are boys. Find the ratio of
   (i) number of boys to the number of girls.
   (ii) number of girls to the total number of students.
   (iii) number of boys to the total number of students.

Objective Type Questions

7. The ratio of ₹1 to 20 paise is _____.

   (a) 1 : 5 (b) 1 : 2 (c) 2 : 1 (d) 5 : 1

8. The ratio of 1 l to 50 ml is _____.

   (a) 1 : 5 (b) 1 : 20 (c) 20 : 1 (d) 5 : 1

9. The length and breadth of a window are in 1m and 70 cm respectively. The ratio of the length to the breadth is _____.

   (a) 1 : 7 (b) 7 : 1 (c) 7 : 10 (d) 10 : 7

10. The ratio of the number of sides of a triangle to the number of sides of a rectangle is

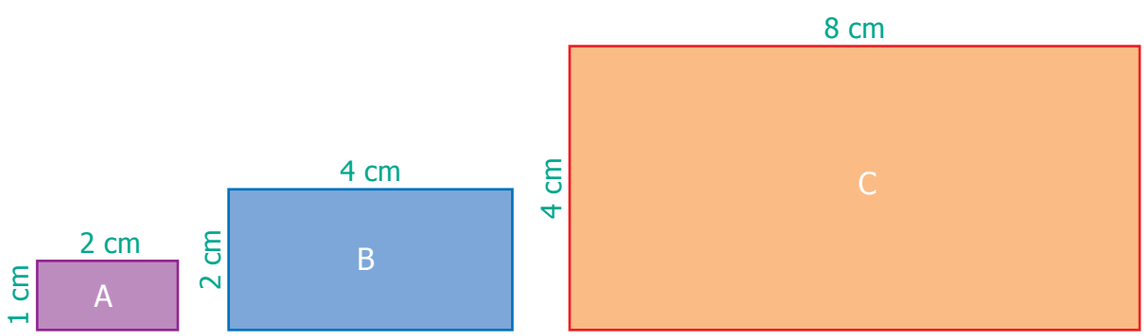
    (a) 4 : 3 (b) 3 : 4 (c) 3 : 5 (d) 3 : 2

11. If Azhagan is 50 years old and his son is 10 years old then the simplest ratio between the age of Azhagan to his son is

    (a) 10 : 50 (b) 50 : 10 (c) 5 : 1 (d) 1 : 5

3.2.5 Equivalent Ratios

We can get equivalent ratios by multiplying or dividing the numerator and denominator by a common number. This is clear from the following example. Let us find the ratio between breadth and length of the following rectangles given below.



- Ratio of breadth to length of **rectangle A** is **1 : 2** (already in simplest form)
- Ratio of breadth to length of **rectangle B** is **2 : 4** (simplest form is 1 : 2)
- Ratio of breadth to length of **rectangle C** is **4 : 8** (simplest form is 1 : 2)
- Thus, the ratios of breadth and length of rectangles **A**, **B** and **C** are said to be *equivalent ratios*.
- That is, the ratios **1 : 2** = **2 : 4** = **4 : 8** are *equivalent*.

TRY THESE

1. For the given ratios, find two equivalent ratios and complete the table.

	Ratio	Fraction Form	Equivalent ratio
(i)	1 : 3	$\frac{1}{3}$	$\frac{1}{3} \times \frac{2}{2} = \frac{2}{6} = 2:6$ and $\frac{1}{3} \times \frac{3}{3} = \frac{3}{9} = 3:9$
(ii)	3 : 7	$\frac{3}{7}$	
(iii)	5 : 8	$\frac{5}{8}$	

2. Write three equivalent ratios and fill in the boxes.

	Ratio	Equivalent Ratios		
(i)	4 : 5	8 : ☐	☐ : 50	12 : ☐
(ii)	7 : 2	☐ : 10	14 : ☐	49 : ☐
(iii)	8 : 5	32 : ☐	☐ : 50	16 : ☐

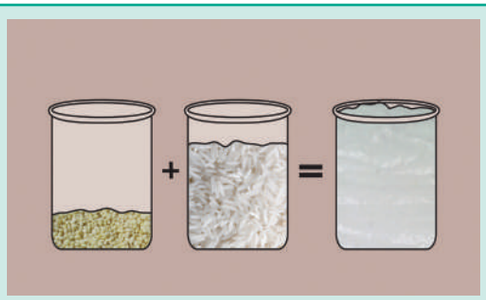
3. For the given ratios, find their simplest form and complete the table.

	Ratio	Fraction Form	Simplest form
(i)	5 : 60	$\frac{5}{60}$	$\frac{5 \div 5}{60 \div 5} = \frac{1}{12} = 1:12$
(ii)	4000 : 6000	$\frac{4000}{6000}$	
(iii)	1100 : 5500		

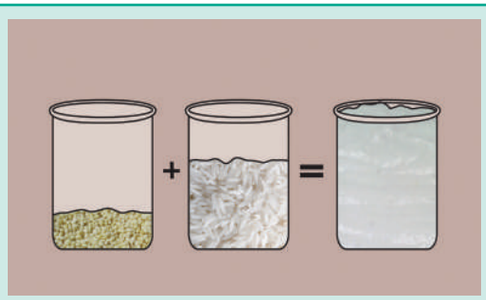
3.2.6 Comparison of Ratios

Consider the following situations.

Situation 1



In the Idly Batter, the ratio of black gram to idly rice is 1 : 4



In the Idly Batter, the ratio of black gram to idly rice is 1 : 3

(a) Fig. 3.2 (b)

Can you find which ratio is greater in Fig. 3.2?

Express ratios as a fraction and then find the equivalent fractions, until the denominators are the same, and compare the fractions with common denominators. This is done as follows :

Idly Batter Ratio - (a)	Idly Batter Ratio - (b)
$\frac{1}{4} \times \frac{2}{2} = \frac{2}{8}$	$\frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$
$\frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$	$\frac{1}{3} \times \frac{3}{3} = \frac{3}{9}$
$\frac{1}{4} \times \frac{4}{4} = \frac{4}{16}$	$\frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$

Comparing the equivalent ratios, $\frac{4}{12}$ & $\frac{3}{12}$, we can conclude that 1 : 3 is greater than 1 : 4

Situation 2

Let us consider another situation. For example, if a thread of 5 m is cut at 3 m, then the length of two pieces are 3 m and 2 m and the ratio of the two pieces is 3 : 2. From this we say that, a ratio '$a : b$' is said to have a total of '$a+b$' parts in it.

Example 3.5

Kumaran has ₹600 and wants to divide it between Vimala and Yazhini in the ratio 2 : 3. Who will get more and how much?

Solution

Divide the whole money into 2 + 3 = 5 equal parts then, Vimala gets 2 parts out of 5 parts and Yazhini gets 3 parts out of 5 parts.

Amount Vimala gets = ₹ 600 × $\frac{2}{5}$ = ₹ 240

Amount Yazhini gets = ₹ 600 × $\frac{3}{5}$ = ₹ 360

Vimala received ₹ 240 and Yazhini gets ₹ 360, which is ₹ 120 more than that of Vimala.

AA3KLK

Exercise 3.2

1. Fill in the blanks for the given equivalent ratios.

   (i) 3 : 5 = 9 : ___ (ii) 4 : 5 = ___ : 10 (iii) 6 : ___ = 1 : 2

2. Complete the table.

(i)

Feet	1	2	3	?
Inch	12	24	?	72

(ii)

Days	28	21	?	63
Weeks	4	3	2	?

3. Say True or False.

(i) 5 : 7 is equivalent to 21 : 15

(ii) If 40 is divided in the ratio 3 : 2, then the larger part is 24.

4. Give two equivalent ratios for each of the following.

(i) 3 : 2 (ii) 1 : 6 (iii) 5 : 4

5. Which of the two ratios is larger?

(i) 4 : 5 or 8 : 15 (ii) 3 : 4 or 7 : 8 (iii) 1 : 2 or 2 : 1

6. Divide the numbers given below in the required ratio.

(i) 20 in the ratio 3 : 2 (ii) 27 in the ratio 4 : 5 (iii) 40 in the ratio 6 : 14

7. In a family, the amount spent in a month for buying Provisions and Vegetables are in the ratio 3 : 2. If the allotted amount is ₹4000, then what will be the amount spent for (i) Provisions and (ii) Vegetables?

8. A line segment 63 cm long is to be divided into two parts in the ratio 3 : 4. Find the length of each part.

Objective Type Questions

9. If 2 : 3 and 4 : ___ are equivalent ratios, then the missing term is

(a) 6 (b) 2 (c) 4 (d) 3

10. An equivalent ratio of 4 : 7 is

(a) 1 : 3 (b) 8 : 15 (c) 14 : 8 (d) 12 : 21

11. Which is not an equivalent ratio of $\frac{16}{24}$?

(a) $\frac{6}{9}$ (b) $\frac{12}{18}$ (c) $\frac{10}{15}$ (d) $\frac{20}{28}$

12. If ₹1600 is divided among A and B in the ratio 3 : 5 then, B's share is

(a) ₹ 480 (b) ₹ 800 (c) ₹ 1000 (d) ₹ 200

3.3 Proportion

When two ratios are equal $\left(\frac{a}{b} = \frac{c}{d}\right)$, we say that the ratios are in Proportion.This is denoted as $a : b :: c : d$ and it is read as 'a is to b as c is to d'. The following situations explain about proportion.

Situation 1

The Teacher said to the students, "You can do a maximum of 4 projects in Mathematics. You will get 5 as internal marks for each project that you do". Kamala asked, "Teacher, What if I do 2 or 3 or 4 projects?" The teacher replied, "For 2 projects you will get 10 marks, for 3 projects you will get 15 marks and for 4 projects you will get 20 marks".

Here "1 project carries 5 marks" is equivalent to saying "2 projects carry 10 marks" and so on and hence the ratios, 1 : 5 = 2 : 10 = 3 : 15 = 4 : 20 are said to be in Proportion. Thus 1 : 5 is in proportion to 2 : 10, 3 : 15, 4 : 20 and so on. This is denoted by 1 : 5 : : 2 : 10 and it is read as '1 is to 5 as 2 is to 10' and so on.

Situation 2

Fig. 3.3(a)

Fig. 3.3(b)

The size of the photograph of Srinivasa Ramanujan as shown in Figure 3.3 (a) is of length 5 grids and breadth 3 grids. Figure 3.3 (b) shows the enlarged size of the photograph of length 10 grids and breadth 6 grids. Here,

Photo grid length	:	Enlarged Photo grid length	=	5 : 10 (1 : 2)	and	Photo grid breadth	:	Enlarged Photo grid breadth	=	3 : 6 (1 : 2)

As the two ratios are equal, the given figures are in proportion. This is represented as 5 : 10 : : 3 : 6 or 5 : 10 = 3 : 6 and it is read as '5 is to 10 as 3 is to 6'

3.3.1 Proportionality law

If two ratios are in proportion ie., $a : b :: c : d$ then the product of the extremes is equal to the product of the means ad=bc. This is called the proportionality law. Here, a and d are the extremes and b and c are the means. Also, if two ratios are equal ie., $\frac{a}{b} = \frac{c}{d} \rightarrow ad = bc$ is called the cross product of proportions.

Example 3.6

By proportionality law, check whether 3 : 2 and 30 : 20 are in proportion.

Solution

Here the extremes are 3 and 20 and the means are 2 and 30.

Product of extremes, $ad = 3 \times 20 = 60$.

Product of means, $bc = 2 \times 30 = 60$.

Thus by proportionality law, we find $ad = bc$ and hence 3 : 2 and 30 : 20 are in proportion.

Example 3.7

A picture is resized in a computer as shown below.

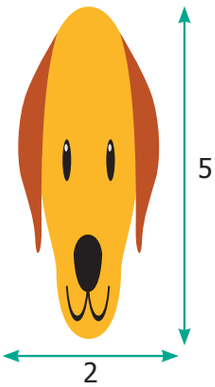


Fig. 3.6 (a)

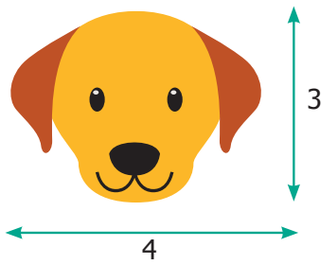


Fig. 3.6 (b)

TRY THIS

1. Fill the box by using cross product rule of two ratios $\frac{1}{8} = \frac{5}{\square}$
2. Use the digits 1 to 9 only once and write as many ratios that are in proportion as possible. (For example : $\frac{2}{4} = \frac{3}{6}$)

Do you observe any change in shape and size of the picture? Check whether the ratios formed by its length and breadth are in proportion by cross product method.

Solution

The given pictures are in the ratio 2 : 5 and 4 : 3 respectively.

Here the extremes are 2 and 3 and the means are 5 and 4.

Product of extremes, $ad = 2 \times 3 = 6$.

Product of means, $bc = 5 \times 4 = 20$.

Thus, we find $ad \neq bc$ and hence 2 : 5 and 4 : 3 are not in proportion.

3.4 Unitary Method

Finding the value of one unit and then using it to find the value of the required number of units is known as unitary method.

Steps involved in Unitary Method

- Express the given problem in Mathematical statement.
- Find the value of one unit of the given item using division.
- Find the value of the required number of the same items using multiplication.

Example 3.8

Pari wants to buy 5 tennis balls from a sports shop. If a dozen balls cost ₹180, how much should Pari pay to buy 5 balls?

Solution

By unitary method, we can solve this as follows :

Cost of a dozen balls = ₹180

Cost of 12 balls = ₹180

Cost of 1 ball = $\frac{180}{12}$ = ₹15

Cost of 5 balls = 5 x 15 = ₹75

Hence, Pari has to pay ₹75 for 5 balls.

Example 3.9

A heater uses 3 units of electricity in 40 minutes. How many units does it consume in 2 hours?

Solution

In 40 minutes, electricity used = 3 units.

In 1 minute, electricity used = $\frac{3}{40}$ units.

In 120 minutes (2 hours), electricity used = $\frac{3}{40} \times 120$ = 9 units

Thus, the heater consumed 9 units of electricity in 2 hours.

AACGN8

Exercise 3.3

1. Fill in the boxes.

   (i) 3 : 5 : : ☐ : 20 (ii) ☐ : 24 : : 3 : 8

   (iii) 5 : ☐ : : 10 : 8 : : 15 : ☐ (iv) 12 : ☐ = ☐ : 4 = 8 : 16

2. Say True or False.

   (i) 7 Persons is to 49 Persons as 11 k.g is to 88 k.g

   (ii) 10 books is to 15 books as 3 books is to 15 books

   (iiii) If the weight of 40 books is 8 k.g, then the weight of 15 books is 3 k.g.

   (iv) A car travels 90 k.m in 3 hours with constant speed. It will travel 140 k.m in 5 hours at the same speed.

3. Fill in the blanks.

   (i) If the cost of 3 pens is ₹18, then the cost of 5 pens is _____ .

   (ii) If Karkuzhali earns ₹1800 in 15 days, then she earns ₹3000 in _____ days.

4. Find whether 12, 24, 18, 36 are in order that can be expressed as two ratios that are in proportion.

5. Write the mean and extreme terms in the following ratios and check whether they are in proportion.

   (i) 78 litre is to 130 litre and 12 bottles is to 20 bottles

   (ii) 400 gm is to 50 gm and 25 rupees is to 625 rupees

6. The America's famous Golden Gate bridge is 6480 ft long with 756 ft tall towers. A model of this bridge exhibited in a fair is 60 ft long with 7 ft tall towers. Is the model, in proportion to the original bridge?

7. If a person reads 20 pages of a book in 2 hours, how many pages will he read in 8 hours at the same speed?

8. Cholan walks 6 km in 1 hour at constant speed. Find the distance covered by him in 20 minutes at the same speed.

9. The number of correct answers given by Kaarmugilan and Kavitha in a quiz competition are in the ratio 10 : 11. If they had scored a total of 84 points in the competition, then how many points did Kavitha get?

10. Karmegan made 54 runs in 9 overs and Asif made 77 runs in 11 overs. Whose run rate is better? (run rate = ratio of runs to overs)

11. You purchase 6 apples for ₹90 and your friend purchases 5 apples for ₹70. Whose purchase is better?

Objective Type Questions

12. Which of the following ratios are in proportion?

    (a) 3 : 5 , 6 : 11 (b) 2 : 3, 9 : 6 (c) 2 : 5, 10 : 25 (d) 3 : 1, 1 : 3

13. If the ratios formed using the numbers 2, 5, x, 20 in the same order are in proportion, then 'x' is

    (a) 50 (b) 4 (c) 10 (d) 8

14. If 7 : 5 is in proportion to x : 25, then 'x' is

    (a) 27 (b) 49 (c) 35 (d) 14

15. If a barbie doll costs ₹90, then the cost of 3 such dolls is ₹ _____.

    (a) 260 (b) 270 (c) 30 (d) 93

16. If a man walks 2 k.m. in 15 minutes, then he will walk _____ k.m. in 45 minutes.

    (a) 10 (b) 8 (c) 6 (d) 12

Exercise 3.4

Miscellaneous Practice Problems

1. The maximum speed of some of the animals are given below :

   the Elephant = 20 k.m./h; the Lion = 80 k.m./h; the Cheetah = 100 k.m./h

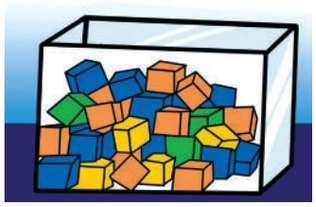
   Find the following ratios of their speeds in simplified form and find which ratio is the least?.

   (i) the Elephant and the Lion (ii) the Lion and the Cheetah

   (iii) the Elephant and the Cheetah

2. A particular high school has 1500 students 50 teachers and 5 administrators. If the school grows to 1800 students and the ratios are maintained, then find the number of teachers and administrators.

3. I have a box which has 3 green, 9 blue, 4 yellow, 8 orange coloured cubes in it.

   (a) What is the ratio of orange to yellow cubes?

   (b) What is the ratio of green to blue cubes?

   (c) How many different ratios can be formed, when you compare each colour to anyone of the other colours?

4. A gets double of what B gets and B gets double of what C gets. Find A : B and B : C and verify whether the result is in proportion or not.

5. The ingredients required for the preparation of Ragi Kali, a healthy dish of Tamilnadu is given below.

Ingredients	Quantity
Ragi flour	4 cups
Raw rice broken	1 cup
Water	8 cups
Sesame oil	15 ml
Salt	10 mg

   (a) If one cup of ragi flour is used then, what would be the amount of raw rice required?

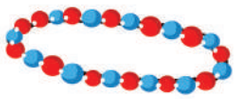
   (b) If 16 cups of water is used, then how much of ragi flour should be used?

   (c) Which of these ingredients cannot be expressed as a ratio? Why?

Challenging Problems

6. Antony brushes his teeth in the morning and night on all days in a week. Shabeen brushes her teeth only in the morning. What is the ratio of the number of times they brush their teeth in a week?

7. Thirumagal's mother wears a bracelet made of 35 red beads and 30 blue beads. Thirumalgal wants to make smaller bracelets using the same two coloured beads in the same ratio. In how many different ways can she make the bracelets?



8. Team A wins 26 matches out of 52 matches. Team B wins three-fourth of 52 matches played. Which team has a better winning record?

9. In a school excursion, 6 teachers and 12 students from 6th standard and 9 teachers and 27 students from 7th standard, 4 teachers and 16 students from 8th standard took part. Which class has the least teacher to student ratio?

10. Fill the boxes using any set of suitable numbers 6 : ☐ : : ☐ : 15.

11. From your school diary, write the ratio of the number of holidays to the number of working days in the current academic year.

12. If the ratio of Green, Yellow and Black balls in a bag is 4 : 3 : 5, then

    (a) Which is the most likely ball that you can choose from the bag?

    (b) How many balls in total are there in the bag if you have 40 black balls in it?

    (c) Find the number of green and yellow balls in the bag.

Summary

- A ratio is a comparison of two quantities by division.
- Ratios are often expressed as fractions in the simplest form.
- A ratio has no unit.
- The two quantities of a ratio should be in the same unit.
- Order of the terms in a ratio cannot be reversed.
- To get an equivalent ratio, multiply or divide the numerator and denominator by the same number.
- When two ratios are equal, they are said to be in proportion.
- The proportionality law states that the product of the extremes is equal to the product of the means.
- Finding the value of required number of units by knowing the value of one unit is known as unitary method.

ICT Corner

RATIO AND PROPORTION

Expected Result is shown in this picture

Step – 1

Open the Browser, Copy and paste the link given below (or) by type the URL given (or) Scan the QR Code.

Step - 2

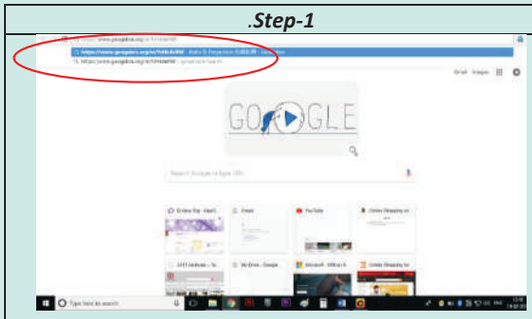
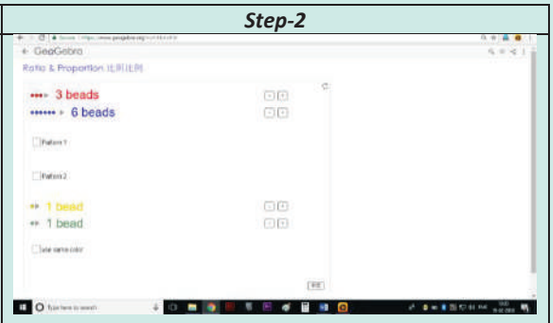
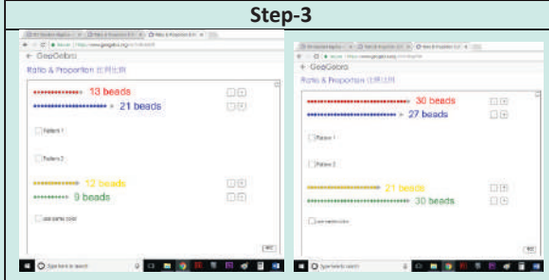
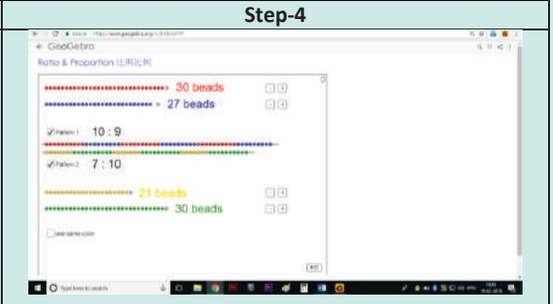
GeoGebra worksheet named "Ratio and Proportion" will open. Two sets of Coloured beads will appear.

Step-3

Find the ratio of coloured beads for each pair. You can Increase or decrease the no's by pressing "+" and "-" button appearing on the right side of the page.

Step-4

To check your answer Press on "Pattern 1" and "Pattern 2" button. Repeat the test by increasing and decreasing the beads.

.Step-1	*Step-2*
	
Step-3	**Step-4**
	

Browse in the link

Ratios: - https://www.geogebra.org/m/fcHk4eRW

Chapter 4

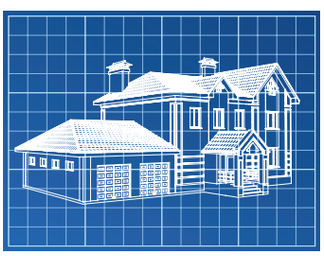
GEOMETRY

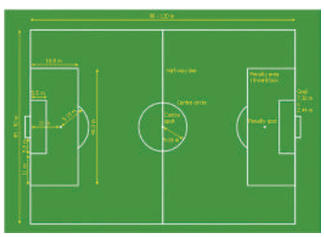
AALCPV

Learning Objectives

- To know about lines, line segments and rays.
- To know angles and its types.
- To know the usage of ruler and protractor.
- To identify parallel and intersecting lines.
- To identify pairs of complementary and supplementary angles.
- To know collinear points and point of concurrency.

4.1 Introduction



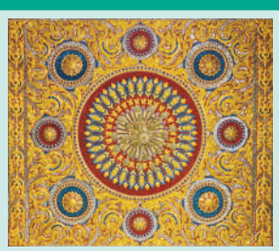


Geometry means the measurement of the earth. It includes the study of the properties of shapes and its measures. In ancient days, geometry was developed for the practical purpose of construction, surveying and various crafts.

Nature evolves out of simple geometrical shapes and patterns from tiny atoms to huge galaxies. The objects that you see in your environment have an impact of geometrical ideas. An appealing appearance of houses and buildings are made possible by geometrical thinking. Vehicles like cycle, car, bus are designed using geometrical concepts. The toys that you play with, the tools like pencil, scale and book that you use with, give rise to geometrical ideas and shapes.

In this chapter, we will learn about the geometrical concepts such as lines, line segments, rays and angles.

MATHEMATICS ALIVE – NATURE'S GEOMETRIC MASTERPIECES

	
Hexagon in Honey Comb	Art of Geometric Patterns

4.1.1 Fun with lines

What shapes can you draw with 3 lines or 4 lines or 5 lines?
We have already seen some shapes with names like triangles, rectangles and squares.

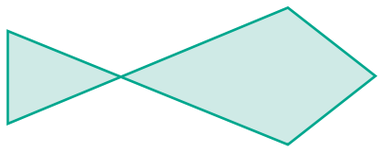


Fig. 4.1

Here is a shape which is in the form of a fish (see Fig. 4.1).
It has 5 lines. Can you draw a fish with 4 lines or with 3 lines? Think!

4.1.2 Only two lines

What shapes can you draw with only TWO lines?
The following forms are possible with 2 lines. Isn't it?

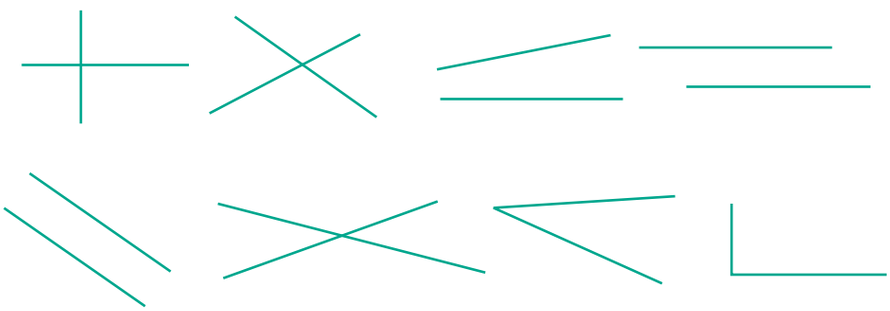


Fig. 4.2

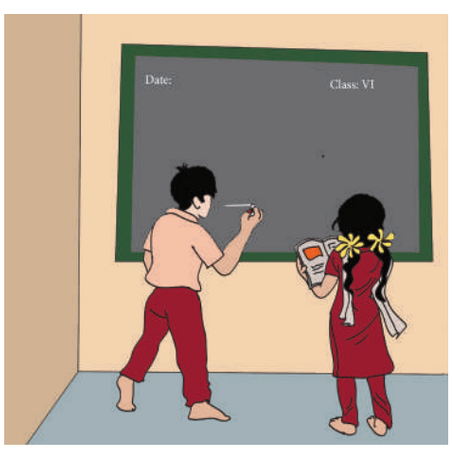
Is there something you notice in all these shapes?

4.1.3 Only one line

What shapes can be drawn with only ONE line? The line may be standing upright, lying flat, or slanting. Perhaps it can be, slant left or slant right. It may be long or short.

Now, consider the following situation.

The teacher gives Yazhini a paper with a line drawn on it and asks Akilan to draw the same line on the black board, as instructed by Yazhini. Then they shall reverse the process. They do the same with other shapes using 2 lines and 3 lines. Try doing this and say, whether this is easy to do!



Observe the following conversation.

Teacher : Sakthi, can you say how to draw lines?

Sakthi : Yes Teacher! Why only lines? I may like to draw curves and circles too!

Teacher : Sakthi, you can do all the shapes you like. But you see, there is enough difficulty in describing shapes made only of lines. So, we will get to curves and circles later.

Sakthi : Teacher, Why should we describe shapes? We can just draw and show them when we want.

Is Sakthi right?

In Mathematics, every thinking is interesting and unlimited. Remember numbers; it is not stopped with adding 2 – digits. Numbers go on endlessly and it is possible to add any two numbers, however large. We know that even a 37- digit number ending in 0 is divisible by 5.

It is the same with shapes too. We are interested in lines, triangles, rectangles and in whatever the shapes may be and the size however large or small. We need to give them names not only to describe them but also to explore a lot with them.

4.2 Describing lines

A line can be long or short. A line can be flat or slant or vertical. If a line is rotated in any direction, it remains to be a line. So, given below (Fig. 4.3) are lines in different positions.

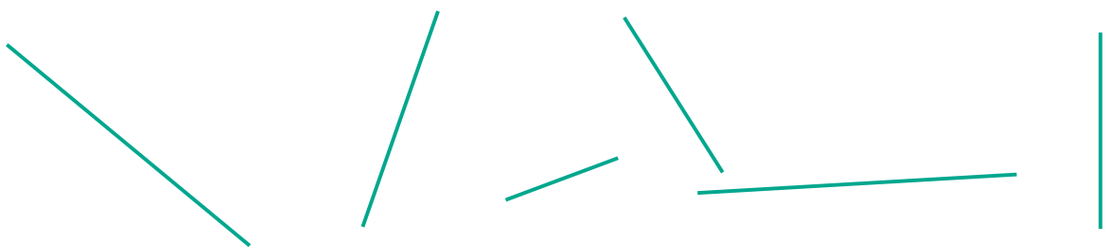


Fig. 4.3

But the following (Fig.4.4) are not lines.

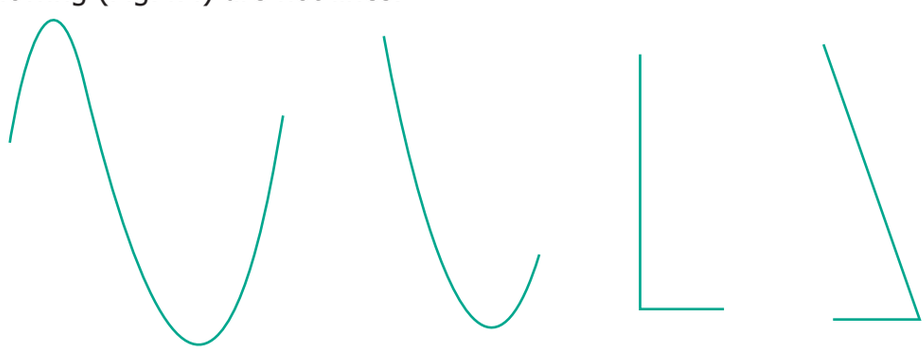


Fig. 4.4

If the length of a line is ignored, then it can be extended in both the directions without ending as in (Fig. 4.5) given below. A line through two points A and B is written as $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$. Also it is denoted by a letter ' l '.

Fig. 4.5

4.2.1 Line segment

What do we call a line that is short and ends on both sides? That we call it as a line segment and name both of its ends with letters as shown in fig. 4.6.

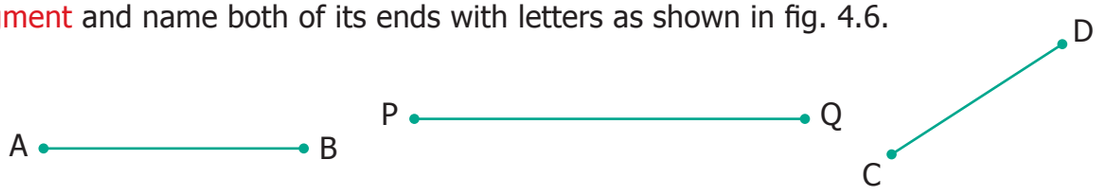


Fig. 4.6

We usually use CAPITAL LETTERS to denote the ends of the line segments. A line segment is denoted by $\overline{AB}$. What can we do with a line segment? We can measure its length. Given two line segments, we can compare their lengths and say which is shorter and which is longer.

Even if we measure length as a number, we get lots of line segments, each with a definite length. Using a ruler, we can draw the following line segments.

1 cm A B

2 cm A B

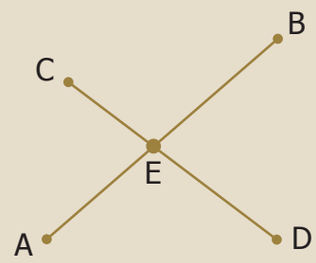
3 cm A B

...

10 cm A B

TRY THIS

Name all the line segments.



What about a line segment of length 17 cm or 20 cm or 30 cm or 378 cm? Like, numbers never end, line segments get longer and longer forever!

4.2.2 Construction of line segment

Learn to measure line segments using the ruler.

Correct way of viewing the scale.

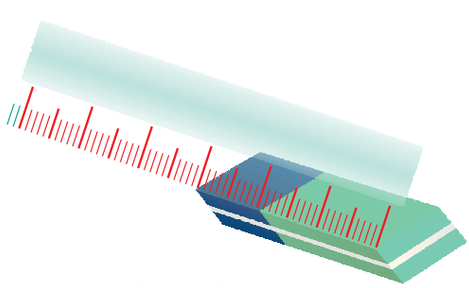


Fig. 4.7

Examples of Measuring Line Segments

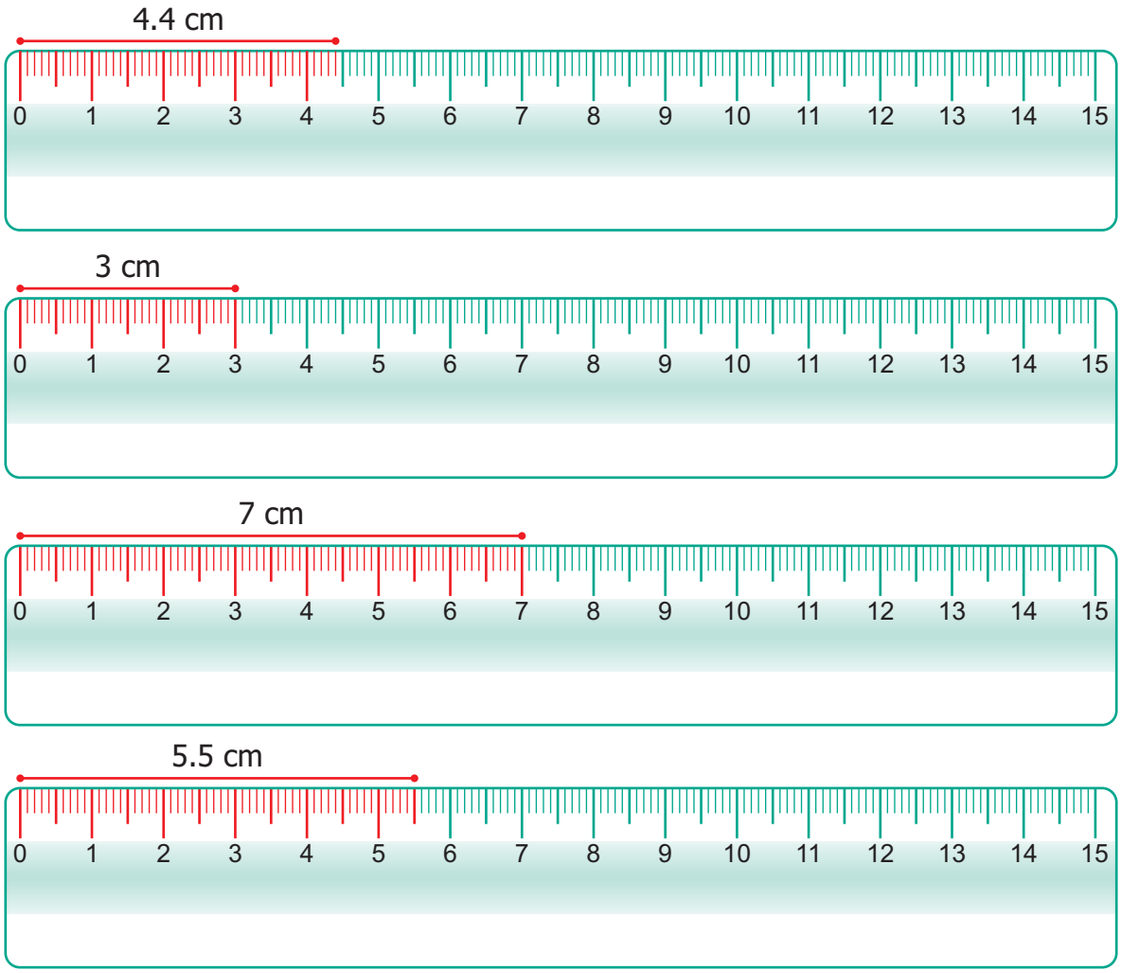


Fig. 4.8

TRY THIS

If AB = 5cm, say which of the measures are correct in fig. 4.9.

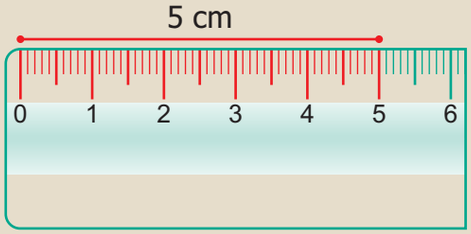


Fig. 4.9 (i)

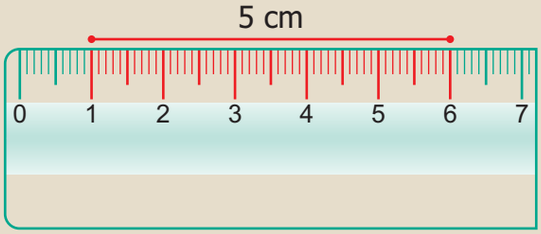


Fig. 4.9 (ii)

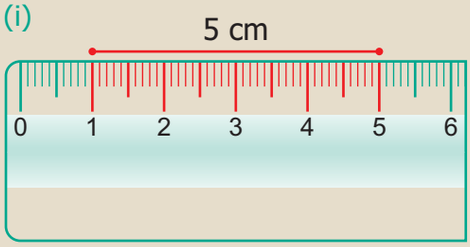


Fig. 4.9 (iii)

Geometry originated from two Greek words, geo, meaning earth and metron meaning measure. Geometry means earth measure. Around 600 B.C.(BCE), Thales of Miletus was the first to use deductive methods to develop geometric concepts. The Greek Mathematician, Pythagoras continued the systematic development of Geometry.

Example 4.1

With the help of a ruler and compass, draw a line segment PQ = 5.5cm.

Solution

- Draw a line ' l ' and mark a point 'P' on it as shown in Fig. 4.10.

Fig. 4.10

- Measure 5.5 cm using compass as shown in Fig. 4.11 placing the pointer at '0' and the pencil pointer at 5.5 cm.

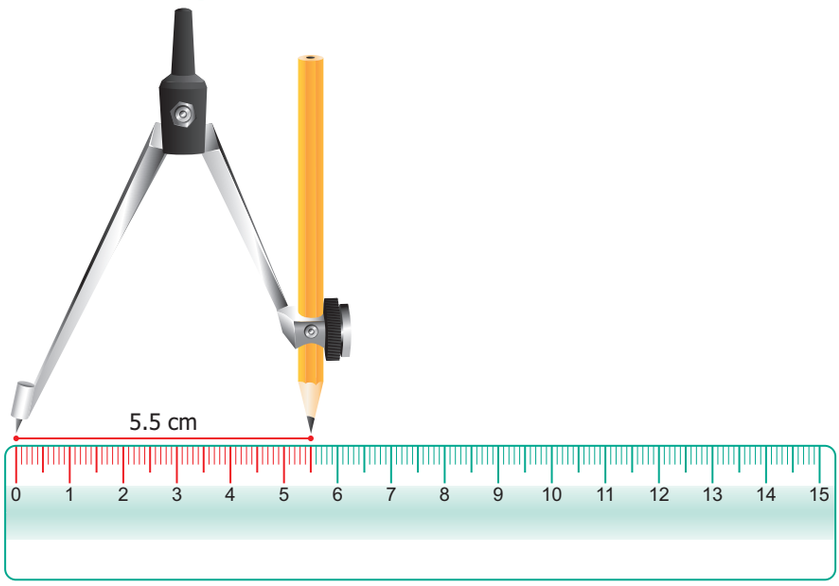


Fig. 4.11

- Place the pointer of the compass at ' P ' then draw a small arc on the line 'l ' with the pencil pointer (Fig. 4.12). It cuts the line ' l ' at a point and name that point as 'Q' (Fig. 4.13).

Fig. 4.12

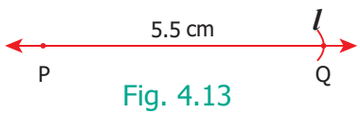


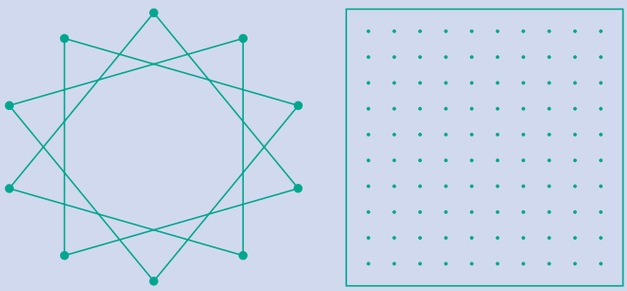
Fig. 4.13

- Now, PQ is the required line segment of length 5.5 cm.

ACTIVITY

This game can be played in small groups. Take 10 or more sticks of equal length. Join them as a bundle and put them on the floor in such a way that they fall one above the other. The challenge is to take one stick after other without disturbing the position of the other sticks.

ACTIVITY



Enjoy trying kolams using line segments!

4.2.3 Two lines

Now let us get back to two lines (Fig. 4.14). Lines that go on forever on either side without meeting each other (i.e. they have a constant distance in between) are called parallel lines.

Fig. 4.14

Thus, parallel lines go forever without meeting.

What will happen if two lines are not parallel?

Then they must meet somewhere! Of course, they go their way after meeting too.

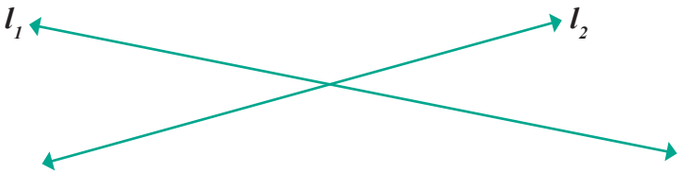


Fig. 4.15

Here, l_1 and l_2 are called intersecting lines.

Of course, we now have parallel line segments and intersecting line segments too.

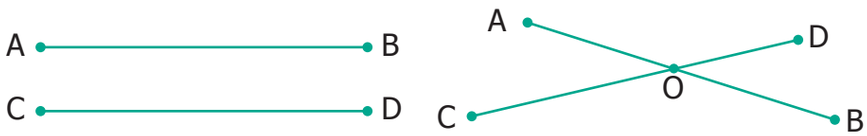


Fig. 4.16

The position 'O' at which the line segments $\overline{AB}$ and $\overline{CD}$ meet is called their point of intersection.

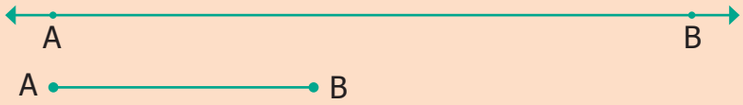
ACTIVITY

Take a piece of paper and fold in as many ways as you can, which generates parallel lines or intersecting lines.

A few examples are shown for you.

NOTE

A line has no end points, whereas a line segment has end points. We can measure the length of a line segment.



4.2.4 Rays

What about lines that end on one side but proceed indefinitely on the other side? We call them rays. They are denoted by $\overrightarrow{AB}, \overrightarrow{PQ}, \overrightarrow{MN}$..., etc. The fixed end point of a ray is called the starting point. (See fig.4.17)

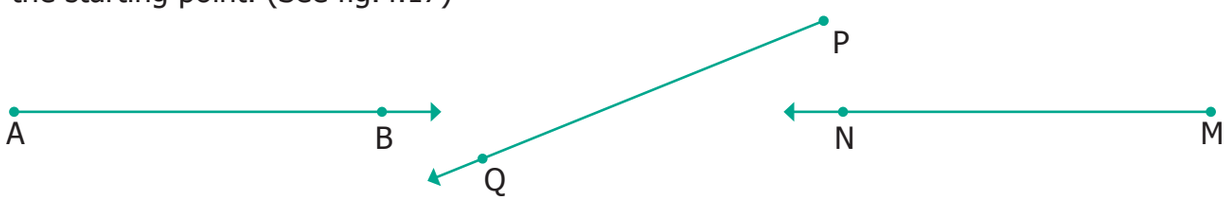


Fig. 4.17

4.2.5 Two rays

With two rays we have more to learn. They can be parallel or intersecting.

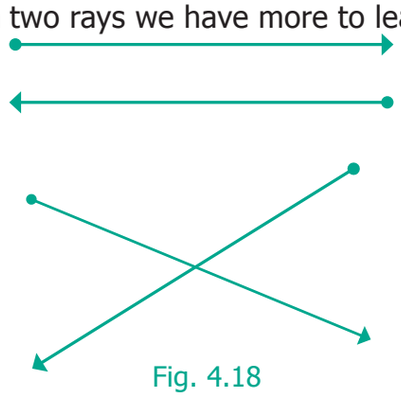


Fig. 4.18

Two rays may have the same starting point.

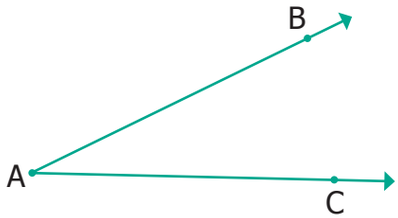
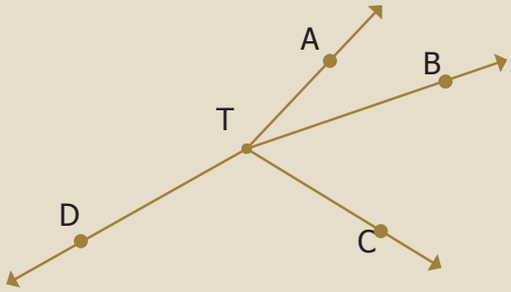


Fig. 4.19

TRY THIS



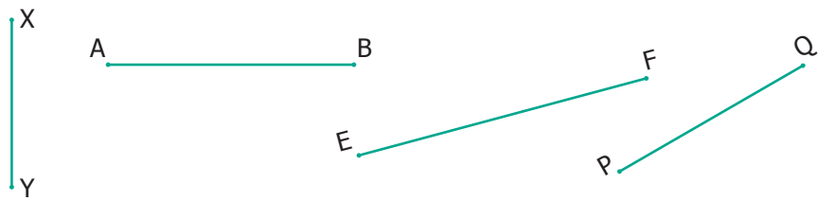
- Name the rays in the given figure.
- What is the common point of all these rays?

Exercise 4.1

1. Fill in the blanks.
   (i) A line through two end points 'A' and 'B' is denoted by _____.
   (ii) A line segment from point 'B' to point 'A' is denoted by _____.
   (iii) A ray has _____ end point(s).

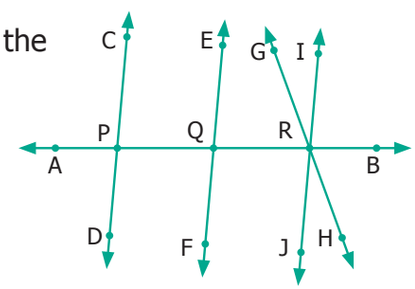
2. How many line segments are there in the given line? Name them.

3. Measure the following line segments.

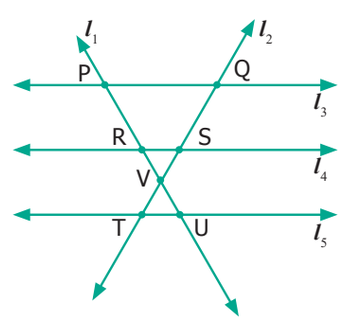


4. Construct a line segment using ruler and compass.
   (i) AB = 7.5 cm (ii) CD = 3.6 cm (iii) QR = 10 cm

5. From the given figure, name the
   (i) parallel lines
   (ii) intersecting lines
   (iii) points of intersection.



6. From the given figure, name
   (i) all pairs of parallel lines.
   (ii) all pairs of intersecting lines.
   (iii) pair of lines whose point of intersection is 'V'.
   (iv) point of intersection of the lines 'l_2' and 'l_3'.
   (v) point of intersection of the lines 'l_1' and 'l_5'.



Objective Type Questions

7. The number of line segments in 

is
   (a) 1 (b) 2 (c) 3 (d) 4

8. A line is denoted as
   (a) AB (b) $\overrightarrow{AB}$ (c) $\overleftrightarrow{AB}$ (d) $\overline{AB}$

4.3 Angles

Can we find a way to describe all these shapes? (shown in fig. 4.20)

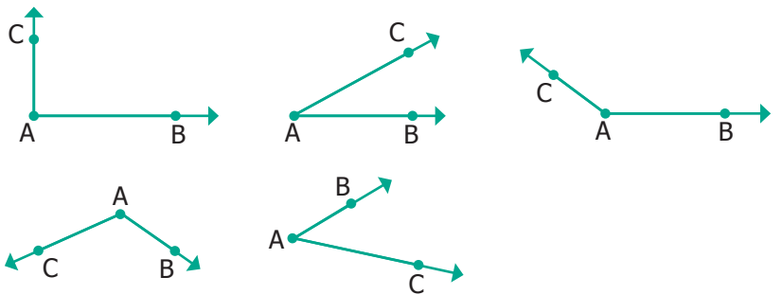
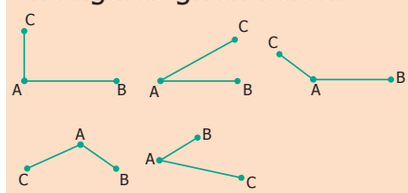


Fig. 4.20

NOTE

We can do the same with two line segments also. See the figures given below.



How would you describe whether a ray (or line segment) is vertical or slanting with respect to another ray (or line segment)?

Carrom board involves many geometric concepts like line segments and angles. When the striker hits the coin, the coin moves in a straight line. When the striker or coins hit the board end they make angles with the board while returning.

DO YOU KNOW?

When two rays or line segments meet at their end points, they form an angle at that point.

Fig. 4.21

In the Fig.4.21 rays $\overrightarrow{AB}$ and $\overrightarrow{AC}$ are the sides and 'A' is the vertex which is the meeting point of both the line segments.

4.3.1 Naming Angles

We name the angle as shown in the Fig.4.22 below.

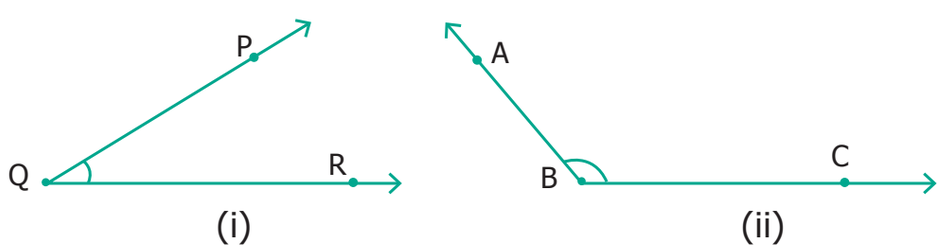


Fig. 4.22

Fig 4.22(i) shows the angle $\angle PQR$; $\overrightarrow{QP}$, $\overrightarrow{QR}$ are its sides. 'P' is on $\overrightarrow{QP}$; 'R' is on $\overrightarrow{QR}$.

Fig 4.22(ii) shows the angle $\angle ABC$; $\overrightarrow{BA}$, $\overrightarrow{BC}$ are its sides. 'A' is on $\overrightarrow{BA}$; 'C' is on $\overrightarrow{BC}$.

We name the angle in fig. 4.22 (i) as ∠Q or ∠PQR or ∠RQP . Similarly, in Fig. 4.22 (ii), we may write ∠B as ∠ABC or ∠CBA.

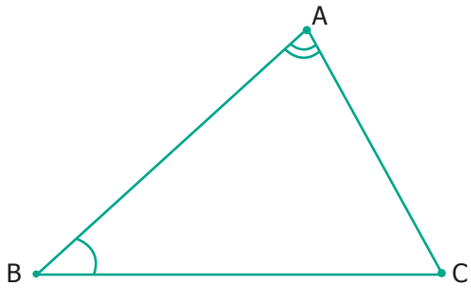


Fig. 4.23

In the Fig. 4.23, two angles are marked.

Note that ∠BAC is not the same as ∠ABC,

as they have different vertices and different sides

4.3.2 Measuring Angles

Can we measure angles too? Yes, using protractor they are measured in degrees which are denoted by the symbol ' ° '. This has to be marked at top right of a number. We write angles as 35°, 78°, 90°, 110°, 145° and so on.

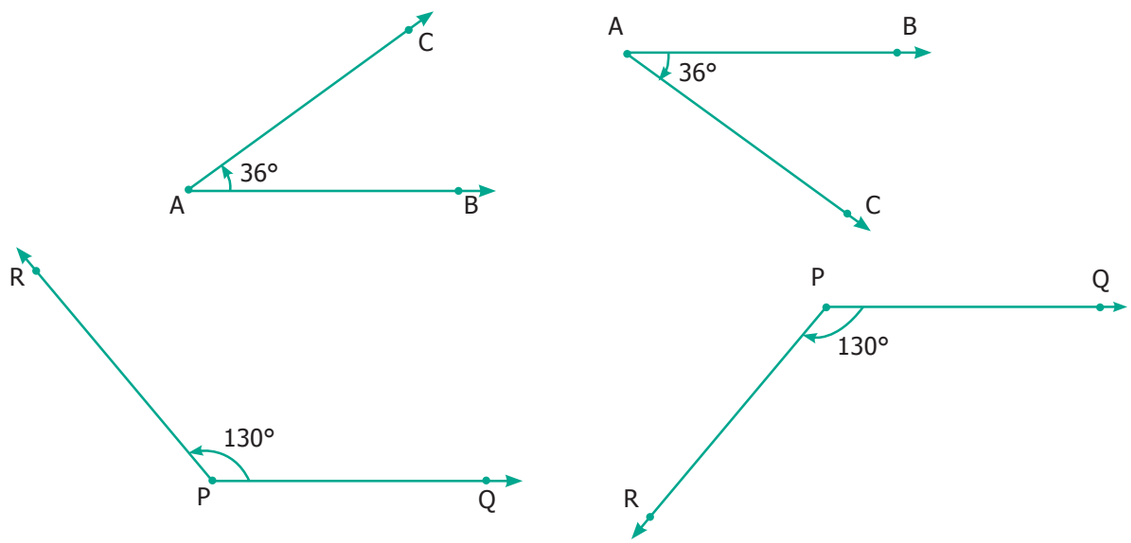


Fig. 4.24

See that angles can be equal even if they are positioned differently.

4.3.3 Special Angles

Some angles are special. 90° is one such. We call it as the right angle.

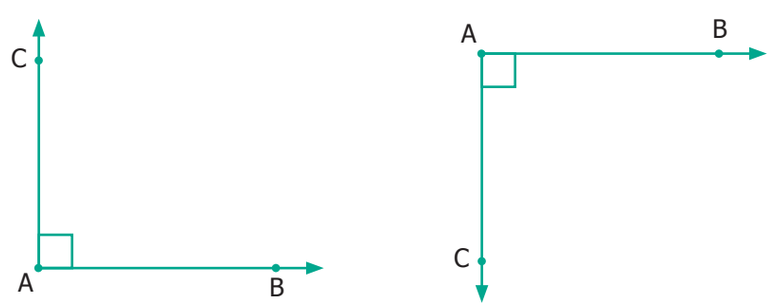


Fig. 4.25

Right angle is most common in life. Examples can be seen at cross-roads, chess board, TV, etc.

Acute Angles

Fig. 4.26

Each of the angles in the above Fig. 4.26 is less than a right angle. Angles smaller than 90° are called Acute angles.

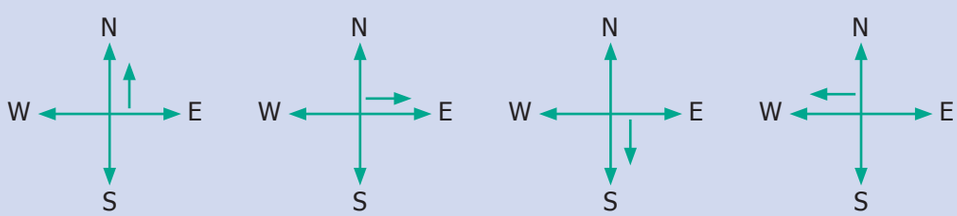
Obtuse Angles

$\overrightarrow{AB}$ $\overrightarrow{AC}$ Fig. 4.27

Each of the angles in the above Fig. 4.27 is greater than right angle. If an angle is more than 90° and less than 180° is called an obtuse angle.

ACTIVITY

Stand facing the north side. Take a 'right angle turn' clockwise; you now face east. Again take another 'right angle turn' in the same direction. You now face south. Once again take another 'right angle turn' in the same direction. You now face west. Then follow the same you will come to the original position. Thus the complete turn is called one revolution. The turn from north to south will be two right angles. It is also called a straight angle. Two straight angles make one complete revolution. This is illustrated in the following figures.

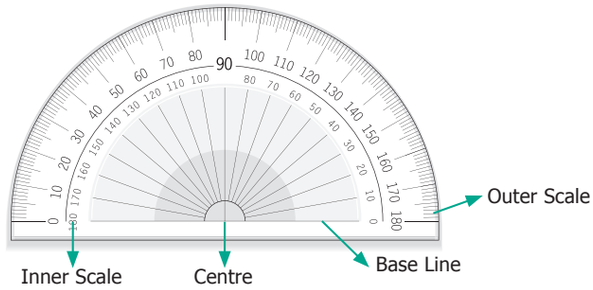


TRY THESE

1. Which direction will you face if you start facing West and take three right turns clockwise?
2. Which direction will you face if you start facing North and take two right turns anti-clockwise?

4.3.4 Angle measurement using Protractor

How do we measure an angle? Using a PROTRACTOR we can measure an angle.



AB54T6

A protractor has one centre and a base line. It has two scales namely, inner scale from 0° to 180° in anti clockwise direction and outer scale from 0° to 180° in the clockwise direction. Why does the protractor stop with 180°? We can rotate the protractor and measure, so 180° is enough.

Steps To Measure an angle

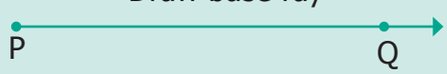
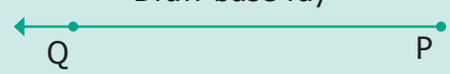
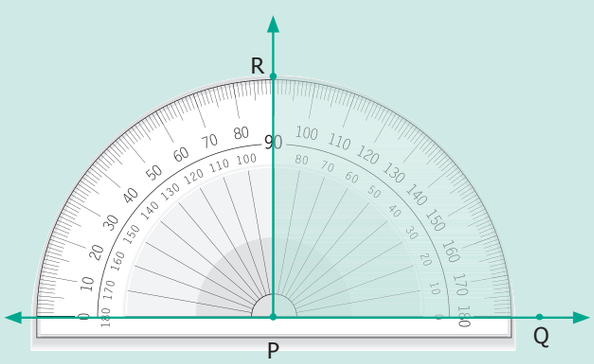
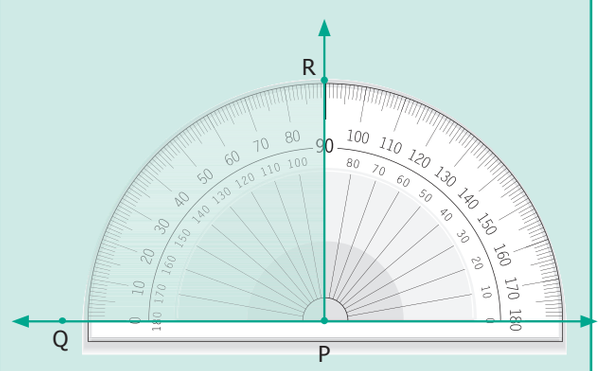
Step 1: Place the centre of the protractor on the vertex of the angle and line up the base line with 0°.

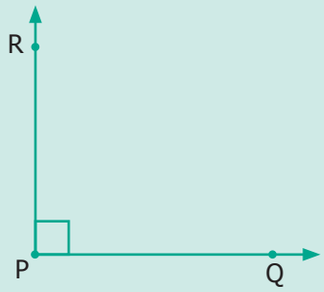
Step 2: Read the measure where the other ray crosses the protractor.

4.3.5 Using Protractor to draw Right Angle (90º)

Example 4.2

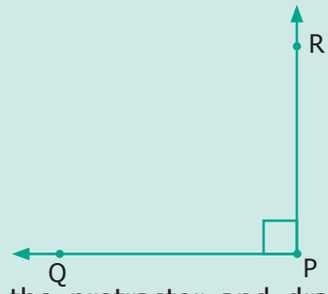
Use a Protractor to draw an angle 90º.

Draw base ray  	Draw base ray 
 Place the center of the protractor at the vertex P. Line up the ray $\overrightarrow{PQ}$ with the 0° line. Then draw and label a point (R) at the 90° mark on the inner scale (anticlockwise)	 Place the center of the protractor at the vertex P. Line up the ray $\overrightarrow{PQ}$ with the 0° line. Then draw and label a point (R) at the 90° mark on the outer scale (clockwise)



Remove the protractor and draw $\overrightarrow{PR}$ to complete the angle.

Now, $\angle P = \angle QPR = \angle RPQ = 90°$



Remove the protractor and draw $\overrightarrow{PR}$ to complete the angle.

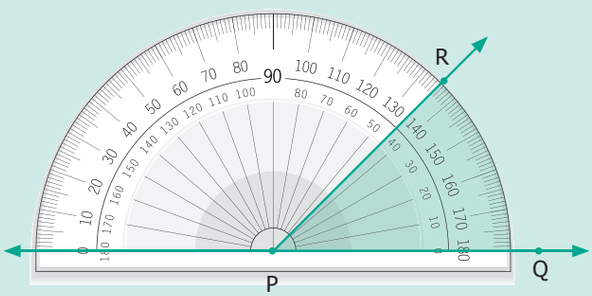
Now, $\angle P = \angle QPR = \angle RPQ = 90°$

4.3.6 Using Protractor to draw an Acute Angle

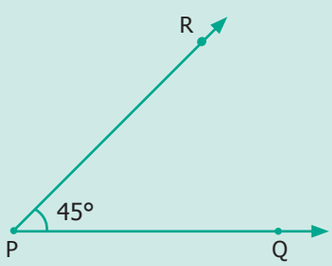
Example 4.3

Use a Protractor to draw an angle 45°.

Draw base ray



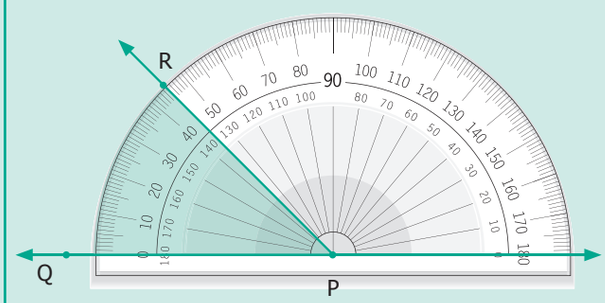
Place the centre of the protractor at the vertex P. Line up the ray $\overrightarrow{PQ}$ with the 0° line. Then draw and label a point (R) at the 45° mark on the inner scale (anticlock wise)



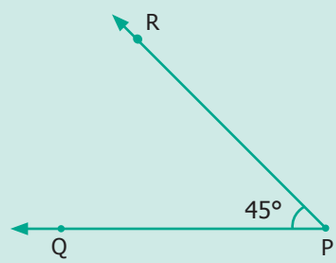
Remove the protractor and draw $\overrightarrow{PR}$ to complete the angle.

Now, $\angle P = \angle QPR = \angle RPQ = 45°$

Draw base ray



Place the centre of the protractor at the vertex P. Line up the ray $\overrightarrow{PQ}$ with the 0° line. Then draw and label a point (R) at the 45° mark on the outer scale (clock wise)



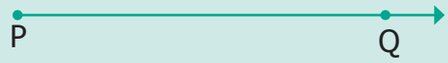
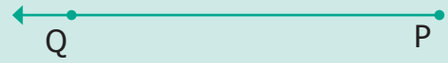
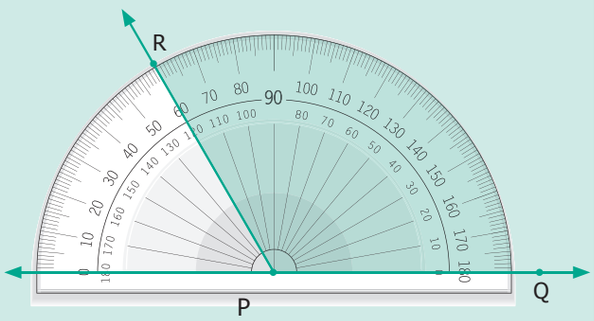
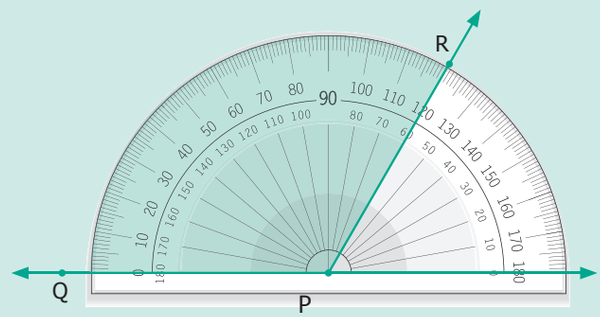
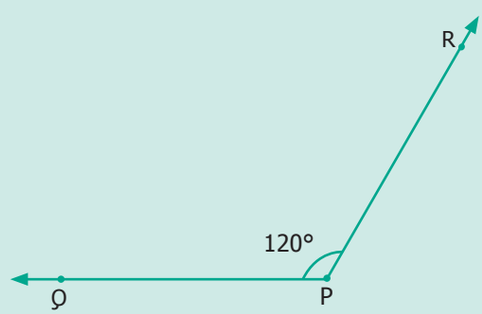
Remove the protractor and draw $\overrightarrow{PR}$ to complete the angle.

Now, $\angle P = \angle QPR = \angle RPQ = 45°$

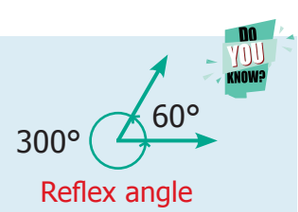
4.3.7 Using Protractor to draw an Obtuse Angle

Example 4.4

Use a protractor to draw an obtuse angle 120°.

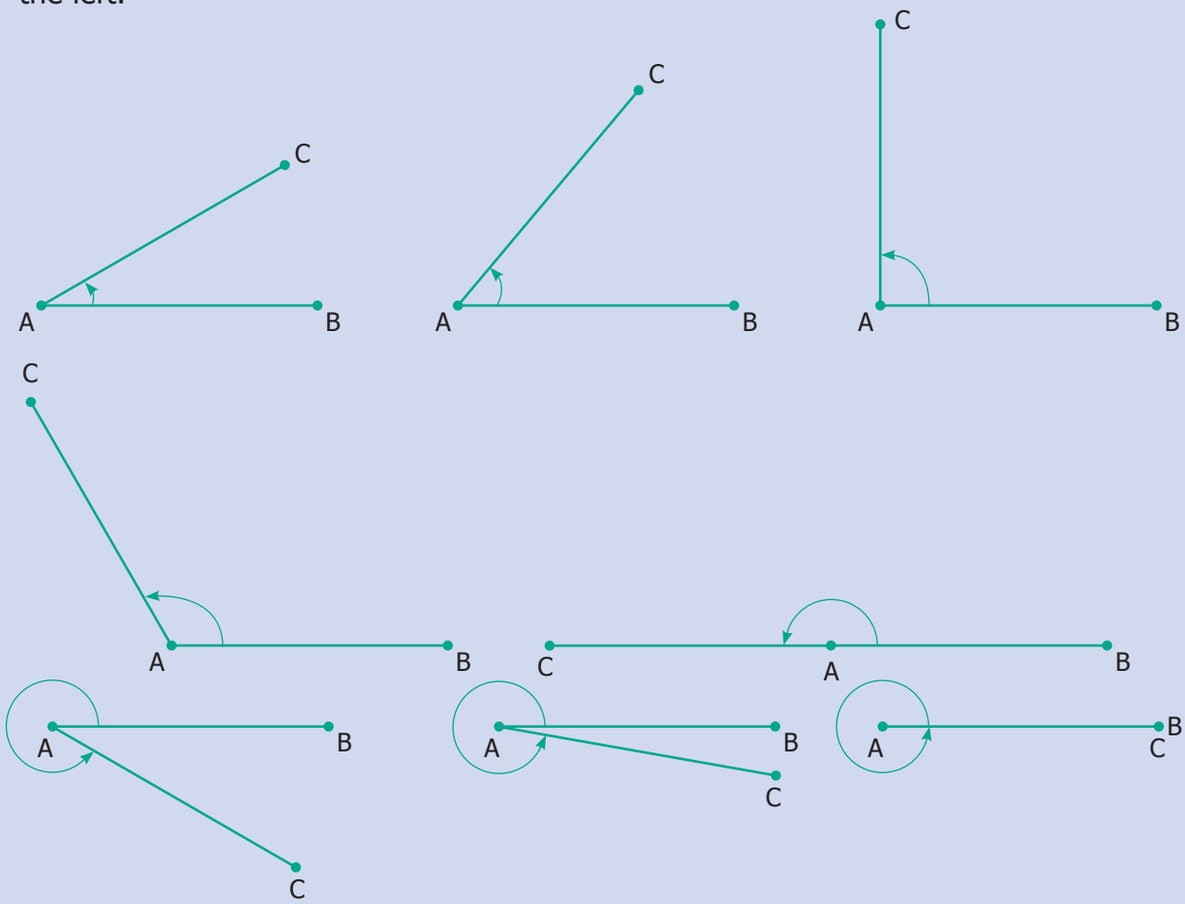
Draw base ray 	Draw base ray 
 Place the centre of the protractor at the vertex P. Line up the ray $\overrightarrow{PQ}$ with the 0° line. Then draw and label a point (R) at the 120° mark on the inner scale (anti clock wise)	 Place the centre of the protractor at the vertex P. Line up the ray $\overrightarrow{PQ}$ with the 0° line. Then draw and label a point (R) at the 120° mark on the outer scale (clock wise)
 Remove the protractor and draw $\overrightarrow{PR}$ to complete the angle. Now, ∠P = ∠QPR = ∠RPQ =120°	 Remove the protractor and draw $\overrightarrow{PR}$ to complete the angle. Now, ∠P = ∠QPR = ∠RPQ =120°

Reflex angles are bigger than 180°. Always subtract the given angle from 360° to get the reflex angle.

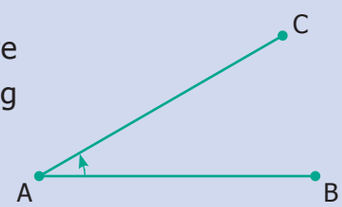


ACTIVITY

Fix a line segment $\overline{AB}$ and let's have another line segment $\overline{AC}$, go on rotating $\overline{AC}$ to the left.



In this rotations, At some point $\overline{AC}$ overlap $\overline{AB}$ and then we are back to the same as before. So angle, keep on increasing and after some point, return to 0º.



Is this familiar? Yes, you can see this in a clock!

TRY THIS

Adjust the hands of the clock for the following time, note the angle made between the hour hand and the minute hand and write the type of angle.

12.10	12.40	3.25	9.40	5.55	1.25	4.25	7.05
Acute angle							

4.3.8 Very special angles

- Here you find $\overrightarrow{AC}$ is exactly on $\overrightarrow{AB}$; then the angle is 0°. It is called the Zero angle.

- If 'C' is exactly on the opposite side 'B', with vertex 'A' in the middle. Then the angle is 180°. It is called the Straight angle.

4.3.9 Special pairs of angles

Two angles are complementary to each other if they add upto 90° [See Fig. 4.28(i)]

Two angles are supplementary to each other if they add upto 180° [See Fig. 4.28(ii)]

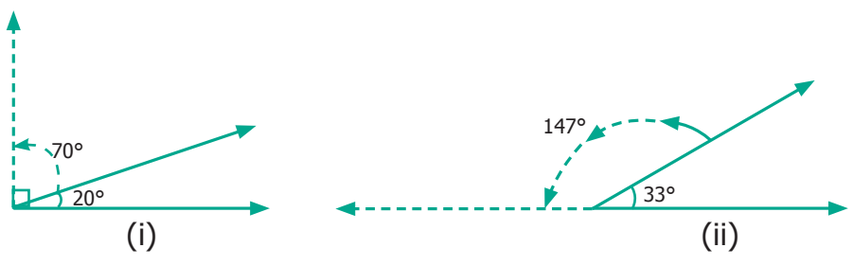


Fig. 4.28

In the above figures, 20° and 70° are complementary angles and 147° and 33° are supplementary angles. But 35° and 75° are neither complementary nor supplementary.

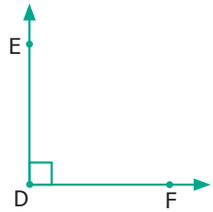
Exercise 4.2

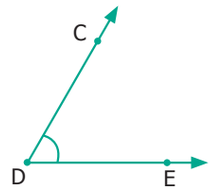
1. Use any number of the given dots to make different angles.

1) An Acute Angle	2) An Obtuse Angle . . . .
3) A Right Angle	4) A Straight Angle . . . .

ABDZUT

2. Name the vertex and sides that form each angle.

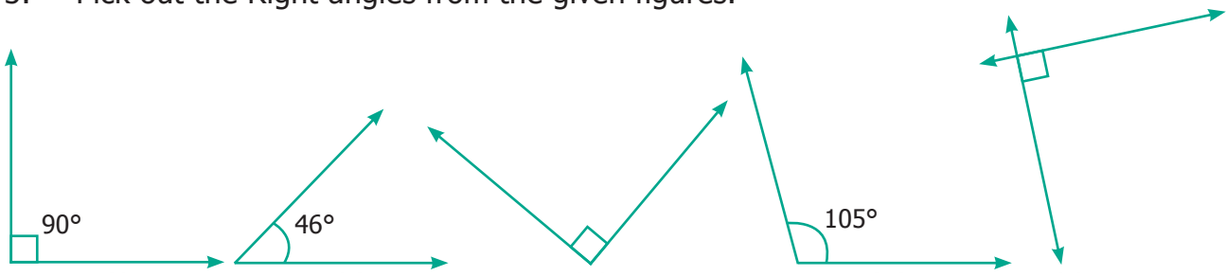




Vertex _____ Vertex _____

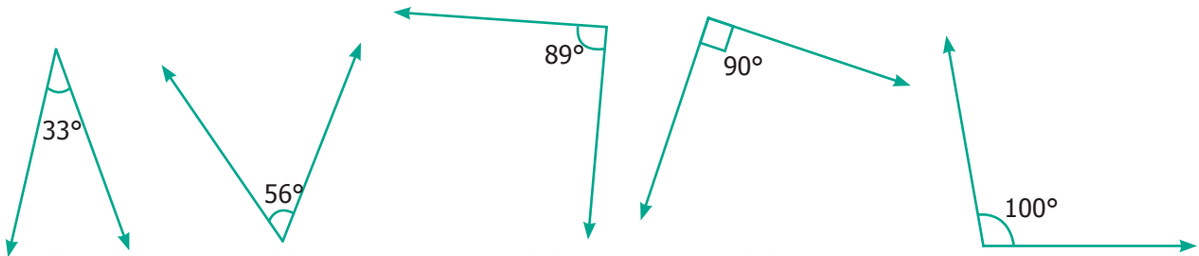
Sides _____ Sides _____

3. Pick out the Right angles from the given figures.



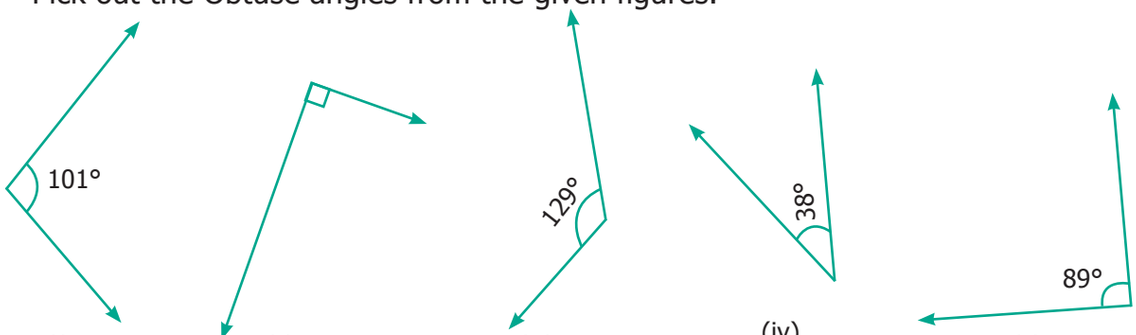
(i) (ii) (iii) (iv) (v)

4. Pick out the Acute angles from the given figures.



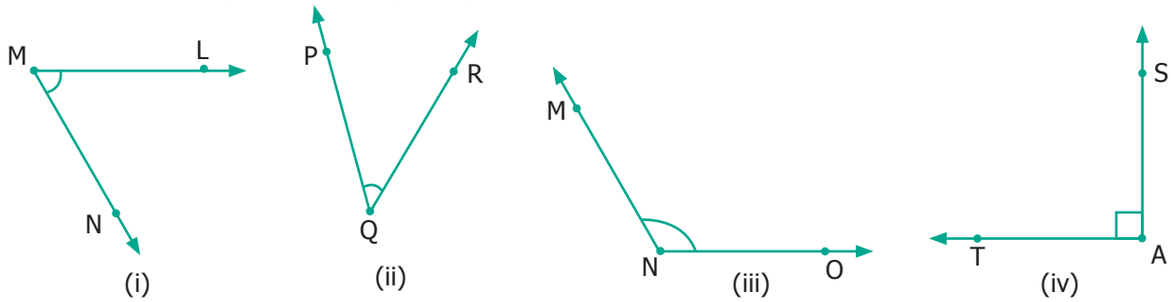
(i) (ii) (iii) (iv) (v)

5. Pick out the Obtuse angles from the given figures.



(i) (ii) (iii) (iv) (v)

6. Name the angle in each figure given below in all the possible ways.



(i) (ii) (iii) (iv)

7. Say True or False.

(i) 20° and 70° are complementary.

