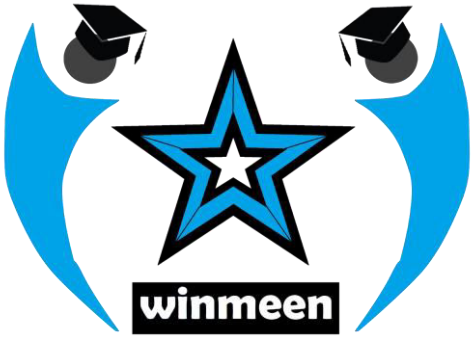

Tnpsc Maths Portion

English Medium - New Book

6th 1st Term

GOVERNMENT OF TAMIL NADU

STANDARD SIX

TERM - I

VOLUME 2

MATHEMATICS

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Department Of School Education

Contents

9Y849B
Text book

DIGI Links

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Evaluation

Chapter 1

NUMBERS

9YQVCL

Learning Objectives

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

1.1 Introduction

Read the following conversation between two classmates.

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

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

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

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

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

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

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

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

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

MATHEMATICS ALIVE - LARGE NUMBERS IN REAL LIFE

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

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

1.2 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 equals _____.
- 10000 – 1 equals _____.
- The predecessor of the smallest 5 digit number is _____.

1.3 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.

Table: 1.1

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	Lakh
Greatest 6 digit number	+ 1	=	Smallest 7 digit number	Ten Lakh
Greatest 7 digit number 9999999	+ 1	=	Smallest 8 digit number 10000000	Crore

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	(Lakh)
100000 × 10	=	1000000	(Ten Lakh)

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.

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 One Thousand has "hundred tens" in it.

Try these

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

1.4 Place Value Chart

Table: 1.2

TC	C	TL	L	T Th	Th	H	T	O
Ten Crores	Crores	Ten Lakh	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones

As in the table:1.2, when writing large numbers we make use of place value chart to ensure that we do not miss any digit in between, while writing it. The ones place can be represented by the letter 'O', tens place by 'T', hundreds place by 'H', thousands place by 'Th', ten thousands place by 'T Th', lakhs place by 'L' , ten lakhs place by 'T L', crores place by 'C' and ten crores by 'T C'.

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	TTh	Th	H	T	O
Number	3	5	9	4	6	8	4	2	1
Number Name	Thirty five crore ninety four lakh sixty eight thousand four hundred twenty one.								

Try these

Complete the table

Table: 1.3

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 Lakh Five Hundred
53409098										
198765912										

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

Example 1.1

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	$\frac{1\text{lakh}}{1\text{thousand}} = \frac{100000}{1000} = 100$
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 thousand.

Example 1.2

Read and expand the number 50000

NUMBER : 50,000

Expanded form : 5 × 10000

Read as : Fifty Thousand

Read and expand the number 676097

NUMBER : 676097

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

Read as : Six Lakh Seventy Six Thousand Ninety Seven

Try these

Read and expand the following numbers:

1. 2304567
2. 4509888
3. 9553556

1.5 Place Value of digits in Large Numbers

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

Finding the place value of all the digits in 9847056

The Place value of 6 is 6 × 1	=	6	(Six)
The Place value of 5 is 5 × 10	=	50	(Fifty)
The Place value of 0 is 0 × 100	=	0	(Zero)
The Place value of 7 is 7 × 1000	=	7000	(Seven Thousand)
The Place value of 4 is 4 × 10000	=	40000	(Forty Thousand)

The Place value of 8 is 8 × 100000 = 800000 (Eight Lakh)

The Place value of 9 is 9 × 1000000 = 9000000 (Ninety Lakh)

Hence, the number 9847056 is read as Ninety Eight Lakh Forty Seven Thousand Fifty Six.

Try these

1. Find the place value of underlined digits.

   (i) 3<u>8</u>, 41, 567

   (ii) 94, <u>4</u>3, 810

2. Write down the numerals and place value of 5 in the numbers represented by the following number names.

   (i) Forty Seven Lakh Thirty Eight Thousand Five Hundred Sixty One.

   (ii) Nine Crore Eighty Two Lakh Fifty Thousand Two Hundred Forty One.

   (iii) Nineteen Crore Fifty Seven Lakh Sixty Thousand Three Hundred Seventy.

1.6 Use of commas and Comparison of Number Systems

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 Lakh place (7 digits from the right) and represents Crore.

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

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

Table: 1.4

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	Lakh	1,00,000	Hundred thousand	100,000	
	Ten Lakh	10,00,000	Million	1,000,000	Millions
Crores	Crore	1,00,00,000	Ten Million	10,000,000	
	Ten crore	10,00,00,000	Hundred Million	100,000,000	
	Hundred crore	100,00,00,000	Billion	1,000,000,000	Billions
	Thousand crore	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.

Now let us discuss simple problems with examples.

Example 1.3

The distance between the Sun and the Earth is about 92900000 miles. Read and write the number in the Indian and the International System by using commas.

Solution

Indian System

Crores	Ten lakhs	Lakhs	Ten thousands	Thousands	Hundreds	Tens	Ones
9	2	9	0	0	0	0	0

i.e., 9,29,00,000

This is read as Nine Crore Twenty Nine Lakh.

International System

Ten Millions	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
9	2	9	0	0	0	0	0

i.e., 92,900,000

This is read as Ninety Two Million Nine Hundred Thousand.

Try these

Identify the incorrect places of comma and rewrite correctly.

Indian System : 56,12,34,0,1,5

9,90,03,2245

International System : 7,5613,4534

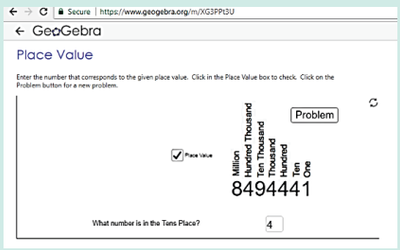
30,30,304,040

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.

NUMBERS

Expected Result is shown in this picture



Step – 1

Open the Browser and copy and paste the Link given below (or) by typing 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.

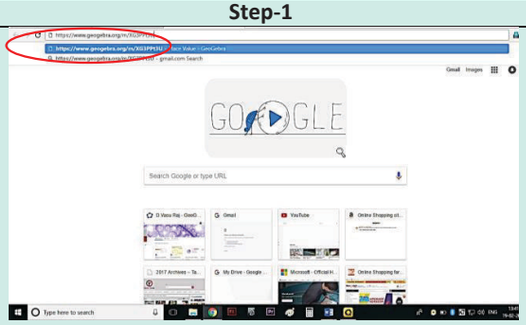
Step-3

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

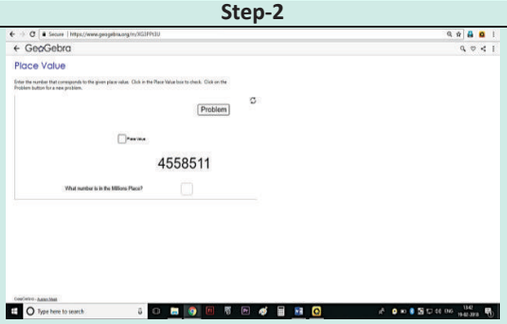
Step-4

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

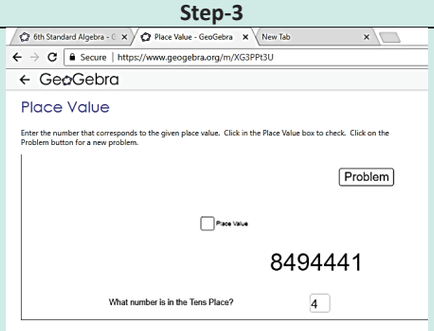
Step-1



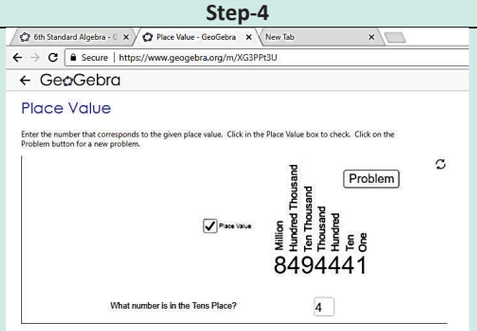
Step-2



Step-3



Step-4



Browse in the link

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

Exercise 1.1

A7QM6R

1. Fill in the blanks.

   (i) The smallest 7 digit number is _____.

