MATHEMATICS

Grade 6

Part - II

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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 mana 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

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ආනන්ද සමරකෝන්

ஒரு தாய் மக்கள் நாமாவோம்
ஒன்றே நாம் வாழும் இல்லம்
நன்றே உடலில் ஓடும்
ஒன்றே நம் குருதி நிறம்

அதனால் சகோதரர் நாமாவோம்
ஒன்றாய் வாழும் வளரும் நாம்
நன்றாய் இவ் இல்லினிலே
நலமே வாழ்தல் வேண்டுமன்றோ

யாவரும் அன்பு கருணையுடன்
ஒற்றுமை சிறக்க வாழ்ந்திடுதல்
பொன்னும் மணியும் முத்துமல்ல - அதுவே
யான்று மழியாச் செல்வமன்றோ.

ஆனந்த சமரக்கோன்
கவிதையின் பெயர்ப்பு.

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

The educational objectives of the contemporary world are becoming more complex along with the economic, social, cultural and technological development. The learning and teaching process too is changing in relation to human experiences, technological differences, research and new indices. Therefore, it is required to produce the textbook by including subject related information according to the objectives in the syllabus in order to maintain the teaching process by organizing learning experiences that suit to the learner needs. The textbook is not merely a learning tool for the learner. It is a blessing that contributes to obtain a higher education along with a development of conduct and attitudes, to develop values and to obtain learning experiences.

The government in its realization of the concept of free education has offered you all the textbooks from grades 1-11. I would like to remind you that you should make the maximum use of these textbooks and protect them well. I sincerely hope that this textbook would assist you to obtain the expertise to become a virtuous citizen with a complete personality who would be a valuable asset to the country.

I would like to bestow my sincere thanks on the members of the editorial and writer boards as well as on the staff of the Educational Publications Department who have strived to offer this textbook to you.

W. M. Jayantha Wickramanayaka,
Commissioner General of Educational Publications,
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Battaramulla.
2019.04.10

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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 problems 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

Contents

12 Rectilinear Plane Figures

By studying this lesson, you will be able to,

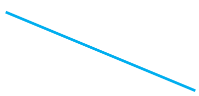
- identify the properties of the rectilinear plane figures triangle, rectangle, square, trapezium and parallelogram.

12.1 Plane figures

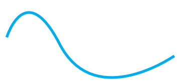
Let us first consider a plane.
The surface of a blackboard, a kitchen table and a notice board lies on a plane.

Now, let us recall about line segments.

The following figures denote a straight line segment and a curved line segment.

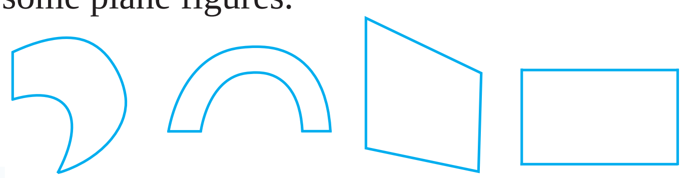


A straight line segment



A curved line segment

In mathematics, figures drawn on flat surfaces using straight line segments and curved line segments are defined as **plane figures**. Given below are some plane figures.



Ball

Since the surface of a ball is not flat, a figure drawn on a ball's surface is not a plane figure.

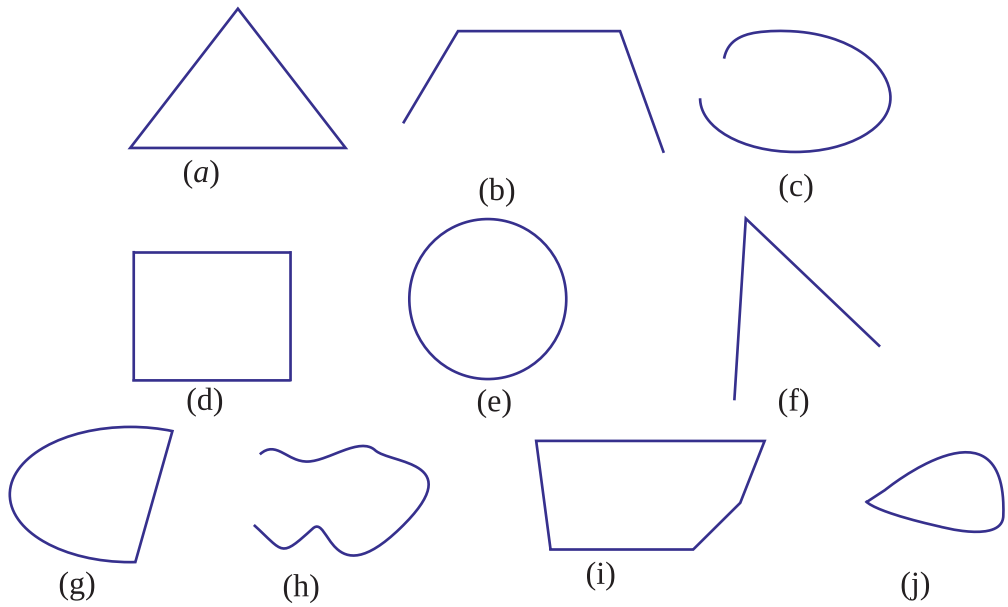
12.2 Closed plane figures and open figures

Plane figures such as the following three figures which are completely bounded by line segments are defined as **closed plane figures**.

Plane figures such as the following figures which are not completely bounded by line segments are called **open figures**.

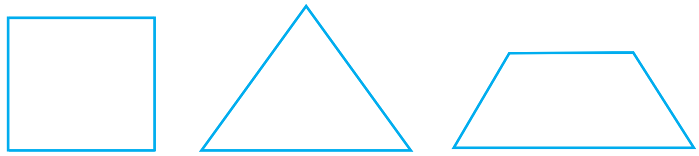
Exercise 12.1

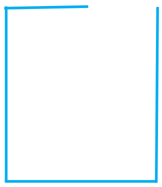
(1) Select the closed plane figures from the following figures and write down the corresponding letters.



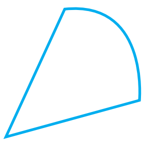
12.3 Rectilinear plane figures

Given below are some examples of closed figures bounded by straight line segments only. Such figures are called **closed rectilinear plane figures**.





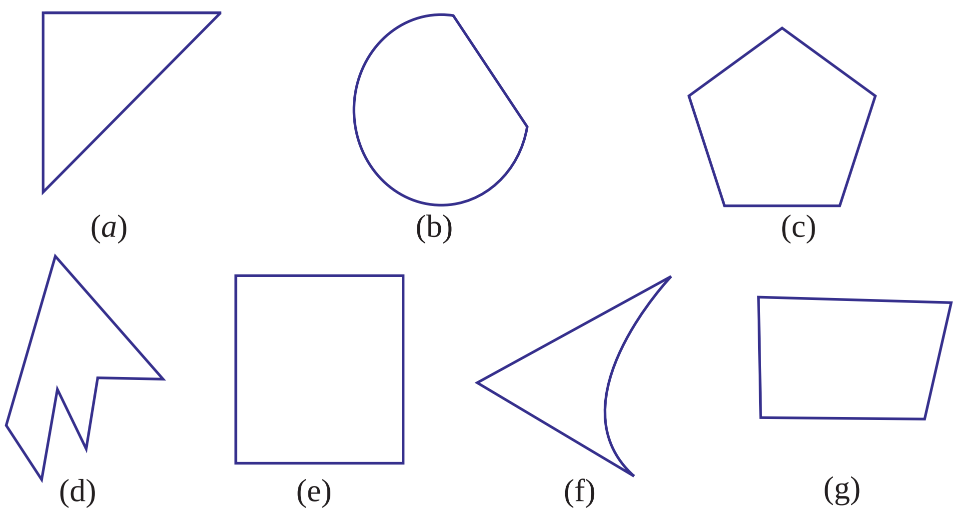
This figure is not closed. Therefore, even though it contains straight line segments only, it is not a closed rectilinear plane figure.



This figure contains curved lines. Therefore, even though it is closed, it is not a closed rectilinear plane figure.

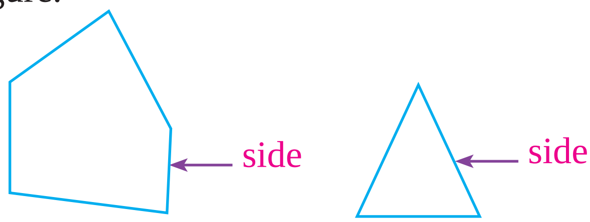
Exercise 12.2

(1) Select the rectilinear plane figures from the following figures and write down the corresponding letters.

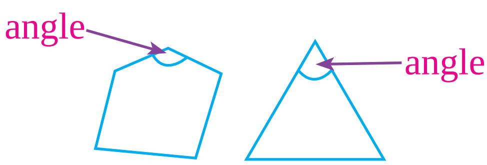


12.4 Elements of rectilinear plane figures

Any straight line segment of a rectilinear plane figure is defined as a side of the figure.



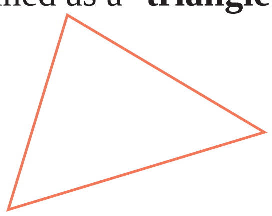
An angle formed inside a rectilinear plane figure by two sides meeting is defined as an angle of the plane figure.



12.5 Triangles and quadrilaterals

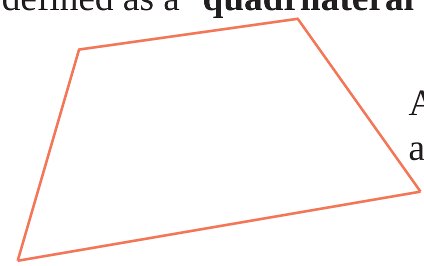
Next, let us look at closed rectilinear plane figures drawn with three straight line segments and drawn with four straight line segments in detail.

A closed rectilinear plane figure drawn with three straight line segments is defined as a "**triangle**".

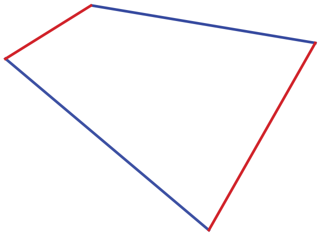


A triangle has three sides and three angles.

A closed rectilinear plane figure drawn with four straight line segments is defined as a "**quadrilateral**".



A quadrilateral has four sides and four angles.

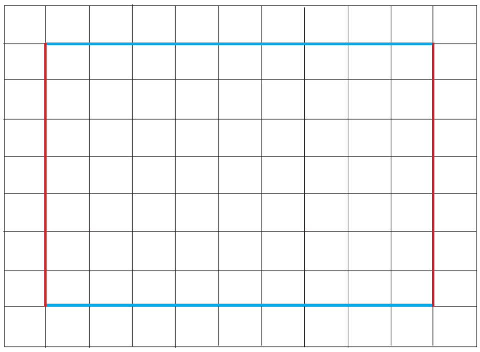


In a quadrilateral, there are two pairs of sides which do not meet each other. Such a pair of sides is defined as a pair of opposite sides.

The pair of sides in red is one pair of opposite sides. The other pair of opposite sides is shown in blue.

