Contents

1. Knowing the Numbers 5
2. Whole Numbers 15
3. Playing with Numbers 19
   - Revision Test Paper-I 31
4. Integers 33
5. Fractions 44
6. Decimal 65
   - Revision Test Paper-II 75
   - Model Test Paper-I 77
7. Introduction to Algebra 79
8. Ratio and Proportion 87
9. Basic Geometrical Ideas 104
   - Revision Test Paper-III 118
10. Understanding Elementary Shapes 120
11. Mensuration 141
12. Data Handling 151
    - Revision Test Paper-IV 156
    - Model Test Paper-II 158
    - Answers 160

1 Knowing the Numbers

Till now, we have learnt that every digit has a place value as well as face value. Face value of a number does not change whereas place value changes according to the position of the digit in a numeral.

No doubt, numbers play an important role in our daily life. We use them to count objects. We use them to arrange objects or collection in order.

In this chapter, we will learn how to count or calculate to solve problems in our daily life. We shall also learn how to recognize, read and write large numbers and do all the four fundamental operations i.e. Addition, Subtraction, Multiplication and Division.

Let us recall and review what we have learnt earlier.

Numbers

A number such as 1, 2, 3 ..... etc is a symbol which is used to count or calculate. There are nine symbols in counting numbers. Every number has a name which is written in words. For example, one, two, three etc. These numbers are called Counting numbers.

We can divide counting numbers in two groups—**Natural numbers** and **Whole numbers**.

Natural Numbers

Counting numbers are called natural numbers. The first counting number is **1** and the last one is **infinity** as each numbers has its successor. We denote the set of natural number by N.

N = {1, 2, 3, 4 ....}

Whole Numbers

When we include 0 in the set of natural numbers, we get a set of **whole numbers**.

We denote the set of whole number by W.

W = {0, 1, 2, 3, ...}

Facts to Know

- The smallest natural number is 1.
- We cannot find the largest natural number.

Successor

When one is added to a given natural number, we get the **successor** of that number. Hence, successor of 1 is 1 + 1 = 2, successor of 2 is 2 + 1 = 3, successor of 3 is 3 + 1 = 4 and so on.

Predecessor

When one is subtracted from a given natural number, we get the **predecessor** of that number. Hence predecessor of 2 is 2 −1=1, predecessor of 3 is 3 − 1 = 2, predecessor of 4 is 4 − 1 = 3 and so on.

Facts to Know

- Every natural number has a successor but every natural number does not have predecessor.

Formation of Numbers with Digits

Let us consider the digits 3, 8 and 9. We can form different numbers using these three digits. The numbers are 389, 398, 839, 893, 938, 983. Here, the greatest number is 983 and the smallest number is 389.

Ascending Order

Ascending order means the arrangement of numbers from the smallest number to the largest number.

Descending Order

Descending order means the arrangement of numbers from the greatest number to the smallest number.

If one of the digits is a zero, then, place the zero at the second position while making the smallest number and place zero at the last while making the largest number.

Comparison of Numbers

We follow the following procedure while comparing two natural numbers:

- The number with more digits is greater than the number with less digits.
- When the numbers have the same number of digits, we follow the following steps:
  - We first compare the left most place from the given numbers.
  - If they are equal, we compare the second digit from the left.
  - If the second digit from the left is also equal, we compare the third digit from the left and continue this process till we find different digits at the corresponding places.
  - The number with greater digit is greater.

Example 1 : Write the successor of each of the following :

(i) 209 (ii) 750 (iii) 1155 (iv) 6412

Solution : The successors are :

(i) $209 + 1 = 210$ (ii) $750 + 1 = 751$ (iii) $1155 + 1 = 1156$ (iv) $6412 + 1 = 6413$

Example 2 : Write the predecessors of each of the following :

(i) 126 (ii) 877 (iii) 1001 (iv) 3105

Solution : The predecessors are :

(i) $126 - 1 = 125$ (ii) $877 - 1 = 876$ (iii) $1001 - 1 = 1000$ (iv) $3105 - 1 = 3104$

Example 3 : Using the following digits make the greatest and the smallest 4-digit numbers without repeating the digits.

(i) 7, 6, 9, 8 (ii) 3, 5, 1, 7 (iii) 8, 4, 9, 1 (iv) 8, 6, 7, 1

Solution :

(i) Greatest : 9876 Smallest : 6789

(ii) Greatest : 7531 Smallest : 1357

(iii) Greatest : 9841 Smallest : 1489

(iv) Greatest : 8761 Smallest : 1678

Example 4 : Compare 7580 and 12512.

Solution : Here 7580 has four digits while 12512 has five digits.

We know that number having more digits is greater

$\therefore 12512 > 7580$

Example 5 : How many 3 digit numbers can be formed by using the digits 0, 4 and 7 without repeating any digit.

Solution : Placing 0 at one's place, we can have two natural numbers 470 and 740. While placing 0 at tens place we can have two natural numbers 407 and 704.

Zero cannot be placed at hundreds place.

Hence, the numbers are 470, 740, 407 and 704.

Example 6 : Which is greater : 96428 or 96728

Solution : Here both the numbers have five digits.

Ten thousands place and thousands place both the numbers have same digits.

At hundreds place the first number is 4 while the second number is 7.

We know that 7 > 4

Hence, 96728 > 96428

Exercise 1.1

1. **Give answers of the following questions :**
   (a) Write the smallest natural number.
   (b) Write the largest natural number.
   (c) Write the smallest 3-digit natural number.
   (d) Write the largest 3-digit natural number.
2. **Write the successors of the following natural numbers:**
   (a) 69 (b) 786 (c) 1252 (d) 6789
3. **Write the predecessors of the following natural numbers:**
   (a) 40 (b) 251 (c) 5000 (d) 39283
4. **Write all counting numbers between :**
   (a) 35 and 49 (b) 105 and 129 (c) 5212 and 5221 (d) 8413 and 8425
5. **Write four consecutive natural numbers starting from 23.**
6. **Arrange the following numbers in the descending order:**
   (a) 1507, 948, 126, 288 (b) 1515, 262, 2403, 175
   (c) 91, 285, 476, 8412 (d) 976, 5628, 3784, 1789
7. **Arrange the following numbers in the ascending order:**
   (a) 178, 6965, 1150, 864 (b) 890, 860, 712, 700
   (c) 88, 69, 115, 162 (d) 2003, 2006, 2018, 1989
8. **Write the smallest five-digit number, without repeating the digits, for the following:**
   (a) 5, 3, 7, 6, 2 (b) 8, 3, 1, 5, 7 (c) 3, 6, 4, 1, 2 (d) 4, 7, 0, 2, 9
9. **Write the largest five-digit number, without repeating the digits, for the following:**
   (a) 8, 1, 5, 7, 9 (b) 2, 3, 4, 7, 0 (c) 4, 9, 6, 5, 2 (d) 6, 9, 3, 4, 7
10. Write all 3-digit even numbers which can be formed using the digits 8, 6 and 3 without repeating any digit.
11. How many times does 9 occur if we write all counting numbers from 1 to 100?

Place Value and Face Value

When a number has more than one digit, each digit has a value depending upon its position. For example, 83 is a 2-digit number. We can expand 83 as follows :

$$83 = 80 + 3 = 8 \times 10 + 3$$

In the same way, we can expand a 3-digit number say 345 as :

$$345 = 300 + 40 + 5$$

$$= 3 \times 100 + 4 \times 10 + 5$$

Here, 5 is at ones place, 4 is at tens place and 3 is hundreds place.

Again the expansion of 6475 is

$$6475 = 6000 + 400 + 70 + 5$$
$$= 6 \times 1000 + 4 \times 100 + 7 \times 10 + 5$$

Thus, the place value of a digit depends upon its position in the number. But face value of a digit remains the same. It does not depend upon the position it occupies.

A numeral can be represented by either of the following place value charts – **Indian System** and **International System**. Let us look at the place value division in both the systems.

Facts to Know

- The face value of a digit is the value of the digit itself. It never changes.

Indian System

The table given below shows the Indian System of Numeration.

Arabs		Crores		Lakhs		Thousands		Ones		
Ten Arabs	Arabs	Ten Crores	Crores	Ten Lakhs	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones
10,00,00,00,000	1,00,00,00,000	10,00,00,000	1,00,00,000	10,00,000	1,00,000	10,000	1000	100	10	1

In Indian system of numeration, the periods are separated into Ones, Thousands, Lakhs, Crores and Arabs. The Ones period has three digits and the remaining periods have two digits each.

For example: 5, 76, 028 is read in five lakh, seventy six thousand and twenty eight.

International System

The following table shows the International System of numeration :

Billions			Millions			Thousands			Ones		
Hundred Billions	Ten Billions	Billions	Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
100,000,000,000	10,000,000,000	1,000,000,000	100,000,000	10,000,000	1,000,000	100,000	10,000	1000	100	10	1

In International System of numeration, the periods are separated into Ones, Thousands, Millions and Billions. Each period has three digits. Periods make the number easier to read the number.

For example : 576028 is read as Five hundred seventy six thousand and twenty eight.

Example 7 : According to Indian System of numeration find the place value and face value of each digit in 684295.

Facts to Know

- 1 million = 10 lakh
- 1 billion = 100 crore

Solution : According to the Indian system of numeration, the digits of the given number are arranged in the following way :

Lakh	Ten Thousands	Thousands	Hundreds	Tens	Ones
6	8	4	2	9	5

(i) The place value of 5 is 5 ones
The face value of 5 is 5 = 5

(ii) The place value of 9 is 9 tens = $9 \times 10 = 90$
The face value of 9 is 9

(iii) The place value of 2 is 2 hundreds = $2 \times 100 = 200$
The face value of 2 is 2

(iv) The place value of 4 is 4 thousands = $4 \times 1000 = 4000$
The face value of 4 is 4

(v) The place value of 8 is 8 ten thousands = $8 \times 10,000 = 80,000$
The face value of 8 is 8

(vi) The place value of 6 is 6 lakhs = $6 \times 1,00,000 = 6,00,000$
The face value of 6 is 6

Example 8 : Write 4652678 in the International System of numeration.

Solution : First Arrange the number in periods, then put comma as given below:

M T O
4, 652, 678

The number is read as four million six hundred fifty two thousand and six hundred seventy eight.

Example 9 : Write the following in numeric form and put commas accordingly.

(i) Eight crore sixty two lakh twenty five thousand four hundred five.

(ii) Sixty two million four hundred forty thousand and seven hundred two

Solution : (i) 8, 62, 25, 405

(ii) 62, 440, 702

Example 10 : Read the following number as per International System of numeration. Also write them in the place value chart.

(i) 675320 (ii) 4278325 (iii) 26754308 (iv) 58436729

Solution : (i) Six hundred seventy five thousand, three hundred and twenty

(ii) Four million, two hundred seventy eight thousand, three hundred twenty five

(iii) Twenty six million, seven hundred fifty four thousand and three hundred eight.

(iv) Fifty eight million, four hundred thirty six thousand, seven hundred twenty nine.

Now, we arrange these numerals in place value chart:

T.M	M	H.Th	T.Th	Th	H	T	O
		6	7	5	3	2	0
	4	2	7	8	3	2	5
2	6	7	5	4	3	0	8
5	8	4	3	6	7	2	9

Exercise 1.2

1. Find the place value and the face value of the digits in the following numerals as per the Indian system of numeration.

(a) 6 in 62580 (b) 8 in 472816 (c) 5 in 6567 (d) 9 in 98654

(e) 6 in 25689 (f) 7 in 76984 (g) 5 in 15887 (h) 2 in 42895

2. Write the following in words according to Indian System of numeration.

(a) 486921 (b) 589708 (c) 767891 (d) 786529

(e) 795638 (f) 824905 (g) 358762 (h) 976428

3. Write the following numerals in words according to International System of numeration.

(a) 485567 (b) 486528 (c) 5892068 (d) 6425895

(e) 6756243 (f) 6251352 (g) 8948842 (h) 3462548

4. Write the following numerals with proper commas for the following.

(a) Sixty lakh fifty seven thousand five hundred twenty one.

(b) Eighty two lakh twenty three thousand six hundred and forty six

(c) Seven crore five lakh twenty two thousand three hundred ninty six.

(d) Sixty five million four hundred twenty seven thousand and three hundred seventy eight

(e) Eighty seven million six hundred thirty eight thousand and six hundred twenty eight

(f) Sixty million nine hundred thirty six and seven hundred five

(g) Two billion eight million nine hundred thirty eight thousand and four hundred seventy two

5. Fill in the blanks of the following.

(a) 1 million = ... lakh

(b) 10 million = ... crore

(c) 1 crore = ... lakh

(d) 1 lakh = ... thousands

Comparison of Numbers

As we know, there are following two rules for the comparison of numbers:

Rule 1 : The number with more digits is greater.

Rule 2 : If the number have same number of digits in both the numbers, then

Step 1 : First compare the left most digit in both the numbers.

Step 2 : If they are equal in value, then compare the second left most digit in both the numbers.

Step 3 : If they are also equal in value, then compare the third left most digit in both the numbers.

Step 4 : Continue this process, until you get the unequal digits.

Clearly, the number with greater digit will be greater.

Example 1 : Compare the following numbers:

(a) 834652 and 7045192 (b) 6204569 and 6204569

(c) 28565291 and 28564721

Solution : (a) 834652 and 7045192

Since 7045192 has more digits than 834652

∴ 834652 < 7045192

(b) 6204569 and 6204569

Let us arrange the given numbers in a place value chart

Ten Lakhs	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones
6	2	0	4	5	6	9
6	2	0	4	5	6	9

Clearly, both the numbers are same.

∴ 6204569 = 6204569

(c) 28565291 and 28564721

Let us arrange the given numbers in a place value chart

Crores	Ten Lakhs	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones
2	8	5	6	5	2	9	1
2	8	5	6	4	7	2	1

Clearly, at the thousands place 5 > 4.

∴ 28565291 > 28564721

Example 2 : Arrange the following numbers in ascending order :

31204751, 1243039, 29300597, 31121469, 83456721

Solution : Let us arrange the given numbers in a place value chart :

Crores	Ten Lakhs	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones
3	1	2	0	4	7	5	1
	1	2	4	3	0	3	9
2	9	3	0	0	5	9	7
3	1	1	2	1	4	6	9
8	3	4	5	6	7	2	1

Clearly, from the place value chart:

1243039 < 29300597 < 31121469 < 31204751 < 83456721

Hence, the ascending order of given numbers are:
1243039, 29300597, 31121469, 31204751, 83456721

Example 3 : Arrange the following numbers in descending order :
7642008, 83407295, 53487029, 4302013, 3010542

Solution : Let us arrange the given numbers in a place value chart :

Crores	Ten Lakhs	Lakhs	Ten Thousands	Thousands	Hundreds	Tens	Ones
	7	6	4	2	0	0	8
8	3	4	0	7	2	9	5
5	3	4	8	7	0	2	9
	4	3	0	2	0	1	3
	3	0	1	0	5	4	2

Clearly, from the place value chart:
83407295 > 53487029 > 7642008 > 4302013 > 3010542
Hence, the descending order of given numbers are :
83407295, 53487029, 7642008, 4302013, 3010542

Exercise 1.3

1. **Compare (>, <, =) the following numbers:**
   (a) 85129861 and 79151562
   (b) 4201568 and 438500
   (c) 9246802 and 9246802
   (d) 2852110 and 2852110
   (e) 4320156 and 4320159
   (f) 7642348 and 7642337
2. **Arrange the following numbers in ascending order:**
   (a) 72791, 38170, 35507, 36105
   (b) 43565103, 7384015, 1045621, 98004865, 32465902
   (c) 2045629, 1245203, 74305709, 8420659, 1090405
   (d) 40506080, 12450311, 60050102, 15112011, 70051121
   (e) 983400974, 4352629, 70080405, 3040129, 83400291
3. **Arrange the following numbers in descending order:**
   (a) 5150, 5990, 75200, 6710
   (b) 28460011, 1004691, 2709472, 7642095, 834280095
   (c) 8706512, 3326594, 5426179, 8050672, 708059162
   (d) 5040550, 4121127, 4495821, 5142125, 4652112
   (e) 98370521, 73226459, 83462050, 60402032, 54005906

Points to Remember

- Counting numbers are called **Natural Numbers.**
- There are 10 symbols to denote numbers. They are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.
- The place value of any digit depends on its position in the number.
- The smallest natural number is 1.
- The face value of any digit is the digit itself regardless of its position in the number.
- There are two numeration systems — the Indian System and the International System.
- The periods in the Indian System of numeration are ones, thousands, lakhs, crores, and arabs.
- The first three places from the right makes the ones period, the next two places make the thousands period and the next two places make the lakhs period and so on, in the Indian System of numeration.
- The periods in the International System of numeration are hundreds, thousands, million, and billions.
- The first three places from the right make the ones period, the next three places make the thousands period and the next three places make millions period, and so on in the International System of numeration.
- To measure length we use metre or kilometre.
- To measure weight we use gram or kilogram.
- To measure capacity we use litre or kilolitre.

EXERCISE

1. MULTIPLE CHOICE QUESTIONS (MCQs):

Tick (✓) the correct options :

(a) The smallest natural number is :

(i) 0 ☐ (ii) 1 ☐ (iii) 2 ☐ (iv) 9 ☐

(b) The successor of 101 is :

(i) 100 ☐ (ii) 99 ☐ (iii) 102 ☐ (iv) 105 ☐

(c) Twenty four crore, six thousand seven can be written in numeral as:

(i) 240060007 ☐ (ii) 24000600 ☐ (iii) 24000067 ☐ (iv) 2406007 ☐

(d) The place value of 7 in 8975423 is:

(i) 7000 ☐ (ii) 70,000 ☐ (iii) 700000 ☐ (iv) 700 ☐

(e) The capacity of an eye drop medicine is 50 ml, how may days will it last if a patient uses it 5 ml 5 times a day?

(i) 1 day ☐ (ii) 2 day ☐ (iii) 3 day ☐ (iv) 4 days ☐

(f) If a swimmer crosses 1 km 75m tunnel, the distance covered in m is:

(i) 1750 m ☐ (ii) 1075 m ☐ (iii) 1175 m ☐ (iv) 10075 m ☐

(g) Total weight of three geometry box weighing 25 g, 75 g and 80 g is:

(i) 180 g ☐ (ii) 280 g ☐ (iii) 80 g ☐ (iv) 200 g ☐

2. **Arrange the following numbers in the ascending order:**

(a) 519, 410, 1011, 712, 918 (b) 9008, 9080, 9280, 8009, 8090

(c) 315, 169, 181, 692, 715 (d) 4028, 4008, 4800, 4828, 4598

3. **Arrange the following numbers in the descending order:**

(a) 272, 467, 298, 359, 978 (b) 991, 919, 979, 969, 999

(c) 1985, 7891, 4258, 3981, 8175 (d) 7890, 7889, 7650, 7668, 7968

4. **Write the following numbers in words according to International System of numeration.**

(a) 295678 (b) 487621 (c) 410135

(d) 6425895 (e) 17563289 (f) 68615001

5. **Write the following numerals in words according to Indian System of numeration:**

(a) 1083756 (b) 8081993 (c) 98188305

(d) 75618830 (e) 2593247 (f) 78192348

HOTS

I am a two digit number below 50. The sum of the digits is 13. The product of the digit is 36. Who am i?

Lab Activity

Objective : To use number cards to compare numbers.

Materials Required : A chart

Procedure :

Cut a 10 cm × 10 cm piece of chart paper for each student in a class. On each card print any digit from 0 to 9. Draw the chart given below such that each cell is about 10 cm × 10 cm.

- Divide the class into groups of nine each. Each group selects one person as its leader. The groups are named A, B, C, etc.
- Each student select a card without looking at the printed number on it.
- Each student in each group is now required to fix his/her number card on the chart in any blank space on the chart in the row assigned to his/her team.
- Once every student has fixed his/her number on the chart, the leader of each group reads out the number formed.

	1	2	3	4	5	6	7	8	9
A									
B									
C									
D									
E									

- The group with the largest nine-digit number is the winner.

2 Whole Numbers

We have learnt that counting numbers are called natural numbers. The smallest natural number is 1. Natural numbers are denoted by N.

Thus, N = {1, 2, 3, 4, 5, ...}

In our daily life we come across many situations where the result cannot be represented by a natural number. Suppose Gopi had 15 toffees. He gave 10 toffees to her sister and 5 toffees to his friend. How many toffees were left with him? Certainly there were no toffee left with him. To denote 'no' or 'nothing' one more symbol is introduced, which is called **zero (0)**. It is not a part of natural number. The set of natural numbers along with zero gives a set of numbers called whole numbers. Whole numbers are denoted by W.

Thus, W = {0, 1, 2, 3, 4, ...}

Facts to Know

The number system was developed in India around the 3rd century BC but the use of zero started around 700 AD. In India the word for zero was 'shunya' that means nothing. The Arabs called it 'cypher' meaning nothing, which later became zero.

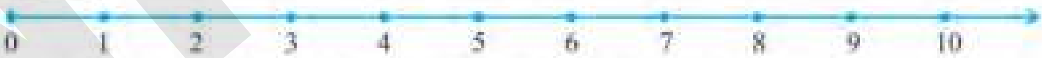
The concept of zero had played a significant role in the development of Mathematics. It helped to develop the decimal place value system of numbers. In spite of having no value itself, zero adds to the value of a number. As we know 10 becomes 100, 100 becomes 1000 and so on by merely adding zero to the right of a natural number.

In this chapter, we will learn about whole numbers, their properties and the process of formulation of patterns.

Representation of Whole Numbers on Number Line

To represent whole numbers on a number line, we proceed as follows:

- Draw a line and mark a point 0 on it representing the number zero.
- Mark another point to the right of zero and label it 1. The distance between these points labelled as 0 and 1 is called a unit distance.



- Mark another point to the right of 1 at a unit distance and name it 2. Continue labelling points at unit distances to the right and label them as 3, 4, 5, ... on the line as shown in the figure.

  Now, answer the following questions:

  What is the distance between the points 4 and 9 ? Obviously it is 5 units.

  What is the distance between 3 and 7? It is 4 units. On the number line, we see that 7 is to the right of 3.

  $\therefore 7 > 3$. Similarly, 8 is to the right of 7 and 10 is to the right of 9.

  Thus, from the number line we observe that :
- The number on the right of the other number is greater number.
- Every whole number has its successor. Successor of 0 is 1, of 1 is 2, of 2 is 3 and so on. Thus, there are infinite number of whole numbers.
- 0 is the smallest whole number.

Addition on Number line

Addition of whole numbers can be shown on the number line. Let us represent addition of 2 and 5.

From 0 we move two steps towards right and then move five more steps towards right. We reach to the point 7.

Thus, the sum of 2 and 5 is 7, i.e. $2 + 5 = 7$

Subtraction on Number line

Subtraction of two whole numbers can also be shown on the number line. Let us find $7 - 4$.

From 0, we move 7 steps to the right and reach point A. Now we move 4 steps to the left of A. We reach the point B which represents 3. Thus, $7 - 4 = 3$

Facts to Know

If any whole number (except 0) is subtracted from zero, then the result is not a whole number.

Multiplication on Number Line

Now we shall represent multiplication of whole numbers on the number line. Let us find 3×4.

From 0 we move 3 steps towards right and reach point A. Repeat this move three times and we reach point B. What does the point B indicates? It indicates the movement of 12 steps to right of zero (0).

Thus, $3 \times 4 = 12$.

Exercise 2.1

1. Write the next four natural numbers after 10799.
2. Write the three whole numbers occurring just before 12001.
3. How many whole numbers are there between 78 and 89.
4. **Write the predecessor of:**

   (a) 75 (b) 15001 (c) 101010 (d) 32546
5. **Write the successor of:**

   (a) 178 (b) 354568 (c) 49999 (d) 297805
6. **See the following pairs of numbers, write which while number is on the left of the other number on the number line. Also write them with the appropriate sign (>,<) between them.**

   (a) 997 , 979 (b) 92392 , 92932 (c) 320001 , 320101 (d) 999949 , 100049

Points to Remember

- To count things, natural numbers are used. 1 is the smallest natural number.
- The set of whole numbers is denoted as W = {0, 1, 2, 3, ...}
- We can represent whole numbers on number line.
- Zero (0) is the smallest whole number.
- We can add and subtract whole numbers on number line.
- We can also find the multiplication of whole numbers on number line.

EXERCISE

1. **MULTIPLE CHOICE QUESTIONS (MCQs):**

   Tick (✓) the correct options.

   (a) Which number was introduced to the set of natural numbers (N) to make it a whole number set?

   (i) 2 ☐ (ii) − 2 ☐ (iii) 0 ☐ (iv) − 5 ☐

   (b) On number line, 550 lies on .... side of 505.

   (i) left ☐ (ii) right ☐ (iii) centre ☐ (iv) none ☐

   (c) Which whole number is not used as divisor ?

   (i) 1 ☐ (ii) 2 ☐ (iii) 5 ☐ (iv) 0 ☐

   (d) Which one is the multiplicative identity for whole numbers?

   (i) 0 ☐ (ii) 1 ☐ (iii) − 1 ☐ (iv) 2 ☐

   (e) What will be the sum of first n odd natural numbers?

   (i) n + 1 ☐ (ii) n − 1 ☐ (iii) 2n ☐ (iv) n^2 ☐

   (f). To make a perfect square by using dots, the number of rows must be .... to the number of columns.

   (i) less ☐ (ii) more ☐ (iii) unequal ☐ (iv) equal ☐

2. In a marriage hall, 28 chairs are arranged in a single row. Find the number of chairs if there are 15 such rows.

3. In a town 1 out of 30 people owns a motorcycle. If the total population of town is 67500, then how many people do have motorcycles?

4. Ritesh and Hitesh went for a long drive. They covered 210 km in 3 hours and still driving. After 10 hours they decided to drive for 1 more hours. Find the total distance travelled by them.

5. Saurabh distributes 4 boxes of sweets. Each box contain 6 chocolates and 8 candies. How many sweets are there in these 4 boxes?

   (Hint : Based on distributive property)

6. A truck is loaded with 150 drums of water. On reaching the first dealer, it unload 100 drums and unloads 20 drums on reaching second dealer. How many drums of water were left?

7. Tina secured 62 marks in Dance & Drama and 89 marks in English, whereas Twinkle secured 87 marks in English and 69 marks in Dance & Drama. Who secured better marks in the aggregate of subjects?

HOTS

Give two examples each for explaining why associative property is not true for subtraction and division.

Lab Activity

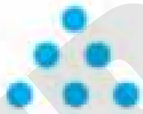
Objective : Making of elementary shapes by arranging numbers in a pattern.

Materials Required : White colour chart paper, green coloured round **bindis.**

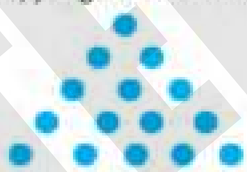
Procedure :

- To make a triangle you need three bindis.

- When you add 3 more bindis to these 3 bindis, you get 3 + 3 = 6 bindis
- You can make a pattern like :



- Now, if 4 is added to 6, you get 6 + 4 = 10. Your will get a patten like this:



- Similarly, next triangle can be formed as 10 + 5 = 15
- You can make more triangles of bindis by following the pattern.

3
3 + 3 = 6
6 + 4 = 10
10 + 5 = 15
15 + 6 = 21
and so on.

3 Playing with Numbers

In the previous class, you have studied about the concept of factors and multiples. You have also studied about the patterns in numbers. In this chapter, you will study about the problems involving more than one operations.

BODMAS Rule

We follow the BODMAS rule to solve the problems where more than two operations are involved.
Look at each of the letters.

- **B** stands for Brackets
- **O** stands for Of (multiplication)
- **D** stands for Division
- **M** stands for Multiplication
- **A** stands for Addition
- **S** stands for Subtraction

Always follow this order while solving problems involving more than one operations. The term 'operation' means addition, subtraction, multiplication, division, etc.

Example 1 : **Solve : 4 of $3\times6\div8$.**

Solutions : According to BODMAS rule, we will apply 'of ' then 'multiplication' and finally 'division'.

$4\times3\times6\div8$ (apply 'of')
$=12\times6\div8$ (apply 'multiplication')
$=72\div8$ (apply 'multiplication')
$=9$ (apply 'division')

If you do not follow BODMAS rule, you may get different result. Look at the problem.

$12-6\times4$
$=(12-6)\times4$
$=6\times4=24$ (apply 'subtraction before multiplication')

Correct Method

$12-6\times4$ (apply 'multiplication')
$=12-24$ (apply 'subtraction')
$=-12$

We get two different results for the same problem. There must be one standard method. Therefore, we must follow BODMAS rule.

Example 2 : **Solve $6\times5+4-9$**

Solution : Applying BODMAS rule we get the following.

$30+4-9$
$=34-9=25$

Example 3 : **Solve $16+8-10\times2$**

Solution : Applying BODMAS rule we will first perform 'multiplication', 'addition' and finally 'subtraction'.

$16+8-20$
$=24-20=4$

Example 4 : **Solve : 7 of 4 − 2 + 10 ÷ 5**

Solution : Similarly, we first perform 'of' operation followed by 'division', 'addition' and finally 'subtraction'.

$= 28 - 2 + 10 \div 5$

$= 28 - 2 + 2$

$= 30 - 2 = 28$

Example 5 : **Solve : 6 + 32 ÷ 2 of 4**

Solution : We first perform 'of' operation followed by 'division' and finally 'addition'.

$= 6 + 32 \div 8$

$= 6 + 4$

$= 10$

Example 6 : **Solve : $[2 \times \{4 + (12 - \overline{9+2})\} + 12 + 3]$**

Solution : $= [2 \times \{4 + (12 - 11)\} + 15]$ [solved firstly vinculum or brackets]

$= [2 \times 5 + 15] = 10 + 15$

$= 25$

While removing the sequence of brackets, we must keep in mind that –

'—' is the line bracket or vinculum to be removed first.

( ) is the simple bracket to be removed second.

{ } is the curly bracket to be removed third.

[ ] is the square bracket to be removed fourth.

Exercise 3.1

1. **Solve the following :**

(a) $12 + \{(64 \div 8) + 12\} \div 5$

(b) $35 - [25 - \{6 \times 3 + (14 - 6 \times 2)\}]$

(c) $[7 \times \{27 - 12 - 8 - 6\} \div 7$

(d) $[48 \div \{8 + 16 \div 4\}] + 6 - 5$

(e) $27 + \{(72 \div 9) + 27\} \div 7$

(f) $5\{(72 \div 9) \times 6 - 20\} - 8$

(g) $20 \div [10 - \{81 \div 9 - (24 - 5 \text{ of } 4)\}]$

(h) $16 + [32 - \{10 + 8 \div 4\}]$

Divisibility Rules

If we need to find whether a given number is divisible by any other number or not, we perform actual division. If the remainder comes zero, it means division process is complete. This method is called **long division** method. Therefore, we check a given number for its divisibility without actual division by using the test of divisibility. Let us do a quick revision of the same.

1. A number is divisible by 2, if the last or right most digit (ones digit) is 0, 2, 4, 6, or 8. The numbers divisible by 2 are called even numbers.
2. A number is divisible by 3, if the sum of its digits is divisible by 3.
3. A number is divisible by 4, if it is formed by last two digits tens and ones are either 00 (two zeroes) or divisible by 4.
4. A number is divisible by 5, if the last digit (ones digit) is either 0 or 5.
5. A number is divisible by 6, if it is even and the sum of its digits is divisible by 3. A number divisible by 6 is also divisible by 2 and 3.
6. A number is divisible by 7 if the difference between twice of the last digit and the number formed by other digits is either 0 or a multiple of 7.
7. A number is divisible by 8, if it is formed by the last three digits (hundreds, tens and ones) is divisible by 8. A number divisible by 8 is also divisible by 2 and 4.

8. A number is divisible by 9, if sum of its digits is divisible by 9.
9. A number is divisible by 10, if the right most digit (ones place) is 0. This number is also divisible by 2 and 5.
10. A number is divisible by 11, if the difference between the sums of alternate digits is either 0 or a multiple of 11.
11. A number is divisible by 12, if it is exactly divisible by both 3 and 4.
12. A number is divisible by 15, if it is divisible by both 3 and 5.
13. A number is divisible by 18, if it is divisible by both 9 and 2.
14. A number is divisible by 25, if the two digits are either 00 (two zeroes) or 25.

Exercise 3.2

1. **Test the divisibility of the following numbers by 6 :**
   (a) 2611 (b) 39235 (c) 902802
2. **Test the divisibility of the following numbers by 3 :**
   (a) 3771 (b) 2594 (c) 3564
3. **Test the divisibilily of the following numbers by 5:**
   (a) 13456 (b) 12095 (c) 26500
4. **Test the divisibility of the following numbers by 6 :**
   (a) 14692 (b) 4884 (c) 49077
5. **Test the divisibility of the following numbers by 9 :**
   (a) 257062 (b) 57969 (c) 94320
6. **Test the divisibility of the following numbers by 7 :**
   (a) 45843 (b) 78526 (c) 936607
7. **Test the divisibility of the following numbers by 11:**
   (a) 7326 (b) 8932 (c) 9790
8. Write down any ten number between 500 and 1000 which are divisibile by 3.
9. If a number is divisible by 8, then it is always divisible by ....
10. Write down the divisiblility test for 18.

Factors and Multiples

Numbers 1, 2, 4, 7, 14, and 28 are all exact divisors of 28, i.e. they leave no remainder.
So, 1, 2, 4, 7, 14 and 28 are factors of 28. Similarly, 1 and 19 are exact divisors of 19. So, 1 and 19 are factors of 19.

Factor

A factor of a number is an exact divisor of that number.

Therefore, we can say that –

- Every number other 1 has at least 2 factors.
- Every number is a factor of itself.
- Every factor is less than or equal to the given number.

Similarly, when a natural number 5 is multiplied with other natural numbers like 2, 3, 7 and 11, we get 10, 15, 35 and 55. Therefore, 10, 15, 35 and 55 are multiples of 5.

In the same way, we find out that 22, 33, 44, 55 are multiples of 11.

Multiple

When a number is multiplied by any natural number, we get a number which is known as multiple of a number.

Let us look at some examples.

Example 7 : Find all the factors of 36.

Solution : We can solve it by two methods :

1st method : 1 × 36 = 36, 2 × 18 = 36 , 3 × 12 =36, 4 × 9 = 36, 6 × 6 = 36. So, 1, 36, 2, 18, 3, 12, 4, 9, and 6 are factors of 36. Therefore, we have used multiplication method.

2nd method : 36 ÷ 1 = 36, 36 ÷ 2 = 18, 36 ÷ 3 = 12, 36 ÷ 4 = 9, 36 ÷ 6 = 6

We find out that quotient and divisor both are the factors of 36. Here division method is used to find factors.

So, 1, 2, 3, 4, 6, 9, 12, 18 and 36 are all factors of 36.

Facts to Know

- Zero (0) is not a natural number. Therefore, zero (0) can not have factors. If we multiply zero (0) with any natural number, we always get zero.

Example 8 : Find the first five multiples of 3.

Solution : We get 3 × 1 = 3, 3 × 2 = 6, 3 × 3 = 9, 3 × 4 = 12 and 3 × 5 = 15

Thus, 3, 6, 9, 12, 15, are the first five multiples of 3.

[One point to note here is that multiples are infinite but factors are limited. It is also possible that two or more numbers may have common multiples.]

Example 9 : Find the first five common multiples of 2 and 3.

Solution : Multiples of 2 = 2, 4 (6) 8, 10 (12) 14, 16 (18) 20, 22 (24) 26, 28 (30)

Multiples of 3 = 3 (6) 9 (12) 15 (18) 21 (24) 27 (30)

Five common multiples are 6, 12, 18, 24, and 30.

We notice that 6 is the first common multiple of both the numbers. It is the least common multiple in both the numbers.

You have already studied about prime numbers in your previous class, so we will not study it in details. We know that prime numbers have only two factors i.e., 1 and number itself.

How to find prime factors?

We can find prime factors in the following ways :

(a) Factor tree or prime factorisation

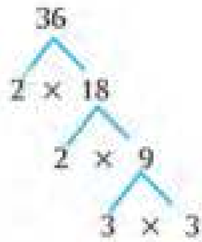
(b) Division method

Example 10 : Find all the prime factors of 36.

Solution : We use two methods.

(a) Factors tree or prime factorisation.

So, prime factors of 36 are 2 × 2 × 3 × 3.



Prime factorisation is a method in which we factorise a given number into a product of prime numbers.

(b) Division method

We simply factorise 36 to find the prime factors.

2	36
2	18
3	9
3	3
	1

Therefore, prime factors of 36 = 2 × 2 × 3 × 3

Exercise 3.3

1. **Find all the factors of the given numbers :**

   (a) 56 (b) 96 (c) 78 (d) 44 (e) 66 (f) 90

2. **Find the first five multiples of the following:**

   (a) 6 (b) 7 (c) 9 (d) 15 (e) 23 (f) 37

3. **Find all the prime factors of the following:**

   (a) 80 (b) 129 (c) 144 (d) 145 (e) 64 (f) 236

Types of Numbers

We can classify natural numbers into different types. Let us study one by one.

Even Number : A number which is either a multiple of 2 or divisible by 2 is called **even number.**

Example 11 : **Find the first five even numbers between 6 to 26.**

Solution : Five numbers between 6 and 26 are 8, 10, 12, 14.

Odd Numbers : A number which is not divisible by 2 or not a multiple of 2. We always get remainder as 1 when divide it by 2.

Example 12 : **Find the odd numbers between 7 to 19.**

Solution : The odd numbers between 7 to 19 are 9, 11, 13, 15, 17.

Prime Numbers : A prime number is a natural number which has only two factors.

Or

A multiple of 1 and the number itself.

Example 13 : **Try to find out the prime numbers.**

(i) 51 (ii) 79 (iii) 87 (iv) 93

Solution : (i) $51 = 3 \times 17$ or 1×51 (Number of factors are more than 2)

Hence, 51 is not a prime number.

(ii) $79 = 1 \times 79$ (Number of factors are only two)

Hence, 79 is a prime number.

(iii) $87 = 1 \times 87$ or 3×29 (Number of factors are more than 2)

Hence, 87 is not a prime number.

(iv) $93 = 1 \times 93$ or 3×31 (Number of factors are more than 2)

Hence, 93 is not a prime number.

Composite Numbers : These are the numbers with more than two distinct factors.

Example 14 : **Do you think 12 is a composite numbers or not.**

Solution : $12 = 1 \times 12$ or 2×6 or 4×3

Since 12 has more than 2 factors, i.e. 1, 2, 3, 4, 6, and 12 itself. Therefore, 12 is a composite number.

Facts to Know

The numbers 1 is neither prime nor composite number.

Twin Prime : It is a pair of prime numbers with the difference of only 2.

Example 15 : **Write any 3 pairs of twin prime numbers.**

Solution : By the concept of prime numbers and twin primes, we have (17, 19), (29, 31) and (41, 43) as the required twin prime numbers.

Prime Triplet : A set of three prime numbers which form and arithmetic sequence with common difference two is called a prime triplet.
(3, 5, 7) is the only prime triplet.

Co-Prime Numbers : Two numbers are said to be co-prime if they do not have a common factor other than 1.

Example 16 : **Find only two pairs of co-prime numbers.**

Solution : We find out that (7, 10) and (31, 65) are two such pairs of co-prime numbers which do not have any common factor other than 1.

Exercise 3.3

1. **Which of the following numbers are prime ?**
   (a) 56 (b) 37 (c) 94
   (d) 19 (e) 21 (f) 29
2. **Separate even and odd numbers of the following.**
   (a) 5, 82, 294 (b) 3, 45, 260 (c) 3, 300
   (d) 1986, 231 (e) 18, 27, 30 (f) 16, 29
3. **Find out whether the following pairs are twin prime or not :**
   (a) (6, 8) (b) (11, 13) (c) (62, 64)
4. Write five pairs of co-prime numbers.
5. Express 55 as a sum of three odd prime.
6. **Express each of the following as sum of two odd prime :**
   (a) 36 (b) 66 (c) 56

Patterns in Numbers

Many years ago, Greeks, Babylonians, Mayans and Egyptians believed that counting numbers were linked to a certain geometric patterns. They used dots and lines to make the numbers.

The Mayans used dots and Egyptians used only vertical lines to express numbers.

We obtain different types of numbers depending upon different geometric shapes. Let us learn about some of them.

(a) Square Numbers : When any number is multiplied by itself, we get a square number. Some examples are 1, 4, 9, 16, 25……. Have a look.

$4 = 2 \times 2 = 2^2$

$9 = 3 \times 3 = 3^2$

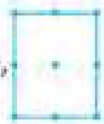
It is read as 4 is equal to 2 to the power 2 or 4 is equal to two square. Similarly, 9 is equal to 3 to the power 2 or 9 is equal to three square.

Similarly, $25 = 5 \times 5 = 5^2$ and so on.

We can represent these numbers with the help of dots arranged in row and columns.

We can arrange dots in 2 rows and 2 columns to represent number 4. For example,

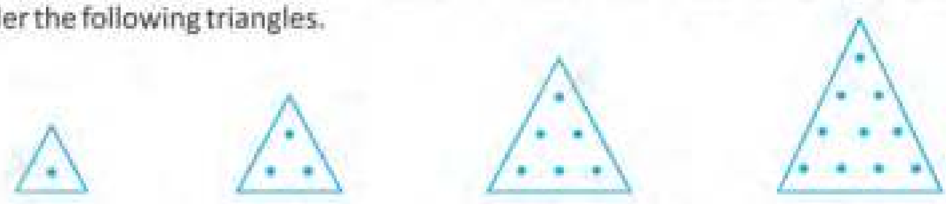
Similarly, we can arrange nine dots in three rows and three columns to represent the number 9. For example,



There is another pattern by which square numbers can be shown.

1 = 1
4 = 1+2+1
9 = 1+2+3+2+1
16 = 1+2+3+4+3+2+1
and so on.

(b) Triangular Numbers : There are some numbers which can be represented in the shapes of triangle. Consider the following triangles.



1     $1 + 2 = 3$ $1 + 2 + 3 = 6$ $1 + 2 + 3 + 4 = 10$

Now, try to represent the following by dots in triangular pattern.

(i) 15   (ii) 21   (iii) 28

(c) Cube Numbers : We get a new number when we multiply a number three times of itself. This new number is called Cube Number.

For example, $2 \times 2 \times 2 = 8 = 2^3$

8 is a cube number. It represents a cubic unit, say length × breadth × height. Therefore, a cubic number will represent a number powered three times.

Can you think of other numbers which represent a cubic form ?

Powers of Numbers

Let us learn to represent the square numbers and cubic numbers with the help of an index. Look at the example.

Example : $8 = 2^3$ (Read as 2 cube)

$36 = 6^2$ (Read as 6 square)

This type of representation is called **index notation.**

In 6^2, 2 is called **power** or **exponent** and 6 is called the **base.**

In scientific notation, we use index notation because some values cannot be represented exclusively by numbers. For example, mass of an electron is 5.489×10^{-4} atomic mass unit (amu).

Exercise 3.5

1. **Find the base and power of the following numbers :**

(a) 7^8 (b) 4^7 (c) 12^6

(d) 5^{-8} (e) 6^5 (f) 3^0

2. **Express the following by index notation:**

(a) 10, 000, 000   (b) 100, 000   (c) 25, 000

H.C.F and L.C.M.

H.C.F. stands for **Highest Common Factor** and L.C.M. stands for **Lowest Common Multiple.** H.C.F. is also known as be **Greatest Common Divisor** (G.C.D.)

Let us find the H.C.F. of 8,16, 24.

The factors of 8 are 1, 2, 4, 8

The factors of 16 are 1, 2, 4, 8, 16

The factors of 24 are 1, 2, 3, 4, 6, 8, 12, 24

The common factors in all are 1, 2, 4 and 8.

We multiply $1 \times 2 \times 4 \times 8$ and get 64 as H.C.F.

We can find H.C.F. by :

- Prime factorization method
- Long Division Method

H.C.F. by Prime Factorization Method

Example 17 : **Find the H.C.F. of 18 and 28 using prime factorization method.**

Solution :

2	18
3	9
3	3
	1

2	28
2	14
7	7
	1

$18 = 2 \times 3 \times 3$ $\quad$ $28 = 2 \times 2 \times 7$

The only common factor between them is 2.

Therefore, H.C.F. of 18 and 28 is 2.

We find it by following two steps :

(1) Find prime factors of each number.

(2) Select all the common numbers among them and multiply them.

H.C.F. by Long Division Method

Example 18 : **Find H.C.F. of 128 and 98**

Solution :

```
      1
 98 ) 128
    − 98   3
     30 ) 98
        − 90   3
          8 ) 30
            − 24   1
              6 ) 8
                  6   3
H.C.F. ——→        2 ) 6
                    − 6
                      0
```

H.C.F. of 128 and 98 is 2 (because 2 is the last divisor).

We find it by following these steps :

1. Divide the bigger number by the smaller one.
2. Again divide the divisor obtained by the remainder.
3. Continue the above two steps till the remainder becomes zero.

Similarly the two or more numbers may have unlimited multiples. The least of them is the Least or Lowest Common Multiple (L.C.M.).

We can calculate it by the following three methods:

L.C.M. through Multiples

Example 19 : **Find L.C.M. of 8 and 12**

Solution : Multiples of 8 are 8, 16, 24, 32, 40, 48, 56, 64, 72, ...

Multiples of 12 are 12, 24, 36, 48, 60, 72, 84, 96, ...

Common multiples are 24, 72, etc.

We find that 24 is the smallest (least) multiple which is common.

Therefore, L.C.M. of 8 and 12 is 24.

L.C.M. by Prime Factorization

Example 20 : Find L.C.M. of 62 and 32

Solution : Solve it using following steps.

Step 1 : We first factorise all the given numbers.

2	62
31	31
	1

2	32
2	16
2	8
2	4
2	2
	1

Step 2 : Write the numbers as their powers of prime factors.

$62 = 2 \times 31$

$32 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$

Step 3 : Now, find the highest powers of the factors.

The highest powers of 2 and 31 are 5 and 1 respectively.

Therefore, L.C.M. $= 2^5 \times 31 = 992$

L.C.M. by Division

Example 21 : Find the L.C.M. of 28, 40, 56 and 105.

2	28, 40, 56, 105
2	14, 20, 28, 105
2	7, 10, 14, 105
3	7, 5, 7, 105
5	7, 5, 7, 35
7	7, 1, 7, 7
	1, 1, 1, 1

Therefore, L.C.M. $= 2 \times 2 \times 2 \times 3 \times 5 \times 7 = 840$

We calculate it by these following steps:

Step 1 : Write all the numbers in a line.

Step 2 : Think of the smallest prime number which is a factor of any of these.

Step 3 : Divide all the numbers by this prime number obtained in step (2). Remember that if any of these numbers is not divisible, retain it as it is.