   (ii) The largest 8 digit number is _____.

   (iii) The place value of 5 in 7005380 is _____.

   (iv) The expanded form of the number 76,70,905 is _____.

2. Say True or False.

   (i) In the Indian System of Numeration the number 67999037 is written as 6,79,99,037.

   (ii) Successor of a one digit number is always a one digit number

   (iii) Predecessor of a 3-digit number is always a 3 or 4-digit number

   (iv) $88888 = 8 \times 10000 + 8 \times 100 + 8 \times 10 + 8 \times 1$

3. Complete the given order.

   Ten crore, crore, ten lakh, _____, _____, _____, _____, _____.

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

5. Using the digits 5, 2, 0, 7, 3 form the largest 5 digit number and the smallest 5 digit number.

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

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

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

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

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

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

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

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

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

11. Write the number name in numerals.

(i) Two crore thirty lakh fifty one thousand nine hundred eighty.

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

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

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

13. The number of employees in the Indian Railways is about 10 lakh. Write this in the International System of numeration.

Objective Type Questions

14. 1 billion is equal to

(a) 100 crore (b) 100 million

(c) 100 lakh (d) 10000 lakh

15. The successor of 10 million is

(a) 1000001 (b) 10000001

(c) 9999999 (d) 100001

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

(a) 90000 (b) 1

(c) 2 (d) 99001

17. 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) $6 \times 100000 + 7 \times 10000 + 0 \times 1000 + 9 \times 100 + 0 \times 10 + 5 \times 1$

1.7 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.

1.7.1 Comparing numbers with unequal number of digits

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

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

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

Try these

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

1.7.2 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 km and Chennai to Noida is 2158 km respectively. Which city is farther from Chennai?

Table: 1.5

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 tens 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.

Example 1.4

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

DO YOU KNOW?

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

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

1.8 Arranging the numbers in ascending and descending order

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

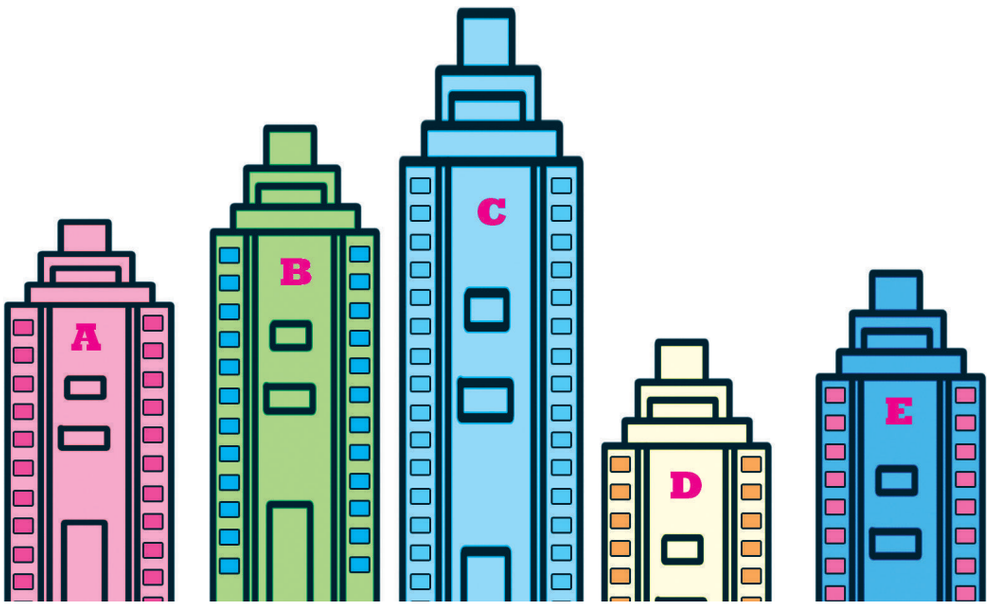


Fig. 1.1

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

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

Table: 1.6

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

Step 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)

Step 2

Compare the three digit numbers 985, 585 and 355. Using the Table 1.6, 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 this

The area in sq. km. of 4 Indian states are given below

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

List the areas of the above 4 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.

1.9 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 this

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.

1.10 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 lakh place and 9 in ten thousand 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	Anaimudi	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 Anaimudi 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

1.11 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 1.5

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 1.6

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

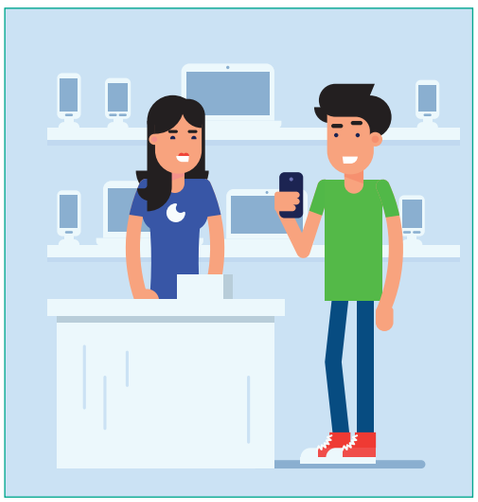
Number of notebooks in the store = 7,50,000

Number of notebooks sold = 6,25,600

Number of notebooks unsold = 1,24,400

Example 1.7

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 1.8

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.

1.12 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.

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 1.9

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

Solution

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

Example 1.10

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

Solution

$20 + [8 \times 2 + \{\overline{6 \times 3} - 10 \div 5\}]$	(given question)
$=20 + [8 \times 2 + \{18 - 10 \div 5\}]$	(bar 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. 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 $24 \div \{8 - (3 \times 2)\}$ is

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

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

    $2 \square 6 - 12 \div (4 + 2) = 10$

    (a) + (b) − (c) × (d) ÷

1.13 Estimation of numbers

- Nearly 60,000 people watched the Republic day parade at Rajpath, New Delhi.
- About 2,80,000 people of various countries died due to earthquake and Tsunami on 26th December 2004 in the Indian ocean.
- 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., is 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 up 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 1.11

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 1.12

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

- Round off the following numbers to the nearest ten.

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

- 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

- 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 _____.

1.13.1 Estimation of Sum and Difference

Example 1.13

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	₹ 15,34,400	₹ 15,34,000
Total amount deposited	₹ 32,88,140	₹ 32,88,000
Difference between the amounts deposited	₹ 2,19,340	₹ 2,20,000

Think

Is 2,19,340 is rounded off to its nearest thousand as 2,20,000. Why?

1.13.2 Estimation of Product and Quotient

Example 1.14

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

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 1.15

Find the estimated value of 5598 ÷ 689.

Solution

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

5600 is nearest to 5598

700 is nearest to 689

Hence, the estimated value of 5598 ÷ 689 is 8

Try these

- Estimate the sum and the difference : 8457 and 4573.
- Estimate the product : 39 × 53
- Estimate the quotient : 5546 ÷ 524

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 _____.

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

1.14 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.

1.14.1 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.

Try these

- Find the value of 6 + 3 + 8 and 3 + 6 + 8
  i) Are they the same?
  ii) Is there any other way of rearranging 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 rearranging 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?

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

1.15 Properties of Whole Numbers

1.15.1 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:

$$43 + 57 = 57 + 43$$

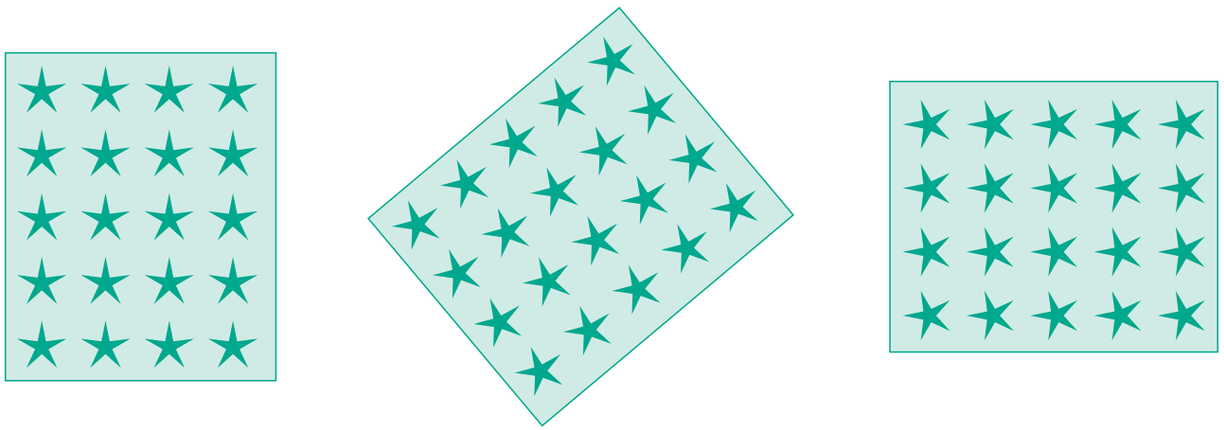
$$12 \times 15 = 15 \times 12$$

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

$$39{,}458 \times 84{,}321 = 84{,}321 \times 39{,}458$$

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 ($5 \times 4 = 20$). See Fig.1.2 below. Now rotate the rectangle, 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, $5 \times 4 = 4 \times 5$.



