GOVERNMENT OF TAMILNADU

Standard Six

TERM I

Volume 2

MATHEMATICS

SCIENCE

SOCIAL SCIENCE

Untouchability
Inhuman- Crime

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S. Maries
R.Raja

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Maniyan Selvam

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Textbook Team

Authors

P.Ramalingam, Chairperson, Senior Lecturer, DIET, Kilpennathur, Tiruvannamalai.

G.Chinnamani, Headmaster, Paruvatharaja Gurukula Hr. Sec. School, Kattumannarkoil, Cuddalore.

K.Balasubramanian, PG Asst., Municipal Boys Hr. Sec. School, Gopichettipalayam, Erode.

G.Palani, PG Asst., Govt. Hr. Sec. School (ADW), Nagalkeni, Chromepet, Kancheepuram.

John Xavier Thangaraj, Little Flower Matriculation School, Kundrathur, Kancheepuram.

S. Ganapathy, BT Asst., Corporation Hr. Sec. School, Kollampalayam, Erode.

M.Chellamuthu, BT Asst., Govt. High School, Koonipalayam, Tiruvallur.

M.K.Thirulokachandar, BT Asst., K.M.N. Brothers Municipal High School, Tiruvallur.

S. Sheela Rajeswari, BT Asst., Sekkizhar Govt. Boys Hr. Sec. School, Kundrathur, Kancheepuram.

A. Vennila, BT Asst., Govt. Girls, Hr. Sec. School, Vandavasi, Tiruvannamalai.

Expert Team

Dr.R.Ramanujam, Professor, Indian Institute of Mathematics, Chennai

Dr.A.Ravishankar, Honorary Asst. Professer, Indian Institute of Technology, Chennai

Review Committee

V.A. Sivagnanam, Formerly Director of School Education, Chennai.

T.M. Soundararajan, Headmaster, Sri Ahobila Madam Oriental Higher Secondary Schoo, Chennai.

Translators

M.Shubhashiny, P.G. Asst, S.B.O.A. Mat. Hr. Sec. School, Anna Nagar West, Chennai - 101.

M.Umamaheswari, P.G. Asst, Anna Adarsh Mat. Hr. Sec. School, Anna Nagar West, Chennai - 101.

K.Bhuvaneswari, T.G.T, S.B.O.A. Mat. Hr. Sec. School, Anna Nagar West, Chennai - 101.

Devi.Ramachandran, B.T.Asst, St. Ursula's A.I. Hr. Sec. School, Church Park, Chennai - 06.

Josephine Michael, S.G.T, St. William's A.I. High School, Royapettah, Chennai - 14.

Laser Typeset : M.Vijaya Sarathy,   Layout : P.K. Ramkumar, V. James Abraham

1. NATURAL NUMBERS & WHOLE NUMBERS

1.1 NATURAL NUMBERS (REVISION)

The children are screaming in a classroom. Shall we visit that class?

"Hundred", "Hundred and ten", "Two hundred and ten", "Two hundred and twenty", "Two hundred and fifty", "Three hundred", "Five hundred" and "Thousand".

Why are they calling out numbers? What order is this?

It is a game. If one student calls out a number, another student calls out a number bigger than that number. A student who calls out the biggest number wins the game. Shall we listen again?

"Ten thousand", "Twenty thousand", "Fifty thousand", "One lakh", "Ten lakhs". You can also play.

"One crore", "Thousand crores", "One lakh crores", "One crore crores", "One crore crore crores", "One crore crore crore crore crores ...".

All the students screamed "Crore crore crore ...". It was announced that all have won the game. Can anyone lose this game? Can anyone claim that he will be the winner?

In Ascending order of numbers there is no end.

It is easy to tell a number bigger than a given number. If you say twenty, I can say twenty one. If I say hundred, you can say two hundred.

We know about Predecessor and Successor

PREDECESSOR	NUMBER	SUCCESSOR
999	1000	1001
54	55	56

A successor of a number is bigger than that number. It takes longer time to complete the game counting by successor method. We can do it faster through addition and multiplication.

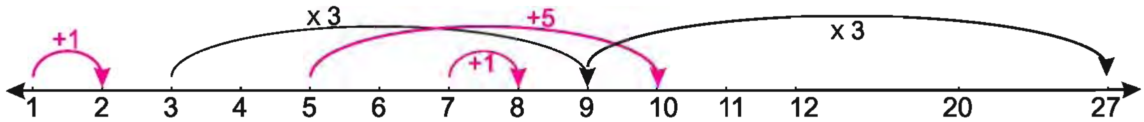
"Hundred", "Hundred and ten", "Hundred and fifty – Addition

"Hundred", "Two hundred", "Five hundred" – Multiplication

One natural number + Another natural number = A bigger natural number.

One natural number x Another natural number = A bigger natural number.

Let us see this in the following Number Line.



Group Activity

Divide the class into groups of 7 each. Each group has to record the date of birth of each child in a paper as shown in the example.

(Eg: 2nd October 1998 as 021098)

1) Find the eldest and youngest child in each group.
2) List out the children who have the same data of birth.
3) Arrange their names in chronological order.

Exercise 1.1

1. Give a number bigger and smaller than the following numbers.

i) Ten thousand. **ii)** Twenty three. **iii)** Twenty lakhs. **iv)** Three crores. **v)** Hundred.

2. Write the following in ascending and descending order.

i) Ten lakhs, Twenty crores, Thirty thousand, Four hundred, Eight thousand.

ii)8888, 55555, 23456, 99, 1111111.

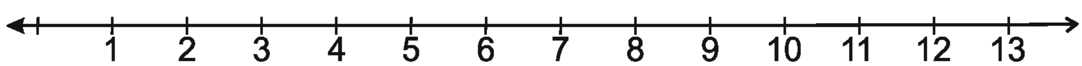
1.2 Small Numbers

Shall we play with small numbers now? Give a number smaller than the given number. The winner of the game is the one who gives the smallest number.

"Thousand", "Five hundred", "Hundred", "Fifty", "Forty".

"Zero", "Zero", "Zero".

It is very easy to win this game. When zero comes the game gets over.



Except zero, all the numbers have a predecessor. Predecessor of any number is smaller than that number.

Given number – Smaller number = A number smaller than the given number.

The counting numbers 1,2,3,... are called Natural numbers.

When there is nothing to count, it is zero. Zero is included with counting numbers to enable subtraction. Since they appear repeatedly in Mathematics they are given a specific name and symbol.

Numbers with more digits are seen not only in games, but also in many places around us. If anyone denote these numbers as "countless", it is wrong. These numbers are definitely countable. Since they are very large it is difficult to count.

Natural numbers are called counting numbers or positive integers.
We denote natural numbers as N={1,2,3,4,…}.

Similarly we denote the whole numbers as W={0, 1,2,3,4,…}.
The other name for the whole numbers is non-negative integers.

Exercise 1.2

1. Complete the following sequence

Crore, Ten lakhs, Lakhs, …

2. Is there an end to the following sequence?

Thousand, Ten thousand, Lakh, …

3. Is there any end to the following sequence?

i) Ten thousand, Twenty thousand, …

ii) Ninety thousand, Lakh, …

iii) Ninety thousand, Eighty thousand, …

1.3 Numbers with more digits

There is a Neem tree near your house. Can you count the number of leaves? Is it in thousands or in lakhs? You cannot count accurately. It is easy to say in thousands and lakhs approximately.

Look at the tree. Assume that there are 9 big branches and in each big branch there are 5 small branches. Let us take a small branch and count the number of leaves. Assume that there are 48 leaves.

Total number of small branches = 9x 5 = 45.

There may be more than 5 small branches in few big branches. If approximately 50 small branches of 48 leaves are there, then the total number of leaves = 50 x 48 = 2400. Hence there may be more than 2000 leaves in the tree. It can be 4000 or 8000 but not in lakhs.

			Number of Zeros
10 ones	= 1 ten	= 10	1
10 tens	= 1 hundred	= 100	2
10 hundreds	= 1 thousand	= 1,000	3
10 thousands	= 1 ten thousand	= 10,000	4
10 ten thousands	= 1 lakh	= 1,00,000	5
10 lakhs	= 1 million	= 10,00,000	6
100 lakhs	= 1 crore (10 million)	= 1,00,00,000	7

1 is followed by 5 zeros in 1 lakh, 7 zeros in 1 crore, 8 zeros in 10 crores, 10 zeros in 1000 crores.

There are many digits in a big number. How many digits are there in a crore? 8 digits. In one lakh there are 6 digits and in one thousand? Four digits.

It is difficult to count the number of zeros if 1 lakh is written as 100000. We use comma to group the number of zeros and write it as follows.

Indian System		International System		
Ten thousand	= 10,000	Ten thousand	= 10,000	
One lakh	= 1,00,000	One lakh	= Hundred thousand	= 100,000
10 lakhs	= 10,00,000	10 lakhs	= One million	= 1,000,000
1 crore	= 1,00,00,000	One crore	= 10 millions	= 10,000,000
100 crores	= 1,00,00,00,000	Hundred crores	=One billion	= 1,000,000,000

Exercise 1.3

1. Discuss in groups how many leaves are there in a mango tree, a neem tree and a tamarind tree near your place.
2. How many thousands, hundreds, tens and ones are there in one lakh?
3. How many lakhs and thousands are there in one crore?
4. There are more than thousand labourers in a factory. Find the minimum amount needed if each gets Rs.1000 as bonus?
5. Find the value of

   i) 6 x 6 = ; 6 x 6 x 6 = ; 6 x 6 x 6 x 6 =

   ii) 10 x 10 = ; 100 x 100 = ; 10,000 x 10,000 =
6. Show which is greater or smaller using the signs > or < for the following;

   Eighty thousand, Ten thousand, Twenty thousand.

1.4 Method of Writing Numbers

How do we read numbers with more digits?

When 1234567 is written as 12, 34, 567 it is easy to read as 12 lakhs, 34 thousand and 567. Similarly the number 12345678 can be read easily when commas are added. (i.e) 1,23,45,678 can be read as 1 crore, 23 lakhs, 45 thousand and 678.

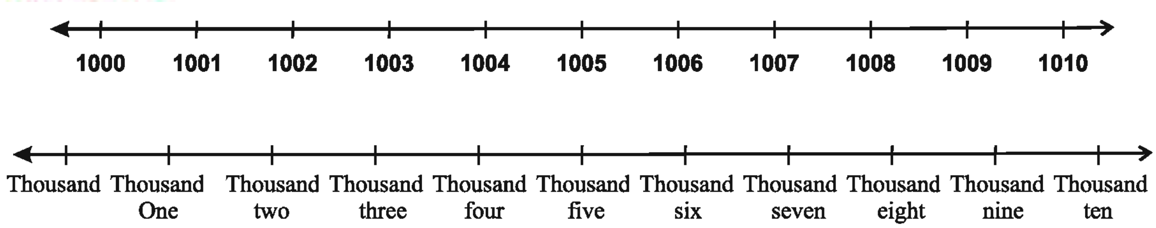
Numbers	Word Form (Number Name)
6	Six
66	Sixty six
666	Six hundred and sixty six
6,666	Six thousand, six hundred and sixty six
66,666	Sixty six thousand, six hundred and sixty six
6,66,666	Six lakhs, sixty six thousand, six hundred and sixty six
1,001	One thousand and one
10,011	Ten thousand and eleven
1,10,101	One lakh, ten thousand , One hundred and one

1.5 Activities of the Numbers

We know many concepts about numbers. Is it applicable to all numbers? Yes, whether a number has more or few digits, it is a number. It has the same property as any number.

Predecessor	Number	Successor
99,999	1,00,000	1,00,001
1,10,004	1,10,005	1,10,006
2,27,226	2,27,227	2,27,228
5,55,499	5,55,500	5,55,501

Number Line



1.5.1 Addition

$$\begin{array}{r} 1,10,110 \\ +\quad 90 \\ \hline 1,10,200 \\ \hline \end{array} \qquad \begin{array}{r} 1,10,110 \\ +\quad 990 \\ \hline 1,11,100 \\ \hline \end{array} \qquad \begin{array}{r} 1,10,110 \\ +\quad 9,990 \\ \hline 1,20,100 \\ \hline \end{array} \qquad \begin{array}{r} 1,10,110 \\ +\quad 99,990 \\ \hline 2,10,100 \\ \hline \end{array}$$

1.5.2 Subtraction

1,10,110	1,10,110	1,10,110	1,10,110
− 90	− 990	− 9,990	− 99,990
1,10,020	1,09,120	1,00,120	10,120

1.5.3 Multiplication

5 lakhs x 6 = 30 lakhs
22 lakhs x 12 = (22 x 12) lakhs = 264 lakhs
1,00,005 x 5 = (1 lakh + 5) x 5 = 5 lakhs and twenty five

1,23,456 x 5 = ?

```
    1,23,456
x          5
------------
    6,17,280
------------
```

1,23,456 x 15 = ?

```
    1,23,456
x         15
------------
     617280
    123456
------------
   18,51,840
```

We can multiply in the usual method. It is little difficult to check if we have written all the digits correctly. We have to be careful while writing and adding many numbers in order.

Importance should be given for the place value of numbers.

Example :

Number	Face Value (digit)	Place Value
456	4	Hundreds
23,456	2	Ten thousand
1,23,456	1	Lakh

When 1,23,456 is multiplied by 5, the result is definitely more than 5 lakhs.

1.5.4 DIVISION

98,76,543 ÷ 3 = ?

By the method of Continuous subtraction we can write the answer as 32,92,181. Division is possible for all numbers. But when the number of digits is more there is a possibility of making mistakes.

```
      3 2 9 2 1 8 1
3)    9 8, 7 6, 5 4 3
      9
        8
        6
        2 7
        2 7
          0 6
            6
            0 5
              3
              2 4
              2 4
                0 3
                  3
                  0
```

MATHEMATICS

Let us see the method of division using numbers having more digits.

32,32,032 ÷ 16 = ?

Take it as (32 lakhs + 32 thousand + 32) ÷ 16.

Separate the number and divide as follows

32 lakhs ÷ 16 = 2 lakhs

32 thousand ÷ 16 = 2 thousand

32 ÷ 16 = 2

and write the answer as 2 lakhs, 2 thousand and two = 2,02,002.

18 lakhs ÷ 9 = 2 lakhs

18 lakhs ÷ 9 lakhs = 2

18 lakhs ÷ 9000 = 200

18 lakhs ÷ 90 = 20,000

Why to stop with crores?
Why the numbers bigger than crores are not named in our country?

How do you read this? 1234567891011

We can read it as one lakh twenty three thousand 456 crores 78 lakh 91 thousand and eleven which is not useful.

It is important to know that the value of this number is more than one lakh crore. 10 digit number is used only in cell phones. No one reads 98404 36985 as 984 crores, 4 lakhs, 36 thousand 985.

In postal address, no one reads pincode number 600113 as 6 lakhs one hundred and thirteen because it is not a number, but a number sequence. So 600113 is considered as a number sequence which is read as six, zero, zero, one, one, three.

Hence we don't add, subtract or multiply the pincode numbers, telephone numbers or bus numbers.

Exercise 1.4

1. The population of Nilgiri district is approximately 7 lakhs and five thousand. In Kanyakumari it is approximately sixteen lakhs. My friend says the population in Kanyakumari is twice as Nilgiri's. Is it true?

2. There are 462 students in a school. It was decided that each one gets a pen costing Rs. 18 as a gift. Is it enough to have Rs.7200 or Rs.10,000 ?

3. 52 students need Rs.5184 to go for an excursion. How much should be collected from each student?

4. i. 28,760 + 38,530 = ______ ii. 22,760 + 40,530 = ______ iii. 20,760 + 40,530 = ______ iv. 119,800 - 88,565 = ______ v. 1,19,800 - 89,565 = ______ vi. 1,19,500 - 89,565 = ______

5. i. 282 x 5 = ii. 256 x 102 = iii. 3789 x 260 = iv. 807 x 70 = v. 189 x 98 =

6. i. 2568 ÷ 3 = ii. 1424 ÷ 4 = iii. 4485 ÷ 5 = iv. 1246 ÷ 7 = v. 1720 ÷ 10 =

7. i. 1,00,000 ÷ 100 = iii. 10,000 ÷ 25 = v. 5,55,555 ÷ 11 =
ii. 1,00,000 ÷ 50 = iv. 1,00,000 ÷ 200 = vi. 90,909 ÷ 9 =

Points to remember

- N = {1,2,3,4,...} Natural numbers.
- W = {0,1,2,3,4,...} Whole numbers.
- There is no end if you extend a number line from zero.
- There is a successor for every whole number.
- You can add and multiply all the whole numbers.
- There is a predecessor for every whole number except zero.
- From any natural number we can subtract a smaller natural number or the same number.
- We can find the remainder, dividing a bigger number by a smaller number.
- All these are possible for any number having more digits.
- When we read 1,23,546 it is important to know that it is greater than one lakh twenty thousand and less than one lakh twenty five thousand.