Relation Between H.C.F. and L.C.M. of Two Natural Numbers

For any two natural numbers:

$$\text{H.C.F.} = \frac{1^{st}\text{ number} \times 2^{nd}\text{ number}}{\text{Their L.C.M.}}$$

$$\text{L.C.M.} = \frac{1^{st}\text{ number} \times 2^{nd}\text{ number}}{\text{Their H.C.F.}}$$

Example 22 : **If the L.C.M. and H.C.F. of two numbers are 40 and 6 respectively, and one of the numbers is 12, find the other number.**

Solution : We know that

1st number × 2nd number = (L.C.M. of these two numbers) × (H.C.F. of these two numbers)

12 × 2nd number = 40 × 6

∴ 2nd number (Other number) = $\frac{40 \times 6}{12}$

= 20

Exercise 3.6

1. **Find H.C.F. by prime factorization method.**
   (a) 28, 14 (b) 85, 102 (c) 56, 85
   (d) 52, 70 (e) 12, 19 (f) 29, 93
2. **Find L.C.M. by prime factorization method.**
   (a) 120, 80 (b) 29, 119 (c) 184, 680
   (b) 85, 102 (e) 96, 132 (f) 210, 185
3. Find out the H.C.F. and L.C.M. of 126, 108, 225.
4. The L.C.M. of two prime numbers is 85. If one number is 5, find the other number.
5. Find out the lowest number which is exactly divisible by 36, 45, 63 and 80.

Points to Remember

- BODMAS rule is used to solve problems where more than two operations are involved.
- If you do not follow BODMAS rule, you may get different results.
- We must follow the sequence or order of brackets in BODMAS rule.
- We apply divisibility rule to check whether a given number is divisible by any other number or not.
- There are some divisibility rules from 2 to 25 that you must remember.
- Factors and multiples are related to each other.
- Factor of a number is an exact divisor of that number.
- Every natural number has infinite number of multiples.
- We can find prime factors with the help of prime factorization method and division method.
- We can classify natural numbers into even numbers, odd numbers, prime numbers, composite numbers, twin primes, prime triplet, co-prime numbers.
- 1 is neither prime nor composite number.
- There are some patterns to represent any number.
- Square numbers and cubic numbers are represented with the help of an index.
- We can find H.C.F. of two or more numbers by prime factorization method and division method.
- We can find LCM or two or more numbers by multiple method, prime factorization and division method.
- There is a relation between H.C.F. and L.C.M. of two numbers.

  (1st Number) × (2nd Number) = (H.C.F. of these two numbers × L.C.M. of these two numbers)

EXERCISE

1. MULTIPLE CHOICE QUESTIONS (MCQs):

Tick (✓) the correct options.

(a) While solving a problem based on BODMAS rule, 'S' stands for :

(i) Subtraction ☐ (ii) Addition ☐ (iii) Multiplication ☐ (iv) Division ☐

(b) The value of $5 \times 24 \div 6 - 10$ is

(i) 20 ☐ (ii) 30 ☐ (iii) 10 ☐ (iv) 15 ☐

(c) While removing brackets, the first one to be removed is

(i) {} ☐ (ii) ‚_‚ ☐ (iii) [ ] ☐ (iv) none ☐

(d) A number is divisible by 5, if the last digit is

(i) 2 ☐ (ii) 7 ☐ (iii) 0 or 5 ☐ (iv) 14 ☐

(e) Which one of the following is divisible by 3 ?

(i) 2481 ☐ (ii) 3706 ☐ (iii) 9173 ☐ (iv) 10510 ☐

(f) If a number is divisible by 8, then it is always divisible by

(i) 2 ☐ (ii) 3 ☐ (iii) 5 ☐ (iv) 25 ☐

(g) Which of the following is a composite number ?

(i) 42 ☐ (ii) 59 ☐ (iii) 19 ☐ (iv) 17 ☐

(h) Prime factors of 188

(i) 2, 3, 2, 57 ☐ (ii) 2, 2 , 57 ☐ (iii) 2, 2, 4, 7 ☐ (iv) 2, 2, 3, 19 ☐

(i) The first four even numbers between 12 to 22 are

(i) 14, 16, 18, 20 ☐ (ii) 8, 10, 12, 14 ☐ (iii) 12, 14, 16, 18 ☐ (iv) 18, 20, 22, 24 ☐

(j) Which of the following is an L.C.M. of 90, 56, 72 ?

(i) 2520 ☐ (ii) 20312 ☐ (iii) 20416 ☐ (iv) none ☐

2. Solve the following by BODMAS rule.

(a) $45 - [38 - \{5 \times 7 + (11 - 2 \times 5)\}]$

(b) $28 \div 4 - 13 + 16$

(c) $96 \div [18 - \{63 \div 7 - (18 - 5 \text{ of } 3)\}]$

(d) $25 - \{(30 \div 5) + 10\} + 6$

3. Without actual division find out whether each number is divisible by 2, 3 and 5 or not.

(a) 3402 (b) 5875 (c) 185

(d) 15000 (e) 2370 (f) 3846

4. Find out all the factors of 82.
5. Write all the prime numbers and composite numbers less than 30.
6. Write three pairs of twin prime numbers.
7. **Find the H.C.F. of the following numbers.**
   (a) 14, 24, 38 (b) 120, 675, 360 (c) 3, 27, 11
8. **Fill up the factor tree using prime numbers.**

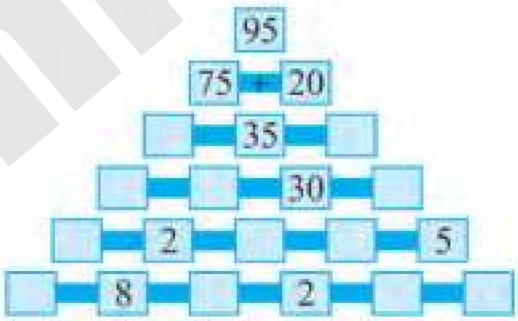
9. Show that H.C.F. of 12 and 15 is not greater than either 12 or 15.
10. The product of two numbers is 2160 and their H.C.F. is 12. Find their L.C.M.

HOTS

I am a number between 20 and 30. If you divide 47 and 92 by me, the remainders are 3 and 4, respectively. What number am I?

Lab Activity

Objective : Complete the pyramid by using (+, −, ×, ÷).



Procedure :

- We are given 21 big squares for numbers and 15 small squares for the operation signs (+, −, ×, ÷).
- Each big square contains a number which is the result of numbers in small rectangle just below it. For example,

- The small squares carry the necessary operation signs.
- Some big and small squares are filled with numbers and signs as a **hint** to make you understand.
- Fill the rest of squares to complete the pyramid.

Revision Test Paper-I

(Based on Chapters 1 to 3)

A. Multiple Choice Questions (MCQs).
Tick (✓) the correct option.

1. The smallest 5-digit number using the digits 8, 0, and 5 is

   (i) 58000 (ii) 50008
   (iii) 55880 (iv) 55080

2. What is the difference between place values of 7 in 975267342?

   (i) 6, 00, 93, 000 (ii) 6, 99, 93, 000
   (iii) 6, 00, 00, 900 (iv) 6, 00, 90, 009

3. Which number was introduced to the set of natural numbers (N) to make it a whole number set.

   (i) 1 (ii) –1
   (iii) 0 (iv) 2

4. Which one of the following is not a prime number ?

   (i) 19 (ii) 17
   (iii) 23 (iv) 27

5. If a = 7, b = 3 and c = 9 the value of a × (b + c) is

   (i) 30 (ii) 84
   (iii) 90 (iv) both (i) and (ii)

6. Which of the following is prime number ?

   (i) 17 (ii) 28
   (iii) 63 (iv) 56

7. By divisibility rule, the number divisible by 7 is

   (i) 7950 (ii) 5976
   (iii) 7352 (iv) 9324

8. The L.C.M. of 15, 18, 10 is

   (i) 80 (ii) 90
   (iii) 70 (iv) 75

9. The sum of – 3 and – 7 is

(i) – 4 (ii) + 10

(iii) 4 (iv) – 10

10. The value of $(-15 \times 12) \div (-6)$ is

(i) 30 (ii) 15

(iii) – 20 (iv) – 14

B. Fill in the blanks.

1. If we multiply zero with any natural number, we always get ....
2. On a number line, the distance between two consecutive numbers is called ....
3. If zero (0) is subtracted from a whole number, then the result is ....
4. In general we can say that

   Dividend = (...................... × Quotient) + Remainder
5. The predecessor of 10080 is ....

C. Tick (✓) for true statement and cross (×) for false statement.

1. Every natural number has predecessor.
2. The use of zero (0) in India started around 700 AD.
3. A natural number having only two factors (1 and the number itself), is called a prime number.
4. A number is divisible by 10, if the right-most digit (i.e., the digit at ones place) is 5.
5. 1 is neither prime nor composite number.
6. A number is divisible by 7 if the difference between twice of the last digit and the number formed by other digits is either 0 or a multiple of 7.
7. Zero is a natural number.
8. In 2^5, 2 is called the power and 5 is called the base.
9. Negative numbers are always less than zero.
10. The number line moves in the increasing order from right to left.

4 Integers

Ranjan purchased a book from a book shop. The cost of the book is ₹ 125. Ranjan paid only ₹ 100 to the shopkeeper. The shopkeeper writes ₹ 25 as due amount from Ranjan. How would he remember whether ₹ 25 has to be taken or to be given to Ranjan? Can he express this due amount by some sign like + 25 or − 25?

Bitto is standing on the bank of a lake and looks at the image of a tree in the water. If he consider ground as base, then how will he express the height of the tree and its image in the lake. Thus, there is a need to extend our numbers so as to represent credit and debit, height and depth, above and below freezing point, profit and loss etc. We need to use some signs which can differentiate numbers either less than zero or more than zero. The numbers which are less than zero (0) represent negative values, these numbers are **negative numbers**.

We can find the examples of negative sign in our daily life. If I receive something from a friend, it is denoted by positive number and if I owe something to him, it is to be denoted by negative sign. I am obliged to pay ₹ 25 to the shopkeeper. So, it is to be denoted by − ₹ 25.

Some other situations where we use signs are above the ground (+) and below the ground (−), profit (+) and loss (−), income (+) and expenditure (−) etc.

Integers

We have studied in previous chapter about the whole numbers, W = 0, 1, 2, 3, ... We have observed in the above examples that we need negative numbers. We can denote it as .... − 5, − 4, − 3, −2, −1, 0, 1, 2, 3, 4, 5, ... These are called integers with negative sign.

Consider that the positive and negative numbers are such that

$1 + (-1) = 0$ $\quad$ $4 + (-4) = 0$

$2 + (-2) = 0$ $\quad$ $5 + (-5) = 0$

$3 + (-3) = 0$ $\quad$ $6 + (-6) = 0$ and so on.

Thus, a new system which has positive and negative numbers separated by zero (0), is called **integers** and expressed by symbol I. Symbolically, we write it as

I = ... −3, −2, −1, 0, 1, 2, 3, ...

Here, the numbers −1, −2, −3, ... are called **negative integers,** 1, 2, 3, ... are called **positive integers** and the number '0' is an integer **neither positive nor negative**.

Representation of integers on a number line

At first we draw a straight line. We know that '0' differentiate the negative and the positive integer. Now we start with marking a point 0 on the line. We set on equal distances (unit distances) on its right side and left side. The points on the right side are marked with 1, 2, 3, 4, ... and the points on the left side are marked with −1, −2, −3, − 4 .... as shown below.

It is clear to see on number line that −1 and 1 are on the opposite sides of zero but at the same distance from it. Similarly, −9 and 9 are at equal distances from 0 but on the opposite sides of zero.

Order of integers

On the number line, every number on the right is greater than every number on its left, i.e., 9 > 6, 4 > 3, 1 > 0 and so on.

From above it may be concluded that :

1. Zero is less than every positive integer.
2. Zero is greater than every negative integer.
3. Zero is neither a positive nor a negative integer.
4. Every positive integer is greater than every negative integer.
5. Farther a number from zero on the right, greater is its value.
6. Farther a number from zero on the left, smaller is its value.

Absolute value of an integer

We can see on the number line, –6 is as far to the left of 0 as + 6 is to the right of 0. We represent the observation using an absolute value notation, i.e.

$|-6| = 6$, i.e. the absolute value of –6 is 6.

$|6| = 6$, i.e. the absolute value of 6 is 6.

We use two **vertical bars**, one on either side of the integer to show its **absolute value.**

As zero is neither positive nor negative, its absolute value is zero, i.e. $|0| = 0$

Thus, the absolute value of an integer is its numerical value only without its sign.

Example 1 : Using integers express the following :

(i) A profit of ₹ 700 (ii) 100°C above zero

(iii) A loss of ₹ 500 (iv) 25°C below zero

(v) Anshu climbs 300 metres on the mountain from the ground.

(vi) A sea diver at a depth of nine hundred metres below sea level.

(vii) A kite is flying 100 metres above the ground.

(viii) A withdrawal of rupees nine hundred.

Solution : (i) +700 (ii) +100 (iii) –500 (iv) –25

(v) +300 (vi) –900 (vii) +100 (viii) –900

Example 2 : Represent the following numbers on the number line :

(i) –7 (ii) +5 (iii) +10 (iv) –8

Solution : Draw a number line on which points P, Q, R and S represent the points –7, +5, + 10 and – 8 respectively.

Example 3 : **In the following pairs of number, identify the numbers which are on the right of others. Hence write the symbol '<' and '>' between them.**

(i) 3, 8 (ii) 5, –5 (iii) 4, – 50 (iv) 0, –1
(v) –5 and –7

Solution :
(i) 8 is to the right of 3, therefore, 8 > 3 or 3 < 8.
(ii) 5 is to the right of –5, therefore, 5 > –5 or –5 < 5
(iii) 4 is to the right of –50, therefore, 4 > –50 or –50 < 4.
(iv) 0 is to the right of –1, therefore, 0 > –1 or –1 < 0.
(v) –5 is to the right of –7, therefore, –5 > –7 or –7 < –5.

Example 4 : **Which one in the following pairs of numbers is smaller ?**

(i) –7 and – 2 (ii) 4 and – 2 (iii) –3 and –6 (iv) 5 and 9

Solution : On seeing number line, the numbers lying in left side is smaller.
(i) –7 is smaller than – 2 (ii) –2 is smaller than 4
(iii) – 6 is smaller than –3 (iv) 5 is smaller than 9

Example 5 : **Arrange the following in ascending order.**

+ 1, 0, –1, –5 + 5, + 9, –9

Solution : Let us put the given numbers on the number line as

The numbers are in decreasing order from right to left. So, arranging the numbers in ascending order, we get – 9, –5, –1, 0, +1, +5, +9.

Example 6 : **Arrange the following numbers in descending order :**

–9, + 5, + 11, –1, 175, – 167

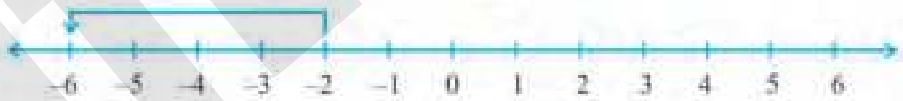
Solution : Let us put the given number on the number line as :

The numbers can be arranged in descending order from right to left as + 175, + 11, + 5, –1, –9, –167

Example 7 : **Draw a number line and answer the following :**

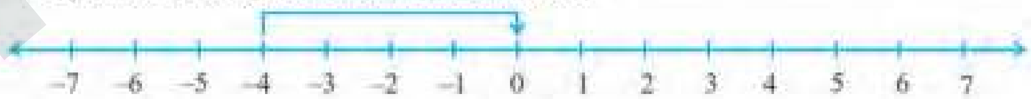
(i) Which number will you reach at if you move 4 numbers to the left of –2?
(ii) Which number will you reach at if you move 4 numbers to the right of –4?

Solution : (i) We denote the expression on number line as



Here, –2 – 4 = –6
So, we will reach at the point –6.

(ii) We denote the expression on number line as



Here, – 4 + 4 = 0
So, we will reach at the point 0.

Example 8 : **Find the value of :**

(i) | –100 | (ii) | 0 | (iii) | 7 – 4 | (iv) | 8 | + | –3 |

Solution : (i) 100 (ii) 0 (iii) 3 (iv) 8 + 3 = 11

Exercise 4.1

1. **Put the sign '>', '<' or '=' in the boxes given below :**

   (a) −18 □ −35   (b) −17 □ −17   (c) −1 □ 0

   (d) −10 □ 9   (e) 0 □ −11   (f) −11 □ −121

2. **Arrange the following in ascending order :**

   (a) −140, +77, −25, −12, 130   (b) 0, −1, +9, 11, −110   (c) −51, +8, 0, −7, 10

   (d) −10, +20, 0, −40, +50   (e) +10, −87, +67, −88   (f) −11, 110, −90, +50, −70

   (g) 55, −76, +83, +99

3. **Arrange the following in descending order :**

   (a) −7, 77, 0, −107, 701   (b) −10, 10, 0, 9, −1   (c) −55, 0, 55, −75, 78

   (d) +50, −55, 110, −107   (e) 607, −706, 809, −709, −708

4. **Write the resultant displacement :**

   (a) P covered 10 km due east, and then 15 km due west.

   (b) Q covered 20 km due north and then 20 km due south.

   (c) R covered 15 km due west and then 30 km due east.

   (d) S covered 35 km due south and then 45 km due north.

5. **Write all integers between the given pairs :**

   (a) −3 and 5   (b) 0 and 6   (c) −3 and 3

   (d) −1 and 7   (e) −3 and −9   (f) −8 and 8

6. **Write three integers :**

   (a) greater than 10   (b) less than 0   (c) greater than 0

7. **Find the value of :**

   (a) $|-11-8|$ (b) $|-5|-|-5|$ (c) $|5-4|$

   (d) $|5|-|-4|$ (e) $|7|+|-6|$ (f) $|7-15|$

8. **Which number in each of the following pairs is to the right of the other on the number line?**

   (a) 3, −3   (b) 0, 11   (c) −7, 0

   (d) -7, 1   (e) 4, −1   (f) 6, −99

9. **Represent the following numbers on the number line :**

   (a) −1   (b) −9   (c) 10   (d) 7

Operation on Integers

We can apply four mathematical operations i.e. Addition, Subtraction, Multiplication and Division on the number line.

Addition of Integers

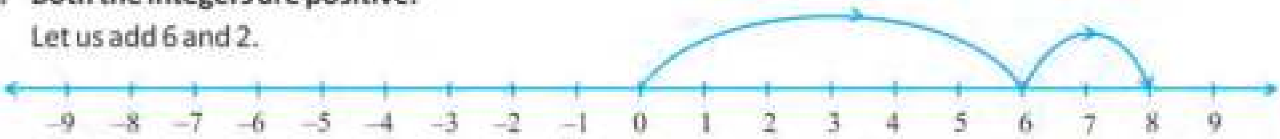
We shall discuss the **addition of Integers** under the following cases:

(i) Both the integers are positive   (ii) Both the integers are negative

(iii) One of the two integers is positive

Case I : Both the integers are positive.

Let us add 6 and 2.

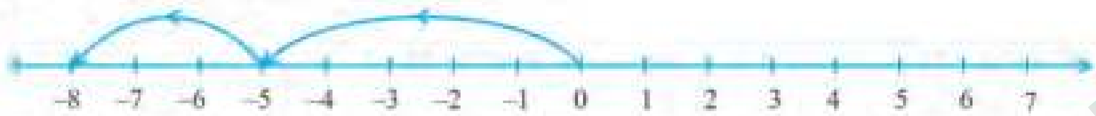


We start from 0 and move right because the sign of first number 6 is positive. Thus, we reach at 6. Again, we move two steps to the right of 6 because the sign of second integer 2 in also positive. Thus, we get $6+2 = 8$.

Therefore, we conclude that the sum of two positive integers in always positive.

Case II : Both the integers are negative.

Let us add – 5 and – 3.



We start from 0 and move towards left reaching –5. Again we move three steps to the left of –5 and reach – 8. Thus, we get $-5+(-3)=-8$. Therefore, we conclude that the sum of two negative integers is always negative.

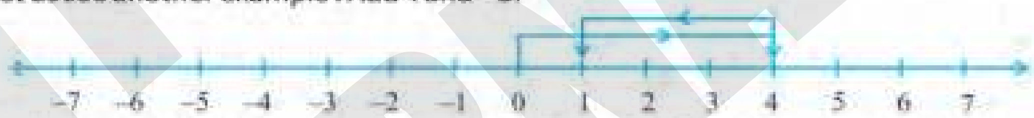
Case III : One of the two integers is negative.

Let us add 3 and – 4.

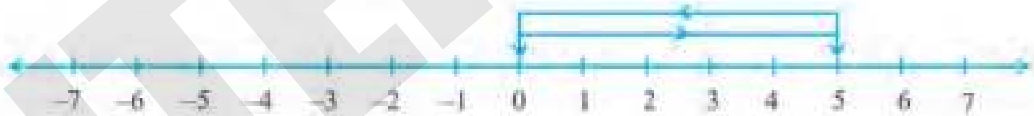
We start from 0 and move towards three steps right from 0 and again move towards four steps left from 3. Now we reach $3+(-4) = -1$.

When negative number is added to an integer, the resulting integer becomes less than the given integer.

Let us see another example : Add 4 and – 3.



On the number line, we move four steps to the right of 0 and reach 4. Again, we move three steps to the left of 4 and reach 1. Thus, we get $4 + (-3) = 1$ Let us consider a special case when an integer is added to its opposite, say $5+(-5)$.

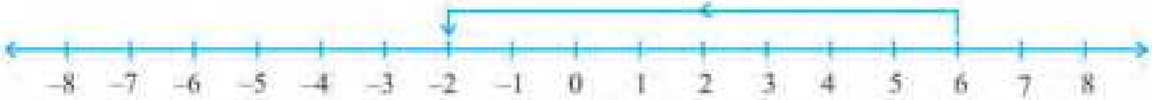


We move five steps to the right of 0 and reach 5. Again, we move five steps to the left of 5 and reach 0. Similarly, we get $6+(-6)=0$, $1+(-1)=0$, $9+(-9)=0$ and so on. These types of numbers when added to each other give the sum zero. They are called additive inverse of each other . Each integer has a successor. 1 is the successor of 0 and 0 is the successor of – 1. Similarly, 2 is the successor of 1. One added to an integer gives its successor.

Example 9 : Find the integer using number line which is :

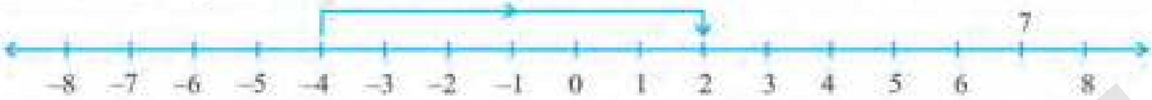
(i) 8 less than 6 (ii) 6 more than – 4

Solution : (i) We have to find the integer 8 less than 6. So, we start from 6 and move 8 steps towards left. We reach at – 2 which is shown on number line as:



Thus, 6 + (−8) = −2

(ii) We have to find the integer 6 more than − 4. So, we start from − 4 and move 6 steps towards right so as to reach 2 which is shown on number line as follows.



Thus, − 4 + 6 = + 2

Example 10 : Add the following integers without using number line :

(i) 8 + 14 (ii) − 8 + (−14) (iii) 8 + (−14) (iv) (−8) + 14

Solution : (i) 8 + 14 = 22 (ii) − 8 − 14 = − 22 (iii) 8 − 14 = − 6 (iv) − 8 + 14 = 6

Example 11 : Find the sum of the following :

(i) − 67 + (−37) (ii) 71 + 53 (iii) 85 + (−37) (iv) (−72) + (−35)

(v) [(−56) + (− 42)] + 24 (vi) [84 + (−32) + (−36) (vii) 0 + (−55)

(viii) (−85) + 0 (ix) 500 + (−500) (x) − 161 + 162

Solution :

(i) − 67 − 37 = −104

(ii) 71 + 53 = 124

(iii) 85 − 37 = 48

(iv) − 72 − 35 = − 107

(v) [(−56)+(− 42)] + 24 = (− 98) + 24 = − 74

(vi) (84 − 32) − 36 = 52 − 36 = 16

(vii) 0 − 55 = − 55

(viii) − 85 + 0 = − 85

(ix) 500 +(− 500) = 0

(x) − 161 + 162 = 1

Example 12 : Find the successor of each of the following:

(i) 100 (ii) − 100 (iii) 1 (iv) − 1 (v) 0

Solution : We know that successor of number is 1 more than that of number. So,

(i) 100 + 1 = 101 (ii) − 100 + 1 = − 99 (iii) 1+1 = 2 (iv) − 1+ 1 = 0 (v) 0 + 1 = 1

1. Write the number by using number line.

(a) 6 less than 4 (b) 7 more than − 7 (c) 5 less than 8 (d) 8 more than 3

Exercise 4.2

2. Show the result of the following on the number line.

(a) 3 + 4 (b) (−6) + (−7) (c) 3 + (−1) (d) 8 + (−3)

(e) (−6) + 7 (f) (−5) + (−7) (g) 8 + 0 (h) 0 + 9

3. Solve the following sums given below without using number line :

(a) 22 + (− 20) (b) 515, −170 and 70 (c) (−17) + 8

(d) 210, −50 and 171 (e) −17 + (-10) (f) −70, −120 and −105

(g) −631 + (−280) + (−610) (h) −870 and −580 (i) −85 + 150 + (− 220) + (−170)

4. What integer should be added to the following integers to get zero?

(a) 71 (b) (−52) (c) (−101) (d) 429 (e) (−6127) (f) 5120

5. Find the successor of each of the following:

(a) 329 (b) −650 (c) −1 (d) 780 (e) 859

In order to add a positive integer, we move towards the right of a number line and to add a negative integer, we move towards left.

Subtraction of Integers

For example : If we are to subtract 3 from 7, we move 3 steps towards left from 7 so as to reach 4. Thus, 7 − 3 = 4

Let us now subtract −3 from 7, i.e., 7 − (−3).

In this case, if we move 3 steps towards 7, we reach to 4 as above. So we can say that $7 - 3 \neq 7 - (-3)$.

Therefore, we shall have to move 3 steps towards the right of 7 as shown in the number line below.

i.e., 7 − (−3) = 10

From the above, we conclude that:

1. When a negative integer is subtracted from an integer, the resultant number is greater than the integer (in the above case, 10 is greater than 7).
2. Subtracting a negative integer from an integer means adding the additive inverse of the negative integer. Here we have added additive inverse of −3, i.e. +3 to 7.

Predecessor of an Integer

Like successor, every number has its predecessor. Predecessor comes just before the number. For example, in number series 0, 1, 2, 3, 4 ....

3 is predecessor of 4, 2 is predecessor of 3 and 0 is the predecessor of 1. Therefore, the predecessor of a number in obtained by subtracting 1 from the number. For example, 4 − 1 = 3, 3 − 1 = 2, 1 − 1 = 0.

Example 13 : **Solve (−9) − (+3)**

Solution :

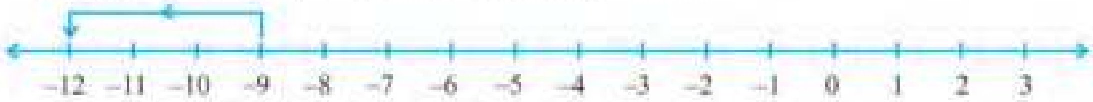
Step 1 : The sign of the integer (that has to be subtracted) is changed to the opposite sign.

−9 − (+3) becomes (−9) + (−3)

Step 2 : Therefore, the answer is −12.

Example 14 : **Solve – 9 – (+3) by using the number line.**

Solution : In this method, we need to add –3 to (–9). Thus, the directions of movement changes to the left of –9 and not to the right of –9. Hence, we get

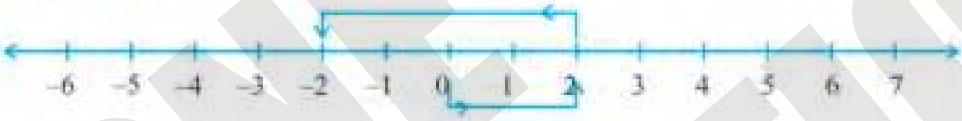


Therefore, the answers is –12

Example 15 : **Solve 2 - 4.**

Solution : After draw a number give are marks the integer 2 on it. Now we move 4 steps of the left of 2. which number represents (-2).

Hence , 2 - 4 = - 2



Therefore, the answer is – 2.

Alternate method

We sloved this problem without number line as follows:

(2) - (4) , becomes (2) (-4) [change the sign of the second integer]

i.e, (-) X (+) = -

Therefore, (2) - (4) = - 2

Exercise 4.3

1. **Subtract the following:**

(a) (–2)–4 (b) (–9) – (–6) (c) (16) – (–16) (d) (+1) – (–0)

(e) (–2) – (–4) (f) (+8) – (+ 4) (g) (–9) – (–10) (h) (+10) – (–9)

(i) 2 – (–4)

2. **Find the value of the following:**

(a) –8 + 9 – (–25) (b) 80 – (–70) – (–5) (c) –30 + 42 – 3 – 4 (d) (– 12) + (– 7) + (19)

(e) (–10) + (–12) +16 (f) 50– (–140) – (–5)

3. **Put >, < or = sign in the boxes gives below:**

(a) 7 – (–18) + (–6) ☐ (–4) – (–9) + 8 (b) (–5) + (10) – (–0) ☐ (–4) – 9 + (–1)

(c) (–18) – (–10) + 16 ☐ 7+ (–15) – (–6) (d) 9 – 7 + (–23) ☐ 8 – 20 + (–7)

(e) (–5) +7 ☐ (–2) + 7

4. **Find the predecessor of the following numbers:**

(a) (–1000) (b) 0 (c) 31001 (d) (–1000) (e) 109 (f) (–909)

5. **What should be added to the sum of (– 64) and 15 to make it equal to the sum of (–25) and (–10)?**

6. **Write 'T' for true and 'F' for false statement of the following.**

(a) The negative of an integer is negative. ☐

(b) The smallest integer is 0. ☐

(c) Every integer has a successor. ☐

(d) The sum of an integer and its additive inverse or opposite is 0. ☐

(e) There is no smallest integer. ☐

Points to Remember

- The number line moves in the decreasing order from right to left.
- Zero is greater than any of the negative integer.
- The sum of negative and positive integers is an integer which carries the sign of greater number.
- The sum of two negative numbers is always a negative number.
- Negative numbers are always less than zero.
- The sum of an integer and its additive inverse or opposite is 0.
- Zero is neither positive nor negative.
- Zero is less than all positive numbers and bigger than all negative numbers.

EXERCISE

1. **MULTIPLE CHOICE QUESTIONS (MCQs):**

Tick (✓) the correct options.

(a) Which one of the following is correct for number line ?

(i) 2 is to the right of –1 ☐ (ii) –7 is the right of –6 ☐

(iii) 2 is the left of –1 ☐ (iv) 5 is the left of –6 ☐

(b) Which one of the following is correct for 7, 5 ?

(i) –5 > –7 ☐ (ii) –7 < – 13 ☐ (iii) 5 > 7 ☐ (iv) –7 < –10 ☐

(c) On subtracting – 3 from –8, the result is :

(i) +5 ☐ (ii) –5 ☐ (iii) –11 ☐ (iv) 11 ☐

(d) What integer should be added to –78 to get 0?

(i) +100 ☐ (ii) –100 ☐ (iii) +78 ☐ (iv) 101 ☐

(e) 'Match won by 3 goals in a soccer match can be represented in integer as :

(i) -4 (ii) –3 (iii) 3 (iv) 1–2

(f) The additive inverse of –5040 is :

(i) –5040 (ii) – 4050 (iii) +5040 (iv) +4050

(g) The successor of 0 is :

(i) 1 (ii) –2 (iii) –1 (iv) none of these

2. Arrange the following in ascending order :

(a) –1, 10, 0, –9, 9, –8 (b) +175, –105, +77, –88, –199

(c) –100, 99, +101, –199, –10 (d) +77, –88, +75, –60, 50

3. Write all integers between the following pairs of numbers.

(a) –7 and 7 (b) –1 and –9 (c) 0 and 10 (d) –9 and 0

4. Which number in each of the following pairs is to the left of the other on the number line.

(a) –9, 10 (b) –45, –50 (c) –1, +1 (d) –99,101

5. Find the integer using number line.

(a) 5 more than –2 (b) 7 more than 0

(c) 10 less than 15 (d) 10 less than –9

6. Show the following on number line :

(a) 5 + (–3) (b) (–15) + 5 (c) 0 + (–11) (d) (–7) + 7

7. Find the successor of each of the following :

(a) –1 (b) –11 (c) 10

(d) 99 (e) –100

8. Add the following integers without using number line.

(a) 17 + 38 (b) –72 + (–55) (c) 19 + (–15) (d) (–15) + 19

9. Subtract the following on number line :

(a) 9 from –15 (b) 7 from 14 (c) –11 from –1 (d) –13 from –18

10. What should be added to the sum of (–25) and 16 to make it equal to 19 ?

(a) 28 (b) –9 (c) 19 (d) –19

11. Find the predecessor of the following numbers.

(a) –100 (b) 99 (c) –1 (d) –10

HOTS

Every negative integer is less than every natural number. Give reason to your answer.

Lab Activity

Objective : To learn addition and subtraction of integers while playing games.

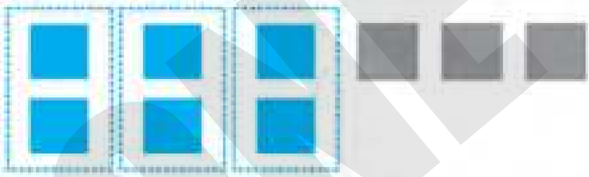
Materials Required : Some wood block, coloured papers (blue and grey).

Procedure :

We stick blue and grey papers on the wood blocks. Blue colour denotes negative integers and grey colour denotes positive integers. Let each block wrapped with blue colour paper represents −1 and each block wrapped with grey colour represents +1.

Addition :

Suppose we have to add (−6) + 3, then, the student will take 6 blue blocks and 3 grey blocks as follows.



3 blue blocks cancel all 3 grey blocks. So, we have 3blue blocks left, which is the result.

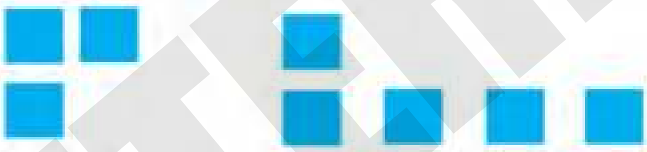
So, (−6) + 3 = −3

Similarly, we can solve many sums.

Suppose the sum given is

(−3) + (−5).

Here, we need only blue blocks. Student will lay out 3 blue blocks and then 5 blue blocks below them as follows:



Here, blocks do not cancel out each other because all are of blue colours.

So, we get 8 bluez blocks, which is the required result.

So, (−3) + (−5) = −8

Student should solve many similar sums.

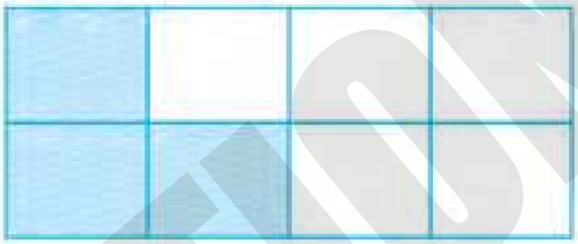
5 Fractions

Fraction are formed by splitting a whole into any number of pieces of equal size.

A number that compares part of an object or a set with the whole is called fraction. The quotient of two whole numbers 'a' and 'b' is written as **a ÷ b**. It means **'a' divided by 'b'**. It can also be written as $\frac{a}{b}$. Here, $\frac{a}{b}$ is called a fraction, where 'a' is the **numerator** of the fraction and 'b' is the **denominator** of the fraction.

If a milk bar is divided into 8 equal parts as shown below.

The 3 parts taken out of it can be expressed as $\frac{3}{8}$ of the whole.

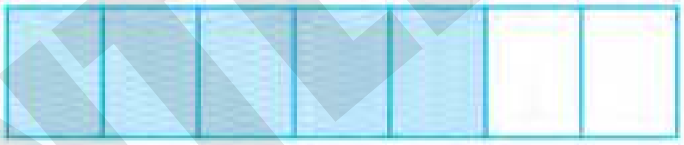


Thus, a fraction is a number representing a part of a whole. The whole may not be necessarily a single object. It may be a group of objects also.

Fraction : A fraction means a part of a whole or region. The whole may be one or more than one object. When a whole is divided into a number of equal parts and some of them are taken out of it, we get a fraction. The number of equal parts into which an object is divided is called the denominator of the fraction while the number of parts which are taken out of it is called the numerator of the fraction. While writing a fraction, the numerator and denominator are separated by a bar, the numerator being above the bar and the denominator below the bar. Thus,

$$\text{Fraction} = \frac{\text{Numerator}}{\text{Denominator}}$$

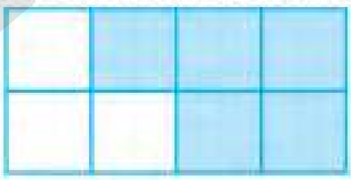
For example : In the fraction $\frac{5}{7}$, 5 is the numerator and 7 is the denominator. It represents '5 out of 7'.



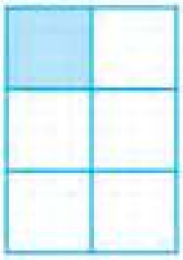
The shaded portion represents $\frac{5}{7}$

Example 1 : **Write the fraction that represents the shaded part of each figure:**

(a)



(b)



Solution :

(a) Total number of equal parts = 8 (denominator)

Total number of shaded parts = 5 (numerator)

Hence, the shaded part represents the fraction $\frac{5}{8}$.

(b) Total number of equal parts = 6 (denominator)

Total number of shaded parts = 1 (numerator)

Hence, the shaded part represents the fraction $\frac{1}{6}$.

Facts to Know

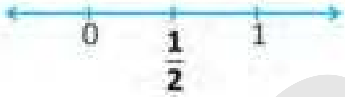
When the numerator and denominator are same, it means the complete whole or one.

Fraction on the Number Line

We have learnt to show natural numbers, whole numbers and integers like 0, 1, 2, 3 .... on a number line.

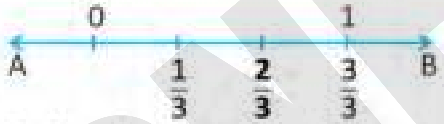
Let us draw a number line and try to mark $\frac{1}{2}$ on it.

We know that $0 < \frac{1}{2} < 1$, so it should be lying between '0' and '1'.



Example 2 : **Show $\frac{2}{3}$ on a number line.**

Solution :

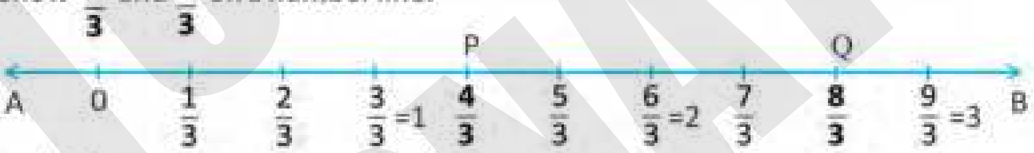


Divide the number line between '0' and '1' into 3 equal parts.

Now, select the gap between 0 and 1 that would be $\frac{2}{3}$.

Example 3 : **Show $\frac{4}{3}$ and $\frac{8}{3}$ on a number line.**

Solution :



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

Since 3 is the denominator, we divide distance between 1 and 2 into three equal parts. Points P and Q denotes $\frac{4}{3}$ and $\frac{8}{3}$ respectively.

Facts to Know

All proper fractions are less than one and therefore, lie between 0 and 1.

Equivalent Fractions

$\frac{1}{2} = \frac{6}{12}$, $\frac{1}{3} = \frac{7}{21}$ and $\frac{1}{4} = \frac{5}{20}$ are examples of equivalent fraction.

Equivalent fractions are obtained by multiplying or dividing the numerator and the denominator with the same number.

$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$$

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

$$\frac{1}{2} \times \frac{6}{6} = \frac{6}{12}$$

Therefore, $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}$ and $\frac{6}{12}$ are equivalent fractions.

$\frac{6}{12} = \frac{6 \div 2}{12 \div 2} = \frac{3}{6}$

$\frac{6}{12} = \frac{6 \div 3}{12 \div 3} = \frac{2}{4}$

$\frac{6}{12} = \frac{6 \div 6}{12 \div 6} = \frac{1}{2}$

Therefore, $\frac{6}{12}, \frac{3}{6}, \frac{2}{4}$ and $\frac{1}{2}$ are equivalent fractions.

For two equations to be equivalent:

Numerator of the first × Denominator of the second = Denominator of the first × Numerator of the second

In other words, equivalent fractions can be verified by cross multiplication of numerators and denominators.

Example : (i) $\frac{P}{Q} = \frac{R}{S}$ then PS = QR

(ii) $\frac{3}{5} = \frac{9}{15}$ then $3 \times 15 = 5 \times 9$

Here, 45 = 45

Example 4 : **Fill in the box to make the fractions equivalent.**

$\frac{12}{42} = \frac{2}{\square}$

Solution : $12 \div 2 = 6$ or 12 has been divided by 6 to obtain the numerator 2.

Hence, 42 also has to divided by 6 to obtain the new denominator.

$42 \div 6 = 7$

Thus, $\frac{12}{42} = \frac{2}{7}$

Example 5 : **Fill in the box to make fractions equivalent.**

$\frac{6}{27} = \frac{\square}{9}$

Solution : $27 \div 9 = 3$ or 27 has been divided by 3 to obtain the denominator 9.

Hence, 6 has to be divided by 3 to obtain the new numerator.

$6 \div 3 = 2$

Thus, $\frac{6}{27} = \frac{2}{9}$

Example 6 : **Check whether $\frac{39}{91}$ and $\frac{3}{7}$ are equivalent fractions.**

Solution : By cross multiplication, $39 \times 7 = 91 \times 3 = 273$

Hence, $\frac{39}{91}$ and $\frac{3}{7}$ are equivalent fractions.

Types of Fractions

We shall discuss the various types of fractions in this section.

Proper Fraction

When the numerator is smaller than the denominator, the fraction is known as proper fraction.

$\frac{1}{18}, \frac{6}{13}, \frac{7}{19}, \frac{2}{5}$ are examples of proper fraction.

Improper Fraction

The fractions in which the numerator is either equal to or greater than the denominator are called improper fractions.

$$\text{Improper Fraction} = \frac{(\text{Whole Number} \times \text{Denominator}) + \text{Numerator}}{\text{Denominator}}$$

For example : $\frac{7}{3}, \frac{8}{5}, \frac{9}{4}$ 1 etc.

Mixed Fraction

A combination of whole number and a proper fraction is called mixed fraction.

Mixed Fraction is written as:

$$\text{Quotient} \frac{\text{Remainder}}{\text{Divisor}}$$

Example : $2\frac{3}{5}, 1\frac{1}{5}, 4\frac{3}{7}$ etc.

Example 7: Write the following as improper fraction:

(i) $5\frac{3}{10}$ (ii) $12\frac{7}{6}$

Solution : (i) $\text{Improper fraction} = \frac{(\text{Whole} \times \text{Denominator}) + \text{Numerator}}{\text{Denominator}}$

$$5\frac{3}{10} = \frac{(5\times10)+3}{10}$$

$$= \frac{50+3}{10}$$

$$= \frac{53}{10}$$

(ii) $12\frac{7}{6} = \frac{12\times6+7}{6}$

$$= \frac{72+7}{6}$$

$$= \frac{79}{6}$$

Example 8: Write the following as mixed fraction:

(i) $\frac{21}{5}$ (ii) $\frac{14}{3}$ (iii) $\frac{29}{4}$

Solution : (i) $\frac{21}{5}$

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

On dividing 21 by 5 (i.e., 21 ÷ 5), we get 4 as quotient and 1 as remainder.

So, $\frac{21}{5} = 4\frac{1}{5}$

(ii) $\frac{14}{3}$

On dividing 14 by 3 (i.e., 14 ÷ 3), we get 4 as quotient and 2 as remainder.

So, $\frac{14}{3} = 4\frac{2}{3}$

(iii) $\frac{29}{4}$

On dividing 29 by 4 (i.e., 29 ÷ 4), we get 7 as quotient and 1 as remainder.

So, $\frac{29}{4} = 7\frac{1}{4}$

Like Fractions

Fractions with the same denominator are called like fraction.

$\frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$ are the examples of a like fraction.

Unlike Fractions

Fractions with different denominators are called unlike fractions.

$\frac{2}{5}, \frac{3}{7}, \frac{4}{9}, \frac{5}{8}$ are examples of unlike fraction.

Conversion of Unlike Fraction into Like Fraction

Take L.C.M. of all Denominators of the given Fractions. Multiply the numerator and denominator by such number so that denominator becomes equal to L.C.M.

Example 9 : **Convert $\frac{2}{3}, \frac{3}{4}, \frac{7}{8}$ into like fractions.**

Solution :

2	3, 4, 8
2	3, 2, 4
2	3, 1, 2
3	3, 1, 1
	1, 1, 1

L.C.M. of 3, 4, 8 = 2 × 2 × 2 × 3 = 24

Now, the required like fractions are given by

$$\frac{2}{3} = \frac{2 \times 8}{3 \times 8} = \frac{16}{24}$$

$$\frac{3}{4} = \frac{3 \times 6}{4 \times 6} = \frac{18}{24} \quad \text{(Making the denominator equal to the L.C.M.)}$$

$$\frac{7}{8} = \frac{7 \times 3}{8 \times 3} = \frac{21}{24}$$

Example 10 : Convert $\frac{8}{9}, \frac{5}{6}, \frac{2}{3}, \frac{1}{2}$ into like fractions.

Solution :

2	9, 6, 3, 2
3	9, 3, 3, 1
3	3, 1, 1, 1
	1, 1, 1, 1

L.C.M. of 9, 6, 3, 2 = 2 × 3 × 3 = 18

Now, the required like fractions are given by

$\frac{8}{9} = \frac{8 \times 2}{9 \times 2} = \frac{16}{18}$

$\frac{5}{6} = \frac{5 \times 3}{6 \times 3} = \frac{15}{18}$

$\frac{2}{3} = \frac{2 \times 6}{3 \times 6} = \frac{12}{18}$ (Making the denominator equal to the L.C.M.)