(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, subtraction and division are NOT commutative.

Try these

- Use at least three different pairs of 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.

1.15.2 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.

1.15.3 Distributivity of multiplication over addition or subtraction

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

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

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

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

In the last two cases, we are actually noting down 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 as property of distributivity of multiplication over addition or subtraction. It is a very useful property to group numbers in a convenient way. Now let us say $18 \times 6 = (10 + 8) \times 6$ in an easy way as shown in Fig.1.3.

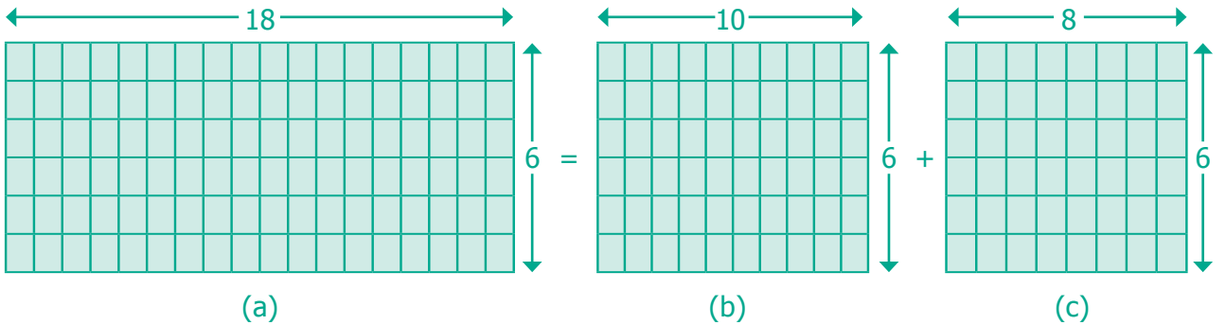


Fig.1.3

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

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

For example,

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

1.15.4 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.

Exercise 1.5

1. Fill in the blanks.

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

   (ii) $17 \times$ _____ $= 34 \times 17$

   (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) $(12 \times 4) \times 8 = 12 \times (4 \times 8)$

   (iii) $50 + 0 = 50$

   (iv) $50 \times 1 = 50$

   (v) $50 \times 42 = 50 \times 40 + 50 \times 2$

4. Use the properties of whole numbers and simplify.

   (i) 50×102

   (ii) $500 \times 689 - 500 \times 89$

   (iii) $4 \times 132 \times 25$

   (iv) $196 + 34 + 104$

Objective Type Questions

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

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

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

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

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

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

   (c) zero (d) none of these

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

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

9. Which of the following expressions is not zero?

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

10. Which of the following is not true?

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

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

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

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

Exercise 1.6

Miscellaneous Practice Problems

1. Try to open my locked suitcase which has the biggest 5 digit odd number as the password comprising the digits 7, 5, 4, 3 and 8. Find the password.

2. As per the census of 2001, the population of four states are given below. Arrange the states in ascending and descending order of their population.

   - 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 this in standard form of 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 Anjali 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 Anjali's 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.

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.

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.

Chapter 2

INTRODUCTION TO ALGEBRA

A8IABP

Learning Objectives

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

2.1 Introduction

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

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

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

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

- If the initial number is 4,

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

- If the initial number is 9,

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

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

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

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

MATHEMATICS ALIVE – ALGEBRA IN REAL LIFE

4 sticks	8 sticks	12 sticks
4 sticks	2 × 4 sticks	3 × 4 sticks

2.2 Patterns

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

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

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

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

Try these

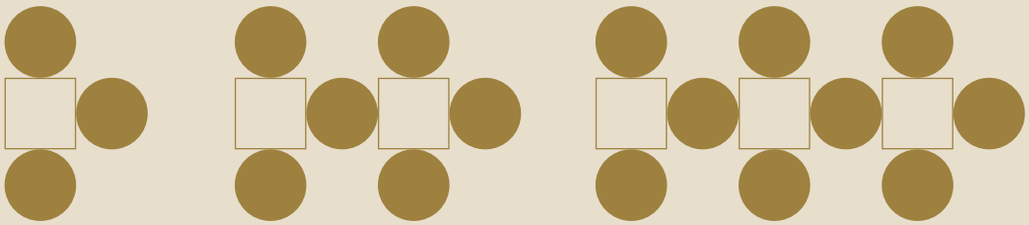
- Observe the following patterns and complete them.

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

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

  15873 × 21 =? and 15873 × 28 =?

- Draw the next two patterns and complete the table.



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

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

2.2.1 Patterns in Number Operations

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

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

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

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

In Algebra, we say that "n" is a variable. A variable is a symbol (usually an alphabet like n or x) that represents a number. Variables often help us to write briefly what we mean by a relation. For example, the following patterns such as,

$$\begin{aligned} 7 + 9 &= 9 + 7 \\ 57 + 43 &= 43 + 57 \\ 123 + 456 &= 456 + 123 \\ 7098 + 2018 &= 2018 + 7098 \\ 35784 + 481269841 &= 481269841 + 35784 \end{aligned}$$

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

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

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

Note

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

2.3 Understanding operations on Variables

Consider the following situations.

Situation 1:

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

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

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

Situation 2:

Patterns using Ice Candy Sticks

Pari and Manimegalai made some patterns with ice candy sticks.

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

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

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

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

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

Exercise 2.1

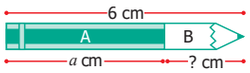
1. Fill in the blanks.

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

   (ii) A quantity that takes _____ values is called a variable.

   (iii) If there are 5 students in a bench, then the number of students in *'n'* benches is '$5 \times n$'. Here _____ is a variable.

2. Say True or False.

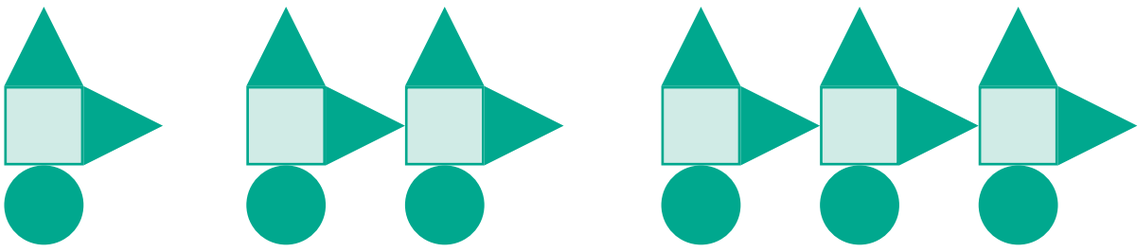
   (i) 

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

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

   (iii) If there are 11 players in a team, then there will be '$11 + q$' players in *'q'* teams.

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



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

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

(a) a pattern of letter C as 

(b) a pattern of letter M as 

5. The teacher forms groups of five students in a class. How many students will be there in 'p' groups?

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

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

(i) the next even number?

(ii) the previous even number?

