MATHEMATICS

Grade 6

Part - I

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The National Anthem of Sri Lanka

Sri Lanka Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Sundara siri barinee, surendi athi sobamana Lanka
Dhanya dhanaya neka mal palaturu piri jaya bhoomiya ramya
Apa hata sepa siri setha sadana jeewanaye matha
Piliganu mena apa bhakthi pooja Namo Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha
Oba we apa vidya
Obamaya apa sathya
Oba we apa shakthi
Apa hada thula bhakthi
Oba apa aloke
Apage anuprane
Oba apa jeevana we
Apa mukthiya oba we
Nava jeevana demine, nithina apa pubudukaran matha
Gnana veerya vadawamina regena yanu mena jaya bhoomi kara
Eka mavakage daru kela bevina
Yamu yamu vee nopama
Prema vada sema bheda durerada
Namo, Namo Matha
Apa Sri Lanka Namo Namo Namo Namo Matha

තිළිණය ලෙසින් රජයෙන් මේ පොත ලදිමි
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அரசின் வெகுமதியாய் நூலிதனைப் பெற்றேன்
அறிவு பெருகிடவே நூலிதனைக் கற்பேன்
தாய் நாட்டின் வளமெனவும் நூலிதனைக் காப்பேன்
பல மாணவரும் பயின்றிடவே நூலிதையே அளிப்பேன்

From the government, I received this as a gift
I'll read it, light up my knowledge and practise thrift
On my country's own behalf , I'll protect the national resources
And offer this book to another one as a fresh garland of roses

Being innovative, changing with right knowledge
Be a light to the country as well as to the world.

Message from the Hon. Minister of Education

The past two decades have been significant in the world history due to changes that took place in technology. The present students face a lot of new challenges along with the rapid development of Information Technology, communication and other related fields. The manner of career opportunities are liable to change specifically in the near future. In such an environment, with a new technological and intellectual society, thousands of innovative career opportunities would be created. To win those challenges, it is the responsibility of the Sri Lankan government and myself, as the Minister of Education, to empower you all.

This book is a product of free education. Your aim must be to use this book properly and acquire the necessary knowledge out of it. The government in turn is able to provide free textbooks to you, as a result of the commitment and labour of your parents and elders.

Since we have understood that the education is crucial in deciding the future of a country, the government has taken steps to change curriculum to suit the rapid changes of the technological world. Hence, you have to dedicate yourselves to become productive citizens. I believe that the knowledge this book provides will suffice your aim.

It is your duty to give a proper value to the money spent by the government on your education. Also you should understand that education determines your future. Make sure that you reach the optimum social stratum through education.

I congratulate you to enjoy the benefits of free education and bloom as an honoured citizen who takes the name of Sri Lanka to the world.

Akila Viraj Kariyawasam
Minister of Education

Foreword

At present, educational aims are becoming more complex along with economic, social, cultural and technological development in the world. Furthermore, the learning and teaching process is constantly being modernized due to human experiences, technological changes, psychological researches and new indices in education. However, the textbook should be produced by including subject - related content in accordance with the aims of the syllabus while enabling to conduct the teaching process to provide learning experiences that suit to the needs of the students. The textbook is not only a learning tool, but it is a blessing to gain a quality education by way of learning experiences, developing aptitudes, attitudes and behavioural skills.

I sincerely hope that this textbook will assist you to gain experience to become a good citizen who has a total personality and who will serve the country.

I would like to bestow my sincere thanks on the members of the writing, editing and evaluation panels as well as on the staff of the Educational Publications Department for their contribution in producing this textbook.

W.D. Padmini Nalika
Commissioner General of Educational Publications,
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07.05.2018

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Message of the Boards of Writers and Editors

This textbook has been compiled in accordance with the new syllabus which is to be implemented from 2015 for the use of grade six students.

We made an effort to develop the attitude "We can master the subject of Mathematics well" in students.

In compiling this textbook, the necessity of developing the basic foundation of studying mathematical concepts in a formal manner was specially considered. This textbook is not just a learning tool which targets the tests held at school. It was compiled granting due consideration to it as a medium that develops logical thinking, correct vision and creativity in the child.

Furthermore, most of the activities, examples and exercises that are incorporated here are related to day to day experiences in order to establish mathematical concepts in the child. This will convince the child about the importance of mathematics in his or her daily life. Teachers who guide the children to utilize this textbook can prepare learning tools that suit the learning style and the level of the child based on the information provided here.

Learning outcomes are presented at the beginning of each lesson. A summary is provided at the end of each lesson to enable the child to revise the important facts relevant to the lesson. Furthermore, at the end of the set of lessons related to each term, a revision exercise has been provided to revise the tasks completed during that term.

Every child does not have the same capability in understanding mathematical concepts. Thus, it is necessary to direct the child from the known to the unknown according to his / her capabilities. We strongly believe that it can be carried out precisely by a professional teacher.

In the learning process, the child should be given ample time to think and practise problemes on his or her own. Furthermore, opportunities should be given to practise mathematics without restricting the child to just the theoretical knowledge provided by mathematics.

Our firm wish is that our children act as intelligent citizens who think logically by studying mathematics with dedication.

Boards of Writers and Editors

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1 Circles

By studying this lesson, you will be able to,

- identify items which have the circular shape and
- create circular designs using items which have the circular shape.

1.1 Identifying items which have the circular shape

A figure of a purple circular shaped card is given here.

Pictures of several more items, in which the circular shape can be observed are given below.

Exercise 1.1

(1) From the following items, select and write down the ones in which the circular shape can be observed.

(i) The mathematics text book
(ii) Drum
(iii) Cricket bat
(iv) Sieve
(v) Winnowing fan
(vi) Wheel of a vehicle
(vii) Steering wheel of a car
(viii) Tea spoon
(ix) Pot

1.2 Drawing circles using items

The following figures illustrate how the circular shape is drawn using various items that have the circular shape. Carefully observe the figures and then engage in the following activity.



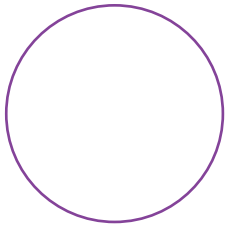
Activity 1

Step 1 - Take a two rupees coin, a cup and a saucer.

Step 2 - Draw the circular shape using each of these items.

Step 3 - Find several other items which have the circular shape, and draw the circular shape using each one of them.

The figure drawn in the above activity using the two rupees coin is shown here. The complete curved line of such a figure is known as a **circle**.



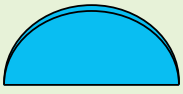
Observe that the circles drawn in the above manner are different from each other in size.

Activity 2

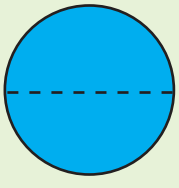
Step 1 - Using a cup, draw the circular shape on a piece of paper.

Step 2 - Separate the circular part, cutting along the curved line of the circular shape. Then we obtain a **circular lamina.**

Step 3 - Fold this circular lamina as shown in the figure, so that it is divided into two equal parts.



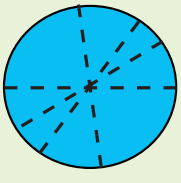
Step 4 - With the aid of a ruler, mark the fold line using a pencil.



Step 5 - Fold the circular lamina again as before, into two equal parts along a different fold line.

Step 6 - Mark this second fold line too with a pencil as done previously. Mark several other such fold lines, in the same manner as above.

Step 7 - Observe that all these fold lines **pass through** the same point. See whether the distance from this point to several points on the curved edge are equal to each other using a ruler.



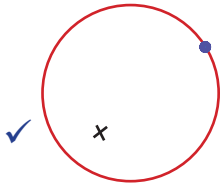
Do the above activity using a saucer and a coin too.

Through this activity, the fact that the distance from the point where the fold lines which divide the circular lamina into two equal parts intersect, to any point on the curved edge of the lamina is the same is established.

Activity 3

Step 1 - Draw a circle in your exercise book by using a coin.
Step 2 - Mark an "✕" **inside** the circle.
Step 3 - Place a dot **on** the circle.
Step 4 - Draw a "✓" **outside** the circle.

Compare the figure you obtained by doing the above activity, with the figure given here.



In this manner, you will be able to identify the positions inside the circle, on the circle and outside the circle.

Exercise 1.2

(1) From the collection of items given below, select the ones that can be used to draw circles and write down the corresponding numbers.


(i)


(ii)


(iii)

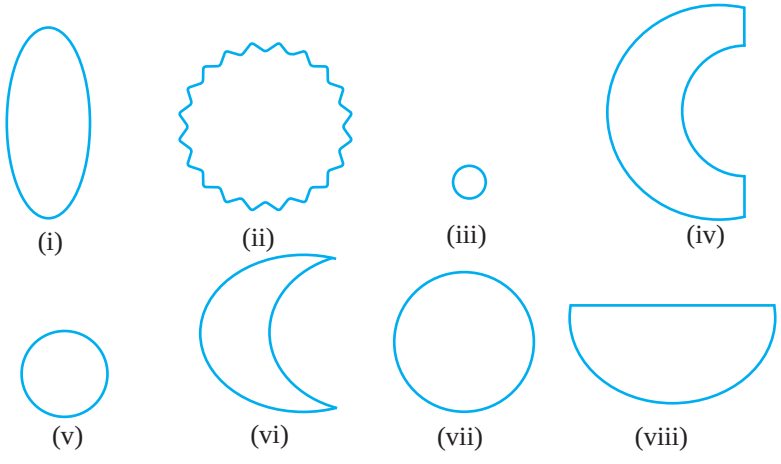

(iv)

(v)


(vi)


(vii)

(2) From the figures shown below, select those which are circles and write down the corresponding numbers.



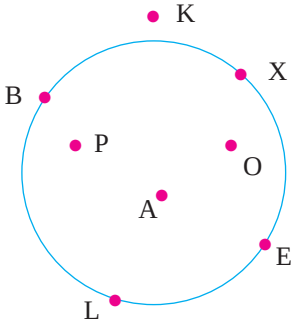
(3) Select various items which have the circular shape, and using them draw several circles which are different in size to each other.

(4) In this figure,

(i) which letters indicate positions inside the circle?

(ii) which letters indicate positions on the circle?

(iii) which letters indicate positions outside the circle?



(5) In a competition of throwing darts onto a circular board by standing at a location in front of it, 10 points are awarded if the dart hits the circle and 5 points are awarded if the dart hits the inside of the circle. But, no points are awarded if the dart hits the outside of the circle.

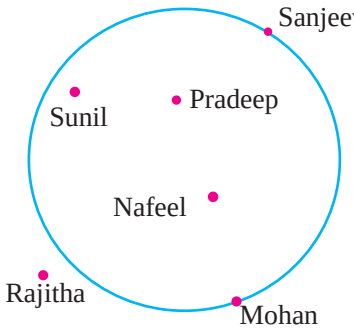
A group of students participated in the above competition. The figure indicates where the darts thrown by each of the students hit the board.

(i) Who are the students who were awarded 10 points?

(ii) Who are the students who were awarded 5 points?

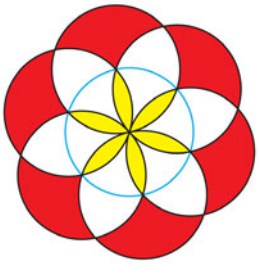
(iii) Who are the students who did not receive any points?

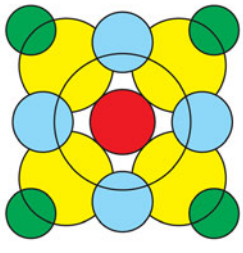
(iv) If each of these student is given two more opportunities to throw darts, what is the maximum number of points that Mohan could receive in total?

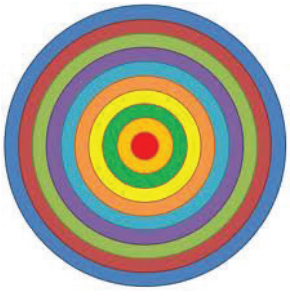


1.3 Creating circular designs

Three circular designs created using circles are shown below. Such designs can frequently be seen on clothing materials, festival decorations and in religious places.



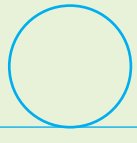




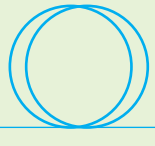
Activity 4

Step 1 - Draw a line on a piece of paper using a ruler.

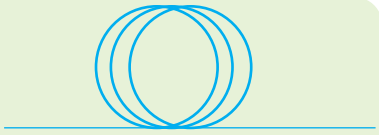
Step 2 - Using a coin, draw a circle as shown in the figure.



Step 3 - Move the coin a short distance along the line and draw another circle as shown in the figure.



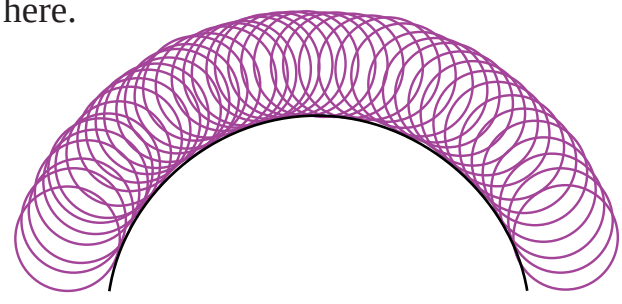
Step 4 - Move the coin a short distance along the line once more and draw another circle.



Step 5 - In the above manner, by moving the coin a short distance along the line several times more, draw about 20 circles.

Create various designs as in the above activity, by moving the coin along different curved lines as well and drawing circles.

One such design is shown here.



Activity 5

Step 1 - Take coloured pencils, pieces of paper and several items which can be used to draw circles.

Step 2 - Using various colours,

(i) create circular designs using only one of the items.

(ii) create circular designs using two or more items of different sizes.

Step 3 - By drawing circular designs, create a decoration to be displayed in your room to make the room attractive.

Summary

- There are many items of different sizes in our environment that have a circular shape.
- Various designs can be created using circles.

2. S. P. C. 170449

2 Place Value

By studying this lesson, you will be able to,

- know the place value corresponding to the position of each digit in a whole number,
- know the value represented by each digit in a whole number and
- read and write in words numbers up to the billions period.

2.1 Place value

When writing numbers, we most often use the **Hindu-Arabic number system.** In this system, the ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are used to write numbers.

When writing **numbers from zero up to nine**, we write one digit in **one position**. As an example, the number three is written as 3 using a digit. That is, one position is used to write 3. The greatest number which can be written using only one position is 9.

The number which is one greater than nine is ten. Each number **from ten up to ninety nine** is written using either two distinct digits or one digit twice using two positions.

As an example, the number ten is written as 10 using digits. The number ninety nine is written as 99 using digits. That is, the numbers 10 and 99 are written using two positions.

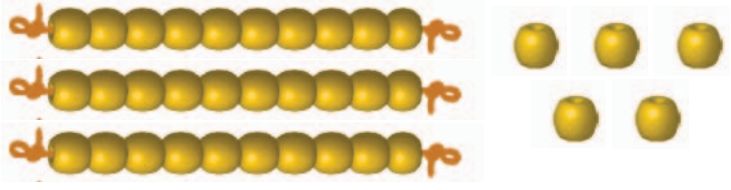
Now, let us consider a couple of numbers written using the digits 3 and 5 in two positions.

When the digits 3 and 5 are written as 35, the number is “thirty five”.
When the digits 3 and 5 are written as 53, the number is “fifty three”.

That is, the numbers obtained are different to each other according to the positions of the digits 3 and 5.

Now, let us describe the place value corresponding to the position of each digit in a number and the value represented by each of the digits.

- Using thirty five beads, if chains containing ten beads each are made by threading the beads, there will be three chains of ten beads each, with five beads remaining.



3 tens 5 ones

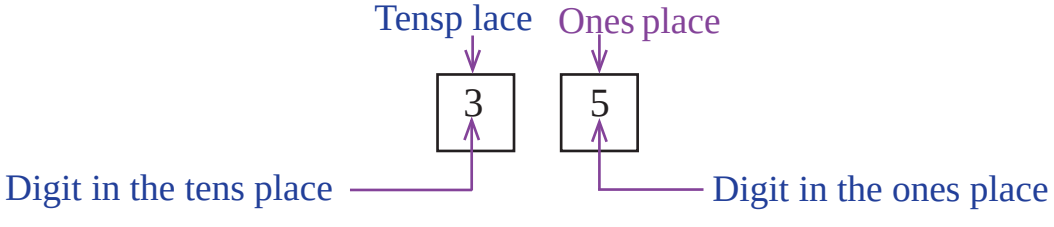
The thirty five beads can be separated into three sets of ten beads each and five sets of one bead each.

That is, Thirty five = 3 tens + 5 ones = 35

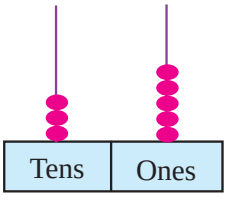
According to the above explanation, the 5 in 35 represents 5 ones. The position which 5 occupies is the **'ones place'**. The place value of the position occupied by the digit 5 is taken as 1.

The 3 in 35 represents 3 tens. The position which 3 occupies is the **'tens place'**. The place value of the position that the digit 3 occupies is 10.

In the following figure, each position has been marked using a square, and the position of each digit of 35 has been indicated.



Let us represent 35 on an abacus.



We learnt that 35 = 3 tens + 5 ones.

In the same manner,

53 = 5 tens + 3 ones = 50 + 3,

65 = 6 tens + 5 ones = 60 + 5

and 99 = 9 tens + 9 ones = 90 + 9

That is, there is a value represented by a digit in a number, according to the position of the digit.

Now, let us find the value represented by each digit of 35.

The value represented by 3 in the number 35 = 3 tens = 30

The value represented by 5 in the number 35 = 5 ones = 5

The maximum value that can be represented by a digit in the ones place is 9.
The maximum value that can be represented by a digit in the tens place is 90.

The maximum number of counters that can be placed on a single rod of an abacus is 9.

Example 1

Number	Digit	Name of the position of the digit	Value represented by the digit
45	4	Tens place	40
45	5	Ones place	5
30	0	Ones place	0

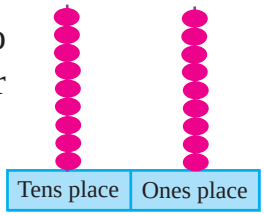
Exercise 2.1

(1) Complete the following table.

Number	Digit in the ones place	Digit in the tens place	Value represented by the digit in the ones place	Value represented by the digit in the tens place
63 76 40 88				

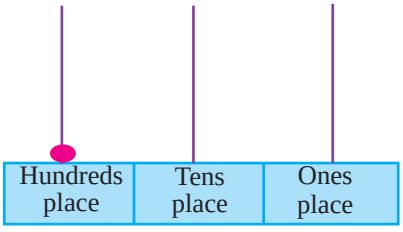
2.2 Place value described further

The greatest number that can be written using two positions is 99. It has 9 tens and 9 ones. The number which is one greater than 99 is hundred.



The tens place and ones place are not sufficient to write the number hundred in digits. Hence the place value corresponding to the position to the left of the tens place is taken as 100 and that position is named as the **hundreds place.**

Therefore hundred is written using three positions as 100.



Number	Hundreds	Tens	Ones
100	1	0	0

Now let us look at numbers which are written by using digits in **three positions.**

Several numbers which can be formed using the digits 2, 4 and 5 are given below. Consider the ways of using 5 in these numbers.

24<u>5</u>	Two hundred forty **<u>five</u>**
2<u>5</u>4	Two hundred **<u>fifty</u>** four
<u>5</u>24	**<u>Five hundred</u>** twenty four

In 245, the digit 5 is in the ones place.
The value represented by 5 in 245 = 5 ones = 5

In 254, the digit 5 is in the tens place.
The value represented by 5 in 254 = 5 tens = 50

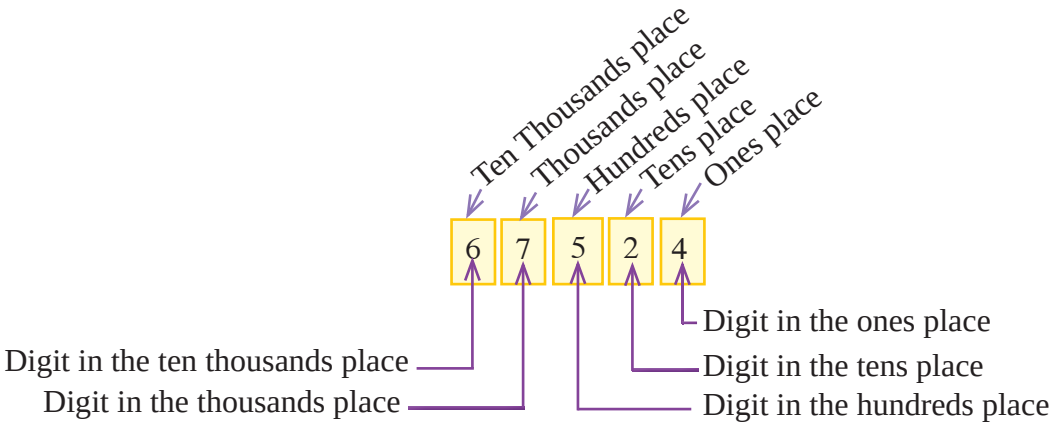
In 524, the digit 5 is in the hundreds place.
The value represented by 5 in 524 = 5 hundreds = 500

It is clear that the value represented by 5 in the above numbers varies according to the position of 5.

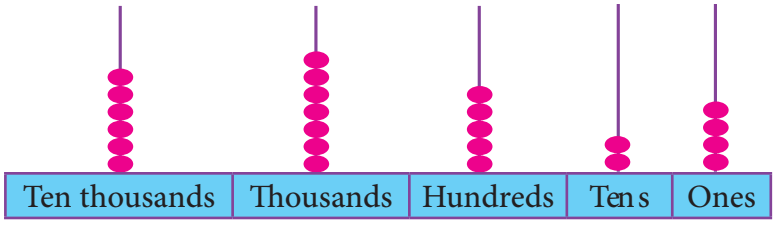
The place value corresponding to the position of each digit in a number from right to left is respectively 1, 10, 100, 1000, 10000 etc.

Accordingly, when two successive digits of a number are considered, the place value corresponding to the position of the digit on the left is ten times the place value corresponding to the position of the digit on the right.

Now, let us name the positions that each of the digits 2, 4, 5, 6 and 7 occupies in the number 67524 by writing these digits in five positions.



Let us represent 67524 on an abacus.



67524 = 6 ten thousands + 7 thousands + 5 hundreds + 2 tens + 4 ones

Let us now consider the value represented by each digit in the number 67524.

4 is in the ones place of 67524.The value represented by 4 is 4.

2 is in the tens place of 67524. The value represented by 2 is 20.

5 is in the hundreds place of 67524. The value represented by 5 is 500.

7 is in the thousands place of 67524. The value represented by 7 is 7000.

6 is in the ten thousands place of 67524. The value represented by 6 is 60000.

Example 1

Write down the value represented by each digit in the number 5968.

The value represented by 8 in 5968 = 8 ones = 8

The value represented by 6 in 5968 = 6 tens = 60

The value represented by 9 in 5968 = 9 hundreds = 900

The value represented by 5 in 5968 = 5 thousands = 5000

Exercise 2.2

(1) In the number 99601,

(i) what is the value represented by 9, which is positioned fourth from the right?

(ii) what is the place value corresponding to the position of 0?

(iii) what is the value represented by 0 ?

(iv) what is the value represented by 9, which is positioned fifth from the right ?

(2) Complete the following table.

Number	Digit	Name of the position of the digit	Value represented by the digit
7940	9		
8095	9		
4568	5		
1273	7		
34856	5		
94512	4		
94512	5		
19085	1		
19085	0		
5436	5		

(3) Write down all the numbers of three positions, that can be written using each of the digits 4, 5 and 8 exactly once. For each of these numbers, write down the place value corresponding to the position of 8 and the value represented by 8.

(4) Using each of the digits 2, 4, 5 and 9 exactly once, write down,

(i) the largest possible number of four positions and the value represented by each digit in that number.

(ii) the smallest possible number of four positions and the value represented by each digit in that number.

2.3 Periods of numbers

The total number of students studying in several schools from grade 6 to 11 is 2836696.

See whether you can read the number of students given in the above statement. How numbers such as the above are read and written in words is described below.

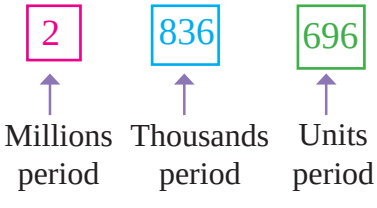
Let us consider the number 2836696.
Let us write this number by separating it into groups of three, starting from the ones place, as given below.

2 836 696

A group separated in the above manner is known as a **period of numbers or number zone.**

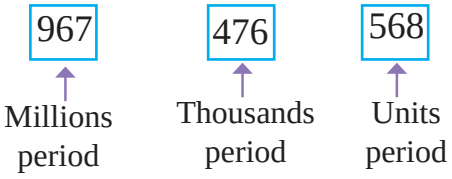
In this separation, the number of positions with digits in the last period, that is, the leftmost period, may be less than three. Only the digit 2 is in the last period of the above number.

Let us name the periods of this number as follows.



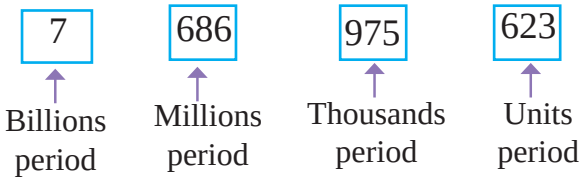
This number is read as two million eight hundred thirty six thousand six hundred ninety six.
Now, let us consider how the number 967476568 is read.
Let us first separate this number into periods from right to left as follows.

3. S. P. C. 170449



This number is read as nine hundred sixty seven million four hundred seventy six thousand five hundred sixty eight.

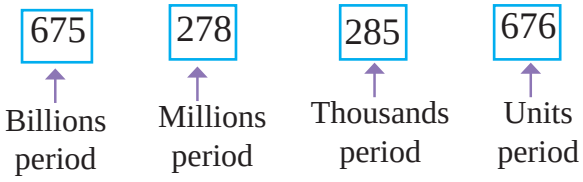
Let us also consider how the number 7686975623 is read. Let us first separate it into periods.



The period which comes after the millions period is named as the **billions period.**

This number is read as seven billion six hundred eighty six million nine hundred seventy five thousand six hundred twenty three.

To find out how the number 675278285676 is read, let us separate it into periods as follows.



This number is read as six hundred seventy five billion two hundred seventy eight million two hundred eighty five thousand six hundred seventy six.

Writing a number in this manner by separating it into groups of three positions, starting from the ones place and moving towards the left,is to represent the number in standard form.

When writing a number in standard form, a small space is left between two periods to separate and identify the periods.

By writing a number in standard form, it can easily be read, and an idea can be obtained about its magnitude.

Note

In some instances, to separate the periods, a comma is written between the periods instead of the small space.

General form	Standard form
2854375	2 854 375
43529644	43 529 644
204007800	204 007 800
8430000000	8 430 000 000

The following table provides several examples of how numbers are read.The way of writing them in words is also the same.

Number	Period			How the number is read /written in words
	Millions	Thousands	Units	
63 276		63	276	Sixty three thousand two hundred seventy six
654 378		654	378	Six hundred fifty four thousand three hundred seventy eight
2 000 375	2	000	375	Two million three hundred seventy five
43 001 000	43	001	000	Forty three million one thousand
204 007 800	204	007	800	Two hundred four million seven thousand eight hundred

The way of reading a number or writing a number in words is known as the **name of the number.**

In most financial documents, the amount is written down in words.

For extra knowledge

Number	Name of the number	Other names used
100 000	Hundred thousand	Lakh
1 000 000	Million	Ten lakhs
10 000 000	Ten million	Crore
100 000 000	Hundred million	Ten crores

Activity 1

(1) Fill in the blanks in the following table.

Number	Name of the number
63 465	.....
71 005	.....
125 368	.....
300 300	.....
2 178 525 348	.....
.....	Three million eight hundred thousand two hundred.
.....	Seven billion two hundred fifty million twenty.
.....	Eight billion eight.

Exercise 2.3

(1) Write down each of the following numbers in standard form.