$\frac{1}{2} = \frac{1 \times 9}{2 \times 9} = \frac{9}{18}$

Exercise 5.1

1. Which of the following pairs are equivalent fractions ?

(a) $\frac{3}{5}$ and $\frac{15}{25}$ (b) $\frac{4}{5}$ and $\frac{28}{35}$ (c) $\frac{5}{6}$ and $\frac{25}{36}$

(d) $\frac{7}{25}$ and $\frac{49}{175}$ (e) $\frac{4}{11}$ and $\frac{9}{16}$ (f) $\frac{3}{7}$ and $\frac{21}{28}$

2. Write 'L' for like pairs and 'U' for unlike pairs of fractions for the followings:

(a) $\frac{5}{9}$ and $\frac{9}{5}$ ☐ (b) $\frac{1}{3}$ and $\frac{2}{3}$ ☐ (c) $\frac{2}{7}$ and $\frac{2}{9}$ ☐

(d) $\frac{1}{7}$ and $\frac{3}{7}$ ☐ (e) $\frac{1}{11}, \frac{3}{11}$ and $\frac{5}{11}$ ☐ (f) $\frac{1}{5}, \frac{5}{6}$ and $\frac{6}{7}$ ☐

3. Write 'P' for proper and 'I' for improper fractions for the following fractions:

(a) $\frac{5}{7}$ ☐ (b) $\frac{18}{23}$ ☐ (c) $\frac{2}{7}$ ☐

(d) $1\frac{4}{3}$ ☐ (e) $6\frac{1}{3}$ ☐ (f) 1 ☐

4. Fill in the boxes to make the following pairs equivalent fractions:

(a) $\frac{2}{5} = \frac{\square}{15}$ (b) $\frac{16}{24} = \frac{\square}{9}$ (c) $\frac{18}{24} = \frac{3}{\square}$

(d) $\frac{3}{5} = \frac{12}{\square}$ (e) $\frac{2}{7} = \frac{16}{\square}$ (f) $\frac{6}{22} = \frac{\square}{33}$

5. **Convert the following fractions into mixed fractions:**

(a) $\frac{9}{7}$ (b) $\frac{19}{4}$ (c) $\frac{27}{5}$ (d) $\frac{150}{17}$ (e) $\frac{18}{7}$ (f) $\frac{11}{5}$

6. **Convert the following mixed fractions into improper fractions:**

(a) $2\frac{3}{11}$ (b) $5\frac{1}{7}$ (c) $4\frac{3}{5}$ (d) $8\frac{4}{9}$ (e) $9\frac{3}{7}$ (f) $3\frac{1}{3}$

7. **Represent the following on number line:**

(a) $\frac{11}{3}$ (b) $\frac{14}{5}$ (c) $\frac{9}{2}$ (d) $\frac{5}{3}$ (e) $\frac{6}{4}$ (f) $\frac{7}{5}$

8. **Which of the following fractions are in the simplest form?**

(a) $\frac{24}{36}$ (b) $\frac{13}{84}$ (c) $\frac{27}{64}$ (d) $\frac{4}{26}$ (e) $\frac{17}{52}$ (f) $\frac{18}{35}$

9. **Reduce the following fractions to their simplest form:**

(a) $\frac{16}{72}$ (b) $\frac{80}{90}$ (c) $\frac{21}{28}$ (d) $\frac{58}{174}$ (e) $\frac{60}{84}$ (f) $\frac{108}{144}$

Comparing Like Fractions

Compare the numerators of like fractions. The fractions having the greater numerator is greater than the fractions having the smaller numerator.

Example 11 : **In $\frac{9}{13}, \frac{3}{13}, \frac{5}{13}$, which is the largest and the smallest factions ?**

Solutions : Since denominators are same in each case, therefore, fractions are like fractions.

$\frac{9}{13}$ is the largest one, because numerator 9 is the largest number of all.

$\frac{3}{13}$ is the smallest one, because numerator 3 is the smallest numerators.

Comparing Unlike Fractions

In case of same numerators, the fraction having the greater denominator is smaller than the fraction having the smaller denominator.

Example 12 : **Compare the following fractions:**

(a) $\frac{7}{15}$ and $\frac{7}{17}$ (b) $\frac{9}{23}$ and $\frac{9}{33}$

Solution : (a) Since denominators are different in each case, therefore fractions are unlike fractions.

In the case, when the numerators are same, the fraction having greater denominator is smaller than the fraction having smaller denominator.

Thus, $\frac{7}{15} > \frac{7}{17}$ (because 15 < 17)

(b) $\frac{9}{23} > \frac{9}{33}$ (because 23 < 33)

Addition and Subtraction of Fractions

If we can differentiate between like and unlike fractions, then it will be easy to learn addition and subtraction of fractions. As we have learnt that fraction can only be compared if they are like fraction. Addition or subtraction of two or more fractions can be done only when they have common denominator.

$$\text{Required fraction} = \frac{\text{Sum or difference of numerators}}{\text{Common denominator}}$$

Addition and Subtraction of Like Fractions

As like fractions have the same denominator, it is easy to add or subtract them. We add numerators while adding fractions and write the answer with the same denominator as that of the given fractions. If any fraction is mixed fraction, then first convert the same into improper fraction and finally add them.

Example 13 : (a) $\frac{2}{5}+\frac{1}{5}$ (b) $\frac{25}{5}+\frac{28}{5}$

Solution : (a) $\frac{2}{5}+\frac{1}{5} = \frac{2+1}{5}$

$= \frac{3}{5}$

(b) $\frac{25}{5}+\frac{28}{5} = \frac{25+28}{5}$

$= \frac{53}{5}$

Example 14 : (a) $\frac{7}{3}-\frac{5}{3}$ (b) $\frac{24}{8}-\frac{17}{8}$

Solution : (a) $\frac{7}{3}-\frac{5}{3} = \frac{7-5}{3}$

$= \frac{2}{3}$

(b) $\frac{24}{8}-\frac{17}{8} = \frac{24-17}{8}$

$= \frac{7}{8}$

Alternate method

Alternately, the integral parts and the improper fractions may be added or subtracted separately.

Example 15 : $\frac{4}{15}+2\frac{1}{15}+2\frac{3}{15}$

Solutions :

$\frac{4}{15}+2\frac{1}{15}+2\frac{3}{15}$

$= (2+2)+\frac{4}{15}+\frac{1}{15}+\frac{3}{15} = 4+\frac{4+1+3}{15}$

$= 4\frac{8}{15}$

Example 16 : $3\frac{7}{3}-2\frac{5}{3}$

Solutions :

$3\frac{7}{3}-2\frac{5}{3}$

$= (3-2) + \left(\frac{7}{3}-\frac{5}{3}\right) = 1 + \frac{2}{3}$

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

Addition and Subtraction of Unlike Fractions

When addition or subtraction is done between unlike fractions, we first convert them to respective like fractions or equivalent fractions and then proceed as done earlier.

Example 17 : **Subtract** $\frac{7}{10}-\frac{9}{15}$

Solutions : In order to convert these into like fractions, find L.C.M. of denominators.

5	10, 15
2	2, 3
3	1, 3
	1, 1

L.C.M. is $5 \times 2 \times 3 = 30$

Now, we proceed to convert the fractions into like fractions.

$\frac{7}{10} = \frac{7 \times 3}{10 \times 3} = \frac{21}{30}$ and $\frac{9}{15} = \frac{9 \times 3}{15 \times 2} = \frac{18}{30}$

Now subtract the like fractions i.e.

$\frac{7}{10}-\frac{9}{15} = \frac{21}{30}-\frac{18}{30} = \frac{21-18}{30} = \frac{3}{30} = \frac{1}{10}$

Facts to Know

We can add or subtract only like fractions. So, unlike fractions must be converted first into like fractions before addition or subtraction.

Example 18 : **Add** $\frac{2}{6}$ **and** $\frac{7}{8}$

Solution : On order to convert these into like fractions, find the L.C.M. of denominators.

2	6, 8
2	3, 4
2	3, 2
3	3, 1
	1, 1

L.C.M $= 2 \times 2 \times 2 \times 3 = 24$

Now, we proceed to convert the fractions into like fractions.

$$\frac{2}{6}=\frac{2\times4}{6\times4}=\frac{8}{24} \quad \text{and} \quad \frac{7}{8}=\frac{7\times3}{8\times3}=\frac{21}{24}$$

Now, add the like fractions.

i.e. $\frac{2}{6}+\frac{7}{8}=\frac{8}{24}+\frac{21}{24}$

$=\frac{8+21}{24}$

$=\frac{29}{24}=1\frac{5}{24}$

Example 19 : **Add $3\frac{1}{2}$ and $2\frac{1}{4}$**

Solutions : Convert the mixed fractions into their respective improper fractions.

$3\frac{1}{2}=\frac{7}{2}$ and $2\frac{1}{4}=\frac{9}{4}$

Now, covert the improper fractions into like fractions.

We need to find the L.C.M. of the denominators of these two fractions.

2	2, 4
2	1, 2
	1, 1

L.C.M. is 2 × 2 = 4

Now, convert the fractions into like fractions.

$$\frac{7}{2}=\frac{7\times2}{2\times2}=\frac{14}{4} \quad \text{and} \quad \frac{9}{4}=\frac{9\times1}{4\times1}=\frac{9}{4}$$

Now, add the mixed fractions

$3\frac{1}{2}+2\frac{1}{4}=\frac{7}{2}+\frac{9}{4}=\frac{14}{4}+\frac{9}{4}$

$=\frac{14+9}{4}$

$=\frac{23}{4}=5\frac{3}{4}$

Alternate method

In this method, we need to group the integral parts together and fractions parts together. Then, we simply add or subtract unlike fractions.

$3\frac{1}{2}+2\frac{1}{4}$

$=(3+2)+\left(\frac{1}{2}+\frac{1}{4}\right)$

$=5+\left(\frac{1}{2}+\frac{1}{4}\right)$

$=5+\left(\frac{2+1}{4}\right)$

$=5\frac{3}{4}$

Example 20 : **Subtract $7\frac{3}{4} - 5\frac{2}{6}$ by using two methods.**

Solutions : Convert the mixed fractions into their respective improper fractions.

$7\frac{3}{4} = \frac{31}{4}$ and $5\frac{2}{6} = \frac{32}{6}$

Now convert the improper fractions into like fractions. We need to find the L.C.M. of the denominators of these two fractions.

2	6, 4
2	3, 2
3	3, 1
	1, 1

L.C.M. is 2 × 2 × 3 = 12

Now, convert the fractions into like fractions.

$\frac{31}{4} = \frac{31 \times 3}{4 \times 3} = \frac{93}{12}$ and $\frac{32}{6} = \frac{32 \times 2}{6 \times 2} = \frac{64}{12}$

Now, subtract the mixed fractions

$$7\frac{3}{4} - 5\frac{2}{6} = \frac{31}{4} - \frac{32}{6} = \frac{93}{12} - \frac{64}{12}$$

$$= \frac{93 - 64}{12}$$

$$= \frac{29}{12} = 2\frac{5}{12}$$

or

Using alternate method, we group the integral parts together and fractions parts together.

$$7\frac{3}{4} - 5\frac{2}{6}$$

$$= (7 - 5)\left(\frac{3}{4} - \frac{2}{6}\right)$$

$$= 2\left(\frac{3}{4} - \frac{2}{6}\right)$$

$$= 2\left(\frac{9 - 4}{12}\right)$$

$$= 2\frac{5}{12}$$

Example 21 : **Find the value of $7\frac{1}{2} - 2\frac{1}{4} + 3\frac{1}{6}$**

Solution :

$$7\frac{1}{2} - 2\frac{1}{4} + 3\frac{1}{6} \quad = (7 - 2 + 3)\left(\frac{1}{2} - \frac{1}{4} + \frac{1}{6}\right)$$

First, we need to find the L.C.M. of denominators to convert them into equivalent fractions.

2	2, 4, 6
2	1, 2, 3
3	1, 1, 3
	1, 1, 1

Therefore, L.C.M. is 2 × 2 × 3 = 12

By converting into like fractions, we get

$$\frac{1\times6}{2\times6}=\frac{6}{12},\quad \frac{1\times3}{4\times3}=\frac{3}{12}\ \text{and}\ \frac{1\times2}{6\times2}=\frac{2}{12}$$

Hence, the final working is as follows :

$$7\frac{1}{2}-2\frac{1}{4}+3\frac{1}{6}=8+\left(\frac{6-3+2}{12}\right)$$
$$=8+\left(\frac{8-3}{12}\right)$$
$$=8\frac{5}{12}$$

Example 22 : **Find the sum of $\frac{1}{2}+\frac{2}{7}+5$**

Solutions : We know that every whole number is a fraction. So, the problem can be written as

$\frac{1}{2}+\frac{2}{7}+\frac{5}{1}$ (A whole number on its own will have 1 as denominator)

Find L.C.M. of the denominators.

2	2, 7, 1
7	1, 7, 1
	1, 1, 1

Therefore, L.C.M. is $2\times7=14$

Convert the fractions into like fractions

$$\frac{1\times7}{2\times7}=\frac{7}{14},\quad \frac{2\times2}{7\times2}=\frac{4}{14}\ \text{and}\ \frac{5\times14}{1\times14}=\frac{70}{14}$$

Finally, add the like fractions

$$\frac{1}{2}+\frac{2}{7}+\frac{5}{1}=\frac{7}{14}+\frac{4}{14}+\frac{70}{14}$$
$$=\frac{7+4+70}{14}$$
$$=\frac{81}{14}=5\frac{11}{14}$$

Example 23 : **Find the value of $2\frac{2}{3}+3\frac{1}{6}-4\frac{3}{4}$**

Solutions : $2\frac{2}{3}+3\frac{1}{6}-4\frac{3}{4}=(2+3-4)\left(\frac{2}{3}+\frac{1}{6}-\frac{3}{4}\right)$

First we need to find the L.C.M. of the denominators to convert them into equivalent fractions.

2	3, 6, 4
2	3, 3, 2
3	3, 3, 1
	1, 1, 1

Therefore, the L.C.M. is $2\times2\times3=12$

Converting the fraction into like fractions, we get

$\frac{2\times4}{3\times4}=\frac{8}{12}, \frac{1\times2}{6\times2}=\frac{2}{12}$ and $\frac{3\times3}{4\times3}=\frac{9}{12}$

Hence, the first working is as follow :

$$= (2+3-4)+\left(\frac{8}{12}+\frac{2}{12}-\frac{9}{12}\right)$$

$$= 1+\left(\frac{8+2-9}{12}\right)$$

$$= 1\frac{1}{12}$$

Example 24 : **Sangeeta bought 5 m ribbon from the market. She cut off $2\frac{3}{4}$ m and gave it to her sister. What is the total length of ribbon left with her?**

Solutions : Length of ribbon left with Sangeeta would be $5-2\frac{3}{4}$ m.

$$5-2\frac{3}{4} = \frac{5}{1}-\frac{11}{4}$$

We have to subtract $\frac{11}{4}$ from $\frac{5}{1}$.

So, we find the L.C.M. of 4 and 1 is 4.

$\frac{5}{1}=\frac{5\times4}{1\times4}=\frac{20}{4}$ and $\frac{11}{4}=\frac{11\times1}{4\times1}=\frac{11}{4}$

Now, find the value

$$5-2\frac{3}{4}=\frac{5}{1}-\frac{11}{4}=\frac{20}{4}-\frac{11}{4}$$

$$=\frac{20-11}{4}$$

$$=\frac{9}{4}=2\frac{1}{4} \quad =2\frac{1}{4}$$

So, length of ribbon left with Sangeeta is $2\frac{1}{4}$ m.

Exercise 5.2

1. **Add the following:**

(a) $\frac{7}{8}+\frac{9}{8}$ (b) $\frac{5}{12}+\frac{3}{12}$ (c) $3\frac{1}{5}+6\frac{2}{5}$ (d) $\frac{4}{9}+\frac{1}{9}$

(e) $\frac{3}{7}+\frac{9}{21}$ (f) $\frac{1}{2}+\frac{1}{4}$ (g) $\frac{3}{4}+\frac{5}{8}$ (h) $5+1\frac{1}{5}+2\frac{2}{3}$

(i) $2\frac{1}{3}+2\frac{5}{6}+\frac{2}{9}$ (j) $2\frac{6}{7}+3\frac{1}{4}+2\frac{2}{3}$ (k) $\frac{2}{15}+1\frac{3}{10}+\frac{1}{36}$

2. **Subtract the following:**

(a) $\frac{2}{9}-\frac{7}{9}$ (b) $\frac{3}{4}-\frac{1}{4}$ (C) $\frac{40}{8}-\frac{25}{8}$ (d) $5\frac{2}{3}-3\frac{1}{3}$

(e) $3-\frac{12}{5}$ (f) $\frac{5}{6}-\frac{3}{4}$ (g) $\frac{4}{3}-\frac{1}{2}$ (h) $2\frac{1}{5}-\frac{7}{4}$

(i) $8\frac{3}{4}-2\frac{1}{6}$ (j) $4\frac{1}{5}-2\frac{3}{4}$ (k) $1\frac{2}{5}-1\frac{2}{7}$

3. **Simplify the following:**

(a) $\frac{4}{5}+\frac{2}{5}-\frac{3}{5}$ (b) $\frac{11}{21}-\frac{4}{21}+\frac{6}{21}$ (C) $3\frac{1}{2}+2\frac{4}{5}+1\frac{1}{2}$ (d) $7+5\frac{1}{8}-3\frac{1}{4}$

(e) $6\frac{3}{4}+4\frac{2}{3}+1\frac{7}{12}$ (f) $\frac{5}{8}+3\frac{7}{12}+4\frac{1}{6}$ (g) $\frac{3}{7}+3-3\frac{1}{3}$ (h) $4\frac{3}{35}+2\frac{5}{7}+1\frac{1}{5}$

4. Rajesh takes $8\frac{3}{5}$ minutes to walk across the park. Ritesh takes $34\frac{1}{5}$ minutes to do the same. Who takes less time and by how much ?

5. Somi bought $\frac{3}{4}$ m of ribbon and Omi $\frac{2}{5}$ m of ribbon. What is the total length of the ribbon they bought together ?

6. What should be added to the difference of $1\frac{1}{2}$ and $\frac{2}{6}$ to get $1\frac{2}{3}$?

7. A boy covers $10\frac{1}{2}$ km long distance. Out of which, he covers $1\frac{7}{11}$ km by scooter and $5\frac{2}{3}$ km by cycle and the rest on foot. Find out the distance covered by the boy on foot.

Multiplication and Division of Fractions

Multiplication of Fractions

The product of two fractions is a fraction whose numerator is equal to the product of the numerators of the given fractions and the denominator is equal to the product of the denominators of the given fractions.

Don't forget to convert the fractions into their lowest terms. If the product is an improper fraction, convert it into a mixed fraction.

Example 25 : **Find the product of $\frac{18}{20}$ and $\frac{16}{15}$**

Solution :

Method 1 : First, we simplify and then multiply

So,

$$\frac{18}{20}\times\frac{16}{15} = \frac{18\times16}{20\times15} = \frac{24}{25}$$

$$= \frac{24}{25}$$

Method 2 : First, we multiply and then simplify

So,

$$\frac{18}{20} \times \frac{16}{15}$$

$$= \frac{18}{20} \times \frac{16}{16}$$

$$= \frac{288}{300}$$

$$= \frac{24}{25}$$

Example 26 : **Find the product of $\frac{10}{12}$ and $\frac{6}{12}$.**

Solution :

$$\frac{10}{12} \times \frac{6}{12}$$

$$= \frac{5}{6} \times \frac{1}{2}$$

$$= \frac{5 \times 1}{6 \times 2}$$

$$= \frac{5}{12}$$

Example 27 : **Simplify $\frac{3}{8} \times 2\frac{1}{9} \times 3\frac{1}{2}$**

Solution :

$$\frac{3}{8} \times 2\frac{1}{9} \times 3\frac{1}{2}$$

$$\frac{3}{8} \times \frac{19}{9} \times \frac{7}{2}$$

$$= \frac{3 \times 19 \times 7}{8 \times 9 \times 2}$$

$$= \frac{399}{144} = 2\frac{111}{144}$$

Division of Fractions

To divide a fraction with another fraction, multiply the first fraction with the reciprocal of the second fraction.

Example 28 : **Divide $\frac{3}{8}$ by $\frac{15}{35}$**

Solution : $\frac{3}{8} \div \frac{15}{35} = \frac{3 \times 35}{8 \times 15} = \frac{105}{120}$ (Since $\frac{35}{15}$ is the reciprocal of $\frac{15}{35}$)

$$= \frac{7}{8}$$

Example 29 : **Divide $\frac{5}{4}$ by 7**

Solution : $\frac{5}{4} \div 7 = \frac{5}{4} \div \frac{7}{1}$ (Since 7 can be written as $\frac{7}{1}$)

$= \frac{5}{4} \times \frac{1}{7}$ (Since $\frac{1}{7}$ is reciprocal of 7)

$$= \frac{5}{28}$$

Example 30 : Simplify $4\frac{1}{5} \div 3\frac{1}{2}$

Solution : $4\frac{1}{5} \div 3\frac{1}{2} = \frac{21}{5} \div \frac{7}{2}$

$= \frac{21}{5} \times \frac{2}{7}$ (Since $\frac{2}{7}$ is reciprocal of $\frac{7}{2}$)

$= \frac{6}{5} = 1\frac{1}{5}$

Exercise 5.3

1. **Find the product of the following:**

(a) $\frac{7}{9} \times \frac{5}{9}$ (b) $\frac{15}{20} \times \frac{26}{52}$ (c) $\frac{10}{11} \times \frac{12}{14}$ (d) $\frac{3}{7} \times \frac{7}{17}$

(e) $\frac{6}{8} \times \frac{4}{3}$ (f) $\frac{9}{16} \times 7$ (g) $3\frac{4}{5} \times 6\frac{3}{7}$ (h) $7\frac{1}{9} \times 8\frac{2}{7}$

2. **Write whether the reciprocals of the following would be proper or improper fractions.**

(a) $\frac{3}{5}$ (b) $\frac{7}{9}$ (c) 11 (d) $\frac{13}{24}$ (e) $1\frac{1}{5}$ (f) $6\frac{4}{7}$

3. **Find the quotients of the following :**

(a) $\frac{5}{4} \div \frac{10}{8}$ (b) $\frac{6}{10} \div 8$ (c) $2\frac{5}{7} \div 1\frac{3}{7}$ (d) $\frac{4}{6} \div \frac{8}{9}$ (e) $\frac{11}{7} \div 2\frac{3}{5}$

(f) $5\frac{1}{2} \div 3$ (g) $2 \div 3\frac{2}{3}$ (h) $\frac{3}{4} \div 5$ (i) $\frac{5}{7} \div 7$ (j) $\frac{1}{10} \div 2$

Simplification and Word Problems

BODMAS

B - Solve operations within brackets first.
First simple brackets ()
Next curly brackets {}
Finally square brackets []

O - Multiply the fraction with the word " of " in between

D - Divide (÷)

M - Multiply (×)

A - Add (+)

S - Subtract (−)

The use of 'of'

$\frac{3}{4}$ of $\frac{8}{5}$ implies $\frac{3}{4}$ is to be multiplied by $\frac{8}{5}$. However, this operation is done even before division, as $\frac{3}{4}$ of $\frac{8}{5}$ is a way of describing the fraction $\frac{6}{5}$. The following example will help in clarifying why the operation 'of' is solved before D, M, A and S.

Example 31 : Simplify $\frac{1}{7} - \frac{3}{5} + \frac{1}{2} \div 8 \text{ of } \frac{1}{16}$

Solution :

$$\frac{1}{7} - \frac{3}{5} + \frac{1}{2} \div \frac{8}{16} \quad \text{(Using 'of' Operation)}$$

$$= \frac{1}{7} - \frac{3}{5} + 1 \quad \text{(Using '÷' Operation)}$$

$$= \frac{8}{7} - \frac{3}{5} \quad \text{(Using '+' Opertion)}$$

$$= \frac{19}{35} \quad \text{(Using '–' operation)}$$

Example 32 : Simplify $\frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \left\{\frac{1}{4} \times \left(\frac{1}{3} + \frac{1}{3} - \frac{1}{2}\right) + \frac{6}{7}\right\} \div \frac{8}{9}\right] \div 7\frac{1}{7}$

Solution :

$$\frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \left\{\frac{1}{4} \times \left(\frac{1}{3} + \frac{1}{3} - \frac{1}{2}\right) + \frac{6}{7}\right\} \div \frac{8}{9}\right] \div 7\frac{1}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \left\{\frac{1}{4} \times \left(\frac{1}{3} + \frac{1}{3} - \frac{1}{2}\right) + \frac{6}{7}\right\} \div \frac{8}{9}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \left\{\frac{1}{4} \times \left(\frac{2+2-3}{6}\right) + \frac{6}{7}\right\} \div \frac{8}{3}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \left\{\frac{1}{4} \times \frac{1}{6} + \frac{6}{7}\right\} \div \frac{8}{9}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \left\{\frac{1}{24} + \frac{6}{7}\right\} \div \frac{8}{9}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \frac{7+144}{168} \div \frac{8}{9}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \div \frac{6}{7} + \frac{151}{168} \div \frac{8}{9}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{3}{4} \times \frac{7}{6} + \frac{151}{168} \times \frac{9}{8}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{7}{8} + \frac{1359}{1344}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \left[\frac{1176+1359}{1344}\right] \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \frac{2535}{1344} \div \frac{50}{7}$$

$$= \frac{2}{5} + \frac{1}{2} - \frac{507}{192} \times \frac{1}{10}$$

$$= \frac{2}{5} + \frac{1}{2} - \frac{507}{1920}$$

$$= \frac{768+960-507}{1920}$$

$$= \frac{1728-507}{1920} = \frac{1221}{1920}$$

Example 33 : **80 sweets are to be distributed among the boys in class VI. If there are 14 students present in the class, of which $\frac{5}{7}$ are boys. How many sweets does each boy get?**

Solution :

$$80 \div \frac{5}{7} \text{ of } 14$$

$$= 80 \div \left(\frac{5}{7} \times 14\right) = 80 \div (5 \times 2)$$

$$= 80 \div 10$$

$$= 8$$

Thus, each boy will get 8 sweets.

Exercise 5.4

1. **Simplify the following:**

   (a) $2\frac{3}{5} \times \frac{7}{9} \times \frac{3}{7}$ (b) $3\frac{2}{7} \div 4\frac{3}{5} \text{ of } 1\frac{1}{2}$ (c) $\left(2\frac{4}{5} \times 1\frac{3}{7}\right) \div \left(1\frac{3}{4} \times 1\frac{1}{7}\right)$

   (d) $\left(\frac{3}{4} - \frac{1}{5}\right) \div \left(\frac{3}{5} + \frac{1}{2}\right) - \frac{1}{3} \div 2$ (e) $\frac{1}{2} \text{ of } \left(\frac{1}{2} + \frac{1}{2}\right) \div \frac{1}{2} - \left[\frac{1}{2} \times \left\{\frac{1}{2} - \frac{1}{2} \times \frac{1}{2}\left(\frac{1}{2} + \frac{1}{2}\right)\right\}\right]$

2. An empty basket weighs $1\frac{3}{4}$ kg. Hari puts $2\frac{1}{2}$ kg of mangoes in the basket. What is the total weight of basket and mangoes altogether ?

3. A cake was shared by three brothers. Piyush ate $\frac{2}{5}$ of the cake, Praveen ate $\frac{3}{8}$ of the cake and Prabhat ate the rest of the cake. Who got the biggest share of the cake?

4. If $\frac{1}{4}$ kg rice costs ₹ $112\frac{1}{2}$, then how much would $1\frac{2}{5}$ kg rice cost?

5. A container had $4\frac{1}{4}$ *l* of milk out of which a cat drank $\frac{3}{8}$ *l*. How much milk was left in the container?

6. After travelling a distance of 24.25 km, Rachit found that $\frac{2}{8}$ of the journey was still left. Find the total distance to be covered by Rachit ?

7. A card of length $71\frac{1}{2}$ m has been cut into 26 pieces of equal lengths. What is the length of each piece?

8. Mauli gave ₹ 100 to a shopkeeper. She bought a pen for ₹ $26\frac{2}{5}$ and a geometry box for ₹ $41\frac{1}{10}$. How much money will Mauli get back from the shopkeeper?

Points to Remember

- A fraction is a part of whole and is represented as: Fraction = $\frac{\text{Numerator}}{\text{Denominator}}$
- A fraction is a number representing a part of whole. The whole may be a single object or a group of objects.
- In a fraction, when numerator is less than denominator it is called **proper fraction**.
- In a fraction, when numerator is greater than denominator it is called **improper fraction**.
- A fraction which consists of a natural number and a proper fraction is called **mixed fraction**.
- Fractions with same denominator are called **like fractions**.
- Fractions with different denominators are called **unlike fractions**.
- When two fractions having the same numerators are compared, then the fraction with the greater denominator will be smaller fraction.
- Two fractions having different numerators and denominators are compared by making the same denominator.

EXERCISE

1. MULTIPLE CHOICE QUESTIONS (MCQs):

Tick (✓) the correct options.

(a) The fraction that represents 8 hours of a day is :

(i) $\frac{8}{12}$ ☐ (ii) $\frac{16}{24}$ ☐ (iii) $\frac{2}{3}$ ☐ (iv) $\frac{1}{3}$ ☐

(b) On the number line, the point representing   lies between :

(i) 1 and 2 ☐ (ii) 0 and 1 ☐ (iii) 2 and 3 ☐ (iv) 3 and 4 ☐

(c) Which of the following are like fractions ?

(i) $\frac{3}{7}, \frac{2}{9}, \frac{8}{13}$ ☐ (ii) $\frac{6}{7}, \frac{5}{9}, \frac{7}{9}$ ☐ (iii) $\frac{2}{3}, \frac{1}{3}, \frac{7}{9}$ ☐ (iv) $\frac{2}{5}, \frac{3}{5}, \frac{4}{5}$ ☐

(d) A fraction equivalent to $\frac{3}{5}$ is :

(i) $\frac{3-2}{5-2}$ ☐ (ii) $\frac{3\times2}{5\times2}$ ☐ (iii) $\frac{3\times0}{5\times0}$ ☐ (iv) $\frac{3+5}{5+5}$ ☐

(e) If $\frac{3}{5}$ is equivalent to $\frac{x}{20}$, then the value of x is :

(i) 10 ☐ (ii) 12 ☐ (iii) 18 ☐ (iv) 15 ☐

(f) The smallest fraction from $\frac{3}{5}, \frac{2}{3}, \frac{5}{6}, \frac{7}{10}$ is :

(i) $\frac{7}{10}$ ☐ (ii) $\frac{2}{3}$ ☐ (iii) $\frac{3}{5}$ ☐ (iv) $\frac{5}{6}$ ☐

(g) The largest fraction from $\frac{7}{12}, \frac{5}{8}, \frac{9}{16}, \frac{12}{20}$ is :

(i) $\frac{7}{12}$ (ii) $\frac{12}{20}$ (iii) $\frac{5}{8}$ (iv) $\frac{9}{16}$

(h) The value of $\frac{2}{3}+\frac{3}{4}$ is :

(i) $\frac{11}{12}$ (ii) $\frac{19}{12}$ (iii) $\frac{17}{12}$ (iv) $\frac{13}{12}$

2. Write four equivalent fractions of the following:

(a) $\frac{3}{8}$ (b) $\frac{6}{7}$ (c) $\frac{11}{13}$ (d) $\frac{15}{17}$

(e) $\frac{2}{7}$ (f) $\frac{5}{8}$ (g) $\frac{7}{13}$ (h) $\frac{5}{7}$

3. Add the following:

(a) $\frac{2}{5}+\frac{3}{8}$ (b) $\frac{3}{10}+\frac{2}{15}$ (c) $\frac{5}{6}+\frac{7}{12}$

(d) $\frac{3}{4}+\frac{7}{12}+\frac{1}{3}$ (e) $\frac{1}{7}+\frac{3}{5}+\frac{7}{13}$ (f) $\frac{7}{17}+\frac{9}{19}$

4. Subtract the following:

(a) $\frac{3}{7}-\frac{1}{7}$ (b) $\frac{2}{3}-\frac{1}{9}$ (c) $\frac{2}{5}-\frac{1}{10}$

(d) $\frac{5}{7}-\frac{2}{9}$ (e) $4\frac{2}{3}-2\frac{1}{3}$ (f) $\frac{5}{12}-\frac{1}{4}$

5. A vessel had $4\frac{1}{4}$ *l* of milk. Out of it a baby drank $\frac{3}{5}$ *l*. How much milk was left in the vessel ?

6. An electric pole is $11\frac{2}{3}$ m long. If it lies $2\frac{1}{3}$ m under the ground, then how much part of the pole is above the ground ?

7. Raju was given $1\frac{1}{2}$ piece of cake and Rinku was given $1\frac{1}{3}$ piece of cake. Find the total amount of cake given to both of them.

HOTS

Here is a fraction $\frac{5}{6}$. Find an equivalent fraction to this where the denominator is 4 more than the numerator.

Lab Activity

With your partner, make a set of fraction cards like these :

$\frac{1}{6}$	$\frac{12}{15}$	$\frac{9}{10}$	$\frac{4}{7}$	$\frac{1}{3}$
$\frac{2}{19}$	$\frac{2}{5}$	$\frac{5}{8}$	$\frac{39}{40}$	$\frac{7}{9}$

Bench marks		
near	near	near
0	$\frac{1}{2}$	1

(a) Sort your cards into three groups - fractions near 0, fractions near $\frac{1}{2}$ and fractions near 1.

(b) Within each group, decide which fraction is the largest and which is the smallest.

(c) Order the fractions from least to greatest by estimating the size of each fraction.

(d) Make a new fraction card. Add it to the set by placing it in the correct group.

(e) Choose a fraction card from the given fractions. Make a new fraction card that, when added to the fraction you have chosen, make '1'.

6 Decimal

A decimal number in a number with a decimal point in it. A decimal number consists of a whole number point and a fractional point. A point or dot in used for decimal like 1.2 or 2.3 Etc.

Any fraction can be converted into a decimal number. The fractional numbers having denominators 10, 100, 1000 etc. are called decimal fractions or decimals. Some decimal fractions are expressed as given below:

(i) $\frac{3}{10}$ is expressed as 0.3 (ii) $\frac{7}{100}$ is expressed as 0.07 (iii) $5\frac{19}{100}$ is expressed as 5.19

The dot "." is called decimal point. Therefore, decimal fraction consists of two parts, i.e., whole number part and decimal part, and they are separated by the decimal point. Let us see :

decimal point ↓

4 . 15

↑ whole number part ↑ decimal part

For example : 8.52 is a decimal number (read as eight point five two). 8 is called the whole number part or integral part and 52 is called decimal part of this number. Now, we try to understand the decimal fraction with the help of the place value chart.

Value Chart of Some Decimal Numbers								
Decimal number	Integral part or whole number part				•	Decimal part		
	Thousands (× 1000)	Hundreds (× 100)	Tens (× 10)	Ones (× 1)	•	Tenths $\left(\times\frac{1}{10}\right)$	Hundreds $\left(\times\frac{1}{100}\right)$	Thousands $\left(\times\frac{1}{1000}\right)$
5791.23	5	7	9	1	•	2	3	
914.125		9	1	4	•	1	2	5
78.106			7	8	•	1	0	6

Equivalent Decimals

Decimals are a special type of fractions. Further, we have equivalent fractions and equivalent decimals too.

Consider, $0.5 = \frac{5}{10} = \frac{1}{2}$ as $\frac{1}{2} \times \frac{5}{5} = \frac{5}{10}$

Now, $0.50 = \frac{50}{100} = \frac{1}{2}$ as $\frac{1}{2} \times \frac{50}{50} = \frac{50}{100}$

and 0.500 $= \frac{500}{1000} = \frac{1}{2}$ as $\frac{1}{2} \times \frac{500}{500} = \frac{500}{1000}$

Thus, 0.5, 0.50, 0.500 are equivalent decimals.

Like and Unlike Decimals

Like Decimal

Decimals with the same number of decimal places are called like decimals. It means that the number of digits after the decimal point are the same.

For example : One decimal place : 3.9, 27.4, 123.6

Two decimal places : 3.92, 27.45, 123.69

Unlike Decimals

Decimals having different number of decimals places are called unlike decimals. It means that the number of digits after the decimal point is not the same.

For example : 31.1, 15.67, 327.111

Convert Unlike Decimals into Like Decimals

We can convert unlike decimals into like decimals by adding zeroes after the last digit to the right of the decimal point.

For example : Consider three unlike decimal fractions

1.4	7.23	4.561
(One decimal place)	(Two decimal places)	(Three decimal places)

If we want to convert the decimals into three places of decimals, then

1.4 = 1.400 (two zeroes added)

7.23 = 7.230 (one zero added)

4.561 = 4.561 (three places of decimals)

Facts to Know

To convert unlike decimals into like decimals, zero can be added after the last digit to the right of the decimal point of any decimal number without changing its value.

Comparison of Decimals

While comparing decimals, the number with the greater whole part is greater or larger. If the whole part is the same then check the tenths part i.e., extreme left digit of the decimal part. The number with the greater tenths part is greater. If both the whole part and tenths part are the same, then we check the hundredth part and the number which has a greater hundredth part is greater or larger.

If the numbers have all these as equal, then we check whether the thousandths part is greater.

Example 1 : Compare the following decimal numbers.

(a) 27.37 and 31.98 (b) 6.78 and 6.79

Solution : (a) Here the whole parts are 27 and 31.

Since 31 > 27, so we can say that 31.98 > 27.37

(b) Here the whole parts are the same i.e., both have '6' as the whole part. So we will check the tenths part. Here tenths parts are same as '7'. So we look hundredth part which is '8' in the first number and '9' in the second number.

As 8 < 9, so we can say

6.78 < 6.79

Example 2: **Compare the following decimal numbers.**

(a) 7.25 and 7.025 (b) 21.45 and 21.406

Solution : (a) 7.25 and 7.025

Here the whole part is the same i.e., '7'. So we will look at the tenth part which is '2' in the first number and '0' in the second.

As 2 > 0, so we say that 7.25 > 7.025

(b) 21.45 and 21.406

Here the whole part is the same as well as the tenths part. So we will look at the hundredth part which is '5' for the first number and '0' for the second number.

As 5 > 0, so we can say that 21.45 > 21.406

Conversion of a Decimal into a Fraction

To change a decimal into a fraction. We should to follow the following steps :

Step 1 : Write the decimal without the decimal point as the numerator of the fraction.

Step 2 : Write 1 in the denominator followed by as many zeros as the number of decimal places in the gives number.

Step 3 : Simplify the fraction and write the fraction in the lowest form.

Example 3: **Convert each of the following decimals into fractions.**

(a) 8.25 (b) 723.246

Solution : (a) $8.25 = \frac{825}{100} = \frac{165}{20} = \frac{33}{4} = 8\frac{1}{4}$

(b) $723.246 = \frac{723246}{1000} = \frac{361623}{500} = 723\frac{123}{500}$

Conversion by Long Division Method

We can change a fraction into decimal by using long division method. For that, we should follow the following steps:

Step 1 : Convert the divided to a suitable equivalent decimal.

Step 2 : When the digit to the right of the decimal point is brought down, a decimal point in to be placed in quotient.

Example 4: **Convert $\frac{4}{10}$ into a decimal fraction.**

Solution : $\frac{4}{10}$ means 4 divided by 10.

4, being less than 10, So, 4 cannot be divided by 10.

But 4 units = 40 tenths, which can be divided by 10

```
      0.4
  10) 40   <---- (decimal point placed in the quotient at this step)
     -40
      00
```

Thus, therefore $\frac{4}{10} = 0.4$

Example 5: Convert $\frac{4}{8}$ into a decimal fraction.

Solution : $\frac{4}{8}$ means, 4 divided by 8

4 is less than 8, so that 4 cannot be divided by 8.

But 4 units = 40 tenths, which can be divided by 8.

$$\begin{array}{r} 0.5 \\ \overline{)4.0} \\ -0 \\ \hline 40 \\ -40 \\ \hline \times \end{array}$$

(decimal point placed in the quotient at this step)

Thus, $\frac{4}{8} = 0.5$

Conversion of a Fraction into a Decimal

To change a fraction into a decimal, we take the following steps :

Step 1 : First change the given fraction into an equivalent fraction with the denominator as 10,100, 1000, etc.

Step 2 : In case the number of digits in numerator is less than the number of zeroes in denominator, we place zero just right to decimal.

Example 6: (a) $\frac{5}{4}$ (b) $3\frac{2}{4}$

Solution : (a) $\frac{5}{4} = \frac{5 \times 25}{4 \times 25} = \frac{125}{100} = 1.25$

(b) $3\frac{2}{4} = \frac{14}{4} = \frac{14 \times 25}{4 \times 25} = \frac{350}{100} = 3.50$

We can convert a fraction into its decimal form using the long division method.

Exercise 6.1

1. Fill in the boxes with '>', '=' or '<' signs to compare the decimals.

(a) 12.35 ☐ 19.1 (b) 83.60 ☐ 83.06 (c) 141.25 ☐ 7.95

(d) 32.5 ☐ 32.500 (e) 42.356 ☐ 42.365 (f) 3.03 ☐ 3.03

(g) 2.43 ☐ 2.04 (h) 261.001 ☐ 261

2. Arrange the following decimals in ascending order.

(a) 77.7, 7.77, 0.777, 7770 (b) 0.07, 0.17, 7.117, 7.007

© 2.1, 2.01, 2.0, 2.25 (d) 26.5, 26.54, 26.57, 2.657

(e) 7.39, 7.19, 17.309, 17.390 (f) 1.617, 1.712, 1.434, 1.999

3. Arrange the following decimals in descending order.

(a) 0.098, 0.56, 0.31, 0.010 (b) 34.1, 34.2, 34.02, 34.01

© 11.11, 1.111, 111.1,1111, (d) 0.4, 0.536, 0.67, 0.112

(e) 89.1, 89.02, 89.01, 89.2 (f) 21.12, 2.112, 211.2, 0.221

4. **Convert the following unlike decimals into like decimals.**

(a) 2.3, 4.34, 5.212 (b) 0.2, 30.27, 30.275 (c) 25.5, 25.55, 0.255

(d) 9.05, 2.5, 2.533 (e) 456.3, .4.56, 4. 356 (f) 1.1, 1.11, 1.111

5. **Convert the following decimal into fractions.**

(a) 4.125 (b) 222.2 (c) 0.25 (d) 0.29 (e) 87.003

(f) 1.7 (g) 0.27 (h) 47.23 (i) 2.111 (j) 0.234

6. **Convert the following fractions into decimals.**

(a) $\frac{23}{100}$ (b) $\frac{235}{10}$ (c) $\frac{2469}{1000}$ (d) $\frac{5}{10}$ (e) $\frac{2211}{100}$

(f) $\frac{131}{10}$ (g) $\frac{39}{10}$ (h) $\frac{2008}{1000}$ (i) $\frac{45}{100}$ (j) $\frac{89}{100}$

7. **Convert the following to decimal fractions by converting the denominator to 10, 100, 1000 etc.**

(a) $\frac{96}{125}$ (b) $\frac{16}{25}$ (c) $\frac{9}{4}$ (d) $\frac{43}{50}$ (e) $\frac{4}{5}$

(f) $\frac{209}{500}$ (g) $\frac{9}{125}$ (h) $\frac{52}{40}$ (i) $\frac{14}{20}$ (j) $\frac{13}{50}$

Addition and Subtraction of Decimals

For the addition and subtraction of decimals, we take the following steps.

Step 1 : If the decimals are unlike, then we need to convert them into like decimals.

Step 2 : The addition and subtraction can them be carried out as we do for whole numbers. But make sure that the decimals are aligned properly. Place them in columns.

Step 3 : The decimal points must be placed directly below each other, so that tenths are below tenths, hundredths are below hundredths and thousandths are below thousandths.

The decimal point will lie directly below the decimal points of the numbers.

Example 7: **Add 7.23 and 4.11**

Solution :

```
   7.23
+  4.11
-------
  11.34
```

So, the sum of 7.23 and 4.11 is 11.34

Facts to Know

Place the decimal points directly above each other and align the numbers accordingly.

Example 8: (a) **Add 3.52, 7.5 and 19.06** (b) **Add 19.2, 0.007 and 3.64**

Solution : (a) As the decimals are unlike, we will convert them into like decimals. So we will write 7.5 as 7.50.

Now,

```
    3.52
    7.50
+  19.06
--------
   30.08
```

(Note the position of the decimal point in the numbers and in the answer)

Thus, 3.52 + 7.5 + 19.06 = 30.08

(b) As the decimals are unlike, we will convert the decimals into like decimals, we will write 19.2 as 19.200 and 3.64 as 3.640

Now,

```
   19.200
    0.007
 +  3.640
 --------
   22.847
```

(Note the position of the decimal point in the numbers and in the answer)

Thus, 19.2 + 0.007 + 3.64 = 22.847

Example 9 : (a) **Subtract 27.6 from 30.05** (b) **Subtract 8.345 from 15**

Solution : (a) At first we will convert the given decimals into like decimals. So we will write 27.6 as 27.60

Now,

```
  (2)(9)(10)
   30.05
 - 27.60
 -------
    2.45
```

(Note the position of the decimal point in the numbers and in the answer)

Thus, 30.05 − 27.6 = 2.45

(b) First we will convert the given decimals into like decimals. So, we will write 15 as 15.000

Now,

```
 (14)(9)(9)(10)
   15.000
    8.345
  -------
    6.655
```

Thus, 15 − 8.345 = 6.665

Example 10: Simplify 24 − 27.047 + 5.26

Solution : First we will convert the given decimals into like decimals. So, we will write 24 as 24.000 and 5.26 as 5.260

Now,

```
   24.000
 +  5.260
 --------
   29.260
```

and

```
      (5)(10)
   29.260
 - 27.047
 --------
    2.213
```

Thus, 24 − 27.047 + 5.26 = 2.213

Exercise 6.2

1. **Add the following.**
   (a) 7.2 + 4.6 (b) 0.5 + 2.6 (c) 523.4 + 641.6
   (d) 71.29 + 88.9 (e) 14.354 + 9.109 (f) 4.11 + 0.7
   (g) 89 + 6.345 (h) 2.567 + 0.798 + 1.46 (i) 162.34 + 73.46
2. **Subtract the following.**
   (a) 78.9 − 4.890 (b) 11.75 − 9.2 (c) 122.50 − 31.239 (d) 1 − 0.005
   (e) 0.206 − 0.001 (f) 784.978 − 456.71 (g) 665.087 − 56.723 (h) 876.2 − 23.55
3. **Simplify the following.**
   (a) 3.9 + 1.3 − 2.5 (b) 31.746 − 105.6 + 200.05 (c) 2.67 − 1.787 + 1.878
   (d) 101.28 + 29.19 − 30.27 (e) 3.28 + 1.63 − 4.9 (f) 65.3 − 42.71 − 23.531 + 33.136
   (g) 131.131 + 113.113 − 211.211 (h) 6.7 + 3.21 − 7.463 (i) 5 − 5.5 + 2.7
4. What should be added to 2.375 to get 5 ?

Multiplication and Division of Decimals

For the multiplication and division of decimals, we take the following steps.

Step 1 : In case of multiplication, the product is a decimal fraction, with the same digits as the multiplicand in which the decimal point has shifted to the right by as many places as the number of zeroes in the multiplier often 1.

Step 2 : If the multiplier is a whole number or a decimal fraction. Then, the product will have as many decimal places as the sum of the decimal places in the multiplicand and the multiplier.

Step 3 : In case of divisions, the quotient is a decimal fraction, with the same digits as the dividend, in which the decimal point has shifted to the left by as many places as the number of zeroes in the divison after 1.