Objective Type Questions

8. Variable means that it

(a) can take only a few values

(b) has a fixed value

(c) can take different values

(d) can take only 8 values

9. '$6y$' means

(a) $6 + y$

(b) $6 - y$

(c) $6 \times y$

(d) $\frac{6}{y}$

10. Radha is 'x' years of age now. 4 years ago, her age was

(a) $x - 4$ (b) $4 - x$

(c) $4 + x$ (d) $4x$

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

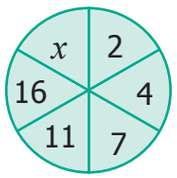
(a) $30 + w$ (b) $30w$

(c) $7 + w$ (d) $7w$

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

(a) 6 (b) 8

(c) 21 (d) 22



2.4 Framing Algebraic Statements

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

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

- Suppose there are unknown number of people in a bus, say 'x' and if 2 more people get into the bus, then there will be '$x + 2$' people in the bus.
- There is a patty of butter which weighs 'w' grams. If you cut off 100 grams from it, you will have '$w - 100$' grams left.
- If you start with a number 'y' and then double it, you can write it as '$2y$' (you know, '$2y$' means 2 multiplied by y).

2.4.1 Converting Algebraic statements to Verbal statements

A few examples are given in the following table.

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

Try these

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

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

2.4.2 Converting Verbal statements to Algebraic Statements

A few examples are given in the following table.

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

Try these

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

2.5 Solving unknowns through examples

Let us fill up the empty boxes

(a) $\square + 3 = 8$

(b) $2 + \square = 9$

(c) $11 - 5 = \square$

The $\square$ stands for an unknown number.

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

Try these

Find the unknown.

- $37 + 43 = 43 + \square$
- $(22 + 10) + 15 = \square + (10 + 15)$
- If $7 \times 46 = 322$ then $46 \times 7 = \square$

Example 2.1

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

According to the given statement,

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

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

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

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

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

Try this

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

m	$m + 4$	Result	Is it 9? Yes / No
1	?	5	
2	2 + 4	?	
3	?	7	
4	4 + 4	?	
5	?	?	

Example 2.2

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

Age of Athiyan = *'p'* years

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

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

= 26 years.

Exercise 2.2

1. Fill in the blanks.

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

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

   (iii) The verbal statement of '$2m$ − 10' is _____.

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

   (v) If 'p − 5' gives 12 then *'p'* is _____.

2. Say True or False.

   (i) 10 more to three times *'c'* is '$3c$ + 13'

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

   (iii) The statements *'x'* divided by 3 and 3 divided by *'x'* are the same.

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

   (v) 7 less to 7 times *'y'* is '$7 - 7y$'.

3. Express the following verbal statement to algebraic statement.

   (i) *'t'* is added to 100.

   (ii) 4 times *'q'*.

   (iii) 8 reduced by *'y'*.

   (iv) 56 added to 2 times *'x'*.

   (v) 4 less to 9 times of *'y'*.

4. Express the following algebraic statement to verbal statement.

   (i) $x \div 3$

   (ii) $5n - 12$

   (iii) $11 + 10x$

   (iv) $70s$

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

6. Answer the following questions.

   (i) If 'n' takes the value 3 then find the value of '$n + 10$' ?

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

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

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

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

Objective Type Questions

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

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

9. 6 less to 'n' gives 8 is represented as

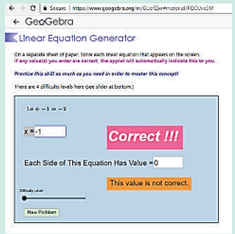
   (a) $n - 6 = 8$ (b) $6 - n = 8$ (c) $8 - n = 6$ (d) $n - 8 = 6$

10. The value of 'c' for which $\frac{3c}{4}$ gives 18 is

    (a) $c = 15$ (b) $c = 21$ (c) $c = 24$ (d) $c = 27$

INTRODUCTION TO ALGEBRA

Expected Result is shown in this picture



Step – 1

Open the Browser and copy and paste the Link given below (or) by typing the URL given (or) Scan the QR Code.

Step - 2

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

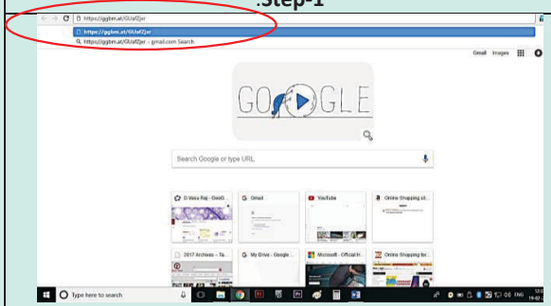
Step-3

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

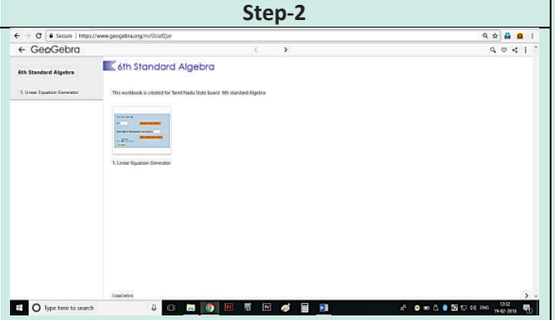
Step-4

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

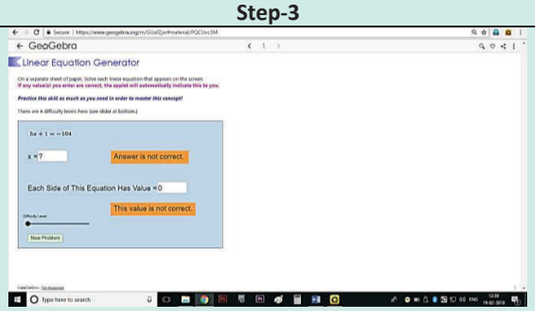
.Step-1



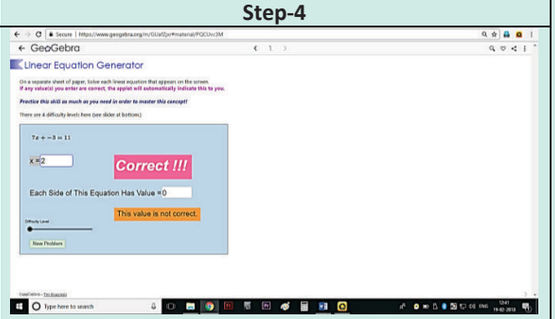
Step-2



Step-3



Step-4



Try the remaining worksheets given in this work book related to your lesson

Browse in the link

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

Exercise 2.3

Miscellaneous Practice Problems

1. Complete the following pattern.

A9AXGM

$9 - 1 =$

$98 - 21 =$

$987 - 32 =$

$9876 - 432 =$

$98765 - 54321 =$

What comes next?

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

   (i) an equilateral triangle

   (ii) a square?

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

				= 30
				= 36
				=
				=
= 32	=	=	=	=

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

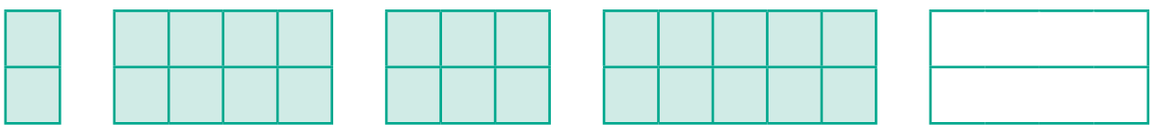
Teams	A	B	C	D	E	F	G	H
Total Matches played	8	7	n	a	9	10	8	y
Matches won	5	6	4	7	b	6	x	3
Matches lost	k	m	6	2	3	c	4	6

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

Challenging Problems

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

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



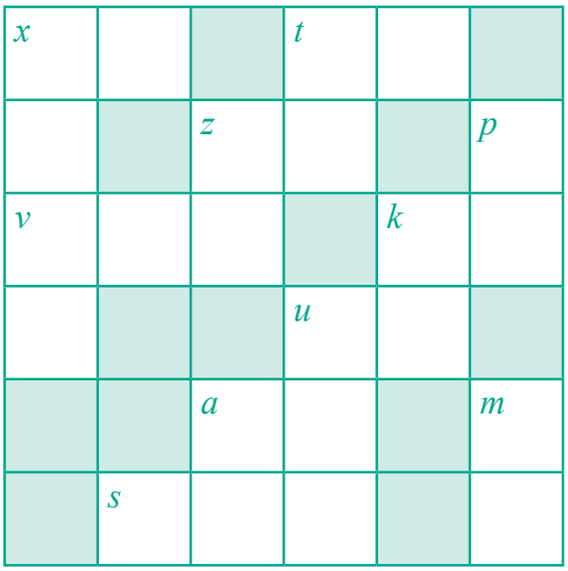
P Q R S T

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

(ii) Fill in the boxes.