(ii) 88° and 12° are complementary.

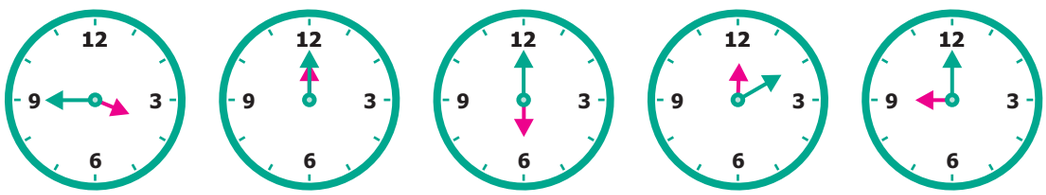
(iii) 80° and 180° are supplementary.

(iv) 0° and 180° are supplementary.

8. Draw and label each of the angles.

(i) ∠NAS = 90° (ii) ∠BIG = 35° (iii) ∠SMC = 145° (iv) ∠ABC = 180°

9. Identify the types of angles shown by the hands of the given clock.



(i) (ii) (iii) (iv) (v)

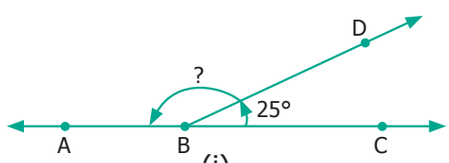
10. Find the complementary angle of

(i) 30° (ii) 26° (iii) 85° (iv) 0° (v) 90°

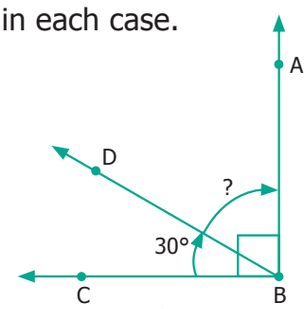
11. Find the supplementary angle of

(i) 70° (ii) 35° (iii) 165° (iv) 90° (v) 0°

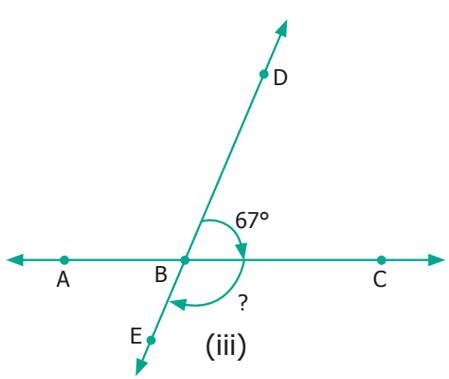
12. Find the supplementary / complementary angles in each case.



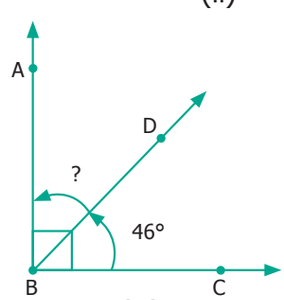
(i)



(ii)

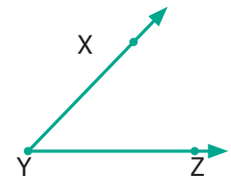


(iii)



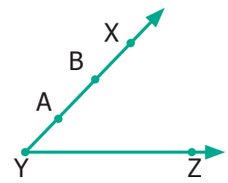
(iv)

Objective Type Questions



13. In this Figure, which is not the correct way of naming an angle?

    (a) ∠Y (b) ∠ZXY (c) ∠ZYX (d)∠XYZ



14. In this Figure, ∠AYZ = 45°. If point 'A' is shifted to point 'B' along the ray, then the measure of ∠BYZ is _____.

    (a) more than 45° (b) 45° (c) Less than 45° (d) 90°

4.4 Points and lines

When we have a line, we can mark a point on the line or not on it.

Fig. 4.29

'A' is on 'l_1', 'B' is not on 'l_1' or 'l_2'. 'B' may be closer or far away, but not on the both of the lines 'l_1' and 'l_2'. However, when any two points are given, there is exactly ONE line passing through them! Take several pairs of points and verify if this is true.

What about 3 points and a line? Consider the following lines 'l_1' 'l_2' 'l_3' and 'l_4' and A,B,C be three points.

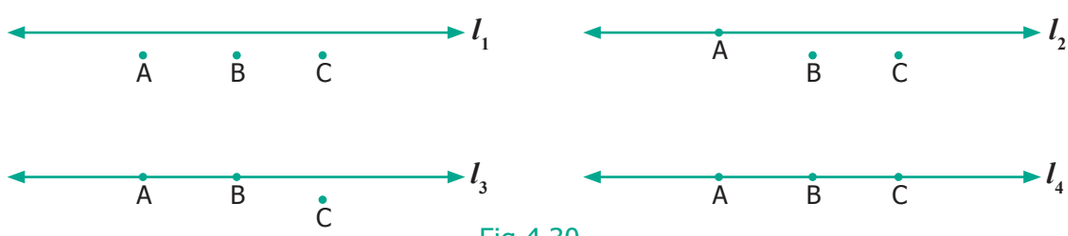


Fig 4.30

When all the three points are on a line, they are special; we call such points as collinear points.

When two lines intersect at right angles (90°), we call them as perpendicular lines. (Refer to 4.31)

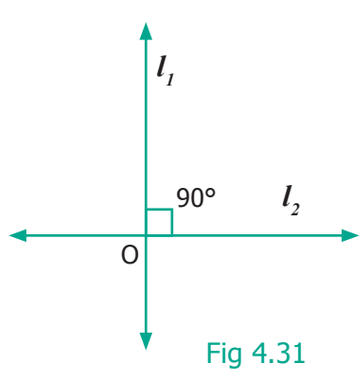


Fig 4.31

ACTIVITY

A book is an object where you can see parallel, perpendicular and intersecting lines.

Suggest atleast 2 more examples having parallel, perpendicular and intersecting lines.

Two intersecting lines cut at a point. Will three lines intersect at one point? Fig.4.32 will help you to answer this.

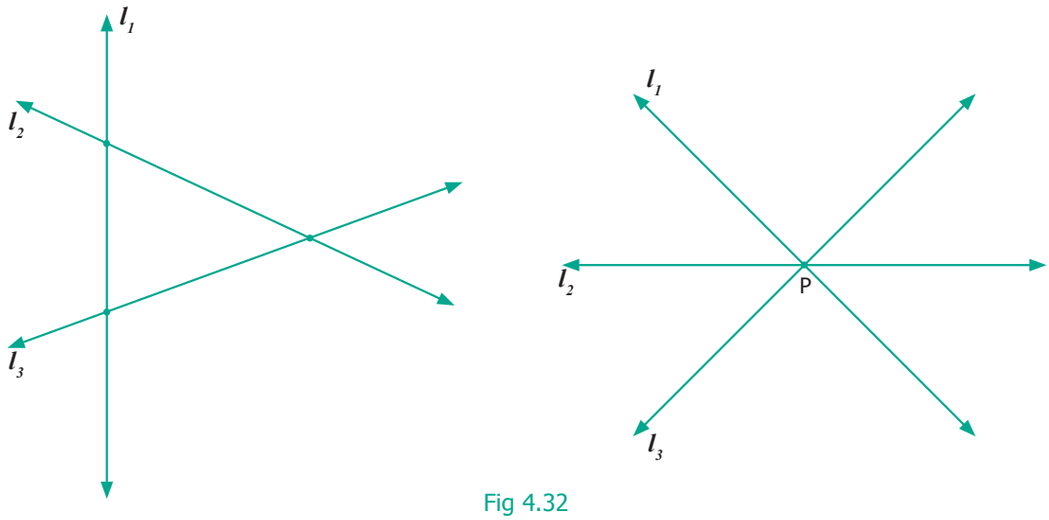
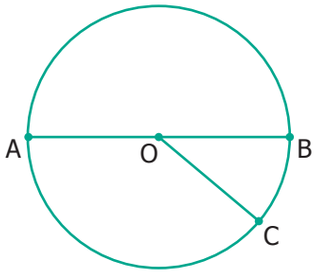


Fig 4.32

When many lines intersect at a single point, that is again special, we call that point P as a point of concurrency. The lines are called concurrent lines.

Exercise 4.3

1. Observe the diagram and fill in the blanks.

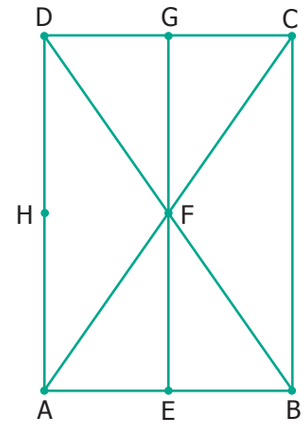


   (i) 'A', 'O' and 'B' are _____ points.
   (ii) 'A', 'O' and 'C' are _____ points.
   (iii) 'A', 'B' and 'C' are _____ points.
   (iv) _____ is the point of concurrency.

2. Draw any line and mark any 3 points that are collinear.
3. Draw any line and mark any 4 points that are not collinear.
4. Draw any 3 lines to have a point of concurrency.
5. Draw any 3 lines that are not concurrent. Find the number of points of intersection.

ABWRY4

Objective Type Questions



6. A set of collinear points in the figure are _____.

   (a) A, B, C (b) A, F, C (c) B, C, D (d) A, C, D

7. A set of non-collinear points in the figure are _____.

   (a) A, F, C (b) B, F, D (c) E, F, G (d) A, D, C

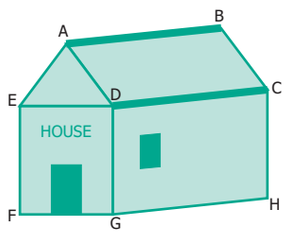
8. A point of concurrency in the figure is _____.

   (a) E (b) F (c) G (d) H

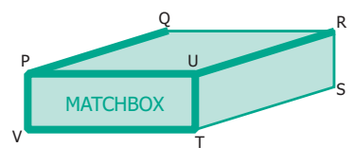
Exercise 4.4

Miscellaneous Practice Problems

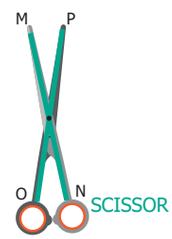
1. Find the type of lines marked in thick lines (Parallel, intersecting or perpendicular).



(i)

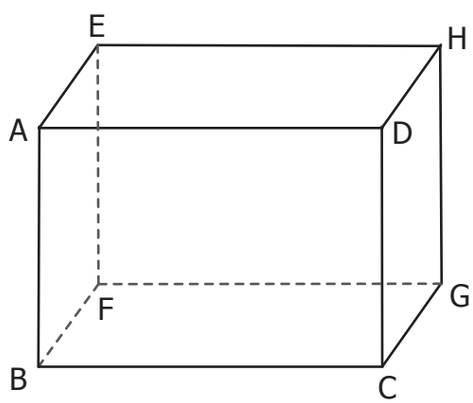


(ii)



(iii)

2. Find the parallel and intersecting line segments in the picture given below.



3. Name the following angles as shown in the figure.

   (i) $\angle 1$ =

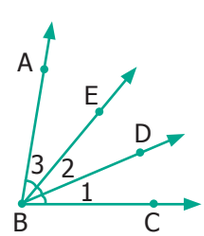
   (ii) $\angle 2$ =

   (iii) $\angle 3$ =

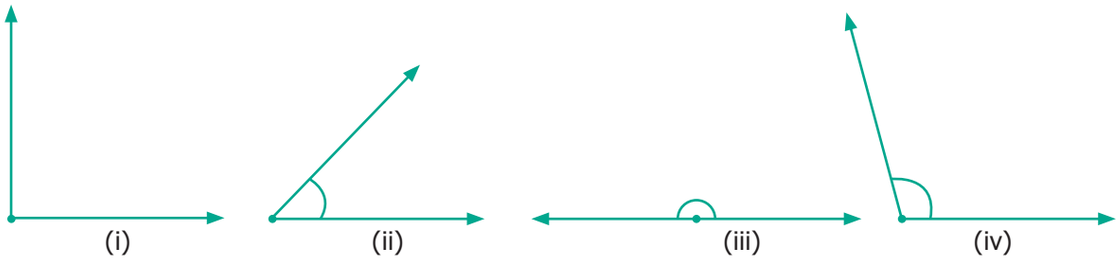
   (iv) $\angle 1 + \angle 2$ =

   (v) $\angle 2 + \angle 3$ =

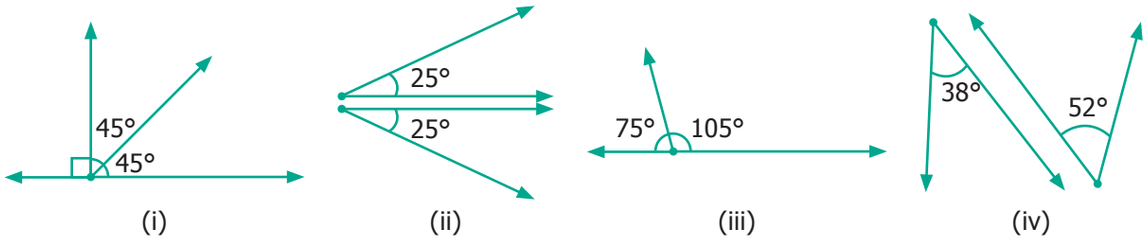
   (vi) $\angle 1 + \angle 2 + \angle 3$ =



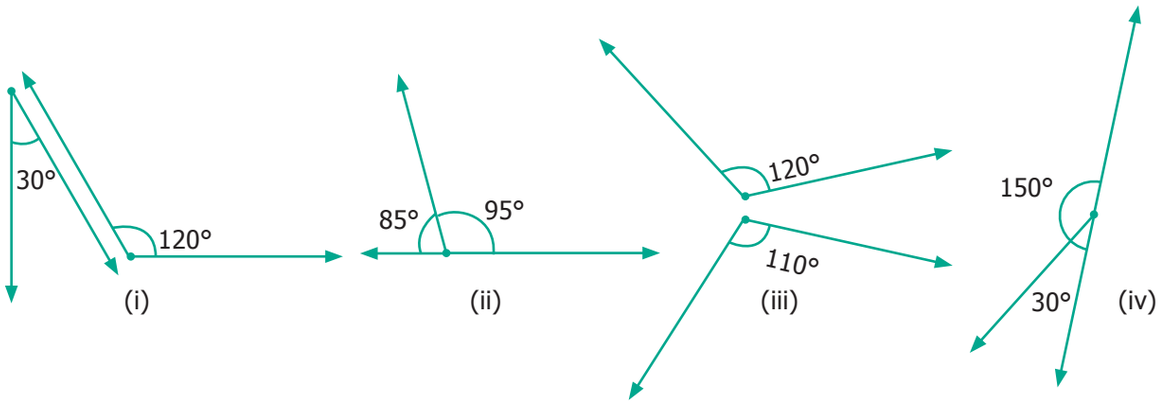
4. Measure the angles of the given figures using protractor and identify the type of angle as acute, obtuse, right or straight.



5. From the figures given below, classify the following pairs of angles into complementary and non complementary.



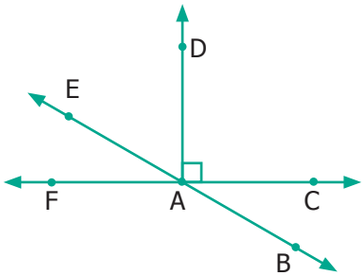
6. From the figures given below, classify the following pairs of angles into supplementary and non supplementary.



7. From the figure

(i) name a pair of complementary angles

(ii) name a pair of supplementary angles



Challenging Problems

8. Think and write an object having
   - Parallel lines (1) _____ (2) _____ (3) _____
   - Perpendicular lines (1) _____ (2) _____ (3) _____
   - Intersecting lines (1) _____ (2) _____ (3) _____
9. Which angle is equal to twice its complement?
10. Which angle is equal to two-third of its supplement?
11. Given two angles are supplementary and one angle is 20º more than other. Find the two angles.
12. Two complementary angles are in ratio 7:2. Find the angles.
13. Two supplementary angles are in ratio 5:4. Find the angles.

Summary

- A line extends along both directions without end.
- A line segment has two end points.
- Parallel lines never meet.
- When two lines meet they are called intersecting lines.
- When two rays have common starting point, they form an angle at that point.
- We measure angles using protractor.
- An angle whose measure is less than 90º is called an acute angle.
- An angle whose measure is exactly 90º is called a right angle.
- An angle whose measure is greater than 90º is called an obtuse angle.
- When the two rays or lines coincide, they are said to make angle zero, that is 0º.
- Two angles are complementary when they add up to 90º.
- Two angles are supplementary when they add up to 180º.
- Given any two points there is a unique line passing through them.
- When three points lie on a line, they are said to be collinear.
- When two lines meet each other at 90° at the point of intersection, they are called perpendicular lines.
- When three or more lines pass through the same point, they are said to be concurrent. That point is called the Point of Concurrency.

ICT Corner

GEOMETRY

Expected Result is shown in this picture

Step – 1

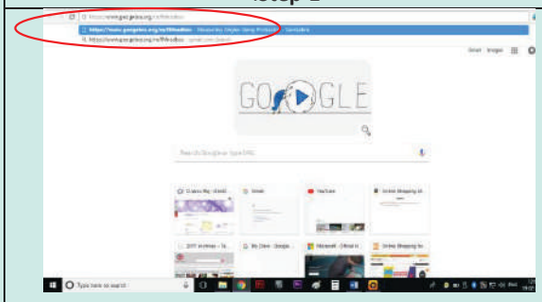
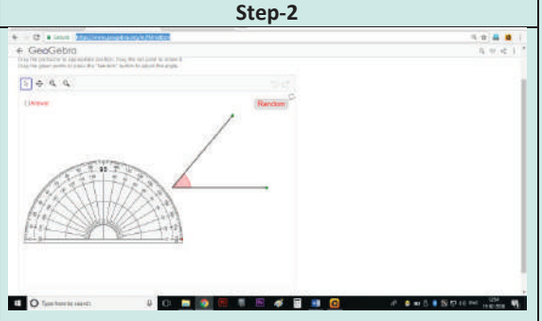
Open the Browser, copy and paste the link given below (or) by type the URL given (or) Scan the QR Code.

Step - 2

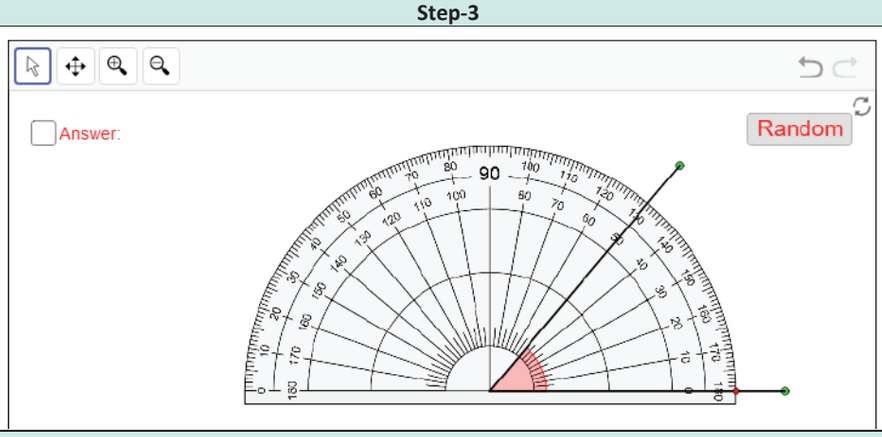
GeoGebra Work Book called "Measuring Angles Using Protractor" will appear. An angle and a Protractor will appear.

Step-3

Drag the protractor and place it on the angle and measure it. Now Click on the "**Answer**" Box to check whether your measurement is correct. Click on "**Random**" button to create new angle and continue till you understand how to measure the angle.

.Step-1	Step-2
	

Step-3



Browse in the link

Measuring Angles: https://www.geogebra.org/m/fMnsdbzv

Chapter 5

STATISTICS

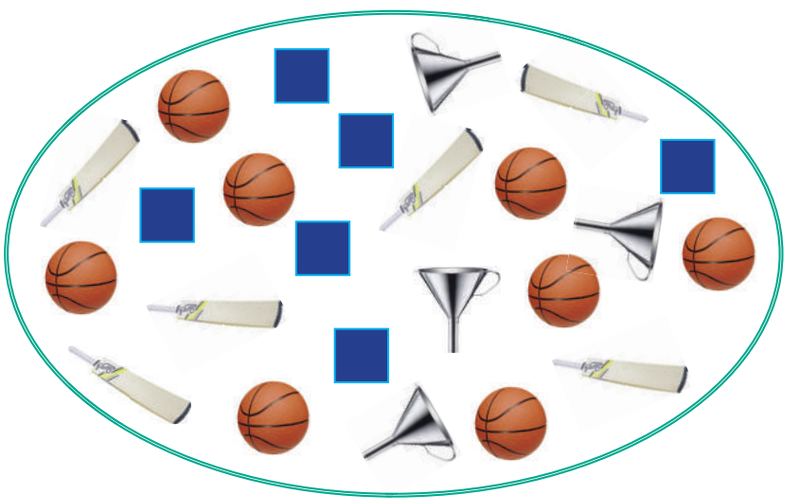
AC6MZR

Learning Objectives

- To understand the necessity of collecting data.
- To organise collected data using tally marks.
- To understand the need for scaling in pictographs.
- To draw pictographs and interpret them.
- To draw bar graphs and interpret them.

Recap

Count the objects in the following figure and complete the table that follows:



Object	Number of Objects
Ball	8
Bat	
Funnel	
Square	

From the given Figure and the table, answer the following questions.

(i) The total number of objects in the above picture is _____.

(ii) The difference between the number of squares and the number of bats is _____.

(iii) The ratio of the number of balls to the number of bats is _____.

(iv) What are the objects equal in number?

(v) How many more balls are there than the number of bats?

5.1 Introduction

Think about this situation

Fig.5.1

The Headmaster of a school (see Fig. 5.1) wanted to open Saving Bank accounts for his students. For this, he needed data from his students. Students did not understand the meaning of the word 'data'. Do you know what it means? Data means, "collection of information about anything". Data is collected, measured and analyzed, whereupon it can be visualized using graphs or images. In this case, the details could consist of information like the ration card number with address, the name of the student, Aadhaar card identity number, date of birth, phone number for communication etc., These are preserved for drawing inferences.

Name of the student	Aadhaar Number	Date of birth	Phone Number
D. Nallathambi	.....	.....	.....

MATHEMATICS ALIVE – STATISTICS IN REAL LIFE

	
Population census	Wickets taken by the bowler in last 5 matches

5.2 Data

In our daily life, we come across many situations where we need to collect information in the form of Facts or Numbers.

For example,

- Number of students using calculators in your class.
- Number of brothers and sisters in your family.

DO YOU KNOW?

The word 'data' was first used in 1640's.In 1946, the word 'data' also meant for "transmittable and storable computer information". In 1954, a term called 'data processing' was introduced. The plural form of 'datum' is 'data'. It also means "given" or "to give" in Latin.

- Number of different types of houses in a village.
- Number of girls wearing bangles.
- Number of buses crossing a certain road junction at a particular time.
- Number of persons in a street who watch T.V. for more than 2 hours a day.
- Number of shops in a shopping mall selling textiles.
- Speeds of bikes, cars and other vehicles passed along a specific highway.

Thus, the numerical information or facts collected are known as Data.

5.2.1 Collection of data

Santhi collected the following information about her friend's preference of sweets which is as shown below.

Friend's name	Sweet preferred	Friend's name	Sweet preferred
Vetri	Gulabjamun	Sadaiyan	Laddu
Kurinji	Laddu	Rafiq	Gulabjamun
Mullai	Cake	Francis	Laddu
Madhavi	Gulabjamun	Vetriselvi	Laddu
Pegan	Cake	Mary	Gulabjamun
Rahim	Laddu	Fathima	Laddu
Nawaz	Cake	Raju	Cake
Siva	Gulabjamun	Robert	Gulabjamun
Joseph	Laddu	Kalai	Cake
Tamil	Gulabjamun	Anbu	Kesari
Malar	Laddu	Thamarai	Gulabjamun
Velan	Kesari	Mariya	Laddu
Malarkodi	Cake	Manimozhi	Kesari
Selvi	Gulabjamun	Mubina	Gulabjamun
Arivu	Laddu	Kottravai	Gulabjamun

This way of collecting the data helps Santhi to decide, what sweets to get for her birthday and how much for each.

TRY THESE

- Tabulate different kinds of crops cultivated by the farmers in a village
- List out different kinds of plants/trees in your school campus

ACTIVITY

Collect the data of the birth months of your classmates.

5.2.2 Types of Data

On the basis of collection, data are of two types. They are primary data and secondary data.

Primary data

Primary data means the raw data (not tailored data) which has just been collected from the original source and has not gone any kind of statistical treatment like sorting and tabulation.

ACTIVITY

Collect data on the level of literacy of people in your street.

Examples

- List of absentees in the class.
- A survey on writing habits of students conducted by a pen manufacturing company.
- The types of leaves collected by students for studying nature.

Secondary Data

Secondary data consists of second hand information which has already been collected. It could have been collected by someone other than the user, for some other purpose.

Examples

- The Headmaster collects the students' absentee list from school office.
- Cricket scores gathered from a website.
- Data from Television and Newspapers.
- List of contact numbers from telephone directory.

DO YOU KNOW?

Primary data is collected in person and so more reliable than Secondary data.

5.2.3 Organizing Data

The collected data are to be arranged methodically or logically so that the information can be looked up fast whenever needed, easily and efficiently. The method of organizing the data is discussed as follows.

Tally Marks

Consider the data collected by Santhi (given in Table). Is it easy to get the required information from the data? For example, can any one quickly tell the number of people who do not like Laddu? No. So she decides to organize the data (See Fig. 5.2).

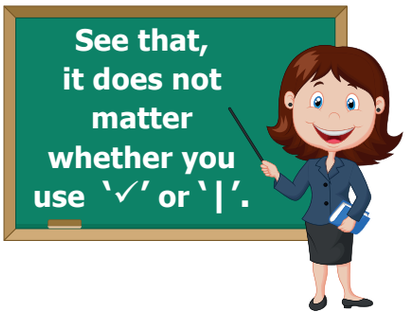
Fig.5.2

Her friends come to help her. Malar arranges the data as given below in the table. She uses '✓' marks to note down how many friends like each of the sweets. The count of each sweet is called as "Frequency".

Sweet	Marks	Frequency
Kesari	✓✓✓	3
Gulabjamun	✓✓✓✓✓✓✓✓✓✓✓	11
Laddu	✓✓✓✓✓✓✓✓✓✓	10
Cake	✓✓✓✓✓✓	6

But, Rahim arranges the data as shown below.

Sweet	Tally Marks	Frequency
Kesari	III	3
Gulabjamun	IIIIIIIIIII	11
Laddu	IIIIIIIIII	10
Cake	IIIIII	6



Both have done well. But one would prefer tally marks as they are very simple.

One	Two	Three	Four	Five
I	II	III	IIII	卌

As in the above table, the teacher arranges the data as follows:

Sweet	Tally Marks	Frequency
Kesari	III	3
Gulabjamun	卌 卌 I	11
Laddu	卌 卌	10
Cake	卌 I	6

The standard form of representing the data is obtained by using 'Tally marks'.

NOTE

- The occurrence of each information is marked by a vertical line '|'.
- Every fifth tally is recorded by striking through the previous four vertical lines as '~~||||~~'.
- This makes counting up the tallies easy.

Example 5.1

Thamarai is fond of reading books. The number of pages read by her on each day during the last 40 days are given below. Make a Tally Marks table.

1 3 5 6 6 3 5 4 1 6 2 5 3 4 1 6 6 5 5 1

1 2 3 2 5 2 4 1 6 2 5 5 6 5 5 3 5 2 5 1

Solution

The Tally marks table is given below.

Number of pages	Tally Marks	Frequency
1	~~||||~~ ||	7
2	~~||||~~ |	6
3	~~||||~~	5
4	|||	3
5	~~||||~~ ~~||||~~ ||	12
6	~~||||~~ ||	7
Total		40

THINK

If someone asks, "typically, how many pages does Thamarai read in one day?", what will be your answer?

Exercise 5.1

ACFJ2E

1. Fill in the blanks.

   (i) The collected information is called _____.

   (ii) An example of a Primary Data is _____.

   (iii) An example of a Secondary Data is _____.

   (iv) The tally marks for number 8 in standard form is _____.

2. Viji threw a die 30 times and noted down the result each time as follows. Prepare a table on the numbers shown using Tally Marks.

1	4	3	5	5	6	6	4	3	5	4	5	6	5	2
4	2	6	5	5	6	6	4	5	6	6	5	4	1	1

3. The following list tells colours liked by 25 students. Prepare a table using Tally Marks.

Red	Blue	White	Grey	White
Green	Grey	Blue	Green	Grey
Blue	Grey	Red	Green	Red
Blue	Blue	Green	Blue	Green
Grey	Grey	Green	Grey	Red

4. The following are the marks obtained by 30 students in a class test out of 20 in Mathematics subject.

11	12	13	12	12	15	16	17	18	12
20	13	13	14	14	14	15	15	15	15
16	16	16	15	14	13	12	11	19	17

Prepare a table using Tally Marks.

5. The table shows the number of calls recorded by a Fire Service Station in one year.

Types of Calls	Tally Marks	Frequency
Building Fires	卌 I	
Other Fires	卌 卌 I	
Hazardous Materials		7
Rescues		4
False Alarms	卌 II	
Total		

Complete the table and answer the following questions.

(i) Which type of call was recorded the most?

(ii) Which type of call was recorded the least?

(iii) How many calls were recorded in all?

(iv) How many calls were recorded as False Alarms?

Objective Type Questions

6. The tally marks for the number 7 in standard form is _____.

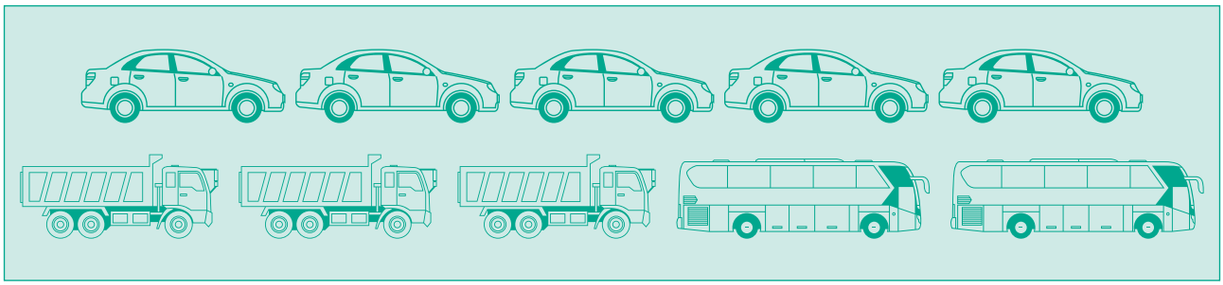
   (a) 7 (b) 𝍸 || (c) ✓✓✓✓✓✓✓ (d) 𝍸𝍸

7. The tally marks 𝍸 |||| represents the number count

   (a) 5 (b) 8 (c) 9 (d) 10

5.3 Representation of data using Pictograph

The teacher was discussing about the pollution caused by the vehicles. The students said that they saw many vehicles when they were standing in the bus stop while coming to school. Everyone described in their own way, but Azhagi drew the pictures of the vehicles that she had seen, as shown below.



All the students were able to easily understand that Azhagi had seen 5 cars, 3 lorries and 2 buses. This sort of representation of data using pictures is called Pictograph.

Nowadays pictographs are frequently used in promotion of tourism, weather forecast, geography etc.

Advantages of using Pictograph

- The data can be easily analyzed and interpreted.
- The pictures and symbols help us to understand better.

NOTE

A pictograph is the representation of data through pictures.

DO YOU KNOW?

- The pictograph is a pictorial representation for a word or Phrase.
- A pictograph is also called Pictogram.
- Pictographs were used as the earliest known form of writing examples having been discovered in Egypt and Mesopotomia since 3000 BC.

5.3.1 Need for scaling in the Pictograph

Fig. 5.3 shows, a fruit stall where there are 40 mangoes, 55 apples, 35 oranges and 60 bananas. How can we represent this data by using pictures? If the data is very large, it is very difficult and time consuming to represent each of the fruits in a pictograph. In such cases, we can use one picture to represent many of the same kind. This is called scaling.

Fig. 5.3

5.3.2 Drawing Pictographs

Consider the above data of fruits. 40 and 60 are multiples of 10, while 55 and 35 are multiples of 5. Let us assume, that One full picture of fruit represents 10 fruits and One half picture represents 5 fruits.

Name of the fruits	Number of fruits
Mangoes	
Apples	
Bananas	
Oranges	

The pictograph can be drawn for the above data as shown in the table.

5.3.3 Interpreting pictograph

From the above pictograph the number of fruits can be calculated very easily.

Number of Mangoes = 4 full pictures $\Rightarrow 4 \times 10 = 40$ mangoes

Number of Apples = 5 full pictures and 1 half picture
$\Rightarrow (5 \times 10) + 5 = 55$ apples

Number of Bananas = 6 full pictures $\Rightarrow 6 \times 10 = 60$ bananas

Number of Oranges = 3 full pictures and 1 half picture
$\Rightarrow (3 \times 10) + 5 = 35$ oranges

Example 5.2

The following table shows the number of vehicles sold in a year.

Car	
Van	
Motor Cycle	
Bus	
Bicycle	

Key: One picture represents 10 vehicles

Look at the pictograph and answer the following questions.

(i) How many motor cycles were sold in a year?

(ii) Number of buses sold in a year is 20. Say True or False.

(iii) How many bicycles were sold ?

(iv) How many cars and vans were sold?

(v) How many vehicles were sold altogether?

Solution

Given : 1 picture represents 10 vehicles

(i) There were 9 × 10 = 90 motor cycles sold.

(ii) True.

(iii) There were 4 × 10 = 40 bicycles sold.

(iv) There were 7 cars and 3 vans pictures.
Therefore 70 + 30 = 100 cars and vans sold.

(v) There were 7 cars, 3 vans, 9 motor cycles, 2 buses and 4 bicycles sold.
Therefore, 70 + 30 + 90 + 20 + 40 = 250 vehicles sold.

Activity

Collect from class VI students data regarding games they like and then draw a pictograph for the data collected.

Exercise 5.2

1. Fill in the blanks.

   (i) If  represents 100 balls then  represents _____ balls.

   (ii) If 200 is represented by  then 600 is represented by _____.

   (iii) Representation of data by using pictures is known as _____.

2. Draw a pictograph for the given data.

Month	June	July	August	September
Number of Computers sold	300	450	600	550

(Choose your own suitable scale)

3. The following table shows the number of tourists who visited the places in the month of May. Draw a pictograph.

Place	Mahabalipuram	Vedanthangal	Hogenakkal	Ooty
Number of Tourists	20,000	15,000	40,000	35,000

(Choose your own suitable scale)

4. The following Pictograph shows the number of students playing different games in a school.

Game	Number of Students
Kho-Kho	
Kabaddi	
Basketball	
Volleyball	
Hockey	

ACPF42

Answer the following questions.

(i) Which is the most popular game among the students?

(ii) Find the number of students playing Kabaddi.

(iii) Which two games are played by equal number of students?

(iv) What is the difference between the number of students playing Kho-Kho and Hockey?

(v) Which is the least popular game among the students?

Objective Type Questions

5. The representation of 'one picture to many objects' in a Pictograph is called _____.

(a) Tally mark (b) Pictoword (c) Scaling (d) Frequency

6. A Pictograph is also known as _____.

(a) Pictoword (b) Pictogram (c) Pictophrase (d) Pictograft

5.4 Representation of data using Bar Graph

Ragavi's father is a mobile shop owner. She finds the following data of sale of mobiles in a week.

Day	Number of Mobiles Sold
Sunday	50
Monday	45
Tuesday	40
Wednesday	20
Thursday	35
Friday	30
Saturday	55

What if the number of mobiles be 4, 37 or 305? How many pictures will be used?

Yes! Try this!

For this data instead of pictographs, something different can be used.

NOTE

A Bar graph consists of equally - spaced parallel bars (Horizontal or Vertical) whose lengths / heights are proportional to the number of items given.

5.4.1 Drawing Bar-Graph

Step 1: Draw two lines which are perpendicular to each other. One of them is horizontal and the other one is vertical.

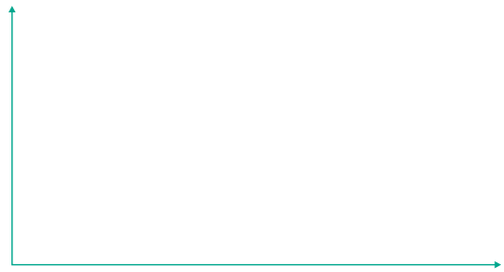


Fig. 5.5

Step 2: A suitable title (Sale of mobiles in a week) is given. The lines are labelled (Horizontal line ⟶ Days of the week; vertical line ⟶ Number of mobiles sold).

Fig. 5.6

Step 3: A suitable scale is chosen. The scale used is stated on the graph.

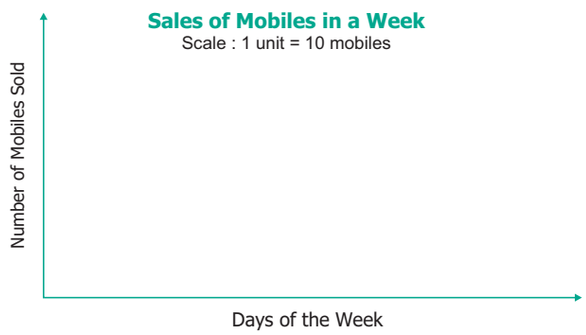


Fig. 5.7

Step 4: Let the vertical line start from 0 and the values of information are marked at equal distances in same increments.

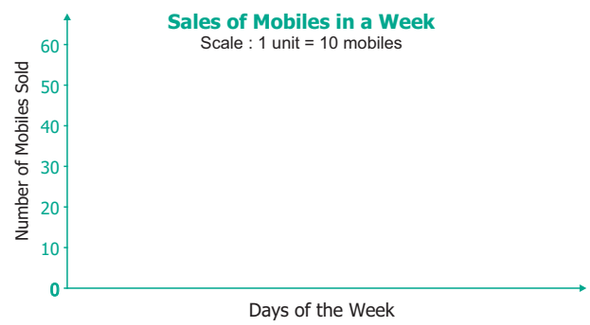


Fig. 5.8

Step 5: For each information vertical bars are drawn on the horizontal line. They are labelled by respective information (as Monday, Tuesday... Sunday).

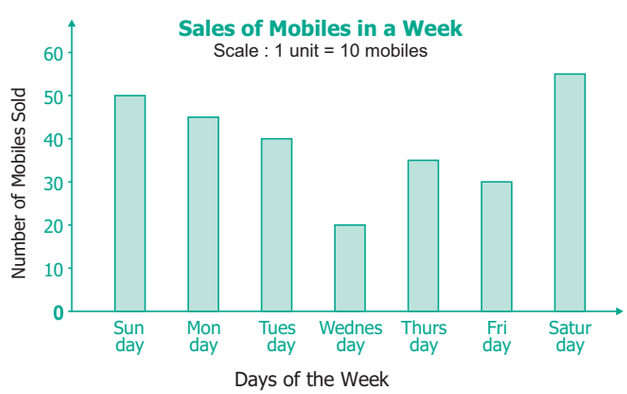


Fig. 5.9

This graph is called as Vertical Bar Graph.

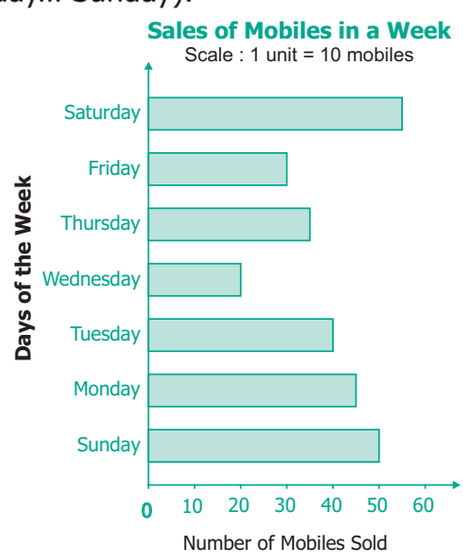


Fig. 5.10

The corresponding horizontal Bar Graph will look like this:

5.4.2 Interpreting the Bar Graph

The data from the above Bar Graph (Fig. 5.10) can be easily interpreted and analyzed as follows.

- The maximum number of mobiles were sold on Saturday (55).
- The minimum number of mobiles were sold on Wednesday (20).
- The total number of mobiles sold in the week (50+45+40+20+35+30+55 = 275).
- The number of mobiles sold on a particular day (for example: on Friday is 30, etc.,).

ACTIVITY

Collect different data from Newspapers, Magazines, etc. and interpret them using Bar graphs.

Example 5.3

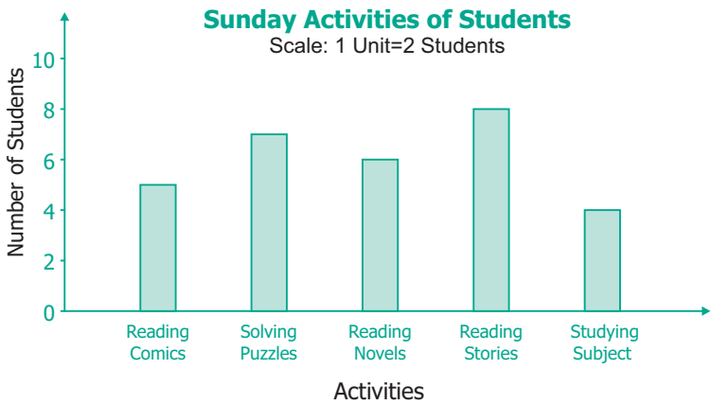


Fig. 5.11

THINK

Why are these important?

- The width of each bar is same.
- The spaces between any two bars are also the same.

Study the above Bar graph and answer the following questions.

(i) Which activity is followed by maximum number of students?

(ii) How many students in all, spend their time on solving puzzles?

(iii) The total number of students who follow either reading stories or reading their subjects is _____.

(iv) The activity followed by minimum number of students is _____.

(v) The number of students who took part in reading comics is _____.

Solution

(i) 'Reading stories' is followed by maximum number of students.

(ii) 7 students spend their time to work out solving puzzles.

(iii) 8 + 4 = 12 students spend their time on reading stories or subjects.

(iv) 'Studying subject' is followed by minimum number of students.

(v) 5 students spend their time on reading comics.

THINK

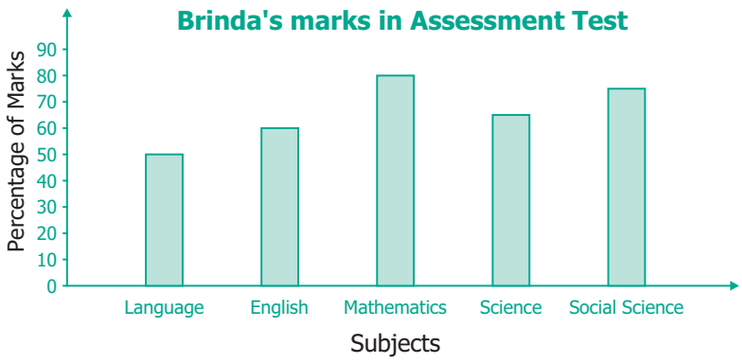
Can you use

1 unit =1 student?

Justify your answer.

Exercise 5.3

1. Read the given Bar Graph which shows the percentage of marks obtained by Brinda in different subjects in an assessment test.



ACYB5P

Observe the Bar Graph and answer the following questions.

(i) 1 Unit = _____ % of marks on vertical line.

(ii) Brinda has scored maximum marks in _____ subject.

(iii) Brinda has scored minimum marks in _____ subject.

(iv) The percentage of marks scored by Brinda in Science is _____.

(v) Brinda scored 60% marks in the subject _____.

(vi) Brinda scored 20% more in _____ subject than _____ subject.

2. Chitra has to buy Laddus in order to distribute to her friends as follows:

Classes	VI	VII	VIII	IX	X
Number of Laddus	70	60	45	80	55

Draw a Bar Graph for this data.

3. The fruits liked by the students of a class are as follows. Draw a Bar Graph for this data.

Fruits	Bananas	Grapes	Apples	Mangoes	Guavas	Papayas	Other fruits
Number of students	8	10	8	7	12	3	2

4. The pictograph below gives the number of absentees on different days of the week in class six. Draw the Bar graph for the same.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Number of Absentees					--	

represents 4 students represents 2 students

Objective Type Questions

5. A bar graph can be drawn using _____.
   (a) Horizontal bars only
   (b) Vertical bars only
   (c) Both horizontal bars and vertical bars
   (d) Either horizontal bars or vertical bars.

6. The spaces between any two bars in a bar graph _____.
   (a) can be different (b) are the same
   (c) are not the same (d) all of these

Exercise 5.4

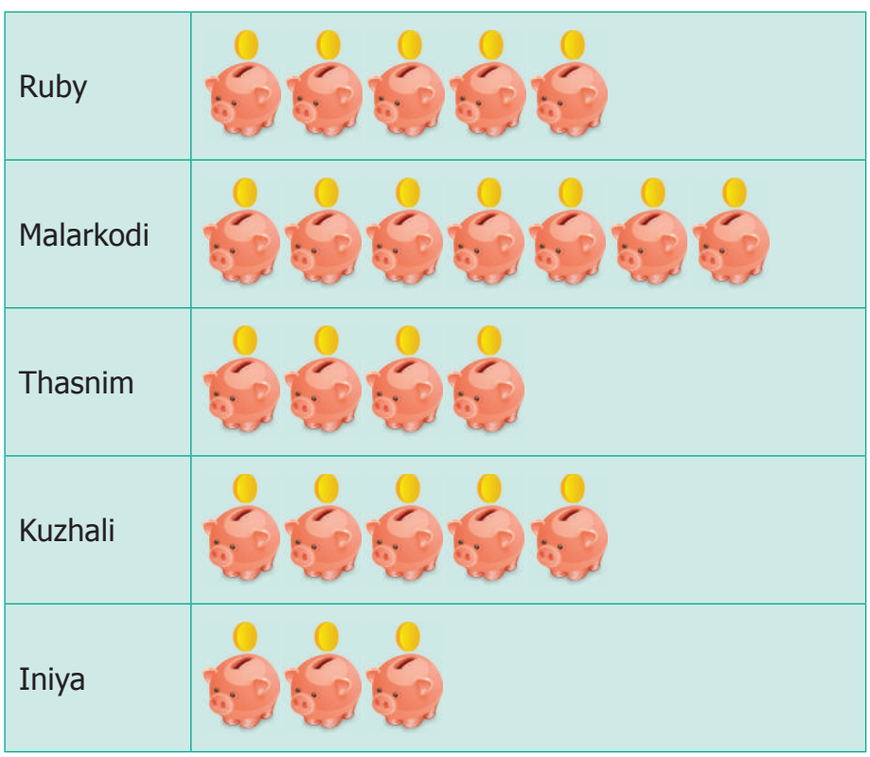
Miscellaneous Practice Problems

1. The heights (in centimeters) of 40 children are.

110	112	112	116	119	111	113	115	118	120
110	113	114	111	114	113	110	120	118	115
112	110	116	111	115	120	113	111	113	120
115	111	116	112	110	111	120	111	120	111

Prepare a tally marks table.

2. The following pictograph shows the total savings of a group of friends in a year. Each picture represents a saving of Rs.100. Answer the following questions.



AD877C

represents Rs.100

(i) What is the ratio of Ruby's saving to that of Thasnim's?

(ii) What is the ratio of Kuzhali's savings to that of others?

(iii) How much is Iniya's savings?

(iv) Find the total amount of savings of all the friends?

(v) Ruby and Kuzhali save the same amount. Say True or False.

3. There are 1000 students in a school. Data regarding the mode of transport of the students is given below. Draw a pictograph to represent the data.

Mode of Travel	On Foot	Bicycle	Scooter	Bus	Car
Number of Students	350	300	150	100	100

Challenging Problems

4. The prediction of Weather in the month of September is given below.

September						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					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

Sunny Partly Cloudy Cloudy Rainy

(i) Make a frequency table of the types of weather by reading the calendar.

(ii) How many days are either cloudy or partly cloudy?

(iii) How many days do not have rain? Give two ways to find the answer?

(iv) Find the ratio of the number of Sunny days to Rainy days.

5. The table shows the number of moons that orbit each of the planets in our solar system.

Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Number of Moons	0	0	1	2	28	30	21	8

Make a Bar graph for the above data.

6. 26 students were interviewed to find out what they want to become in future. Their responses are given in the following table.

Profession	Tally marks
Teacher	卌 ||
Pilot	|||
Bank Manager	卌
Doctor	|||
Engineer	卌
Other Professions	|||

Represent this data using Pictograph.

7. Yasmin of class VI was given a task to count the number of books which are biographies, in her school library. The information collected by her is represented as follows.

Biographies	Number of books
Mathematicians	
Scientists	
Novelists	
Sportspersons	
Politicians	

Key:

 represents 20 books

Observe the pictograph and answer the following questions.

(i) Which title has the maximum number of biographies?

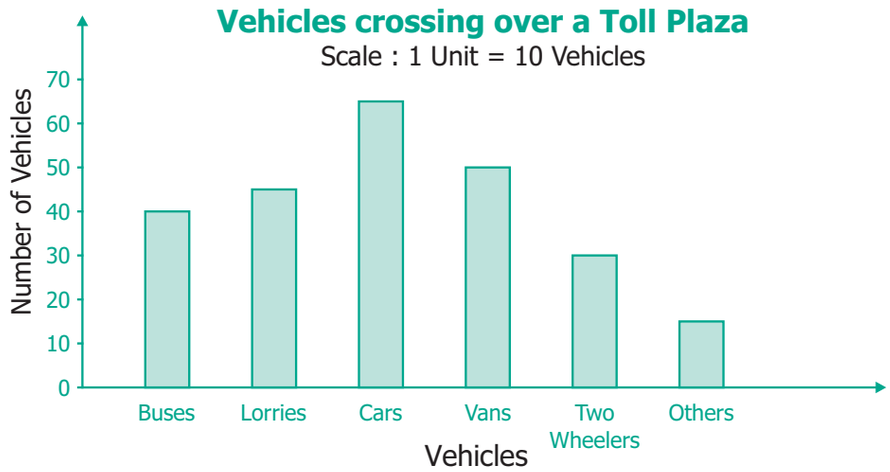
(ii) Which title has the minimum number of biographies?

(iii) Which title has exactly half the number of biographies as Novelists?

(iv) How many biographies are there on the title of Sportspersons?

(v) What is the total number of biographies in the library?

8. The bar graph illustrates the results of a survey conducted on vehicles crossing over a Toll Plaza in one hour.



Observe the bar graph carefully and fill up the following table.

Vehicles	Buses	____	Cars	Vans	____	Others	Total vehicles
Number of Vehicles	____	45	____	____	30	____	____

9. The lengths (in the nearest centimetre) of 30 drumsticks are given as follows.

Lengths	Number of drumsticks
24	卌
25	--
26	--
27	卌 I
28	--
29	卌 III
30	卌 I
31	卌

Draw the bar graph showing the same information.

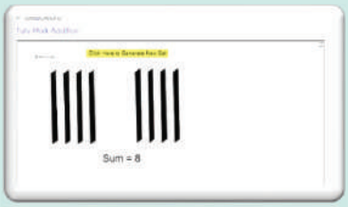
Summary

- Information collected is known as data.
- First-hand information is called primary data.
- The data collected by someone else is called secondary data.
- The data collected is organized usually in a tally marks table.
- The organized data can be represented using a pictograph or a bar graph.
- A pictograph is the representation of data through pictures of objects.
- A bar graph consists of parallel bars (horizontal or vertical) whose length corresponds to the number of items.

ICT Corner

STATISTICS

Expected Result is shown in this picture



Step – 1

Open the Browser, Copy and paste the link given below (or) by type the URL given (or) Scan the QR Code.

Step - 2

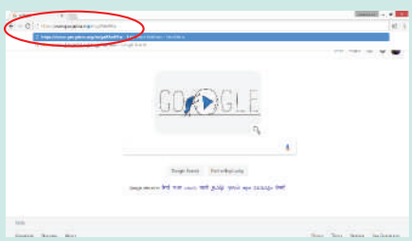
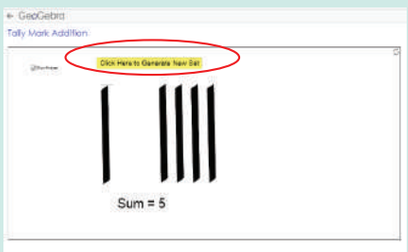
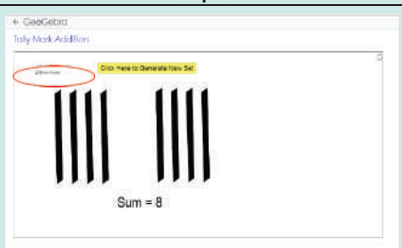
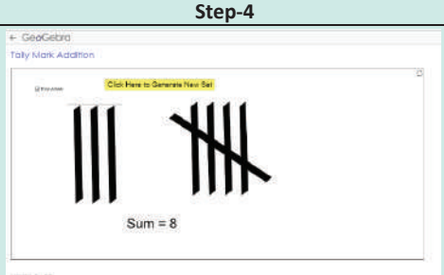
GeoGebra worksheet "Tally Mark Addition" will appear. You can generate a new set by clicking "Click here to generate a new set".

Step-3

Select "Show Answer" check box to view the answers for the sets.

Step 4:

Generate various results and observe the difference in set formation

Step-1	Step-2
	
Step-3	**Step-4**
	

Geogebra's url :

https://www.geogebra.org/m/gzRAnHKw

Alternate source to try tally calculations:

https://play.google.com/store/apps/details?id=org.geogebra&hl=en

Chapter 6 INFORMATION PROCESSING

ADH38Z

Learning Objectives

- To learn about systematic listing and counting.
- To solve puzzles like Sudoku and triangles by systematics completion.

6.1 Introduction

Ponmozhi is at her cousin's wedding which has a large gathering of people. There are a few hundred people, for sure. Suddenly her uncle comes and says, "We are getting ready to serve the meal; one of you quickly count the number of people and tell me". "Ponmozhi, you are good at counting; Do this quickly and tell to me, I will be inside, getting the plantain leaves ready."

It will be very tedious to count each and everyone assembled there. Ponmozhi is standing on a chair and is trying to count everyone. Suddenly, Ponmozhi is unsure of the count that she made and she did not want to count the same head more than once.

Ponmozhi was told that the task of counting was not easy. While counting, some people may leave, some may enter and some may move here and there. So it is difficult to make sure that her count would be correct.

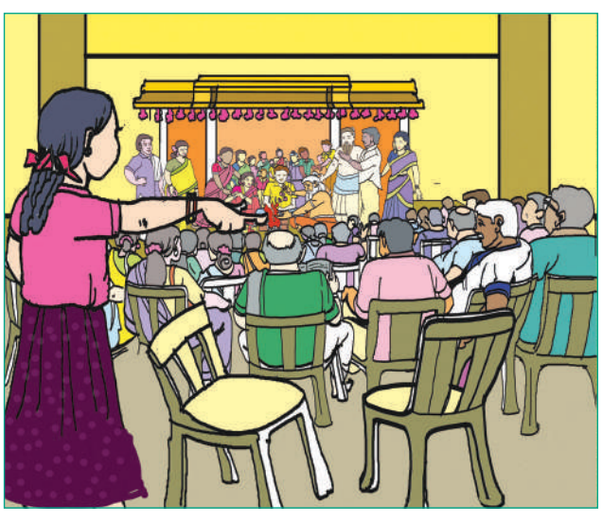


Fig. 6.1

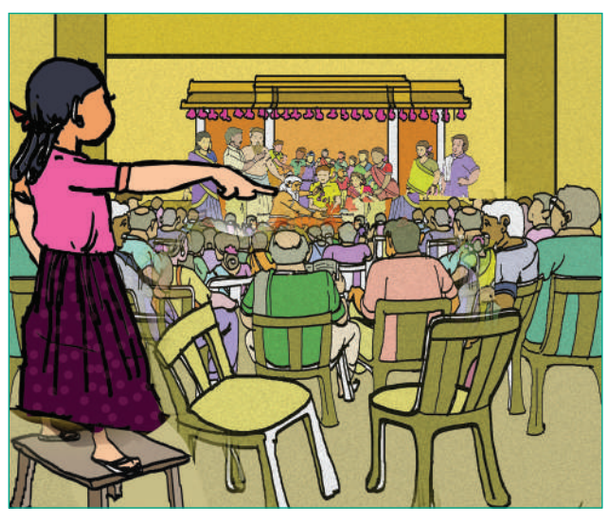


Fig. 6.2

But in a wedding feast it does not matter if there is a small error in the count: Whether there are 384 persons or 417 persons in the hall it does not really make much of a difference. Food made ready for 400 persons can be sufficient for 20 more persons. Mathematics will help not only in exact counting but also in estimation and approximate counting, depending on what is actually needed.

Instead of the above wedding hall situation, counting the number of children in the classroom is very easy. But counting the number of people in the wedding hall is difficult. There are many reasons for this.

The number of children in the classroom is small, in 10s rather than 100s. Children sit in the benches, the same number on each bench and the benches are organized in rows and columns. Children sit in one place when you are counting. The number is too small to ask the children to count starting from the left of the first row to the right of the last row, as the children themselves have collectively counted the number present in the class. But again we need not do this. If 3 children sit on each bench and there are 3 benches in a row and there are 4 rows, and every bench in the class is fully occupied, then we have $3 \times 3 \times 4 = 36$ children in class. But what should we do if all benches are not occupied full? If there are 3 benches with only 2 children and one bench with only one child, we only need to subtract (3+2) from 36 to get 31 children in the class. Importantly, not only we can get the answer, but also we can be confident that everyone was counted, and that nobody was left uncounted or counted twice.

The absence of these factors makes counting in wedding halls more difficult. In general, we can say:

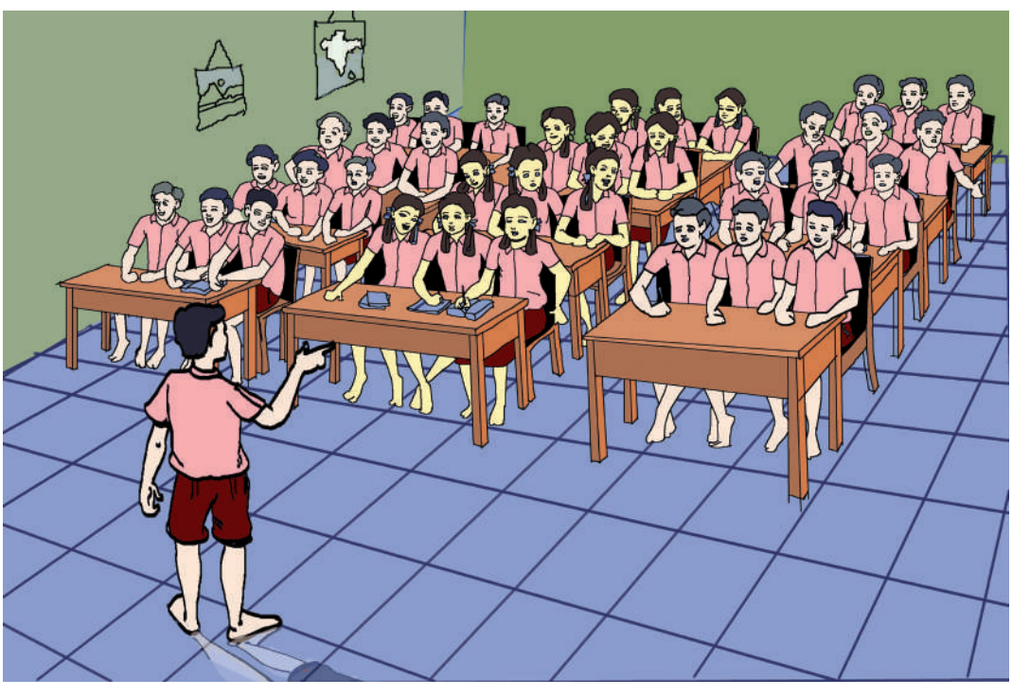
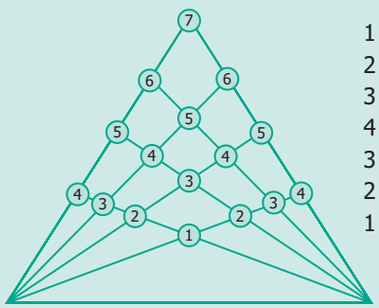


Fig. 6.3

The place in which the things are counted is fixed and arranged in some order, then counting is easy, otherwise it is difficult.

This suggests that the things should be in order if it is needed to be counted easily.

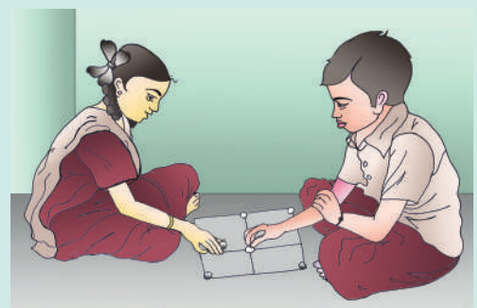
MATHEMATICS ALIVE - INFORMATION PROCESSING IN REAL LIFE



$1 \times 1 = 1$
$2 \times 2 = 4$
$3 \times 3 = 9$
$4 \times 4 = 16$
$3 \times 5 = 15$
$2 \times 6 = 12$
$1 \times 7 = 7$
64

Systematic sorting of triangles

Fig.6.4



Logical reasoning in 3 kal-aattam

Fig.6.5

6.2 Systematic listing

There are two shorts and three shirts. In how many different combinations can you wear them?

At a time you are going to pick one of the shorts and different shirts. We denote the shorts as A and B, and the shirts as p, q and r. Then you can wear one of these: A p, A q, A r, B p, B q and B r.

Thus you have six different combinations and you know that you have counted all the possibilities. This is systematic listing.

Situation 1

Your friend has built a house with three floors. He wants to paint each floor with three different colours red, blue and green. Can you help him to find different ways of possible colour combinations to paint the home?

Fig.6.6

In how many ways can his house be painted with these three colours?

Let us consider the floors as the Third floor, the Second floor and the First floor. We can say that

the painting can be done as RBG, BRG, GRB…etc. But here it is possible that we may miss out some patterns of colours. So, we can use systematic listing as given below.

Step 1: Fix one colour; try the possible arrangements with other colours. For example, if the Third floor is fixed as Red, then we get 2 ways which is shown in the table below.

Fix Third floor Colour	Second floor Colour	First floor Colour
Red	Blue	Green
Red	Green	Blue

Step 2: If the Third floor is fixed as Blue, then we get another 2 ways which is shown in the table below.

Fix Third floor Colour	Second floor Colour	First floor Colour
Blue	Green	Red
Blue	Red	Green

Step 3: If the Third floor is fixed as Green, then we get 2 more ways which is shown in the table below.

Fix Third floor Colour	Second floor Colour	First floor Colour
Green	Blue	Red
Green	Red	Blue

Hence, we get 6 different ways of painting the three floors, which are R-B-G, R-G-B, B-G-R, B-R-G, G-B-R and G-R-B.

Situation 2

Suppose you want to write four digit numbers by using the digits 3, 6, 9 and 5. What are the possible numbers you can write using each digit exactly once?
If you list randomly, for example 9365, 3695, 5639 and so on, you may not write all the possibilities. So, write in ascending order.

- All numbers beginning with 3:

Fix next digit and change the other 2 digits. We get, 3569, 3596, 3659, 3695, 3956, 3965.
Similarly,

- All numbers beginning with 5 : 5369, 5396, 5639, 5693, 5936, 5963
- All numbers beginning with 6 : 6359, 6395, 6539, 6593, 6935, 6953
- All numbers beginning with 9 : 9356, 9365, 9536, 9563, 9635, 9653
  Totally, we can have 6+6+6+6 = 24 numbers

TRY THESE

Mother had a lot of wooden pieces in different shapes with her. She gave 6 triangles to Kannagi and 6 circles to Madhan and asked them to create different figures using them. They tried and got some interesting figures. Can you create figures like them that are nice and interesting?

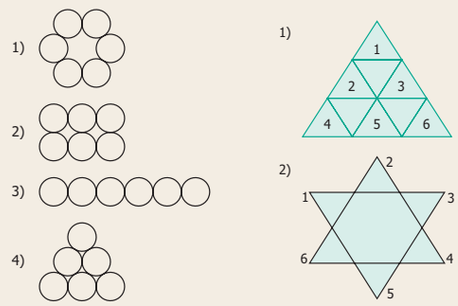


Fig.6.7

Space for new figures

6.3 Systematic completion of lists

Suppose that you are already given a list that is partially filled. How would you complete it? In the activity with 4-digit numbers we had experienced this already. The idea is to find how the filled in part is arranged and use the same idea to complete the rest.

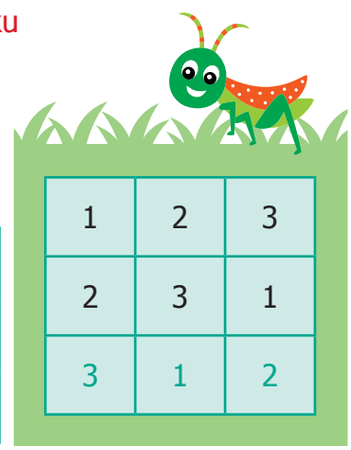
6.3.1 Sudoku

Sudoku is a number game. Completion with some constraints is best enjoyed in Sudoku. This is a puzzle where there is a partially filled in grid. Horizontal lines of cells in the grid are called as rows and vertical lines of cells in the grid are called as columns. In 9x9 Sudoku, you have to fill in the remaining blank cells with numbers from 1 to 9 so that no number repeats in a row, or in a column. In 3x3 Sudoku, you can use only the numbers from 1 to 3. In 4x4 Sudoku, you can use only the numbers from 1 to 4 and so on.

(i) 3X3 Sudoku

1	2	3
2	3	1

(a)



(b)

Fig. 6.8

Sudoku

DO YOU KNOW?

The word Sudoku comes from the Japanese language. Su means 'number' and Doku means 'single'. It refers to the condition that each number is listed only once in each row, column. The modern version of this puzzle is said to have come from Howard Garns.

In Fig, 6.8 (a) two rows are fixed. We get only one possible way to complete the third row (Fig. 6.8 (b)).

(ii) 3X3 sudoku

1	2	3

Fig. 6.9

In the above 3 x 3 sudoku, the first row only is fixed. The second row can be filled in 2 ways either by 2 3 1 or 3 1 2

1	2	3
2	3	1
3	1	2

(a)

1	2	3
3	1	2
2	3	1

(b)

Fig. 6.10

To fill the third row, bear in mind that numbers cannot be repeated in the row or in the column. The third row can be filled by only one way in each case.

(iii) 3 × 3 sudoku

In how many different ways can the first row be arranged?

The first row can be arranged in six ways as (1,2,3), (1,3,2), (2,1,3), (2,3,1), (3,1,2) and (3,2,1).

(iv) Let us find all possible solutions to solve 3 × 3 sudoku puzzle.

1	2	3
2	3	1
3	1	2

(a)

1	2	3
3	1	2
2	3	1

(b)

2	3	1
3	1	2
1	2	3

(c)

2	3	1
1	2	3
3	1	2

(d)

1	3	2
3	2	1
2	1	3

(e)

1	3	2
2	1	3
3	2	1

(f)

3	2	1
2	1	3
1	3	2

(g)

3	2	1
1	3	2
2	1	3

(h)

2	1	3
1	3	2
3	2	1

(i)

2	1	3
3	2	1
1	3	2

(j)

3	1	2
1	2	3
2	3	1

(k)

3	1	2
2	3	1
1	2	3

(l)

Fig. 6.11

We get 12 possible ways.

(iv) Here is a partially filled 4x4 sudoku.

1	4	3	
3			4
	1	2	
2		4	1

Fig. 6.12

One way of completing it is given below. Is there any other way to complete the sudoku?

1	4	3	2
3	2	1	4
4	1	2	3
2	3	4	1

Fig. 6.13

In the 4 × 4 Sudoku, there is an extra condition. We have four 2 × 2 grid boxes in the 4 × 4 sudoku. You have to be careful that no number from 1 to 4 repeats within that 2 × 2 grid also.

6.3.2 Magic triangle

Magic triangles are also very interesting in a similar way.

In a magic triangle, numbers are to be filled without repetition on the sides of a triangle. So that the sum of each side remains the same.

Fill up the circle with the numbers from 1 to 6 without repetition so that each side of the magic triangle adds upto 12.

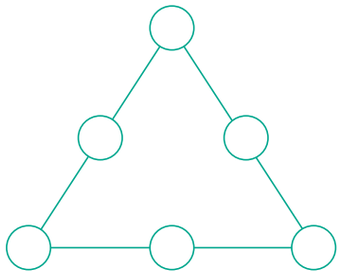


Fig. 6.14

Step 1: Place the larger numbers at the corners of the triangle i.e., 4 ,5, and 6.

Step 2: Place the smaller numbers i.e., 1,2 and 3 in the middle of each side.

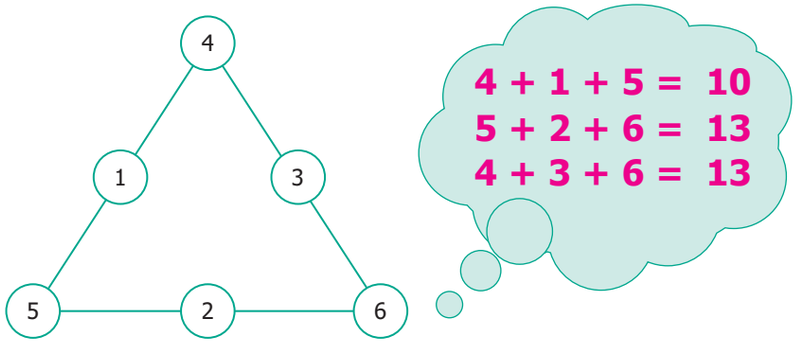


Fig. 6.15

Wrong Placement of numbers (first row 4, second row 1, 3 and third row 5, 2, 6)

Sum of the numbers on three sides of the triangle are 10, 13 and 13. All the total are not the same. This placement of numbers is not correct.

Try the other way, by changing the numbers as shown in the figure, given below.

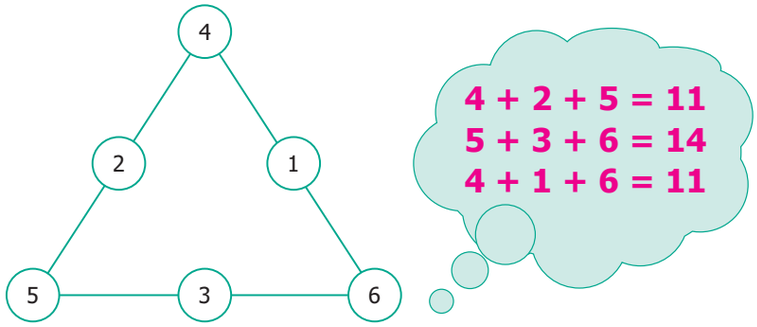


Fig. 6.16

Wrong Placement of numbers (first row 4, second row 2, 1 and third row 5, 3, 6)

Sums of the numbers on three sides of the triangle are 11, 14 and 11. Again, the totals are not the same.

Try again. Change the numbers to get a total of 12 on each side.

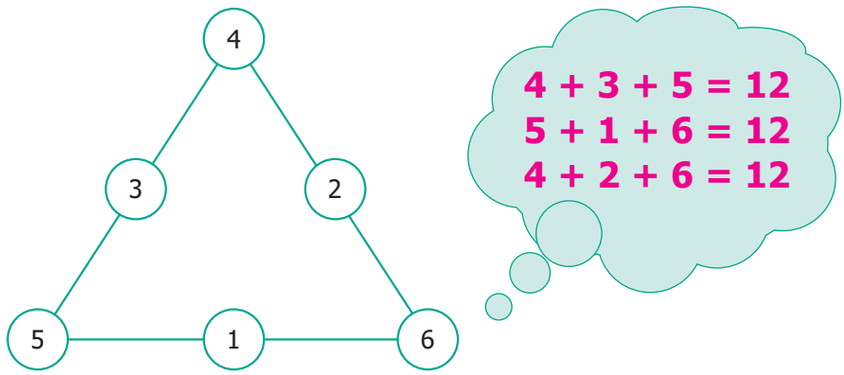


Fig. 6.17

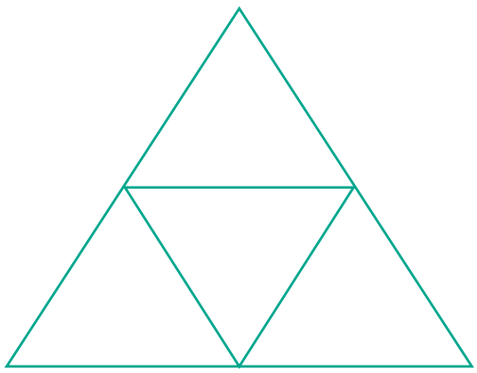
Correct placement of numbers. (first row 4, second row 3, 2 and third row 5, 1, 6)
This is the desired magic triangle.

6.3.3 More figures in a figure

Examples

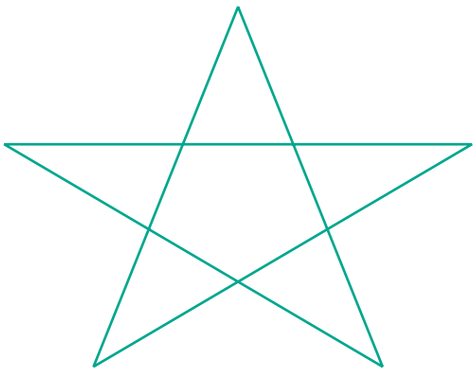
How many triangles are there in the given figures?

(i)



(a)

(ii)



(b)

Fig. 6.18

(i) Solution

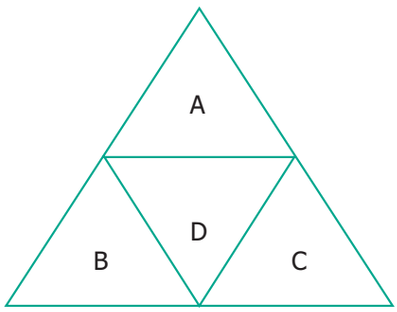
A, B, C, D are four triangles.

Combining A & D, B & D and D & C do not form any triangles.

Combining A, B & D; A, C & D and B, D & C also do not form any triangles.

Combining A, B, C & D = 1 triangle

$\therefore$ Total number of triangles = 4 + 1 = 5



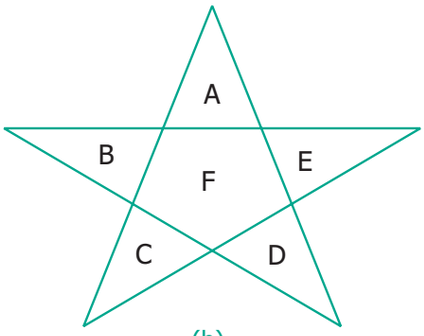
(a)

(ii) Solution

A, B, C, D, & E are five triangles.

No combination of these triangles taken 2 at a time, form any triangle.

Only the combinations of A, F & C; A, F & D; B, F & E; B, F & D and C, F & E form triangles when taken 3 triangles at a time. Hence, the total number of triangles = 5 + 5 = 10.



(b)

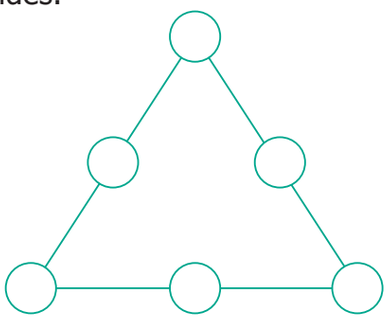
Exercise 6.1

1. Suppose, you have two shorts, one is black and the other one is blue; three shirts which are in white, blue and red. You again wish to make different combinations, but you always want to make sure that the shorts and shirt that you wear are of different colours. List and check how many combinations are possible now.