Step 4 : If the divisor is a whole number or a decimal fraction then the divided as well as the divisor are multiplied by 10,100, 1000, etc. In order to make the divisor a whole number. Then the division is carried out, taking care to place a decimal point in the quotient as soon as the tenths digit is brought down from the dividend.

Example 11: Solve the following.

(a) 51.12×10 (b) 2.345×10000

(c) 17.137×21.14

Solution : (a) 51.12×10

Number of zeroes in multiplier after 1 is 1, move decimal point 1 place to the right.

Thus, 51.12×10

$= 511.20$

(b) 2.345×10000

Number of zeroes in multiplier after 1 is 4, move decimal point 4 places to the right.

Thus, $2.345 \times 10000 = 23450$

(c) 17.137×21.14

Multiply by ignoring the decimal point

```
      17137
    × 2114
    -------
      68548
     17137×
    17137××
   34274×××
   --------
   36227618
```

64.23 × 1

Decimal places in 17.137 = 3

Decimal places in 21.14 = 2

Decimal places in product = 5

Thus, $17.137 \times 21.14 = 362.27618$

Example 12: Find the quotients of the following :

(a) 16.15 ÷ 10 (b) 5.9 ÷ 1000 (c) 282.04 ÷ 11

Solution : (a) 18.21 ÷ 10

Number of zeroes in divisor after 1 is 1

Move decimal point 1 place to the left.

Thus, 16.15 ÷ 10 = 1.615

(b) 5.9 ÷ 1000

Number of zeros in divisor after 1 is 3

Move decimal point 3 places to the left

Thus, 5.9 ÷ 1000 = 0.0059

(c) 282.04 ÷ 11

1. Find the products of the following.

```
     25.64
11) 282.04
    22
    ---
     62
    -55
    ---
      70   <-- Place decimal point in quotient as the tenths place & brought down.
     -66
     ---
      44
     -44
     ---
      00
```

Since the divisor is a whole number, there is no need to multiply the dividend and divisor by 10, 100, 1000, etc.

Thus, 282.04 ÷ 11 = 25.64

Exercise 6.3

1. (a) 0.132 × 10 (b) 6.354 × 100 (c) 72.09 × 100
   (d) 182.03 × 10 (e) 0.005 × 100 (f) 152.115 × 100
   (g) 114.2 × 2.14 (h) 1.475 × 2.112 (i) 22.43 × 6.78
   (j) 6.567 × 1.143 (k) 3.17 × 2.36 × 11.47 (l) 22.48 × 112.36

2. **Find the quotients of the following.**
   (a) 11.13 ÷ 2.1 (b) 1.56 ÷ 1.3 (c) 364.19 ÷ 10 (d) 0.001 ÷ 100
   (e) 108.5 ÷ 50 (f) 10.101 ÷ 1000 (g) 6.752 ÷ 5.275 (h) 3.8778 ÷ 1.124

Points to Remember

- Fractions with denominators 10,100,1000, etc, are known as decimal fractions or decimals.
- Decimal number has whole number part and decimal part separated by decimal point.
- Zeros to the extreme right side of the decimals does not have any value.
- Two decimal having same number of decimal places are like decimal and decimals having different decimal places are unlike decimals.
- To add or subtract decimals, it is easier to convert them as like decimals and then add or subtract, as we do for whole numbers.

EXERCISE

1. **MULTIPLE CHOICE QUESTIONS (MCQs):**
   Tick (✓) the correct options.

(a) The value of $\frac{52}{1000}$ is:

(i) .52 ☐ (ii) 0.00052 ☐ (iii) 0.0052 ☐ (iv) 0.052 ☐

(b) The value of $3\frac{7}{100}$ is :

(i) 3.7 ☐ (ii) 0.37 ☐ (iii) 3.07 ☐ (iv) 3.70 ☐

(c) Which of the following are unlike decimals ?

(i) 2.2, 3.4, 4.2, 5.1 ☐ (ii) 3.5, 4.05, 5.5, 6.5 ☐

(iii) 0.8, 5.1, 0.5, 10.8 ☐ (iv) 12.12, 0.15, 5.51, 0.79 ☐

(d) 8.25 is equal to :

(i) $8\frac{1}{2}$ ☐ (ii) $8\frac{2}{5}$ ☐ (iii) $8\frac{1}{4}$ ☐ (iv) $8\frac{3}{4}$ ☐

(e) The value of $\frac{12}{1000}$ is :

(i) 0.012 ☐ (ii) 0.120 ☐ (iii) 0.011 ☐ (iv) 12000 ☐

(f) The value of $\frac{5}{100}$ is:

(i) 0.005 ☐ (ii) 0.5 ☐ (iii) 0.05 ☐ (iv) 0.0005 ☐

(g) 7.5 is equal to :

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

2. **Fill in the boxes with '>', '=' or '<' signs to compare the decimals.**

(a) 8.25 ☐ 7.005 (b) 69.002 ☐ 2.567 (c) 2.43 ☐ 2.43

(d) 42.326 ☐ 42.336 (e) 84.878 ☐ 85.979 (f) 17.9 ☐ 17.09

(g) 2.223 ☐ 2.224 (h) 3.03 ☐ 3.03

3. **Convert the following fractions into decimals.**

(a) $\frac{32}{100}$ (b) $\frac{235}{10000}$ (c) $\frac{2008}{1000}$ (d) $\frac{2211}{100}$

(e) $\frac{31}{10}$ (f) $\frac{39}{100}$ (g) $\frac{2009}{100}$ (h) $\frac{45}{1000}$

4. **Convert the following fractions into decimals by long division method.**

(a) $12\frac{12}{15}$ (b) $\frac{9}{15}$ (c) $\frac{5}{8}$ (d) $3\frac{4}{5}$

(e) $2\frac{2}{25}$ (f) $7\frac{4}{25}$ (g) $70\frac{1}{4}$ (h) $\frac{9}{20}$

5. **Find the product of the following.**

(a) 1.09×100 (b) 8.321×1.006 (c) 8.25×1.009 (d) 2.23×1.0023

(e) 1.235×1000 (f) 2.895×10 (g) 191.1×2.234 (h) 9.89×1000

(i) 21.23×1000 (j) 8.531×100

6. **Find the quotients of the following.**

(a) 231.7 ÷ 70 (b) 100.32 ÷ 80 (c) 3.8778 ÷ 1.124

(d) 108.5 ÷ 50 (e) 364.19 ÷ 100 (f) 10.101 ÷ 1000

HOTS

Pooja bought a book for rupees 69 and 25 paise, a pen for ₹ 19.75, a geometry box for ₹ 53.25 and gave the shopkeeper 500 rupees note. How much balance did she get back? Express the answer in rupees.

Lab Activity

COLOURING DECIMAL NUMBERS

Objective : To create decimal numbers.

Materials Required : Colour pencils.

Procedure :

- In the tables below, create the target decimal numbers by colouring two boxes with the same colour. Suppose target number is 7.9.

  We know that: 7 + 0.9 = 7.9, so 7 and 0.9 should be coloured same. First one is done for you.

Table 1

0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2	3	4	5	6	7	8	9

Target numbers :

(a) 8.9 (b) 6.1 (c) 3.9

(d) 6.1 (e) 8.3 (f) 9.4

Table 2

0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2	3	4	5	6	7	8	9

Target numbers :

(a) 6.89 (b) 9.23 (c) 2.56

(d) 8.09 (e) 5.27 (f) 3.34

Revision Test Paper-II

(Based on Chapters 4 to 6)

A. Multiple Choice Questions (MCQs).
Tick (✓) the correct option.

1. What fraction of a day is 4 hours ?
   (i) $\frac{2}{6}$ ☐ (ii) $\frac{3}{6}$ ☐
   (iii) $\frac{1}{6}$ ☐ (iv) $\frac{4}{6}$ ☐

2. $\frac{8}{5}$ represents
   (i) mixed fraction ☐ (ii) like fraction ☐
   (iii) improper fraction ☐ (iii) proper fraction ☐

3. $\frac{2}{10}$ is expressed as
   (i) 0.03 ☐ (ii) 5.13 ☐
   (iii) 0.2 ☐ (iv) none ☐

4. On subtracting 27.6 from 30.05, we get
   (i) 3.45 ☐ (ii) 5.42 ☐
   (iii) 1.45 ☐ (iv) 2.45 ☐

5. Which of the following sign will show the relation $-11 \square -118$
   (i) > ☐ (ii) < ☐
   (iii) = ☐ (iv) None of these ☐

6. Find the value of 15 | − | −2|
   (i) −1 ☐ (ii) −3 ☐
   (iii) 3 ☐ (iv) 1 ☐

7. A variable is an algebra identity that can be assigned any value from the set of
   (i) Natural numbers ☐ (ii) Whole numbers ☐
   (iii) Real numbers ☐ (iv) None ☐

8. Algebraic expressions with only one term are called as
   (i) Binomials ☐ (ii) Polynomials ☐
   (iii) Monomials ☐ (iv) Trinomials ☐

9. The value of 9.5 is equal to

(i) $9\frac{1}{4}$ ☐ (ii) $9\frac{2}{5}$ ☐

(iii) $9\frac{1}{2}$ ☐ (iv) $9\frac{3}{4}$ ☐

B. Fill in the blanks.

1. Zeroes to the extreme right side of the decimals do not have any ....
2. While comparing decimals, the number with the greater whole part is ....
3. The number of digits after the decimal point are ....
4. A fraction is said to be in its lowest form if the numerator and denominator do not have any common factor except ....

C. Tick (✓) for the true statement and cross (×) for the false statement.

1. The product of $\frac{25}{36}$ and $\frac{12}{15}$ is $\frac{5}{9}$. ☐
2. The decimals value of $\frac{3}{5}$ is 0.5. ☐
3. The descending order of 0.4, 0.536, 0.67, 0.112 is 0.67, 0.536, 0.4, 0.112 ☐
4. If the decimals are unlike, then we convert them into like decimals to add. ☐
5. Zero is greater than any of the negative integer. ☐
6. In a fraction, when numerator is greater than denominator, it is called improper fraction. ☐
7. Any fixed number is not constant. ☐
8. The sum of two negative numbers is always a negative number. ☐
9. When the numerator and denominator are same, it means the complete whole or one. ☐
10. $9\frac{28}{100}$ is express as 92.8. ☐

Model Test Paper-I

(Based on Chapters 1 to 6)

Instructions :

1. All questions are compulsory.
2. The question paper consists of 18 questions divided into three sections — A, B, C. Section A consists of 10 questions of 2 marks each, Section B of 5 questions of 3 marks each, and Section C of 3 questions of 5 marks each.

SECTION - A

1. Find the difference between the greatest and smallest number that can be written by using digits 7, 0, 9, 4 and 2 only once.
2. What is the smallest 4 digit number which does not change if digits are written in reverse order?
3. **If a = 7, b = 9 and c = 2, find the following:**

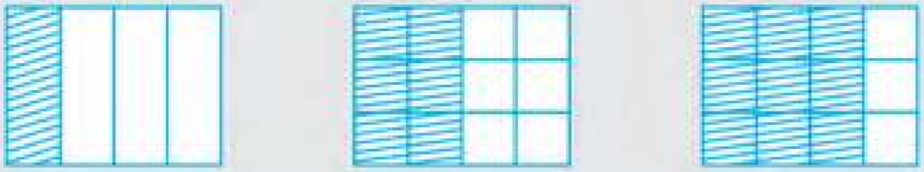
   (i) $a \times (b + c)$ (ii) $ab + ac$
4. Test the divisibility of 70169803 by 11.
5. The product of two numbers is 2160 and their HCF is 12. Find their LCM.
6. **Write the Roman number for each of the following:**

   (i) 637 (ii) 89
7. Mr. Rajdeep bought 1 kg of ice-cream bar. After his children had eaten some, $\frac{2}{5}$ kg of ice-cream bar were left. How much had they eaten?
8. On a particular day, Mr Ramesh Walked $7\frac{1}{2}$ km, Mr. Suresh $3\frac{1}{4}$ km and Mr. Sharma $12\frac{1}{2}$ km. Calculate the total distance covered by all of them.
9. **Write in expanded form :**

   (i) 7.94 (ii) 175.38
10. Write four negative integers greater than – 15 and four negative integers less than – 5.

SECTION - B

11. Identify the fraction in each and write. Are these fractions equivalent? Also add these fractions.



12. Find HCF of 144, 180, 384 by division method.

13. Subtract $\frac{3}{4}$ from $\frac{5}{6}$ and add $\frac{2}{5}$ to $\frac{1}{3}$

14. Add $3\frac{1}{2}$ and $2\frac{1}{4}$.

15. Convert $\frac{8}{9}, \frac{5}{6}, \frac{2}{3}, \frac{1}{2}$ into like fractions.

SECTION - C

16. Mithun purchased 40 bottles of Pepsi, 20 Bread Pakora and 25 Samosas for a party. The cost of a bottle of Pepsi, a Bread Pakora and a Samosa is ₹ 15, ₹ 6 and ₹ 7 respectively. Find the total amount spent by Mithun.

17. Find the sum of four square numbers i.e., $2^2 + 3^2 + 4^2 + 5^2$, and subtract this number from the sum of $3^2 + 4^2$.

18. **Write each of following as decimals.**

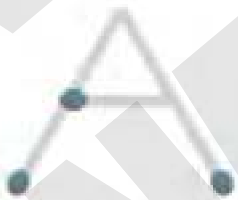
(i) $\frac{7}{10} + \frac{5}{100} + \frac{3}{1000}$ (ii) $\frac{3}{5} + \frac{2}{5}$

7 Introduction to Algebra

Algebra is genralised of arithmetic.
Algebra is a branch of mathematics that deals with variables, constants and algebraic expressions. Aryabhatta, Mahavira, Bhaskara, and Brahma Gupta were the major mathematicians of ancient India. They contributed a lot to algebra and mathematics. Algebra deals with variables and equations. We have to find solutions or situations which have been represented through algebraic equations and inequalities.

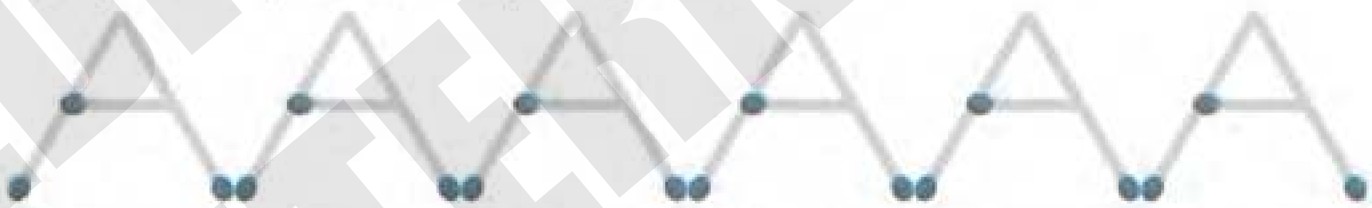
Understanding the Basic Logic

When variables, numbers and brackets are logically combined to represent a phenomenon of science or mathematics the above expression and reaction is called the basic logic if algebraic expression. i-e $\frac{(y+7)}{6} - 12$ etc.
Let us take up a simple experiment. Take a box of matchsticks. You can also take small sticks made of plastic to conduct this experiment. Make the following pattern with the help of three matchsticks:



Note that you have used three sticks to show the letter 'A' of the English alphabet.

Now, scrap this 'A' now, create the second pattern, as follows :



From the given pattern, it is clear that you have made 6 A's. The total number of sticks used to make it = 6 × 3 = 18.

Let us make a table now :

No. of A's Formed	1	2	3	4	5	6
No. of Matchsticks used	3	6	9	12	15	18

We have skipped the exercise of making 2, 3, 4, and 5 A's from the matchsticks.
We know that a relationship exists between the number of single patterns (A's) and the total number of sticks used to create them. Thus, we have :
No. of matchsticks used = 3 × No. of A's created
Let no. of A's created = m
So, no. of matchsticks used = 3 m
We can use this simple expression to get the number of matchsticks used for all patterns that are in the shape of 'A'.

In algebra, letters represent numbers. They are variables. They can acquire any value.

Eg : We want to create 'A' 355 times using matchsticks.

$\Rightarrow$ No. of matchsticks required = 3 m

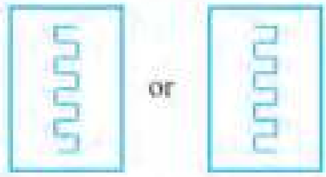
= 3 × 355 = 1065

Facts to Know

Here, m is a variable. It is always in lower case letter (in algebra). The numbers 1, 2, 3, 4 ... are constants. We use constants and variables in algebra. We use them to find out the values of variables.

Example 1 : The letter of the English Alphabet requires 5 matchsticks to get completed. Further, more sticks are placed to continue. The pattern of or reverse of i.e. makes a fine structure. Derive an algebraic formula for matchsticks needed to make patterns, all connected to make a chain.

Solution : The first needs 5 matchsticks. The next is to be placed in such a manner that it supports the pattern or first . So, second is an inverted and it needs only 4 matchsticks. The first matchstick of the new (second) is the last matchstick of the first . This logic has been repeated. The final pattern has been shown here, in given figure.



Let n = number of patterns (in forward or reverse patterns)

First needs = 5 matchsticks

The other patterns need only 4 matchsticks = n − 1

So, the algebraic expression is

No. of matchsticks needed = 5 + (n − 1) 4

In our case, n = 4

So, no. of matchsticks needed = 5 + (n − 1) 4

= 5 + (4 − 1) 4

= 5 + (3 × 4)

= 5 + 12 = 17

The given figure shows 17 matchsticks. That is how we derive algebraic expressions to solve problems.

Constants and Variables

There are two types of symbols in Algebra ......

(i) Contents and

(ii) variables

Algebra is based on the relationships of constants and variables. Let us define them.

Constant : A constant is a fixed value of a real number that is part of an algebraic expression.

Eg : 2 m = 10

Here 2 and 10 are constants

$\Rightarrow \quad m = \frac{10}{2} = 5$

So, m also is a constant in this example. The value of constant does not vary.

Variable

A variable is an algebraic entity that can be assigned any value from the set of **Real Numbers**. Variables are used to do calculations in algebraic condition. Constants help them in this process :

Eg. $2m + 4n = 10$

If $m = 1, n = 2$

we get,

$(2 \times 1) + (4 \times 2) = 10$

$\Rightarrow 10 = 10$ which is true.

Here, the value of the variable should be such that it satisfies the algebraic expression, equality or inequality.

Eg. : Fine to be given to school = $100 + (30 \times n)$

Where n = number or days for which child remains absent from school. This value (n) can vary. The basic fine (₹ 100) remains fixed for all children.

If $n = 3$ days, we have

Fine to be given to school $= 100 + (30 \times n)$

$= 100 + (30 \times 3)$

$= 100 + 90 =$ ₹ 190

Facts to Know

You can use variables like a, b, c, p, q, r, m, n, o etc. or any other letter of the alphabet. But note that it must be used in a lower-case letter.

Mathematical Operations, Symbols and Inputs

All form of arithmetic operations (+, −, ÷, ×) are valid in the calculations of algebra. Moreover, the brackets and powers of variables and constants are also used in algebra.

Eg : 1. $2^3 = 8$

2. $2^3 = m^n \Rightarrow n = 3, \quad m = 2$

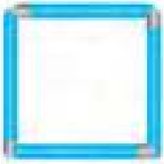
3. $(a + b) + (c + d) = 10 \Rightarrow a + b + c + d = 10$

4. $5x + 7 = 37 \Rightarrow x = 6$

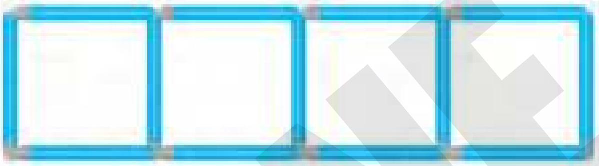
Let us revise some basic mathematical concepts and from basic arithmetic operations in the exercise that follows (we would need the same later).

Exercise 7.1

1. **A pattern of squares is created in which the first square takes four matchsticks and subsequent patterns (squares) require only 3 matchsticks each. Develop an algebraic expression to calculate the number of matchsticks in the pattern with the given number of squares.**



4 matchsticks required



3 matchsticks required for all plus 1 addition (for the first square).

   (a) Find out the algebraic expression.

   (b) Find the number of matchsticks needed to make such 12 boxes.

2. Write the formula for calculating the perimeter of an equilateral triangle.

3. **Write the formula for the perimeter of the following:**

   (a) A square (b) A rectangle

4. **Write algebraic expressions for the following:**

   (a) The sum of m and n (b) l divided by p (c) $\frac{y}{100}$ divided by 320

   (d) Subtract 105 from x (e) The sum of n and 422 (f) The product of k and p

5. A room has 25 desks. Find a rule which should give the total number of desks in the rooms specified by us.

6. **Write the following as products:**

   (a) $l+l+l+l$ (b) $b+b+b+b+b+b$

7. **Write the following as additions:**

   (a) 4x (b) 7x

Algebra– The Basic Rules

The following rules are applicable (we assume that you are aware of the concept of constant, variable, arithmetic operators parentheses, symbols and inputs).

Arithmetic Expression

When numbers are connected to one another through basic arithmetic operators and brackets, they are together called **arithmetic expression.**

Eg : $(2 \times 3) \times 9 - 5 \times 3 + 64$

Algebraic Expression:- In Algebra we not only dead with numbers, we deal with some letters also which represents different numbers: For Example, Formula in the generalised result of arithmetic but We use letters to represent numbers from it.

Suppose (E.g) we consider three circles of radius 5cm, 6cm, 7cm respectively, So we can say or write radius r = 5cm, 6cm, 7cm, These "r" represents different number.

Main Features of Algebraic Expressions

1. They have a few parts which may be constants or variable or both.
2. The every part of an algebraic expression is called **term**. In some terms (like $\frac{9}{25}$ or 3m etc., the arithmetic operations may be missing.
3. Algebraic expressions with only one term are called **monomials.**

   Eg : $7p, \frac{a}{70}, s', -4r$
4. Algebraic expressions with two variables are called **binomials**. Eg: $n + 4$ and $\frac{7k+8}{10}$ are binominals (having two terms each). In these cases, arithmetic operations have been done (plus and minus in these two expressions respectively)
5. Algebraic expressions with three term are called **trinomials.**

   Eg: $4p - 4q + 80$ and $12l - 11m - 25$ are trinomials.
6. Algebraic expressions with more than three terms are called **polynomials.** They involve two or more variables. Constants may also be used.

   Eg : $30p + 11q + 10r - 12$ and $6l + 7m - 8n + 100$ are the examples of polynomials.
7. The algebraic expressions have the feature that only the variables of the same type can be added, subtracted, divided or multiplied. Two different variables can be multiplied, divided, added or subtracted but they need more inputs or processing. They cannot give results if they have simple relationship or one algebraic expression only the idea is to calculate the value of one or more variables to satisfy a given condition or to achieve a particular result in mathmatics or science. Deep calculations may be involved in higher classes.

Rules for Algebraic Expressions

(a) Commutative Property over Addition

If a and b are two real numbers, we have: $a + b = b + a$

All cases must be considered to satisfy the rule.

If , $a = 12, \quad b = 8 \quad \Rightarrow \quad a + b = 12 + 8 = 20$

$\Rightarrow a + b = 12 + 8 = b + a = 8 + 12$

This is called the **commutativity of addition** or **variables.**

Also note that $a + 7 = 7 + a$

So, the order of addition is not important.

(b) Commutative Property over Multiplication

If a and b are two real numbers, we have:

$a \times b = b \times a$

All cases must be considered to satisfy the rule.

If $a = 30$ and $b = 18$

$\Rightarrow a \times b = 30 \times 18 = b \times a = 18 \times 30$

This is called the **commutation of multiplication of variables.**

Also note that $a \times 15 = 15 \times a$

So, the order of multiplication is not important.

(c) Associative Property over Addition

If a, b and c are three real numbers, we have:

$(a + b) + c = a + (b + c) = b + (a + c)$

All cases must be considered to satisfy the rule.

If $a = 19$, $b = 17$ and $c = 31$, we have:

$(a + b) + c = (19 + 17) + 31 = 36 + 31 = 67$

$a + (b + c) = 19 + (17 + 31) \quad = 19 + 48 = 67$

$b + (a + c) = 17 + (19 + 31) = 17 + 50 = 67$

This is called **associative property of variables over addition.**

Note that : $(a + b) + 15 = a + (b + 15) = b + (a + 15)$

So, the order of addition is not important.

(d) Associative Property over Multiplication

If a, b and c are three real numbers, we have:

$(a \times b) \times c = a \times (b \times c) = b \times (a \times c)$

All cases must be considered to satisfy the rule.

If $a = 10$, $b = 12$ and $c = 5$, we have:

$(a \times b) \times c = (10 \times 12) \times 5 = 120 \times 5 = 600$

$a \times (b \times c) = 10 \times (12 \times 5) = 10 \times 60 = 600$

$b \times (a \times c) = 12 \times (10 \times 5) = 12 \times 50 = 600$

This is called **associative property of variables over multiplication.**

Also note that $(b \times c) \times 25 = b \times (c \times 25)$

$= c \times (b \times 25)$

So, the order or multiplication is not important.

(e) Distributive Property over Addition

Let a, b and c are three real numbers. Thus, we have:

$a \times (b + c) = a \times b + a \times c = ab + ac$

All cases must be considered to satisfy the rule.

If $a = 5$, $b = 8$ and $c = 11$, we have $a \times (b + c) = 5 \times (8 + 11) = 5 \times 19 = 95$

$(a \times b) + (a \times c) = 5 \times 8 + 5 \times 1 = 40 + 55 = 95$

This is called **distributive property of variables over addition.**

Note that : $a \times (b + 6) \quad = a \times b + a \times 6$

$= ab + 6a$

So, the order of multiplication is not important.

(f) Additive Identity of Variables

If we add a variable to zero or zero to a variable, the result is always the given variable.

If a is a real number, we have:

$a + 0 = 0 + a = a$

So, zero (0) is called **additive identity.**

(g) Multiplicative Identity of Variable

If use multiply a variable with 1 or if 1 is multiplied with a variable, the result is always the given variable.

If a is a real number, we have:

$a \times 1 = 1 \times a = a$

So, one (1) is called **multiplicative identify.**

Facts to Know

The associative and commutative properties do not hold true for subtraction and division.

Points to Remember

- Algebra is a branch of mathematic. It deals with variables, constants, algebraic expressions and equations.
- The letters used in place of numbers are known as **variables.** They do not have a fixed value and can be assigned any value.
- Any fixed number is a **constant.**
- Algebraic terms have constants and variables.
- Algebraic expressions are of more than one term. They represent mathematical and/or scientific conditions.
- Algebraic expressions can be monomials (1 term), binomials (2 terms), trinomials (3 terms), and polynomials (more than 3 terms).
- Algebraic expressions can be processed using additions subtractions, division and multiplication procedures.
- The algebraic variables follow the rules of associative commutative properties in the cases of addition and multiplication but not in the cases of subtraction and division.

EXERCISE

1. MULTIPLE CHOICE QUESTIONS (MCQs):

Tick (✓) the correct options.

(a) $x + 28 = 30$.

The value of x is

(i) 8 ☐ (ii) 2 ☐ (iii) 12 ☐ (iv) 2 ☐

(b) $a \times 1 = 1 \times a = a$. This is known as

(i) Additives identity of variables (ii) Productive identity of constants

(iii) Productive identity of variables (iv) Multiplicative identity of variable

(c) $3x + 4y + 8 = 0$ is an algebraic equation whose number of terms is

(i) 8 ☐ (ii) 3 ☐ (iii) 4 ☐ (iv) 5 ☐

(d) Which one of the following is not true?

(i) $a + b = b + a$ ☐ (ii) $p \times 3 = 3 \times p = 3p$ ☐ (iii) ☐ (iv) $a(b + c) = ab + ac$ ☐

(e) Which one of the following is true?

(i) a + u = o + a = a ☐ (ii) l × 1 = 1 × l = 2 l ☐

(iii) (p×q) × r = p × (q×r) = q × (p×r) ☐ (iv) All of these are true ☐

(f) Find the value of the following expression if t = 0.3 $\frac{r}{s}=\frac{s}{r}$

Amount = 0.2t + 11.7

(i) 1176 ☐ (ii) 11.76 ☐ (iii) 117.6 ☐ (iv) 11.72 ☐

(g) The average speed of the car is x km/hr. What is the distance covered in 17.6 hours?

(i) $\frac{17.6}{x}$ ☐ (ii) $\frac{x}{17.6}$ ☐ (iii) 17.6 ☐ (iv) None of these ☐

2. **Solve the following algebraic equation:**

12a = 144

3. The present age of Jonathan D'souza is 12 years. Find out the age of his elder brother who is 8 years elder to him. Also find out the age of his father, who is 3.5 times older than him.

4. **Represent the following statements through algebraic equations:**

(a) Six times a number is 1840. (b) Thrice the number m added to 100 is 400.

5. **Write the following as products.**

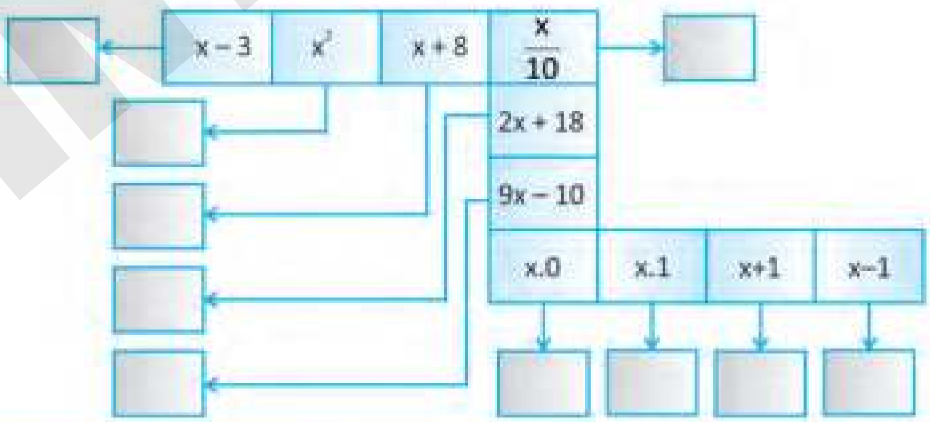
(a) p + p + p (b) x + x + x + x + x

HOTS

Roli read the algebraic expression 9 pq + 5 ab. He said that this expression has 6 terms such as 9, p, q, 5, a, b. Mauli said that there are only 5 terms as 9 and 5 are constants and form one term. What is your answer? Give reasons for your answer.

Lab Activity

Use only one value of x for all the boxes and complete the operations mentioned inside the boxes of this game. Write the results in the circles that are connected to these boxes with the help of arrows :



8 Ratio and Proportion

We face many situations in which we compare similar things. The magnitude of similar things (i.e, items of same type) can be different. We may have to compare for the sake of commercial or scientific practice. So, we need a system of comparison. Let us take a simple example.

Example 1 : Height of Abraham = 135 cm

Height of Dhawan = 137.5 cm

Difference = 137.5 − 135 = 2.5 cm

So, we can state that the height of Dhawan is more than that of Abraham by 2.5 cm. Now, we are clear because we have compared two heights.

Example 2 : Suppose that the weight of Sukriti is 42 kg. The weight of her friend Kriti is 56 kg. So, the comparison of weight can be done. We can state that Kriti's weight is more than Sukriti's weight by a value of 56 – 42 = 14 kg. It is pretty simple. But let us go further. We should try to find out how many times is the weight of Kriti more than that of Sukriti. This is a more accurate way of comparison.

$$\frac{\text{Weight of Kriti}}{\text{Weight of Sukriti}} = \frac{56}{42} = \frac{4}{3}$$

So, we can state that the weight of Kriti is $\frac{4}{3}$ times the weight of Sukriti.

Example 3 : The cost of 1 kg of flour is ₹ 30. The cost of 1 kg of spices is ₹ 1800. So, we can calculate how many number of times coffee is costlier than rice.

$$\frac{\text{spices price / kg}}{\text{flour price / kg}} = ₹\ \frac{1800}{30}$$

$$= \frac{1800}{30} = 60$$

So, spices is 60 times as costly as rice. So, we have been able to compare the two prices well. The concept of "how many times" is called Ratio.

Ratio : The Concept

Ratio compares two quantities of the same class.

Through it, we are able to determine how many times, is a quantity cheap, costly, big, small than another quantity.

The definition of ratio is as follows: "It is a fraction that describes (in mathematical terms) how many times a quantity is of another quantity of the same class. It is a fraction. It can be a whole number, too.

Example 4 : The cost of a pen is ₹ 30. The cost of a pencil is ₹ 6. So, we can determine that

$$\frac{\text{Cost of pen}}{\text{Cost of pencil}} = \frac{30}{6} = \frac{5}{1}$$

So, the cost of pen is 5 times the cost of pencil. Here, the two items are different but we are comparing their single parameter which is cost. Note that two items can be different but the unit to be compared must be the same. Examples of such units are price, cost, value , height , length, weight, volume, bill amount, number, distance travelled, time taken and so on.

Let us write the ratio again

$$\frac{\text{Cost of pen}}{\text{Cost of pencil}} = \frac{5}{1}$$

We can also write :

Cost of pen : Cost of pencil = 5 : 1

So, this is the proper method of writing a ratio. This term indicates that the cost of pen and cost of pencil are in the ratio of 5 is to 1.

Therefore, ratio is a fraction that shows how many times one quantity is in relation to another quantity. The unit of comparison must be the same. Two items can be different.

Generally speaking, the ratio of two quantities x and y ($y \neq 0$) is represented as x : y. The first term (x) is called antecedent. The second term (y) is called consequent.

Facts to Know

Ratio is a pure number.
a : b and b : a are totally different.
It has no unit.
It can be put in the form of fraction.

Properties of Ratios

1. Ratio is always represented in its simplest fraction or ratio form.

   Eg. $\frac{p}{q} = \frac{7}{3}$ (correct)

   $\frac{p}{q} = \frac{14}{6}$ (incorrect)

   The ratio's antecedent and consequent must have no other common factor except 1.

2. We can increase the ratio by multiplying both antecedent and consequent with the same number or variable. This is done to compare quantities or solve difficult questions. The ratio will remain the same. Read Equivalent Ratios for more detail.

   Eg. $\frac{p}{q} = \frac{2}{3}$

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

Facts to Know

Assume that $\frac{p}{q} = \frac{4}{6} = \frac{16}{24} = \frac{32}{48}$ and so on.

But basic ratio is p : q = 2 : 3. This is the simplest or lowest form of ratio.

3. Ratios can exist between two quantities of the same or different class but their unit must be the same.

   Eg :- Currency volume, weight, length, area etc. can be expressed as ratios, if the two items have these as a single unit. You cannot make a ratio with 10 grams and 100 kg. But you can make a ratio with 50 yards of cloth with 150 yards of load strip.

4. Ratios do not have units. That is because the units of the quantities are cancelled by each other.

   Eg : $\frac{\text{Area of field A}}{\text{Area of field B}} = \frac{3600 \text{ sq.m}}{2400 \text{ sq.m}}$

$$= \frac{3600}{2400}$$

$$= \frac{36}{24}$$

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

$$= 3:2$$

Equivalent Ratios

It is very important to learn about equivalent ratios, which are the by-products of the **simplest form of ratio**. An example would make the concept clear.

Eg : Ratios 30 : 20 and 24 : 16 are equivalent . When solved, they both yield a simplest form, i.e. 3 : 2

$$30:20 = \frac{30}{20} = \frac{3}{2} = 3:2$$

$$24:16 = \frac{24}{16} = \frac{12}{8} = \frac{3}{2} = 3:2$$

So, the basic ratio is the same for both the ratios (3 : 2). So, they are equivalent to each other.

We can get equivalent ratios by dividing or multiplying the numerator and denominator by numbers such as 2, 3, 5, 7, 11 etc.

Eg : The equivalent ratios of

$\frac{21}{29}$ are (a) $\frac{21}{29} \times \frac{2}{2} = \frac{42}{58}$

(b) $\frac{21}{29} \times \frac{3}{3} = \frac{63}{87}$

(c) $\frac{21}{29} \times \frac{5}{5} = \frac{105}{145}$ and so on.

Ratio : An Effective Tool for Distribution

We shall describe a very interesting use of ratios in this section. Let us suppose that your father has given ₹ 500 to you. You are supposed to share the money with your brother in the ratio of 2 : 3. How would you proceed?

Let us work in a systematic way.

Amount to be divided = ₹ 500

Ratio of two children $\frac{A}{B} = \frac{2}{3}$

We assume that you are A and your brother is B.

Or A : B = 2 : 3

Sum of ratios $= 2+3=5$

Amount given to A $= \frac{2}{5} \times 500$

$= 2 \times 100 =$ ₹ 200

Amount given to B $= \frac{3}{5} \times 500$

$= 3 \times 100 =$ ₹ 300

So, you would get ₹ 200 and your brother would get ₹ 300. That is how the concept of ratio is used to distribute money, articles, chocolates, pens, pencils, eatables etc. between 2 persons. The number of persons can be more as well.

Let us take up some examples now.

Example 5 : In a school, there are 3,000 students. Out of those, 2000 students are girls. Find out the ratio of the

(a) Number of boys to the number of girls.

(b) Number of girls to the number of boys.

(c) Number of girls to the total number of students.

Solution : Total number of students = 3000

Number of girls = 2000

Number of boys = $3000-2000 = 1000$

(a) Ratio : $\frac{\text{No. of Boys}}{\text{No. of Girls}} = \frac{1000}{2000}$

$= \frac{1}{2} = 1:2$

(b) Ratio : $\frac{\text{No. of Girls}}{\text{No. of Boys}} = \frac{2000}{1000}$

$= \frac{2}{1} = 2:1$

(c) Ratio : $\frac{\text{No. of Girls}}{\text{No. of Total Students}} = \frac{2000}{3000}$

$= \frac{2}{3} = 2:3$

Example 6 : Divide ₹ 4590 between Sridhar and Naman in the ratio of 8 : 7.

Solution : Total amount = ₹ 4590.

Ratio : $\frac{\text{Sridhar}}{\text{Naman}} = \frac{8}{7}$

Sum of ratios $= 8+7=15$

Amount received by Sridhar $= \frac{8}{15} \times 4590$

$= 8 \times 306 =$ ₹ 2448

Amount received by Naman $= \frac{7}{15} \times 4590$

$= 7 \times 306$

$=$ ₹ 2142

Example 7 : **Aralia has 2 dozen egg. Rahana has 2 score of pineapples. Her father gives him 2 more pineapple. Find out the ratio of items with both of them.**

Solution : 1 dozen items = 12 items

1 score items = 20 items

No. of egg with Aralia	=	2 dozen
	=	$2 \times 12 = 24$
No. of pineapples with Rahana	=	2 score
	=	2×20
	=	40
Pineapple given by Rahana's father	=	2
Total no. of apples with Rahana	=	$40 + 2$
	=	42

$$\text{Ratio} = \frac{\text{Aralia's total no. of egg}}{\text{Rahana's total no. of pineapples}} = \frac{24}{42} = \frac{4}{7} = 4:7$$

Example 8 : **If A : B = 3 : 4 and B : C = 4 : 5, find out the ratio A : B : C.**

Solution : A : B : C

3 : 4 .... (i)

4 : 5 .... (ii)

So, A : B : C = 3 : 4 : 5

Since it is a continued proportion.

Facts to Know

In questions involving A, B and C, look at the ratios of B. Multiply the ratio A : B with the lower number (ratio) of B. Multiply the ratio B : C with the upper number (ratio) of B. So, you get one single ratio of B.

Example 9 : **The sides of a triangle are in the ratio of 3 : 4 : 5. If the sum of length of all sides is 84 cm, find out the length of each side of the triangle.**

Solution : Let the sides of the triangle be AB, BC and AC.

Ratio of lengths = 3 : 4 : 5

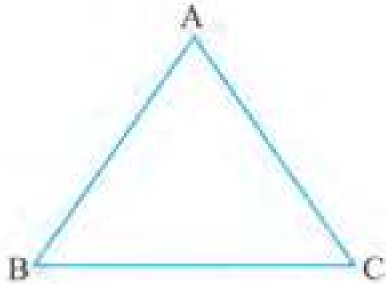
Sum of ratios = 3 + 4 + 5 = 12

Length of side AB = $\frac{3}{12} \times 84 = 3 \times 7 = 21$ cm

Length of side BC = $\frac{4}{12} \times 84$

$= 4 \times 7 = 28$ cm

Length of side AC = $\frac{5}{12} \times 84 = 5 \times 7 = 35$ cm



Example 10 : **Out of 1800 students in a school, 750 opted for basketball, 800 opted for cricket and remaining students opted for hockey.**

If a student can choose only one game, then find the ratio of

(a) Number of students who opted for basketball to the number of students who opted for hockey.

(b) Number of students who opted for cricket to the number of students who opted for basketball.

(c) Number of students who opted for hockey to the total number of students.

Solution : Total no. of students in school = 1800

No. of students who choose basketball = 750

No. of students who choose cricket = 800

No. of students who choose hockey = 1800 − (750 + 800)

= 1800 − 1550

= 250

(a) Ratio : $\dfrac{\text{No. of students who choose basketball}}{\text{No. of students who choose hockey}} = \dfrac{750}{250} = \dfrac{75}{25} = \dfrac{3}{1} = 3:1$

(b) Ratio : $\dfrac{\text{No. of students who choose cricket}}{\text{No. of students who choose basketball}}$

$= \dfrac{800}{750}$

$= \dfrac{80}{75} = \dfrac{16}{15} = 16:15$

(c) Ratio : $\dfrac{\text{No. of students who choose hockey}}{\text{Total no. of students}} = \dfrac{250}{1800} = \dfrac{25}{180} = \dfrac{5}{36} = 5:36$

Facts to Know

For comparing two ratios, express each one of the ratios as a fraction. Now, compare the fractions by rationalizing the denominator of both.

Example 11 : **Compare the following ratios.**

(i) 5 : 6 and 19 : 12

(ii) 15 : 16 and 24 : 25

Solution : (i) $5:6 = \dfrac{5}{6}$

$19:12 = \dfrac{19}{12}$

LCM of 6 and 12 is 12

Rationalizing the denominators of both fractions, we get :

$\dfrac{5}{6} \times \dfrac{2}{2} = \dfrac{10}{12}$

$\dfrac{19}{12} \times \dfrac{1}{1} = \dfrac{19}{12}$

Now, the equivalent fractions are :

$\dfrac{10}{12}$	$\dfrac{19}{12}$

But 19 > 10 [12 is common in these two fractions]

So, $\dfrac{19}{12} > \dfrac{10}{12}$

(ii) $15:16 = \frac{15}{16}$

$24:25 = \frac{24}{25}$

LCM of 16 and 25 is 400

Rationalizing the denominators of both fraction, we get:

$\frac{15}{16} \times \frac{25}{25} = \frac{375}{400}$

$\frac{24}{25} \times \frac{16}{16} = \frac{384}{400}$

Now, the equivalent fractions are :

$\boxed{\frac{375}{400}}$ $\boxed{\frac{384}{400}}$

But $384 > 375$

So, $\frac{384}{400} > \frac{375}{400} = \frac{24}{25} > \frac{15}{16}$

Facts to Know

Two quantities can be compared only if their unit is the same. Eg : pens, apples, pencils and books can be compared if all of them are in dozens.

Example 12 : **Express the following ratios in the simplest form :**

(a) 48 minutes to 3 hours (b) 750 ml to 5 litres

Solution : (a) 48 minutes = 48 minutes

3 hours = $3 \times 60 = 180$ minutes

Ratio = $\frac{48}{180} = 48:180$

H.C.F. of 48 and 180 is 12.

Divide the ratio by 12.

So, Ratio = $48:180 = 4:15$

(b) 750 ml = 750 ml

5 litres = $5 \times 1000 = 5000$ ml

Ratio = $\frac{750}{5000} = 750:5000$

The H.C.F. of 750 and 5000 is 250.

Divide the ratio by 250.

So, Ratio = $750:5000 = 3:20$

Exercise 9.1

1. Rosy earns ₹ 50,000 per month. She saves ₹ 15000 per month. What is the ratio between her expenditure and saving?
2. **Find out the ratios of the following in the simplest form.**

(a) 7 meters to 35 cm (b) 5 litres to 1500 ml

(c) 500 paise to ₹ 50 (d) 9 kg to 50 gm

3. **Write two equivalent ratios for each one of the following :**

(a) 3 : 5 (b) 21 : 31 (c) 17 : 82 (d) 15 : 60

4. Find out the ratio between the cost of a pencil and that of a pen when pencils cost ₹ 24 per score and pens cost ₹ 16.80 per dozen.

1 dozen = 12 items, 1 score = 20 items

5. **Compare the following ratios :**

(a) 7 : 9 and 10 : 12 (b) 3 : 5 and 5 : 7 (c) 3 : 4 and 5 : 6 (d) 13 : 17 and 351 : 189

6. **The present age of mother is 60 years and the present age of her daughter is 35 years. Find out the ratio of**

(a) the present age of daughter to that of her mother.

(b) the age of mother to the age of daughter when the daughter would be 70 years of age.

(c) the age of mother to that of her daughter 20 years from the present time.

7. **A factory opens at 10 am and closes at 5 pm. There is a lunch time of 45 minutes only. Find out the ratio of**

(a) Lunch break to the total working hours.

(b) Lunch break to the total factory hours.

8. (a) If A : B = 3 : 4 and B : C = 7 : 6, find out A : B : C.

(b) If A : B = 2 : 5 and B : C = 7 : 9, find out A : B : C

(c) If A : B = 19 : 21 and B : C = 21 : 7, find out A : B : C

9. A motorcycle rider covers 160 km in 2 hours. A scooter rider covers 270 km in 3 hours. What is the ratio of the speed of scooter rider to that of motorcycle rider? [Hints : Speed = $\frac{\text{Distance}}{\text{Time}}$]

10. **In an educational institute, there are 4320 students in all. Out of them, 2300 students are girls. Find the ratio of**

(a) Number of boys to number of girls.

(b) Number of girls to the total number of students.

(c) Number of boys to the total number of students.

11. **Complete the following table by filling up ratios in the simplest form.**

(a)	3 dozen to 2 score	
(b)	50 cm to 5 m	
(c)	₹ 200 to ₹ 520	
(d)	2 l to 950 ml	
(e)	3 years to 6 months	
(f)	50 paise to ₹ 10	
(g)	75 days to 1 year	
(h)	4 days to 2 weeks	

[Hints : 1 years = 365 days
1 dozen = 12 units
1 score = 20 units]

12. Two workers were paid ₹ 5925 after they completed their work. They divided this amount in the ratio of 13 : 12. How much did each one of them get from the total amount?

13. Priyanka went to a shopping mall. She had ₹ 3000 with her. She purchased items worth ₹ 1620 from the shopping mall. Find out the ratio of

(a) amount spent to the total amount.

(b) amount not spent to total amount.