• Various types of quadrilaterals and their properties

It is possible to distinguish acute angles, right angles and obtuse angles by using a right angled corner. Also, when a rectilinear plane figure has been drawn on a square grid, the length of a side and the gap between opposite sides can be found by counting the number of squares (appropriately).



In the above quadrilateral,

- the length of each side in blue is 9 squares.
- the length of each side in red is 7 squares.
- all angles are right angles.
- the gap between the pair of sides in blue is 7 squares.
- the gap between the pair of sides in red is 9 squares.

Now let us engage in an activity and identify various types of quadrilaterals and their properties.

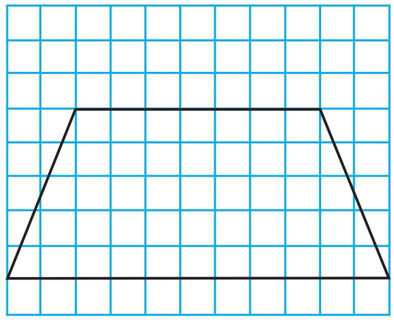
Activity 1

By using a right angled corner and by counting squares or by some other method such as using a string, establish that the given properties of the following rectilinear plane figures are correct.

(1) Trapezium

Properties:

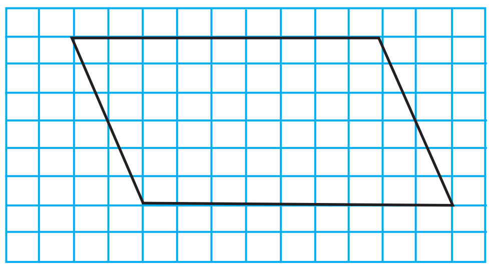
- The gap between one pair of opposite sides is constant.



(2) Parallelogram

Properties:

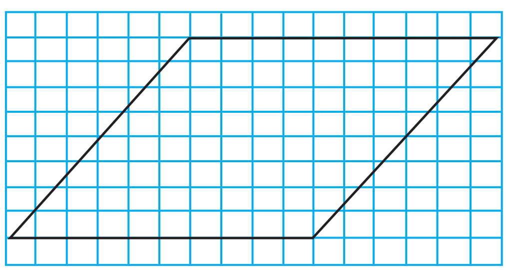
- The gap between pairs of opposite sides is constant.
- Opposite sides are equal in length.



(3) Rhombus

Properties:

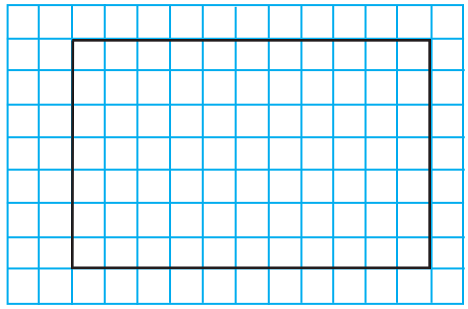
- The gap between pairs of opposite sides is constant.
- All the sides are equal in length.



(4) Rectangle

Properties:

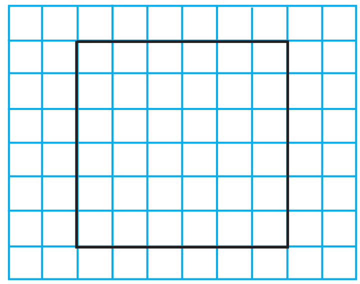
- The gap between pairs of opposite sides is constant.
- Opposite sides are equal in length.
- All the angles are right angles



(5) Square

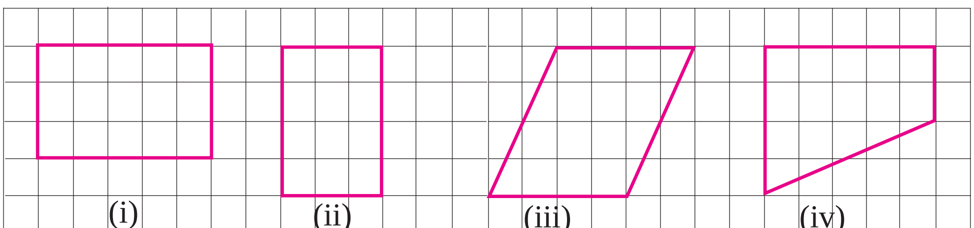
Properties:

- The gap between pairs of opposite sides is constant.
- All the sides are equal in length.
- All the angles are right angles.

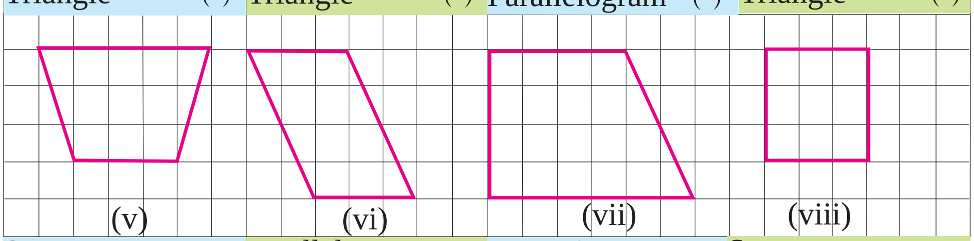


Exercise 12.3

(1) From the plane figure names given below each figure, select the suitable name and mark ✓or × appropriately within brackets.



(i)		(ii)		(iii)		(iv)	
Square	( )	Square	( )	Square	( )	Square	( )
Rectangle	( )	Rectangle	( )	Rectangle	( )	Trapezium	( )
Triangle	( )	Triangle	( )	Parallelogram	( )	Triangle	( )

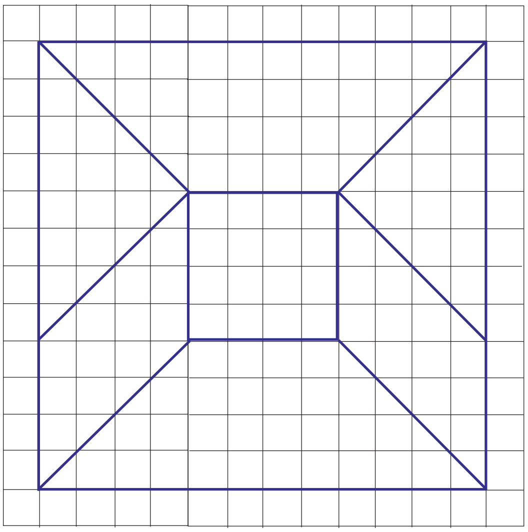


(v)		(vi)		(vii)		(viii)	
Square	( )	Parallelogram	( )	Trapezium	( )	Square	( )
Trapezium	( )	Square	( )	Parallelogram	( )	Triangle	( )
Rectangle	( )	Rectangle	( )	Square	( )		

(2) Draw two figures of each of the following types of rectilinear plane figures on your square ruled exercise book.

(i) Square (ii) Rectangle (iii) Parallelogram (iv) Trapezium

(3) A window grill design drawn on a square ruled paper is given below.



(i) Copy this design onto your exercise book.

(ii) Identify each of the following rectilinear plane figures in the grill design you copied and using different colours for the different shapes, colour a figure of each type.

(a) Triangle (b) Square (c) Parallelogram (d) Trapezium

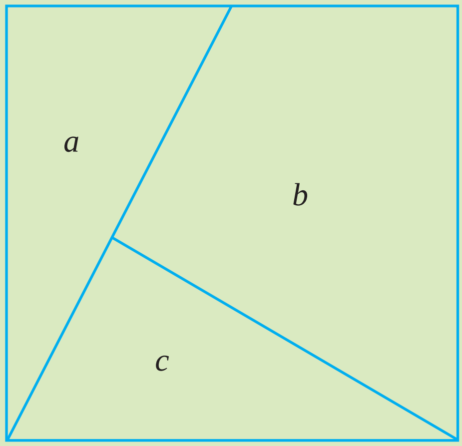
Activity 2

Copy the given figure on a cardboard.

(i) Cut out and separate the pieces *a*, *b*, *c*.

(ii) Organize the pieces that were cut out to form the following figures.

Pieces	Plane figure
a, *b*	Triangle
a, *b*, *c*	Triangle
a, *b*	Trapezium
a, *b*, *c*	Square, Rectangle, Parallelogram



Summary

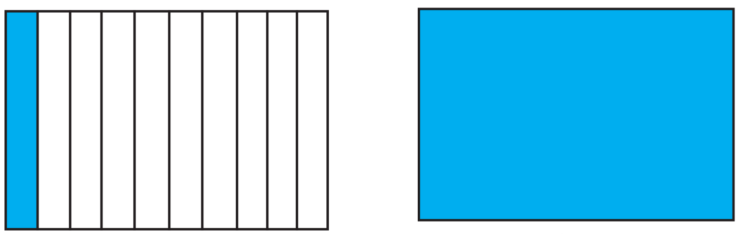
- A closed rectilinear plane figure drawn with three straight line segments is defined as a triangle.
- A closed rectilinear plane figure drawn with four straight line segments is defined as a quadrilateral.
- Trapezium – A quadrilateral with a constant gap between one pair of opposite sides.
- Parallelogram – A quadrilateral with a constant gap between each pair of opposite sides.
- Rhombus – A parallelogram with four equal sides.
- Rectangle – A parallelogram whose angles are right angles.
- Square – A rectangle with four equal sides.

13 Decimals

By studying this lesson, you will be able to,
- recognize decimal numbers,
- compare decimal numbers and
- add decimal numbers having two decimal places.

13.1 Introduction to decimals

When we divide 1 into 10 equal parts, one part is equal to $\frac{1}{10}$. We learnt this in the lesson on fractions.
Likewise, 1 is ten $\frac{1}{10}$s.



1

The coloured quantity is $\frac{1}{10}$. 1 is ten $\frac{1}{10}$s.

Another way to write $\frac{1}{10}$ is 0.1. That is, $0.1 = \frac{1}{10}$

We read 0.1 as "zero point one".

Likewise, $\frac{2}{10}$ is two $\frac{1}{10}$s. That is, $0.2 = \frac{2}{10}$

0.2 is read as "zero point two".

So, $0.3 = \frac{3}{10}$, $0.4 = \frac{4}{10}$, $0.5 = \frac{5}{10}$, $0.6 = \frac{6}{10}$, $0.7 = \frac{7}{10}$, $0.8 = \frac{8}{10}$ and $0.9 = \frac{9}{10}$.

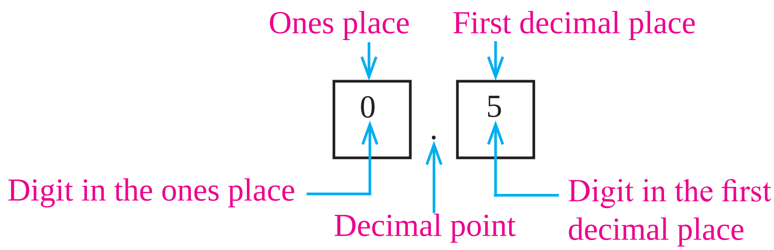
Each of the digits in a whole number occupies a place. We learnt about this in the lesson on place value.

Let us now name the places occupied by the digits in each of 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9.