ADQYAM

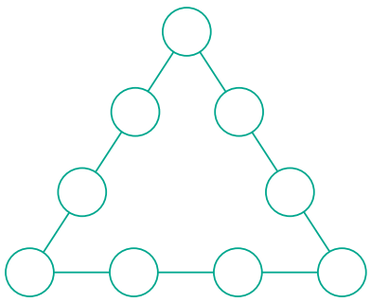
2. You have two red and two blue blocks. How many different towers can you build that are four blocks high using these blocks? List all the possibilities.

3. In the following magic triangle, arrange the numbers from 1 to 6, so that you get the same sum on all its sides.

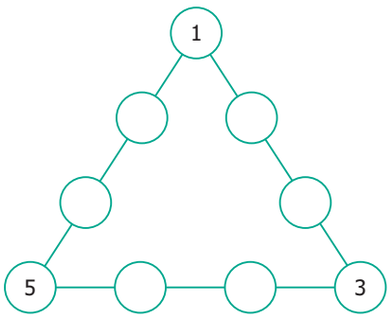


ADZUCA

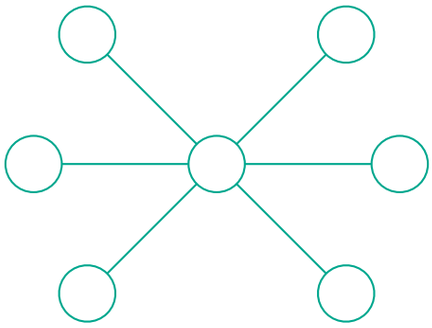
4. Using the numbers from 1 to 9
   (i) Can you form a magic triangle?
   (ii) How many magic triangles can be formed?
   (iii) What are the sums of the sides of the magic triangle?



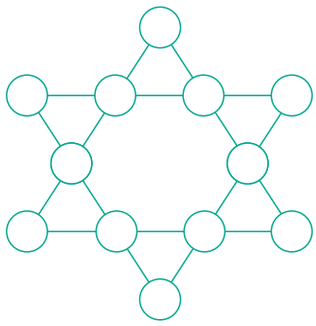
5. Arrange the odd numbers from 1 to 17 without repetition to get a sum of 30 on each side of the magic triangle.



6. Put the numbers 1, 2, 3, 4, 5, 6, & 7 in the circles so that each straight line of three numbers add up to the same total.

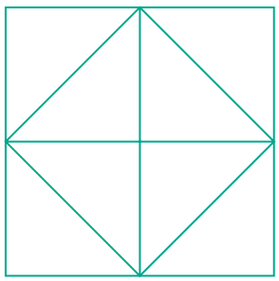


7. Place the number 1 to 12 in the 12 circles so that the sum of the numbers in each of the six lines of the star is 26. Use each number from 1 to 12 exactly once. Find more possible ways?



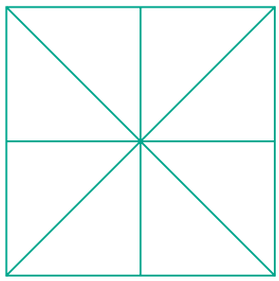
8. How many Triangles are there in each of the following figures?

(i)



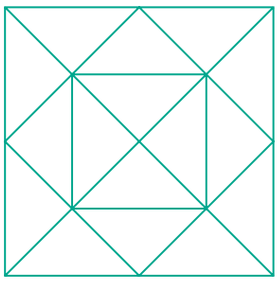
(a)

(ii)



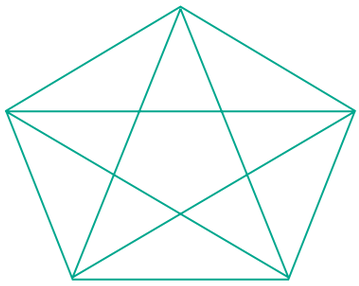
(b)

(iii)



(c)

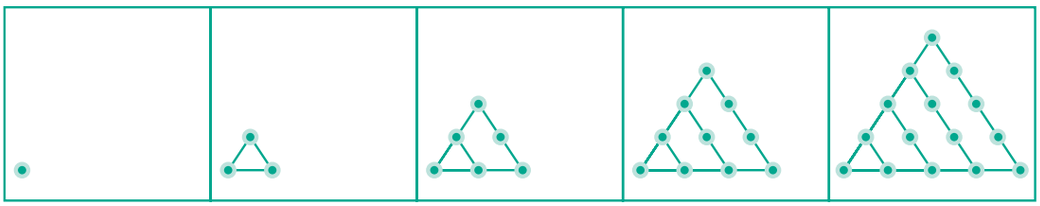
(iv)



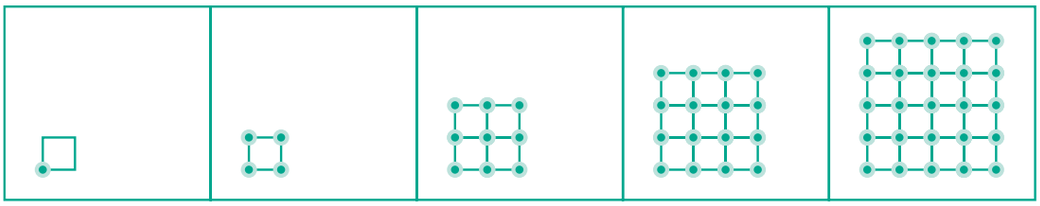
(d)

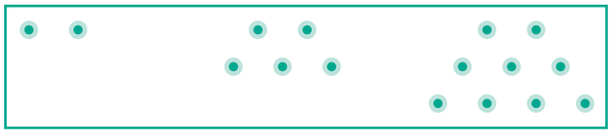
9. Find the number of dots in the tenth figure of the following patterns.

(i)



(ii)



10. 

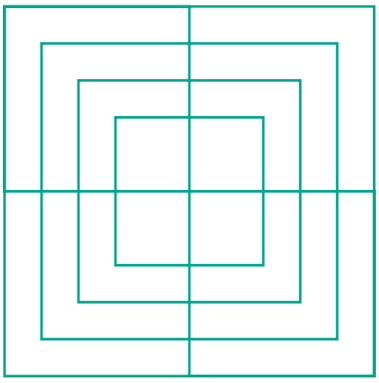
(i) Draw the next pattern.

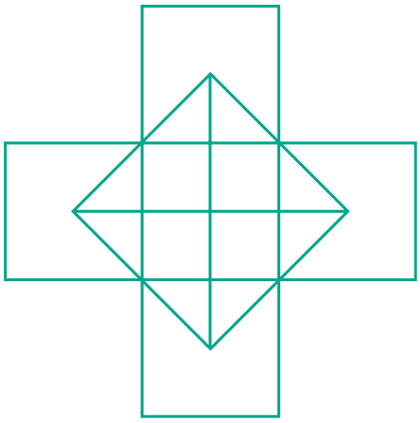
(ii) Prepare a table for the number of dots used for each pattern.

(iii) Explain the pattern.

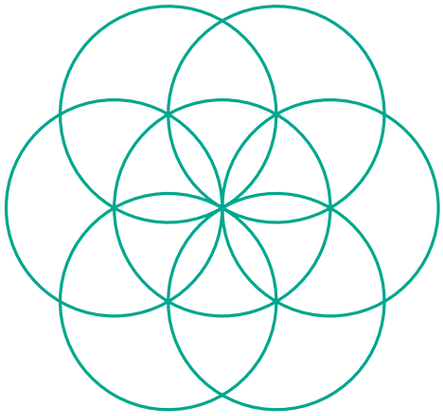
(iv) Find the number of dots in the 25th pattern.

11. Count the number of squares in each of the following figures?

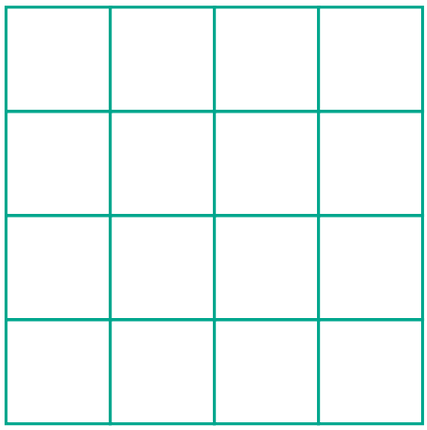
(i) 

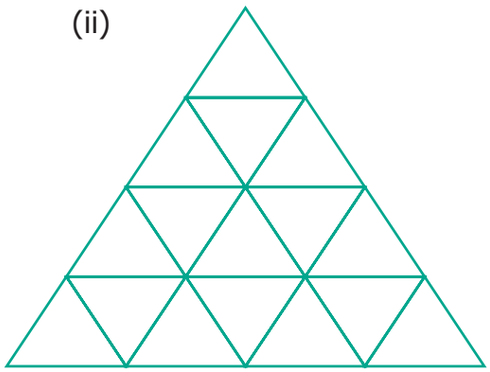
(ii) 

12. How many Circles are there in the following figure?



13. Find the minimum number of straight lines used in forming the following figures.

(i) 

(ii) 

ICT Corner

INFORMATION PROCESSING

Expected Result is shown in this picture

Step – 1

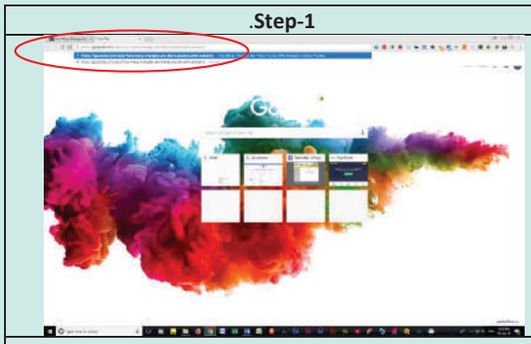
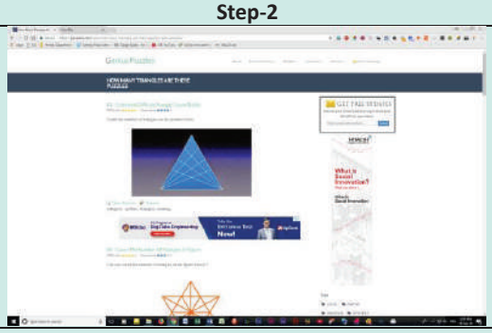
Open the Browser, copy and paste the link given below (or) by type the URL given (or) Scan the QR Code.

Step - 2

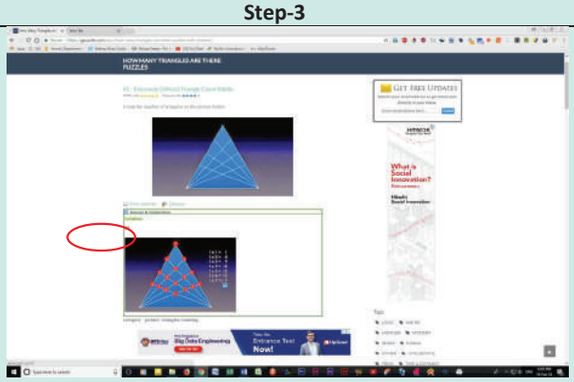
"Genius Puzzles" web page will appear. There are many PUZZLES related to the triangle are present. This page is to find "HOW MANY TRIANGLES ARE THERE" in the given figure.

Step-3

Calculate your answer and click "View Answer" to check whether your answer is correct for each puzzle.

.Step-1	Step-2
	

Step-3



Browse in the link

Triangles: https://gpuzzles.com/quiz/how-many-triangles-are-there-puzzles-with-answers/

ANSWERS

NUMBERS

Exercise 1.1

1) (i) 10,00,000 (ii) 9,99,99,999 (iii) Five Thousand (iv) 7000000+600000+70000+900+5

2) (i) False (ii) False (iii) True (iv) False

3) 10 4) (i) 70,00,000 (ii) 7,000,000

5) (i) 347,056 (ii) 7,345,671 (iii) 634,567,105 (iv) 1,234,567,890

6) Indian System : 9,99,999 (Nine Lakh Ninety Nine Thousand Nine Hundred Ninety Nine)
International System : 999,999 (Nine Hundred Ninety Nine Thousand, Nine Hundred Nintey Nine)

7) (i) Seventy five lakh thirty two thousand one hundred five
(ii) Nine crore seventy five lakh sixty three thousand four hundred fifty three

8) (i) Three hundred forty five thousand six hundred seventy eight
(ii) Eight million three hundred forty three thousand seven hundred ten
iii) One hundred three million four hundred fifty six thousand seven hundred eighty nine

9) (i) 2,30,51,980 (ii) 66,345,027 (iii) 789,213,456 10) 26,345

11) 1,000,000 (One million)

Objective Type Questions

12) (a) 100 Crore 13) (b) 10000001 14) (c) 2

15) (d) $6\times 100000 + 7 \times 10000 +0\times 1000 +9\times 100 +0\times 10 +5\times 1$

Exercise 1.2

1) (i) 48792< 48972 (ii) 1248654> 1246854 (iii) 658794 = 658794

2) (i) False (ii) False (iii) True

3) The greatest number is 1386787215
The smallest number is 86720560

4) 128435 > 25840 > 21354 > 10835 > 6348

5) 76095321, 86593214 (Similarly, we can write many numbers)

6) 479, 497, 749, 794, 947, 974 7) 4698

8) The smallest Postal Index Number is 631036
The largest Postal Index Number is 631630

9) (i) Aanaimudi (ii) Aanaimudi > Dottabetta > Velliangiri > Mahendragiri
(iii) 1048 m

Objective Type Questions

10) (c) 134205, 134208, 154203 11) (a) 1489000 and 1492540 12) (d) 26

Exercise 1.3

1) (i) 360 (ii) 150 (iii) 1 2) (i) False (ii) True (iii) False 3) 11910

4) 2,15,750 5) 39,000 bicycles 6) ` 2500 7) (i) 9 (ii) 11 (ii) 107

8) (d) 1 9) (b) 12 10) (c) ×

Exercise 1.4

1) (i) 800 (ii) 1000 (iii) 90,000 2) (i) False (ii) True (iii) False

3) (i) 4100 (ii) 45,000 (iii) 90,000 (iv) 51,00,000 (v) 30,00,00,000

4) 1,90,000 5) (i) 12,300 (ii) 18,99,600 6) 3,37,000

Objective Type Questions

7) (b) 10855 8) (c) 76800 9) (a) 9800000 10) (b) 165000

Exercise 1.5

1) (i) 1 (ii) 34 (iii) 0 (iv) Zero (v) one

2) (i) False (ii) False (iii) True (iv) True (v) True

3) (i) Commutativity for Addition (ii) Associativity for Multiplication
(iii) Zero is Additive Identity (iv) One is Multiplicative Identity
(v) Distributivity of Multiplication over Addition

4) (i) 5100 (ii) 3,00,000 (iii) 13,200 (iv) 334

Objective Type Questions

5) (b) 0 6) (d) 59 7) (a) an even number

8) (b) 0 9) (c) 2/0 10) (c) 4237+ 5498 × 3439 = (4237 + 5498) × 3439

Exercise 1.6

1) 87543

2) Ascending Order : 6,85,48,437 < 7,21,47,030 < 7,26,26,809 < 9,12,76,115
Descending Order: 9,12,76,115 >7,26,26,809 >7,21,47,030 > 6,85,48,437

3) (i) 1706 tigers in 2011 (ii) 2100 (iii) 520 tigers increased from 2011 to 2014

4) among 6 friends, each of them get 37 apples. 3 apples left over

5) 515 + 1 = 516 trays required

6) (i) Indian System:Two crore fifty nine lakh forty one thousand nine hundred
International System : Twenty five million nine hundred forty one thousand nine hundred
(ii) 5,50,500 (iii) Eighty six crore forty lakh seven hundred thirty
(iv) Ninteen million eight hundred eighty eight thousand eight hundred
(v) Indian System : 60,53,100 - Sixty lakh fifty three thousand one hundred
International System : 6,053,100 - Six million fifty three thousand one hundred

7) One of the answers is 43781. Many answers are possible

8) (i) 85 rows are required to fill 7650 chairs (ii) The remaining chairs are 39

9) Yes, both are same (30,00,000) 10) Relevant answers are yours

ALGEBRA

Exercise 2.1

1) (i) Variables (ii) f - 5 (iii) $\frac{s}{5}$ (iv) n - 7 (v) 17

2) (i) False (ii) True (iii) False (iv) True (v) True

3)

Shapes	1st Pattern	2nd Pattern	3rd Pattern	4th Pattern	5th Pattern
Squares	1	2	3	4	5
Circles	1	2	3	4	5
Triangles	2	4	6	8	10

4) Arivazhagan's age is 'n-30'

5) (i) u + 2 (ii) u – 2

6) (i) t + 100 (ii) 4q (iii) 9y - 4

7) (i) x divided by 3 (ii) 11 added to 10 times x (iii) product of 70 and s

8) Vetri's answer is correct

9) (i) 299; 301 (ii)18

10)

k	3	6	9	12	15	18
$\frac{k}{3}$	1	2	3	4	5	6

The value of 'k' is 15.

Objective Type Questions

11) c) can take different values

12) d) 7w

13) d) 22

14) b) y = 6

15) a) n - 6 = 8

Exercise 2.2

1) 8; 77; 666; 5555; 44444; 333333

2) (i) 4s (ii) 3s

3)

8	7	7	8	=30
8	8	10	10	=36
8	10	7	7	=32
8	7	10	7	=32
=32	=32	=34	=32	=130

4) k = 3; m = 1; n = 10; a = 9; b = 6; c = 4; x = 4; y = 9.

5) 19

6) (i) P=2; Q=8; R=6; S=10

(ii)

Rectangle	P	Q	R	S	T
Number of squares along the breadth	2	2	2	2	2
Number of squares along the length	1	4	3	5	x
Total number of squares in rectangle	2	8	6	10	2x

7)

x 6	0 0		t 3	8	
0		z 2	5		p 9
v 3	6	5		k 4	9
0			u 2	4	
		a 6	0		m 1
	s 2	4	7		0

RATIO AND PROPORTION

Exercise 3.1

1) (i) 3 : 5 (ii) 3 : 2 (iii)25 : 2 (iv)3 : 8 2) (i) True (ii) False

3) (i) 3 : 4 (ii) 4 : 3 (iii) 7 : 15 (iv) 4 : 9 (v) 3 : 4 4) 5 : 3 5) 1 : 3

6) (i) 3 : 5 (ii)2 : 5 (iii)3 : 2 7) (d) 5 : 1 8) (c) 20 : 1 9) (d) 10 : 7

10. (b) 3 : 4 11. (c) 5 : 1

Exercise 3.2

1) (i) 15 (ii) 8 (iii) 12 2) (i) 36 inches, 6 Feet (ii) 14 days, 9 weeks

3) (i) False (ii) True 4) (i) 6 : 4, 9 : 6 (ii) 2 : 12, 3 : 18 (iii) 10 : 8, 15 : 12

5) (i) 4 : 5 is larger than 8 : 15 (ii) 7 : 8 is larger 3 : 4 (iii) 2 : 1 is larger than 1 : 2

6) (i) 12, 8 (ii) 12, 15 (iii) 12, 28 7) (i) Rs.2400 (ii) Rs.1600

8) 21 cm, 42 cm 9) (a) 6 10) (d) 12 : 21 11) (d) 20/28 12) (c) Rs.1000

Exercise 3.3

1) (i) 12 (ii) 9 (iii) 4; 12 (iv) 24; 2 2) (i) False (ii) False (iii) True (iv) False

3) (i) Rs.30 (ii) 25 days 4) Yes, 12:24, 18:36

5) (i) Yes, Extrem values - 78, 20; Inbetween values - 130, 12

(ii) No, Extrem values - 400, 625; Inbetween values - 50, 25

6) Yes 7) 80 Pages 8) 2 km 9) 44 points

10) Asif's run rate is better 11) My friend's rate of purchase is better than me.

Objective Type Questions

12) (c) 2 : 5 , 10 : 25 13) (d) 8 14) (c) 35 15) (b) 270 16) (c) 6 km

Exercise 3.4

1) (i) 1 : 4 (ii) 4 : 5 (iii) 1 : 5 (iv) Ratio of elephant to cheetah is least

2) 60 teachers and 6 administrators 3) (i) 2 : 1 (ii) 1 : 3 (iii) 12 ratios

4) A : B = 2 : 1, B : C = 2 : 1; They are in proportion.

5) (a) $\frac{1}{4}$ cup (b) 8 cups

(c) Ragi flour, Raw rice and water are in one unit, Sesame oil and salt are in different units. these different units cannot be compared and cannot be expressed as a ratio.

6) 2 : 1 7) There are four different ways. 8) Team B has better record

9) The standard 8 is the least ratio

10) The six different answers are : 1 and 90; 2 and 45; 30 and 3; 5 and 18; 6 and 15, 9 and 10.

11) 29 : 44 12) (a) Black balls (b) 96 balls (c) 32 balls, 24 balls

GEOMETRY

Exercise 4.1

1) i) $\overleftrightarrow{AB}$ ii) $\overline{BA}$ iii) One 2) 10, $\overline{PQ}$, $\overline{PA}$, $\overline{PB}$, $\overline{PC}$, $\overline{AB}$, $\overline{BC}$, $\overline{CQ}$, $\overline{AQ}$, $\overline{BQ}$, $\overline{AC}$

3) $\overline{XY}$ =2.4 cm, $\overline{AB}$ = 3.4cm, $\overline{EF}$ = 4 cm, $\overline{PQ}$ = 3cm.

5) (i) $\overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$, $\overleftrightarrow{CD}$ and $\overleftrightarrow{IJ}$, $\overleftrightarrow{EF}$ and $\overleftrightarrow{IJ}$

(ii) $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{EF}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{IJ}$, $\overleftrightarrow{GH}$ and $\overleftrightarrow{IJ}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{GH}$ (iii) P, Q and R

6) (i) l_3 and l_4 , l_4 and l_5 , l_3 and l_5

(ii) l_1 and l_2, l_1 and l_3 , l_1 and l_4 , l_1 and l_5 , l_2 and l_3 , l_2 and l_4 , l_2 and l_5

(iii) l_1 and l_2 (iv) Q (v) U

Objective Type Questions

7) c) 3 8) d) $\overline{AB}$

Exercise 4.2

2) i) D, $\overrightarrow{DE}$ and $\overrightarrow{DF}$ ii) D, $\overrightarrow{DE}$, $\overrightarrow{DC}$

3) i), iii), v) are right angles 4) i), ii) and iii) are acute angles

5) i), iii) are obtuse angles

6) i) ∠LMN, ∠NML, ∠M ii) ∠PQR, ∠RQP, ∠Q

iii) ∠MNO, ∠ONM, ∠N iv) ∠TAS, ∠SAT, ∠A

7) i) True ii) False iii) False iv) True

9) i) Obtuse angle ii) Zero angle iii) Straight angle iv) Acute angle v) Right angle

10) i) 60° ii) 64° iii) 5° iv) 90° v) 0°

11) i) 110° ii) 145° iii) 15° iv) 90° v) 180°

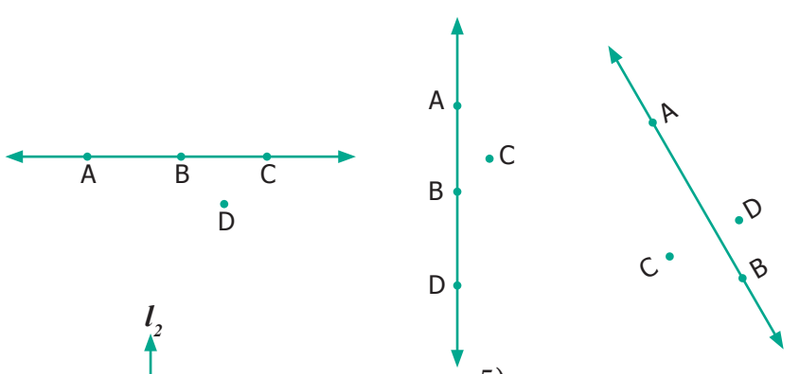
12) i) 155° ii) 60° iii) 44° iv) 113° 13) b) ∠ZXY 14) b) 45°

Exercise 4.3

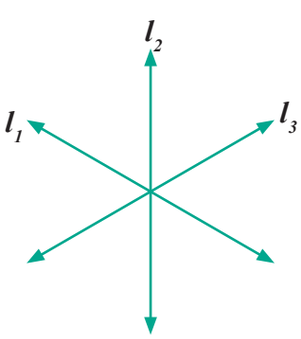
1) i) Collinear ii) Non-Collinear iii) Non-Collinear iv) O

2)

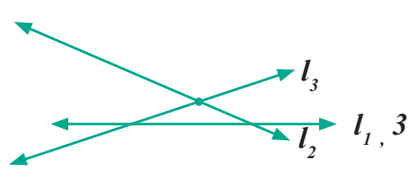
3)



4)



5)



Objective Type Questions

6) b) A, F, C 7) d) A, D, C 8) b) F

Exercise 4.4

1) i) Parallel lines ii) Parallel and Perpendicular lines

iii) Intersecting lines

2)

Parallel lines	Intersecting Lines
$\overline{AB}$ and $\overline{DC}$	$\overline{AB}$, $\overline{AE}$, $\overline{AD}$
$\overline{AD}$ and $\overline{BC}$	$\overline{DA}$, $\overline{DH}$, $\overline{DC}$
$\overline{DC}$ and $\overline{HG}$	$\overline{CB}$, $\overline{CG}$, $\overline{CD}$
$\overline{AD}$ and $\overline{EH}$	$\overline{HD}$, $\overline{HG}$, $\overline{HE}$
$\overline{AE}$ and $\overline{DH}$	$\overline{EA}$, $\overline{EH}$...
$\overline{DH}$ and $\overline{CG}$	

3) i) $\angle 1 = \angle CBD$ or $\angle DBC$ ii) $\angle 2 = \angle DBE$ or $\angle EBD$

iii) $\angle 3 = \angle ABE$ or $\angle EBA$ iv) $\angle 1 + \angle 2 = \angle CBE$ or $\angle EBC$

v) $\angle 2 + \angle 3 = \angle ABD$ or $\angle DBA$ vi) $\angle 1 + \angle 2 + \angle 3 = \angle ABC$ or $\angle CBA$

4) i) right angle ii) acute angle iii) straight angle iv) obtuse angle

5) (i) and (iv) are complementary angles (ii) and (iii) are non-complementary angles

6) ii) and iv) are supplementary i) and iii) are not supplementary

7) i) $\angle FAE$; $\angle EAD$

ii) $\angle FAD$; $\angle DAC$ $\angle BAC$; $\angle CAE$ $\angle DAB$; $\angle DAE$ $\angle FAB$; $\angle BAC$ $\angle FAB$; $\angle FAE$

8) i) Legs of the table, railway track, edges of the scale

ii) Adjacent sides of a Board, Cross bars of windows, Adjacent sides of the textbook

iii) Cross bars of windows, Ladder, blades of a scissor.

9) 60° is twice its complement. 10) 72° 11) The two angles are 80° and 100°

12) Two angles are 70° and 20°. 13) The angles are 100° and 80°.

STATISTICS

Exercise 5.1

1) (i) Data (ii) List of absentees in a class

(iii) Cricket scores gathered from a website (iv) 卌 |||

2)

Face of die	Tally Marks	Frequency
1					3
2				2
3				2
4	卌	6
5	卌 ||||	9
6	卌 |||	8
		30

3)

Colours	Tally Marks	Frequency
Red	||||	4
Blue	卌	6
White	||	2
Grey	卌 ||	7
Green	卌	6
		25

4)

Numbers	Tally Marks	Frequency
11				2
12	卌	5
13						4
14						4
15	卌	6
16						4
17				2
18			1
19			1
20			1
		30

5)

Types of Calls	Tally Marks	Frequency
Building fires	卌	6
Other fires	卌 卌	11
Hazardous materials	卌 ||	7
Rescues	||||	4
False Alarms	卌 ||	7
		35

(i) Other fires (ii) Rescues (iii) 35 (iv) 7

6) (b) 卌 || 7) (c) 9

Exercise 5.2

1) i) 150 ii)  iii) Pictograph

4) i) kabaddi ii) 110 iii) Kho-Kho and Hockey iv) 0 v) Basketball

5) (c) Scaling 6) (b) Pictogram

Exercise 5.3

1) i) 10 ii) Mathematics iii) Language iv) 65% v) English
vi) Mathematics; English

5) (d) Both horizontal bars or vertical bars. 6) (b) are the same

Exercise 5.4

Heights (in Cms)	Tally Marks	Frequency
110	卌	5
111	卌 |||	8
112	||||	4
113	卌	5
114	||	2
115	||||	4
116	|||	3
117		
118	||	2
119	|	1
120	卌 |	6
		40

2) i) 5 : 4 ii) 5 : 19 iii) ` 300 iv) ` 2400 v) true

4) ii) 14 days iii) 24 days iv) 5 : 3

7) i) Novelists ii) Scientists iii) Sportspersons iv) 25 v) 160

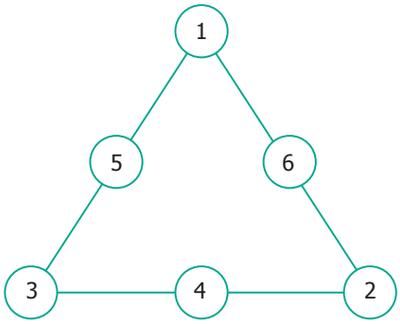
INFORMATION PROCESSING

Exercise 6.1

1) 5 combinations are possible, Black - White Black - Blue Black - Red
Blue - white Blue - Red

2) 6 possibilities, R - B - R - B R - R - B - B B - R - R - B
B - R - B - R B - B - R - R R - B - B - R

(3) One of the answers is,

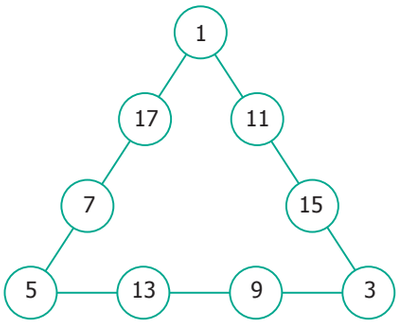


(4) (i) Yes

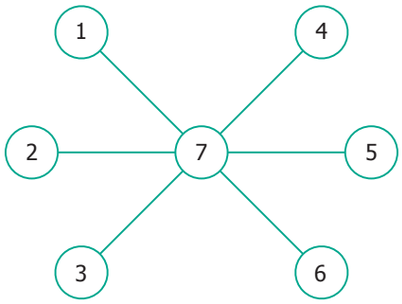
(ii) 5

(iii) 17, 19, 20, 21, 23

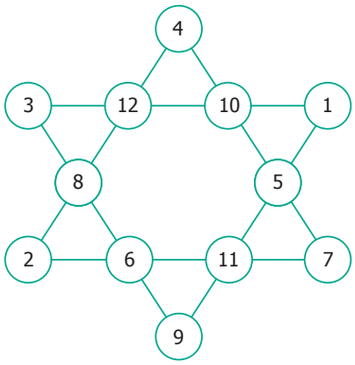
5)



6)



(7) There are many other possible ways.



(8) (i) 12 triangles

(ii) 16 triangles

(iii) 32 triangles

(iv) 35 triangles

(9) (i) 55

(ii) 100

(10) (i)

(ii)

Pattern	1	2	3	4
Number of dots	2	5	9	14

(iii)

Pattern	1	2	3	4
Number of dots	2	2 + 3	2 + 3 + 4	2 + 3 + 4 + 5

(iv) 350

(11) (i) 20 squares (ii) 10 squares

(12) 7 circles

(13) (i) 10 (ii) 12

MATHEMATICAL TERMS

Acute angle	குறுங்கோணம்
Additive Identity	கூட்டல் சமனி
Algebra	இயற்கணிதம்
Algebraic Expressions	இயற்கணித கோவைகள்
Algebraic Statement	இயற்கணித கூற்று
Angle	கோணம்
Associative	சேர்ப்பு
Bar graph	பட்டை வரைபடம்
Classification	வகைப்படுத்துதல்
Closure	அடைவு
Coincide	ஒன்றுதல்
Collecting data	தரவு திரட்டுதல்
Collinear points	ஒரு கோடமை புள்ளிகள்
Commutative	பரிமாற்று
Complementary angles	நிரப்புக் கோணங்கள்
Construction	வரைமுறை
Data/Information	தரவு / தகவல்
Denominator	பகுதி
Discrete	தொடர்ச்சியற்ற
Distributive	பங்கீட்டு
Equation	சமன்பாடு
Equivalent Ratio	சமான விகிதம்
Estimation	மதிப்பீடு
Expanded form	விரிவாக்கம்
Facts	உண்மைகள்
First hand information	முதல்நிலை தரவு
Fractions	பின்னங்கள்
Frequency	நிகழ்வெண்
Geometry	வடிவியல்
Horizontal bars	கிடைமட்ட பட்டைகள்
Information Processing	தகவல் செயலாக்கம்
Integers	முழுக்கள்
Interchanging Digits	இலக்கங்களின் இடமாற்றம்
Intersecting lines	வெட்டும் கோடுகள்
Interpret	விவரித்தல்
Line segment	கோட்டுத்துண்டு
Lines	கோடுகள்
Magic triangle	மாய முக்கோணம்
Measure	அளவீடு
Multiplicative identity	பெருக்கல் சமனி
Natural Numbers	இயல் எண்கள்
Notation	குறியீடு
Number patterns	எண் அமைப்புகள்
Numerator	தொகுதி
Obtuse angle	விரிகோணம்
Operation on Variables	மாறிகள் மீதான செயல்பாடு
Organizing data	தரவு ஒருங்கமைப்பு
Parallel lines	இணை கோடுகள்
Pictograph	உருவ விளக்கப்படம்
Place Value Chart	இடமதிப்பு அட்டவணை
Plane	தளம்
Point of Intersection	வெட்டும் புள்ளி
Points	புள்ளிகள்
Points of concurrency	ஒருங்கமை புள்ளிகள்
Predecessor	முன்னி
Primary data	முதன்மை தரவு
Product	பெருக்கற்பலன்
Properties	பண்புகள்
Proportion	விகித சமம்
Proportionality law	விகித சம விதி
Protractor	பாகைமாணி
Quotient	ஈவு
Ratio	விகிதம்
Rays	கதிர்கள்
Right angle	செங்கோணம்
Rounding off	முழுமையாக்கல்
Scaling	அளவுத்திட்டம்
Secondary data	இரண்டாம் நிலைத் தரவு
Sequence	தொடர்கள்
Set Square	முக்கோணமானிகள்
Shaded portion	நிழலிடப்பட்டபகுதி
Solve	தீர்வு காணல்
Standard form	திட்ட வடிவம்
Statistics	புள்ளியியல்
Straight angle	நேர்கோணம்
Successor	தொடரி
Sudoku	சுடோகு
Supplementary angles	மிகை நிரப்புக் கோணங்கள்
Systematic listing	முறையான பட்டியல்
Tabulation	பட்டியலிடுதல்
Tally mark	நேர்கோட்டு குறிகள்
Unitary method	அலகு முறை
Unshaded portion	நிழலிடப்படாத பகுதி
Variables	மாறிகள்
Variation	மாறல்
Verbal statements	சொற்றொடர் கூற்று
Vertex	முனை
Vertical bars	செங்குத்து பட்டைகள்
Vice-versa	மறுதலை
Whole Numbers	முழு எண்கள்

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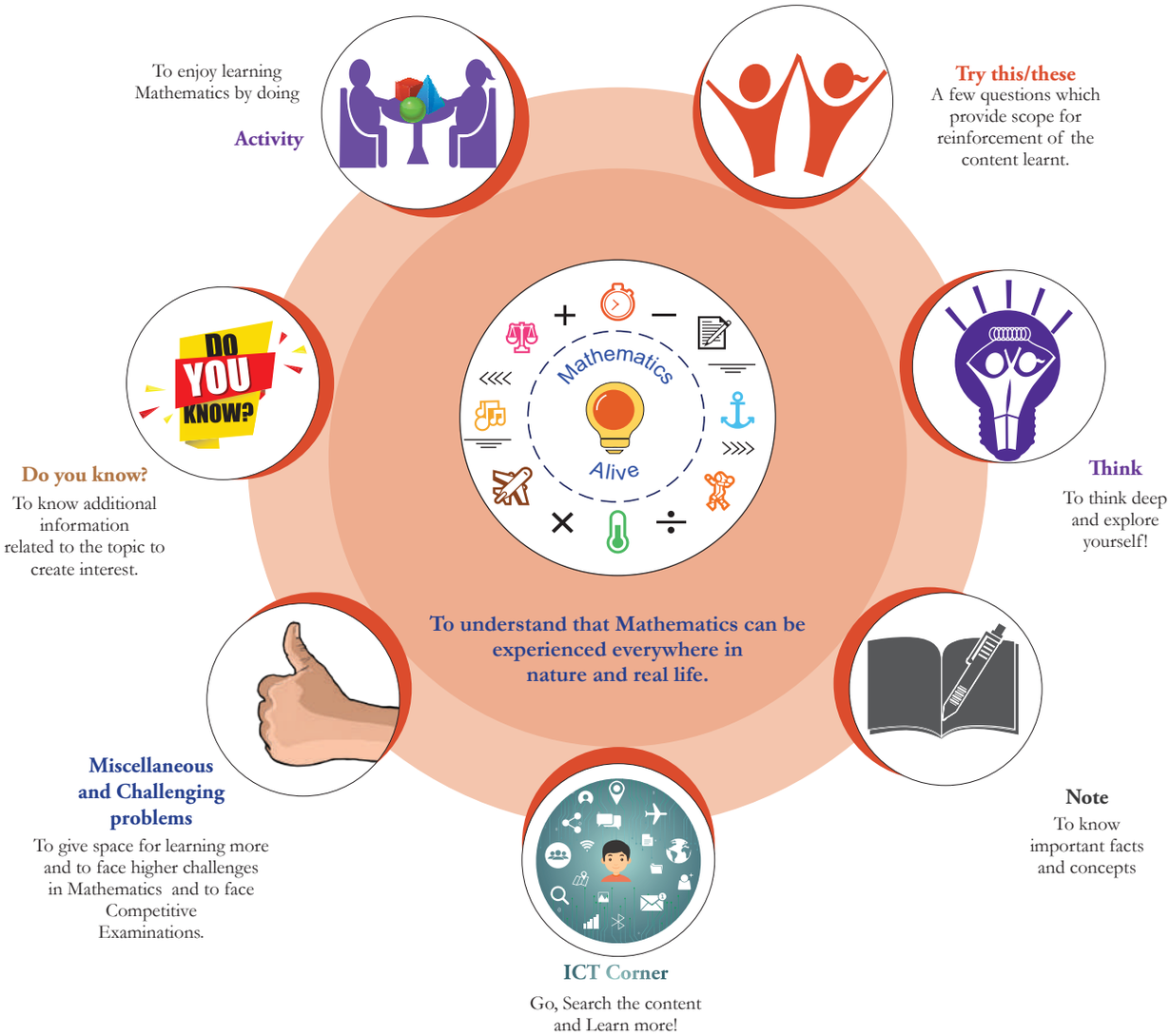
Mathematics is a unique symbolic language in which the whole world works and acts accordingly. This text book is an attempt to make learning of Mathematics easy for the students community.

Mathematics is not about numbers, equations, computations or algorithms; it is about understanding

— William Paul Thurston



To enjoy learning Mathematics by doing

Activity

Try this/these

A few questions which provide scope for reinforcement of the content learnt.

Do you know?

To know additional information related to the topic to create interest.

Think

To think deep and explore yourself!

Miscellaneous and Challenging problems

To give space for learning more and to face higher challenges in Mathematics and to face Competitive Examinations.

Note

To know important facts and concepts

ICT Corner

Go, Search the content and Learn more!

QR GUIDE

Let's use the QR code in the text books! How?

- Download the QR code scanner from the Google PlayStore/ Apple App Store into your smartphone
- Open the QR code scanner application
- Once the scanner button in the application is clicked, camera opens and then bring it closer to the QR code in the text book.
- Once the camera detects the QR code, a url appears in the screen.Click the url and go to the content page.

The main goal of Mathematics in School Education is to mathematise the child's thought process. It will be useful to know how to mathematise than to know a lot of Mathematics.

CONTENT

9PHQ9B
Text book

9PRLAY
Evaluation

B442_MAT_6_T2_EM
DIGI Links

CHAPTER 1

NUMBERS

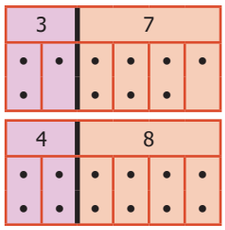
9Q1HCL

Learning Objectives:

- To identify prime and composite numbers.
- To know the divisibility rules and use them to find the factors of a number.
- To write a composite number as a product of prime numbers.
- To find the HCF and the LCM of two or more numbers and use them in real life situations.

Recap

1. Odd and Even Numbers



- A number is called an ***odd number*** if it cannot be grouped equally in twos. 1, 3, 5, 7, ..., 73, 75, ..., 2009,... are ***odd numbers.***
- A number is called an ***even number*** if it can be grouped equally in twos. 2, 4, 6, 8, ..., 68, 70, . . , 4592,... are ***even numbers.***
- All odd numbers end with any one of the digits 1, 3, 5, 7 or 9.
- All even numbers end with any one of the digits 0, 2, 4, 6 or 8.
- In whole numbers, odd and even numbers come alternatively.

Try these

(i) Observe and complete:	(ii) Observe and complete:
1+3 = ?	5 x 3 = ?
5+11 = ?	7 x 9 = ?
21+47 = ?	11 x 13 = ?
.....+..... = ?	....x ..... = ?
From this observation, we conclude that "the sum of any two odd numbers is always an _____"	From this observation, we conclude that "the product of any two odd numbers is always an _____"

Justify the following statements with appropriate examples:

(iii) The sum of an odd and an even number is always an odd number.
(iv) The product of an odd and an even number is always an even number.
(v) The product of any three odd numbers is always an odd number.

Note

- 1 is odd, its successor 2 is even and so its predecessor 0 is also even.
- The first natural number 1 is odd and the first whole number 0 is even.

2. Factors

Think about the situation:

The teacher gives Velavan two numbers 8 and 20 and asks him to write them as a product of two numbers. Velavan, with his mental math skills and also using the multiplication tables, quickly finds that 8 = 2 x 4; 20 = 2 x 10 and 4 x 5. From this, we can say that 2 and 4 are factors of 8 and also 2, 4, 5 and 10 are factors of 20. We can also write 8 as 1 x 8 and hence conclude that 1 and 8 are also factors of 8.

From the above examples, we observe that,

- **A factor is a number that divides the given number exactly (gives remainder zero).**
- **Every number has two factors that is 1 and the number itself.**
- **Every factor of a given number is less than or equal to that number.**

3. Multiples

Look at the multiplication table of (say) 7:

1 x 7 = **7**

2 x 7 = **14**

3 x 7 = **21**

4 x 7 = **28**

5 x 7 = **35** ...

We say that the numbers 7, 14, 21, 28, 35,... are multiples of 7.

From this, we observe that

- **Every multiple of a given number is greater than or equal to that number.**

  Multiples of 7 are 7, 14, 21, 28,... . They are greater than or equal to 7.

- **Multiples of a number are endless.**

  Multiples of 5 are 5, 10, 15, 20,... . They are endless.

Try these

(i) Say True or False.

a) The smallest odd natural number is 1.

b) 2 is the smallest even whole number.

c) 12345 + 5063 is an odd number.

d) Every number is a factor of itself.

e) A number which is a multiple of 6 is also a multiple of 2 and 3.

(ii) Is 7, a factor of 27?

(iii) Is 12, a factor or a multiple of 12?

(iv) Is 30, a factor or a multiple of 10?

(v) Which of the following numbers has 3 as a factor?

a) 8 b) 10 c) 12 d) 14

(vi) The factors of 24 are 1, 2, 3,◇, 6,◇,12, and 24. Find the missing ones.

(vii) Look at the following numbers carefully and find the missing multiples.

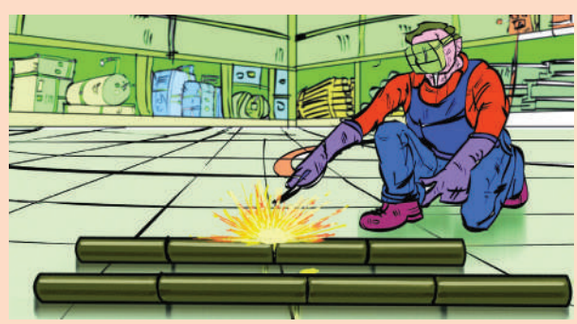
9	4		8	27			16	45			24

1.1 Introduction

In the first term, we have learnt about the natural numbers and the whole numbers. Now, we are going to learn about special numbers namely Prime and Composite, the rules for test of divisibility of numbers and also about the HCF and the LCM of numbers.

MATHEMATICS ALIVE – NUMBERS IN REAL LIFE

Use of prime numbers as a protecting key for the database of an organisation (large composite numbers are formed as a product of two large prime numbers)



HCF in day-to-day life

1.2 Prime and Composite Numbers

Think about the situation:

The teacher gave 5 buttons to Anbuselvan and 6 buttons to Kayalvizhi and asked them to arrange the buttons in all possible rows in such a way that the number of buttons in each row is equal. They did it, in different ways as shown below:

Anbuselvan's Ways	
By arranging 5 buttons in a row, he gets 1 row  1x5=5	By arranging 1 button in each row, he gets 5 rows  5 x1=5
He realises that 5 buttons can be arranged in only 2 rectangular ways. Hence, the only factors of 5 are 1 and 5 (number of rows).	

Kayalvizhi's Ways			
By arranging 6 buttons in a row, she gets 1 row  1x6=6	By arranging 3 buttons in each row, she gets 2 rows  2x3=6	By arranging 2 buttons in each row, she gets 3 rows  3x2 = 6	By arranging 1 button in each row, she gets 6 rows  6 x 1 = 6
She realises that 6 buttons can be arranged in 4 rectangular ways. Hence, the factors of 6 are 1, 2, 3 and 6 (number of rows).			

- Make different rectangular arrangements using 1 button, 2 buttons, 3 buttons, 4 buttons,…, 10 buttons and complete the following table:

Number	Rectangular arrangements possible	Factors	Number of Factors
1		1	
2	1 x 2; 2 x 1	1, 2	2
3			
……			
10	1x 10; 10 x 1; 2x 5; 5 x 2		

From the table, we conclude that

- **A natural number greater than 1, having only two factors namely 1 and the number itself, is called a *prime number.***
  For example, 2 (1 x 2) is a prime number as is 13 (1 x 13).

Note

The number '1' is neither prime nor composite

- **A natural number having more than 2 factors is called a *composite number.***

  For example, 15 is a composite number (15 = 1 x 3 x 5) as is 70 (1 x 2 x 5 x 7).

DO YOU KNOW?

A number is a ***perfect number*** if the sum of its factors other than the given number gives the same number. For example, ***6 is a perfect number***, since adding the factors of 6 (other than 6), namely 1, 2 and 3 gives the given number 6. i.e.,1+2+3 = 6 is the given number.

Check whether 28, 54 and 496 are perfect numbers or not.

Activity

(i) List out the prime and composite numbers represented by the dates in the month of October.

(ii) Generate a few composite numbers by product of two or more natural numbers.

(iii) Classify the numbers 34, 57, 71, 93, 101, 111 and 291 as prime or composite.

October 2018

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
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				

1.2.1 Finding the Prime Numbers by Sieve of Eratosthenes Method

Sieve of Eratosthenes, is a simple method of elimination by which we can easily find the prime numbers upto a given number. This method given by a Greek Mathematician, Eratosthenes of Alexandria, follows some simple steps which are listed below, by which we can find the prime numbers.

Step 1: Create 10 rows and 10 columns and write the numbers from 1 to 10 in the first row, 11 to 20 in the second row and continue the same as 91 to 100 in the tenth row.

Step 2: Leave **1** as it is neither prime nor composite (Why?). Start with the smallest prime 2. Encircle and colour 2 and cross out all other multiples of 2 (all even numbers) in the grid.

Step 3: Now, take the next prime 3. Encircle and colour 3 and cross out all other multiples of 3 in the grid.

Step 4: As 4 is crossed out already, go for the next prime 5 and cross out multiples of 5, except 5.

Step 5: Keep doing this, for two more primes 7 and 11 and stop. (Think why?)

The above steps are carried out to find prime numbers upto 100 in the following grid.

SIEVE OF ERATOSTHENES

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~~

From the Sieve of Eratosthenes, we observe that,

- The crossed-out numbers are ***composite*** and the ***coloured numbers*** (encircled) are ***primes.*** The total number of primes upto 100 is 25.
- The only prime number that ends with 5 is 5.

1.2.2 Expressing a Number as the Sum of Prime Numbers

Any number greater than 3 can always be expressed as the sum of two or more prime numbers. Let us illustrate this in the following examples.

Example 1: Express 42 and 100 as the sum of two consecutive primes.

Solution: 42 = 19+23;

100 = 47+53

Example 2: Express 31 and 55 as the sum of any three odd primes.

Solution: 31 = 5+7+19 (find another way, if possible!)

55 = 3 + 23+29

Try these

(i) Express 68 and 128 as the sum of two consecutive primes.

(ii) Express 79 and 104 as the sum of any three primes.

1.2.3 Twin Primes

A pair of prime numbers whose difference is 2, is called *twin primes*.

For example, (5, 7) is a twin prime pair as is (17,19).

Try to find a few more *twin prime pairs!*

DO YOU KNOW?

If three successive prime numbers differ by 2, then the prime numbers form a prime triplet. The only prime triplet is (3, 5, 7).

1.3 Rules for Test of Divisibility of Numbers

Suppose that, you are asked to simplify a fraction say $\frac{126}{216}$. Since the numbers are relatively bigger, the task is not easy. Observe that, these numbers are not only divisible by 2 and 9 exactly but by other numbers too! How do we know that 2 and 9 are factors of 126 and 216? We are going to see ***divisibility tests*** in this section which are rules, that will improve your mental math skills for such determinations.

Divisibility tests, in common, are useful in the prime factorisation of a number. Also, it is fun to find whether any large number is exactly divisible by 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 (and more...) by simply observing, examining and performing basic operations with the digits of the given number and not by doing the actual division! Curious to know? Then, remember the following interesting rules and have fun...! As divisibility by 2, 3 and 5 gain importance in the prime factorisation of a number, we will define the rules for them first!

Divisibility by 2

A number is divisible by 2, if its ones place is any one of the even numbers 0, 2, 4, 6 or 8.

Examples:

1. 456368 is divisible by 2, since its ones place is even(8).
2. 1234567 is not divisible by 2, since its ones place is not even(7).

Divisibility by 3

Divisibility of a number by 3 is interesting! We can find that 96 is divisible by 3. Here, note that the sum of its digits 9+6 = 15 is also divisible by 3. Even 1+5 = 6 is also divisible by 3. This is called as *iterative* or *repeated* addition. So,

A number is divisible by 3 if the sum of its digits is divisible by 3.

Examples:

1. 654321 is divisible by 3.

   Here 6+5+4+3+2+1= 21 and 2+1=3 is divisible by 3.

   Hence, 654321 is divisible by 3.

2. The sum of any three consecutive numbers is divisible by 3.
   (For example: 33+34+35=102, is divisible by 3)
3. 107 is not divisible by 3 since 1+0+7=8, is not divisible by 3.

Divisibility by 5

Observe the multiples of 5. They are 5, 10, 15, 20, 25,.., 95, 100, 105, …., and keeps on going. It is clear, that multiples of 5 end either with 0 or 5 and so,

A number is divisible by 5 if its ones place is either 0 or 5.

Examples: 5225 and 280 are divisible by 5

Try these

(i) Are the leap years divisible by 2?
(ii) Is the first 4 digit number divisible by 3?
(iii) Is your date of birth (DDMMYYYY) divisible by 3?
(iv) Check whether the sum of 5 consecutive numbers is divisible by 5.
(v) Identify the numbers in the sequence 2000, 2006, 2010, 2015, 2019, 2025 that are divisible by both 2 and 5.

Divisibility by 4

A number is divisible by 4 if the last two digits of the given number is divisible by 4.
Note that **if the last two digits of a number are zeros, then also it is divisible by 4.**

Examples: 71628, 492, 2900 are divisible by 4, because 28 and 92 are divisible by 4 and 2900 is also divisible by 4 as it last 2 digits are zero.

Divisibility by 6

A number is divisible by 6 if it is divisible by both 2 and 3.

Examples: 138, 3246, 6552 and 65784 are divisible by 6.

Note

Though a rule for divisibility of a number by 7 exists, it is a bit tricky and dividing directly by 7 will be easier.

Divisibility by 8

A number is divisible by 8 if the last three digits of the given number is divisible by 8.
Note that **if the last three digits of a number are zeros, then also it is divisible by 8.**

Examples: 2992 is divisible by 8 as 992 is divisible by 8 and 3000 is divisible by 8 as its last three digits are zero.

Divisibility by 9

A number is divisible by 9 if the sum of its digits is divisible by 9. Note that the numbers divisible by 9 are also divisible by 3.

Examples: 9567 is divisible by 9 as 9+5+6+7=27 is divisible by 9.

Divisibility by 10

A number is divisible by 10 if its ones place is only zero. Observe that numbers divisible by 10 are also divisible by 5.

Examples:

1. 2020 is divisible by 10 (2020÷10 = 202) where as 2021 is not divisible by 10.
2. 26011950 is divisible by 10 and hence divisible by 5.

Divisibility by 11

A number is divisible by 11 if the difference between the sum of alternative digits of the number is either 0 or divisible by 11.

Examples: Consider the number 256795. Here, the difference between the sum of alternative digits = (2+6+9)−(5+7+5)=17−17=0.
Hence, 256795 is divisible by 11.

Activity

The teacher may ask all the students to check mentally for divisibility by 2, 3, 4, 5, 6, 8, 9, 10 and 11. If divisible, let them write 'yes', otherwise 'no'(the first one is done for you!).

Number	÷ 2	÷ 3	÷ 4	÷ 5	÷ 6	÷8	÷9	÷10	÷11
68	yes	no	yes	no	no	no	no	no	no
99									
300									
495									
1260									
7920									
11880									
13650									
600600									
15081947									

1.4 Prime Factorisation

Expressing a given number as a product of factors that are all prime numbers is called the ***prime factorisation*** of a number. For example, 36 can be written as product of factors as

36 =1 x 36; 36 = 2 x 18; 36 = 3 x 12; 36 = 4 x 9; 36 = 6 x 6

Here, the factors of 36 can be found easily as 1, 2, 3, 4, 6, 9, 12, 18 and 36. Note that not all the factors of 36 are prime numbers. To find the prime factors of 36, we do the prime factorisation by the following methods.

1. Division Method **2. Factor Tree Method**

1. Division Method: We can find the prime factorisation of 36 as follows:

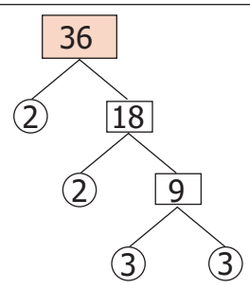
2 | 36 2 | 18 3 | 9 3 | 3 | 1 36 = 2 x 2 x 3 x 3	3 | 36 2 | 12 2 | 6 3 | 3 | 1 36 = 3 x 2 x 2 x 3

In the above method, why do we start with 2 or 3 ? why not with 5? Because, we know that 36 is not a multiple of 5 and hence not divisible by 5. So, to find the prime factors of a number, it will be useful to check for divisibility by smaller numbers like 2, 3 and 5 first and not take numbers at random.

2. Factor Tree Method:

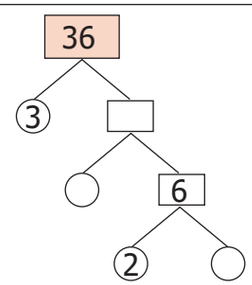
Another way to find the prime factorisation of a number is to use a visual representation called **factor tree**. As we add more branches, we will see that this visual representation looks like an upside down tree. Let us find the prime factorisation of 36 as shown below. (Solution for the first one is given for you! Complete the remaining).

1



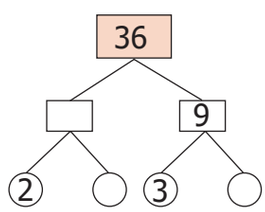
36 = 2x18 = 2x2x9 = 2x2x3x3

2



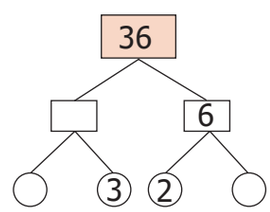
36 = ...

3



36 = ...

4



36 = ...

What we observe from the above is that, the factors of 36 are the same in all the cases, though the order of the factors is different. Usually, the factors are ordered from the least to the greatest as 2x2x3x3.

Note

- Since multiplication satisfies commutativity, the order of the factors in the product does not affect the value of the number.

DO YOU KNOW?

All the prime numbers, except 2 and 3 can be expressed as 1 more or 1 less to a multiple of 6 (For example, 37= 6x6+1). Explore this statement for other primes!

Exercise 1.1

1. Fill in the blanks

(i) The number of prime numbers between 11 and 60 is_____.

(ii) The numbers 29 and_____ are twin primes.

(iii) 3753 is divisible by 9 and hence divisible by _____ .

(iv) The number of distinct prime factors of the smallest 4 digit number is _____.

(v) The sum of distinct prime factors of 30 is_____.

2. Say True or False

(i) The sum of any number of odd numbers is always even.

(ii) Every natural number is either prime or composite.

(iii) If a number is divisible by 6, then it must be divisible by 3.

(iv) 16254 is divisible by each of 2, 3, 6 and 9.

(v) The number of distinct prime factors of 105 is 3.

3. Write the smallest and the biggest two digit prime number.

4. Write the smallest and the biggest three digit composite number.

5. The sum of any three odd natural numbers is odd. Justify this statement with an example.

6. The digits of the prime number 13 can be reversed to get another prime number 31. Find if any such pairs exist upto 100.

7. Your friend says that every odd number is prime. Give an example to prove him/her wrong.

8. Each of the composite numbers has atleast three factors. Justify this statement with an example.

9. Find the dates of any month in a calendar which are divisible by both 2 and 3.

10. I am a two digit prime number and the sum of my digits is 10. I am also one of the factors of 57. Who am I?

11. Find the prime factorisation of each number by factor tree method and division method.

a) 60 b) 128 c) 144 d) 198 e) 420 f) 999

12. If there are 143 math books to be arranged in equal numbers in all the stacks, then find the number of books in each stack and also the number of stacks.

Objective Type Questions

13. The difference between two successive odd numbers is
    a) 1 b) 2 c) 3 d) 0

14. The only even prime number is
    a) 4 b) 6 c) 2 d) 0

15. Which of the following numbers is not a prime?
    a) 53 b) 92 c) 97 d) 71

16. The sum of the factors of 27 is
    a) 28 b) 37 c) 40 d) 31

17. The factors of a number are 1, 2, 4, 5, 8, 10, 16, 20, 40 and 80.What is the number?
    a) 80 b) 100 c) 128 d) 160

18. The prime factorisation of 60 is $2 \times 2 \times 3 \times 5$. Any other number which has the same prime factorisation as 60 is
    a) 30 b) 120 c) 90 d) impossible

19. If the number $6354 * 97$ is divisible by 9, then the value $*$ is
    a) 2 b) 4 c) 6 d) 7

20. The number 87846 is divisible by
    a) 2 only b) 3 only c) 11 only d) all of these

1.5 Common Factors

Consider the numbers 45 and 60. Use of divisibility tests will also help us to find the factors of 45 and 60. The factors of 45 are 1,3,5,9,15 and 45 and the factors of 60 are 1,2,3,4,5,6,10,12,15,20, 30 and 60. Here, the common factors of 45 and 60 are 1,3,5 and 15.

As factors of a number are finite, we can think of the **Highest Common Factor** of numbers, shortly denoted as **HCF**.

1.5.1 Highest Common Factor (HCF)

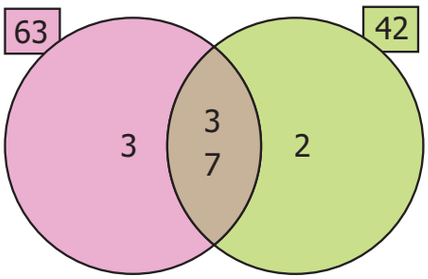
Think about the situation:

Situation 1:

Pavithra plans to celebrate Deepavali by distributing sweets and savouries to the families which cannot afford to buy them. Pavithra's mother gives her 63 athirasams and 42 murukkus. Each family should be given the same number of athirasams and the same number of murukkus. What is the greatest number of families that she can distribute?

Now, Pavithra can tackle this situation by using HCF as given in the following illustration.

Illustration: Find the HCF of 63 and 42.

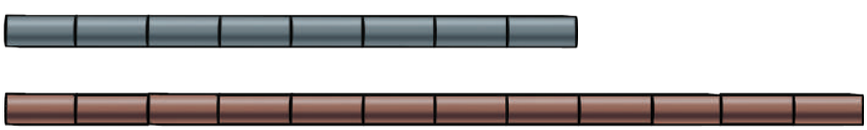
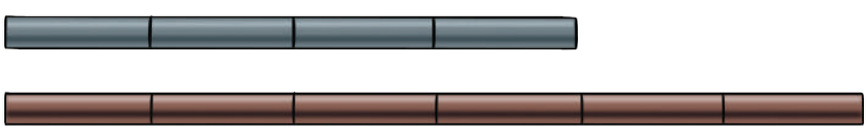
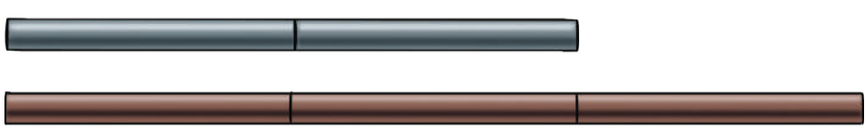


Solution: The prime factorisation of 63 is 3 x 3 x 7 and the prime factorisation of 42 is 2 x 3 x 7. We find that the common prime factors of 63 and 42 are 3 and 7 (see the diagram) and so the highest common factor is 3 x 7 =21. So, Pavithra can distribute equal number of athirasams (3 per family) and murukkus (2 per family) for a maximum of 21 families.

Situation 2:

Consider the rods of length 8 feet and 12 feet. We have to cut these rods into pieces of equal length. How many pieces can we get? What will be the length of the longest piece that is common for both the rods?

The rod of 8 feet can be divided into small rods of length 1 foot or 2 feet or 4 feet (These are factors of 8). The rod of 12 feet can be divided into small rods of length 1 foot or 2 feet or 3 feet or 4 feet or 6 feet (These are factors of 12). This is represented as follows:

	Number of pieces
First, it is possible to cut the 8 feet and 12 feet rods equally into 1 foot rods. 	8 12
Second, it is also possible to cut the 8 feet and 12 feet rods equally into 2 feet rods. 	4 6
Third, it is also possible to cut the 8 feet and 12 feet rods equally into 4 feet rods 	2 3

The length of the pieces that are common to both the rods (as given above) are of length 1 foot, 2 feet and 4 feet (i.e., common factors of 8 and 12).

Hence, the HCF of 8 and 12 is the length of the longest rod i.e., **4 feet** that can be cut equally from the rods of length 8 feet and 12 feet.

So, the **Highest Common Factor (HCF)** of two numbers is the largest factor that is common to both of them.The Highest Common Factor of the numbers *x* and *y* can be written as HCF (*x*,*y*).

Note

- The Highest Common Factor (HCF) is also called as the Greatest Common Divisor (GCD) or the Greatest Common Factor (GCF).
- HCF (1, x) =1
- HCF (x, y) = x, if y is a multiple of x. For example, HCF (3, 6) = 3.
- If the HCF of two numbers is 1, then the numbers are said to be **co-primes** or **relatively prime.** Here, the two numbers can both be primes as (5, 7) or both can be composites as (14, 27) or one can be a prime and other a composite as (11, 12).

Example 3: Find the HCF of the numbers 40 and 56 by division method.

Solution:

2	40
2	20
2	10
5	5
	1

2	56
2	28
2	14
7	7
	1

or

2	40, 56
2	20, 28
2	10, 14
	5, 7

Prime factorisation of 40 = 2 x 2 x 2 x 5
Prime factorisation of 56 = 2 x 2 x 2 x 7
The product of common factors of 40 and 56
= 2 x 2 x 2 = 8 and so, HCF (40, 56) = 8

Dividing by the common factor 2, (in 3 steps)
HCF = Product of common factors
= 2 x 2 x 2 = 8

Example 4: Find the HCF of the numbers 18, 24 and 30 by factor tree method.

Solution:

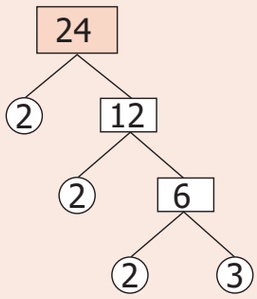
Let us find the factors of 18, 24 and 30 (use of divisibility test rules will also help).

The factors of 18 are 1, 2, 3, 6, 9 and 18.
The factors of 24 are 1, 2, 3, 4 , 6, 8, 12 and 24.
The factors of 30 are 1, 2, 3, 5, 6, 10, 15 and 30.

The factors that are common to all the three given numbers are 1, 2, 3 and 6 of which 6 is the highest.
Hence, HCF (18, 24, 30) = 6.

Note that 1 is a trivial factor of all numbers.

Let us find the factors of 24 by tree method.



Here, 24 = 2 x 2 x 2 x 3
Similarly, we can find the factors of 18 and 30.

1.6 Common Multiples

Let us now write the multiples of 5 and 7

Multiples of 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70,...

Multiples of 7 are 7, 14, 21, 28, 35, 42, 49, 56, 63, 70,...

Here, the common multiples of 5 and 7 are 35 and 70 and will go on without ending.

As multiples of a number are infinite, we can think of the **Least Common Multiple** of numbers, shortly denoted as **LCM**.

1.6.1 Least Common Multiple (LCM)

Think about the situation:

Situation 1: Write the multiplication table of 4 and 5 (upto 10).

4th Table	5th Table
1x4 = 4	1x5 = 5
2x4 = 8	2x5 = 10
3x4 = 12	3x5 = 15
4x4 = 16	4x5 = **20**
5x4 = **20**	5x5 = 25
6x4 = 24	6x5 = 30
7x4 = 28	7x5 = 35
8x4 = 32	8x5 = **40**
9x4 = 36	9x5 = 45
10x4 = **40**	10x5 = 50

Observing the multiplication tables, can you find the multiples (product of numbers) that are the same in the 4th table and 5th table?. If yes, what are they? Yes, they are **20, 40,**...etc. From the multiples of 4 and 5, we can easily find that 20 is the least common multiple of 4 and 5.

Situation 2:

Anu wants to buy Ragi Laddus and Thattais to serve at her sister's birthday party. Ragi Laddus come in packets of 4 and Thattais come in packets of 6. Anu has to buy these packets so that there are the same number of Ragi Laddus and Thattais to serve at the party. How will Anu tackle this situation?

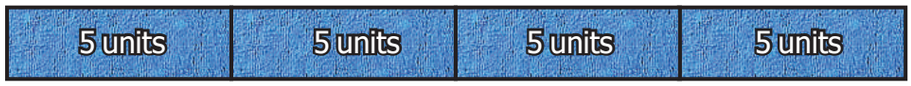
This situation can be tackled by Anu using the concept of LCM. Here, multiples of 4 are 4, 8, 12, 16, 20, 24, ... and multiples of 6 are 6, 12, 18, 24, 30, 36, ... We find that the common multiples are 12, 24, ... of which 12 is the least common multiple. Hence, Anu should buy a minimum of 3 packets of Ragi Laddus and 2 packets of Thattais so that there are the same number of Ragi Laddus (12) and Thattais (12) to serve at the party.

Situation 3:

Consider the red and the blue coloured floor mats of length 4 units and 5 units as follows.

Five red coloured floor mats of 4 units each can be arranged as follows. Its total length is 5 x 4 = 20 units.

Four blue coloured floor mats of 5 units each can be arranged as follows. Its total length is also the same 4 x 5 = 20 units.



Note that the 5 floor mats each of length 4 units are required to equal 4 floor mats each of length 5 units and that is, the length 20 units is the smallest common length that can be matched by both sizes. From the above, it shows that the least common multiple of 4 and 5 is 4x5=20.

The **Least Common Multiple** of any two non-zero whole numbers is the smallest or the lowest common multiple of both the numbers. The Least Common Multiple of the numbers *x* and *y* can be written as LCM (*x,y*).

We can find the least common multiple of two or more numbers by the following methods.

1. **Division Method**
2. **Prime Factorisation Method**

Example 5: Find the LCM of 156 and 124.

Solution: By **Division method**

Step 1: Start with the smallest prime factor and go on dividing till all the numbers are divided as given below.

2	156,124
2	78, 62
3	39, 31
13	13, 31
31	1, 31
	1,1

Step 2: LCM = product of all prime factors

= 2 x 2 x 3 x 13 x 31 = 4836

Thus, the LCM of 156 and 124 is 4836.

By **Prime Factorisation method**

Step 1: We write the prime factors of 156 and 124 as given below (use of divisibility test rules will also help).

156 = 2 x 78 = 2 x 2 x 39 = 2 x 2 x 3 x 13

124 = 2 x 62 = 2 x 2 x 31

Step 2: The product of common factors is 2 x 2 and also the product of the factors that are not common is 3 x 13 x 31.

Step 3: Now, LCM = product of common factors x product of factors that are not common

= (2 x 2) x (3 x 13 x 31) = 4 x 1209 = 4836

Thus, LCM of 156 and 124 is 4836.

(or)

156 = 2 x 78 = 2 x 2 x 39 = 2 x 2 x 3 x 13;

124 = 2 x 62 = 2 x 2 x 31

The prime factor 2 appears a maximum of 2 times in the prime factorization of 156 and 124, the prime factor 3 appears only 1 time in the prime factorization of 156, the prime factor 13 appears only 1 time in the prime factorization of 156 and the prime factor 31 appears only 1 time in the prime factorization of 124.

Hence, the required LCM = (2 x 2) x 3 x 13 x 31 = 4836.

1.7 Application Problems on HCF and LCM

Let us see the word problems that involve the HCF and the LCM concepts in daily life situations.

Example 6: What is the greatest number that will divide 62, 78 and 109 leaving remainders 2, 3 and 4 respectively?

Solution: Get all the common factors of 62 – 2, 78 – 3 and 109 – 4, i.e., 60, 75 and 105 and see that the common factors will divide them all. The greatest number is the H.C.F of 60, 75 and 105.

60=2 x 2 x 3 x 5 75=3 x 5 x 5 105=3 x 5 x 7

Hence, the HCF is 3 x 5=15, which is the greatest number that will divide 62, 78, 109 leaving remainders 2, 3 and 4 respectively.

Example 7: A book seller has 175 English books, 245 Science books and 385 Mathematics books. He wants to sell the books in a box, subject-wise in equal numbers. What will be the greatest number of the boxes required? Also find the number of books for each subject in a box.

Solution: This is a HCF related problem. So, we need to find the HCF of 175, 245 and 385.

5	175
5	35
7	7
	1

5	245
7	49
7	7
	1

5	385
7	77
11	11
	1

175 = 5 x 5 x 7; 245 = 5 x 7 x 7; 385 = 5 x 7 x 11

The HCF of 175, 245 and 385 is the product of the common factors 5 and 7 i.e, 5 x 7=35

Since each box contains equal number of books, the greatest possible number of boxes = 35

The number of English books in each box = 175÷35=5

The number of Science books in each box = 245÷35=7

The number of Maths books in each box = 385÷35=11

Hence, the total number of books in each box is 5+7+11=23.

Note

- LCM is always greater than or equal to the largest of the given numbers.
- LCM will always be a multiple of HCF.

Example 8: Find the ratio of the HCF and the LCM of the numbers 18 and 30.

Solution: Now, 18 = 2 x 3 x 3 and 30 = 2 x 3 x 5
and their HCF is 2 x 3 = 6 and LCM is 2 x 3 x 3 x 5 = 90
Hence, HCF : LCM = 6:90 = 1:15

Example 9: Find the smallest number that can be divided by 254 and 508 which leaves the remainder 4.

Solution: All common multiples of 254 and 508 will be divisible by both the numbers. Let us find the LCM of 254 and 508 (by division method).

2	254, 508
2	127, 254
127	127, 127
	1, 1

LCM of 254, 508 = 2 x 2 x 127 = 508

Thus, 508 is the smallest common number that is divisible by 254 and 508. Now, as we need remainder 4 while dividing, the required number is 4 more than the LCM and so, the required number is 508 + 4 =512.

Example 10: What is the smallest 5 digit number that is exactly divisible by 72 and 108?

Solution: First let us find the LCM of 72 and 108 (by division method).

2	72,108
2	36,54
2	18,27
3	9,27
3	3,9
3	1,3
	1,1

LCM of 72 and 108= 2 x 2 x 2 x 3 x 3 x 3 = 216

Now, all multiples of 216 will also be common multiples of 72 and 108.

The smallest 5 digit number = 10,000.

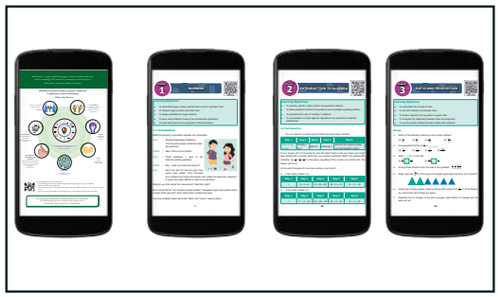
Now, 10,000 ÷ 216 gives quotient as 46 and remainder as 164.

Hence the next multiple of 216 i.e., 216 x 47 = 10,152 is the required smallest 5 digit number that is exactly divisible by 72 and 108.

Example 11: There are four Mobile Phones in a house. At 5 a.m, all the four Mobile Phones will ring together. Thereafter, the first one rings every 15 minutes, the second one rings every 20 minutes, the third one rings every 25 minutes and the fourth one rings every 30 minutes. At what time, will the four Mobile Phones ring together again?

Solution: This is a LCM related sum. So, we need to find the LCM of 15, 20, 25 and 30.

2	15, 20, 25, 30
2	15, 10, 25, 15
5	15, 5, 25, 15
3	3, 1, 5, 3
5	1, 1, 5, 1
	1, 1, 1, 1



The LCM of 15, 20, 25 and 30 is 2 x 2 x 3 x 5 x 5
= 300 minutes = 5 x 60 minutes = 5 x 1 hour = 5 hours
Thus, the four Mobile Phones will ring together again at 10.00 a.m.

Try this

A small boy went to a town to sell a basket of wood apples. On the way, some robbers grabbed the fruits from him and ate them. The small boy went to the King and complained. The King asked him, "How many wood apples did you bring?". The boy replied, "Your Majesty! I didn't know, but I knew that if you divided my fruits into groups of 2, one fruit would be left in the basket". He continued saying that if the fruits were divided into groups of 3, 4, 5 and 6, the fruits left in the basket would be 2, 3, 4 and 5 respectively. Also, if the fruits were divided into groups of 7, no fruit would be there in the basket. Can you find the number of fruits, the small boy had initially?

(This problem is taken from the famous Mathematics problems collection book in Tamil called **"Kanakkathikaram"** under the heading of **"Wood Apple Problem"**)

1.8 Relationship between the Numbers and their HCF and LCM

Let us find the HCF and the LCM of 36 and 48. First, find the factors of 36 and 48 using division method.

2	36
2	18
3	9
3	3
	1

2	48
2	24
2	12
2	6
3	3
	1

36 = 2 x 2 x 3 x 3; 48 = 2 x 2 x 2 x 2 x 3
HCF = 2 x 2 x 3 = 12
LCM = 2 x 2 x 3 x 2 x 2 x 3 =144
Observe that, 36 x 48 = 144 x 12 = 1728
We find that,
product of two given numbers = their HCF x LCM
In general, for any 2 numbers *x* and *y*,
$x \times y$ = HCF $(x, y) \times$ LCM (x, y)

Example 12: The LCM of two numbers is 432 and their HCF is 36. If one of the numbers is 108, then find the other number.

Solution: We know that, the product of the two numbers=LCM x HCF

108 x (the other number) = 432 x 36

The other number = (432 x 36) ÷ 108 = 144

Example 13: The LCM of two co-prime numbers is 5005. If one of the numbers is 65, then find the other number.

Solution: We know that, the product of the two numbers = LCM x HCF

As the HCF of co-primes is 1,

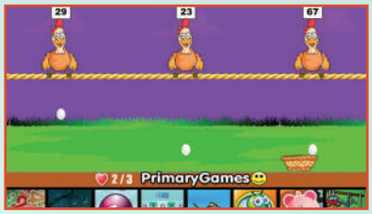
65 x (the other number) = 5005 x 1

The other number = 5005 ÷ 65 = 77

NUMBERS

ICT CORNER

Expected Outcome



Step 1

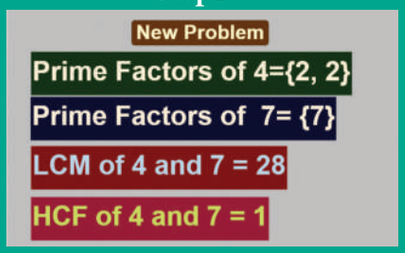
Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Numbers" will open. The work sheet contains two activities. 1. LCM and HCF and 2. Prime number game.

In the first activity Click on New Problem and solve the problem, then check your answer.

Step 2

In the second activity catch the egg which shows prime number as quick as possible. You can select the level of speed in the beginning.