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

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



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

Summary

- Variables are quantities that can take any value and they are denoted by small alphabets $a,b,c, \ldots, x,y,z$.
- A Variable allows us to express relations easily in all practical situations.
- Variables are used to generalise and express many common rules of Geometry and Arithmetic.

Chapter 3 RATIO AND PROPORTION

A9JTIA

Learning Objectives

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

Recap

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

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

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

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

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

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

4. Arrange these fractions from the least to the greatest : $\frac{1}{2}, \frac{1}{4}, \frac{6}{8}, \frac{1}{8}$

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

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

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

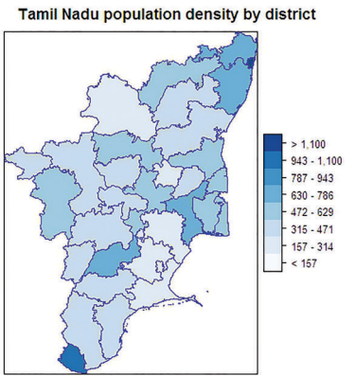
8. After sowing seeds on day one, Muthu observes the growth of two plants and records it. In 10 days, if the first plant grew $\frac{1}{4}$ th of an inch and the second plant grew $\frac{3}{8}$ th of an inch, then which plant grew more?

3.1 Introduction

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

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

MATHEMATICS ALIVE – RATIO IN REAL LIFE



555 persons to one square km

HEIGHT TO WEIGHT RATIO CHART

FEMALE				MALE			
HEIGHT	Low	Target	High	HEIGHT	Low	Target	High
4' 10"	100	115	131	5' 1"	123	134	145
4' 11"	101	117	134	5' 2"	125	137	148
5' 0"	103	120	137	5' 3"	127	139	151
5' 1"	105	122	140	5' 4"	129	142	155
5' 2"	108	125	144	5' 5"	131	145	159
5' 3"	111	128	148	5' 6"	133	148	163
5' 4"	114	133	152	5" 7"	135	151	167
5' 5"	117	136	156	5' 8"	137	154	171
5' 6"	120	140	160	5' 9"	139	157	175
5' 7"	123	143	164	5' 10"	141	160	179
5' 8"	126	146	167	5' 11"	144	164	183
5' 9"	129	150	170	6' 0"	147	167	187
5' 10"	132	153	173	6' 1"	150	171	192
5' 11"	135	156	176	6' 2"	153	175	197
6' 0"	138	159	179	6' 3"	157	179	202

Comparison of height and weight by using ratio

3.2 Ratio

Think about this Situation

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

DO YOU KNOW?

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

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

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

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

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

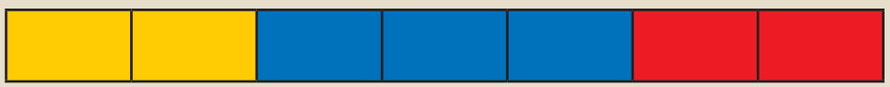
Such comparison is called as a Ratio.

Note

- A ratio is a comparison of two quantities.
- A ratio can be written as a fraction; ratios are mostly written in the simplest form.
- In the above example, the ratio of rice to water in terms of the number of cups can be written in three different ways as 1 : 2 or $\frac{1}{2}$ or 1 to 2 .

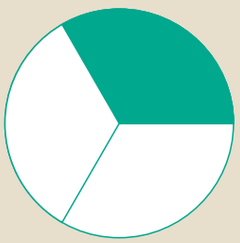
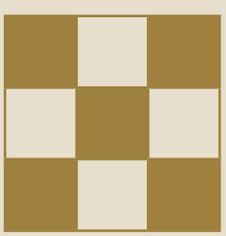
Try these

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



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

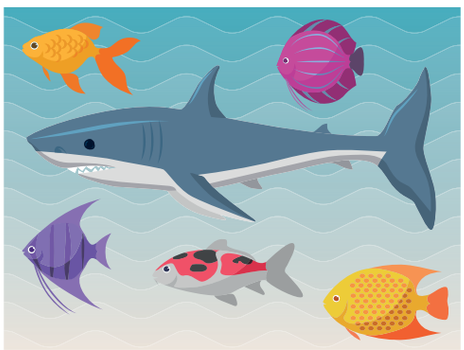
3. Write the ratio of shaded portion to the unshaded portions in the following shapes.

	
Ratio	Ratio

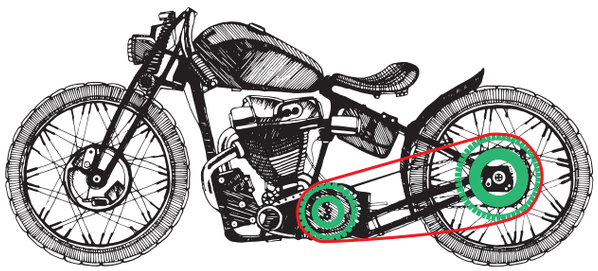
3.2.1 Properties of Ratio

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

A few examples are given below.



(a)



(b)

Fig. 3.1

(a)	(b)
Ratio of the number of small fish to the number of big fish is 5 : 1	Ratio of number of teeth in front gear to number of teeth in back gear is 25 : 50

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

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

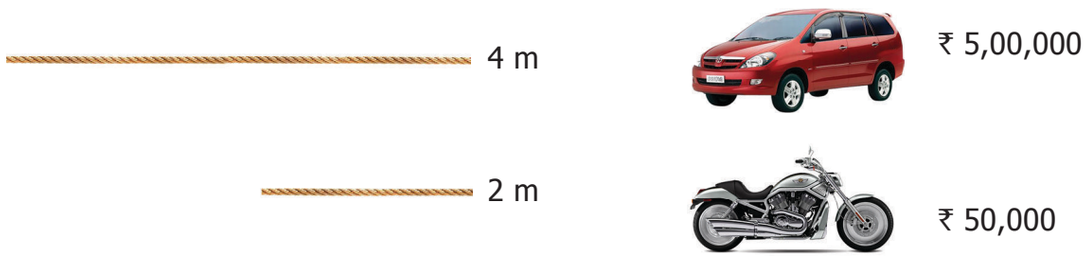
Try this

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

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

3.2.2 Ratios in simplest form

Think about these situations



(a) Fig. 3.2 (b)

1. The larger rope is 4 m long and the smaller rope is 2 m long. This is expressed in the form of ratio as 4 : 2 and the simplest form of ratio of the larger rope to the smaller rope is 2 : 1 (See Fig. 3.2 (a))

2. The cost of a car is ₹ 5,00,000 and the cost of a motorbike is ₹ 50,000. This is expressed as 500000 : 50000 = 50 : 5 and the simplest form of ratio of the car to the motorbike is 10 : 1 (See Fig. 3.2 (b))

3.2.3 Simplifying ratios of same unit

Example 3.1

Simplify the ratio 20 : 5.

5 x 1 = 5
5 x 2 = 10
5 x 3 = 15
5 x 4 = 20

Solution

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

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

This is the ratio in the simplest form.

Example 3.2

Find the ratio of 500 g to 250 g.

Solution

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

This is the ratio in the simplest form.

Example 3.3

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

Solution

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

$= 900:750 = \frac{900}{750} \Rightarrow \frac{900 \div 150}{750 \div 150} = \frac{6}{5} = 6:5$

This is the ratio in the simplest form.

3.2.4 Simplifying ratios of different units

Example 3.4

What is the ratio of 40 minutes to 1 hour?

1 hour = 60 minutes
20 x 1 = 20
20 x 2 = 40
20 x 3 = 60

Solution

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

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

This is the ratio in the simplest form.

Try these

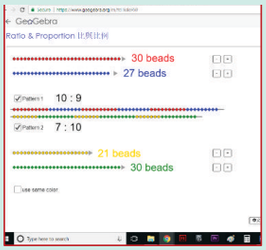
Write the ratios in the simplest form and fill in the table.

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

ICT Corner

RATIO AND PROPORTION

Expected Result is shown in this picture



Step – 1

Open the Browser and copy and paste the Link given below (or) by typing the URL given (or) Scan the QR Code.