(i) 72350 (ii) 55000 (iii) 27201125
(iv) 300001279 (v) 299000001 (vi) 21345699

(2) Write down each of the following numbers which have been separated into periods in words.

	Period				The number in words
	Billions	Millions	Thousands	Units	
(i)	10	040	500	000	
(ii)	4	750	050	000	
(iii)	1	010	100	500	
(iv)	75	004	350	050	

(3) Write down each of the following numbers in standard form and then write them in the table separated into periods.

(i) 76735 (ii) 864657 (iii) 2769812
(iv) 47867619 (v) 763156561 (vi) 6746971256
(vii) 2765231

Number	Period				The number in words
	Billions	Millions	Thousands	Units	

(4) Write down each of the following numbers in standard form and write down the name of the number as well.

(i) 50800435000 (ii) 43050800500 (iii) 585000430
(iv) 300001283 (v) 299000003 (vi) 272000023
(vii) 100200030000 (viii) 553000000 (ix) 47000005

(5) Write the following numbers, which have been given in words in standard form.

(i) Four hundred five thousand

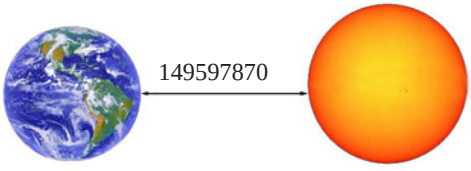
(ii) Three hundred twenty five thousand five hundred

(iii) Four million eight hundred thousand

(iv) Six billion sixty million

(v) Eighteen million twenty four thousand fifty

(6)



The distance between the earth and the sun is 149597870 in kilometers. Write this number in standard form and write it in words too.

(7) A businessman plans to deposit Rs 15006500 in a bank. How does he write this amount in word on a bank slip?

Miscellaneous Exercise

(1) Write down each of the following numbers by expanding in terms of the place value as shown in the example.

Example:

6745 = 6 thousands + 7 hundreds + 4 tens + 5 ones

(i) 24 (ii) 40 (iii) 546 (iv) 7163 (v) 92651

(2) Complete the following table.

	Number	Digit	Place value of the digit	Value represented by the digit
(i)	80 341	3		
(ii)	64 592	9		
(iii)	200 450	2		
(iv)	185 340	8		
(v)	4 500 000	4		

(3) Using each of the digits 8, 6, 5, 3 and 1 exactly once, write down

(i) the largest possible number of four positions and the value represented by 3 in the number.

(ii) the smallest possible number of four positions and the value represented by 3 in the number.

(4) Write the following numbers in standard form and write also how they are read.

(i) 450050 (ii) 37504537 (iii) 212345699

(iv) 8432109640 (v) 2003040050 (vi) 143021000

(5) What is the smallest number that can be written using three different digits, which has the millions period as its last period? Write this number in words too.

(6) What is the greatest number, which has the billions period as its last period? Write this number in words too.

Summary

- The place value corresponding to the position of each digit in a number from right to left is respectively 1, 10, 100, 1000, 10000 etc.
- The value represented by each digit in a number is decided according to the position of the digit in the number.
- It is convenient to read and write a number in words, when that number is written in standard form.

3 Mathematical Operations on Whole Numbers

By studying this lesson, you will be able to,

- add whole numbers,
- subtract a whole number from a larger whole number,
- multiply whole numbers and
- divide a whole number by a whole number.

In this lesson, the operations of addition, subtraction, multiplication and division, which you have learnt earlier will be studied more methodically.

3.1 Adding whole numbers

Numbers such as 0, 1, 2, 3, 4, … are known as **whole numbers.**

First vendor

Second Vendor

The first vendor has 12 balloons and the second vendor has 13 balloons. By counting the balloons, we can find out that the total number of balloons that the two vendors have is 25.

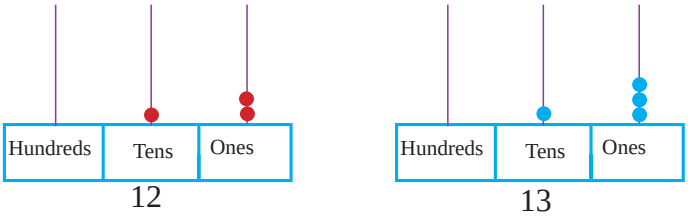
This answer can also be obtained by separately adding the two digits in the ones (units) place together, and the two digits in the tens place together.

$$\begin{array}{r} 12 \\ +\,13 \\ \hline 25 \end{array}$$

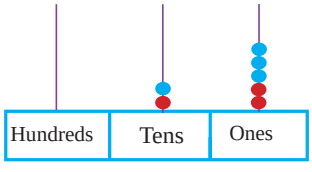
Let us explain this addition using two methods.

(1) Let us add numbers together using counting frames.

Let us represent the numbers 12 and 13 on two counting frames.



Let us place all the counters in the ones place of these two counting frames in the ones place of another counting frame. Let us also place all the counters in the tens place of both counting frames in the tens place of the new counting frame. This is illustrated below.



The number that is represented on this counting frame is 25.
That is, $12 + 13 = 25$

(2) Let us add the two numbers 12 and 13 by considering the value represented by the digit in each place of the numbers.

Number	Value represented by the digit in the tens place	Value represented by the digit in the ones place
12	10	2
13	10	3
Sum	20	5

The value represented by the digit in the tens place of the answer is 20. 20 is 2 tens. That is, the digit in the tens place of the answer is 2.

Similarly, the value represented by the digit in the ones place of the answer is 5. 5 is 5 ones. That is, the digit in the ones place of the answer is 5.

Since the digit in the tens place is 2 and the digit in the ones place is 5, the answer is 25. That is, $12 + 13 = 25$

Next, let us find the sum of the following numbers.

$$\begin{array}{r} 4768 \\ +\,3986 \\ \hline \end{array}$$

Let us explain this addition using the following steps.

Thousands	Hundreds	Tens	Ones
		1	
4	7	6	8
+3	9	8	6
			4
		14	

Step 1 – Let us add the ones.

$8 + 6 = 14$

14 ones is 1 tens and 4 ones.

Let us carry over the 1 tens to the tens column.

Let us write the 4 ones in the ones column.

Thousands	Hundreds	Tens	Ones
	1	1	
4	7	6	8
+3	9	8	6
		5	4
		15	

Step 2 – Let us add the tens.

$1 + 6 + 8 = 15$

15 tens is 150.

There are 1 hundreds and 5 tens here.

Let us carry over the 1 hundreds to the hundreds column.

Let us write the 5 tens in the tens column.

Thousands	Hundreds	Tens	Ones
1	1	1	
4	7	6	8
+3	9	8	6
	7	5	4
	17		

Step 3 – Let us add the hundreds.

$1 + 7 + 9 = 17$

17 hundreds is 1700.

There are 1 thousands and 7 hundreds here.

Let us carry over the 1 thousands to the thousands column.

Let us write the 7 hundreds in the hundreds column.

Thousands	Hundreds	Tens	Ones
1	1	1	
4	7	6	8
+3	9	8	6
8	7	5	4

Step 4 – Let us add the thousands.

$1 + 4 + 3 = 8$

Let us write the 8 thousands in the thousands column.

The answer is 8754.

Example 1

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ } \\ 627 \\ +283 \\ \hline 910 \\ \hline {\scriptstyle 11\ 10} \end{array}$$

Example 2

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ } \\ 1458 \\ +2926 \\ \hline 4384 \\ \hline {\scriptstyle 13\ \ 14} \end{array}$$

Example 3

$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 456 \\ 376 \\ +1208 \\ \hline 2040 \\ \hline {\scriptstyle 10\ 14\ 20} \end{array}$$

Example 4

Simplify 157 + 26

$$\begin{array}{r} {\scriptstyle 1\ \ } \\ 157 \\ +\ 26 \\ \hline 183 \\ \hline {\scriptstyle 13} \end{array}$$

Let us write the numbers one below the other as indicated here, such that the digits in the ones place of the numbers are in one column, the digits in the tens place of the numbers are in one column and the digits in the hundreds place are in one column. Then let us add the numbers together.

Exercise 3.1

(1) Simplify the following.

(i) $34 + 25$ (ii) $52 + 39$ (iii) $67 + 45$ (iv) $126 + 352$ (v) $435 + 348$ (vi) $597 + 398$

(vii) $728 + 469$ (viii) $1438 + 2680$ (ix) $2753 + 489$ (x) $85 + 2946$ (xi) $375 + 689 + 171$ (xii) $89 + 1121 + 107$

(2) Simplify the following.

(i) 27 + 31 (ii) 43 + 29 (iii) 176 + 217 (iv) 352 + 189

(v) 2187 + 1854 (vi) 3095 + 1936 (vii) 84 + 258 (viii) 7 + 195

(ix) 139 + 2875 (x) 1987 + 36 + 171 (xi) 657 + 11 389 + 64 721

(3) There are 486 boys and 658 girls in a certain school. How many students are there in total in this school?

(4) In January, 1846 coconuts were plucked from the coconut trees in a certain estate and in March, another 1384 coconuts were plucked. How many coconuts were plucked in total during the two months?

(5) The number of shoes manufactured by a certain company during the months January, February and March were 1395, 1426 and 1737 respectively. How many shoes were manufactured in total during the three months?

(6) Nimal who is a businessman received an income of Rs 810 on the first day, an income of Rs 985 on the second day and an income of Rs 1130 on the third day. What was his total income during the three days?

(7) If 974 milk bottles were collected at a certain collection centre on Monday, and if 103 more milk bottles were collected on Tuesday than on Monday, then how many bottles of milk were collected in total on the two days?

3.2 Subtracting a smaller whole number from a given whole number

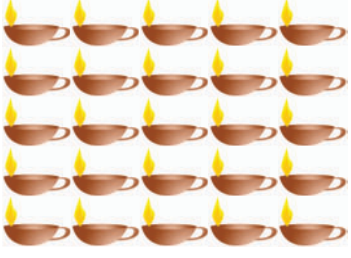


Figure 1

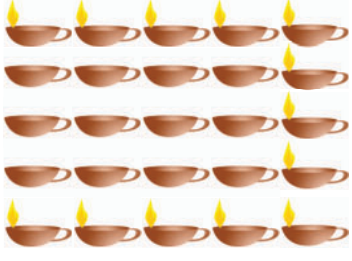


Figure 2

The first figure shows 25 lamps which are lit. The second figure shows the same 25 lamps after 12 lamps had burnt out. By counting them, we can find out that there are 13 lamps which are lit in the second figure.

We can also find the number of lamps which are lit in the second figure by subtracting 12 from 25.

As in the case of addition, in subtraction too, we subtract the digits in the ones place and the digits in the tens place separately.

25
– 12
13

When 2 ones are subtracted from 5 ones, we obtain 3 ones. When 1 tens is subtracted from 2 tens, we obtain 1 tens. Accordingly, there are 1 tens and 3 ones in the answer. That is, the answer is 13.

Example 1

Simplify the following.

(i) 76 − 41 = 35

(ii) 354 − 123 = 231

(iii) 4257 − 2132 = 2125

Now, let us subtract 1896 from 6753.

Let us write the numbers in the following manner so that the digits in each place are in the relevant columns.

Let us explain this subtraction using the following steps.

Thousands	Hundreds	Tens	Ones
6	7	4 5	13 3
– 1	8	9	6
			7

Step 1 – Let us subtract the ones.

- The 3 in the ones place is less than the 6.
- Therefore, let us carry over 1 tens, that is, 10 ones from the 5 tens in the tens place to the ones place.
- Then, there are 13 ones in the ones place.
- Also, there are 4 tens remaining in the tens place.
- When 6 ones are subtracted from 13 ones, there are 7 ones.

Thousands	Hundreds	Tens	Ones
6	6 7	14 4 5	13 3
– 1	8	9	6
		5	7

Step 2 – Let us subtract the tens.

- The 4 remaining in the tens column is less than the 9.
- Therefore, let us carry over 1 hundreds, that is, 10 tens, from the 7 hundreds in the hundreds place to the tens place.
- Then, there are 14 tens in the tens place.
- Also, there are 6 hundreds remaining in the hundreds place.
- When 9 tens are subtracted from 14 tens, there are 5 tens.

Thousands	Hundreds	Tens	Ones
5 6	16 6 7	14 4 5	13 3
- 1	8	9	6
	8	5	7

Step 3 - Let us subtract the hundreds.

- The 6 remaining in the hundreds column is less than the 8.
- Therefore, let us carry over 1 thousands, that is 10 hundreds from the 6 thousands in the thousands place to the hundreds place.
- Then there are 16 hundreds in the hundreds place.
- Also, there are 5 thousands remaining in the thousands place.
- When 8 hundreds are subtracted from the 16 hundreds, there are 8 hundreds.

Thousands	Hundreds	Tens	Ones
5 6	16 6 7	14 4 5	13 3
−1	8	9	6
4	8	5	7

Step 4 - Let us subtract the thousands.

- When 1 thousands is subtracted from the remaining 5 thousands in the thousands place, there are 4t housandsr emaining.

Hence, when 1896 is subtracted from 6753, the answer is 4857.

Exercise 3.2

(1) Simplify the following.

(i) 35 − 23 = ____

(ii) 478 − 153 = ____

(iii) 3975 − 2341 = ____

(iv) 72 − 38 = ____

(v) 576 − 129 = ____

(vi) 352 − 175 = ____

(vii) 814 − 359 = ____

(viii) 506 − 273 = ____

(ix) 602 − 435 = ____

(x) 700 − 354 = ____

(xi) 7481 − 2154 = ____

(xii) 4201 − 1758 = ____

(xiii) 3023 − 1496 = ____

(xiv) 6000 − 2358 = ____

(2) Simplify the following.

(i) 782 − 257 (ii) 524 −175 (iii) 631 − 58

(iv) 246 − 89 (v) 3532 − 785 (vi) 4000 − 356

(3) If Nimal, who took 475 coconuts, was able to sell 297 of them, how many coconuts were remaining?

(4) If there were 192 males in a gathering of 300 people, how many females were there?

(5) In a certain factory, 1450 cars were manufactured in 2013 and 2325 cars were manufactured in 2014. How many more cars were manufactured in 2014 than in 2013?

(6) Heshan received Rs 325 from his father and Rs 430 from his mother. If he bought a pair of slippers for Rs 149, and a book for Rs 225 from this money, how much money was left over?

3.3 Multiplying whole numbers

The figure depicts three groups of 5 guavas each.

There are 15 guavas in total in these three groups.

$5 + 5 + 5 = 15$

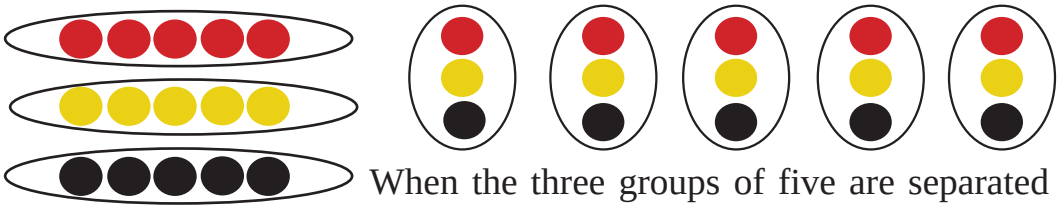
"Three fives" is denoted as a multiplication in the form 5×3,
That is $5 \times 3 = 15$

Similarly, $2 + 2 + 2 + 2 + 2 = 2 \times 5 = 10$ and
$10 + 10 + 10 + 10 = 10 \times 4 = 40$

Let us explain the fact that $5 \times 3 = 3 \times 5$ in the following manner.

Three groups of five is 15.

Let us separate 15 into groups of three each as below.



When the three groups of five are separated into groups of three,we obtain five groups.

That is, $5 \times 3 = 3 \times 5$.

A multiplication table of the whole numbers from 0 up to 9 is given below.

×	0	1	2	(3)	4	5	[6]	7	⟨8⟩	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
(5)	0	5	10	(15)	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
[7]	0	7	14	21	28	35	[42]	49	56	63
8	0	8	16	24	32	40	48	56	64	72
⟨9⟩	0	9	18	27	36	45	54	63	⟨72⟩	81

The multiplication of two whole numbers, which are less than 10 can be performed using the above table.

Clarify it by the following examples.

$5 \times 3 = 15$ (see the sign ○)

$7 \times 6 = 42$ (see the sign ▭)

$9 \times 8 = 72$ (see the sign ⬡)

The product of 34×2 cannot be obtained directly from the above table. Let us find the product in cases.

2 thirty fours is 34 + 34. That is, 68.

This answer can also be obtained in the following manner.

By multiplying the value represented by the digit in the ones place and the value represented by the digit in the tens place separately by 2, the value 68 is obtained.

$$\begin{array}{r} 34 \\ \times\ 2 \\ \hline 68 \end{array}$$

When 4, which is in the ones place of 34 is multiplied by 2, we obtain 8 ones.

When 3, which is in the tens place of 34 is multiplied by 2, we obtain 6 tens.

Accordingly, 8 ones + 6 tens = 8 + 60 = 68

Exercise 3.3

(1) Obtain the following products using the multiplication table given above.

(i) 3×4 (ii) 7×3 (iii) 8×0 (iv) 9×6

(2) Evaluate the following.

(i) 42×3 (ii) 122×4 (iii) 78×7 (iv) 96×9

3.4 Multiplying a whole number by 10, by 100 and by 1000

Let us consider the following products.

2×10 is 10 twos. That is, 2 tens. Its value is 20.
2×100 is 100 twos. That is, 2 hundreds. Its value is 200.
$2 \times 1\,000$ is 1000 twos. That is 2 thousands. Its value is 2000.
12×10 is 10 twelves. That is 12 tens. That is, 10 tens and 2 tens.
Therefore, its value is 100 + 20 = 120.

Accordingly, let us consider the following products.

$2 \times 10 = 20$	$2 \times 100 = 200$	$2 \times 1000 = 2000$
$3 \times 10 = 30$	$3 \times 100 = 300$	$3 \times 1000 = 3000$
$7 \times 10 = 70$	$7 \times 100 = 700$	$7 \times 1000 = 7000$
$12 \times 10 = 120$	$12 \times 100 = 1200$	$12 \times 1000 = 12\,000$
$15 \times 10 = 150$	$15 \times 100 = 1500$	$15 \times 1000 = 15\,000$

4. S. P. C. 170449

By examining the above products, the following facts are discovered.

- The number obtained, when a number is multiplied by 10 can be obtained by placing 1 zero at the right end of the initial number.
- The number obtained, when a number is multiplied by 100 can be obtained by placing 2 zeros at the right end of the initial number.
- The number obtained, when a number is multiplied by 1000 can be obtained by placing 3 zeros at the right end of the initial number.

3.5 Multiplication of whole numbers described further

Let us consider 25×14.

25×14 is 14 twenty fives. This 14 twenty fives can be considered as 10 twenty fives and 4 twenty fives.

10 twenty fives is 250. 4 twenty fives is 100. Therefore, 14 twenty fives is 250 + 100, which is equal to 350.

That is, 25×14 = 10 twenty fives + 4 twenty fives
= 250 + 100 = 350

What has occurred here is, that 25 has been multiplied by the value represented by each digit in 14 and the resulting values have been added together to obtain the answer.

Accordingly, when multiplying 25 by 14, it can be written in the following way too.

$$\begin{array}{rl} 25 & \\ \times\ 14 & \\ \hline 100 & 25 \times 4 = 100 \\ 250 & 25 \times 10 = 250 \\ \hline 350 & \end{array}$$

Example 1

Evaluate 64 × 36.

$$\begin{array}{r} 64 \\ \times\ 36 \\ \hline 384 \\ 1920 \\ \hline 2\,304 \end{array}$$

$64 \times 6 = 384$

$64 \times 30 = 1920$

Example 2

Evaluate 157 × 52.

$$\begin{array}{r} 157 \\ \times\ 52 \\ \hline 314 \\ 7\,850 \\ \hline 8\,164 \end{array}$$

$157 \times 2 = 314$

$157 \times 50 = 7\,850$

Usually, when finding the product of two numbers, the larger number is multiplied by the smaller number.

Exercise 3.4

(1) Fill in the blanks.

(i) 13 × 10 = ... (ii) 72 × 100 = ... (iii) 54 × 1000 =.....

(iv) 39 × 100 = ... (v) 43 × ..... = 430 (vi) 67 × ..... = 6700

(vii) ..... × 100 = 2900 (viii) 2450 × 100 = ...

(ix) 1700× ..... = 17 000 (x) ..... × 1000 = 40 000

(2) Fill in the blanks using suitable values.

(i)
$$\begin{array}{r} 52 \\ \times\ 13 \\ \hline 15\square \\ 5\square 0 \\ \hline 6\square 6 \end{array}$$

(ii)
$$\begin{array}{r} 78 \\ \times\ 24 \\ \hline \square 1\square \\ 15\square 0 \\ \hline 1\square 7\square \end{array}$$

(iii)
$$\begin{array}{r} 136 \\ \times\ 32 \\ \hline 2\square\square \\ \square\square 8\square \\ \hline 4\square\square 2 \end{array}$$

(3) Simplify the following.

(i) 64×21 (ii) 59×63 (iii) 76×54 (iv) 82×45 (v) 125×32 (vi) 248×70

(vii) 348 × 25 (viii) 515 × 36 (ix) 47 × 805 (x) 2015 × 36

(xi) 5115 × 29 (xii) 3042 × 42 (xiii) 4004 × 73 (xiv)86 × 6029

(4) In a certain hall, there are 35 rows containing 57 chairs each. How many chairs are there in total in the hall?

(5) The price of a bag of rice is Rs 1225. What is the price of 75 such bags of rice?

(6) The number of students who can travel in a school bus is 55. How many students can travel in 6 such buses?

(7) A school student needs 8 exercise books. The price of an exercise book is Rs 48. The number of students in a certain class is 35. How much money in total is required to buy the exercise books needed for all 35 students?

3.6 Dividing a whole number by another whole number

The figures show the number of olives, two friends named Rasika and Sameera received, when 10 olives were divided equally between the two.

Total number of olives is 10.

The number of olives that Sameera received is five.

The number of olives that Rasika received is five.

Rasika and Sameera each received 5 olives.

We describe how the olives were divided between the two of them as "10 divided by 2".

This is written as $10 \div 2$.

Accordingly, $10 \div 2 = 5$.

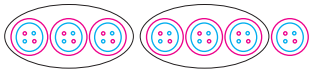
This can be clarified in the following manner too.

There are 2 groups of five in 10. That is, $10 = 5 \times 2$. Therefore, a group has 5, when 10 is divided into two equal groups.

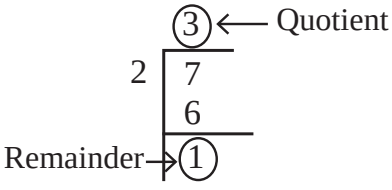
That is, $10 \div 2 = 5$.

Now, let us divide 7 buttons equally between two friends.

In this case, each child would receive three buttons and there will be one button remaining.



That is, $7 \div 2$ is 3 with 1 remaining.
How we obtain $7 \div 2$, using the long division method is shown below.



7 consists of at most 3 twos and $3 \times 2 = 6$. When 7 is divided by 2 we obtain 3, with a remainder of 1.

3.7 Dividing a whole number by 10, by 100 and by 1000

Let us consider the following divisions.

$20 \div 10$ means, "how many tens are there in 20?".
$200 \div 100$ means, "how many hundreds are there in 200?".
$2000 \div 1000$ means "how many thousands are there in 2000?".

Let us consider the following divisions accordingly.
Let us find the value of $20 \div 10$.
Since, $2 \times 10 = 20$, we obtain $20 \div 10 = 2$.
Similarly, we have

$30 \div 10 = 3$	$200 \div 100 = 2$	$300 \div 100 = 3$
$400 \div 10 = 40$	$700 \div 100 = 7$	$2000 \div 1000 = 2$
$3000 \div 1000 = 3$	$7000 \div 1000 = 7$	$520 \div 10 = 52$
$15000 \div 100 = 150$		

By observing the above divisions, the following facts are discovered.

- When a number, which has a zero at the right end is divided by 10, the answer is obtained by removing that 0.
- When a number, with 2 zeros at the right end is divided by 100, the answer is obtained by removing these 2 zeros.
- When a number, with 3 zeros at the right end is divided by 1000, the answer is obtained by removing these 3 zeros.

Note

When any number is multiplied by zero, the answer is zero.

$2 \times 0 = 0$
$28 \times 0 = 0$
$412 \times 0 = 0$

When zero is divided by any number other than zero, the answer is zero.

$0 \div 2 = 0$
$0 \div 13 = 0$
$0 \div 971 = 0$

- But, no number can be divided by zero.

3.8 The division of whole numbers described further

Let us find the value of $75 \div 5$ using the long division method.

$$\begin{array}{r} 1 \\ 5\overline{)75} \\ 5 \\ \hline 2 \end{array} \quad 1 \times 5 = 5$$

Step 1 – The digit in the tens place of 75 is 7.That is, there are 7 tens.
When 7 is divided by 5, we obtain 1 with a remainder of 2.
That is, there is a remainder of 2 tens.

$$\begin{array}{r} 1 \\ 5\overline{)75} \\ 5\downarrow \\ \hline 25 \end{array}$$

Step 2 – Let us add the remaining 2 tens to the 5 ones. Then there are 25 ones.

$$\begin{array}{r} 15 \\ 5\overline{)75} \\ 5\downarrow \\ \hline 25 \\ 25 \\ \hline 0 \end{array} \quad 5 \times 5 = 25$$

Step 3 – Let us divide the 25 ones by 5. Then we obtain 5 ones.
That is, the value of $75 \div 5$ is 15.

Next, Let us find the value of $20 \div 5$.

We know that this is denoted by either $5\overline{)20}$ or $5\overline{)20}$.

$$\begin{array}{r} 4 \\ 5\overline{)20} \\ \hline 0 \end{array} \quad \text{or} \quad \begin{array}{r} 4 \\ 5\overline{)20} \\ 20 \\ \hline 0 \end{array}$$

Now, let us divide a number by a number with two digits.
Let us consider the division of 38 by 12.

$$\begin{array}{r|l} & 3 \\ 12 & 38 \\ & 36 \\ \hline & 2 \end{array}$$

There are no twelves in 3. Therefore, let us find how many twelves are there in 38. There are 3 twelves in 38 with 2 remaining.

Accordingly, when 38 is divided by 12, we obtain 3 with 2 remaining.

Example 1

Simplify the following.

(i) $470 \div 10$

$$\begin{array}{r|l} & 47 \\ 10 & 470 \\ & 40 \quad 10 \times 4 = 40 \\ & 70 \\ & 70 \quad 10 \times 7 = 70 \\ & 0 \end{array}$$

$470 \div 10 = 47$

(ii) $253 \div 11$

$$\begin{array}{r|l} & 23 \\ 11 & 253 \\ & 22 \quad 11 \times 2 = 22 \\ & 33 \\ & 33 \quad 11 \times 3 = 33 \\ & 0 \end{array}$$

$253 \div 11 = 23$

(iii) $419 \div 13$

$$\begin{array}{r|l} & 32 \\ 13 & 419 \\ & 39 \quad 13 \times 3 = 39 \\ & 29 \\ & 26 \quad 13 \times 2 = 26 \\ & 3 \end{array}$$

$419 \div 13 = 32$ with a remainder of 3

Exercise 3.5

(1) Fill in the blanks.

(i) $40 \div 10$ = ... (ii) $720 \div 10$ = ...
(iii) $600 \div 100$ = ... (iv) $1300 \div 100$ = ...
(v) $5000 \div 1000$ = ... (vi) $12\,800 \div 10$ = ...
(vii) $19\,000 \div 1000$ = ... (viii) $8300 \div$ ..... = 83
(ix) $24\,380 \div 10$ = ... (x) $31\,000 \div$ ..... = 3 100

(2) Simplify using the long division method.

(i) $525 \div 7$ (ii) $240 \div 9$ (iii) $416 \div 13$ (iv) $625 \div 25$
(v) $448 \div 14$ (vi) $2244 \div 17$ (vii) $2772 \div 21$ (viii) $1980 \div 15$
(ix) $3696 \div 24$ (x) $2052 \div 19$

(3) The van fare was Rs 10 800 for a journey made by 16 people. If this cost was met equally by fifteen of them, how much did each pay?

