Chapter 1

NUMBERS

Learning Objectives

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

1.1 Introduction

Read the following conversation between two classmates.

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

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

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

Mallika : Why... what is so important about it?

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

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

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

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

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

MATHEMATICS ALIVE - LARGE NUMBERS IN REAL LIFE

Tamil Nadu has about 26,345 square kilometre of forest land.

The number of stars in the Milky way galaxy is about 20,000 crore

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

Recap of Successor and Predecessor

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

TRY THESE

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

1.2 Formation of large numbers

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

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

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

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

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

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

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

NOTE

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

TRY THESE

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

1.3 Place Value Chart

1.3.1 Indian Method

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

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

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

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

Use of comma

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

Example 1.1

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

Solution

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

TRY THESE

Complete the table

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

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

1.3.2 International Method

This system is followed by many countries in the world.

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

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

Read and write 35694568421 in the international method

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

Use of commas

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

Example 1.2

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

Solution

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

1.3.3 Comparison of Number Systems

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

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

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

TRY THESE

Identify the incorrectly placed comma and rewrite correctly.

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

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

ACTIVITY

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

1.3.4 Place Value of digits in Large Numbers

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

Write the number 676097 in expanded form:

Number : 6,76,097

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

: 6 × 100000 + 7 × 10000 + 6 × 1000 + 0 × 100 + 9 × 10 + 7 × 1

: 600000 + 70000 + 6000 + 90 + 7

Finding the place value of all the digits in 9847056:

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

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

TRY THESE

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

Example 1.3

How many thousands are there in 1 lakh?

Solution

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

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

Example 1.4

How many thousands are there in 1 million?

Solution

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

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

TRY THESE

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

Exercise 1.1

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

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

4. Observe the commas and write down the place value of 7.
   (i) 56,74,56,345 (ii) 567,456,345

5. Write the following numbers in the International System by using commas.
   (i) 347056 (ii) 7345671 (iii) 634567105 (iv) 1234567890

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

7. Write the number names of the following numerals in the Indian System.
   (i) 75,32,105 (ii) 9,75,63,453

8. Write the number names in words using the International System.
   (i) 345,678 (ii) 8,343,710 (iii) 103,456,789

9. Write the number name in numerals.
   (i) Two crores thirty lakhs fifty one thousand nine hundred eighty.
   (ii) Sixty six millions three hundred forty five thousand twenty seven.
   (iii) Seven hundred eighty nine millions, two hundred thirteen thousand four hundred fifty six.

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

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

Objective Type Questions

12. The successor of 10 million is
   (a) 1000001 (b) 10000001 (c) 9999999 (d) 100001

13. The difference between the successor and the predecessor of 99999 is
   (a) 90000 (b) 1 (c) 2 (d) 99001

14. 1 billion is equal to
   (a) 100 crore (b) 100 million (c) 100 lakh (d) 10000 lakh

15. The expanded form of the number 6,70,905 is
   (a) $6 \times 10000 + 7 \times 1000 + 9 \times 100 + 5 \times 1$
   (b) $6 \times 10000 + 7 \times 1000 + 0 \times 100 + 9 \times 100 + 0 \times 10 + 5 \times 1$
   (c) $6 \times 1000000 + 7 \times 10000 + 0 \times 1000 + 9 \times 100 + 0 \times 10 + 5 \times 1$
   (d) $6 \times 100000 + 7 \times 10000 + 0 \times 1000 + 9 \times 100 + 0 \times 10 + 5 \times 1$

1.4 Comparison of Numbers

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

1.4.1 Comparing numbers with unequal number of digits

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

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

TRY THESE

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

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

1.4.2 Comparing numbers with equal number of digits

Think about the situation

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

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

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

2 = 2	1 = 1	8 > 5

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

Example 1.5

Compare 59283746 and 59283748 using place value chart.

Solution

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

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

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

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

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

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

Hence, 59283746 < 59283748.