14. The boys and girls in a school are in the ratio of 2 : 3. If the total strength of school is 1550, find out the number of boys and girls in the school.

15. The ratio of gold and cadmium in an ornament is 93 : 7. If the weight of the ornament is 300g, find out the weight of cadmiam and gold in the ornament.

Proportion : The Concept

Let us study an example.

Preeti goes to the market to purchase apples. One vendor tells her that apples cost ₹ 100 for 5 kg. She goes ahead and enquires from another vendor. He tells her that apples would cost ₹ 60 per 3 kg. She must decide quickly because guests are waiting at home.

Ratio of money asked for = ₹100 : ₹60 = 5 : 3

Ratio of weight of apples = 5 kg : 3 kg = 5 : 3

So, both ratios are the same. Hence Preeti can purchase apples from either shop. That is because the price of both these vendors is the same.

Let us study another example.

Julia sells 2 kg of mangoes for ₹ 60.

John sells 4 kg of mangoes for ₹120.

Whose mangoes are costlier ? Let us find out.

Ratio of cost of mangoes = 60 : 120 = 1 : 2

Ratio of weight of mangoes = 2 : 4 = 1 : 2

Again, the ratio of cost of mango is exactly equal to the ratio of its weight.

From these two examples, we can conclude that both the ratios are equal. We can state that two ratios are in proportion.

If a and b are in the same ratio and c and d are also in that very ratio, we can state

a is to b as c is to d

So, numbers a, b, c, d are said to be in proportion if the ratio a : b is equal to the ratio c : d.

Mathematically, we can write.

a : b = c : d or a : b : : c : d

[Pronounce : a is to b as c is to d]

The equality of two ratios is known as proportion.

Facts to Know

The symbol : : is spoken as "is to". But you can also put the equality sign (=) in its place.

Properties of Proportion

1. Two ratios are in proportion because they are equivalent ratios.
2. The first and fourth terms of a proportion are called **extreme terms**.
3. The second and third terms of a proportion are called **middle terms**.
4. We can get proportion from pairs of equivalent fractions.

Eg. $\frac{4}{7} = \frac{16}{28}$

We can write it as :

4 : 7 : : 16 : 28

Facts to Know

The middle terms are also called means. The meaning of both of these is the same.

5. In equivalent fractions, the products of cross multiplication are equal to each other.
Thus, we have

$$\frac{4}{7} \times \frac{16}{28}$$

Cross multiplying, we get
$4 \times 28 = 16 \times 7$
$112 = 112$ which is true.

Note that $\frac{4}{7} = \frac{16}{28}$ can be written as

4 : 7 : : 16 : 28

4 and 28 are the extreme terms. 7 and 16 are the middle terms. So, we can conveniently write :

4 : 7 : : 16 : 28

Thus, in a proportion, the product of extreme terms is equal to the product of the middle terms. This property helps us to confirm whether a given set of numbers is in proportion or not.

6. The three terms of any proportion must be known. Then, we can calculate the fourth term by cross multiplying and calculating for the unknown variable, which represents fourth term.

Continued Proportion

Let us take up the following proportion.

4 : 8 :: 8 : 16

By checking the proportion, we get

$8 \times 8 = 64$; $4 \times 16 = 64$

When extreme and middle terms are multiplied, they give equal result (64). So, these numbers are in proportion. Note that the second and third terms are the same number (8). Hence, we can state that 4, 8, 8 and 16 are in **continued proportion**.

Similarly, 1 : 4 : 4 : 16 and 3 : 9 : 9 : 27 are also in continued proportion.

Example 13 : **Check whether the following numbers are in proportion or not.**

(i) 7 : 2 :: 3 : 5
(ii) 4 : 3 : : 12 : 9
(iii) 11 : 17 :: 55 : 80

Solution : (i) 7 : 2 :: 3 : 5

Multiplying as shown above, we get :
Product of middle terms $= 2 \times 3 = 6$ — (i)
Product of extreme terms $= 7 \times 5 = 35$ — (ii)
(i) ≠ (ii)
So, the numbers 7, 2, 3, 5 are not in proportion.

(ii) 4 : 3 :: 12 : 9

Multiplying as shown above, we get :
Product of middle terms $= 3 \times 12 = 36$ — (i)
Product of extreme terms $= 4 \times 9 = 36$ — (ii)

Eqns. (i) = (ii)

So, the numbers 4, 3, 12, 9 are in proportion.

(iii) 11 : 17 :: 55 : 80

Multiplying, as shown above, we get :

Product of middle terms	=	$17 \times 55 = 935$	— (i)
Product of extreme terms	=	$11 \times 80 = 880$	— (ii)

(i) ≠ (ii)

So, the number 11, 17, 55, 80 are not in proportion.

Example 14 : Three numbers 4, 20 and m are in continued proportion. Find the value of m.

Solution : The numbers 4, 20, m are in continued proportion.

So, the proportion is 4 : 20 :: 20 : m

Multiplying, as shown above, we get :

Product of middle terms	=	$20 \times 20 = 400$	— (i)
Product of extreme terms	=	$4 \times m = 4m$	— (ii)

(i) = (ii) because the numbers are in continued proportion.

Hence, 400 = 4m

or, 4m = 400

or, m = 400/4 = 100

Hence, the value of m = 100

Example 15 : Are the ratios 15 cm to 2 m and 10 sec to 3 minutes in a proportion ?

Solution : $2 \text{ m} = 2 \times 100 = 200$ cm

3 minutes = $3 \times 60 = 180$ seconds

So, the proportion can be made as follows (to check its accuracy).

15 cm : 200 cm :: 10 sec : 180 sec

or, 15 : 200 :: 10 : 180

Multiplying, as shown above, we get :

Product of middle terms	=	$200 \times 10 = 2000$	— (i)
Product of extreme terms	=	$15 \times 180 = 2700$	— (ii)

(i) ≠ (ii)

Hence, 15, 200, 10, 180 are not in proportion.

Hence, 15 cm, 2m, 10 sec and 3 min are not in proportion.

Example 16 : State whether the following proportions are true or false.

(i) 12 : 20 :: 96 : 160 (ii) 4 : 12 :: 8 : 24

Solution : (i) We take :

12 : 20 :: 96 : 160

Multiplying, as shown here, we get :

Product of middle terms $= 20 \times 96 = 1920$ — (i)

Product of extreme terms $= 12 \times 160 = 1920$ — (ii)

(i) = (ii)

Hence, this proportion is true.

(ii) We have

4 : 12 :: 8 : 24

Multiplying as shown above, we get :

Product of middle terms $= 12 \times 8 = 96$ — (i)

Product of extreme terms $= 4 \times 24 = 96$ — (ii)

(i) = (ii)

Hence, 4 , 12, 8, 24 are in proportion.

Hence, this proportion is true.

Example 17 : The first, second, third and fourth terms of a proportion are 4, y, 16 and 250. Find the value of y.

Solution : The numbers 4, y, 16, and 250 are in proportion.

Thus, we having

$$\frac{4}{y} = \frac{16}{250}$$

$16y = 1000$ (Applied cross multiplication method)

$$\Rightarrow y = \frac{1000}{16}$$

Therefore, $y = \frac{125}{2}$

Hence, the value of $y = \frac{125}{2}$

Exercise 9.2

1. **Find out whether the following ratios form proportions or not. Write the middle terms and extreme terms where the ratios form a proportion.**
   (a) 200 ml : 2.5 litre and ₹ 6 : ₹ 78 (b) 32 : 48 and 70 : 105
   (c) 5.2 : 3.9 and 3 : 4 (d) 39 litres : 65 litres and 6 bottles : 10 bottles
2. **Are the following statements true ?**
   (a) 4 : 6 :: 8 : 10 (b) 99 kg : 45 kg :: ₹ 44 : ₹ 20
   (c) 33 : 44 :: 75 : 100 (d) 7 mm : 1cm :: 70 cm : 1 m [Hint : 1 cm = 10 mm]
3. **Find out the value of r in all of the following proportions :**
   (a) 5 : r :: 35 : 49 (b) 7 : 11 :: r : 55
   (c) 5 : 10 :: 10 : r (d) r : 2 :: 380 : 76
4. Check whether the ratios 4 : 12 and 9 : 27 are in proportion. If yes, write them in the proper form.
5. **Check whether these ratios are in proportion.**
   If yes, write them in the fraction form.
   2 : 9 and 18 : 81

Unitary Method

Let us imagine the following situation :

Monty goes to market. He purchases 6 pencils from a stationery shop and pays ₹ 30. What is the price of one pencil?

We can write it as follows:

Cost of 6 pencils = ₹ 30

Cost of 1 pencil = ₹ $\frac{30}{6}$

= ₹ 5

Let us go further. Suppose that Monty has to purchase pencils for his sister, Rinky. He knows that she needs 10 pencils. He goes back to the stationery shop and purchases 10 more pencils. How much he pays?

We have calculated the price of 1 pencil. So, it is easy to do the calculation. From the calculation done above, we have :

Cost of 1 pencil = ₹ 5

So, Cost of 10 pencils = ₹ 5×10

= ₹ 50

This is called unitary method. It is used quite often in arithmetical calculations and everyday life. Your mother purchases vegetables, lentils and grains according to this rule only.

Let us consider another example. Suppose that your father buys petrol at the petrol pump. He tells the pump operator to fill 30 litres in his car tank. He pays ₹ 1800 to the pump operator. How much he pays for 1 litre of petrol? What would he have paid for buying 42 litres of petrol? Let us find out.

Cost of 30 litres of petrol = ₹ 1800

Cost of 1 litre of petrol = ₹ $\frac{1800}{30}$

= ₹ 60

So, your father paid ₹ 60 for each litre of petrol.

Now, cost of 1 litre of petrol = ₹ 60

Cost of 42 litres of petrol = ₹ 60×42

= ₹ 2520

So, your father would pay ₹ 2520 for 42 litres of petrol to the pump operator.

So, the method in which we find out the value of one unit and then the value of the required number of units is called unitary method.

Example 18 : **The weight of 18 books is 45 kg. What would be the weight of 7 such books?**

Solution : Weight of 18 books = 45 kg

Weight of 1 book = $\frac{45}{18}$

Weight of 7 books = $\frac{45}{18} \times 7$

$= \frac{15}{6} \times 7$

$= \frac{5}{2} \times 7$

$= 2.5 \times 7$

$= 17.5$ kg

Facts to Know

While using the unitary method, we put the item to be calculated on the right side of the equality sign (=).

Example 19 : The cost of 20 pencils is ₹ 320. Find out the cost of 42 such pencils.

Solution : Cost of 20 pencils = ₹ 320

Cost of 1 pencil $= \frac{320}{20}$

Cost of 42 pencils $= \frac{320}{20} \times 42$

$= \frac{32}{2} \times 42$

$= 16 \times 42$

= ₹ 672

Example 20 : Kunal bought 12 rose flowers for ₹ 384. Mona bought 20 rose flowers for ₹ 560. Johny bought 16 rose flowers for ₹ 592. Who got the best deal? Who got the worst deal?

Solution : **Kunal**

Cost of 12 rose flowers = ₹ 384

Cost of 1 rose flower = ₹ $\frac{384}{12}$

= ₹ 32

Mona

Cost of 20 rose flowers = ₹ 560

Cost of 1 rose flower = ₹ $\frac{560}{20}$

= ₹ 28

Johny

Cost of 16 rose flowers = ₹ 592

Cost of 1 rose flower = ₹ $\frac{592}{16}$

= ₹ 37

Therefore, Mona paid the least amount per rose flower. So, she had the best deal. Further, Johny paid the highest amount per rose flower. So, he had the worst deal.

Example 21 : The cost of 21 tables is ₹ 6300. How many tables can be bought with ₹ 11,100?

Solution : With ₹ 6300, we can buy = 21 tables

With ₹ 1, we can buy $= \frac{21}{6300}$ tables

With ₹ 11,100, we can buy $= \frac{21}{6300} \times 11{,}100$ tables

$$= \frac{21}{63} \times 111 \text{ tables}$$

$$= \frac{7}{21} \times 111 \text{ tables}$$

$$= \frac{1}{3} \times 111 \text{ tables}$$

$$= 37 \text{ tables}$$

Exercise 8.3

1. The cost of 5 kg of rice is ₹ 82.50. Find out the cost of 7.5 kg of rice.
2. A car needs 19 kg of CNG for covering a distance of 171 km. How much CNG is needed to cover 324 km?
3. The cost of a dozen pens is ₹ 53.60. Find out the cost of 47 such pens.
4. **A train covers 120 km in 2 hours.**
   (i) How much time is needed to cover 540 km at the same speed?
   (ii) Find out the distance covered in 7 hours at the same speed.
5. The cost of 12 bottles of honey is ₹ 1050. What is the cost of 23 such honey bottles?
6. Two dozen bananas cost ₹82. What is the cost of 8 dozen such bananas?
7. There are 2275 items in 65 boxes. If we assume that all boxes have equal number of items, what is the number of items in 39 such boxes?
8. The cost of 12 cans of fruit juice is ₹ 840. What is the cost of 3 dozen such cans of juice?

Points to Remember

- A ratio is a fraction. It describes how many times a quantity is of another quantity of the same class.
- Do not compare ratios if the units are not same.
- Ratio is a pure number; it does not have units.
- Ratios can be put in the form of fractions.
- $\frac{p}{q} \neq \frac{q}{p}$
- In the ratio x : y, x is the Antecedent and y is the Consequent.
- If a, b and c, d are in the same ratio, then a, b, c, d, are in the same proportion.

  Thus, a : b :: c : d

  [Pronounce : a is to b as c is to d]
- If a : b :: c : d, then a and b are called extreme terms and c and d are called middle terms. Further, bc = ad
- In a proportion, if the second and third term is the same, then the three terms (first, second/third and fourth) are said to be in a continued proportion.
- The method in which we find out the value of one unit and then of multiple units is called **unitary method**.

EXERCISE

1. **MULTIPLE CHOICE QUESTIONS (MCQs):**
Tick (✓) the correct options.

(a) If l : m :: n : k, then the extreme terms of this proportion are :

(i) l, m (ii) m, n (iii) n, k (iv) l, k

(b) The simplest form of $\frac{36}{24}$ is

(i) $\frac{3}{2}$ (ii) $\frac{36}{24}$ (iii) $\frac{2}{3}$ (iv) None of these

(c) Which one of the following is not an equivalent ratio of $\frac{7}{11}$?

(i) $\frac{14}{22}$ (ii) $\frac{21}{33}$ (iii) $\frac{35}{44}$ (iv) $\frac{42}{66}$

(d) A man purchased 3 dozen bananas for ₹ 252. What is the price of 7 bananas ?

(i) ₹ 50 (ii) ₹ 31 (iii) ₹ 28 (iv) None of these

(e) If A : B is 7 : 37 and B : C is 37 : 41, then A : B : C are in the ratio of

(i) 37 : 7 : 41 (ii) 7 : 37 : 41 (iii) 41 : 37 : 7 (iv) 41 : 41 : 7

(f) In the proportion a : 3 :: 24 : 12, the value of a is

(i) 6 (ii) 8 (iii) 12 (iv) 24

(g) In 14 : 17, the term 14 is known as

(i) Precedent (ii) Consequent (iii) Antecedent (iv) None of these

(h) Which one of the following is an equivalent ratio of $\frac{1}{2}$?

(i) $\frac{44}{55}$ (ii) $\frac{73}{146}$ (iii) $\frac{27}{71}$ (iv) $\frac{525}{25}$

2. If a train covers 195 km in 3 hours, what distance will the train cover in 5 hours travelling at the same speed?
3. The rent of a room for 4 months is ₹ 4500. What is the rent of the room for a year?
4. **Find the ratio of the following.**
(a) 36 minutes to 2 hours
(b) 50 cm to 5 metres
(c) 32 g to 3 kg
(d) 3 days to 1 year
5. Mr Dayal divided ₹ 84,630 between Manoj and Tipu in the ratio 3:4. How much did each of them get?
6. Length and breadth of a rectangular field are 20 m and 15 m respectively. Find the ratio of the length to the breadth of the field.
7. If a:30 : : 7:15, find the value of a.
8. The sum of two angles is 90 degrees. The angles are in the ratio 2:3. Find the measure of each angle.
9. Princy purchased 12 notebooks for ₹ 96. If Madhu wants to buy 20 notebooks of the same price, how much does she have to pay?
10. Madan drives his car at a constant speed. If he travels 8 km in 10 minutes, how long will he take to travel 36 km?

HOTS

The perimeter of a rectangular room is 160 metres. Their length and breadth are in the ratio 3:5. What is the area of the room?

Lab Activity

Objective : To find equivalent fractions.

Procedure :

- In the grid shown here, a fraction $\left(\frac{3}{7}\right)$ has been given. Find out the equivalent fraction of $\frac{3}{7}$ and quickly fill them up in the boxes in any order. After this, at least two boxes would remain empty because you would use multiplying factors only from 2 to 10. Fill up those two blank boxes with the colours of your choice. They should be two different colours. The first three students, who complete this task, are the winners.

			$\frac{3}{7}$

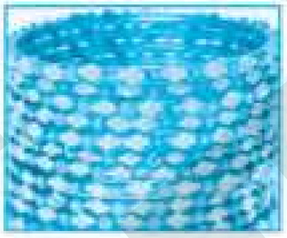
The fraction grid for winners.

9 Basic Geometrical Ideas

Geometry is as old as Early Man. Circles, straight lines, triangles and other shapes are clearly visible in all the ancient and the medieval buildings, temple, forts and artifacts. Man used the basic concepts of geometry in the field of art, architecture, construction, warfare, etc.

Even today, we use advanced and basic concepts of geometry in engineering, space research, construction and design. In this chapter, we shall study straight lines, angles, triangles, polygons, circles and other shapes.






The Foundation Of Geometry

Point

We can use the tip of a pen or pencil to make an impression on a sheet of paper. We get a small dot which is called **point**. A point is a basic geometrical shape that occupies space. It does not have length or breadth.

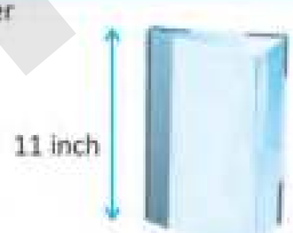
Points are represented by capital letters like A, B, C . . . . . P, Q, R . . . . . and so on.

Line Segment

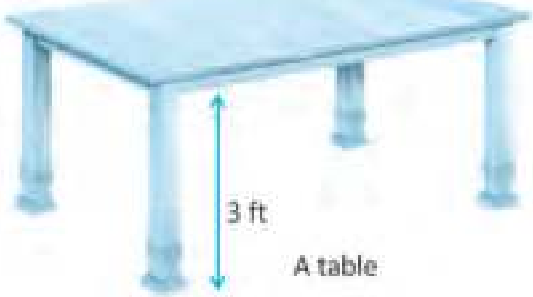
It is the shortest distance between two points. Look at the figures given here :

Can you see their edges ? They all are line segments. They have fixed length and you can measure their edge lengths with the help of a scale. Look at the figure shown ahead.

A Ruler



A book



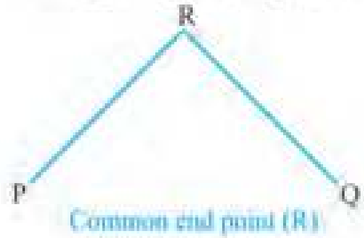
A table

Line segment $\overline{PQ}$

The line segment has two fixed points. In the given figure they are P and Q. We write this segment as $\overline{PQ}$. Note that P and Q are called **end points**.

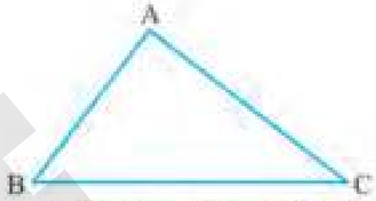
In the given figure, R is the common end point of a line segments $\overline{PR}$ and $\overline{QR}$.

Similarly, A, B and C are the three ends points of line segments : AB, AC and BC. In the given figure, they are also common end points of two line segments in this figure.



Common end point (R)

Straight Line



Common end points (A, B and C)

Let us suppose that we have been given a line segment $\overline{MN}$. Its length is 15 cm. Let us extend its two ends beyond M and N. Let them go up to infinity (at least, we can imagine that). Thus, line segment $\overline{MN}$ has become a straight line now.

(a) (b)

The straight lines are represented by small letters like l, m, n . . . . and so on. They extend to infinity on both sides but on a piece of paper, we show them fixed length. A line connect countless number of points. Two points can determine a line.

We can also write straight lines as $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$, and so on, where $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, and $\overleftrightarrow{EF}$, are line segments, each one of them being extended on both sides.

Lines and line segment

Collinear and Non-collinear Points

Three or more points that lie on the same straight line, are called collinear points. For example, P, Q, R, and S are collinear points in the given figure.

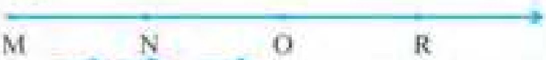
If three or more points do not lie on the same straight line, they are called non-collinear points.

Ray

A ray is a part of a straight line but with a difference. It has one end point. The other end extends to infinity.

The starting point of ray PQ is P. The point Q has been taken to represent line segment $\overline{PQ}$ as a ray. The ray extends beyond the point Q.

We represent ray PQ as $\overrightarrow{PQ}$.



Look at the given figure. Rays $\overrightarrow{MN}$, $\overrightarrow{NO}$ and $\overrightarrow{OR}$ are three different rays. But they do lie on the same ray, i.e., $\overrightarrow{MR}$.

Facts to Know

- A line segment has two end points.
- A straight line has no end point.
- A ray has one end point.

Parallel Lines

Have you seen a railway track ? Its two rails are exactly parallel to each other. If they are not, trains cannot run on them. Other examples of parallel lines are scale (ruler), parallel edges of a note book, square's parallel sides and parallel edges of a rectangular table. Note that two parallel lines never meet each other.


railway track


The banks of a river never meet each other

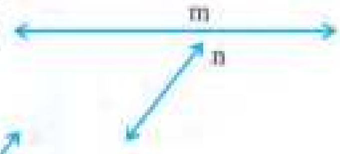
Intersecting Lines

Look at the figure. These two lines are not parallel to each other.

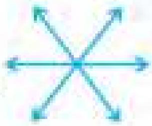
They have one intersecting point. Some examples of intersecting lines are – scissors, cross-roads, adjacent sides of a book, adjacent sides of a triangle and so on.

They are interesting lines.

Look at the given figure. The lines m and n are not intersecting. But if we extend n, it would certainly meet m at one point. They are not parallel lines because they can intersect when n is extended.



Concurrent Lines

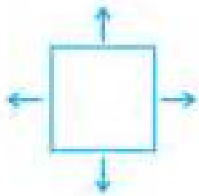


When more than two lines meet at a point, then are said to be concurrent lines.

The point of meeting is called points of Concurrence.

Plane

A plane is a smooth surface, when extends to infinity on all of its 4 sides. We can't imagine the extreme ends of the plane. We cannot draw a plane, just like the strength line. But we can show it is as a paralleloram on a sheet a paper. The points, lines, rays and other objects lying on a plane are called coplaner objects. A plane extends to infinity.



Facts to Know

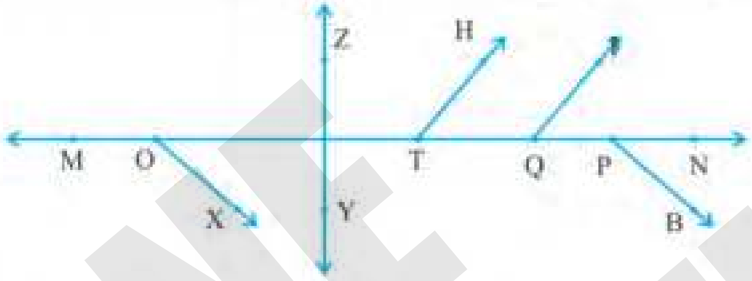
An infinite number of lines can be drawn through a single point.

Example 1 : Count the number of edges of the following objects :

(i)  (ii)  (iii) 

Solution : (i) 5 (ii) None (iii) 12

Example 2 : How many interesting lines or rays are there in the following figure?



Solution : The pairs intersecting lines and /or rays are :

(a) $\overleftrightarrow{MN}$ and $\overrightarrow{OX}$

(b) $\overleftrightarrow{MN}$ and $\overleftrightarrow{ZY}$

(c) $\overleftrightarrow{MN}$ and $\overrightarrow{TH}$

(d) $\overrightarrow{MN}$ and $\overrightarrow{QI}$

(e) $\overrightarrow{MN}$ and $\overrightarrow{PB}$

Example 3 : Why does a circle not have a straight edge ?

Solution : In order to have a straight edge, we need two points that may be joined to form a line segment. In case of a circle, there are no such points. Hence, the circle does not have a straight edge. Note that it does have a circular edge.

Exercise 9.1

1. Join the following points to get line segments. Now write their names below them.

   (a) (b) (c) (d)

2. Join the following points to get intersecting lines. Give them correct shape so that they look like line. Give them proper names and write the same below each line.

   (a) (b) (c)

3. Measure the length of the following line segments :

(a) 

________ cm

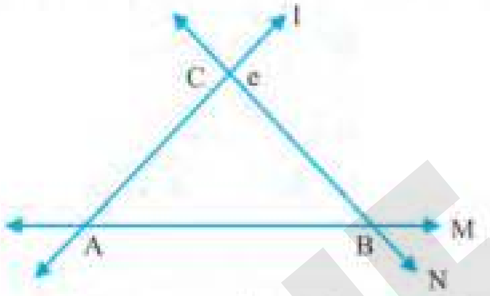
(b) 

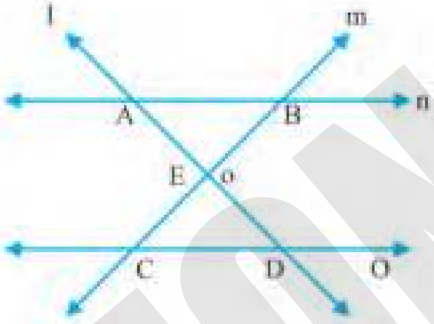
________ inch

(c) 

________ mm

4. Write the points where two lines intersect with each other.

(a) 

(b) 

5. How many lines can pass through a point ? Draw the sketch.

6. Can a ray be divided into two equal halves ?

7. State whether the following statements are true or false.

(a) Two straight lines can intersect at two points at the most.

(b) A line has a fixed length.

(c) Two lines in a plane may be parallel or intersecting.

(d) A ruler has two edges.

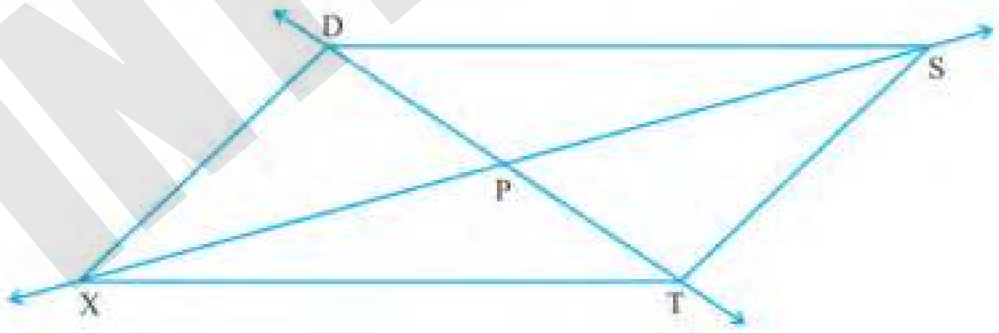
(e) A line has width and thickness.

(f) If l is a vertical line and m is a horizontal line, then they would certainly intersect each other.

(g) A line segment has no fixed length.

(h) A point has width.

8. Look at the figure and name the following :



(a) A line containing point X.

(b) Lines containing points P and S

(c) All line segments (pairs) which are parallel to each other.

(d) 1 pair of intersecting lines.

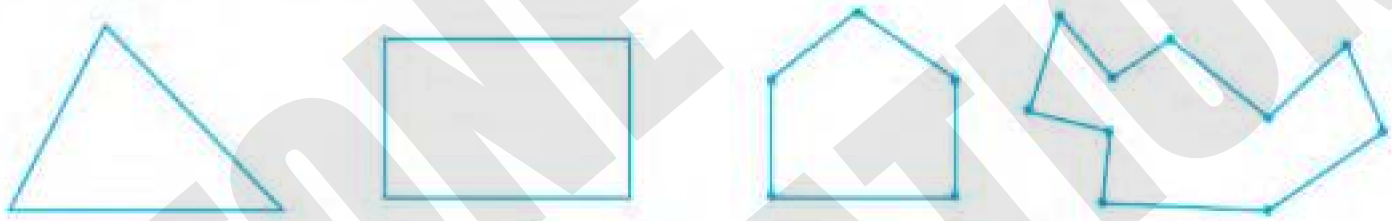
Open and Closed Figures

Look at the figure shown here:

(a) (b) (c) (d)

They all are open figures because they have loose ends and are not enclosing any space.

Now, look at the figures shown here :

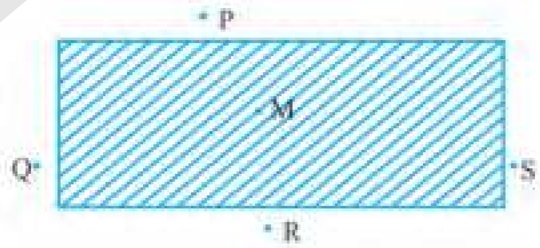


(a) (b) (c) (d)

They all are **closed figures** because they have no loose ends and are enclosing space. These are made of 3 or more than 3 lines.

Internal and Exterior of a Figure

You are standing in a room. All things inside that room are the interior of the room. All things outside the room are the exterior of the room. Look at the figure of rectangle. The interior of this rectangle is the shaded area. The exterior of this rectangle is points P, Q, R, and S. Note that point M is in interiors.



Facts to Know

In a closed curve there are three parts– inside, outside and on the curve.

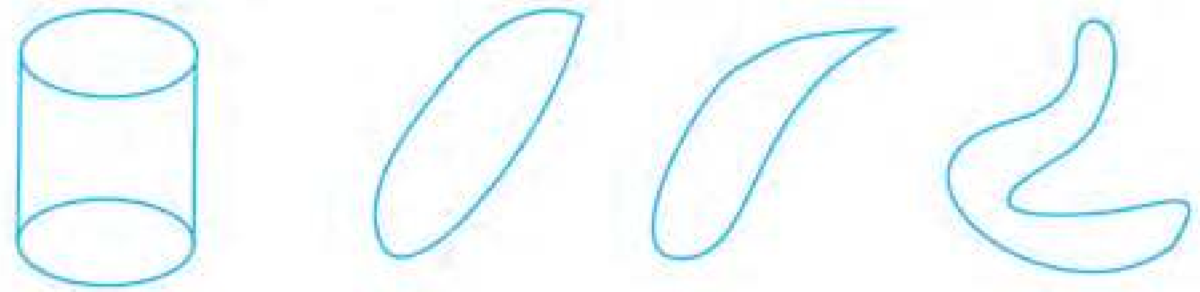
Curvilinear and Linear Boundaries

Take any two points on a football. Join them with the help of a pencil. Do you get a straight line ? No! you don't. This is a curvilinear boundary.

Now, go near a table. Take two points on its top. Join them with the help of a scale. Do you get a straight line ? Yes, you surely do. This is a linear boundary.

So, we can draw curvilinear and linear boundaries but surfaces must be accordingly made.

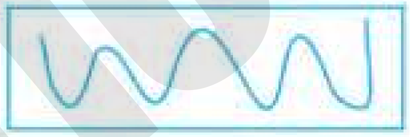
Curvilinear boundaries are found in sketches and figures similar to ones shown below.



(a) (b) (c) (d)

Curve

A figure that can be drawn with the help of a pencil, without lifting the pencil, is called **curve**. Note that curves may or may not have straight lines as their integral part. Look at the given figure. It is a curve.



Simple Curve

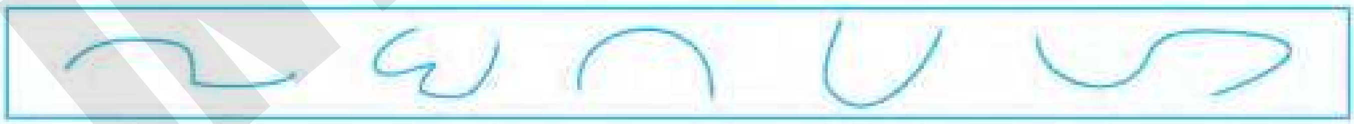
A curve that does not cross itself is called simple curve.

Look at the given figures. Each figures has simple curves.

(a) (b) (c) (d)

Open Curve

The curves that do not start and end at the same point are called open curves. The following figures show open curve.



Closed Curve

The curves that start and end at the same point are called closed curves. The following figures show closed curves.

Facts to Know

The following curve cross their own selves.

Exercise 9.2

1. **Classify the following figures as open or closed :**

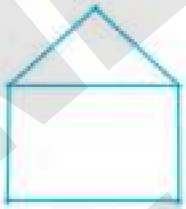
(a) T

(b) D

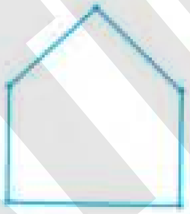
(c) R

(d) O

(e)

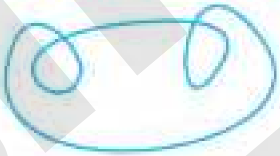


(f)



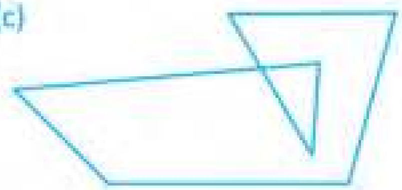
2. **Which ones of the following are simple curves and which ones are not ?**

(a)

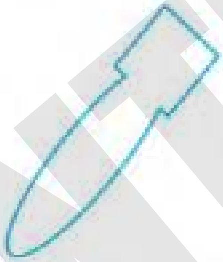


(b)

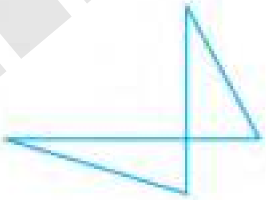
(c)



(d)



(e)



3. **Draw a closed curve that is not a polygon.**

4. **What are the definitions of :**

(a) open curve (b) simple curve (c) closed curve (d) exterior of a triangle

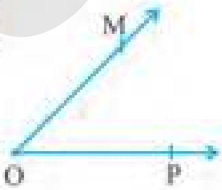
Angles

Look at the scissors shown here. Its blades are making certain angles. The same is true for the stapler that you use everyday. The hands of a clock make many angle everyday. Refer to the given figure.

Scissors

Watch

Plier

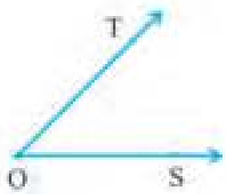


Therefore, whenever two rays move outwards from their point of origin and the point of origin is common between them, an angle is formed. Look at the given figure, two rays $\overrightarrow{OP}$ and $\overrightarrow{OM}$ makes an angle.

Here, they have made an angle MOP. The rays are called **arms** or sides of the angle. The **vertex** of this angle is O. The vertex is always written in the middle of a angle. A symbol (∠) is used along with the angle. Eg. ∠ POM, ∠ MOP and so on.

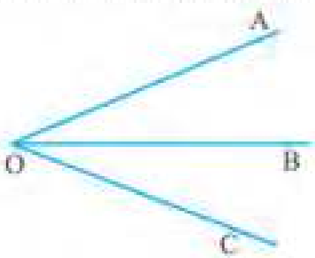
Facts to Know

The vertex itself can denote an angle. Look at this angle. This is ∠TOS = ∠O. Both are the same thing.



Multiple Angles

It is just possible that we have more than one angle with the same origin points.

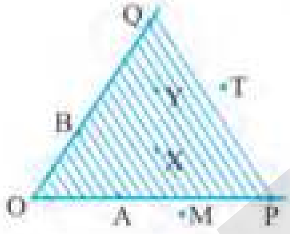


Here, ∠AOB and ∠BOC are multiple angles. So, we cannot write :

∠O for any one of the angles. Hence, it is appropriate to use the full form of angles at all times. In the given figure the these angles are — ∠AOB, ∠ BOC and ∠AOC. Note that O comes in the centre of all angle names because it is the common vertex for all of them. But the measures of all angles are totally different from one another .

Interior and Exterior of an Angle

Let us assume that a ray OP is rotating in an anticlockwise direction. It reaches the position OQ. The point O remains fixed. So, it forms an angle ∠QOP. Note that the shaded region of ∠QOP is **the region of ∠QOP**.



Points X and Y are within the shaded region. So they are part of the interior of ∠QOP. Points A and B are on the arms of ∠QOP. Points Q and P are also an arms of ∠QOP.

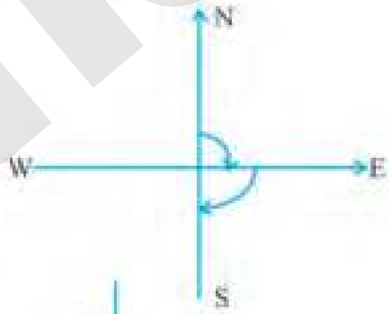
Points T and M, which are neither in the shaded part nor on the arms of ∠QOP are said to be in the exterior of ∠QOP.

The Right Angle

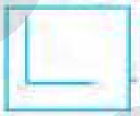
The walls of your home and school buildings are standing on floors. They make certain angle with floors. Have you ever noticed that? Also imagine what would have happened if the angle were different from the one we have now? Use a D (protractor) to measure the angle. Give it a name and write its measure. What do you get? Refer to the given figure.

Let us now look at four directions.

The figure shows four directions. There are certain angles between any two directions. Use a 'D' to measure them.

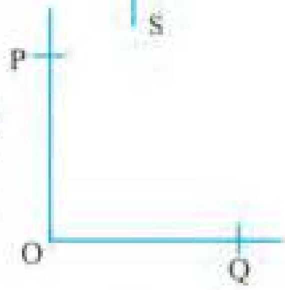


Do the above given two figures have any similarity?

Yes, the measure of all angles of these two figures is one, i.e. 90°. This angle is also called **right angle.** It is represented as .

Facts to Know

When two lines meet at a right angle, they are said to be perpendicular to each other.



How to Represent Angles

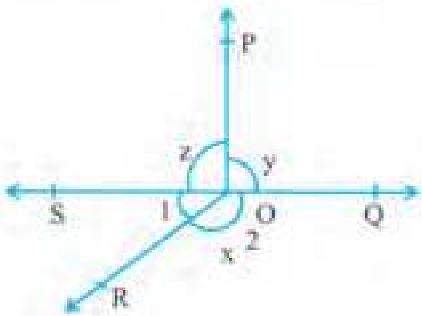
One method is the use of symbol (∠) and the complete name i.e. ∠POQ, ∠ROS etc. The other method is use of a small letter to represent the angle or, you can use simple numbers. Look at the given figure :

Here, ∠1 = ∠SOR

∠2 = ∠x = ∠ROQ

∠POQ = ∠y

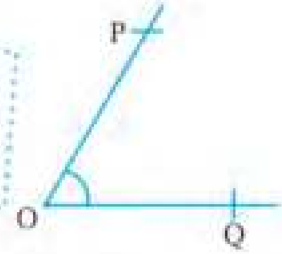
∠POS = ∠POQ = ∠z = ∠y



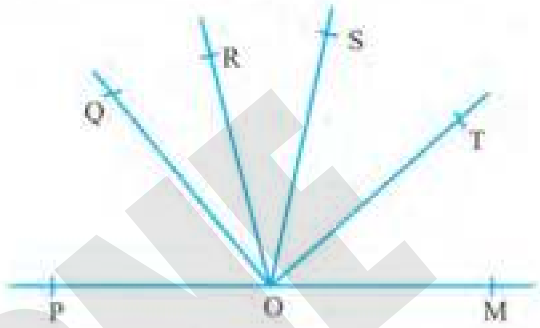
These notations – 1, 2 and x, y, z are simple and save a lot of time of the student.

Facts to Know

- ∠POQ = ∠QOP
- The reason is that the measure of both these angles is the same. Moreover, the vertex always remains in the center.



Example 4 : Name all the possible angles for the given figure.

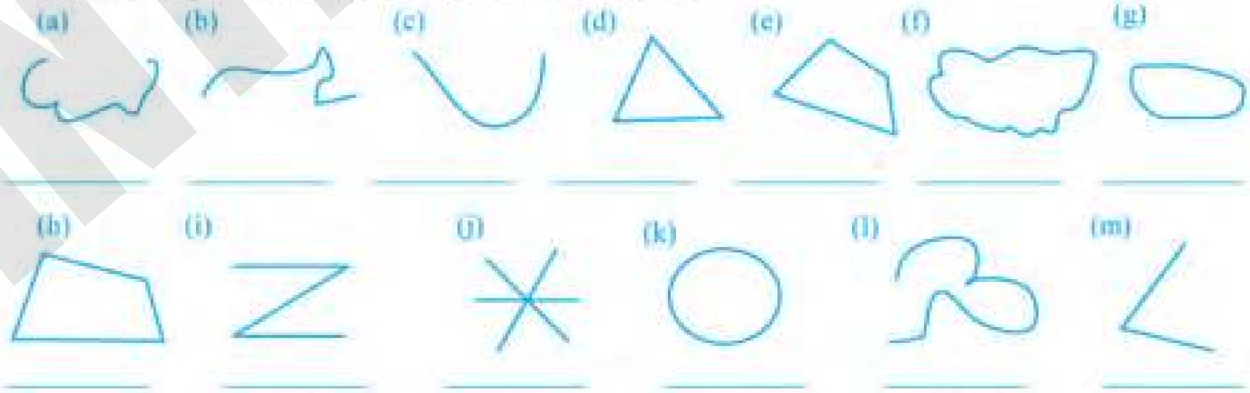


Solution : The angles are as follows : ∠POQ, ∠QOR, ∠ROS, ∠SOT, ∠TOM, ∠POR, ∠ROM, ∠POM, ∠SOM, ∠SOQ, ∠ROT, ∠POT, ∠MOQ, ∠QOT, ∠POS

Example 5 : Which points are in the interior of ∠MON?

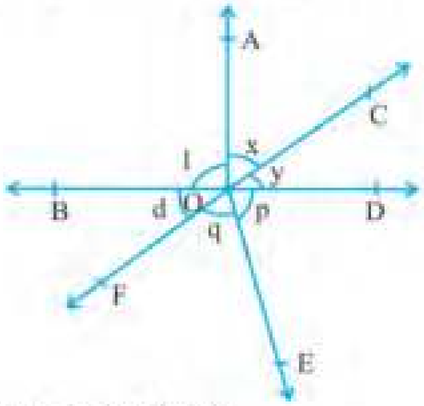
Solution : Only the point L is in the interior of ∠MON.

Example 6 : Which one of the following are open and close figures?



Solution : Open figures are (a), (b), (c), (i), (j), (l) and (m). Closed figures are (d), (e), (f), (g), (h) and (k).

Example 7 : Identify and name the angles in this figure:



Solution : In the given figure, we have:

$\angle l = \angle AOB$

$\angle x = \angle AOC$

$\angle y = \angle COD$

$\angle p = \angle DOE$

$\angle q = \angle EOF$

$\angle d = \angle FOB$

$\angle AOD = \angle x + \angle y = 90°$

$\angle AOB = \angle l = 90°$

Points to Remember

- A point determines a location. It is represented by a fine dot made by sharp pencil on a paper.
- The shortest join of two points is called the Line Segment.
- A line is obtained when a line segment like $\overline{AB}$ is extended a both sides indefinitely. It is denoted by AB or sometimes by a single letter like L.
- Two distinct lines meeting at a point are called intersecting lines.
- Two lines in a plane are said to be parallel if they do not meet.
- A ray is a portion of line starting at a point and going in one direction endlessly.
- A plane is a flat surface that extends indefinitely in all directions.
- A curve is closed if its ends join, other wise it is said to be open.
- A polygon is a closed figure made up entirely of line segments.
- An angle is made up of two rays starting from a common fixed point (initial point).
- An angle divides the plane in three regions: on the angle, the interior of the angle and the exterior of the angle.

EXERCISE

1. MULTIPLE CHOICE QUESTIONS (MCQs) :

Tick (✓) the correct options.

(a) The number of sides of a regular heptagon is:

(i) 5 ☐ (ii) 7 ☐ (iii) 6 ☐ (iv) 3 ☐

(b) The radius of a circle is 5 cm. Its diameter is:

(i) 5m ☐ (ii) 10m ☐ (iii) 10cm ☐ (iv) 15 cm ☐

(c) If two lines never meet, they are:

(i) intersecting ☐ (ii) parallel ☐ (iii) segments ☐ (iv) none of these ☐

(d) An eraser is an example of :

(i) cube ☐ (ii) cuboid ☐ (iii) pyramid ☐ (iv) circle ☐

(e) A plane is a :

(i) flat surface ☐ (ii) three-dimensional object ☐

(iii) geometrical figure ☐ (iv) all of these ☐

(f) The point of concurrence on the medians of a triangle is called:

(i) center ☐ (ii) orthocenter ☐ (iii) centroid ☐ (iv) none of these ☐

(g) The other name of the altitude of a triangle can be:

(i) line ☐ (ii) segment ☐ (iii) standing ☐ (iv) perpendicular ☐

2. State whether the following statements are true or false :

(a) OB is a line segment. (b) PQ is a ray.

(c) The two rays that from an angle are the sides of the angle.

(d) The number lines that can be drawn through two given points is infinite.

3. Refer to figure shown here. Give the names of the following:

(a) Arc (b) segment

(c) Diameter (d) Radius

(e) Sector (f) Point inside the circle (interior point)

(g) Point outside the circle (exterior point)

4. Answer the following questions:

(a) What are intersecting lines ? (b) Does a triangle have a diagonal ?

HOTS

How many lines can be drawn passing through

(a) one point (b) two given points

(c) three given points not in a straight line

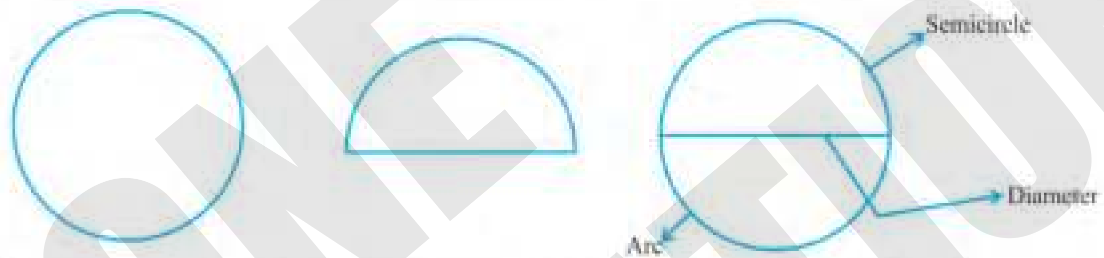
Lab Activity

Objective : To study the different parts of a circle.