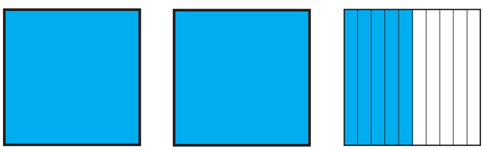
In these numbers, the place where 0 is written is the ones place. The dot that appears after 0 is called the decimal point. The place of the digit that appears soon after the decimal point is called the first decimal place. The place value corresponding to the first decimal place is $\frac{1}{10}$.

Let us consider the number 0.5.

The figure below shows the place each digit in 0.5 occupies. These places are indicated by squares.



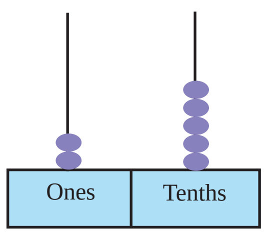
Let us consider the number 2.5.



1 1 $\frac{5}{10}$

$$2.5 = \text{Two ones} + \text{Five } \frac{1}{10}\text{s}$$
$$2.5 = 2 + 0.5$$

Let us represent 2.5 using the abacus.



The ones place of 2.5 is occupied by 2. The value represented by 2 is two ones, that is, two. The first decimal place of 2.5 is occupied by 5. The value represented by 5 is five. That is $\frac{5}{10}$ or 0.5.

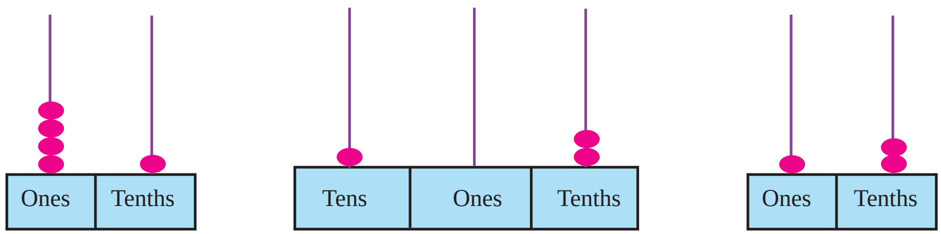
Exercises 13.1

(1) Fill in the blanks of the table below.

Number	In words
1.8	....
25.7	....
10.6	....
....	Sixty nine point four
18.2	....
....	Three hundred and ninety six point seven

(2) Write down the value represented by each abacus below.

(i) (ii) (iii)



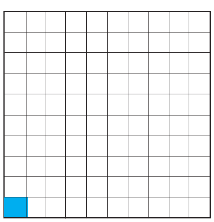
(3) (a) Represent each of the numbers below on an abacus.

(i) 0.7 (ii) 9.6 (iii) 9.9 (iv) 15.2

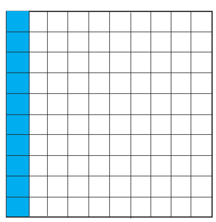
(b) Write down the value represented by each digit in each of the numbers given above.

13.2 More on introduction to decimals

When we divide 1 into 100 equal parts, one part is $\frac{1}{100}$. We learnt this in the lesson on fractions.



$\frac{1}{100}$



Ten $\frac{1}{100}$s is $\frac{1}{10}$.

Ten $\frac{1}{10}$s is 1.

Using decimal places, $\frac{1}{100}$ is written as 0.01. That is $0.01 = \frac{1}{100}$.

We read 0.01 as "**zero point zero one**".

Likewise, four $\frac{1}{100}$s is $\frac{4}{100}$. Using decimal places $\frac{4}{100}$ is written as 0.04.

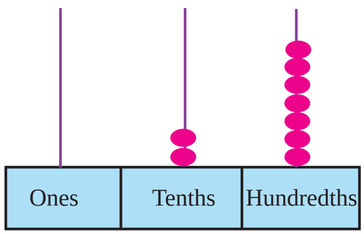
We read 0.04 as "zero point zero four".

Let us consider $\frac{27}{100}$.

$$\frac{27}{100} = \frac{20}{100} + \frac{7}{100} = \frac{2}{10} + \frac{7}{100} = \text{Two } \frac{1}{10}\text{s} + \text{Seven } \frac{1}{100}\text{s} = 0.2 + 0.07$$

Using decimal places, we write $\frac{27}{100}$ as 0.27. We read 0.27 as "zero point two seven".

Let us represent 0.27 on an abacus.



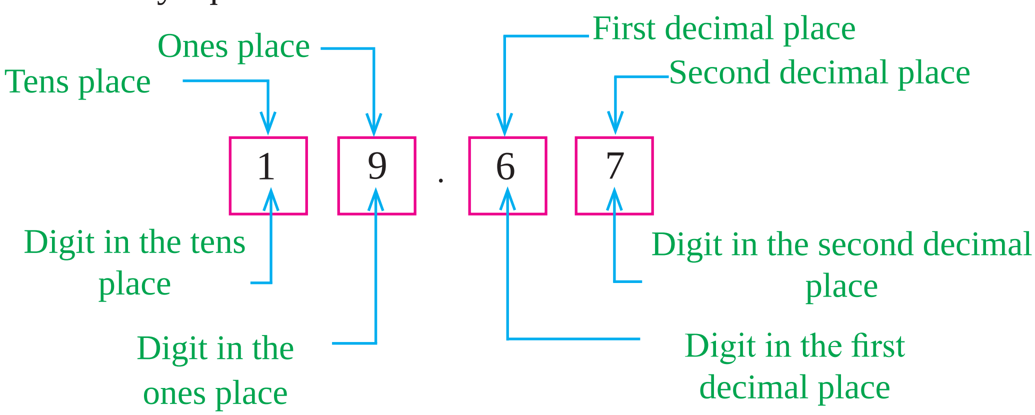
Likewise, $\frac{45}{100} = 0.45$ and $\frac{67}{100} = 0.67$.

The place occupied by the digit that comes after the digit in the first decimal place is called **the second decimal place.** The place value corresponding to the second decimal place is $\frac{1}{100}$.

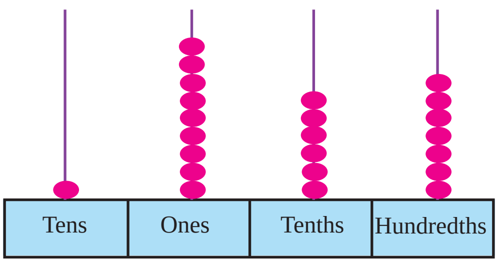
Let us find the value represented by each digit of a number with two decimal places.

Let us consider the number 19.67.

The place of each digit in the number 19.67 is shown below. These are indicated by squares.



Let us represent 19.67 on an abacus.



The place 1 appears in 19.67 is the tens place. The value represented by $1 = 10 \times 1 = 10$

The place 9 appears in 19.67 is the ones place. The value represented by $9 = 1 \times 9 = 9$

The place 6 appears in 19.67 is the first decimal place. The value represented by 6 = Six $\frac{1}{10}$s $= \frac{6}{10} = 0.6$

The place 7 appears in 19.67 is the second decimal place. The value represented by 7 =Seven $\frac{1}{100}$s $= \frac{7}{100} = 0.07$

The part of the number that appears to the left of the decimal point is called the **whole number part**. For example 19 is the whole number part of 19.67.

Example 1

Complete the following table.

Number	Digit	Name of the position of the digit	Value represented by the digit.
1.3	3	First decimal place	Three $\frac{1}{10}$s = $\frac{3}{10}$
1.28	8	Second decimal place	Eight $\frac{1}{100}$s = $\frac{8}{100}$
14.65	4	Ones place	4 ones = 4
25.39	9	Second decimal place	Nine $\frac{1}{100}$s = $\frac{9}{100}$
1991.06	0	First decimal place	Zero $\frac{1}{10}$s = 0

Activity 1

(1) Represent each of the numbers below on an abacus.

(i) 0.21 (ii) 6.78 (iii) 9.99 (iv) 10.01 (v) 112.65

Exercise 13.2

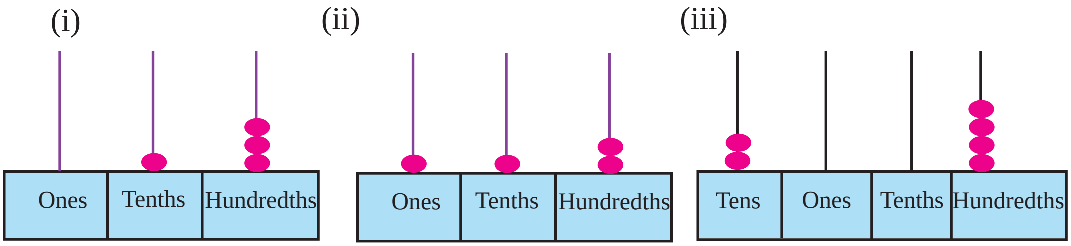
(1) Write down each fraction below, using decimal places.

(i) $\frac{4}{10}$ (ii) $\frac{28}{100}$ (iii) $\frac{7}{10}$ (iv) $\frac{9}{100}$ (v) $\frac{30}{100}$ (vi) $\frac{8}{10}$

(2) Write down the numbers below in words.

(i) 0.1 (ii) 0.52 (iii) 12.7 (iv) 18.3 (v) 8.99

(3) Write down the number represented by each abacus below.



(4) The numbers below are given in words. Write them using digits.

(i) Zero point two one
(ii) One point one
(iii) Hundred and two point zero two
(iv) Seventeen point one seven
(v) Ten point eight five

(5) Complete the following table.

Number	Digit	Name of the position of the digit	Value represented by the digit
2.73	2		
0.61	6		
21.17	7		
1.03	0		
2.0	0		
145.91	9		

13.3 Comparison of decimals

Comparison of decimals using fractions

$\frac{1}{10} = 0.1$ $\frac{2}{10} = 0.2$

We know $\frac{1}{10} < \frac{2}{10}$. We learnt this in the lesson on fractions.

That is, 0.1 is less than 0.2.

Let us now try to find the greater number from 0.7 and 0.5.

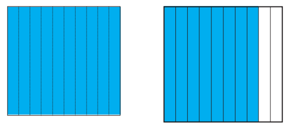
$\frac{7}{10} = 0.7$ and $\frac{5}{10} = 0.5$

Since $\frac{7}{10} > \frac{5}{10}$, $0.7 > 0.5$.

That is 0.7 is greater than 0.5.

Let us compare 1 and 0.8.

$1 = \frac{10}{10}$ and $0.8 = \frac{8}{10}$



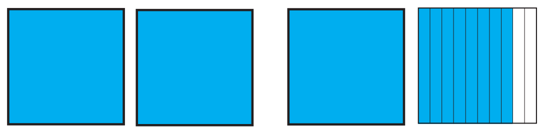
$\frac{10}{10} = 1$ $\frac{8}{10} = 0.8$

Since $\frac{10}{10} > \frac{8}{10}$, we have $1.0 > 0.8$

That is 1 is greater than 0.8.

Let us compare 2 and 1.8.

From the figure, it is clear that 2 > 1.8.



2 1.8

So far we have learnt how to compare parts of ten. Let us now learn how to compare parts of hundred.

Let us compare 0.23 and 0.52.

$0.23 = \frac{23}{100}$ and $0.52 = \frac{52}{100}$.

Since $\frac{23}{100} < \frac{52}{100}$, we have $0.23 < 0.52$. That is 0.52 is greater than 0.23.