(4) If 6480 chairs are to be distributed equally among 20 schools, how many chairs will each school get?

(5) If the cakes of soap in 12 boxes, each containing 25 cakes of soap, are divided equally among 15 employees, how many cakes of soap will each employee get?

Miscellaneous Exercise

(1) The number of people who visited an art exhibition on the first three days of the exhibition was respectively 1320, 1567 and 1624. How many people in total visited the art exhibition on these three days?

(2) A factory produced 3788 yoghurts during the first week and 4124 yoghurts during the second week. How many more yoghurts were produced in the second week than in the first week?

(3) There are 10 identical book racks in a library. Each book rack contains 5 shelves. 30 books are placed on each of these shelves. How many books are there in total in the library in these 10 book racks?

(4) A man needs to plant 152 coconut plants. However, he is able to plant only 8 per day. How many days will he require to plant all 152 of them?

(5) It is required to bring 740 cement bags to a cement sales centre. The maximum number of cement bags that can be transported in a vehicle is 24. Find the number of trips the vehicle needs to make to bring all the cement bags to the centre.

Summary

- When adding and subtracting whole numbers, the relevant mathematical operation should be performed separately in relation to the different places, namely ones place, tens place etc.,
- The following steps are carried out in multiplying two whole numbers.
  - Obtain the value represented by each digit in one number.
  - Multiply the other number by each of these values.
  - Obtain the final answer by adding all these products.
- The long division method can be used to divide a whole number by another whole number.

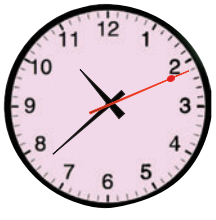
4 Time

By studying this lesson, you will be able to,

- identify the units of measuring time,
- identify the relationships between different units of measuring time,
- find the time taken for an activity,
- express the time in terms of the 24 hour clock and
- write the date in standard form.

4.1 Reading the time on a 12 hour clock accurately

Find a clock similar to the one shown in the figure, which shows the correct time and observe it carefully.



- In this clock, the circular edge has been divided into 60 equal parts by short line segments.
- The numbers from 1 up to 12 have been marked on the face of the clock, such that there are five equal parts between any two adjacent numbers.
- From the three hands which are fixed at the centre, the shortest hand is the hour hand. The narrow hand in red is the seconds hand, and the remaining hand is the minute hand.
- The three hands rotate in the direction in which the numbers on the face are increasing.
- The time it takes for the pointed end of the hour hand to move from one number to the next is one hour.
- The time it takes for the pointed end of the minute hand to move from one short line segment to the next is one minute.
- The time it takes for the pointed end of the seconds hand to move from one short line segment to the next is one second.
- During an hour, the minute hand rotates one round.

1 hour = 60 minutes

- During one minute the seconds hand rotates one round.

1 minute = 60 seconds

- When the time is being read, the hour is taken to be the number which the hour hand is pointing towards or has last passed.
- The number of minutes and the number of seconds is taken to be the number of line segments each hand has last passed or is pointing towards.

Let us read the time denoted by the clock in the figure.

Since the hour hand lies between the numbers 10 and 11, the number that the hour hand has last passed is 10.

The minute hand lies between the 25th and 26th line segments. Hence, the line segment that the minute hand has last passed is 25. The seconds hand is pointing towards the 13th line segment.

Therefore, the time is read as 25 minutes and 13 seconds past 10. This is written as 10.25.13. Sometimes, the number of seconds is not indicated. In such a case, the time is expressed as 10.25.

Exercise 4.1

(1) Write down the time denoted by each of the following clock faces, in terms of hours, minutes and seconds.

(i)

(ii)

(iii)

(iv)

- **Identifying the periods a.m. (ante meridiem) and p.m. (post meridiem)**

The time according to both the above clocks is 7.00.

- One clock shows the time a child goes to school as 7.00 in the morning.
- The other clock shows the time a child is studying as 7.00 in the evening.

Accordingly, since the clock shows the same time at two different instances of the day, how the time is indicated precisely is described below.

* When all three hands of a clock point at 12 during the day time, the time is **12 noon.**
* When all three hands of a clock point at 12 during the night time, the time is **12 midnight.**
* The 12 hour time period between 12 midnight and 12 noon is known as **“ante meridiem”** (before midday).
* The 12 hour time period between 12 noon and 12 midnight is known as **“post meridiem”** (after midday).
* The period of time from 12 midnight of one day to 12 midnight of the next is called a **day.**

The hour hand completes two rounds of the clock during a day.

That is, one day = 2 periods = 24 hours

Accordingly, in the above example,

7.00 in the morning is denoted by 7.00 a.m.
(ante meridiem is written in short as a.m.)

7.00 in the evening is denoted by 7.00 p.m.
(post meridiem is written in short as p.m.)

4.2 Reading the time on a 24 hour clock

The figure depicts a 24 hour clock. The numbers from 1 up to 12 have been marked around the outer edge, and the numbers 13 up to 24 have been marked on an inner circle.

The ante meridiem time is read by considering the numbers from 1 to 12 and the post meridiem time is read by considering the number from 13 upto 24. The day starts at midnight. This time is denoted by 00:00.

Also, the day ends at midnight.This time is denoted by 24 :00.

The time, 30 minutes past the starting time of the day is denoted as 00:30.

10.30 a.m. is expressed as 10:30.
12 noon is expressed as 12:00.
1.00 p.m. is expressed as 13:00.
6.00 p.m. is expressed as 18:00.

The time is written in international standard form as follows.

Hours : Minutes : Seconds
hh : mm : ss

In this form, the hours, minutes and seconds have all to be expressed using two digits. When the number of seconds is not required, the time is expressed in hours and minutes.
For example, 3 minutes and 48 seconds past 1 in the afternoon written in international standard form is 13:03:48.

The following table shows how different times within the same day are written in international standard form.

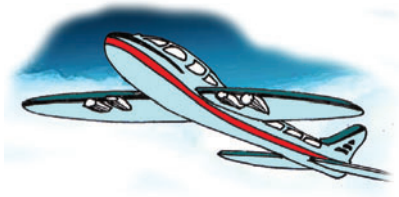
Time according to the 12 hour clock	Time according to the standard form
1.00 a.m.	01:00
2.00 a.m.	02:00
3.00 a.m.	03:00
4.00 a.m.	04:00
5.00 a.m.	05:00
6.00 a.m.	06:00
7.00 a.m.	07:00
8.00 a.m.	08:00
9.00 a.m.	09:00
10.00 a.m.	10:00
11.00 a.m.	11:00
12.00 noon	12:00
1.00 p.m.	13:00
2.00 p.m.	14:00
3.00 p.m.	15:00
4.00 p.m.	16:00
5.00 p.m.	17:00
6.00 p.m.	18:00
7.00 p.m.	19:00
8.00 p.m.	20:00
9.00 p.m.	21:00
10.00 p.m.	22:00
11.00 p.m.	23:00
12.00 midnight	24:00

Example 1

Write 2.35 p.m. in international standard form.
The answer is 14 :35.

Exercise 4.2

(1) The following table provides information on the time of departure of several flights, flying out from the Bandaranaike International Airport. Copy the table and fill in the blanks.



Destination	Time of departure	
	Time according to the 12 hour clock	Standard form
Kuala Lumpur	7.05 a.m	.....
Trivandrum	.....	08:25
Singapore	7.10 p.m.	.....
New Delhi	.....	19:15
Chennai	10.30 a.m.	.....
Karachi	.....	19:55
Dubai	6.45 p.m.	.....
Paris	.....	08:00
London	11.10 a.m.	.....
Bangkok	.....	20:30
Maldives	1.25 p.m.	.....

(2) Re-write the following sentences expressing the given time in international standard form.

(i) The train "Udarata Menike" which leaves the Fort station at 10.30 a.m. is expected to reach Badulla at 5.40 p.m.

(ii) The prize giving, which commences at 11.00 a.m. is expected to conclude at 2.30 p.m.

(iii) The mathematics test, which commences at 11.30 a.m. will end at 1.30 p.m.

(3) Express the times given in the following table in terms of the 12 hour clock .

	Time in standard form	Time according to the 12 hour clock
Time the train commenced its journey	08:32	.....
The time the post office opens	08:00	.....
The time the hearth fire is lit	20:18	.....
The time period during which patients are seen	08:00 - 16:00	.....
The time period during which there is a power cut	11:30 - 15:45	.....

4.3 Representing the date in standard form

When writing the date in standard form,

- first the year, then the month and finally the day should be written.
- four digits should be used to represent the year, two digits to represent the month and two digits to represent the day.

The 8th of April, 2015 is represented in international standard form as 2015 - 04 - 08.

The time the day 2015 - 05 - 08 ends at 12 midnight is represented by 2015 - 05 - 08 24:00. This time can also be written as 2015 - 05 - 09 00:00.

4.4 Relationships between units of measuring time

Seconds, minutes, hours and days are several units that are used to measure time. Now, let us consider the relationships between these units.

- **Representing time given in minutes, in terms of seconds**

Since 1 minute = 60 seconds,
2 minutes = 120 seconds and
3 minutes = 180 seconds.

That is, to represent the time given in minutes, in terms of seconds, the given number of minutes needs to be multiplied by 60.

Example 1

Express 8 minutes in seconds.

1 minute = 60 seconds
8 minutes = 60 × 8 seconds
= 480 seconds

Exercise 4.3

(1) Express each of the following times given in minutes, in terms of seconds.

(i) 1 minute (ii) 6 minutes (iii) 30 minutes
(iv) 20 minutes (v) 38 minutes (vi) 48 minutes

- **Representing time given in seconds, in terms of minutes**

Since 60 seconds = 1 minute,
120 seconds = 2 minutes and
180 seconds = 3 minutes.

That is, to represent time given in seconds, in terms of minutes, the given number of seconds needs to be divided by 60.

Example 1

Express 360 seconds in minutes.

60 seconds = 1 minute
360 seconds = 360 ÷ 60 minutes
= 6 minutes

Example 2

Express 150 seconds in minutes and seconds.
60 seconds = 1 minute
150 seconds = 120 seconds + 30 seconds
Since 120 seconds = 2 minutes,
150 seconds = 2 minutes and 30 seconds

Exercise 4.4

(1) Express each of the following times given in seconds, in terms of minutes.

(i) 60 seconds (ii) 120 seconds (iii) 240 seconds
(iv) 300 seconds (v) 1200 seconds (vi) 3600 seconds

(2) Express each of the following times given in seconds, in terms of minutes and seconds.

(i) 75 seconds (ii) 100 seconds (iii) 150 seconds
(iv) 200 seconds (v) 250 seconds (vi) 325 seconds

• Representing time given in hours, in terms of minutes

Since 1 hour = 60 minutes,
2 hours = 120 minutes and
3 hours = 180 minutes.

That is, to represent time given in hours, in terms of minutes, the given number of hours needs to be multiplied by 60.

Example 1

Express 8 hours in minutes.

1 hour = 60 minutes
8 hours = 60 × 8 minutes
= 480 minutes

Exercise 4.5

(1) The conversions done to find the number of seconds in one hour are given below. Write down the numbers suitable for the blank boxes.

1 hour = ☐ minutes = ☐ seconds

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(2) Express each of the following times given in hours, in terms of minutes.

(i) 1 hour (ii) 2 hours (iii) 3 hours
(iv) 5 hours (v) 12 hours (vi) 24 hours

• Representing time given in minutes, in terms of hours

Since 60 minutes = 1 hour,
120 minutes = 2 hours and
180 minutes = 3 hours.

That is, to represent time given in minutes, in terms of hours, the given number of minutes needs to be divided by 60.

Example 1

Express 720 minutes in hours.

60 minutes = 1 hour

720 minutes = 720 ÷ 60 hours

= 12 hours

Example 2

Express 200 minutes in hours and minutes.

60 minutes = 1 hour

200 minutes = 180 minutes + 20 minutes

= 3 hours and 20 minutes

Exercise 4.6

(1) Express each of the following times given in minutes, in terms of hours.

(i) 60 minutes (ii) 180 minutes (iii) 540 minutes
(iv) 300 minutes (v) 360 minutes (vi) 600 minutes

(2) Express each of the following times given in minutes, in terms of hours and minutes.

(i) 90 minutes (ii) 100 minutes (iii) 115 minutes
(iv) 150 minutes (v) 245 minutes (vi) 320 minutes

• Relationship between days and hours

Since 1 day = 24 hours,
2 days = 48 hours and
3 days = 72 hours.

That is, to represent a certain number of days in hours, the given number of days needs to be multiplied by 24.

Similarly, 24 hours = 1 day
48 hours = 2 days
72 hours = 3 days

That is, to represent a time given in hours, in terms of days, the given number of hours needs to be divided by 24.

Example 1

Express 4 days in terms of hours.

1 day = 24 hours
4 days = 24 × 4 hours
= 96 hours

Example 2

Express 144 hours in terms of days.

24 hours = 1 day
144 hours = 144 ÷ 24 days
= 6 days

Example 3

Express 37 hours in days and hours.

24 hours = 1 day
37 hours = 24 hours + 13 hours
= 1 day and 13 hours

Exercise 4.7

(1) Express each of the following times in hours.

(i) 1 day (ii) 2 days (iii) 3 days
(iv) 5 days (v) 8 days (vi) 30 days

(2) Express the following times in days.

(i) 24 hours (ii) 48 hours (iii) 96 hours
(iv) 120 hours (v) 240 hours (vi) 360 hours

(3) Express the following times in days and hours.

(i) 34 hours (ii) 58 hours (iii) 80 hours
(iv) 130 hours (v) 255 hours (vi) 400 hours

(4) The conversion steps carried out by a certain student to obtain the number of seconds in a day is given below.

1 day = ☐ hours = ☐ minutes = ☐ seconds

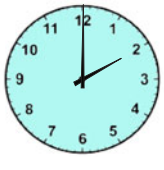
Find the number suitable for each box.

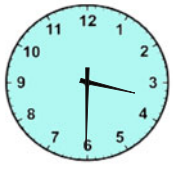
(5) Join the pairs that express the same time.

110 seconds	4 days
75 minutes	3 minutes
180 seconds	5 days
180 minutes	72 hours
4 hours	3 hours
120 hours	1 minute 50 seconds
3 days	1 hour 15 minutes
96 hours	240 minutes

4.5 Elapsed time

Now, let us find the elapsed time by considering two times.





Sumith's mother left home at 2.00 p.m. to visit the market. She returned home at 3.30 p.m. Let us find the time that has elapsed from the moment she left her home until she returned from the market.

Method 1

The time period between 2.00 p.m. and 3.00 p.m. is 1 hour.
The time period between 3.00 p.m. and 3.30 p.m. is 30 minutes.
Therefore, the time that has elapsed is 1 hour and 30 minutes.

- Elapsed time corresponding to an incident which has occured during a period (a.m. or p.m.) can be found easily as follows.

Method 2

Time his mother returned home = 3.30 p.m.
Time his mother left home = 2.00 p.m.

To find the time that has elapsed, the difference between the time she returned and the time she left has to be found.

	Hours	Minutes
	3	30
–	2	00
	1	30

Accordingly, the time that elapsed between the time Sumith's mother left home and the time she returned is 1 hour and 30 minutes.

To find the elapsed time of a task or an event, the difference between the time it started and the time it ended needs to be found.

Example 1

To prepare for the term test, Samith's sister studied from 7.30 p.m. to 10.15 p.m. yesterday. Find the time his sister spent studying.

Time she finished studying = 10.15 p.m.
Time she started studying = 7.30 p.m.

Here both the times are in p.m.

To find the time she spent studying, let us find the difference between the time she started studying and the time she finished studying.

Hours	Minutes
10	15
– 7	30
2	45

- Since 30 minutes cannot be subtracted from 15 minutes, let us carry 1 hour, that is 60 minutes, from the 10 hours in the hours column to the minutes column.
- Then, number of minutes = 15 + 60 minutes = 75 minutes.
- Now, let us subtract 30 minutes from 75 minutes. Then we obtain 45 minutes.
- Now, let us subtract 7 hours from the remaining 9 hours in the hours column. Then we obtain 2 hours.
- Therefore, the answer is 2 hours and 45 minutes.

Example 2

A school prize giving started at 9.30 a.m. and ended at 1.45 p.m. Find the duration of the event.

Since the starting time is ante meridiem and the ending time is post meridiem, to find the duration, let us write the time according to the 24 - hour clock.

Starting time = 09:30
Ending time = 13:45
Duration = 13:45 – 09:30
= 4 hours and 15 minutes

In problems related to elapsed time (or duration), corresponding to incidents which have occured during the same day, it is convenient to solve the problem by writing the time, according to the 24 - hour clock.

Exercise 4.8

(1) The way Sameera spent his time from 3.00 p.m. to 7.00 p.m. is given below. The clocks indicate the starting time and ending time of each activity he was involved in. Find the time in minutes that he spent on each activity by considering the times indicated by the clocks.

(i)

The time Sameera spent playing = …… minutes

(ii)

Time it took Sameera to have a bath = …… minutes

(iii)

Time Sameera spent helping his mother = …… minutes

(iv)

Time Sameera spent watching TV = …… minutes

(v)

Time Sameera spent studying = …… minutes

(2) Copy the following table and complete it.

Event	Starting Time	Ending Time	Elapsed Time
First period in school	7.30 a.m.	8.10 a.m.	.....
School interval	10.45 a.m.	11.00 a.m.	.....
Listening to the radio	5.25 a.m.	6.05 a.m.	.....
Exercising	6.10 a.m.	6.25 a.m.	.....
Going to school	6.10 a.m.	.....	35 minutes 30 seconds
Cleaning the house	10.30 a.m.	.....	2 hours 25 minutes
Watching TV	8.30 p.m.	.....	28 minutes 15 seconds

(3) There are two routes from Kurunegala to Anuradhapura.

(i) A bus which left Kurunegala at 5.10 a.m. reached Anuradhapura at 7.55 a.m. passing through Ambanpola. Find the time this journey took.

(ii) A bus which left Kurunegala at 5.45 a.m. reached Anuradhapura at 8.20 a.m. passing through Dambulla. Find the time this journey took.

(iii) Via which of the above routes will a person reach Anuradhapura in less time?

(4) The agenda of a prize giving is given below.

8.30 a.m.	–	Guests enter the hall in a procession accompanied by a perahera.
8.40 a.m.	–	Lighting of the traditional oil lamp
8.45 a.m.	–	Welcome song
8.50 a.m.	–	Welcome speech (Principal)
9.05 a.m.	–	Prize distribution - Primary section
9.35 a.m.	–	Chief Guest's speech
9.50 a.m.	–	Prize distribution - Secondary section
10.25 a.m.	–	Drama
10.45 a.m.	–	Prize Distribution - To those selected to the university
11.00 a.m.	–	Vote of Thanks
11.10 a.m.	–	National Anthem and the end of the event

Find the time allocated for each of the following.

(i) Welcome speech (ii) Chief Guest's speech

(iii) Prize distribution - Primary section (iv) Drama

(v) Prize distribution - Secondary section

4.6 Addition of time described further

A bus takes 1 hour and 30 minutes to travel from Matara to Galle and 3 hours and 20 minutes to travel from Galle to Colombo. Let us find the total time it takes for the bus to travel from Matara to Colombo.

Time taken to travel from Matara to Galle = 1 hour and 30 minutes
Time taken to travel from Galle to Colombo = 3 hours and 20 minutes

Let us add these two times to find the total time taken for the journey.

Hours	Minutes
1	30
+ 3	20
4	50

Example 1

Hours	Minutes
$^{1}3$	50
+ 4	40
8	30

Let us add the minutes in the minutes column.

50 minutes + 40 minutes = 90 minutes

90 minutes = 1 hour and 30 minutes

Let us write the 30 minutes in the minutes column.

Let us carry the 1 hour to the hours column and add the hours in that column. 1 + 3 + 4 = 8. That is, 8 hours.

The answer is 8 hours and 30 minutes.

Example 2

Minutes	Seconds
3	20
+ 2	30
5	50

Example 3

Days	Hours
2	10
+ 1	12
3	22

Example 4

Minutes	Seconds
3	45
+ 5	30
9	15

Let us add the seconds in the seconds column.

45 seconds + 30 seconds = 75 seconds

75 seconds = 60 seconds + 15 seconds

Since, 60 seconds = 1 minute,

75 seconds = 1 minute + 15 seconds

Let us write the 15 seconds in the seconds column.

Let us carry the 1 minute to the minutes column and add the minutes in that column.

1 + 3 + 5 = 9. That is, 9 minutes.

The answer is 9 minutes and 15 seconds.

Example 5

Days	Hours
2	20
+ 3	15
6	11

Let us add the hours in the hours column.

20 hours + 15 hours = 35 hours

35 hours = 24 hours + 11 hours

Since 24 hours = 1 day,

35 hours = 1 day + 11 hours

Let us write the 11 hours in the hours column.

Let us carry the 1 day to the days column and add the days in that column.

1 + 2 + 3 = 6. That is, 6 days.

The answer is 6 days and 11 hours.

Exercise 4.9

(1)

Minutes	Seconds
2	15
+ 3	20

(2)

Minutes	Seconds
4	10
+ 2	30

(3)

Minutes	Seconds
3	10
+ 4	50

(4)

Minutes	Seconds
3	25
+ 2	50

(5)

Minutes	Seconds
4	20
+ 3	45

(6)

Hours	Minutes
1	15
+ 2	30

(7)

Hours	Minutes
3	15
+ 4	45

(8)

Hours	Minutes
4	10
+ 3	50

(9)

Hours	Minutes
3	45
+ 2	25

(10)

Days	Hours
10	10
+ 2	8

(11)

Days	Hours
10	12
+ 2	12

(12)

Days	Hours
8	15
+ 3	20

(13) The timings of 4 athletes who participated in a 4 × 400 metres relay are given below.

		Minutes	Seconds
Timing of the first athlete	=	1	08
Timing of the second athlete	=	1	02
Timing of the third athlete	=	0	52
Timing of the fourth athlete	=	0	48

Find the total time taken by the four athletes to complete the relay.

(14) Time allocated for the Mathematics I question paper = 45 minutes

Interval = 15 minutes

Time allocated for the Mathematics II question paper = 2 hours 30 minutes

If the Mathematics I paper starts at 8.00 a.m., at what time does the Mathematics II paper end?

(15) A man travelled a part of a journey by bus. The bus journey lasted 1 hour and 45 minutes. He walked the remaining part of the journey in 35 minutes. Find the total time the man spent on this journey.

4.7 Subtraction of time described further

Example 1

Minutes	Seconds
4	30
− 2	15
2	15

Example 2

Hours	Minutes
5	35
− 2	25
3	10

Example 3

Minutes	Seconds
3	15
– 1	40
1	35

40 seconds cannot be subtracted from 15 seconds. Let us carry 1 minute from the 3 minutes in the minutes column, that is 60 seconds, to the seconds column.
Then, 60 seconds + 15 seconds = 75 seconds
75 seconds – 40 seconds = 35 seconds
Let us write the 35 seconds in the seconds column.
When 1 minute is subtracted from the remaining 2 minutes in the minutes column, we obtain 1 minute.
The answer is 1 minute and 35 seconds.

Example 4

Hours	Minutes
4	15
– 1	45
2	30

45 minutes cannot be subtracted from 15 minutes. Let us carry 1 hour, that is 60 minutes, from the 4 hours in the hours column to the minutes column.
60 minutes + 15 minutes = 75 minutes
75 minutes – 45 minutes = 30 minutes
Let us write the 30 minutes in the minutes column.
Now, when 1 hour is subtracted from the remaining 3 hours in the hours column, we obtain 2 hours.
The answer is 2 hours and 30 minutes.

Exercise 4.10

(1)

Minutes	Seconds
5	40
– 3	10

(2)

Minutes	Seconds
20	55
– 10	45

(3)

Minutes	Seconds
10	30
– 5	50

(4) It took Nimal 25 minutes and 30 seconds to return home from school on his bicycle. If he stopped at a shop for 3 minutes and 45 seconds on his way, how much time did he spend cycling?

(5) 12 minutes and 40 seconds have been allocated for advertisements to be run during a TV programme which is telecasted from 7.00 p.m. to 7.30 p.m.. During this period, for how much time is the programme shown?

(6)

Hours	Minutes
5	35
– 2	25

(7)

Hours	Minutes
6	12
– 3	20

(8)

Hours	Minutes
12	18
– 10	20

(9) An express train took 2 hours and 40 minutes to travel from Matara to Colombo. A bus which left Matara at the same time took 3 hours and 20 minutes to reach Colombo.

(i) How much time would a commuter save travelling by train instead of by bus?

(ii) At what times would the train and the bus reach Colombo if they both left Matara at 9.45 a.m.?

Miscellaneous Exercise

(1) The timing of an athlete who won a track event was 3 minutes and 52 seconds. The timing of the athlete in second position was 4 minutes and 15 seconds. How many seconds after the athlete who came first did the athlete who came second complete the race?

(2) The time of departure and the time of arrival of flights between cities in different countries is given in the following table according to the time in Sri Lanka. Find the flight time for each case.

Cities	Time of departure	Time of arrival	Flight time
Colombo - Chennai	15:00	16:10	.....
Dubai - Colombo	19:25	23:25	.....
Colombo - Bangkok	19:20	21:50	.....
Male - Colombo	01:45	02:35	.....

(3) The time taken by a bus which started its journey from Galle at 10.45 a.m. and travelled to Maharagama along the expressway is 1 hour and 22 minutes. A bus which left Galle at the same time and travelled along the normal road took 54 minutes longer to reach Maharagama than the bus which travelled along the expressway. At what time would a commuter who came on the bus which travelled along the normal road have reached Maharagama?

Summary

- The 24 - hour clock time is written in international standard form as follows.

  Hours : minutes : seconds
  hh : mm : ss

  Here, the number of hours, minutes and seconds is expressed using two digits

- The date is written in international form as follows.

  year – month – day
  yyyy - mm - dd

  Here, the year is represented using four digits while the month and the day are represented using 2 digits each.

- Seconds, minutes, hours and days are several units used to measure time. The following are relationships between these units.

  60 seconds = 1 minute
  60 minutes = 1 hour
  24 hours = 1 day

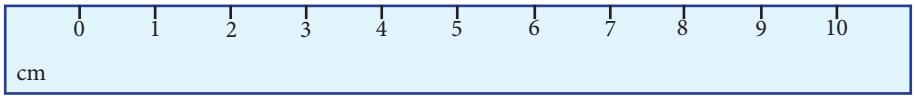
5 Number Line

By studying this lesson, you will be able to,

- identify the number line,
- identify negative numbers,
- identify integers,
- represent integers on a number line and
- compare integers.

5.1 Marking whole numbers on a number line

Some of the instruments that we use when we perform various tasks are marked with numbers. A ruler which has been calibrated as mentioned is shown below.



Observe whether there are similarities between the ruler depicted above and the ruler in your instrument box.

Several properties which are similar that were obtained through such an observation are given below.

(i) The measuring edge of a ruler is made straight.

(ii) The whole numbers 0, 1, 2, 3, … have been marked on it with equal gaps between the numbers, starting from 0 and gradually increasing in value.

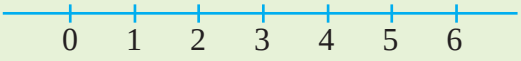
Such calibrations can also be observed in a spring balance used to measure weights and a measuring cylinder used to measure liquid amounts.

Activity 1

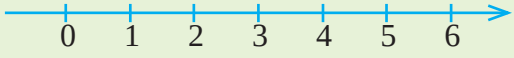
Step 1 - Draw a line using a ruler as shown in the figure.

Step 2 - Mark several points on the line, leaving equal gaps between the points .

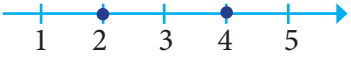
Step 3 - Name the points as 0, 1, 2, 3, 4.... etc., starting from the leftmost point and gradually increasing in value towards the right.



Step 4 - Draw an arrowhead at the right end of the line.



- A line such as this, which is used to represent numbers is called a **number line.**
- An arrowhead is drawn at the right end of the number line.
- The values of the numbers on a number line increase gradually towards the right.
- The difference between two numbers which are next to each other on the above number line is 1. Two such whole numbers, where the difference between them is 1, are called consecutive whole numbers.
- The quantitative information of certain things can be represented on a number line.
- A number is marked on a number line by placing a dot as shown below.