Activity

CROSS NUMBER PUZZLE

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
■	1	■	26		■	27		28	■	
29		30		■	31		■	32	33	
	■	34		35		■	36			
■	37				■	38	■	39		40
41			■	42			43	■	44	
45		■	46		■	47			■	

ACROSS

1 .. 620+376
4 .. 1809÷9
6 .. 304-3
8 .. 5055÷5
10 .. 25+186
13 .. 3003÷3
15 .. 79+18
16 .. 16+7
18 .. 5+6
20 .. 83+16
21 .. 919+68
22 .. 3306÷3
24 .. 69+23
26 .. 16+7
27 .. 196-92
29 .. 30x107
31 .. 17+5
32 .. 120+8
34 .. 1439+572
36 .. 75x4
37 .. 28328-18418
39 .. 203-98
41 .. 1600÷8
42 .. 963+41
44 .. 17+13
45 .. 33+17
46 .. 54-30
47 .. 611-11

DOWN

2 .. 67+24
3 .. 609-8
4 .. 219-9
5 .. 7+5
6 .. 19+12
7 .. 30+77
9 .. 918÷9
11 .. 11+3
12 .. 403+326
14 .. 222÷2
15 .. 626+373
17 Fill 2122,2977,______,4687
19 .. 6072÷6
22 .. 9+4
23 .. 13+7
25 .. 67+165
26 .. 1449+552
28 .. 12303÷3
29 .. 21+11
30 .. 1251+39
31 .. 15+6
33 .. 1031-28
35 .. 1075-61
37 .. 918-18
38 .. 205-99
40 .. 302+198
41 .. 7+29
43 .. 11+29

2. DIVISORS AND FACTORS

2.1 ADDITION AND MULTIPLICATION

One day in 1784, a German teacher in his primary school felt tired as he entered the class. So he decided to give a difficult addition problem to his students and rest for a while. He asked them to find the total of "1 to 100".

Within a few seconds one particular student called out the answer 5050. The teacher was astonished and asked for the explanation. The explanation was as follows

$1 + 2 + 3 + \ldots\ldots + 98 + 99 + 100$

(3 + 98 = 101; 2 + 99 = 101; 1 + 100 = 101)

100 numbers are equal to
50 pairs
$100 \div 2 = 50$

The above representation shows 50 pairs. The value of each pair is 101.

So altogether $50 \times 101 = 5050$.

The student who gave the above explanation was Gauss. He lived in the period 1777 to 1855 A.D. and was titled 'Emperor of mathematicians'. How is it possible to change an addition to multiplication? Is it possible always? Basically this is what Gauss understood.

$$1 + 2 + 3 + \ldots + 99 + 100 = (1 + 100) + (2 + 99) + (3 + 98) \ldots + (50 + 51)$$
$$= 101 \times 50$$
$$= 5050$$

Here the arrangement of numbers in a particular sequence is very important. Addition becomes easier when we rearrange them. This is possible for any sequence of natural numbers.

At the age of three Gauss was able to find mistakes in his father's office accounts.

Verify:

35 + 65	=	65+35 = 100	
33 + 34 + 35	=	33+35+34 = 35 + 34 + 33	
	=	34+33+35 = 35 + 33 + 34	
	=	102	
1777 + 1784 + 1855	=	1855 + 1777 + 1784 = 5416	
5050 + 50 + 1050	=	50 + 1050 + 5050 = 6150	

A sequence of numbers added in any order gives the same answer.

This will help us in many ways.

32 + 2057 + 68	=	2057 + (32 + 68)
	=	2057 + 100
	=	2157
125 + 250 + 125 + 250	=	(2x 250) + 125+ 125
	=	(2x 250) + 250
	=	3x 250
	=	750

If you want to add many numbers we have to do the following

i) Split the suitable numbers first.

ii) Add them separately.

iii) Finally add them all.

The above property is true for multiplication also.

Check them:			
	5 x 7 x 20	=	(20 x 5) x 7
		=	100 x 7 = 700
	125 x 20 x 8 x 50	=	(125 x 8) X (20 x 50)
		=	1000 x 1000 = 10,00,000

A sequence of numbers multiplied in any order gives the same result.

We must be careful while addition and multiplication are involved together.

What is the answer for 5 x 8 + 3?

If we multiply, 5 x 8 = 40 and add 3 we get 40 + 3 = 43 as the answer. If we add 8 +3 = 11 and then multiply we get 5 x 11 = 55 as the answer. There is no two different answers for one problem. Therefore (5x8) + 3 or 5 x (8+3) are correct.

You can see (.....) brackets used in the above examples.

Check them.

When both the operations addition and multiplication are involved it is important to use these ( ) brackets.

2.1.1 PROBLEMS INVOLED IN SUBTRACTION AND DIVISION

- Whole number + Whole number = Whole number
- Whole number x Whole number = Whole number
- This is called as closure property of addition and multiplication.
- Is there any closure property for subtraction and division?
- We should be careful about this.
- Is it possible to subtract a number from any number?

5050 – 50 = 5000

5050 – 5050 = 0

50 – 5050 = ?

While subtracting it is not always necessary to get the answer as a natural number, zero (or whole number). This is applicable for division also.

5050 ÷ 50 = 101

5050 ÷ 5050 = 1

50 ÷ 5050 = ?

- ☐ There is no closure property for division.
- ☐ Arrangement is very important for subtraction and division.

(23 – 12) – 5 = 6

23 – (12 –5) = 16

The above given statements are not the same.

23–12 = 11 but

12–23 = ?

Arrangement is important for division.

120 ÷ 12 = 10

12 ÷ 120 = ?

Group Activity

Using short cut method, pair the numbers to get a sum of 1000

(i) 155, 124, 16, 45, 484, 176

(ii) 111, 222, 333, 78, 167, 89

Group Activity

Using short cut method, pair the numbers to get a product of 1000

(i) 2, 4, 5, 25 (ii) 5, 5, 2, 20 (iii) 2, 2, 125, 2

Exercise 2.1

1. Add the following by simple method.

(i) 25 + 69 + 75 (ii) 119 + 64 + 1 + 80 (iii) 750 + 60 + 240 + 250

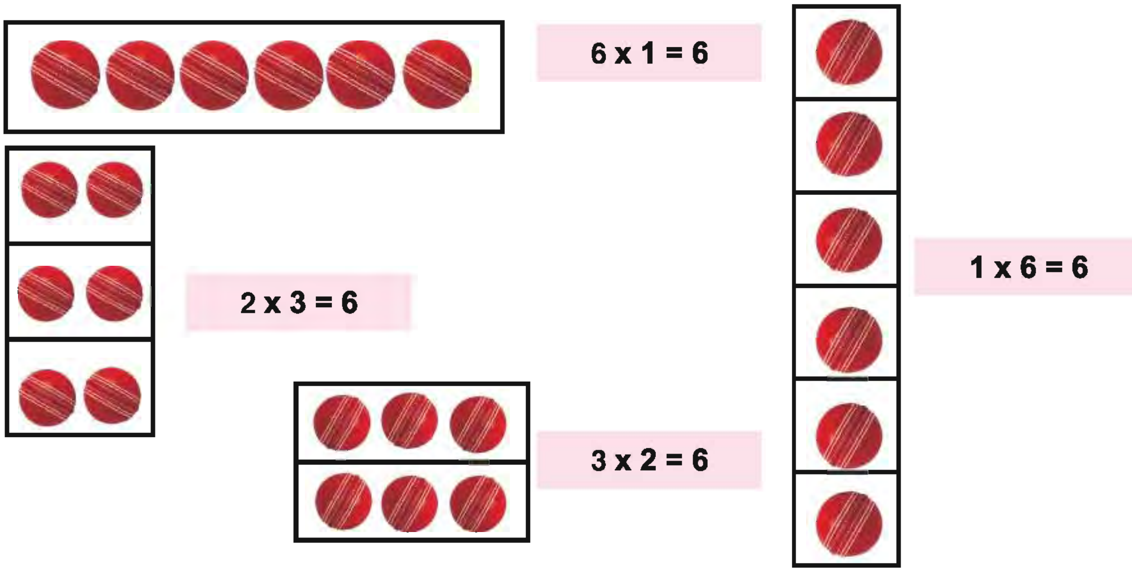
2. Answer the following 51 + 52 + … +99 + 100

3. Find the product using short methods.

(i) 25 x 62 x 4 (ii) 5 x 125 x 2 x 2 (iii) (75 x 5) + (30 x 5) + (25 x 5)

2.2 DIVISORS

Manoj has 6 cricket balls. He is trying to arrange them in a rectangular form.



Any natural number other than one can be written as a product of 2 or more numbers.

Can we arrange 6 balls in any other rectangular form?
The answer would be obtained by dividing 6 by a number smaller than 6.

1) 6 (6 6 ----------- 0 -----------	2) 6 (3 6 ----------- 0 -----------
3) 6 (2 6 ----------- 0 -----------	4) 6 (1 4 ----------- 2 -----------
5) 6 (1 5 ----------- 1 -----------	6) 6 (1 6 ----------- 0 -----------

It is found that by dividing 6 by some numbers the remainder is '0' and by some numbers the remainder is not zero.

Divisors of 6 are 1, 2, 3, 6.

All the numbers which divide a given number leaving 0 as remainder are called divisors of the given number.

Observe the following table

Number	Divisors	Expressing in different rectangular form
12	1, 2, 3, 4, 6, 12	1 x 12 ; 2 x 6 ; 3 x 4
17	1,17	1 x 17
25	1, 5, 25	1 x 25 ; 5 x 5
28	1, 2, 4, 7, 14, 28	1 x 28 ; 2 x 14 ; 4 x 7
31	1,31	1 x 31
35	1, 5, 7, 35	1 x 35 ; 5 x 7
42	1, 2, 3, 6, 7, 14, 21, 42	1 x 42 ; 2 x 21 ; 3 x 14 ; 6 x 7

The following are observed from the above table

- ★ 1 and number itself are divisors of any number.
- ★ Is there any number which has no divisor? No, because 1 is a divisor of all numbers.
- ★ Some numbers have many divisors. 42 has 8 divisors.
- ★ All the numbers from 1 to 10 except 7 are the divisors of 720.
  Try to find more divisors.
- ★ Some numbers have only 2 divisors.
- ★ For Example : divisors of 7 are 1 and 7. Likewise prime numbers 11,13,17,19 have only two divisors.

Prime numbers are numbers which are divisible by 1 and itself.

2.2.1 FACTORS

In the previous section we have observed that 1 and the number itself were the divisor of any number along with other divisors. For Example : divisors of 45 are 1, 3, 5, 9, 15, 45. Here other than 1 and 45 the remaining numbers are called factors.

The divisors of a number other than 1 and the number itself are called the factors of that number.

Think Over:

"All factors are divisors". Are all divisors factors?

A prime number does not have any factors.

Can you factorise 7?

Numbers having more than two divisors are called composite numbers

2.2.2 METHODS OF FINDING PRIME NUMBERS

All even numbers are divisible by 2. Two is the only even prime number.
How to find whether a given number is a prime number? It is difficult. Why?
Is 200 divisible by 4? Yes by division.
Is 200 divisible by 9? No by division.
Is 131 divisible by 11? No.
Is 1137 divisible by 11?
Is 1234567 divisible by 133? Try to get the answer.

It is possible to find out whether a number is divisible by any number. But this is not enough to find out whether it is a prime number.

Prime numbers are only divisible by 1 and itself.

There is no other divisor for prime numbers proving the above is difficult for bigger numbers.

How many prime numbers are there from 1 to 100? Find them.

1. Form a tabular column for numbers 1 to 100.
2. Except 2, cross all the even numbers.
3. Next except 3, cross all the multiples of 3.
4. Next 5, because 4 and even number has already been crossed. Now cross all the multiples of 5.
5. Follow the same; the left out numbers are prime numbers.

A Greek mathematician Eratosthenes (BC 276 – BC 175) suggested this method for finding the prime numbers.

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~~

Totally there are 25 prime numbers.

1 has only one divisor, so 1 is neither a prime nor a composite number.

2.2.3 MULTIPLES

Observe the given table

Multiples

x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
4	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
6	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
7	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
8	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
9	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
10	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200

Example : 1

Write 4 multiples of 7 above 100
Answer: 105, 112, 119, 126.

105 is a multiple of 7, At the same time 7 is a divisor of 105. So a number is a multiple of its divisor.

Example : 2

Write 4 multiples of 5 just before 80 and 4 multiples of 5 just after 80 including 80.
Answer: 60, 65, 70, 75, 80, 85, 90, 95, 100.

Activity

Frame all posible two digit number from 2, 5, 7 (repitition of numbers are not allowed)
List out all the factors of the numbers formed.

Exercise 2.2

1. State true or false for the following

i. 4 is one of the divisors of 7.
ii. One of the factors of 21 is 3.
iii. 1 is one of the divisors of 24.
iv. 9 is one of the factors of 45.
v. One of the multiples of 5 is 105.

2. Choose the correct answer

i. Which of the following has all the divisors of 10?

(a) 1,2,5 (b) 2,5 (c) 1,2,5,10 (d) 2,10

ii. Which of the following has all the divisors of 4?

(a) 2,4 (b) 1,2 (c) 1,2,4 (d) 2

iii. 3 is the divisor of _____

(a) 18 (b) 19 (c) 20 (d) 29

iv. 4 is the multiple of _____

(a) 5 (b) 2 (c) 3 (d) 8

v. 15 is the multiple of _____

(a) 3 (b) 45 (c) 7 (d) 11

3. Find the divisors of the following

(i) 8 (ii) 15 (iii) 45 (iv) 121 (v) 14

4. Write all the multiples of 3 between 80 and 100.

5. Write all the multiples of 5 and 10 between 21 and 51. What do you understand from this?

6. Say true or false for the following

(i) 1 is the smallest prime number.

(ii) There are two even prime numbers.

(iii) 6 is a prime number.

(iv) 13 is a composite number.

(v) 61 is a prime number.

Activity

Game based on factors

Students have to pick up the number cards kept on the table. They will have to go and stand in the corner where the chosen number is a factors of the given number. Then they pair up with their co-factors that the product is the given number.

7. Choose the correct answer

(i) The prime factor of 24 is

(a) 3 (b) 4 (c) 6 (d) 12

(ii) The prime number between 5 and 11 is

(a) 6 (b) 7 (c) 8 (d) 10

(iii) Number of one digit prime numbers are

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

(iv) Number of prime numbers between 20 and 30 are

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

(v) The smallest two digit prime number is

(a) 37 (b) 7 (c) 11 (d) 10

8. Write all the prime numbers between 30 and 60

9. Are the addition, subtraction, multiplication and division of two prime numbers, is also a prime number? check with examples.

2.3 DIVISIBILITY

To find all the divisors of a non-negative integer we should divide the number by all the numbers smaller than it, which is time consuming. Moreover the quotient is not important.

Our aim is to find whether it could be divided leaving 0 as the remainder. This could be found by simple methods.

Test of divisibility by 2

If we keep subtracting 2 from the odd numbers like 37, 453 we get a remainder. But, we get 0 as a remainder for even numbers such as 48, 376. So, all even numbers are divisible by 2.

Numbers ending with 0, 2, 4, 6 or 8 are divisible by 2.

Test of divisibility by 5

If we keep subtracting 5 from 1005 we get numbers such as 1000, 995, 900 whose last digit is 5 and 0 alternatively and finally it ends with 0.

If 5 is subtracted from a number ending with 7 (for e.g 237) we get numbers ending with 2, 7, 2, ... At last it ends with 2. So 237 is not divisible by 5.

Numbers ending with 0 or 5 are divisible by 5.

Test of divisibility by 10

If we keep subtracting 10 from 3010 we get numbers ending with 0 such as 3000, 2990, 2980.

Numbers ending with 0 are divisible by 10.

It is enough to see the last digit to know if a number is divisible by 2, 5, 10.

Test of divisibility by 4

Is 138 divisible by 4?

138 = 100 + 38; If we keep subtracting 4 from 100 we get 0 as the remainder. Therefore to know if 138 is divisible by 4 it is enough to find out if 38 is divisible by 4. Likewise 1792 = 1700 + 92. 92 is divisible by 4. So 1792 is divisible by 4. 2129 is not divisible by 4 (check), because 29 is not divisible by 4.

If the number formed by last two digits (unit and tenth digit) of a given number is divisible by 4, it will be divisible by 4.

Test of divisibility by 8

Is 1248 divisible by 8? 1248 = 1000 + 248. 1000 = 125 x 8. So it is enough to see if 248 is divisible by 8. 248 = 31 x 8. So 1248 is divisible by 8.

If the number formed by the last three digits of a given number is divisible by 8, the given number will be divisible by 8.

Are all numbers that are divisible by 2 are divisible by 4 also? For Example : 26 is divisible by 2 but not divisible by 4. Likewise all the numbers that are divisible by 4 need not be divisible by 8.

To test (i) if a number is divisible by 4, check only the last two digits.

(ii) If a number is divisible by 8 check only the last three digits.

Test of divisibility by 9

Is 45 divisible by 9?

45 = 10 + 10 + 10 + 10 + 5

= 9 + 1 + 9 + 1 + 9 + 1 + 9 + 1 + 5

If we keep subtracting 9 we get

= 1 + 1 + 1 + 1 + 5

= 4 + 5 = 9

If the last 9 is subtracted the remainder is 0. So, 45 is divisible by 9.

Is 123 divisible by 9?

123 = 100 + 10 + 10 + 3

= (99+1) + (9+1) + (9+1) + 3

= (99+1) + (9+9+2) + 3

If 9 or multiples of 9 are subtracted we get 1 + 2 + 3 = 6. So, 123 is not divisible by 9.

Note that after subtracting 9 the remainder is the sum of the digits of the given number.

If the sum of the digits of a number is divisible by 9, the number is divisible by 9.