Let us compare 0.3 and 0.32.

$0.3 = \frac{3}{10}$ and $0.32 = \frac{32}{100}$.

To compare $\frac{3}{10}$ and $\frac{32}{100}$, we need to express them as fractions having the same denominator.

$$\frac{3}{10} = \frac{3 \times 10}{10 \times 10} = \frac{30}{100}$$

That is, $\frac{30}{100}$ is a fraction equivalent to $\frac{3}{10}$.

Since $\frac{30}{100} < \frac{32}{100}$, we get 0.30 < 0.32

That is, 0.3 < 0.32

• Another method of comparing decimals

We can compare decimals using the values of its digits.

When comparing two decimal numbers the number having the greater whole number part, is the greater number of the two. If both numbers have the same whole number part, then we need to compare the digits in their decimal places.

Then the number having the greater digit in the first decimal place is the greater number of the two. If both numbers have the same digit in the first decimal place, then we need to compare the digits in the second decimal place. Then the number having the greater digit in the second decimal place is the greater number of the two.

Example 1

Write down the numbers 4.15, 3.76 and 3.52 in ascending order.

Of these three numbers, the number with the greatest whole number part is 4.15. Therefore the greatest number out of the given three numbers is 4.15.

The whole number parts of both 3.76 and 3.52 are the same. So let us compare the digits in the first decimal place.

In 3.76 the digit in the first decimal place is 7. In 3.52 the digit in the first decimal place is 5. Since 7 > 5, we have 3.76 > 3.52.

Therefore the above numbers written in ascending order is 3.52, 3.76, 4.15.

Example 2

Find the greater number from 8.76 and 8.72.

The whole number parts of both 8.76 and 8.72 are the same. The digit in the first decimal place of both numbers is 7. So let us compare the digit in the second decimal place.

In 8.76, the digit in the second decimal place is 6. In 8.72, the digit in the second decimal place is 2. Since 6 > 2, we have 8.76 > 8.72. Therefore, the greater number is 8.76.

Example 3

Write down the numbers 0.3, 0.33 and 0.03 in ascending order.

Since 0.3 = 0.30, let us consider 0.30, 0.33 and 0.03.

- The whole number parts of all these numbers are equal.
- The number with the smallest digit in the first decimal place is 0.03, and therefore, it is the smallest.
- The digit in the first decimal place of 0.33 and 0.30 is the same. Of these two, 0.33 is the one with the greater digit in the second decimal place.

Therefore, 0.33 > 0.3

- Therefore, 0.03, 0.30, 0.33 are in ascending order.

Exercise 13.3

(1) Out of each pair of numbers below, write down the greater number.

(i) 0.1 and 0.5 (ii) 0.06 and 0.6 (iii) 2.35 and 2.53
(iv) 3.05 and 3.51 (v) 7.1 and 7.09 (vi) 2.58 and 5.21

(2) For each pair of decimals below, fill in the blank using one of the symbols < , > or =.

(i) 0.05 .... 0.50 (ii) 0.7 .... 0.70 (iii) 2.81 .... 3.18
(iv) 4.04 .... 4.40 (v) 1.2 .... 1.20 (vi) 2.85 .... 2.82

(3) Arrange the numbers below in ascending order.

(i) 0.25, 0.5, 0.52, 2.05

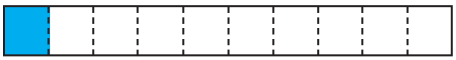
(ii) 2.35, 3.78, 1.23, 4.35

(iii) 0.04, 4, 4.04, 0.44

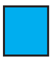
(iv) 1.31, 1.33,3.13, 3.03

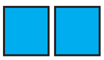
13.4 Adding decimal numbers

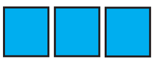
Let us add 0.3 and 0.2.



This figure represents one unit divided into 10 equal parts.

 represents $\frac{1}{10}$, that is 0.1.

 represents $\frac{2}{10}$, that is 0.2 and

 represents $\frac{3}{10}$, that is 0.3.

Therefore,

$$\frac{2}{10} + \frac{3}{10} = \frac{5}{10}$$

$$0.2 + 0.3 = 0.5$$

0.2 and 0.3 can be added in the following way.

$$\begin{array}{r} 0.2 \\ +\ 0.3 \\ \hline 0.5 \\ \hline\hline \end{array}$$

As shown, the two numbers are written in such a way that the digits corresponding to each place are aligned in the same column and the decimal points are also aligned in one column. Once the two numbers are written down in this manner, we can add the digits in the same place separately.

Find the sum, $\begin{array}{r} 2.57 \\ +\ 1.68 \\ \hline \hline \end{array}$

Let us explain this addition using the following steps.

	Ones		Tenths	Hundredths
	2	.	^{1}5	7
+	1	.	6	8
				5
				15

Step 1 - Let us add the $\frac{1}{100}$s.

7 + 8 = 15.

Fifteen $\frac{1}{100}$s is $\frac{10}{100} + \frac{5}{100}$.

That is, one $\frac{1}{10}$s and five $\frac{1}{100}$s

Let us represent the five $\frac{1}{100}$s in the second decimal place by the digit 5 and take one $\frac{1}{10}$s to the first decimal place.

	Ones		Tenths	Hundredths
	^{1}2	.	^{1}5	7
+	1	.	6	8
			2	5
			12	

Step 2 - Let us add the $\frac{1}{10}$s.

1 + 5 + 6 = 12

Twelve $\frac{1}{10}$s is 1 ones and two $\frac{1}{10}$s.

Let us represent the two $\frac{1}{10}$s in the first decimal place by the digit 2 and take one 1 to the ones place.

	Ones		Tenths	Hundredths
	^{1}2	.	^{1}5	7
+	1	.	6	8
	4	.	2	5
			12	15

Step 3 -

Let us write the decimal point of the result such that all the decimal points are in the same column. Let us add the digits in the ones place.

1 + 2 + 1 = 4

That is, four ones.

Let us write 4 in the ones place.

Therefore, the answer is 4.25.

Let us add 5.7 to 2.53.

Let us add the numbers by writing them with the digits corresponding to each place aligned in the same column. Since there is a digit in the second decimal place of 2.53, we write 5.7 as 5.70 in the addition.

$$\begin{array}{r} 5.70 \\ +\ 2.53 \\ \hline 8.23 \\ \hline\hline \end{array}$$

Exercise 13.4

(1) Find the value.

(i) $\begin{array}{r} 0.1 \\ +\ 0.3 \\ \hline \\ \hline\hline \end{array}$
(ii) $\begin{array}{r} 0.71 \\ +\ 0.23 \\ \hline \\ \hline\hline \end{array}$
(iii) $\begin{array}{r} 2.71 \\ +\ 5.16 \\ \hline \\ \hline\hline \end{array}$
(iv) $\begin{array}{r} 5.32 \\ +\ 1.83 \\ \hline \\ \hline\hline \end{array}$
(v) $\begin{array}{r} 2.7 \\ +\ 3.85 \\ \hline \\ \hline\hline \end{array}$

(vi) $\begin{array}{r} 1.8 \\ +\ 0.2 \\ \hline \\ \hline\hline \end{array}$
(vii) $\begin{array}{r} 18.35 \\ +\ 35.26 \\ \hline \\ \hline\hline \end{array}$
(viii) $\begin{array}{r} 1.28 \\ +\ 3.84 \\ \hline \\ \hline\hline \end{array}$
(ix) $\begin{array}{r} 3.88 \\ +\ 9.52 \\ \hline \\ \hline\hline \end{array}$
(x) $\begin{array}{r} 5.96 \\ +\ 4.04 \\ \hline \\ \hline\hline \end{array}$

(2) The electricity consumption of a household in the first two weeks of last month was 45.7 units. The electricity consumption in the last two weeks was 50.3 units. What is the total electricity consumption during the last month?

13.5 Subtraction of decimals

Let us find the value of 0.7 – 0.3.

$$\begin{array}{r} 0.7 \\ -\ 0.3 \\ \hline 0.4 \\ \hline\hline \end{array}$$

Subtracting is done by writing the digits in the ones place in one column, the decimal points in one column and the digits in the first decimal place in one column.

Find the value of 3.65 – 1.98.

Let us explain this subtraction using the following steps.

	Ones		Tenths	Hundredths
	3	.	$\overset{5}{6}$	$\overset{15}{5}$
−	1	.	9	8
				7

Step 1 - Let us subtract the $\frac{1}{100}$s.

5 is less than 8.

Let us bring one $\frac{1}{10}$s to the second decimal place.

Then, there are five $\frac{1}{10}$s remaining in the first decimal place.

One $\frac{1}{10}$s is ten $\frac{1}{100}$s.

10+5=15. That is, there are fifteen $\frac{1}{100}$s in the second decimal place now.

When eight $\frac{1}{100}$s are subtracted from fifteen $\frac{1}{100}$s, there are seven $\frac{1}{100}$s remaining.

Let us represent the seven $\frac{1}{100}$s in the second decimal place by the digit 7.

	Ones		Tenths	Hundredths
	3	.	$\overset{\not 5}{6}$	$\overset{15}{5}$
−	1	.	9	8
		.	6	7

Step 2 - Let us subtract the $\frac{1}{10}$s.

5 is less than 9.

Let us bring one unit from the three units in the ones place to the first decimal place. One unit is ten $\frac{1}{10}$s

Then there are fifteen $\frac{1}{10}$s.

When nine $\frac{1}{10}$s are subtracted from fifteen $\frac{1}{10}$s there are six $\frac{1}{10}$s remaining.

Let us represent the six $\frac{1}{10}$s in the first decimal place by the digit 6.

Ones		Tenths	Hundredths
$\overset{2}{\cancel{3}}$	.	$\overset{5}{\cancel{6}}$	$\overset{15}{5}$
− 1	.	9	8
1	.	6	7

Step 3 -

Let us write the decimal point of the result such that all the decimal points are in the same column. Let us subtract the ones.

2 – 1 = 1

That is, one ones.
Let us write 1 in the ones place.

Then the answer is 1.67.

Example 1

Find the value of 12.7– 8.53.

$$\begin{array}{r} 12.70 \\ -\ \ 8.53 \\ \hline 4.17 \\ \hline\hline \end{array}$$

Let us write the digits of a particular place in the same column and subtract. When 12.7 is written as 12.70 the number of decimal places in both numbers is the same.

Exercise 13.5

(1) Find the value.

(i) $\begin{array}{r} 0.9 \\ -\ 0.5 \\ \hline \end{array}$ (ii) $\begin{array}{r} 3.6 \\ -\ 2.5 \\ \hline \end{array}$ (iii) $\begin{array}{r} 2.3 \\ -\ 1.7 \\ \hline \end{array}$ (iv) $\begin{array}{r} 8.39 \\ -\ 2.21 \\ \hline \end{array}$ (v) $\begin{array}{r} 2.85 \\ -\ 1.08 \\ \hline \end{array}$

(vi) $\begin{array}{r} 15.08 \\ -\ 1.79 \\ \hline \end{array}$ (vii) $\begin{array}{r} 15.08 \\ -\ 0.84 \\ \hline \end{array}$ (viii) $\begin{array}{r} 7.22 \\ -\ 5.34 \\ \hline \end{array}$ (ix) $\begin{array}{r} 80.01 \\ -\ 19.99 \\ \hline \end{array}$ (x) $\begin{array}{r} 2.08 \\ -\ 1.99 \\ \hline \end{array}$

(2) Nimal and Sunil inherited 0.75 of the total land owned by their father. If Nimal inherited 0.48 of the total land, how much of the land did Sunil inherit?