Step1



Step2

Browse in the link:

Numbers: https://ggbm.at/Exu3mtz5 or Scan the QR Code.

B442_MAT_6_T2_EM

Exercise 1.2

9QADE9

1. Fill in the blanks

(i) The HCF of 45 and 75 is _____.

(ii) The HCF of two successive even numbers is _____.

(iii) If the LCM of 3 and 9 is 9, then their HCF is _____.

(iv) The LCM of 26, 39 and 52 is_____.

(v) The least number that should be added to 57 so that the sum is exactly divisible by 2,3, 4 and 5 is _____.

2. Say True or False

(i) The numbers 57 and 69 are co-primes.

(ii) The HCF of 17 and 18 is 1.

(iii) The LCM of two successive numbers is the product of the numbers.

(iv) The LCM of two co-primes is the sum of the numbers.

(v) The HCF of two numbers is always a factor of their LCM .

3. Find the HCF of each set of numbers using prime factorisation method.

(i) 18,24 (ii) 51,85 (iii) 61,76 (iv) 84,120 (v) 27,45,81 (vi) 45,55,95

4. Find the LCM of each set of numbers using prime factorisation method.

(i) 6,9 (ii) 8,12 (iii) 10,15 (iv) 14,42 (v) 30,40,60 (vi) 15,25,75

5. Find the HCF and the LCM of the numbers 154, 198 and 286.

6. What is the greatest possible volume of a vessel that can be used to measure exactly the volume of milk in cans (in full capacity) of 80 litres, 100 litres and 120 litres?

7. The traffic lights at three different road junctions change after every 40 seconds, 60 seconds and 72 seconds respectively. If they changed simultaneously together at 8 a.m at the junctions, at what time will they simultaneously change together again?

8. The LCM of two numbers is 210 and their HCF is 14. How many such pairs are possible?

9. The LCM of two numbers is 6 times their HCF. If the HCF is 12 and one of the numbers is 36, then find the other number.

Objective Type Questions

10. Which of the following pairs is co-prime?

a) 51, 63 b) 52, 91 c) 71, 81 d) 81, 99

11. The greatest 4 digit number which is exactly divisible by 8, 9 and 12 is

a) 9999 b) 9996 c) 9696 d) 9936

12. The HCF of two numbers is 2 and their LCM is 154. If the difference between the numbers is 8, then the sum is

a) 26 b) 36 c) 46 d) 56

13. Which of the following cannot be the HCF of two numbers whose LCM is 120?

a) 60 b) 40 c) 80 d) 30

Exercise 1.3

Miscellaneous Practice Problems

1. Every even number greater than 2 can be expressed as the sum of two prime numbers. Verify this statement for every even number upto 16.
2. Is 173 a prime? Why?
3. For which of the numbers, from n = 2 to 8, is $2n - 1$ a prime?
4. State true or false and explain your answer with reason for the following statements.
   a) A number is divisible by 9, if it is divisible by 3.
   b) A number is divisible by 6, if it is divisible by 12.
5. Find A as required:
   (i) The greatest 2 digit number 9A is divisible by 2.
   (ii) The least number 567A is divisible by 3.
   (iii) The greatest 3 digit number 9A6 is divisible by 6.
   (iv) The number A08 is divisible by 4 and 9.
   (v) The number 225A85 is divisible by 11.
6. Numbers divisible by 4 and 6 are divisible by 24. Verify this statement and support your answer with an example.
7. The sum of any two successive odd numbers is always divisible by 4. Justify this statement with an example.
8. Find the length of the longest rope that can be used to measure exactly the ropes of length 1m 20cm, 3m 60cm and 4m.

Challenge Problems

9. The sum of three prime numbers is 80. The difference of two of them is 4. Find the numbers.
10. Find the sum of all the prime numbers between 10 and 20 and check whether that sum is divisible by all the single digit numbers.
11. Find the smallest number which is exactly divisible by all the numbers from 1 to 9.
12. The product of any three consecutive numbers is always divisible by 6. Justify this statement with an example.
13. Malarvizhi, Karthiga and Anjali are friends and natives of the same village. They work at different places. Malarvizhi comes to her home once in 5 days. Similarly, Karthiga and Anjali come to their homes once in 6 days and 10 days respectively. Assuming that they met each other on the 1st of October, when will all the three meet again?

14. In an apartment consisting of 108 floors, two lifts A & B starting from the ground floor, stop at every 3rd and 5th floors respectively. On which floors, will both of them stop together?

15. The product of 2 two digit numbers is 300 and their HCF is 5. What are the numbers?

16. Find whether the number 564872 is divisible by 88.
(use of the test of divisibility rule for 8 and 11 will help!)

17. Wilson, Mathan and Guna can complete one round of a circular track in 10, 15 and 20 minutes respectively. If they start together at 7 a.m from the starting point, at what time will they meet together again at the starting point?

DO YOU KNOW?

Two numbers are said to be ***amicable numbers*** if the sum of the factors of one number (except the number itself) gives the other number.

The numbers **220** and **284** are amicable, since the sum of the factors of **220** (except **220**) i.e., $1+2+4+5+10+11+20+22+44+55+110$ = **284** and the sum of the factors of **284** (except **284**) i.e., $1+2+4+71+142$ = **220**.

Check whether **1184** and **1210** are amicable numbers.

Summary

- A natural number greater than 1, having only two factors namely 1 and the number itself, is called a *prime number*.
- A natural number having more than two factors is called a *composite number*.
- A pair of prime numbers whose difference is 2 is called as *twin primes*.
- Every composite number can be expressed as a product of prime numbers in a *unique way*.
- The *Highest Common Factor* of any two non-zero whole numbers is the largest common factor of both the numbers.
- The *Least Common Multiple* of any two non-zero whole numbers is the smallest common multiple of both the numbers.
- Two numbers having 1 as their only common factor are said to be *co-primes* or *relatively prime*.
- The product of two given numbers is equal to the product of their HCF and LCM.

CHAPTER 2

MEASUREMENTS

9QJ9FH

Learning Objectives:

- To understand the position of decimal point in the conversion of smaller unit to larger unit and vice versa.
- To do the four fundamental operations on quantities of different units.
- To read time in a clock and convert the 12 hour format to the 24 hour format and vice versa.
- To find duration between 2 given time instances.
- To do conversion of units of time.

2.1 Introduction

Let us listen to the following conversation between a teacher and a student:

Teacher: Have you ever noticed your mother buying knotted flowers? How is it measured?

Student: Yes teacher. The flower seller measures the string of flowers using her/his hand. She/He measures in cubit (முழம் in tamil).

Teacher: If you measure the same using your hand, what would you observe?

Student: It would measure more than one cubit,because my hand is shorter.

Teacher: Yes, how far is your house from the school?

Student: Just 100 feet, teacher.

Teacher: How do you buy rice, milk, cloth from the shop?

Student: We buy the rice in kilogram, milk in litre , cloth in metre.

Teacher: How much time do you spend on your homework?

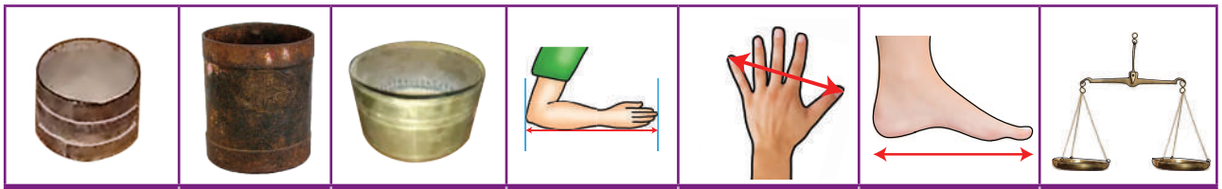
Student: I usually spend an hour to do my homework.

Teacher: How do you measure height and weight?

Student: Height in centimetre, Weight in kilogram.

Teacher: Have you heard about any other measures used in earlier days?

Student: My grandparents talk of measures used in their days such as Padi (படி), Uzhakku (உழக்கு), Aazhakku (ஆழாக்கு), Marakkal (மரக்கால்), Feet (அடி), Span (சாண்), Cubit (முழம்).

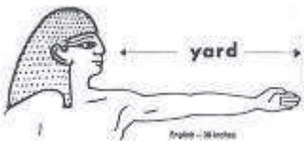


Uzhaku	Padi	Marakkal	Cubit	Hand span	Foot	Balance

Teacher: Then why do we use kilogram, metre, litre instead of those units?

Student: I don't know teacher, please tell us why?.

Teacher: As we started trading world wide ,we found people in various places using different measures. The 'kings foot', the 'kings arm' and the 'yard' (the distance between the tip of his nose to the tip of the thumb) were used as units to measure small length in various places. As these lengths differed from person to person and place to place, it was necessary to standardize measurements throughout the world. The metric measures were defined in 1971 by the General Conference of Weights and Measures.



The basic metric units are Metre, Litre, Gram, Seconds and so on. It is based on the decimal system (10), which is easier to convert from one unit to another. We use kilometre, metre, centimetre, millimetre to measure length; kilogram, gram, milligram for weight and kilolitre, litre, millilitre for volume in shops, schools ,office, railways and many other places.

An eye blink represents a second; heart beats are counted per minute; working time of an employee is calculated in hours.

MATHEMATICS ALIVE – MEASUREMENTS IN REAL LIFE

Cloth measure in a textile shop

Weighing Vegetables in a market

Measuring the volume of milk by the seller

2.2 Recap

Universally accepted basic metric units are

- Length in metre.
- Weight in gram.
- Capacity (volume) in litre.

We use different metric units for different sizes in various situations

Size	Metric units
Large ones	Kilometre / Kilolitre / Kilogram
Medium ones	Metre / Litre /Gram
Small ones	Centimetre / Centilitre /Centigram
Very small ones	Millimetre/Millilitre / Milligram

Try this

1. Complete the following table:

Metric Unit Table (Hierarchy of Units)						
For Length						
Kilometre (km)	Hectometre (hm)	Decametre (dam)	Metre (m)	Decimetre (dm)	Centimetre (cm)	Millimetre (mm)
For Weight						
			Gram			
For Volume						
			Litre			

2. Determine which metric unit you would use to express the following :

   i. The length of your middle finger.

   ii. The weight of an elephant.

   iii. The weight of the ring.

   iv. The weight of the tablet.

   v. The length of the safety pin.

   vi. The height of the building.

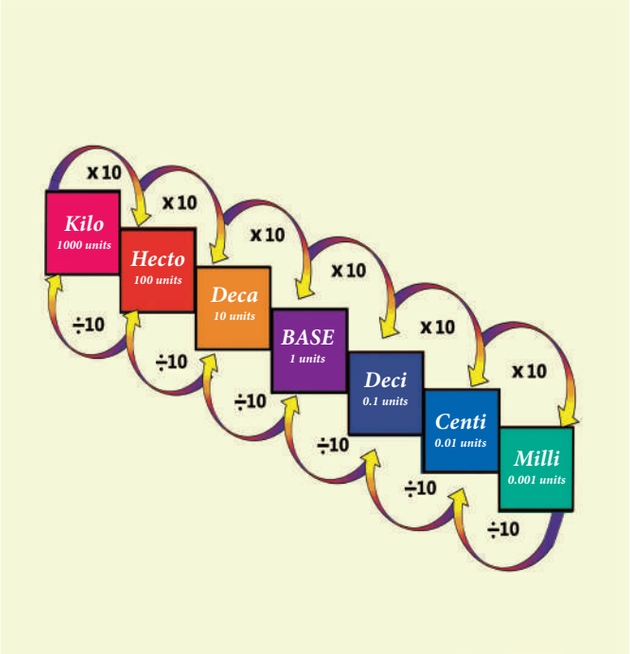
   vii. The length of the sea shore in tamilnadu.

   viii. The volume of cup of coffee.

   ix. The capacity of water in the tank.

2.3 Conversions within the Metric System

All units of length in the metric system are defined in terms of the metre. A prefix is added to indicate the decimal place value position of the measurements. Similarly the units of weight and volume are defined in terms of gram and litre respectively. Let us observe the conversion chart.



- When we move from higher unit to lower unit, multiply the given measure by the powers of 10's.
- When we move from lower unit to higher unit, divide the given measure by the powers of 10's.

Remember the following Conversion table:

Length	Weight	Volume (Capacity)
• 1 km = 1000 m • 1 m = 100 cm • 1 m = 1000 mm • 1 cm = 10 mm	• 1 kg = 1000 g • 1 g = 1000 mg	• 1 kl = 1000 l • 1 l = 1000 ml

Before we study Conversion of metric units, we should learn about decimal point position when multiplying / dividing of a decimal number by the powers of ten.

When a decimal number is multiplied by 10, 100, 1000, 10000, we move the decimal point by 1, 2 ,3 ,4 places to the right respectively.	**When a decimal number is divided by 10, 100, 1000, or 10000, we move the decimal point 1, 2, 3, 4 places to the left respectively.**
Example: **Multiply 345.972 by 10,100,1000 and 10000** 345.972 × 10 = 3459.72 (move the decimal point by one place to the right) 345.972 × 100 = 34597.2 (move the decimal point by two places to the right) 345.972 × 1000 = 345972 (move the decimal point by three places to the right) 345.9720 × 10000 = 3459720 (move the decimal point by four places to the right) Since, there are only 3 digits in the decimal part, add a zero to the right and then place the decimal point.	**Example :** **Divide 647.39 by 10,100 and 1000 and 10000** $\frac{647.39}{10} = 64.739$ (move the decimal point one place towards its left) $\frac{647.39}{100} = 6.4739$ (move the decimal point two places towards its left) $\frac{647.39}{1000} = 0.64739$ (move the decimal point three places towards its left) $\frac{0647.39}{10000} = 0.064739$ (move the decimal point four places towards its left) Since there are only 3 digits in the integral part , add one zero and place the point before it.

Example 1: The official distance of Marathon race is 42.195 km. Express this distance in metre.

Solution : The official distance of Marathon race is 42.195 km.

= 42.195 X 1000 m

= 42195 m

1 km = 1000 m

Example 2: The average rainfall of Tamilnadu is 998 mm. convert it into cm.

Solution : The average rainfall =998 mm = 998.0 x $\frac{1}{10}$ cm

$= \frac{998.0}{10}$ cm

= 99.8 cm

1 cm = 10 mm

$\frac{1}{10}$ cm = 1 mm

Example 3: A flag pole is 5 m 35 cm long. What is the length of the flag pole in cm?

Solution : The length of a flag pole = 5 m 35 cm long

= (5× 100) cm + 35 cm

= 500 cm + 35 cm

= 535 cm

The flag pole is 535 cm long.

1 m = 100 cm

Example 4: Janaki bought 650 mg of a tablet. What is its weight in gram?

Solution : weight of a tablet = 650 mg

$= 650.0 \times \frac{1}{1000} g$

$= \frac{650.0}{1000} g = 0.65\ g$

1 g = 1000 mg

$\frac{1}{1000} g$ = 1 mg

Example 5: Murali has a bag that weighs 3 kg and 450 g. What is its weight in gram?

Solution : weight of Murali's bag = 3 kg and 450 g ,

= (3x1000 g) + 450 g

= 3000 g + 450 g

= 3450 g

1 kg = 1000 g

Example 6: A calf drinks 5.750 l of water ,convert into ml

Solution : Quantity of water drunk by the calf = 5.750 l

= 5.750 x 1000 ml

= 5750 ml

1 l = 1000 ml

Example 7: Convert 526 ml into l

Solution : $526\ ml = 526.0 \times \frac{1}{1000} l$

$= \frac{526.0}{1000} l = 0.526\ l$

1 l = 1000 ml

$\frac{1}{1000} l$ = 1 ml

Try these

Convert the following

i) 23 km into m

ii) 1.78 m into cm

iii) 7814 m into km

iv) 8.67 mm into cm

v) 16 l into ml

vi) 1500 ml into l

vii) 2360 l into kl

viii) 873 l into ml

ix) 40 mg into g

x) 1550g into kg

xi) 6.5 kg into g

xii) 723g into mg

Think

Which of these is heavier in weight? 5 kg of cotton; 5000 g of Iron

Some measures that are not part of metric system.

➢ 1 $inch$ = 2.54 cm	➢ 1 tonne = 1000 kg;
➢ 1 m = 3.281 ft	➢ 1 quintal=100 kg;
➢ 1 m = 39.37 $inches$	➢ 1 tonne = 10 quintal
➢ 1 ft = 0.305 m = 30.48 cm	➢ 1 soverign = 8 g
➢ 1 $mile$ = 1.609 km	➢ TMC: (Thousand Million Cubic feet), 1 TMC =28,316,846,592 litres

DO YOU KNOW?

1 kg = 1000 g

¼ kg = 250 g

½ kg = 500 g

¾ kg = 750 g

The following Tamil puzzle is taken from the famous Mathematics problems collection book in Tamil called "Kanakkathikaram" in which is a good example of conversion of units of distance :

முப்பத்தி ரண்டு முழம்உளமுட் பனையை
தப்பாமல் ஒந்தி தவழ்ந்தேறிச் - செப்பமுடச்
சாணேறி நான்குவிரற்கிழியும் என்பரே
நாணா தொரு நாள் நகர்ந்து

Meaning of this puzzle:

On a palm tree of height 32 cubit , a chameleon tried to reach the top of the tree. If it climbed one hand span on it but slipped four fingers on one day, in how many days will it reach the top of the tree?

Solution:

1 hand span = 12 fingers;
1 cubit = 2 hand spans = 24 fingers.
Height of the palm tree = 32 cubit = 32 x 24 fingers = 768 fingers.
Distance climbed in 1 day = 1 hand span = 12 fingers.
Distance slipped in 1 day = 4 fingers.
Actual distance climbed in 1 day = 12 – 4 = 8 fingers.
Number of days required to climb the top of the tree = 768/ 8 = 96 days

2.4 Fundamental Operations on Quantities with Different Units

We can do the basic operations on the metric units as we do the decimal operations. Note that, measurements with the same unit can be added/ subtracted, but unlike units of measurements should be converted into like units and then they can be added / subtracted.

Example 8: Saritha bought 6 *m* and 40 *cm* of cloth for herself and 3 *m* and 80 *cm* of cloth for her sister. What was the total length of the cloth bought by her?

Solution:

	m	*cm*
	1	
Length of cloth bought for Saritha	6	40
Length of cloth bought for Saritha's sister	3	80
Total length of the cloth	10m	20cm

Example 9: Pradeep travels 4 *km* and 350 *m* to reach to the market, while Kandan travels 6 *km* and 200 *m* to reach to the same market from their houses. How much distance does Kandan travel more than Pradeep?

Solution:

	km	*m*
	1000 m	
Distance travelled by Kandan	5 ~~6~~	1200 ~~200~~
Distance travelled by Pradeep	4	350
Difference in distance of their travel	1*km*	850*m*

Kandan travelled 1 *km* and 850 *m* more than Pradeep.

Example 10: A child needs 100 g of vegetables per day. How many kg of vegetables will be needed for a school of strength 90.

Solution :

Total strength of the school	= 90
Weight of vegetables for each child per day	= 100 g
Total weight of vegetables for 90 children per day	= 90 x 100 g
	= 9000 g
	= 9 kg.

Example 11: A bag contains 81 kg of sugar. If the shopkeeper fill up these into small packets of 750 g. each, then how many packets can be made from 81 kg of sugar?

Solution :

Quantity of sugar in the bag	= 81 kg
Quantity of sugar filled in each packet	=750 g
Number of packets required	= 81 kg÷750 g
	= 81x1000 g÷750 g
	= 81000 g÷750 g
	= 108

```
      108
750 ) 81000
      750
       6000
       6000
          0
```

Think

1. Five kilograms of compost is needed for a coconut tree for every six months. How many kilograms of compost is needed for 50 such coconut trees for one and half years.?
2. a. Is it correct: 4 m+3 cm =7 m
   b. Can we add the following?
   i) 6l + 7kg, ii) 3 m +5 l iii) 400 ml +300 g

Exercise 2.1

1. Fill in the blanks

(i) 250 ml + ½ l = ... l

(ii) 150 kg 200 g + 55 kg 750 g =.....kg .....g

(iii) 20 l – 1 l 500 ml = ...l .....ml

(iv) 450 ml x 5 =..... l ..... ml

(v) 50 kg ÷ 100 g =.....

2. True or False

(i) Pugazhenthi ate 100 g of nuts which is equal to 0.1 kg.

(ii) Meena bought 250 ml of buttermilk which is equal to 2.5 l.

(iii) Karkuzhali's bag 1 kg 250 g and Poongkodi's bag 2 kg 750 g. The total weight of their bags 4 kg.

(iv) Vanmathi bought 4 books each weighing 500 g. Total weight of 4 books is 2 kg.

(v) Gayathri bought 1 kg of birthday cake. She shared 450 g with her friends. The weight of cake remaining is 650 g.

3. Convert into indicated units:

   (i) 10 *l* and 50 *ml* into *ml* (ii) 4 *km* and 300 *m* into *m* (iii) 300 *mg* into *g*

4. Convert into higher units : (i) 13000 *mm* (*km, m, cm*) (ii) 8257 *ml* (*kl, l*)

5. Convert into lower units : (i) 15 *km* (*m, cm, mm*) (ii) 12 *kg* (*g, mg*)

6. Compare and put >or< or = in the following:

   (i) 800 *g* + 150 *g* ☐ 1 *kg* (ii) 600 *ml*+400 *ml* ☐ 1 *l*

   (iii) 6 *m* 25 *cm* ☐ 600 *cm*+25 *cm* (iv) 88 *cm* ☐ 8 *m* 8 *cm*

   (v) 55 *g* ☐ 550 *mg*

7. Geetha brought 2 *l* and 250 *ml* of water in a bottle. Her friend drank 300 *ml* from it. How much of water is remaining in the bottle?

8. Thenmozhi's height is 1.25 *m* now. She grows 5 *cm* every year. What would be her height after 6 years?

9. Priya bought 22½ *kg* of onion, Krishna bought 18¾ *kg* of onion and Sethu bought 9 *kg* 250 *g* of onion. What is the total weight of onion did they buy?

10. Maran walks 1.5 *km* every day to reach the school while Mahizhan walks 1400 *m*. Who walks more distance and by how much?

11. In a JRC one day camp, 150 *gm* of rice and 15 *ml* oil are needed for a student. If there are 40 students to attend the camp how much of rice and oil are needed?

12. In a school,200 litres of lemon juice is prepared. If 250 *ml* lemon juice is given to each student, how many students get the juice?

13. How many glasses of the given capacity will fill a 2 litre jug?

    (i) 100 *ml*_____ (ii) 50 *ml*_____ (iii) 500 *ml*____

    (iv) 1 *l*_____ (v) 250 *ml*_____

Objective Type Questions

14. 9 *m* 4 *cm* is equal to _____

    a. 94 *cm* b. 904 *cm* c. 9.4 *cm* d. 0.94 *cm*

15. 1006 *g* is equal to _____

    a. 1 *kg* 6 *g* b. 10 *kg* 6 *g* c. 100 *kg* 6 *g* d. 1 *kg* 600 g

16. Every day 150 *l* of water is sprayed in the garden. Water sprayed in a week is _____

    a. 700 *l* b. 1000 *l* c. 950 *l* d. 1050 *l*

17. Which is the greatest? 0.007 *g*, 70 *mg*, 0.07 *cg*

    a. 0.07 *cg* b. 0.007 *g* c. 70 *mg* d. all are equal

18. 7 *km* – 4200 *m* is equal to _____

    a. 3 *km* 800 *m* b. 2 *km* 800 *m* c. 3 *km* 200 *m* d. 2 *km* 200 *m*

2.5 Measures of Time

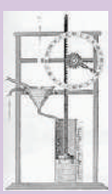
The teacher asks students to answer the following questions:

- How long do you take to run 100 metres?
- How long do you take to walk one kilometre?
- What is the time taken for a cup of rice to be cooked?
- What is the cultivation period of groundnut?

These questions will help us to find the importance of time in our day-to-day life.
Now let us discuss the development of measures of time.

The procedure of measuring time has undergone several changes from ancient period. Initially, a stick in the sand was used to measure time by measuring the length of the shadow of that stick. Then horizontal and vertical plates were used as sundials to measure time between sunrise and sunset, that is in the day time. Firing of knotted ropes was used to measure time in the darkness. The approximate time taken for the fire to travel from one knot to other formed the part of night. In later days, a day was divided into 24 equal parts (hours) of which 12 hours were for daytime and 12 hours were for night time approximately. Time taken by the Earth to complete one full rotation around the Sun is known as the **Solar Year**. It was divided into 12 equal parts which is known as the **Solar month**. The duration between two full moons is known as the lunar month and 12 lunar months are known as lunar year. But we follow solar year and month.

Various clocks had been designed and used to measure time from different parts of world, like water clock, sun dial candle clock, sand clock, rope clock, etc…. Have you seen those clocks? Look at the clocks shown below.

			
Water clock	**Sun dial**	**Candle Clock**	**Sand Clock**

Study of devices that are measuring the time is called **'HOROLOGY'**.

Nowadays, we use pendulum clock,digital clock, quartz clock, atomic clock to find time accurately.

DO YOU KNOW?

Our Tamil people were experts in the Astronomical science. The Tholkappiam deals the pozhuthu (time). They divide a day into six major divisions, together called **"Sirupozhuthu (சிறுபொழுது)"** . A year into six major divisons, together called **"Perumpozhuthu (பெரும்பொழுது)"**

1 Nazhigai = 24 min; 1 hour = 2.5 nazhigai = 1 Orai; 1 day = 24 hours = 60 nazhigai

[Tamil people used the device " kuri neer kannel" to measure night times.....]

Unit of Time: Today we are measuring time accurately. The units of time are second, minute, hour, day, week, month, year, etc. They are interrelated.

Recap:

1. Read and write the time in the appropriate place.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2.5.1 Reading the time

Practise to say time in two ways:-

When the minute hand is on the left hand side of the clock, (from 6 hours to 12 hours) we read the time as __ minute to ___hour.

Example: 20 min to 10

When the minute hand is on the right hand side of the clock.(from 12 hours to 6 hours) we read the time as __ minute past ___hour.

Example:
25 min past 4

Practise to say the time using **"past"**

						
4.00 4 o'clock	4.05 5 min past 4	4.10 10 min past 4	4.15 15 min past 4 or quarter past 4	4.20 20 min past 4	4.25 25 min past 4	4.30 30 min past 4 or half past 4

Practise to say the time using **"To"**

				
4.35 (i) 25 min to 5	4.40 (i) 20 min to 5	4.45 (i) 15 min to 5 or Quarter to 5	4.50 (i) 10 min to 5	4.55 (i) 5 min to 5

Try these

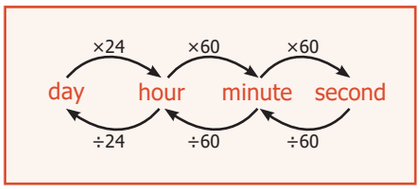
Say the following time in appropriate ways:

a) 9.20 b) 4.50 c) 5.15 d) 6.45 e) 11.30

2.5.2 Conversion of Time

Calculation of time to the nearest seconds is very essential in some situations like launching rocket, running race, arrival and departure. So, we need to know the conversion of time.

Let us remember the time related chart as follows:



Example 12: A farmer ploughed the field for 3 hours 35 minutes. How many minutes did he plough?

Solution:

Time for which the farmer ploughed the field = 3 hours and 35 minutes
= 3 x 60 minutes + 35 minutes
= 180 minutes + 35 minutes
= 215 minutes

Examples 13: A handloom weaver takes 6 hours 20 minutes 30 seconds and 5 hours 50 minutes 45 seconds to weave two silk sarees. What is the total time to weave the two silk sarees?

Solution:

	Hours	Minutes	Seconds
Time taken to weave the first silk saree	6	20	30
Time taken to weave the second silk saree	5	50	45
Total time taken to weave the two silk sarees	11 hours	70 minutes	75 seconds
	= 11 hours	60 minutes+10 minutes	60 seconds+15 seconds
	= 11 hours = 12 hours	1 hour+10 minutes 11 minutes	1 minute + 15 seconds 15 seconds

Example 14: A satellite is placed in its orbit in 7 hours 16 minutes 20 seconds. Calculate it in seconds.

Solution: The satellite reaches its orbit in 7 hours + 16 minutes + 20 seconds
= (7 x 60 x 60) seconds +(16 x 60) seconds +20 seconds
= 25200 seconds + 960 seconds + 20 seconds
= 26,180 seconds

The satellite reaches its orbit in 26,180 seconds

Example 15: Two cyclists took 5 hours 35 minutes 10 seconds and 8 hours respectively to cover the same distance. Find the difference in time taken by them

Solution:

Hours	Minutes	Seconds
1 hour	1 minute	
7 ~~8~~	59 ~~60~~ ~~00~~	60 ~~00~~
5	35	10
2	24	50

Try these

Convert the following:

i) 4 hours =____ minutes
ii) 240 minutes =____ hours
iii) 30 minutes =____ seconds
iv) 3600 seconds =____ hours
v) 2 hours = ____ seconds

2.5.3 Ordinary Time or the 12-Hour Format

The 12 hour clock has ante meridiem (a.m) and post meridiem (p.m) because the number of hours in a day is divided into day and night. In the clock, exactly 12.00 at night is called midnight; and exactly 12.00 at day is called noon.

a.m (ante meridiem) denotes the time that is after 12:00 midnight and before 12:00 noon.

p.m (post meridiem) denotes the time that is after 12:00 noon and before 12:00 midnight.

Example:

- Morning 5 o' clock is denoted as 5.00 a.m
- Evening 5 o' clock is denoted as 5.00 p.m
- In 3.20 a.m., the point does not mean the usual decimal point.

2.5.4 Railway Time or the 24-Hour Format

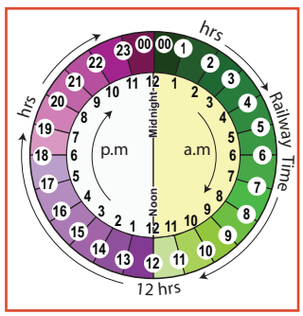
Generally, we use 12 hour clock but Railways, Airways, Defence forces and Television networks use 24 hour clock to avoid morning or evening confusions. When you are in a railway station, you can hear the announcement and see the use of hours instead of a.m. and p.m, because they follow the 24 hour format. Therefore, there is no need to say morning and evening in their time. Railway time is usually denoted in **4 digits.** The first two digits shows the hours and the last two digits shows the minutes. For example, 5 p.m is denoted as **17:00 hours.**

Example: 7 o' clock morning = 07:00 hours
1 o' clock evening = 13:00 hours (12+1 hour)
i.e., after 12 noon they count continuously up to 24 hours.
12 midnight is written as 00:00 hours or 24:00 hours.
12 noon is written as 12:00 hours

2.5.5 Conversion of Time Formats

Let us observe the clock. Remember the following points while converting from one type of time to another type

- To convert 12 hour time to 24 hour time, simply change 12 hours as 00:00 hours between 12.00 midnight and 01.00 a.m there is no change upto 01.00 p.m. Add 12:00 hours to any hour from 01.00 p.m.
- To convert 24 hour time to 12 hour time simply change 00:00 hours as 12 hours between 00:00 hours and 01:00 hour. There is no change upto 13:00 hours. Subtract 12:00 hours from any hours from 13:00 hours. Minutes will not change in both the formats



Convert into the 12 hour format: (Ordinary time)

24 hour format	>12 hour	if >12 hour then subtract 12	12 hour format
09:25 hours	No	-	9.25 a.m
18:40 hours	Yes	18-12= 6	6.40 p.m
03:15 hours	No	-	3.15 a.m
15:30 hours	Yes	(15-12=3)	3.30 p.m
23:50 hours	Yes	(23-12=11)	11.50 p.m

Convert into the 24 hour format (Railway time)

12 hour time	a.m/p.m	add 12 hr to p.m	24 hour time
04.15 a.m	a.m	-	04:15 hours
07.40 p.m	p.m	(7+12) hours	19:40 hours
10.05 p.m	p.m	(10+12) hours	22:05 hours
06.00 a.m	a.m	-	06:00 hours
12.25 a.m	a.m	-	00:25 hours

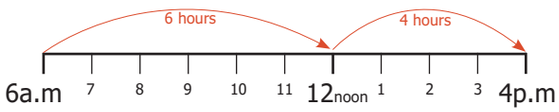
Try these

Convert the 12 hour format into the 24 hour format and vice versa

10.40 a.m	= 10:40 hours	1 p.m	= 13:00 hours
11 a.m	= 11:00 hours	11.15 p.m	= 23:15 hours
1.15 a.m	= _____hours	3 p.m	= _____hours
5 a.m	= _____hours	12 midnight	= _____hours
16:20 hours	= _____a.m/p.m	12:25 hours	= _____a.m/p.m
00:40 hours	= _____a.m/p.m	4:10 hours	= _____a.m/p.m

2.5.6 Duration between the two given time instances

Example16: Find the duration between 6 a.m and 4 p.m

Solution : Method-1	Method-2
Conversion of 6 a.m to Railway time = 06:00 hours Conversion of 4 p.m to Railway time = (4+12) hours = 16:00 hours Time duration between 6 a.m and 4 p.m = The difference between 16 hours and 6 hours = 16 hours - 6 hours = 10 hours	 = 6 hours + 4 hours = 10 hours

Example 17:

The arrival and departure timings of the Chennai – Trichy Express are given below.

Station	Arrival	Departure
Chennai Egmore	-	20:30
Chengalpattu	21:30	21:32
Villupuram junction	23:15	23:25
Virudhachalam junction	00:07	00:10
Trichy	04:30	-

(i) At what time does the train depart from Chennai Egmore to arrive at Trichy?
The train departs from Egmore at 20:30 hours to arrive Trichy at 4:30 hours.

(ii) How long does it halt at Villupuram?
It halts at Villupuram for 10 minutes.

(iii) How many halts are there in between Chennai and Trichy ?
There are 3 halts (1) Chengalpattu (2) Villupuram (3) Virudhachalam

(iv) Find the total journey time of the train from Chennai to Trichy.

Hint: If the journey crosses the midnight, calculate the time duration from starting hours to midnight, then from midnight to arrival time.

Method-1	Method-2
Duration up to midnight 1 hour 23 60 Midnight : ~~24~~ :~~00~~ hours Starting time : 20 :30 hours Duration 03:30 hours	 Total journey time = 3 hours 30 minutes+4 hours 30 minutes = 7 hours 60 minutes = 7 hours +1 hour = 8 hours

Duration from midnight to arrival = 4 hours 30 minutes
Total journey time = Duration up to midnight + Duration from midnight to arrival
= 3 hours 30 minutes + 4 hours 30 minutes
= 7 hours 60 minutes = 7 hours + 1 hour = 8 hours

Example 18:

The clock is set at 7 a.m. If the clock slows down two minutes every hour, find the time shown by the clock at 6 p.m.

Solution : Time slowed down for 1 hour = 2 minutes

Time slowed down for 11 hours =11 x 2 = 22 minutes

So, at 6 p.m the clock slows down by 22 minutes. That means the clock shows 5 hours 38 minutes at 6 p.m.

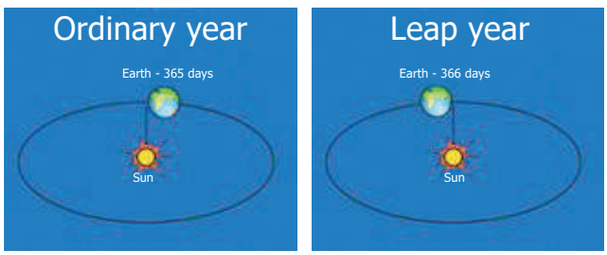
Ordinary time	Railway time
6.00 p.m	18:00 hours
7.00 a.m	07:00 hours
Time duration	11:00 hours

2.5.7 Year

A year is the time taken by the Earth to make one revolution around the Sun. A year has 12 months or 365 days. Each month is divided into weeks. A month has 4 weeks and a few more days. A week is of 7 days. A month has 30 days / 31 days except February. February has 28 or 29 days.

Leap Year

We know that the Earth revolves around the Sun as well as rotates to itself. The Earth takes 365 days 6 hours to make a complete revolution around the sun. We take 365 days as one year. To adjust 6 hours each year, we add one day to every fourth year (4 years × 6 hours = 24 hours = 1 day). Every 4th year has 365 +1 day = 366 days and one day is added to the month of February. Therefore a year which has 366 days is called a **Leap Year.** In a Leap Year the month of February has 29 days. Every year you are celebrating birthday. If a person's birthday falls on 29th February, he/she has to celebrate the birthday once in 4 years only.

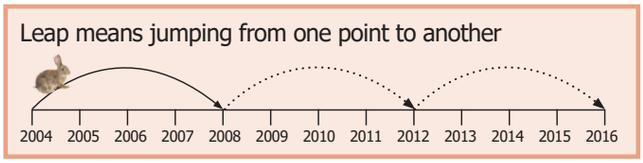


How can we identify a leap year?

I. Generally a year which is divisible by 4 is considered as a leap year.

Examples:

1. 2016 is a leap year, because 2016 is exactly divisible by 4
2. 2018 is not divisible by 4 and it leaves remainder. So it is not a leap year.



II In centuries:

Years which are multiples of 100 are centuries, such as 1100, 1200, 1300....1900, 2000, 2100 ....etc. The century which is divisible by 400 is a leap year.

Think

Why do we divide the centuries by 400 to find whether it is leap year or not?

Examples:

1. 1200 is divisible by 400; and so it is a leap year.
2. 1700 is not divisible by 400. and so it is not a leap year.

Example 19: If Wednesday falls on 20th of December 2017. What is the day on 8th june 2018? Also say the number of days between these two dates.

Month	Days	
December	12	(31 – 19)
January	31	
February	28	(2018 is a non-leap year)
March	31	
April	30	
May	31	
June	07	
Total	**170 days**	

```
     24
7 ) 170
    14
     30
     28
      2
```

170 day ÷ 7 (why?)

170 days = 24 weeks +2 days

Required day is the second day after Wednesday. Therefore 8th of june is Friday.

Example 20: Mala's date of birth is 20-11-1999. What is her age on 05-10-2018?

Solution:

Convert in the format : YYYY/MM/DD

YYYY (12 months)	MM (30 days)	DD
2017	21 (9+12)	35 (5+30)
~~2018~~	~~10~~	~~05~~
1999	11	20
18 yrs	10 months	15 days

Mala's age : 18 yrs 10 months 15 days

Activity

1. Collect some famous personalities whose birthday falls on 29th February.
2. Collect the interesting facts about Big Ben clock in London.

Try these

1. Check whether the following years are Ordinary or Leap Year?
   1994; 1985; 2000; 2007; 2010; 2100
2. How many days are there from 1st April to 30th June?

DO YOU KNOW?

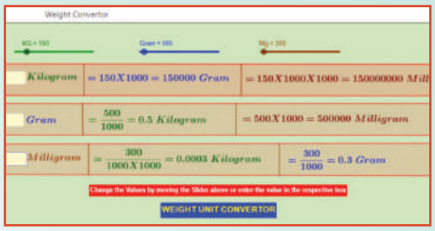
A Jubilee is a particular anniversary of an event.	
Silver Jubliee	25th anniversary
Ruby Jubilee	40th anniversary
Golden Jubilee	50th anniversary
Diamond Jubilee	60th anniversary
Sapphire Jubilee	65th anniversary
Platinum Jubilee	70th anniversary

- 10 years = 1 decade
- 100 years = 1 century
- 1000 years = 1 millennium
- 21st century 2001 – 2100, we are in this century
- 3rd millennium - 2001 – 3000 yrs, we are in this millennium

Measurements

ICT CORNER

Expected Outcome



Step 1

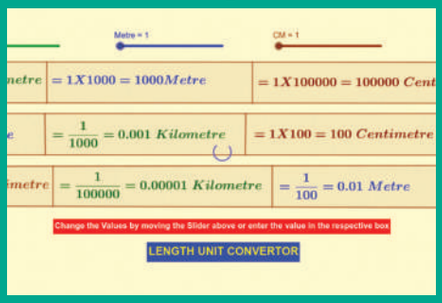
Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Measurement Unit convertor" will open. The work sheet contains three activities.
1. Length convertor and **2.** Weight convertor and **3.** Convertor for all measurements

In the first activity move the sliders to change the value of kilometre, metre and centimetre and check the conversion.

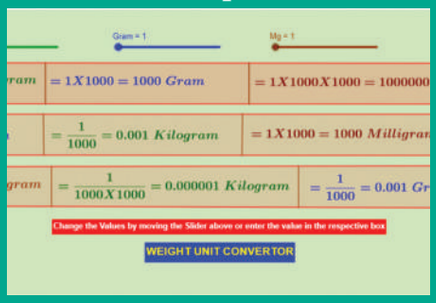
Step 2

In the second activity move the sliders to change the value of Kilogram, Gram and Milligram and check the conversion.

Step1



Step2



B442_MAT_6_T2_EM

Browse in the link:

Measurements: https://ggbm.at/p7DZHP6K or Scan the QR Code.

Exercise 2.2

1. Say the time in two ways:

				
i.	ii.	iii.	iv.	v

2. Match the following:

(i) 9.55	a. 20 minutes past 2
(ii) 11.50	b. quarter past 4
(iii) 4.15	c. quarter to 8
(iv) 7.45	d. 5 minutes to 10
(v) 2.20	e. 10 minutes to 12

9QT5HJ

3. Convert the following:

   (i) 20 minutes into seconds
   (ii) 5 hours 35 minutes 40 seconds into seconds
   (iii) 3 ½ hours into minutes
   (iv) 580 minutes into hours
   (v) 25200 seconds into hours

4. The duration of electricity consumed by the farmer for his pumpset on Monday and Tuesday was 7 hours 20 minutes 35 seconds and 3 hours 44 minutes 50 seconds respectively. Find the total duration of consumption of electricity.

5. Subtract 10 hours 20 minutes 35 seconds from 12 hours 18 minutes 40 seconds

6. Change the following into 12 hour format
   (i) 02:00 hours (ii) 08:45 hours
   (iii) 21:10 hours (iv) 11:20 hours (v) 00:00 hours

7. Change the following into 24 hour format
   (i) 3.15 a.m (iii) 12.35 p.m
   (iv) 12.00 noon (v) 12.00 midnight

8. Calculate the duration of time
   (i) from 5.30 a.m to 12.40 p.m
   (ii) from 1.30 p.m to 10.25 p.m
   (iii) from 20:00 hours to 4:00 hours
   (iv) from 17:00 hours to 5:15 hours

9. The departure and arrival timing of the Vaigai Superfast Express (No. 12635) from Chennai Egmore to Madurai Junction are given. Read the details and answer the following.

Station	Arrival	Departure
Chennai Egmore	-	13:40
Tambaram	14:08	14:10
Chengalpattu	14:38	14:40
Villupuram	15:50	15:55
Virudhachalam	16:28	16:30
Ariyalur	17:04	17:05
Trichy	18:30	18:35
Dindigul	20:03	20:05
Sholavandan	20:34	20:35
Madurai	21:20	-

(i) At what time does the Vaigai Express start from Chennai and arrive at Madurai?
(ii) How many halts are there between Chennai and Madurai?
(iii) How long does the train halt at the Villupuram junction?
(iv) At what time does the train come to Sholavandan?
(v) Find the journey time from Chennai Egmore to Madurai?

10. Manickam joined a chess class on 20.02.2017 and due to exam, he left practice after 20 days. Again he continued practice from 10.07.2017 to 31.03.2018. Calculate how many days did he practice?

11. A clock gains 3 minutes every hour. If the clock is set correctly at 5 a.m, find the time shown by the clock at 7 p.m?

12. Find the number of days between the Republic day and Kalvi Valarchi Day in 2020.

13. If 11th of January 2018 is Thursday , what is the day on 20th July of the same year?

14. (i) Convert 480 days into years.
(ii) Convert 38 months into years.

15. Calculate your age as on 01.06.2018

Objective Type Questions

16. 2 days =_____hours.

a) 38 b) 48 c) 28 d) 40

17. 3 weeks = _____days

a) 21 b) 7 c) 14 d) 28

18. Number of ordinary years between two consecutive leap years is _____

a) 4 years b) 2 years

c) 1 year d) 3 years

19. What time will it be 5 hours after 22:35 hours ?

a) 2:30 hours b) 3:35 hours

c) 4:35 hours d) 5:35 hours

20. 2 ½ years is equal to _____ months.

a) 25 b) 30 c) 24 d) 5

Exercise 2.3

Miscellaneous practice Problems

1. Two pipes whose lengths are 7 m 25 cm and 8 m 13 cm joined by welding and then a small piece 60 cm is cut from the whole. What is the remaining length of the pipe?

2. The saplings are planted at a distance of 2 m 50 cm in the road of length 5 km by saravanan. If he has 2560 saplings, how many saplings will be planted by him? how many saplings are left?

3. Put ✓mark in the circles which adds upto the given measure.

1.	1 *Kg*	◯ 500 *g*	◯ 50 *g*	◯ 100 *g*	◯ 200 *g*	◯ 250 *g*
2.	1 *m*	◯ 10 *cm*	◯ 30 *cm*	◯ 40 *cm*	◯ 25 *cm*	◯ 5 *cm*
3.	1 *l*	◯ 200 *ml*	◯ 100 *ml*	◯ 50 *ml*	◯ 500 *ml*	◯ 200 *ml*

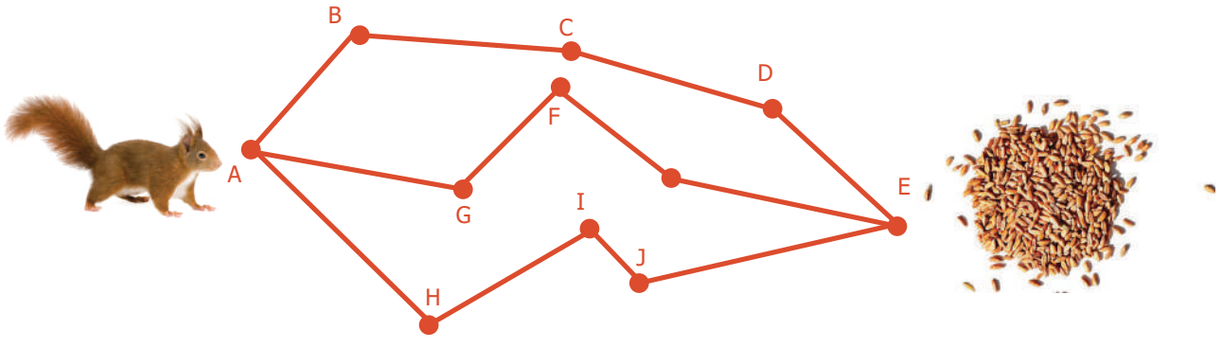
4. Make a calendar for the month of February 2020. (Hint: January 1st 2020 is Wednesday)

5. Observe and Collect the data for a minute:

i.	Number of times a person breathes		ii.	Number of situps	
ii.	Number of times heart beats		iv.	Number of claps	
iii.	Number of times the eyes blink		vi.	Number of lines to write	
iv.	Distance by walking		viii.	Number of lines to read	
v.	Distance by running		x.	Number of Tamil verbs to say	

Challenge Problems

6. A squirrel wants to eat the grains quickly. Help the Squirrel to find the shortest way to reach the grains. (Use your scale to measure length of the line segments)



7. A room has a door whose measures are 1 m wide and 2 m 50 cm high.
   i. Can we take a bed of 2 m and 20 cm length and 90 cm wide into the room.?
8. A post office functions from 10 a.m to 5.45 p.m with a lunch break of 1 hour. If the post office works for 6 days a week, find the total duration of working hours in a week.
9. Seetha wakes up at 5.20 a.m. She spends 35 minutes to get ready and travels 15 minutes to reach the railway station. If the train departs exactly at 6:00 a.m, will Seetha catch the train?
10. A doctor advised Vairavan to take one tablet every 6 hours once in the 1st day and once every 8 hours on the 2nd and 3rd day. If he starts to take 9.30 a.m first dose. Prepare a time chart to take tablet in railway time.

Summary

- Basic metric units of length is metre, weight is gram and capacity (volume) is litre.
- Different unit measurements should be converted into same unit for addition and subtraction of units.
- **a.m** (ante meridiem) denotes the time that is after 12:00 midnight and before 12:00 noon.
- **p.m** (post meridiem) denotes the time that is after 12:00 noon and before 12:00 midnight.
- To convert 12 hour time to 24 hour time, add 12 to any hours 1 p.m to 11 p.m and change 12 a.m as 00:00 hours
- To convert given time greater than 12 in railway time to an ordinary time, subtract 12 from it.
- Ordinary and Railway time are the same in a.m and it is less than 12.
- In both the formats there is no change in minutes.
- A year which is divisible by 4 is considered as a leap year.
- A century year which is divisible by 400 is a leap year.

CHAPTER 3

BILL, PROFIT AND LOSS

9R31J7

Learning Objectives

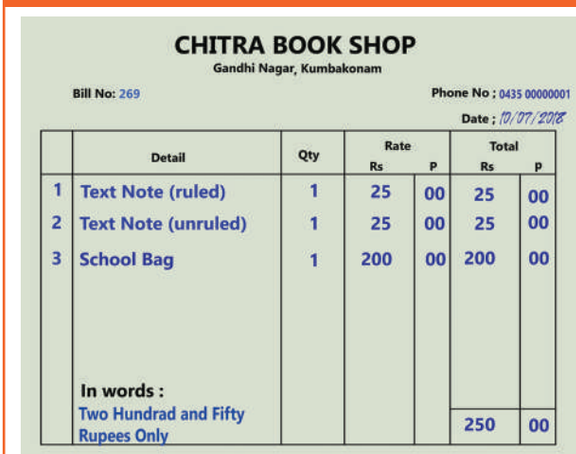
- To prepare a bill and verify the bill amount.
- To calculate profit and loss.
- To calculate Cost Price (C.P.), Selling Price (S.P.), Marked Price (M.P.) and Discount.

3.1 Introduction

As everyone cannot produce each and every commodity that he/she uses in the day-to-day life, one has to buy them from companies, firm, stores, shops or individuals. In all these activities, business takes place. So, business is an organised effort of individuals to produce and sell the commodities that satisfies the needs of the society. Every business involves bills, profit, loss etc.

In this chapter, we are going to learn about the bills that we come across in everyday life. Also, we will learn about profit and loss in a transaction of a business.

MATHEMATICS ALIVE – BILL, PROFIT AND LOSS IN REAL LIFE



CHITRA BOOK SHOP
Gandhi Nagar, Kumbakonam

Bill No: 269 Phone No : 0435 00000001
Date : 10/07/2018

	Detail	Qty	Rate Rs	Rate P	Total Rs	Total P
1	Text Note (ruled)	1	25	00	25	00
2	Text Note (unruled)	1	25	00	25	00
3	School Bag	1	200	00	200	00
	In words : Two Hundrad and Fifty Rupees Only				250	00

An example of Bill

An example of Sale Counter

3.2 Bill

Kothai is getting ready for Term – II studies in her school. Her mother gives Kothai ₹300 to purchase the stationery items like note book, pen, pencil, geometry box etc. Kothai purchased some stationery items and brought home the following bill.

CASH BILL ABC STATIONERY MART, PERIYAR SALAI, ERODE				
Bill No. 75				Date : 20.04.2018
Sl. No.	Items	Quantity	Rate (in ₹)	Amount (in ₹)
1.	192 pages unruled note books	3	21	63
2.	Ink pen	2	35	70
3.	Pencil	2	15	30
4.	Eraser	1	5	5
5.	Geometry Box	1	52	52
	Total	9		220

From the above bill, Kothai understands that the bill has the following details.

1. Name of the shop.
2. Serial number of the bill.
3. Date on which the bill is produced.
4. The list of items purchased.
5. Cost of each item.
6. Total number of items purchased.
7. Amount paid for the purchase.
8. Tax details. You will learn in the higher classes.

After the purchase, she has some amount left with her. She wants to verify whether the expenses made by her are correct.

3.2.1 Verification of Bill

Kothai verifies the above bill as follows :

Item 1. 21 × 3 = 63 ✓
Item 2. 35 × 2 = 70 ✓
Item 3. 15 × 2 = 30 ✓
Item 4. 5 × 1 = 5 ✓
Item 5. 52 × 1 = 52 ✓
220 ✓

Think

If 55 bills are produced on a day, then which information is same on all the bills?

Kothai's father asks some questions about the bill and Kothai answers him as follows.

(i) How many notebooks are purchased ? 3

(ii) What is the cost of each pen ? ₹35

(iii) What is the amount paid for pencils ? ₹30

(iv) How much the shopkeeper will give you back if you give 3 currencies of ₹100 ? ₹80

Activity

Raise a few more questions on this bill.

3.2.2 Preparation of a Bill

Arivu purchased the following vegetables from a petty shop.

2 kg of Brinjal @ ₹12 per kg, 3 kg of Onion @ ₹16 per kg, 3 kg of Tomato @ ₹20 per kg and 2 kg of Potato @ ₹24 per kg.

The shopkeeper of a petty shop doesn't provide the bill. So, Arivu prepares the bill as follows, which helps him to verify whether he has paid correct amount for the purchase.

CASH BILL PQR VEGETABLE SHOP VIVEKANANDA STREET, TRICHY				
Bill No. 786				Date : 25.04.2018
Sl. No.	Items	Quantity (in kg)	Rate (in ₹)	Amount (in ₹)
1.	Brinjal	2	12	24
2.	Onion	3	16	48
3.	Tomato	3	20	60
4.	Potato	2	24	48
	Total			180

DO YOU KNOW?

@ represents "at the rate of"

Think

Will there be any change in the value of the bill if the columns 'Rate' and 'Quantity' are interchanged?

Example 1: Ramya purchases some make-up items and gets the following bill.

CASH BILL SHANTHI FANCY STORE				
Bill No. 100				Date : 15.05.2018
Sl. No.	Items	Rate (in ₹)	Quantity	Amount (in ₹)
1.	Hair clip	15 each	6	90
2.	Hair pin	10 each	4	40
3.	Ribbon	12 per m	3	36
4.	Handkerchief	25 each	2	50
	Total			216

Observe the bill and answer the following questions.

(i) What is the bill number?
(ii) Mention the date of the bill.
(iii) How many different items were purchased?
(iv) What is the cost of an hair clip?
(v) What is the total cost of the ribbon?

Solution :

(i) The bill number is 100.
(ii) The date of the bill is 15.05.2018.
(iii) There were four different items purchased.
(iv) The cost of 1 hair clip is ₹15.
(v) The total cost for the ribbon is ₹36.

Note

Most of the bills will have GST in them. GST stands for Goods and Services Tax, which is a single indirect tax in India which has been recently introduced to replace all other taxes like Service Tax, VAT, etc. The GST is imposed at various rates on various items. The GST is of two types. They are Central GST (CGST) and State GST (SGST).

Example 2: Prepare a bill for the following purchases at Aavin sales counter in Coimbatore on 25-06-2018 bearing the Bill number 160.

1. 5 packets Milk Khoa of 100 gm @ ₹40 each
2. 5 packets of Butter Milk @ ₹8 each
3. 6 packets Milk of 500ml @ ₹25 each
4. 5 packets Ghee of 100gm @ ₹40 each

Solution :

1.	Milk Khoa	⇒	5 × ₹40	= ₹200
2.	Butter Milk	⇒	5 × ₹ 8	= ₹ 40
3.	Milk	⇒	6 × ₹25	= ₹150
4.	Ghee	⇒	5 × ₹40	= ₹200
			Total	₹590

CASH BILL
AAVIN PARLOUR, COIMBATORE

Bill No. 160 Date : 25.06.2018

Sl. No.	Items	Rate (in ₹)	Quantity (packets)	Amount (in ₹)
1.	Milk Khoa	40/packet	5	200
2.	Butter milk	8/packet	5	40
3.	Milk	25/packet	6	150
4.	Ghee	40/packet	5	200
	Total			590

3.3 Profit and Loss

In our day-to-day life, we use many commodities like food, clothes, vehicles, books etc. Everything is produced by someone or by a team of people and sold directly to the people or through the dealers. When we buy anything, a dealer charges more than what the manufacturer charges. Because, the dealer invests some money to buy the goods, spends his time to bring them to his place and he wants to earn a bit more money than his investment. The excess money that the dealer collects from the people is called **gain** or **profit**. If he is in the situation of collecting less money than what he has paid to the manufacturer due to the urgent need of money or some other reason, he loses some money. This losing of money in his investment is called **loss**. This process of buying and selling goods involves either profit or loss. We shall discuss this in detail.

Cost Price (C.P.)

Think

The C.P. of a commodity differs from the manufacturer to the dealer or the shopkeeper. Why? Discuss.

A shopkeeper purchases goods from a manufacturer or a supplier. This is called Purchase Price. He also meets out the overhead expenses like transport charges, wages, etc. So, the **Cost Price (C.P.)** consists of the capital, the cost of raw materials, the labour charges for production, the electricity charges, the transport charges etc.

C.P. = Purchase price + Overhead expenses

For example, ABC Cars, the car manufacturing company buys raw materials for ₹2,00,000 per car, pays ₹70,000 to labourers, ₹15,000 towards electricity bill, ₹10,000 towards transports. Therefore, the Cost Price (C.P.) of a car produced is
₹2,00,000 + ₹70,000 + ₹15,000 + ₹10,000 = ₹2,95,000.

Note

The shopkeeper may require to spend some amount to bring the purchased commodities, like transport charges, wages to workers, toll fee etc., which come as part of "overhead expenses".

Marked Price (M.P.)

When a shopkeeper takes the goods from the dealer to his outlet for sales, he has to make profit in his business. So, he marks the price higher than the cost price of the goods. This price is called as **Tag price or Marked Price (M.P.)**.

In the above example, ABC cars likes to make ₹50,000 as its profit. So, it fixes up the Marked Price (M.P.) of the car as ₹2,95,000 + ₹50,000 = ₹3,45,000.

Discount

The reduction of cost on the Marked Price for the purpose of attracting the customers or some other reasons is called **Discount**.

To increase the sales, ABC cars is ready to reduce ₹5,000 to its customers, who is buying the car. Here the discount is ₹5,000.

Note

M.R.P. is Maximum Retail Price, which is fixed by the manufacturer. No commodity can be sold beyond this price.

Think

Which is greater M.P. or C.P?

Selling Price (S.P.)

The amount that a customer pays to a commodity, after availing the discount (wherever possible) is called as **Selling Price (S.P.)**.

The Marked Price of the car is ₹3,45,000. The S.P. of the car sold by ABC cars is ₹3,45,000 – ₹5,000 = ₹3,40,000. i.e., M.P. – Discount = S.P.

From the above discussion we can come to the following conclusions.

- If C.P. < S.P., there is Profit ⇒ Profit = S.P. – C.P.
- If C.P. > S.P., there is loss ⇒ Loss = C.P. – S.P.
- If C.P. = S.P., there is no profit or loss.
- Discount = M.P. – S.P. (or) S.P. = M.P. – Discount.
- If there is no discount, then M.P. = S.P.

Example 3: Fill up the appropriate boxes in the following table:

	C.P.	S.P.	Profit	Loss
(i)	₹50	₹60		
(ii)	₹70	₹60		
(iii)	₹100		₹20	
(iv)	₹80			₹15
(v)		₹70	₹25	
(vi)		₹100		₹30

Try these

Arrange in ascending order:
(i) C.P., M.P., Discount
(ii) M.P., S.P., Discount

Solution :

(i) C.P. < S.P. ⇒ Profit = S.P. – C.P. = ₹60 – ₹50 = ₹10

(ii) C.P. > S.P. ⇒ Loss = C.P. – S.P. = ₹70 – ₹60 = ₹10

(iii) Profit = S.P. – C.P.
⇒ ₹20 = S.P. – ₹100
⇒ S.P. = ₹20 + ₹100 = ₹120

(iv) Loss = C.P. – S.P.
⇒ ₹15 = ₹80 – S.P.
⇒ S.P. = ₹80 – ₹15 = ₹65

(v) Profit = S.P. – C.P.
⇒ ₹25 = ₹70 – C.P.
⇒ C.P. = ₹70 – ₹25 = ₹45

Think

Which is greater S.P. or M.P.?

(vi) Loss = C.P. – S.P.

$\Rightarrow$ ₹30 = C.P. – ₹100

$\Rightarrow$ C.P. = ₹30 + ₹100 = ₹130

Example 4: A table is bought for ₹4500 and sold for ₹4800. Find the profit or loss.

Solution:

C.P. = ₹4500

S.P. = ₹4800

Here, C.P. < S.P. $\Rightarrow$ Profit = S.P. – C.P.

= ₹4800 – ₹4500 = ₹300

Example 5: A fruit seller bought a basket of fruits for ₹500. During the transit some fruits were damaged. So, he was able to sell the remaining fruits for ₹480. Find the profit or loss in his business.

Solution :

C.P. = ₹500

S.P. = ₹480

Here, C.P. > S.P. $\Rightarrow$ Loss = C.P. – S.P. = ₹500 – ₹480 = ₹20

Example 6: Pari bought a Motor cycle for ₹55,000 and he gained ₹5500 on selling the same. What is the selling price of the motor cycle?

Solution :

C.P. = ₹55,000

Profit = ₹5,500

Profit = S.P. – C.P.

$\Rightarrow$ ₹5,500 = S.P. – ₹55,000

$\Rightarrow$ S.P.= ₹5,500 + ₹55,000 = ₹60,500

Example 7: Manimegalai purchased a house for ₹25,52,500 and spent ₹2,28,350 for its repair. She sold it for ₹30,52,000. Find her gain or loss.

Solution :

C.P. = ₹25,52,500 + ₹2,28,350 = ₹27,80,850

S.P. = ₹30,52,000.

C.P. < S.P. $\Rightarrow$ Profit = S.P. – C.P.= ₹30,52,000 – ₹27,80,850 = ₹2,71,150.

Example 8: A man bought 75 Mangoes for ₹300 and sold 50 Mangoes for ₹300. If he sold all the mangoes at the same price, find his profit or loss.

Solution :

If the man bought 75 Mangoes for ₹300 then, Cost Price of 1 Mango = 300/75 = ₹4

If 50 Mangoes were sold for ₹300 then, Selling Price of 1 Mango is 300/50 = ₹6

∴ Selling price of 75 Mangoes at the rate of ₹6 is 75 x 6 = ₹450

Selling Price > Cost Price

∴ Profit = Selling Price – Cost Price = 450 – 300 = ₹150

Example 9: A fruit seller bought a dozen apples for ₹84. 2 apples got rotten. If he has to get a profit of ₹16, find the S.P. of each apple.

Solution :

Cost price of 12 apples = ₹84.

Since 2 apples got rotten, the number of remaining apples = 10

Since profit is ₹16, Selling price of 10 apples = C.P. + Profit = ₹84 + ₹16 = ₹100

∴ Selling price of 1 apple = 100/10 = ₹10

Example 10: Wheat is being sold at ₹1550 per bag of 25 kg at a profit of ₹150. Find the cost price of the wheat bag.

Solution :

Selling price = ₹1550

Profit = ₹150

Profit = S.P. – C.P.

⇒ ₹150 = ₹1550 – C.P.

⇒ Cost price = ₹1550 – ₹150 = ₹1400

Example 11: Complete the following table.

Sl. No	C.P. in ₹	M.P. in ₹	S.P. in ₹	Discount in ₹	Profit in ₹	Loss in ₹
i	110	130		5		
ii	110	130		20		
iii		130		15	30	
iv		130		Nil		25
v		125		Nil	Nil	Nil
vi			350	50	100	Nil

Solution:

(i) C.P. = ₹110
M.P. = ₹130
Discount = ₹5
S.P. = M.P. – Discount
= ₹130 – ₹5
= ₹125
Profit = S.P. – C.P.
= ₹125 – ₹110
= ₹15

(ii) C.P. = ₹110
M.P. = ₹130
Discount = ₹20
S.P. = M.P. – Discount
= ₹130 – ₹20
= ₹110
C.P. = S.P. ⇒ No profit or No loss.

(iii) M.P. = ₹130
Discount = ₹15
S.P. = M.P. – Discount
= ₹130 – ₹15
= ₹115
Profit = ₹30
Profit = S.P. – C.P.
₹ 30 = ₹115 – C.P.
C.P. = ₹115 – ₹30
= ₹85

(iv) M.P. = ₹130
Loss = ₹25
S.P. = M.P. – Discount
= ₹130 – ₹0
= ₹130
Loss = C.P. – S.P.
₹25 = C.P. – ₹130
C.P. = ₹25 + ₹130
= ₹155

(v) M.P. = ₹125
Discount = ₹0
S.P. = M.P. – Discount
= ₹125 – ₹0
= ₹125
No profit / No loss
C.P. = S.P.
C.P. = ₹125

(vi) S.P. = ₹350
Discount = ₹50
Profit = ₹100
M.P. = S.P.+ Discount
= ₹350+₹50 = ₹400
Profit = S.P. – C.P.
₹100 = ₹350 – C.P.
C.P. = ₹350 – ₹100
= ₹250

Example 12: Barathan offers his customers a discount of ₹50 on each shirt and still makes a profit of ₹100 per shirt. What is the actual cost price of the shirt that is marked @ ₹800 ?

Solution :

Discount = ₹50

Profit = ₹100

M.P. = ₹800
S.P. = M.P. – Discount
= ₹800 – ₹50
= ₹750
Profit = S.P. – C.P.
₹100 = ₹750 – C.P.
C.P. = ₹750 – ₹100
= ₹650

Example 13: Raghu buys a chair for ₹3000. He wants to sell it at a profit of ₹500 after making a discount of ₹300. What is the M.P. of the chair?

Solution :

C.P. = ₹3000; Profit = ₹500; Discount = ₹300

S.P. = M.P. – Discount = M.P. – ₹300

Profit = S.P. – C.P.

₹500 = M.P. – ₹300 – ₹3000

M.P. = ₹500 + ₹300 + ₹3000 = ₹3800

Example 14: Mani buys a gift article for ₹1500. He wants to sell it at a profit of ₹150 on sales and he marks @ ₹1800. What is the discount that he will give to his customers?

Solution :

C.P. = ₹1500; Profit = ₹150; M.P. = ₹1800

S.P. = M.P. – Discount = ₹1800 – Discount

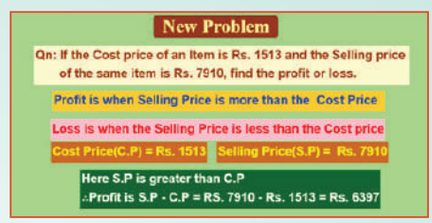
Profit = S.P. – C.P. ⇒ ₹150 = ₹1800 – Discount – ₹1500

Discount = ₹1800 – ₹1500 – ₹150 = ₹150

BILL, PROFIT and LOSS

ICT CORNER

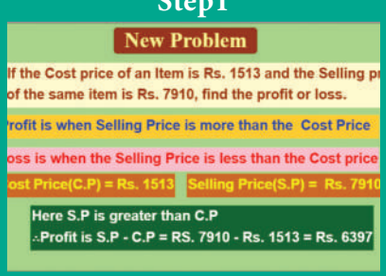
Expected Outcome



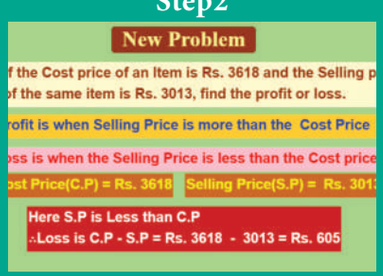
Step 1 Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Profit and Loss" will open. The work sheet contains two activities. Click on "New Problem to change the problem. Read the given problem carefully.

Step 2 Work out yourself and check whether the answer is correct.

Step1



Step2



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Browse in the link:

BILLS, PROFIT and LOSS: **https://ggbm.at/p7DZHP6K or Scan the QR Code.**

Exercise 3.1

1. A school purchases some furniture and gets the following bill.

CASH BILL MULLAI FURNITURE MART, THANJAVUR				
Bill No. 728				Date : 23.04.2018
Sl. No.	**Items**	**Quantity**	**Rate (in ₹)**	**Amount (in ₹)**
1.	Sitting bench	50	1200	60,000
2.	Writing desk	50	1500	75,000
3.	Black board	2	3000	6,000
4.	Chair	10	950	9,500
5.	Table	10	1750	17,500
	Total			1,68,000

Questions:

(i) What is the name of the store?

(ii) What is the serial number of the bill?

(iii) What is the cost of a black board?

(iv) How many sets of benches and desks does the school buy?

(v) Verify whether the total bill amount is correct.

9RBWKU

2. Prepare a bill for the following books of biographies purchased from Maruthu Book Store, Chidambaram on 12.04.2018 bearing the bill number 507.
10 copies of Subramanya Bharathiar @ ₹55 each, 15 copies of Thiruvalluvar @ ₹75 each, 12 copies of Veeramamunivar @ ₹60 each and 12 copies of Thiru.Vi.Ka @ ₹70 each.

3. Fill up the appropriate boxes in the following table.

Sl. No	C.P. in ₹	S.P. in ₹	Profit in ₹	Loss in ₹
(i)	100	120		
(ii)	110	120		
(iii)	120		20	
(iv)	100	90		
(v)	120		25	

4. Fill up the appropriate boxes in the following table.

Sl. No	C.P. in ₹	M.P. in ₹	S.P. in ₹	Discount in ₹	Profit in ₹	Loss in ₹
(i)	110	130		Nil		
(ii)	110	130		10		
(iii)	110	130		30		
(iv)	110	120			Nil	10
(v)		120		10	20	Nil

5. Rani bought a set of bangles for ₹310. Her neighbour liked it most. So, Rani sold it to her for ₹325. Find the profit or loss to Rani.
6. Sugan bought a Jeans pant for ₹750. It did not fit him. He sold it to his friend for ₹710. Find the profit or loss to sugan.
7. Somu bought a second hand bike for ₹28,000 and spent ₹2,000 on its repair. He sold it for ₹30,000. Find his profit or loss.
8. Muthu has a car worth ₹8,50,000 and he wants to sell it at a profit of ₹25,000. What should be the selling price of the car?
9. Valarmathi sold her pearl set for ₹30,000 at profit of ₹5000. Find the cost price of the pearl set.
10. If Guna marks his product to be sold for ₹325 and gives a discount of ₹30, then find the S.P.
11. A man buys a chair for ₹1500. He wants to sell it at a profit of ₹250 after making a discount of ₹100. What is the M.P. of the chair ?
12. Amutha marked her home product of pickle as ₹300 per pack. But she sold it for only ₹275 per pack. What was the discount offered by her per pack ?
13. Valavan bought 24 eggs for ₹96. Four of them were broken and also he had a loss of ₹36 on selling them. What is the selling price of one egg?
14. Mangai bought a cell phone for ₹12585. It fell down. She spent ₹500 on its repair. She sold it for ₹7500. Find her profit or loss.

Objective Type Questions

15. Discount is subtracted from _____ to get S.P.
    (a) M.P. (b) C.P. (c) Loss (d) Profit
16. 'Overhead expenses' is always included in _____.
    (a) S.P. (b) C.P. (c) Profit (d) Loss
17. There is no profit or loss when
    (a) C.P. = S.P. (b) C.P > S.P. (c) C.P < S.P. (d) M.P. = Discount
18. Discount = M.P. – .....
    (a) Profit (b) S.P. (c) Loss (d) C.P.

Exercise 3.2

Miscellaneous Practice Problems

1. A shopkeeper buys three articles for ₹325, ₹450 and ₹510. He is able to sell them for ₹350, ₹425 and ₹525 respectively. Find the gain or loss to the shopkeeper on the whole.
2. A stationery shop owner bought a scientific calculator for ₹750. He had put a battery worth ₹100 in it. He had spent ₹50 for its outer pouch. He was able to sell it for ₹850. Find his profit or loss.
3. Nathan paid ₹800 and bought 10 bottles of honey from a village vendor. He sold them in a city for ₹100 per bottle. Find his profit or loss.
4. A man bought 400 metre of cloth for ₹60,000 and sold it at the rate of ₹400 per metre. Find his profit or loss.

Challenge Problems

5. A fruit seller bought 2 dozen bananas at ₹20 a dozen and sold them at ₹3 per banana. Find his gain or loss.
6. A store purchased pens at ₹216 per dozen. He paid ₹58 for conveyance and sold the pens at the discount of ₹2 per pen and made a overall profit of ₹50. Find the M.P. of each pen.
7. A vegetable vendor buys 10 kg of tomatoes per day at ₹10 per kg, for the first three days of a week. 1 kg of tomatoes got smashed on everyday for those 3 days. For the remaining 4 days of the week he buys 15 kg of tomatoes daily at ₹8 per kg. If for entire week he sells tomatoes at ₹20 per kg, then find his profit or loss for the week.
8. An electrician buys a used T.V. for ₹12,000 and a used Fridge for ₹11,000. After spending ₹1000 on repairing the T.V. and ₹1500 on painting the Fridge, he fixes up the M.P. of T.V. as ₹15,000 and that of Fridge as ₹15,500. If he gives ₹1000 discount on each find his profit or loss.

Summary

- Every bill of a purchase of goods contains the name of the shop from which the goods are purchased, the serial number, the date, the number of items, the rate, the amount of each item and the total amount of the bill etc.
- Selling Price (S.P.) is the price at which an item is sold.
- Profit is the difference between S.P. and C.P., when S.P. > C.P.
- Loss is the difference between C.P and S.P, when C.P. > S.P.
- Discount = M.P. – S.P. $\Rightarrow$ S.P. = M.P. – Discount.

CHAPTER 4

GEOMETRY

9RKSMH

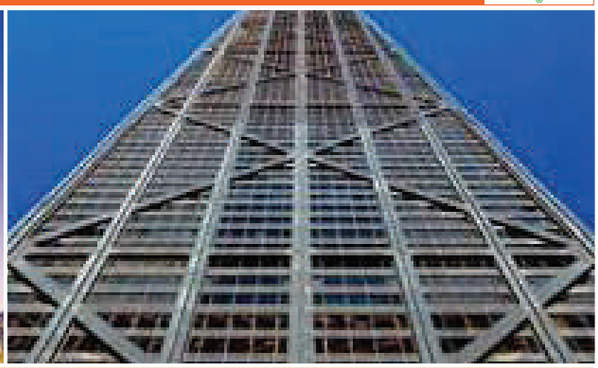
Learning Objectives

- To understand the formation of triangles and the basic elements of a triangle.
- To know the types of triangles and their properties.
- To draw parallel and perpendicular lines using a set square.

4.1 Introduction

We already studied the basic geometrical concepts such as angles and its types, drawing line segments, drawing and measuring angles in the first term. In this term, we will study triangles and their types, construction of parallel and perpendicular lines to a given line segment.

MATHEMATICS ALIVE – TRIANGLES IN REAL LIFE



The triangle is used in most types of construction work including bridges, buildings, cell-phone towers, aeroplane wings and pitched roofs. Its use in construction gives an object the quality of stiffness, resulting in rigid and strong structures.

Think about the situation:

A teacher distributes 2, 3, 4 and 5 sticks of equal lengths to four students and asks them to form a closed figure. Three students make the following figures.

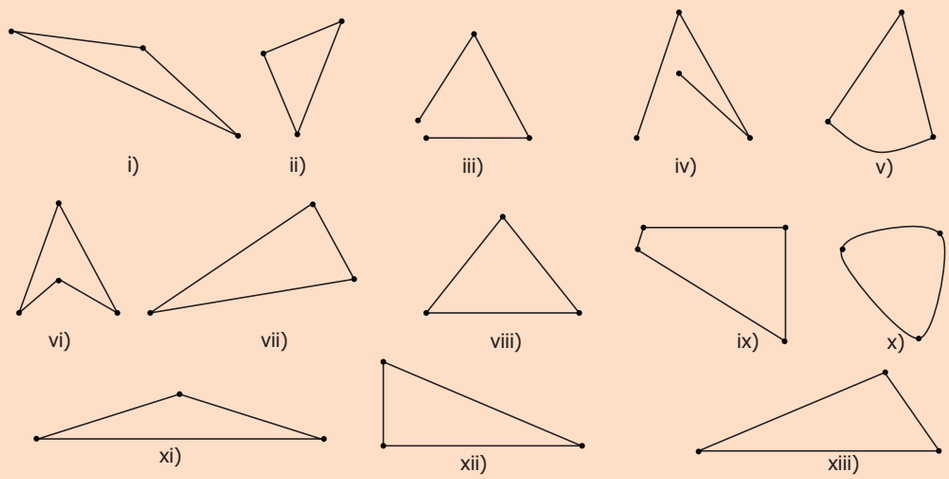
But one of the students who has 2 sticks with him creates the following figure.

He is not able to create a closed figure. Do you know why? Can you guess the least number of sticks required to form a closed figure? Three sticks. If you had formed a closed figure with three sticks, then what shape would you get? Is there any special name for it? Yes. Its ***triangle.***

A closed figure formed by three line segments is called a triangle.

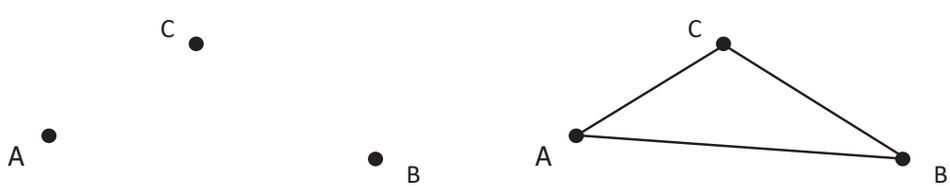
Activity

Classify the given shapes into triangles and non triangles.