Given Number	Sum of the digits	Is it divisible by 9?	Verify by multiplication
61	6 + 1 = 7	No	61 = 6 x 9 + 7
558	5 + 5 + 8 = 18; 1 + 8 = 9	Yes	558 = 62 x 9
971	9 + 7 + 1 = 17; 1 + 7 = 8	No	971 = 107 x 9 + 8
54000	5 + 4 + 0 + 0 + 0 = 9	Yes	54000 = 6000 x 9

Test of divisibility by 3

If we keep subtracting 3 from 42 we get 0 as remainder (ie. 42, 39, 36, … 0). This can also be checked by another method.

$$42 = 10 + 10 + 10 + 10 + 2$$
$$= 9+1 + 9+1 + 9+1 + 9+1 + 2$$

Instead of subtracting 3, 9 can be subtracted (because 9 = 3 x 3). Finally we get,

$$= 1 + 1 + 1 + 1 + 2$$
$$= 4 + 2$$
$$= 6$$

6 is divisible by 3. So, 42 is also divisible by 3.

Note that after subtracting 9 the remainder is the sum of the digits of the given number.

If the sum of the digits of a number is divisible by 3, the number is divisible by 3.

Note: Numbers that are divisible by 2 and 3 are also divisible by 6.

Activity

From the given five numbers 2, 5, 7, 9, 0 frame all possible two digit number divisible by 2, 3, 5, 6, 10.

Test of divisibility by 11

	Digits						Sum of the digits in the odd places	Sum of the digits in the even places	Difference
	6	5	4	3	2	1			
3 x 11					3	3	3	3	0
71 x 11				7	8	1	8 (7+1)	8	0
948 x 11		1	0	4	2	8	13(1+4+8)	2 (0+2)	11
5102 x 11		5	6	1	2	2	8	8	0
73241 x 11	8	0	5	6	5	1	7	18	11

From the above table we know that the difference between the sum of the digits in the odd places and sum of the digits in the even places is a multiple of 11.

If the difference between the sum of the digits in the odd places and sum of the digits in the even places is either 0 or multiples of 11, the number is divisible by 11.

Generally it is difficult to find if a number is divisible by 11. But, if the numbers are in a particular pattern, we know that they are divisible by 11. For Example : 121, 1331, 4994, 56265, 1234321, 4754574 are divisible by 11. How?

Exercise 2.3

1. State true or false for the following

(i) 120 is divisible by 3.

(ii) All the numbers that are divisible by 8 are also divisible by 2.

(iii) All the numbers that are divisible by 10 are also divisible by 5.

2. Circle the numbers divisible by8.

22, 35, 70, 64, 8, 107, 112, 175, 156

3. Check if the numbers divisible by 3 and 5 are also divisible by 15 with a suitable examples.

Activity

4. Tabulate if the numbers given below are divisible by 2, 3, 4, 5, 6, 8, 9 , 10, 11

Numbers	DIVISIBILITY								
	2	3	4	5	6	8	9	10	11
77	No	No	No	No	No	No	No	No	Yes
896	Yes	No	Yes	No	No	Yes	No	No	No
918									
1,453									
8,712									
11,408									
51,200									
732,005									
12,34,321									

5. Fill the following tabular column with a suitable number.

The smallest number divisible by 2	7	6	0	4	3	1	2	
The biggest number divisible by 3						7	3	2
The smallest number divisible by 4				9	8	2	6	
The biggest number divisible by 5			4	3	1	9	6	
The smallest number divisible by 6		1		9	0	1	8	4
The biggest number divisible by 8	3	1	7	9	5		7	2
The smallest number divisible by 9				3	2	0		7
Any number divisible by 10	1	2	3	4	5	6	7	
Any number divisible by 11			8	6	9	4		4
The smallest number divisible by 3				5	6		1	0
Any number divisible by 11			9	2	3		9	3

Activity

i) If the number 48327 ∗ 8 is divisible by 11, find the missing number.

ii) Form 3 digit numbers using 4, 9, 5 so that each of the number so formed is divisible by only one of the following numbers 5, 6, 7, 9, 11.

2.4 PRIME FACTORISATION

The method of expressing a number as a product of prime numbers is called prime factorization.

(i) Division method (ii) Factor tree method are the two methods to find the prime factors of the given numbers.

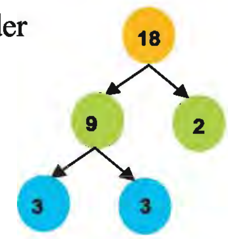
Factorise 18, 120 by division method and factor tree method.

Given number is 18

Division method

		Remainder
2	18	
3	9	-0
3	3	-0
	1	-0

Factor tree method



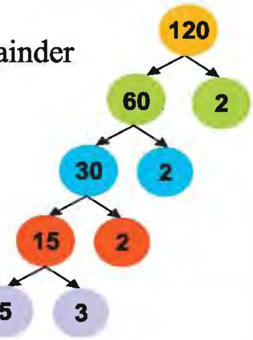
Prime factors of 18 are
$18 = 2 \times 3 \times 3$

Given number is 120

Division method

		Remainder
5	120	
3	24	-0
2	8	-0
2	4	-0
2	2	-0
	1	-0

Factor tree method



Prime factors of 120 are
$120 = 2 \times 2 \times 2 \times 3 \times 5$

Exercise 2.4

1. Express the following numbers as a product of prime factors.

(i)	6	(ii)	15	(iii)	21	(iv)	30	(v)	121
(vi)	145	(vii)	162	(viii)	170	(ix)	180	(x)	200

2. Which has more prime factors: 21 or 8? Find using a factor tree.

2.5 Greatest Common Divisor (G.C.D.) Least Common Multiple (L.C.M.)

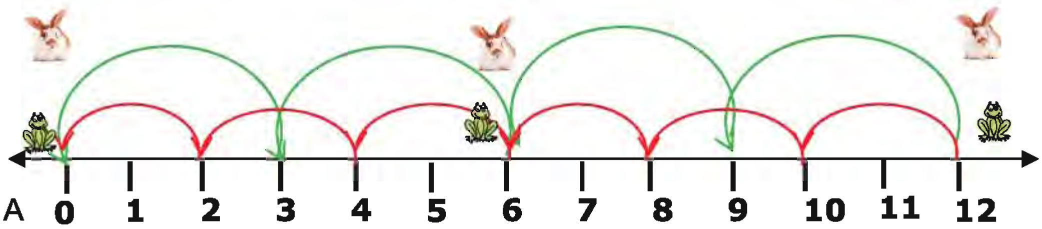
2.5.1 Least Common Multiple (L.C.M.)

A rabbit covers 3 feet in one jump. But a frog can cover only 2 feet in one jump.

Both of them start from the same point A.

From point A, the points of landing of the rabbit is at 3, 6, 9, 12,...

From point A, the points of landing of the frog is at 2, 4, 6 , 8,...



Both of them land at common points 6, 12 …. Here 6 is the LCM of 2 and 3.

> The smallest among the common multiples of two numbers is called their least common multiple (LCM).

We can find the LCM of given numbers by 2 methods

Common Multiple method

Step 1: List the multiples of the given numbers.

Step 2: Circle and write the common multiples

Step 3: The smallest common multiple is the LCM.

Given numbers: 16, 24

Multiples of 16: = 16, 32, 48, 64, 80, 96, 112, 128, 144, 160,.....

Multiples of 24: = 24, 48, 72, 96, 120, 144, 168,....

Common multiples of 16 and 24 = 48, 96, 144, ...

(The smallest multiple among the common multiples is the LCM)

∴ The LCM of 16 and 24 = 48.

Factorisation method

Step1: Find the prime factors of the given numbers.

Step2: Circle the common prime factors

Step3: Find the product of the common factors. Multiply this product with independent factors.

Given numbers: 16, 24

Factors of 16

		Remainder
2	16	
2	8	-0
2	4	-0
2	2	-0
	1	-0

Factors of 24

		Remainder
2	24	
2	12	-0
2	6	-0
3	3	-0
	1	-0

Factors of 16 = 2 x 2 x 2 x 2

Factors of 24 = 2 x 2 x 2 x 3

LCM is the product of the common factors and independent factors.

LCM of 16 &24 = 2 x 2 x 2 x 2 x 3 = 48

2.5.2 Greatest Common Divisor (G.C.D.)

We know that different numbers have common divisors. Among the common divisors the greatest divisor is the G.C.D.

There are 2 methods to find the G.C.D. of the given numbers.

Common divisor method

Step 1: Find the divisors of the given numbers.

Step 2: Circle and write the common divisors

Step 3: Among the common divisors the greatest divisor is the G.C.D.

Given numbers: 30, 42

Divisors of 30 : 1, 2, 3, 5, 6, 10, 15, 30

Divisors of 42 : 1, 2, 3, 6, 7, 14, 21, 42

Common divisors : 1, 2, 3, 6

G.C.D. = 6

Given numbers = 35, 45, 60

Divisors of 35 : 1, 5, 7, 35

Divisors of 45 : 1, 3, 5, 9, 15, 45

Divisors of 60 : 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Common divisors : 1, 5

G.C.D. : 5

Factorisation method

Step 1: Find the prime factors of the given numbers.

Step 2: Circle the common prime factors.

Step 3: Product of the common factors is the G.C.D. of the given numbers.

Given numbers: 30, 42

Prime factors of 30

		Remainder
2	30	
3	15	– 0
5	5	– 0
	1	– 0

Prime factors of 42

		Remainder
2	42	
3	21	–0
7	7	–0
	1	–0

Factors of 30: = 2 x 3 x 5

Factors of 42: = 2 x 3 x 7

(circle the common factors)

G.C.D = 2 x 3 = 6

MATHEMATICS

Example : 3

Find the G.C.D. of 85, 45, 60 by factorization method.

Factors of 85

		Remainder
5	85	
17	17	-0
	1	-0

Factors of 45

		Remainder
3	45	
3	15	-0
5	5	-0
	1	-0

Factors of 60

		Remainder
2	60	
2	30	-0
3	15	-0
5	5	-0
	1	-0

Factors of 85 = (5) x 17

Factors of 45 = 3 x 3 x (5)

Factors of 60 = 2 x 2 x 3 x (5)

(Circle the common factors of all the three numbers)

G.C.D. of the given numbers = 5.

2.5.3 Relatively Prime Numbers

Let us form ordered pairs of any two numbers.

For Example : (5, 12), (9, 17), (11, 121), ...

G.C.D. of the ordered pair (3, 5) is 1. G.C.D. of the ordered pair (5, 15) is 5.

If the G.C.D. of any ordered pair is 1, then they are said to be relatively prime numbers.

(3, 5) are relatively prime numbers. (5, 15) are not relatively prime numbers.

Example : 4

Are the given ordered pairs relatively prime numbers?

(13, 17), (7, 21), (101, 201), (12, 13)

ANSWERS

1. (13, 17) – Relatively prime numbers as G.C.D. of (13, 17) is 1
2. (7, 21) – Not relatively prime numbers as G.C.D. of (7, 21) is 7
3. (101, 201) – Relatively prime numbers as G.C.D. of (101, 201) is 1
4. (12, 13) – Relatively prime numbers as G.C.D. of (12, 13) is 1.

Note: G.C.D. of any pair of consecutive numbers is 1.
So, they are said to be relatively prime numbers.

Exercise 2.5

1. State true or false for the following:
   - (I) G.C.D. of 2, 3 is 1
   - (ii) LCM of 4, 6 is 24
   - (iii) (5, 15) are relatively prime numbers.
   - (iv) G.C.D. of any two number is less than their L.C.M.

2. Choose the correct answer
   - (i) The G.C. D. of 3, 6 is
     (a) 1 (b) 2 (c) 3 (d) 6
   - (ii) The L.C.M. of 5, 15 is
     (a) 5 (b) 10 (c) 15 (d) none of these
   - (iii) The G.C.D. of two prime numbers is
     (a) 1 (b) a prime number (c) a composite number (d) 0
   - (iv) The G.C.D. and L.C.M. of the relatively prime numbers (3, 5) are
     (a) 1, 3 (b) 1, 5 (c) 1, 15 (d) 1, 8

3. Find the G.C.D. and L.C.M. of the following
   (i) 30, 42 (ii) 34, 102 (iii) 12, 42, 75 (iv) 48,72, 108.

4. Puspha bought 2 rice bags each weighing 75 kg and 60 kg. The rice must be completely filled in smaller bags of equal weight. What is the maximum weight of each bag?.

Activity

At a birthday function chocolates were distributed as 6 or 12 or 15 chocolates to each person. What is the least number of chocolates required?

2.6. Relation between G.C.D. and L.C.M.

Observe the following table and fill in the blanks.

First number	Second number	Product	L.C.M.	G.C.D.	G.C.D. x L.C.M.
8	12	96	24	4	96
18	36	648	36	18	648
5	?	75	15	5	75
3	9	27	?	3	27

From the above table

Product of two numbers = G.C.D. x L.C.M.

Example : 5

The G.C.D. of 36, 156 is 12.

Find their L.C.M.

First number = 36

Second number = 156

G.C.D. = 12

$$L.C.M. = \frac{\text{Product of the two numbers}}{G.C.D.}$$

$$= \frac{36 \times 156}{12}$$

$$= 468$$

Example : 6

The G.C.D. and L.C.M. of two number are 3 and 72 respectively. If one number is 24. Find the other.

One number = 24.

G.C.D. = 3

L.C.M. = 72

$$\text{Other number} = \frac{G.C.D. \times L.C.M.}{\text{One number}}$$

$$= \frac{3 \times 72}{24}$$

$$= 9$$

Exercise 2.6

1. Find the correct relationship between G.C.D. and L.C.M.

(i) G.C.D. = L.C.M. (ii) G.C.D. $\leq$ L.C.M.

(ii) L.C.M. $\leq$ G.C.d. (iv) L.C.M. > G.C.D.

2. The L.C.M. of 78, 39 is 78. Find their G.C.D.

3. The G.C.D. and L.C.M. of two numbers are 2 and 28 respectively. One number is 4. Find the other number.

Activity

i) Two baskets contain 77 and 121 fruits. These are to be packed in different baskets containing equal number. Find the greatest number that can be packed in each basket.

ii) There are two tubs containing 1248 and 704 litres of water respectively. What is the vessel of the greatest capacity that can be used to measure these quantities of water an exact number of times.

iii) The length and breadth of a rectangular sheet are 16 cm and 12 cm respectively. A square of maximum size is to be cut without wasting the sheet. What will be the side of such a square.

iv) Mary, Fathima and Seetha started running on the track at 4 p.m and took 6.30 and 5 minutes respectively to run around the track once. If they continued at the same speed after how much time will they meet at the starting point again.

To think

1. What is the G.C.D. of any two consecutive even numbers?
2. What is the G.C.D. of any two consecutive odd numbers?
3. What is the G.C.D. of any two consecutive numbers?
4. Is the sum of any two consecutive odd numbers divisible by 4? Verify with examples.
5. Is the product of any three consecutive numbers divisible by 6? Verify with examples

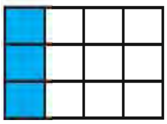
Points to remember

- Numbers can be added and multiplied in any order. (This is not applicable for subtraction and division)
- A number which divides a given number leaving '0' as remainder is called a divisor of the given number.
- 1 is a divisor for all numbers. A number is a divisor for itself.
- Numbers which are divisible by 1 and itself are called prime numbers. The remaining numbers are composite numbers.
- Divisibility of a number by 2, 3, 5, 6, 8, 9, 10, 11 can be easily found.
- The method of expressing a number as a product of prime numbers is called prime factorization.
- Among the common divisors of given numbers, the greatest divisor is the G.C.D.
- If the G.C.D. of any two numbers is 1 they are said to be relatively prime number.
- Among the common multiples of given numbers, the least is the L.C.M.
- The product of any two numbers is equal to the product of their G.C.D. and L.C.M.

3. FRACTIONS AND DECIMAL NUMBERS

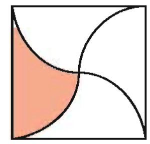
3.1 FRACTIONS – REVISION

A fraction is a part or parts of a whole.

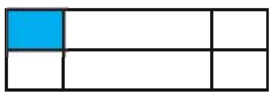


$\frac{3}{12}$

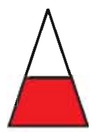
$\frac{2}{6}$



$\frac{1}{4}$



This is not $\frac{1}{6}$
(All the parts are not equal)



This is not $\frac{1}{2}$
(Both the parts are not equal)

This is $\frac{2}{8}$
(All the parts are equal)

In a fraction, the number above the line is called the numerator and the number below the line is called the denominator.

$$\text{FRACTION} = \frac{\text{NUMERATOR}}{\text{DENOMINATOR}}$$

We know to divide the whole into quarter, half and three quarters

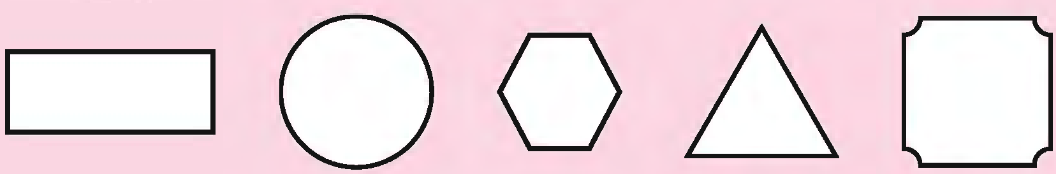
We denote them as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$.

We call these numbers as fractions.

Activity

Do it yourself :

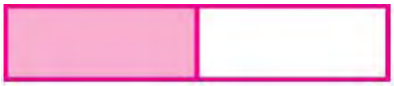
Shade the given shapes for the corresponding fraction in the following shapes.



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

3.1.1 Equivalent Fractions (Revision)

Let us divide a rectangle into two equal parts and shade one part.

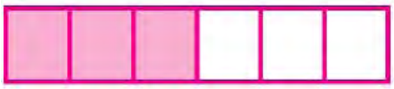


Shaded part = $\frac{1}{2}$

Let us divide the same rectangle into four equal parts and shade 2 parts.

Shaded part = $\frac{2}{4}$

Divide the same rectangle into 6 equal parts and shade 3 parts.



