

Knowing our Numbers



Chapter 1

1.1 Introduction



Counting things is easy for us now. We can count objects in large numbers, for example, the number of students in the school, and represent them through numerals. We can also communicate large numbers using suitable number names.



It is not as if we always knew how to convey large quantities in conversation or through symbols. Many thousands years ago, people knew only small numbers. Gradually, they learnt how to handle larger numbers. They also learnt how to express large numbers in symbols. All this came through collective efforts of human beings. Their path was not easy, they struggled all along the way. In fact, the development of whole of Mathematics can be understood this way. As human beings progressed, there was greater need for development of Mathematics and as a result Mathematics grew further and faster.

We use numbers and know many things about them. Numbers help us count concrete objects. They help us to say which collection of objects is bigger and arrange them in order e.g., first, second, etc. Numbers are used in many different contexts and in many ways. Think about various situations where we use numbers. List five distinct situations in which numbers are used.

We enjoyed working with numbers in our previous classes. We have added, subtracted, multiplied and divided them. We also looked for patterns in number sequences and done many other interesting things with numbers. In this chapter, we shall move forward on such interesting things with a bit of review and revision as well.



1.2 Comparing Numbers

As we have done quite a lot of this earlier, let us see if we remember which is the greatest among these :

(i) 92, 392, 4456, 89742 **I am the greatest!**

(ii) 1902, 1920, 9201, 9021, 9210 **I am the greatest!**

So, we know the answers.

Discuss with your friends, how you find the number that is the greatest.

Try These

Can you instantly find the greatest and the smallest numbers in each row?

- | | |
|----------------------------------|---|
| 1. 382, 4972, 18, 59785, 750. | Ans. 59785 is the greatest and
18 is the smallest. |
| 2. 1473, 89423, 100, 5000, 310. | Ans. _____ |
| 3. 1834, 75284, 111, 2333, 450 . | Ans. _____ |
| 4. 2853, 7691, 9999, 12002, 124. | Ans. _____ |

Was that easy? Why was it easy?



We just looked at the number of digits and found the answer. The greatest number has the most thousands and the smallest is only in hundreds or in tens.

Make five more problems of this kind and give to your friends to solve.

Now, how do we compare 4875 and 3542?

This is also not very difficult. These two numbers have the same number of digits. They are both in thousands. But the digit at the thousands place in 4875 is greater than that in 3542. Therefore, 4875 is greater than 3542.

Try These

Find the greatest and the smallest numbers.

- 4536, 4892, 4370, 4452.
- 15623, 15073, 15189, 15800.
- 25286, 25245, 25270, 25210.
- 6895, 23787, 24569, 24659.

Next tell which is greater, 4875 or 4542? Here too the numbers have the same number of digits. Further, the digits at the thousands place are same in both. What do we do then? We move to the next digit, that is to the digit at the hundreds place. The digit at the hundreds place is greater in 4875 than in 4542. Therefore, 4875 is greater than 4542.

4. Take two digits, say 2 and 3. Make 4-digit numbers using both the digits equal number of times.

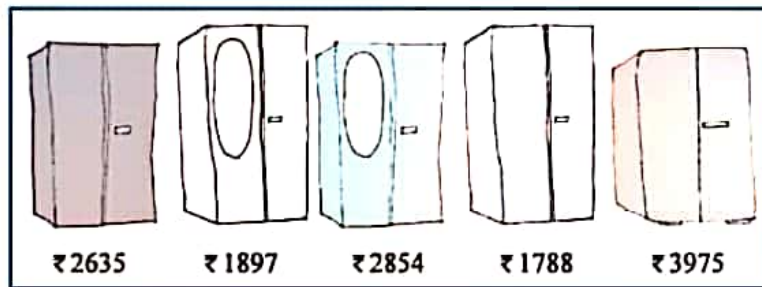
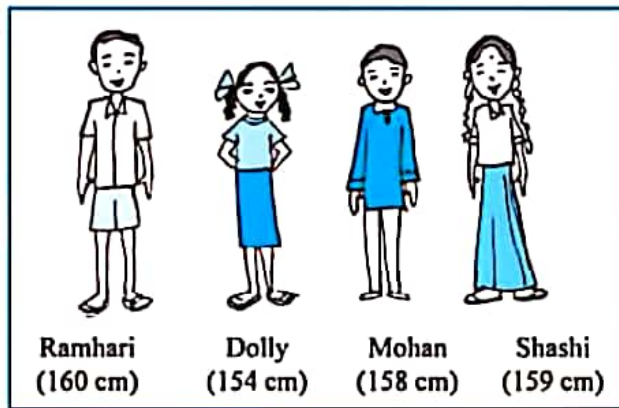
Which is the greatest number?

Which is the smallest number?

How many different numbers can you make in all?

Stand in proper order

1. Who is the tallest?
2. Who is the shortest?
 - (a) Can you arrange them in the increasing order of their heights?
 - (b) Can you arrange them in the decreasing order of their heights?



Which to buy?

Sohan and Rita went to buy an almirah. There were many almirahs available with their price tags.

Try These

Think of five more situations where you compare three or more quantities.

- (a) Can you arrange their prices in increasing order?
- (b) Can you arrange their prices in decreasing order?

Ascending order Ascending order means arrangement from the smallest to the greatest.

Descending order Descending order means arrangement from the greatest to the smallest.

Try These

1. Arrange the following numbers in ascending order :
 (a) 847, 9754, 8320, 571 (b) 9801, 25751, 36501, 38802
 2. Arrange the following numbers in descending order :
 (a) 5000, 7500, 85400, 7861 (b) 1971, 45321, 88715, 92547
- Make ten such examples of ascending/descending order and solve them.