(3) A reservoir was filled to 0.7 of its total capacity. 0.15 of its total capacity was used to produce electricity. Of the total capacity, how much water is now left in the reservoir?

Summary

- In a decimal number, the place occupied by the digit that appears just after the decimal point is the first decimal place.
- The place occupied by the digit that appears just after the first decimal place is the second decimal place.
- Decimal numbers can be compared either by writing them as fractions or by comparing the values of the digits in the corresponding places of the two numbers.
- When adding and subtracting decimals, the mathematical operation should be performed by considering for each number, the value represented by the digit in each of the places of the number.

14 Types of Numbers and Number Patterns

By studying this lesson, you will be able to,

- identify odd numbers, even numbers, prime numbers, composite numbers, square numbers and triangular numbers among the whole numbers and
- identify number patterns formed by the above types of numbers.

14.1 Even numbers and odd numbers

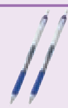
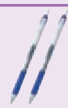
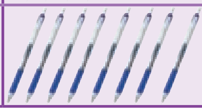
Let us identify even numbers and odd numbers among the whole numbers.

Six pens can be equally divided between Nimali and Vimali in the following manner.

Number of pens Nimali received

Number of pens Vimali received

Let us see whether the number of pens in the table below can be divided equally between the two.

Number of pens	Number of pens pictorially	Number of pens Nimali received	Number of pens Vimali received	Remainder
2				No remainder
3				
5				
4				No remainder
8				No remainder

This shows that, if the quantity is 2, 4, 6 or 8, then it can be divided into two equal parts without a remainder. That is, these numbers are divisible by 2. Numbers such as 2, 4, 6 and 8, which when divided by 2 have zero remainder, are called **even numbers**. 0 is also an even number.

When a whole number is divided by 2, if the remainder is zero, then the number is an even number.

Accordingly, even numbers starting from zero can be written as 0, 2, 4, 6, 8, 10, 12, ...

From the above information we see that when the number of pens is 3 or 5, then the pens cannot be divided equally between Nimali and Vimali. When an equal number of pens are given to both, then in the end, there is one remaining.

Numbers such as 1, 3, 5, 7, 9 and 11, which when divided by 2, have a non-zero remainder, are called **odd numbers.**

When a whole number is divided by 2, if the remainder is one, then the number is an odd number.

Accordingly, odd numbers starting from one can be written as 1, 3, 5, 7, 9, 11, 13, ...

Note

- When the two even numbers 2 and 6 are added, the result is 8, which is also an even number. When we add any two even numbers in this manner, the result is also an even number.
- We can verify the following statements by using the examples.
- When two odd numbers are added together, the result is an even number.
- When an even number and an odd number are added together, the result is an odd number.
- When an even number is subtracted from an even number, the result is an even number.
- When an odd number is subtracted from an odd number, the result is an even number.
- When an odd number is subtracted from an even number, the result is an odd number.
- When an even number is subtracted from an odd number, the result is an odd number.
- When two odd numbers are multiplied together, the result is also an odd number.
- When any whole number is multiplied by an even number, the result is an even number.

Example 1

Write whether each number below is an even number or an odd number.

(i) 8 (ii) 13 (iii) 32 (iv) 17 (v) 100 (vi) 351 (vii) 1001

(i) 8 ÷ 2 = 4. That is, 8 is an even number.
(ii) 13 ÷ 2 = 6 with a remainder of 1. That is, 13 is an odd number.
(iii) 32 ÷ 2 = 16. That is, 32 is an even number.
(iv) 17 ÷ 2 = 8 with a remainder of 1. That is, 17 is an odd number.
(v) 100 ÷ 2 = 50. That is, 100 is an even number.
(vi) 351 ÷ 2 = 175 with a remainder of 1. That is, 351 is an odd number.
(vii) 1001 ÷ 2 = 500 with a remainder of 1. That is, 1001 is an odd number.

Exercise 14.1

(1) Copy the table below and complete it.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Even		✓																		
Odd	✓																			

(2) From the numbers given below, choose the even numbers. Write them in the first row of the table below. Choose the odd numbers, and write them in the second row.

6, 7, 21, 24, 30, 35, 62, 70, 59, 100, 87, 71, 93, 94

Even numbers							
Odd numbers							

(3) State whether the answer of each of following expressions is even or odd without solving.

(i) 31 + 52 (ii) 103 + 527 (iii) 32 − 15 (iv) 88 + 424
(v) 101 − 27 (vi) 298 − 114 (vii) 89 − 22 (viii) 32 × 18
(ix) 153 × 36 (x) 27 × 39

• Identifying even numbers and odd numbers by considering the digit in the ones place.

Let us consider another method of finding out whether numbers like 2157 and 34 826 are odd numbers or even numbers without dividing the number by 2.

Now let us consider several whole numbers. Let us write each of them using the numbers its digits represent.

$$124 = 100 + 20 + 4$$
$$230 = 200 + 30 + 0$$
$$395 = 300 + 90 + 5$$
$$761 = 700 + 60 + 1$$
$$842 = 800 + 40 + 2$$
$$2157 = 2000 + 100 + 50 + 7$$
$$34\ 826 = 30\ 000 + 4000 + 800 + 20 + 6$$

The numbers represented by the digits in the tens place, hundreds place and the thousands place of any whole number given above, are multiples of 10. Therefore, those numbers are divisible by 2 (without a remainder). So, if the digit in the ones place is divisible by 2, (with zero remainder) then the given number is divisible by 2.

If the ones place of a number has one of the digits 0, 2, 4, 6 or 8 then the number is an even number.

If the ones place of a number has one of the digits 1, 3, 5, 7 or 9 then the number is an odd number.

Example 1

(i) Write the even numbers between 0 and 10 (Here the answer does not include 0 and 10).
2, 4, 6, 8

(ii) Write the even numbers from 0 till 10 (Here the answer includes 0 but not 10).
0, 2, 4, 6, 8

(iii) Write the even numbers from 0 to 10 (Here the answer includes 0 and 10).
0, 2, 4, 6, 8, 10

Exercise 14.2

(1) Write the even numbers between 10 and 25.

(2) Write the odd numbers from 19 till 35.

(3) Write the even numbers from 13 to 24.

(4) From the list of numbers given below, write the even numbers and the odd numbers separately.
456, 395, 714, 1852, 341, 27 850, 148 400, 397 659, 8 000 008

(5) Write your year of birth, month of birth and the date of birth respectively. Write whether each of them is an odd number or an even number.

(6) In a certain street of a city, the following sign is posted, "Vehicles can be parked here only on odd days of the month". What are the days in the month of June that vehicles can be parked along the street?

(7) Write 5 even numbers and 5 odd numbers that can be written using the digits 4, 2, 3, 1 and 0 exactly once.

14.2 Prime numbers and Composite numbers

Recall what you learnt in the Factors lesson. Now let us find the factors of several numbers.

Number	As a product	Factors
2	1×2	1, 2
3	1×3	1, 3
4	$1 \times 4,\ 2 \times 2$	1, 2, 4
5	1×5	1, 5
6	$1 \times 6,\ 2 \times 3$	1, 2, 3, 6
7	1×7	1, 7
8	$1 \times 8,\ 2 \times 4$	1, 2, 4, 8
9	$1 \times 9,\ 3 \times 3$	1, 3, 9

Each of the numbers 2, 3, 5 and 7 has only two different positive factors.

Each of the numbers 4, 6, 8 and 9 has more than two different factors.

Whole numbers greater than one such as 2, 3, 5 and 7 which have exactly two distinct factors are called prime numbers.

Let us now write the prime numbers from 1 to 20.
They are 2, 3, 5, 7, 11, 13, 17 and 19.

Of these prime numbers only 2 is even. All the others are odd.

Apart from 2, all the other even numbers have more than two factors. Therefore, of all prime numbers, 2 is the only even prime number.

Whole numbers such as 4, 6, 8 and 9 which have more than two distinct factors are called **composite numbers**.

Therefore whole numbers greater than one, other than prime numbers are called composite numbers.

1 is neither a prime nor a composite number.

Activity 1

Fill in the blanks in the table below.

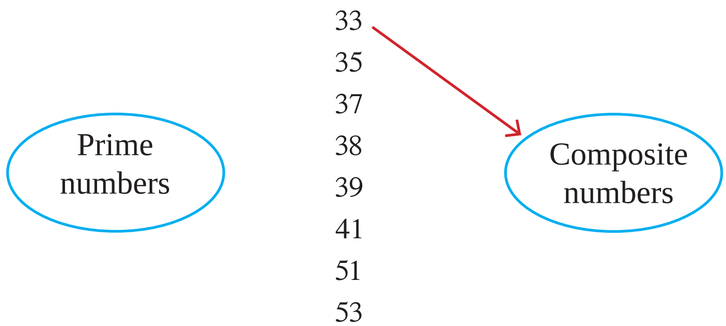
Number	Factors	Number of factors	The number is a prime number (✓) / if not (×)	The number is a composite number (✓) / if not (×)
1				
2	1, 2	2	✓	
3				
4				
5				
6	1, 2, 3, 6	4	×	✓
7				
8				
9				
10				
11				
12				
13				
14				
15				

Exercise 14.3

(1) The month of January of a certain calendar is given below. Draw circles around the prime numbers and draw triangles around the composite numbers.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

(2) Copy the figure given below. From the given numbers, choose the prime numbers. Draw an arrow from each prime number to the circle indicating "prime numbers". From the given numbers, choose the composite numbers. Draw an arrow from each composite number to the circle indicating "composite numbers".



(3) (i) Write two successive prime numbers.

(ii) Write two successive composite numbers.

(4) Find the odd number between 1 and 10 which is not a prime.

(5) (i) Find a pair of prime numbers whose addition is 30.

(ii) Write 14 as a product of two prime numbers.

(6) (i) What is the smallest prime number?

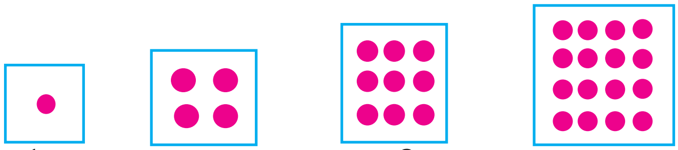
(ii) What is the smallest composite number?

(7) Write the composite numbers between 20 and 30.

(8) What is the only even prime number?

14.3 Square numbers

Several numbers that can be represented using dots, arranged in a square formation are given below.



1	4	9	16
1 row	2 rows	3 rows	4 rows
1 column	2 columns	3 columns	4 columns

In each of the given boxes, the number of dots in a row is equal to the number of dots in a column. By multiplying these two numbers the number represented by the dots can be obtained.

That is,

$$1 = 1 \times 1$$
$$4 = 2 \times 2$$
$$9 = 3 \times 3$$
$$16 = 4 \times 4$$

We can write 25, 36 and 49 also in the above manner. Such numbers are called **square numbers**.