4.2 Basic Elements of a Triangle

Mark 3 points A, B, C on a paper, such that they do not lie on a straight line. Join the line segments AB, BC and CA.

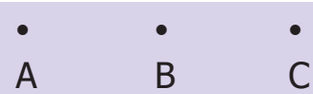


This forms a ***triangle ABC*** represented as ***△ ABC or △BCA or △CAB.***

In △ ABC, the line segments **AB, BC** and **CA** are called the ***sides of the triangle*** and **∠CAB, ∠ABC** and **∠BCA (∠A, ∠B & ∠C)** are called the ***angles of the triangle.*** The point of intersection of two sides of the triangle is called the ***vertex.*** **A, B** and **C** are ***three vertices of Δ ABC.*** Hence, ***a triangle has 3 sides, 3 angles and 3 vertices.***

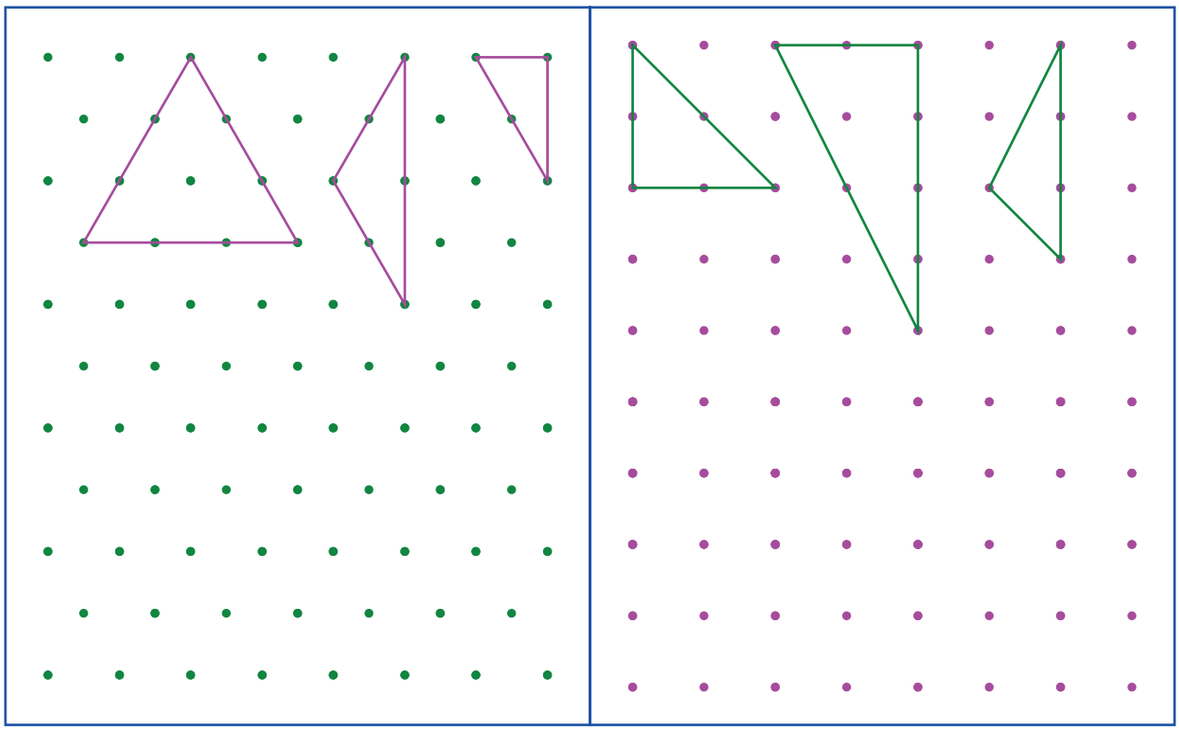
Think

Can a triangle be drawn using 3 points on a straight line?



4.3 Types and Properties of Triangles

Some triangles are drawn in the dotted sheet. Try to draw as many triangles as you can. Then, measure the sides and angles of all triangles and fill the table given below



S. No	Measure of angles	Sum of the measure of angles	Nature of angles	Measure of sides	Nature of Sides
1	60° , 60°, 60°	180°	Three angles are equal	3 cm, 3 cm, 3cm	Three sides are equal

From the table, we observe the following:

In a triangle,

- If the measure of all angles are different, then all sides are different.
- If the measure of two angles are equal, then two sides are equal.
- If the measure of three angles are equal, then three sides are equal and each angle measures 60°.
- Sum of three angles of a triangle is 180°.

Activity

Students are divided into groups and each group is given 3 sticks of length 9 units, 2 sticks of length 3 units, 2 sticks of length 2 units, 1 stick of length 5 units and 1 stick of length 4 units. Using the given sticks they are asked to form three triangles, find the length of the sides of each triangle and tabulate them.

Triangle	Length of side 1	Length of side 2	Length of side 3	All sides are equal / 2 sides are equal / 3 sides are different
1				
2				
3				

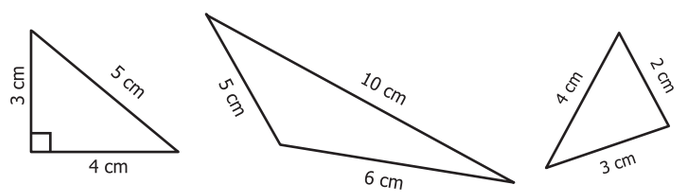
Read the table and answer the following questions.

1. Was each group able to form 3 triangles?
2. In each of the triangle formed, how many sides are equal?

4.3.1 Types of triangle based on its sides

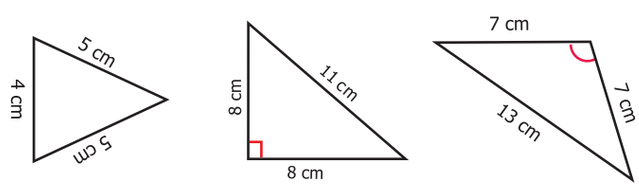
i) If three sides of a triangle are different in lengths, then it is called a ***Scalene Triangle***

Examples:



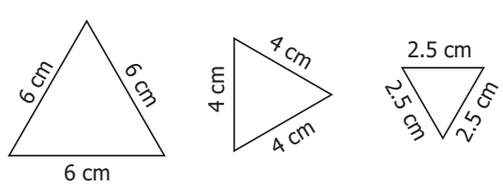
ii) If any two sides of a triangle are equal in length, then it is called an ***Isosceles Triangle***

Examples:



iii) If three sides of a triangle are equal in length, then it is called an ***Equilateral Triangle***

Examples:



Thus, based on the sides of triangles, we can classify triangles into 3 types.

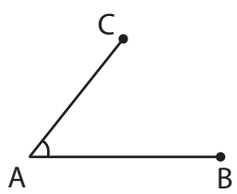
Try these

Complete the following table. In any triangle,

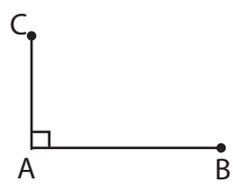
Sl. No	Side 1	Side 2	Side 3	Type of Triangle
1.	6cm	7cm	8cm	Scalene Triangle
2.	5cm	5cm	5cm	
3.	2.2cm	2.5cm	3.2cm	
4.	7cm	7cm	10cm	
5.	10cm	10cm	10cm	
6.	10cm	8cm	8cm	

4.3.2 Types of triangle based on its angles

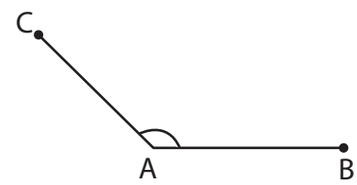
Write the given angles as acute, obtuse or right angle formed by two line segments AB and AC



∠A is _____

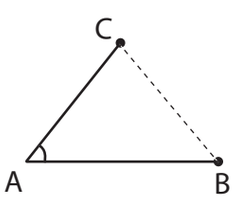


∠A is _____



∠A is _____

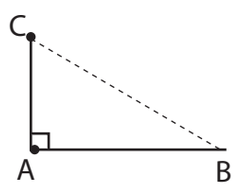
Now, join the third side to form a triangle in each case and identify the kinds of angles and list them down.



∠A is _____

∠B is _____

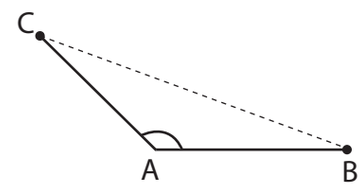
∠C is _____



∠A is _____

∠B is _____

∠C is _____



∠A is _____

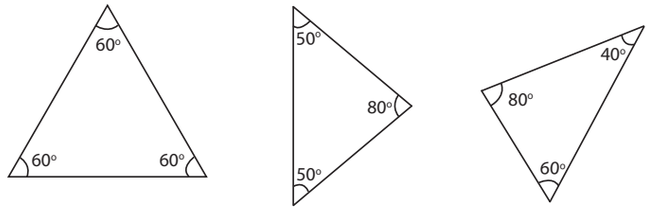
∠B is _____

∠C is _____

Now carefully look at these three triangles,

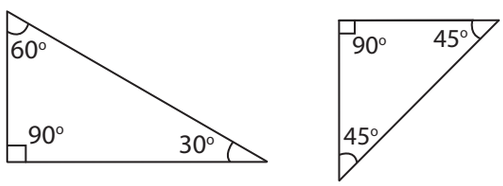
i) If three angles of a triangle are acute angles (between 0° and 90°), then it is called an ***Acute Angled Triangle.***

Examples:



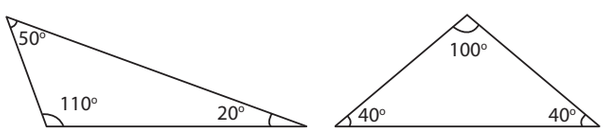
ii) If an angle of a triangle is a right angle (90°), then it is called a ***Right Angled Triangle.***

Examples:



iii) If an angle of a triangle is an obtuse angle (between 90° and 180°),then it is called an ***Obtuse Angled Triangle.***

Examples:



Thus, based on the angles of triangles, we can classify triangles into 3 types.

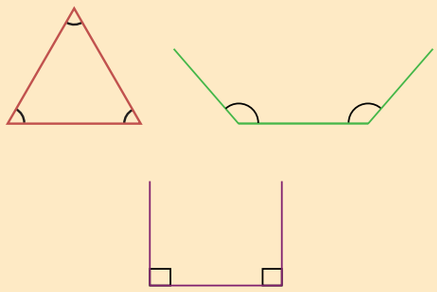
Try these

Complete the table

S.No.	∠ A	∠ B	∠ C	Sum of three angles	Can a △ABC be formed?	Type of Triangle
1	60°	60°	60°	180°	Yes	Acute angled triangle
2	50°	40°	90°			
3	60°	30°	90°			
4	95°	40°	35°			
5	110°	40°	30°			
6	150°	60°	70°			

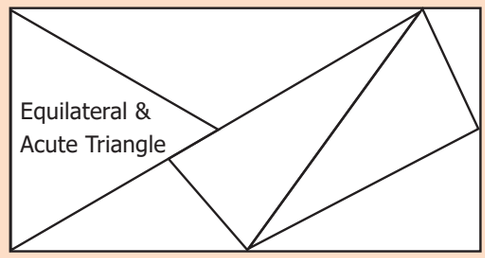
DO YOU KNOW?

A triangle can have three acute angles, but cannot have more than one right angle or an obtuse angle.



Activity

In the given figure, there are some triangles. Measure their sides and angles and name them in two ways. (One is done for you!)



4.3.3 Triangle Inequality property

Think about the situation:

Three students Kamala, Madhan and Sumathi are asked to form triangles with the given sticks of measure **6cm, 8cm, 5cm; 4cm, 10cm, 5cm** and **10cm, 6cm, 4cm** respectively. All of them try to form a triangle. While Kamala, the first girl is successful in forming a triangle, Madhan and Sumathi, next to Kamala are struggling. Why?

When they are trying to join the ends of the two smaller sticks, they find that the two smaller sticks coincide with the longer stick or shorter than the longer stick and they are unable to form triangles. From this, they understand that,

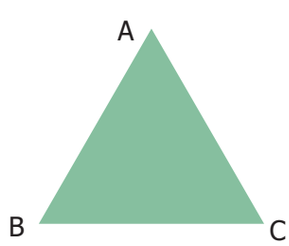
To form a triangle the sum of two smaller sides must be greater than the third side. Thus,

In a triangle, the sum of any two sides of a triangle is greater than the third side. This is known as Triangle Inequality property.

$AB + BC > CA$

$BC + CA > AB$

$CA + AB > BC$



Note

If three sides are equal in length, then definitely a triangle can be formed

DO YOU KNOW?

If any two sides of the triangle are given, then the length of the third side will lie between the difference and sum of the lengths of two given sides.

Example 1: Can a triangle be formed with 7 cm, 10 cm and 5 cm as its sides?

Solution: Instead of checking triangle inequality by all the sides in the triangle, check only with two smaller sides.

Sum of two smaller sides of the triangle = 5+7=12 cm > 10 cm, the third side.

It is greater than the third side.

So, a triangle can be formed with the given sides.

Example 2: Can a triangle be formed with 7 cm, 7 cm and 7 cm as its sides?

Solution: If three sides are equal, then definitely a triangle can be formed, as the triangle inequality is satisfied.

Example 3: Can a triangle be formed with 8 cm, 3 cm and 4 cm as its sides?

Solution: The sum of two smaller sides = 3+4=7 cm <8 cm, the third side.

It is less than the third side.

So, a triangle cannot be formed with the given sides.

Try these

Can a triangle be formed with the given sides? If yes, state the type of triangle formed.

S.No.	$\overline{AB}$	$\overline{BC}$	$\overline{CA}$	Can a ΔABC be formed?	Type of triangle
1	7 cm	10 cm	6 cm		
2	10 cm	8 cm	8 cm		
3	8.5 m	7.3 m	6.8 m		
4	4 cm	5 cm	12 cm		
5	15 m	20 m	20 m		
6	23 cm	20 cm	18 cm		
7	3.2 cm	1.5 cm	1.5 cm		

Example 4: Can a triangle be formed with the angles 80°, 30°, 40°?

Solution: The sum of three angles = 80°+ 30°+ 40° = 150° **(not equal to 180°)**

In a triangle, the sum of three angles is 180°.

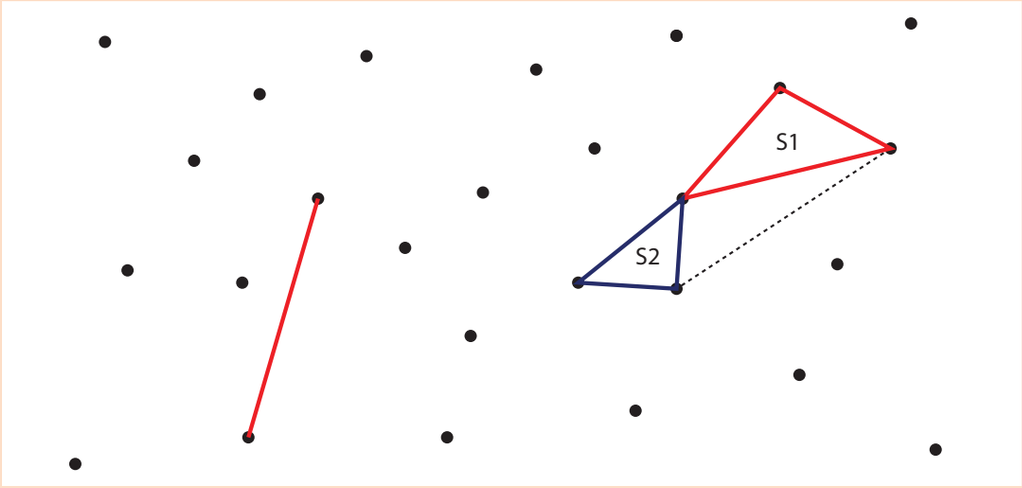
So, a triangle cannot be formed with the given angles.

Think

Can the difference between two larger sides be less than the third side?

Activity

A triangle game : In each turn a student must draw one line connecting two dots. A line should not cross other lines or touch other dots than the two that are connected to. If a student closes a triangle with his line then he gets a point. Once there are no more lines that can be drawn the game is over and the student who gains more points wins the game.



Think

In a right angled triangle, what measures can the other two angles have?

Exercise 4.1

1. Fill in the blanks:

a) Every triangle has at least _____ acute angles.

b) A triangle in which none of the sides equal is called a _____.

c) In an isosceles triangle _____angles are equal.

d) The sum of three angles of a triangle is _____.

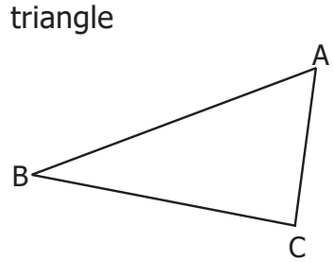
e) A right angled triangle with two equal sides is called _____.

2. Match the following:

(i)	No sides are equal	-	Isosceles triangle
(ii)	One right angle	-	Scalene triangle
(iii)	One obtuse angle	-	Right angled triangle
(iv)	Two sides of equal length	-	Equilateral triangle
(v)	All sides are equal	-	Obtuse angled triangle

9RUNP5

3. In ΔABC, name the

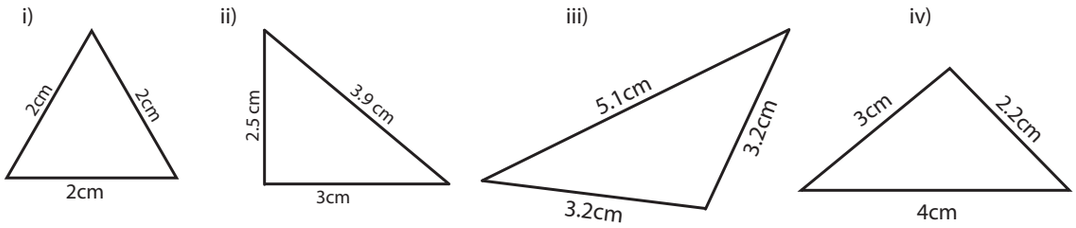


a) Three sides: _____ , _____ , _____

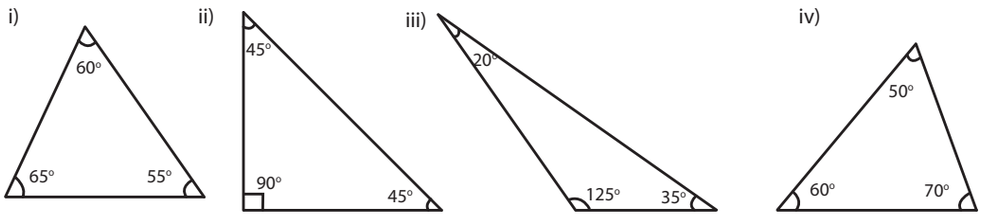
b) Three Angles: _____ , _____ , _____

c) Three Vertices: _____ , _____ , _____

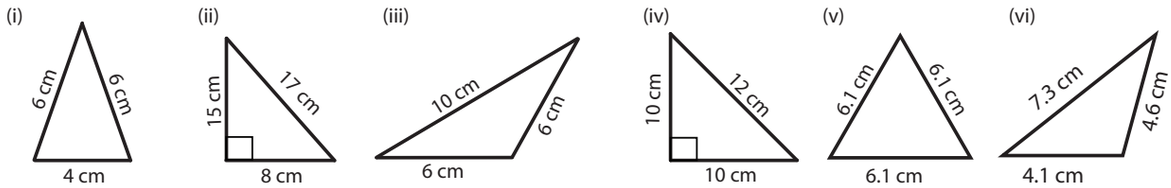
4. Classify the given triangles based on its sides as scalene, isosceles or equilateral.



5. Classify the given triangles based on its angles as acute angled, right angled or obtuse angled.



6. Classify the following triangles based on its sides and angles.



7. Can a triangle be formed with the following sides? If yes, name the type of triangle.

(i) 8 cm, 6 cm, 4 cm (ii) 10 cm, 8 cm, 5 cm

(iii) 6.2 cm, 1.3 cm, 3.5 cm (iv) 6 cm, 6 cm, 4 cm

(v) 3.5 cm, 3.5 cm, 3.5 cm (vi) 9 cm, 4 cm, 5 cm

8. Can a triangle be formed with the following angles? If yes, name the type of triangle.

(i) 60°, 60°, 60° (iii) 60°, 40°, 42° (v) 70°, 60°, 50°

(ii) 90°, 55°, 35° (iv) 60°, 90°, 90° (vi) 100°, 50°, 30°

9. Two angles of the triangles are given. Find the third angle.

(i) 80°, 60° (iii) 52°, 68° (v) 120°, 30°

(ii) 75°, 35° (iv) 50°, 90° (vi) 55°, 85°

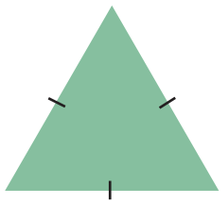
10. I am a closed figure with each of my three angles is 60°. Who am I?

11. Using the given information, write the type of triangle in the table given below

S.No.	∠1	∠2	∠3	Type of triangle based on angles	Type of triangle based on sides
i.	60°	40°	80°	Acute angled triangle.	Scalene Triangle
ii.	50°	50°	80°		
iii.	45°	45°	90°		
iv.	55°	45°	80°		
v.	75°	35°	70°		
vi.	60°	30°	90°		
vii.	25°	64°	91°		
viii.	120°	30°	30°		

Objective Type Questions

12. The given triangle is_____.



a) a right angled triangle b) an equilateral triangle

c) a scalene triangle d) an obtuse angled triangle

13. If all angles of a triangle are less than a right angle, then it is called _____.

a) an obtuse angled triangle b) a right angled triangle

c) an isosceles right angled triangle d) an acute angled triangle

14. If two sides of a triangle are 5 cm and 9 cm, then the third side is_____.

a) 5 cm b) 3 cm c) 4 cm d) 14 cm

15. The angles of a right angled triangle are

a) acute, acute, obtuse b) acute, right, right

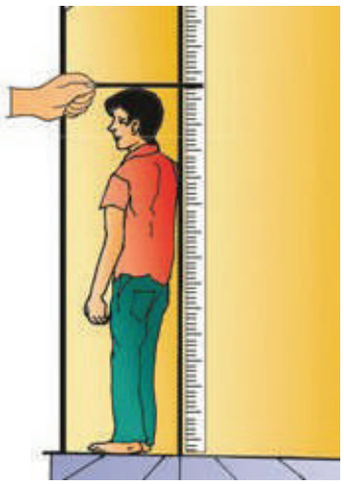
c) right, obtuse, acute d) acute, acute, right

16. An equilateral triangle is

a) an obtuse angled triangle b) a right angled triangle

c) an acute angled triangle d) a scalene triangle

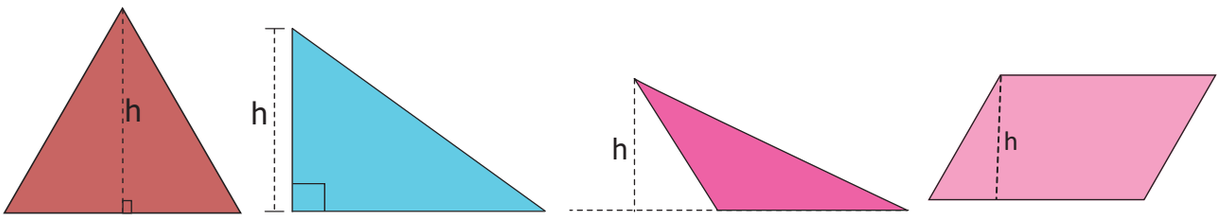
4.4 Construction of Perpendicular Lines



4.4.1 Introduction

Have you ever noticed that the wall and floor are always perpendicular to each other? So, to measure our heights, we make use of scale represented on the walls as shown in the figure.

In Geometry, to measure the height of figures, we use perpendicular lines .Using a set square, find the height of the given figures.



h=_____cm h=_____cm h=_____cm h=_____cm

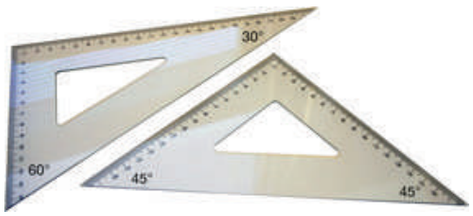
Let us learn to construct perpendicular lines by using set square.

4.4.2 Set Squares

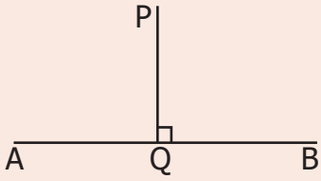
The set squares are two triangle shaped instruments in the Geometry Box. Each of them has a right angle. One set square has the angles 30°, 60°, 90° and the other set square has the angles 45°, 45°, 90°. The perpendicular edges are graduated in centimetres.

Set squares have several uses:

- To construct the specific angles 30°, 45°, 60°, 90°
- To draw parallel and perpendicular lines
- To measure the height of the shapes

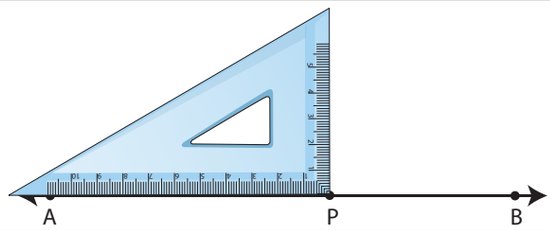
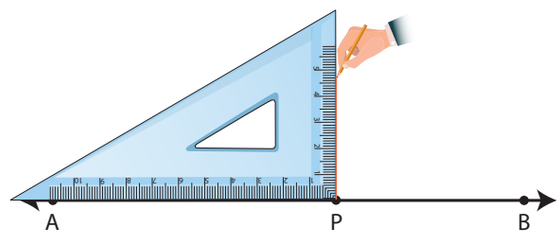
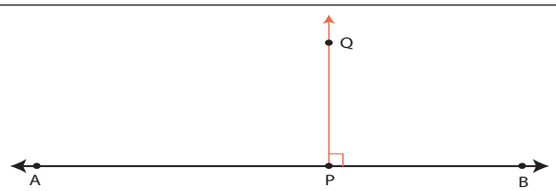


DO YOU KNOW?

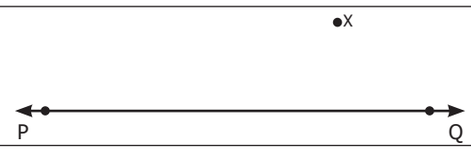
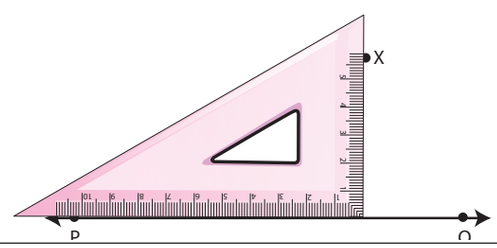
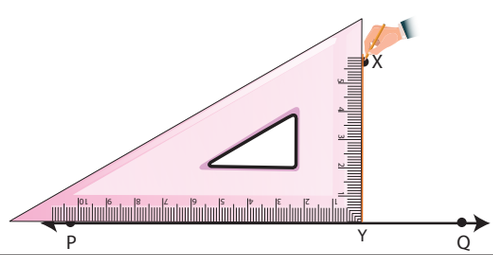
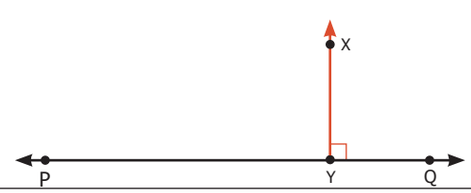


If the perpendicular from P meets AB at Q, the point Q is called the foot of the perpendicular from P to AB and the symbol "⊥" means "is perpendicular to". i.e., PQ ⊥ AB

Example 5: Construct a line perpendicular to the given line at a point on the line.

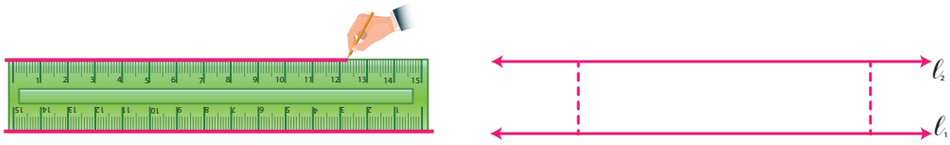
Step 1: Draw a line AB and take a point P anywhere on the line.	
Step 2: Place the set square on the line in such a way that the vertex which forms right angle coincides with P and one arm of the right angle coincides with the line AB.	
Step 3: Draw a line PQ through P along the other arm of the right angle of the set square.	
Step 4: The line PQ is perpendicular to the line AB at P. That is, PQ ⊥ AB and ∠APQ= ∠BPQ=90°.	

Example 6: Construct a line perpendicular to the given line through a point above it.

Step 1: Draw a line PQ. Take a point X anywhere above the line PQ.	
Step 2: Place one of the arms of the right angle of a set square along the line PQ and the other arm of its right angle touches the point X.	
Step 3: Draw a line through the point X meeting PQ at Y.	
Step 4: The line XY is perpendicular to the line PQ at Y. That is, XY ⊥ PQ	

4.5 Construction of Parallel Lines

Place a scale on a paper and draw lines along both the edges of the scale as shown.



Place the set square at two different points on ℓ_1 and find the distance between ℓ_1 and ℓ_2. Are they equal? Yes. Thus, the perpendicular distance between a set of parallel lines remains the same.

Note

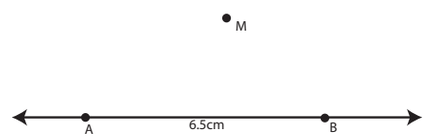
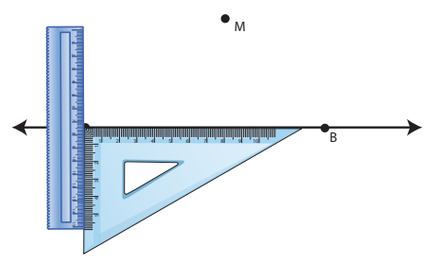
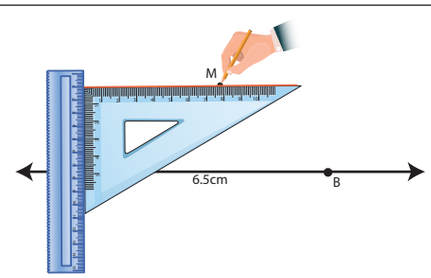
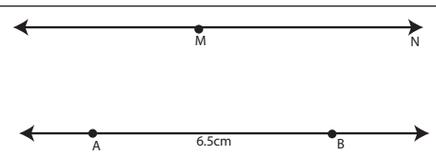
Parallel line segments need not be of equal length

Think

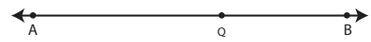
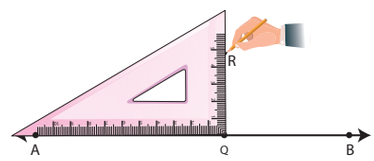
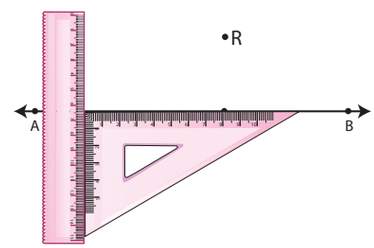
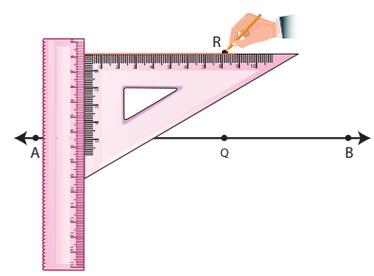
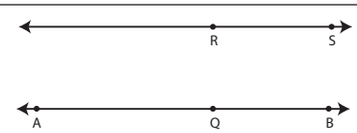
Identify the parallel lines in English alphabets (Capital Letters) and list the letters.

Examples: E W

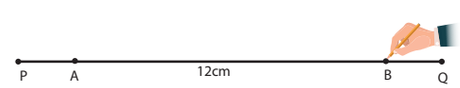
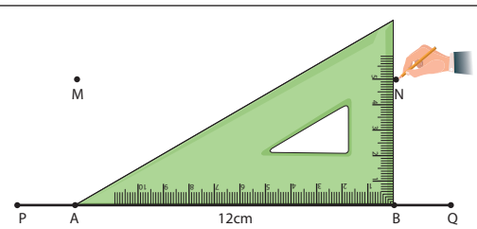
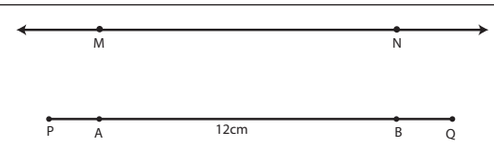
Example 7: Draw a line segment AB = 6.5 cm and mark a point M above it. Through M draw a line parallel to AB.

Step 1: Draw a line. Mark two points A and B on the line such that AB = 6.5 cm. Mark a point M anywhere above the line.	
Step 2: Place the set square below AB in such a way that one of the edges that form a right angle lies along AB. Place the scale along the other edge of the set square as shown in the figure.	
Step 3: Holding the scale firmly, Slide the set square along the edge of the scale until the other edge of the set square reaches the point M. Through M draw a line as shown.	
Step 4: The line MN is parallel to AB. That is, MN ∥ AB	

Example 8: Draw a line and mark a point R at a distance of 4.8 cm above the line. Through R draw a line parallel to the given line.

Step 1: Using a scale draw a line AB and mark a point Q on the line.	
Step 2: Place the set square in such a way that the vertex of the right angle coincides with Q and one of the edges of right angle lies along AB. Mark the point R such that QR = 4.8 cm.	
Step 3: Place the scale and the set square as shown in the figure.	
Step 4: Hold the scale firmly and slide the set square along the edge of the scale until the other edge touches the point R. Draw a line RS through R.	
Step 5: The line RS is parallel to AB. That is, RS ∥ AB.	

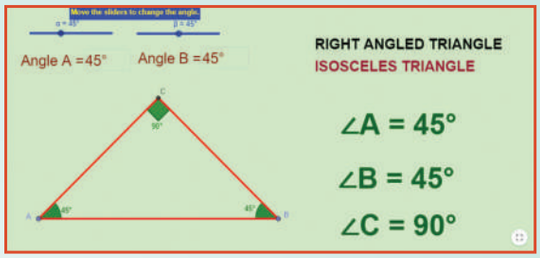
Example 9: Draw a line segment PQ = 12 cm. Mark two points M, N at a distance of 5 cm above the line segment PQ. Through M and N draw a line parallel to PQ.

Step 1: Using a scale, draw a line segment PQ = 12 cm. Mark two points A and B on the line segment.	
Step 2: Using the set square as shown, mark points M and N such that AM = BN = 5 cm.	
Step 3: Using the scale, join M and N. MN is parallel to PQ. That is, MN ∥ PQ.	

GEOMETRY

ICT CORNER

Expected Outcome



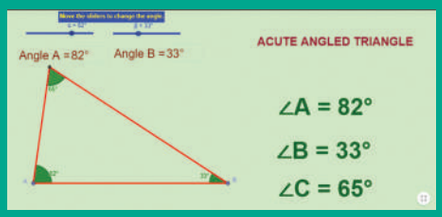
Step 1

Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Geometry" will open. The work sheet contains three activities. 1. Types of triangles, 2. Perpendicular line construction and 3. Parallel line construction.

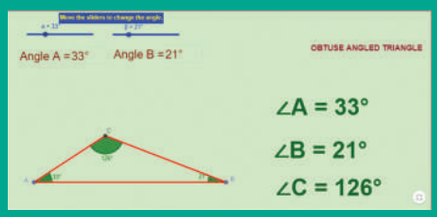
In the first activity move the sliders or enter the angle to change the Angles of the triangle and check what type of triangle is it and compare with the angles.

Step 2

In the second and third activity you can learn how to draw Perpendicular and parallel lines through a Video.



Step1



Step1

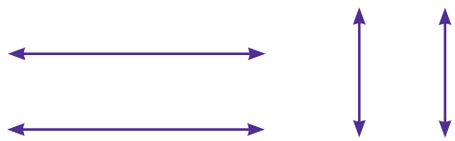
Browse in the link:

Geometry: https://ggbm.at/dPXHSSTF or Scan the QR Code.

B442_MAT_6_T2_EM

Exercise 4.2

1. Draw a line segment AB = 7 cm and mark a point P on it. Draw a line perpendicular to the given line segment at P.
2. Draw a line segment LM = 6.5 cm and take a point P not lying on it. Using a set square construct a line perpendicular to LM through P.
3. Find the distance between the given lines using a set square at two different points on each of the pairs of lines and check whether they are parallel.

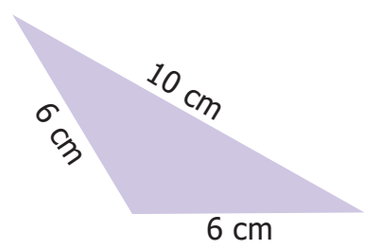


4. Draw a line segment measuring 7.8 cm. Mark a point B above it at a distance of 5 cm. Through B draw a line parallel to the given line segment.
5. Draw a line and mark a point R below it at a distance of 5.4 cm Through R draw a line parallel to the given line.

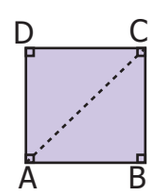
Exercise 4.3

Miscellaneous Practice Problems

1. What are the angles of an isosceles right angled triangle?
2. Which of the following correctly describes the given triangle?
   (a) It is a right isosceles triangle.
   (b) It is an acute isosceles triangle.
   (c) It is an obtuse isosceles triangle.
   (d) It is an obtuse scalene triangle.



3. Which of the following is not possible?
   (a) An obtuse isosceles triangle (b) An acute isosceles triangle
   (c) An obtuse equilateral triangle (d) An acute equilateral triangle
4. If one angle of an isosceles triangle is 124°, then find the other angles.
5. The diagram shows a square ABCD. If the line segment joins A and C, then mention the type of triangles so formed.



6. Draw a line segment AB of length 6 cm. At each end of this line segment AB, draw a line perpendicular to the line AB. Are these lines parallel?

Challenge Problems

7. Is a triangle possible with the angles 90°, 90° and 0°? Why?
8. Which of the following statements is true? Why?
   (a) Every equilateral triangle is an isosceles triangle.
   (b) Every isosceles triangle is an equilateral triangle.

9. If one angle of an isosceles triangle is 70°, then find the possibilities for the other two angles.

10. Which of the following can be the sides of an isosceles triangle?

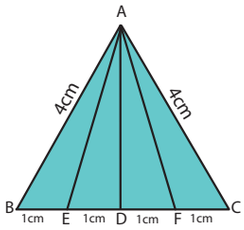
a) 6cm, 3cm, 3cm b) 5cm, 2cm, 2cm c) 6cm, 6cm, 7cm d) 4cm, 4cm, 8cm

11. Study the given figure and identify the following triangles.

(a) equilateral triangle (b) isosceles triangles

(c) scalene triangles (d) acute triangles

(e) obtuse triangles (f) right triangles



12. Two sides of the triangle are given in the table. Find the third side of the triangle.

Sl. No.	Side - 1	Side - 2	The length of the third side (any three measures)
i.	7 cm	4 cm	
ii.	8 cm	8 cm	
iii.	7.5 cm	3.5 cm	
iv.	10 cm	14 cm	

13. Complete the following table:

Types of Triangle / Its Angles	Acute angled triangle	Right angled triangle	Obtuse angled triangle
Any two angles	Always acute angles	i.	Always acute angles
Third angle	ii.	Right angle	iii.

Summary

- A closed figure formed by three line segments is called a triangle.
- A triangle has 3 sides, 3 angles and 3 vertices.
- Based on the sides of triangles, we can classify triangles into 3 types as scalene triangle, isosceles triangle and equilateral triangle.
- Based on the angles of triangles, we can classify triangles into 3 types as acute angled triangle, right angled triangle and obtuse angled triangle.
- In a triangle, the sum of any two sides is greater than the third side. This is known as Triangle Inequality property.
- Sum of three angles of a triangle is 180°.
- Parallel and Perperndicular lines can easily be drawn using set squares.
- The distance between a set of parallel lines always remains the same.

CHAPTER 5

INFORMATION PROCESSING

9S4JQS

Learning Objectives

- To know how to represent numerical and algebraic expressions by tree diagrams.
- To know how to write numerical and algebraic expressions from tree diagrams.

5.1 Introduction

In today's digital era, it is almost impossible to imagine a day without computers. Right from small shops to big software companies, the use of computers is inevitable. If there are no computers, most of the works will be stopped. Computers are able to find solutions even for complicated numerical expression and algebraic expression in quick and easy way. The answer given by the computer will be very precise and need not to be recalculated. There will be a question, how the computer read these expression?

Yes, Computers use **Tree diagram** to perform billions of operations in a uniform way and gives the answer. In this chapter we will learn about the **Tree diagram for both numeric and algebraic expressions**.

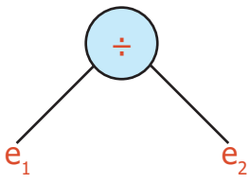
MATHEMATICS ALIVE – INFORMATION PROCESSING IN REAL LIFE

Information process in the Human Brain

Information process in computer

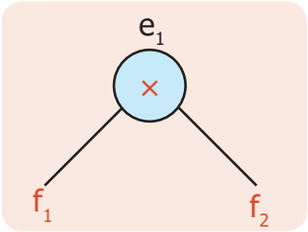
Consider the numerical expression [(9 − 4)×8] ÷ [(8+2)×3]. We can try to understand the expression in a better way through the tree diagram.

1) Let us consider e_1 = (9 − 4)×8, e_2 = (8+2)×3 we get



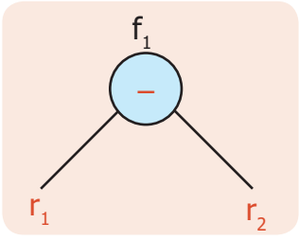
2) $e_1 = f_1 \times f_2$

Where, $f_1 = 9 - 4$ and $f_2 = 8$



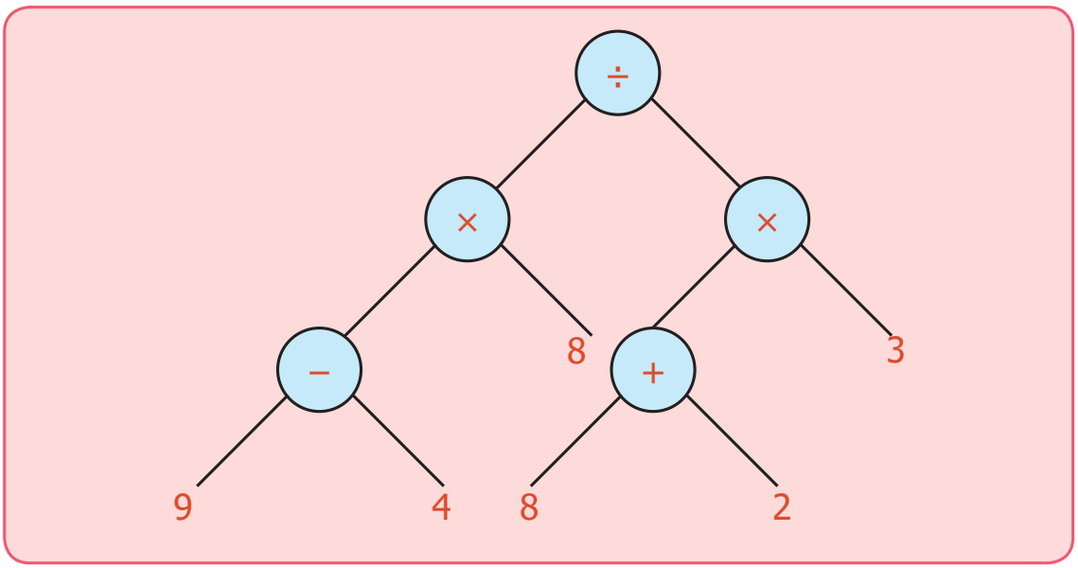
3) $f_1 = r_1 - r_2$ where $r_1 = 9$ and $r_2 = 4$.

f_1 is represented as:



Similarly, the trees can be developed from e_2.

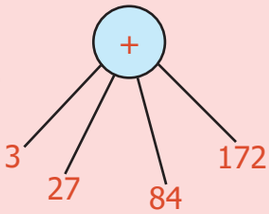
4) Putting all together, we get the following tree diagram



It is a picture which look like an upside-down tree! Every node has one or two branches. And the leaves are numbers. The branching nodes have operations on them. It is called **tree diagram** and the tree diagrams are general ways of representing arithmetical expressions. Here trees are drawn upside down.

The root is at the top, the leaves are at the bottom. Since all the arithmetical operations are binary (Involving two numbers) we have only 2 way branching in the tree.

Can you represent the addition of four numbers in the same way?
Yes, there is a way for addition of 4 numbers.



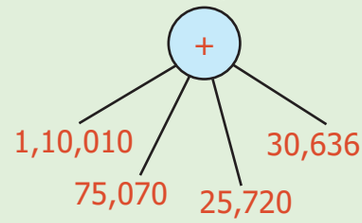
Let us learn how to represent the statement problems in tree diagram

Example 1: In the flower exhibition conducted at Ooty for 4 days the number of tickets sold on the first, second, third and fourth days are 1,10,010; 75,070; 25,720 and 30,636 respectively. Find the total number of tickets sold.

Solution:

Number of tickets sold on the first day	=	1,10,010
Number of tickets sold on the second day	=	75,070
Number of tickets sold on the third day	=	25,720
Number of tickets sold on the fourth day	=	30,636
Total	=	2,41,436
Total number of tickets sold	**=**	**2,41,436**

Tree Diagram

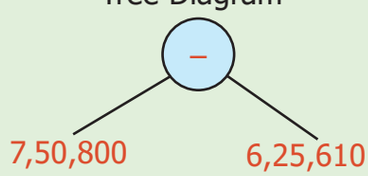


Example 2: In one year, a paper company had sold 6,25,610 notebooks out of a stock of 7,50,800 notebooks. Find the number of notebooks left unsold.

Solution:

Number of Notebooks in stock	=	7,50,800
Number of Notebooks sold	=	6,25,610
Number of notebooks left unsold	=	**1,25,190**

Tree Diagram



Example 3: Vani and Kala along with three other friends went to a butter milk shop. The cost of one butter milk is ₹ 6. If 9 more friends joined them, then how much money did they have to pay? Vani said they had to pay ₹ 84 whereas Kala said they had to pay ₹ 59. Who is correct?

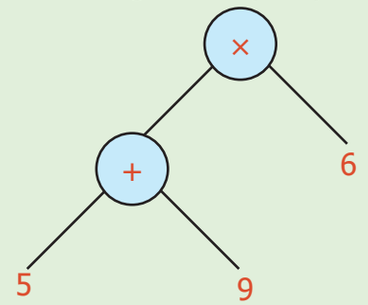
Solution:

This confusion can be resolved by using the brackets in the correct places like (5+9)×6.

It is further clear from the tree diagram.

Therefore Vani is correct

Tree Diagram of (5+9)×6



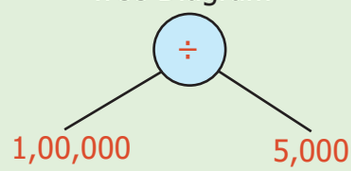
Example 4: If a ration shop has distributed 1,00,000 kg of rice to 5000 families, then find the quantity of rice given to each family?

Solution:

Quantity of rice to be distributed to 5000 families	=1,00,000 kg
Quantity of rice distributed to each family	=1,00,000÷5,000
	=20 kg

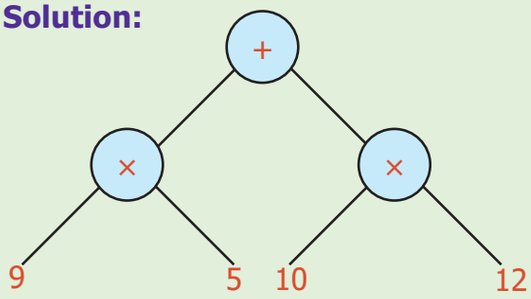
Each family was given 20 kg of rice.

Tree Diagram



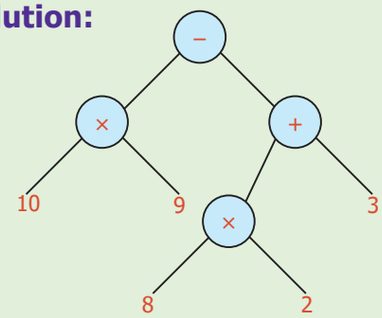
Example 5: Convert into a Tree diagram
$(9\times5)+(10\times12)$

Solution:



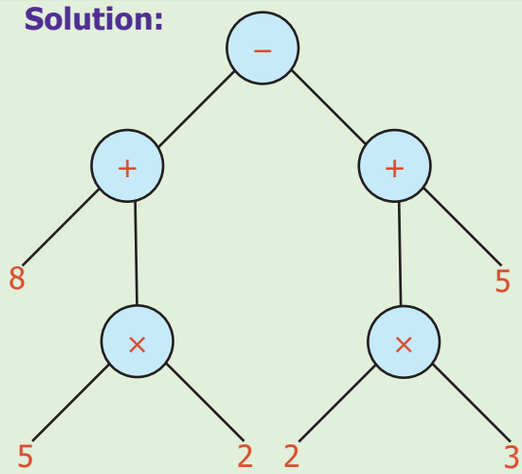
Example 6: Convert into a Tree diagram
$(10\times9)-[(8\times2)+3]$

Solution:



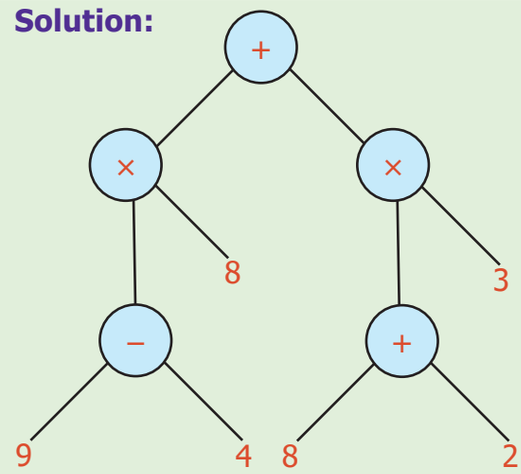
Example 7: Convert into a Tree diagram
$[8+(5\times2)]-[(2\times3)+5]$

Solution:



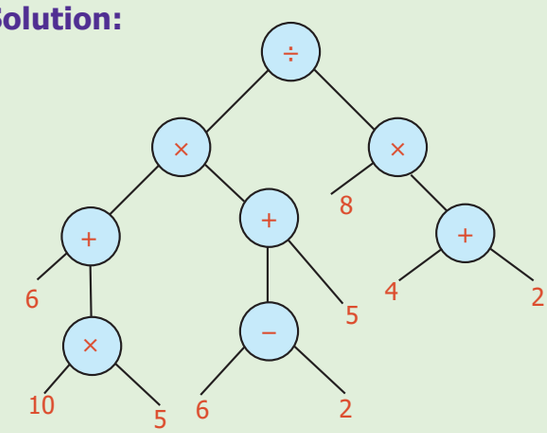
Example 8: Convert into a Tree diagram
$[(9-4)\times8]+[(8+2)\times3]$

Solution:



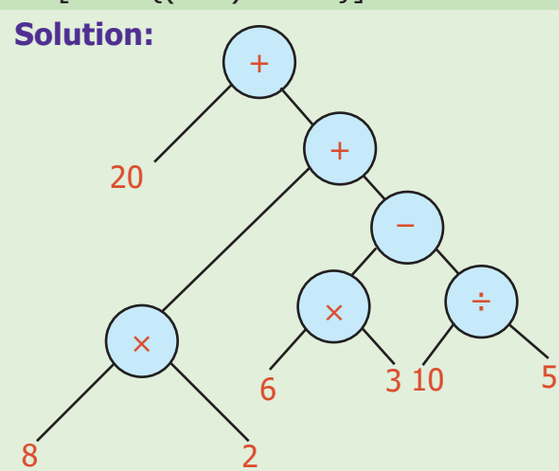
Example 9: Convert into a Tree diagram
$\{[(10\times5)+6]\times[5+(6-2)]\}\div[8\times(4+2)]$

Solution:



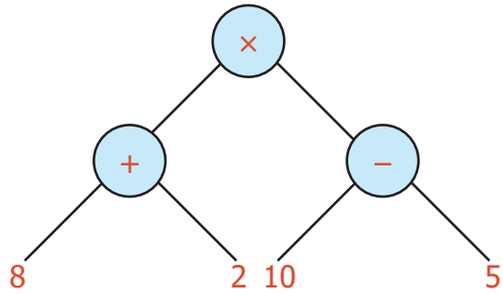
Example 10: Convert into a Tree diagram
$20+[8\times2+\{(6\times3)-10\div5\}]$

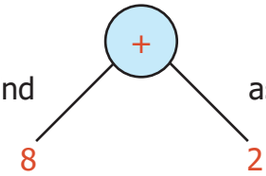
Solution:

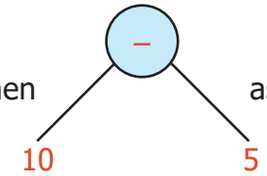


5.2 Conversion of Tree Diagrams into Numerical Expressions

For instance, consider the tree

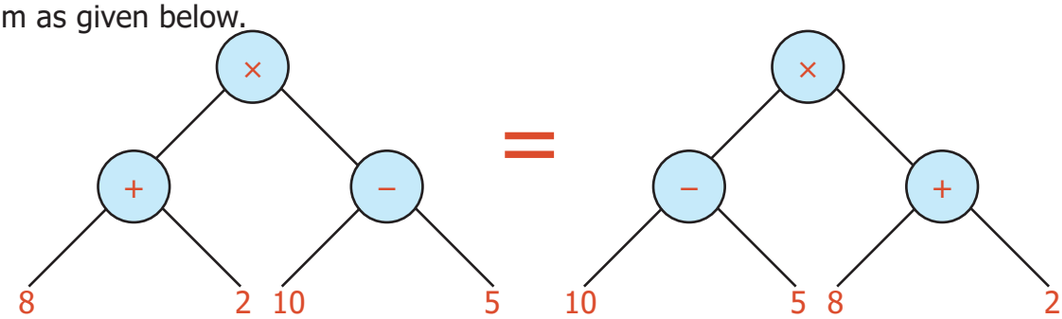


We could first find 

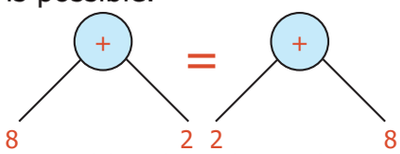
as 10, then 

as 5

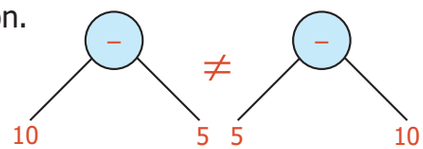
When we multiply the results 10 and 5 we get 50. When the nodes for addition and subtraction are interchanged the value remains the same which is represented using tree diagram as given below.



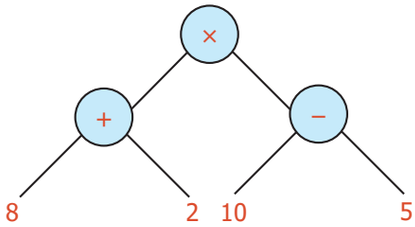
Does it mean that the branches also can be interchanged? Yes, when the node represents addition it is possible.



But it is not possible when the node represents subtraction.

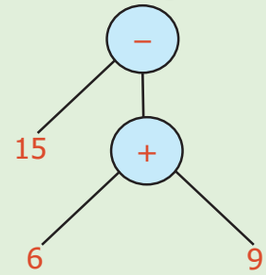


Therefore from this tree diagram.



Example 11: Convert the tree diagram into numerical expression.

Tree diagram



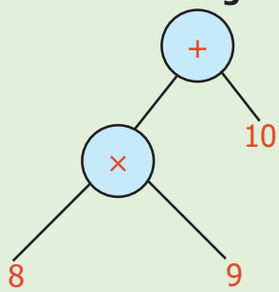
Numerical Expression

15−(6+9)

The expression can be converted into either (10−5)×(8+2) or (8+2)×(10−5) or (2+8)×(10−5) or (10−5)×(2+8) without changing the value.

Example 12: Convert the Tree diagram into a numerical expression.

Tree diagram

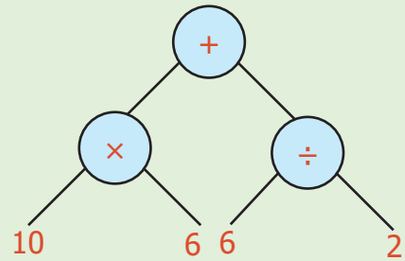


Numerical Expression

(8×9)+10

Example 13: Convert the Tree diagram into a numerical expression.

Tree diagram

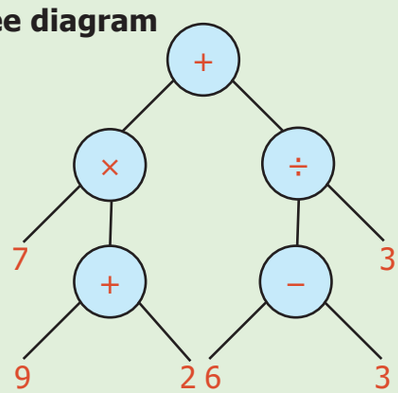


Numerical Expression

(10×6)+(6+2)

Example 14: Convert the Tree diagram into a numerical expression.

Tree diagram

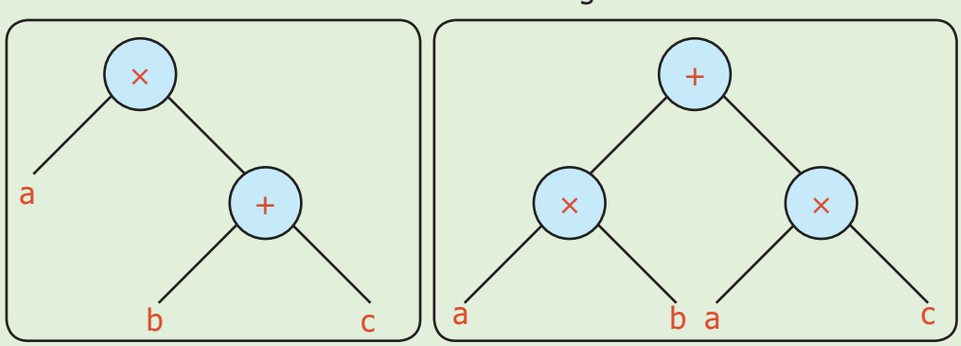


Numerical Expression

[7×(9+2)]+[(6–3)+3]

5.3 Conversion of Algebraic Expressions into Tree Diagrams

There is more fun with trees. Observe the following trees

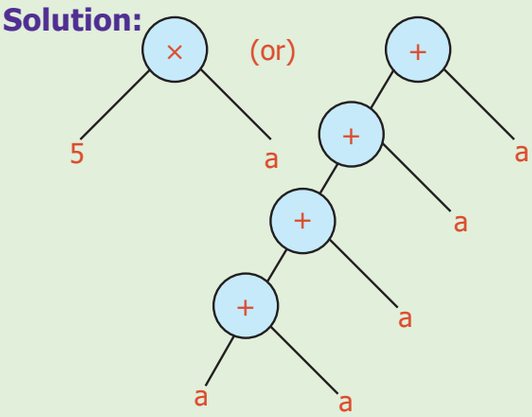


The above tree is nothing but the familiar expression a×(b+c)=(a×b)+(a×c). Thus we can see the algebraic expressions as trees.

- The tree on the left has less number of nodes and looks simple.
- The tree on the right has more number of nodes
- Can we conclude that the value of both the trees are different?

Example 15: Convert '5a' into Tree diagram.

Solution:

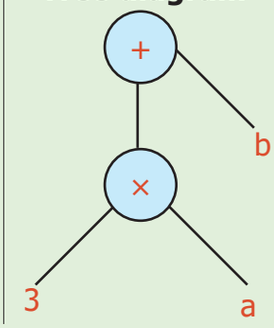


Example 16: Convert '3a+b' into Tree diagram.

Algebraic expression

3a+b

Tree diagram

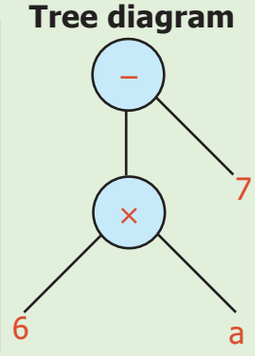


Example 17: '6 times a and 7 less ' Convert into a Tree diagram.

Algebraic expression

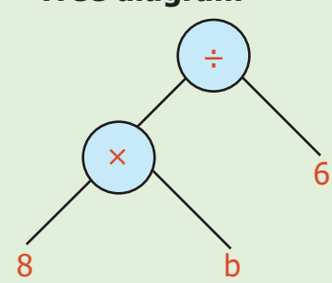
6a−7

Tree diagram



Example 18: Convert the tree diagram into an algebraic expression.

Tree diagram

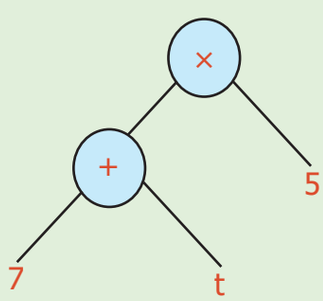


Algebraic expression

8b÷6

Example 19: Convert the tree diagram into an algebraic expression.

Tree diagram

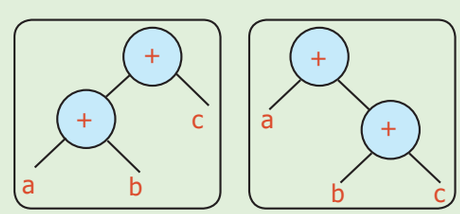


Algebraic expression

(7 + t)5

Example 20: Verify whether given trees are equal or not.

Tree diagram



(a+b)+c a+(b+c)

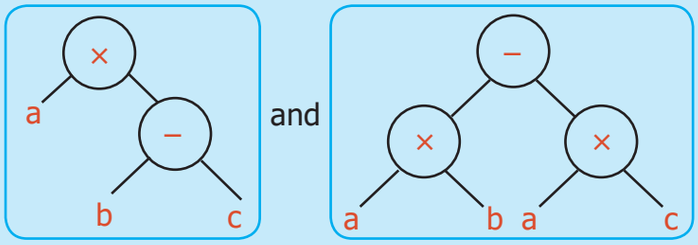
(a+b)+c=a+(b+c)

Yes, they are equal.

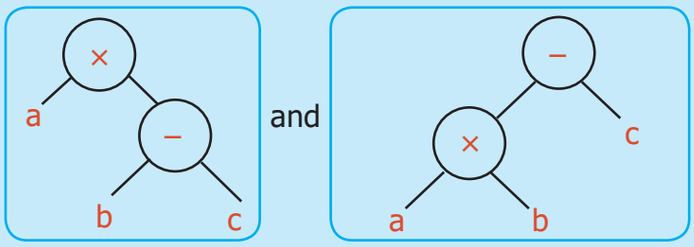
Try these

1. Check whether the Tree diagrams are equal or not

i)



ii)



2. Check whether the following algebraic expressions are equal or not by using Tree diagrams

i) $(x-y)+z$ and $x-(y+z)$

ii) $(p \times q) \times r$ and $p \times (q \times r)$

iii) $a-(b-c)$ and $(a-b)-c$

DO YOU KNOW?

Consider the numerical expression 9 – 4. which means 4 is to be subtracted from 9. 9 – 4 can be represented as – 9 4 (so far we have come across with operation in between the operands)

Suppose the expression is 9 – 4 × 2. This can be represented as × – 9 4 2 gives the meaning of

Step 1: × 9 – 4 2

Step 2: (9 – 4) × 2

Take the expression + × – 9 4 2 5

Step 1: + × 9 – 4 2 5

Step 2: + (9 – 4) × 2 5

Step 3: [(9 – 4) × 2] + 5

This is reading an expression from "left to right". Similarly, we can read expressions from "right to left" also

9 4 2 5 + × – can be read as "right to left" expression which gives the meaning of

9 4 2 5 + × – => (9–4) 2 5 + ×

=> (9–4) × 2 5 +

=> [(9–4) × 2] + 5

Hence an expression can be read as "left to right" or "right to left" giving the same answer which is similar to name 4 as Naangu (நான்கு), Four, Nalagu (నాలుగు) and Char(चार), all of them representing the collection of four objects. Similarly the numerical expression

[(9–4) × 8] ÷ [(8 + 2) × 3] can be written as ÷ × – 9 4 8 × + 8 2 3 (left to right) or 8 9 4 – × 3 8 2 + × ÷ (right to left).

Try these: 1) × – + 9 7 8 2

2) ÷ × + 2 3 8 5

Exercise 5.1

1. Convert the following numerical expressions into Tree diagrams.

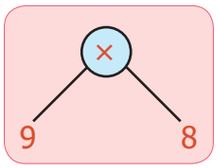
(i) 8 + (6 × 2) (ii) 9 – (2 × 3)

(iii) (3 × 5) – (4 ÷ 2) (iv) [(2 x 4)+2] × (8 ÷ 2)

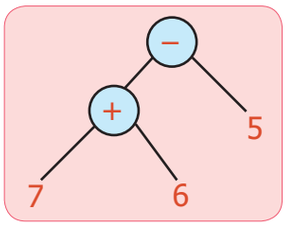
(v) [(6 +4) × 7] ÷ [2 × (10 –5)] (vi) [(4 × 3) ÷ 2] + [8 × (5 – 3)]

2. Convert the following Tree diagrams into numerical expressions.

(i)

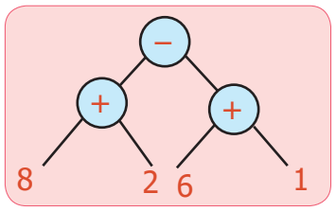


(ii)

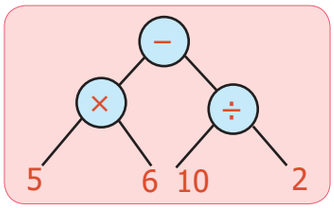


9SDFSF

(iii)



(iv)



3. Convert the following algebraic expressions into tree diagrams.

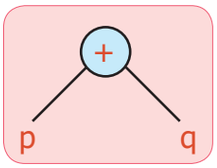
(i) 10v (ii) 3a–b (iii) 5x+y

(iv) 20t × p (v) 2(a+b) (vi) (x x y) – (y x z)

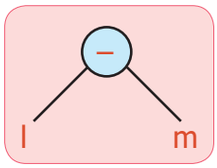
(vii) 4x+5y (viii) (lm–n)÷(pq+r)

4. Convert Tree diagrams into Algebraic expressions.

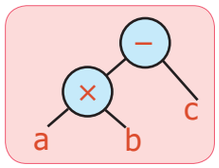
(i)



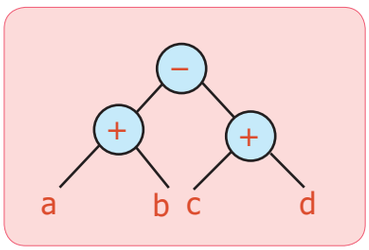
(ii)



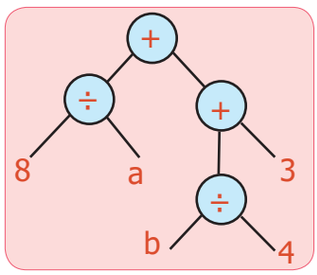
(iii)



(iv)



(v)

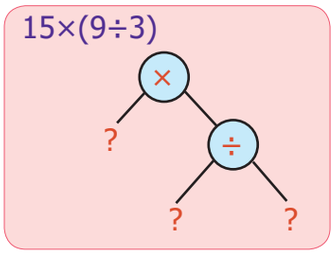


Exercise 5.2

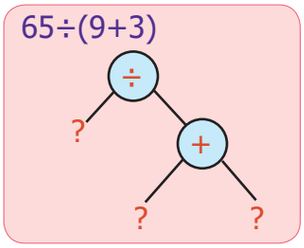
Miscellaneous practice problems

1. Write the missing numbers in the trees.

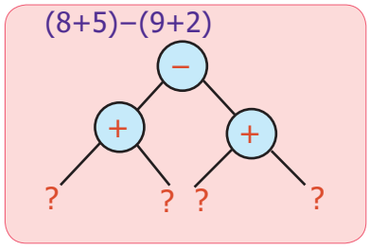
(i) 15×(9÷3)



(ii) 65÷(9+3)

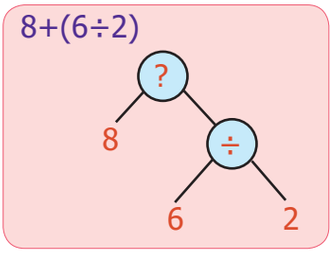


(iii) (8+5)−(9+2)

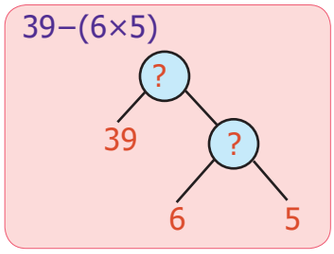


2. Write the missing operations in the trees.

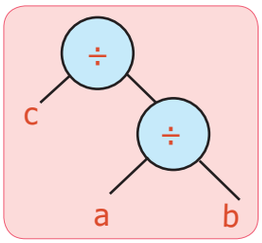
(i) 8+(6÷2)



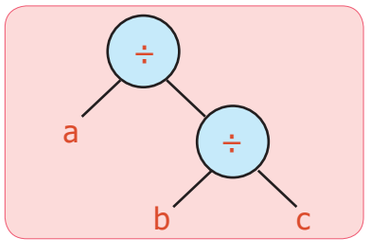
(ii) 39−(6×5)



3. Check whether the Tree diagrams are equal or not.



and



Challenge problems

4. Convert the following questions into tree diagrams:
   (i) The number of people who visited a library in the last 5 months were 1210, 2100, 2550, 3160 and 3310. Draw the tree diagram of the total number of people who had used the library for the 5 months.
   (ii) Ram had a bank deposit of ₹ 7,55,250 and he had withdrawn ₹ 5,34,500 for educational purpose. Draw a tree diagram for this.
   (iii) In a cycle factory, 1,600 bicycles were manufactured on a day. Draw tree diagram to find the number of bicycles produced in 20 days.
   (iv) A company with 30 employees decided to distribute ₹ 90,000 as a special bonus equally among its employees. Draw tree diagram to show how much will each receive?
5. Write the numerical expression which gives the answer 10 and also convert into tree diagram.
6. Use brackets in appropriate place to the expression 3×8−5 which gives 19 and convert it into tree diagram for it.
7. A football team gains 3 and 4 points for successive 2 days and loses 5 points on the third day. Find the total points scored by the team and also represent this in tree diagram.

ANSWERS

Chapter 1 Numbers

Exercise 1.1

1. i) 12 ii) 31 iii) 3 iv) 2 v) 10
2. i) False ii) False
   iii) True iv) True v) True
3. smallest → 11; biggest → 97
4. smallest → 100; biggest → 999
5. True. 3 + 7 + 9 = 19 is odd
6. (17, 71),(37,73) & (79,97)
7. False. 9 is odd number but not prime
8. True. The composite number 4 has 3 factors namely 1, 2, and 4.
9. 6, 12, 18, 24, 30 (excluding February)
10. 19
11. a) 60 = 2 x 2 x 3 x 5
    b) 128 = 2 x 2 x 2 x 2 x 2 x 2 x 2
    c) 144 = 2 x 2 x 2 x 2 x 3 x 3
    d) 198 = 2 x 3 x 3 x 11
    e) 420 = 2 x 2 x 3 x 5 x 7
    f) 999 = 3 x 3 x 3 x 37
12. (11, 13) or (13, 11)

Objective Type Questions

13. b) 2 14. c) 2 15. b) 92 16. c) 40
17. a) 80 18. d) impossible 19. a) 2
20. d) all of these

Exercise 1.2

1. i) 15 ii) 2
   iii) 3 iv) 156 v) 3
2. i) False ii) True
   iii)True iv) False v)True
3. i) 6 ii) 17
   iii) 1 iv) 12
   v) 9 vi) 5
4. i) 18 ii) 24
   iii) 30 iv) 42
   v) 120 vi)75
5. HCF → 22; LCM → 18018
6. HCF=20 litres
7. After 360 seconds (6 min), at 8.06 a.m
8. 2 pairs possible
9. 24

Objective Type Questions

10. c) 71, 81 11. d) 9936
12. b) 36 13. c) 80

Exercise 1.3

1. 4 = 2 + 2; 6 = 3 + 3; 8 = 3 + 5;
   10 = 3 + 7 (or) 5 + 5; 12 = 5 + 7;
   14 = 7 + 7 (or) 3 + 11;
   16 = 5 + 11 (or) 3 + 13
2. Yes, because it has only two factors.
3. For n = 2, 3, 4, 6 and 7
4. a) False, 3 is a factor of 9
   b) True, 12 is a multiple of 6
5. i) 8 ii) 0 iii) 9 iv) 1 v) 8
6. False. 12 is divisible by both 4 and 6 but not by 24
7. True. 17+19=36 is divisible by 4
8. 40 cm

Challenge problems

9. 2, 37, 41
10. 11, 13, 17, 19; The sum 60 is divisible by 1, 2, 3, 4, 5 and 6 but not divisible by 7, 8 and 9
11. 2520
12. Yes. 2 x 3 x 4=24 is divisible by 6.
13. Once in 30 days, 31st October
14. The lifts will stop at floors 15, 30, 45, 60, 75, 90 and 105
15. (15, 20)
16. Yes. Since it is divisible by both 8 and 11 and hence by 88
17. After 60 minutes, at 8 a.m

Chapter 2 Measurements

Exercise : 2.1

1. i. 3/4 *l* ii. 205 *kg* 950 *g* iii. 18 *l* 500 *ml*
   iv. 2 *l* 250 *ml* v. 500
2. i. True ii. False iii. True
   iv. True v. False
3. i. 10005 *ml* ii. 4300 *m* iii. 0.3 *g*
4. (i) 1300 *cm*, 13 *m*, 0.013 *km*
   (ii) 8.257 *l*, 0.008257 *kl*
5. i) 15000 *m*, 1500000 *cm*, 15000000 *mm*
   ii) 12000 *g*, 12000000 *mg*
6. i) < ii) = iii) = iv) < v) >
7. 1 *l* 950 *ml*
8. 155 *cm*
9. 50 *kg* 500 *g*
10. Maran ,100 *m*
11. 6 *kg*, 0.6 *l*
12. 800 students
13. i. 20 glasses ii. 40 glasses
    iii. 4 glasses iv. 2 glasses
    v.8 glasses

Objective Type Questions

14. (b) 904 *cg* 15. (a)1 *kg* 6 *g*
16. (d)1050 *l* 17. (d)70 *mg*
18. (b) 2 *km* 800 *m*

Exercise : 2.2

1. i) 10:15 hours; quarter past 10
   ii) 6:45 hours ; quarter to 7
   iii) 4:10 hours ; 10 minutes past 4
   iv) 3:30 hours; half past 3
   v) 9:40 hours; 20 minutes to 10;
2. i. (d) ii. (e) iii. (b) iv. (c) v. (a)
3. i) 1200 seconds ii) 20140 seconds
   iii) 210 minutes iv) 9 hours 40 minutes
   v) 7 hours
4. 11 hours 5 minutes 25 seconds
5. 1 hour 58 minutes 5 seconds
6. i) 2 a.m ii) 8:45 a.m
   iii) 9:10 p.m iv)11:20 a.m
   v) 12 midnight
7. i) 3:15 hours ii) 12:35 hours
   iii) 12:00 hours iv) 00:00 or 24:00 hours
8. i) 7 hours 10 minutes
   ii) 8 hours 55 minutes
   iii) 8 hours
   iv) 12 hours 15 minutes
9. i) 13:40 hours , 21:20 hours
   ii) 8 halts iii) 5 minutes
   iv) 20:34 hours
   v)7 hours 40 minutes
10. 285 days 11. 7 hour 42 minutes
12. 172 days 13. Friday
14. (i) 1 year 3 months 25 days
    (ii) 3 years 2 months

Objective Type Questions

16. (b) 48 17. (a) 21
18. (d) 3 19. (b) 3:35 hours 20. (b) 30

Exercise : 2.3

1. 14 m 78 cm 2. 2000; 560
6. i) Yes
7. 40 hours 30 minutes
9. She will not catch the train

Chapter 3 Bill, Profit and Loss

Exercise 3.1

1. i) Mullai Furniture mart iv) 50 sets
   ii) Serial No: 728 v) correct
   iii) ₹3000
2.