1.2.2 Shifting digits

Have you thought what fun it would be if the digits in a number could shift (move) from one place to the other?

Think about what would happen to 182. It could become as large as 821 and as small as 128. Try this with 391 as well.

Now think about this. Take any 3-digit number and exchange the digit at the hundreds place with the digit at the ones place.

- (a) Is the new number greater than the former one?
- (b) Is the new number smaller than the former number?

Write the numbers formed in both ascending and descending order.



Before **7** **9** **5**
 Exchanging the 1st and the 3rd tiles.
 After **5** **9** **7**

If you exchange the 1st and the 3rd tiles (i.e. digits), in which case does the number become greater? In which case does it become smaller?

Try this with a 4-digit number.

1.2.3 Introducing 10,000

We know that beyond 99 there is no 2-digit number. 99 is the greatest 2-digit number. Similarly, the greatest 3-digit number is 999 and the greatest 4-digit number is 9999. What shall we get if we add 1 to 9999?

Look at the pattern :
 $9 + 1 = 10 = 10 \times 1$
 $99 + 1 = 100 = 10 \times 10$
 $999 + 1 = 1000 = 10 \times 100$

We observe that

- Greatest single digit number + 1 = smallest 2-digit number
- Greatest 2-digit number + 1 = smallest 3-digit number
- Greatest 3-digit number + 1 = smallest 4-digit number

We should then expect that on adding 1 to the greatest 4-digit number, we would get the smallest 5-digit number, that is $9999 + 1 = 10000$.

The new number which comes next to 9999 is 10000. It is called ten thousand. Further, $10000 = 10 \times 1000$.

1.2.4 Revisiting place value

You have done this quite earlier, and you will certainly remember the expansion of a 2-digit number like 78 as

$$78 = 70 + 8 = 7 \times 10 + 8 \times 1$$

Similarly, you will remember the expansion of a 3-digit number like 278 as

$$278 = 200 + 70 + 8 = 2 \times 100 + 7 \times 10 + 8 \times 1$$

We say, here, 8 is at ones place, 7 is at tens place and 2 at hundreds place.

Later on we extended this idea to 4-digit numbers.

For example, the expansion of 5278 is

$$\begin{aligned} 5278 &= 5000 + 200 + 70 + 8 \\ &= 5 \times 1000 + 2 \times 100 + 7 \times 10 + 8 \times 1 \end{aligned}$$

Here, 8 is at ones place, 7 is at tens place, 2 is at hundreds place and 5 is at thousands place.

With the number 10000 known to us, we may extend the idea further. We may write 5-digit numbers like

$$45278 = 4 \times 10000 + 5 \times 1000 + 2 \times 100 + 7 \times 10 + 8 \times 1$$

We say that here 8 is at ones place, 7 at tens place, 2 at hundreds place, 5 at thousands place and 4 at ten thousands place. The number is read as forty five thousand, two hundred seventy eight. Can you now write the smallest and the greatest 5-digit numbers?

Try These

Read and expand the numbers wherever there are blanks.

Number	Number Name	Expansion
20000	twenty thousand	2×10000
26000	twenty six thousand	$2 \times 10000 + 6 \times 1000$
38400	thirty eight thousand four hundred	$3 \times 10000 + 8 \times 1000$ $+ 4 \times 100$
65740	sixty five thousand seven hundred forty	$6 \times 10000 + 5 \times 1000$ $+ 7 \times 100 + 4 \times 10$

89324	eighty nine thousand three hundred twenty four	$8 \times 10000 + 9 \times 1000$ $+ 3 \times 100 + 2 \times 10 + 4 \times 1$
50000	_____	_____
41000	_____	_____
47300	_____	_____
57630	_____	_____
29485	_____	_____
29085	_____	_____
20085	_____	_____
20005	_____	_____

Write five more 5-digit numbers, read them and expand them.

1.2.5 Introducing 1,00,000

Which is the greatest 5-digit number?

Adding 1 to the greatest 5-digit number, should give the smallest 6-digit number : $99,999 + 1 = 1,00,000$

This number is named one lakh. One lakh comes next to 99,999.

$$10 \times 10,000 \approx 1,00,000$$

We may now write 6-digit numbers in the expanded form as

$$2,46,853 = 2 \times 1,00,000 + 4 \times 10,000 + 6 \times 1,000 + 8 \times 100 + 5 \times 10 + 3 \times 1$$

This number has 3 at ones place, 5 at tens place, 8 at hundreds place, 6 at thousands place, 4 at ten thousands place and 2 at lakh place. Its number name is two lakh forty six thousand eight hundred fifty three.

Try These

Read and expand the numbers wherever there are blanks.

Number	Number Name	Expansion
3,00,000	three lakh	$3 \times 1,00,000$
3,50,000	three lakh fifty thousand	$3 \times 1,00,000 + 5 \times 10,000$
3,53,500	three lakh fifty three thousand five hundred	$3 \times 1,00,000 + 5 \times 10,000$ $+ 3 \times 1000 + 5 \times 100$
4,57,928	_____	_____
4,07,928	_____	_____
4,00,829	_____	_____
4,00,029	_____	_____

1.2.6 Larger numbers

If we add one more to the greatest 6-digit number we get the smallest 7-digit number. It is called **ten lakh**.

Write down the greatest 6-digit number and the smallest 7-digit number. Write the greatest 7-digit number and the smallest 8-digit number. The smallest 8-digit number is called **one crore**.