Shaded part = $\frac{3}{6}$

In all the above figures the shaded portions are equal but they can be represented by different fractions.

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$$

When two or more fractions represent the same part of a whole, the fractions are called equivalent fractions.

Activity-Equivalent Fractions:

In a card write the multiples of 1 to 10. Cut as strips as shown below.

These cards are called "multiple cards".

Let us now find the equivalent fractions of $\frac{2}{3}$

Solution:

Keep the multiple cards of the numerator and the denominator as shown in the figure.

2^{nd} multiple card.	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3^{rd} multiple card.	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45

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

$$\frac{2}{3} = \frac{2 \times 3}{3 \times 3} = \frac{6}{9}$$

$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

$$\frac{2}{3} = \frac{2 \times 9}{3 \times 9} = \frac{18}{27}$$

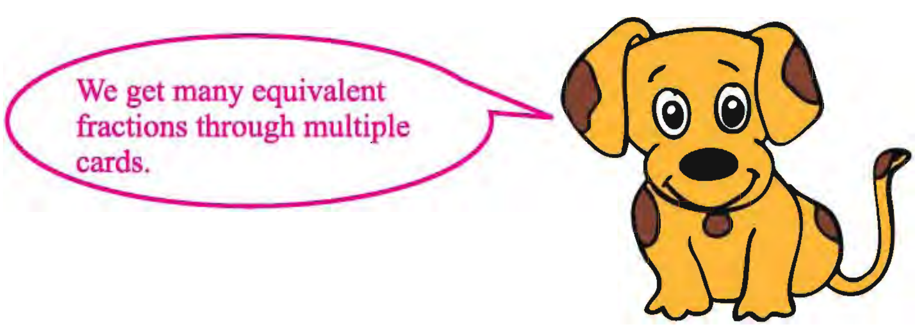
$$\frac{2}{3} = \frac{4}{6} = \frac{6}{9}$$

These fractions are called equivalent fractions.

When the numerator and the denominator are multiplied by the same number, we get equivalent fractions.

Therefore $\frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{2 \times 3}{3 \times 3} = \frac{2 \times 5}{3 \times 5} = \frac{2 \times 9}{3 \times 9} = \frac{2 \times 10}{3 \times 10}$

$$\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{10}{15} = \frac{18}{27} = \frac{20}{30}$$



Example : 1

Find the missing numbers in the following equivalent fractions using the multiple cards.

$$\frac{4}{9} = \frac{8}{18} = \frac{\square}{45} = \frac{32}{\square}$$

4^{th} multiple card.	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
9^{th} multiple card.	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135

From the above figure

1. If the denominator is 45, the numerator is 20.
2. Similarly if the numerator is 32, the denominator is 72.

$$\therefore \frac{4}{9} = \frac{8}{18} = \frac{\boxed{20}}{45} = \frac{32}{\boxed{72}}$$

Example : 2

Write any 5 equivalent fractions to $\frac{3}{7}$

To get equivalent fractions multiply the numerator and the denominator by the same number.

$$\frac{3}{7} = \frac{3x2}{7x2} = \frac{3x4}{7x4} = \frac{3x5}{7x5} = \frac{3x9}{7x9} = \frac{3x10}{7x10}$$

$$\frac{3}{7} = \frac{6}{14} = \frac{12}{28} = \frac{15}{35} = \frac{27}{63} = \frac{30}{70}$$

3.1.2 Expressing the fractions in its lowest form (simplest form)

Now consider $\frac{15}{18}$

Divisors of 15 are 1, 3, 5, 15

Divisors of 18 are 1, 2, 3, 6, 9, 18

$$\frac{15}{18} = \frac{3x5}{3x6}$$

$$\frac{15}{18} = \frac{\not{3}x5}{\not{3}x6} = \frac{5}{6}$$ (We cancel 3 which is common.)

Divisors of 5 are 1, 5

Divisors of 6 are 1, 2, 3, 6

As there is no common divisor for 5 and 6 (except 1)

$\frac{5}{6}$ is the lowest form of $\frac{15}{18}$

Equivalent fractions have the same value. So they can be represented by a single number. So we express it in the lowest form where there is no common factor for the numerator and denominator.

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Example : 3

Reduce $\frac{12}{16}$ into lowest terms

Factors of 12 are 2, 3, 4, 6
Factors of 16 are 2, 4, 8

There are two common factors 2,4.

Considering 2 as a factor,

$$\frac{12}{16} = \frac{2x6}{2x8} = \frac{6}{8}$$

Factors of 6 are 2, 3
Factors of 8 are 2, 4

$$\frac{6}{8} = \frac{\cancel{2}x3}{\cancel{2}x4} = \frac{3}{4}$$

Considering 4 as a factor,

$$\frac{12}{16} = \frac{4x3}{4x4} = \frac{3}{4}$$

There is no common factor for 3 and 4.

$\therefore$ The Lowest form of $\frac{12}{16} = \frac{3}{4}$

So, when there are more than one common factor, use the greatest common factor, to get the lowest term easily.

Example : 4

Write the lowest form of $\frac{24}{40}$

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

Factors of 40 are 2, 4, 5, 8, 10, 20

8 is the greatest common factor. $\therefore \frac{24}{40} = \frac{8x3}{8x5} = \frac{3}{5}$

Exercise : 3.1

1. Write 4 equivalent fractions for each of the following : (i) $\frac{5}{6}$ (ii) $\frac{3}{8}$ (iii) $\frac{2}{7}$ (iv) $\frac{3}{10}$

2. Pick out the equivalent fractions: $\frac{2}{5}, \frac{12}{16}, \frac{1}{3}, \frac{5}{15}, \frac{16}{40}, \frac{3}{4}, \frac{9}{12}$

3. Express the following in its lowest form:

   (i) $\frac{12}{14}$ (ii) $\frac{35}{60}$ (iii) $\frac{48}{64}$ (iv) $\frac{27}{81}$ (v) $\frac{50}{90}$

4. Find the missing number.

   (i) $\frac{1}{4} = \frac{?}{20} = \frac{3}{?}$ (ii) $\frac{3}{5} = \frac{21}{?} = \frac{?}{20}$ (iii) $\frac{5}{9} = \frac{35}{?} = \frac{?}{72}$

3.1.3 Comparison of fractions, addition, subtraction – Revision

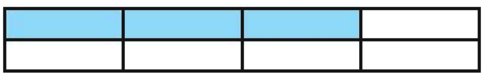
> Like fractions have the same denominators.
> (Eg: $\frac{2}{7}$ $\frac{5}{7}$)

We have learnt to add, subtract and to compare the numbers. Similarly we can do it for the fractions also.

Comparison of fractions:

Which is greater? $\frac{3}{8}$ or $\frac{5}{8}$

Let us take a rectangle

 $\frac{3}{8}$  $\frac{5}{8}$

From the figure, we observe that $\frac{3}{8} < \frac{5}{8}$. When fractions have the same denominator we can compare only the numerators and decide which fraction is greater.

$$\therefore \frac{3}{8} < \frac{5}{8}$$

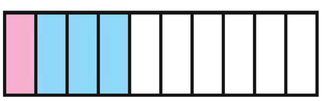
Example : 5

Which is greater ? $\frac{9}{11}$ or $\frac{7}{11}$

The denominators of $\frac{9}{11}$ and $\frac{7}{11}$ are same. So compare the numerators.

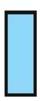
As 9>7, $\frac{9}{11} > \frac{7}{11}$

Addition of like fractions



In this figure

 Represents $\frac{1}{10}$

 Represents $\frac{3}{10}$

From the figure we can see that the total coloured part = $\frac{4}{10}$

$$\therefore \boxed{\frac{1}{10} + \frac{3}{10} = \frac{4}{10}}$$

We can see that both the fractions have same denominator.

Activity

Do it Yourself :

1. $\frac{3}{11} + \frac{1}{11} = ?$
2. $\frac{3}{8} + \frac{4}{8} + \frac{2}{8} = ?$
3. $\frac{1}{31} + \frac{15}{31} + \frac{7}{31} = ?$

For addition of fractional numbers with the same denominator, all the numerators are added and the sum is written as numerator in the result, keeping the denominator same.

Subtraction of like fractions

In subtraction of like fractions, find out which is greater and subtract the smaller from the greater.

1. $\frac{2}{4} - \frac{1}{4} = \frac{2-1}{4} = \frac{1}{4}$ 2. $\frac{6}{7} - \frac{4}{7} = \frac{6-4}{7} = \frac{2}{7}$

Can we subtract greater fraction from smaller fraction?

Exercise 3.2

1. Find which is greater fraction:

(i) $\frac{3}{7}, \frac{5}{7}$ (ii) $\frac{2}{12}, \frac{7}{12}$ (iii) $\frac{6}{19}, \frac{16}{19}$ (iv) $\frac{13}{34}, \frac{31}{34}$ (v) $\frac{37}{137}, \frac{33}{137}$

2. Add the following like fractions:

(i) $\frac{1}{4} + \frac{2}{4} = ?$ (ii) $\frac{3}{7} + \frac{4}{7} = ?$ (iii) $\frac{3}{13} + \frac{9}{13} = ?$ (iv) $\frac{5}{7} + \frac{3}{7} + \frac{4}{7} = ?$

(v) $\frac{5}{124} + \frac{43}{124} + \frac{33}{124} = ?$ (vi) $\frac{23}{432} + \frac{23}{432} + \frac{32}{432} = ?$

3. Simplify the following:

(i) $\frac{12}{13} - \frac{4}{13} = ?$ (ii) $\frac{9}{17} - \frac{6}{17} = ?$ (iii) $\frac{34}{39} - \frac{33}{39} = ?$ (iv) $\left\{\frac{75}{47} + \frac{3}{47}\right\} - \frac{14}{47} = ?$

(v) $\left\{\frac{125}{214} - \frac{25}{214}\right\} + \frac{50}{214} = ?$ (vi) $\left\{\frac{24}{122} + \frac{2}{122}\right\} - \frac{13}{122} = ?$

Activity

Observe and shade the answer part

$\frac{3}{8}$ + $\frac{4}{8}$ =

3.1.4 Unlike Fractions: Comparison, addition, subtraction.

Which is greater ? $\frac{1}{4}$ or $\frac{2}{5}$

Observe that the denominators are different.
Fractions having different denominators are called unlike fractions.
Convert the unlike fractions to like fractions to add, subtract and to compare.

How to convert the unlike fractions into like fractions ?

Consider the unlike fractions $\frac{1}{4}$ and $\frac{2}{5}$

Convert them into like fractions, without changing their values.
How to covert them in to like fractions without changing their values?
Convert unlike fractions into like fractions, by finding their equivalent fractions.

Equivalent fractions of $\frac{1}{4} \rightarrow \frac{1}{4}=\frac{2}{8}=\frac{3}{12}=\frac{4}{16}=\frac{5}{20}=\frac{6}{24}=\frac{7}{28}$

Equivalent fractions of $\frac{2}{5} \rightarrow \frac{2}{5}=\frac{4}{10}=\frac{6}{15}=\frac{8}{20}=\frac{10}{25}=\frac{12}{30}=\frac{14}{35}$

It is important to see, whether the denominators of the two fractions are same.

We can write $\frac{1}{4}$ as $\frac{5}{20}$ and $\frac{2}{5}$ as $\frac{8}{20}$ without changing their values.

Now $\frac{5}{20}$ and $\frac{8}{20}$ are like fractions.

As $\frac{8}{20} > \frac{5}{20}$, $\frac{2}{5} > \frac{1}{4}$

Example : 6

Which is greater? $\frac{1}{2}$ or $\frac{3}{5}$

$\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{4}{8}=\frac{5}{10}=\frac{6}{12}=\frac{7}{14}=\frac{8}{16}=\frac{9}{18}=\frac{10}{20}$

$\frac{3}{5}=\frac{6}{10}=\frac{9}{15}=\frac{12}{20}=\frac{15}{25}=\frac{18}{30}=\frac{21}{35}=\frac{24}{40}=\frac{27}{45}=\frac{30}{50}$

Unlike fractions can be converted into like fractions by finding many sets of equivalent fractions. We can use any one pair of equivalent fractions to find which is greater.

$\frac{6}{10} > \frac{5}{10}$ Therefore $\frac{3}{5} > \frac{1}{2}$ or $\frac{12}{20} > \frac{10}{20}$ Therefore $\frac{3}{5} > \frac{1}{2}$

Activity

Prepare multiple cards for 1 to 10 as shown below

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45

Let us take $\frac{3}{4}$ and $\frac{2}{5}$ and convert them into like fractions

$\frac{3}{4}$	3	6	9	12	15	18	21	24	27	30
	4	8	12	16	20	24	28	32	36	40
$\frac{2}{5}$	2	4	6	8	10	12	14	16	18	20
	5	10	15	20	25	30	35	40	45	50

Keep the multiple cards of $\frac{3}{4}$ and $\frac{2}{5}$ as shown above.

Observe the denominators of multiple cards and find where they are equal.
20 and 40 are found in both the multiple cards.

Therefore we can write, $\frac{3}{4}=\frac{15}{20}$ and $\frac{2}{5}=\frac{8}{20}$

Using this activity, we can compare, add and subtract fractions.

3.1.5 Addition of unlike fractions

$\frac{1}{4}+\frac{2}{5}=?$

To add, convert the given fractions into like fractions.

Equivalent fractions of $\frac{1}{4}$ $\rightarrow \frac{1}{4}=\frac{2}{8}=\frac{3}{12}=\frac{4}{16}=\frac{5}{20}=\frac{6}{24}=\frac{7}{28}$

Equivalent fractions of $\frac{2}{5}$ $\rightarrow \frac{2}{5}=\frac{4}{10}=\frac{6}{15}=\frac{8}{20}=\frac{10}{25}=\frac{12}{30}=\frac{14}{35}$

$\frac{1}{4}=\frac{5}{20}$, $\frac{2}{5}=\frac{8}{20}$ $\quad\therefore \frac{1}{4}+\frac{2}{5}=\frac{5}{20}+\frac{8}{20}=\frac{13}{20}$

Example : 7

$\frac{2}{5}+\frac{5}{6}=?$ $\quad \frac{2}{5}=\frac{4}{10}=\frac{6}{15}=\frac{8}{20}=\frac{10}{25}=\frac{12}{30}=\frac{14}{35}$ $\quad \frac{5}{6}=\frac{10}{12}=\frac{15}{18}=\frac{20}{24}=\frac{25}{30}=\frac{30}{36}=\frac{35}{42}$

$\frac{2}{5}=\frac{12}{30}$, $\frac{5}{6}=\frac{25}{30}$ $\quad\therefore \frac{2}{5}+\frac{5}{6}=\frac{12}{30}+\frac{25}{30}=\frac{37}{30}$

Let us take the examples given above,

$$\frac{1}{4}+\frac{2}{5}=\frac{5}{20}+\frac{8}{20}$$

(i.e) $\frac{1}{4}$ is equivalent to $\frac{5}{20}$

$\frac{2}{5}$ is equivalent to $\frac{8}{20}$

(i.e) $$\frac{1x5}{4x5}+\frac{2x4}{5x4}=\frac{5}{20}+\frac{8}{20}=\frac{13}{20}$$

Similarly, $$\frac{2}{5}+\frac{5}{6}=\frac{2x6}{5x6}+\frac{5x5}{6x5}$$

$$=\frac{12}{30}+\frac{25}{30}=\frac{37}{30}$$

To add unlike fractions, we can use the following steps.

$$\frac{1}{4}+\frac{2}{5}$$

Step: 1 Multiply the two denominators $\frac{1}{4}+\frac{2}{5}=\frac{}{4x5}$

Step: 2 Multiply the numerator of each fraction by the denominator of other fraction. $\frac{1x5}{4x5}+\frac{2x4}{5x4}=\frac{(1x5)+(2x4)}{4x5}$

Step: 3 $\frac{1}{4}+\frac{2}{5}=\frac{5+8}{4x5}=\frac{13}{20}$

Example : 8

$$\frac{3}{8}+\frac{5}{7}=\frac{(3x7)+(5x8)}{8x7}$$

$$=\frac{21+40}{56}$$

$$=\frac{61}{56}$$

Example : 9

$$\frac{11}{10}+\frac{4}{9}=\frac{(11x9)+(4x10)}{10 x 9}$$

$$=\frac{99+40}{90}$$

$$=\frac{139}{90}$$

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3.1.6 Subtraction

Subtraction is similar to addition

To subtract,

(i) Convert the given fractions into like fractions.