Cash Bill				
Maruthu Book Store, Chidambaram				
Bill No.570				Date : 12.04.2018
Sl. No.	Item	Quantity	Rate	Amount
1.	Subramanya Bharathiyar	10	55	550
2.	Thiruvalluvar	15	75	1125
3.	Veeramamunivar	12	60	720
4.	Thiru.Vi.Ka	12	70	840
Total				3235

3. i) Profit = ₹20 ii) Profit = ₹10
   iii) S.P. = ₹140 iv) Loss = ₹10
   v) S.P. = ₹145
4. i) S.P. = ₹130 Profit = ₹20
   ii) S.P. = ₹120 Profit = ₹10
   iii) S.P. = ₹100 Loss = ₹10
   iv) S.P. = ₹90 Discount = ₹30
   v) S.P. = ₹110 C.P. = ₹90

5. Profit = ₹15
6. Loss = ₹40
7. No Profit / Loss
8. S.P. = ₹8,75,000
9. C.P. = ₹25,000
10. Discount = ₹295
11. M.P. = ₹1850
12. Discount = ₹25
13. S.P = ₹3
14. Loss = ₹5585

Objective Type Questions

15. (a) M.P.
16. (b) C.P
17. (a) C.P = S.P
18. (b) S.P

Exercise 3.2

1. Gain = ₹15
2. Loss = ₹50
3. Profit = ₹200
4. Profit =₹1,00,000
5. Gain = ₹32
6. M.P. = ₹29
7. Profit =₹960
8. Profit = ₹3000

Chapter 4 Geometry

Exercise 4.1

1. a) two b) scalene triangle c) two
   d) 180° e) isosceles right angled triangle
2. i) Scalene triangle
   ii) Right angled triangle
   iii) Obtuse angled triangle
   iv) Isosceles triangle
   v) Equilateral triangle
3. a) $\overline{AB}$, $\overline{BC}$, $\overline{CA}$
   b) $\angle ABC$, $\angle BCA$, $\angle CAB$ or $\angle A$, $\angle B$, $\angle C$
   c) A, B, C
4. i) Equilateral triangle ii) Scalene triangle
   iii) Isosceles triangle iv) Scalene triangle
5. i) Acute angled triangle
   ii) Right angled triangle
   iii) Obtuse angled triangle
   iv) Acute angled triangle
6. i) a) Isosceles Acute angled triangle
   ii) a) Scalene Right -angled triangle
   iii) a) Isosceles Obtuse angled triangle
   iv) a) Isosceles Right -angled triangle
   v) a) Equilateral Acute angled triangle
   vi) a) Scalene Obtuse angled triangle
7. i) Yes, Scalene triangle
   ii) Yes, Scalene triangle
   iii) No, The triangle cannot be formed
   iv) Yes, Isosceles triangle
   v) Yes, Equilateral triangle
   vi) No, The triangle cannot be formed
8. i) Yes, Acute angled triangle
   ii) Yes, Right angled triangle
   iii) No, The triangle cannot be formed
   iv) No, The triangle cannot be formed
   v) Yes, Acute angled triangle
   vi) Yes, Obtuse angled triangle
9. i) 40° ii) 70° iii) 60°
   iv) 40° v) 30° vi) 40°
10. Equilateral Triangle
11. ii) Acute angled triangle, Isosceles triangle
    iii) Right angled triangle, Isosceles triangle
    iv) Acute angled triangle, Scalene triangle
    v) Acute angled triangle, Scalene triangle
    vi) Right angled triangle, Scalene triangle
    vii) Obtuse angled triangle, Scalene triangle
    viii) Obtuse angled triangle, Isosceles triangle

Objective Type Questions

12. b 13. d 14. a 15. d 16. c

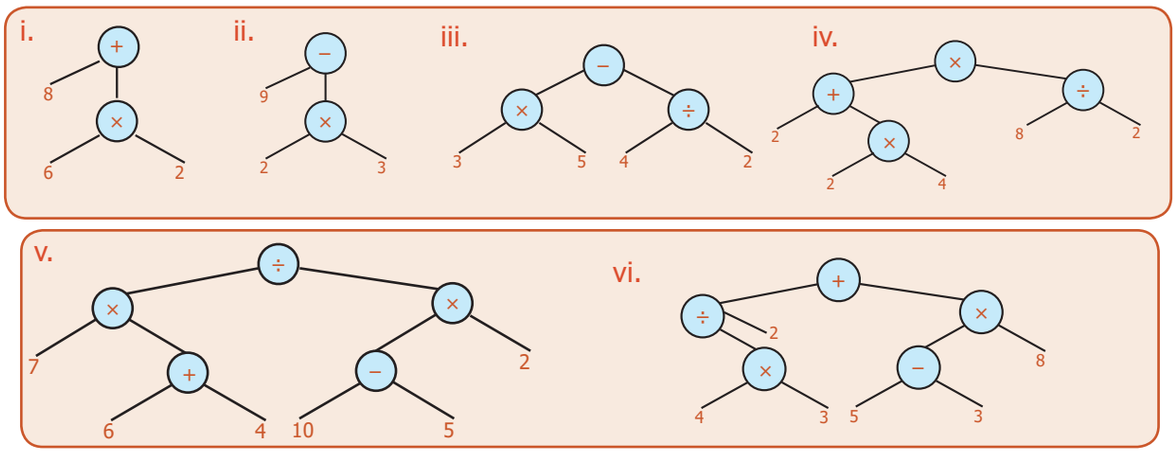
Exercise 4.3

1. 90°, 45° , 45°
2. c
3. c
4. 28°, 28°
5. Both are Isosceles Right angled triangles
6. Yes
7. No, A triangle cannot have more than one right angle
8. "a" is true, because an isosceles triangle need not have three equal sides
9. 70°,40° or 55°,55°
10. c
11. a) ΔABC b) ΔABC , ΔAEF
    c) ΔAEB, ΔAED, ΔADF, ΔAFC, ΔABD, ΔADC, ΔABF, ΔAEC
    d) ΔABC, ΔAEF, ΔABF, ΔAEC
    e) ΔAEB, ΔAFC
    f) ΔADB, ΔADC, ΔADE, ΔADF
12. (i) between 3 and 11 (iii) between 4 and 11
    (ii) between 0 and 16 (iv) between 4 and 24
13. i. Always acute angles ii. Acute angle
    iii. Obtuse angle

Chapter 5 Information Processing

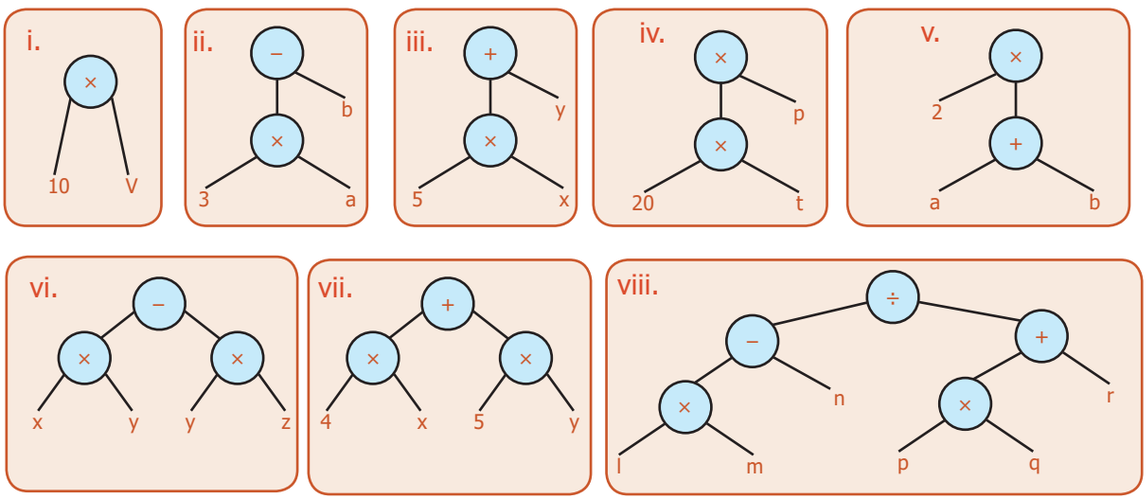
Exercise 5.1

1)



2) i. 9×8 ii. (7+6)–5 iii. (8+2)–(6+1) iv. (5×6)–(10÷2)

3)

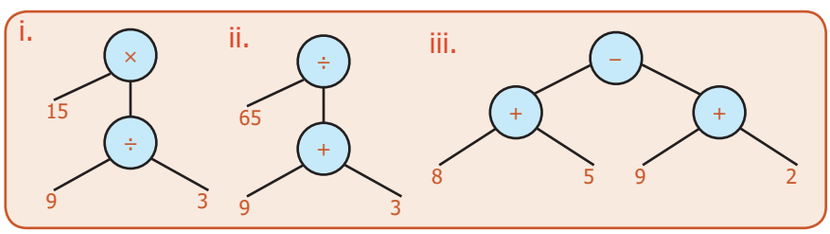


4) Algebraic expression

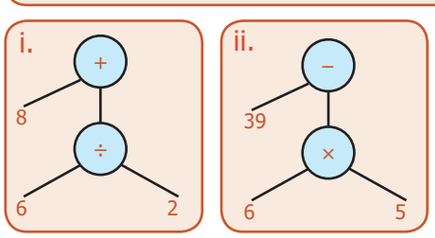
(i) p+q	(ii) l−m	(iii) ab−c	(iv) (a+b)−(c+d)	(v) (8÷a)+[(b÷4) + 3]

Exercise 5.2

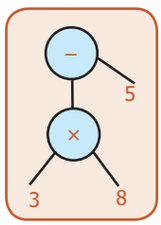
1)



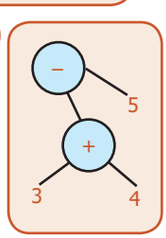
2)



6) (3×8)−5=19

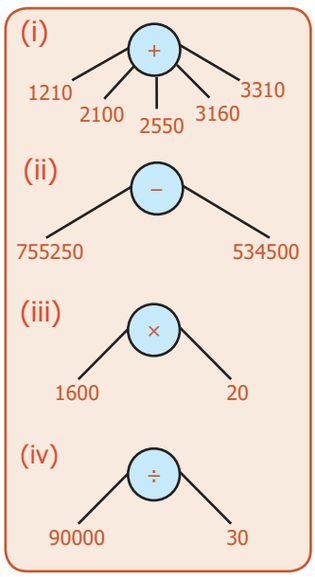


7)



3) Not equal

4)



MATHEMATICAL TERMS

Acute angled triangle	குறுங்கோண முக்கோணம்	Measurement	அளவைகள்
Algebraic expression	இயற்கணித கோவை	Metric units	மெட்ரிக் அளவைகள்
Amicable numbers	இணக்கமான எண்கள் / நட்பு எண்கள்	Midnight	நள்ளிரவு
Angles	கோணங்கள்	Millennium	ஆயிரம் ஆண்டுகள்
Antemeridian	முற்பகல்	Minute hand	நிமிட முள்
Arrival time	வந்து சேரும் நேரம்	Multiple	மடங்கு
Astronomical units	வானவியல் அலகு	Node	கணு
Atomic clock	அணு கடிகாரம்	Numerical expression	எண்கணித கோவை
Bill	பட்டியல்	Obtuse angled triangle	விரிகோண முக்கோணம்
Bottom	கீழ்பாகம்	Odd number	ஒற்றை எண்
Branches	கிளைகள்	Ordinary time	சாதாரண நேரம்
Candle clock	மெழுகுவர்த்தி கடிகாரம்	Parallel lines	இணை கோடுகள்
Capacity	கொள்ளளவு	Pendulum clock	ஊசல் கடிகாரம்
Century	நூற்றாண்டு	Perfect Number	செவ்விய எண் / நிறைவு எண்
Composite number	பகு எண்	Perpendicular lines	செங்குத்துக் கோடுகள்
Co-prime numbers	சார் பகா எண்கள்	Postmeridian	பிற்பகல்
Cost price	அடக்க விலை	Prime number	பகா எண்
Cubit	முழம்	Profit	லாபம்
Dealer	முகவர்	Quartz clock	குவார்ட்ஸ் கடிகாரம்
Departure time	புறப்படும் நேரம்	Railway time	இரயில்வே நேரம்
Digital clock	இலக்க முறை கடிகாரம்	Revolves	சுற்றி வருவது
Discount	தள்ளுபடி	Right angled triangle	செங்கோண முக்கோணம்
Duration	நேர இடைவெளி	Rotate	தன்னைத் தானே சுற்றுவது
Edge	விளிம்பு	Sand clock	மணற் கடிகாரம்
Equilateral triangle	சமபக்க முக்கோணம்	Standard Units	திட்ட அலகுகள்
Even number	இரட்டை எண்	Scalene triangle	அசமபக்க முக்கோணம்
Factor	காரணி	Seconds hand	நொடிமுள்
Foot	அடி	Selling price	விற்ற விலை
Higher units	மேலின அலகுகள்	Set square	முக்கோணமானி / மூலை மட்டம்
Highest Common Factor	மீப்பெரு பொது காரணி	Shopkeeper	கடைக்காரர்
Horology	காலங்காட்டிகளை பற்றிய படிப்பு	Side	பக்கம்
Hour hand	மணி முள்	Span	சாண்
Isosceles triangle	இருசமபக்க முக்கோணம்	Standardised measure	திட்ட அளவைகள்
Leap year	லீப் ஆண்டு / நெட்டாண்டு	Tree diagram	மரவுரு படம் / மரச் செடி வரைபடம்
Least Common Multiple	மீச்சிறு பொது மடங்கு	Triangle	முக்கோணம்
Light year	ஒளியாண்டு	Triangle Inequality	முக்கோண சமனின்மை
Line segment	கோட்டுத்துண்டு	Triplet	மூன்றன் தொகுதி
Loss	நட்டம்	Twin primes	இரட்டை பகா எண்கள்
Lower units	கீழின அலகுகள்	Vacuum	வெற்றிடம்
Manufacturer	உற்பத்தியாளர்	Vertex	உச்சி / முனை
Marked price	குறித்த விலை	Volume	கனஅளவு
Maximum retail price	அதிகபட்ச விற்பனை விலை	Water clock	நீர் கடிகாரம்

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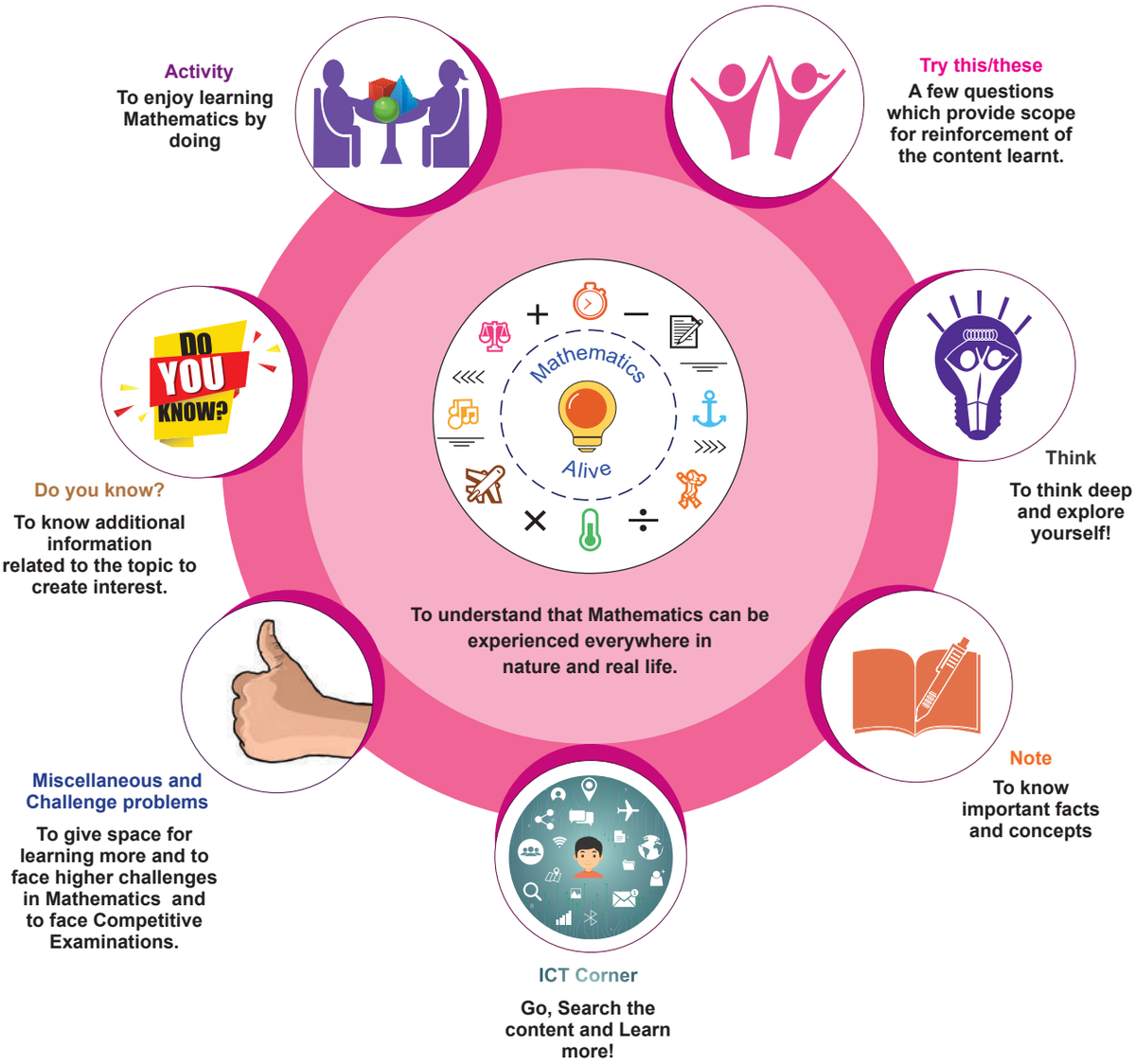
Mathematics is not about numbers, equations, computations or algorithms; it is about understanding

— William Paul Thurston



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The main goal of Mathematics in School Education is to mathematise the child's thought process. It will be useful to know how to mathematise than to know a lot of Mathematics.

CONTENTS

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Text book

E4Q2JU

Evaluation

B542_6_MAT_EM_T3

DIGI Links

CHAPTER 1

FRACTIONS

Learning Objectives

- To add and subtract unlike fractions.
- To understand improper and mixed fractions.
- To express improper fractions into mixed fractions and vice versa.
- To do fundamental operations on mixed fractions.

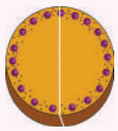
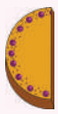
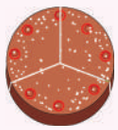
E58TN5

Recap

I Fractions

On Anbu's birthday function, his father, mother and uncle have bought one cake each of equal size. At the time of cutting a cake, two friends were present for the celebration. He divided the cake into 2 equal pieces and gave the pieces to them. After some time, three of his friends arrived. He took another cake and divided it into 3 equal pieces and gave the pieces to them. Still he has one more cake at home. Anbu wanted to share it among his four family members. Third cake is divided into 4 equal pieces and given to them.

Following table shows how Anbu divided the cake equally according to the number of persons.

Division of Cake	Number of persons shared	Each one's share
		 $\frac{1}{2}$ or **one half** of the cake
		 $\frac{1}{3}$ or **one third** of the cake
		 $\frac{1}{4}$ or **one fourth** of the cake

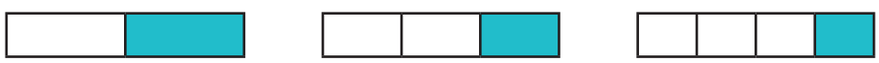
In the above situation, each of 3 cakes was divided equally according to the number of persons attended the function. When Anbu shared one cake to 4 persons, each one got quarter of the cake which was comparatively smaller than the share got by one person when it was divided equally between 2 and 3 persons. When the number of persons increases the size of the cake becomes smaller.

Suppose all the three cakes of equal size are shared equally with the family members of Anbu, what would be each one's share?

Division of Cake	Number of persons shared	Each one's share
		 $\frac{3}{4}$ or **three fourth** of the cake

Each one would get $\frac{3}{4}$ of the cake. Here we have divided the whole into equal parts, each part is called a ***Fraction***. We say a fraction as selected part(s) out of total number of equal parts of an object or a group.

Each one's share of dividing one cake between 2, 3 and 4 persons respectively can be represented as follows.



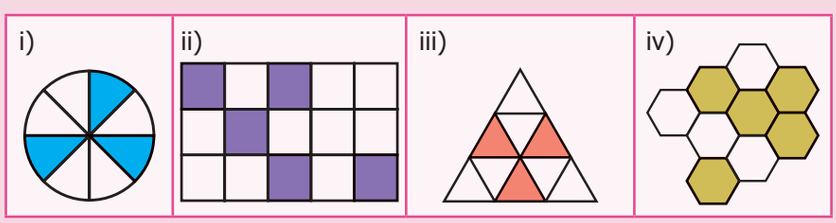
$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$

Think

If all the three cakes are divided among the total participants of the function what would be each one's share? Discuss.

Try these

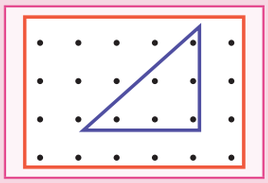
1. Observe the following and represent the shaded parts as fraction.



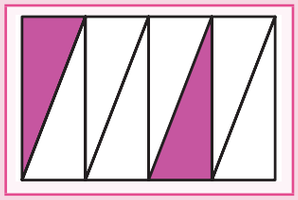
2. Look at the following beakers. Express the quantity of water as fractions and arrange them in ascending order.

3. Write the fraction of shaded part in the following.

4. Write the fraction that represents the dots in the triangle.

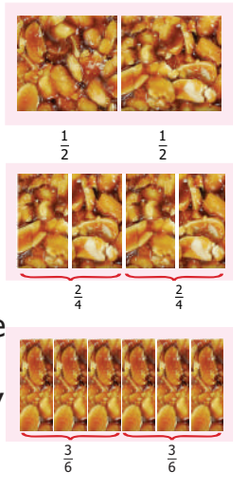


5. Find the fractions of the shaded and unshaded portions in the following.



II Equivalent Fractions

Murali has one peanut bar. He wants to share it equally with Rani. So he divided it into two equal pieces, each one has got 1 piece out of 2, which is half of the peanut bar. They both decided to have half of their share in the morning break and another half in the evening break. Now the total number of pieces becomes 4. Each one has 2 pieces out of 4. That is $\frac{2}{4}$ which is nothing but half of the peanut bar. Look at the figures. In both the type of sharing, they got only the same half of the peanut bar. Therefore, $\frac{1}{2} = \frac{2}{4}$. Hence, $\frac{2}{4}$ is ***equivalent to*** $\frac{1}{2}$.



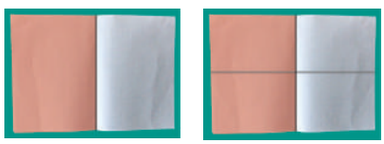
If the peanut bar had been divided into 6 equal pieces, each one would have got $\frac{3}{6}$. What about each one's share if it is divided into 8 equal pieces? $\frac{4}{8}$ We can observe that $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$. How do we get these equivalent fractions of $\frac{1}{2}$?

$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4} \qquad \frac{1}{2} \times \frac{3}{3} = \frac{3}{6}$$

Hence, to get equivalent fractions of the given fraction, the numerator and denominator are to be multiplied by the same number.

Activity

Take a rectangular paper. Fold it into two equal parts. Shade one part, write the fraction. Again fold it into two halves. Write the fraction for the shaded part. Continue this process 5 times and write the fraction of the shaded part. Establish the equivalent fractions of $\frac{1}{2}$ in the folded paper to your friends.



Example 1 Find three equivalent fractions of $\frac{3}{4}$ and $\frac{2}{7}$.

Solution

Equivalent Fraction of $\frac{3}{4}$	Equivalent Fraction of $\frac{2}{7}$
$\frac{3}{4}=\frac{3\times2}{4\times2}=\frac{6}{8}$	$\frac{2}{7}=\frac{2\times2}{7\times2}=\frac{4}{14}$
$\frac{3}{4}=\frac{3\times3}{4\times3}=\frac{9}{12}$	$\frac{2}{7}=\frac{2\times3}{7\times3}=\frac{6}{21}$
$\frac{3}{4}=\frac{3\times4}{4\times4}=\frac{12}{16}$	$\frac{2}{7}=\frac{2\times4}{7\times4}=\frac{8}{28}$

Equivalent fractions of $\frac{3}{4}$: $\frac{3}{4}=\frac{6}{8}=\frac{9}{12}=\frac{12}{16}$

Equivalent fractions of $\frac{2}{7}$: $\frac{2}{7}=\frac{4}{14}=\frac{6}{21}=\frac{8}{28}$

Try these

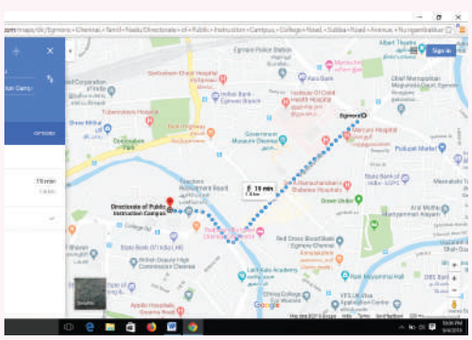
Find the unknown in the following equivalent fractions

i) $\frac{3}{5}=\frac{9}{\square}$ ii) $\frac{\square}{7}=\frac{16}{28}$ iii) $\frac{\square}{3}=\frac{10}{15}$ iv) $\frac{42}{48}=\frac{\square}{8}$

1.1 Introduction

Fractions are used in life situations such as

- To express time as quarter past 3, half past 4, quarter to 5.
- To say the quantum of work completed as quarter / half / three quarters of the work completed.
- To say the distance between two places as half a kilometre / two and half kilometre.
- To express the quantity of ingredients to be used in a recipe as half of the rice taken, half of the dhal taken etc.

Mathematics Alive - Fractions in Real Life	
	
Nine-Tenths of water on the earth is salty.	The distance between Chennai Egmore and the Directorate of Public Instruction Campus (DPI) is nearly $1\frac{1}{2}$ kilometre.

1.2 Comparison of Unlike Fractions

Think about the situation 1

Murugan has scored $\frac{7}{10}$ in Science and $\frac{9}{10}$ in Mathematics test. In which subject he has performed better? It is quite easy to say his performance is better in Mathematics. But can you find, the better performance of Murugan between the two test scores such as $\frac{9}{10}$ and $\frac{13}{20}$ in Mathematics. We need to convert both the marks as like fractions.

The equivalent fraction of $\frac{9}{10}$ is $\frac{18}{20}$. Now we can compare the first test score with that of the second test score because both the scores are out of 20 marks. Here 18 > 13. So, $\frac{18}{20} > \frac{13}{20}$. Thus, Murugan has performed better in the first test.

Think about the situation 2

In a Hockey tournament, Team A played 6 matches and won 5 matches out of it. Team B played 5 matches and won 4 matches out of it. If both the teams performed consistently in this way, find out which team will win the tournament?

From these we need to see which is greater $\frac{5}{6}$ or $\frac{4}{5}$? How can we find this? The total number of matches played by each team differs. By finding the equivalent fractions of $\frac{5}{6}$ and $\frac{4}{5}$, we can equalize the number of matches played by team A and team B.

$$\frac{5}{6} = \frac{10}{12} = \frac{15}{18} = \frac{20}{24} = \frac{25}{30} \qquad \frac{4}{5} = \frac{8}{10} = \frac{12}{15} = \frac{20}{25} = \frac{24}{30}$$

Note that the common denominator of equivalent fraction is 30, which is 5×6. It is the common multiple of both 5 and 6.

Here $\frac{25}{30} > \frac{24}{30}$. So Team A will win the game.

Note

To compare two or more unlike fractions, we have to convert them into 'like fractions'. These 'like fractions' are the equivalent fractions of the given fractions. The denominator of the 'like fractions' is the Least Common Multiple (LCM) of the denominators of the given unlike fractions.

Example 2 Madhu ate $\frac{2}{5}$ of the chocolate bar and Nandhini ate $\frac{1}{3}$ of the chocolate bar. Who has eaten more?

Solution

The portion of the chocolate eaten by Madhu $= \frac{2}{5}$

The portion of the chocolate eaten by Nandhini $= \frac{1}{3}$

Here the portions of the chocolates eaten by both differ.

To make it same, their equivalent fractions are to be found.

Finding the equivalent fractions of $\frac{2}{5}$ and $\frac{1}{3}$ having common denominators are the same as finding the least common multiple of the denominators of the given fractions.

Hence $\frac{2}{5}=\frac{2\times3}{5\times3}=\frac{6}{15}$ and $\frac{1}{3}=\frac{1\times5}{3\times5}=\frac{5}{15}$ So, $\frac{6}{15} > \frac{5}{15}$

Therefore, we can conclude that Madhu has eaten more chocolates.

Note

The process of finding the like fractions of the given unlike fractions can be made easier by finding the common multiples of the denominators of the unlike fractions.

Example 3 Vinotha, Mugilarasi, Senthamizh were participating in the water filling competition. Each one was given a bottle of equal volume to fill water in it within 30 seconds. If Vinotha filled $\frac{1}{2}$ portion of her bottle, Senthamizh filled $\frac{3}{4}$ portion of her bottle and Mugilarasi filled $\frac{1}{4}$ portion of her bottle, then who would get the first, second and third prize?

Solution The equivalent fractions need to be written until the denominator becomes 4 which is the LCM of 2 and 4.

Equivalent fraction of $\frac{1}{2}$ is $\frac{2}{4}$

Vinotha's portion	Mugilarasi's portion	Senthamizh's portion
$\frac{1}{2}=\frac{2}{4}$	$\frac{1}{4}$	$\frac{3}{4}$

Here $\frac{1}{4}<\frac{2}{4}<\frac{3}{4}$. Therefore, Senthamizh would get the first prize, Vinotha would get the second prize and Mugilarasi would get the third prize.

Example 4 Arrange $\frac{2}{3},\frac{1}{6},\frac{4}{9}$ in ascending order.

Solution Equivalent fractions of $\frac{2}{3}$ are $\frac{4}{6},\frac{6}{9},\frac{8}{12},\frac{10}{15},\frac{12}{18},\ldots$

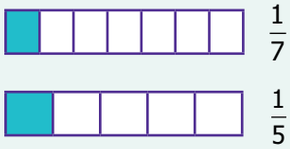
Equivalent fractions of $\frac{1}{6}$ are $\frac{2}{12},\frac{3}{18},\ldots$

Equivalent fraction of $\frac{4}{9}$ is $\frac{8}{18},\ldots$

Therefore $\frac{3}{18}<\frac{8}{18}<\frac{12}{18}$

The ascending order of given fractions is $\frac{1}{6},\frac{4}{9},\frac{2}{3}$.

Comparison of Unit Fractions: ***Unit fractions*** are fractions having 1 as its numerator. For example compare $\frac{1}{7}$ and $\frac{1}{5}$. One can conclude that $\frac{1}{5} > \frac{1}{7}$ by observing the diagram. So, in unit fraction the larger the denominator the smaller will be the fraction. Hence, we conclude that if the numerators are the same in two fractions, the fraction with the smaller denominator is greater of the two.



Try these

1. Shade the rectangle for the given pair of fractions and say which is greater among them.

i) $\frac{1}{3}$ and $\frac{1}{5}$		ii) $\frac{2}{5}$ and $\frac{5}{8}$	
Shade $\frac{1}{3}$	Shade $\frac{1}{5}$	Shade $\frac{2}{5}$	Shade $\frac{5}{8}$
$\frac{1}{3}$ is _____ than $\frac{1}{5}$. That is $\frac{1}{3}$ _____ $\frac{1}{5}$.		$\frac{2}{5}$ is _____ than $\frac{5}{8}$. That is $\frac{2}{5}$ _____ $\frac{5}{8}$.	

2. Which is greater $\frac{3}{8}$ or $\frac{3}{5}$?
3. Arrange the fractions in ascending order: $\frac{3}{5}, \frac{9}{10}, \frac{11}{15}$
4. Arrange the fractions in descending order: $\frac{9}{20}, \frac{3}{4}, \frac{7}{12}$

1.3 Addition and Subtraction of Unlike Fractions

Think about the situation

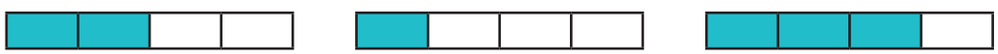
Venkat went to buy milk. He bought $\frac{1}{2}$ litre first and then he bought $\frac{1}{4}$ litre. He wanted to find how much milk he bought altogether? In order to find the total quantity of milk, he has to add $\frac{1}{2}$ and $\frac{1}{4}$. That is $\frac{1}{2} + \frac{1}{4}$. To add or subtract two unlike fractions, first we need to convert them into like fractions.

Example 5 The teacher had given the same situation mentioned above and asked two students Ravi and Arun to solve it. They came out with the answers for $\frac{1}{2} + \frac{1}{4}$.

Solution

Ravi's way	Arun's way
Common Multiple of 2 and 4 = 4. Equivalent Fractions of $\frac{1}{2}=\frac{1\times2}{2\times2}=\frac{2}{4}$ Now, add $\frac{1}{2}+\frac{1}{4}=\frac{2}{4}+\frac{1}{4}$ $=\frac{2+1}{4+4}=\frac{3}{8}$ Therefore Venkat has bought $\frac{3}{8}$ litres of milk.	Common Multiple of 2 and 4 = 4. Equivalent Fractions of $\frac{1}{2}=\frac{1\times2}{2\times2}=\frac{2}{4}$ Now, add $\frac{1}{2}+\frac{1}{4}=\frac{2}{4}+\frac{1}{4}$ $=\frac{2+1}{4}=\frac{3}{4}$ Therefore Venkat has bought $\frac{3}{4}$ litres of milk.

The teacher concludes that Arun's way is correct. This can be verified by the following diagram.



$\frac{2}{4}$ + $\frac{1}{4}$ = $\frac{3}{4}$

In the above illustration note that while adding two like fractions the total number of parts (denominator) remains the same and the two shaded parts (numerator) are added.

Example 6 Add $\frac{2}{3}$ and $\frac{3}{5}$.

Solution These are unlike fractions, aren't they ? So first we need to convert them into like fractions ? Is it possible ? Yes, always. How do we do so ? The common multiple of 3 and 5 is 15. Hence, we find the equivalent fractions of $\frac{2}{3}$ and $\frac{3}{5}$ with denominator 15.

$$\frac{2}{3}=\frac{2\times5}{3\times5}=\frac{10}{15} \qquad \frac{3}{5}=\frac{3\times3}{5\times3}=\frac{9}{15}$$

$$\frac{2}{3}+\frac{3}{5}=\frac{10}{15}+\frac{9}{15}=\frac{19}{15}$$

In the above example, the common denominator is 15 (3×5). Now we observe that the numerator and denominator of the first fraction is multiplied by 5 which is the denominator of the second fraction. In the same way, the second fraction is multiplied by 3 which is the denominator of the first fraction. Now in finding the numerator of both the like fractions, we need to multiply the numerator of the first fraction by 5 and the numerator of the second by 3. In the denominator, 3×5 and 5×3 are of course the same. Thus, the technique of finding the like fraction is called ***Cross Multiplication*** technique.

That is $\frac{2}{3}+\frac{3}{5}=\frac{(2\times5)+(3\times3)}{3\times5}=\frac{10+9}{15}=\frac{19}{15}$

Example 7 Simplify : $\frac{3}{7}+\frac{2}{3}$

Solution By Cross Multiplication technique, $\frac{3}{7}+\frac{2}{3}=\frac{(3\times3)+(2\times7)}{7\times3}=\frac{9+14}{21}=\frac{23}{21}$.

Think about the situation

Vani has $\frac{3}{4}$ litre of water in her bottle. She drank $\frac{1}{2}$ litre of it. How much water is left in the bottle? To find the amount of water remaining in her bottle, the amount of water consumed by her must be subtracted from the amount of water she had initially. That is $\frac{3}{4}-\frac{1}{2}$. This is solved in the following example.

Example 8 Simplify: $\frac{3}{4}-\frac{1}{2}$

Solution Common multiple of 2 and 4 is 4

Equivalent fraction of $\frac{1}{2}$ is

$$\frac{1}{2}=\frac{1\times2}{2\times2}=\frac{2}{4}$$

Now, $\frac{3}{4}-\frac{1}{2}=\frac{3}{4}-\frac{2}{4}=\frac{3-2}{4}=\frac{1}{4}$

Therefore, Vani has $\frac{1}{4}$ amount of water in the bottle. This can be verified by the following diagram.

$\frac{3}{4}$ – $\frac{2}{4}$ = $\frac{1}{4}$

Example 9 Find the difference between $\frac{3}{4}$ and $\frac{2}{7}$.

Solution To find the difference, first we should know, which is bigger between the two given fractions ? How do we find out ?

We know that comparing 'like fractions' is easy, but these are unlike fractions. So, let us convert them into 'like fractions' and compare. Again, we use common multiple 28 (4×7) to get equivalent fractions of $\frac{3}{4}$ and $\frac{2}{7}$ as $\frac{21}{28}$ and $\frac{8}{28}$. Here, $\frac{21}{28}>\frac{8}{28}$ and hence $\frac{3}{4}>\frac{2}{7}$.

Therfore, $\frac{3}{4}-\frac{2}{7}=\frac{21}{28}-\frac{8}{28}=\frac{13}{28}$.

This can also be done by Cross Multiplication technique as $\frac{3}{4}-\frac{2}{7}=\frac{(3\times7)-(2\times4)}{4\times7}=\frac{21-8}{28}=\frac{13}{28}$.

Try these

i) $\frac{2}{3}+\frac{5}{7}$ ii) $\frac{3}{5}-\frac{3}{8}$

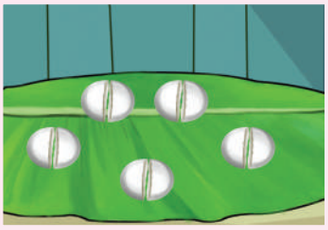
Activity

Using the given fractions $\frac{1}{5}, \frac{1}{6}, \frac{1}{10}, \frac{1}{15}, \frac{2}{15}, \frac{4}{15}, \frac{1}{30}, \frac{7}{30}$ and $\frac{9}{30}$ fill in the missing ones in the given 3×3 square in such a way that the addition of fractions through rows, columns and diagonals give the same total $\frac{1}{2}$.

	$\frac{1}{30}$	
	$\frac{1}{6}$	
$\frac{2}{15}$		

1.4 Improper and Mixed Fractions

Think about the situation



Iniyan had 5 idlis for his breakfast. When he was about to eat, his friend Abdul came. He wanted to share it equally with his friend Abdul. Both of them have taken 2 each and $\frac{1}{2}$ of the remaining idli.

Each one has eaten 2 full idlis and $\frac{1}{2}$ idli. This can be represented as $2+\frac{1}{2}=2\frac{1}{2}$. This representation is called a ***mixed fraction***. Thus, a ***mixed fraction*** is the sum of a whole number and a proper fraction. Also we can express an improper fraction as a mixed fraction by dividing the numerator by denominator to get quotient and remainder. Thus, any mixed fraction can be written as

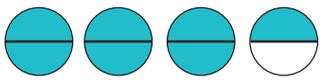
$$\text{Quotient} + \frac{\text{Remainder}}{\text{Divisor}} = \text{Quotient}\frac{\text{Remainder}}{\text{Divisor}}.$$

Another way to share these idlis is as follows: Now can you see how many halves are there in 5 idlis. There are 10 halves. If we share these $\frac{1}{2}$ idlis each time, then Iniyan and Abdul has eaten 5 halves each. That is $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=\frac{5}{2}$ which is same as $2\frac{1}{2}=2+\frac{1}{2}=\frac{(2\times 2)+1}{2}=\frac{5}{2}$. Thus, any improper fraction can be written as mixed fraction as

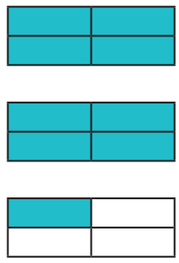
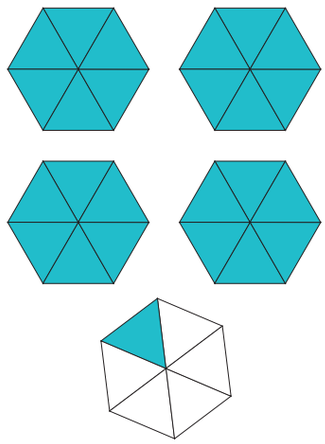
$$\text{Improper fraction} = \frac{\text{(Whole number X Denominator) + Numberator}}{\text{Denominator}}.$$

Try these

1. Complete the following table. The first one is done for you.

Mixed Fraction	Diagrams	Improper Fraction
i) **3** circles are **completely shaded.** $\frac{1}{2}$ of another circle is shaded. That is totally $3\frac{1}{2}$ circles are shaded.		Each circle is divided into halves. There are totally **7 half circles shaded** which is equal to $\frac{7}{2}$.

Try these

Mixed Fraction	Diagrams	Improper Fraction
ii) _____ rectangles are **completely shaded**. _____ portion of another rectangle is shaded. That is totally _____ rectangles are shaded.		Each rectangle is divided into $\frac{1}{4}$ or quarters or **one fourth**. There are totally_____ quarters of rectangles shaded which is equal to _____ .
iii) _____ hexagons are **completely shaded**. _____ portion of another hexagon is shaded. That is totally _____ hexagons are shaded.		Each hexagon is divided into $\frac{1}{6}$ or **one sixth**. There are totally_____ one sixths of hexagons shaded which is equal to _____ .

Example 10 Convert $5\frac{3}{7}$ into an improper fraction.

Solution Improper fraction $\frac{\text{(Whole number X Denominator) + Numberator}}{\text{Denominator}}$.

$$5\frac{3}{7} = \frac{(5\times 7)+3}{7}$$

$$= \frac{35+3}{7} = \frac{38}{7}$$

Think

i) Are $5\frac{2}{3}$ and $5\frac{4}{6}$ equal?

ii) $\frac{3}{2} \neq 3\frac{1}{2}$ Why?

Example 11 Convert $\frac{17}{3}$ into a mixed fraction.

Solution

$$\begin{array}{r} 5 \\ 3\overline{)17} \\ -15 \\ \hline 2 \end{array}$$

Divisor → 3; Quotient → 5; Remainder → 2

$$\frac{17}{3} = \text{Quotient}\,\frac{\text{Remainder}}{\text{Divisor}} = 5\frac{2}{3}$$

Try these

i) Convert $3\frac{1}{3}$ into improper fraction.

ii) Convert $\frac{45}{7}$ into mixed fraction.

1.5 Addition and Subtraction of Mixed Fractions

Think about the situation

In a joint family of Saravanan, during pongal festival celebration, his grandfather, his father and himself wanted to wear the same colour shirt. The cloth needed for stitching 3 shirts are $2\frac{3}{4}$ m, $2\frac{1}{2}$ m and $1\frac{1}{4}$ m respectively. How many metres of cloth has to be purchased in total?

So the total length of the cloth bought by his father is $2\frac{3}{4}+2\frac{1}{2}+1\frac{1}{4}$. This is solved in the following example.

Example 12 Saravanan's father bought $2\frac{3}{4}$ m, $2\frac{1}{2}$ m and $1\frac{1}{4}$ m of cloth. Find the total length of the cloth bought by him?

Solution Total length of the cloth = $\left(2\frac{3}{4}+2\frac{1}{2}+1\frac{1}{4}\right)$ m

First we add whole numbers: 2 + 2 + 1 = 5 m

Then, add the fractions: $\left(\frac{3}{4}+\frac{1}{2}+\frac{1}{4}\right)=\frac{3}{4}+\frac{2}{4}+\frac{1}{4}=\frac{3+2+1}{4}=\frac{6}{4}=\frac{3\times\cancel{2}}{2\times\cancel{2}}=\frac{3}{2}=1\frac{1}{2}$ m

Therefore, the total length of the cloth bought = $5+1+\frac{1}{2}=6\frac{1}{2}$ m

Example 13 Add: $3\frac{2}{4}+7\frac{2}{5}$

Solution

$$3\frac{2}{4}+7\frac{2}{5}=3+\frac{2}{4}+7+\frac{2}{5}$$
$$=3+7+\left(\frac{2}{4}+\frac{2}{5}\right)$$
$$=10+\left(\frac{10}{20}+\frac{8}{20}\right)$$
$$=10+\frac{18}{20}=10+\frac{9}{10}=10\frac{9}{10}$$

E5HPPS

Think about the situation

One day Anitha's mother bought $5\frac{1}{2}$ litres of milk. She has used only $3\frac{1}{4}$ litres of milk to prepare payasam. How much milk is left? That is $5\frac{1}{2}-3\frac{1}{4}$.

Example 14 In the above situation, find the quantity of milk left over. So, subtract $3\frac{1}{4}$ from $5\frac{1}{2}$

Solution The quantity of milk left over = $5\frac{1}{2}-3\frac{1}{4}$

Here, note that 5 > 3 and $\frac{1}{2}>\frac{1}{4}$

The whole numbers 5 and 3 and the fractional numbers $\frac{1}{2}$ and $\frac{1}{4}$ can be subtracted separately.

Note

This method is applicable only when both integral and fractional parts of minuend is greater than that of the subtrahend.

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

$= 2 + \left(\frac{2}{4} - \frac{1}{4}\right)$ (Since the equivalent fraction of $\frac{1}{2}$ is $\frac{2}{4}$)

$= 2 + \frac{1}{4} = 2\frac{1}{4}$ litres

Example 15 Simplify: $9\frac{1}{4} - 3\frac{5}{6}$

Solution Here 9 > 3 and $\frac{1}{4} < \frac{5}{6}$, So we proceed as follows:
We convert the mixed fraction into improper fraction and then subtract.

$9\frac{1}{4} = \frac{(9\times4)+1}{4} = \frac{37}{4}$

and $3\frac{5}{6} = \frac{(3\times6)+5}{6} = \frac{23}{6}$

Common multiple of 4 and 6 is 12.

Now, $\frac{37}{4} - \frac{23}{6} = \frac{37\times3}{12} - \frac{23\times2}{12}$

$= \frac{111}{12} - \frac{46}{12} = \frac{65}{12} = 5\frac{5}{12}$

Try these

i) Find the sum of $5\frac{4}{9}$ and $3\frac{1}{6}$

ii) Subtract $7\frac{1}{6}$ from $12\frac{3}{8}$.

iii) Subtract the sum of $6\frac{1}{6}$ and $3\frac{1}{5}$ from the sum of $9\frac{2}{3}$ and $2\frac{1}{2}$.

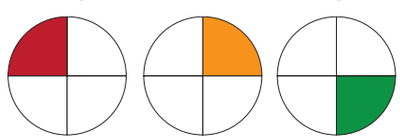
1.6 Multiplication of Fractions

Think about the situation 1 (Multiplication of a fraction by a whole number)

Sunitha wanted to give $\frac{1}{4}$ kg of sweets to each of her 3 friends. So she went to a sweet stall and she asked the salesman to give three $\frac{1}{4}$ kg packets of sweets, how much sweet did she buy?

Solution Weight of three $\frac{1}{4}$ kg packets of sweets $= \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{1+1+1}{4} = \frac{3}{4}$ kg

We can illustrate this in the following diagram. In each of these the shaded part is $\frac{1}{4}$ of a circle. Can you find the shaded parts in 3 circles together?



To know the fraction of shaded part in all the three circles, we add the fractions which are represented in each of the circles. So $3 \times \frac{1}{4} = \frac{3}{4}$.

The adjacent circle represents $\frac{3}{4}$ parts of the circle.

Think about the situation 2 (Multiplication of a fraction using the operator 'of')

Kannan has 30 beads and Kanmani has one sixth **of** it. How many beads does Kanmani have?

Solution The number of beads that Kanmani has = $\frac{1}{6}$ **of** 30 beads

$= \frac{1}{6} \times 30 = \frac{30}{6}$

= 5 beads

Think about the situation 3 (Multiplication of a fraction by another fraction)

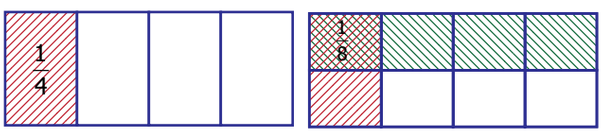
Sunitha bought three $\frac{1}{4}\,kg$ sweet packets for her three friends from a sweet stall. But 6 of her friends had come to her home. So she decided to divide each $\frac{1}{4}\,kg$ sweet packets into halves. If she has done in that way, what would be the weight of the sweet packet that each one of her friend will receive?

Solution The weight of the sweet packets that each one of her friends will receive } = half **of** $\frac{1}{4}\,kg$

$= \frac{1}{2}$ **of** $\frac{1}{4}\,kg$

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

The product $\frac{1}{2}$ and $\frac{1}{4}$ means $\frac{1}{2}$ **of** $\frac{1}{4}$. This can be illustrated as follows. We shade 1 part out of 4 parts which represents $\frac{1}{4}$. Now divide this horizontally into 2 equal parts and shade one part of it.



Here, the double shaded part represents the product $\frac{1}{8}$ and it is got by finding the product of the numerators and the product of denominators as follows:

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

Example 16 Maruthu, a milk man has 4 bottles of milk each containing $1\frac{1}{2}$ litres. How much milk does he have in all?

Solution Since Maruthu has 4 bottles of milk and each containing $1\frac{1}{2}$ litres, he has 4 times of $1\frac{1}{2}$ litres of milk.

$$1\frac{1}{2} \times 4 = \left(1 + \frac{1}{2}\right) \times 4 = 4 + \frac{4}{2}$$

$$= 4 + 2 = 6 \text{ litres.}$$

E5RKRF

Example 17 A man wants to fill $3\frac{3}{4}\ kg$ of rice equally in 3 bags. How much rice does each bag contain?

Solution Each bag contains $\frac{1}{3}$ of $3\frac{3}{4}\ kg$ of rice.

That is $\frac{1}{3}\times 3\frac{3}{4}=\frac{1}{3}\times\left(3+\frac{3}{4}\right)=\left(\frac{3}{3}\right)+\left(\frac{1}{3}\times\frac{3}{4}\right)$

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

Think

$2\frac{1}{4}\times 3$ is not equal to $6\frac{1}{4}$. Why?

Example 18 In a juice shop, if a man prepared $1\frac{1}{2}$ litres of juice from $1\ kg$ of oranges, then how many litres of juice can be prepared from $12\frac{3}{4}\ kg$ of oranges?

Solution The quantity of juice prepared from $1kg$ of oranges $= 1\frac{1}{2}$ litres

The quantity of juice prepared from $12\frac{3}{4}\ kg$ of oranges $= 12\frac{3}{4}\times 1\frac{1}{2}$

$= \frac{51}{4}\times\frac{3}{2}=\frac{153}{8}$

$= 19\frac{1}{8}$ litres

Try these

i) Simplify: $35\times\frac{3}{7}$

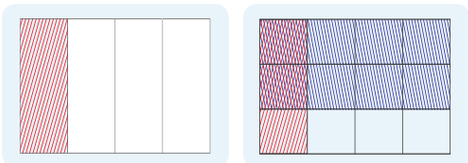
ii) Find the value of $\frac{1}{5}$ of 15.

iii) Find the value of $\frac{1}{3}$ of $\frac{3}{4}$

iv) Multiply $7\frac{3}{4}$ by $5\frac{1}{2}$

Activity

Take a paper. Fold it into 4 parts vertically of equal width. Shade one part of it with red. Then, fold it into 3 parts horizontally of equal width. Shade two parts of it with blue. Now, you count the number of shaded grids which have both the colours.



(Hint:The number of grids shaded in both colours out of the total number of grids gives the product $\frac{2}{12}$ of $\frac{2}{3}$ and $\frac{1}{4}$)

1.7 Division of Fractions

Think about the situation 1

A camp was organized in a school in which12 students participated. The camp leader wanted to divide them into groups of 2 students. How many groups were there?

There were 6 groups which was got by the division of 12 by 2.

That is 12 ÷ 2 = 6 which means there are six 2's in 12.

If the camp leader distributes 6 litres of water in $\frac{1}{2}$ litre water bottles to the students, then how many students will get water bottles? This means finding how many $\frac{1}{2}$ litres are there in 6 litres. For this we need to calculate $6 \div \frac{1}{2}$.

Solution Let us describe the situation

Amount of water	Picture	Amount of water distributed	Method of finding it	Number of persons received
6 litres		1 litre	$6 \div 1$	6
6 litres		$\frac{1}{2}$ litre	$6 \div \frac{1}{2}$	12
6 litres		$\frac{1}{4}$ litre	$6 \div \frac{1}{4}$	24

This means that if you share 6 litres of water into 1 litre bottles, 6 persons can get water. If you share in $\frac{1}{2}$ litre water bottles, 12 persons can get water. If you share it in $\frac{1}{4}$ litre water bottles, 24 persons can get water. That is

$6 \div 1 = 6$	$6 \div \frac{1}{2} = 12$	$6 \div \frac{1}{4} = 24$

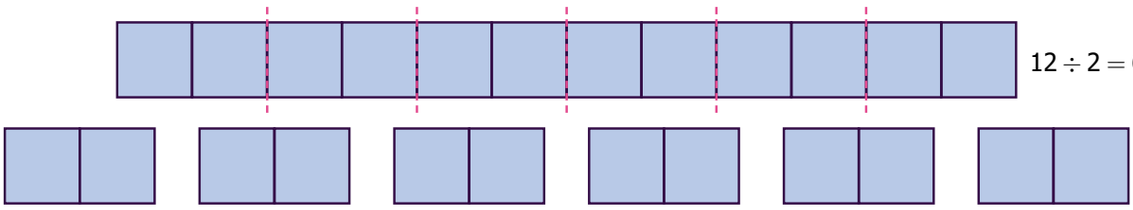
We can illustrate this in the following diagram. We divide each circle into halves such that each part is $\frac{1}{2}$ of the whole. The number of such halves would be $6 \div \frac{1}{2}$. In the figure how many halves do you see? There are 12 halves. So $6 \div \frac{1}{2} = 6 \times 2 = 12$.

As one circle has 2 halves, 6 circles will have 12 halves = 6×2. Therefore, $6 \div \frac{1}{2} = 6 \times 2 = 12$

Here, we can observe that, dividing a whole number 6 by a fraction $\frac{1}{2}$ is the same as multiplying a whole number 6 by 2, where 2 is the ***reciprocal*** of $\frac{1}{2}$. Generally, dividing a number by a fraction is the same as multiplying that number by the reciprocal of the fraction.

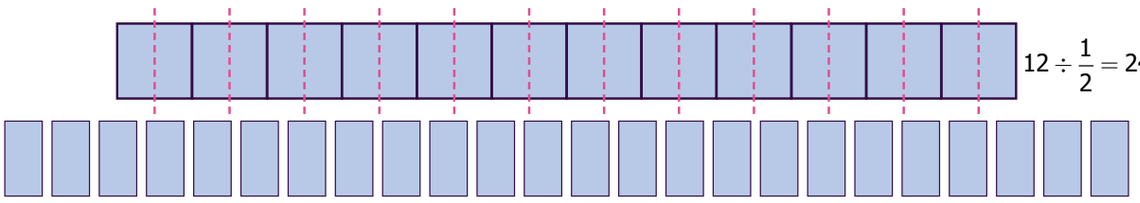
Let us discuss the same situation in another way. Let us take a bar of length 12 cm

How many 2 cm bars are there in a 12 cm bar?



$12 \div 2 = 6$ bars

Now find how many $\frac{1}{2}$ cm bars are there in a 12 cm bar?



$12 \div \frac{1}{2} = 24$ bars

Let us observe and complete the following:

i) $\frac{3}{7} \times \frac{7}{3} = \frac{21}{21} = 1$ ii) $\frac{1}{9} \times 9 = \frac{9}{9} = 1$ iii) $8 \times \frac{1}{8} = \frac{8}{8} = ?$ iv) $\frac{13}{4} \times ? = 1$ v) $\frac{4}{3} \times ? = 1$

From the above, we can see that ***the Product of a fraction and its reciprocal is always 1***.

Example 19 Kandan shares $\frac{1}{2}$ piece of a cake between 2 persons. What will be the share of each?

Solution To know the share, we need to find $\frac{1}{2} \div 2$

$\frac{1}{2} \div 2 = \frac{1}{2} \times \frac{1}{2}$ (reciprocal of 2 is $\frac{1}{2}$)

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

Try these

i) How many 6 s are there in 18?

ii) How many $\frac{1}{4}$ s are there in 5?

iii) $\frac{1}{3} \div 5 = ?$

Example 20 Divide $4\frac{1}{2}$ by $3\frac{1}{2}$

Solution $4\frac{1}{2} \div 3\frac{1}{2} = \frac{9}{2} \div \frac{7}{2}$

$= \frac{9}{2} \times \frac{2}{7}$ (reciprocal of $\frac{7}{2}$ is $\frac{2}{7}$)

$= \frac{9}{7}$

Example 21 An oil tin contains $7\frac{1}{2}$ litres of oil which is poured in $2\frac{1}{2}$ litres bottles. How many bottles are required to fill $7\frac{1}{2}$ litres of oil?

Solution The number of bottles required = $\frac{15}{2} \div \frac{5}{2} = \frac{15}{2} \times \frac{2}{5}$ (reciprocal of $\frac{5}{2}$ is $\frac{2}{5}$)

= 3 bottles

Example 22 A rod of length 6m is cut into small rods of length $1\frac{1}{2}m$ each. How many small rods can be cut?

Solution

The number of small rods $= 6 \div 1\frac{1}{2}$

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

$= 6 \times \frac{2}{3}$ (reciprocal of $\frac{3}{2}$ is $\frac{2}{3}$)

$= 4$ rods

Try these

i) Find the value of $5 \div 2\frac{1}{2}$.

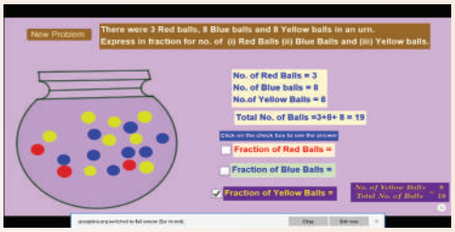
ii) Simplify: $1\frac{1}{2} \div \frac{1}{2}$

iii) Divide $8\frac{1}{2}$ by $4\frac{1}{4}$.

Fractions

ICT CORNER

Expected Outcome



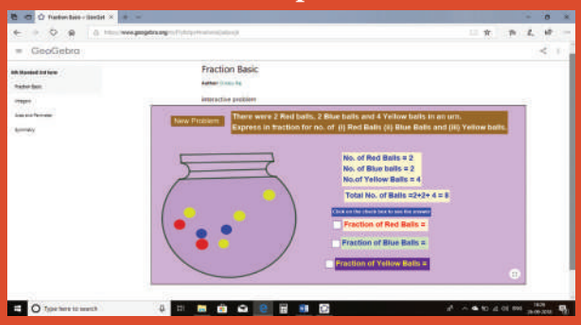
Step 1

Open the Browser by typing the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Fraction Basic" will open. Click on New Problem and solve the problem.

Step 2

Click the check boxes on right hand side bottom to check respective answers

Step1



Step2

Browse in the link:

Fraction Basic: https://ggbm.at/jafpsnjb or Scan the QR Code.

B542_6_MAT_EM_T3

This puzzle involves fraction in Tamil song and its explanation	
கட்டியால் எட்டு கட்டி கால்அரை முக்கால் மாற்று வியாபாரி சென்று விட்டார் சிறுபிள்ளை மூன்று பேர்கள் கட்டியும் புக் கொணாது கணக்கிலும் பிச கொணாது கட்டியாய் பகர வல்லார் கணக்கினில் வல்லா ராவார்	**Explanation** A jaggery merchant had 8 jaggery balls with different weights such as $\frac{1}{4}\,kg$ $\frac{1}{2}\,kg$ and $\frac{3}{4}\,kg$. He called his 3 children and asked them to share those jaggery balls equally. How did the children share it equally among themselves? (Hint: The number of jaggery balls with the given weights are 5, 2 and 1 respectively.).

Exercise 1.1

1. Fill in the blanks

i) $7\frac{3}{4}+6\frac{1}{2}=$ _____

ii) The sum of a whole number and a proper fraction is called _____

iii) $5\frac{1}{3}-3\frac{1}{2}=$ _____

iv) $8\div\frac{1}{2}=$ _____

v) The number which has its own reciprocal is _____

E61GT3

2. Say True or False

i) $3\frac{1}{2}$ can be written as $3+\frac{1}{2}$.

ii) The sum of any two proper fractions is always an improper fraction.

iii) The mixed fraction of $\frac{13}{4}$ is $3\frac{1}{4}$.

iv) The reciprocal of an improper fraction is always a proper fraction.

v) $3\frac{1}{4}\times3\frac{1}{4}=9\frac{1}{16}$

3. Answer the following:

i) Find the sum of $\frac{1}{7}$ and $\frac{3}{9}$.

ii) What is the total of $3\frac{1}{3}$ and $4\frac{1}{6}$?

iii) Simplify : $1\frac{3}{5}+5\frac{4}{7}$.

iv) Find the difference between $\frac{8}{9}$ and $\frac{2}{7}$.

v) Subtract $1\frac{3}{5}$ from $2\frac{1}{3}$.

vi) Simplify : $7\frac{2}{7}-3\frac{4}{21}$.

4. Convert mixed fractions into improper fractions and vice versa:

i) $3\frac{7}{18}$ ii) $\frac{99}{7}$ iii) $\frac{47}{6}$ iv) $12\frac{1}{9}$

5. Multiply the following:

i) $\frac{2}{3} \times 6$ ii) $8\frac{1}{3} \times 5$ iii) $\frac{3}{8} \times \frac{4}{5}$ iv) $3\frac{5}{7} \times 1\frac{1}{13}$

6. Divide the following:

i) $\frac{3}{7} \div 4$ ii) $\frac{4}{3} \div \frac{5}{9}$ iii) $4\frac{1}{5} \div 3\frac{3}{4}$ iv) $9\frac{2}{3} \div 1\frac{2}{3}$

7. Gowri purchased $3\frac{1}{2}$ kg of tomatoes, $\frac{3}{4}$ kg of brinjal and $1\frac{1}{4}$ kg of onion. What is the total weight of the vegetables she bought?

8. An oil tin contains $3\frac{3}{4}$ litres of oil of which $2\frac{1}{2}$ litres of oil is used. How much oil is left over?

9. Nilavan can walk $4\frac{1}{2}$ km in an hour. How much distance will he cover in $3\frac{1}{2}$ hours?

10 Ravi bought a curtain of length $15\frac{3}{4}$ m. If he cut the curtain into small pieces each of length $2\frac{1}{4}$ m, then how many small curtains will he get?

Objective Type Questions

11. Which of the following statement is incorrect?

a) $\frac{1}{2} > \frac{1}{3}$ b) $\frac{7}{8} > \frac{6}{7}$ c) $\frac{8}{9} < \frac{9}{10}$ d) $\frac{10}{11} < \frac{9}{10}$

12. The difference between $\frac{3}{7}$ and $\frac{2}{9}$ is

a) $\frac{13}{63}$ b) $\frac{1}{9}$ c) $\frac{1}{7}$ d) $\frac{9}{16}$

13. The reciprocal of $\frac{53}{17}$ is

a) $\frac{53}{17}$ b) $5\frac{3}{17}$ c) $\frac{17}{53}$ d) $3\frac{5}{17}$

14. If $\frac{6}{7} = \frac{A}{49}$, then the value of A is

a) 42 b) 36 c) 25 d) 48

15. Pugazh has been given four choices for his pocket money by his father. Which of the choices should he take in order to get the maximum money?

a) $\frac{2}{3}$ of ₹150 b) $\frac{3}{5}$ of ₹150 c) $\frac{1}{5}$ of ₹150 d) $\frac{1}{5}$ of ₹150

Exercises 1.2

Miscellaneous Practice problems

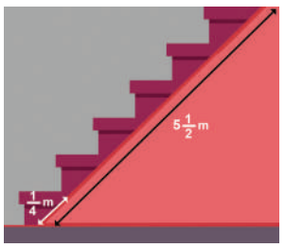
1. Sankari purchased $2\frac{1}{2}m$ cloth to stich a long skirt and $1\frac{3}{4}$ m cloth to stitch blouse. If the cost is ₹120 per metre then find the cost of cloth purchased by her.

2. From his office, a person wants to reach his house on foot which is at a distance of $5\frac{3}{4}$ km. If he had walked $2\frac{1}{2}$ km, how much distance still he has to walk to reach his house?

3. Which is smaller? The difference between $2\frac{1}{2}$ and $3\frac{2}{3}$ or the sum of $1\frac{1}{2}$ and $2\frac{1}{4}$.

4. Mangai bought $6\frac{3}{4}$ kg of apples. If Kalai bought $1\frac{1}{2}$ times as Mangai bought, then how many kilograms of apples did Kalai buy?

5. The length of the staircase is $5\frac{1}{2}$ m. If one step is set at $\frac{1}{4}$ m, then how many steps will be there in the staircase?



Challenge Problems

6. By using the following clues, find who am I?

   i) Each of my numerator and denominator is a single digit number.

   ii) The sum of my numerator and denominator is a multiple of 3.

   iii) The product of my numerator and denominator is a multiple of 4.

7. Add the difference between $1\frac{1}{3}$ and $3\frac{1}{6}$ and the difference between $4\frac{1}{6}$ and $2\frac{1}{3}$.

8. What fraction is to be subtracted from $9\frac{3}{7}$ to get $3\frac{1}{5}$?

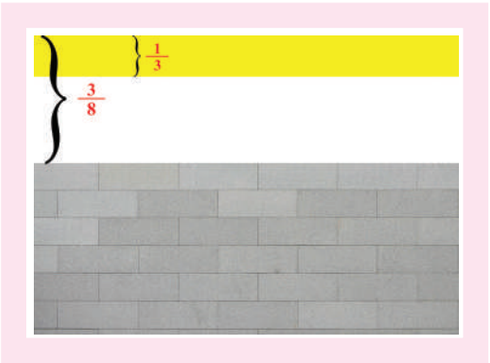
9. The sum of two fractions is $5\frac{3}{9}$. If one of the fractions is $2\frac{3}{4}$, find the other fraction.

10. By what number should $3\frac{1}{16}$ be multiplied to get $9\frac{3}{16}$?

11. Complete the fifth row in the Leibnitz triangle which is based on subraction.

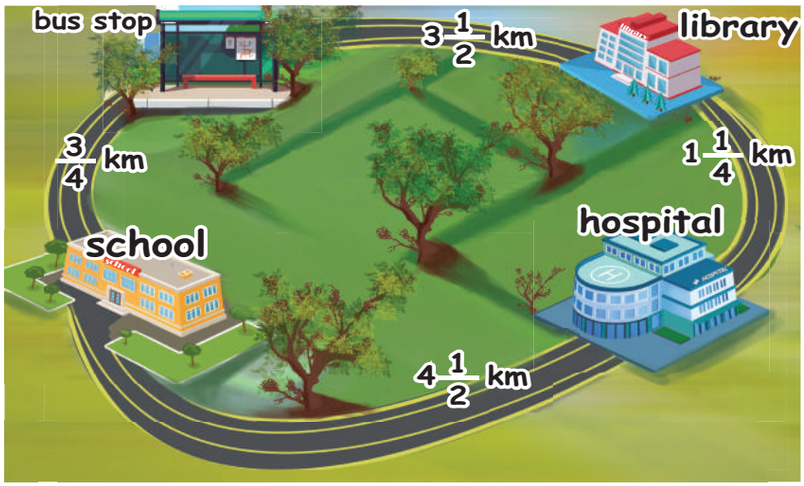
$\frac{1}{1}$				
$\frac{1}{2}$	$\frac{1}{2}$			
$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{3}$		
$\frac{1}{4}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{4}$	
$\frac{1}{5}$				$\frac{1}{5}$

12) A painter painted $\frac{3}{8}$ of the wall of which one third is painted in yellow colour. What fraction is the yellow colour of the entire wall?



13) A rabbit has to cover $26\frac{1}{4}$ m to fetch its food. If it covers $1\frac{3}{4}$ m in one jump, then how many jumps will it take to fetch its food?

14) Look at the picture and answer the following questions:



i) What is the distance from School to Library via Bus stop?

ii) What is the distance between School and Library via Hospital?

iii) Which is the shortest distance between (i) and (ii)?

iv) The distance between School and Hospital is _____ times the distance between School and Bus stop.

Summary

- Fractions is a part of a whole. The whole may be a single object or a group of objects.
- Equivalent fractions are got by multiplying the numerator and denominator of a given fraction by the same number.
- Unlike fractions can be added or subtracted by converting them into 'like fractions'.
- Mixed fraction is the sum of a whole number and a proper fraction.
- Product of two fractions = $\frac{\text{Product of their numerators}}{\text{Product of their denominators}}$.
- The numerator and denominator of a fraction are interchanged to get its reciprocal.
- Dividing a number by a fraction is the same as multiplying that number by the reciprocal of the fraction.

CHAPTER 2

INTEGERS

E6ACUQ

Learning Objectives

- To understand the necessity for extension of whole numbers to negative numbers.
- To know that the collection of zero, positive and negative numbers forms integers.
- To represent integers on the number line.
- To compare and arrange integers in ascending and descending order.

2.1 Introduction

We already have learnt about natural numbers, whole numbers and their properties which were dealt in the first term. Now we shall know about another set of numbers.

Think about the situation

The teacher sees that Yuvan and Subha are ready to play a game with a deck of playing cards. Two different coloured tokens (blue and yellow here) are taken so that they represent the position on a number strip which is numbered from 0 to 20 with 0 as the starting point and which can be extended further.

Consider the cards A, J, Q, K and cards from 2 to 10. Here, let A, J, Q and K denote the numbers 1,11,12 and 13 respectively. We have two designs ♠ ♣ in black colour and two designs ♥ ♦ in red colour inside a deck of cards. Let the joker card represent 0.

Rules for the game

i) If a black card is picked, the player should move the token forward and if a red card is picked, the player should move the token backward as per the number shown on the card.

ii) Whoever reaches the number 20 first will be declared as the winner.
(more students can play this game by choosing different coloured tokens)

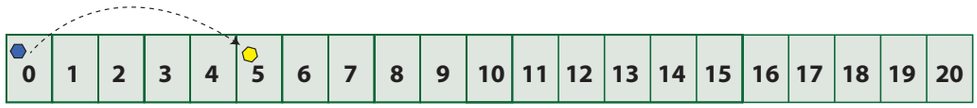
Observe the following conversation

Yuvan : Subha, I have chosen the blue token.

Subha : Okay, Then I shall take the yellow token.

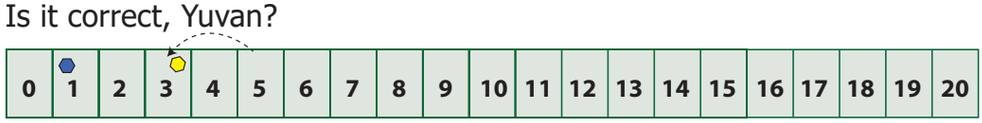
Yuvan : The number strip is ready as shown below and let both the tokens be placed at the starting position 0. Shall we start playing?

Subha : Yes. I shall pick a card first. I have picked a black card and it shows 5. So I will move forward to keep my yellow token at 5 on the number strip.



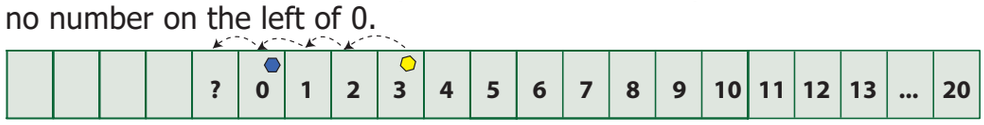
Yuvan : Now, I pick ...It is black card again and it shows A on it. I will keep my blue token by moving one step forward at 1 on the number strip.

Subha : I pick a red card now and it shows 2 on it.
I need to move backward by 2 steps and I shall keep my token at 3.
Is it correct, Yuvan?



Yuvan : Fine Subha. Now, I too have picked the red card and it shows A again. Oh, no..!
I will move backward by one step to be again at the starting position 0.

Subha : I am 3 steps ahead of you! Now, I have the red card showing 4 on it. I need to move 4 places backward from 3. But,where shall I keep my token, Yuvan? I moved 3 places only but need one more place behind 0. There is no number on the left of 0.



Subha : Shall I mark it as 1 again?

Yuvan : No, Subha. That won't be correct. We know that 1 already exists to the right of 0.

Subha : Then, what should I do? I can't move to the left of '0'.
Is the game over or shall I pick another card to continue?

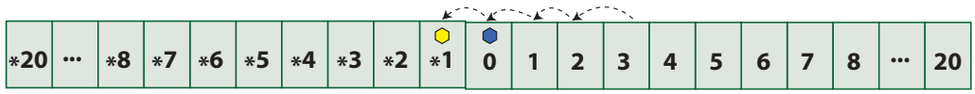
The Teacher intervenes ...

Teacher : Yuvan and Subha, why can't you think of extending the number strip to the left of 0 as $*1$, $*2$,$*3$ and so on such that the distance between $*1$ and 0 is the same as the distance between 0 and 1 and also the distance between $*2$ and 0 is the same as the distance between 0 and 2 and extending likewise?

Subha : Yes Teacher, I understand that the $*$ will now indicate that the numbers are on the left of 0, and also the numbers are less than 0.

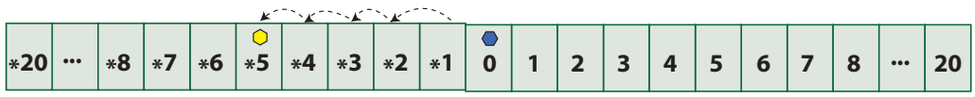
Teacher : To sustain the interest in the game, continue playing with a small addition in the rule as whoever reaches ∗20 first, will also be considered as the winner!

Yuvan : So Subha, you shall keep it at ∗1.



Yuvan : What, if you pick the red card again which shows 4 ?

Subha : I am clear Yuvan. I will move backward 4 places from ∗1 to keep my token at ∗5.



Yuvan : Well said…! What can you say, assuming that I am at 5?

Subha : Yes, Yuvan. We will be at the same distance but on the opposite sides of '0'. Am I right?

Yuvan : Yes. you are right but your value is less than mine as you go to the left of '0'.

Think

Who will win finally? Which is the factor that will decide the winner? How far can you extend the numbers on both sides of the strip?

From the above game, we understand that there is a need to go beyond 0 on to its left! We also observe that as 1 is to the right of 0, there should exist ∗1 to its left with the same distance as 1 and it extends on both sides in the same way.

We generalise this ∗ symbol to '–' (minus or negative sign) to denote the numbers less than '0' which conveys the meaning as less, deficit, reduce, down, left, etc.,

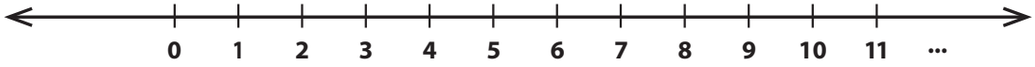
MATHEMATICS ALIVE – INTEGERS IN REAL LIFE

	
Mariana Snailfishes live in the Mariana Trench at 26,200 feet below the sea level.	Temperature in the Ladakh region of India records at –14°C below 0°C on an average in the month of January every year.

2.2 Introduction of Integers and its representation on a number line

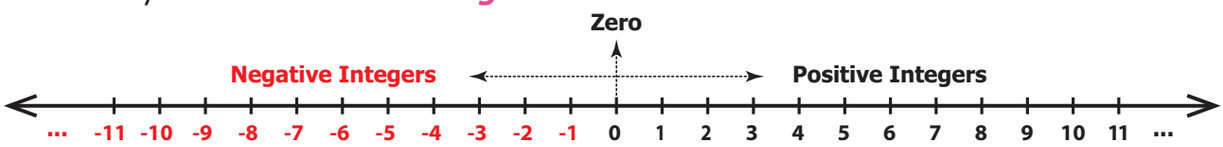
We know that when zero is included to the set of natural numbers then the set of numbers is called as ***Whole numbers***.

Now, let us recall the number line which shows the representation of whole numbers.



Whole numbers

We have seen the need to extend the number line beyond 0 to its left. We call the numbers –1, –2, –3, ... (to the left of zero) as negative numbers or negative integers and the numbers 1, 2, 3,... (to the right of zero) as ***positive numbers*** or ***positive integers.*** Hence, the new set of numbers ..., -3, -2, -1, 0, 1, 2, 3,... are called ***Integers.*** It is denoted by the letter '**Z**'. The ***Integers*** are shown in the number line below.



The 'plus' and 'minus' sign before a number tells, on which side the number is placed from zero. '–' symbol in front of a number is read as 'negative' or 'minus'. For example, –5 is read as negative 5 or minus 5.

Note

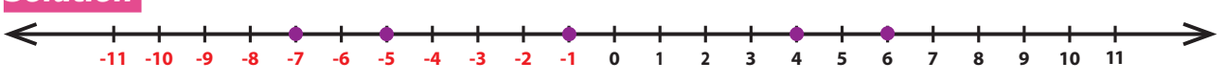
- The number line can be shown both in horizontal and vertical directions.
- The number 0 is neither positive nor negative and hence has no sign.
- Natural numbers are also called as ***positive integers*** and Whole numbers are also called as ***non-negative integers***.
- The positive and the negative numbers together are called as ***Signed numbers***. They are also called as ***Directed numbers***.
- A number without a sign is considered as a positive number.
  For example, 5 is considered as +5.

The letter '**Z**' was first used by the Germans, because the word for Integers in the German language is "**Zahlen**" which means "**number**".

DO YOU KNOW?

Example 1 Draw a number line and mark the integers 6, –5, –1, 4 and –7 on it.