Complete the pattern :

$$\begin{aligned}
 9 + 1 &= 10 \\
 99 + 1 &= 100 \\
 999 + 1 &= \underline{\hspace{2cm}} \\
 9,999 + 1 &= \underline{\hspace{2cm}} \\
 99,999 + 1 &= \underline{\hspace{2cm}} \\
 9,99,999 + 1 &= \underline{\hspace{2cm}} \\
 99,99,999 + 1 &= 1,00,00,000
 \end{aligned}$$

Remember

1 hundred	= 10 tens
1 thousand	= 10 hundreds
	= 100 tens
1 lakh	= 100 thousands
	= 1000 hundreds
1 crore	= 100 lakhs
	= 10,000 thousands

Try These

1. What is $10 - 1 = ?$
 2. What is $100 - 1 = ?$
 3. What is $10,000 - 1 = ?$
 4. What is $1,00,000 - 1 = ?$
 5. What is $1,00,00,000 - 1 = ?$
- (Hint : Use the said pattern.)



We come across large numbers in many different situations. For example, while the number of children in your class would be a 2-digit number, the number of children in your school would be a 3 or 4-digit number.

The number of people in the nearby town would be much larger.

Is it a 5 or 6 or 7-digit number?

Do you know the number of people in your state?

How many digits would that number have?

What would be the number of grains in a sack full of wheat? A 5-digit number, a 6-digit number or more?

Try These

1. Give five examples where the number of things counted would be more than 6-digit number.
2. Starting from the greatest 6-digit number, write the previous five numbers in descending order.
3. Starting from the smallest 8-digit number, write the next five numbers in ascending order and read them.

1.2.7 An aid in reading and writing large numbers

Try reading the following numbers :

- (a) 279453 (b) 5035472
- (c) 152700375 (d) 40350894

Was it difficult?

Did you find it difficult to keep track?

Sometimes it helps to use indicators to read and write large numbers.

Shagufta uses indicators which help her to read and write large numbers. Her indicators are also useful in writing the expansion of numbers. For example, she identifies the digits in ones place, tens place and hundreds place in 257 by writing them under the tables O, T and H as

H	T	O	Expansion
2	5	7	$2 \times 100 + 5 \times 10 + 7 \times 1$

Similarly, for 2902,

Th	H	T	O	Expansion
2	9	0	2	$2 \times 1000 + 9 \times 100 + 0 \times 10 + 2 \times 1$

One can extend this idea to numbers upto lakh as seen in the following table. (Let us call them placement boxes). Fill the entries in the blanks left.

Number	TLakh	Lakh	TTh	Th	H	T	O	Number Name	Expansion
7,34,543	—	7	3	4	5	4	3	Seven lakh thirty four thousand five hundred forty three	—=—=—=—=
32,75,829	3	2	7	5	8	2	9	_____	$3 \times 10,00,000$ $+ 2 \times 1,00,000$ $+ 7 \times 10,000$ $+ 5 \times 1000$ $+ 8 \times 100$ $+ 2 \times 10 + 9$

Similarly, we may include numbers upto crore as shown below :

Number	TCr	Cr	TLakh	Lakh	TTh	Th	H	T	O	Number Name
2,57,34,543	—	2	5	7	3	4	5	4	3
65,32,75,829	6	5	3	2	7	5	8	2	9	Sixty five crore thirty two lakh seventy five thousand eight hundred twenty nine

You can make other formats of tables for writing the numbers in expanded form.

Use of commas

You must have noticed that in writing large numbers in the sections above, we have often used commas. Commas help us in reading and writing large numbers. In our **Indian System of Numeration** we use ones, tens, hundreds, thousands and then lakhs and crores. Commas are used to mark thousands, lakhs and crores. The first comma comes after hundreds place (three digits from the right) and marks thousands. The second comma comes two digits later (five digits from the right). It comes after ten thousands place and marks lakh. The third comma comes after another two digits (seven digits from the right). It comes after ten lakh place and marks crore.

While writing number names, we do not use commas.

For example, 5,08,01,592

3,32,40,781

7,27,05,062

Try reading the numbers given above. Write five more numbers in this form and read them.

International System of Numeration

In the International System of Numeration, as it is being used we have ones, tens, hundreds, thousands and then millions. One million is a thousand thousands. Commas are used to mark thousands and millions. It comes after every three digits from the right. The first comma marks thousands and the next comma marks millions. For example, the number 50,801,592 is read in the International System as fifty million eight hundred one thousand five hundred ninety two. In the Indian System, it is five crore eight lakh one thousand five hundred ninety two.

How many lakhs make a million?

How many millions make a crore?

Take three large numbers. Express them in both Indian and International Numeration systems.

Interesting fact :

To express numbers larger than a million, a billion is used in the International System of Numeration: 1 billion = 1000 million.

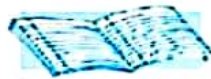
Do you know?
 India's population increased by about
 27 million during 1921-1931;
 37 million during 1931-1941;
 44 million during 1941-1951;
 78 million during 1951-1961!

How much was the increase in population during 1991-2001? Try to find out.

Do you know what is India's population today? Try to find this too.

Try These

- Read these numbers. Write them using placement boxes and then write their expanded forms.
 (i) 475320 (ii) 9847215 (iii) 97645310 (iv) 30458094
 (a) Which is the smallest number?
 (b) Which is the greatest number?
 (c) Arrange these numbers in ascending and descending orders.
- Read these numbers.
 (i) 527864 (ii) 95432 (iii) 18950049 (iv) 70002509
 (a) Write these numbers using placement boxes and then using commas in Indian as well as International System of Numeration..
 (b) Arrange these in ascending and descending order.
- Take three more groups of large numbers and do the exercise given above.