Step - 2

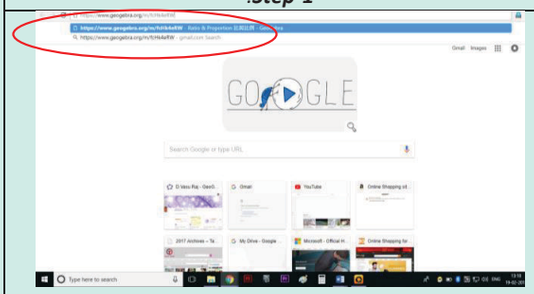
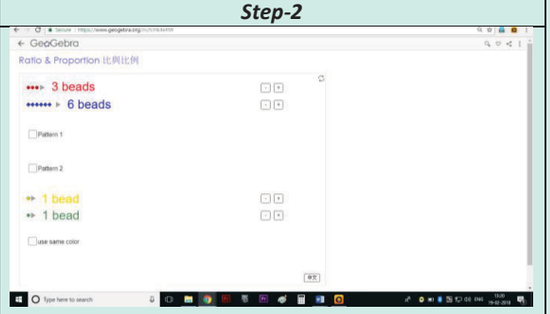
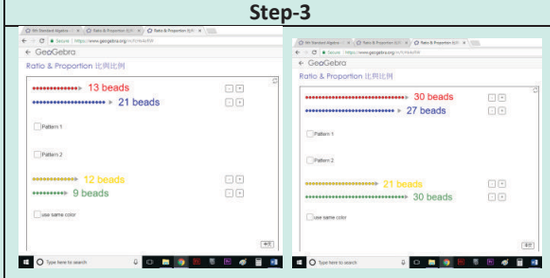
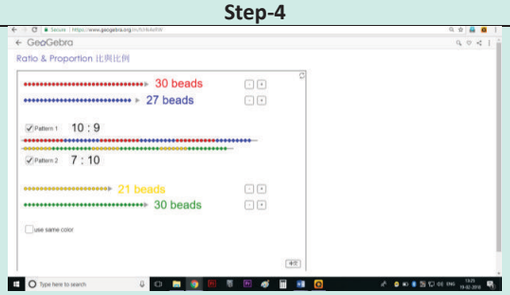
GeoGebra worksheet named "Ratio and Proportion" will open. Two sets of Coloured beads will appear.

Step-3

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

Step-4

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

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

Browse in the link

Ratio and Proportion - https://www.geogebra.org/m/fcHk4eRW

Exercise 3.1

A9TPJX

1. Fill in the blanks.

   (i) Ratio of ₹ 3 to ₹ 5 = _____.

   (ii) Ratio of 3m to 200cm = _____.

   (iii) Ratio of 5 km 400 m to 6 km = _____.

   (iv) Ratio of 75 paise to ₹ 2 = _____.

2. Say whether the following statements are True or False.

   (i) The ratio of 130 cm to 1 m is 13 : 10.

   (ii) One of the terms in a ratio cannot be 1.

3. Find the simplified form of the following ratios.

   (i) 15 : 20 (ii) 32 : 24 (iii) 7 : 15 (iv) 12 : 27 (v) 75 : 100

4. Akilan walks 10 km in an hour while Selvi walks 6 km in an hour. Find the simplest ratio of the distance covered by Akilan to that of Selvi.

5. The cost of parking a bicycle is ₹ 5 and the cost of parking a scooter is ₹ 15. Find the simplest ratio of the parking cost of a bicycle to that of a scooter.

6. Out of 50 students in a class, 30 are boys. Find the ratio of

   (i) number of boys to the number of girls.

   (ii) number of girls to the total number of students.

   (iii) number of boys to the total number of students.

Objective Type Questions

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

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

8. The ratio of 1 m to 50 cm is _____.

   (a) 1 : 50 (b) 50 : 1 (c) 2 : 1 (d) 1 : 2

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

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

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

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

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

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

3.2.5 Equivalent Ratios

We can get equivalent ratios by multiplying or dividing the numerator and denominator by a common number. This is clear from the following example. Let us find the ratio between breadth and length of the following rectangles given in the Figure 3.3

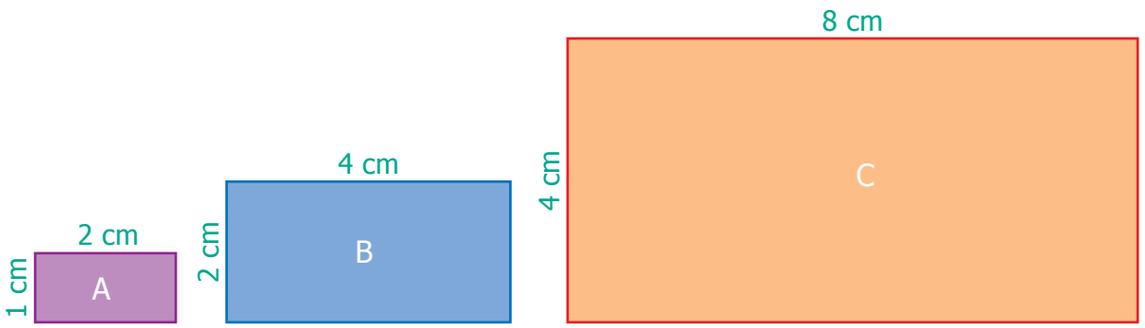


Fig. 3.3

- Ratio of breadth to length of **rectangle A** is **1 : 2** (already in simplest form)
- Ratio of breadth to length of **rectangle B** is **2 : 4** (simplest form is 1 : 2)
- Ratio of breadth to length of **rectangle C** is **4 : 8** (simplest form is 1 : 2)
- Thus, the ratios of breadth and length of rectangles **A**, **B** and **C** are said to be equivalent ratios.
- That is, the ratios **1 : 2** = **2 : 4** = **4 : 8** are equivalent. (See Fig. 3.3)

Try these

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

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

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

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

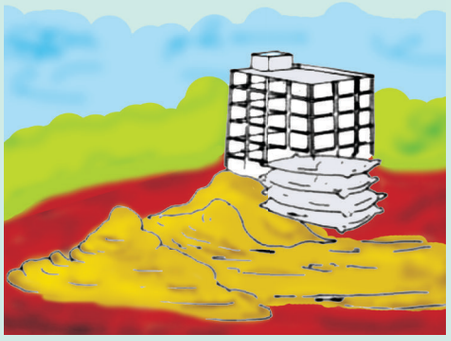
3. For the given ratios, find their simplest form and complete the table.

	Ratio	Fraction Form	Simplest form
(i)	5 : 60	$\frac{5}{60}$	$\frac{5\div5}{60\div5}=\frac{1}{12}=1:12$
(ii)	4000 : 6000	$\frac{4000}{6000}$	
(iii)	1100 : 5500		

3.2.6 Comparison of Ratios

Consider the following situations.

Situation 1

	
In the Idly Batter, the ratio of black gram to idly rice is 1 : 4	In the Concrete Mixture, the ratio of cement to sand is 1 : 3

(a) Fig. 3.4 (b)

Can you find which ratio is greater in Fig. 3.4?

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

Idly Batter Ratio	Concrete Mixture Ratio
$\frac{1}{4}\times\frac{2}{2}=\frac{2}{8}$	$\frac{1}{3}\times\frac{2}{2}=\frac{2}{6}$
$\frac{1}{4}\times\frac{3}{3}=\frac{3}{12}$	$\frac{1}{3}\times\frac{3}{3}=\frac{3}{9}$
$\frac{1}{4}\times\frac{4}{4}=\frac{4}{16}$	$\frac{1}{3}\times\frac{4}{4}=\frac{4}{12}$

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

Situation 2

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

Example 3.5

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

Solution

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

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

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

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

AA3KLK

Exercise 3.2

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

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

2. Complete the table.

   (i)

Feet	1	2	3	?
Inch	12	24	?	72

   (ii)

Days	28	21	?	63
Weeks	4	3	2	?