TRY THESE

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

15475		3214
73204		973561
8975430		8975430
1899799		1899799

1.4.3 Arranging the numbers in ascending and descending order

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

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

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

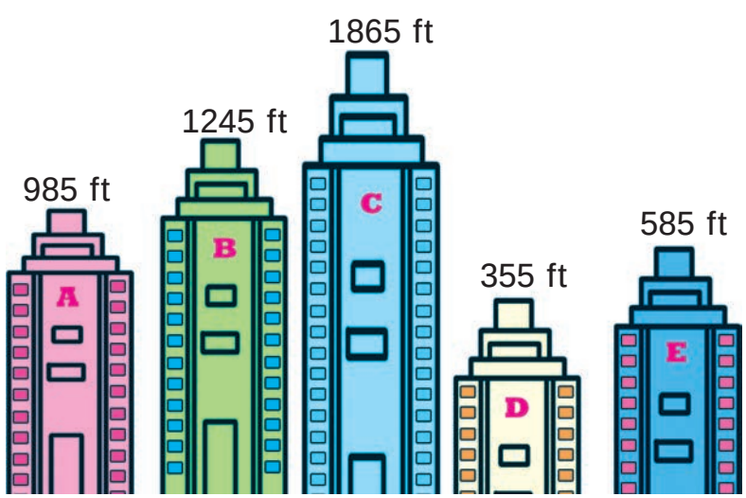


Fig. 1.1

Step 1

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

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

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

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

Step 2

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

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

355 < 585 < 985 < 1245 < 1865

D E A B C

TRY THESE

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

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

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

DO YOU KNOW?

Thomas Harriot

(1560 - 1621)

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

1.5 Creating New Numbers

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

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

TRY THESE

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

ACTIVITY

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

Impact of Place Value

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

TRY THESE

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

Exercise 1.2

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

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

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

(i) Which is the highest mountain listed above?

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

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

Objective Type Questions

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

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

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

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

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

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

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

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

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

1.6 Use of Large Numbers in Daily Life Situations

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

Example 1.6

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

Solution

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

Example 1.7

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

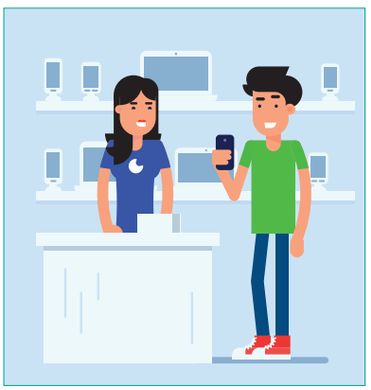
Solution

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

Example 1.8

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

Solution



Number of mobiles sold in 1 month = 1250

1 year = 12 months

2 years = 2 × 12

= 24 months

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

Number of mobiles sold in 2 years = 30,000

Example 1.9

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

Solution

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

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

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

1.7 Order of Operations

Think about the situation

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

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

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

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

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

Now, we try to solve 9 + 5 × 2 by using BIDMAS,

9 + (5 × 2) = 9 + 10

= 19

Example 1.10

Simplify : 24 + 2 × 8 ÷ 2 – 1

Solution

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

Example 1.11

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

Solution

Given,

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

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

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

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

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

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

$=52$ (+ completed last)

Exercise 1.3

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

Objective Type Questions

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

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

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

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

2 ☐ 6 −12 ÷ (4 + 2) = 10

(a) + (b) − (c) × (d) ÷

1.8 Estimation of numbers

Let us see few examples now,

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

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

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

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

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

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

Some real life situations where we use estimates are

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

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

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

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

ACTIVITY

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

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

Example 1.12

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

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

Example 1.13

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

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

TRY THESE

1. Round off the following numbers to the nearest ten.
   (i) 57 (ii) 189 (iii) 3,956 (iv) 57,312
2. Round off the following numbers to the nearest ten, hundred and thousand.
   (i) 9,34,678 (ii) 73,43,489 (iii) 17,98,45,673
3. The tallest mountain in the world Mount Everest, located in Nepal is 8,848 m high. Its height can be rounded to the nearest thousand as _____.

1.8.1 Estimation of Sum and Difference

Example 1.14

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

Solution

Rounding off to the nearest thousand is as follows.

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

THINK

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

1.8.2 Estimation of Product and Quotient

Example 1.15

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

DO YOU KNOW?

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

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

Solution

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

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

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

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

Example 1.16

Find the estimated value of 5598 ÷ 689.