EXERCISE 1.1

1. Fill in the blanks:
 - (a) 1 lakh = _____ ten thousand.
 - (b) 1 million = _____ hundred thousand.
 - (c) 1 crore = _____ ten lakh.
 - (d) 1 crore = _____ million.
 - (e) 1 million = _____ lakh.
2. Place commas correctly and write the numerals:
 - (a) Seventy three lakh seventy five thousand three hundred seven.
 - (b) Nine crore five lakh forty one.
 - (c) Seven crore fifty two lakh twenty one thousand three hundred two.
 - (d) Fifty eight million four hundred twenty three thousand two hundred two.
 - (e) Twenty three lakh thirty thousand ten.
3. Insert commas suitably and write the names according to Indian System of Numeration :
 - (a) 87595762 (b) 8546283 (c) 99900046 (d) 98432701
4. Insert commas suitably and write the names according to International System of Numeration :
 - (a) 78921092 (b) 7452283 (c) 99985102 (d) 48049831

1.3 Large Numbers in Practice

In earlier classes, we have learnt that we use centimetre (cm) as a unit of length. For measuring the length of a pencil, the width of a book or notebooks etc., we use centimetres. Our ruler has marks on each centimetre. For measuring the thickness of a pencil, however, we find centimetre too big. We use millimetre (mm) to show the thickness of a pencil.

Try These

1. How many centimetres make a kilometre?
2. Name five large cities in India. Find their population. Also, find the distance in kilometres between each pair of these cities.

- (a) 10 millimetres = 1 centimetre

To measure the length of the classroom or the school building, we shall find centimetre too small. We use metre for the purpose.

- (b) 1 metre = 100 centimetres
= 1000 millimetres

Even metre is too small, when we have to state distances between cities, say, Delhi and Mumbai, or Chennai and Kolkata. For this we need kilometres (km).

(c) 1 kilometre = 1000 metres

How many millimetres make 1 kilometre?

Since 1 m = 1000 mm

1 km = 1000 m = 1000 × 1000 mm = 10,00,000 mm



We go to the market to buy rice or wheat; we buy it in kilograms (kg). But items like ginger or chillies which we do not need in large quantities, we buy in grams (g). We know 1 kilogram = 1000 grams.

Try These

1. How many milligrams make one kilogram?
2. A box contains 2,00,000 medicine tablets each weighing 28 mg. What is the total weight of all the tablets in the box in grams and in kilograms?

Have you noticed the weight of the medicine tablets given to the sick? It is very small. It is in milligrams (mg).

1 gram = 1000 milligrams.

What is the capacity of a bucket for holding water? It is usually 20 litres (l). Capacity is given in litres. But sometimes we need a smaller unit, the millilitres. A bottle of hair oil, a cleaning liquid or a soft drink have labels which give the quantity of liquid inside in millilitres (ml).

1 litre = 1000 millilitres.

Note that in all these units we have some words common like kilo, milli and centi. You should remember that among these kilo is the greatest and milli is the smallest; kilo shows 1000 times greater, milli shows 1000 times smaller, i.e. 1 kilogram = 1000 grams, 1 gram = 1000 milligrams.

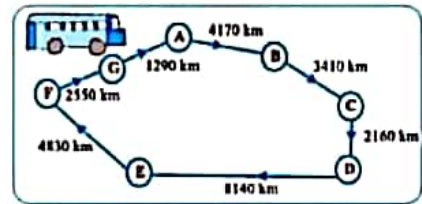
Similarly, centi shows 100 times smaller, i.e. 1 metre = 100 centimetres.

Try These

1. A bus started its journey and reached different places with a speed of 60 km/hour. The journey is shown on page 14.
 - (i) Find the total distance covered by the bus from A to D.
 - (ii) Find the total distance covered by the bus from D to G.
 - (iii) Find the total distance covered by the bus, if it starts from A and returns back to A.
 - (iv) Can you find the difference of distances from C to D and D to E?



- (v) Find out the time taken by the bus to reach
- (a) A to B (b) C to D
 (c) E to G (d) Total journey



2. Raman's shop

Things	Price
Apples	₹ 40 per kg
Oranges	₹ 30 per kg
Combs	₹ 3 for one
Tooth brushes	₹ 10 for one
Pencils	₹ 1 for one
Note books	₹ 6 for one
Soap cakes	₹ 8 for one



The sales during the last year

Apples	2457 kg
Oranges	3004 kg
Combs	22760
Tooth brushes	25367
Pencils	38530
Note books	40002
Soap cakes	20005

- (a) Can you find the total weight of apples and oranges Raman sold last year?
 Weight of apples = _____ kg
 Weight of oranges = _____ kg
 Therefore, total weight = _____ kg + _____ kg = _____ kg
 Answer – The total weight of oranges and apples = _____ kg.
- (b) Can you find the total money Raman got by selling apples?
- (c) Can you find the total money Raman got by selling apples and oranges together?
- (d) Make a table showing how much money Raman received from selling each item. Arrange the entries of amount of money received in descending order. Find the item which brought him the highest amount. How much is this amount?

We have done a lot of problems that have addition, subtraction, multiplication and division. We will try solving some more here. Before starting, look at these examples and follow the methods used.

Example 1 : Population of Sundarnagar was 2,35,471 in the year 1991. In the year 2001 it was found to be increased by 72,958. What was the population of the city in 2001?

Solution : Population of the city in 2001
 = Population of the city in 1991 + Increase in population
 = 2,35,471 + 72,958

Now,

$$\begin{array}{r} 235471 \\ + 72958 \\ \hline 308429 \end{array}$$

Salma added them by writing 235471 as 200000 + 35000 + 471 and 72958 as 72000 + 958. She got the addition as 200000 + 107000 + 1429 = 308429. Mary added it as 200000 + 35000 + 400 + 71 + 72000 + 900 + 58 = 308429

Answer : Population of the city in 2001 was 3,08,429.