(ii) Subtract the numerators

Example : $\frac{4}{5} - \frac{1}{3} = ?$

Step 1: Convert into like fractions

$\frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15}, \quad \frac{1}{3} = \frac{5 \times 1}{5 \times 3} = \frac{5}{15},$

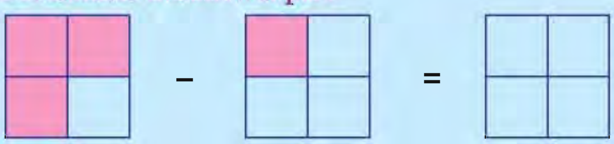
$\frac{12}{15}, \frac{5}{15}$ are like fractions of $\frac{4}{5}$ and $\frac{1}{3}$ respectively

Step 2 : Subtraction

$\frac{4}{5} - \frac{1}{3} = \frac{12}{15} - \frac{5}{15} = \frac{7}{15} \qquad \therefore \frac{4}{5} - \frac{1}{3} = \frac{7}{15}$

Activity

Observe and shade the answer part



$\frac{3}{4} \quad - \quad \frac{1}{4} \quad =$

Exercise:3.3

1. Which is greater?

(i) $\frac{5}{7}, \frac{3}{8}$ (ii) $\frac{2}{10}, \frac{7}{12}$ (iii) $\frac{6}{5}, \frac{2}{4}$ (iv) $\frac{6}{9}, \frac{4}{3}$ (v) $\frac{3}{2}, \frac{3}{7}$

2. Simplify the following:

(i) $\frac{3}{4} + \frac{2}{3} = ?$ (ii) $\frac{3}{8} + \frac{2}{4} = ?$ (iii) $\frac{3}{5} + \frac{9}{9} = ?$ (iv) $\frac{5}{3} + \frac{3}{8} + \frac{4}{3} = ?$

(v) $\frac{3}{10} + \frac{4}{100} = ?$ (vi) $\frac{3}{4} + \frac{2}{5} + \frac{4}{8} = ?$

3. Simplify the following:

(i) $\frac{2}{3} - \frac{1}{4} = ?$ (ii) $\frac{9}{10} - \frac{3}{5} = ?$ (iii) $\frac{3}{4} - \frac{3}{8} = ?$ (iv) $\frac{6}{7} - \frac{1}{4} = ?$ (v) $\left\{\frac{8}{9} - \frac{1}{9}\right\} - \frac{2}{9} = ?$

3.1.7 Improper fractions and mixed fractions

$\frac{3}{4}, \frac{1}{2}, \frac{9}{10}, \frac{5}{6}$ In these fractions, denominator is greater than the numerator. They are called proper fractions.

If the numerator is greater than the denominator, the fraction is called an improper fraction. (e.g) $\frac{5}{4}, \frac{6}{5}, \frac{41}{30}$

What is meant by $\frac{5}{4}$?

Velu, Appu, Vasu and Kala had 5 dosas with them. How to divide them equally ?

First we can give 1 dosa each to all the four. Then the remaining 5^{th} dosa can be divided into 4 equal parts, and each one can be given 1 part.

The total quantity of dosa received by Velu, Appu, Vasu and Kala= 1 whole dosa + $\frac{1}{4}$ dosa

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

This can be written as $1\frac{1}{4}$

How else can you divide the dosa among them?

Each dosa can be divided into 4 equal parts and each one would receive five $\frac{1}{4}$ parts.

Each one would have got $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$ = five $\frac{1}{4} = \frac{5}{4}$

But the dosa received by each in each method must be same.

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

$1\frac{1}{4}$ is called mixed fraction.

A mixed fraction has one natural number and one proper fraction.

Any improper fraction can be converted into mixed fraction.

Note: Mixed fraction = Natural number + proper fraction.

$4\frac{1}{2} = 4 + \frac{1}{2}$ and $22\frac{1}{3} = 22 + \frac{1}{3}$

3.1.8 Conversion of improper fractions into mixed fractions.

Example : 10

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

$$= \frac{6}{3} + \frac{1}{3}$$

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

Divide 7 by 3

```
3) 7 (2
   6
-----------
   1
-----------
```

Divisor = 3
Quotient = 2
Remainder = 1

$$\text{Mixed fraction} = \text{Quotient} + \frac{\text{Remainder}}{\text{Divisor}}$$

Think over!
There are two groups of people. In the first group, 4 apples are shared equally among 3 people and in the second group 3 apples are shared equally among 4 people. Which group you will join, if you want to get more apples?

Do it yourself : Convert the following improper fractions into mixed fractions.

(i) $\frac{11}{3}$ (ii) $\frac{23}{7}$ (iii) $\frac{22}{5}$ (iv) $\frac{45}{6}$ (v) $\frac{59}{8}$ (vi) $\frac{73}{9}$ (vii) $\frac{87}{4}$

3.1.9: Conversion of mixed fractions into improper fractions.

Example : 11

Convert $3\frac{2}{7}$ into improper fraction.

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

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

$$= \frac{7+7+7+2}{7} = \frac{23}{7}$$

$$\boxed{3\frac{2}{7} = \frac{23}{7}}$$

$$\text{Improper fraction} = \frac{(\text{Natural number x denominator}) + \text{Numerator}}{\text{Denaominator}}$$

$$3\frac{2}{7} = \frac{(3 \times 7) + 2}{7}$$

$$= \frac{21+2}{7} = \frac{23}{7}$$

∴ The improper fraction of $3\frac{2}{7}$ is $\frac{23}{7}$

All non negative numbers can be considered as fractions. In these numbers, denominator can be considered as 1

Discuss: What kind of fractions are these?

$\frac{7}{7}$, $\frac{0}{7}$ and $\frac{1}{7}$

Do it yourself

Convert the following mixed fractions into improper fractions

$1\frac{1}{3}$, $2\frac{3}{5}$, $3\frac{5}{7}$, $1\frac{4}{10}$

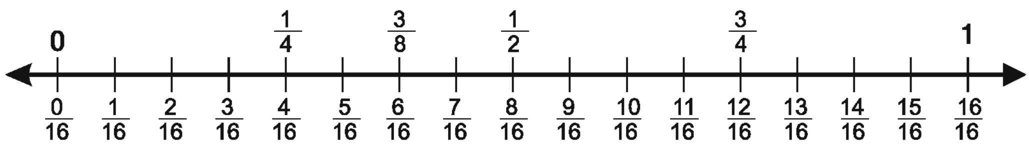
3.1.10 Fractions on number line

We have $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ between 0 and 1

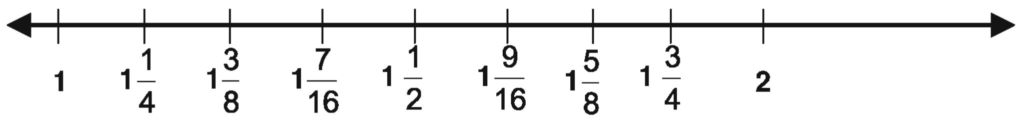
$\frac{3}{8}$ lies between $\frac{1}{4}$ and $\frac{1}{2}$

$\frac{7}{16}$ lies between $\frac{3}{8}$ and $\frac{1}{2}$

$\frac{9}{16}$ lies between $\frac{1}{2}$ and $\frac{3}{4}$



Similarly, there are many fractions between 1 and 2



Similarly, we can draw number lines between 101 and 102 , 134 and 135, 2009 and 2010.

On a number line, there are plenty of fractions. Moreover, when you add or subtract two fractions, we get a number or a fraction on the number line.

Between any two whole numbers we get many fractions.

Actually, between any two fractions, we can find a fraction! Thus many new fractions can be obtained! If each one of you find hundred fractions, there will be always a few more new fractions.

3.1.11 Miscellaneous Problems

Example : 12

There are 20 balls in a box. How many balls should be taken from the box, if you want to take three quarters of them?

Solution:

Total No.of balls = 20

Balls to be taken = $\frac{3}{4} \times 20$

= 3 x 5

= 15 balls

Example : 13

There are 60 students in a class. $\frac{2}{5}$ of them are boys. Find the number of boys

Solution

Total number of students = 60

No. of boys = $\frac{2}{5} \times 60$

$= 2 \times 12 = 24$ boys

Exercise: 3.4

1. Find any ten fractions between 0 and $\frac{1}{4}$.
2. There are 50 goats in a village. $\frac{2}{5}$ of them were lost. How many goats were lost?
3. The population of a village is 1000. One fourth of them are children. Find the number of adults.
4. Convert the following into improper fractions:

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

Activity

i) Rajan sold $7\frac{1}{2}$ kg of brinjals, $3\frac{1}{4}$ kg of carrot and $3\frac{3}{4}$ kg of tomato. How many kg of vegetables did he sell in all?

ii) A merchant sold $82\frac{1}{2}$ kg of raw rice and $77\frac{3}{4}$ kg of boiled rice. How much rice did he sell.

iii) A sweet box weighed $3\frac{5}{8}$ kg. $1\frac{3}{4}$ kg of sweet was taken out. Find the remaining weight of the box.

iv) A tin contains $15\frac{3}{4}$ kg sugar. $8\frac{5}{6}$ kg is used. What quantity is left over?

v) A milk vendor has $4\frac{3}{4}$ litres, $5\frac{3}{4}$ litres and $2\frac{1}{2}$ litres of milk in three cans. How much milk does he have in all the cans put together?

Points to remember:

- When a whole is divided into a number of equal parts, we get fractions.
- When we multiply numerators and denominators of fractions by the same number, we get equivalent fractions.
- To compare, add or subtract the like fractions, we can take only the numerators and perform the operation.
- To compare, add or subtract unlike fractions, convert them into equivalent fractions.
- We can find a fraction between any two fractions on the number line.

3.2 DECIMAL NUMBERS

Introduction:

We have learnt about very big numbers (a number with more number of digits) and fractions which are less than 1. We often use fractions like $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$. By addition or subtraction of fractions we got fractions like $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{16}$. Very small numbers also can be written as fractions.

Why can't we use fractions to represent all small numbers? It is because of the difficulties in using fractions.

$\frac{2}{3} + \frac{3}{4} = ?$

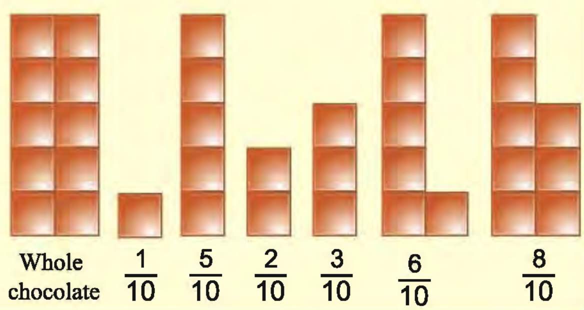
We convert them into like fractions by finding equivalent fractions and then add.
It is easy if all the fractions are in the form of $\frac{1}{10}, \frac{1}{100}, \frac{1}{1000}$ ....

$\frac{15}{100} + \frac{235}{1000}$ can be easily added as $\frac{150}{1000} + \frac{235}{1000} = \frac{385}{1000}$

It was easy to use multiples of 10 in measurements. It will be easy if small numbers can be written as fractions with multiples of ten as denominators.

3.2.1 One Tenths ($\frac{1}{10}$)

Kannan has 6 chocolate bars,each with 10 connected pieces.
He gave some pieces to his friends.
He finds that
1 piece out of 10 from the first chocolate
5 pieces out of 10 from the second chocolate
2 pieces out of ten from the third
3 pieces out of ten from the fourth
6 pieces out of ten from the fifth
8 pieces out of ten from the sixth remaining.



We can write them as
$\frac{1}{10}, \frac{5}{10}, \frac{2}{10}, \frac{3}{10}, \frac{6}{10}, \frac{8}{10}$ in fractions
This can be written as **0.1**, 0.5 , 0.2 , 0.3 , 0.6 , 0.8 in decimals

Fractions with powers of ten as denominators are called decimal fractions.

0.1 is read as zero point one. The point between the numbers is called the decimal point.

3.2.2 Decimal numbers - Definition

A decimal number has two parts namely an integral part and a decimal part.

Example:

A. Decimal Number = 0.6 = 0 + 0.6 Integral part = 0 : Decimal Part = 6
B. Decimal Number = 7.2 = 7 + 0.2 Integral part = 7 : Decimal Part = 2

In a decimal number the digits to the left of the decimal point is the integral part. The digits to the right of the decimal point is the decimal part.

The value of all the decimal parts is less than 1.

Example : 13

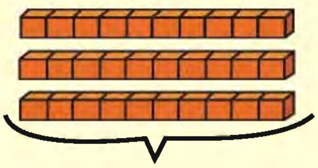


Fig.1

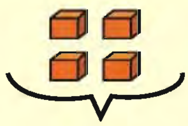


Fig.2

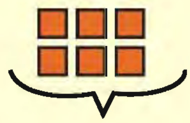


Fig.3

In figure 1 each wooden bar represents ten units.
In figure 2 each wooden bar represents one unit.
In figure 3 each wooden bar represents $\frac{1}{10}$ units.

Tens (10)	ones (1)	one tenths ($\frac{1}{10}$)
3	4	6

(i.e) $30 + 4 + \frac{6}{10} = 34 + 0.6 = 34.6$

It is read as thirty four point six

Example : 14

How to read decimal numbers?

S.No	Decimal Number	Integral Part	Decimal Part	Methods of reading numbers
1	6.5	6	5	Six point five
2	12.6	12	6	Twelve point six
3	91.8	91	8	Ninety one point eight

Do you know?

In olden days we used Ana, Chakkram, Kasu, Panam to denote money. Only from 1957 the decimal method of Rupees and paisa was introduced.

All whole numbers can be considered as decimals. 5 can be written as 5.0.
The zero to the extreme right of the decimal point has no value.

3.2.3 Place value of decimal numbers.

In decimal system, The place value of the integral part increases in powers of ten from right to left. The place value of the decimal part decreases in powers of ten from left to right.

Example : 15

Find the place value of the digits in the decimal number 67.8

Solution

Tens (10)	ones (1)	one tenths($\frac{1}{10}$)
6	7	8

Do it yourself: Find the place value of 32.7 , 78.6 , 201.0

Example : 16

Write the decimal numbers for the following:

1) Four ones and 3 tenths
2) Seventy two and 6 tenths.

Solution: i) Four ones and 3 tenths

$$4 + \frac{3}{10} = 4 + 0.3 = 4.3$$

ii) Seventy two and 6 tenths

$$72 + \frac{6}{10} = 72 + 0.6 = 72.6$$

Example : 17

Change the following fractions into decimal fractions.

(i) $30 + 8 + \frac{4}{10}$ (ii) $400 + 80 + \frac{6}{10}$

Solution:

(i) $30 + 8 + \frac{4}{10}$ (ii) $400 + 80 + \frac{6}{10}$

$= 38 + 0.4 = 38.4$ $= 480 + 0.6 = 480.6$

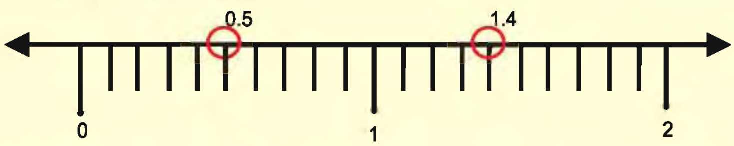
3.2.4 Representation of decimal numbers on the number line.

We know how to represent numbers and fractions on the number line. In a similar way we can represent decimal numbers on the number line.

Example : 18

Represent 0.5 , 1.4 on the number line

Solution

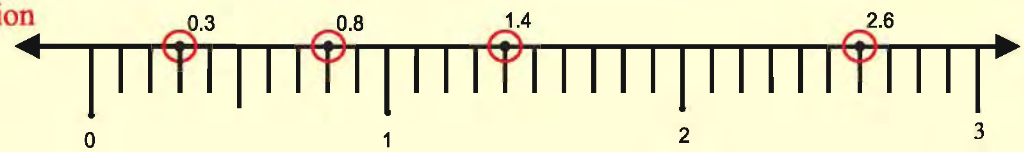


There are 10 equal parts between 2 whole numbers. The length of each equal part is $\frac{1}{10}$ part. So five tenths is the 5^{th} part from zero.

Example : 19

Represent 0.3 , 0.8 , 1.4 , 2.6 on the number line.

Solution



Do it yourself

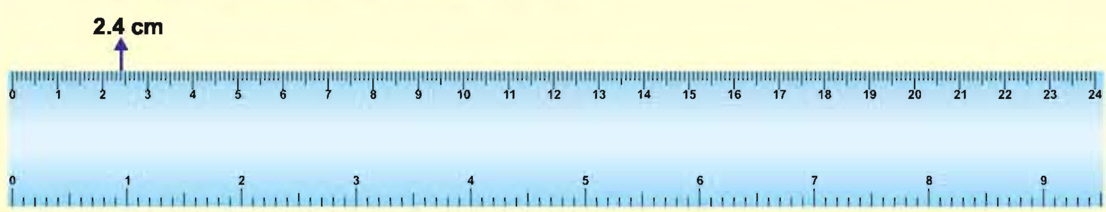
Represent 0.9 , 1.2 on the number line

Do you know ?

In cricket we denote 4 overs and 2 balls as 4.2 overs. This 4.2 is not a decimal number.

Example : 20

You can mark 2.4 cm on a scale like this



Exercise 3.5

1) Fill in the blanks

- i) The decimal fraction of 0.7 is----------
- ii) The integral part of 12.8 is------------------
- iii) The digit in the one's place of 60.1 is---------------
- iv) The place value of 4 in 9.4 is--------------
- v) The point between the integral part and the decimal part of the decimal number is called------------

2) Complete the following table

Tens (10)	Ones (1)	One-tenths ($\frac{1}{10}$)	Decimal Nos
2	3	4	
6	9	2	
8	2	8	

3) Complete the following table

Decimal Nos.	Integral part	Decimal part	Value of the decimal part	Number name
7.6				
28.5				
24.0				
5.06				

4) Write the decimal for each of the following

- i) One hundred and twenty four and six tenths
- ii) Eighteen and three tenths
- iii) Seven and four tenths

5) Represent the following decimal numbers on a number line

(i) 0.7 (ii) 1.9 (iii) 2.1

6) Convert the following fractions into decimal numbers.

(i) $\frac{2}{10}$ (ii) $3 + \frac{7}{10}$ (iii) $700 + 80 + 6 + \frac{3}{10}$

MATHEMATICS

Activity

1. Divide the students of a class into groups. Ask them to visit a hotel, grocery shop, ration shop etc. Collect the price list and discuss.

2. Let them measure the length and breadth of different objects at home. Prepare a table using decimal numbers.

3.2.5 One-hundredths – Introduction

Mahesh measured the length of a black board in his class using a ruler. The length is 345 cm. Shall we help him to write the length of the blackboard in metres?