Solution

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

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

Hence, the estimated value of 5598 ÷ 689 is 8

TRY THESE

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

Exercise 1.4

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

AHR4V

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

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

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

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

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

Objective Type Questions

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

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

8. The estimation to the nearest hundred of 76812 is

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

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

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

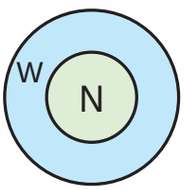
10. The estimated difference of 167826 and 2765 rounded off to the nearest thousand is

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

1.9 Whole Numbers

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

1.9.1 Recall the facts on Natural and Whole Numbers



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

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

TRY THESE

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

1.10 Properties of Whole Numbers

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

1.10.1 Commutativity of addition and multiplication

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

Observe the given facts:

(i) 43 + 57 = 57 + 43

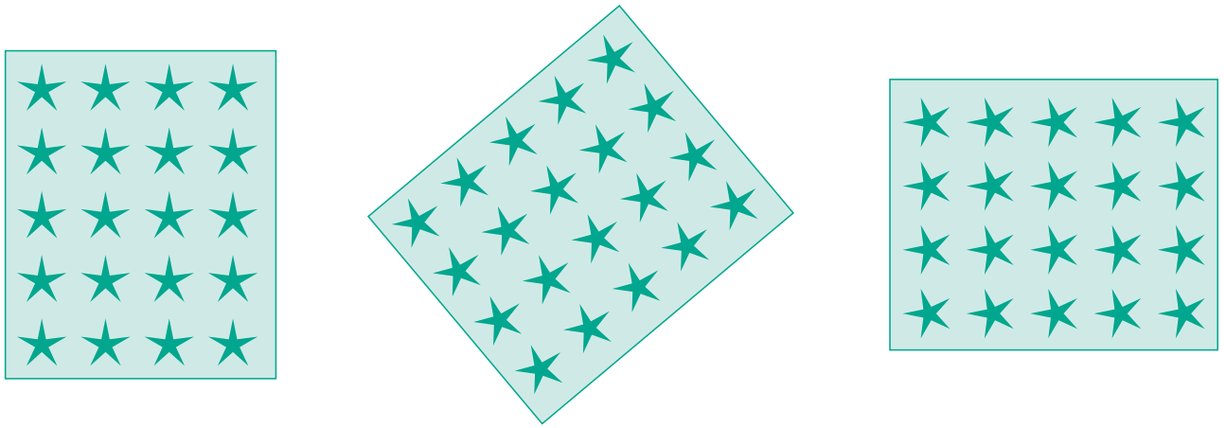
(ii) 12 × 15 = 15 × 12

(iii) 35,784 + 48,12,69,841 = 48,12,69,841 + 35,784

(iv) 39,458 × 84,321 = 84,321 × 39,458

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

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



(a) (b) (c)

Fig. 1.2

Now, look at the following example.

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

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

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

TRY THESE

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

1.10.2 Associativity of addition and multiplication

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

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

$$(43 + 57) + 25 = 43 + (57 + 25)$$

$$12 \times (15 \times 7) = (12 \times 15) \times 7$$

$$35{,}784 + (48{,}12{,}69{,}841 + 3) = (35{,}784 + 48{,}12{,}69{,}841) + 3$$

$$(39{,}458 \times 84{,}321) \times 17 = 39{,}458 \times (84{,}321 \times 17)$$

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

1.10.3 Distributivity of multiplication over addition or subtraction

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

$$(72 \times 13) + (28 \times 13) = (72 + 28) \times 13$$

$$37 \times 102 = (37 \times 100) + (37 \times 2)$$

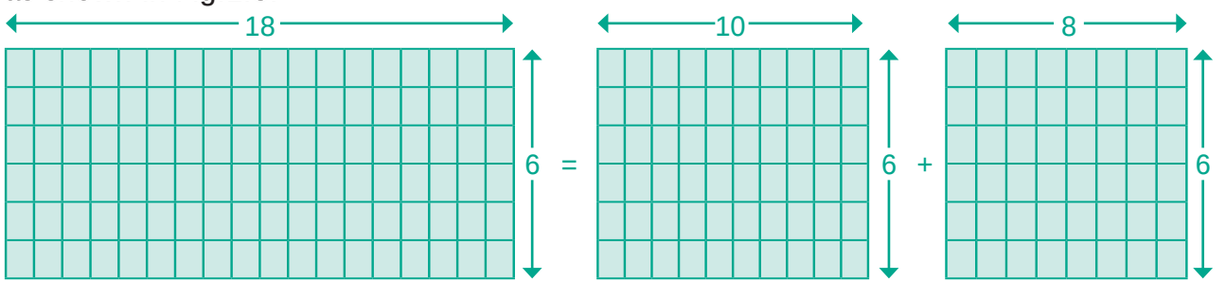
$$37 \times 98 = (37 \times 100) - (37 \times 2)$$

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

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

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

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



(a) (b) (c)

Fig.1.3

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

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

For example,

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

1.10.4 Identity for addition and multiplication

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

TRY THESE

Complete the following tables.