All three methods are correct.

Example 2 : In one state, the number of bicycles sold in the year 2002-2003 was 7,43,000. In the year 2003-2004, the number of bicycles sold was 8,00,100. In which year were more bicycles sold? and how many more?

Solution : Clearly, 8,00,100 is more than 7,43,000. So, in that state, more bicycles were sold in the year 2003-2004 than in 2002-2003.



$$\begin{array}{r} \text{Now, } 800100 \\ - 743000 \\ \hline 057100 \end{array}$$

Check the answer by adding

$$\begin{array}{r} 743000 \\ + 57100 \\ \hline 800100 \end{array} \quad (\text{the answer is right})$$

Can you think of alternative ways of solving this problem?

Answer : 57,100 more bicycles were sold in the year 2003-2004.

Example 3 : The town newspaper is published every day. One copy has 12 pages. Everyday 11,980 copies are printed. How many total pages are printed everyday?

Solution : Each copy has 12 pages. Hence, 11,980 copies will have $12 \times 11,980$ pages. What would this number be? More than 1,00,000 or lesser. Try to estimate.

Now,

$$\begin{array}{r} 11980 \\ \times 12 \\ \hline 23960 \\ + 119800 \\ \hline 143760 \end{array}$$



Answer: Everyday 1,43,760 pages are printed.

Example 4 : The number of sheets of paper available for making notebooks is 75,000. Each sheet makes 8 pages of a notebook. Each notebook contains 200 pages. How many notebooks can be made from the paper available?

Solution : Each sheet makes 8 pages.

Hence, 75,000 sheets make $8 \times 75,000$ pages,

Now,

$$\begin{array}{r} 75000 \\ \times 8 \\ \hline 600000 \end{array}$$



Thus, 6,00,000 pages are available for making notebooks.

Now, 200 pages make 1 notebook.

Hence, 6,00,000 pages make $6,00,000 \div 200$ notebooks.

Now,

$$\begin{array}{r} 3000 \\ 200 \overline{) 600000} \\ \underline{- 600} \\ 0000 \end{array}$$

The answer is 3,000 notebooks.



EXERCISE 1.2

1. A book exhibition was held for four days in a school. The number of tickets sold at the counter on the first, second, third and final day was respectively 1094, 1812, 2050 and 2751. Find the total number of tickets sold on all the four days.
2. Shekhar is a famous cricket player. He has so far scored 6980 runs in test matches. He wishes to complete 10,000 runs. How many more runs does he need?
3. In an election, the successful candidate registered 5,77,500 votes and his nearest rival secured 3,48,700 votes. By what margin did the successful candidate win the election?
4. Kirti bookstore sold books worth ₹ 2,85,891 in the first week of June and books worth ₹ 4,00,768 in the second week of the month. How much was the sale for the

two weeks together? In which week was the sale greater and by how much?

5. Find the difference between the greatest and the least 5-digit number that can be written using the digits 6, 2, 7, 4, 3 each only once.
6. A machine, on an average, manufactures 2,825 screws a day. How many screws did it produce in the month of January 2006?
7. A merchant had ₹ 78,592 with her. She placed an order for purchasing 40 radio sets at ₹ 1200 each. How much money will remain with her after the purchase?
8. A student multiplied 7236 by 65 instead of multiplying by 56. By how much was his answer greater than the correct answer? (**Hint:** Do you need to do both the multiplications?)
9. To stitch a shirt, 2 m 15 cm cloth is needed. Out of 40 m cloth, how many shirts can be stitched and how much cloth will remain?
(**Hint:** convert data in cm.)
10. Medicine is packed in boxes, each weighing 4 kg 500g. How many such boxes can be loaded in a van which cannot carry beyond 800 kg?
11. The distance between the school and a student's house is 1 km 875 m. Everyday she walks both ways. Find the total distance covered by her in six days.
12. A vessel has 4 litres and 500 ml of curd. In how many glasses, each of 25 ml capacity, can it be filled?

1.3.1 Estimation

News

1. India drew with Pakistan in a hockey match watched by approximately 51,000 spectators in the stadium and 40 million television viewers world wide.
2. Approximately, 2000 people were killed and more than 50000 injured in a cyclonic storm in coastal areas of India and Bangladesh.
3. Over 13 million passengers are carried over 63,000 kilometre route of railway track every day.

Can we say that there were exactly as many people as the numbers quoted in these news items? For example,

In (1), were there exactly 51,000 spectators in the stadium? or did exactly 40 million viewers watched the match on television?



Obviously, not. The word *approximately* itself shows that the number of people were near about these numbers. Clearly, 51,000 could be 50,800 or 51,300 but not 70,000. Similarly, 40 million implies much more than 39 million but quite less than 41 million but certainly not 50 million.



MATHEMATICS

The quantities given in the examples above are not exact counts, but are estimates to give an idea of the quantity.

Discuss what each of these can suggest.

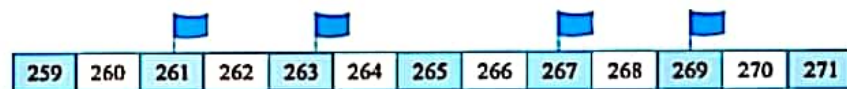
Where do we approximate? Imagine a big celebration at your home. The first thing you do is to find out roughly how many guests may visit you. Can you get an idea of the exact number of visitors? It is practically impossible.

The finance minister of the country presents a budget annually. The minister provides for certain amount under the head 'Education'. Can the amount be absolutely accurate? It can only be a reasonably good estimate of the expenditure the country needs for education during the year.