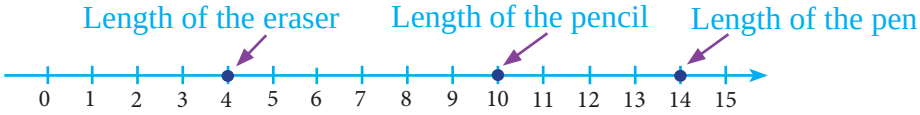


The numbers 2 and 4 have been marked on the above number line.

6. S. P. C. 170449

Let us consider an instance of using the number line to represent quantitative information.

A grade 6 student knows that the lengths of his eraser, pencil and pen are 4 cm, 10 cm and 14 cm respectively. When these three numerical values are marked on a number line, it is as follows.



Accordingly , it is clear that the following statements are true.

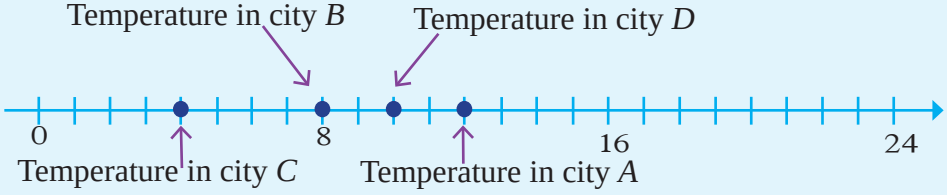
(i) The length of the pen is greater than the length of the pencil.
(ii) The length of the eraser is less than the length of the pen.
(iii) The length of the pencil is 6 units greater than the length of the eraser.

Example 1

A number line which can be used to represent the temperature in Celsius in several cities is given below.

(i) The temperature in city *A* is 12°C.
(ii) The temperature in city *B* is 8°C.
(iii) The temperature in city *C* is 4°C.
(iv) The temperature in city *D* is 10°C.

Mark these temperatures on the above number line.



Exercise 5.1

(1) Copy the following number line. Mark the numbers 1, 2 and 5 on it.

(2) Write down the numbers that have been marked on the number line given below.

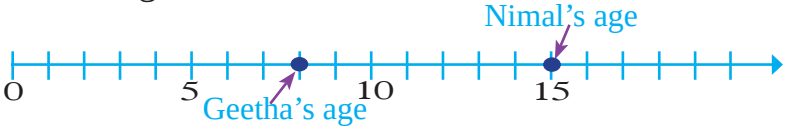
(3) Write down two special features of a number line.

(4) Mark the numbers 4, 7 and 2 on a number line.

(5) Nimal is 8 years old. His younger sister is 5 years old. Mark these values on a number line.

(6) Write down the numbers that have been marked on the number line given below.

(7) Geetha's and Nimal's ages in years have been indicated on the number line given below.



(i) Who is older from Geetha and Nimal?

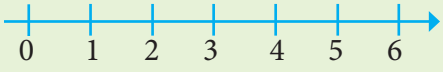
(ii) What is Geetha's age now?

(iii) How old will Nimal be when Geetha is 10 years old?

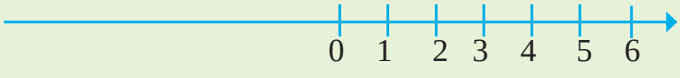
5.2 Negative numbers

Activity 2

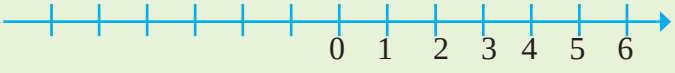
Step 1 - Draw a number line similar to the one given below.



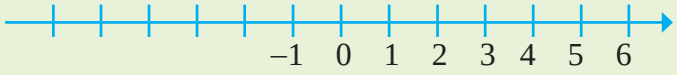
Step 2 - Using a ruler, extend the above line towards the left of 0 and obtain a line similar to the one in the figure given below.



Step 3 - Mark points to the left of 0 leaving the same gap between these points as the gap marked on the number line initially.



Step 4 - The number corresponding to the point which is one gap to the left of 0 is called negative one. This is denoted by –1.The sign '–' is called the negative sign.



The distance from 0 to 1 and from 0 to –1 is the same. Similarly, the number corresponding to the point which is two gaps to the left of 0 is called negative two. It is denoted by –2. Here, the distance from 0 to 2 and from 0 to –2 is the same.

In the same manner, moving further towards the left from 0, mark the rest of the points as –3, – 4 and –5.

Note

- An arrowhead is drawn at the right end of the number line consisting of negative numbers as well.
- However, there are instances where arrowheads are drawn at both ends of a number line consisting of positive and negative numbers.
- Furthermore, there are instances where no arrowheads are used on either end.

The whole numbers to the right of zero on this number line are called **positive integers**. The positive integers are 1, 2, 3, 4, … and so on. The three dots to the right of the numbers indicate that there are more numbers in the given manner.

The numbers to the left of zero on the number line are **negative numbers.**The negative whole numbers to the left of zero are called **negative integers.** The negative integers are –1, –2, –3, … and so on. These negative numbers are also indicated in the following manner; …, –3, –2, –1.

The number zero is neither positive nor negative.

The positive integers, the negative integers and zero, all taken together are called the **integers.**
The integers are … , –3, –2, –1, 0, 1, 2, 3, …

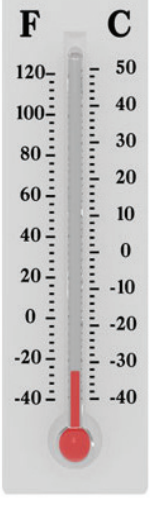
There are many instances where negative numbers are used. One such case is described below.

There are many places in the world, where the temperature drops below zero degrees Celsius. The maximum and minimum temperatures recorded in five main cities around the world on a particular day are given in the following table.

City / Temperature	New York	Paris	Tokyo	Moscow	Peking
Maximum value	15 °C	18 °C	0 °C	–2 °C	2 °C
Minimum value	–2 °C	–5 °C	–12 °C	–10 °C	–8 °C

A certain standard temperature is taken as 0 °C.
In this table, certain temperatures such as –2 °C, –5 °C and –10 °C have the negative sign written in front of the number. This is used to indicate that those temperatures are less than the above standard temperature.

Similarly, in thermometers which are used to measure the temperature, the negative sign is written in front of the numbers to indicate temperatures which are below 0 °C.



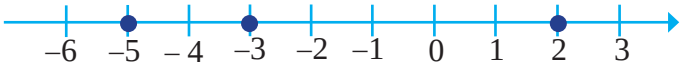
Example 1

On a certain day, the minimum temperature in degrees Celsius in several cities around the world was as follows.

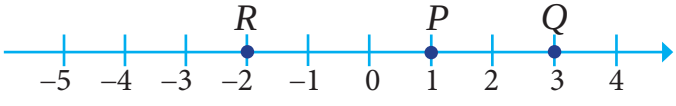
Moscow –12 °C, Tokyo 3 °C, Peking –4 °C and London –3 °C. Represent these values on a suitable number line.

Exercise 5.2

(1) Write down the numbers that have been marked on the number line given below.



(2) Write down the values represented by *P*, *Q* and *R* on the number line given below.



Value denoted by *P* =
Value denoted by *Q* =
Value denoted by *R* =

(3) Copy the number line given below and mark the numbers 4, 1 and –3 on it.

(4) On a number line from –5 to 5, mark the numbers 4, – 4 and –1 and name them as *A*, *B* and *C* respectively.

5.3 Comparison of integers

Let us consider the numbers five and two. We know that five is greater than two. We can write this as "five is greater than two". The way this can be expressed concisely using symbols is given below.

$$5 > 2$$

Here the symbol " > " which expresses the meaning "greater than" has been placed between the numbers five and two.

Similarly, the fact that 9 is greater than 4 can be expressed as $9 > 4$.

The fact that two is less than five can be expressed as follows.

$$2 < 5$$

The symbol "< " expresses the meaning "less than".
Accordingly, 4 is less than 9 is symbolized as $4 < 9$.

When two integers are being compared, these symbols need to be used in the following manner.

Larger integer > Smaller integer
Smaller integer < Larger integer

The symbols ">" and "<" are called **inequality signs.**

The pointed side of these symbols is in the direction of the smaller number.

The above mentioned numbers have been marked on the number line given below.

Any number to the right of a particular number on the number line is greater (larger) than the said number. This property is applicable to the whole number line. Therefore, this rule can be applied to compare integers using the number line.

Let us consider which number from 0 and –2 is greater.
Let us draw a number line and mark 0 and –2 on it.

On the number line, 0 is to the right of – 2. Therefore, 0 is greater than –2.

This can be written as $0 > -2$.

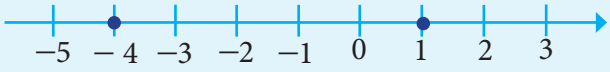
In the same manner, let us consider which number from –5 and –1 is greater.
Let us draw a number line and mark –5 and –1 on it.

On the number line, –1 is to the right of –5.

Therefore, –1 is greater than –5. This can be written as $-1 > -5$

Example 1

Compare the numbers – 4 and 1.
Let us draw a number line and mark – 4 and 1 on it.



On the number line, 1 is to the right of – 4. The comparison of these two numbers can therefore be expressed in either one of the following two ways.
1 is greater than – 4 can be expressed as $1 > -4$.
– 4 is less than 1can be expressed as $-4 < 1$.

Example 2

Fill in the following blanks using a suitable number from 6, 11 and 13.

(i) 11 < ..... (ii) 11 > ..... (iii) 11 = ...

then we have,

(i) 11 < 13. (ii) 11 > 6. (iii) 11 = 11.

Exercise 5.3

(1) Given below are pairs of integers which have been compared using inequality signs. Write down how each inequality is described in words.

	Inequality	How the inequality is described in words
(i)	6 > 2	Six is greater than two
(ii)	25 > 12	
(iii)	4 > 0	
(iv)	0 < 7	
(v)	15 < 50	
(vi)	0 > –3	
(vii)	–1 > –8	
(viii)	–6 < –2	

(2) For each of the following, write down whether the relationship is correct or incorrect.

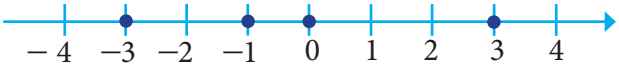
(i) $-5 > -8$ (ii) $-3 < 2$ (iii) $-7 > 0$

(iv) $-2 = 2$ (v) $8 < -9$ (vi) $6 < -4$

5.4 Comparison of integers described further

The number line can easily be used to compare more than two numbers together.

For example, let us take the integers 3, 0, –1 and –3 and compare them by using a number line.



On a number line, "the values of numbers increase gradually from left to right". Therefore, if the above numbers are written in increasing order of their values, we get –3, –1, 0, 3. If we write numbers in increasing order of their values as above, we say that the numbers are written in **ascending order.**

The above numbers can also be written as 3, 0, –1, –3 with the values gradually decreasing. If we write several numbers in this manner in decreasing order of their values, we say that the numbers are written in **descending order.**

Exercise 5.4

(1) Write down the numbers marked on the number line, in ascending order.

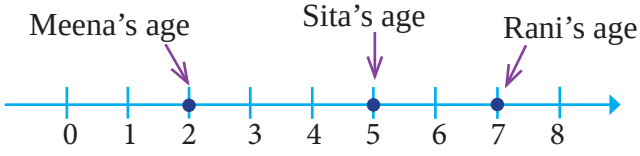
(2) Write down the following numbers in descending order with the aid of a number line.

–2, 2, 0, –4

(3) Write the following integers in ascending order with the aid of a number line.

0, –1, 2, –4, –2

(4) Consider the following number line on which the ages in years of three children have been represented.

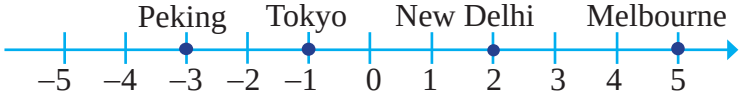


(i) Write down the ages of the children in descending order.

(ii) Write down the names of the children in the order of decreasing age.

(iii) Who is the oldest child? Who is the youngest child?

(5) The average temperature in degrees Celsius of several cities around the world on a certain day, has been marked on the number line given below.



According to the number line,

(i) which city recorded the lowest temperature?

(ii) which city recorded the highest temperature?

(iii) on that day, how many units less was the average temperature in Peking than the average temperature in New Delhi?

(iv) when the difference between the temperatures of New Delhi and Peking and of New Delhi and Melbourne are considered, which is greater?

5.5 Finding integers between two non-consecutive integers

Sitha is 10 years old. Her brother, Madhava is 6 years old. Sriya who lives in a nearby house comes often to play with the two of them. Her age in years is between 6 and 10.

The integers between 6 and 10 are only 7, 8, and 9.
Therefore, Sriya's age in years can be considered to be either 7, 8 or 9.
This can easily be found using a number line too.

In this manner integers between two non - consecutive integers can easily be identified using a number line.

Now, for each of the following pairs of integers, let us write down with the aid of the number line, all the integers that lie between them.

Pair of integers	All the integers that lie between those integers
(i) – 4 and 1	–3, –2, –1, 0
(ii) 0 and –5	–1, –2, –3,–4
(iii) –1 and –5	–2, –3, –4
(iv) –3 and 3	–2, –1, 0, 1, 2

Exercise 5.5

(1) Write down all the integers that lie between 2 and 8.

(2) Write down the greatest integer and the smallest integer that lie between 5 and 13.

(3) Write down all the integers that lie between –4 and 4.

(4) Write down all the integers that lie between –10 and 2.

(5) Write down all the integers that lie between 2 and –5 in ascending order.

Miscellaneous Exercise

(1) Mark the points 5, –3 and 2 on a suitable number line. Write these numbers in ascending order.

(2)

Write down the numbers which are represented by *P*, *Q* and *R* on the above number line.

(3) Write down the following values in ascending order with the aid of a number line.

3, 0, –1, – 4

(4) Mark the numbers –6, –2, –1, 0, 1, 3 and 5 on a number line.

(i) From the marked numbers

which is the greatest integer?
which is the smallest integer?

(ii) Fill in the following blanks using a suitable inequality sign.

(a) –6 ..... 3 (b) –2 ..... –1 (c) 0 ..... –2
(d) 5 ..... –1 (e) –1 ..... –6

(iii) Write down all the integers between –6 and 5 in descending order.

(iv) How many integers are there between –1 and 1?

(v) Are there any negative integers between 0 and 5?

(vi) Are there any positive integers between –6 and 0?

(vii) Are there any positive or negative integers between –1 and 1?

Summary

- A line as depicted below, on which integers are indicated with equal gaps between them, and gradually increasing towards the right is called a number line.

- The numbers to the left of zero on the number line are negative numbers.
- The numbers ...., –3, –2, –1, 0, 1, 2, 3, ... are integers. Zero is an integer which is neither positive nor negative.
- When comparing a pair of integers, the symbol ">" is used to denote " greater than" and the symbol "<" is used to denote 'less than'.
- When comparing two numbers on a number line, the number on the right is considered to be greater than the number on the left.
- Integers between two non - consecutive integers can easily be identified using a number line.

6 Estimation and Rounding Off

By studying this lesson, you will be able to,

- understand what estimation means,
- give a good estimate when required,
- understand what rounding off means and
- round off a whole number to the nearest multiple of ten.

6.1 Estimation

How many pieces of milk rice are there on the plate in this figure? 12

How many olives are there in the palm of this hand? 7

In the above two situations the correct amounts could easily be told by counting the number of items there are.

Can the correct number of newspapers, the correct number of bananas and the correct number of marbles in the following figures be stated as easily by counting the items?

To know the exact number of items in each figure, it is necessary to count the items. This is not always possible. However, a person with experience can make a good guess and come up with a close value.

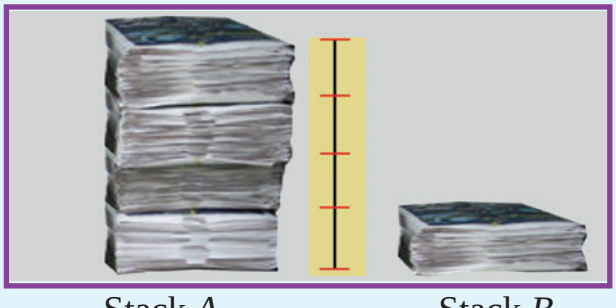
Finding a close value for the number of items there are in a certain collection of items, without counting the items, but using a suitable method instead, is defined as **estimation.**

In estimation, the method that is most often used to guess the number of items there are in a collection, is to find a value close to the total number of items, by considering the number of items there are in a portion of the collection. In this method, the portion that is considered is taken as a unit, and the total number of items is estimated by considering the number of items there are in the unit.

Example 1

The figure shows two stacks of copies of a certain newspaper. There are 10 newspapers in stack *B*. Estimate the number of newspapers there are in stack *A*.

It is clear by making a comparison of the heights of the two stacks using the divided line in the figure, that the height of stack *A* is roughly four times the height of stack *B*.



Stack *A* Stack *B*

The number of newspapers in stack *B* $= 10$

The number of newspapers in stack *A* is approximately $= 10 \times 4$

$= 40$

Example 2

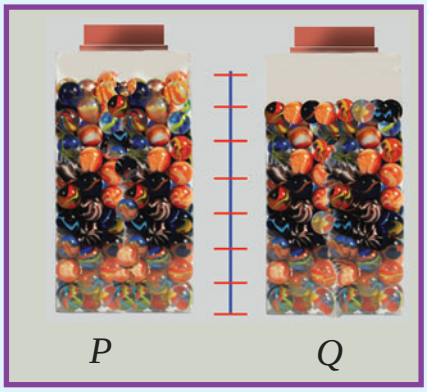


Figure P shows a glass container filled with marbles that were for sale in a certain shop. Figure Q shows the same container after 16 marbles were sold. Estimate the total number of marbles there were in the container initially.

The space that was initially occupied by the marbles is about seven times the space that has been emptied by the sale of the marbles.

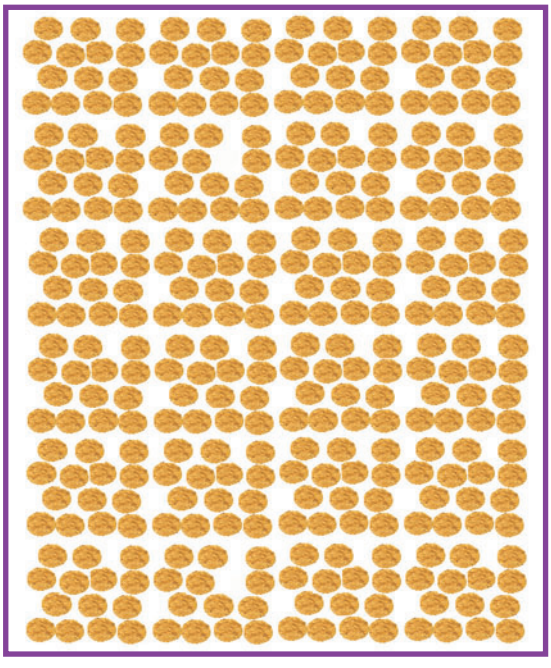
Therefore, the number of marbles there were initially in the container P is approximately $= 16 \times 7$

$= 112$

Exercise 6.1

(1) The figure shows a wall which is being built. Estimate the total number of bricks that are required for the whole wall, and write it down.

(2) The figure illustrates how "pappadams" have been spread out and left to dry. Estimate the number of pappadams there are, and write it down.



(3) The figure illustrates how 11 books have been placed in a compartment of a book rack. Estimate the number of similar books that are required to fill up the book rack completely, and write it down.

(4) In a certain school, there are three parallel classes in each grade from grade 6 to grade 11, named 6A, 6B, 6C, 7A, 7B, 7C, … etc. Each class has approximately the same number of students. The number of students in class 6A is 36. Estimate the total number of students there are in this school in grades 6 to 11, and write it down.

6.2 Rounding off

38 students are to participate in a field trip. However, the teacher in charge informs the Principal that the number of students who will be participating in the field trip is about 40. Here 40, which is the multiple of ten that is closest to 38 has been given as an approximate value of 38.

There are many instances in day to day activities when the multiple of ten which is closest to a given number is used as an approximate value of that number. We do this in order to get an idea about the number easily.

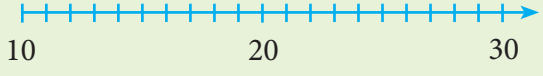
For example, the number of students in six classes in grade 6 of a particular school are 28, 31, 29, 30, 31 and 32. In such an instance we may say that the number of students in a class is approximately 30.

In the above instance, a number which is greater than 10 has been expressed as the multiple of ten which is closest to it. That is, the number has been **rounded off to the nearest multiple of ten**.

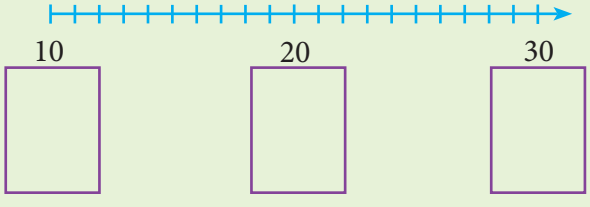
- **Identifying the rules of rounding off**

Activity 1

- Copy the number line from 10 to 30 given below in your exercise book.



- Draw three small boxes under the numbers 10, 20 and 30 as shown in the figure.



- Mark the numbers 11, 12, 14, 15, 18, 22, 24, 25 and 28 on the number line that you have drawn.

- Write down each of these numbers in the box which is under the multiple of ten that is closest to it. If a number is right in the middle of two multiples of ten, write the number in the box which is under the nearest multiple of ten which is larger than it.
- Identify how a number can be rounded off to the nearest multiple of ten by examining the digit in the ones place of the number.
- Were you able to grasp the following rules of rounding off through the above activity?

When rounding off a number to the nearest multiple of ten, if the digit in the ones place of the number

- is less than 5, then the closest multiple of ten which is less than that number is selected.
- is 5 or greater than 5, then the closest multiple of ten which is greater than that number is selected.

Example 1

Round off the following numbers to the nearest multiple of ten and write them down.

(i) 78 (ii) 36 (iii) 53 (iv) 85

(i) 80 (ii) 40 (iii) 50 (iv) 90

Example 2

From the following numbers, select and write down the numbers which when rounded off to the nearest multiple of ten, has 40 as the solution.

45, 44, 37, 48, 35

44, 37 and 35

Example 3

When the marks that Iresha received for Science at the term test were rounded off to the nearest multiple of ten, the value obtained was 70. Niromi who received 67 marks had scored more marks than Iresha at this test. What are the values that the marks Iresha received can take?

Niromi received 67 marks. Since she received more marks than Iresha did, Iresha's marks should be less than 67.

The values that are less than 67, which when rounded off to the nearest multiple of ten gives 70 are 65 and 66 only. Therefore, the values that the marks Iresha received can take are 65 and 66.

Exercise 6.2

(1) Round off the following prices to the nearest multiple of ten and write them down.

(i) Price of a pen is Rs 12.
(ii) Price of an apple is Rs 38.
(iii) Price of a book is Rs 83.
(iv) Price of a piece of cheese is Rs 75.

(2) When a certain number is rounded off to the nearest multiple of ten, the value obtained is 90. Write down the values that this number can take.

(3) For each number in group A, select the number in group B which is obtained when the number is rounded off to the nearest multiple of 10, and join the two numbers with a straight line.

Group A	Group B
37	
48	30
32	
45	40
55	
36	50
54	
43	60

(4) When the number of students in a class was rounded off to the nearest multiple of ten, the value obtained was 40.

(i) What is the least number of students that can be in the class?

(ii) What is the the most number of students that can be in the class?

(5) The marks that were obtained for mathematics by a group of grade 6 students are given below.

Name	Marks	Rounded Off Value
Amanthi	77	
Sandalee	75	
Akshi	96	
Sandun	58	
Isuru	45	
Nipuna	85	
Total		

(i) Copy this table in your exercise book and complete it by writing the values which are the nearest multiples of ten of the given marks.

(ii) What is the sum of all the marks received by the students?

(iii) What is the sum of all the rounded off values?

(6) When the total number of mangoes that a certain trader had was rounded off to the nearest multiple of ten, the value obtained was 60. When two fruits which were spoilt were removed from the stock and the remaining number was rounded off to the nearest multiple of ten, the value obtained was 50. What are the values that the total number of mangoes he initially had can take?

Miscellaneous Exercise

(1) Every part of the Earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every clear and humming insect is holy in the memory and experience of my people. The sap which courses through the trees carries the memories of the red man. The white man's dead forget the country of their birth when they go to walk among the stars. Our dead never forget this beautiful Earth, for it is the mother of the red man. We are part of the Earth and it is part of us. The perfumed flowers are our sisters, the deer, the horse, the great eagle, these are our brothers. The rocky crests, the juices in the meadows, the body heat of the pony, and the man, all belong to the same family.

(This is part of a speech made by Native American Chief Seattle in 1854).

(i) Count the number of words there are in any three lines of the above paragraph and write it down.

(ii) Using the above answer, estimate the total number of words there are in the paragraph and write it down.

(2) Gihan mentions that when an estimate is made, the answer depends on the person who is making the estimate. Do you agree with his idea? Explain your answer.

(3) 

Figure 1 Figure 2

Figure 1 illustrates a bottle containing marbles that was in a certain shop. It is mentioned that there are 200 marbles in the bottle. Nimal, who bought the bottle of marbles, distributed most of it among his friends, and what was remaining is illustrated in figure 2. Estimate the number of marbles that he distributed among his friends.

(4) The value of the marks that Sachini received for mathematics at the term test, when rounded off to the nearest multiple of ten was 80. Gayathri, whose actual marks were 82, had scored less than Sachini. What are the values that the actual marks which Sachini received can take?

(5) The number of students in a certain class rounded off to the nearest multiple of ten was 40. When nine new students joined this class, the number of students in the class rounded off to the nearest multiple of ten was still 40. How many students were there in the class initially?

(6) The number of story books that Mohammed has, when rounded off to the nearest multiple of ten is 30. The number of books that Fathima has, when rounded off to the nearest multiple of ten is 20. Fathima has three books less than the number that Mohammed has. If the two of them together have 49 books, how many books does Mohammed have?

Summary

- Finding a close value for the number of items in a certain collection of items, without counting all of them, but using a suitable method is called estimation.
- Expressing a whole number as the multiple of ten which is closest to it, is called rounding off to the nearest multiple of ten.

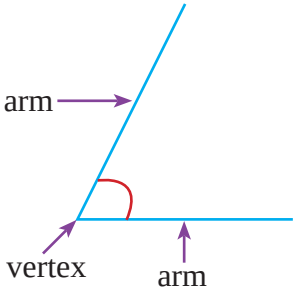
7 Angles

By studying this lesson, you will be able to,

- identify an angle,
- identify a right angle and
- identify an acute angle, an obtuse angle, a straight angle and a reflex angle, in terms of the right angle.

7.1 Identifying an angle

The following figure depicts a part of a line drawn straight. This is known as the straight line segment *AB*.



An angle is formed by two straight line segments meeting as shown in the figure. The point at which the two straight line segments meet is known as the **vertex of the angle**.

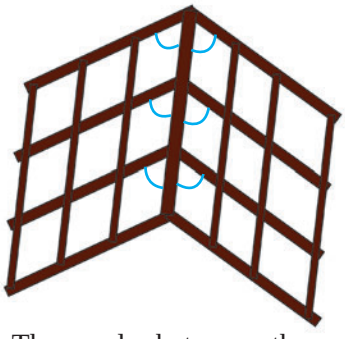
The two straight line segments are known as the **arms of the angle**. The angle is marked with a curved line segment as indicated in red.

Several angles are shown in the following figure.

We see angles such as those given above in various places in the environment. The following figures are several such examples.

The angle between the minute hand and the hour hand

The angle between the two aerials of a TV antenna



The angle between the wood beams of a roof

The knowledge of angles is used in many practical situations such as in the construction of roofs and the production of household items.