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

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

Finally, these are some simple observations that are important.

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

NOTE

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

TRY THESE

Complete the table.

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

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

DO YOU KNOW?

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

Exercise 1.5

FWO9G

1. Fill in the blanks.

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

   (ii) 17 × _____ = 34 × 17

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

   (iv) Division by _____ is not defined.

   (v) Multiplication by _____ leaves a number unchanged.

2. Say True or False.

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

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

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

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

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

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

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

   (iii) 50 + 0 = 50 (iv) 50 × 1 = 50

   (v) 50 × 42 = 50 × 40 + 50 × 2

4. Use the properties of whole numbers and simplify.

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

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

Objective Type Questions

5. (53 + 49) × 0 is

   (a) 102 (b) 0 (c) 1 (d) 53 + 49 × 0

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

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

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

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

   (c) zero (d) none of these

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

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

9. Which of the following expressions is not zero?

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

10. Which of the following is not true?

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

    (b) (4237 × 5498) × 3439= 4237 × (5498 × 3439)

    (c) 4237 + 5498 × 3439 = (4237 + 5498) × 3439

    (d) 4237 × (5498 + 3439) = (4237 × 5498) + (4237 × 3439)

Exercise 1.6

Miscellaneous Practice Problems

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

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

3. Study the following table and answer the questions.

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

(i) How many tigers were there in 2011?

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

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

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

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

Challenging Problems

6. Read the table and answer the following questions.

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

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

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

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

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

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

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

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

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

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

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

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

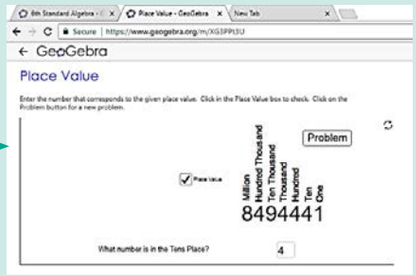
Summary

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

ICT Corner

NUMBERS

Expected Result is shown in this picture



Step – 1

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

Step - 2

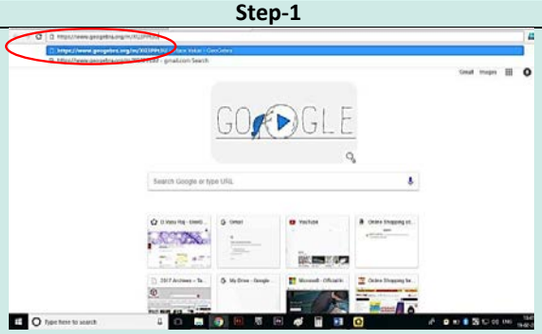
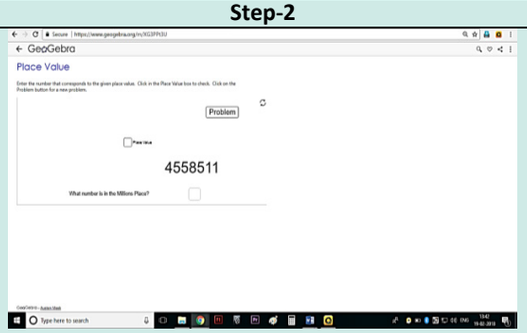
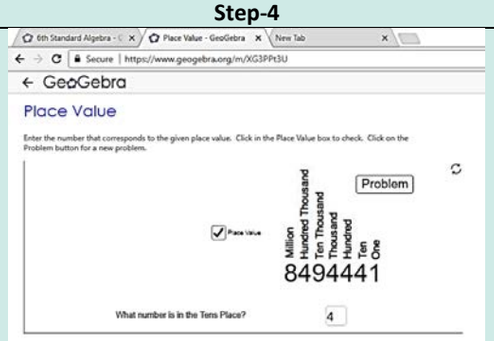
GeoGebra worksheet named “Place Value” will open. A Natural number is given. You can change the problem by clicking on “Problem” button.

Step-3

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

Step-4

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

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

Browse in the link

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

Chapter 2

INTRODUCTION TO ALGEBRA

Learning Objectives

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

2.1 Introduction

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

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

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

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

- If the initial number is 4,

Step 1	Step 2	Step 3	Step 4	Step 5
4	4 × 2 = 8	8 + 20 = 28	28 ÷ 2 = 14	14 – 4 = 10

- If the initial number is 9,

Step 1	Step 2	Step 3	Step 4	Step 5
9	9 × 2 = 18	18 + 20 = 38	38 ÷ 2 = 19	19 – 9 = 10