Think about the situations where we need to have the exact numbers and compare them with situations where you can do with only an approximately estimated number. Give three examples of each of such situations.

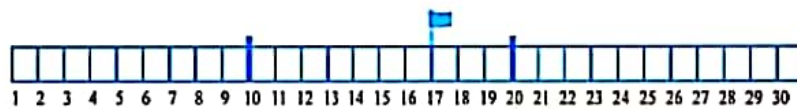
1.3.2 Estimating to the nearest tens by rounding off

Look at the following :



- (a) Find which flags are closer to 260.
- (b) Find the flags which are closer to 270.

Locate the numbers 10, 17 and 20 on your ruler. Is 17 nearer to 10 or 20? The gap between 17 and 20 is smaller when compared to the gap between 17 and 10.



So, we round off 17 as 20, correct to the nearest tens.

Now consider 12, which also lies between 10 and 20. However, 12 is closer to 10 than to 20. So, we round off 12 to 10, correct to the nearest tens.

How would you round off 76 to the nearest tens? Is it not 80?

We see that the numbers 1, 2, 3 and 4 are nearer to 0 than to 10. So, we round off 1, 2, 3 and 4 as 0. Number 6, 7, 8, 9 are nearer to 10, so, we round them off as 10. Number 5 is equidistant from both 0 and 10; it is a common practice to round it off as 10.



KNOWING OUR NUMBERS

Try These

Round these numbers to the nearest tens.

28	32	52	41	39	48
64	59	99	216	1453	2936

1.3.3 Estimating to the nearest hundreds by rounding off

Is 410 nearer to 400 or to 500?

410 is closer to 400, so it is rounded off to 400, correct to the nearest hundred.

889 lies between 800 and 900.

It is nearer to 900, so it is rounded off as 900 correct to nearest hundred.

Numbers 1 to 49 are closer to 0 than to 100, and so are rounded off to 0.

Numbers 51 to 99 are closer to 100 than to 0, and so are rounded off to 100. Number 50 is equidistant from 0 and 100 both. It is a common practice to round it off as 100.

Check if the following rounding off is correct or not :

841 \rightarrow 800; 9537 \rightarrow 9500; 49730 \rightarrow 49700;2546 \rightarrow 2500; 286 \rightarrow 200; 5750 \rightarrow 5800;168 \rightarrow 200; 149 \rightarrow 100; 9870 \rightarrow 9800.

Correct those which are wrong.

1.3.4 Estimating to the nearest thousands by rounding off

We know that numbers 1 to 499 are nearer to 0 than to 1000, so these numbers are rounded off as 0.

The numbers 501 to 999 are nearer to 1000 than 0 so they are rounded off as 1000.

Number 500 is also rounded off as 1000.

Check if the following rounding off is correct or not :

2573 \rightarrow 3000; 53552 \rightarrow 53000;6404 \rightarrow 6000; 65437 \rightarrow 65000;7805 \rightarrow 7000; 3499 \rightarrow 4000.

Correct those which are wrong.

Try These

Round off the given numbers to the nearest tens, hundreds and thousands.

Given Number	Approximate to Nearest	Rounded Form
75847	Tens	_____
75847	Hundreds	_____
75847	Thousands	_____
75847	Ten thousands	_____

1.3.5 Estimating outcomes of number situations

How do we add numbers? We add numbers by following the algorithm (i.e. the given method) systematically. We write the numbers taking care that the digits in the same place (ones, tens, hundreds etc.) are in the same column. For example, $3946 + 6579 + 2050$ is written as —

$$\begin{array}{r}
 \text{Th} \quad \text{H} \quad \text{T} \quad \text{O} \\
 3 \quad 9 \quad 4 \quad 6 \\
 + 6 \quad 5 \quad 7 \quad 9 \\
 + 2 \quad 0 \quad 5 \quad 0 \\
 \hline
 \hline
 \end{array}$$

We add the column of ones and if necessary carry forward the appropriate number to the tens place as would be in this case. We then add the tens column and this goes on. Complete the rest of the sum yourself. This procedure takes time.

There are many situations where we need to find answers more quickly. For example, when you go to a fair or the market, you find a variety of attractive things which you want to buy. You need to quickly decide what you can buy. So, you need to estimate the amount you need. It is the sum of the prices of things you want to buy.

A trader is to receive money from two sources. The money he is to receive is ₹ 13,569 from one source and ₹ 26,785 from another. He has to pay ₹ 37,000 to someone else by the evening. He rounds off the numbers to their nearest thousands and quickly works out the rough answer. He is happy that he has enough money.

Do you think he would have enough money? Can you tell without doing the exact addition/subtraction?

Sheila and Mohan have to plan their monthly expenditure. They know their monthly expenses on transport, on school requirements, on groceries,

on milk, and on clothes and also on other regular expenses. This month they have to go for visiting and buying gifts. They estimate the amount they would spend on all this and then add to see, if what they have, would be enough.



Would they round off to thousands as the trader did?

Think and discuss five more situations where we have to estimate sums or remainders.

Did we use rounding off to the same place in all these?

There are no rigid rules when you want to estimate the outcomes of numbers. The procedure depends on the degree of accuracy required and how quickly the estimate is needed. The most important thing is, how sensible the guessed answer would be.

1.3.6 To estimate sum or difference

As we have seen above we can round off a number to any place. The trader rounded off the amounts to the nearest thousands and was satisfied that he had enough. So, when you estimate any sum or difference, you should have an idea of why you need to round off and therefore the place to which you would round off. Look at the following examples.

Example 5 : Estimate: $5,290 + 17,986$.