Exercise 14.4

(1) Look at the dates in the month of January in a calendar. Which dates are square numbers?

(2) Write down the square numbers from 1 to 100.

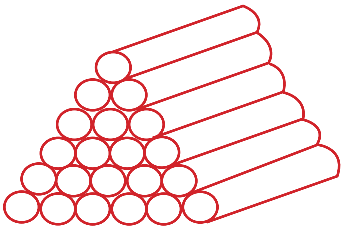
(3) Write down the square numbers between 50 and 150.

(4) Add the odd numbers between 0 and 6. Find whether the sum is a square number.

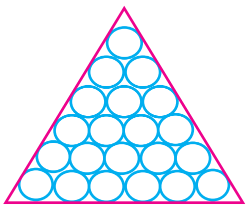
(5) Add the odd numbers between 0 and 10. Find whether the sum is a square number.

14.4 Triangular numbers

In a certain shop, pipes are arranged as in the figure below.



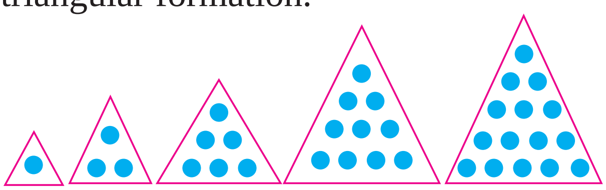
The manner in which the pipes are seen from the front is,



It takes the shape of a triangle. Let us find out the number of pipes here.

The number of pipes in each row from the top is 1, 2, 3, 4, 5 and 6. By adding these numbers, the total number of pipes is obtained as 21. Therefore 21 can be represented using dots, where the dots are placed in a triangular formation.

Let us find out about such numbers that can be represented using dots, arranged in a triangular formation.



1 3 6 10 15

Numbers that can be represented as above are called **triangular numbers.**

Considering the number of dots in each row,

Triangular number represented in the first figure $= 1 = 1$

Triangular number represented in the second figure $= 1 + 2 = 3$

Triangular number represented in the third figure $= 1 + 2 + 3 = 6$

Triangular number represented in the fourth figure $= 1 + 2 + 3 + 4 = 10$

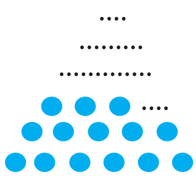
Triangular number represented in the fifth figure $= 1 + 2 + 3 + 4 + 5 = 15$

As explained above, by starting at 1 and adding successive numbers to it, we can obtain triangular numbers. Therefore, if we want to obtain the tenth triangular number, we need to start at 1 and add to it the successive numbers, up to 10.

$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55$

That is, the 10^{th} triangular number is 55.

Exercise 14.5

(1) 

Complete the figure given here in triangular formation and find the triangular number represented by it.

(2) Complete the rows below as given in the first four rows.

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

(3) What is the smallest triangular number?

(4) A number is represented using dots that are arranged in a triangular formation. Then the bottom row consists of 11 dots. What is the triangular number?

(5) Add two consecutive numbers given in exercise (2). Is the sum a square number?

14.5 Number patterns

Let us write the even numbers in ascending order, starting at 2.

2, 4, 6, 8, 10, ...

This is the even number pattern starting at 2 written in ascending order.

Let us write the odd numbers in ascending order, starting at 1.

1, 3, 5, 7, 9, ...

This is the odd number pattern starting at 1 written in ascending order.

Let us write the square numbers in ascending order, starting at 9.

9, 16, 25, 36, ...

This is the square number pattern starting at 9 written in ascending order.

1, 3, 6, 10, 15 is the triangular number pattern written in ascending order.

Each number in a number pattern which has been arranged as above according to a mathematical rule is called a **term in that pattern.**

Exercise 14.6

(1) 1, 3, 6, 10, ... is the triangular number pattern starting at 1, written in ascending order. Find the 8^{th} term.

(2) (i) 1, 4, 9, 16, … is the square number pattern starting at 1, written in ascending order. Find the 12^{th} term.

(ii) In the above square number pattern, which term is 49?

(iii) Is 65 a term in this number pattern?

(iv) What are the terms that are between 50 and 100 in this pattern?

(3) Write the first 5 numbers in the number patterns given below.

(i) The pattern consisting of all even numbers greater than 5, written in ascending order.

(ii) The pattern consisting of all multiples of 3 greater than 10, written in ascending order.

(iii) The pattern starting at 1 and consisting of triangular numbers that are not primes, written in ascending order.

Miscellaneous Exercises

(1)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32								

(i) As given in the above order, write the numbers from 1 to 50 in your exercise book.

(ii) Now draw a line across 1.

(iii) Draw a circle around 2.

(iv) Now draw lines across all multiples of 2 other than 2.

(v) Draw a circle around 3.

(vi) Now draw lines across all multiples of 3 other than 3.

(vii) Draw a circle around 5. Now draw lines across all multiples of 5 other than 5.

(viii) Draw a circle around 7. Now draw lines across all multiples of 7 other than 7.

(ix) Now draw circles around the remaining numbers. Confirm whether the numbers inside the circles are prime numbers?

(2) Amali says that, when we consider two consecutive whole numbers, one of them is an even number while the other is an odd number. Is this statement true or false?

(3) Jayamini explains that, by adding two consecutive triangular numbers, we obtain a square number, by using the examples below.

$1 + 3 = 4$ $\qquad\qquad$ $3 + 6 = 9$

Check whether her statement is true. Give 3 more examples to verify this.

(4) Consider the sentences below. Mark the ones that are correct as "✓" and the others as "✗".

(i) 1 is a prime number.

(ii) The smallest prime number is 2.

(iii) All square numbers are composite numbers.

(iv) All triangular numbers are composite numbers.

(v) 36 is a composite number which is a square number as well as a triangular number.

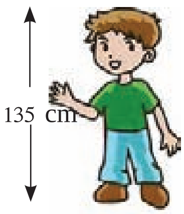
Summary

- If the ones place of a number has one of the digits 0, 2, 4, 6 or 8 then the number is an even number.
- If the ones place of a number has one of the digits 1, 3, 5, 7 or 9 then the number is an odd number.
- Whole numbers greater than one, which have only two different factors are called prime numbers.
- Whole numbers greater than one, having more than two different factors are called composite numbers.

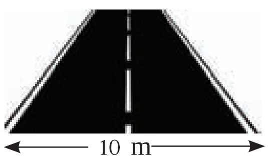
15 Length

By studying this lesson, you will be able to,
- identify the units that are used to measure length,
- identify the relationship between the different units of measuring length and
- find the perimeter of a rectilinear plane figure.

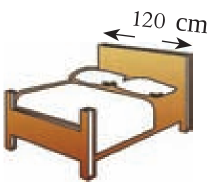
15.1 Length, height, width, depth and thickness are indicators of length



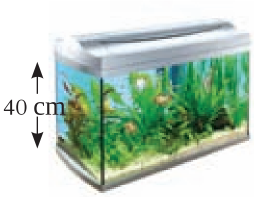
Ganesh's height is 135 cm.



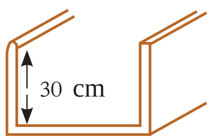
The width of the road is 10 m.



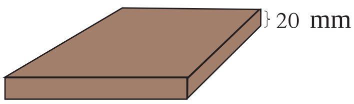
Width of the bed is 120 cm.



The depth of the fish tank is 40 cm .



The depth of the drain is 30 cm.



The thickness of a wooden plank is 20 mm.

In our day to day lives we come across this kind of information. In such instances the linear distance from one end to the other end is indicated.

The meaning of length is the linear distance from one end to the other end.

Accordingly height, width, depth and thickness also indicate lengths.

Furthermore, the length, width and thickness of a book indicate the various lengths associated with the book.

Exercise 15.1

(1) Write five examples for situations where information is given using each of the following.

(i) Height (ii) Depth
(iii) Width (iv) Thickness

15.2 Measuring tools and units of measurement

Some measuring tools that are used to measure lengths are shown below.

Look at your 15 cm ruler. The sixteen long lines with equal gaps between them are marked as 0, 1, 2, 3, ... 15. The gap between every two long lines is again divided into 10 similar parts using short lines.

The distance between each two long lines on the ruler is 1 centimetre.
The distance between each two short lines is 1 millimetre.

That is, one centimetre is 10 millimetres.
One centimetre is written as 1cm, and 1 millimetre is written as 1 mm.
So, **10 mm = 1cm**

Look at the metre ruler and measuring tapes of different lengths that are given to you. You will notice that in those tools also there are numbers such as 0, 1, 2… and lines.

Check carefully as to how many centimetres are marked on the metre ruler. You will notice that it has numbers marked from 0 centimetres to 100 centimetres. The length of a hundred centimetre is one metre.
One metre is written as 1 m.

That is **100 cm = 1 m**

The ruler having a length of one metre is called the metre ruler.
Check carefully as to how many metres are marked on a measuring tape.

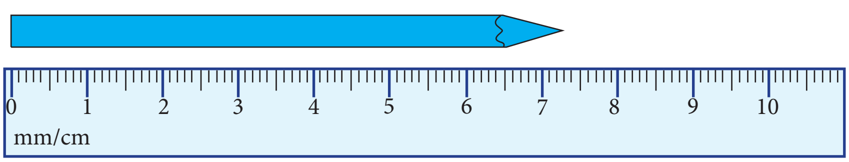
Now you can identify measuring tapes of different lengths.

The distance between two towns or the length of a highway is measured in kilometres. A length of 1000 metres is one kilometre. One kilometre is written as 1 km.

That is **1000 m = 1 km**

15.3 Measuring lengths

The diagram below shows how the length of a pencil is measured using a ruler.

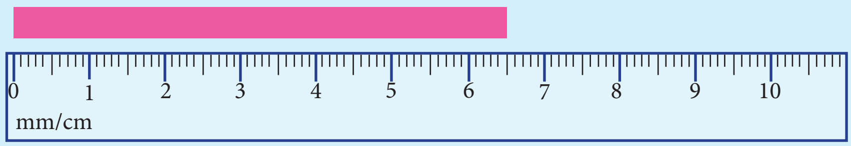


One end of the pencil is placed at the zero line . The sharpened end of the pencil is at 7 cm and three short lines.

So , the length of the pencil is 7 cm 3 mm.

Example 1

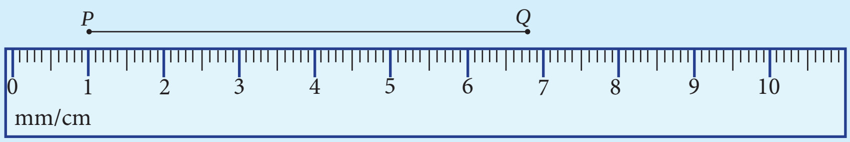
The diagram shows how the length of a strip of paper is measured using a ruler.



What is the length of the strip of paper?

The length of the strip of paper is 6 cm 5 mm.

Example 2



What is the length of *PQ* in the diagram shown above?

The point *Q* is at 6 cm 8 mm.
Since the point *P* is at 1 cm, the length of the line is 1 cm less than 6 cm 8 mm.
So the length of the line *PQ* is 5 cm 8 mm.