3. Say True or False.

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

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

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

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

5. Which of the two ratios is larger?

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

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

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

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

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

Objective Type Questions

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

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

10. An equivalent ratio of 4 : 7 is

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

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

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

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

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

3.3 Proportion

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

Situation 1

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

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

Situation 2

Fig. 3.5(a)

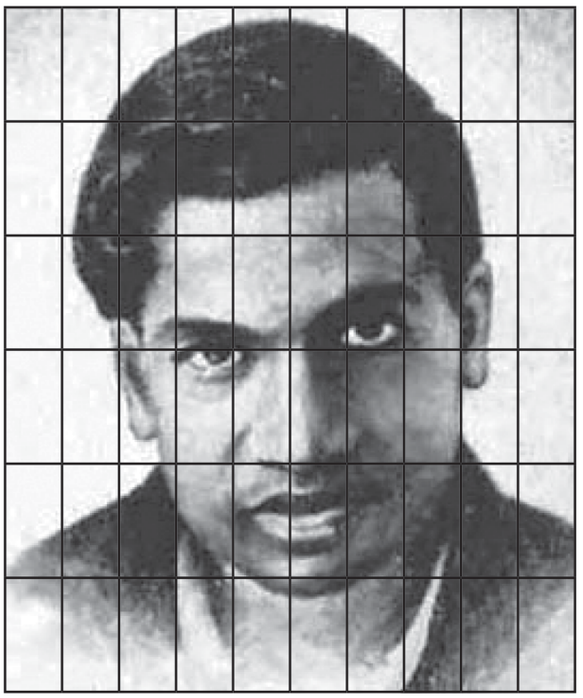


Fig. 3.5(b)

The size of the photograph of Srinivasa Ramanujan as shown in Figure 3.5(a) is of length 5 grids and width 3 grids. Figure 3.5(b) shows the enlarged size of the photograph of length 10 grids and width 6 grids. Here,

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

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

3.3.1 Proportionality law

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

Example 3.6

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

Solution

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

Product of extremes, ad = 3 × 20 = 60.

Product of means, bc = 2 × 30 = 60.

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

Example 3.7

A picture is resized in a computer as shown below.

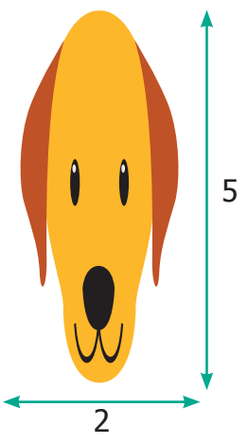


Fig. 3.6 (a)

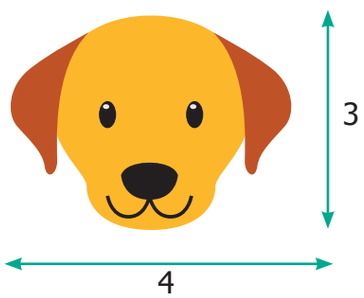


Fig. 3.6 (b)

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

Solution

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

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

Product of extremes, ad = 2 × 3 = 6.

Product of means, bc = 5 × 4 = 20.

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

Try this

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

Exercise 3.3

1. Fill in the boxes.

   AACGN8

   (i) 3 : 5 : : ☐ : 20

   (ii) ☐ : 24 : : 3 : 8

   (iii) 5 : ☐ : : 10 : 8 : : 15 : ☐

   (iv) 12 : ☐ = ☐ : 4 = 8 : 16

2. Say True or False.

   (i) 2 : 7 : : 14 : 4

   (ii) 7 Persons is to 49 Persons as 11 kg is to 88 kg

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

3. Using the numbers 3, 9, 4, 12 write two ratios that are in proportion.

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

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

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

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

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

Objective Type Questions

7. Which of the following ratios are in proportion?

   (a) 3 : 5 , 6 : 11 (b) 2 : 3, 9 : 6

   (c) 2 : 5, 10 : 25 (d) 3 : 1, 1 : 3

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

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

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

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

3.4 Unitary Method

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

Steps involved in Unitary Method

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

Example 3.8

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

By unitary method, we can solve this as follows :

Cost of a dozen balls = ₹ 180

⇒ Cost of 12 balls = ₹ 180

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

Cost of 5 balls = 5 x 15 = ₹ 75

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

Example 3.9

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

Solution

In 40 minutes, electricity used = 3 units.

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

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

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

Exercise 3.4

1. Fill in the blanks.

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

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

2. Say True or False.

   (i) If the weight of 40 books is 8 kg, then the weight of 15 books is 3kg.

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

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

4. The cost of 15 chairs is ₹ 7500. Find the number of such chairs that can be purchased for ₹ 12,000?

5. A car covers a distance of 125 km in 5 kg of LP Gas. How much distance will it cover in 3 kg of LP Gas?

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

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

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

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

Objective Type Questions

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

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

11. If 8 oranges cost ₹ 56, then the cost of 5 oranges is ₹ _____.

    (a) 42 (b) 48 (c) 35 (d) 24

12. If a man walks 2 km in 15 minutes, then he will walk _____ km in 45 minutes.

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

Exercise 3.5

Miscellaneous Practice Problems

1. The maximum speed of some of the animals are given below :
   the Elephant=20 km/h; the Lion=80 km/h; the Cheetah=100 km/h
   Find the following ratios of their speeds in simplified form and find which ratio is the least?.

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

   (iii) the Elephant and the Cheetah

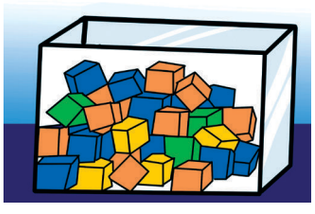
2. A particular high school has 1500 students 50 teachers and 5 administrators. If the school grows to 1800 students and the ratios are maintained, then find the number of teachers and administrators.

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

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

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

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



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

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

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

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

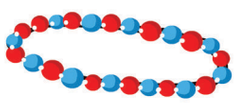
(b) If 16 cups of water is used, then how much of ragi flour should be used?

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

Challenging Problems

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

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



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

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

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

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

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

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

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

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

Summary

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

Summary

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

Answers

CHAPTER 1 - NUMBERS

Exercise 1.1

1) (i) 10,00,000 (ii) 9,99,99,999 (iii) Five Thousand
(iv) 7000000+600000+70000+900+5

2) (i) True (ii) False (iii) False (iv) False

3) Lakh, Ten thousand, Thousand, Hundred, Ten, One

4) 10

5) Largest - 75320 Smallest - 20357

6) (i) 70,00,000 (ii) 7,000,000

7) (i) 347,056 (ii) 7,345,671 (iii) 634,567,105 (iv) 1,234,567,890

8) Indian System : 9,99,999 (Nine Lakh Ninety Nine Thousand Nine Hundred Ninety Nine)
International System : 999,999 (Nine Hundred Ninety Nine Thousand, Nine Hundred Nintey Nine)

9) (i) Seventy five lakh thirty two thousand one hundred five

(ii) Nine crore seventy five lakh sixty three thousand four hundred fifty three

10) (i) Three hundred forty five thousand six hundred seventy eight

(ii) Eight million three hundred forty three thousand seven hundred ten

(iii) One hundred three million four hundred fifty six thousand seven hundred eighty nine

11) (i) 2,30,51,980 (ii) 66,345,027 (iii) 789,213,456

12) 26,345

13) 1,000,000 (One million)

Objective Type Questions

14) (a) 100 Crore

15) (b) 10000001

16) (c) 2

17) d) 6× 100000 + 7 × 10000 +0× 1000 +9× 100 +0× 10 +5× 1

Exercise 1.2

1) (i) 48792< 48972 (ii) 1248654> 1246854 (iii) 658794 = 658794

2) (i) False (ii) False (iii) True

3) The greatest number is 1386787215

The smallest number is 86720560

4) 128435 > 25840 > 21354 > 10835 > 6348

5) 76095321, 86593214 (Similarly, we can write many numbers)

6) 479, 497, 749, 794, 947, 974

7) 4698

8) The smallest Postal Index Number is 631036

The largest Postal Index Number is 631603

9) (i) Anaimudi (ii) 2695 > 2637 > 1778 > 1647 (iii) 1048 m

10) (c) 134205, 134208, 154203

11) (a) 1489000 and 1492540

12) (d) 26

Exercise 1.3

1) (i) 360 (ii) 150 (iii) 1

2) (i) False (ii) True (iii) False

3) 11910

4) 2,15,750

5) 39,000 bicycles

6) ₹ 2500

7) (i) 9 (ii) 11 (ii) 107

8) (d) 1

9) (b) 12

10) (c) ×

Exercise 1.4

1) (i) 800 (ii) 1000 (iii) 90,000

2) (i) False (ii) True (iii) False

3) (i) 4100 (ii) 45,000 (iii) 90,000 (iv) 51,00,000 (v) 30,00,00,000

4) 1,90,000

5) (i) 12,300 (ii) 18,99,600

6) 3,37,000

7) (b) 10855

8) (c) 76800

9) (a) 9800000

10) (b) 165000

Exercise 1.5

1) (i) 1 (ii) 34 (iii) 0 (iv) Zero (v) one

2) (i) False (ii) False (iii) True (iv) True (v) True

3) (i) Commutativity for Addition (ii) Associativity for Multiplication

(iii) Zero is Additive Identity (iv) One is Multiplicative Identity

(v) Distributivity of Multiplication over Addition

4) (i) 5100 (ii) 3,00,000 (iii) 13,200 (iv) 334

5) (b) 0

6) (d) 59

7) (a) an even number

8) (b) 0

9) (c) 2/0

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

Exercise 1.6

1) 87543

2) Ascending Order : 6,85,48,437 < 7,21,47,030 < 7,26,26,809 < 9,12,76,115

Descending Order: 9,12,76,115 >7,26,26,809 >7,21,47,030 > 6,85,48,437

3) (i) 1706 tigers in 2011 (ii) 2100 (iii) 520 tigers increased from 2011 to 2014