You know that 100cm = 1m

$\therefore$ 1cm = $\frac{1}{100}$ m so 345 cm = 300 cm + 45 cm

$= 3 \text{ m} + \frac{45}{100} \text{ m}$

$= 3 \text{m} + 0.45 \text{ m} = 3.45 \text{ m}$

Therefore 345cm is converted into a decimal number as 3.45m.

We know what is one-tenths. Can we find one-tenths of one-tenths?
Let us see that in the following figure

Fig 1

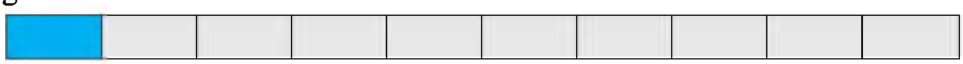
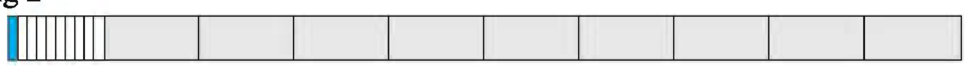


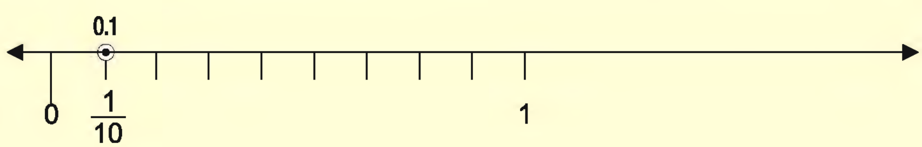
Fig 2

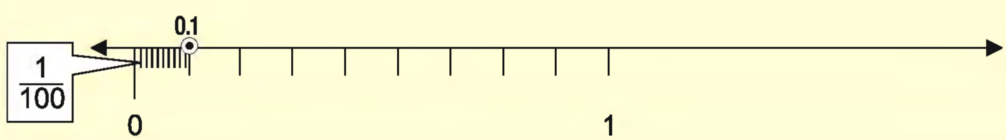


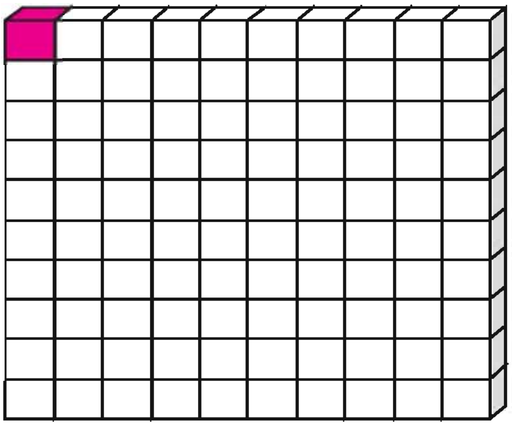
The shaded portion in fig 1 is $\frac{1}{10}$ and the shaded portion in fig 2 is $\frac{1}{100}$.

Example : 21

Represent $\frac{1}{10}$ and $\frac{1}{100}$ on the number line







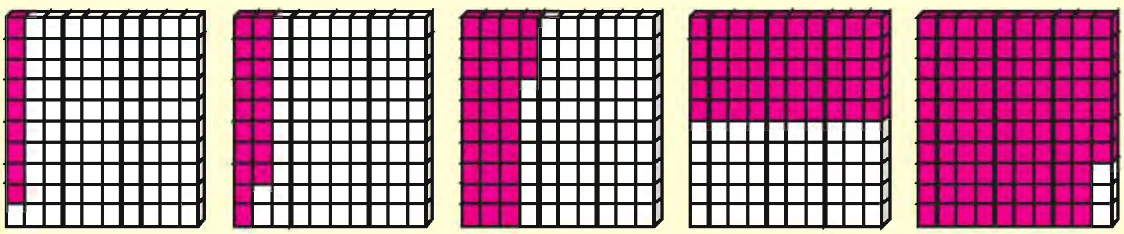
The shaded region in the figure is one-hundredths.

Fractional form = $\frac{1}{100}$

Decimal form = 0.01

Example : 22

Using the following figures, Convert into Fractional and Decimal forms.



S.No	Shaded Portions	Fractional form	Decimal form
1	9 squares	$\frac{9}{100}$	0.09
2	18 squares	$\frac{18}{100}$	0.18
3	33 squares	$\frac{33}{100}$	0.33
4	50 squares	$\frac{50}{100}$	0.50
5	97 squares	$\frac{97}{100}$	0.97

Example : **23**

Convert into decimals (i) $\frac{4}{100}$ (ii) $\frac{36}{100}$ (iii) $6+\frac{7}{10}+\frac{8}{100}$

Solution

(i) $\frac{4}{100} = 0.04$

(ii) $\frac{36}{100} = 0.36$

(iii) $6+\frac{7}{10}+\frac{8}{100} = 6+\frac{70}{100}+\frac{8}{100}$

$= 6+\frac{78}{100}$

$= 6 + 0.78 = 6.78$

Activity

Do it Yourself

Convert into decimal numbers

(i) $\frac{6}{100}$ (ii) $\frac{36}{100}$ (iii) $200+80+9+\frac{3}{100}$

Example : **24**

Write the decimal number: Eighteen and forty five hundredths.

Solution

Eighteen and forty five hundredths= $18+\frac{45}{100} = 18 + 0.45 = 18.45$

Example : **25**

Convert the following decimal numbers into fractions

(i) 0.09 (ii) 0.83

Solution

(i) $0.09 = \frac{9}{100}$ (ii) $0.83 = \frac{83}{100}$

Do you know?

While reading decimal numbers, the digits to the Right of decimal point must be read individually. For Example : 8.29 must be read as "Eight point two nine"

Activity

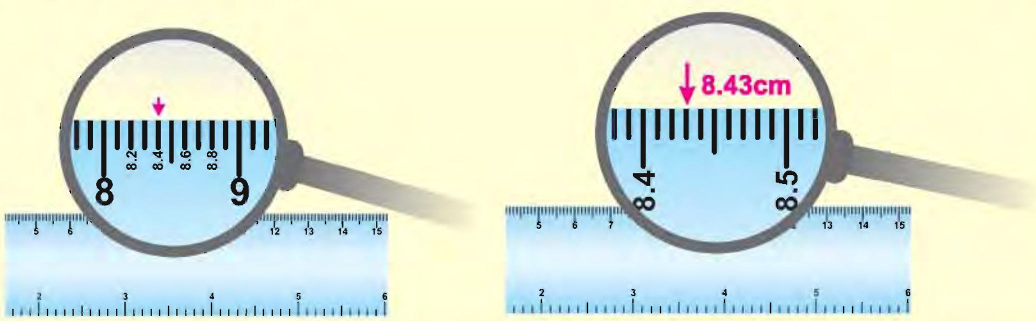
Do it yourself

Convert into fractions

a) 1.45 b) 0.13

Example : **26**

Let us mark 8.43 cm on a scale



Exercise 3.6

1) State whether the following are true or false:

   i) Non negative integers can be considered as decimals

   ii) Fractional form of 3.76 is $3 + \frac{76}{10}$

   iii) The place value of 3 in 82.03 is $\frac{3}{100}$

   iv) The place value of 0 in 70.12 is 70

2) Write as decimal numerals

   i) Twenty three and eighteen-hundredths

   ii) Nine and five-hundredths

3) Find the place value of the underlined digits in the following decimal numbers.

   i) $\underline{9}227.42$ ii) $208.0\underline{6}$ iii) $34\underline{3}.17$ iv) $166.\underline{2}4$

4) Convert the following fractions into decimals

   i) $20 + 3 + \frac{4}{10} + \frac{7}{100}$ ii) $137 + \frac{5}{100}$ iii) $\frac{3}{10} + \frac{9}{100}$

5) Convert the following decimals into fractions

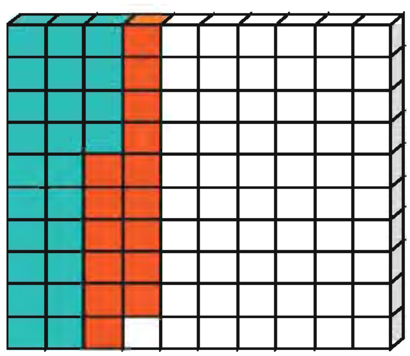
   i) 106.86 ii) 1.20 iii) 76.45 iv) 0.02

3.2.6 Addition and subtraction of decimals

The process of adding decimals is similar to that of adding whole numbers. The place value is important. It is important to arrange the digits one below the other according to place values.

While adding 7235 with 47 we arrange the numbers as $\begin{array}{r} 7235 \\ +\ 47 \\ \hline \\ \hline \end{array}$ Not as $\begin{array}{l} 7235 \\ +47 \\ \hline \\ \hline \end{array}$

Observe the figure



0.24 and 0.15 are shaded in two different colours.
Now the sum of 0.24 and 0.15 is 0.39
(i.e.) 3 tenths and 9 hundredths

Method: 1

	Ones	decimal point ●	one-tenths	one-hundredths
	0	●	2	4
	0	●	1	5
Sum	0	●	3	9

Method:
Arrange the decimal numbers according to place values as we arrange in whole numbers. Then add or subtract.

$\therefore$ 0.24 + 0.15 = 0.39

Method :2

$$\begin{array}{r} 0.24 \\ +\ 0.15 \\ \hline 0.39 \\ \hline \end{array}$$

$\therefore$ 0.24 + 0.15 = 0.39

Example : 27

(i)
$$\begin{array}{r} 0.5 \\ +\ 0.5 \\ \hline 1.0 \\ \hline \end{array}$$

(ii)
$$\begin{array}{r} 0.75 \\ +\ 0.25 \\ \hline 1.00 \\ \hline \end{array}$$

(iii)
$$\begin{array}{r} 0.75 \\ +\ 0.50 \\ \hline 1.25 \\ \hline \end{array}$$

Note that in the problem (iii), while adding 0.75 and 0.5, 0.5 is written 0.50

Example : 28

Simplify (i) 7.3 + 11.46 (ii) 6.07 + 29

Solution (i)
$$\begin{array}{r} 7.30 \\ +\ 11.46 \\ \hline 18.76 \\ \hline \end{array}$$

(ii)
$$\begin{array}{r} 6.07 \\ +\ 29.00 \\ \hline 35.07 \\ \hline \end{array}$$

$\therefore$ 7.3 + 11.46 = 18.76 $\therefore$ 6.07+29 = 35.07

Example : 29

(i) Subtract 1.52 from 3.29

Solution:
$$\begin{array}{r} 3.29 \\ -\ 1.52 \\ \hline 1.77 \\ \hline \end{array}$$

(ii) Subtract 120-12.02

Solution:
$$\begin{array}{r} 120.00 \\ -\ 12.02 \\ \hline 107.98 \\ \hline \end{array}$$

Exercise 3.7

1) Fill in the blanks

(i) 7.25 + 3.50 = ______ (ii) 8.18 − 5.00 = ______

(iii) 9.69 − 1.11 = ______ (iv) 5.83 − 3.14 = ______

2) Add: (i) 9.005 + 300 (ii) 142.36 + 158.25

3) Subtract: (i) 9.756 − 6.79 (ii) 250 − 202.54

Action plan

A student has made mistakes in all his sums in the home work. Discuss in groups to find the method of correcting his mistakes.

(i) 6.7 + 2.5

$$\begin{array}{r} 6.7 \\ +\,2.5 \\ \hline 8.12 \end{array} \times$$

(ii) 8.9 + 4.3

$$\begin{array}{r} 8.9 \\ +\,4.3 \\ \hline 12.12 \end{array} \times$$

(iii) 48.3 + 17.6

$$\begin{array}{r} 48.3 \\ +\,17.6 \\ \hline 515.9 \end{array} \times$$

(iv) 38.3 – 17.9

$$\begin{array}{r} 38.3 \\ -\,17.9 \\ \hline 21.6 \end{array} \times$$

(v) 28.4 – 4

$$\begin{array}{r} 28.9 \\ -\;\;4 \\ \hline 28.5 \end{array} \times$$

(vi) 9.4 – 6.7

$$\begin{array}{r} 9.4 \\ -\,6.7 \\ \hline 3.3 \end{array} \times$$

Activity

i) Raju deposited Rs.105.75, Rs.1200, Rs.165.50, Rs.665.75 in the month of August. Find the total amount he deposited.

ii) A jewellery shop presented four silver medals in a school day fun. Their weights are 8.25 g, 12.2 g, 13.15 g and 7.35 g. What is the total weight of the metal?

iii) The Capacity of a water tank is 125.12 kl, 78.725 kl of water is drawn off from the tank. How much water remains in the tank?

iv) The sum of two numbers is 168.65. One number is 68.75. Find the other number.

v) A man earns Rs.2675 in a month. He spends Rs.2500.75. Find his savings.

Points to remember:

- Decimal fractions are fractions having ten or powers of ten as denominators
- A decimal number has two parts namely (i) integral part (ii) decimal part
- They are separated by a decimal point
- All non negative integers can be considered as decimal numbers.
- In a decimal number, the zeros to the extreme right of decimal point has no value
- While adding or subtracting decimals, arrange the decimal numbers according to the place values as we do in whole numbers.

4. METRIC MEASURES

4.1 INTRODUCTION

Find how many kilograms are there in 1padi.

Priyas's grand mother said, "There is not even one padi of rice in the house. Buy some rice when you are back from school". Priya asked her teacher "We measure rice using Kilogram but, what is one padi of rice?" Many students in the class said that they have also heard about this. The teacher explained "when India was ruled by the British, the measures used by the Britishers and the ancient Indians were in practice. But, after Independence it was decided to use only Metric measures throughout the country and people started using the same".

"Why did we change to metric? What is the speciality about it?" asked Nilavan.

The teacher thought for a while and said "Everybody has a scale with you isn't it? It is marked with inches on one side and centimetres on the other side. You all know about this. 12 inches make a feet.

Moreover 100 cm make one metre.

Which is easier?

Students screamed "feet, Metre".

Teacher formed the following table.

Measurement of length			
British tradition		Metric Measure	
12 inches	1 feet	10 Millimetre	1 Centimetre
660 feet	1 furlong	100 Centimetre	1 Metre
8 furlong	1 Mile	1000 Metre	1 Kilometre

Teacher asked "Which is easier among these two measures? Students answered "Metric measures" in a loud voice.

Measurement of weight			
British tradition		Metric Measure	
28.35 Grams	= 1 Ounce	1000 Milligram	= 1 Gram
16 Ounce	= 1 Pound	1000 Grams	= 1 Kilogram
2000 Pound	= 1 tonne	1000 Kilograms	= 1 tonne

Again the teacher questioned "Which is easier?". The children answered Metric measures.

Measurement of Volume			
British tradition		Metric Measure	
29.6 ml	= 1 liquid ounce	1000 Milli litre	= 1 litre
20 liquid ounce	= 1 pint	1000 litre	= 1 Kilo litre
2 pints	= 1 quart		
4 quarts	= 1 gallon		

Before the teacher could question, the children screamed out "Metric measures".

Yes, Isn't multiples of 10 easier?

4.1.1 MEASURES – REVISION

Most of the measures used us in our day-to-day life are based on business – that is to purchase goods from the shop. Some goods are got in numbers. For Example :, 4 Choclates, 5 Mysorepaks, 2 Ice creams, 6 Bananas. But, we buy cloth using measurement of length. Vegetables, rice, dal are the provisions bought using measurement of weight. Liquids like milk and oil are bought using measurement of volume.

Usually we measure length in metres, weight in grams and volume in litres.

- Stretch out your hands to show the measurement of 1 metre.
- List out the goods that weight more or less 1 gram.
- Take any bottle and check whether it can be filled with one litre of water.

When we measure the distance between the school and your house metre is a small unit, whereas when you measure the length of a pencil metre is a big unit.

Likewise to purchase rice, gram is a very small unit. But it is a big unit when you buy gold.

To measure water in a pot, litre is a big unit. But it is a smaller unit while measuring water in a pond.

Though the measures 1 metre, 1 gram, 1 litre are easily understood by every one, they are not sufficient to measure in all situations. So, we use higher and lower multiples of these units. They are usually in powers of 10 or fractions with denominators in powers of 10.

Metric Measures

1000 Metre	= 1 Kilometre
100 Metre	= 1 Hectametre
10 Metre	= 1 Decametre
1 Metre	
$\frac{1}{10}$ Metre	= 1 Decimetre
$\frac{1}{100}$ Metre	= 1 Centimetre
$\frac{1}{1000}$ Metre	= 1 Millimetre

Likewise try to frame tables for grams and litres.

Here the measures hectametre, decametre and decimetre are not very much in use in our day-to-day life.

Kilometre, Metre, Centimetre and Millimetre are used to measure length. Kilogram and gram are used to measure weight. Kilolitre and litre are used to measure volume.

Activity

Ask the students to bring the bill from different shops and group the items based on measurement of length, weight and volume.

Exercise 4.1

1. Which is better unit to measure a bucket of water? (Litre/Millilitre).
2. What is the approximate weight of an egg?
3. What is the approximate length of a snake guard?
4. What is the approximate time you require to cover a distance of 1 Kilometre by walk?

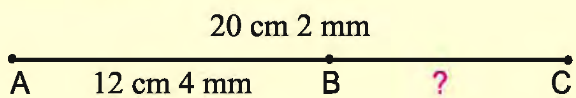
4.2 PROBLEMS INVOLVING MEASURES

Any measure is a number. So it can be added, subtracted, multiplied and divided.

If the quantities are in two different units convert them to the lower unit and continue with the four operations – addition, subtraction, multiplication and division.