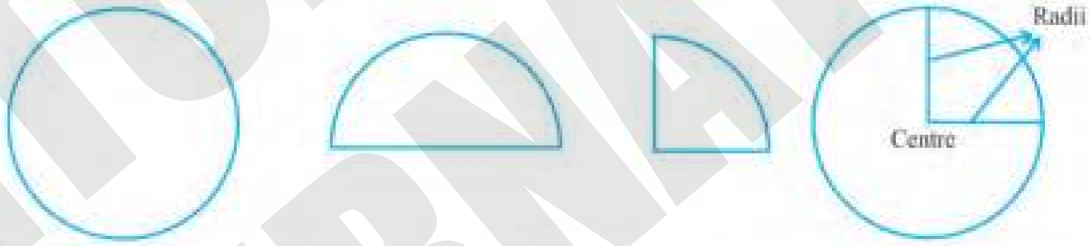
Material Required : A bangle, chart paper, a pair of scissors, pencil and coloured sketch pens.

Procedure :

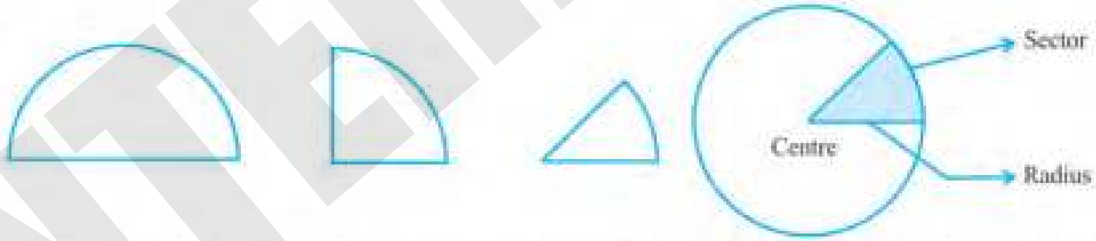
- Draw four circles on a piece of chart paper with the help of a bangle.
- Cut out the four circles.
- Fold the circle in half as shown. Then open it out. Mark the crease as diameter and also mark the semicircle. Mark an arc also.



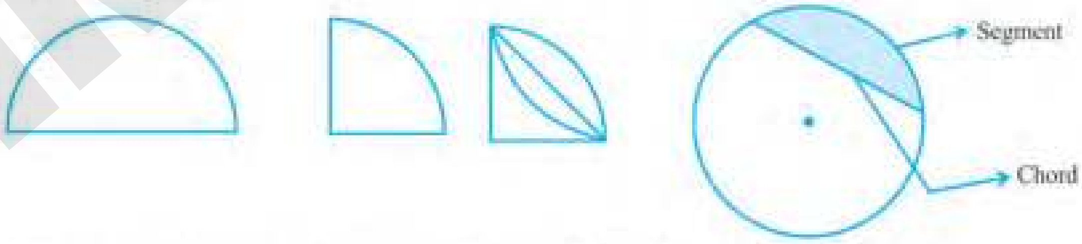
- Fold the circle in half and again in half as shown. Open it out. Mark the centre and the radii.



- Fold the circle in half, again in half and once more in half. Now open it out. Mark the radii and colour the sector.



- Fold the circle in half and again in half. Turn one of the four folds as shown. Then open it out. Mark the chord and colour the segment.



Now stick these 4 circles in your notebook with all the parts of the circle clearly marked.

Revision Test Paper-III

(Based on Chapters 7 to 9)

A. Multiple Choice Questions (MCQs).
Tick (✓) the correct option.

1. Ratios can exist between two quantities of the same or different class but their unit must be
   - (i) different ☐ (ii) same ☐
   - (iii) one bigger than other ☐ (iv) one smaller than other ☐
2. How may lines can be drawn passing through one point?
   - (i) one ☐ (ii) two ☐
   - (iii) three ☐ (iv) infinite ☐
3. For comparing two ratios, express each one of the ratios as a
   - (i) decimal ☐ (ii) fraction ☐
   - (iii) integer ☐ (iv) whole ☐
4. One meter is equal to
   - (i) 100 decimeters ☐ (ii) 50 decimeters ☐
   - (iii) 10 decimeters ☐ (iv) none of these ☐
5. A straight angle is equal to
   - (i) 4 right angles ☐ (ii) 3 right angles ☐
   - (iii) 1 right angle ☐ (iv) 2 right angles ☐
6. A complete angle is equal to
   - (a) 90° ☐ (b) 270° ☐
   - (c) 360° ☐ (d) 180° ☐
7. The ratio of 3ℓ 750 ml to 5 litres in simplest form is
   - (i) $\frac{2}{5}$ ☐ (ii) $\frac{3}{4}$ ☐
   - (iii) $\frac{1}{4}$ ☐ (iv) $\frac{2}{4}$ ☐
8. When two lines meet at right angle, they are said to be
   - (i) perpendicular ☐ (ii) vertex ☐
   - (iii) segment ☐ (iv) none of these ☐

9. A curve that starts and ends at same point is called

(i) open curve (ii) closed curve

(iii) a line (iv) both (a) and (b)

10. When two lines meet at a right angle, they are said to be

(i) parallel to each other (ii) perpendicular to each other

(iii) adjacent to each other (iii) collinear on each other

B. Fill in the blanks.

1. A curve that does not cross itself is called ....
2. A line segment has .... end point.
3. Angle can be measured with the help of .... that looks like a letter 'D'.
4. Mathematically a : b = c : d or a : b .... c: d
5. Two lines can intersect at only .... point.

C. Tick (✓) for the true statement and cross (×) for false statement.

1. Any fixed number is a constant.
2. Algebra deals with variables and constants.
3. Ratio can not be put in the term of fraction.
4. A ray has one end point.
5. Ratio compares two quantities of same class.
6. In the ratio *x*:y, *x* is the consequent and y is the antecedent.
7. If three or more points do not lie on the same straight line, they are called collinear points.
8. The diameter of a circle divides it into two semi-circles.
9. Angles are formed when two rays meet at a point.
10. We can compare the ratios of the quantities having different units.

10 Understanding Elementary Shapes

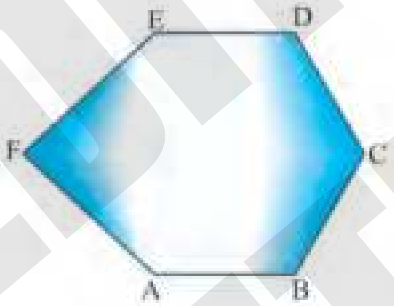
In our daily life, we come across different objects having different shapes. All these objects are formed using curves or lines. Most of them have corners, edges and planes. They have different sizes and measures. We compare their shapes with the line segments, angles, triangles, polygons and circles. In this chapter, we shall develop tools to compare their sizes.

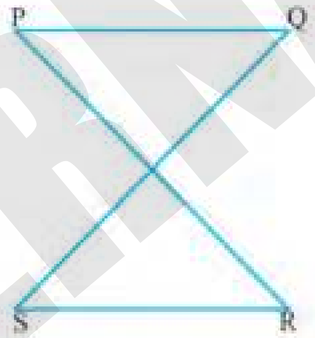
Line Segment

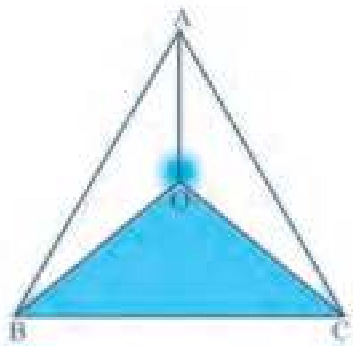
A line segment is a part of a line. It has two end points and has a definite length, no breadth, and no thickness. A line is drawn with arrows on both its ends, because it can be extended in both directions.

Consider a line make two points P and Q on it. The portion of the line with end points P and Q is called the **line segment** PQ. It is represented as PQ. A line segment is named using capital letters. Generally a line segment has a definite length, whereas a line does not have a definite length.

Look at the figures given below carefully.







How many line segments do you observe in each figure ?

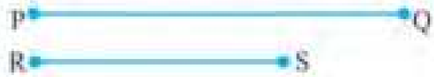
Measuring Line Segments

The measure of each line segment is called its **length**. To measure line segments, we use a scale that has metres, centmeters, millimeters etc. The most commonly used tool is a ruler or scale. It is either 12 inches long (30 cm) or 6 inch long (15 cm).

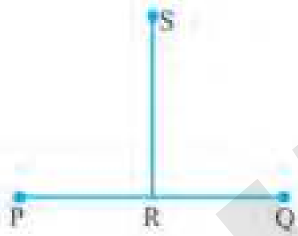
The methods that compare the length of line segments are as follows:

(i) Comparison by Observation:

By comparison of two line segments, we understand to know relation between their lengths, that mean, which of them is longer or shorter. Suppose we are given two line segments PQ and RS. By just looking at the two line segments carefully, we can say that the line segment PQ is longer than RS.



But we cannot always be sure about our usual judgement.



For example, look at the adjoining segments.

The difference in lengths between two segments may not be clear. We need some other method to compare the lengths of segments in such situations.

In the adjacent figure, PQ and RS have the same lengths. This is not quite clear.

(ii) Comparison by Tracing

To compare line segments PQ and RS by tracing method. Trace one of the line segments, say RS, on a tracing paper and place it along PQ in such a way that point R of traced segments RS coincides with the point P of the line segments PQ. By doing so, we observe the following condition:

S lies between P and Q,

So that, RS < PQ

(i)

R lies on P, and S lies on Q

So that, PQ = RS

(ii)

S lies beyond Q

So that, RS > PQ

(iii)

This method of comparing lengths of line segments is not practical as we cannot trace the length everytime you want to compare them.

(iii) Comparison using Ruler and a Divider

The pictures of a ruler and a divider are shown below.

Ruler

Divider

RULER

To measure line segments, the most commonly used tool is a ruler. It is marked in centimetres or inches, or both. We use a scale or ruler that has centimetre marks one edge and inch marks on the other edge. Observe that each centimetre is divided into 10 equal parts and each part is called a **millimetre** (mm).

Relation between m, dm, cm and mm.

10 mm (millimetres)	=	1 *cm* (centimeter)
10 cm (centimetres)	=	1 *dm* (decimeter)
10 dm (decimetres)	=	1 *m* (meter)

Measuring line segments with a ruler

Step - 1: Draw a line segment and mark the end points P and Q.

Step - 2: Place the 0 cm mark on the ruler at point P and mark 5 coincides with point Q of the line segment $\overline{PQ}$. Hence, we say, length of $\overline{PQ}$ = 5 cm. If the corner of a scale is broken or 0 mark is faded, we measure from mark 1 and subtract 1 cm from the reading corresponding to the end point of the line segment on the scale or ruler.

There are chance for errors even in this procedure. The thickness of the ruler may cause difficulties in reading off the marks on it. This problem can be avoided by using a divider.

DIVIDER

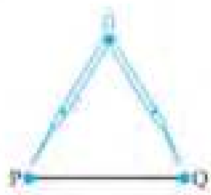
In geometry box, there is an instrument called **divider**. A divider has two arms hinged together. Each arm has a pointed metallic end. The distance between the two ends can be increased or decreased as required.

Measuring line segments with divider

There are following steps to measure a line segment using divider:

Step - 1: Open the divider and place one end on P and the other end on Q.

Step - 2: Without disturbing this distance between the two ends, place the divider on the ruler in such a manner that one end falls on the 0 mark. Note the point on which the other end falls. If it shows 4 cm, then the length of the line PQ you have drawn is 4 cm.



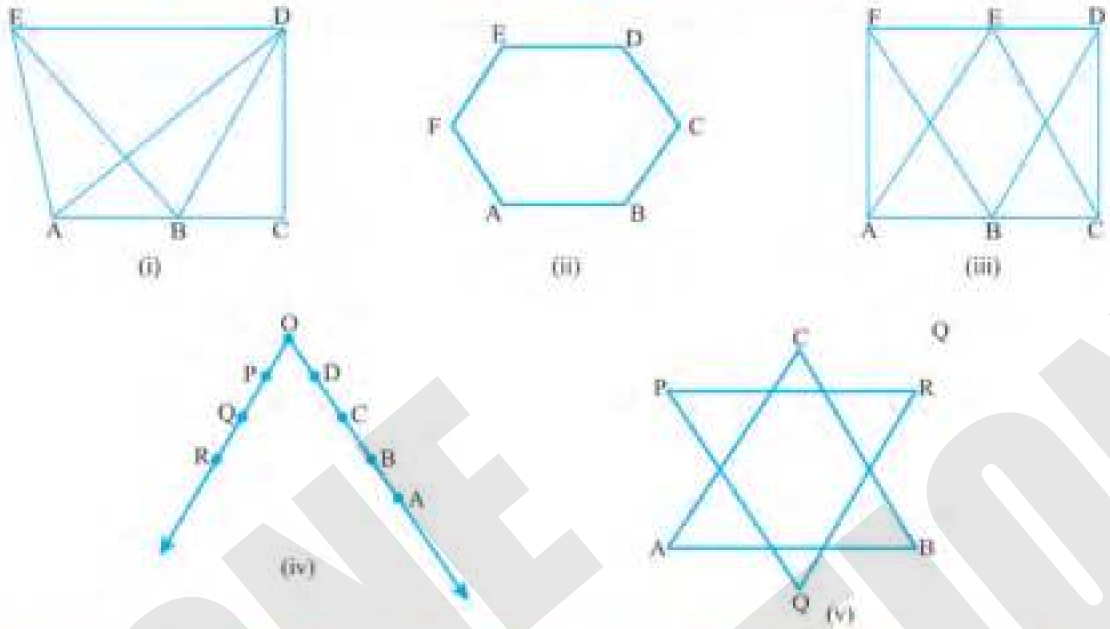
Exercise 10.1

1. **Draw line segments for the following measurements using ruler.**

(a) 5.8 cm (b) 3.6 cm (c) 4.4 cm (d) 7.2 cm
(e) 5 inch (f) 2.5 inch (g) 3.5 inch (h) inch

2. **Compare $\overline{AB}$ and $\overline{CD}$ by tracing.**

3. What do you mean by "line segment"?
4. How many line segments can you find in the following figure? Write them.



5. Why is it better to use a divider than a ruler, while measuring the length of a line segment?
6. Fill in the blank?
   (a) 1 cm (centimetre) = ... mm
   (b) 1 m (metre) = ... dm
   (c) In a ruler, each centimetre is divided into .... sub parts.
   (d) 1 dm (decimetre) = ... cm
7. If 'B' is the mid point of AC and 'C' is the mid point of BD, where A, B, C, D lie on a straight line, say why AB = CD?

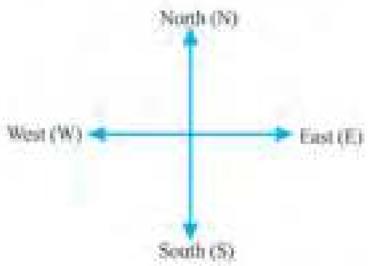
Angles – 'Right' and 'Straight'

You know that there are four main directions. They are North **(N)**, South **(S)**, East **(E)** and West **(W)**. The four directions have been shown in the figure.

Do you know which direction is opposite to North?

Which direction is opposite to West?

Just recall what you have learnt about directions earlier. We would use this knowledge to study a few properties about angles.



Let us discuss with an example

Stand facing towards North.

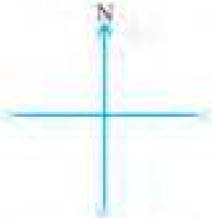
Turn clockwise to East.

We say, you have turned through a right angle. A right angle is equal to 90°.

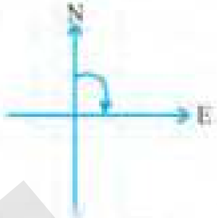
Follow this by a 'right-angle-turn', clockwise. Now, you face south.

If you turn by a right angle in the anti-clockwise direction, which direction will you face?

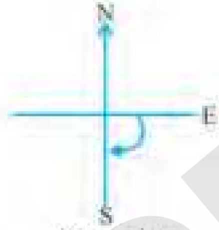
It is East again! (Why?). Now study the following positions :



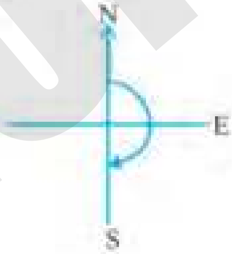
You stand facing North



By a 'Right-angle-turn' clockwise, now you face East



By another 'right-angle-turn' clockwise for finally face South.



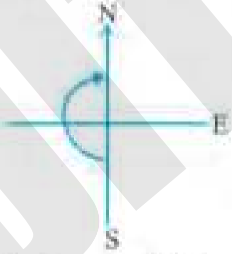
From facing North to facing South, you have turned by two right angles.

It is same as a single turn by two right angles.

The turn from North to East is by a right angle.

The turn from North to South is by two right angles; it is called **straight angle** (NS is a straight line!). A straight angle is equal to two right angles = 180°.

Stand facing South.

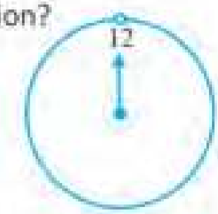


Turn by a straight angle.

In this situation you would be facing North.

To turn from North to South, you took a two right angle turn, again to turn from South to North, you took another two right angle turn in the same direction. Thus, turning by two, two right angles you reach your original position.

By how many right angles should one turn in the same direction to reach his/her original position?

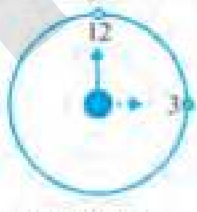


Turning by two, two right angles (or four right angles) in the same direction makes a full turn. This one complete turn is called **one revolution.** The angle for one revolution is a complete angle.

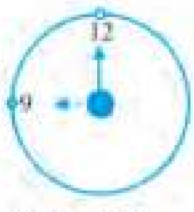
A complete angle is equal to four right angles = **360°.**

Such revolutions on clock-faces. When the hand of a clock moves from one position to another, it turns through an angle.

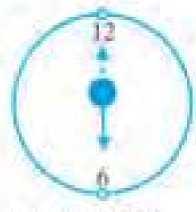
Suppose the hand of a clock starts at 12 then in making one revolution it goes round until it reaches at 12 again. Consider these examples :



From 12 to 3
$\frac{1}{4}$ of a revolution
or 1 right angle.



From 12 to 9
$\frac{3}{4}$ of a revolution
or 3 right angles.



From 12 to 6
$\frac{1}{2}$ of a revolution
or 2 right angles.

Example 1 : Where will the hour hand of a clock stop if it:

(a) Starts at 3 and makes $\frac{3}{4}$ of a revolution.

(b) Starts at 12 and makes $\frac{1}{4}$ of a revolution.

(c) Starts at 12 and makes $\frac{1}{2}$ of a revolution.

Solution :

(a) In $\frac{3}{4}$ of a revolution, it will rotate by 270° (i.e. $360 \times \frac{3}{4}$) and hence it will stop at 12.

(b) In $\frac{1}{4}$ of a revolution, it will rotate by 90° (i.e. $360 \times \frac{1}{4}$) and hence it will stop at 3.

(c) In $\frac{1}{2}$ of a revolution, it will rotate by 180° (i.e. $360 \times \frac{1}{2}$) and hence it will stop at 6.

Example 2: What fraction of a clockwise revolution does the hour hand of a clock turn through, when it goes from:

(a) 6 to 9 (b) 3 to 12 (c) 9 to 3

Solution : We observe that in one complete revolution, the hour hand rotates by 360°.

(a) When the hour hand goes from 6 to 9, it will rotate by one right angle.

$\therefore$ Fraction $= \frac{90}{360} = \frac{1}{4}$

b) When the hour hand goes from 3 to 12, it will rotate by three right angles

$\therefore$ Fraction $= \frac{3 \times 90}{360} = \frac{3}{4}$

c) When the hour hand goes from 9 to 3, it will rotate by two right angles

$\therefore$ Fraction $= \frac{2 \times 90}{360} = \frac{1}{2}$

Exercise 10.2

1. **What fraction of a complete revolution have you turned through if you stand facing**
   (a) South and turn clockwise to west?
   (b) West and turn anti-clockwise to East?
   (c) South and turn anti-clockwise to North?
2. **How many right angles have you turned through if you stand facing**
   (a) South and turn clockwise to face North?
   (b) North and turn anti-clockwise to face West?
   (c) East and turn anti-clockwise to face West?
3. **What rotation is needed to turn**
   (a) From North to South in a clockwise direction?
   (b) From South to East in a anti-clockwise direction?
   (c) From East to West in a clockwise direction?
4. **Where will the hour hand of a clock stop if it**
   (a) Starts at 3 and makes $\frac{3}{4}$ of a revolution, anti-clockwise?

(b) Starts at 6 and makes $\frac{1}{2}$ of revolution, clockwise?

(c) Starts at 9 and makes $\frac{1}{4}$ of revolution, anti-clockwise?

5. Find the number of right angles turned through by the hour hand of a clock when it goes from :

(a) 6 to 9 (b) 9 to 12 (c) 3 to 6 (d) 12 to 6

6. Where will the hour hand of a clock stop if it starts

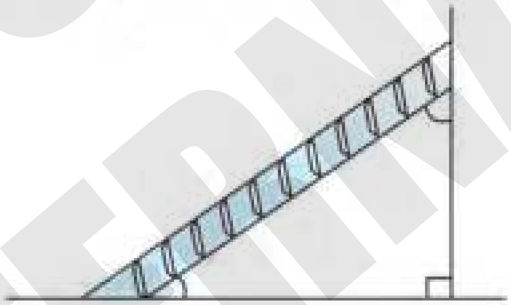
(a) from 7 and turns through 2 right angles?

(b) from 10 and turns through 3 right angles?

(c) from 6 and turns through 1 right angle?

'Acute', 'Obtuse' and 'Reflex' Angles

Till now we are aware of a right angle and a straight angle. An angles are formed when two rays meet at a point. The two rays are called the **arms** of an angles. Different angles are formed by the rotation of a ray. Generally, measure of a right angle is 90° and that the measure of two right angles or a straight angle is 180°. However, not all the angles we come across are one of these two kinds. The angle made by a ladder with the wall (or with the floor) is neither a right angle nor a straight angle. Magnitude of an angle does not depend upon the length of its arms.



The angle made by a ladder with the wall (or floor) is less than a right angle.

Let us know what the acute, obtuse and reflex angles are:-

(i) Acute angle : An angle whose measure is more than 0° but less than 90° is called **acute angle.** An acute angle is less than one-fourth of a revolution.

(ii) Obtuse Angle : An angle whose measure is more than 90° but less than 180° is called **obtuse angle.** An obtuse angle is greater than one-fourth of a revolution but less than half a revolution.

(iii) Reflex Angle : The angles which have measures more than 180° but less than 360° is called **reflex angle.**

There are following **acute angles** shown in the figure!

There are following **obtuse angles** shown in the figure:

There are following **reflex angles** shown in the figure:

Exercise 10.3

1. Give two examples from the environment for each one of the following.

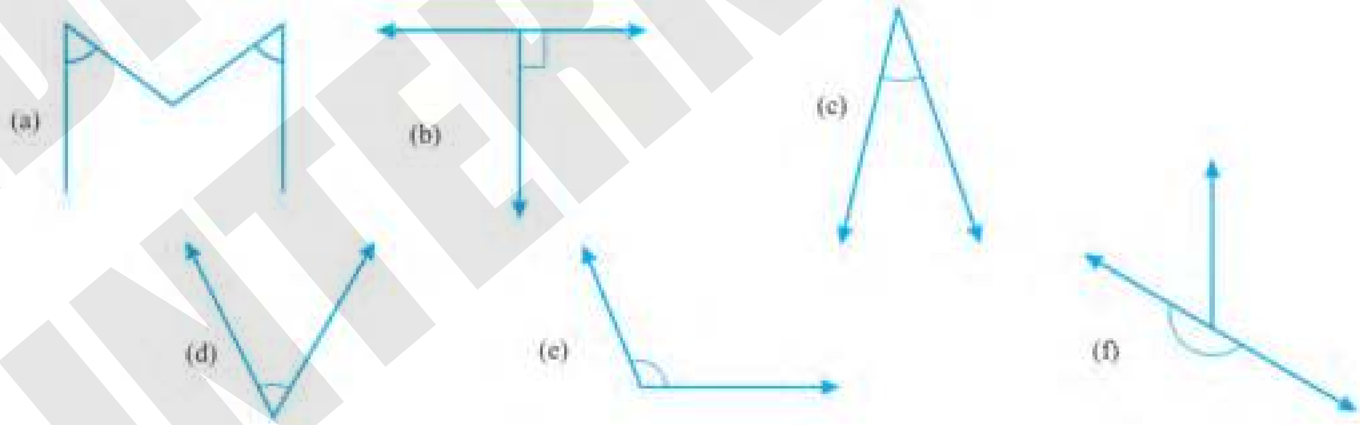
(a) Right angles (b) Obtuse angles (c) Reflex angles

2. Classify the following angles as acute, obtuse and reflex angle.

(a) 35° (b) 325° (c) 120° (d) 45° (e) 150°

(f) 200° (g) 145° (h) 220° (i) 21° (j) 135°

3. Without measuring find out what kind of angle is each one of the following?



4. Look at the figure and name the following.

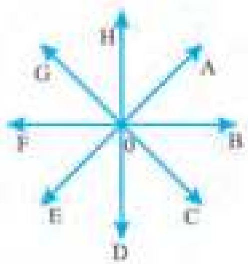
(a) Four right angles

(b) Four acute angles

(c) Four straight angles

(d) Four obtuse angles

(e) Four reflex angles



5. **Match column 'A' with column 'B'**

Column 'A'	Column 'B'
(i) Obtuse angle	(a) Rotation of four right angles in either direction
(ii) Straight angle	(b) Half of a revolution
(iii) Right angle	(c) Less than one-fourth of a revolution
(iv) Reflex angle	(d) More than half a revolution
(v) Acute angle	(e) One-fourth of a revolution
(vi) Complete rotation	(f) Between $\frac{1}{4}$ and $\frac{1}{2}$ of a revolution

Measuring Angles
"D-scale / Protractor"

We were able to measure angles, now we used for 'measure' to the angles like acute, obtuse or reflex. We can easily found with a "D- scale or protractor".

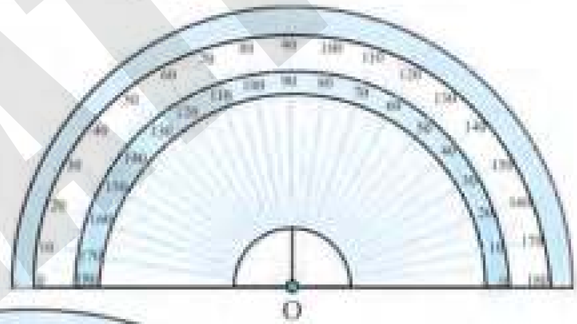
The measure of angle

The measure of an angle is called '**degree measure**'. One complete revolution is divided into 360 equal parts. Each part is a degree which is denoted as '°'. We write 360° to say 'three hundred sixty degrees'.

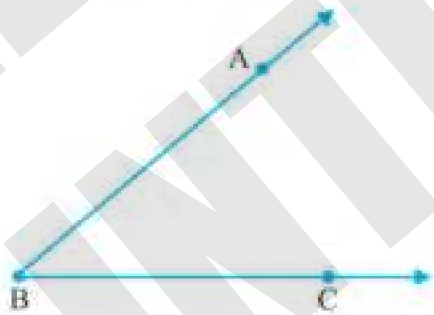
The Protractor

Angles can be measured using a 'protractor'. A protractor is a geometrical instrument that looks like a letter 'D'.

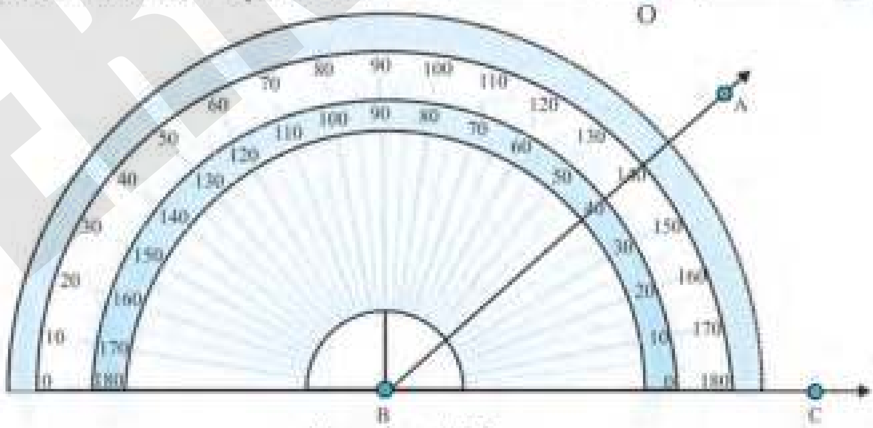
You can find a protractor in your 'geometry box'. The curved edge is divided into 180 equal parts. Each part is equal to a 'degree'. The angles are marked from 0° to 180° on the edge in clockwise direction as well as in anti-clockwise direction. 'O' is the midpoint at the base line of the protractor.



Let us measure angle ABC



Given ∠ABC



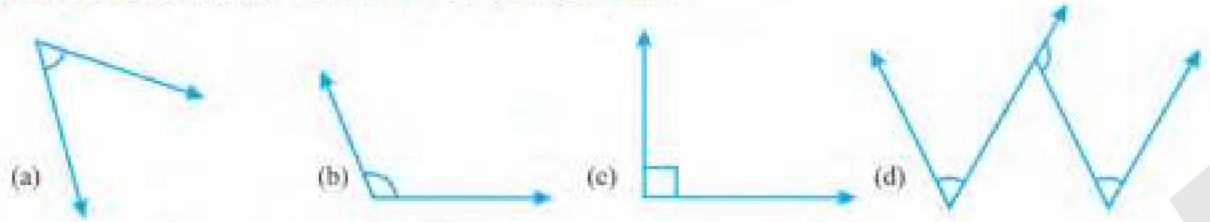
Measuring ∠ABC

1. Place the protractor in such a way that midpoint 'O' of the base line coincides with 'B' and base line exactly overlaps on the line segments $\overline{BC}$.
2. Adjust the protractor so that is along the straight-edge of the protractor.
3. There are two 'scales' on the protractor : read that scale which has the mark coinciding with the straight edge (i.e. with ray $\overline{BC}$).
4. The mark shown by BA on the curved edge gives the degree measure of the angle.

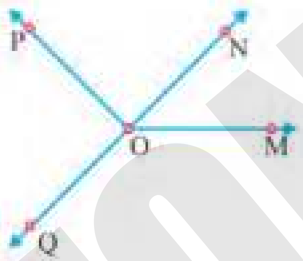
   We write m ∠ABC = 40° or simply ∠ABC = 40°

Exercise 10.4

1. **With the help of a protractor, measure the following angles: .**



2. **Measure and classify each angle using protractor:**

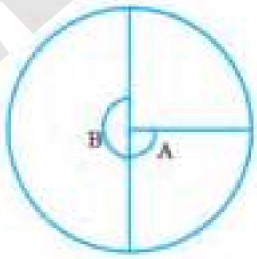


	Angle	Measure	Type
(a)	∠MON		
(b)	∠MOP		
(c)	∠NOP		
(d)	∠QOP		
(e)	∠QOM		
(f)	∠QON		

3. **Measure the unknown angles A and B in degrees.**

(a)

(b)



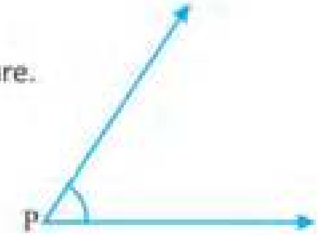
4. **Write 'T' for True and 'F' for False for the following statements.**
   (a) The measure of an obtuse angle < 90°
   (b) The measure of one complete revolution = 180°
   (c) The measure of a reflex angle > 180°
   (d) The measure of an acute angle < 90°.
5. **Fill in the blanks with acute, obtuse, right or straight :**
   (a) An angle whose measure is the sum of the measures of two right angles is __________.
   (b) When the sum of the measures of two angles is that of a straight angle and if one of them is acute then the other should be __________ .
   (c) An angle whose measure is greater than that of a right angle is __________.
   (d) An angle whose measure is less than that of a right angle is __________ .
   (e) When the sum of the measures of two angles is that of a right angle, then each one of them is ____________ .
6. (a) Draw an acute angle of measure 45° with the help of a protractor.
   (b) Draw an obtuse angle of 135° with the help of a protractor.

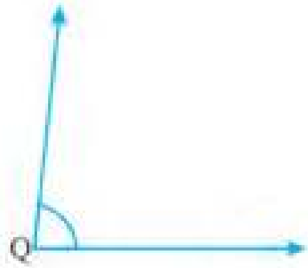
7. Which angle is larger?

First estimate and then measure.

Measure of angle P =

Measure of angle Q =





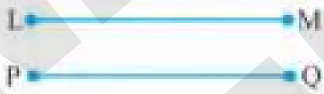
Pair of Lines

A pair of lines in a plane may be:

(a) Parallel lines (b) Intersecting lines

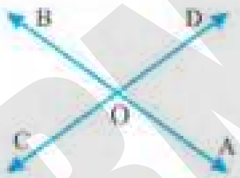
(a) Parallel Lines

The figure given here shows two lines LM and PQ that never intersect each other at any point in a same plane. i.e., they are equidistance from each other at each and every point. This distance is called the distance between two parallel lines. Parallel lines LM and PQ are represented as $\overleftrightarrow{LM} \mid\mid \overleftrightarrow{PQ}$. Here, symbol '| |' is read as 'is parallel to'.



(b) Intersecting Lines

In the figure given below, lines AB and CD intersect each other at a point 'O', such lines are called intersecting lines.



Facts to Know

The angle of 50° in measurement on inner scale, when angle is measured anti- clockwise.

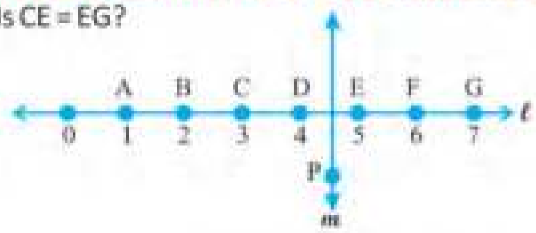
Exercise 10.5

1. Give three examples from the environment for each of the following:

(a) Perpendicular lines (b) Parallel lines (c) Intersecting lines

2. Study the diagram. The line '*l*' is perpendicular to line '*m*'.

(a) Is CE = EG?



(b) Does DE bisect CG?

(c) Identify any two line segments for which '*m*' is the perpendicular bisector '*l*'

(d) Are these true?

(i) AC > FG (ii) CD = EG (iii) BC < EG.

3. Write 'T' for True and 'F' for False for the following statements.

(a) Parallel lines meet each other at infinity.

(b) Intersecting lines never meet each other at any point.

(c) The symbol '⊥' is read 'is perpendicular to'.

(d) The symbol '⊥' is read as 'is parallel to'.

(e) Perpendicular lines intersect each other at right angles.

4. Which of the following are models for perpendicular lines :

(a) The adjacent edges of a table top.

(b) The line segments forming the letter 'L'

(c) The letter V.

5. There are two set-squares in your box. What are the measures of the angles that are formed at their corners? Do they have any angle measure that is common?

Classification of Triangles

A closed two-dimensional shape bounded by straight lines is called a **polygon.** The word 'Polygon' comes from a Greek word meaning 'many angles'. A three-sided polygon is called a **triangle.** The sum of the three angles of a triangle is always equal to 180^0.

Triangles can be classified in two ways:

(i) By their sides

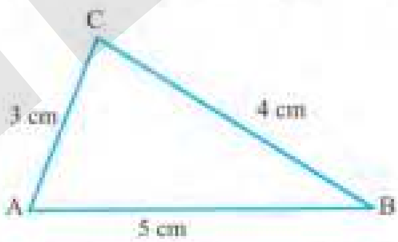
(ii) By their angles

(i) By their sides:

• Scalene triangle **• Isosceles triangle** **• Equilateral triangle**

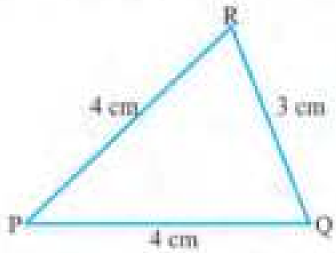
Scalene triangle: A triangle having all three sides unequal is called **scalene triangle.**

In figure given below AB $\neq$ BC $\neq$ CA, so ΔABC is a scalene triangle.



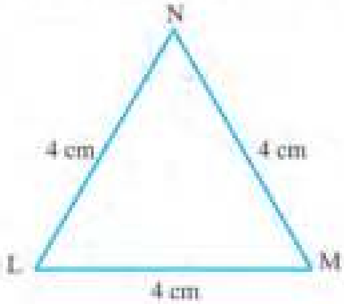
Isosceles triangle: A triangle which has two sides of equal length, is called **isosceles triangle.**

In the adjoining figure PR = PR = 4 cm. So, Δ PQR is an isosceles triangle.



Equilateral triangle : A triangle having all the three sides equal is called **equilateral triangle.**

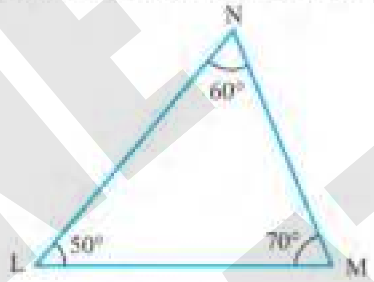
In the figure given below, LM = MN = LN = 4 cm. So, Δ LMN is an equilateral triangle.



(ii) By their angles:

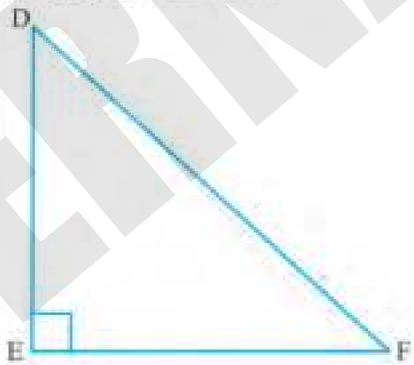
- **Acute-angled triangle**
- **Right-angled triangle**
- **Obtuse-angled triangle**
- **Equiangular triangle**

Acute-angled triangle: If in a triangle, each angle is less than 90°, then the triangle is called **acute-angled triangle.** In the triangle shown here ∠L, ∠M and ∠N are all less than 90°, hence Δ LMN is an acute-angled triangle.



Right-angled triangle: If in a triangle, any one angle is a right angle, i.e. one angle is 90°, then the triangle is called **right-angled triangle** or simply **right triangle**. The side opposite the right angle is called **hypotenuse.** DF is the hypotenuse.

Δ DEF shown here a right-angled triangle, as ∠E = 90°.

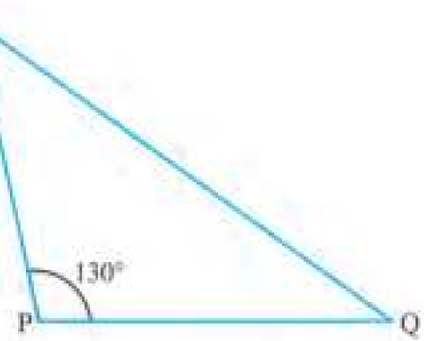


Facts to Know

Δ The sum of three angles in triangle is always 180°.

Obtuse-angled triangle: If in a triangle, any one angle is an obtuse angle, i.e., more than 90°, then the triangle is called **obtuse-angled triangle.**

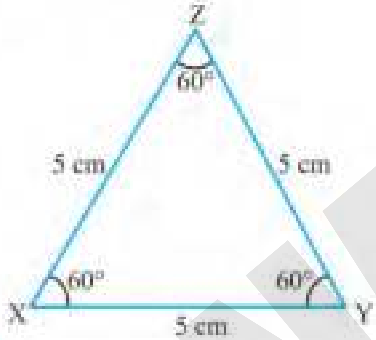
In Δ PQR, ∠P is an obtuse angle, so Δ PQR is called **obtuse-angled triangle.**



Equiangular triangle : If in a triangle, all the three angles are equal, then that triangle is called an **equiangular triangle.**

An equiangular triangle is also known as **equilateral triangle** because all of its sides are equal.

ΔXYZ is an equiangular triangle because in ΔXYZ, $\angle X = \angle Y = \angle Z = 60°$



Facts to Know

To A right angled triangle may be either isocele

Exercise 10.6

1. Define the following:

(a) Triangle
(b) Scalene triangle
(c) Right - angled triangle
(d) Equilateral triangle
(e) Isosceles triangle

2. The length of sides of triangles is given below. Classify them as scalene, equilateral or isosceles triangles.

(a) 8.7 cm, 7.2 cm, 11.1 cm
(b) 3 cm, 5 cm, 8 cm
(c) 4 cm, 4 cm, 4 cm
(d) 3 cm, 6 cm, 3 cm
(e) 7 cm, 7.5 cm, 7.5 cm
(f) 5.3 cm, 5.3 cm, 5.3 cm
(g) 2.3. cm, 3.3 cm, 3.8 cm
(h) 3.8 cm, 4.8 cm, 3.8 cm

3. The two angles of a triangle are given below:

(a) $A = 60°, B = 65°, C =$?
(b) $P = 45°, Q = 90°, R =$?
(c) $D = 35°, E = 135°, F =$?
(d) $X = 53°, Y = 42°, Z =$?
(e) $P = 60°, Q = 60°, R =$?
(f) $A = 55°, B = 65°, C =$?

4. Look at the measures of the triangles and name their types :

(a) ΔABC with $m\angle B = 90°$, AB = 6 cm and BC = 4 cm
(b) ΔXYZ with $m\angle Y = 60°$ and XY = YZ.
(c) Triangle with lengths of sides 7 cm, 8 cm and 9 cm.
(d) ΔABC with AB = 9.7 cm, AC = 5 cm and BC = 4 cm.
(e) ΔPQR such that PQ = QR = RP = 6 cm.

5. Match the column 'A' with column 'B' :

COLUMN 'A'	COLUMN 'B'
(i) 1 right angle with two sides of equal length	(a) Acute angled
(ii) 3 sides of equal length	(b) Right angled
(iii) 1 right angle	(c) Isosceles
(iv) 3 sides are of different length	(d) Obtuse angled
(v) 3 acute angles	(e) Equilateral
(vi) 2 sides of equal length	(f) Isosceles right angled
(vii) 1 obtuse angle	(g) Scalene

Quadrilaterals

The figure is enclosed by 4 sides is called a **Quadrilateral**. We can say that a quadrilateral is a polygon which has four sides. The sum of the angles of a quadrilateral is 360°. Let us learn about the types of quadrilaterals and its properties.

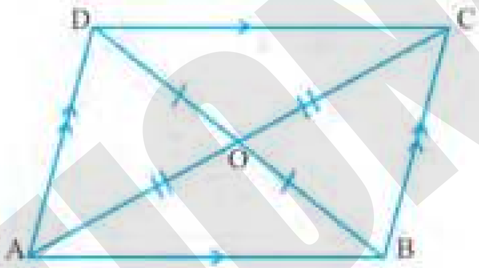
Types of Quadrilaterals

Quadrilaterals can be divided into 3 parts:

1. Kite 2. Trapezium 3. Parallelogram

Parallelogram : A quadrilateral in which the pairs of opposite sides are parallel is called **parallelogram.**

In the parallelogram ABCD:

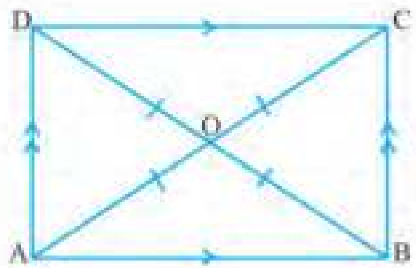


- The opposite sides are parallel
  AB || CD and AD || BC
- The opposite sides are equal
- AB = CD and AD = BC
- The opposite angles are equal ∠A = ∠C and ∠B = ∠D
- The diagonals bisect each other.
  AO = OC and BO = OD
- The diagonal divides the parallelogram into two equal triangles.
- The diagonal AC divides the parallelogram into two triangles, ABC and ACD.
- The diagonal BD divides the parallelogram into two triangles, ABD and BCD.

Rectangle (Parallelogram)

A quadrilateral in which each angle is a right angle is called **rectangle.**

In rectangle ABCD:

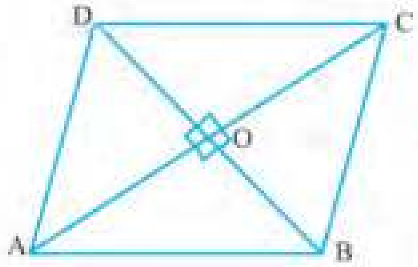


- The opposite sides are parallel
  AB || CD and AD || BC
- The opposite sides are equal.
  AB = CD and AD = BC
- All angle are equal and measure 90°
  ∠A = ∠B = ∠C = ∠D = 90°
- The diagonals are equal
  AC = BD
- The diagonals bisect each other
  AO = OC = OB = OD (Sine AC = BD)

Rhombus (Parallelogram)

A quadrilateral in which all four sides are equal, is called a **rhombus.**

In the rhombus ABCD :



- All sides are equal
  AB = BC = CD = DA
- The opposite sides are parallel.
  AB || CD and AD || BC
- The opposite angles are equal.
  ∠A = ∠C and ∠B = ∠D
- The diagonals bisect each other.
  AO = OC and OB = OD
- The diagonals are perpendicular to each other.
  ∠AOB = ∠BOC = ∠COD = ∠AOD = 90°

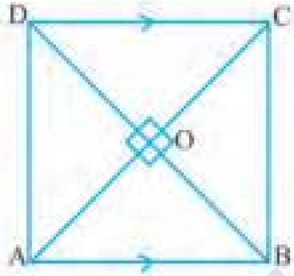
Facts to Know

A Polygon does not have a curve in it.

Square (Parallelogram)

A quadrilateral in which all sides are equal and every angles is a right angle is called a **square.**

In the square ABCD:



- All sides are equal
  AB = BC = CD = DA
- Opposite side are parallel.
  AB || CD and AD || BC
- All angles are equal and measure 90° each. So, ∠A = ∠B = ∠C = ∠D = 90°
- The diagonals bisect each other
  AO = OC = OB = OD.

The diagonals are perpendicular to each other and equal.

Trapezium

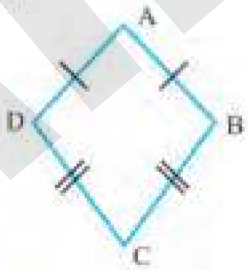
A quadrilateral in which one pair of opposite sides is parallel is called a **trapezium.**

In the trapezium ABCD:

- A pair of opposite sides is parallel.
- The opposite sides are not equal.
- The opposite angles are not equal.
- The diagonals are not equal.