Exercise 15.2

(1) (i) The table below gives some activities in our daily life which involve measuring length. Copy the table.

(ii) Write four more examples of activities in our daily life which involve measuring length in the table.

(iii) Complete the table by writing suitable measuring tools or instruments and units of measurement.

Activity	Suitable measuring tools or instruments	Unit
1. Tom easure the length of a straight line drawn in your exercise book		
2. To measure the depth ofa drinking glass		
3. To measur e the thi ckne ss of a wooden plank		
4. Tom easure the length of a school building		
5. To measure the width of the drain		
6. To measure the height of a wall		
7.		
8.		
9.		
10.		

(2) What is the length of each of the straight lines shown below?

(i) ______________________________

(ii) ________________________________

(iii) ____

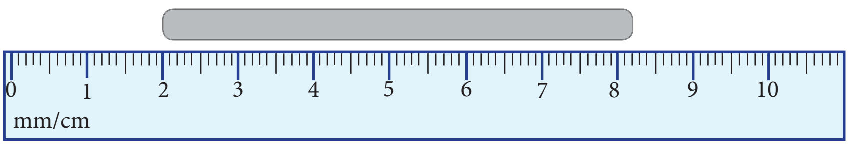
(3) Measure and write the length and the width of the given rectangle.

(Note: The length of the longer side of the rectangle is considered as its length and the length of the shorter side is considered as its width).

(4) Measure and write down the thickness of a five rupee coin.

(5) Use the metre ruler and take measurements of
   (i) the length and the width of the teacher's table.
   (ii) the length and the width of the class room.
   (iii) the length and the width of the black board.
   (iv) the depth of a gutter or a pit.
   (v) the height from the ground to the bottom edge of the blackboard.

(6) The diagram below shows a piece of chalk.



Your friend says that the piece of chalk shown above has a length of 8 cm 2 mm. Do you agree with your friend? Explain your answer giving reasons.

15.4 Relationships between the different units of measuring length

We have learnt that millimetre, centimetre and metre are some units that are used to measure length. Now let us discuss the relationships between these units.

• Relationship between a millimetre and a centimetre

By observing the 15 cm ruler you identified that a length of 10 millimetres is indicated as one centimetre.

$10 \text{ mm} = 1 \text{ cm}$

Therefore, $1 \text{ mm} = \frac{1}{10} \text{cm}$

In the lesson on decimals you learnt that $\frac{1}{10} = 0.1$.

Therefore , 1 mm = 0.1 cm

Now let us consider how we express a length given in centimetres, in terms of millimetres.

Since 1 cm = 10 mm,
2 cm = 20 mm
3 cm = 30 mm

To express the length given in centimetres in terms of millimetres, the number of centimetres needs to be multiplied by ten.

Now let us consider how we express a length given in millimetres in terms of centimetres.

Since 10 mm = 1 cm,
20 mm = 2 cm
30 mm = 3 cm

To express the length given in millimetres in terms of centimetres, the number of millimetres needs to be divided by ten.

Example 1

Express 8 cm, in millimetres.

8 cm = 8 × 10 mm
= 80 mm

Example 2

Express 60 mm in centimetres.

10 mm = 1 cm

$60 \text{ mm} = \frac{60}{10} \text{ cm}$

= 6 cm

Example 3

Express 27 mm in centimetres and millimetres.

27 mm = 20 mm + 7 mm

Since 10 mm = 1 cm, 20 mm = 2 cm

27 mm = 2 cm + 7 mm

27 mm = 2 cm 7 mm

Accordingly, to express a length of 10 mm or more, in terms of centimetres and millimetres, the amount of millimetres is written as lesser than 10.

Example 4

Express 0.7 cm in millimetres.

1 cm = 10 mm
0.1 cm = 1 mm
0.7 cm = 7 mm

Example 5

Express 35 mm in centimetres.

10 mm = 1 cm

35 mm = 30 mm + 5 mm

$= 3\text{ cm} + \frac{5}{10}\text{ cm}$

= 3 cm + 0.5 cm

= 3.5 cm

Example 6

Express 5.3 cm, in millimetres.

5.3 cm = 5 cm + 0.3 cm

Since 5 cm = 50 mm and 0.3 cm = 3 mm,

5.3 cm = 50 mm + 3 mm

= 53 mm

Example 7

In Parami's pencil box, there are several pencils.

The length of the red pencil is 13.3 cm.

The length of the blue pencil is 138 mm.

The length of the yellow pencil is 12 cm 8 mm.

Out of these pencils, which one is the longest? Explain your answer.

Let's write the lengths of the 3 pencils in the same unit.

The length of the red pencil = 13.3 cm
= 13 cm + 0.3 cm
= 130 mm + 3 mm
= 133 mm

The length of the blue pencil = 138 mm

The length of the yellow pencil = 12 cm 8 mm = 120 mm + 8 mm
= 128 mm

Since 138 is the largest number out of 133, 138 and 128, the blue pencil is the longest pencil.

Exercise 15.3

(1) Express each of the following lengths given in centimetres, in terms of millimetres.

(i) 40 mm (ii) 240 mm (iii) 280 mm
(iv) 70 mm (v) 450 mm (vi) 100 mm

(2) Complete the blanks below.

(i) 8 cm 4 mm = 8 cm + ...mm
= ... mm + ...mm
= ....mm

(ii) 15 cm 8 mm = ... cm + 8 mm
= ... mm + ... mm
= .... mm

(iii) 35 cm 7 mm = ... cm + ...mm
= .... mm + ...mm
= .... mm

(3) Express each of the following lengths given in centimetres, in terms of millimetres.

(i) 7 cm (ii) 15 cm (iii) 5 cm 4 mm
(iv) 22 cm 5 mm (v) 8.6 cm (vi) 0.4 cm

(4) Express each of the following lengths given in millimetres, in terms of centimetres and millimetres.

(i) 12 mm (ii) 138 mm (iii) 235 mm (iv) 301 mm

(5) Express each of the following lengths given in millimetres in terms of centimetres.

(i) 25 mm (ii) 3 mm (iii) 123 mm

(6) Nethmi's middle finger is 5.8 cm long. Amaya's middle finger is 57 mm long. Amali's middle finger is 5 cm 9 mm long.

(i) Write the lengths of the middle fingers of Nethmi, Amali and Amaya in millimetres.
(ii) Who has the longest middle finger? Explain your answer.

(7) The lengths of 3 straight line segments are as below.

The length of the first straight line is 18 cm.
The length of the second straight line is 195 mm.
The length of the third straight line is 18 cm and 7 mm.

(i) Write the length of each straight line segment above in millimetres.
(ii) Which is the shortest line segment?

(8) Three students measured the length of a pencil. Their records are as follows.

Gayan wrote 133 mm as the length.
Suresh wrote 13 cm and 3 mm as the length.
Asith wrote 13.3 cm as the length.
Explain with reasons that the three students have obtained the same measurement.

• Relationship between a centimetre and a metre.

When we observe a tape or a metre ruler, we see that a length of 100 cm is 1 m.

Since $100 \text{ cm} = 1\text{m}$,

$$1 \text{ cm} = \frac{1}{100}\text{m}$$

Since $\frac{1}{100} = 0.01$, 1 cm = 0.01 m

Now let us consider how we express a length given in metres, in terms of centimetres.

Since 1 m = 100 cm,
2 m = 200 cm
3 m = 300 cm

Accordingly, to express a length given in metres in terms of centimetres, the number of metres needs to be multiplied by 100.

Now let us express a length given in centimetres, in terms of metres.

Since 100 cm = 1 m,

200 cm = 2 m

300 cm = 3 m

Accordingly, to express a length given in centimetres in terms of metres, the number of centimetres needs to be divided by 100

Example 1

Express 7 m in centimetres.

Since 1 m = 100 cm,

7 m = 100 × 7 cm

= 700 cm

Example 2

Express 6 m and 23 cm in centimetres.

6 m 23 cm = 6 m + 23 cm

= 600 cm + 23 cm

= 623 cm

Example 3

Express 800 cm in metres.

100 cm = 1 m

800 cm = $\frac{800}{100}$ m

= 8 m

Example 4

Express 875 cm in metres and centimetres.

875 cm = 800 cm + 75 cm

Since 800 cm = 8 m,

875 cm = 8 m + 75 cm

= 8 m 75 cm

Accordingly, to express a length of 100 cm or more, in terms of metres and centimetres the number of centimetres is written as lesser than 100.

Example 5

Express 7.85 m in centimetres.

7.85 m = 7 m + 0.85 m

= 700 cm + 85 cm

= 785 cm

Example 6

Express 54 cm in metres.

54 cm = $\frac{54}{100}$ m

Since $\frac{54}{100}$ = 0.54,

54 cm = 0.54 m

Exercise 15.4

(1) Write each of the lengths below in centimetres.

(i) 10 m (ii) 675 m (iii) 2 m 25 cm

(iv) 8 m 18 cm (v) 6.95 m (vi) 11.08 m

(2) Write each of the lengths below in metres and centimetres.

(i) 105 cm (ii) 318 cm (iii) 1508 cm
(iv) 20 001 cm (v) 1025 cm

(3) Write each of the lengths below in metres.

(i) 100 cm (ii) 500 cm (iii) 1100 cm
(iv) 25 000 cm (v) 96 cm (vi) 49 cm
(vii) 125 cm (viii) 1349 cm

(4) The heights of three students are given below.

Height of Anjula = 156 cm
Height of Saranga = 1 m 53 cm
Height of Supun = 1.6 m

(i) Write the height of each student in centimetres.
(ii) Who is the tallest student?

(5) Pubudini has a red ribbon one and a half metres long, a blue ribbon 105 cm long and a white ribbon 1 m and 55 cm long.

(i) What is the colour of the longest ribbon?
(ii) Explain how you obtained the answer.

(6) Three workers *A*, *B* and *C* were digging a drain. The depth of the drain completed by each worker is given below.

A – 1.8 m
B – 108 cm
C – 1 m 18 cm

Which worker has done the least amount of digging? Explain your answer.

(7) Minraj threw a stone a distance of 1830 cm. Dinuraj threw the same stone a distance of 18.03 m. Kavishka says that Minraj threw the stone a longer distance than Dinuraj did. Do you agree with Kavishka? Give reasons for your answer.

- ## The relationship between a metre and a kilometre

Now let us express a length given in kilometres in terms of metres.

Since 1 km = 1000 m,
2 km = 2000 m
3 km = 3000 m

Accordingly, to express a length given in kilometres in terms of metres, the number of kilometres needs to be multiplied by 1000.

Now let us express a length given in metres, in terms of kilometres.

Since 1000 m = 1 km,
2000 m = 2 km
3000 m = 3 km

Accordingly, to express a length given in metres in terms of kilometres, the number of metres needs to be divided by 1000.

Example 1

Express 5 km in metres.

1 km = 1000 m
5 km = 1000 × 5 m
= 5000 m

Example 2

Express 3 km750 m in metres.

3 km 750 m = 3 km + 750 m
= 3000 m + 750 m
= 3750 m

Example 3

Express 5000 m in kilometres.

$5000 \text{ m} = \frac{5000}{1000} \text{ km}$

5000 m = 5 km

Example 4

Express 3725 m, in kilometres and metres.