Solution : You find $17,986 > 5,290$.

$$\begin{array}{r}
 \text{Round off to thousands.} \\
 17,986 \text{ rounds off to} \quad 18,000 \\
 +5,290 \text{ rounds off to} \quad + 5,000 \\
 \hline
 \text{Estimated sum} \quad = \quad 23,000
 \end{array}$$

Does the method work? You may attempt to find the actual answer and verify if the estimate is reasonable.

Example 6 : Estimate: $5,673 - 436$.

Solution : To begin with we round off to thousands. (Why?)

$$\begin{array}{r}
 5,673 \text{ rounds off to} \quad 6,000 \\
 - 436 \text{ rounds off to} \quad - 0 \\
 \hline
 \text{Estimated difference} \quad = \quad 6,000
 \end{array}$$

This is not a reasonable estimate. Why is this not reasonable?

To get a closer estimate, let us try rounding each number to hundreds.

$$\begin{array}{r} 5,673 \text{ rounds off to } 5,700 \\ - 436 \text{ rounds off to } - 400 \\ \hline \text{Estimated difference} = 5,300 \end{array}$$

This is a better and more meaningful estimate.

1.3.7 To estimate products

How do we estimate a product?

What is the estimate for 19×78 ?

It is obvious that the product is less than 2000. Why?

If we approximate 19 to the nearest tens, we get 20 and then approximate 78 to nearest tens, we get 80 and $20 \times 80 = 1600$

Look at 63×182

If we approximate both to the nearest hundreds we get $100 \times 200 = 20,000$. This is much larger than the actual product. So, what do we do? To get a more reasonable estimate, we try rounding off 63 to the nearest 10, i.e. 60, and also 182 to the nearest ten, i.e. 180. We get $60 \times 180 = 10,800$. This is a good estimate, but is not quick enough.

If we now try approximating 63 to 60 and 182 to the nearest hundred, i.e. 200, we get 60×200 , and this number 12,000 is a quick as well as good estimate of the product.

The general rule that we can make is, therefore, *Round off each factor to its greatest place, then multiply the rounded off factors.* Thus, in the above example, we rounded off 63 to tens and 182 to hundreds.

Now, estimate 81×479 using this rule :

479 is rounded off to 500 (rounding off to hundreds),

and 81 is rounded off to 80 (rounding off to tens).

The estimated product = $500 \times 80 = 40,000$

An important use of estimates for you will be to check your answers.

Suppose, you have done the multiplication 37×1889 , but are not sure about your answer. A quick and reasonable estimate of the product will be 40×2000 i.e. 80,000. If your answer is close to 80,000, it is probably right. On the other hand, if it is close to 8000 or 8,00,000, something is surely wrong in your multiplication.

Same general rule may be followed by addition and subtraction of two or more numbers.



Try These

Estimate the following products :

- (a) 87×313
- (b) 9×795
- (c) 898×785
- (d) 958×387

Make five more such problems and solve them.



EXERCISE 1.3

- Estimate each of the following using general rule:
 (a) $730 + 998$ (b) $796 - 314$ (c) $12,904 + 2,888$ (d) $28,292 - 21,496$
 Make ten more such examples of addition, subtraction and estimation of their outcome.
- Give a rough estimate (by rounding off to nearest hundreds) and also a closer estimate (by rounding off to nearest tens):
 (a) $439 + 334 + 4,317$ (b) $1,08,734 - 47,599$ (c) $8325 - 491$
 (d) $4,89,348 - 48,365$
 Make four more such examples.
- Estimate the following products using general rule:
 (a) 578×161 (b) 5281×3491 (c) 1291×592 (d) 9250×29
 Make four more such examples.

1.4 Using Brackets

Seema bought 6 notebooks from the market and the cost was ₹ 10 per notebook. Her sister Meera also bought 7 notebooks of the same type. Find the total money they paid.

Seema calculated the amount like this

$$\begin{aligned} &6 \times 10 + 7 \times 10 \\ &= 60 + 70 \\ &\approx 130 \\ \text{Ans. } &\text{₹ } 130 \end{aligned}$$

Meera calculated the amount like this

$$\begin{aligned} &6 + 7 = 13 \\ \text{and } &13 \times 10 \approx 130 \\ \text{Ans. } &\text{₹ } 130 \end{aligned}$$

You can see that Seema's and Meera's ways to get the answer are a bit different. But both give the correct result. Why?

Seema says, what Meera has done is $7 + 6 \times 10$.

Appu points out that $7 + 6 \times 10 = 7 + 60 = 67$. Thus, this is not what Meera had done. All the three students are confused.

To avoid confusion in such cases we may use brackets. We can pack the numbers 6 and 7 together using a bracket, indicating that the pack is to be treated as a single number. Thus, the answer is found by $(6 + 7) \times 10 = 13 \times 10$.

This is what Meera did. She first added 6 and 7 and then multiplied the sum by 10.