Kite

A quadrilateral in which both pairs of adjacent sides are equal is called **kite.**



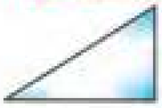
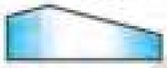
Exercise 10.7

1. **Give reasons for the following.**
   (a) A square can be thought of as a special rhombus.
   (b) A rectangle can be thought of as a special parallelogram.
   (c) A square can be thought of as a special rectangle.
   (d) Squares, rectangles, parallelograms are all quadrilaterals.
   (e) Square is also a parallelogram.
2. **Write 'T' for True and 'F' for False for the following statements.**
   (a) Each angle of a rectangle is a right angle.
   (b) All the sides of a parallelgram are of equal length.
   (c) The diagonals of a square are perpendicular to one another.
   (d) All the sides of a rhombus are of equal length.
   (e) The opposite sides of a trapezium are parallel.
   (f) The opposite sides of a rectangle are equal in length.

Polygons

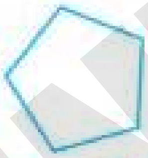
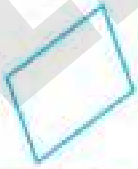
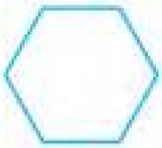
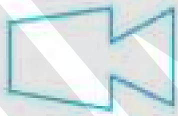
A Polygon does not have a curve in it.

A polygon is a plane figure that is made by joining the line segments. Where each line segment meets exactly two other line segment. The intersection points of two line segments is called the vertex of the polygon. So far, we have studied about triangles (3 sided figures) and quadrilaterals (4 sided figures). We now try to extend the idea of polygon to figures with more number of sides. We may classify polygons according to the number of their sides.

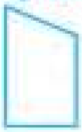
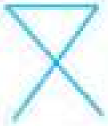
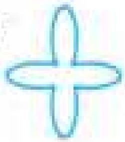
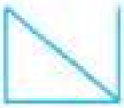
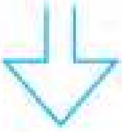
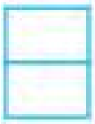
Number of Sides	Name	Illustration
3	Triangle	
4	Quadrilateral	
5	Pentagon	
6	Hexagon	
7	Heptagon	
8	Octagon	
9	Nonagon	

Exercise 10.8

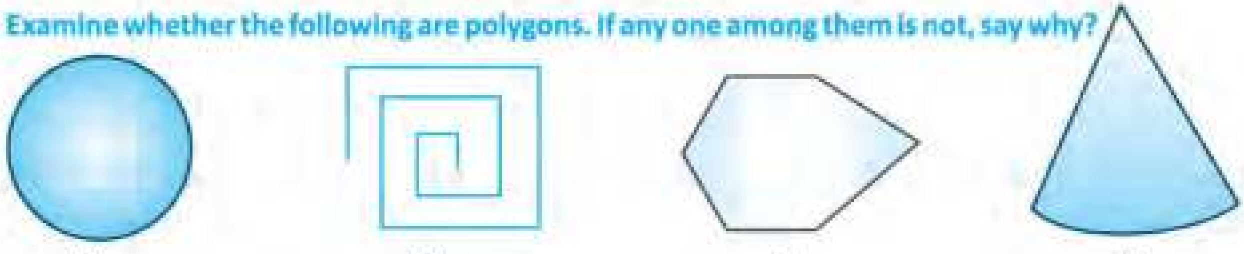
1. Classify the following polygons according to the numbers of sides:

(a) 
(b) 
(c) 
(d) 
(e) 
(f) 
(g) 
(h) 

2. Which ones of the following closed plane figures are not polygons?

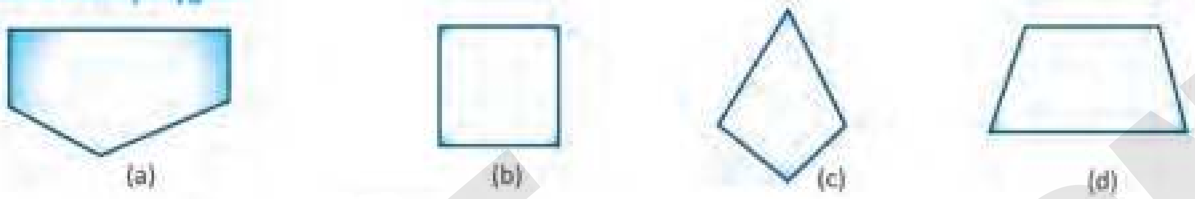
(a) 
(b) 
(c) 
(d) 
(e) 
(f) 
(g) 
(h) 
(i) 
(j) 
(k) 

3. Examine whether the following are polygons. If any one among them is not, say why?



(a) (b) (c) (d)

4. Name each polygon.



(a) (b) (c) (d)

Points to Remember

- A circle in not a polygon as its does not have straight sides.
- An angles whose measure is more than 0° but less than 90° is called **acute angle.**
- An obtuse angle is greater than one-fourth of a revolution but less than half a revolution.
- The angles which have measure more than 180° but less than 360° is called **reflex angle.**
- When two lines intersect and the angle between them is a right angle, then the lines are said to be **perpendicular.**
- The two lines that never intersect each other at any point in a same plane is called **parallel lines.**
- A triangle having all three sides unequal is called **scalene triangle**.
- A triangle having all the three sides equal is called **equilateral triangle.**
- If in a triangle, each angle is less than 90°, then the triangle is called **acute-angled triangle.**
- Triangles can be classified as follows base on the lengths of their sides:

Nature of sides in the triangle	*Name*
All the three sides are of unequal length	Scalene triangle
Any two of the sides are of equal length	Isosceles triangle
All the three sides are of equal length	Equilateral triangle

- Quadrilaterals are further classified with reference to their properties.

Properties	*Name of the Quadrilateral*
Parallelogram with 4 right angles	Rectangle
A rhombus with 4 sides of equal length	Parallelogram
One pair of parallel sides	Trapezium
Two pairs of parallel sides	Parallelogram
Parallelogram with 4 right angles	Rectangle

EXERCISE

1. MULTIPLE CHOICE QUESTIONS (MCQS):

Tick (✓) the correct options.

(a) A triangle with all its angles equal to 60° is:

(i) Scalene ☐ (ii) Equilateral ☐ (iii) Isosceles ☐ (iv) right ☐

(b) Where will the hour hand of a clock stop if it from 10 and turns through 3 right angles?

(i) 4 ☐ (ii) 2 ☐ (iii) 7 ☐ (iv) 8 ☐

(c) If two angles of a triangle are 70° and 45°, what is the measure of the third angle?

(i) 35° ☐ (ii) 65° ☐ (iii) 45° ☐ (iv) 70° ☐

(d) When two angles of a triangle are same, the third angle will be:

(i) The same ☐ (ii) different ☐

(iii) dependent on size ☐ (iv) dependent on angle ☐

(e) If three angles of a quadrilateral are 100°, 80°, and 70°, what is the measure of the fourth angle?

(i) 100° ☐ (ii) 105° ☐ (iii) 120° ☐ (iv) 110° ☐

(f) A scalene triangle has:

(i) two angles equal ☐ (ii) all angles equal ☐

(iii) No two angles equal ☐ (iv) None of these ☐

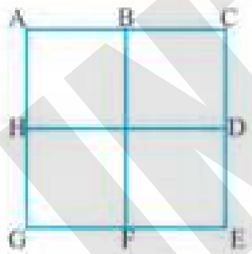
(g) Two angles of a triangle are 135° and 35°, third angle will be:

(i) 60° ☐ (ii) 10° ☐ (iii) 75° ☐ (iv) 235° ☐

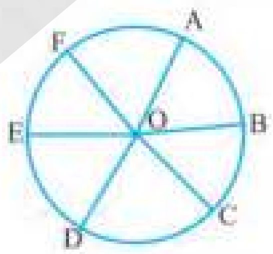
(h) How many right angles do you make if you start facing? West and turn clock wise to face East?

(i) 4 ☐ (ii) 2 ☐ (iii) 3 ☐ (iv) 1 ☐

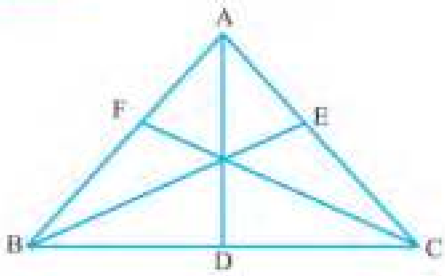
2. How many line segments can you find in the following figures ? Write them.



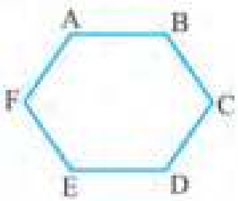
(i)



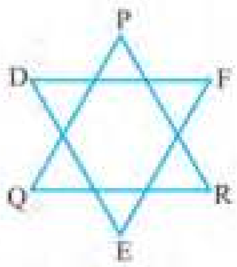
(ii)



(iii)



(iv)



(v)

3. **Classify the following angles as acute, obtuse reflex angles.**

(a) 35° (b) 118° (c) 325° (d) 150°
(e) 221° (f) 300° (g) 48° (h) 125°
(i) 145° (j) 92° (k) 85° (l) 30°

4. **The two angles of a triangle have been given. Then, find out the third angle.**

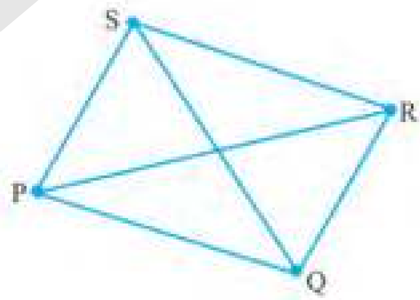
(a) A = 60°, B = 75°, C = ? (b) P = 45°, Q = 90°, R = ?
(c) X = 90°, Y = 25°, Z = ? (d) A = 55°, B = 65°, C = ?
(e) P = 53°, Q = 80°, R = ?

5. **Look at the measures of the triangles and name their types.**

(a) ΔPQR with M$\angle$Q = 90°, PQ = 6 cm and QR = 4 cm.
(b) ΔXYZ with M$\angle$Y = 60° and XY = YZ
(c) ΔABC with AB = 6.9 cm, AC = 5 cm and BC = 4.2 cm
(d) Triangle with length of sides 6 cm, 7.9 cm and 8.3 cm.
(e) ΔPQR such that PQ = QR = RP = 5.5 cm.

Lab Activity

1. Place a pair of unequal sticks such that they have their end points joined at one end. Now place another such pair meeting the free ends of the first pair.



What is the figure enclosed?

It is a quadrilateral, like the one you see here.

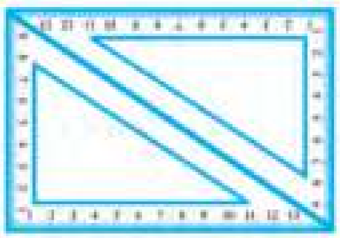
The sides of the quadrilateral are, $\overline{PQ}$, $\overline{QR}$, ____, ____,

There are 4 angles for this quadrilateral.

They are given by $\angle$SPQ, $\angle$PQR, $\angle$QRS and ________,

QS is one diagonal. What is the other?

Measure the length of the sides and the diagonal. Measure all the angles also.



2. You have two set-squares in your instrument box. One is 30°-60°-90° set-square, the other is 45°-45°-90° set square.

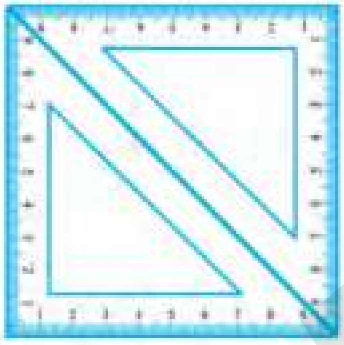
You and your friend can jointly do this.

(a) Both of you will have a pair of 30° - 60° - 90° set-squares. Place them as shown in the figure.

Can you name the quadrilateral described?

What is the measure of each of its angles?

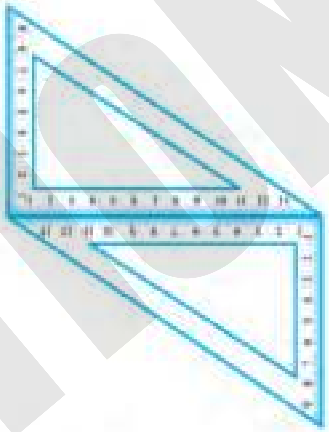
This quadrilateral is a **rectangle.**



One more obvious property of the rectangle you can see is that opposite sides are of equal length. What other properties can you find?

(b) If you use a pair of $45^\circ - 45^\circ - 90^\circ$ set-squares, you get another quadrilateral this time.

It is a **square.**



Are you able to see that all the sides are of equal length? What can you say about the angles and the diagonals? Try to find a few more properties of the square.

(c) If you place the pair of $30^\circ - 60^\circ - 90^\circ$ set-squares in a different position, you get a **parallelogram**. Do you notice that the opposite sides are parallel?

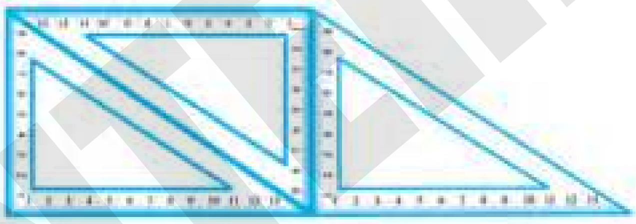
Are the opposite sides equal?

Are the diagonals equal?

(d) If you use several set-squares you can build a shape like the one given here.

Here is a quadrilateral in which two sides are parallel.

It is a **trapezium**.



(e) Here is an outline-summary of your findings. Fill up the boxes.

Quadrilateral	Opposite sides		All sides	Opposite Angles	Diagonals	
	Parallel	Equal	Equal	Equal	Equal	Perpendicular
Parallelogram		Yes	No	Yes		No
Rectangle				No		
Square						Yes
Rhombus						
Trapezium		No				

11 Mensuration

We are already familiar with various shapes like square, rectangle, triangle, parallelogram, circle etc. Now we will further study about these shapes in terms of measurement. In this chapter, we will learn about the area and perimeter of closed figures that are both regular and irregular. Perimeters refers to the boundary of a flat shape and area refers to the space occupied or enclosed by the boundary. Circumferences is the special kind of perimeter that means distance around a circle.

Perimeter

The sum of the lengths of all sides of a closed figure is called its **perimeter**. On the other hand, we can say that the perimeter of any figure is the measure of its boundary.

Thus, **Perimeter = sum of all sides of the figure**

Perimeter is calculated in different ways. For example, to find the perimeter of a square, we multiply the length of one of its side by 4, because all sides of a square are equal.

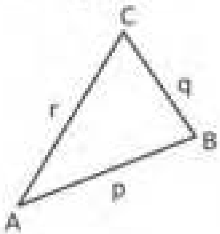
On the other hand, to find the perimeter of rectangle, we add the length and breadth and then multiply the sum by 2 because rectangle has two equal lengths and two equal widths.

Perimeter is measured in kilometers, metres or centimeters, depending on the size of the closed figure we are trying to measure.

Perimeter of Triangle

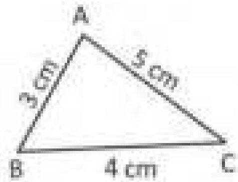
If the sides of triangle ABC are represented by the letters p, q and r, respectively, then the perimeter is given as:

Perimeter of $\Delta ABC = p + q + r$



Let us consider sides of ΔABC are represented by

$AB = 3$ cm, $BC = 4$ cm and $AC = 5$ cm.



Then, the perimeter of $\Delta ABC = AB + BC + AC$

$= 3\text{ cm} + 4\text{ cm} + 5\text{ cm}$

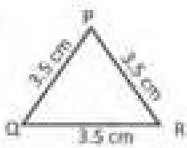
$= 12$ cm

Let us consider an equilateral triangle with each side equal to 5 cm. Can we find its perimeter ?

Perimeter of this equilateral triangle $= PQ + QR + RP$

$= 3.5\text{ cm} + 3.5\text{ cm} + 3.5\text{ cm}$

$= 3 \times 3.5\text{ cm} = 10.5$ cm.



So, we find that:

Perimeter of an equilateral triangle = 3 × length of a side

Facts to Know

The formula for finding the perimeter of a triangle is expressed as the sum of the length of all sides. It is not necessary that all the three sides should be of same length in a triangle.

Perimeter of Rectangle

The length of a rectangle ABCD is represented by the letter 'l' whereas its breadth is represent by the letter 'b'

Perimeter of rectangle ABCD $= AB + BC + CD + DA$
$= l + b + l + b$
$= 2l + 2b$
$= 2 \times (l + b)$

Let us consider a rectangle ABCD, whose length and breadth are 12 cm and 7 cm respectively. What will be its perimeter ?

Perimeter of the rectangle = Sum of the length of its four sides.
$= AB + BC + CD + DA$
$= AB + BC + AB + BC$ ($\because AB = CD$ and $BC = DA$)
$= 2 \times AB + 2 \times BC$
$= 2 \times (AB + BC)$
$= 2 \times (12\text{ cm} + 7\text{ cm})$
$= 2 \times 19\text{ cm}$
$= 38\text{ cm}$

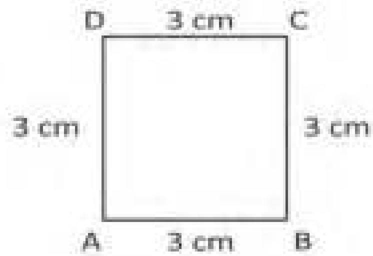
We notice that:

Perimeter of a rectangle = length + breadth + length + breadth
= 2 × (length + breadth)

Facts to Know

Rectangle has opposite sides equal. Its perimeter is the sum of the two lengths and two breadths. So, we write: 2 × (length + breadth).

Perimeter of Square



The sides of square ABCD, being equal, are represented by 3 cm.

The perimeter of square ABCD $= AB + BC + CD + DA$
$= 3\text{ cm} + 3\text{ cm} + 3\text{ cm} + 3\text{ cm}$
$= 12\text{ cm}.$

Thus, perimeter of a square = 4 × length of a side

A regular pentagon has 5 equal sides, a regular hexagon has 6 equal sides, a regular heptagon has 7 equal sides and so on.

Therefore, perimeter of a regular pentagon = 5 × length of one side
Perimeter of a regular hexagon = 6 × length of one side
Perimeter of a regular heptagon = 7 × length of one side.

From the above concept, we observe that :

$$\text{Length of one side} = \frac{\text{Perimeter}}{\text{Number of sides}}$$

Example 1 : Find the perimeter of Δ ABC if AB = 8 cm, BC = 10 cm and CA = 12 cm.

Solution : We know that, the perimeter of $\Delta ABC = AB + BC + CA$
$= 8\text{ cm} + 10\text{ cm} + 12\text{ cm}$
$= 30\text{ cm}$

Example 2 : **Find the perimeter of a square of side 6 m.**

Solution : Given that the side of the square is 6 m.

We know that, perimeter of the square = 4 × length

= 4 × 6 m

= 24 m

Example 3 : **The length and breadth of a rectangle are 10 m and 6 m, respectively. Find its perimeter.**

Solution : Given that the length of the rectangle, l = 10 m and breadth of the rectangle, b = 6 m.

Perimeter of the rectangle = $2 \times (l + b)$

= 2 × (10 + 6) m

= 2 × 16 m

= 32 m

Example 4 : **Find the perimeter of a rectangle whose length and breadth are 125 cm and 2 m respectively.**

Solution : Given that :

Length = 125 cm

Breadth = 2 m = 200 cm

We know that perimeter of the rectangle = 2 × (length + breadth)

= 2 × (125 cm + 200 cm)

= 2 × 325 cm

= 650 cm

Example 5 : **An athlete takes 8 rounds of a rectangular park, 45 m long and 25 m wide. Find the total distance covered by him.**

Solution : Length of the rectangular park = 45 m

Breadth of the rectangular park = 25 m

Total distance covered by the athlete in one round will be perimeter of the park.

Now, perimeter of the rectangular park = 2 × (length + breadth)

= 2 × (45 m + 25 m)

= 2 × 70 m

= 140 m

So, the distance covered by the athlete in one round is 140 m.

Thus, distance covered in 8 rounds = 8 × 140 m

= 1120 m

Example 6 : **Ranjan runs around a square field of side 60 m and Dinesh runs around a rectangular field with length 150 m and breadth 110 m. Who covers more distance and by how much ?**

Solution : Distance covered by Ranjan in one round = Perimeter of the square

= 4 × length of a side

= 4 × 60 m

= 240 m.

Distance covered by Dinesh in one round = 2 × (length + breadth)

= 2 × (150 m + 110 m)

= 2 × 260 m

= 520 m.

Difference in the distance covered = 520 m − 240 m

= 280 m

Therefore, Dinesh covers more distance by 280 m.

Example 7 : **The perimeter of a regular hexagon is 30 m. How long is its one side ?**

Solution : A regular hexagon has 6 sides with perimeter 30 m.

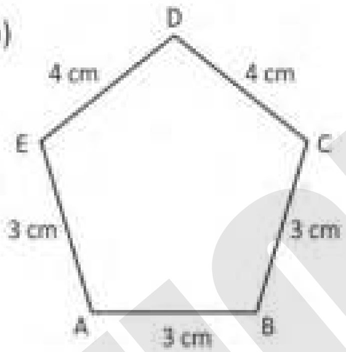
Thus, length of one side $= \frac{\text{Perimeter}}{\text{Number of sides}} = \frac{30}{6}$ m = 5 m

Therefore, the length of each side of a regular hexagon is 5 m.

Example 8 : **Find the perimeter of the following figures :**

(a)

(b)



Solution : (a) Perimeter = XY + YZ + ZW + WX

= 3.5 cm + 4.5 cm + 4 cm + 5 cm

= 17 cm.

(b) Perimeter = AB + BC + CD + DE + EA

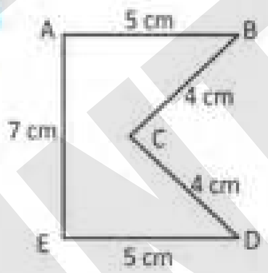
= 3 cm + 3cm + 4 cm + 4 cm + 3 cm

= 17 cm

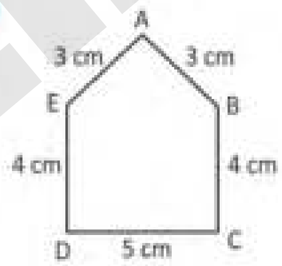
Exercise 11.1

1. **Find the perimeter of each of the following figures :**

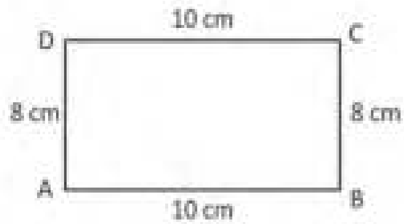
(a)



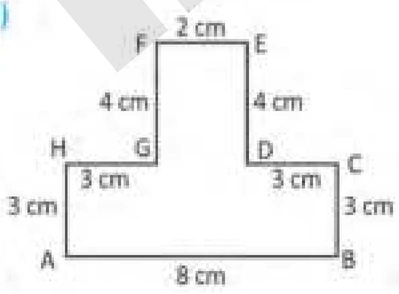
(b)



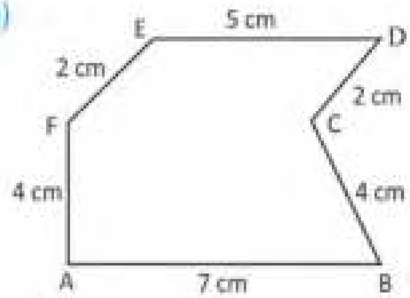
(c)



(d)



(e)



2. Find the perimeter of a rectangular garden whose length and breadth are 75.6 m and 42.7 m respectively.
3. The sides of a triangle field are 12 cm, 18 cm and 20 cm. Find the total distance travelled by a boy in taking 3 complete rounds of this field.
4. Find the length of a side of an equilateral triangle whose perimeter is 2 m 25cm.
5. Rohan takes 3 rounds of a square park of side 115 m and Abdul takes 4 rounds of a rectangular park of length 75m and breadth 55 m. Who covers more distance and by how much ?
6. The perimeter of a regular octagon is72 m. How long is its one side ?
7. **Find the perimeters of the rectangles whose length and breadth are respectively :**

   (a) 15 m, 8 m (b) 1 m, 70 cm (c) 10.5 m, 68 m

   (d) 2 m 25 cm, 1 m 50 cm (e) 2 m, 75 cm (f) 80 cm, 62 cm
8. **Find the perimeters of the square whose length of a side is :**

   (a) 18 m (b) 5 m (c) 1 m 25cm

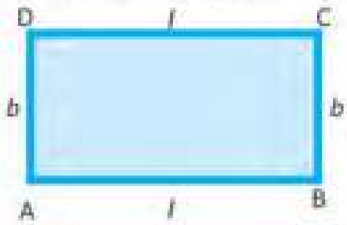
   (d) 1 m 5 cm (e) 71 cm (f) 4.5 m
9. **Find the perimeter of each of the following:**

   (a) A triangle of side 6 cm, 11 cm and 15 cm

   (b) An equilateral triangle of side 8 cm.

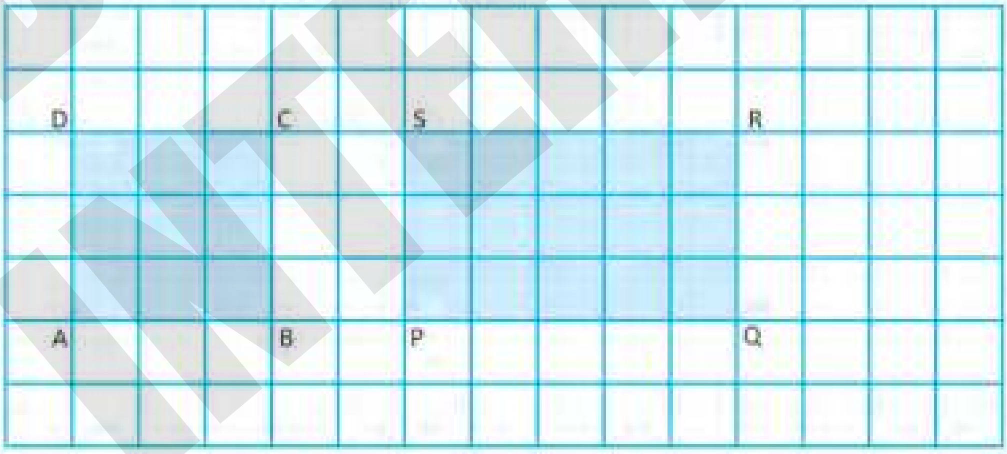
Area of a Plane Figure

The space enclosed within the boundary of any figure is called the **area**. On the other hand, we can say that the amount of surface enclosed by a figure is called its **area**.



Let us consider an example :

ABCD is a rectangle. The boundary ABCD is the perimeter of the rectangle. The shaded region within the boundary is the area of the rectangle. But we can easily calculate the area of a ractangle using graph paper.



Let us find the area of the figure given here :

1. Area of ABCD = 3 squares length wise × 3 square breadth wise
   = 9 sq cm (each length is in cm)
2. Area of PQRS = 5 squares length wise × 3 squares breadth wise
   = 15 sq cm

Thus, area of a rectangle = $l \times b$ square (sq) units

A square has length = breadth

that is, $l = b$

Area of a square $= l \times l$ sq units

$= l^2$ sq units

= side × side sq units

The area of a square of side 1 cm is 1 square centimeter and is written as cm^2.

The area of a square of side 1 m is 1 square meter and is written as m^2.

The area of a square of side 1 km is 1 square kilometer and is written as km^2.

Facts to Know

Area of a square of side 1 cm is 1 cm^2, because when we multiply the lengths of two sides, we also multiply their units as cm × cm, i.e., equal to cm^2. The standard unit of area is cm^2.

We know :

Area of a rectangle = length × breadth

From the above equation, we can also find the value of length or breadth.

(i) Length $= \dfrac{\text{Area of rectangle}}{\text{breadth}}$

(ii) Breadth $= \dfrac{\text{Area of rectangle}}{\text{length}}$

Example 9 : **Find the area of rectangle whose length and breadth are 12 cm and 4 cm respectively.**

Solution : Length of the rectangle = 12 cm

Breadth of the rectangle = 4 cm

Area of rectangle = length × Breath

= 12 cm × 4 cm

= 48 sq. cm

Example 10 : **Find the area of a handkerchief with measuring each side of which is 12 cm.**

Solution : Area of a square = side × side

= 12 cm × 12 cm

= 144 cm^2 or 144 sq cm

Example 11 : **How many tiles whose length and breadth are 12 cm and 5 cm respectively will be required to fit in a rectangular floor whose length and breadth are 4 m and 3 m respectively ?**

Solution : Area of the floor must be equal to the total area of tiles.

Here, length of the floor = 4 m = 400 cm

and breadth of the floor = 3 m = 300 cm

Therefore, area of floor = 400 cm × 300 cm

= 120000 cm^2

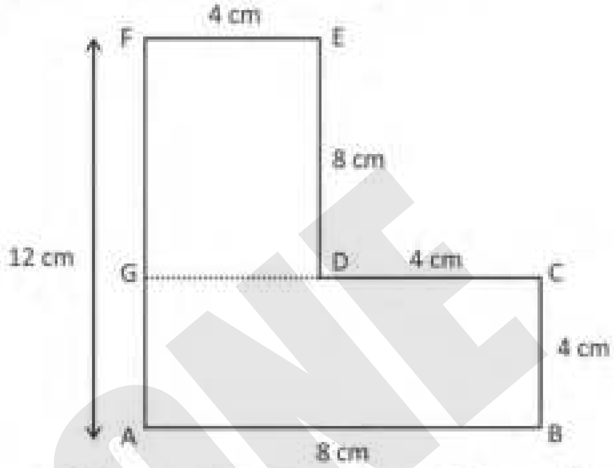
Area of one tile = 12 cm × 5 cm = 60 cm^2

Number of tiles required $= \dfrac{\text{Area of the floor}}{\text{Area of one tile}}$

$= \dfrac{120000}{60} = 2000$

Hence, the number of tiles required = 2000

Example 12 : Find the area of the given figure.



Solution : Area of the rectangle DEFG = length × breadth

$= 8\text{ cm} \times 4\text{ cm}$

$= 32\text{ cm}^2$

Area of the rectangle ABCG = length × breadth

$= 8\text{ cm} \times 4\text{ cm} = 32\text{ cm}^2$

Area of the complete figure: = Area of the rectangle DEFG + area of the rectangle ABCG

$= 32\text{ cm}^2 + 32\text{ cm}^2$

$= 64\text{ cm}^2$

Exercise 11.2

1. Find the area of a rectangle whose :

	Length (l)	Breadth (b)	Area (l × b)
(a)	8 cm	5 cm	
(b)	18 cm	12 cm	
(c)	25.5 m	14.5 m	
(d)	32 cm	26 cm	
(e)	48 m	35 m	

2. Find the length of a rectangular park whose area is 204 sq m and breadth is 12 m.

3. The area of a square field is $576m^2$. Find the side of the square.

4. A room is 4m long and 3 m 50 cm wide. How many square metres of carpet is needed to cover the floor of the room ?

5. **Find the areas of the squares whose sides are:**

(a) 8 cm (b) 17 cm (c) 5 m (d) 21 m

6. Find the area of a square if the length of its sides is doubled. Also, find the ratio of new area to its previous area.

7. A rectangular field is 75 m long and its breadth is 15 m less than its length. Find the cost of fencing it at the rate of ₹ 4 per metre. Also find the cost of turfing it at the rate of ₹ 7 per sq m.

8. What happens to the area of a rectangle of its length is halved and its breadth is doubled?

9. Find the breadth of a rectangular park whose area is 286 sq m and length is 13 m.

Points to Remember

- Perimeter is the sum of the lengths of all sides of a closed figure.
- Perimeter of a rectangle = 2 × (length + breadth)
- Perimeter of a square = 4 × length of its side
- Perimeter of an equilateral triangle = 3 × length of a side
- Figures in which all sides and angles are equal are called **regular closed figures.**
- The amount of surface enclosed by a closed figure is called its **area.**
- Area of a rectangle = length × breadth
- Area of a square = side × side
- To calculate the area of a combined figure, we divide the figure into square, rectangle, or triangle (if needed) and calculate their area. The sum of all these area will be the area of the combined figure.

EXERCISE

1. **MULTIPLE CHOICE QUESTIONS (MCQs):**

Tick (✓) the correct options.

(a) If each side of a regular octagon is 'a', then its perimeter is equal to:

(i) 5 a (ii) 6 a (iii) 7 a (iv) 8 a

(b) The perimeter of rectangle of length 'l' and breadth 'b' is equal to.

(i) $l \times b$ (ii) $l + b$ (iii) $2(l + b)$ (iv) $2lb$

(c) If side of a square is 2.5 cm, its area is :

(i) 6.25 sq. cm ☐ (ii) 6 sq. cm ☐ (iii) 6.25 sq. cm ☐ (iv) 6.sq. cm ☐

(d) The perimeter of a triangle with sides a,b,c, is equal to:

(i) a + b+ c ☐ (ii) a × b× c ☐ (iii) 2 abc ☐ (iv) 2 (a + b + c) ☐

(e) If length of a rectangle is x and breadth is half of the length, then perimeter of the rectangle is given by:

(i) 3 x ☐ (ii) 5 x ☐ (iii) 2 x ☐ (iv) 4 x ☐

(f) If breadth and perimeter of a rectangle are 12.5 cm and 101 cm respectively, its length is of :

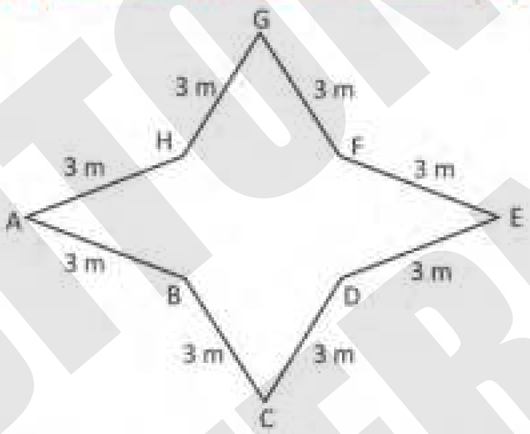
(i) 50 cm ☐ (ii) 50.5 cm ☐ (iii) 38 cm ☐ (iv) 87.5 cm ☐

(g) If side of a square is x cm, its area is given by.

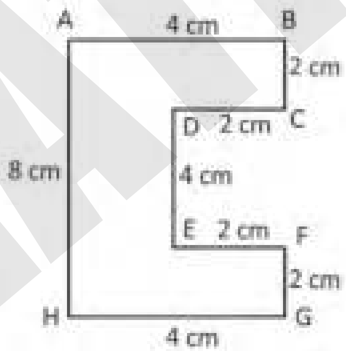
(i) 2x sq cm ☐ (ii) x^2 sq cm ☐ (iii) 4 x sq cm ☐ (iv) x sq. cm ☐

2. Find the perimeter of each of the following figures.

(a)



(b)



3. One side of a square is 50 cm. Find its perimeter.
4. A rectangular mirror is 30 cm long and 20 cm wide. A wooden frame is to be fixed around it find the total length of the frame.
5. The perimeter of a square is 80 m. Find the side of this square. Also find its area.
6. The length and breadth of a rectangular field are 75 cm and 35 cm respectively. Find the area of the field.
7. The perimeter of a triangle is 115 cm. If two of its sides are of 45 cm and 48 cm, find the third side of the triangle.
8. A rectangular piece of land measures 3 m 35 cm by 4 m 45 cm. What is the perimeter of this land?

HOTS The length of a rectangular field is 300 m and its breadth is $\frac{2}{3}$ its length. If a road of width 10 m is built along the inner wall of the field, what is the area of the road?

Lab Activity

Studying the perimeter and area

Objective : To distinguish between the perimeter and area of a rectangle/square.

Materials Required : Coloured ribbon or wool, a pair of scissors, graph paper and glue.

Procedure :

- Cut a length of ribbon (say 20 cm)
- Draw a rectangle of length 6 cm × 4 cm on the graph paper.
- Cut 20 cm ribbon into four pieces, two pieces of 6 cm each and two pieces of 4 cm each.
- Paste them on the rectangle.
- The region enclosed within the rectangle is the area., i.e. $6 \times 4 = 24\ cm^2$
- The length of 20 cm ribbon is the perimeter of the rectangle.
- You may now cut another 20 cm piece of ribbon.
- Now, divide it into 4 equal parts of 5 cm each.
- Put them around a square of side 5 cm drawn on the graph paper.
- The area of the square is $5 \times 5\ cm^2 = 25\ cm^2$.
- The perimeter of the square is also 20 cm. This shows that the perimeters may be the same but the areas can be different.

12 Data Handling

Just imagine you are watching a chess match between two teams or two players on your tv screens, now you have to collect information (data) about :

- Players in both the teams
- Total score of first team in round based
- Total score of second team in round based
- Highest scored by the team/player on round based of the matches further
- who is declared winner on Grandmaster title.

Similarly, a school teacher keeps record of marks obtained by students in each term end examination and makes a final result (grade) card at the end of the session.

Also, we make a budget of our household expenses. We note down the budget either on paper or remember in mind. We collect and use relevant numbers, figures, facts or symbols.

Data

Data come from datum and is plural also.

Data is collection of information in the form of numerical figures.

Or

Data is the facts collected to draw some inference.

Data can be classified into two types — **Primary Data** and **Secondary Data**.

Primary Data : The data collected directly for the first time by the observer is called primary data.

For example, you have gone to a grocery shop and purchase some daily usable items and make a list as :

Particulars	Quantity	Rate per item	Total
Biscuits	6 packets	₹ 15	₹ 90
Tooth Paste	2 units	₹ 70	₹ 140
Atta	10 kg	₹ 16	₹ 160

Secondary Data : The data collected from any external source like internet, advertising agency, newspaper, etc., is called a secondary data.

For example :

(1) You can collect information about arrival and departure time of trains with the help of data available at reservation counter.

(2) You get information about the number of kids getting polio vaccination drops in your locality from health centres.

Organization of Data

Suppose, 40 students likes to play different games such as Football, Chess, Cricket, Badminton etc. If we arrange it in a tabular form, it becomes very easy to understand it.

Name of the game	Number of students
Football	13
Chess	8
Cricket	15
Badminton	4

Hence, understanding and analysing the data becomes easy by means of organising the data into a tabular form.

Facts to Know

- Nowadays, the Word 'Data' is used in singular as well as plural form. The singular form of data is 'datum'.

Frequency

Frequency is the number of times of a repeating event or value.

Suppose you are watching a cricket match between India and Pakistan. Each player has scored some runs as given below :

55, 35, 42, 25, 49, 25, 49, 104, 25, 35, 78, 35, 74, 104, 25, 38, 55, 42, 78, 74, 25, 35.

This ways of recording data does not help us to know the answers of some questions :

- How many players scored minimum 25 runs?
- What is the maximum number of run scored?
- How many players scored 78 runs or less than 78 runs ?

If we arrange the data in either ascending or descending order, it will take a lot of time (time consuming) and some values may go missing.

Therefore, we use tally marks to minimise the number of errors, if the number of observations is larger.

Runs	Tally Marks	No. of Players (Frequency)
25	𝍸	5
35	IIII	4
38	I	1
42	II	2
49	II	2
55	II	2
74	II	2
78	I	2
104	II	2

Tally marks are always recorded in bunch of five. Fifth tally mark is drawn diagonally across the first four to make a group of five.

For example : 𝍸 II = 7

Representation of Data

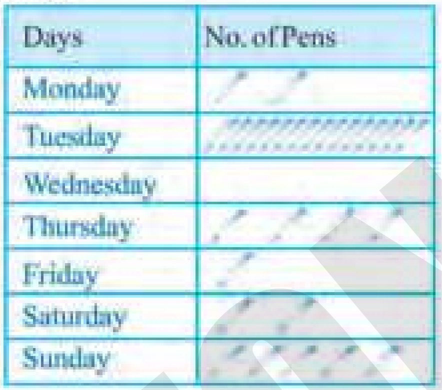
We can represent numerical data in the form of pictograph and bar graph.

PICTOGRAPH

Sometimes, we represent numerical data in the form of pictures of objects in a table. This representation is called **pictograph**.

For example:

A shopkeeper sold different number of pens on different days of week. Read the pictograph and answer the following :



1. On which day did the shopkeeper sell maximum pens?
2. On which day did the shopkeeper sell 15 pens?
3. On which day did the shopkeeper sell no pens?

Solution :

1. The shopkeeper sold most pens on Sunday.
2. The shopkeeper sold 15 pens on Tuesday.
3. The Shopkeeper did not sell any pen on Wednesday.

Exercise 12.1

1. A computer lab of a school has 25 computer systems. Java is installed in only 10 computer systems. Acrobat Reader is installed in 7 computer systems. The remaining systems have 'C++' installed. Record the observation using tally marks.
2. The age (in yrs) of 10 teachers in of Government school is 52, 45, 54, 38, 29, 35, 25, 40, 47 and 27. Arrange (organise) the data in ascending order in a table and answer the following questions :
   (i) What is the age of the youngest teacher?
   (ii) How many teachers are there between the age 40 and 55?
3. In a Mathematics test, the following marks were obtained by 20 students out of 25 marks.

   17, 20, 24, 16, 17, 24, 15, 17, 12, 10,

   7, 15, 18, 10, 17, 20, 19, 20, 24, 20

   Arrange the data in tabular form using tally marks.

Points to Remember

- Data are the collection of information in the form of numerical figures.
- Data can be classified into Primary and Secondary data.
- Primary data is collected directly for the first time by the observer.
- Secondary data is the data that we get from Internet, T.V., newspaper, etc.
- We can arrange data in tabular form to analyse and understand it.
- Datum is the singular form of the word 'data'.
- Frequency is the number of times of a repeating value or event.

EXERCISE

1. **Multiple Choice Questions (MCQs):**
   Tick (✓) the correct options.

   (a) A data can be classified into how many types?

   (i) 4 (ii) 2 (iii) 3 (iv) 6

   (b) We get secondary data from –

   (i) T.V. (ii) Internet (iii) newspaper (iv) all of these

   (c) The width of bars and gap between the bars should be:

   (i) unequal every time (ii) opposite

   (iii) parallel (iv) uniform throughout

   (d) 90, 122, 144, 150, 90, 122, 144, 75, 185, 90, 144, 82, 75, 150 and 90. From the data, the frequency of 90 is:

   (i) 6 (ii) 1 (iii) 3 (iv) 4

   (e) The heights (in cm) of 10 students of class VI of a school are as:

   145 cm, 150 cm, 120 cm, 115 cm, 110 cm, 130 cm, 125 cm, 136 cm, 141 cm and 124 cm,

   The shortest student's height is:

   (i) 124 cm (ii) 110 cm (iii) 141 (iv) 130 cm

2. Collect information of the marks obtained by your classmates in the Class test in mathematics and prepare a table using tally marks.

3. Given below is the data of money (in ₹) spent by class VI students in the school canteen in a particular month:
   150, 250, 145, 150, 122, 160, 250, 150, 145, 175, 145, 150, 250, 145, 200, 230, 160, 175, 150, 145.
   Make a table for the above data using tally marks.

Lab Activity

Objective : Take a data from your SST test book and represent it graphically.

Materials Required : An article or paragraph cutting from book, sketch pen or pencil, geometry box, etc.

Procedure : Note down or cut a paragraph from a book:

> Education is the basis of ones life. Education means study of school text books, besides reading of newspapers and magazines, listening to radio and television news watching/listening programmes of useful information. Education means gaining knowledge.

Read each word of above paragraph and make a frequency table for the following ending alphabets of the words like A, B, C, D .... (ignore Capital or Small)

Letter	Tally marks	Frequency
A		
B		
C		
D		
E		
F		
G		

Find out which alphabets has been used most frequently and which one least frequently.

Revision Test Paper-IV

(Based on Chapters 10 to 12)

A. Multiple Choice Questions (MCQs).
Tick (✓) the correct option.

1. 1 cm is equal to:

   (i) 100mm (ii) 1 mm (iii) 10mm (iv) 0.1mm

2. Complete angle is equal to:

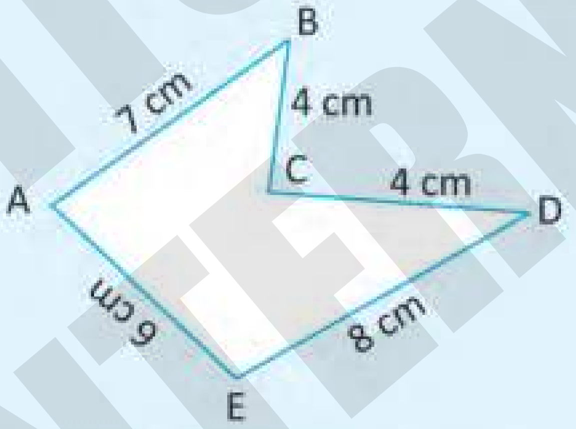
   (i) one right angle (ii) two right angle
   (iii) three right angle (iv) four right angle

3. The area of a room with length and breadth measuring 21m and 15m respectively is:

   (i) 415 m^2 (ii) 575 m^2 (iii) 315 m^2 (iv) 215 m^2

4. Which of the following cannot be a unit of area ?

   (i) cm^2 (ii) m^2 (iii) m^3 (iv) dm^2



5. Perimeter of the given figure is:

   (i) 30 cm (ii) 25 m (iii) 29 cm (iv) 25 cm

6. Acute angle is:

   (i) more than 0° but less than 90° (ii) more than 90° but less than 180°
   (iii) more than 180° but less than 270° (iv) more than 270° but less than 360°

7. The sum of three angles in triangle is always:

   (i) 180° (ii) 270° (iii) 360° (iv) none of these

8. The singular form of data is:

(i) datun (ii) data (iii) datum (iv) doton

9. The number of times of a repeating event or value is called:

(i) bar graph (ii) primary data (iii) pictograph (iv) frequency

10. How many sides are equal in a regular hexagon ?

(i) 6 (ii) 7 (iii) 8 (iv) 4

B. Fill in the blanks:

1. Euclid is known as the father of ....
2. Perimeter of a decagon is sum of its .... sides.
3. Perimeter of a square with its side measuring 21 cm is ....
4. Parallel lines has .... introduction points.
5. Data collected directly for the first time by the observer is called .... data.

C. Tick (✓) for true statement and cross (×) for false one:

1. An angle can only be constructed with the help of a protractor.
2. Area of a closed figure is sum of the length of all sides.
3. A polygon may have a curve in it.
4. Tally marks are always recorded in bunch of '5'.
5. A line segment is bounded by one end point.
6. Hexagon has 5 sides.
7. Perimeter of a square = side × side.
8. Figures in which all sides and angles are equal are called regular closed figures.
9. A quadrilateral in which each angle is a right angle is called rectangle.
10. The data collected directly for the first time by the observer is called primary data.