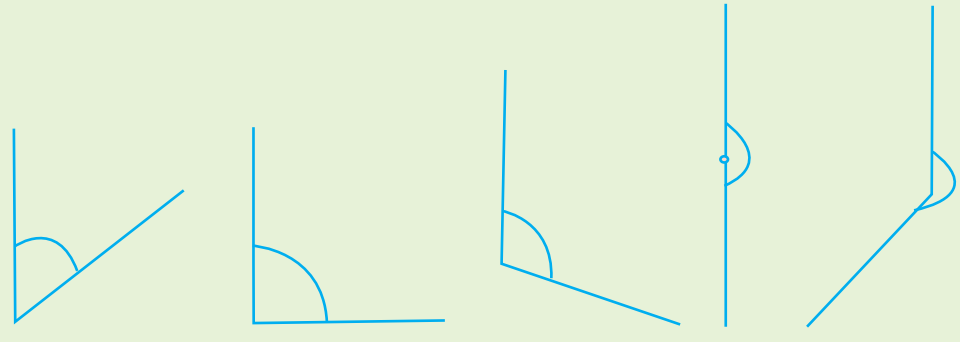
Activity 1

Step 1 - Take a fresh green ekel and bend it into two parts at the centre, taking care not to break it.

Step 2 - Overlap the two parts of the ekel and place it on a table. Hold part one tightly on the table.

Step 3 - In your exercise book, draw several situations that are obtained by rotating the other part on the table.

A few such situations that can be obtained are shown below.

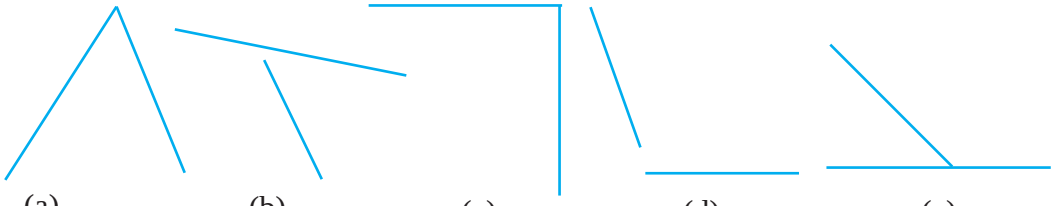


(i) (ii) (iii) (iv) (v)

Observe the angles created in all these situations. In each situation, the amount that the second part is rotated is the **magnitude of the angle**. The figures have been organized in the order of increasing magnitude of the angles.

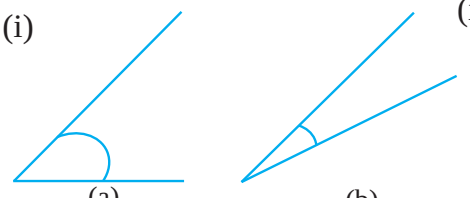
Exercise 7.1

(1) From the following figures, select the ones which depict angles and write down the corresponding letters.

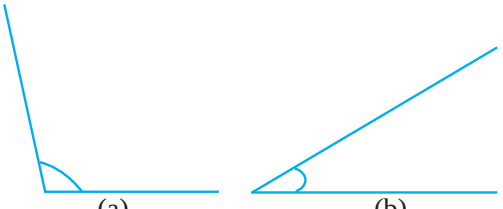


(2) From each pair of angles in the figures given below, select the larger one and write the corresponding letter.

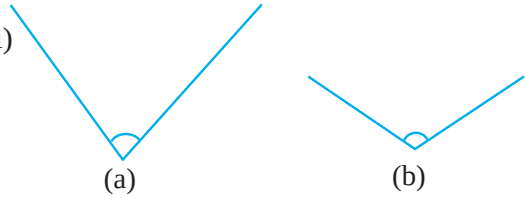
(i)



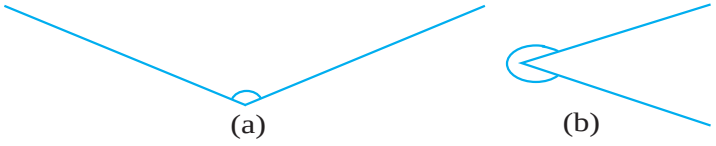
(ii)



(iii)



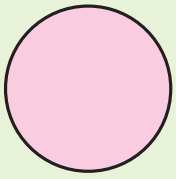
(iv)



7.2 The right angle

Activity 2

Step 1 - Draw a circle on a piece of paper using a circular shape.



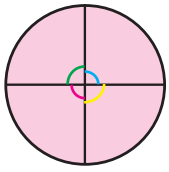
Step 2 - Cut along the circle that has been drawn and separate out the circular lamina.

Step 3 - Fold the circular lamina into two.

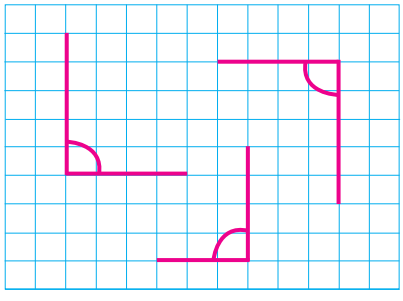
Step 4 - Without opening out the folded lamina, fold it again into two.

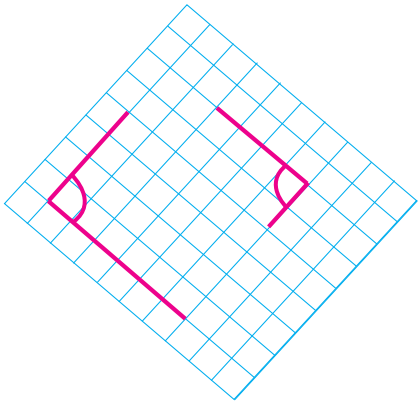
Step 5 - Open out the lamina that was folded as above, and with a ruler, mark the fold lines using a dark colour.

The final figure illustrates how the lamina has been divided into four equal parts by the two straight line segments.



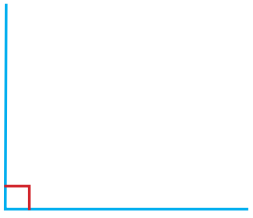
- Here, four angles of equal size have been created as depicted in the figure.
- An angle of magnitude equal to the magnitude of each of these angles is known as a **right angle.**





A figure showing the positions of the minute hand and the hour hand when it is 3 o'clock and two figures of several angles drawn on square ruled papers are given on page 88. All the angles in the above figures are right angles which are equal in magnitude.

The symbol in red in the figure is used to denote a right angle.



Several places in the class room, where the shape of a right angle can be observed are given below.

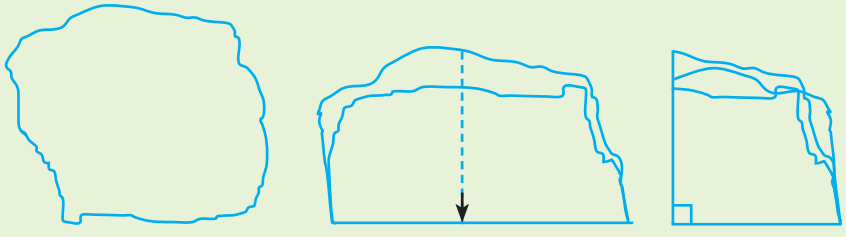
- The position at which two edges of the cover of a book meet.
- A corner of the surface of the teacher's table.
- A corner of the black board.

Activity 3

Step 1 - Take a piece of paper of any shape (Figure 1).

Step 2 - Fold the piece of paper into two in any way you like. Draw an arrowhead on the fold edge (Figure 2).

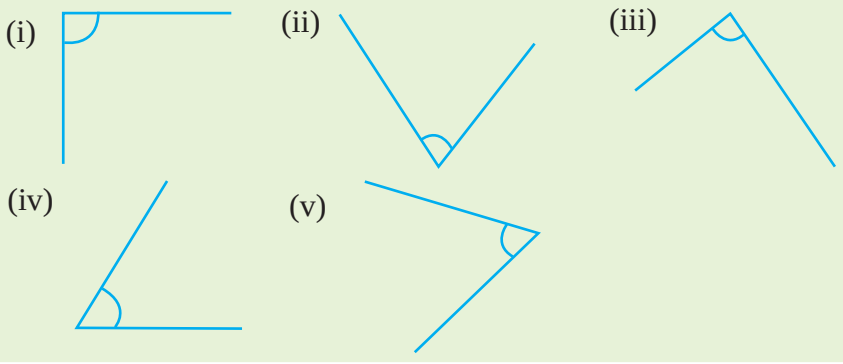
Step 3 - Fold the piece of paper again so that the two parts of the initial fold edge which are separated by the arrowhead overlap each other (Figure 3).



1 **2** **3**

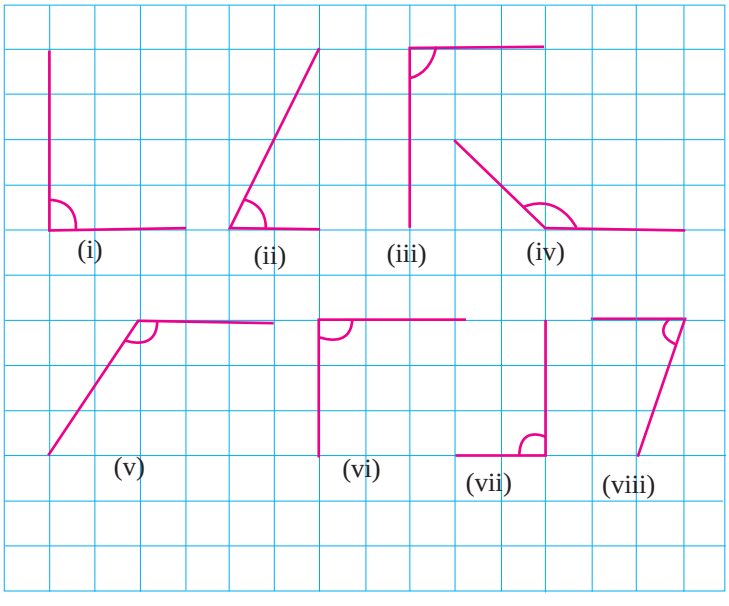
The angle which is now formed between the two fold edges is a right angle. What you have obtained here is known as a **right angled corner**.

Step 4 - Now, place the vertex of the right angled corner on the vertex of each of the angles given below, such that one edge of the right angled corner overlaps with an arm of the angle. Thereby, identify the right angles and write down their numbers.



Exercise 7.2

(1) From the following angles, select the ones which are right angles and write down their numbers.



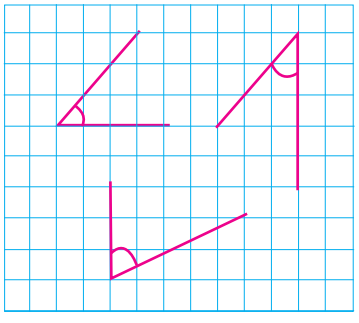
(2) Draw a right angle on a square ruled paper. Use the relevant symbol to denote the fact that it is a right angle.

(3) Write down 5 situations in the environment, where the shape of a right angle can be observed.

7.3 Identifying different types of angles in terms of the right angle

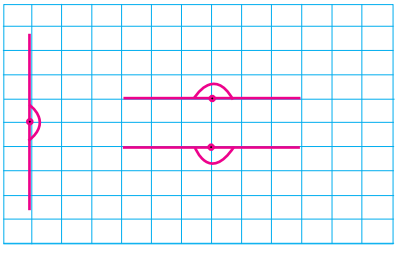
1. Acute Angles

Angles which are smaller in magnitude than a right angle are known as **acute angles**.



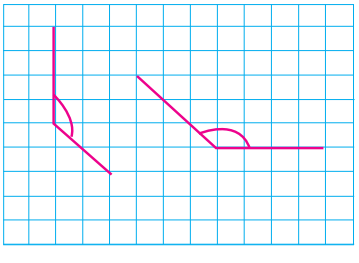
2. Straight Angles

Angles which are equal in magnitude to two right angles are known as **straight angles.**



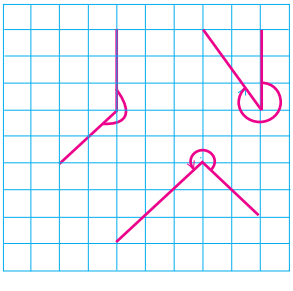
3. Obtuse Angles

Angles which are larger in magnitude than a right angle but smaller in magnitude than a straight angle are known as **obtuse angles.**



4. Reflex Angles

Angles which are larger in magnitude than a straight angle but smaller in magnitude than four right angles are known as **reflex angles.**

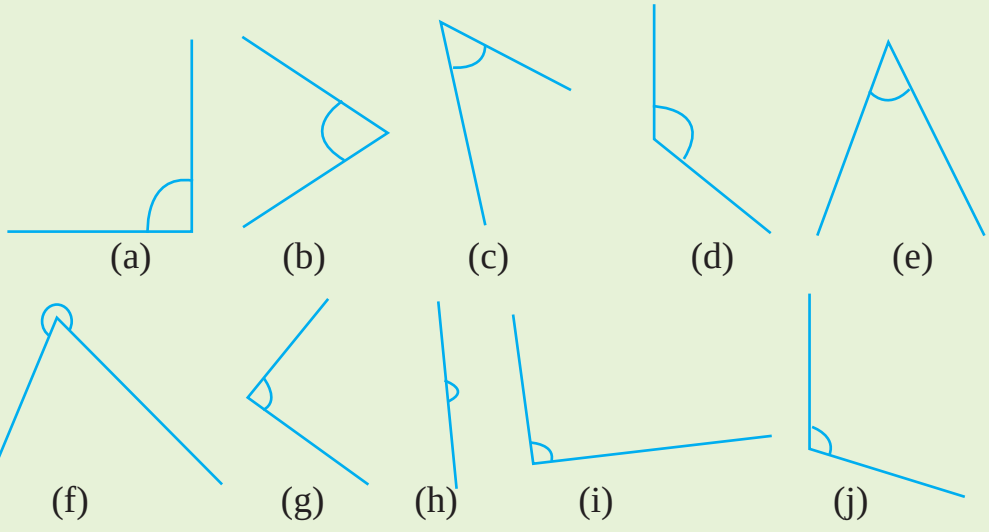


Now, you have identified five types of angles as right angles, acute angles, straight angles, obtuse angles and reflex angles.

Activity 4

Step 1 - Using a piece of paper, make a right angled corner as in activity 3.

Step 2 - Place the vertex of the right angled corner on the vertex of each of the angles given below, such that one edge of the right angled corner overlaps with an arm of the angle. Thereby identify the type of each angle. Write down the type of each angle together with the corresponding letter (Use the edge of the ruler as a straight angle, if necessary).

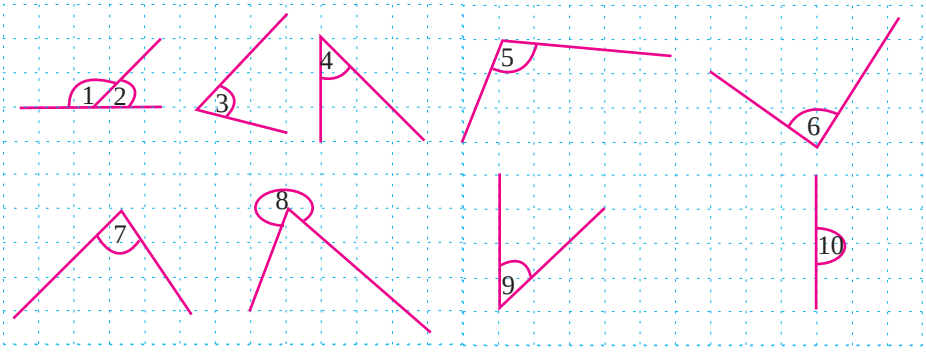


Exercise 7.3

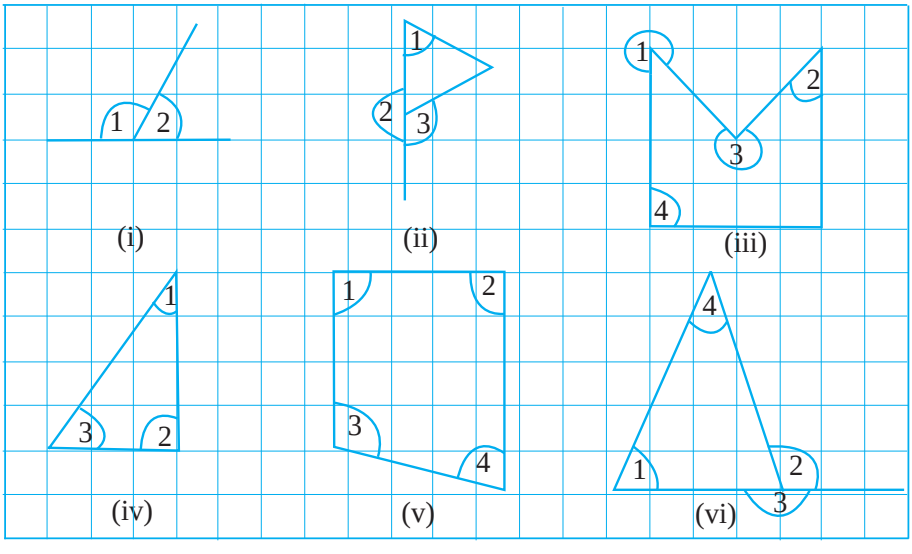
(1) Write down which type the angle marked between the hour hand and the minute hand of each clock face belongs to.

(iv) (v) (vi)

(2) Write down in order, the type of each angle denoted by the numbers from 1 upto 10 in the following figures.

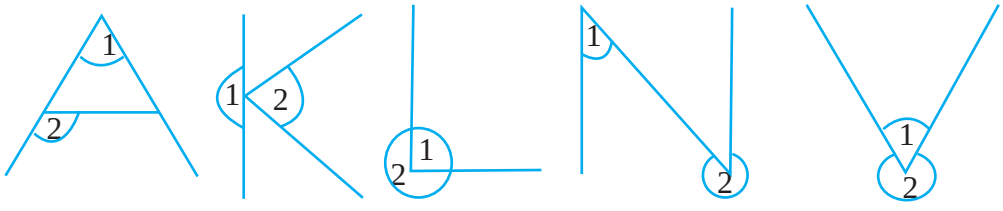


(3) For each of the following figures, write down the type of angle that is denoted by each number together with the relevant number.



(4) Copy the following table in your exercise book and complete it by writing the type of angle denoted by 1 and 2 in each of the figures given below.

Figure	Type of angle	
	1	2
(i) (ii) (iii) (iv) (v)		



(i) (ii) (iii) (iv) (v)

(5) On a square ruled paper, draw two angles of each type that is mentioned below. Mark each of the angles.

- Acute angle
- Right angle
- Obtuse angle
- Straight angle
- Reflex angle

(6) When window grills are made, the iron rods are welded together such that they form various types of angles. Illustrate such situations in your environment to indicate various types of angles.

Summary

- An angle is formed by two straight line segments meeting.
- Angles which are smaller in magnitude than a right angle are known as acute angles.
- Angles whose magnitude is equal to the magnitude of two right angles are known as straight angles.
- Angles which are larger in magnitude than a right angle but smaller than a straight angle are known as obtuse angles.
- Angles which are larger in magnitude than a straight angle but smaller in magnitude than four right angles are known as reflex angles.

8 Directions

By studying this lesson, you will be able to,

- express the location of a place from a given location in terms of the eight directions and
- identify the horizontal and the vertical.

8.1 The main directions

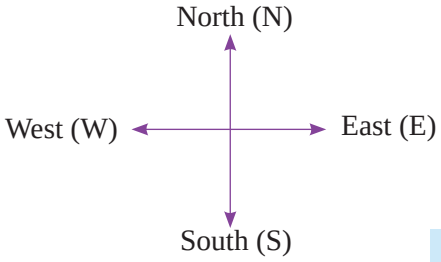
- Strong winds in the North-eastern shores of the island – A weather notification
- It is auspicious to light the hearth at 8.05 a.m. while facing the East – a New Year Custom
- A meteor shower can be observed in the south-western sky between 3 a.m. and 5 a.m. – A news item.

The above are several instances in day to day life, where directions are mentioned. Thus, knowledge of directions is required when conducting daily activities.

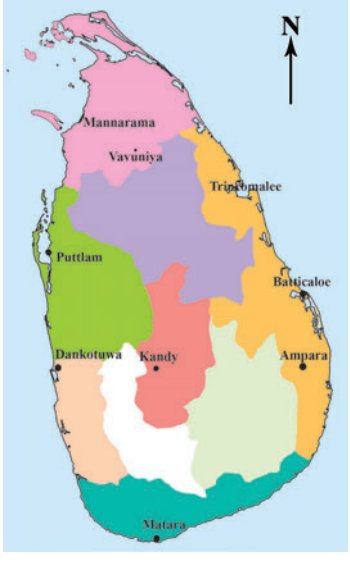
Now, let us recall what was learnt earlier regarding the four main directions.

The East is the direction in which the sun rises. If you stand as shown in the figure with your arms stretched out, facing the East, then the direction indicated by your right hand is the South and the direction indicated by your left hand is the North. Then the direction behind you is the West.

When directions are drawn in a book, the following convention is used.



The North is indicated in maps and in house plans by the notation " N " .

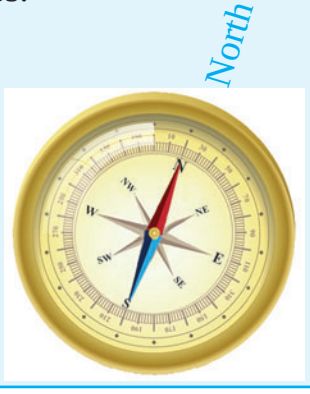


A compass can be used to accurately find the directions from a given position. Let us now consider how it works.

When a compass is placed on a flat surface, the red needle points in the direction of the North. When the compass is rotated such that the letter N is aligned with the point of the red needle, the remaining directions too are indicated by the compass.

The following figure shows an instance where the needle is pointed in the direction of the North.

The following figure shows the instance of aligning the point of the needle with the letter N of the compass.



Let us identify the location of the following in the figure in terms of directions.

According to the above figure,

1. the tree is to the north of the child.
2. the well is to the east of the child.
3. the house is to the west of the child.
4. the gate is to the south of the child.
5. the child is facing the South.
6. the child and the tree are both to the north of the gate.

Exercise 8.1

(1) Fill in the blanks by considering the following figure.

(i) The black board is to the …….. of the teacher's table.

(ii) The desk is to the …… of the teacher's table.

(iii) The …….. is to the east of the teacher's table.

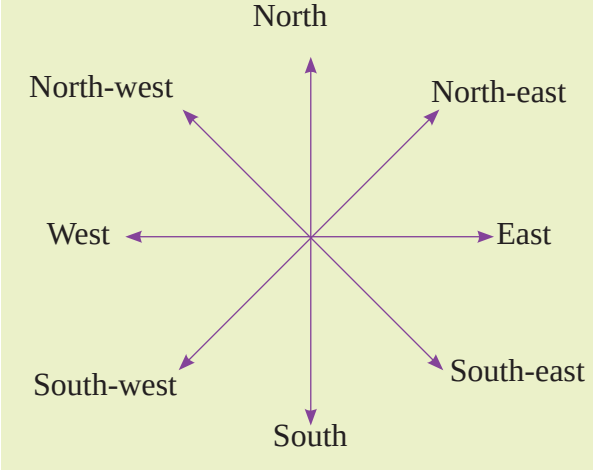
(iv) The …….. is to the west of the teacher's table.

8.2 Sub directions

Apart from these four main directions, let us now learn about four other sub directions.

* The direction which divides the right angle between the North and the East exactly into two as shown in the figure is the **North-east.**
* The direction which divides the right angle between the East and the South exactly into two as shown in the figure is the **South-east**.
* The direction which divides the right angle between the South and the West exactly into two as shown in the figure is the **South-west.**
* The direction which divides the right angle between the West and the North exactly into two as shown in the figure is the **North-west.**

Eight directions - North, East, South, West, North-east, South-east, South-west and North-west.

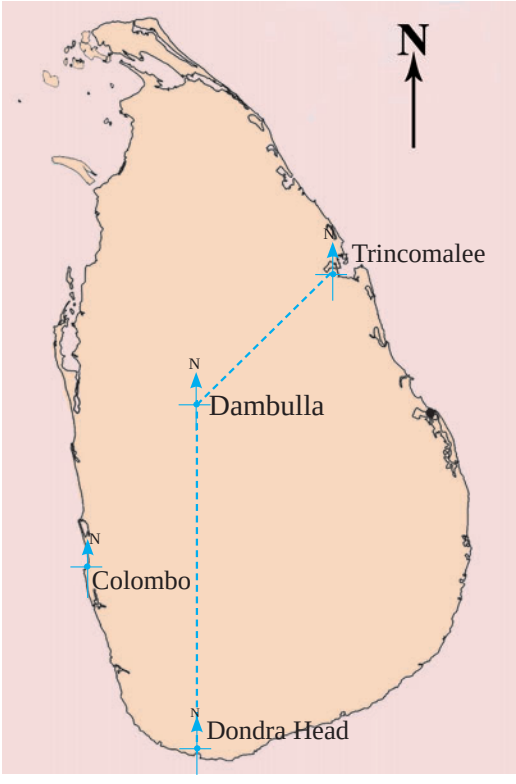


Now, let us study further about directions by considering several places that are marked in the following map of Sri Lanka.

Trincomalee is to the north-east of Dambulla.
Dambulla is to the south-west of Trincomalee.

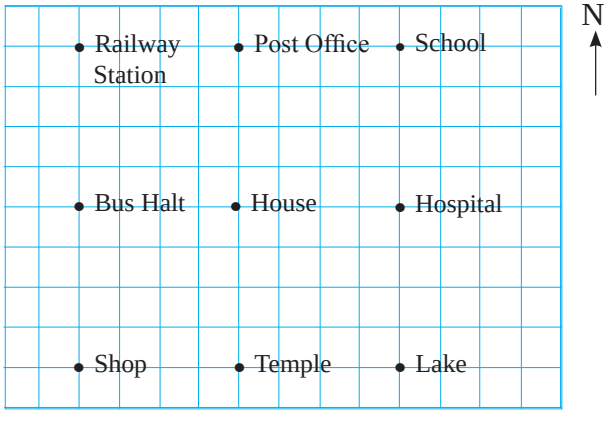
Dondra Head is to the south of Dambulla. Dambulla is to the north of Dondra Head.

It is clear from this that although the location of a place is fixed, the direction in which it lies depends on the place from which we observe it.



Exercise 8.2

(1) Upul's house and various places around his house are shown below.



(a) Complete the following table by writing the direction in which each place is located with respect to the house.

Place	Temple	Shop	Post Office	School	Hospital	Lake	Bus Halt	Railway Station
Direction								

(b) Copy the following sentences and fill in the blanks.

(i) While the post office is located to the ……of the house, the house is located to the ……of the post office.

(ii) To go from the bus halt to the post office, one should travel towards the ……and when returning from the post office to the bus halt, one should travel towards the ……...

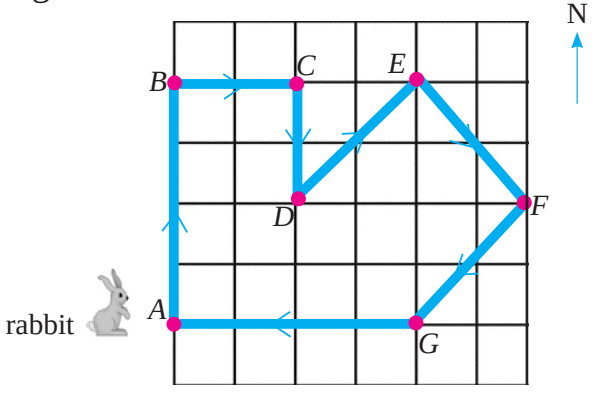
(iii) While the hospital is located to the …… of the post office, the ……is located to the south-west of the hospital.

(iv) While the ……is located to the north-east of the temple, the …… is located to the north of the hospital.

(v) If a person travels from the temple towards the ……., he would come across the house. If he travels from the house towards the west, he would come across the …… To reach the temple again from the bus halt, he should travel towards the ……

(2) The square grid given below illustrates several places that are located on a flat ground.

A rabbit who starts moving from the place named *A*, travels along the path indicated by the arrows eating Desmodium (Undupiyaliya) and returns again to *A*.