4) among 6 friends, each of them get 37 apples. 3 apples left over

5) 515 + 1 = 516 trays required

6) (i) Indian System:Two crore fifty nine lakh forty one thousand nine hundred

International System : Twenty five million nine hundred forty one thousand nine hundred

(ii) 5,50,500 (iii) Eighty six crore forty lakh seven hundred thirty

(iv) Ninteen million eight hundred eighty eight thousand eight hundred

(v) Indian System : 60,53,100 - Sixty lakh fifty three thousand one hundred

International System : 6,053,100 - Six million fifty three thousand one hundred

7) One of the answers is 43781. Many answers are possible

8) (i) 85 rows are required to fill 7650 chairs (ii) The remaining chairs are 39

9) Yes, both are same (30,00,000)

10) Relevant answers are yours

CHAPTER 2 - ALGEBRA

Exercise 2.1

1) (i) Variables (ii) Different (iii) n

2) (i) False (ii) True (iii) False

3)

Shapes	1st Pattern	2nd Pattern	3rd Pattern	4th Pattern	5th Pattern
Squares	1	2	3	4	5
Circles	1	2	3	4	5
Triangles	2	4	6	8	10

4) a) 3n b) 4n

5) 5p

6) Arivazhagan's age is 'n-30'

7) (i) u + 2 (ii) u – 2

Objective Type Questions

8) c) can take different values

9) c) $6 \times y$

10) a) x - 4

11) d) $7w$

12) d) 22

Exercise 2.2

1) (i) f - 5 (ii) $\frac{s}{5}$ (iii) 10 less to 2 times m
(iv) n - 7 (v) 17

2) (i) False (ii) True (iii) False (iv) True (v) False

3) (i) t + 100 (ii) 4q (iii) 8 - y (iv) 56 + $2x$ (v) $9y$ - 4

4) (i) x divided by 3 (ii) 12 less to 5 times n (iii) 11 added to 10 times x
(iv) product of 70 and s

5) Vetri's answer is correct

6) (i) 13 (ii) 299; 301 (iii)18

7)

k	3	6	9	12	15	18
$\frac{k}{3}$	1	2	3	4	5	6

The value of 'k' is 15.

8) b) $y = 6$

9) a) n - 6 = 8

10) c) c = 24

Exercise 2.3

1) 8; 77; 666; 5555; 44444; 333333

2) (i) 4s (ii) 3s

3)

8	7	7	8	=30
8	8	10	10	=36
8	10	7	7	**=32**
8	7	10	7	**=32**
=32	**=32**	**=34**	**=32**	**=130**

4) k = 3; m = 1; n = 10; a = 9; b = 6; c = 4; x = 4; y = 9.

5) 19

6) (i) P=2; Q=8; R=6; S=10

(ii)

Rectangle	P	Q	R	S	T
Number of squares along the breadth	2	2	2	2	2
Number of squares along the length	1	4	3	5	x
Total number of squares in rectangle	2	8	6	10	$2x$

7)

x 6	0 0		t 3	8	
0		z 2	5		p 9
v 3	6	5		k 4	9
0			u 2	4	
		a 6	0		m 1
	s 2	4	7		0

CHAPTER 3 - RATIO AND PROPORTION

Exercise 3.1

1) (i) 3 : 5 (ii) 3 : 2 (iii)9 : 10 (iv)3 : 8

2) (i) True (ii) False

3) (i) 3 : 4 (ii) 4 : 3 (iii) 7 : 15 (iv) 4 : 9 (v) 3 : 4

4) 5 : 3

5) 1 : 3

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

7) (d) 5 : 1

8) (c) 2 : 1

9) (d) 10 : 7

10. (b) 3 : 4

11. (c) 5 : 1

Exercise 3.2

1) (i) 15 (ii) 8 (iii) 12

2) (i) 36 inches, 6 Feet (ii) 14 days, 9 weeks

3) (i) False (ii) True

4) (i) 6 : 4, 9 : 6 (ii) 2 : 12, 3 : 18 (iii) 10 : 8, 15 : 12

5) (i) 4 : 5 is larger than 8 : 15 (ii) 7 : 8 is larger 3 : 4 (iii) 2 : 1 is larger than 1 : 2

6) (i) 12, 8 (ii) 12, 15 (iii) 12, 28

7) (i) Rs.2400 (ii) Rs.1600

8) 27 cm, 36 cm

9) (a) 6

10) (d) 12 : 21

11) (d) 20/28

12) (c) Rs.1000

Exercise 3.3

1) (i) 12 (ii) 9 (iii) 4; 12 (iv) 24; 2

2) (i) False (ii) False (iii) False

3) (i) 3 : 9 : : 4 : 12 (ii) 9 : 3 : : 12 : 4

4) Yes

5) (i) Yes (ii) No

6) Yes

7) (c) 2 : 5 , 10 : 25

8) (d) 8

9) (c) 35

Exercise 3.4

1) (i) Rs.30 (ii) 25 days

2) (i) True (ii) False

3) 80 Pages

4) 24 Chairs

5) 75km

6) 2 km

7) 44 points

8) Asif's run rate is better

9) My friend's rate of purchase is better than me.

10) (b) 270

11) (c) 35

12) (c) 6 km

Exercise 3.5

1) (i) 1 : 4 (ii) 4 : 5 (iii) 1 : 5 (iv) Ratio of elephant to cheetah is least

2) 60 teachers and 6 administrators

3) (i) 2 : 1 (ii) 1 : 3 (iii) 12 ratios

4) A : B = 2 : 1, B : C = 2 : 1; They are in proportion.

5) (a) $\frac{1}{4}$ cup (b) 8 cups

(c) Ragi flour, Raw rice and water are in one unit, Sesame oil and salt are in different units. these different units cannot be compared and cannot be expressed as a ratio.

6) 2 : 1

7) There are four different ways.

8) Team B has better record

9) The standard 8 is the least ratio

10) The four different answers are : 1 and 90; 2 and 45; 30 and 3; 5 and 18; 6 and 15

11) 29 : 44

12) (a) Black balls (b) 96 balls (c) 32 balls, 24 balls

CHAPTER 4 - GEOMETRY

Exercise 4.1

1) i) $\overleftrightarrow{AB}$ ii) $\overline{BA}$ iii) One

2) 10, $\overline{PQ}, \overline{PA}, \overline{PB}, \overline{PC}, \overline{AB}, \overline{BC}, \overline{CQ}, \overline{AQ}, \overline{BQ}, \overline{AC}$,

3) $\overline{XY}$=2.4 cm, $\overline{AB}$=3.4cm, $\overline{EF}$=4 cm, $\overline{PQ}$=3cm.

5) (i) $\overleftrightarrow{EF}$ and $\overleftrightarrow{GH}$, $\overleftrightarrow{CD}$ and $\overleftrightarrow{AB}$ (ii) $\overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{EF}$, $\overleftrightarrow{CD}$ and $\overleftrightarrow{GH}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{GH}$

(iii) P, Q, R and S

6) (i) $\overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$, $\overleftrightarrow{CD}$ and $\overleftrightarrow{IJ}$, $\overleftrightarrow{EF}$ and $\overleftrightarrow{IJ}$

(ii) $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{EF}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{IJ}$, $\overleftrightarrow{GH}$ and $\overleftrightarrow{IJ}$, $\overleftrightarrow{AB}$ and $\overleftrightarrow{GH}$

(iii) P, Q and R