Solution

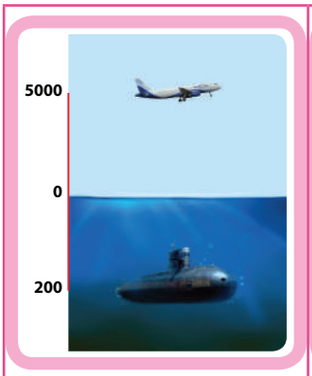
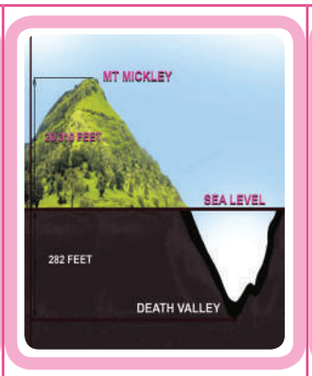


Try these

1 Read the following numbers orally.
  i) +24 ii) –13 iii) –9 iv) 8
2 Draw a number line and mark the following integers.
  i) 0 ii) –6 iii) 5 iv) –8
3 Are all natural numbers integers?
4 Which part of the integers are not whole numbers?
5 How many units should you move to the left of 3 to reach –4?

E6J8HD

2.2.1 More situations on Integers

			
An aeroplane is flying at a height of 5,000m above the sea level and a submarine is at 200m below sea level.	The height of the peak Mt.McKinley is 20,310 feet above the sea level and the death valley is 282 feet below the sea level.	The depth at which sharks are found in the deep sea say at 800 m below the sea level.	The temperature at the hill station Oymyakon, the coldest place in Russia going – 45°C below 0°C.

Activity

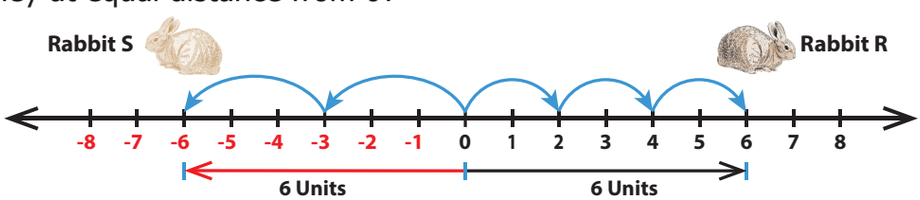
Ask your parents / grandparents about the depth at which the various types of vegetables (seeds) should be planted, for their better and efficient growth. For the same, draw a number line indicating the depth of various vegetable seeds. (Draw the planting chart!).

2.2.2 Opposite of a number

The idea of opposite of a number is not a new one. A few situations like, a man makes a profit of ₹500 or he loses ₹500 by selling an article; credit and debit of ₹75000 in a cash transaction of a business are 'opposite' to each other.

Think about the situation

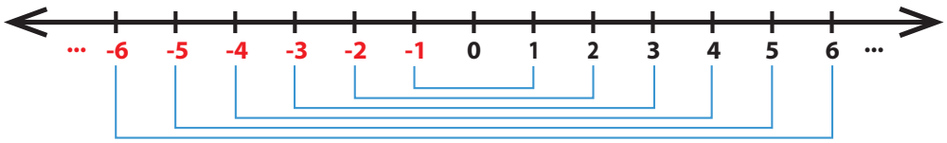
Suppose two rabbits R and S jump along a number line (like) on the opposite sides of 0. Rabbit R jumps 2 steps 3 times to the right of 0 and Rabbit S jumps 3 steps 2 times to the left of 0 as shown in the figure below. Where will both of them stand on the number line? Are they at equal distance from 0?



Clearly, the rabbit R stands at 6 and the rabbit S stands at –6 on the number line. The distance from 0 to 6 on the number line is 6 units and the distance from 0 to –6 on the number line is also 6 units.The numbers 6 and –6 are at the same distance from 0 on

the number line. That is, the rabbits R and S stand at the same distance from 0, but in opposite directions.

Here, 6 and –6 are ***opposite*** to each other. That is, two numbers that are at the same distance from 0 on the number line, but are on the opposite sides of it, are ***opposite*** to each other. For every positive integer, there is a corresponding negative integer and vice versa. The opposite of each integer is shown in the figure.



Opposites

Note

The opposite of the opposite of a number is the number itself. For example –(–5) read as negative of negative 5 or minus of minus 5 is equal to 5 itself.

Now, it is easy to write the opposite of the numbers –7, 12, –225 and 6000. Note that, the opposite of a positive integer is negative, and the opposite of a negative integer is positive, whereas the opposite of zero is zero.

Number	Its opposite
12 or +12	–12
–7	+7 or – (–7) = 7
–225	+225
6000 or +6000	–6000

The "opposites" are naturally more convenient to relate and understand with many of our daily-life situations like saving-spending, credit-debit, height above-below, where

i) the saving is treated as positive and the spending is treated as negative.

ii) a credit is considered positive whereas a debit is considered negative.

iii) the height above the sea level is regarded as positive and the height below the sea level is regarded as negative.

Example 2 Represent the following situations as integers:

i) A gain of ₹1000 ii) 20°C below 0°C iii) 1990 BC (BCE)

iv) A deposit of ₹15847 v) 10 kg below normal weight

Solution

i) As gain is positive, ₹1000 is denoted as + ₹1000.

ii) 20°C below 0°C is denoted as –20°C.

iii) A year in BC (BCE) can be considered as a negative number and a year in AD (CE) can be considered as a positive number. Hence, 1990 BC (BCE) can be represented as –1990.

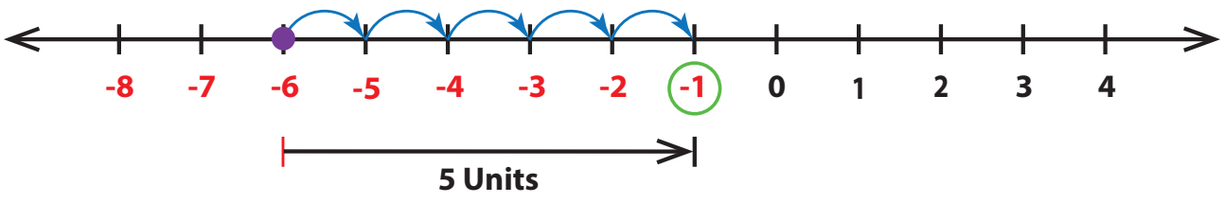
iv) A deposit of ₹15847 is denoted as + ₹15847.

v) 10 kg below normal weight is denoted as –10 kg.

Example 3 Using the number line, write the integer which is 5 more than −6.

Solution

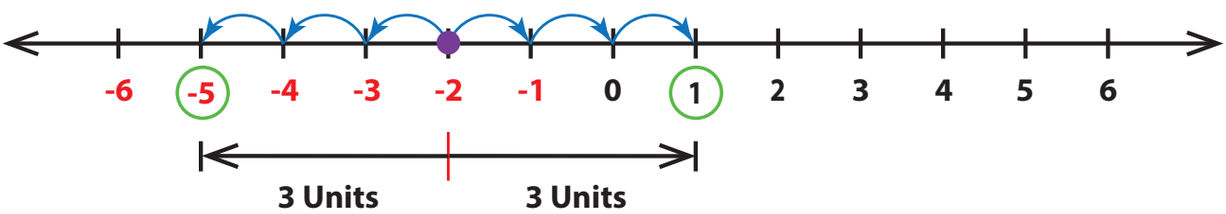
From −6, we can move 5 units to its right to reach −1 as shown in the figure.



Example 4 Find the numbers on the number line that are at a distance of 3 units in the opposite directions to −2.

Solution

From −2, we can move 3 units to the left and right as shown in the figure.



The required numbers are: 1 on the right of −2 and −5 to the left of −2.

Try these

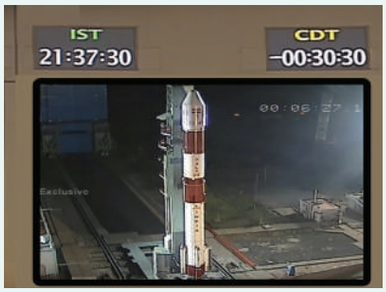
1 Find the opposite of the following numbers:
i) 55 ii) −300 iii)+5080 iv) −2500 v) 0

2 Represent the following situations as integers.
i) A loss of ₹2000
ii) 2018 AD (CE)
iii) Fishes found at 60 m below the sea level
iv) 18°C below 0°C
v) Gaining 13 points
vi) A jet plane at a height of 2500 m

3 Suppose in a building, there are 2 basement floors. If the ground floor is denoted as zero, how can we represent the basement floors?

DO YOU KNOW?

ISRO Scientists often find it convenient to designate a given time as zero time and then refer to the time before and time after as being negative and positive respectively. This practice is followed in the launching of rockets. If the time to take off is 1 minute, then it is 1 minute before the launch and hence denoted as -1 minute.



2.3 Ordering of Integers

We have already seen the ordering of numbers in the set of natural and whole numbers. The ordering is possible for integers also.

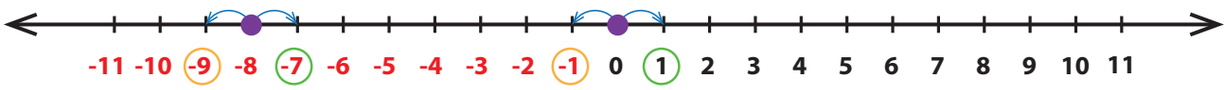
2.3.1 Predecessor and Successor of an Integer

Recall that for a given number its predecessor is one less than it and its successor is one more than it. This applies for integers also.

Example 5 Find the predecessor and successor of i) 0 and ii) −8 on a number line.

Solution

Place the given numbers on the number line then move one unit to their right and left to get the successor and the predecessor respectively.



We can see that the successor of 0 is +1 and the predecessor of 0 is −1 and the successor of −8 is −7 and the predecessor of −8 is −9.

Note

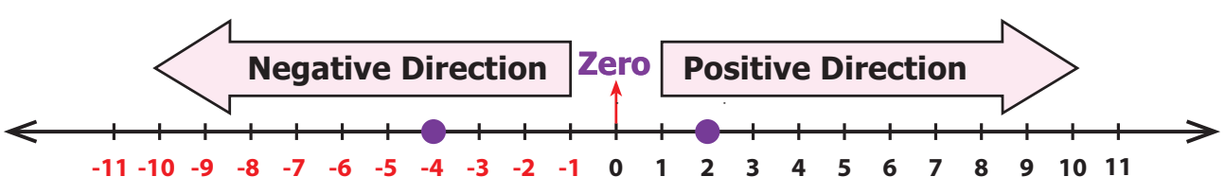
- Every positive integer is greater than each of the negative integers. Example: 3 > −5
- 0 is less than every positive integer but greater than every negative integer. Example: 0<2 but 0> −2

2.3.2 Comparing Integers

Ordering of integers is to compare them. It is very easy to compare and order integers by using a number line.

When we move towards the right of a number on the number line, the numbers become larger. On the other hand, when we move towards the left of a number on the number line, the numbers become smaller.

We know that 4 < 6 , 8 > 5 and so on. Now let us consider two integers say −4 and 2. Mark them on the number line as shown below.

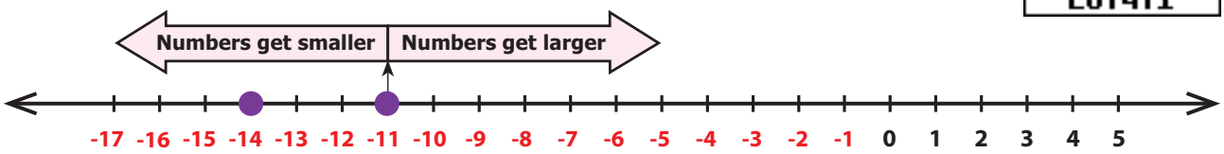


Fix −4 now. See whether 2 is to the right or the left of −4. In this case, 2 is to the right of−4 and in the positive direction. So, 2 > −4 or otherwise −4 < 2.

Example 6 Compare −14 and −11

Solution

Draw number line and plot the numbers −14 and −11 as follows.



Fixing −11, we find −14 is to the left of −11. So, −14 is smaller than −11. That is, −14 < −11.

Think

For two numbers, say 3 and 5, we know that 5 > 3. Will there be a change in the inequality if both the numbers have negative sign before them?

Activity

Take two cards from a deck of playing cards and identify, which is greater between them, assuming that the Joker card represents zero, black cards represent positive integers, red cards represent negative integers and the cards A, J, Q and K represent 1,11,12 and 13 respectively.

Example 7 Arrange the following integers in ascending order:

−15, 0, −7, 12, 3, −5, 1, −20, 25, 18

Solution

Step 1: First, separate the positive integers as 12, 3, 1, 25, 18 and the negative integers as −15, −7, −5, −20

Step 2: We can easily arrange positive integers in ascending order as 1, 3, 12, 18, 25 and negative integers in ascending order as −20, −15, −7, −5.

Step 3: As 0 is neither positive nor negative, it stays at the middle and now the arrangement −20, −15, −7, −5, 0, 1, 3, 12, 18 and 25 is in ascending order.

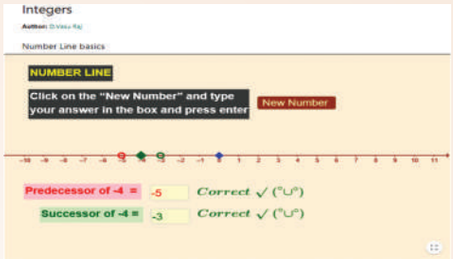
Try these

i) Is −15 < −26? Why?
ii) Which is smaller −3 or −5? Why?
iii) Which is greater 7 or −4? Why?
iv) Which is the greatest negative integer?
v) Which is the smallest positive integer?

Integers

ICT CORNER

Expected Outcome



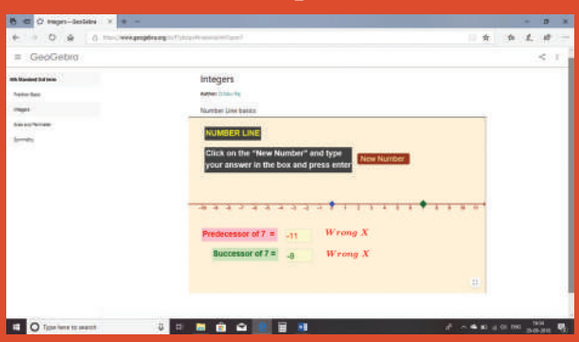
Step 1

Open the Browser by typing the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Integers" will open. There is a worksheet under the title Number Line basics.

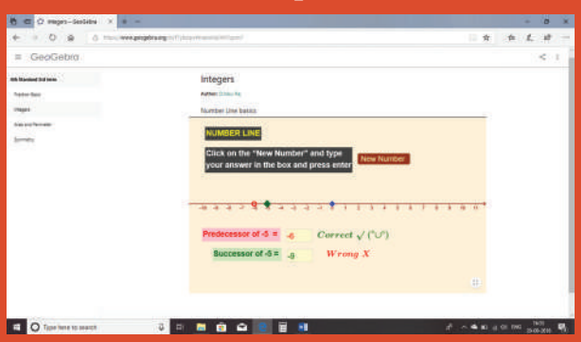
Step 2

Click on the "New Number" to get new question and type your answer in the respective check boxes, next to Predecessor and Successor and press enter..

Step1



Step2



Browse in the link:

Integers: https://ggbm.at/mt7qxxn7 or Scan the QR Code.

B542_6_MAT_EM_T3

Exercise 2.1

1. Fill in the blanks

i) The potable water available at 100m below the ground level is denoted as _____ m.

ii) A swimmer dives to a depth of 7 feet from the ground into the swimming pool. The integer that represents this, is _____ feet.

iii) −46 is to the_____ of −35 on the number line.

iv) There are _____ integers from−5 to +5 (both inclusive).

v) _____ is an integer which is neither positive nor negative.

2. Say True or False

i) Each of the integers −18, 6, −12, 0 is greater than −20.

ii) −1 is to the right of 0.

iii) −10 and 10 are at equal distance from 1.

iv) All negative integers are greater than zero.

v) All whole numbers are integers.

E72ZZN

3. Mark the numbers 4, −3, 6, −1 and −5 on the number line.

4. On the number line, which number is

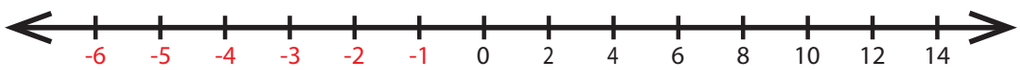
i) 4 units to the right of −7? ii) 5 units to the left of 3?

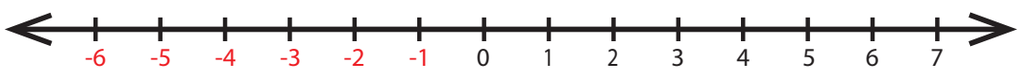
5. Find the opposite of the following numbers.

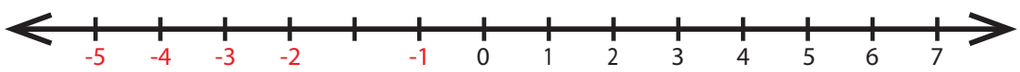
i) 44 ii) −19 iii) 0 iv) −312 v) 789

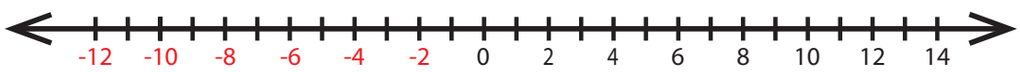
6. If 15 km east of a place is denoted as + 15 km, what is the integer that represents 15 km west of it?

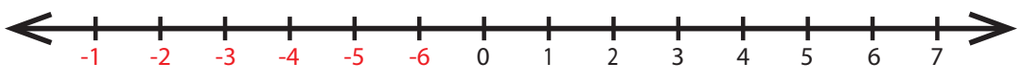
7. From the following number lines, identify the correct and the wrong representations with reason.

i) 

ii) 

iii) 

iv) 

v) 

8. Write all the integers between the given numbers.

i) 7 and 10 ii) −5 and 4 iii) −3 and 3 iv) −5 and 0

9. Put the appropriate signs as <, > or = in the box.

i) −7 ☐ 8 ii) −8 ☐ −7 iii) −999 ☐ −1000

iv) −111 ☐ −111 v) 0 ☐ −200

10. Arrange the following integers in ascending order.

i) −11, 12, −13, 14, −15, 16, −17, 18, −19, −20

ii) −28, 6, −5, −40, 8, 0, 12, −1, 4, 22

iii) −100, 10, −1000, 100, 0, −1, 1000, 1, −10

11. Arrange the following integers in descending order.
    i) 14, 27, 15, −14, −9, 0, 11, −17
    ii) −99, −120, 65, −46, 78, 400, −600
    iii) 111, −222, 333, −444, 555, −666, 7777, −888

Objective Type Questions

12. There are _____ positive integers from −5 to 6.
    a) 5 b) 6 c) 7 d) 11
13. The opposite of 20 units to the left of 0 is
    a) 20 b) 0 c) −20 d) 40
14. One unit to the right of −7 is.....
    a) +1 b) −8 c) −7 d) −6
15. 3 units to the left of 1 is
    a) −4 b) −3 c) −2 d) 3
16. The number which determines marking the position of any number to its opposite on a number line is
    a) −1 b) 0 c) 1 d) 10

Exercise 2.2

Miscellaneous Practice Problems

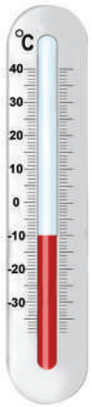
1. Write two different real life situations that represent the integer −3.
2. Mark the following numbers on a number line
    i) All integers which are greater than −7 but less than 7.
    ii) The opposite of 3.
    iii) 5 units to the left of −1.
3. Construct a number line that shows the depth of 10 feet from the ground level and its opposite.
4. Identify the integers and mark on the number line that are at a distance of 8 units from −6.
5. Answer the following questions from the number line given below .

    i) Which integer is greater : G or K ? Why ?
    ii) Find the integer that represents C.
    iii) How many integers are there between G and H?
    iv) Find the pairs of letters which are opposite of a number.
    v) Say True or False : 6 units to the left of D is −6.

6. If G is 3 and C is −1, what numbers are A and K on the number line?

7. Find the integers that are 4 units to the left 0 and 2 units to the right of −3.

Challenge Problems

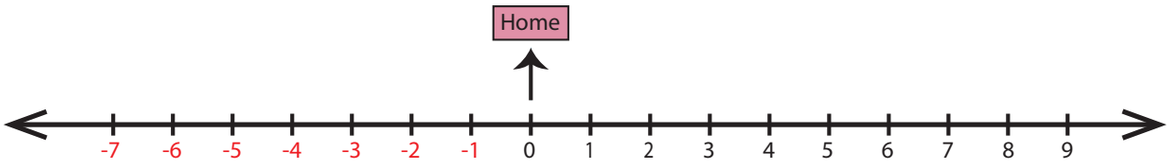


8. Is there the smallest and the largest number in the set of integers? Give reason.

9. Look at the Celsius Thermometer and answer the following questions:
   i) What is the temperature that is shown in the Thermometer?
   ii) Where will you mark the temperature 5^0 C below 0^0 C in the Thermometer?
   iii) What will be the temperature, if 10^0 C is reduced from the temperature shown in the Thermometer?
   iv) Mark the opposite of 15^0 C in the Thermometer.

10. P, Q, R and S are four different integers on a number line. From the following clues, find these integers and write them in ascending order.
   i) S is the least of the given integers.
   ii) R is the smallest positive integer.
   iii) The integers P and S are at the same distance from 0.
   iv) Q is 2 units to the left of integer R.

11. Assuming that the home to be the starting point, mark the following places in order on the number line as per instructions given below and write their corresponding integers.



Places: Home, School, Library, Playground, Park, Departmental Store, Bus Stand, Railway Station, Post Office, Electricity Board.

Instructions:
   i) Bus Stand is 3 units to the right of Home.
   ii) Library is 2 units to the left of Home.
   iii) Departmental Store is 6 units to the left of Home.
   iv) Post Office is 1 unit to the right of the Library.
   v) Park is 1 unit right of Departmental Store.
   vi) Railway Station is 3 units left of Post Office.
   vii) Bus Stand is 8 units to the right of Railway Station.
   viii) School is next to the right of Bus Stand.
   ix) Playground and Library are opposite to each other.
   x) Electricity Board and Departmental Store are at equal distance from Home.

12. Complete the table using the following hints:

C1: the first non-negative integer.

C3: the opposite to the second negative integer.

C5: the additive identity in whole numbers.

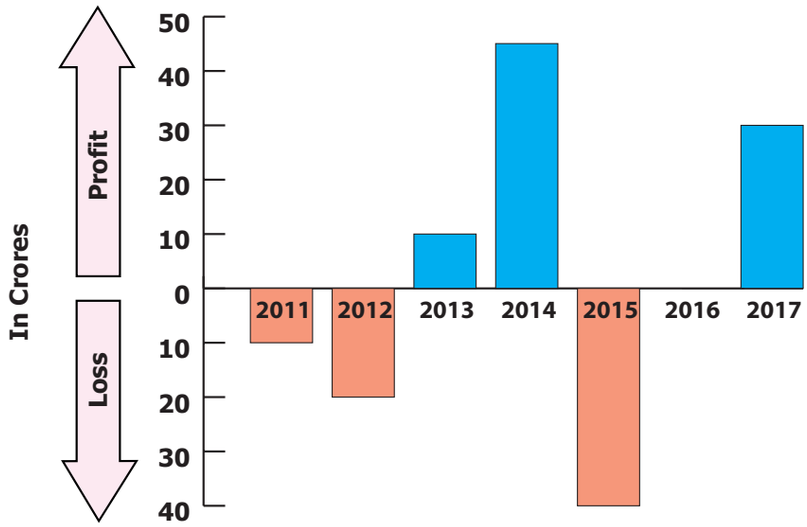
C6: the successor of the integer in C2.

C8: the predecessor of the integer in C7.

C9: the opposite to the integer in C5.

C1	C2 -5	C3
C4 6	C5	C6
C7 -7	C8	C9

13. The following bar graph shows the profit (+) and loss (−) of a small scale company (in crores) between the years 2011 to 2017.



i) Write the integer that represents a profit or a loss for the company in 2014?

ii) Denote by an integer on the profit or loss in 2016.

iii) Denote by integers on the loss for the company in 2011 and 2012.

iv) Say True or False: The loss is minimum in 2012.

v) Fill in: The amount of loss in 2011 is _____ as profit in 2013.

Summary

- The set of numbers …, -3, -2, -1, 0, 1, 2, 3,… is called Integers. It is denoted by the letter Z.
- The number 0 is neither positive nor negative
- Two numbers that are at the same distance from 0 on the number line, but are on the opposite sides of it, are opposite to each other.
- Natural numbers are called as positive integers and Whole numbers are called as non-negative integers.
- Positive and negative numbers together are called as Signed numbers. Signed numbers are also called as Directed numbers.

CHAPTER 3

PERIMETER AND AREA

E7BH2B

Learning Objectives

- To understand the concept of perimeter and area of closed shapes.
- To calculate the perimeter and area of square, rectangle, right angled triangle and their combined shapes.
- To understand the usage of units appropriately for area and perimeter.

3.1 Introduction

We come across many situations in our day to day life which deal with shapes, their boundaries and surfaces. For example,

- A fence built around a land.
- Frame of a photograph.
- Calculating the surface of the wall to know the quantity of the paint required.
- Wrapping the textbooks and notebooks with brown sheets.
- Calculating the number of tiles to be laid on the floor.

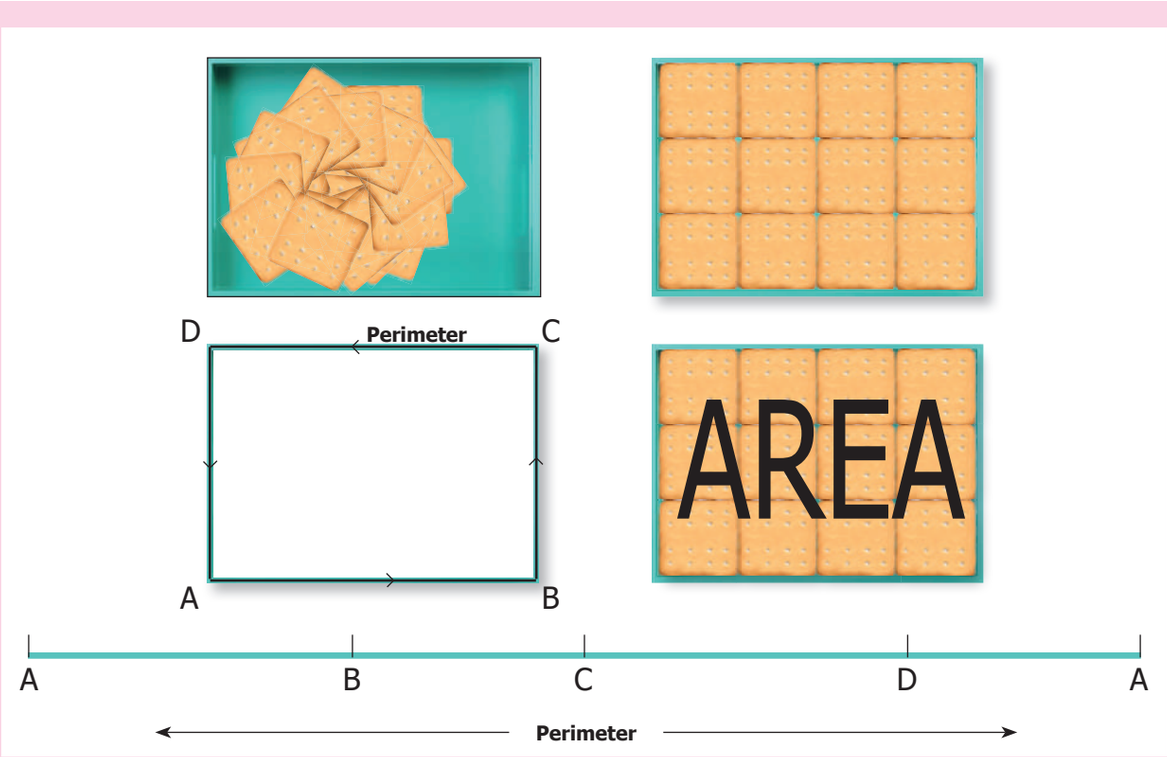
Some situations need to be handled tactfully and efficiently for the following reasons.

- Using the optimum space to build a dining hall, kitchen, bedroom etc., in constructing a house in the available land and planning of materials required.
- Arranging the things like cot, television, cup-board, table etc., in the proper place within the available space at home.
- Reducing the expenses in all the above activities.

In this context, learning of perimeter and area will be of great importance.

Think about the situation

Apoorva and her brother return from school. Their mother serves them some biscuits. While they eat them one by one, Apoorva arranges the biscuits on a tray. She finds that the tray can hold only 12 biscuits. If she has to extend spreading the remaining biscuits also in the same manner, she will need a bigger tray in size because, already 12 biscuits occupied the surface of the tray completely. The total length of the visible borders of the tray is said to be the ***perimeter*** and the surface occupied by the biscuits is said to be the ***area*** of the tray. Let us discuss about the perimeter and area in detail in this chapter.



MATHEMATICS ALIVE – PERIMETER AND AREA IN REAL LIFE

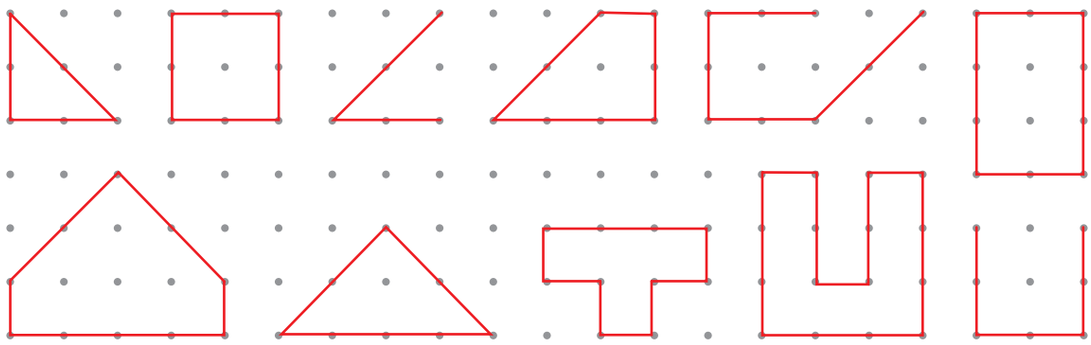
Carpenters measure the length of wood required to make a chair

Mason fixing the tiles on the floor.

3.2 Perimeter

Activity

Observe the following shapes and answer the questions given below:



i) Mark the closed shapes as '✓' and open shapes as 'x'.

ii) Find the measure of the boundary of closed shapes by using a ruler.

iii) Which closed shape has the shortest boundary?

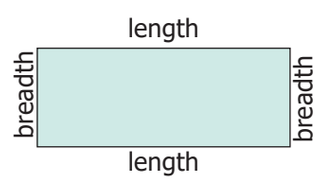
iv) Which closed shape has the longest boundary?

The length of the boundary of any closed shape is called its ***perimeter***. Hence, 'the measure around' of a closed shape is called its ***perimeter***. The unit of perimeter is the unit of length itself. The units of length may be expressed in terms of metre, millimetre, centimetre, kilometre, inch, feet, yard etc.,

DO YOU KNOW?

The word perimeter is derived from the Greek words 'peri' and 'metron', where 'peri' means 'around' and 'metron' means 'measure'.

3.2.1 Perimeter of a Rectangle



Perimeter of a rectangle = Total boundary of the rectangle

= length + breadth + length + breadth

= 2 length + 2 breadth

= 2 (length + breadth)

Let us denote the length, breadth and the perimeter of a rectangle as l, b and P respectively.

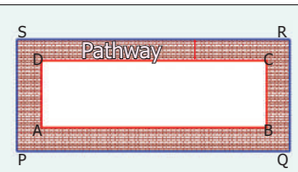
Perimeter of the rectangle, P= 2 x (l + b) *units*

Note

In a rectangle the opposite sides are equal in length.

DO YOU KNOW?

For the pathway shown in the figure, the outer boundary of the pathway is PQRS and its inner boundary is ABCD.



Example 1 If the length of a rectangle is 12 cm and the breadth is 10 cm, then find its perimeter.

Solution

$l = 12\ cm$

$b = 10\ cm$

$P = 2\ (l + b)\ units$

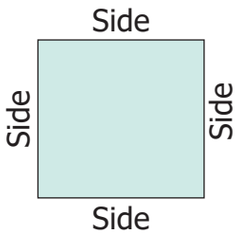
$= 2\ (12 + 10)$

$= 2 \times 22$

$= 44\ cm$

Perimeter of the rectangle is 44 cm.

3.2.2 Perimeter of a Square



Perimeter of a square = Total boundary of the square

= side + side + side + side

= (4 × side) $units$

If the side of a square is 's' units, then

Perimeter of the square, P = (4 × s) $units$ = 4s $units$.

Note

- In a square, all the sides are equal in length.
- The perimeter of a regular shape with any number of sides = number of sides x length of a side

Example 2 The side of a square is 5 cm. Find its perimeter.

Solution

s = 5 cm

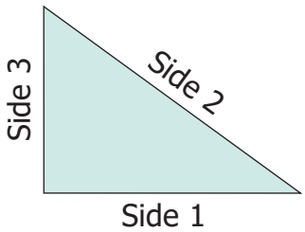
P = (4 × s) $units$

= 4 × 5

= 20 cm

Perimeter of the square is 20 cm.

3.2.3 Perimeter of a Triangle



Perimeter of a triangle = Total boundary of the triangle

= side 1 + side 2 + side 3

If three sides of a triangle are taken as a, b and c, then the

Perimeter of the triangle, P = (a + b + c) $units$.

Example 3 Find the perimeter of a triangle whose sides are 3 cm, 4 cm and 5 cm.

Solution

a = 3 cm

b = 4 cm

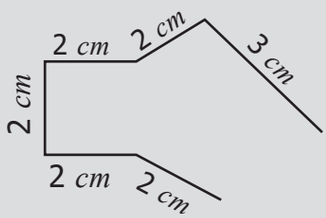
c = 5 cm

P = (a + b + c) $units$

= 3 + 4 + 5 = 12 cm

Perimeter of the triangle is 12 cm.

Think



Is the perimeter of the given shape possible? Why?

Try these

i) Draw a shape with perimeter 16 cm in a dot sheet.
ii) What is the perimeter of a rectangle if the length is twice its breadth?
iii) What would be the perimeter of a square if its side is reduced to half?
iv) What is the perimeter of a triangle if all sides are equal in length?

Activity

Choose any five items like Table, A4 sheet, Note-book., etc in the classroom. Guess the approximate length of each side by observation and write down the estimated perimeter of the item. Then, measure by using ruler and record the actual perimeter and find the difference in the following table (to the nearest cm).

Item	Estimated Perimeter	Actual Perimeter	Difference

Example 4 Find the length of the rectangular black board whose perimeter is 6 m and the breadth is 1 m.

Solution Perimeter of the black board, P= 6 m

Breadth of the black board, b=1 m

length, l =?

$2(l + b) = 6$

$2(l + 1) = 6$

$l + 1 = \frac{6}{2}$

$= 3$

$l = 3 - 1$

$= 2\ m$

The length of the black board is 2 m.

Example 5 Find the side of a square shaped postal stamp of perimeter 8 cm.

Solution Perimeter of the square, P= 8 cm

$4 \times S = 8$

$S = \frac{8}{4}$

$= 2\ cm$

The side of the stamp is 2 cm.

Example 6 Find the side of the equilateral triangle of perimeter 129 cm.

Solution Perimeter of the equilateral triangle, P $= 129\ cm$

$$a + a + a = 129$$
$$3 \times a = 129$$
$$a = \frac{129}{3}$$
$$= 43\ cm$$

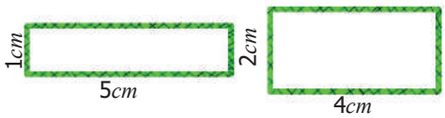
The side of the equilateral triangle is 43 cm.

Example 7 Thendral, Tharani and Thanam are given a thread piece each of length 12 cm. They are asked to make a rectangle, a square and a triangle respectively with the thread for their Math activity. In how many ways, can they make the respective shapes?

Solution **Thendral**

Perimeter of the rectangle, P $= 12\ cm$

$$2(l + b) = 12$$
$$l + b = \frac{12}{2} = 6\ cm$$



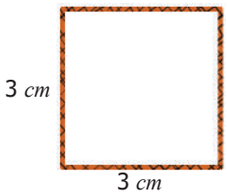
The possible pairs of measures whose sum is 6 are (5,1) and (4, 2).

Hence, Thendral can make a rectangle in 2 ways. She can make a rectangle of length 5 cm and breadth 1 cm and another one with length 4 cm and breadth 2 cm.

Tharani

Perimeter of the square, P $= 12\ cm$

$$4 \times s = 12$$
$$s = \frac{12}{4} = 3\ cm$$



Hence, Tharani can make only one square of side 3 cm.

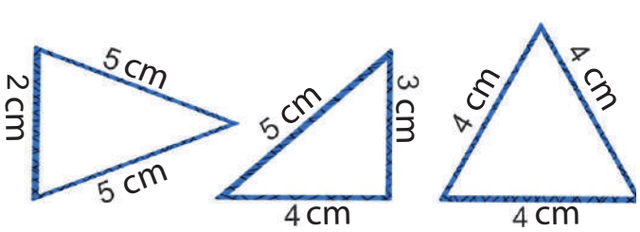
Thanam

Perimeter of the triangle, P $= 12\ cm$

$$a + b + c = 12\ cm$$

The possible triplets of measures whose sum is 12 and also satisfying the triangle inequality are (2, 5, 5) ; (3, 4, 5) ; (4, 4, 4).

Hence, Thanam can make 3 triangles of sides 2 cm, 5 cm & 5 cm; 3 cm, 4 cm & 5 cm and 4 cm, 4 cm & 4 cm.



Think

Can different shapes have the same perimeter?

Example 8 Find the cost of fencing a square plot of side 12 m at the rate of ₹15 per metre.

Solution

Side of a square plot = 12 m

Perimeter of the square plot = (4 × s) *units*

= 4 × 12 = 48 m

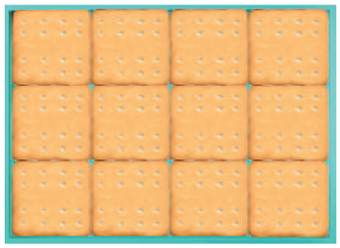
Cost of fencing the plot at the rate of ₹15 per metre = 48 × 15 = ₹720

Try these

i) Find the breadth of the rectangle with perimeter 14 m and length 4 m.

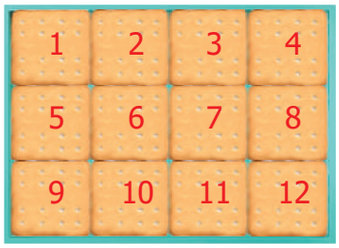
ii) The perimeter of an isoseles triangle is 21 cm. Find the measure of equal sides given that the third side is 5 cm.

3.3 Area



Recall the 'Apoorva and her biscuits arrangement' in the beginning of this chapter. We do not know the measure of the side of the biscuit. But we know it is in the shape of a square. Let its side be 1 unit. The tray can hold 12 square biscuits (square units). That is, 12 square biscuits (square units) occupy the entire surface of the tray. This space of the tray is called the ***Area*** of the tray. Thus, the area of any closed shape is the surface occupied by the number of unit squares within its boundary. Suppose each side of a biscuit is of 1 inch length, then the area of the tray is 12 square inches.

3.3.1 Area of a Rectangle



As the above tray is in the shape of a rectangle, split it into small and uniform squares called unit squares. There are 4 unit squares along its length and 3 unit squares along its breadth. Totally, 12 square biscuits occupy this rectangle and so the area of this rectangle is 12 square units.

Suresh brought a groundnut burfi packet to school as snacks to eat during the break. As he peeled off the cover, he saw that there are 3 rows and each row has 5 square pieces. What he sees here is that the total number of small squares in the given burfi is 15. So, the area of the given rectangular burfi is 15 square burfi pieces.

Tamizhazhagi wants to share a chocolate bar with her friends on her birthday. The chocolate bar that she has bought has 5 square pieces horizontally and 4 square pieces vertically. She finds that there are 20 identical unit square chocolate pieces so that she can give it to 19 of her friends and have 1 for herself.

Here, the total number of square chocolate pieces is 20, which represents the area of the whole chocolate bar.

The total number of squares in all these cases can be arrived by multiplying the number of squares along its length with the number of squares along its breadth instead of counting them.

Note

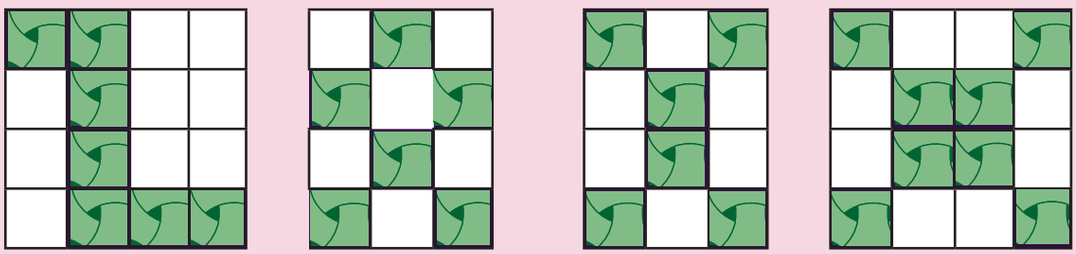
'Square units' can also be written as 'unit^2'.

Therefore the area of any rectangle = (length x breadth) square units.

= (l x b) sq. units.

Try these

Find the number of tiles required to fill the area of following figures.



i) ii) iii) iv)

Example 9 Find the area of a rectangle of length 12 cm and breadth 7 cm.

Solution

Length of the rectangle, l = 12 cm.

Breadth of the rectangle, b = 7 cm.

Area of the rectangle A = (l x b) $sq.\ units$.

= 12 x 7 = 84 $sq.\ cm$.

3.3.2 Area of a Square

If the length and breadth of a rectangle are equal, then it becomes a square.

Area of the rectangle = (length x breadth) square units.

= (side x side) $sq.\ units$.

= (s x s) $sq.\ units$.

= Area of a square

Therefore area of a square = (s x s) $sq.\ units$.

Note

When the rectangle is made into a square then length (l)=breadth (b)=side (s)

Example 10 Find the area of a square of side 15 cm.

Solution

Side of the square, s = 15 cm

Area of the square, A = (s x s) $sq.\ units$.

= 15 x 15

= 225 sq. cm. (or) 225 cm^2

3.3.3 Area of a Right Angled Triangle

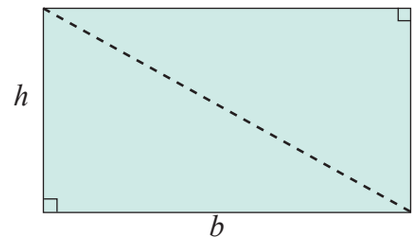
In a right angled triangle one of the sides containing the right angle is treated as its base (b units) and the other side as its height (h units).

When a rectangular sheet is cut along its diagonal, two right angled triangles are obtained.

Area of two right angled triangles = Area of the rectangle

2 x Area of a right angled triangle = l x b

Area of the right angled triangle = $\frac{1}{2}$ (l x b) *sq. units.*

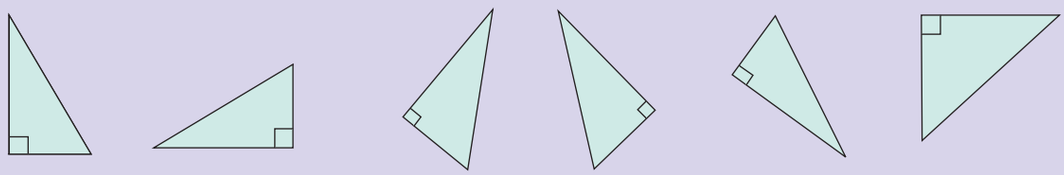


The length and breadth of the rectangle are respectively the base (b) and height (h) of the right angled triangle.

Hence, area of the right angled triangle = $\frac{1}{2}$ (b x h) *sq. units*.

Activity

Mark the base and height of the following right angled triangles.



Example 11 Find the area of a right angled triangle whose base is 18 *cm* and height is 12 *cm*.

Solution

Base, b = 18 *cm*

Height, h = 12 *cm*

Area, A = $\frac{1}{2}$ (b x h) *sq. units*

= $\frac{1}{2}$(18 x 12)

= 108 *sq. cm*. (or) 108 cm^2

E7KS3Y

Try these

Draw the following in a graph sheet.

i) Two different rectangles whose areas are 16 cm^2 each.

ii) A shape with perimeter 14 *cm* and area 12 *sq. cm*.

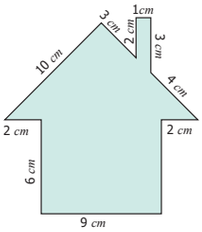
iii) A shape with area 36 *sq. cm*.

iv) Form different shapes using 4 *unit* squares and find their perimeter and area. (Sides of the squares must fit exactly)

3.4 Perimeter and Area of Combined Shapes

A ***Combined shape*** is the combination of several closed shapes. The perimeter is calculated by adding all the outer sides (boundaries) of the combined shape. The area is calculated by adding all the areas of closed shapes from which the combined shape is formed.

Example 12 Find the perimeter of the given figure.

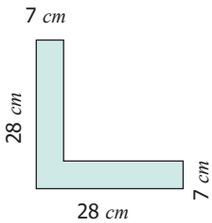


Solution Perimeter = Total length of the boundary

= (6 + 2 + 10 + 3 + 2 + 1 + 3 + 4 + 2 + 6 + 9) *cm*

= 48 *cm*

Example 13 Find the perimeter and the area of the following 'L' shaped figure.

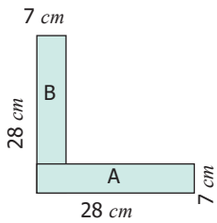


Solution Perimeter = (28 + 7 + 21 + 21 + 7 + 28) *cm*.

= 112 *cm*.

To find the area of the L shaped figure, it is divided into two rectangles A and B.

Rectangle-A	Rectangle-B
l = 28 *cm*	l = 21 *cm*
b = 7 *cm*	b = 7 *cm*
A = l x b sq. *cm*	A = l x b sq. *cm*.
= 28 x 7	= 21 x 7
= 196 sq. *cm*	= 147 sq. *cm*



The area of the 'L' shaped figure = (196 + 147) *sq. cm*

= 343 *sq. cm*.

Activity

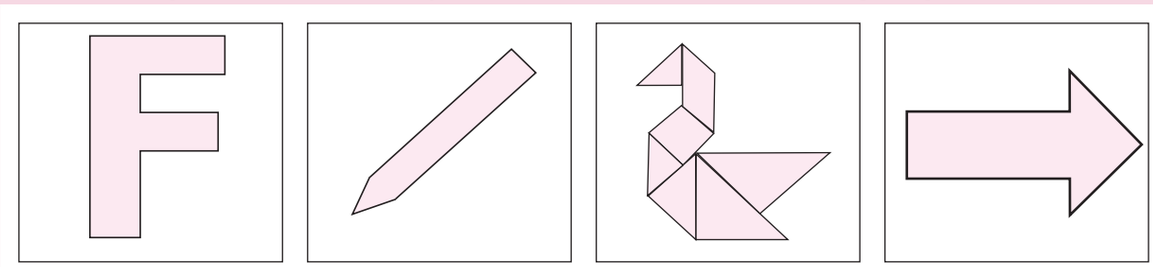
Find the area of the given 'L' shaped rectangular figure by dividing it into squares of equal sizes.

Think

Can you find the area of 'L' shaped figure as the difference between two areas.

Try these

Measure using ruler and find the perimeter of each of the following diagram.



Activity

Form all possible shapes of perimeter 80 *cm* with 9 identical squares, each of side 4 *cm*.

3.4.1 Impact on Removing / Adding a portion from / to a given shape

Consider a rectangle of sides 8 *cm* and 12 *cm*.

Length, l = 12 *cm*; Breadth b = 8 *cm*.

Area, A = (l x b) *sq. units.*

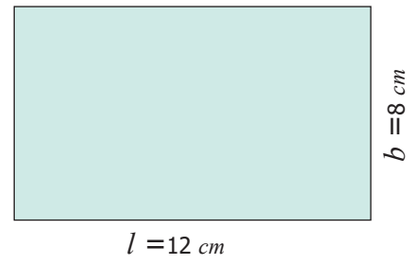
= 12 x 8

= 96 *sq. cm.*

Perimeter, P = 2 (l + b) *units.*

= 2 (12 + 8)

= 40 *cm*.



Find the area and perimeter of the rectangle in the following situations and observe the changes.

Situation 1

A square of side 3 *cm* is cut at a corner of the rectangle.

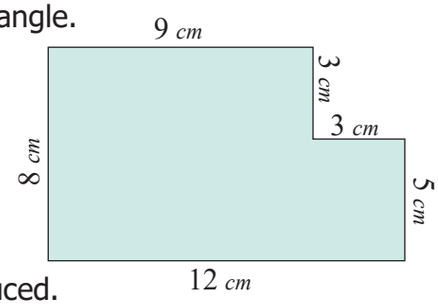
Area, A = (l x b) – (s x s) *sq. units.*

= (12 x 8) – (3 x 3)

= 87 *sq. cm*.

Perimeter, P = (Total boundary) *units.*

= 8+12+5+3+3+9 = 40 *cm*.



The perimeter is not changed. But the area is reduced.

Situation 2

A square of side 3 *cm* is attached to the rectangle.

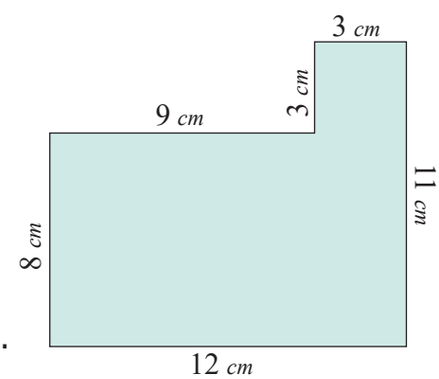
Area, A = (l x b) + (s x s) *sq. units.*

= (12 x 8) + (3 x 3)

= 105 *sq. cm*.

Perimeter, P = (Total boundary) units.

= 8+12+11+3+3+9 = 46 *cm*.



Here both the perimeter and the area are increased.

Example 14 Four identical square floor mats of side 15 *cm* are joined together to form either a rectangular mat or a square mat. Which mat will have a larger area and a longer perimeter?

Solution Perimeter of a rectangle, P = 2 (l + b) *units.*

= 2 (60+15) *cm*. = 150 *cm*.

Area of a rectangle, A = (l x b) *sq. units.*

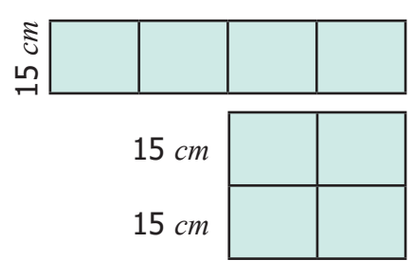
= 60 x 15 = 900 *sq. cm*.

Perimeter of a square, P = (4 × s) *units*

= (4 x 30) *cm* = 120 *cm*

Area of a square, A = (s x s) *sq. units.*

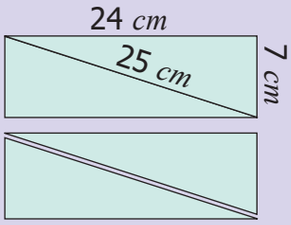
= 30 x 30 = 900 *sq. cm*.

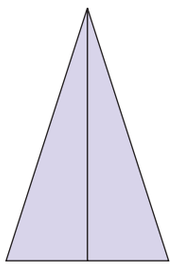
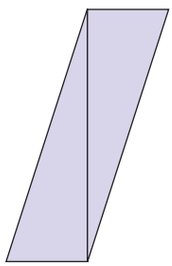
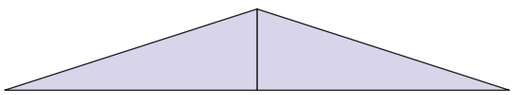
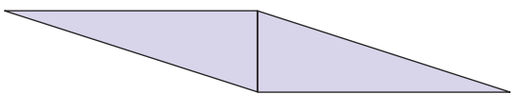


There is no change in their areas. But, the rectangular mat will have longer perimeter.

Activity

Cut a rectangular sheet along one of its diagonals. Two identical scalene right angled triangles are obtained. Join them along their sides of identical length in all possible ways. Six different shapes can be obtained. Four of them are given. Find the remaining two shapes. Find the perimeter of all the six shapes and fill in the table.



Sl. No.	Shape obtained	Perimeter
1		
2		
3		
4		
5		
6		

Based on the above activity answer the following questions:

i) Are the perimeters same for all the shapes?

ii) Which shape has the longest perimeter?

iii) Which shape has the shortest perimeter?

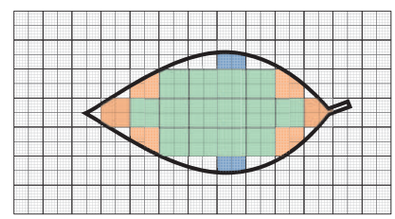
iv) Are the areas of all the shapes same? Why?

- Shapes with the same perimeter may have different areas.
- Shapes with the same area may have different perimeters.

3.5 Area of Irregular Shapes

The area of the shapes like triangle, square etc., are found by standard formulae. But we can find the approximate area of shapes like leaves as follows.

Place a leaf on a graph sheet and trace its boundary. Now observe the squares of size 1 cm x 1 cm inside of this boundary. We get complete squares (Green), partial but bigger than half squares (Orange) and half squares (Blue). The smaller than half squares which have negligible area are omitted.



Now the approximate area of the leaf

= (Number of full squares + Number of more than half squares + $\frac{1}{2}$ x Number of half squares) $sq.\ units$

= $(14 + 6 + \frac{1}{2} \times 2)\ sq.\ cm$

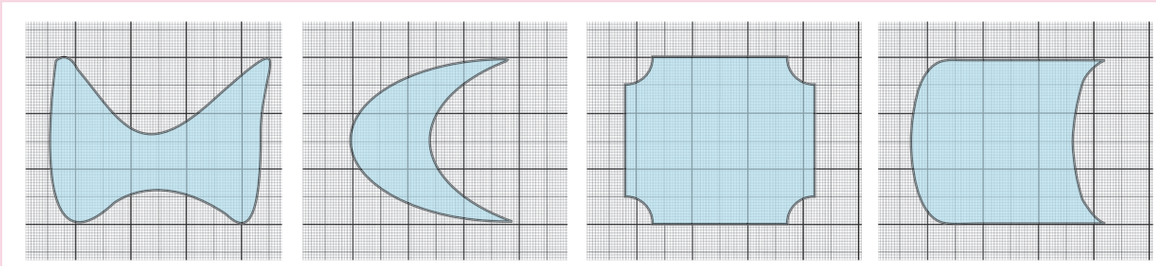
= $21\ sq.\ cm$

Note

You will learn to find the actual area of irregular shapes like leaves in your higher classes.

Try these

Find the approximate area of the following figures:



3.6 Expressing the Area in Square Units

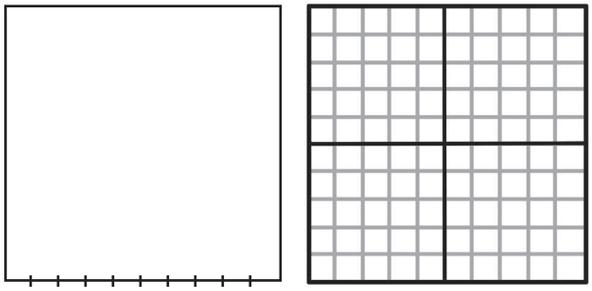
Consider a square of side 1 cm. Therefore, its area is 1 $sq.\ cm$ (1 cm^2). Divide one of its sides into 10 equal parts. One such part is equal to 1 mm. We know that 1 cm = 10 mm. That is a square of side 1 cm is made up of 100 small squares with 1 mm square area each. Therefore, the side of this square is 10 mm and the area of this square = side x side =10 mm x 10 mm = 100 $sq.\ mm$ (100 mm^2). Therefore, the area of a square with 1 cm side is 1 cm^2 = 100 mm^2.

Similarly, the other conversions can also be done. For example,

i) 1 cm^2 = 10 mm x 10 mm
= 100 mm^2

ii) 1 m^2 = 100 cm x 100 cm
= 10,000 cm^2

iii) 1 km^2 = 1000 m x 1000 m
= 10,00,000 m^2



Example 15 Fill in the blanks.

i) 2 cm^2 = _____ mm^2

ii) 18 m^2 = _____ cm^2

iii) 5 km^2 = _____ m^2

DO YOU KNOW?

1 acre = 4046.86 m^2

1 hectare = 10,000 m^2

Solution

i) 2 cm^2 = 2 x 100 = 200 mm^2

ii) 18 m^2 =18 x 10000 = 1,80,000 cm^2

iii) 5 km^2 = 5 x 1000000 = 50,00,000 m^2

Try these

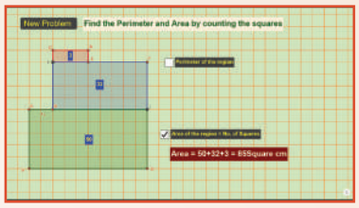
Fill in the blanks

i) 7 cm^2 = _____ mm^2 ii) 10 m^2 = _____ cm^2 iii) 3 km^2 = _____ m^2

Perimeter and Area

ICT CORNER

Expected Outcome



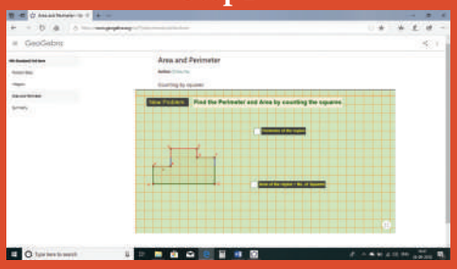
Step – 1

Open the Browser by typing the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Perimeter and Area" will open. There is a worksheet under the title Counting by squares.

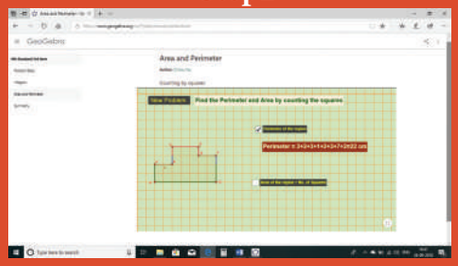
Step - 2

Click on New Problem and find the perimeter and Area of the shape by counting along the squares. Click on the respective check boxes to check your answer.

Step1



Step2



Browse in the link:

Perimeter and Area: https://ggbm.at/dxv8xvhr or Scan the QR Code.

B542_6_MAT_EM_T3

Exercise 3.1

1. The table given below contains some measures of the rectangle. Find the unknown values.

S. No	Length	Breadth	Perimeter	Area
i)	5 *cm*	8 *cm*	?	?
ii)	13 *cm*	?	54 *cm*	?
iii)	?	15 *cm*	60 *cm*	?
iv)	10 *m*	?	?	120 *sq. m*
v)		4 *feet*	?	20 *sq. feet*

2. The table given below contains some measures of the square. Find the unknown values.

S. No	Side	Perimeter	Area
i)	6 *cm*	?	?
ii)	?	100 *m*	?
iii)	?	?	49 *sq. feet*

E84J79

3. The table given below contains some measures of the right angled triangle. Find the unknown values.

S. No	Base	Height	Area
i)	20 *cm*	40 *cm*	?
ii)	5 *feet*	?	20 *sq. feet*
iii)	?	12 *m*	24 *sq. m*

4. The table given below contains some measures of the triangle. Find the unknown values.

S. No	Side 1	Side 2	Side 3	Perimeter
i)	6 *cm*	5 *cm*	2 *cm*	?
ii)	?	8 *m*	3 *m*	17 *m*
iii)	11 *feet*	?	9 *feet*	28 *feet*

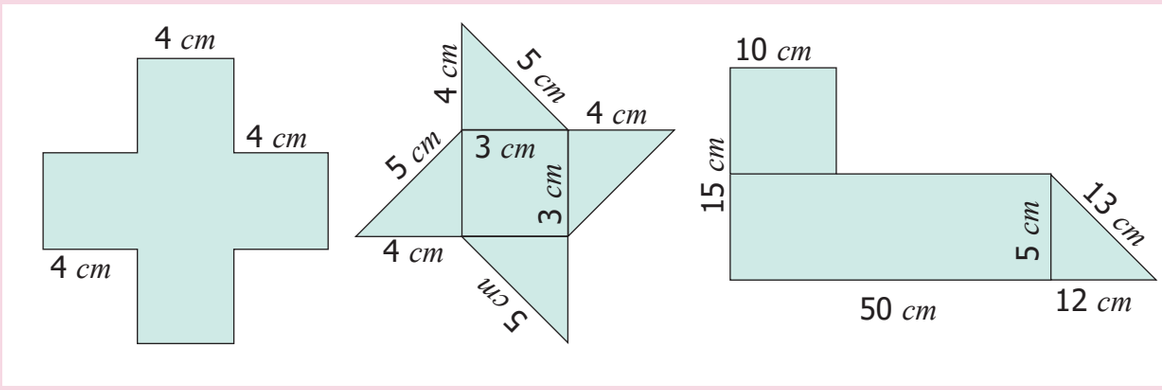
5. Fill in the blanks.

i) 5 cm^2 = _____ mm^2

ii) 26 m^2 = _____ cm^2

iii) 8 km^2 = _____ m^2

6. Find the perimeter and area of the following shapes.

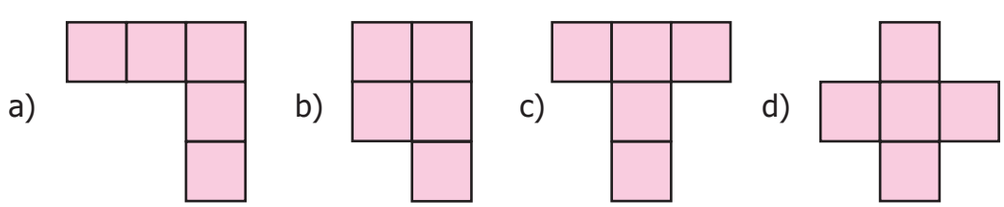


(i) (ii) (iii)

7. Find the perimeter and the area of the rectangle whose length is 6 m and breadth is 4 m.
8. Find the perimeter and the area of the square whose side is 8 cm.
9. Find the perimeter and the area of a right angled triangle whose sides are 6 *feet*, 8 *feet* and 10 *feet*.
10. Find the perimeter of
    i) A scalene triangle with sides 7 m, 8 m, 10 m.
    ii) An isosceles triangle with equal sides 10 cm each and third side is 7 cm.
    iii) An equilateral triangle with side 6 cm.
11. The area of a rectangular shaped photo is 820 $sq.\ cm.$ and its width is 20 cm. What is its length? Also find its perimeter.
12. A square park has 40 m as its perimeter. What is the length of its side? Also find its area.
13. The scalene triangle has 40 cm as its perimeter and whose two sides are 13 cm and 15 cm, find the third side.
14. A field is in the shape of a right angled triangle whose base is 25 m and height 20 m. Find the cost of levelling the field at the rate of ₹45 per sq. m^2.
15. A square of side 2 cm is joined with a rectangle of length 15 cm and breadth 10 cm. Find the perimeter of the combined shape.

Objective Type Questions

16. The following figures are of equal area. Which figure has the least perimeter?



17. If two identical rectangles of perimeter 30 cm are joined together, then the perimeter of the new shape will be
    a) equal to 60 cm b) less than 60 cm
    c) greater than 60 cm d) equal to 45 cm
18. If every side of a rectangle is doubled, then its area becomes _____ times.
    a) 2 b) 3 c) 4 d) 6
19. The side of a square is 10 cm. If its side is tripled, then by how many times will its perimeter increase?
    a) 2 times b) 4 times c) 6 times d) 3 times
20. The length and breadth of a rectangular sheet of a paper are 15 cm and 12 cm respectively. A rectangular piece is cut from one of its corners. Which of the following statement is correct for the remaining sheet?
    a) Perimeter remains the same but the area changes
    b) Area remains the same but the perimeter changes
    c) There will be a change in both area and perimeter.
    d) Both the area and perimeter remains the same.

Exercise 3.2

Miscellaneous Practice Problems

1. A piece of wire is 36 cm long. What will be the length of each side if we form
   i) a square ii) an equilateral triangle.
2. From one vertex of an equilateral triangle with side 40 cm, an equilateral triangle with 6 cm side is removed. What is the perimeter of the remaining portion?
3. Rahim and Peter go for a morning walk, Rahim walks around a square path of side 50 m and Peter walks around a rectangular path with length 40 m and breadth 30 m. If both of them walk 2 rounds each, who covers more distance and by how much?
4. The length of a rectangular park is 14 m more than its breadth. If the perimeter of the park is 200 m, what is its length? Find the area of the park.
5. Your garden is in the shape of a square of side 5 m. Each side is to be fenced with 2 rows of wire. Find how much amount is needed to fence the garden at ₹ 10 per metre.

Challenge Problems

6. A closed shape has 20 equal sides and one of its sides is 3 cm. Find its perimeter.
7. A rectangle has length 40 cm and breadth 20 cm. How many squares with side 10 cm can be formed from it.
8. The length of a rectangle is three times its breadth. If its perimeter is 64 cm, find the sides of the rectangle.

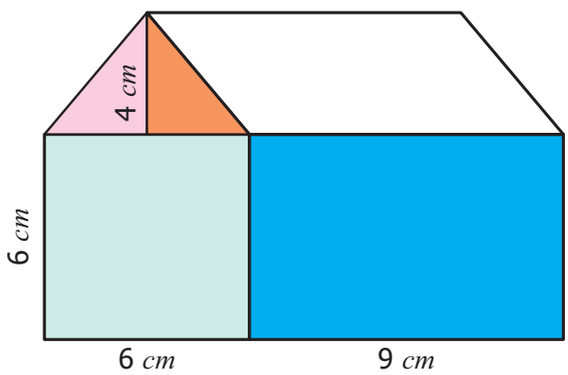
9. How many different rectangles can be made with a 48 cm long string? Find the possible pairs of length and breadth of the rectangles.

10. Draw a square B whose side is twice of the square A. Calculate the perimeters of the squares A and B.

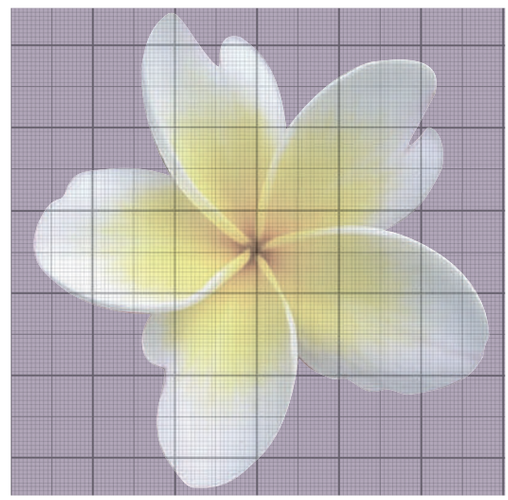
11. What will be the area of a new square formed if the side of a square is made one-fourth?

12. Two plots have the same perimeter. One is a square of side 10 m and another is a rectangle of breadth 8 m. Which plot has the greater area and by how much?

13. Look at the picture of the house given and find the total area of the shaded portion.



14. Find the approximate area of the flower in the given square grid.



Summary

- The perimeter of any closed figure is the total length of its boundary.
- Perimeter of the rectangle, P= 2 x (l + b) $units$.
- Perimeter of the square, P = (4 x S) $units$.
- Perimeter of the triangle, P = (a + b + c) $units$.
- Perimeter of the shape with equal sides = Number of sides x Length of a side.
- The area is the measure of the region/surface occupied by a closed figure.
- Area of a rectangle, A = length x breadth = (l x b) $sq.\ units$.
- Area of a square, A = side x side = (s x s) $sq.\ units$.
- Area of the right angled triangle, A = $\frac{1}{2}$ (b x h) $sq.\ units$.
- The perimeter of a combined shape is the sum of the length of all outer sides of the shapes.
- The area of a combined shape is the sum of all the areas of regular/simpler shapes by which the combined shape is formed.

CHAPTER 4

SYMMETRY

E8DF8H

Learning Objectives

- To identify symmetrical objects in our surroundings.
- To understand the types of symmetry.

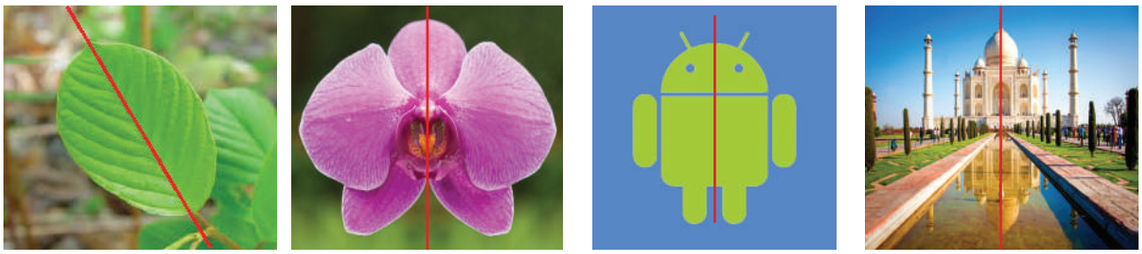
4.1 Introduction

Looking at our surroundings, we see that most of the objects appear with certain beauty. Do you know why these objects look beautiful? The balanced harmony at a perfect ratio makes these objects look beautiful. This kind of organized pattern is called ***symmetry***. Symmetry plays a vital role in many fields of work like making toys, drawings, kolams, household goods, manufacturing vehicles, construction of buildings etc.,

MATHEMATICS ALIVE – SYMMETRY IN REAL LIFE

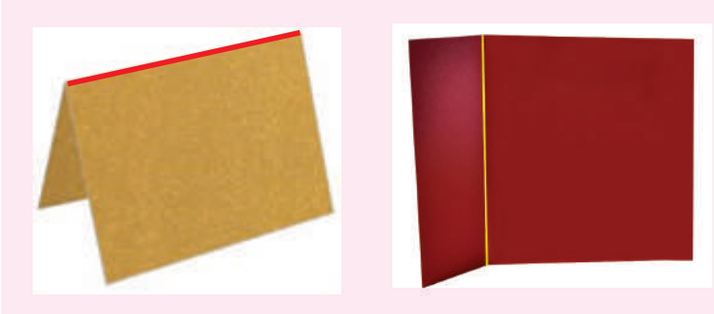
	
Symmetrical plants in the garden	Rotational Symmetry in Hibiscus flower

4.2 Line of Symmetry

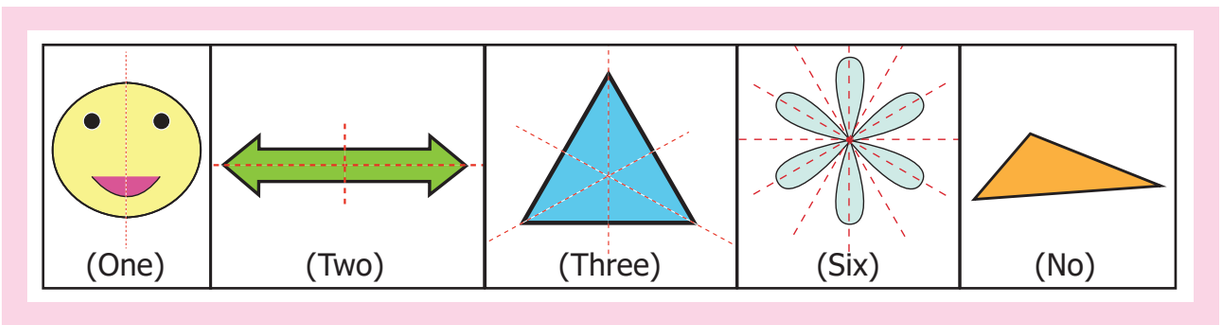


In the given figures, the red coloured line divides each figure into two equal halves and suppose we fold them along that line, we will see that one half of each figure exactly coincides with the other half. Such figures are symmetrical about that line and that line is called ***the line of symmetry or the axis of symmetry.***

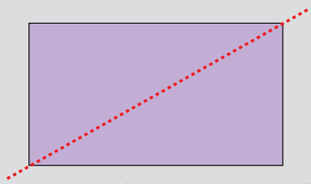
Look at the given invitation cards, the fold line of the first card divides it into two equal halves and each half exactly coincides. Hence it is a line of symmetry but in the second card, the fold line does not divide it into two equal halves. So,it is not a line of symmetry.



A figure may have one, two, three or more lines of symmetry or no line of symmetry.



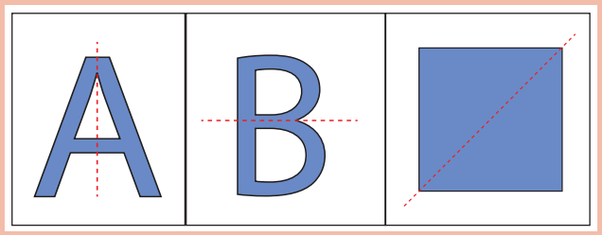
Think



The diagonal of a rectangle divides it into two equal halves but it is not a line of symmetry. Why?

Note

The line of symmetry can be vertical, horizontal or slant.



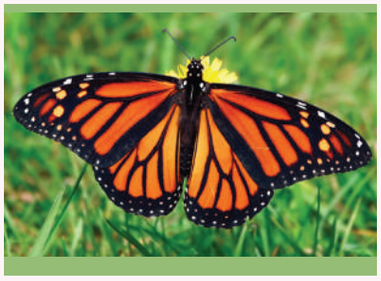
DO YOU KNOW?

The word "symmetry" comes from the Greek word "symmetros" which means "having a common measure".

Some examples for Symmetry

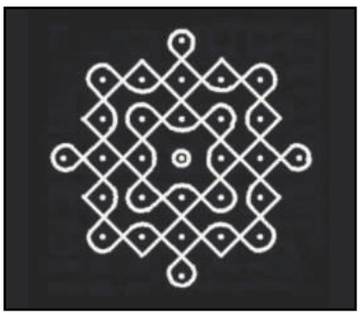
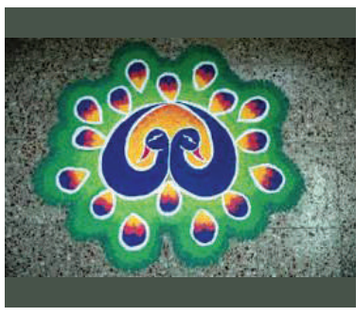
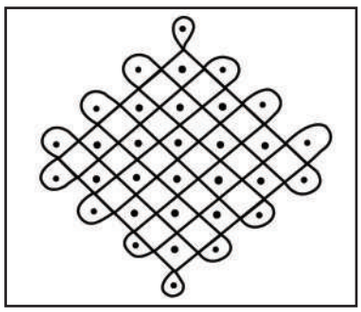
Symmetry can be found anywhere in nature as well as in man-made objects. A few of them are leaves, insects, flowers, animals, note books, bottles, architecture, designs and shapes, etc.,

We observe a few symmetrical things in our surroundings as follows.

In flowers	In Insects	In Artificial work
		
Sun flower	Butterfly	Grill Gate

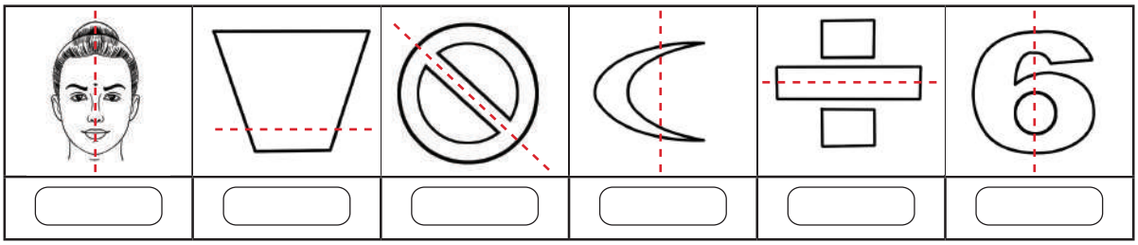
Symmetry in *Kolams*

In Tamilnadu, our people usually decorate their corridors by beautiful *kolams* using rice flour. Those *kolams* look beautiful as most of them are symmetrical.

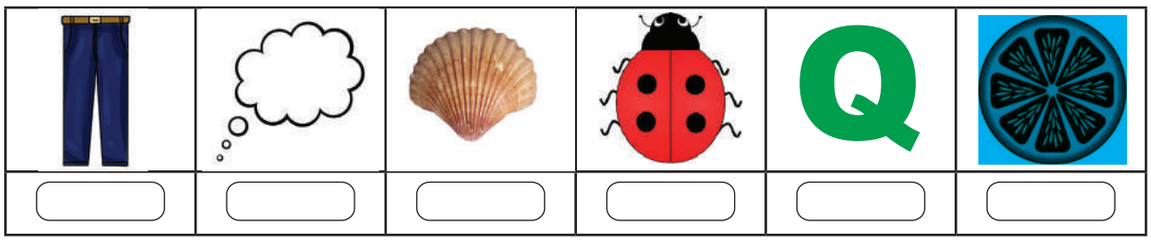




Try these

1. Is the dotted line shown in each figure a line of symmetry? If yes put ✓ otherwise put x. Justify your answer.



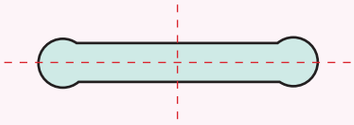
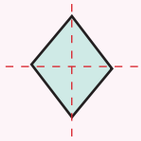
2. Check the following figures for symmetry? Write YES or NO.