Example : 1

Three points A,B,C are in the same straight line. If AB = 12 cm 4 mm; AC = 20 cm 2 mm. Find BC = ?



Solution:

AC = 20 cm2mm = (20 x 10)mm + 2 mm = 202 mm
AB = 12 cm4 mm = (12 x 10)mm + 4 mm = 124 mm
BC = AC – AB = 202 mm – 124 mm = 78 mm
= 7 cm 8 mm

10mm = 1cm

Example : 2

If 200 ml of milk is required for a child, how many litres of milk are required for a class containing 40 children.

Solution:

One child requires 200 ml.
Therefore, for 40 children 40 x 200 = 8000 ml.
(i.e) 8 litres of milk is required.

1000 ml = 1 litre

Example : 3

350 grams of rice is required for one day meal in our house. I bought 5 kilograms of rice. How long will it last?

5 Kilogram = 5000 grams

5000 ÷ 350 = 14, Remainder 100

∴ after 14 days, 100 grams of rice will be left.

So, the rice will last for 14 days.

350)5000(14
350
1500
1400
100

Exercise 4.2

1. Fill in the blanks

   i) 1 cm = ______ mm ii) 3 km = ______ m

   iii) 1.5 m = ______ cm iv) 750 m = _____ km

   v) 5 cm 3 mm = ______ mm

2. Convert into Lower unit

   i) 4 km 475 m

   ii) 10 m 35 cm

   iii) 14 cm 7 mm

3. What is the length of the cloth required for 12 shirts, if the shirt requires 2 m 25 cm?

4. A person has three rods measuring 3 m 2 cm, 2 m 15 cm, 7 m 25 cm. If all the three rods are joined, find the length of the single rod obtained.

5. Fill in the blanks

   i) 2000 g = _____ kg ii) 7 kg = ______ g

6. Convert the following into the lower unit

   i) 10 g 20 cg ii) 3 kg 4 g

7. Salim has 3 iron balls each weighing 4 kg 550 g; 9 kg 350 g; 4 kg 250 g. What is the total weight of all the three iron balls.

8. If the weight of one iron chair is 5 kg 300 g, find the weight of 7 such chairs.

9. If Sugar weighing 100 kg is filled equally in bags of 500 g each, how many such bags are required.

10. Two vessels contain water measuring 14 *l* 750 *ml* and 21 *l* 250 *ml* each. What is the total quantity of water?

11. There is 75 *l* of gingely oil in Jamal's shop. He sold 37 *l* 450 *ml*. Find the quantity of gingely oil left.

12. A flask contains 250 *ml* of acid. How many litres of acid is there in 20 such flasks?

Activity

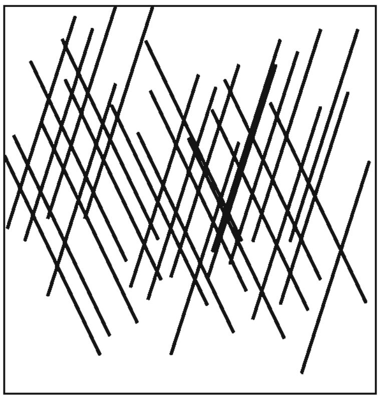
Match the following:

1.	Distance between two cities	- kilo gram
2.	Oil in a can	- kilo metre
3.	Saree	- Milligram
4.	Weight of a nose ring	- metre
5.	Bag of rice	- litre

5. POINT, LINE, LINE SEGMENT AND PLANE

Vani and Selvi started playing with a few long sticks. When it was Selvi's turn she had to take one stick without disturbing the other sticks. She loses her game even if there is a slight shake in the other sticks. Oh! What a different game.

Many questions arose in the mind of the third person who was observing this game. Try to answer the following questions.



- All those sticks are line segments – what can be done with these?
- If these line segments are arranged close to each other. How far can it be extended? Which is the longest line in the world?
- If a lamp post is fixed in our Village, how high will it be? How far will it go piercing the sky? If it is sent piercing the earth, will it come through the other side?
- What do we get finally if we keep breaking the sticks?
- Railway tracks and electric wire above our heads do not touch each other however far they are extended. They keep moving in a very friendly manner. Do they meet anywhere?
- Using line segments tower shaped figures can be formed? Can we form a circle?

Geometry is a branch of Mathematics which answers such type of questions. Geometry gives the idea of various shapes and figures.

We know about different kinds of lines. Some are small and some are big. Some meet each other but some do not meet. Few lines keep extending. The length of small lines can be measured. Is there a small line without any length? If so, its length should be 0 cm! Such a line can be consider as a point.

So, a line is made up of many points.

We can name

i) A line with definite length as line segment

ii) Which extends indefinitely on both directions as lines

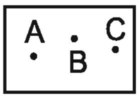
iii) Which extends indefinitely in one direction as a ray.

5.1 POINTS

Point is not something new to us. You would have seen Rangoli designs being drawn using points either everyday or during festival seasons such as Pongal etc.

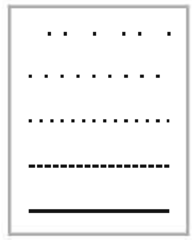
A point indicates a definite position.

A point is smaller than a tip of a pencil or a pen used by us. Therefore a point has no length, breadth, height or thickness.

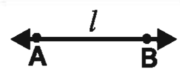


Points are usually denoted by capital letters A, B, C and so on.

5.2 LINE



Observe the given figure carefully. As the space in between the points decreases they join to form a line. A line is a set of points closely arranged without gap.



Mark points A, B on a sheet of paper using a scale draw a line passing through these points. This is a straight line.

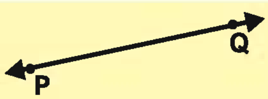
It is represented as $\overleftrightarrow{AB}$ or line 'l'.

When we represent a straight line as $\overleftrightarrow{AB}$ it means

(i) The line passes through the points A, B.

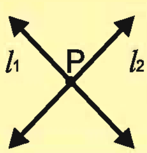
(ii) The line extends on either side of A and B.

Observe the names given for the following straight lines.



This is $\overleftrightarrow{PQ}$ or a straight line PQ

This is a straight line l



Lines l_1 and l_2 are two straight lines passing through the point P.

Activity

Do it yourself

- Draw a straight line XY.
- Draw a straight line and mark three points A, B, C.
- Draw 3 straight lines passing through the point R.

5.3 RAY

A ray starts from a fixed point and extends indefinitely in the other direction.

A Ray is denoted as $\overrightarrow{AB}$

1. Starting point of the ray is A.
2. The ray passes through the points A, B.
3. The ray extends through the point B.

Activity

Do it yourself

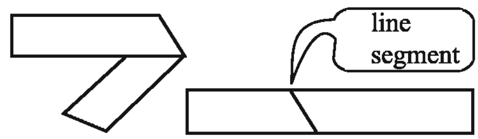
1) Draw a ray XY.

2) From a point P draw $\overrightarrow{PA}, \overrightarrow{PB}, \overrightarrow{PC}, \overrightarrow{PD}$

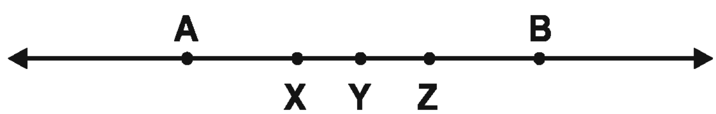
A Ray is a straight line with a starting point and extends indefinitely in one direction.

5.4 LINE SEGMENT

If a sheet of paper is folded and then opened, the folded part represents a line segment.



Mark points X, Y, Z on the straight line $\overline{AB}$.



Consider AX a part of the straight line, which starts at A and ends at X. So, it has a particular length. This is called as a line segment. It can be denoted as line segment AX. Few more line segments from the above figure are AY, AB, XY, XB, YB, XZ.

Therefore line segment is a part of a line. It has a starting point and an end point. A line segment has a definite length.

5.5 PLANE

Straight lines, points and rays can be represented in a sheet of paper or on the black board. Isn't it? Likewise floor, wall, black board, card board and top portion of the table are few examples for a plane.

A plane is a flat surface which extends indefinitely in all directions.

How many points are required to form a plane?

It is enough to have three points that do not lie on the same straight line.

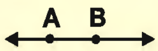
Discuss:

If 3 students hold 3 pencils with their tips in the same direction, a note book can be placed on it. Now hold all the 3 pencils in a same straight line. Will the note book stand erectly? Why?

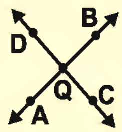
Exercise 5.1

1. 

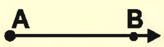
is a ______________________

2. 

The points on the straight line are ______________________

3. 

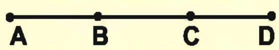
The lines $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$ intersect at a point______________________

4. 

is called ______________________

5. 

On PQ, Q is a ______________________

6. 

Name the line segments in the figure. ______________

5.6 RELATION BETWEEN POINTS AND LINES

Points which lie on the same straight line are called collinear points.

1.Draw a straight line passing through the points A, B

A• •B

2.Check whether you can draw a straight line passing through the points A, B, C

A•

B• C•

Draw a straight line passing through the points P, Q, R.

P Q R

Do you know:

1.Sun, Moon and earth lie on the same straight line during Solar and Lunar eclipse.

2.When it is 6 o'clock, the centre point and numbers 12 and 6 lie on the same straight line.

1. You can draw a straight line passing through the two points A, B.
2. Since A, B, C are not on the same straight line, a straight line cannot be drawn.
3. A straight line can be drawn through P, Q, R, as they lie on the same straight line. P, Q, R are collinear points.

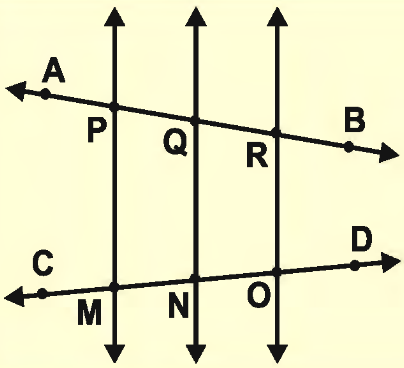
So, the following statements are true.

1. A straight line can be drawn through any two given points.

2. It is not always possible to draw a straight line passing through any 3 points.

3. But a straight line can be drawn passing through 3collinear points .

Example : 1



Name the collinear points from the figure?

Solution:

1. Collinear points on the straight line AB are P, Q, R.
2. Collinear points on the straight line CD are M, N, O.

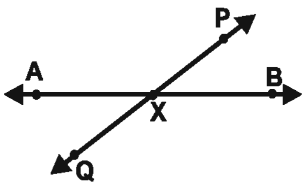
Activity

Using the dots draw (a) a line (b) a line segment (c)a ray and answer the following question.

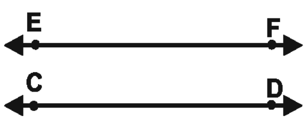
(i) Does a line have a finite length?
(ii) How many end points does a line segment have?
(iii) Does a ray have a end point?

5.6.2 PARALLEL LINES

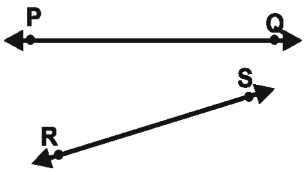
Observe the straight lines given below



Lines $\overleftrightarrow{AB}$, $\overleftrightarrow{PQ}$ meet at a point *X*. '*X*' is the point of intersection of these two straight lines. So, these lines are called intersecting lines.



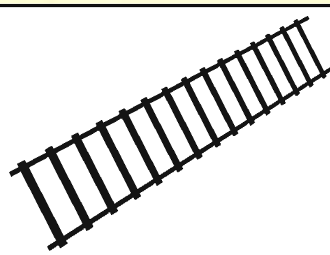
Lines $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$ do not meet each other at any point.
So, they are called parallel lines.



Straight lines $\overleftrightarrow{PQ}$, $\overleftrightarrow{RS}$ do not meet each other at any point.
But, they will meet at a point. Why?

- Non parallel lines intersect at a point.
- Lines which do not intersect each other are called parallel lines.

Observe a railway track



The tracks do not meet each other. Isn't? This is an example for parallel lines.

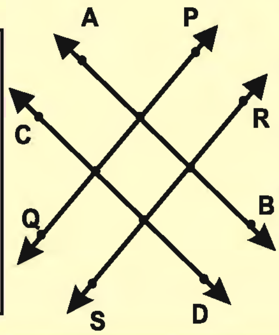
The two opposite edges of a note book are parallel lines.

Example : 2

Activity

Do it yourself

List a few examples for parallel lines from your class room.



Name the parallel lines in the figure.

Solution:

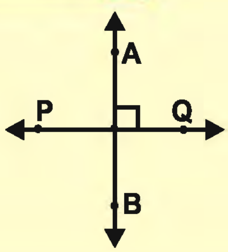
$\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$ are parallel lines, $\overleftrightarrow{PQ}$, $\overleftrightarrow{RS}$ are also parallel lines. This can be denoted using the symbol $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$ and $\overleftrightarrow{PQ} \parallel \overleftrightarrow{RS}$

5.6.3 PERPENDICULAR LINES

Normally, we would have seen perpendicular pillars in buildings. We would have observed that these pillars stand perpendicular to the floor. We already know these are perpendiculars.

When two lines are perpendicular lines, it is denoted by the symbol $\perp$.

Example : 3

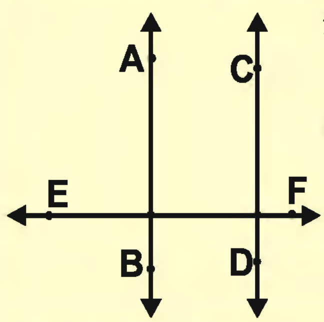


From the figure the two perpendicular lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{PQ}$ can be denoted as $\overleftrightarrow{AB} \perp \overleftrightarrow{PQ}$.

Do you know:

Flag posts, Cell phone tower, Tall buildings are all perpendicular to the floor.

Example : 4



Find the parallel lines and perpendicular lines from the following figure.

Solution:

$\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$ are parallel lines.

(ie) $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$.

$\overleftrightarrow{AB}$, $\overleftrightarrow{EF}$ and $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$ are perpendicular lines.

(ie) $\overleftrightarrow{AB} \perp \overleftrightarrow{EF}$ and $\overleftrightarrow{CD} \perp \overleftrightarrow{EF}$

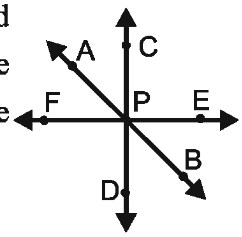
Activity

Identify parallel lines and perpendicular lines in English alphabets (capital letters only)

5.6.4 CONCURRENT LINES

Example : 5

We know that two non-parallel lines intersect at a point. If a third line is drawn passing through the same point, these 3 straight lines are called **concurrent lines**. In the figure lines $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$ pass through one point. Here point 'P' is the **point of concurrency**.

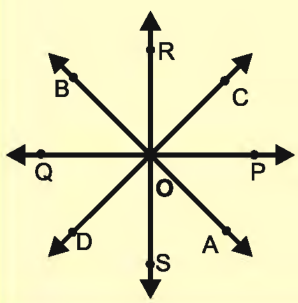


Three or more lines passing through a point are called 'Concurrent Lines'. The point through which the lines pass is called 'Point of Concurrency'.

1. The junction of many roads is an Example : for point of concurrency.
2. If we draw more than 2 diameters for a circle, all the diameters meet at the centre of the circle. These are concurrent lines.
3. The spokes of the wooden wheel of a bullock cart are concurrent lines.

Example : 6

From the given figure, find out the concurrent lines and point of concurrency.



Solution:

$\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, $\overleftrightarrow{PQ}$, $\overleftrightarrow{RS}$ are concurrent lines.

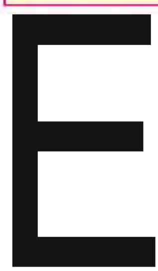
These lines pass through the point 'O'.

Therefore 'O' is the point of concurrency.

Do it yourself

Activity

Check if there are concurrent lines at road junction of your village or in the things used by you.



Discuss:

Does the letter 'E' contain parallel lines, perpendicular lines, intersecting lines, concurrent lines and point of concurrency?

Activity

Group Game:

The teacher should arrange the students in a straight line. As the teacher calls out 'parallel lines', 'perpendicular lines', etc. the students should stretch and fold their arms accordingly. As the teacher increases the speed, the student who performs wrong is sent out. The student who performs correctly till the end is the winner.

Exercise 5.2

1. Collinear points are points that lie on the ______.

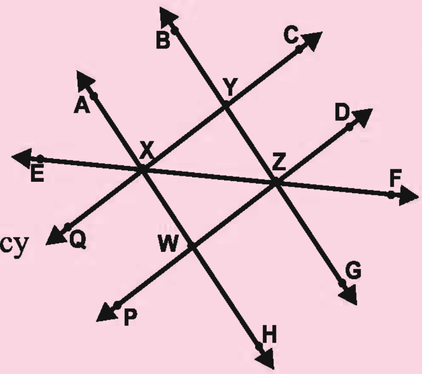
2. 3 points lying on the same straight line are called ______.

3. ______ lines can be drawn passing through one point.