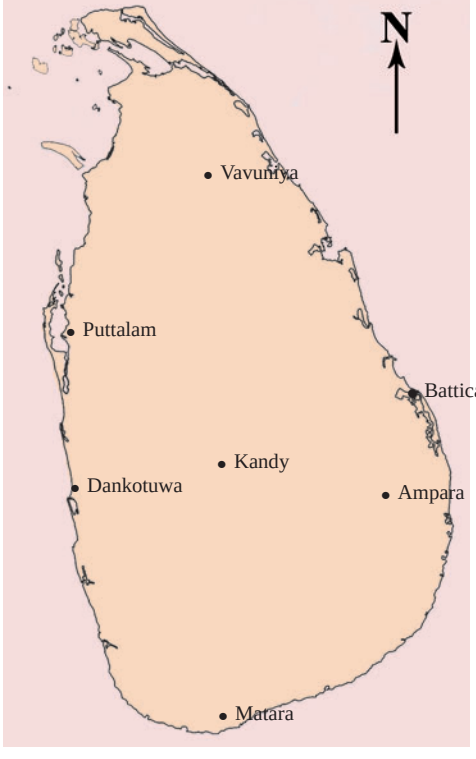
(a) Complete the following table by writing the directions along the path which the rabbit travels.

Path	Direction
From *A* to *B*	North
From *B* to *C*	
From *C* to *D*	
From *D* to *E*	
From *E* to *F*	
From *F* to *G*	
From *G* to *A*	

(b) If you stood at position *A* and observed the movements of the rabbit, write down the direction in which you would see the rabbit as it passes each of the following locations.

(i) *B* (ii) *D* (iii) *E* (iv) *G*

(3) Answer the following questions by considering the cities marked on the given map.



(i) Mention the direction in which Puttalam lies with respect to Kandy, and the direction in which Kandy lies with respect to Puttalam.

(ii) Name the city you think would be most affected by a cyclone which blows across the island in the south-west direction from the Batticaloe shores.

(iii) If straight roads are marked from Dankotuwa to Matara and from Matara to Ampara, mention in order, the two directions which a person who goes from Dankotuwa to Ampara along those roads, will travel.

(iv) Mention two places that are approximately north of Matara.

(4) A soldier who was being trained to walk through forests was taken to a rocky surface in a forest and given the following instructions based on which he had to complete his journey.

(i) After travelling 500 m towards the east of the rocky surface, you will come across a footbridge that lies across a stream.

(ii) After crossing the footbridge, and travelling 800 m towards the north-east, you will come across a waterfall.

(iii) When you travel a distance of 600 m from the waterfall towards the south-east, you will come across a Kitul tree.

(iv) When you travel 750 m towards the south-west from the Kitul tree, you will come across a cave.

(v) By travelling 800 m from the cave towards the north-west you will return to the camp.

Based on the information that has been provided to the soldier, draw a rough diagram of the path that he should take.

8.3 The horizontal and the vertical

Apart from the directions we have talked about so far, there are two other concepts which are necessary to describe the location of an object. These are the **horizontal** and the **vertical**.

The surface of the water in a large basin is considered to be horizontal when the water is still.

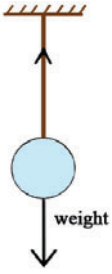
A flat surface which is not inclined, is said to be in a horizontal plane.

Any straight line which lies on a horizontal plane is called a **horizontal line**.

Any two points which lie on a horizontal plane, are said to be at the same level.

Consider several small balls on a horizontal plane. We say that these balls are in the same horizontal level.

Take a string which has a small weight tied to it at one end, and hold it by the other end. Wait until the string stops moving. Then the line along which the string lies is a **vertical line**.



If a plane contains a vertical line, then it is a **vertical plane**.

Any straight line which lies on a horizontal plane is a horizontal line. But any straight line which lies on a vertical plane is not necessarily a vertical line.

When two points lie on the same vertical line, we say that one point lies vertically above the other. For example, the given line is vertical and point *B* lies vertically above the point *A*.

Let us identify several other vertical and horizontal positions.

The top surface lies in a horizontal plane. The top surface is said to be horizontal.

The edge of the leg lies on a vertical line. The edge is said to be vertical.

The edge lies along a horizontal line. The edge is said to be horizontal.

A horizontal surface

A horizontal edge

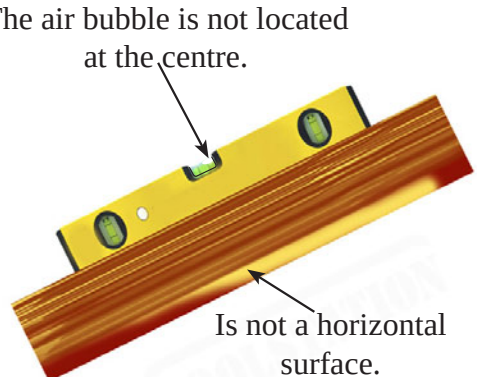
A vertical surface

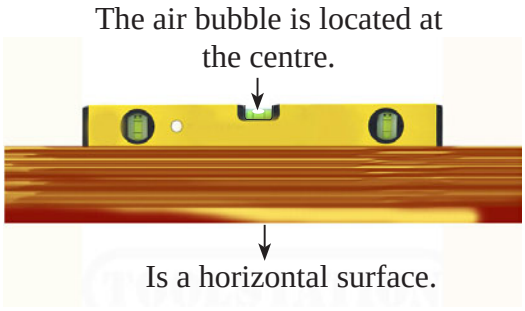
A horizontal edge

A vertical edge

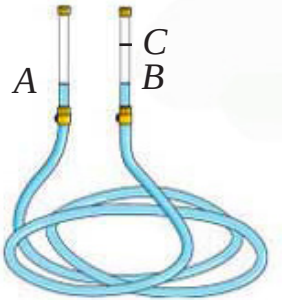
The wall and the door are vertical.
The floor and the ceiling are horizontal.

A spirit level is used to determine whether a plane surface is horizontal.





A **plumb** is used to identify vertical positions.



A transparent tube of water can be used to see whether two points are at the same level.

A and *B* are at the same level.
A and *C* are not at the same level.

Exercise 8.3

(1) A cube placed on a horizontal plane is shown in the figure. Name the horizontal and vertical edges that you see.

(2) Draw a simple sketch of the chair given here and mark 3 horizontal and vertical surfaces as well as 3 horizontal and vertical edges.

(3) The following figure is a vertical pigeon cage. The pigeons are named as *A*, *B*, *C*, *D*, *E*, *F* and *G*. Fill in the following blanks with the aid of the figure.

A		*C*	
	E		*F*
B		*D*	*G*

(i) The pigeon hole with pigeon *A* lies horizontal to the pigeon hole with pigeon .....

(ii) The pigeon hole with pigeon *B* lies vertically below the pigeon hole with pigeon .....

(iii) The pigeon hole with pigeon *F* lies ..... to the pigeon hole with pigeon *E*.

(iv) The pigeon hole with pigeon *C* lies ..... the pigeon hole with pigeon *D*.

(v) The pigeon holes with pigeons *B*, *D* and *G* lies on the same ..... plane.

Summary

- The direction in which the sun rises is the East and the direction in which the sun sets is the West.
- The eight directions can be used to express a certain location in relation to another location.
- The eight directions - North, East, South, West, North-east, South-east, South-west and North-west.
- Sub directions - North-east, North-west, South-east and South-west
- Main directions - North, South, East and West
- The horizontal and the vertical are also useful in expressing the location of objects.

Revision Exercise

(1) For the number 53 428,

(i) write down the place value corresponding to the position of each digit.

(ii) write down the value represented by each digit.

(2) "One hundred fifty five billion eight million two hundred five thousand four hundred eight"
Write down this number in the standard form in digits.

(3) Write down each of the following numbers in standard form. Name the number too.

(i) 750037 (ii) 1024839

(4) Sri Lanka got independence from the English regime on 4th February 1948. Write down this date in standard form.

(5) Write down the digits suitable for the blanks boxes.

(i) 85 + ☐☐☐ = 232 (ii) 3156 – ☐☐☐ = 2825

(6) The daily wage of a labourer is Rs 750. What is the total amount that should be paid, if 8 labourers are hired for 10 days?

(7) Round off the following numbers to the nearest multiple of ten.

(i) 64 (ii) 97 (iii) 45

(8) Fill in the blanks.

(i) 67 651 × 1 = ... (ii) 875 × 37 = 37 × .....

(iii) 31 611 × 0 = ... (iv) 0 ÷ 31 611 = ...

(v) 28 971 ÷ 1 = ... (vi) 478 × 1000 = ...

(vii) 98 714 ÷ ... = 98 714 (viii) ..... × 1 = 3325

(ix) If the number 67 000 is divided by 10, the quotient is ..... and the remainder is ..... .

(9) Simplify.

(i) 4343 + 75 (ii) 6848 – 959 (iii) 3328 × 25 (iv) 3227 ÷ 19

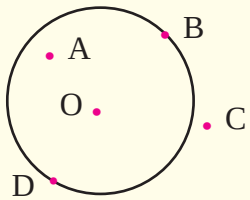
(10) Fill in the blanks in the given table.

Event	Time according to 12 hour clock	Time in international standard form
Starting time of the meeting	1.00 p.m	.....
Ending time of the meeting	.....	16 : 50

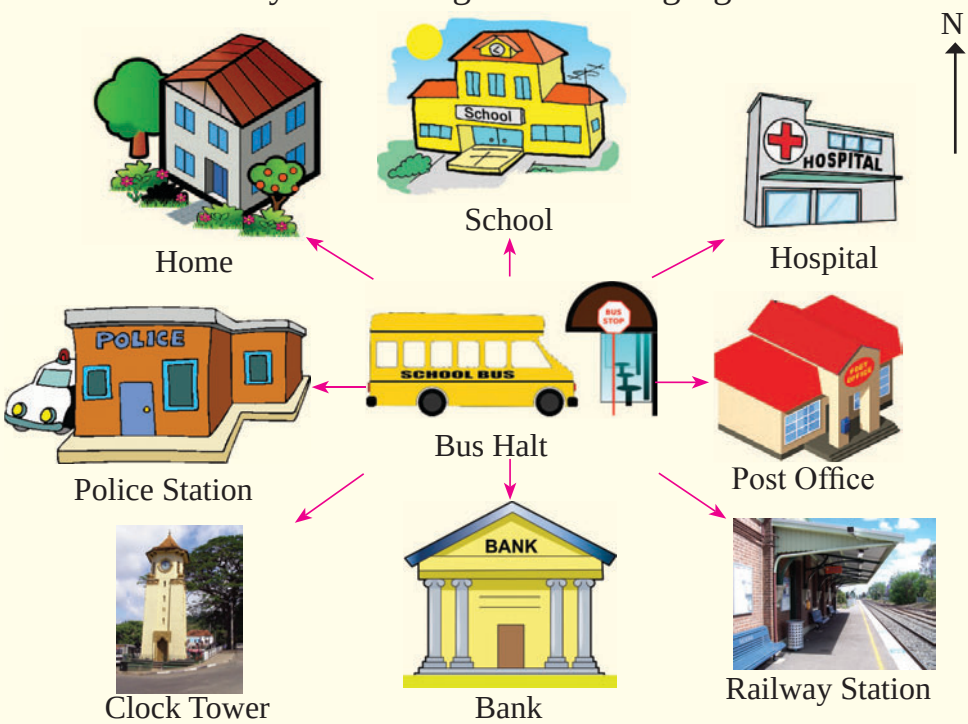
(11) In this figure,

(i) which letters indicate positions on the circle?

(ii) which letters indicate positions inside the circle?



(12) Fill in the blanks by considering the following figure.



(i) The post office is located to the .....of the bus halt.

(ii) The bus halt is located to the ..... of the police station.

(iii) The ..... and ..... are located to the north of the bank.

(13) (i) Draw a number line and represent the integers 6 and -4 on it.

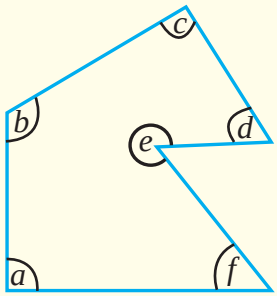
(ii) Write down all the integers between these two integers.

(iii) Fill in the blanks using either the sign > or the sign <.

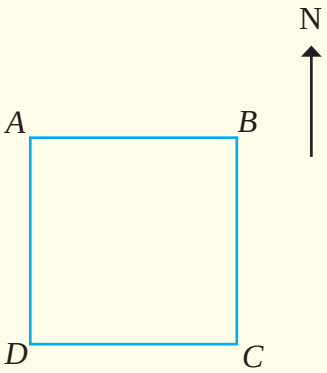
(a) -4 ...3 (b) 0 ... -3

(c) -3 .... -4 (d) -1 ... 0

(14) (a) Write the type of each angle shown by the letters a, b, c, d, e and f in the given figure.



(b) Four corners of a square shaped land on a flat landscape are named A, B, C and D as shown in the figure. D lies in the direction of the south when observed from A. One can walk along straight paths between the four corners. Write down the directions, that someone should walk in each of the following situations.



(i) To go from D to C

(ii) To go from C to A

(iii) To go from A to C

(iv) To go from C to B

(v) To go from B to D

(vi) To go from D to B

(vii) To go from B to A

(viii) To go from A to D

(15) (i) When a whole number is rounded off to the nearest multiple of ten, the number 40 is obtained. Write down all the possible numbers that the above whole number could be.

(ii) Write down two situations, where estimation is used in day to day life.

(iii) Since the railway track was blocked due to an earth slip, it was decided to bring the passengers to the next main railway station by buses. A bus can carry about 45 passengers. How many buses should be used to bring 673 passengers at the same time?

(16) It usually takes 3 hours to reach the Katunayake Airport from Galle along the old Galle road. This journey can be done in 1 hour and 20 minutes using the new Galle-Katunayake road.

(i) Express the time in hours and minutes, that is saved by using the new road for this journey.

(ii) Suppose that a passenger should be in the airport by 2.00 p.m.. Write down the time by the 12 hour clock that the passenger should leave from Galle,

(a) if he plans to use the new road.

(b) if he plans to use the old road.

(iii) The flight that passenger should take departs at 17:10. Write down this time by the 12 hour clock.

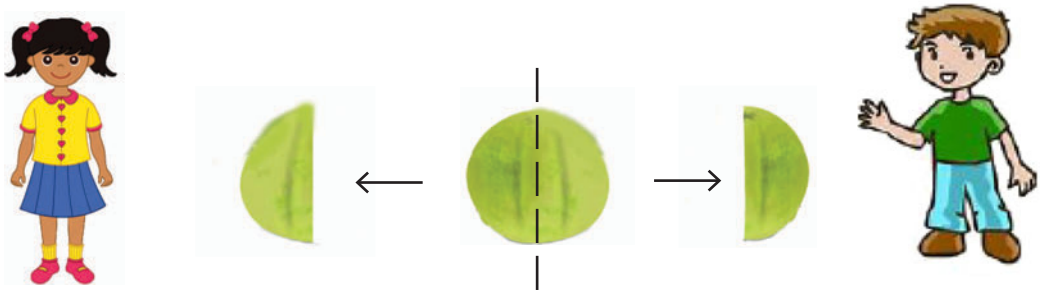
9 Fractions

By studying this lesson, you will be able to,

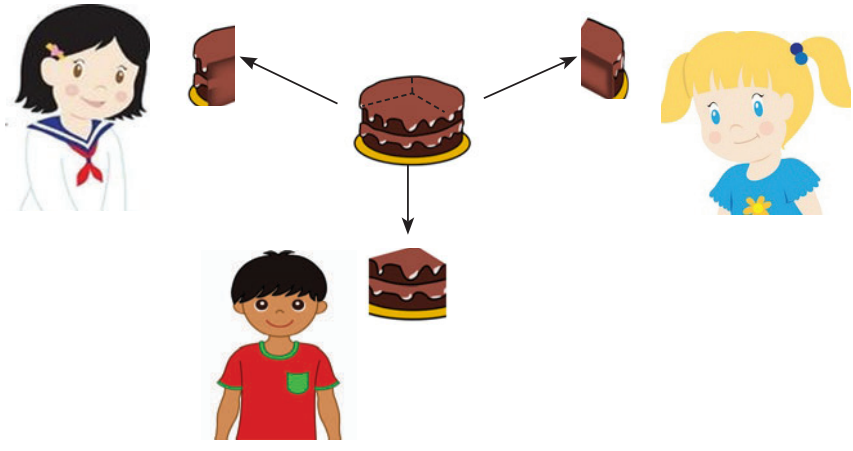
- identify proper fractions, unit fractions and equivalent fractions,
- compare proper fractions and
- add and subtract proper fractions.

9.1 Introduction

The picture below shows how a sister and a brother divided a Guava into two equal parts.



The picture below shows how three people divided a cake into three equal parts.



There are many such situations where a whole unit is divided into equal parts.

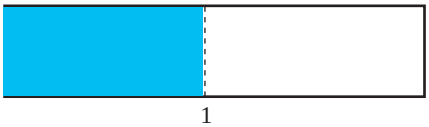
In the first situation, a person received one part out of the two equal parts of the Guava. If we numerically represent the Guava as 1 , then the numerical representation of the part a person receives is $\frac{1}{2}$. This is read as “one half ”.

In the above second situation, a person received one part of the three equal parts the cake was divided. If we numerically represent the cake as 1, then the quantity one person receives is $\frac{1}{3}$. This is read as “one third”.

Let us consider further, the parts obtained by dividing a whole unit into equal parts as shown in the pictures below.

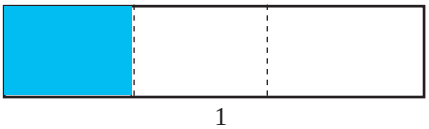
1

Let us take the coloured quantity as one unit , and represent it numerically as one.



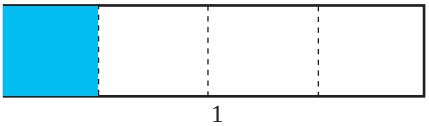
$\frac{1}{2}$

The same unit is now divided into two equal parts , and one part is coloured. The coloured quantity is $\frac{1}{2}$. This is read as “one half ”. There are two $\frac{1}{2}$ quantities in a unit.



$\frac{1}{3}$

The same unit is now divided into three equal parts , and one part is coloured. The coloured quantity is $\frac{1}{3}$. This is read as “one third ”. There are three $\frac{1}{3}$ quantities in a unit.



$\frac{1}{4}$

The same unit is now divided into four equal parts , and one part is coloured. The coloured quantity is $\frac{1}{4}$. This is read as “one fourth ”. There are four $\frac{1}{4}$ quantities in a unit.

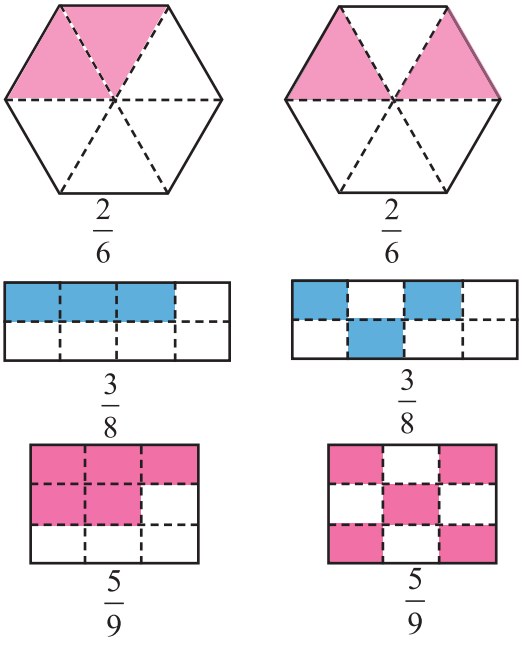
$\frac{2}{3}$

The same unit is now divided into three equal parts, and two parts are coloured. The coloured quantity is $\frac{2}{3}$. This is read as "two thirds ".

Note

In general use, we read $\frac{1}{2}$ as **half**, $\frac{1}{4}$ as **quarter** and $\frac{3}{4}$ as **three quarters.**

If we consider each of the figures below as a whole unit, and numerically represent each figure as 1, then the coloured quantities are $\frac{2}{6}, \frac{2}{6}, \frac{3}{8}, \frac{3}{8}, \frac{5}{9}$, and $\frac{5}{9}$ respectively.



$\frac{2}{6}$ $\frac{2}{6}$ $\frac{3}{8}$ $\frac{3}{8}$ $\frac{5}{9}$ $\frac{5}{9}$

What we have done so far is to,

- numerically represent the quantity shown by a unit as 1.
- divide that unit into equal parts.
- numerically represent the quantity shown by one or several of those parts.

The numbers, which are less than one and greater than zero represented in this manner are known as **proper fractions.**

Some examples of proper fractions are $\frac{1}{2}$, $\frac{1}{4}$, $\frac{2}{3}$ and $\frac{3}{8}$.

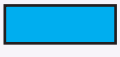
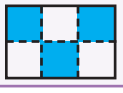
Note

There are fractions which are greater than one as well. You will be able to learn those in a higher grade.

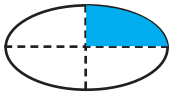
This picture has been divided into four parts. But, the coloured part is not $\frac{1}{4}$ of the whole unit.

Exercise 9.1

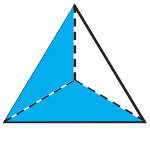
(1) Fill in the blanks given in the table.

Unit	Represented quantity	Number of parts divided equally	Number of coloured parts	Quantity of the coloured part as a fraction	The way of reading
		2	1	$\frac{1}{2}$	One half
		3	.....	.....	.....
		.....	.....	.....	.....
		.....	.....	.....	.....

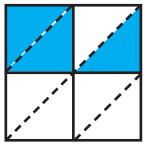
(2) Consider each of the figures below as a whole unit. Now write down the coloured quantity as a fraction.



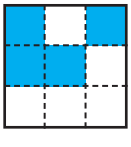
(i)



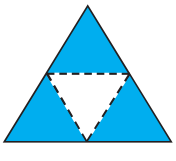
(ii)



(iii)

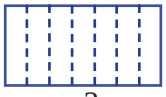


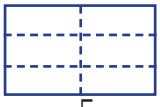
(iv)

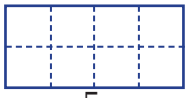


(v)

(3) Copy each of the pictures below and colour the quantity indicated by the fraction.

(i)  $\frac{3}{7}$

(ii)  $\frac{5}{6}$

(iii)  $\frac{5}{8}$

9.2 The denominator and the numerator of a fraction

Consider the fraction $\frac{4}{7}$.

Here, 7 is the number of parts a whole unit is divided equally into. We call it the **denominator** of the fraction. It is written below the line of the fraction.

4 is the number of parts considered. We call it the **numerator** of the fraction. It is written above the line of the fraction.

$\frac{4}{7}$ ← numerator
← denominator

When we write a fraction numerically in this manner,

- the number written below the line is defined as the **denominator** of the fraction.
- the number written above the line is defined as the **numerator** of the fraction.

In a proper fraction, the numerator is always less than its denominator.

Consider the fractions such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{5}$, where the numerator is one. Such fractions are called **unit fractions.**

Such a fraction indicates the quantity of one part by dividing a whole unit into equal parts. These fraction are important because they can be used to explain other fractions.

Let us now explain $\frac{2}{3}$ in terms of $\frac{1}{3}$.

Let us represent this by a figure.

This picture is divided into three equal parts. One part is $\frac{1}{3}$ of the whole unit. The coloured quantity, that is, $\frac{2}{3}$ is two such parts.

That is $\frac{2}{3}$ is two $\frac{1}{3}$s.

Similarly,

$\frac{3}{4}$ is, three $\frac{1}{4}$s, $\frac{5}{7}$ is five $\frac{1}{7}$s and three $\frac{1}{5}$ s is $\frac{3}{5}$.

Exercise 9.2

(1) Fill in the blanks using the words "denominator" and "numerator" appropriately.

(i) The ..... of $\frac{3}{8}$ is 8. (ii) The ..... of $\frac{5}{11}$ is 5.

(2) Write down the fraction with denominator 5 and numerator 2.

(3) Out of the proper fractions given below, choose and write down the unit fractions.

$\frac{3}{5}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{1}{7}$, $\frac{4}{11}$, $\frac{7}{10}$, $\frac{1}{15}$, $\frac{1}{27}$

(4) Choose the appropriate value from the brackets and fill in the blanks.

(i) $\frac{2}{5}$ is.... $\frac{1}{5}$s. (one, two, three) (ii) $\frac{4}{7}$ is.... $\frac{1}{7}$s. (eight, seven, four)

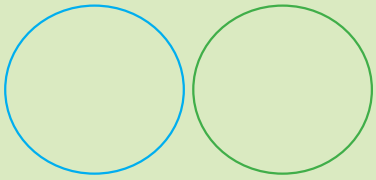
(iii) $\frac{2}{3}$ is two.....s. ($\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{6}$) (iv) $\frac{3}{4}$ is three.....s. ($\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{4}$)

(v) Three.....is $\frac{3}{5}$.($\frac{1}{3}$s, $\frac{1}{5}$s, $\frac{1}{4}$s) (vi) Five.....is $\frac{5}{8}$. ($\frac{1}{7}$s, $\frac{1}{8}$s, $\frac{1}{12}$s)

9.3 Equivalent fractions

Activity 1

Take two white circular shaped cards of the same size.

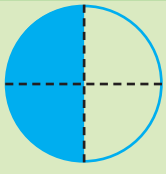


Step 1 - Fold the first circular card once, so that it is divided into two equal parts.

Step 2 - Fold the second circular card twice, so that it is divided into four equal parts.

Step 3 - Unfold both cards and colour half of each of them. Then we obtain the following figure.

The coloured portion of this card is $\frac{1}{2}$ of the entire card.



The coloured portion of this card is $\frac{2}{4}$ of the entire card.

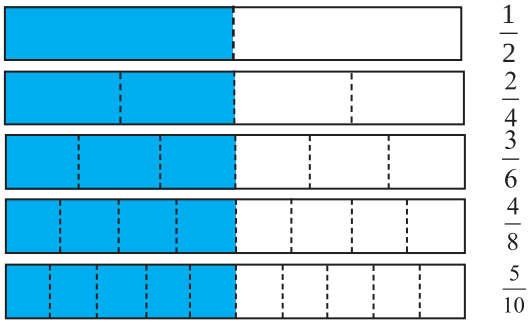
The coloured quantity of the entire card is the same in both cards. Therefore, the numbers represented by $\frac{1}{2}$ and $\frac{2}{4}$ are the same.

Accordingly, $\frac{1}{2} = \frac{2}{4}$

Such fractions which represent the same value although they have different denominators and different numerators, are known as **equivalent fractions.**

Accordingly, $\frac{1}{2}$ and $\frac{2}{4}$ are equivalent fractions.

Let us consider equivalent fractions further.



The shaded quantities in each of the figures above are the same.

Therefore, the fractions $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}, \frac{4}{8}$ and $\frac{5}{10}$ represented by them are equal. Therefore, these fractions are equivalent fractions.

Let us consider two other methods of obtaining these equivalent fractions.

Method 1

$\frac{1}{2} = \frac{1\times2}{2\times2} = \frac{2}{4}$, Here, the denominator and the numerator are multiplied by 2.

$\frac{1}{2} = \frac{1\times3}{2\times3} = \frac{3}{6}$, Here, the denominator and the numerator are multiplied by 3.

$\frac{1}{2} = \frac{1\times4}{2\times4} = \frac{4}{8}$, Here, the denominator and the numerator are multiplied by 4.

$\frac{1}{2} = \frac{1\times5}{2\times5} = \frac{5}{10}$, Here, the denominator and the numerator are multiplied by 5.

This shows that, by multiplying both the numerator and the denominator of a fraction by the same whole number (except zero), a fraction which is equivalent to the first fraction can be obtained.

Method 2

$\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}$, Here, both the denominator and the numerator are divided by 2

$\frac{3}{6} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2}$, Here, both the denominator and the numerator are divided by 3

$\frac{4}{8} = \frac{4 \div 4}{8 \div 4} = \frac{1}{2}$, Here, both the denominator and the numerator are divided by 4

This shows that, by dividing both the numerator and the denominator of a fraction by the same whole number (where the division gives zero remainder), a fraction which is equivalent to the first fraction can be obtained.

Example 1

Write down two fractions equivalent to $\frac{2}{10}$.