This clearly tells us : *First, turn everything inside the brackets () into a single number and then do the operation outside which in this case is to multiply by 10.*

MATHEMATICS

Try These

- Write the expressions for each of the following using brackets.
 - Four multiplied by the sum of nine and two.
 - Divide the difference of eighteen and six by four.
 - Forty five divided by three times the sum of three and two.
- Write three different situations for $(5 + 8) \times 6$.
(One such situation is : Sohani and Reeta work for 6 days; Sohani works 5 hours a day and Reeta 8 hours a day. How many hours do both of them work in a week?)
- Write five situations for the following where brackets would be necessary. (a) $7(8 - 3)$ (b) $(7 + 2)(10 - 3)$

1.4.1 Expanding brackets

Now, observe how use of brackets allows us to follow our procedure systematically. Do you think that it will be easy to keep a track of what steps we have to follow without using brackets?

$$(i) 7 \times 109 = 7 \times (100 + 9) = 7 \times 100 + 7 \times 9 = 700 + 63 = 763$$

$$(ii) 102 \times 103 = (100 + 2) \times (100 + 3) = (100 + 2) \times 100 + (100 + 2) \times 3$$

$$= 100 \times 100 + 2 \times 100 + 100 \times 3 + 2 \times 3$$

$$= 10,000 + 200 + 300 + 6 = 10,000 + 500 + 6$$

$$= 10,506$$

$$(iii) 17 \times 109 = (10 + 7) \times 109 = 10 \times 109 + 7 \times 109$$

$$= 10 \times (100 + 9) + 7 \times (100 + 9)$$

$$= 10 \times 100 + 10 \times 9 + 7 \times 100 + 7 \times 9$$

$$= 1000 + 90 + 700 + 63 = 1,790 + 63$$

$$= 1,853$$

1.5 Roman Numerals

We have been using the Hindu-Arabic numeral system so far. This is not the only system available. One of the early systems of writing numerals is the system of Roman numerals. This system is still used in many places.



For example, we can see the use of Roman numerals in clocks; it is also used for classes in the school time table etc.

Find three other examples, where Roman numerals are used.

The Roman numerals :

I, II, III, IV, V, VI, VII, VIII, IX, X denote 1,2,3,4,5,6,7,8,9 and 10 respectively. This is followed by XI for 11, XII for 12,... till XX for 20. Some more Roman numerals are :

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

The rules for the system are :

- (a) If a symbol is repeated, its value is added as many times as it occurs:
i.e. II is equal 2, XX is 20 and XXX is 30.
- (b) A symbol is not repeated more than three times. But the symbols V, L and D are never repeated.
- (c) If a symbol of smaller value is written to the right of a symbol of greater value, its value gets added to the value of greater symbol.
VI = 5 + 1 = 6, XII = 10 + 2 = 12
and LXV = 50 + 10 + 5 = 65
- (d) If a symbol of smaller value is written to the left of a symbol of greater value, its value is subtracted from the value of the greater symbol.
IV = 5 - 1 = 4, IX = 10 - 1 = 9
XL = 50 - 10 = 40, XC = 100 - 10 = 90
- (e) The symbols V, L and D are never written to the left of a symbol of greater value, i.e. V, L and D are never subtracted.
The symbol I can be subtracted from V and X only.
The symbol X can be subtracted from L, M and C only.

Following these rules we get,

1 = I	10 = X	100 = C
2 = II	20 = XX	
3 = III	30 = XXX	
4 = IV	40 = XL	
5 = V	50 = L	
6 = VI	60 = LX	
7 = VII	70 = LXX	
8 = VIII	80 = LXXX	
9 = IX	90 = XC	

Try These

Write in Roman numerals.
1. 73
2. 92

- (a) Write in Roman numerals the missing numbers in the table.
- (b) XXXX, VX, IC, XVV are not written. Can you tell why?

Example 7 : Write in Roman Numerals (a) 69 (b) 98.

Solution : (a) 69 = 60 + 9	(b) 98 = 90 + 8
= (50 + 10) + 9	= (100 – 10) + 8
= LX + IX	= XC + VIII
= LX IX	= XCVIII

What have we discussed?

- Given two numbers, one with more digits is the greater number. If the number of digits in two given numbers is the same, that number is larger, which has a greater leftmost digit. If this digit also happens to be the same, we look at the next digit and so on.
- In forming numbers from given digits, we should be careful to see if the conditions under which the numbers are to be formed are satisfied. Thus, to form the greatest four digit number from 7, 8, 3, 5 without repeating a single digit, we need to use all four digits, the greatest number can have only 8 as the leftmost digit.
- The smallest four digit number is 1000 (one thousand). It follows the largest three digit number 999. Similarly, the smallest five digit number is 10,000. It is ten thousand and follows the largest four digit number 9999.
Further, the smallest six digit number is 100,000. It is one lakh and follows the largest five digit number 99,999. This carries on for higher digit numbers in a similar manner.
- Use of commas helps in reading and writing large numbers. In the Indian system of numeration we have commas after 3 digits starting from the right and thereafter every 2 digits. The commas after 3, 5 and 7 digits separate thousand, lakh and crore respectively. In the International system of numeration commas are placed after every 3 digits starting from the right. The commas after 3 and 6 digits separate thousand and million respectively.
- Large numbers are needed in many places in daily life. For example, for giving number of students in a school, number of people in a village or town, money paid or received in large transactions (paying and selling), in measuring large distances say between various cities in a country or in the world and so on.
- Remember kilo shows 1000 times larger, Centi shows 100 times smaller and milli shows 1000 times smaller, thus, 1 kilometre = 1000 metres, 1 metre = 100 centimetres or 1000 millimetres etc.
- There are a number of situations in which we do not need the exact quantity but need only a reasonable guess or an estimate. For example, while stating how many spectators watched a particular international hockey match, we state the approximate number, say 51,000, we do not need to state the exact number.

8. Estimation involves approximating a quantity to an accuracy required. Thus, 4117 may be approximated to 4100 or to 4000, i.e. to the nearest hundred or to the nearest thousand depending on our need.
9. In number of situations, we have to estimate the outcome of number operations. This is done by rounding off the numbers involved and getting a quick, rough answer.
10. Estimating the outcome of number operations is useful in checking answers.
11. Use of brackets allows us to avoid confusion in the problems where we need to carry out more than one number operation.
12. We use the Hindu-Arabic system of numerals. Another system of writing numerals is the Roman system.