4. Through the two given points _______ line can be drawn.

Activity

5. From the given figure list out
   a. Intersecting lines
   b. Parallel lines
   c. Collinear points
   d. Concurrent lines and their point of concurrency



Points to Remember

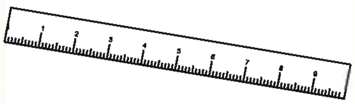
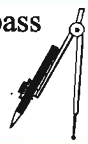
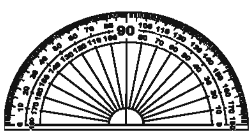
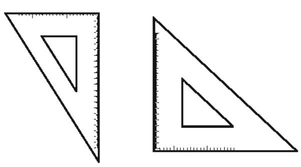
1. Points indicate a definite position.
2. A line is a set of points closely arranged.
3. A straight line extends in both the direction.
4. A ray is a line with a starting point.
5. A line segment is a part of a line between two points.
6. A plane is a flat surface which extends indefinitely in all directions.
7. Two non-parallel lines intersect at a point.
8. Lines which do not intersect at any point are called parallel lines.
9. Two lines which intersect each other at right angles are called perpendicular lines.
10. Three or more points which lie on the same straight line are called collinear points.
11. Three or more lines passing through a point are called concurrent lines.

6. Practical Geometry

In our daily life we come across many shapes. These shapes contain many lines and angles. Many shapes are drawn as pictures. To draw these pictures we use instruments such as a ruler, compass, divider, protractor and set squares. All these instruments are in the geometry box.

6.1 Geometrical instrument box:

The instruments found in the geometry box are ruler, compass, divider, protractor and a pair of set squares.

S.No	Name and Diagram	Description	Uses
1	Ruler 	One edge of the ruler is graduated in centimetres and the other in inches	1. To draw lines 2. To measure the length of the line segment
2	Compass 	One side has a sharp edge and the other has a provision to insert a pencil	To draw a circle or a segment of a circle with the given measurement.
3	Divider 	Sharp edges on both the sides	1. To measure the length of a line segment 2. To compare the lengths of two given line segments.
4	Protractor 	It is in a semi-circular shape. The graduation starts from 0 $^\circ$on the right side and ends with 180 $^\circ$ on the left side and vice versa	1. To measure angle 2. To construct angles
5	Pair of set squares 	1. One set square has 45 $^\circ$,45 $^\circ$,90 $^\circ$ at the vertices 2. The other has 30 $^\circ$, 60 $^\circ$,90 $^\circ$ at the vertices	1. To draw perpendicular lines 2. To draw parallel lines

POINTS TO REMEMBER

1. In the instrument box all the instruments should have fine edges and tips.
2. It is better to have two sharp edged pencils, one to insert in the compass and the other to draw lines and mark points.
3. There should be an eraser and a sharpner also in the geometry box.

6.2 To draw and measure line segments

We know

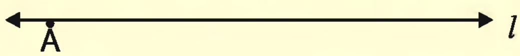
- A line segment is the shortest distance that connects two given points, but a line has no end points.
- The line segment AB can be written as $\overline{AB}$ or line segment AB.
- Length of the line segment AB = length of the line segment BA ($\overline{AB} = \overline{BA}$).
- A line segment can be measured either with a ruler or a divider.

Construction of a Line Segment:

Example : 1

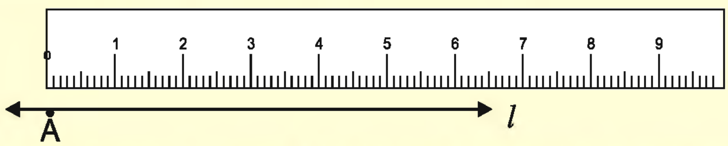
Draw a line segment AB = 5.8 cm using a ruler.

Step 1:



Draw a line "*l*" and mark a point A on it.

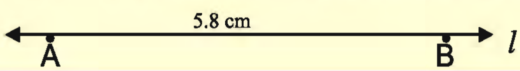
Step 2:



Fix a ruler on the line. Fix it in such a way that the zero on the scale and the point " A" coincides.

Step 3:

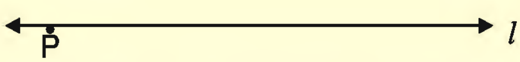
1. From A, measure 5.8 cm
2. Mark the point as B
3. $\overline{AB}$ = 5.8 cm is the required line segment



Example : 2

With the help of a ruler and compass draw a line segment $\overline{PQ}$ = 2.5 cm

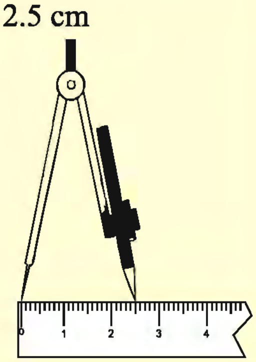
Step 1:



Draw a line "*l*" and mark a point P on it.

Step 2:

With the help of a compass measure 2.5cm as shown in the figure.

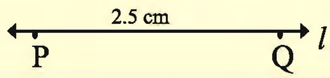


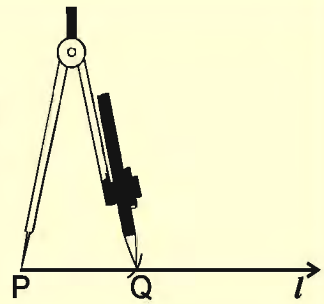
Step 3:

(I) Place the sharp edge of the compass at P

(ii) Then with the pencil point draw a small arc on l to cut the line. Mark the point as Q.

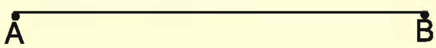
(iii) $\overline{PQ}$ = 2.5 cm is the required line segment

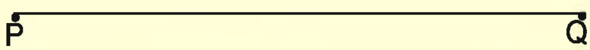




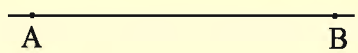
Exercise 6.1

1. With the help of a ruler and a compass find the length of the following line segments.

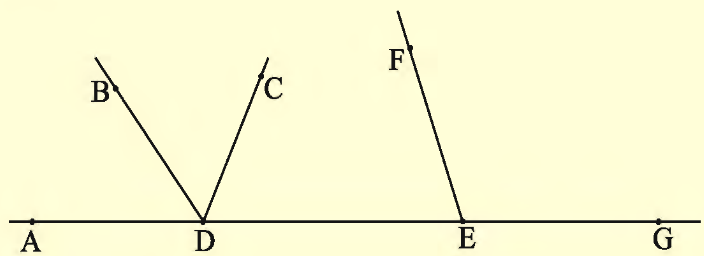
i) 

ii) 

2. Find the length of the following line segments.

i) 

AB = -------

ii) 

AD =
BD =
CD =
AE =

DE =
EF =
EG =
DG =
AG =

3. Draw a line segment for the following measurements using a ruler.

(i) CD = 7.5 cm (ii) MN = 9.4 cm (iii) RS = 5.2 cm

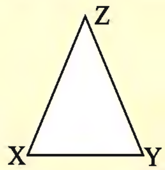
4. With the help of a ruler and a compass draw line segment for the following measurements.

(i) XY = 7.8 cm (ii) PQ = 5.3 cm (iii) AB = 6.1 cm

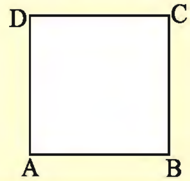
MATHEMATICS

5. Find the perimeter for the following figures.

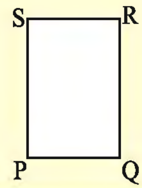
i)



ii)



iii)



Activity

1. Draw any shape of your choice using staright lines (closed figures). Measure length of each line and also find its total length (perimeter)

2. Take two set squares from your geometry box. Place them on a paper such that any 2 sides coincide to form a four sided figure. Draw the outline, Measure the length of each side and find its total length.

3. On a sheet of paper place 3 points and name them. Join the points. Measure and write the length between each of the two points.

Answers

Exercise1.1

1) (i) Thousand, 20 Thousand (ii) 12, 27 (iii) 1 lakhs, 30 lakhs (iv) 2 crore, 5 crore 1 lakhs (v) 97, 109 (similarly we can give many more answer)
2) (i) Four Hundred, Eight Thousand, Thirty Thousand, Ten lakhs, Twenty crores (Ascending Order)
Twenty crores, Ten lakhs, Thirty Thousand, Eight Thousand, Four Hundred (Descending Order)
(ii) 99, 8888, 23456, 55555, 1111111 (Ascending Order)
1111111, 55555, 23456, 8888, 99 (Descending Order)

Exercise1.2

1) Ten Thousand, Thousand, Hundred, Ten, One 2) No
3) (i) No (ii) No (iii) Yes

Exercise1.3

2) One Lakh = 100 Thousands = 1000 Hundreds = 10000 Tens = 100000 Ones
3) One Crore = 100 Lakhs = 10000 Thousands
4) Rs.10 lakhs 5) (i) 36, 216, 1296 (ii) 100, 10,000, 10,00,00,000.
6) Eighty Thousand > Twenty Thousands > Ten Thousand,
Ten Thousand < Twenty Thousands < Eighty Thousand

Exercise1.4

1) Yes (7 lakhs, 5 Thousand x 2 = 14 Lakhs 10 Thousand)
2) 10,000 Enough. (Science 462 x 18 = 7,668 < 10,000)
7200 not enough (Science 462 x 18 = 7,668 > 7,200)
3) Rs. 100
4) (i) 67,290 (ii) 63,290 (iii) 61,290 (iv) 31,235 (v) 30,235 (vi) 29,935
5) (i) 1410 (ii) 26112 (iii) 985140 (iv) 56490 (v) 18522
6) (i) 856 (ii) 356 (iii) 897 (iv) 178 (v) 172
7) (i) 1000 (ii) 2000 (iii) 400 (iv) 500 (v) 50,505 (vi) 10,101

Exercise 2.1

1) (i)169 (ii) 264 iii) 1300 (2) 3775 (3)(i)6200 (ii) 2500 (iii) 650

Exercise 2.2

1) (i) False (ii) True (iii) True (iv) True (v) True
2) (i) c (ii) c (iii) a (iv) b (v) a
3) (i) 1,2,4,8 (ii) 1,3,5,15 (iii) 1,3,5,9,15,45 (iv) 1,11,121 (v) 1,2,7,14
4) 81,84,87,90,93,96,99
5) (i) 25,30,35,40,45,50 (ii) 30,40,50, all multiples of 10 are multiples 5 also
6) (i) False (ii) False (iii) False (iv) False (v) True
7) (i) a (ii) b (iii) d (iv) b (v) c
8) 31,37,41,43,47,53,59
9) No

Exercise 2.3

1) i) True ii) True iii) True

2) 64,8,112 3) Yes

4)

	Divisibility								
Numbers	2	3	4	5	6	8	9	10	11
918	Yes	Yes	No	No	Yes	No	Yes	No	No
1,453	No	No	No	No	No	No	No	No	No
8,712	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
11,408	Yes	No	Yes	No	No	Yes	No	No	No
51,200	Yes	No	Yes	Yes	No	Yes	No	Yes	No
732,005	No	No	No	Yes	No	No	No	No	No
12,34,321	No	No	No	No	No	No	No	No	Yes

5) 76043120, 9732, 98260, 431965, 1190184, 31795872, 32067, 12345670, 869484, 56010,923593

Exercise 2.4

1. (i) 2 x 3 (ii) 3 x 5 (iii) 3 x 7 (iv) 2 x 3 x 5 (v) 11 x 11 (vi) 5 x 29
   (vii) 2 x 3 x 3 x 3 x 3 (viii) 2 x 5 x 17 (ix) 2 x 2 x 3 x 3 x 5 (x) 2x 2x 2x 5x5

Exercise 2.5

1) i) True ii) False iii) False iv) True

2) i) (c) ii) (c) iii) (a) iv) (c)

3) i) 6 , 210 ii) 34 , 102 iii) 3 , 900 iv) 12 , 432

4) 15 kg

Exercise 2.6

1) (iv) 2) 39 3) 14

Exercise 3.1

1. (i) $\frac{10}{12},\frac{15}{18},\frac{20}{24},\frac{30}{36}$ (ii) $\frac{9}{24},\frac{15}{40},\frac{21}{56},\frac{6}{16}$ (iii) $\frac{6}{21},\frac{14}{49},\frac{12}{42},\frac{16}{56}$

iv) $\frac{6}{20},\frac{9}{30},\frac{12}{40},\frac{15}{50}$ 2. $\frac{2}{5},\frac{16}{40}$ $\frac{3}{4},\frac{9}{12},\frac{12}{16}$ 3. (i) $\frac{6}{7}$ (ii) $\frac{7}{12}$ (iii) $\frac{3}{4}$ (iv) $\frac{1}{3}$ (v) $\frac{5}{9}$

4. (i) 5 , 12 (ii) 35 , 12 (iii) 63 , 40

Exercise 3.2

1. (i) $\frac{5}{7}$ (ii) $\frac{7}{12}$ (iii) $\frac{16}{19}$ (iv) $\frac{31}{34}$ (v) $\frac{37}{137}$

2. (i) $\frac{3}{4}$ (ii) $\frac{7}{7}=1$ (iii) $\frac{12}{13}$ (iv) $\frac{12}{7}$ (v) $\frac{81}{124}$ (vi) $\frac{13}{72}$

3. (i) $\frac{8}{13}$ (ii) $\frac{3}{17}$ (iii) $\frac{1}{39}$ (iv) $\frac{64}{47}$ (v) $\frac{75}{107}$ (vi) $\frac{13}{122}$

Exercise 3.3

1. (i) $\frac{5}{7}$ (ii) $\frac{7}{12}$ (iii) $\frac{6}{5}$ (iv) $\frac{4}{3}$ (v) $\frac{3}{2}$
2. (i) $\frac{17}{12}$ (ii) $\frac{7}{8}$ (iii) $\frac{8}{5}$ (iv) $\frac{27}{8}$ (v) $\frac{17}{50}$ (vi) $\frac{33}{20}$
3. (i) $\frac{5}{12}$ (ii) $\frac{3}{10}$ (iii) $\frac{3}{8}$ (iv) $\frac{17}{28}$ (v) $\frac{5}{9}$

Exercise 3.4

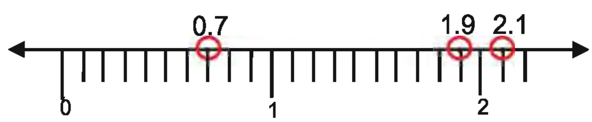
1. $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{20}, \frac{1}{50}, \frac{1}{100}, \frac{1}{200}$ 2) 20 Goats 3) 750 Adults

Exercise 3.5

1) (i) $\frac{7}{10}$ (ii) 12 (iii) 0 (iv) $\frac{1}{10}$ (v) Decimal Point
2) 23.4 69. 2 82.8
3)

Decimal Nos	Integral Part	Decimal Part	Value of the Decimal Part	Number Name
7.6	7	6	0.6	Seven units and six-tenths
28.5	28	5	0.5	Twenty eight and five-tenths
24.0	24	0	0	Twenty Four

4) (i) 124.6 (ii) 18.3 (iii) 7.4

5) 

6) (i) 0.2 (ii) 3.7 (iii) 786.3

Exercise 3.6

1) (i) True (ii) False (iii) True (iv) False
2) (i) 23.18 (ii) 9.05
3) (i) 9 Thousand (ii) 6 hundredths (iii) 3-Ones (iv) 2 tenths
4) (i) 23.47 (ii) 137.05 (iii) 0.39
5) (i) $106+\frac{86}{100}$ (ii) $1+\frac{2}{10}$ (iii) $76+\frac{45}{100}$ (iv) $\frac{2}{100}$

Exercise 3.7

1) (i) 10.75 (ii) 3.18 (iii) 8.58 (iv) 2.69
2) (i) 309.005 (ii) 300.61 3) (i)2.966 (ii) 47.46

Exercise 4.2

1)	(i) 10 mm	(ii) 3000 m	(iii) 150 cm	(iv) 0.75 km	(v) 53 mm
2)	(i) 4475 m	(ii) 1035 cm	(iii) 147 mm	3) 27 m	
4)	1242 cm (or) 12 m 42cm				
5)	(i) 2 kg	(ii) 7000 g	6) (i) 1020 cg	(ii) 3004 g	7) 18 kg 150 g
8)	37 kg 100 g	9)200 packets	10) 36 *l*		11) 37 *l* 550 *ml*
12)	5 *l*				

Exercise 5.1

1) Straight line 2) A, B 3) Q 4) Ray AB 5) Starting Point 6) AB; AC; AD; BC; BD; CD

Exercise 5.2

1) Straight line 2) Collinear points 3) Many 4) Only One

5) (a) ($\overleftrightarrow{AH}$, $\overleftrightarrow{CQ}$), ($\overleftrightarrow{AH}$, $\overleftrightarrow{DP}$), ($\overleftrightarrow{AH}$, $\overleftrightarrow{EF}$), ($\overleftrightarrow{BG}$, $\overleftrightarrow{CQ}$), ($\overleftrightarrow{BG}$, $\overleftrightarrow{DP}$), ($\overleftrightarrow{BG}$, $\overleftrightarrow{EF}$), ($\overleftrightarrow{CQ}$, $\overleftrightarrow{EF}$), ($\overleftrightarrow{DP}$, $\overleftrightarrow{EF}$)

(b) ($\overleftrightarrow{AH}$, $\overleftrightarrow{BG}$), ($\overleftrightarrow{CQ}$, $\overleftrightarrow{DP}$)

(c) A, X, W, H are the collinear points on $\overleftrightarrow{AH}$

B, Y, Z, G are the collinear points on $\overleftrightarrow{BG}$

C, Y, X, Q are the collinear points on $\overleftrightarrow{CQ}$

D, Z, W, P are the collinear points on $\overleftrightarrow{DP}$

E, X, Z, F are the collinear points on EF

(d) $\overleftrightarrow{AH}$, $\overleftrightarrow{CQ}$, $\overleftrightarrow{EF}$ are concurrent line passing through X

$\underleftrightarrow{BG}$, $\underleftrightarrow{DP}$, $\underleftrightarrow{EF}$ are concurrent line passing through Z