$\frac{2}{10} = \frac{2 \times 3}{10 \times 3} = \frac{6}{30}$

$\frac{2}{10} = \frac{2 \div 2}{10 \div 2} = \frac{1}{5}$

$\frac{6}{30}$ and $\frac{1}{5}$ are equivalent to $\frac{2}{10}$.

Example 2

Determine whether $\frac{2}{10}$ and $\frac{3}{15}$ are equivalent fractions.

$\frac{2}{10} = \frac{2 \div 2}{10 \div 2} = \frac{1}{5}$

$\frac{3}{15} = \frac{3 \div 3}{15 \div 3} = \frac{1}{5}$

Accordingly, $\frac{2}{10} = \frac{3}{15}$.

Therefore, $\frac{2}{10}$ and $\frac{3}{15}$ are equivalent fractions.

Exercise 9.3

(1) Fill in the blanks so that you obtain fractions that are equivalent to the first fraction.

(i) $\frac{1}{3}=\frac{1\times 2}{3\times\square}=\frac{2}{6}$ (ii) $\frac{3}{4}=\frac{3\times\square}{4\times 3}=\frac{\square}{\square}$

(iii) $\frac{8}{12}=\frac{8\div\square}{12\div 4}=\frac{\square}{\square}$ (iv) $\frac{10}{20}=\frac{10\div\square}{20\div\square}=\frac{\square}{2}$

(v) $\frac{4}{9}=\frac{8}{\square}=\frac{\square}{36}=\frac{\square}{\square}$ (vi) $\frac{4}{8}=\frac{4\div 2}{8\div\square}=\frac{\square}{\square}$

(vii) $\frac{2}{7}=\frac{2\times\square}{7\times\square}=\frac{\square}{14}$ (viii) $\frac{4}{5}=\frac{\square}{10}=\frac{\square}{15}$

(2) For each fraction below, write down two equivalent fractions.

(i) $\frac{1}{4}$ (ii) $\frac{3}{5}$ (iii) $\frac{7}{8}$

(iv) $\frac{6}{12}$ (v) $\frac{8}{10}$ (vi) $\frac{2}{7}$

(3) (i) Determine whether $\frac{2}{4}$ and $\frac{6}{12}$ are equivalent fractions.

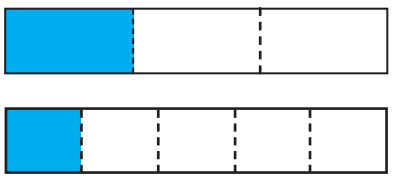
(ii) Determine whether $\frac{1}{6}$ and $\frac{3}{12}$ are equivalent fractions.

(4) Write down a fraction having denominator 6, which is equivalent to $\frac{1}{2}$ and a fraction having denominator 6, which is equivalent to $\frac{2}{3}$.

9.4 Comparison of fractions

• Comparison of fractions having the numerator as 1

The figures below represent the fractions $\frac{1}{3}$ and $\frac{1}{5}$.



$\frac{1}{3}$

$\frac{1}{5}$

According to the figures above, it is clear that $\frac{1}{3}$ is greater than $\frac{1}{5}$. We write this symbolically as $\frac{1}{3} > \frac{1}{5}$.

Out of $\frac{1}{3}$ and $\frac{1}{5}$, the fraction with the smaller denominator is $\frac{1}{3}$.

In this manner, out of two unit fractions, the larger fraction is the fraction with the smaller denominator.

• Comparison of fractions having the same numerator

Compare the fractions $\frac{2}{3}$ and $\frac{2}{5}$.

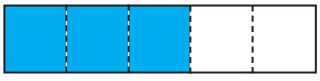
We learnt that, $\frac{2}{3}$ is two $\frac{1}{3}$s and $\frac{2}{5}$ is two $\frac{1}{5}$s.

Since $\frac{1}{3} > \frac{1}{5}$, we have $\frac{2}{3} > \frac{2}{5}$.

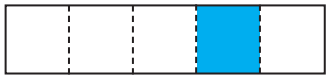
In this manner, out of two fractions having the same numerator, the larger fraction is the fraction with the smaller denominator.

• Comparison of fractions having the same denominator

Suppose a cake is cut into five equal parts and brother took three parts while sister took one part. Here, brother has taken a larger portion of the cake. Let us represent this by a figure.



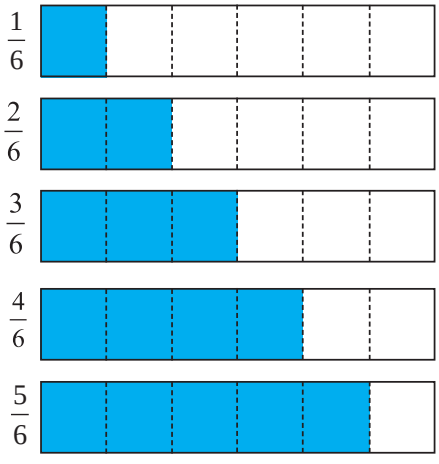
The portion that brother has taken is $\frac{3}{5}$.



The portion that sister has taken is $\frac{1}{5}$.

Accordingly, $\frac{3}{5} > \frac{1}{5}$. We can also write this as $\frac{1}{5} < \frac{3}{5}$.

Let us consider another example.
Fractions having 6 as their denominator are represented in the figure below.



According to the figures, it is clear that,

$$\frac{1}{6} < \frac{2}{6} < \frac{3}{6} < \frac{4}{6} < \frac{5}{6} < 1.$$

We can also write this as,

$$1 > \frac{5}{6} > \frac{4}{6} > \frac{3}{6} > \frac{2}{6} > \frac{1}{6}.$$

Out of two fractions having the same denominator, the larger fraction is the fraction with the larger numerator.

Example 1

Arrange the fractions $\frac{4}{5}, \frac{1}{5}, \frac{2}{5}$ in ascending order.

$\frac{1}{5} < \frac{2}{5} < \frac{4}{5}$. The ascending order of these fractions is $\frac{1}{5}$, $\frac{2}{5}$, $\frac{4}{5}$.

More on comparison of fractions

Let us consider the comparison of fractions such as $\frac{1}{6}$ and $\frac{5}{12}$, where the numerators and denominators are not equal.

Let us write these fractions as fractions having the same denominator using equivalent fractions.
Thereafter, we can identify the larger fraction as in the earlier situation.

$\frac{1}{6} = \frac{1\times2}{6\times2} = \frac{2}{12}$.

$\frac{5}{12}$ is greater than $\frac{2}{12}$.

That is, $\frac{5}{12} > \frac{2}{12}$. Accordingly, $\frac{5}{12} > \frac{1}{6}$.

Example 1

Select the larger fraction out of $\frac{1}{2}$ and $\frac{3}{4}$.

$\frac{1}{2} = \frac{1\times2}{2\times2} = \frac{2}{4}$

Since $\frac{3}{4} > \frac{2}{4}$, we have $\frac{3}{4} > \frac{1}{2}$. Therefore, the larger fraction is $\frac{3}{4}$.

Exercise 9.4

(1) Find the largest fraction out of the fractions in each of the following parts.

(i) $\frac{1}{6}, \frac{1}{2}$ (ii) $\frac{1}{11}, \frac{1}{15}$ (iii) $\frac{1}{8}, \frac{1}{3}$

(iv) $\frac{1}{5}, \frac{1}{3}, \frac{1}{7}$ (v) $\frac{1}{12}, \frac{1}{5}, \frac{1}{6}$ (vi) $\frac{2}{3}, \frac{2}{5}$

(vii) $\frac{5}{7}, \frac{5}{6}$ (viii) $\frac{3}{4}, \frac{3}{8}$ (ix) $\frac{4}{9}, \frac{4}{5}, \frac{4}{7}$

(x) $\frac{6}{11}, \frac{6}{17}, \frac{6}{13}$

(2) Fill in the blanks by inserting one of the symbols < , > or = appropriately.

(i) $\frac{1}{5}$.....$\frac{3}{5}$ (ii) $\frac{8}{13}$.....$\frac{5}{13}$ (iii) $\frac{1}{6}$.....$\frac{1}{2}$

(iv) $\frac{5}{7}$.....$\frac{5}{11}$ (v) $\frac{4}{9}$.....$\frac{4}{7}$ (vi) $\frac{1}{3}$.....$\frac{5}{6}$

(vii) $\frac{6}{10}$.....$\frac{3}{5}$ (viii) $\frac{7}{18}$.....$\frac{2}{3}$ (ix) $\frac{3}{4}$.....$\frac{9}{12}$

(x) $\frac{2}{5}$.....$\frac{1}{2}$ (xi) $\frac{2}{10}$.....$\frac{1}{9}$ (xii) $\frac{1}{2}$.....$\frac{7}{11}$

(3) Write down the fractions in each of the following parts in ascending order.

(i) $\frac{1}{7}, \frac{1}{4}, \frac{1}{9}$ (ii) $\frac{4}{5}, \frac{4}{11}, \frac{4}{7}$ (iii) $\frac{3}{8}, \frac{5}{8}, \frac{1}{8}$

(iv) $\frac{7}{12}, \frac{11}{12}, \frac{5}{12}$ (v) $\frac{11}{12}, \frac{5}{6}, \frac{7}{12}$ (vi) $\frac{7}{10}, \frac{7}{11}, \frac{13}{22}$

(4) Write down two fractions less than $\frac{1}{2}$ and having different denominators to each other.

9.5 Addition and subtraction of fractions

- Addition and subtraction of fractions having the same denominator.

A cake was brought home. Mother divided it into 8 equal parts. Then one part is $\frac{1}{8}$ of the whole cake.

Damith ate 2 parts, that is $\frac{2}{8}$ of the cake at tea time. His sister ate another part, that is $\frac{1}{8}$ of the cake at tea time. The total amount Damith and his sister ate is three $\frac{1}{8}$s. That is, $\frac{3}{8}$.

Therefore, when a quantity of $\frac{2}{8}$ is added to a quantity of $\frac{1}{8}$, the total quantity is $\frac{3}{8}$.

Let us show this symbolically.

$$\frac{2}{8}+\frac{1}{8}=\frac{3}{8}$$

In this manner, when adding two fractions having the same denominator, the denominator of the answer is the same as the denominators of the added fractions. The numerator of the answer is the addition of the numerators of the added fractions.

Example 1

Add $\frac{2}{4}$ to $\frac{1}{4}$.

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

Example 2

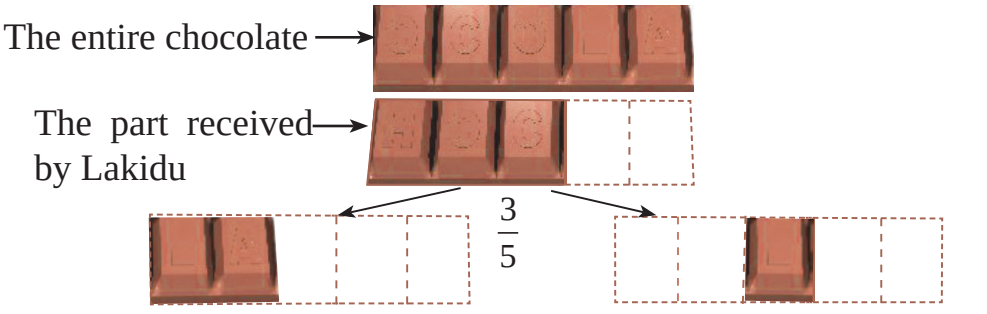
Find the value of $\frac{2}{9}+\frac{5}{9}$.

$$\frac{2}{9}+\frac{5}{9}=\frac{2+5}{9}$$
$$=\frac{7}{9}$$

• Subtraction of fractions having the same denominator

Lakindu received $\frac{3}{5}$ of a chocolate that can be divided into 5 equal parts. A part equal to $\frac{1}{5}$ of the entire chocolate was given to Sakindu, from the part $\frac{3}{5}$ that Lakindu recieved.

Then, Lakindu was left with $\frac{2}{5}$ of the entire chocolate.



Let us represent this symbolically.

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

When subtracting fractions having the same denominator, the denominator of the answer is same as the denominator of those fractions. The numerator of the answer is the value that is obtained by subtracting the numerator of the second fraction from the numerator of the first fraction.

Example 1

Find the value of $\frac{5}{7}-\frac{2}{7}$

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

Example 2

Find the value of $\frac{10}{13}-\frac{4}{13}$

$$\frac{10}{13}-\frac{4}{13}=\frac{10-4}{13}$$
$$=\underline{\underline{\frac{6}{13}}}$$

Example 3

Find the value of $\frac{7}{15}-\frac{2}{15}$

$$\frac{7}{15}-\frac{2}{15}=\frac{7-2}{15}=\frac{5}{15}$$
$$=\frac{5\div 5}{15\div 5}$$
$$=\underline{\underline{\frac{1}{3}}}$$

If it is necessary, the following equivalent fraction can also be obtained.

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Exercise 9.5

(1) Simplify the following.

(a) $\frac{2}{5}+\frac{1}{5}$ (b) $\frac{2}{7}+\frac{1}{7}$ (c) $\frac{1}{9}+\frac{1}{9}$

(d) $\frac{1}{6}+\frac{2}{6}$ (e) $\frac{1}{4}+\frac{2}{4}$ (f) $\frac{5}{11}+\frac{1}{11}$

(g) $\frac{3}{5}+\frac{1}{5}$ (h) $\frac{3}{8}+\frac{5}{8}$ (i) $\frac{7}{12}+\frac{5}{12}$

(j) $\frac{4}{7}+\frac{2}{7}$ (k) $\frac{3}{10}+\frac{3}{10}$ (l) $\frac{4}{8}+\frac{3}{8}$

(m) $\frac{2}{6}+\frac{3}{6}$ (n) $\frac{7}{15}+\frac{3}{15}$ (o) $\frac{2}{7}+\frac{1}{7}+\frac{3}{7}$

(p) $\frac{2}{8}+\frac{3}{8}+\frac{1}{8}$ (q) $\frac{3}{10}+\frac{4}{10}+\frac{2}{10}$ (r) $\frac{3}{9}+\frac{1}{9}+\frac{2}{9}$

(s) $\frac{1}{6}+\frac{2}{6}+\frac{3}{6}$ (t) $\frac{7}{15}+\frac{6}{15}+\frac{2}{15}$

(2) Write the relevant values in the boxes.

(a) $\frac{7}{9}-\frac{2}{9}=\frac{7-\square}{9}=\frac{\square}{9}$ (b) $\frac{5}{7}-\frac{2}{7}\ \frac{\square-2}{7}=\frac{\square}{7}$

(c) $\frac{7}{10}-\frac{3}{10}=\frac{\square-\square}{10}=\frac{\square}{10}$ (d) $\frac{7}{8}-\frac{4}{8}=\frac{\square-\square}{\square}=\frac{\square}{\square}$

(e) $\frac{8}{15}-\frac{7}{15}=\frac{\square-\square}{\square}=\frac{\square}{\square}$

(3) Simplify the following.

(a) $\frac{2}{3}-\frac{1}{3}$ (b) $\frac{3}{5}-\frac{1}{5}$ (c) $\frac{9}{10}-\frac{1}{10}$

(d) $\frac{3}{4}-\frac{1}{4}$ (e) $\frac{6}{8}-\frac{1}{8}$ (f) $\frac{7}{8}-\frac{3}{8}$

(g) $\frac{6}{11}-\frac{5}{11}$ (h) $\frac{5}{9}-\frac{4}{9}$ (i) $\frac{6}{7}-\frac{1}{7}$

(j) $\frac{5}{6}-\frac{4}{6}$ (k) $\frac{11}{15}-\frac{4}{15}$ (l) $\frac{9}{13}-\frac{4}{13}$

(m) $\frac{5}{8}-\frac{3}{8}$ (n) $\frac{7}{9}-\frac{6}{9}$ (o) $\frac{17}{20}-\frac{7}{20}$

(4) Write the relevant values in the boxes.

(a) $\frac{7}{15}+\frac{\square}{15}=\frac{12}{15}$ (b) $\frac{\square}{6}+\frac{3}{6}=\frac{5}{6}$ (c) $\frac{6}{8}+\frac{\square}{8}=\frac{7}{8}$

(d) $\frac{2}{7}+\frac{\square}{7}=\frac{6}{7}$

• More on addition of fractions

Let us consider fractions such as $\frac{3}{10}$ and $\frac{2}{5}$, where the denominators are different.

Let us add $\frac{3}{10}$ to $\frac{2}{5}$.

Find the fraction having denominator 10, which is equivalent to $\frac{2}{5}$.

$\frac{2}{5}=\frac{2\times 2}{5\times 2}=\frac{4}{10}$

Therefore $\frac{3}{10}+\frac{2}{5}=\frac{3}{10}+\frac{4}{10}=\frac{7}{10}$

First, fractions having the same denominator, and which are equal to the given fractions are obtained in terms of equivalent fractions. Thereafter, the addition is carried out.

Example 1

Find the value of $\frac{1}{2}+\frac{1}{4}$.

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

Example 2

Find the value of $\frac{2}{3}+\frac{1}{15}$.

$$\frac{2}{3}+\frac{1}{15}=\frac{2\times 5}{3\times 5}+\frac{1}{15}$$
$$=\frac{10}{15}+\frac{1}{15}$$
$$=\frac{10+1}{15}$$
$$=\frac{11}{15}$$

• More on subtraction of fractions

Let us consider about subtracting $\frac{1}{4}$ from $\frac{1}{2}$, where the fractions have different denominators.

Let us write the fraction equivalent to $\frac{1}{2}$ having 4 as the denominator.

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

Then,

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

Here also, subtraction is carried out by obtaining fractions equivalent to the given fractions with the same denominator.

Example 1

Find the value of $\frac{7}{10}-\frac{2}{5}$.

$$\frac{7}{10}-\frac{2}{5}=\frac{7}{10}-\frac{2\times 2}{5\times 2}$$
$$=\frac{7}{10}-\frac{4}{10}$$
$$=\underline{\underline{\frac{3}{10}}}$$

Example 2

Find the value of $\frac{2}{3}-\frac{3}{12}$.

$$\frac{2}{3}-\frac{3}{12}=\frac{2\times 4}{3\times 4}-\frac{3}{12}$$
$$=\frac{8}{12}-\frac{3}{12}$$
$$=\frac{8-3}{12}$$
$$=\underline{\underline{\frac{5}{12}}}$$

Exercise 9.6

(1) Simplify the following.

(a) $\frac{1}{3}+\frac{1}{6}$ (b) $\frac{1}{4}+\frac{1}{2}$ (c) $\frac{3}{10}+\frac{3}{5}$

(d) $\frac{1}{4}+\frac{3}{8}$ (e) $\frac{2}{9}+\frac{2}{3}$ (f) $\frac{2}{7}+\frac{4}{21}$

(g) $\frac{3}{12}+\frac{2}{3}$ (h) $\frac{2}{5}+\frac{11}{20}$ (i) $\frac{2}{15}+\frac{2}{3}$

(j) $\frac{3}{4}+\frac{3}{20}$ (k) $\frac{3}{18}+\frac{2}{3}$ (l) $\frac{1}{4}+\frac{11}{24}$

(m) $\frac{7}{30}+\frac{2}{3}$ (n) $\frac{1}{2}+\frac{5}{16}$ (o) $\frac{5}{21}+\frac{2}{3}$

(2) Simplify the following.

(a) $\frac{1}{3}-\frac{1}{6}$ (b) $\frac{3}{4}-\frac{1}{2}$ (c) $\frac{3}{5}-\frac{3}{10}$

(d) $\frac{5}{6}-\frac{2}{3}$ (e) $\frac{8}{15}-\frac{2}{5}$ (f) $\frac{3}{4}-\frac{5}{12}$

(g) $\frac{17}{18}-\frac{5}{6}$ (h) $\frac{4}{5}-\frac{7}{20}$ (i) $\frac{13}{15}-\frac{2}{3}$

(j) $\frac{2}{3} - \frac{5}{12}$ (k) $\frac{19}{20} - \frac{3}{4}$ (l) $\frac{27}{30} - \frac{5}{6}$

(m) $\frac{3}{4} - \frac{17}{24}$ (n) $\frac{1}{2} - \frac{5}{16}$ (o) $\frac{2}{3} - \frac{9}{21}$

(3) On Monday Amal read $\frac{1}{2}$ of a story book. On Tuesday he read another $\frac{1}{4}$ of the book .What fraction of the book was read in total by Amal on the two days?

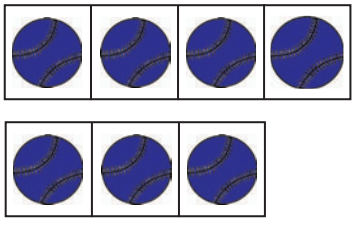
(4) Father spends $\frac{1}{4}$ of his monthly salary on his children's clothes and $\frac{1}{12}$ of his salary on books.

(i) What is the total amount spent as a fraction of the monthly salary?

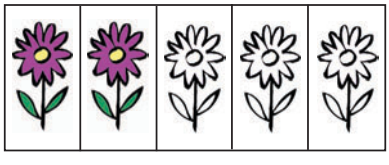
(ii) How much more is spent on clothes than on books as a fraction of the monthly salary?

9.5 A fraction of a homogeneous collection

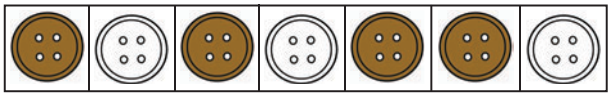
We already know to express parts of a whole unit as fractions. Now, let us express a part of a collection as a fraction.



Let us take a collection of four balls as a unit. Remove one of it. Then, the amount of balls remaining is $\frac{3}{4}$ as a fraction of the collection.



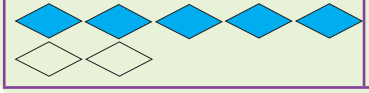
From a collection of five flowers, the amonut of purple flowers is $\frac{2}{5}$ as a fraction of the collection.



From a collection of seven buttons, the amount of brown buttons is $\frac{4}{7}$ as a fraction of the collection.

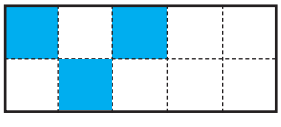
Activity 2

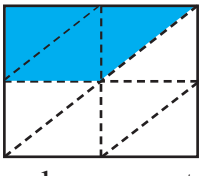
Fill in the blanks in the table given below.

Collection	Total number of parts in the collection	Number of coloured parts	Coloured quantity as a fraction of the total quantity
	2	1	$\frac{1}{2}$
	3	.....	.....
	.....	.....	.....
	.....	.....	.....

Miscellaneous Exercises

(1) Write down the coloured part as a fraction of each unit given below.

(i) 

(ii) 

(2) Consider a suitable figure as a unit and represent each fraction given below.

(i) $\frac{1}{5}$ (ii) $\frac{4}{7}$ (iii) $\frac{3}{8}$ (iv) $\frac{5}{6}$ (v) $\frac{7}{9}$

(3) For each fraction given below, write down two equivalent fractions.

(i) $\frac{5}{6}$ (ii) $\frac{3}{4}$ (iii) $\frac{1}{7}$ (iv) $\frac{10}{15}$ (v) $\frac{8}{12}$

(4) Write down the fractions $\frac{8}{15}, \frac{4}{15}, \frac{2}{3}$ and $\frac{3}{5}$, in ascending order.

(5) Write down the fractions $\frac{1}{2}, \frac{2}{3}, \frac{2}{9}$ and $\frac{7}{18}$, in descending order.

(6) Find the value of the following.

(i) $\frac{1}{2}+\frac{2}{10}$ (ii) $\frac{7}{8}-\frac{1}{4}$ (iii) $\frac{10}{13}-\frac{4}{13}$ (iv) $\frac{4}{5}-\frac{7}{15}$

(v) $\frac{1}{2}+\frac{1}{6}+\frac{1}{6}$ (vi) $\frac{1}{2}+\frac{1}{5}+\frac{2}{10}$ (vii) $\frac{1}{12}+\frac{1}{6}+\frac{1}{2}$ (viii) $\frac{1}{2}+\frac{2}{12}+\frac{1}{24}$

(ix) $\frac{1}{16}+\frac{5}{8}+\frac{1}{4}$ (x) $\frac{1}{10}+\frac{2}{5}+\frac{1}{20}$

(7) Father distributed $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{12}$ of his money among his three children.

(i) What is the total amount given to the children as a fraction of the father's money ?

(ii) What is the difference between the greatest amount and the least amount received as a fraction of the father's money?

Summary

- Fractions with numerator equal to one are known as unit fractions.
- Fractions which are less than one and greater than zero are known as proper fractions.
- By multiplying or dividing both the numerator and the denominator of a fraction by the same whole number (except zero), a fraction which is equivalent to the first fraction can be obtained.
- The answers obtained by adding or subtracting fractions which have the same denominator also have the same denominator.
- In adding fractions having the same denominator, the numerator of the answer is obtained by adding the numerators.
- In subtracting fractions having the same denominator, the numerator of the answer is obtained by subtracting the numerators.

10 Selection

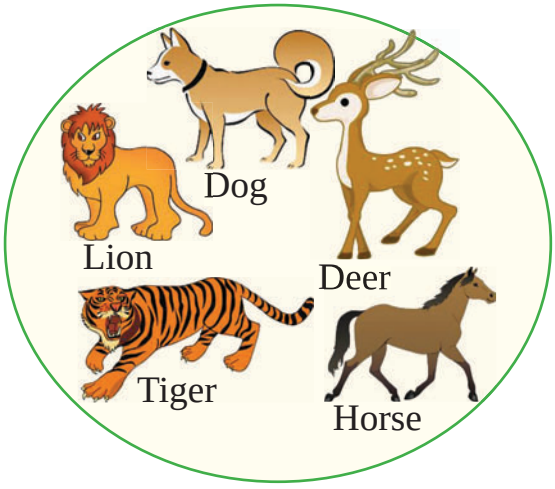
By studying this lesson, you will be able to,

- separate items in a collection into groups that have common characteristics and
- name the group according to the common characteristics of the group.

Most of the things we know can be separated into groups, which have common characteristics that have been identified.

As an example, let us consider the following collection of animals.

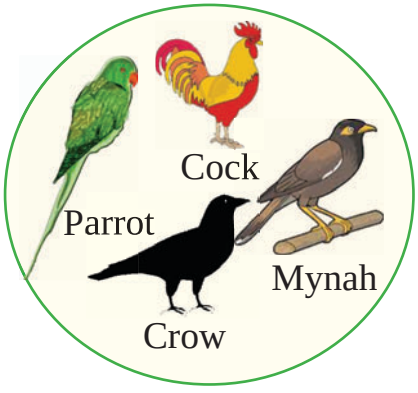
The animals in this figure can be grouped in various ways. A way of separating these animals into two groups is given below.



Group 1

A common characteristic of the animals in this group is that they each have four feet.

Therefore, this group can be named as "Four-footed animals in this collection of animals".



Group 2

A common characteristic of the animals in this group is that they all can fly. Therefore this group can be named as "Birds in this collection of animals".

Another common characteristic is that they each have only two feet. Therefore, this group can also be named as "Two-footed animals in this collection of animals".

These animals can also be separated into three groups named Herbivores, Carnivores and Omnivores based on what they eat.

Example 1

(i) Separate the numbers 2, 5, 3, 8, 11, 4, 7, 9 and 6 into two groups based on a common characteristic and write them down.

(ii) What is the characteristic which is common to each group?

(iii) Propose a suitable name for each group based on the common characteristic.

2	4	6	8

Common characteristic is that these numbers can be divided by two without a remainder.
Proposed name – Even Numbers in this collection

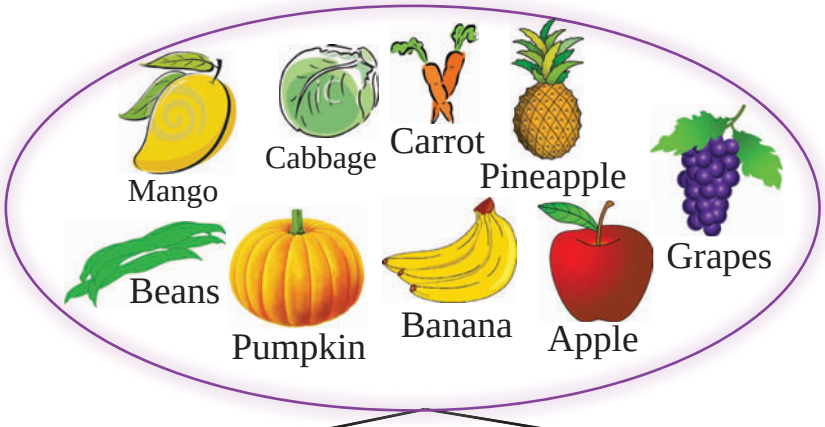
3	5	7	9	11

Common characteristic is that these numbers have a remainder of 1 when divided by two.
Proposed name – Odd Numbers in this collection

Exercise 10.1

(1) Separate the collection of items in each of the figures given below into two groups according to the given characteristics and write them down.