Example 1 Draw the lines of symmetry for the given figures and also find the number of lines of symmetry.

i)  ii)  iii) 

Solution

S.No	Draw the line of symmetry	Number of lines of symmetry
i)		2
ii)		1
iii)		2

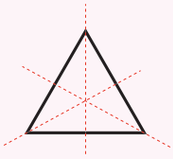
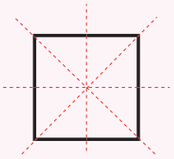
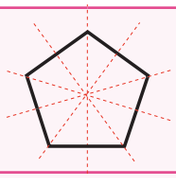
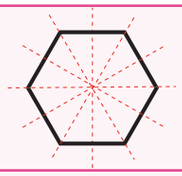
Example 2 Draw the lines of symmetry for each of the letters in the word **RHOMBUS** and also find the number of lines of symmetry. (**Note:** Here the letter 'O' is in circle shape.)

Solution

Letters	R	H	O	M	B	U	S
Number of lines of symmetry	0	2	infinite	1	1	1	0

Example 3 Draw the lines of symmetry for an equilateral triangle, a square, a regular pentagon and a regular hexagon and also find the number of lines of symmetry.

Solution

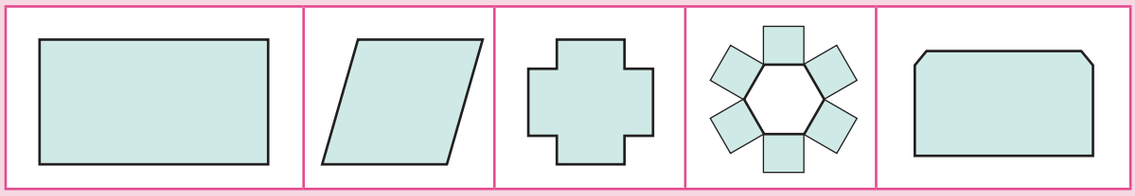
i) 	ii) 	iii) 	iv) 
An equilateral triangle has 3 lines of symmetry	A square has 4 lines of symmetry	A regular pentagon has 5 lines of symmetry	A regular hexagon has 6 lines of symmetry

Note

The number of lines of symmetry of each regular polygon (a closed figure having equal sides and equal angles) is equal to its number of sides.

Try these

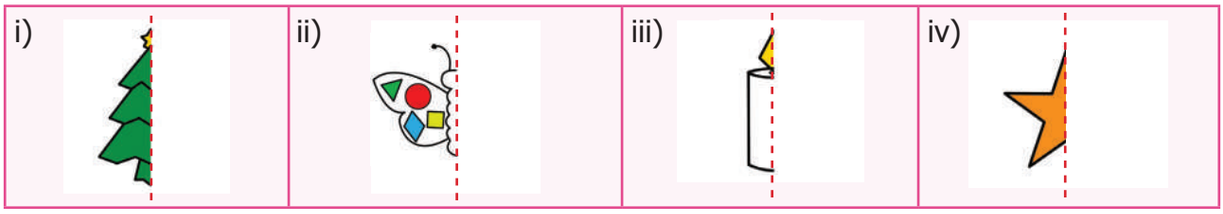
1. Draw the following figures in a paper. Cut out each of them and fold so that the two parts of each figure exactly coincide.



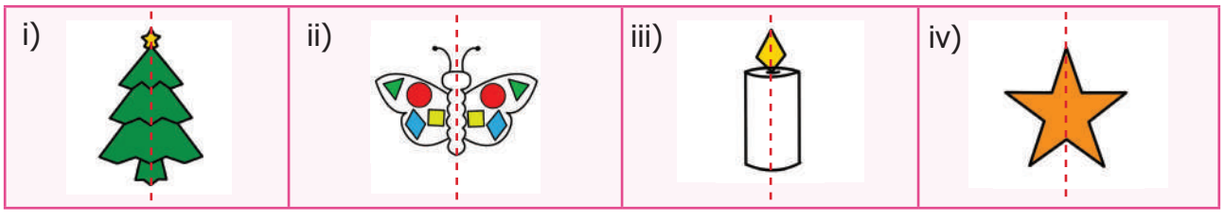
   i) Which of the above figures have one, two or more lines of symmetry?
   ii) Which of the above figures do not have any line of symmetry?

2. Write the numbers from 0 to 9.
   i) Which numbers have a line of symmetry?
   ii) List out the numbers which do not have a line of symmetry.

Example 4 Complete the other half of the following figures such that the dotted line is a line of symmetry.

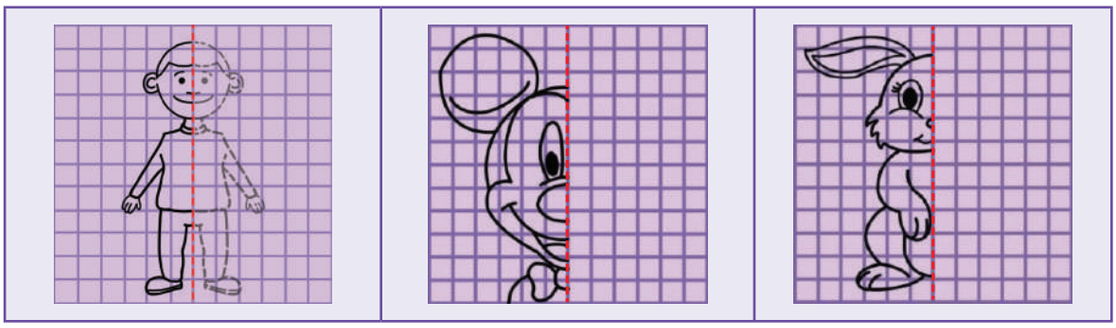


Solution



Activity

Complete the other half of the following figures such that the dotted line is the line of symmetry.



4.3 Reflection Symmetry

Standing in front of a mirror, Kumaran was getting ready to celebrate his birthday. He noticed a beautiful sentence **I LOVE MOM** written on his T-shirt which was presented by his uncle.

In these words, he saw **I** and **MOM** were looking the same in the mirror. But the word **LOVE** did not appear the same.It looked as **ƎVOꓶ**.

Out of curiosity, he took out some alphabet cards and started checking which of the alphabets would look the same in the mirror. He found a few alphabets **A, H and I** look the same in the mirror, because they have lines of symmetry.

Already we know that a line of symmetry divides the figure into two equal halves. When you keep a mirror along the line of symmetry the other half of the figure gets reflected by the mirror and it looks the same. This is known as ***reflection symmetry*** or ***mirror symmetry***.

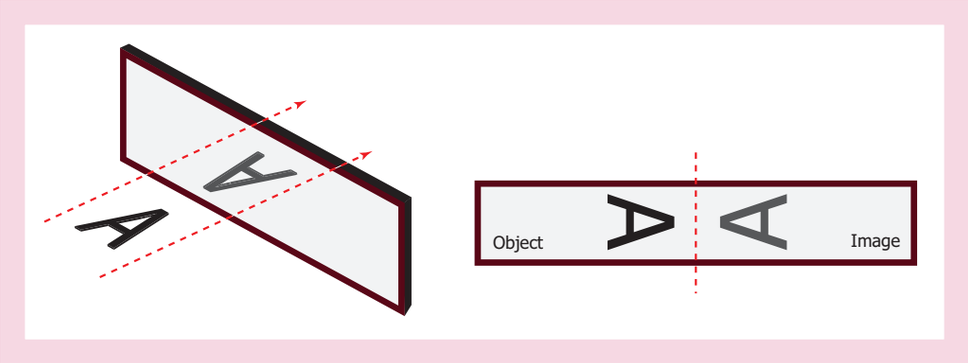
Think

Which other capital letters of English alphabets look like the same in the mirror?

Note

A shape has **reflection symmetry** if it has a **line of symmetry**.

When an object is seen in a mirror, the image obtained on the other side of the mirror is called its ***reflection***. The following figure shows the reflection of the English alphabet A. Let us assume that there is a line between A and its image in the place of a mirror.



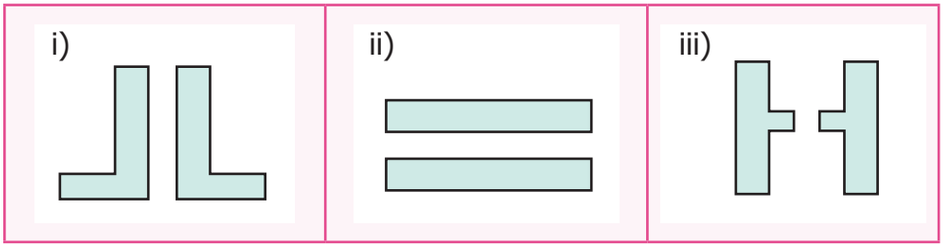
E8MBAJ

We observe that an object and its mirror image are symmetrical with reference to the mirror line. If the paper is folded, the mirror line becomes the line of symmetry.

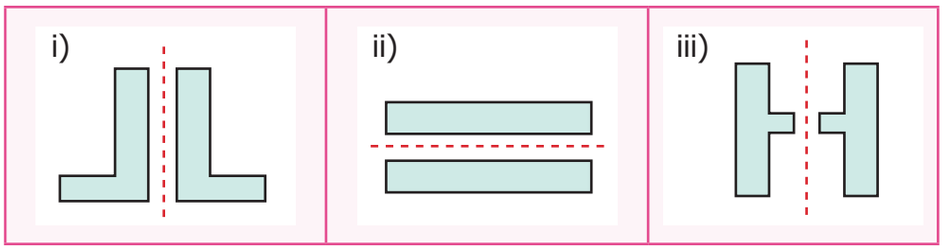
Note

- The object and its image will lie at the same distance from the mirror.
- The only difference is that the left side is on the right and vice-versa.

Example 5 Assuming one shape is the reflection of the other, draw the mirror line for each of the given figures.

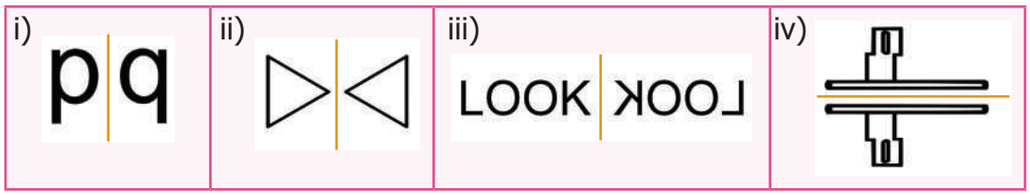


Solution



Example 6 Draw the reflection image of the following figures about the given line.

Solution

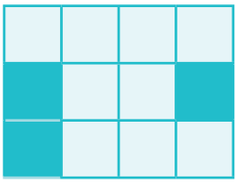


Example 7 What words will you see if a mirror is placed below the words **MOM, COM, HIDE** and **WICK**?

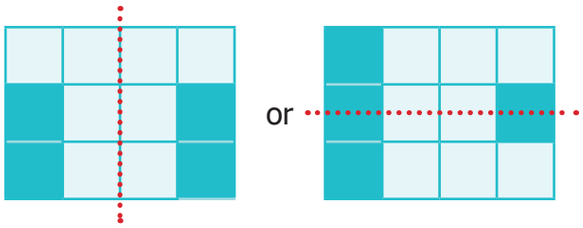
Solution

MOM	COM	HIDE	WICK
MOM	COM	HIDE	MICK

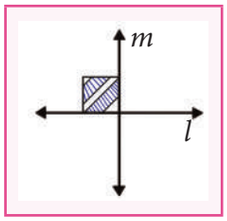
Example 8 Colour any one box in the given grid sheet so that it has reflection symmetry and draw the lines of symmetry.



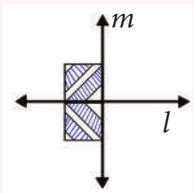
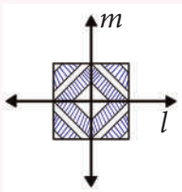
Solution



Example 9 In the given figure first reflect the shaded part about the line 'l' and then reflect it about the line 'm'.



Solution

	
Reflection about 'l'	Reflection about 'm'

Activity

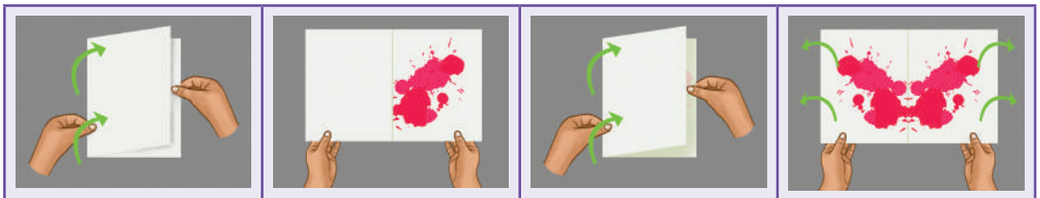
Symmetrical figures by ink blots

Step 1: Take a sheet of paper and fold it into half to make the crease.

Step 2: Put some ink blots on one side of the crease of the paper.

Step 3: Fold the paper along the crease and press it.

Step 4: Open the paper, you will find an imprint of the ink blots on the other part also which is symmetrical about the crease.

			
Step 1	Step 2	Step 3	Step 4

Try these

1. Find the password:

   "Kannukkiniyal has a new game app in her laptop protected with a password. She has decided to challenge her friends with this paragraph which contains that password".

   If you follow the steps given below, you will find it.

   Steps:

   i) Write the above paragraph in capital letters.

   ii) Turn that paper upside down and look at it in the mirror.

   iii) The word which remains unchanged in the mirror is the password.

2. Form words using the letters **B, C, D, E, H, I, K, O** and **X**. Write those words in paper in capital letters. Turn it upside down and look at them in the mirror.

   i) List the letters which have horizontal and vertical line of symmetry.

   ii) Do the words **HIKE, DICE, COOK** remain unchanged in the mirror?

   iii) The words which you have found that remain unchanged in the mirror are

   _____, _____, _____. . . .

4.4 Rotational Symmetry

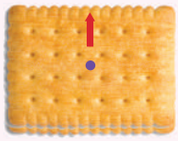
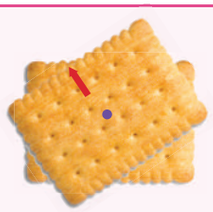
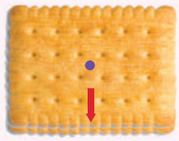
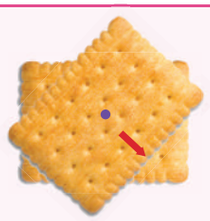
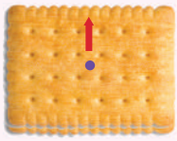
We have already learnt about rotation. **Rotation** means turning around a centre. The paper windmill, merry-go-round, fan, tops, wheels of vehicles, fidget spinner are few examples of rotating objects that we see in our life.

			
Paper wind mill	Wheels	Fan	Merry-go-round

When one rotation is completed, the rotating object comes back to the position where it started. During a complete rotation, the object moves through 360°.

Think about the situation

1) Take two rectangular biscuits from the same packet and put one on the other. Holding one biscuit firmly rotate the other on it about the centre.

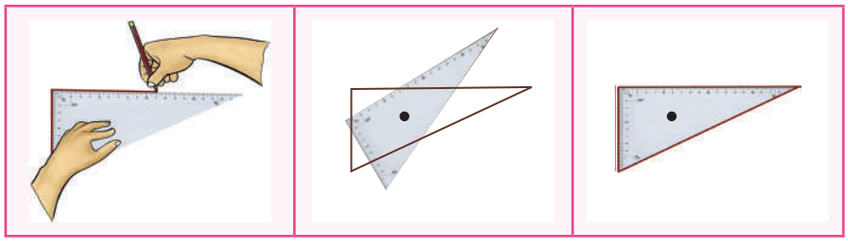
				
Initial position	Rotation	First Match	Rotation	Second Match

How many times does it fit exactly on the other in a complete rotation? Two times.

2) In the example given below, if you rotate the fidget spinner about the centre, there are three positions in which the fidget spinner matches exactly the same in a full rotation.

						
Initial position	Rotation	I-Match	Rotation	II-Match	Rotation	III-Match

3) Place a set square (containing angles 60°, 30° and 90°) on a paper and draw an outer line around it. What type of triangle do you get? Yes, Scalene triangle. If you rotate it about the centre, there is only one position in which the set square fits exactly inside the outer line.



E8W7C7

In the above situations 1 and 2, the total number of times the rectangular biscuit and the fidget spinner matches exactly with itself in one complete rotation is 2 and 3. This is called the ***order of rotational symmetry.*** In situation 3, the set square matches itself only once in one complete rotation and hence has no rotational symmetry.

An object is said to have a ***rotational symmetry*** if it looks the same after being rotated about its centre through an angle less than 360° (If the order of rotation of an object is atleast two).

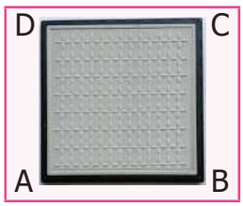
Think

Can you identify the object which does not have rotational symmetry in the above situations? Why?

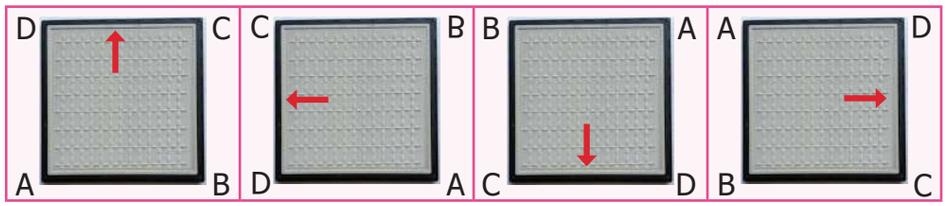
Example 10 A man-hole cover of a water sump is in square shape.

i) In how many ways we can fix that to close the sump?

ii) What is its order of rotational symmetry?



Solution



i) We can fix it in 4 ways as shown above.

ii) The order of rotational symmetry is 4.

Think

Suppose, the man hole cover of the water sump is in circular shape.

i) The number of ways to close that circular lid is _____

ii) What is its order of rotational symmetry?

Activity

Find the order of rotational symmetry by fixing the relevant shape in different ways.

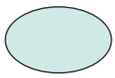
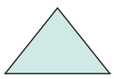
Example 11 Find the order of rotation for the following figures.

i)	ii)	iii)	iv)
			

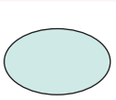
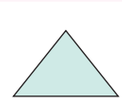
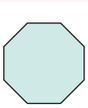
Solution

Figures	i) 	ii) 	iii) 	iv) 
Order of rotation	4	5	2	5

Example 12 Find the order of rotation for the following shapes.

i)	ii)	iii)	iv)	v)
				

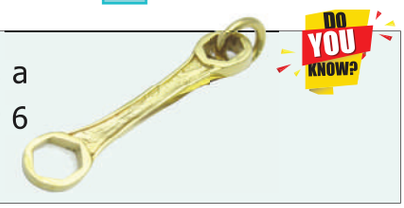
Solution

Shapes	i) 	ii) 	iii) 	iv) 	v) 
Order of rotation	2	2	3	8	2

Example 13 Join six identical squares so that atleast one side of a square fits exactly with any other square and have rotational symmetry (any three ways).

Solution

The opening in the given spanner has six sides, so it is a hexagon. The spanner has rotational symmetry of order 6 and fits a hexagonal bolt in any of six positions.



4.5 Translational Symmetry

Look at the following figures:

			
Kolam design	Tyre grip design	Saree design	Bracelet design

Here a particular pattern or design is continued throughout. The pattern changes its place without rotation or reflection. The exact image is found without changing its orientation.

Thus, ***translation symmetry*** occurs when a pattern slides to a new position. The sliding movement involves neither rotation nor reflection.

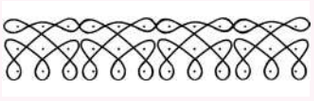
DO YOU KNOW?

	
Translation symmetry in art.	A chess board is seemed to follow translation of black and white squares .

Example 14 Which pattern is translated in the given *kolams*?

i) 

ii) 

iii) 

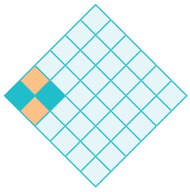
Solution

i) 

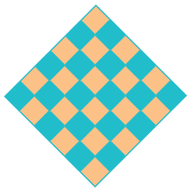
ii) 

iii) 

Example 15 Using the given pattern, colour and complete the boxes in such a way that it posseses translation symmetry.



Solution



Example 16 Translate the given pattern and complete the design in the rectangular strip.

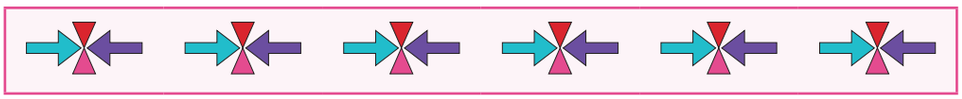
i) 

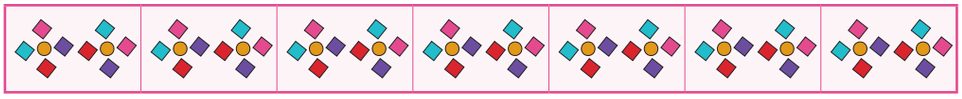
ii) 

iii) 

Solution

i) 

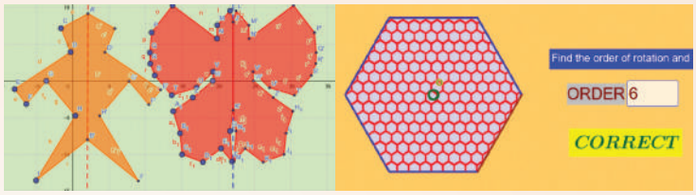
ii) 

iii) 

Symmetry

ICT CORNER

Expected Outcome



Step – 1

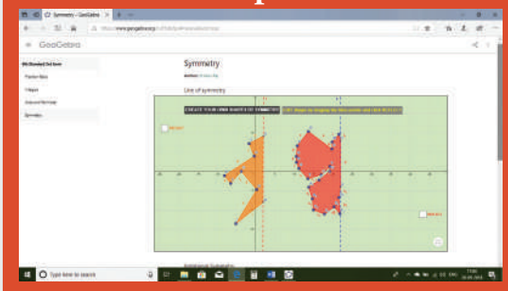
Open the Browser by typing the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Symmetry" will open. There are two worksheets under the title "Line of Symmetry" and "Rotational Symmetry".

In the Line of Symmetry drag the points on left side of both the figures and click reflect to see full figure

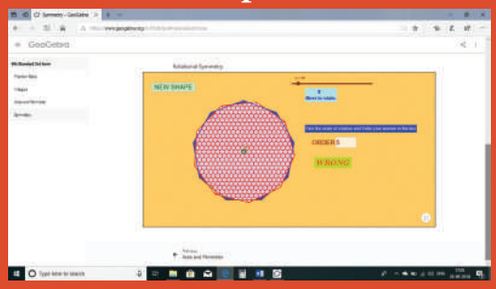
Step - 2

In Rotational Symmetry click on New Shape and find the order of rotational symmetry. Type your answer in the box and hit enter key to see whether your answer is right.

Step1



Step2



Browse in the link:

Symmetry: https://ggbm.at/udcrmzyror Scan the QR Code.

B542_6_MAT_EM_T3

Exercise 4.1

1. Fill in the blanks

i) The reflected image of the letter 'q' is _____

ii) A rhombus has _____ lines of symmetry.

iii) The order of rotational symmetry of the letter 'z' is _____

iv) A figure is said to have rotational symmetry, if the order of rotation is atleast _____

v) _____ symmetry occurs when an object slides to new position.

E963DU

2. Say True or False

i) A rectangle has four lines of symmetry.

ii) A shape has reflection symmetry if it has a line of symmetry.

iii) The reflection of the name **RANI** is **INAЯ**

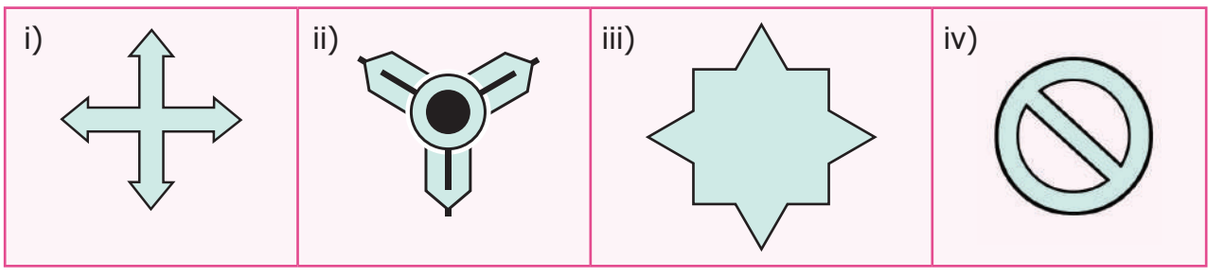
iv) Order of rotation of a circle is infinite.

v) The number 191 has rotational symmetry.

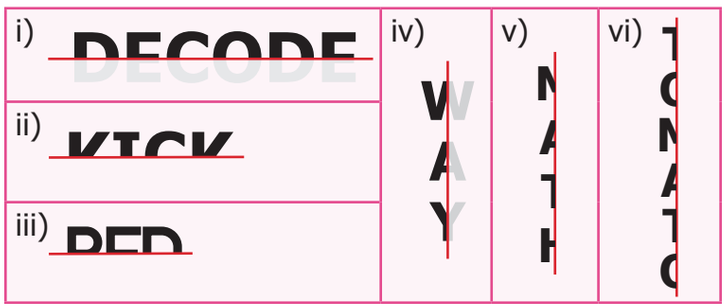
3. Match the following shapes with their number of lines of symmetry.

i)	Square	a)	No line of symmetry
ii)	Parallelogram	b)	One line of symmetry
iii)	Isosceles triangle	c)	Two lines of symmetry
iv)	Rectangle	d)	Four lines of symmetry

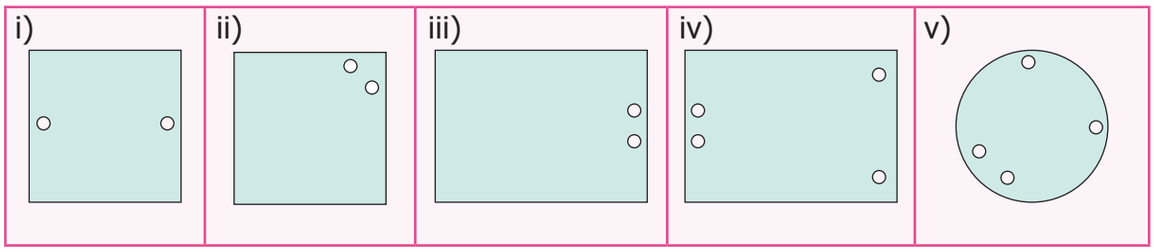
4. Draw the lines of symmetry of the following.



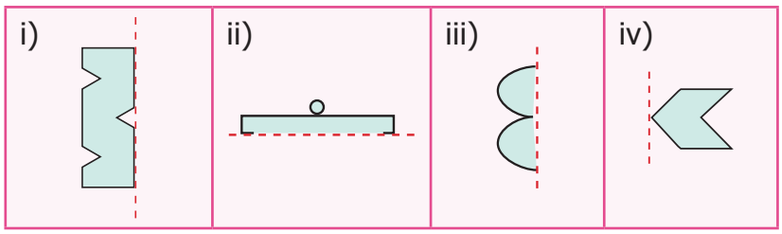
5. Using the given horizontal line/vertical line as a line of symmetry, complete each alphabet to discover the hidden word.



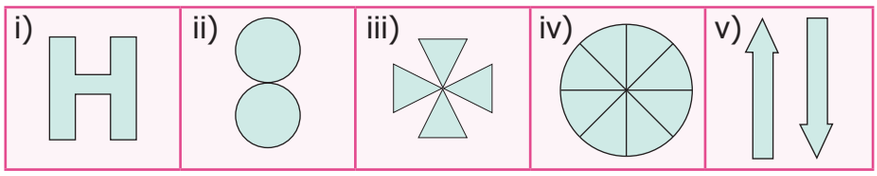
6. Draw a line of symmetry of the given figures such that one hole coincide with the other hole(s) to make pairs.



7. Complete the other half of the following figures such that the dotted line is the line of symmetry.

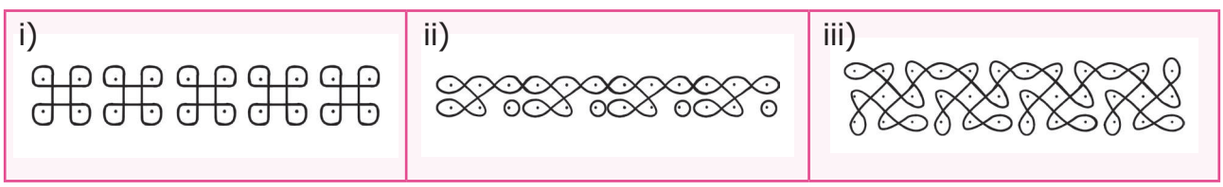


8. Find the order of rotation for each of the following.



9. A standard die has six faces which are shown below. Find the order of rotational symmetry of each face of a die?

10. What pattern is translated in the given border *kolams*?



Objective Type Questions

11. Which of the following letter does not have a line of symmetry?

a) A b) P c) T d) U

12. Which of the following is a symmetrical figure ?

a)  b)  c)  d) 

13. Which word has a vertical line of symmetry?

a) DAD b) NUN c) MAM d) EVE

14. The order of rotational symmetry of 818 is _____

a) 1 b) 2 c) 3 d) 4

15. The order of rotational symmetry of ☆ is _____

a) 5 b) 6 c) 7 d) 8

Exercise 4.2

Miscellaneous Practice Problems

1. Draw and answer the following.

i) A triangle which has no line of symmetry

ii) A triangle which has only one line of symmetry

iii) A triangle which has three lines of symmetry

2. Find the alphabets in the box which have

i) No line of symmetry

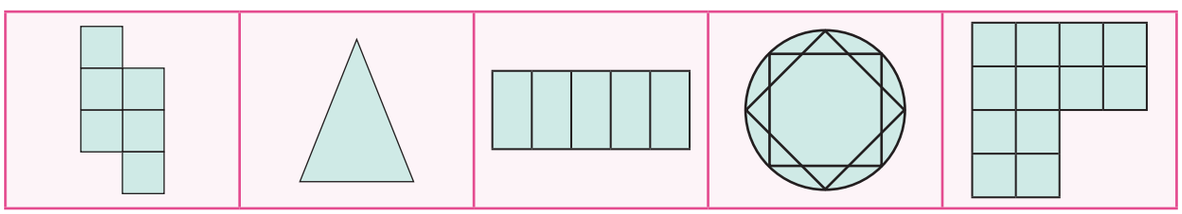
ii) Rotational symmetry

iii) Reflection symmetry

iv) Reflection and rotational symmetry

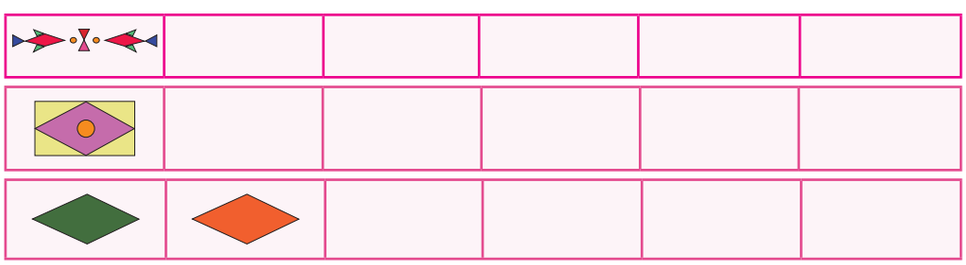
A	M	P	E
D	I	K	O
N	X	S	H
U	V	W	Z

3. For the following pictures, find the number of lines of symmetry and also find the order of rotation.



4. The three digit number **101** has rotational and reflection symmetry. Give five more examples of three digit numbers which have both rotational and reflection symmetry.

5. Translate the given pattern and complete the design in rectangular strip?

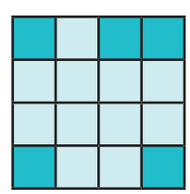


Challenge Problems

6. Shade one square so that it possesses

i) One line of symmetry

ii) Rotational symmetry of order 2



7. Join six identical squares so that atleast one side of a square fits exactly with any other side of the square and have reflection symmetry (any three ways).

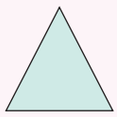
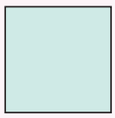
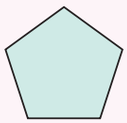
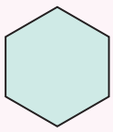
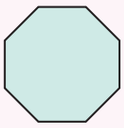
8. Draw the following :

i) A figure which has reflection symmetry but no rotational symmetry.

ii) A figure which has rotational symmetry but no reflection symmetry.

iii) A figure which has both reflection and rotational symmetry.

9. Find the line of symmetry and the order of rotational symmetry of the given regular polygons and complete the following table and answer the questions given below.

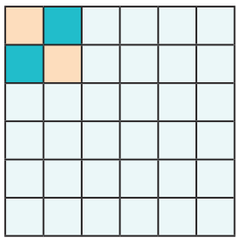
Shape	Equilateral triangle 	Square 	Regular pentagon 	Regular hexagon 	Regular octagon 
Number of lines of symmetry					
Order of rotational symmetry					

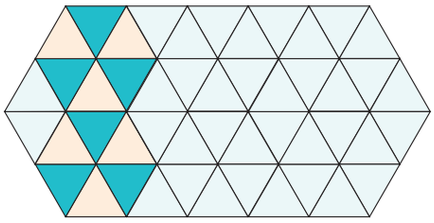
i) A regular polygon of 10 sides will have _____ lines of symmetry.

ii) If a regular polygon has 10 lines of symmetry, then its order of rotational symmetry is _____

iii) A regular polygon of 'n' sides has _____ lines of symmetry and the order of rotational symmetry is _____.

10. Colour the boxes in such a way that it posseses translation symmetry.

i) 

ii) 

Summary

- The line that divides any figure into two equal halves such that each half exactly coincides with the other is known as the **line of symmetry** or **axis of symmetry.**
- A shape has **reflection symmetry** if it has a **line of symmetry**.
- An object is said to have a **rotational symmetry** if it looks the same after being rotated about its centre through an angle less than 360°.
- The total number of times a figure coincides with itself in one complete rotation is called the **order of rotational symmetry.**
- **Translation symmetry** occurs when an object slides to a new position. The sliding movement involves neither rotation nor reflection.

CHAPTER 5

INFORMATION PROCESSING

Learning Objectives

- To perceive iterative processes and patterns.
- To see Euclid's game as an iterative process.
- To learn to devise and follow algorithms.
- To learn the advantage of ordering information.

E9BBRK

5.1 Introduction

Everyday morning, waking up, brushing teeth, doing physical exercise, drinking milk, having bath, having breakfast and then getting ready to school are some of the activities we do.

Everyday such activities happen. Don't they?

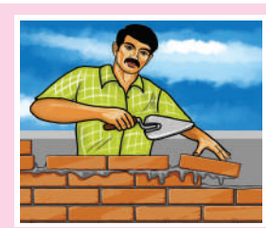
Do we see a pattern getting repeated? In our life, there are many such repeating patterns. In fact , "EAT" ; " STUDY" ; " PLAY" ; " SLEEP" is a pattern repeated daily, isn't it?

When we go on doing same activities again and again, it gives rise to a new form.

Let us see some more examples for repeated processes.

- We can see that some patterns are getting repeated in kolams, so as to get larger kolams.

- In the construction of a wall, a mason places the bricks one upon another and adds plaster to them in an organized manner repeatedly. After some days we can see that a nice wall is getting constructed.



- Bees make hives which are formed by the increasing pattern of hexagons where they can store optimum amount of honey and feed themselves during winter.

- Take a spot of red paint, add a little bit of green paint to it. The change in colour cannot be seen immediately. Add a little more, now, you can see a slight change in the colour. A little more ….., Hey! don't you see a different colour now? You add green paint drop by drop to red paint, you finally get a new colour. The activities explained above follow ***iterative processes***.

Hence, an ***iterative process*** is a procedure that is repeated many times which gives rise to a new form.

MATHEMATICS ALIVE – INFORMATION PROCESSING IN REAL LIFE	
	
Fibonacci sequence in nature	**Orderly arrangement of fruits in the shop**

5.2 Iterative Process in Numbers

The above iterative processes can be seen in our daily life. It can be seen in number sequences also. The numbers may increase or decrease following a pattern.

1. Observe the following sequences and find the pattern that generates each one of them.

   - 1, 3, 5, 7, … The pattern which generates these numbers is 1, 1+2, 3+2, 5+2...
   - 50, 48, 46, 44,… The pattern which generates these numbers is 50, 50-2, 48-2, 46-2...
   - 2, 4, 6,… The pattern which generates these numbers is 1x2, 2x2 ; 3x2, ...
   - 1, 4, 9, 16… The pattern which generates these numbers is 1x1, 2x2 , 3x3...
   - 2, 6, 12, 20, 30,… The pattern which generates these numbers is 1x2, 2x3, 3x4, 4x5, ...
   - 2, 4, 8,16,… The pattern which generates these numbers is 2x1, 2x2, 2x2x2...

2. Observe the pattern, 1, 10, 100, ... When the number of zeros increase the value also increases.

3. In the same way, can you guess the next number in the special number sequence given below?

1, 1, 2, 3, 5, 8, 13, 21, 34,...

Yes it is 55, how? You have got it by adding 21 and 34. Haven't you?

Are you able to recognize the pattern in the above sequence? Yes, if we add the previous two consecutive terms, we get the next term as

1+1 =2, 1+2=3, 2+3=5, 3+5=8 , 5+8=13,...

This special pattern of numbers is called the ***Fibonacci sequence***. Each term in the Fibonacci sequence is called a ***Fibonacci number***.

4. ***Lucas numbers*** form a sequence of numbers like the Fibonacci numbers and they are closely related to the Fibonacci numbers. Instead of starting with 1 and 1, Lucas numbers start with 1 and 3. The Lucas sequence is 1, 3, 4, 7, 11, 18, 29, 47, 76, 123, ... In all the above patterns of numbers, we can see the iterative processes.

Try these

i) Find the 10th term of the Fibonacci sequence.

ii) If the 11th term of the Fibonacci sequence is 89 and 13th term is 233 then, what is the 12th term?

E9EYFH

Fibonacci numbers in nature

We come across the existence of Fibonacci sequence in many natural phenomena like spiral in a shell, arrangement of petals in flowers, branches of a tree, seeds in the head of a sunflower, petals on a daisy, the cells in the bee-hive, etc. Mathematical patterns are found in the distinct marking on animals and the structure of seashells also.








Note

We can also begin the Fibonacci sequence with 0 and 1, instead of 1 and 1.

Think

Are two consecutive Fibonacci numbers relatively prime?

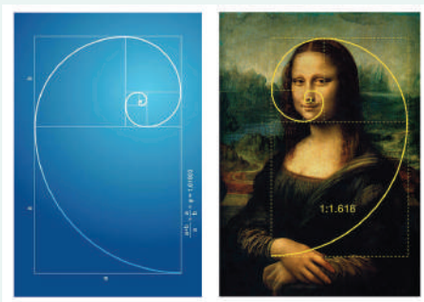
DO YOU KNOW?

Golden Ratio:

Consider the ratio of successive Fibonacci numbers $\frac{3}{2}=1.5$, $\frac{5}{3}=1.66$, $\frac{8}{5}=1.6$, $\frac{13}{8}=1.625$, $\frac{21}{13}=1.6153,\ldots)$ you can see the pattern, getting closer to 1.618 and that is denoted by Φ called the Golden Ratio (Φ=1.618). It is observed that shapes having Golden Ratio appear beautiful.

DO YOU KNOW?

The Portrait of Mona Lisa has Fibonacci spiral pattern. This is one of the reasons for the enhanced beauty of Mona Lisa.



5.3 Euclid's game

Ammu and Balu are playing a game. Each one can choose any number and they write it down on a piece of paper. If Ammu picks up the number greater than what Balu picked up, then Ammu will find the difference of the two numbers. That difference will be shown to Balu. Now Balu takes the chance to find the difference between the number what he has and the number shown to him by Ammu. They will continue the process until the difference and the numbers they have become equal. Finally, the person who gets the number equal to the difference wins the game Let us see how it works

Ammu	:	(34,19)	34-19=15
Balu	:	(19,15)	19-15=4
Ammu	:	(15, 4)	15-4=11
Balu	:	(11, 4)	11-4=7
Ammu	:	(7, 4)	7-4=3
Balu	:	(4, 3)	4-3=1
Ammu	:	(3, 1)	3-1=2
Balu	:	(2, 1)	2-1=1
Ammu	:	(1, 1)	same numbers

Suppose Ammu picked the number 34 and Balu picked the number 19. Ammu first finds the difference between 34 and 19 which gives 15. She shows the difference to Balu. Now Balu has 19 and she has 15, the difference is 4. He shows to Ammu and so on. (the bigger number should be kept first to find the difference). So Ammu wins.

E9K7T8

Now suppose they start with Ammu (24, 18).

It goes: (24, 18) $\xrightarrow{\text{Ammu}}$ (18, 6) $\xrightarrow{\text{Balu}}$ (12, 6) $\xrightarrow{\text{Ammu}}$ (6, 6). Ammu wins again!

If they start with Ammu (18, 6), we get (18, 6) $\longrightarrow$ (12, 6) $\longrightarrow$ (6, 6) Balu wins!

Play the game with your friends and see for what pairs of numbers the first player (Ammu) wins, and when the second player wins.

Now we can notice something interesting! Begin with any pair of numbers. Can you say anything about the pair of numbers. Remember that we stop the process when both the numbers are same. It is the Highest Common Factor (HCF) of the two numbers we started with. So what we have seen here is an iterative process which leads us to the HCF of two given numbers. The HCF of *a* and *b* (here *a*>*b*) is the same as for *a* and *a-b.*

Example 1

Find the HCF of two numbers 16 and 28.

Solution

Now the HCF of 16,28	Now the HCF of (16 , 28-16)
16 = 2 x 2 x 2 x 2	16 = 2 x 2 x 2 x 2
28 = 2 x 2 x 7	12 = 2 x 2 x 3
HCF of (16, 28) = 2 x 2 = 4	HCF of (16, 12) = 2 x 2 = 4

Therefore HCF of (16, 28) = HCF of (16, 28-16).

Hence, HCF of two numbers *a* and *b, a* > *b*, is same as the HCF of *a* and *a* – *b*.

Euclidean algorithm

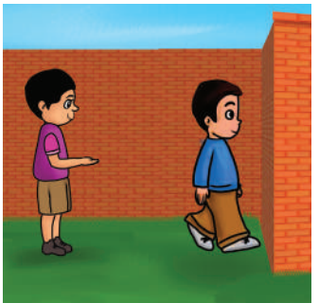
Let us take a number 12.

If we divide 12 by 7 then, we get quotient=1, remainder=5 and 12 can be written as 12 = (1 x 7) + 5.

If we divide 12 by 2 then, we get quotient=6, remainder=0 and 12 can be written as 12 = (2 x 6) + 0.

From this, we observe that, if a number '*a*' is divided by some number '*b*' then we get the quotient '*q*' and remainder '*r*', and '*a*' can be written in a unique way as *a = (b x q) + r*. That is, Dividend = (Divisor x Quotient) + Remainder. This is called the Euclidean algorithm.

5.4 Following and Devising Algorithms



Do you know the robot game? One child acts as a robot. Another child gives instructions to the child enacting as robot. The robot child should follow instructions. If the robot child stands at the wall by facing it, the instructor has to say, "move forward'. The robot child can only try to move forward, but can't. The robot child cannot say "it is not possible". This humorous activity shows that instructions are mechanically followed by robots. Unlike robots, human brain is capable of thinking and modifying algorithms based on situations.

Think about the situation

Recipe for preparing lemonade for a group of 6 members.

- Squeeze 3 half lemons in a bowl.
- Add 5 glasses of normal water into the bowl.
- Add 4 teaspoons of sugar into the lemon juice.
- Stir the content well.
- Filter the content.
- Pour the filtered content into 6 glasses and serve.

E9NUH5

Using the above instructions, prepare lemonade for 12 members, 24 members and 3 members.

Example 2

Follow the instructions in the given puzzle to arrive at the same number (36).

Instructions

- Think of a number from 1 to 9.
- Multiply it by 9.
- If you have two digit number, add the digits together.
- Subtract 3 from the answer.
- Multiply the number by itself.

Solution

Let us take a number: 6
Multiply it by 9 : 9 x 6 = 54
Add the digits together : 5 + 4 = 9
Subtract 3 from the answer : 9 – 3 = 6
Multiply the number by itself : 6 x 6 = 36
Try for number other than 6.

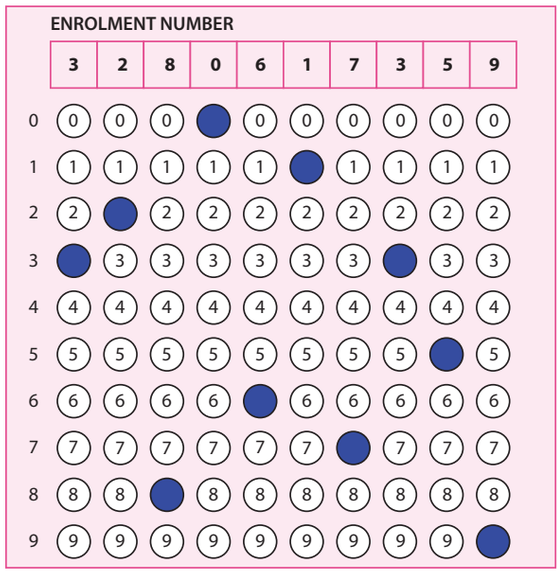
Example 3

You need to read the instructions carefully before filling the OMR sheet. The given OMR sheet is shaded based on the following instructions.

Instructions

- Observe the enrolment number written on the top row.
- The digits are to be shaded from left to right.
- Shade the corresponding bubbles under each of the number boxes.
- Only one digit is to be shaded in each column.
- Use only ball point pen for shading the bubbles.

Solution



This activity is very important as children need to fill OMR for various examinations like **NAS, NMMS**.

Example 4

Observe the given 4 x 4 square grid and follow the instructions given below to appreciate the uniqueness of the arrangement of numbers that gives the total 139.

22	12	18	87
88	17	9	25
10	24	89	16
19	88	23	11

Instructions

- Add the numbers horizontally.
- Add the numbers vertically.
- Add the numbers diagonally.
- Add the numbers in the four corners of the square.
- Divide the square into four 2 x 2 squares and add all the numbers in each of the squares.

Each of the above instructions gives the same answer. Doesn't it?

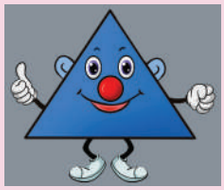
In all the above examples, we note that delivering instructions as well as following them are interesting.

Try these

1. The teacher should give oral instructions to the students to draw the geometrical figure already drawn by him / her.

   i) Draw a square. In the middle of the square, draw a circle in such a way that the circle does not touch any side of the square. Divide the circle into four equal parts. Shade the bottom right part of the circle. Ask the students to show that figure drawn by them.

   ii) Draw a triangle on a piece of paper. Make it crazy looking by adding some features. Give instructions to your friend to draw it exactly the same.



2. Suppose your friend wants to come to your house from his / her house. Give clear instructions in order, to reach your house.

5.5 Arranging things and putting them in order

In day-to-day life, sorting things such as arranging books on shelves, lining up foot wears in racks, segregating vegetables in trays, keeping household things in an almirah, arranging provisions in a cupboard, listing out expenditure etc, become inevitable. These activities help us to recall the things available, to have an easy access, avoid wastage and so on. Similar kind of arrangements are available in numbers also. Example : Calendar.

Discuss the following situations in groups

Situation 1

Suppose you need to arrange 100 books of same size in a shelf. The shelf has 10 rows and each row can accommodate 10 books. Besides, each book has an ID number written on it. How will you arrange the books based on their ID numbers, the smallest number should be on the left top row and the greatest ID number must on the right bottom row.

Discuss the following questions

i) Are there different ways to arrange the books?

ii) How do you know that one method is better than the other?

iii) If two persons together do the arrangement, how will you divide the work between them?

iv) If the books do not have any numbers written on them, how will you arrange them?

v) Is arranging them by number better than arranging them by size? why?

Situation 2

Suppose you have saved some coins in your piggy bank. If you want to know the amount saved, what can you do?

i) What are the ways to count the amount?

ii) Which is the easy way to count?

iii) Can the coins be arranged by their value?

Situation 3

Have you seen the garbage being sorted out in the streets? Some materials are bio-degradable and some are not bio-degradable like hospital wastes, plastics, glass materials and other wastes. How are the garbages sorted?

Note

The teacher may discuss this with students to create more awareness on segregating of waste, at the source.

Example 5 Observe the calendar showing the month of January 2019.

Answer the following questions

i) Sort out the prime and composite numbers from the calendar.

ii) Sort out the odd and even numbers.

iii) Sort out the multiples of 6; multiples of 4; the common multiples of 4 and 6 and LCM of the two numbers.

iv) Sort out the dates which fall on Monday.

January 2019

Su	M	T	W	Th	F	S
		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		

Solution

i) Prime numbers = 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31

Composite numbers = 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 21, 22, 24, 25, 26, 27, 28, 30

ii) Odd numbers = 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31

Even numbers = 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

iii) Multiples of 6 = 6, 12, 18, 24, 30,

Multiples of 4 = 4, 8, 12, 16, 20, 24, 28

Common multiples = 12, 24

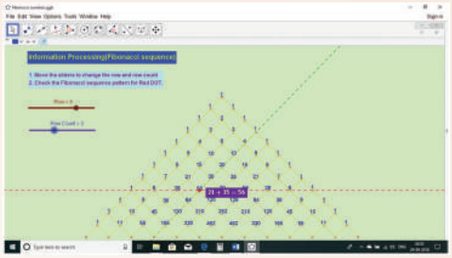
LCM = 12

iv) Monday falls on = 7,14,21,28

Information Processing

ICT CORNER

Expected Outcome



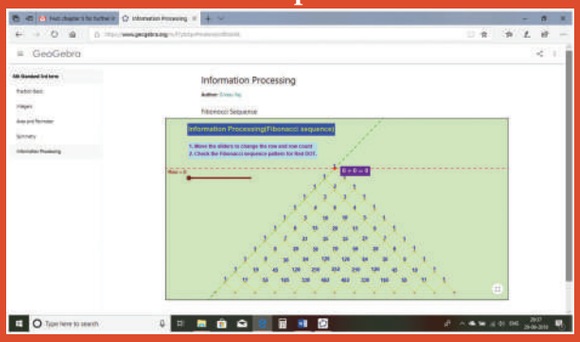
Step 1

Open the Browser by typing the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Information Processing" will open. There is a worksheet under the title Fibonacci Sequence.

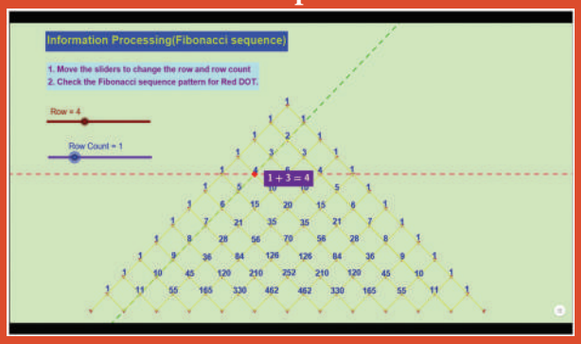
Step 2

Move the sliders to move Red point vertically and horizontally along the numbers and check how Fibonacci sequence is formed.

Step1



Step2



Browse in the link:

Information Processing: https://ggbm.at/dfktdr6k or Scan the QR Code.

B542_6_MAT_EM_T3

Exercise 5.1

1. Study and complete the following pattern

i) 1 x 1 = 1

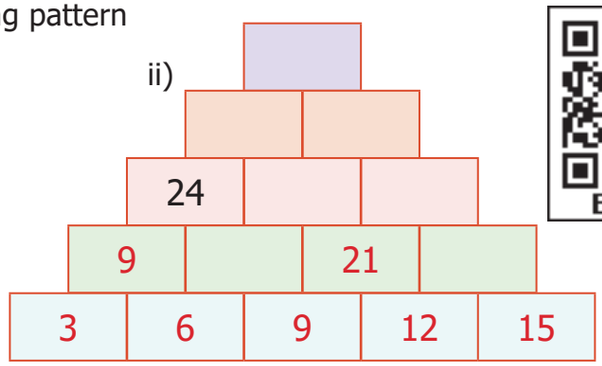
11 x 11 = 121

111 x 111 = 12321

1111 x 1111 = ?

11111 x 11111 = ?

ii)



E9U3UV

2. Find next three numbers in the following number patterns.

i) 50, 51, 53, 56, 60, ... ii) 77, 69, 61, 53,...

iii) 10, 20, 40, 80, ... iv) $\frac{21}{33}, \frac{321}{444}, \frac{4321}{5555}, \ldots$

3. Consider the Fibonacci sequence 1, 1, 2, 3, 5, 8,13, 21, 34, 55,... Observe and complete the following table by understanding the number pattern followed. After filling the table discuss the pattern followed in addition and subtraction of the numbers of the sequence.

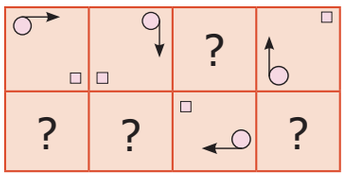
Steps	Pattern 1	Pattern 2
i)	1+3 = 4	5 -1 =4
ii)	1+3+8=_____	?
iii)	1+3+8+21 =_____	?
iv)	?	?

4. Complete the following patterns.

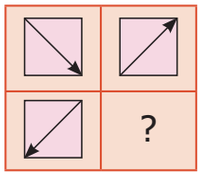
i)

A	∀	∀	?
N	Z	N	?
W	?	M	?

ii)



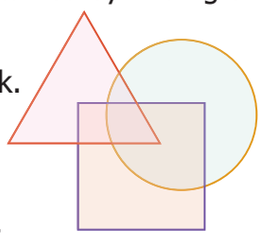
iii)



5. Find HCF of the following pair of numbers by Euclid's game.

i) 25 and 35 ii) 36 and 12 iii) 15 and 29

6. Find HCF of 48 and 28. Also find the HCF of 48 and the number obtained by finding their difference.



7. Give instructions to fill in a bank withdrawal form issued in a bank.

8. Arrange the name of your classmates alphabetically.

9. Follow and execute the instructions given below.

i) Write the number 10 in the place common to the three figures

ii) Write the number 5 in the place common for square and circle only.

iii) Write the number 7 in the place common for triangle and circle only.

iv) Write the number 2 in the place common for triangle and square only.

v) Write the numbers 12, 14 and 8 only in square, circle and triangle respectively.

10. Fill in the following information.

Candidate's EMIS No

1. Name of the candidate in Capital Letters followed by initial leaving one box blank. (Do not write Miss/Master)

2. Class Date of birth

Date Month Year

3. Father's name in Capital Letters followed by initial leaving one box blank. (Do not write Mr./Dr./Prof)

4. Mother's Name in Capital Letters followed by initial leaving one box blank. (Do not write Mrs./Dr./Prof)

5. Sex (Put ✓mark) **6. Area to which candidates resides. (Put ✓mark)**

Male Female Rural Urban

Objective Type Questions

11. The next term in the sequence 15, 17, 20, 22, 25,... is
    a) 28 b) 29 c) 27 d) 26
12. What will be the 25th letter in the pattern? ABCAABBCCAAABBBCCC,...
    a) B b) C c) D d) A
13. The difference between 6th term and 5th term in the Fibonacci sequence is
    a) 6 b) 8 c) 5 d) 3
14. The 11th term in the Lucas sequence 1, 3, 4, 7, ... is
    a) 199 b) 76 c) 123 d) 47
15. If the Highest Common Factor of 26 and 54 is 2, then HCF of 54 and 28 is...
    a) 26 b) 2 c) 54 d) 1

Exercise 5.2

Miscellaneous Practice problems

1. Find HCF of 188 and 230 by Euclid's game.
2. Write the numbers from 1 to 50. From that find the following.
   i) The numbers which are neither divisible by 2 nor 7.
   ii) The prime numbers between 25 and 40.
   iii) All square numbers upto 50.
3. Complete the following pattern

i) 1+2+3+4 = 10	ii) 1+3+5+7 = 16	iii) AB, DEF, HIJK, ☐, STUVWX
2+3+4+5 = 14	☐+5+7+9 = 24	iv) 20, 19, 17, ☐, 10, 5
☐+4+5+6 = ☐	5+7+9+☐ = ☐	
4+5+6+☐ = ☐	7+9+☐+13 = ☐	

4. Complete the table by using the following instructions.
   A: It is the 6th term in the Fibonacci sequence.
   B: The predecessor of 2.
   C: LCM of 2 and 3.
   D: HCF of 6 and 20
   E: The reciprocal of 1/5.
   F: The opposite number of –7.
   G: The first composite number.
   H: Area of a square of side 3 cm.
   I: The number of lines of symmetry of an equilateral triangle.
   After completing the table, what do you observe? Discuss.

A	B	C
D	E	F
G	H	I

5. Assign the number for English alphabets as 1 for A, 2 for B upto 26 for Z.
   Find the meaning of

7	15	15	4	13	15	18	14	9	14	7	

6. Replace the letter by symbols as + for A, – for B, × for C and ÷ for D.
   Find the answer for the pattern 4B3C5A30D2 by doing the given operations.

7. Observe the pattern and find the word by hiding the numbers
   1H2O3W 4A5R6E 7Y8O9U?

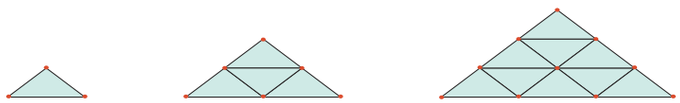
8. Arrange the following from the eldest to the youngest. What do you get?

A - refers to parents	L - refers to you	F - refers to grandparents
I - refers to elder sister	Y - refers to younger brother	M - refers to uncle

Challenge problems

9. Prepare a daily time schedule for evening study at home.

10. Observe the geometrical pattern and answer the following questions

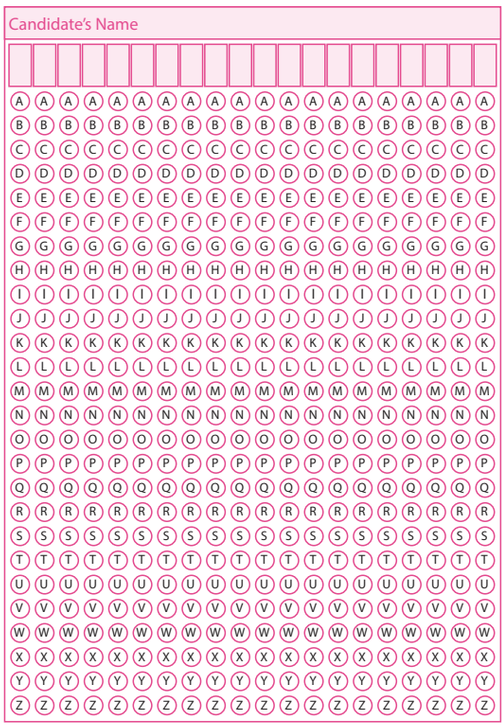


   i) Write down the number of sticks used in each of the iterative pattern.
   ii) Draw the next figure in the pattern also find the total number sticks used in it.

11. Find HCF of 28,35,42 by Euclid's game.

12. Follow the given instructions to fill your name in the OMR sheet.

- The name should be written in capital letters from left to right.
- One alphabet is to be entered in each box.
- If any empty boxes are there at the end they should be left blank.
- Ball point pen is to be used for shading the bubbles for the corresponding alphabets.



13. Consider the Postal Index Number (PIN) written on the letters as follows:604506; 604516; 604560; 604506; 604516; 604516; 604560; 604516; 604505; 604470; 604515; 604520; 604303; 604509; 604470. How the letters can be sorted as per Postal Index Numbers?

Summary

- An Iterative process is a procedure that is repeated many times to give new results.
- The Fibonacci sequence is 1, 1, 2, 3, 5, 8, 13, 21, 34,...
- If a number '*a*' is divided by some number '*b*' then we get the quotient '*q*' and remainder '*r*', and '*a*' can be written in a unique way as $a = (b \times q) + r$. that is., Dividend = (Divisor x Quotient) + Remainder. This is called the Euclidean algorithm.

ANSWERS

Chapter 1 Fractions

Exercise 1.1

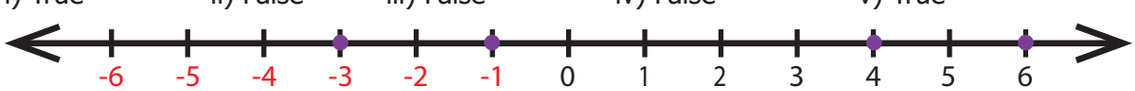
1. i) $14\frac{1}{4}$ ii) Mixed Fraction iii) $1\frac{5}{6}$ iv) 16 v) 1
2. i) True ii) False iii) True iv) True v) False
3. i) $\frac{10}{21}$ ii) $7\frac{1}{2}$ iii) $7\frac{6}{35}$ iv) $\frac{38}{63}$ v) $\frac{11}{15}$ vi) $4\frac{2}{21}$
4. i) $\frac{61}{18}$ ii) $14\frac{1}{7}$ iii) $7\frac{5}{6}$ iv) $\frac{109}{9}$
5. i) 4 ii) $41\frac{2}{3}$ iii) $\frac{3}{10}$ iv) 4
6. i) $\frac{3}{28}$ ii) $2\frac{2}{5}$ iii) $1\frac{3}{25}$ iv) $5\frac{4}{5}$
7. $5\frac{1}{2}$ *kg* 8. $1\frac{1}{4}$ *l* 9. $15\frac{3}{4}$ *km* 10. 7
11. d) $\frac{10}{11} < \frac{9}{10}$ 12. a) $\frac{13}{63}$ 13. c) $\frac{17}{53}$ 14. a) 42 15. c) $\frac{4}{5}$ of ₹150

Exercise 1.2

1. ₹510 2. $3\frac{1}{4}$ *km* 3. The difference between $2\frac{1}{2}$ and $3\frac{2}{3}$ is smaller 4. $10\frac{1}{8}$ *kg*
5. 22 steps 6. $\frac{4}{8}$ & many answers 7. $3\frac{2}{3}$ 8. $6\frac{8}{35}$ 9. $2\frac{7}{12}$
10. 3 11. $\frac{1}{20}, \frac{1}{30}, \frac{1}{20}$ 12. $\frac{1}{8}$ 13. 15
14. i) $4\frac{1}{4}$ *km* ii) $5\frac{3}{4}$ *km* iii) Via Bus Stand iv) 6 times

Chapter 2 Integers

Exercise 2.1

1. i) −100 ii) −7 iii) left iv) 11 v) 0
2. i) True ii) False iii) False iv) False v) True
3. 

4. i) −3 ii) −2
5. i) −44 ii) +19 or 19 iii) 0 iv) 312 v) −789
6. i) −15 km
7. i) Wrong, Integers are not continuously marked
   ii) Correct, Integers are correctly marked.
   iii) Wrong, Integer −2 is marked wrongly.
   iv) Correct, Integers are marked at equal distance.
   v) Wrong, negative integers marked wrongly.

8. i) 8, 9 ii) −4, −3, −2, −1, 0, 1, 2, 3 iii) −2, −1, 0, 1, 2 iv) −4, −3, −2, −1

9. i) −7 < 8 ii) −8 < −7 iii) −999 >−1000 iv) −111 = −111 v) 0 > −200

10. i) −20, −19,−17, −15, −13, −11, 12, 14, 16, 18
ii) −40, −28, −5, −1, 0, 4, 6, 8, 12, 22
iii) −1000, −100, −10, −1,0, 1, 10, 100, 1000

11. i) 27, 15, 14, 11, 0, −9, −14, −17
ii) 400, 78, 65, −46, −99, −120, −600
iii) 777, 555, 333, 111, −222,−444, −666, −888

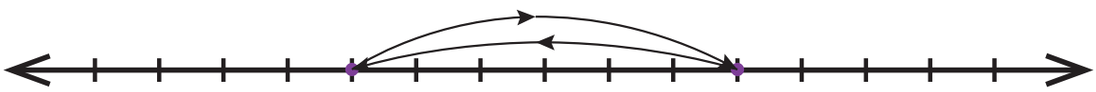
12. c) 7 13) a) 20 14) d) −6 15) c) −2 16) b) 0

Exercise 2.2

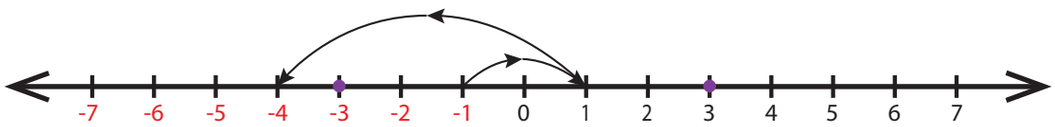
1. i) a sapling planted at a depth of 3m ii) a pit which is 3m deep

2. i)

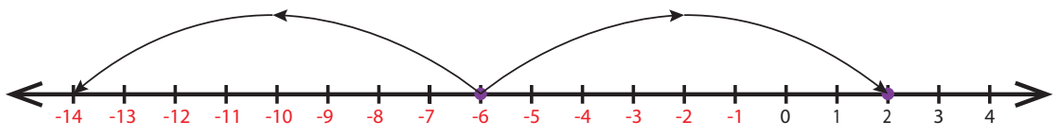
ii)



iii)



4.



5. i) K (−1) ii) −4 iii) 6 (−2, −1, 0, 1, 2, 3) iv) 2 pairs v) False, 0

6. −3, 7 7. −4, −1

8. No, as the number line number extends on both sides without any end, we cannot find the smallest (−) and the largest (+) number

9. i) – 10°C ii) At −5°C iii)−20°C iv) −15°C

10. S<Q<0<R<P

11. i) 3 ii) −2 iii) −6 iv) −1 v) −5
vi) −4 vii) 4 viii) 4 ix) 5 x) 2

12. C1: 0, C3: 2, C5: 0, C6: -4, C8: -8, C9: 0

13. i) + 45 ii) 0 iii) −10 & – 20 iv) False v) the same

Chapter 3 Perimeter and Area

Exercise 3.1

1. i) 26 cm, 40 cm^2 ii) 14 cm, 182 cm^2 iii) 15 cm, 225 cm^2 iv) 12 m, 44 cm v) 5 feet, 18 feet

2. i) 24 cm, 36 cm^2 ii) 25 m, 625 cm^2 iii) 7 feet, 28 feet

3. i) 400 cm^2 ii) 8 feet iii) 4 m

4. i) 13 m ii) 6 m iii) 8 feet

5. i) 500 ii) 2,60,000 iii) 80,00,000

6. i) 48 cm, 80 cm^2 ii) 36 cm, 49 cm^2 iii) 150 cm, 380 cm^2

7. 20 m, 24 m^2 8. 32 cm, 64 cm^2 9. 24 feet, 24 sq. feet

10. i) 25 m ii) 27 cm iii) 18 cm

11. 41 cm, 122 cm 12. 10 m, 100 m^2 13. 12 cm 14. 250 m^2, ₹11250/- 15. 54 cm

16. b)  17. b) less than 60 cm 18. c) 4 times 19. d) 3 times

20. c) Both the area & perimeter are changed

Exercise 3.2

1. i) 9 cm ii) 12 cm 2. 114 cm

3. Rahim, 120 m 4. 57 m, 2451 m^2 5. ₹400/- 6. 60 cm

7. 8 8. 8 cm, 24 cm 9. 12, (1,23), (2,22), (3,21), (4,20), (5,19), (6,18), (7,17), (8,16), (9,15), (10,14), (11,13), (12,12)

10. Perimeter of square B is twice that of square A

11. Area of the new square is reduced to 1/16 times to that of original area

12. Square plot by 4 m^2 13. 102 cm^2 14. 15.5 sq.units

Chapter 4 Symmetry

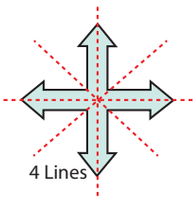
Exercise 4.1

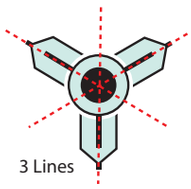
1. i) P ii) Two iii)Two iv) Two v) Translation

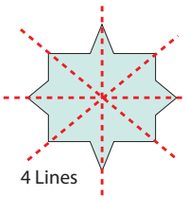
2. i) False ii) True iii) False iv) True v) False

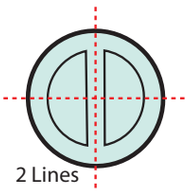
3. i) d ii) a iii) b iv) c

4.

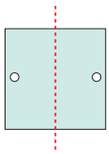
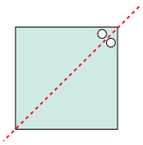
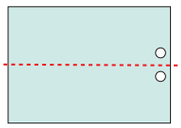
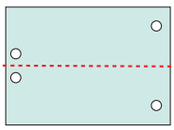
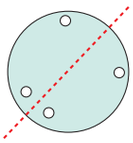
i) 

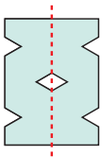
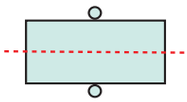
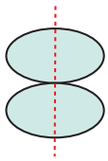
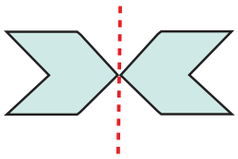
ii) 

iii) 

iv) 

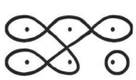
5. i) DECODE ii) KICK iii) BED iv) WAY v) MATH vi) TOMATO

6. i)  ii)  iii)  iv)  v) 

7. i)  ii)  iii)  iv) 

8. i) 2 ii) 2 iii) 4 iv) 8 v) 2

9. i) 4 ii) 2 iii) 2 iv) 4 v) 4 vi) 2

10. i)  ii)  iii) 

11. b) P 12. c) 

13. c) MAM 14. b) 2 15. a) 5

Exercise 4.2

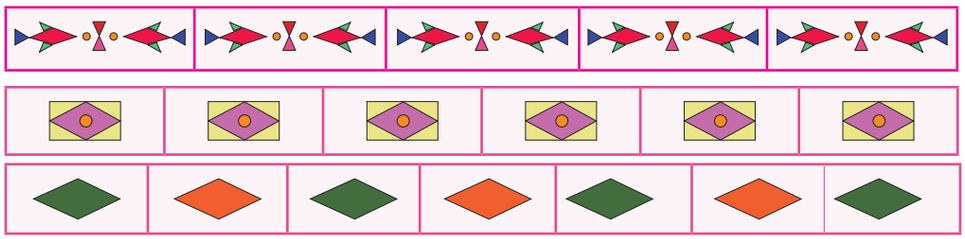
1. i) Scalene triangle ii) Isosceles triangle iii) Equilateral triangle

2. i) P, N, S, Z ii) I, O, N, X, S, H, Z iii) A, M, E, D, I, K, O, X, H, U, V, W iv) I, O, X, H

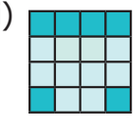
3. i) 0, 2 ii) 1, 0 iii) 2, 2 iv) 8, 8 v) 1, 0

4. I8I, III, 808, 8I8, 888

5.

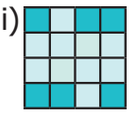


6. i)

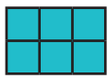


(Many answers)

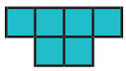
ii)



7. i)

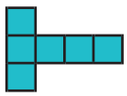


ii)



(Many answers)

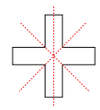
iii)



8. i)

ii)

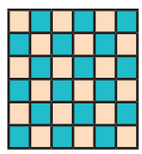
iii)



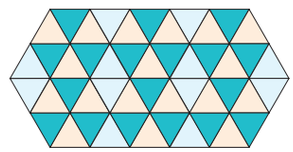
(Many answers)

9. i) 10 ii) 10 iii) n, n

10. i)



ii)



Chapter 5 Information processing

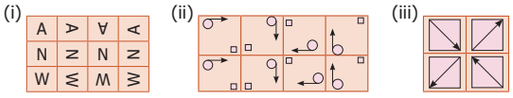
Exercise 5.1

1. i) 1234321; 123454321
   ii) 144, 60, 84, 36, 48, 15, 27

2. i) 65,71,78 ii) 45,37,29
   iii) 160, 320, 640 iv) $\frac{54321}{66666}, \frac{654321}{777777}, \frac{7654321}{8888888}$

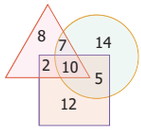
3. ii) 12, 13-1=12 iii) 33, 34-1=33
   iv) 1+3+8+21+55=88, 89-1=88

4.



5. i) 5 ii) 12 iii) 1 6. 4

9.



11. c) 27 12. a) B 13. d) 3

14. a) 199 15. b) 2

Exercise 5.2

1. 2

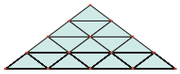
2. i) 9, 11, 13, 15, 17, 19, 23, 25, 27, 29, 31, 33, 37, 39, 41, 43, 45, 47
   ii) 29, 31, 37 iii) 1,4, 9, 16, 25, 36, 49

3. i) 3, 18; 7, 22 ii) 3; 11,32; 11, 40
   iii) MNOPQ iv) 14

4. A-8, B-1, C-6, D-2, E-5, F-7, G-4, H-9, I-3

5. GOOD MORNING 6. 4 7. HOW ARE YOU?

8. FAMILY 10. i) 3, 9, 18 ii)



30

11. 7

13. 604 is common for all postal index numbers. Compare the remaining 3 digits, 303, 470, 505, 506 (two), 509, 510, 515, 516 (four), 520, 560 (Two)

MATHEMATICAL TERMS

Algorithm	வழிமுறை / படிமுறை
Approximate	தோராயமாக
Area	பரப்பளவு
Ascending order	ஏறுவரிசை
Asymmetrical	சமச்சீரற்ற
Axis of symmetry	சமச்சீர் அச்சு
Base	அடிப்பக்கம்
Boundary	எல்லை
Breadth	அகலம்
Closed figure	மூடிய உருவம்
Combined shapes	கூட்டு வடிவங்கள்
Consecutive	அடுத்தடுத்த
Descending order	இறங்குவரிசை
Directed number	திசை எண்
Distance	தொலைவு
Equilateral triangle	சமபக்க முக்கோணம்
Equivalent fraction	சமான பின்னம்
Estimated value	உத்தேச மதிப்பு
Fraction	பின்னம்
Fraction bars	பின்ன பட்டைகள்
Golden ratio	தங்க விகிதம்
Half squares	அரை சதுரங்கள்
Height	உயரம்
Horizontal line	கிடைமட்டக் கோடு
Improper fraction	தகா பின்னம்
Inner boundary	உட்புற எல்லை
Instruction	அறிவுறுத்துதல்
Integers	முழுக்கள்
Inverse	எதிர்மறை / நேர்மாறு
Irregular shapes	ஒழுங்கற்ற வடிவங்கள்
Iterative pattern	தொடர் வளர் அமைப்பு
Iterative process	தொடர் வளர் செயல்முறை
Largest	மிகப் பெரிய
Length	நீளம்
Like fraction	ஓரின பின்னம்
Line of symmetry	சமச்சீர்க் கோடு
Measure	அளவை
Mixed fraction	கலப்பு பின்னம்
Natural number	இயல் எண்
Negative integers	குறை முழுக்கள்
Negative number	குறை எண்
Non-negative integers	குறையற்ற முழுக்கள்

Number line	எண் கோடு
Opposite number	எதிரெண்
Outer boundary	வெளிப்புற எல்லை
Oval shape	நீள் வடிவம்
Perimeter	சுற்றளவு
Positive integers	மிகை முழுக்கள்
Positive number	மிகை எண்
Predecessor	முன்னி
Proper fraction	தகு பின்னம்
Reciprocal	தலைகீழி
Rectangle	செவ்வகம்
Reflection	எதிரொளிப்பு
Reflection symmetry	எதிரொளிப்பு சமச்சீர்
Regular hexagon	ஒழுங்கு அறுங்கோணம்
Regular pentagon	ஒழுங்கு ஐங்கோணம்
Regular shapes	ஒழுங்கு வடிவம்
Reshape	உருமாற்றம்
Resize	அளவு மாற்றம்
Rhombus	சாய்சதுரம்
Right angled triangle	செங்கோண முக்கோணம்
Rotation	சுழற்சி
Rotational symmetry	சுழல் சமச்சீர்
Sequence	தொடர் வரிசை
Side	பக்கம்
Signed number	குறியீட்டு எண்
Slant	சாய்வாக
Smallest	மிகச்சிறிய
Sorting	வகைப்படுத்துதல் / முறைப்படுத்துதல்
Square	சதுரம்
Square units	சதுர அலகுகள்
Successor	தொடரி
Surface	மேற்பகுதி / தளம்
Symmetry	சமச்சீர்
Translation	இடப் பெயர்வு
Translational symmetry	இடப் பெயர்வு சமச்சீர்
Triangle	முக்கோணம்
Unit fraction	ஓரலகு பின்னம்
Unit square	ஓரலகு சதுரம்
Unlike fraction	வேற்றின பின்னம்
Vertical line	குத்துக் கோடு
Whole number	முழு எண்

VI MATHEMATICS - TERM - III

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