Model Test Paper-II

(Based on Chapters 7 to 12)

Instructions :

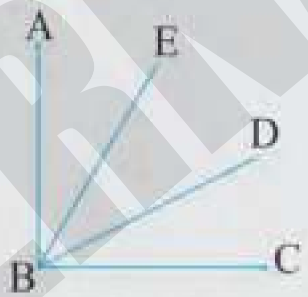
1. All questions are compulsory.
2. The question paper consists of 18 questions divided into three sections — A, B, C. Section A consists of 10 questions of 2 marks each, section B of 5 questions of 3 marks each and section C of 3 questions of 5 marks each.

SECTION - A

1. **Simplify :** $\frac{3x}{5} = 81$
2. **Write two equivalent rations for the following :**

   (a) $\frac{21}{36}$ (b) $\frac{4}{7}$

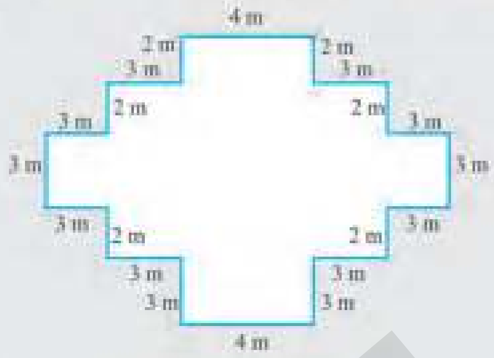
3. **Name all possible angles for the given figure.**



4. What fraction of a clockwise revolution does the hour hand of clock turn through, when it goes from 4 to 7.
5. The perimeter of the rectangular ground is 340 m. Find the breadth if its length is 100 m.
6. If the cost of 5 trousers is ₹ 3125, find the cost of 7 trousers.
7. Bunty gets ₹ 850 as pocket money per month. If he saves ₹ 375, find the ratio between his expenditure and savings.
8. Differentiate between parallelogram and trapezium.
9. In a right angled triangle if one angle measures 60°, find other angles.
10. Find the perimeter of a rectangle whose length and breath are 125 cm and 1 m respectively.

SECTION - B

11. Draw the perpendicular bisector of a line segment AB = 7.2 cm. Do write the steps of construction.

12. 

Find the perimeter of the given closed figure.

13. **Solve :**

$$\frac{2x+1}{3} - \frac{3x-4}{5} = 2$$

14. **Define the following:**

(a) Triangle (b) Scalene triangle (c) Isosceles triangle

15. Classify a triangle based on their angles. Do define each type with figures.

SECTION - C

16. **Simplify :**

(a) $\frac{3x+4}{2} = 8$ by systematic method (b) $\frac{2x+4}{3} = 4$ by trial and error method.

17. Writing all the steps of construction draw an angle of 135° with the help of compass. Do bisect the angle and find its value.

18. The following table represents number of runs scored by Indian players in recently concluded ODI series with Australia.

Players	Sehwag	Gautam	Virat	Raina	Dhoni	Yuvraj
Runs scored	200	300	400	175	325	275

Represent above information in the form of a tally marks.

Answers

Ch-1 Knowing the Numbers

Exercise 1.1

1. (a) 1 (b) Infinity (c) 100 (d) 999
2. (a) 70 (b) 787 (c) 1253 (d) 6790
3. (a) 39 (b) 250 (c) 4999 (d) 39282
4. (a) 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48
   (b) 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128
   (c) 5213, 5214, 5215, 5216, 5217, 5218, 5219, 5220
   (d) 8414, 8415, 8416, 8417, 8418, 8419, 8420, 8421, 8422, 8423, 8424
5. 23, 24, 25, 26
6. (a) 1507, 948, 288, 126 (b) 2403, 1515, 262, 175 (c) 8412, 476, 285, 91 (d) 5628, 3784, 1789, 976
7. (a) 178, 864, 1150, 6965 (b) 700, 712, 860, 890 (c) 69, 88, 115, 162 (d) 1989, 2003, 2006, 2018
8. (a) 23567 (b) 13578 (c) 12346 (d) 20479
9. (a) 98751 (b) 74320 (c) 96542 (d) 97643
10. 368, 386, 638, 836
11. 20 times

Exercise 1.2

1. (a) Place value = 60000, Face value = 6 (b) Place value = 800, Face value = 8 (c) Place value = 500, Face value = 5
   (d) Place value = 90000, Face value = 9 (e) Place value = 600, Face value = 6 (f) Place value = 70000, Face value = 7
   (g) Place value = 5000, Face value = 5 (h) Place value = 2000, Face value = 2
2. (a) Four lakh eighty six thousand nine hundred twenty one. (b) Five lakh eighty nine thousand seven hundred eight.
   (c) Seven lakh sixty seven thousand eight hundred ninety one. (d) Seven lakh eighty six thousand five hundred twenty nine.
   (e) Seven lakh ninety five thousand six hundred thirty eight. (f) Eight lakh twenty four thousand nine hundred five.
   (g) Three lakh fifty eight thousand seven hundred sixty two. (h) Nine lakh seventy six thousand four hundred twenty eight.
3. (a) Four hundred eighty five thousand and five hundred sixty seven.
   (b) Four hundred eighty six thousand and five hundred twenty eight.
   (c) Five million, eight hundred ninety two thousand and sixty eight.
   (d) Six million, four hundred twenty five thousand and eight hundred ninety five.
   (e) Six million, seven hundred fifty six thousand and two hundred forty three.
   (f) Six million, two hundred fifty one thousand and three hundred fifty two.
   (g) Eight million, nine hundred forty eight thousand and eight hundred forty two.
   (h) Three million, four hundred sixty two thousand and five hundred forty eight.
4. (a) 60, 57, 521 (b) 82, 23, 646 (c) 7, 05, 22, 396 (d) 65, 427, 378 (e) 87, 638, 628
   (f) 60, 936, 705 (g) 2,008, 938, 472
5. (a) 10 (b) 1 (c) 100 (d) 100

Exercise 1.3

1. (a) > (b) > (c) = (d) = (e) < (f) >
2. (a) 35507, 36105, 38170, 72791 (b) 1045621, 7384015, 32465902, 43565103, 98004865
   (c) 1090405, 1245203, 2045629, 8420659, 74305709 (d) 15112011, 12450311, 40506080, 60050102, 70051121
   (e) 3041029, 4352629, 70080405, 83400291, 983400974
3. (a) 75200, 6710, 5990, 5150 (b) 834280095, 284660011, 7642095, 2709472, 1004691
   (c) 708059162, 8706512, 8050672, 5426179, 3326594 (d) 5142125, 5040550, 4652112, 4495821, 4121127
   (e) 98370521, 83462050, 73226459, 60402032, 54005906

Revision Exercise

1. (a) (ii) (b) (iii) (c) (ii) (d) (ii) (e) (ii) (f) (ii) (g) (i)
2. (a) 410, 519, 712, 918, 1011 (b) 8009, 8090, 9008, 9080, 9280 (c) 169, 181, 315, 692, 715 (d) 4008, 4028, 4598, 4800, 4828
3. (a) 978, 467, 359, 298, 272 (b) 999, 991, 979, 969, 919 (c) 8175, 7891, 4258, 3981, 1985 (d) 7968, 7890, 7889, 7668, 7650
4. (a) Two hundred ninety five thousand and six hundred seventy eight.
   (b) Four hundred eighty seven thousand and six hundred twenty one.

(c) Four hundred ten thousand and one hundred thirty five.

(d) Six million, four hundred twenty five thousand and eight hundred ninety five.

(e) Seventeen million, five hundred sixty three thousand and two hundred eighty nine.

(f) Sixty eight million, six hundred fifteen thousand and one.

5. (a) Ten lakh eighty three thousand seven hundred fifty six.

(b) Eighty lakh eighty one thousand nine hundred ninety nine.

(c) Nine crore eighty one lakh eighty eight thousand three hundred five.

(d) Seven crore fifty six lakh eighteen thousand eight hundred thirty.

(e) Twenty five lakh ninety three thousand two hundred forty seven.

(f) Seven crore eighty one lakh ninety two thousand three hundred forty eight.

Ch-2 Whole Numbers

Exercise 2.1

1. 10800 10801 10802 10803

2. 12000 11999 11998 **3.** 20

4. (a) 74 (b) 15000 (c) 101009 (d) 32545

5. (a) 179 (b) 354569 (c) 50000 (d) 297806

6. (a) 979 is on the left of 997; 997 > 979

(b) 92392 is on the left of 92932; 92392 < 92932

(c) 320001 is on the left of 320101; 320001 < 320101

(d) 100049 is on the left of 999949; 999949 > 100049

Revision Exercise

1. (a) (iii) (b) (ii) (c) (iv) (d) (ii) (e) (iv) (f) (iv)

2. 420 chairs **3.** 2250 people **4.** 980 km **5.** 56 sweets **6.** 30 drums **7.** Twinkle

Ch-3 Playing with Numbers

Exercise 3.1

1. (a) 16 (b) 30 (c) 1 (d) 5 (e) 32 (f) 132 (g) 4 (h) 36

Exercise 3.2

1. (c) (b) **2.** (a) (c) **3.** (b) (c) **4.** (b) **5.** (b) (c) **6.** (a) (b) (c) **7.** (a) (b) (c)

8. 507, 546, 564, 579, 588, 591, 597, 609, 639, 645

9. 2 and 4 **10.** A number is divisible by 18, if the sum of digits is divisible by 2 and 9.

Exercise 3.3

1. (a) 1, 2, 4, 7, 8, 14, 28, 56 (b) 1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96 (c) 1, 2, 3, 6, 13, 26, 39, 78 (d) 1, 2, 4, 11, 22, 44

(e) 1, 2, 3, 6, 11, 22, 33, 66 (f) 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90

2. (a) 6, 12, 18, 24, 30 (b) 7, 14, 21, 28, 35 (c) 9, 18, 27, 36, 45

(d) 15, 30, 45, 60, 75 (e) 23, 46, 69, 92, 115 (f) 37, 74, 111, 148, 185

3. (a) 2X2X2X2X5 (b) 3×43 (c) 2X2X2X2X3X3 (d) 5×29 (e) 2X2X2X2X2X2 (f) 2×2×59

Exercise 3.4

1. (b) (d) (f)

2.

	Even	Odd
a.	82, 294	5
b.	260	3, 45
c.	300	3
d.	1986	231
e.	18, 30	27
f.	16	29

3. (b) is twin prime
4. (6, 11), (7, 10), (8, 13), (9, 16) and (5, 14)
5. 5 + 13 + 37 = 55
6. (a) 13, 23 (b) 23, 43 (c) 13, 43

Exercise 3.5

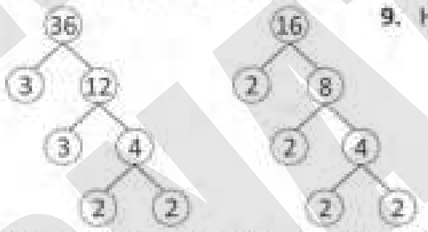
1. (a) Base = 7, Power = 6 (b) Base = 4, Power = 7 (c) Base = 12, Power = 6 (d) Base = 5, Power = 8
   (e) Base = 6, Power = 5 (f) Base = 3, Power = 0
2. (a) 10^7 (b) 10^8 © $5^7\times10^7$

Exercise 3.6

1. (a) 14 (b) 17 (c) 1 (d) 2 (e) 1 (f) 1
2. (a) 240 (b) 3451 (c) 15640 (d) 510 (e) 1056 (f) 7770
3. HCF = 9, LCM = 18900 4. 17 5. 5040

Revision Exercise

1. (a) (i) (b) (iii) (c) (ii) (d) (iii) (e) (i) (f) (i) (g) (i) (h) (iii) (i) (i) (j) (i)
2. (a) 43 (b) 10 (c) 8 (d) 15
3. (a) not (b) not (c) not (d) yes (e) yes (f) not 4. 1, 2, 41, 82
5. Prime numbers = 2, 3, 5 7, 11, 13, 17, 19, 23, 29 6. (3, 5) ; (5, 7) ; (11, 13)
   Composite numbers = 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28
7. (a) 2 (b) 15 (c) 1 8. 9. HCF = 3 10. L.C.M = 180



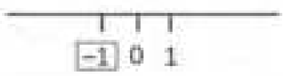
Revision Test Paper-I

A. 1. (ii) 2. (ii) 3. (iii) 4. (iv) 5. (ii) 6. (i) 7. (iv) 8. (ii) 9. (iv) 10 (i)
B. 1. 7 (I, V, X, L, C, D, M) 2. unit distance 3. number itself 4. Divisor 5. Zero.
C. 1. ✘ 2. ✓ 3. ✓ 4. ✘ 5. ✓ 6. ✓ 7. ✘ 8. ✘ 9. ✓ 10. ✘

Integers

Exercise 4.1

1. (a) > (b) = (c) < (d) <
   (e) > (f) >
2. (a) −140, −25, −12, +77, 130
   (b) −110, −1, 0, +9, 11
   (c) −51, −7, 0, 8, 10 (d) −40, −10, 0, +20, +50 (e) −88, −87, +10, +67
   (f) −90, −70, −11, +50, 110 (g) −76, 55, 83, 99
3. (a) 701, 77, 0, −7, −107 (b) 10, 9, 0, −1, −10 (c) 78, 55, 0, −55, −75
   (d) 110, +50, −55, −107 (e) 809, 607, −706, −708, −709
4. (a) 5 (b) 0 (c) −15 (d) +10
5. (a) −2, −1, 0, 1, 2, 3, 4 (b) 1, 2, 3, 4, 5 (c) −2, −1, 0, 1, 2
   (d) 0, 1, 2, 3, 4, 5, 6 (e) −4, −5, −6, −7, −8 (f) −7, −6, −5, −4, −3, −2, −1, 0, 1, 2, 3, 4, 5, 6, 7
6. (a) 11, 12, 13 (b) −1, −2, −3 (c) 1, 2, 3 7. (a) -19 (b) 0 (c) 1 (d) 1 (e) 13 (f) 8
8. (a) 3 (b) 11 (c) 0 (d) 1 (e) 4 (f) 6
9. (a)



(b)

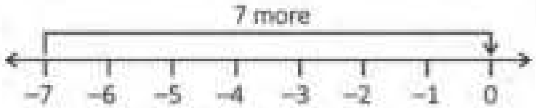
(c)

(d)

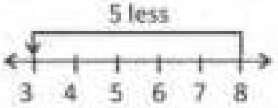
Exercise 4.2

1. (a)

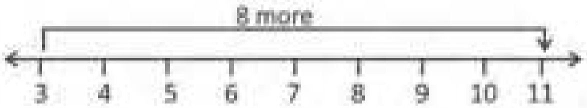
(b)



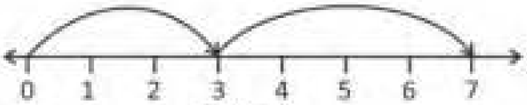
(c)



(d)

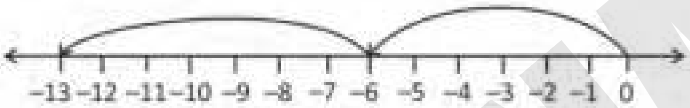


2. (a)



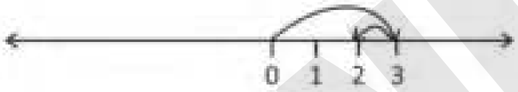
3 + 4 = 7

(b)



(−6) + (−7) = −13

(c)



3 + (−1) = 2

(d)

(8) + (−3) = 5

(e)

(−6) + 7 = 1

(f)

(−5) + (−7) = −12

(g)

8 + 0 = 8

(h)

0 + 9 = 9

3. (a) 4 (b) 415 (c) −9 (d) 331 (e) 0 (f) −295 (g) −1521 (h) −1450 (i) −325
4. (a) −71 (b) +52 (c) +101 (d) −429 (e) +6127 (f) −5120
5. (a) 330 (b) −649 (c) 0 (d) 781 (e) 860

Exercise 4.3

1. (a) 7 (b) −3 (c) 32 (d) 1 (e) 0 (f) 4 (g) 1 (h) 19 (i) 2
2. (a) 26 (b) 155 (c) 5 (d) 0 (e) −6 (f) 195
3. (a) > (b) > (c) > (d) < (e) <
4. (a) −999 (b) −1 (c) 31000 (d) −1001 (e) 108 (f) −910 5. 14
6. (a) ✓ (b) ✗ (c) ✓ (d) ✓ (e) ✓

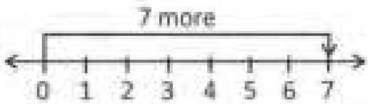
Revision Exercise

1. (a) (i) (b) (i) (c) (ii) (d) (iii) (e) (iii) (f) (iii) (g) (i)
2. (a) −9, −8, −1, 0, 9, 10 (b) −199, −105, −88, +77, +175 (c) −199, −100, −10, 99, +101 (d) −88, −60, 50, +75, +77
3. (a) −6, −5, −4, −3, −2, −1, 0, 1, 2, 3, 4, 5, 6 (b) −8, −7, −6, −5, −4, −3, −2 (c) 1, 2, 3, 4, 5, 6, 7, 8, 9 (d) −8, −7, −6, −5, −4, −3, −2, −1
4. (a) −9 (b) −50 (c) −1 (d) −99

5. (a)

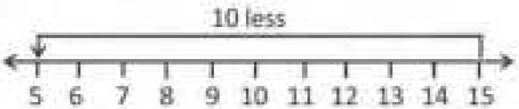
(2)+5=3

(b)

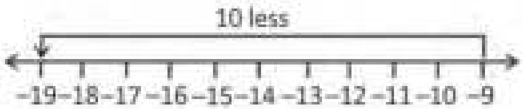


0+7 = 7

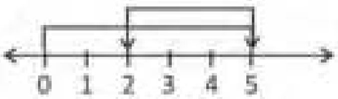
(c)



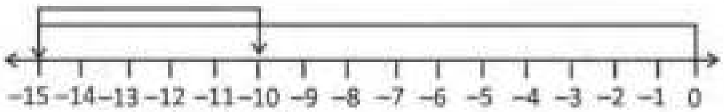
(d)



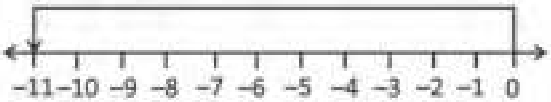
−9−10 = −19

6. (a) 

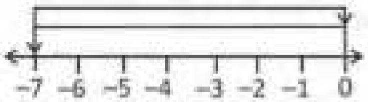
$5 + (-3) = 2$

(b) 

$(-15) + 5 = -10$

(c) 

$0 + (-11) = -11$

(d) 

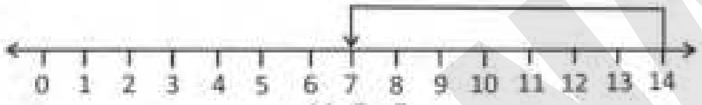
$(-7) + 7 = 0$

7. (a) 0 (b) −10 (c) 11 (d) 100 (e) −99

8. (a) 55 (b) −127 (c) 4 (d) 4

9. (a) 

$-15 - 9 = -24$

(b) 

$14 - 7 = 7$

(c) 

$-1 - (-11) = 10$

(d) 

$-18 - (-13) = -5$

10. (a)

11. (a) −101 (b) 98 (c) −2 (d) −11

Ch-5 Fraction

Exercise 5.1

1. (a), (b) and (d) 2. (a) U (b) L (c) U (d) L (e) L (f) U

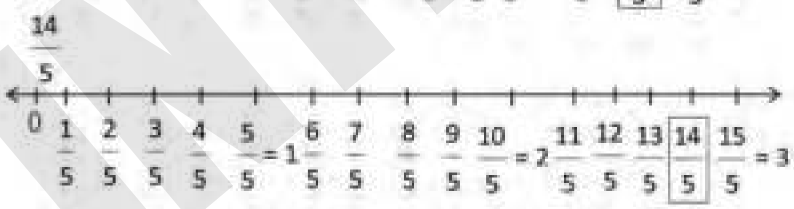
3. (a) P (b) P (c) P (d) I (e) I (f) I

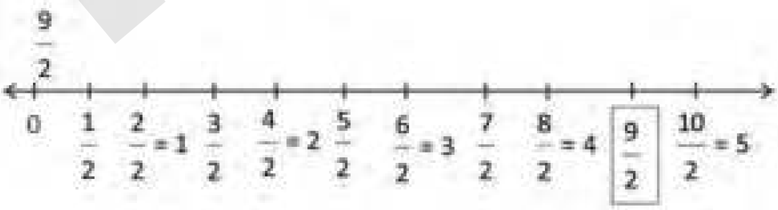
4. (a) 6 (b) 6 (c) 4 (d) 20 (e) 56 (f) 9

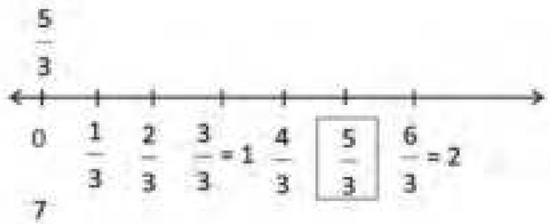
5. (a) $1\frac{2}{7}$ (b) $4\frac{3}{4}$ (c) $5\frac{2}{5}$ (d) $8\frac{14}{17}$ (e) $2\frac{4}{7}$ (f) $2\frac{1}{5}$

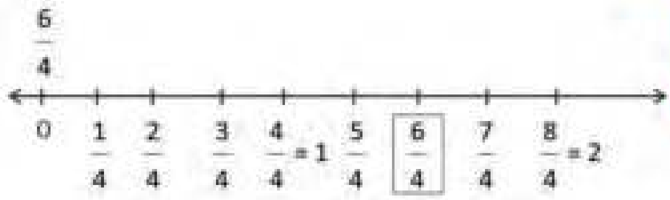
6. (a) $\frac{25}{11}$ (b) $\frac{36}{7}$ (c) $\frac{23}{5}$ (d) $\frac{76}{9}$ (e) $\frac{66}{7}$ (f) $\frac{10}{3}$

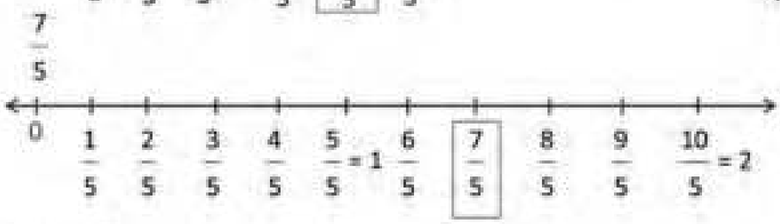
7. (a) 

(b) 

(c) 

(d) 

(e) 

(f) 

8. (b), (c), (e) and (f)

9. (a) $\frac{2}{9}$ (b) $\frac{8}{9}$ (c) $\frac{3}{4}$ (d) $\frac{1}{3}$ (e) $\frac{5}{7}$ (f) $\frac{3}{4}$

Exercise 5.2

1 (a) 2 (b) $\frac{2}{3}$ (c) $9\frac{3}{5}$ (d) $\frac{5}{9}$ (e) $\frac{6}{7}$ (f) $\frac{3}{4}$ (g) $1\frac{3}{8}$ (h) $8\frac{13}{15}$

(i) $5\frac{7}{18}$ (j) $8\frac{65}{84}$ (k) $1\frac{83}{180}$

2. (a) $\frac{-5}{9}$ (b) $\frac{1}{2}$ (c) $1\frac{7}{8}$ (d) $2\frac{1}{3}$ (e) $\frac{3}{5}$ (f) $\frac{1}{12}$ (g) $\frac{5}{6}$ (h) $\frac{9}{20}$

(i) $6\frac{7}{12}$ (j) $1\frac{9}{20}$ (k) $\frac{4}{35}$

3. (a) $\frac{3}{5}$ (b) $\frac{13}{21}$ (c) $7\frac{4}{5}$ (d) $8\frac{7}{8}$ (e) 13 (f) $8\frac{3}{8}$ (g) $\frac{2}{21}$ (h) 8

4. Ramesh, $25\frac{3}{5}$ minutes 5. $1\frac{3}{20}$ m 6. $\frac{1}{2}$ 7. $3\frac{13}{66}$ km

Exercise 5.3

1. (a) $\frac{35}{81}$ (b) $\frac{3}{8}$ (c) $\frac{60}{77}$ (d) $\frac{3}{17}$ (e) 1 (f) $3\frac{15}{16}$ (g) $24\frac{3}{7}$ (h) $58\frac{58}{63}$

2. (a) Improper (b) Improper (c) Proper (d) Improper (e) Proper (f) Proper

3. (a 1 (b) $\frac{3}{40}$ (c) $1\frac{9}{10}$ (d) $\frac{3}{4}$ (e) $\frac{55}{91}$ (f) $1\frac{5}{6}$ (g) $\frac{6}{11}$ (h) $\frac{3}{20}$ (i) $\frac{5}{49}$ (j) $\frac{1}{20}$

Exercise 5.4

1. (a) $\frac{13}{15}$ (b) $\frac{10}{21}$ (c) 2 (d) $\frac{1}{3}$ (e) $\frac{7}{8}$

2. $4\frac{1}{4}$ kg 3. Pradeep 4. ₹ 630 5. $3\frac{7}{8}$ l 6. $\frac{175}{2}$ km 7. $2\frac{3}{4}$ m 8. ₹ $32\frac{1}{2}$

Revision Exercise

1. (a) (iv) (b) (iii) (c) (iv) (d) (ii) (e) (ii) (f) (iii) (g) (iii) (h) (iii)

2. (a) $\frac{6}{16}, \frac{9}{24}, \frac{12}{32}, \frac{15}{40}$ (b) $\frac{12}{14}, \frac{18}{21}, \frac{24}{28}, \frac{30}{35}$ (c) $\frac{22}{26}, \frac{33}{39}, \frac{44}{52}, \frac{55}{65}$ (d) $\frac{30}{34}, \frac{45}{51}, \frac{60}{68}, \frac{75}{85}$

(e) $\frac{4}{14},\frac{6}{21},\frac{8}{28},\frac{10}{35}$ (f) $\frac{10}{16},\frac{15}{24},\frac{20}{32},\frac{25}{40}$ (g) $\frac{14}{26},\frac{21}{39},\frac{28}{52},\frac{35}{65}$ (h) $\frac{10}{14},\frac{15}{21},\frac{20}{28},\frac{25}{35}$

3. (a) $\frac{31}{40}$ (b) $\frac{13}{30}$ (c) $1\frac{5}{12}$ (d) $1\frac{2}{3}$ (e) $1\frac{128}{455}$ (f) $\frac{286}{323}$

4. (a) $\frac{2}{7}$ (b) $\frac{5}{9}$ (c) $\frac{3}{10}$ (d) $\frac{31}{63}$ (e) $2\frac{1}{3}$ (f) $\frac{1}{6}$ **5.** $3\frac{13}{20}\,l$ **6.** $9\frac{1}{3}$m **7.** $2\frac{5}{6}$

Ch-6 Decimal

Exercise 6.1

1. (a) < (b) > (c) > (d) = (e) < (f) = (g) > (h) >

2. (a) 0.777, 7.77, 77.7, 7770 (b) 0.07, 0.17, 7.007, 7.117 (c) 2.0, 2.01, 2.1, 2.25
(d) 2.657, 26.5, 26.54, 26.57 (e) 7.19, 7.39, 17.309, 17.390 (f) 1.434, 1.617, 1.712, 1.999

3. (a) 0.56, 0.31, 0.010, 0.098 (b) 34.2, 34.1, 34.02, 34.01 (c) 1111, 111.1, 11.11, 1.111
(d) 0.67, 0.536, 0.4, 0.112 (e) 89.2, 89.1, 89.02, 89.01 (f) 211.2, 21.12, 2.112, 0.221

4. (a) 2.300, 4.340, 5.212 (b) 0.200, 30.270, 30.275 (c) 25.500, 25.550, 0.255
(d) 9.050, 2.500, 2.533 (e) 456.300, 4.560, 4.356 (f) 1.100, 1.110, 1.111

5. (a) $\frac{33}{8}$ (b) $\frac{1111}{5}$ (c) $\frac{1}{4}$ (d) $\frac{29}{100}$ (e) $\frac{87003}{1000}$ (f) $\frac{17}{10}$
(g) $\frac{27}{100}$ (h) $\frac{4723}{100}$ (i) $\frac{2111}{1000}$ (j) $\frac{117}{500}$

6. (a) 0.23 (b) 23.5 (c) 2.469 (d) 0.5 (e) 22.11 (f) 13.1 (g) 3.9 (h) 2.008 (i) 0.45 (j) 0.89

7. (a) $\frac{768}{1000}=0.768$ (b) $\frac{64}{100}=0.64$ (c) $\frac{225}{100}=2.25$ (d) $\frac{86}{100}=0.86$ (e) $\frac{8}{10}=0.8$ (f) $\frac{418}{1000}=0.418$
(g) $\frac{72}{1000}=0.072$ (h) $\frac{1300}{1000}=1.300$ (i) $\frac{70}{100}=0.7$ (j) $\frac{26}{100}=0.26$

Exercise 6.2

1. (a) 11.8 (b) 3.1 (c) 1165.0 (d) 160.19 (e) 23.463 (f) 4.81 (g) 95.345 (h) 4.825 (i) 235.80

2. (a) 74.010 (b) 2.55 (c) 91.261 (d) 0.995 (e) 0.205 (f) 328.268 (g) 608.364 (h) 852.65

3. (a) 2.7 (b) 126.196 (c) 2.761 (d) 100.2 (e) 0.01 (f) 32.195 (g) 33.033 (h) 2.447 (i) 2.2

4. 2.625

Exercise 6.3

1. (a) 1.32 (b) 635.4 (c) 7209 (d) 1820.3 (e) 0.5 (f) 15211.5
(g) 244.388 (h) 3.1152 (i) 152.0754 (j) 7.506081 (k) 85.809364 (l) 2525.8528

2. (a) 5.3 (b) 1.2 (c) 36.419 (d) 0.00001 (e) 2.17 (f) 0.010101 (g) 1.28 (h) 3.45

Revision Exercise

1. (a) (iv) (b) (iii) (c) (ii) (d) (iii) (e) (i) (f) (iii) (g) (ii)

2. (a) > (b) > (c) = (d) < (e) < (f) > (g) < (h) =

3. (a) 0.32 (b) 0.0235 (c) 2.008 (d) 22.11 (e) 3.1 (f) 0.39 (g) 20.09 (h) 0.045

4. (a) 12.8 (b) 0.6 (c) 0.625 (d) 3.8 (e) 2.08 (f) 7.16 (g) 70.25 (h) 0.45

5. (a) 109 (b) 8.370926 (c) 8.32425 (d) 2.235129 (e) 1235
(f) 28.95 (g) 426.9174 (h) 9890 (i) 21230 (j) 853.1

6. (a) 3.31 (b) 1.254 (c) 3.45 (d) 2.17 (e) 3.6419 (f) 0.010101

Revision Test Paper-II

A. 1. (iii) 2. (i) 3. (iii) 4. (iv) 5. (i) 6. (iii) 7. (iii) 8. (iii) 9. (iii) 10. (iii)

B. 1. value 2. unlike 3. greater 4. decimal part 5. 1

C. 1. ✓ 2. ✗ 3. ✓ 4. ✓ 5. ✓ 6. ✓ 7. ✗ 8. ✓ 9. ✓ 10. ✗

Model Test Paper-I

Section-A.

1. 76941 2. 1001 3. (a) 77 (b) 77 4. Difference between the sums of alternate digits 17–17 = 0, So 70169803 is divisible by 11.

5. LCM = 180 6. (i) DCXXXVII (ii) LXXXIX

7. $\frac{3}{5}$ kg 8. $23\frac{1}{4}$ km 9. (i) $7+\frac{9}{10}+\frac{4}{100}$ (ii) $100+70+5+\frac{3}{10}+\frac{8}{100}$

10. −14, −13, −12, −11 and −6, −7, −8, −9 $\frac{1}{P}$ $\frac{Y}{100}+320$

Section-B.

11. $\frac{1}{4}$, $\frac{6}{12}$, $\frac{9}{12}$, These are not equivalent fractions Sum = $1\frac{1}{2}$

12. 12 13. $\frac{1}{12}$ and $\frac{11}{15}$ 14. $5\frac{3}{4}$ 15. $\frac{16}{18}, \frac{15}{18}, \frac{12}{18}, \frac{9}{18}$

Section-C.

16. ₹895 17. 54, −29 18. (i) 0.753 (ii) 1.0

Ch-7 Introduction to Algebra

Exercise : 7.1

1. (a) 3n+1, where n = number of squares (b) 37 2. 3 s, where s = side 3. (a) P = 4s (b) P = 2(l+b)
4. (a) m+n (b) (c) (d) x−105 (e) n+422 (f) kp
5. D = 25 r, where r = no. of rooms D = Total no of desks
6. (a) 4l (b) 6b 7. (a) x+x+x+x (b) x+x+x+x+x+x+x

Revision Exercise

1. (a) (ii) (b) (iv) (c) (ii) (d) (iii) (e) (iii) (f) (ii) (g) (iv)
2. 12 3. brother's age = 20 years, father's age = 42 years 4. (a) 6x = 1840 (b) 3m + 100 = 400
5. (a) 3p (b) 5x

Ch-9 Ratio and Proportion

Exercise 8.1

1. 7:3 2. (a) 20:1 (b) 10:3 (c) 1:10 (d) 180:1
3. (a) 6:10, 9:15 (b) 42 : 62, 63 : 93 (c) 34 : 164, 51 : 246 (d) 30:120, 45 : 180 4. 6:7
5. (a) 7:9<10:12 (b) 3:5 <5:7 (c) 3:4 <5:6 (d) 13 :17<351:189
6. (a) 7:12 (b) 19:14 (c) 16 : 11 7. (a) 3:25 (b) 3 :28
8. (a) 21:28:24 (b) 14:35:45 (c) 19:21:7 9. 8:9
10. (a) 101:115 (b) 115:216 (c) 101:216
11. (a) 9:10 (b) 1:10 (c) 5:13 (d) 40:19 (e) 6:1 (f) 1:20 (g) 15:73 (h) 2:7
12. ₹3081, ₹2844 13. (a) 27:50 (b) 23:50 14. Boys = 620, Girls = 930 15. Cadmiam = 21g, Gold = 279 g

Exercise 8.2

1. (a) not (b) yes, middle = 48×70 = 3360 extreme = 32×105 = 3360
   (c) not (d) yes, middle = 65×6 = 390, extreme = 39×10 = 390
2. (a) No (b) Yes (c) Yes (d) Yes 3. (a) r = 7 (b) r = 35 (c) r = 20 (d) r = 10
4. yes, 1:3 : : 1:3 5. yes,

Exercise 8.3

1. ₹123.75 2. 36 kg 3. ₹209.93 4. (i) 9 hours (ii) 420 km
5. ₹2012.5 6. ₹328 7. 1365 items 8. ₹2520

Revision Exercise

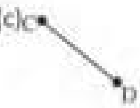
1. (a) (iv) (b) (i) (c) (ii) (d) (iv) (e) (ii) (f) (i) (g) (iii) (h) (ii)
2. 325 km 3. ₹ 13500 4. (a) 3:10 (b) 1:10 (c) 4:375 (d) 3:365
5. Ranjan = ₹36, 270 ; Tapan = ₹48, 360 6. 4:3 7. a = 14 8. 36°, 54° 9. ₹160 10. 45 minutes

Ch-10 Basic Geometrical Ideas

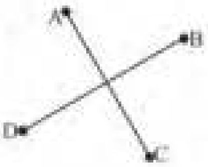
Exercise 9.1

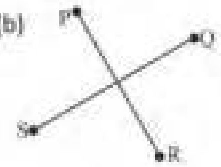
1. (a)

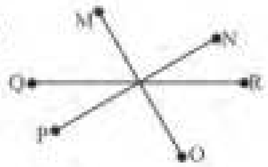

(b)

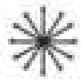

(c)


(d)


2. (a) 

(b) 

(c) 

3. (a) 2.8 cm (b) 1.2 inch (c) 30 mm 4. (a) A, B, C (b) A, B, C, D, E 5. Infinite
6. No 7. (a) False (b) False (c) True (d) False (e) False 
(f) True (g) False (h) False
8. (a) XT (b) PS (c) (XT, DS), (XD, TS) (d) (XS, DT)

Exercise 9.2

1. (a) open (b) close (c) open (d) close (e) close (f) close
2. (a) not (b) yes (c) not (d) yes (e) not 3. 
4. (a) Open curve : The curves that do not start and end at the same point are called open curves.
(b) Simple curve : A curve that does not cross itself is called simple curve.
(c) Close curve : The curves that start and end at the same point are called closed curves.
(d) Exterior of a triangle : All the points outside the triangle are the exterior of the triangle.

Revision Exercise

1. (a) (ii) (b) (iii) (c) (ii) (d) (ii) (e) (i) (f) (iii) (g) (iv)
3. (a) False (b) True (c) True (d) False
4. (a) $\overparen{TY}$, $\overparen{ML}$ (b) none (c) XY, TL (d) OX, OY, OT, OL, OM (e) OTY, OML (f) B (g) A
5. (a) Two or more lines that meet at a point are called intersecting lines.
(b) Diameter is the longest chord of the circle.
(c) No, a triangle does not have a diagonal.
(d) Arc is a part of a circle. Chord is a line segment joining any two point on the circle.

Revision Test Paper-III

A. 1. (ii) 2. (iv) 3. (ii) 4. (iii) 5. (iv) 6. (c) 7. (ii) 8. (i) 9. (ii) 10. (ii)
B. 1. simple curve 2. 90° 3. two 4. :: 5. one
C. 1. ✓ 2. ✓ 3. ✗ 4. ✓ 5. ✓ 6. ✗ 7. ✗ 8. ✓ 9. ✓ 10. ✗

Ch-10 Understanding Elementary Shapes

Exercise 10.1

1. Do it yourself 2. AB = CD 3. A line segment is a part of a line. It has two ends points and a definite length.
4. (i) AB, BC, AC, AD, AE, BE, BD, ED, CD (ii) AB, BC, CD, DE, EF, FA
(iii) AB, AE, AF, AC, BC, BF, BD, CE, CD, FE, FD, DE (iv) OP, OQ, OR, PR, PQ, QR, OD, OC, OB, OA, DC, DB, DA, CB, CA, BA
(v) AB, AC, BC, PQ, PR, QR
5. The thickness of a ruler may cause difficulties in reading of the marks on it. This problem can be avoided by using a divider.
6. (a) 10 (b) 10 (c) 10 (d) 10 7. Do it yourself

Exercise 10.2

1. (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{1}{2}$ 2. (a) 2 right angles (b) 1 right angle (c) 2 right angles
3. (a) 180° (b) 90° (c) 180° 4. (a) stop at 6 (b) stop at 12 (c) stop at 6
5. (a) 1 right angle (b) 1 right angle (c) 1 right angle (d) 2 right angles

6. (a) stop at 1 (b) stop at 7 (c) stop at 9

Exercise 10.3

1. Do it yourself
2. (a) acute angle (b) reflex angle (c) obtuse angle (d) acute angle (e) obtuse angle
   (f) reflex angle (g) obtuse angle (h) reflex angle (i) acute angle (j) obtuse angle
3. (a) acute angle (b) right angle (c) acute angle
   (d) acute angle (e) obtuse angle (f) straight angle
4. (a) ∠AOC, ∠BOD, ∠COE, ∠DOF (b) ∠AOB, ∠BOC, ∠COD, ∠DOE (c) ∠AOE, ∠BOF, ∠COG, ∠DOH
   (d) ∠AOD, ∠BOE, ∠COF, ∠DOG (e) ∠AOF, ∠BOG, ∠COH, ∠DOA
5. (i) (f) (ii) (b) (iii) (e) (iv) (d) (v) (c) (vi) (a)

Exercise 10.4

1. (a) 55° (b) 110° (c) 90° (d) 55°, 125°, 55°
2. (a) 45° acute (b) 135° obtuse (c) 90° right (d) 90° right (e) 225° or 135° obtuse (f) 180° straight
3. (a) A=135°, B=90° (b) A=90°, B=180°
4. (a) F (b) F (c) T (d) T
5. (a) straight (b) obtuse (c) obtuse (d) acute (e) acute
6. (a) Do it yourself (b) Do it yourself
7. ∠Q, P = 55°, Q = 65°

Exercise 10.5

1. Do it yourself
2. (a) Yes (b) No (c) DE, CE (d) (i) Yes (ii) No (iii) Yes
3. (a) F (b) F (c) T (d) F (e) T
4. (a) ✓ (b) ✓ (c) ✗
5. 60°, 90°, 30° and 45°, 90°, 45°. They have a common angle of 90°.

Exercise 10.6

1. (a) Triangle : A three sides polygon is called a triangle. The sum of the three angles of a triangle is always 180°.
   (b) Scalene triangle : A triangle having all three sides unequal is called scalene triangle.
   (c) Right-angled triangle : If any one angle in a triangle is a right angle then the triangle is called right-angled triangle.
   (d) Equilateral triangle : A triangle having all the three sides equal in length is called equilateral triangle.
   (e) Isosceles triangle : A triangle which has two sides of equal length is called isosceles triangle.
2. (a) Scalene (b) Scalene (c) Equilateral (d) Isosceles
   (e) Isosceles (f) Equilateral (g) Scalene (h) Isosceles
3. (a) C = 55° (b) R = 45° (c) F = 10° (d) Z = 85° (e) R = 60° (f) C = 60°
4. (a) Right-angled triangle (b) Isosceles Acute-angled triangle (c) Scalene triangle
   (d) Scalene triangle (e) Equilateral triangle
5. (i) (f) (ii) (e) (iii) (b) (iv) (g) (v) (a) (vi) (c) (vii) (d)

Exercise 10.7

1. (a) because, all the sides are equal. (b) because opposite sides are equal. (c) because, all the angles are 90°.
   (d) because, these all have four sides. (e) because, it has pairs of 2 parallel.
2. (a) T (b) F (c) T (d) T (e) F (f) T

Exercise 10.8

1. (a) Pentagon (b) Quadrilateral (c) Hexagon (d) Pentagon (e) Octagon
 (f) Heptagon (g) Nonagon (h) Hexagon **2.** (a) (c) (d) (f) (h) (k)

3. (a) A circle is not a polygon because, it does not have straight sides.
 (b) It is not a polygon because, it is not a closed figure. (c) It is a polygon
 (d) It is not a polygon because, it has a curve line.

4. (a) Pentagon (b) Square (c) Quadrilateral (d) Trapezium (e) Triangle (f) Octagon

Revision Exercise

1. (a) (ii) (b) (iii) (c) (ii) (d) (iv) (e) (iv) (f) (iv) (g) (ii) (h) (ii)

2. (i) AB, BC, CD, DE, EF, FG, GH, HA, AC, CE, EG, GA, BF, HD (ii) OA, OB, OC, OD, OE, OF
 (iii) AB, BC, CA, AD, AF, FB, BD, BE, DC, CE, CF, EA (iv) AB, BC, CD, DE, EF, FA
 (v) PQ, QR, RP, DE, EF, FD

3. (a) acute (b) obtuse (c) reflex (d) obtuse (e) reflex (f) reflex
 (g) acute (h) obtuse (i) obtuse (j) obtuse (k) acute (l) reflex

4. (a) C=45 (b) R=45 (c) Z=65 (d) C=60 (e) R=47

5. (a) Right-angled triangle (b) Isosceles Acute-angled triangle (c) Scalene triangle
 (d) Scalene triangle (e) Equilateral triangle

Ch-11 Mensuration

Exercise 11.1

1. (a) 25 cm (b) 19 cm (c) 36 cm (iv) 30 cm (e) 24 cm

2. 236.6 m **3.** 150 cm **4.** 75 cm **5.** Ramesh, 340m **6.** 9m

7. (a) 46 m (b) 3 m 40 cm (c) 157 m (d) 7 m 50 cm (e) 5 m 50 cm (f) 2 m 84 cm

8. (a) 72m (b) 20m (c) 5 m (d) 4 m 20 cm (e) 2 m84 cm (f) 18m

9. (a) 32 cm (b) 24 cm

Exercise 11.2

1. (a) 40 cm^2 (b) 216 cm^2 © 369.75 m^2 (d) 832 cm^2 (e) 1680 m^2 **2.** 17 m

3. 24 m **4.** 14 m^2 **5.** (a) 64 cm^2 (b) 289 cm^2 (c) 25 m^2 (d) 441 m^2

6. $4s^2$, 1:4 **7.** Cost of fencing = ₹ 1080 Cost of turfing = ₹ 31500 **8.** Area will not be change. **9.** 22 m

Revision Exercise

1. (a) (iv) (b) (iii) (c) (i) (d) (i) (e) (i) (f) (iii) (g) (ii)

2. (a) 24 m (b) 28 cm **3.** 200 cm **4.** 100 cm **5.** 320 m **6.** 2625 cm^2 **7.** 22 cm **8.** 15 m 60 cm

Ch-12 Data Handling

Exercise 12.1

1.

Name of Software	Computer System	Tally Marks
Java	10	卌 卌
Acrobat	7	卌 ||
C++	8	卌 |||

2. 25, 27, 29, 35, 38, 40, 45, 47, 52, 54
 (i) 25 years (ii) five teachers

3.

Marks	No. of Student	Tally marks
17	4	IIII
20	4	IIII
24	3	III
16	1	I
15	2	II
12	1	I
10	2	II
7	1	I
18	1	I
19	1	I

Total students 20

Revision Exercise

1. (a) (ii) (b) (iv) (c) (i) (d) (iv) (e) (iv) (f) (ii)

2. Do it yourself

3.

Money (in ₹)	No. of students	Tally marks
150	5	~~IIII~~
250	3	III
145	5	~~IIII~~
122	1	I
160	2	II
175	2	II
200	1	I
230	1	I

Revision Test Paper-IV

A. 1. (iii) 2. (iv) 3. (iii) 4. (iii) 5. (iii) 6. (i) 7. (i) 8. (iii) 9. (iv) 10. (i)

B. 1. geometry 2. 10 3. 84 cm 4. zero 5. primary

C. 1. ✗ 2. ✗ 3. ✗ 4. ✓ 5. ✗ 6. ✗ 7. ✗ 8. ✓ 9. ✓ 10. ✓

Model Test Paper-2

Section-A

1. x = 135 2. (a) $\frac{14}{24}, \frac{28}{48}$ (b) $\frac{8}{14}, \frac{12}{21}$

3. ∠ABC, ∠EBC, ∠DBC,
∠ABE, ∠ABD, ∠EBD

4. $\frac{1}{4}$ 5. 70m 6. ₹4375 7. 19:15

8. Every triangle has three medians but only one centroid. Medians are line segments but centroid is a point where the three medians bisect each other.

9. 90° and 30°. 10. 4m 50cm

Section-B

11. Do it yourself 12. 56m 13. x = 13

14. (a) OB, OD, OE, OG, OI, OJ (b) BG, DI, EJ
    (c) AC, FH (d) O

15. Do it yourself.

Section-C

16. (a) x = 4 (b) x = 4 17. Do it yourself

18.