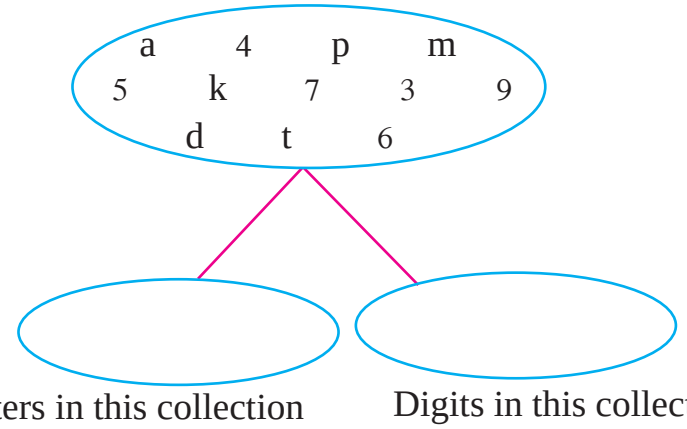
(i)



Vegetables in this collection

Fruits in this collection

(ii)



(2) Separate the following items into three groups based on their common characteristics and write down their names. Write a suitable name for each group.

(i)


Bus

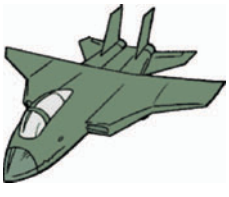

Ship


Lorry


Motorboat


Three wheeler


Motor Cycle


Jet

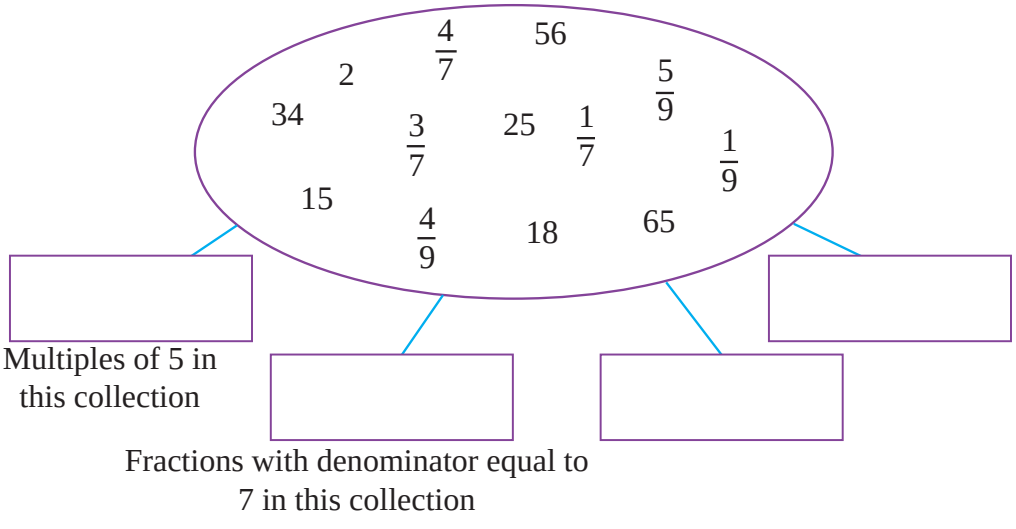

Helicopter


Sailboat

(ii)

27	1453	61	795
2015	149	460	3333
97	606	9532	12
893	7995	80	

(3) Two of the common characteristics that were used to separate the following numbers into four groups are given. Identify a common characteristic for each of the other two groups. Give a suitable name to each group and then separate all the given numbers appropriately into the four groups and write them down.



Summary

- A collection of items having certain characteristics can be separated into groups based on their common characteristics.
- Groups of items having common characteristics can be named based on their common characteristics.

11 Factors and Multiples

By studying this lesson, you will be able to,

- find the factors and multiples of a whole number,
- solve problems related to factors and multiples and
- examine whether a whole number is divisible by 2, 5 and 10.

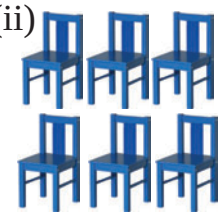
11.1 Identifying factors

Consider a class consisting of six children. Suppose an equal number of children should sit in each row. The ways in which the 6 chairs can be arranged is shown below.

(i)

1 row with 6 chairs in the row

(ii)



2 rows with 3 chairs in each row

(iii)

3 rows with 2 chairs in each row

(iv)

6 rows with 1 chair in each row

In such arrangements, the total number of 6 chairs is obtained by the product of the number of chairs in a row and the number of rows. By that it is clear that, there are many ways of writing 6, as a product of two whole numbers.

$6 = 1 \times 6$
$6 = 2 \times 3$
$6 = 3 \times 2$
$6 = 6 \times 1$

Now, let us consider how the chairs in a classroom can be arranged as above if there are twelve chairs. In this arrangement also, the total number of chairs is obtained by the product of the number of chairs in a row and the number of rows.

$12 = 1 \times 12$

$12 = 2 \times 6$

$12 = 3 \times 4$

$12 = 4 \times 3$

$12 = 6 \times 2$

$12 = 12 \times 1$

In this manner, any whole number can be written as a product of two whole numbers in various ways.

When a whole number is written as a product of two whole numbers, those two numbers are known as **factors** of the original number.

Since $6 = 1 \times 6$, the numbers 1 and 6 are factors of 6.
Since $6 = 2 \times 3$, the numbers 2 and 3 are also factors of 6.

When the products relevant to 6 are considered, we obtain that the factors of 6 are 1, 2, 3 and 6.
Similarly, the factors of 12 are 1, 2, 3, 4, 6 and 12.

Now, let us find the factors of 16.
We can write 16 in the following ways as a product of two whole numbers.

$16 = 1 \times 16$
$16 = 2 \times 8$
$16 = 4 \times 4$
$16 = 8 \times 2$
$16 = 16 \times 1$

Accordingly, the factors of 16 are 1, 2, 4, 8 and 16.

When we consider the above products relevant to 16, we see that it is sufficient to write only the following products to obtain the factors of 16.

$16 = 1 \times 16$ $16 = 2 \times 8$ $16 = 4 \times 4$

Example 1

Find the factors of 20.

$20 = 1 \times 20$
$20 = 2 \times 10$
$20 = 4 \times 5$

The factors of 20 are 1, 2, 4, 5, 10 and 20.

Note

- 0 is not a factor of a whole number.

Exercise 11.1

(1) Fill in the blanks with the appropriate whole numbers.

(i) $4 = 1 \times$ .....
$4 = 2 \times$ .....
1, 2 and …… are the factors of 4.

(ii) $7 = 1 \times$ .....
1 and …. are the factors of 7.

(iii) $8 = 1 \times$ .....
$8 = 2 \times$ .....
1, 2, …… and …… are the factors of 8.

(iv) $15 = 1 \times 15$
$15 = 3 \times$ .....
1, 3, …… and …… are the factors of 15.

(v) $24 = 1 \times$ .....
$24 = 2 \times$ .....
$24 = 3 \times$ .....
$24 = 4 \times$ .....
1, 2, ……, ……, ……., ……, …… and …... are the factors of 24.

(vi) When the factors of 18 are written, we obtain 1, 2, …., 6, 9 and 18.

(vii) When the factors of 40 are written, we obtain 1, 2, …., 5, …,10, 20 and ....

(2) Find the factors of each of the following numbers.

(i) 5 (ii) 27 (iii) 17 (iv) 22 (v) 21
(vi) 31 (vii) 32 (viii) 45 (ix) 50 (x) 60

11.2 Finding factors using the multiplication table

Now let us consider how factors of a whole number are found by using the 10 × 10 multiplication table.

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Let us find the factors of 20 using the above multiplication table. For this, let us identify the instances when 20 is obtained as the product.

$20 = 2 \times 10$
$20 = 4 \times 5$

The numbers 2, 4, 5 and 10 are four factors of 20.

Example 1

What are the factors of 72 that can be found using the above multiplication table?

$72 = 8 \times 9$

8 and 9 are the two factors of 72 that can be found using the above multiplication table.

Example 2

What are the factors of 18 that can be found using the above multiplication table?

$18 = 3 \times 6$
$18 = 2 \times 9$

2, 3, 6 and 9 are the four factors of 18 that can be found using the above multiplication table.

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Exercise 11.2

(1) What are the factors of each of the following numbers that can be found using the 10 ×10 multiplication table?

(i) 48 (ii) 81 (iii) 2 (iv) 28 (v) 40

(2) Obtain different ways in which 36 can be written as a product of two whole numbers using the 10 ×10 multiplication table and fill in the blanks.

(i) 9 × ..... (ii) 4 × ..... (iii) 6 × .....

Write down in ascending order, the factors of 36 which can be obtained from the above products.

(3) Obtain different ways in which 9 can be written as a product of two numbers using the 10 × 10 multiplication table and fill in the blanks.

(i) ..... × ..... (ii) ..... × .....

(4) Write down the different ways in which 30 can be written as a product of two whole numbers using the 10 ×10 multiplication table. Thereby write down factors of 30.

(5) Is 4 a factor of 9? Explain the reason for your answer.

11.3 Finding the factors using the method of division

When a number is divided by a factor, there is no remainder. Let us establish this fact through the following examples. The factors of 6 have been obtained before as 1, 2, 3 and 6. When 6 is divided by each of the numbers 1, 2, 3 and 6, there is no remainder.

$6 \div 1 = 6$ with remainder 0. $6 \div 2 = 3$ with remainder 0.

$6 \div 3 = 2$ with remainder 0. $6 \div 6 = 1$ with remainder 0.

Let us divide 6 by 4 and 5 which are not factors of 6.

$$\begin{array}{r} 1 \\ 4\overline{)\,6} \\ \underline{4} \\ 2 \end{array}$$

$6 \div 4 = 1$ with a remainder of 2.

$$\begin{array}{r} 1 \\ 5\overline{)\,6} \\ \underline{5} \\ 1 \end{array}$$

$6 \div 5 = 1$ with a remainder of 1.

Accordingly, when 6 is divided by any of its factors 1, 2, 3 or 6, there is no remainder. However, when 6 is divided by 4 or 5 which are not factors of 6, there is a remainder of 2 and 1 respectively.

If a certain whole number can be divided by another whole number such that there is no remainder, then we identify the second number as a factor of the first number.

Since any whole number can be divided by 1 and the number itself with no remainder, 1 and the number itself are factors of the given number.

Example 1

Find three factors of 30 by using the method of division.

$$\begin{array}{r} 15 \\ 2\overline{)\,30} \\ \underline{2} \\ 10 \\ \underline{10} \\ 0 \end{array} \qquad \begin{array}{r} 10 \\ 3\overline{)\,30} \\ \underline{30} \\ 0 \end{array} \qquad \begin{array}{r} 6 \\ 5\overline{)\,30} \\ \underline{30} \\ 0 \end{array}$$

The number 30 can be divided by 2, 3 and 5 with no remainder. Therefore, 2, 3 and 5 are three factors of 30.

Example 2

Is 9 a factor of 12? Explain the reason for your answer.

9 is not a factor of 12.
$12 \div 9 = 1$ with a remainder of 3.
12 cannot be divided by 9 with a zero remainder.
Therefore, 9 is not a factor of 12.

$$\begin{array}{r} 1 \\ 9\overline{)\,12} \\ \underline{9} \\ 3 \end{array}$$

Exercise 11.3

(1) Find three factors of each of the following numbers using the method of division.
(i) 28 (ii) 32 (iii) 54 (iv) 90 (v) 21

(2) Is 6 a factor of 84? Explain the answer by the method of division.

(3) Is 5 a factor of 48? Explain the reason for your answer.

11.4 Multiples

The answers that are obtained when 2 is multiplied by the whole numbers 1, 2, 3, 4 and 5 are given below.

$2 \times 1 = 2$
$2 \times 2 = 4$
$2 \times 3 = 6$
$2 \times 4 = 8$
$2 \times 5 = 10$

A number which is obtained by multiplying 2 by a whole number in this manner is known as a **multiple of 2.**

In the same manner, a number which is obtained by multiplying 3 by a whole number is known as a multiple of 3.

- 3, 6, 9, 12, 15 and 18 are several multiples of three.

Similarly,

- 5, 10, 15 and 20 are several multiples of five.

Also, observe the following results.

- All the multiples of 2 can be divided by 2 with no remainder.
- All the multiples of 3 can be divided by 3 with no remainder.

It is clear that any multiple of a whole number can be divided by that number with no remainder.

Let us discuss more about multiples.

Consider the numbers which can be written as a product of two whole numbers.

For example, $18 = 3 \times 6$.

Here 18 is obtained by multiplying 3 by 6. That is, 18 is a multiple of 3.

We may write $18 = 6 \times 3$ as well.

Therefore 18 is obtained by multiplying 6 by 3 and hence 18 is a multiple of 6.

That is, 18 is a multiple of both 3 and 6.

Example 1

Check whether 14 is a multiple of 2 by dividing 14 by 2.

$$2 \overline{)\,14} \quad 7$$
$$14$$
$$0$$

Since 14 can be divided by 2 with no remainder, 14 is a multiple of 2.

Example 2

Check whether 42 is a multiple of 3 by dividing 42 by 3.

$$3 \overline{)\,42} \quad 14$$
$$3$$
$$12$$
$$12$$
$$0$$

Since 42 can be divided by 3 with no remainder, 42 is a multiple of 3.

Activity 1

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

(i) Copy the given multiplication table.

(ii) Draw a circle around each of the multiples of 2 in the table.

(iii) Enclose each multiple of three within a triangle.

(iv) Write down 5 numbers which are enclosed within both a circle and a triangle.

(v) What is the smallest number which is a multiple of both 2 and 3?

(vi) You will notice that the numbers which are enclosed within both a circle and a triangle are the multiples of 6. Accordingly, which two numbers are the multiples of 6 necessarily a multiple of?

(vii) According to the above conclusions, 15 is a multiple of 15. What other numbers is 15 a multiple of ?

(viii) Of which numbers is 45 a multiple?

Exercise 11.4

(1) Write down five multiples of 2 which are greater than 10.

(2) Write down four multiples of 3 between 1 and 20.

(3) Write down all the multiples of 4 between 1 and 25.

(4) From the following numbers, select and write down the multiples of three.

26, 60, 115, 48, 26, 14, 27

(5) (i) How many multiples of 9 are there between 1 and 100?

(ii) Of these numbers, which is the greatest multiple of 9?

(6) Write down three multiples of 18.

(7) What is the largest multiple of 9 which is less than 150?

(8) Write down five multiples of each of the following numbers.

(i) 4 (ii) 13 (iii) 15 (iv) 18 (v) 20

(9) Fill in the blanks.

(i) Any multiple of 10 is necessarily a multiple of ……. and .....

(ii) $11 \times 7 = 77$. Therefore, 77 is a multiple of …. and of …….

(10) Write down two numbers which are multiples of both 3 and 4.

(11) Write down a number which is a multiple of 2, 3 and 4.

• Solving problems related to factors and multiples

Now let us solve problems related to factors and multiples.

Example 1

There are 30 apples in a bag. They are separated into bags such that each bag has an equal number of apples.

Find out the number of apples in a bag and the number of bags in each instance.

The total number of apples is obtained by the product of the number of apples in a bag and the number of bags.

Hence we can find out the number of bags and the number of apples in each bag by considering the products of two factors of 30.

$30 = 1 \times 30$ $30 = 6 \times 5$
$30 = 2 \times 15$ $30 = 10 \times 3$
$30 = 3 \times 10$ $30 = 15 \times 2$
$30 = 5 \times 6$ $30 = 30 \times 1$

Accordingly there are eight ways of grouping 30 apples in bags containing the same number of apples.

30 bags with 1 apple in a bag.
15 bags with 2 apples in a bag.
10 bags with 3 apples in a bag.
6 bags with 5 apples in a bag.
5 bags with 6 apples in a bag.
3 bags with 10 apples in a bag.
2 bags with 15 apples in a bag.
1 bag with 30 apples inside it.

Exercise 11.5

(1) The price of a ballpoint pen is Rs 12. Find the price of 8 such pens.
Is it a multiple of 8 and 12?

(2) A water pump takes a day to fill a household tank of capacity 75 gallons.What is the number of times and the total volume of water it can fill during a week?

(3) The price of a Rambutan is 6 rupees. Five children bought 2, 3, 4, 5 and 6 Rambutans respectively. Find the amount each student spent.

(4) A parcel containing the following items needs to be given to each student who participated in a certain event. Find how much it will cost to give 50 students a parcel each.

There are three gingerly rolls (thalaguli), one fish bun, two bananas and a packet of milk in each parcel.

The price of one packet of milk is Rs 30.00
The price of a gingerly roll is Rs 5.00
The price of a fish bun is Rs 30.00
The price of a banana is Rs 10.00

(5) Separate 50 pupils into groups such that each group has an equal number of pupils. What are the numbers which can be taken in each group?

11.5 Divisibility

Through divisibility we can learn about the ability of one whole number to divide another whole number, without a remainder.

Given two numbers, if there is no remainder when one number is divided by the other, then the first number is said to be divisible by the second number.

For example, when 27 is divided by 3, there is no remainder. Therefore, 27 is divisible by 3.

• Examining whether a number is divisible by 2

Activity 2

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

- Draw a circle around each of the above numbers which is divisible by 2.
- Write down the digit in the ones place of each number that is divisible by 2.
- Then you will obtain the numbers 2, 4, 6, 8 and 0. Observe that these too are divisible by 2.
- Examine the digits in the ones place of the numbers which are not divisible by 2 (not circled). They are 1, 3, 5, 7 and 9. These are not divisible by 2.

Accordingly, if the value of the digit in the ones place of a number is divisible by 2, then the number is divisible by 2. Also, if the value of the digit in the ones place of a number is not divisible by 2, then the number is not divisible by 2.

• Examining whether a number is divisible by 5

We have learnt earlier that multiples of 5 such as 5, 10, 15, 20, 25, 30, 35, 40, 45, ... can be divided by 5 without a remainder.
Examine the digit in the ones place of these numbers.

The digit in the ones place of these numbers is always 0 or 5.

That is, if the digit in the ones place of a number is 0 or 5 then that number is divisible by 5.

• Examining whether a number is divisible by 10

We have learnt earlier that multiples of 10 such as 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, … can be divided by 10 without a remainder.
Examine the digit in the ones place of these numbers.
The digit in the ones place of all these numbers is 0.

That is, if the digit in the ones place of a number is 0, then that number is divisible by 10.

Exercise 11.6

(1) From the following, select and write down the numbers which are divisible by 2.

25, 33, 42, 57, 64, 69, 126, 135, 148, 250, 331, 1457, 3263, 4584, 2689, 3150, 2472

(2) What are the digits that the blank box in 128☐ can be filled with, if this number consisting of four digits is divisible by 2?

(3) Select and write down the numbers which are suitable for the blank boxes to the right of the box containing numbers. (A number could be included in more than one box)

105, 212, 310, 256, 125, 375, 420, 860, 1236, 3245, 5180, 1800

(a) Numbers which are divisible by 2.

(b) Numbers which are divisible by 5.

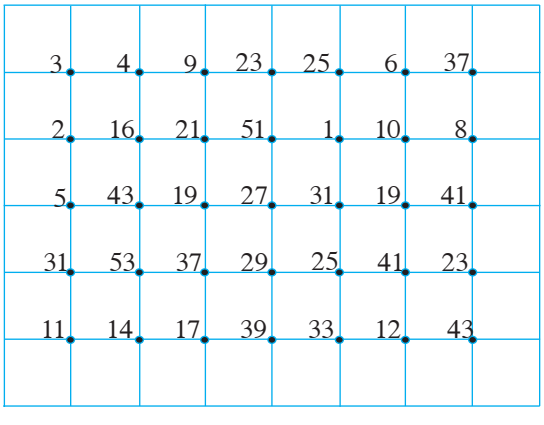
(c) Numbers which are divisible by 10.

(4) (i) Are there numbers which are common to all three of the boxes on the right in question 3 above? What are these numbers?

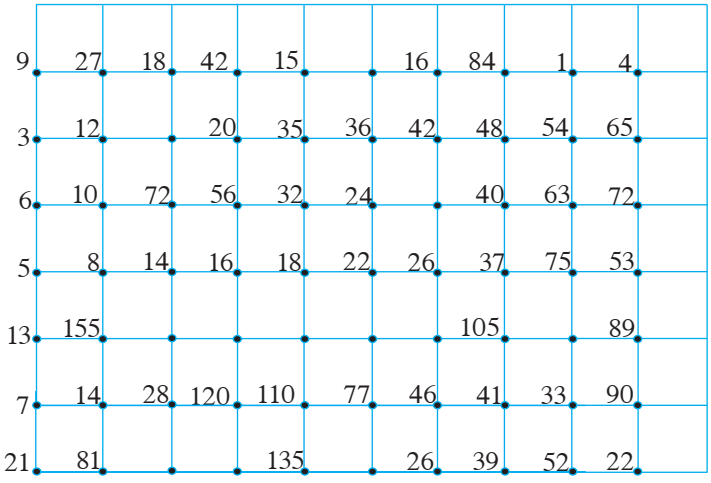
(ii) Are the numbers in box (c) essentially in boxes (a) and (b) ?

(iii) What are the numbers that are common to both boxes (a) and (b) in question 3 above. Examine whether these numbers are in box (c) as well. Accordingly, write down the conclusion that you can draw.

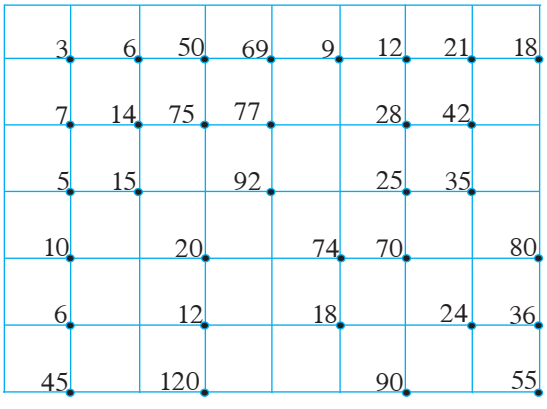
(5) Join the points relevant to the numbers which are divisible by 2 in ascending order. Then, join the points relevant to the smallest number and the largest number you joined.



(6) Join the points relevant to the numbers which are divisible by 5 in ascending order. Then join the points relevant to the smallest number and the largest number you joined.



(7) Join the points relevant to the numbers which are divisible by 10 in ascending order. Then join the points relevant to the smallest number and the largest number you joined.



Miscellaneous Exercise

(1) Give reasons why 7 is not a factor of 45.

(2) All the factors of a certain number, apart from the number itself are 1, 2, 3, 4 and 6.What is this number ?

(3) The number of marbles in a certain box is a multiple of 6. When this number is rounded off to the nearest multiple of ten, the value obtained is 40. Write down the two values that the number of marbles in the box can take.

(4) The number of biscuits there are in a certain packet of biscuits is a multiple of four which is less than 20. When this number is rounded off to the nearest multiple of 10, the value obtained is 20. How many biscuits are there in the packet?

Summary

- A whole number is divisible by each of its factors.
- When a whole number is multiplied by another whole number, a multiple of the initial number is obtained.
- If the value of the digit in the ones place of a number is divisible by 2, then the number is divisible by 2.
- The digit in the ones place of a number which is divisible by 5 is either 0 or 5.
- The digit in the ones place of a number which is divisible by 10 is 0.

Glossary of Technical terms

Acute angle	සුළු කෝණය	கூர்ங்கோணம்
Addition	එකතු කිරීම	கூட்டல்
Angle	කෝණය	கோணம்
Arm	බාහුව	புயம்
Ascending order	ආරෝහණ පටිපාටිය	ஏறுவரிசை
Billion	බිලියනය	பில்லியன்
Circle	වෘත්තය	வட்டம்
Countable	ගිණිය හැකි	எண்ண முடியுமான
Denominator	හරය	பகுதி எண்
Descending order	අවරෝහණ පටිපාටිය	இறங்குவரிசை
Digits	ඉලක්කම්	எண்கள்
Direction	දිශාව	திசை
Divisibility	භාජ්‍යතාව	வகுபடுதன்மை
Division	බෙදීම	வகுத்தல்
Estimation	නිමානය	மதிப்பிடல்
Factors	සාධක	காரணிகள்
Fraction	භාගය	பின்னம்
Group	කාණ්ඩය	கூட்டம்
Half	බාගය	அரை
Horizontal	තිරස	கிடை
Hundreds place	සියස්ථානය	நூறுகளின் இடம்
Integers	නිඛිල	நிறைவெண்கள்
Lamina	ආස්තරය	அடர்
Mathematical operations	ගණිත කර්ම	கணிதச் செய்கைகள்
Million	මිලියනය	மில்லியன்
Multiples	ගුණාකාර	மடங்குகள்
Multiplication	ගුණ කිරීම	பெருக்கல்
Multiplication table	ගුණන වගුව	பெருக்கல் அட்டவணை

Negative numbers	ඍණ සංඛ්‍යා	மறை எண்கள்
Number line	සංඛ්‍යා රේඛාව	எண்கோடு
Numerator	ලවය	தொகுதி எண்
Obtuse angle	මහා කෝණය	விரிகோணம்
Ones place	එකස්ථානය	ஒன்றுகளின் இடம்
Place value	ස්ථානීය අගය	இடப்பெறுமானம்
Product	ගුණිතය	பெருக்கம்
Proper fraction	නියම භාගය (තත්‍ය)	முறைமைப் பின்னம்
Quarter	කාල	கால்
Quotient	ලබ්ධිය	ஈவு
Reflex angle	පරාවර්ත කෝණය	பின்வளைகோணம்
Remainder	ශේෂය	மிகுதி
Right angle	ඍජු කෝණය	செங்கோணம்
Rounding off	වටැයීම	மட்டந்தட்டல்
Selecting	තේරීම	தெரிதல்
Straight angle	සරල කෝණය	நேர்கோணம்
Subtraction	අඩු කිරීම	கழித்தல்
Tens place	දසස්ථානය	பத்துகளின் இடம்
Ten thousands place	දස දහස්ථානය	பத்தாயிரங்கள் இடம்
Thousand	දහස	ஆயிரம்
Thousands place	දහස්ථානය	ஆயிரங்கள் இடம்
Unit fraction	ඒකක භාගය	அலகுப் பின்னம்
Vertex	ශීර්ෂය	உச்சி
Vertical	සිරස	நிலைக்குத்து
Whole numbers	පූර්ණ සංඛ්‍යා	முழு எண்கள்

Lesson Sequence

Content	Number of periods	Competency levels
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1. Circles	03	24.1
2. Place Value	06	1.1
3. Mathematical Operations on whole numbers	10	1.4, 1.5
4. Time	06	12.1, 12.2
5. Number Line	11	1.2, 1.3
6. Estimation and Rounding off	08	1.8, 1.9
7. Angles	04	21.1
8. Directions	05	13.1
	53	
Term 2		
9. Fractions	12	3.1, 3.2, 3.3, 3.4
10. Selecting	04	30.1
11. Factors and Multiples	09	1.6, 1.7
12. Rectilinear plane Figures	04	23.1
13. Decimals	06	3.5, 3.6
14.Types of Numbers and Number Patterns	10	2.1, 2.2 7.1, 7.2
15. Length	08	11.1
16. Liquid Measurements	04	22.1
17. Solids	08	
	65	
Term 3		
18. Algebraic Symbols	04	14.1
19.Constructing Algebraic Expressions and Substitution	04	14.2
20.Mass	05	9.1
21.Ratio	06	4.1
22.Data Collection and Representation	06	28.1
23.Data Interpretation	05	29.1
24.Indices	04	6.1
25.Area	05	8.1
	39	
TOTAL	157	