3725 m = 3000 m + 725 m

$3000 \text{ m} = \frac{3000}{1000} \text{ km} = 3 \text{ km}$

3725 m = 3 km + 725 m
= 3 km 725 m

Accordingly, to express a length of 1000 m or more, in terms of kilometres and metres, the number of metres is written as lesser than 1000.

Exercise 15.5

(1) Express each of the distances given below in metres.

(i) 3 km (ii) 16 km (iii) 15 km 25 m (iv) 2 km 750 m

(2) Express each of the distances given below in kilometres.

(i) 3000 m (ii) 12000 m (iii) 25000 m (iv) 500 m

(3) Express each of the distances given below in kilometres and metres.

(i) 3715 m (ii) 1005 m (iii) 2030 m
(iv) 15 120 m (v) 20 225 m

(3) Naveen, Gayan and Kasun took part in the Marathon at the school sports meet. Naveen had run 1850 m, Gayan had run 1 km 800 m and Kasun had run 1 km 90 m in ten minutes.

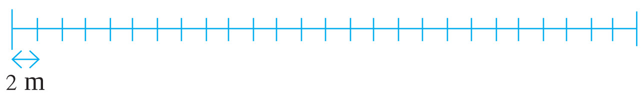
(i) Express the distance run by each student in metres.

(ii) Which athlete is ahead of the other two? Give reasons for your answer.

15.5 Estimating the length

Let us understand the estimation of length through the following examples.

A linear fence has 27 poles fixed to it . The distance between two poles which are next to each other is about 2 m. Estimate the total length of the fence.



The distance between two poles is about 2 m.

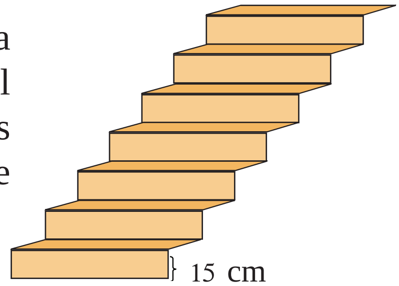
The number of spaces in between 27 poles = 26

Estimated length of the fence $= 2 \times 26$ m
$= 52$ m

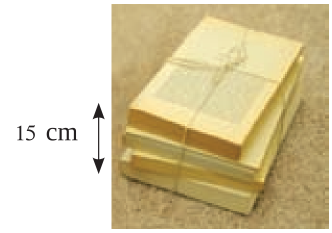
Exercise 15.6

(1) A wooden plank has a thickness of about 2 cm. 67 such planks are arranged one on top of the other. Estimate the height of the set of planks.

(2) In the staircase shown here, one step has a height of about 15 cm. Estimate the vertical distance travelled by a person who has climbed to the top of the stair case? Give your answer in meters.

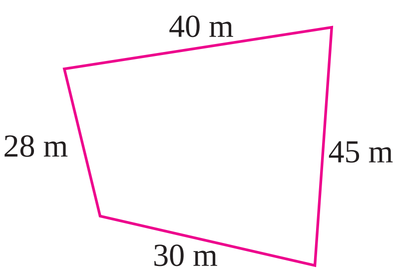


(3) The photograph here shows a pile of books. Twenty such piles are to be kept on a rack, having a height of 2 m. Explain whether this can be done.



15.6 Perimeter

A man decides to put up a wire fence around his plot of land.
Let us calculate the length of a single strand of wire needed to build the fence.



This diagram shows the lengths of the four sides of the plot of land.
The length around the land
= 40 m + 28 m +30 m + 45 m
= 143 m

The length of a single strand of wire needed to build the fence is 143 m.

This type of calculation is needed when we arrange bricks around a flower bed, build a wall around a plot of land and construct a frame for a picture. The perimeter of a plane figure is the sum of the lengths of the sides of that figure.

Let us find the perimeter of plane figures.
The picture below shows a wall hanging. A ribbon has to be sewn around it. Let us find the length of this ribbon.
The length of this ribbon = 68 cm 7 mm + 68 cm 7 mm + 60 cm 4 mm

Let us find out how to add these numbers.

cm	mm
68	7
68	7
+ 60	4
197	8

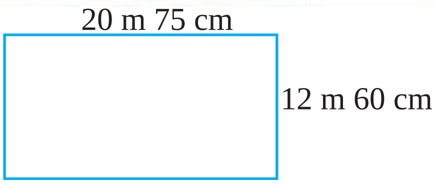
Step 1 - Let us add the numbers in the millimetre column separately.

7 mm + 7 mm + 4 mm = 18 mm.
18 mm = 10 mm + 8 mm
= 1 cm + 8 mm

Let us write 8 mm in the millimetre column. Let us carry the 1 cm to the centimetre column.

Step 2 - Let us add the numbers in the centimetre column.
1 cm + 68 cm + 68 cm + 60 cm = 197 cm

So the length of the ribbon is 197 cm and 8 mm.



A certain ground has a rectangular shape (See figure). Its length is 20 m 75 cm and its width is 12 m 60 cm. We need to find the perimeter of the ground.

First, let us add the two lengths together.

m	cm
20	75
+ 20	75
41	50

Let us add the numbers in the centimetre column. It is 75 cm + 75 cm = 150 cm

150 cm = 100 cm + 50 cm

150 cm = 1 m + 50 cm

Let us write the 50 cm in the centimetre column. Now let us add the 1 m we obtained here to the numbers in the metre column.

1 m + 20 m + 20 m = 41 m

So the sum of the two lengths is 41 m 50 cm.

Similarly let us add the two widths.

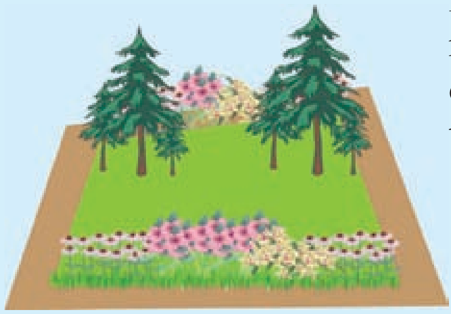
m	cm
12	60
+ 12	60
25	20

We need to add the two lengths and the two widths to find the perimeter.

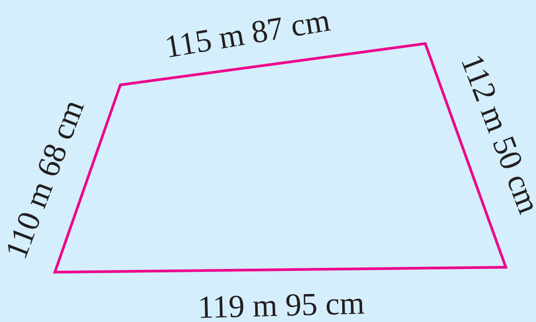
m	cm
41	50
+ 25	20
66	70

So the perimeter is 66 m 70 cm.

Example 1



Every morning, Nimali walks one round around the park. Find the total distance she walks around the park in two days.



We need to find the distance around the park, in order to find the required distance. So let us find the sum of the lengths of the four sides of the park.

m	cm
115	87
119	95
112	50
110	68
459	00

Let us add the numbers in the centimetre column.
It is 87 + 95 + 50 + 68 = 300
Since 300 cm = 3 m, let us write zero in the centimetre column.
Let us carry the 3 m to the metre column.
115 + 119 + 112 + 110 + 3 = 456

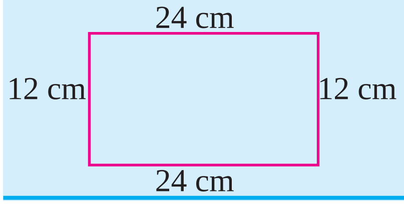
Therefore, the distance Nimali walks around the park in a day is 459 m.

So the distance Nimali walks around the park in two days } = 459 m + 459 m
= 918 m

Example 2

The width of a rectangle is 12 cm. Its lengths is twice its width. Find the perimeter of the rectangle.

Let us draw a sketch and mark the given data.

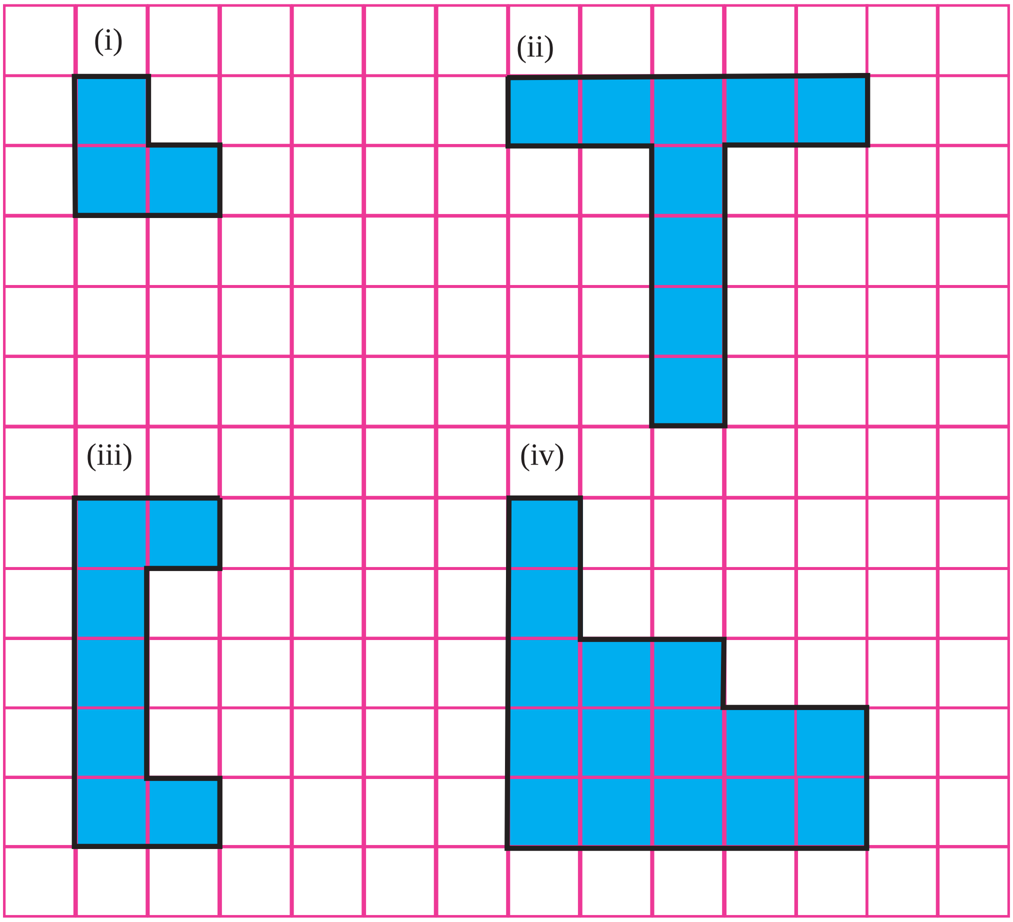


Consider the scale roughly.

The perimeter of the rectangle
= 24 cm + 12 cm + 24 cm +12 cm
= 72 cm

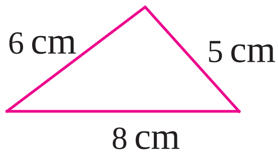
Exercise 15.7

(1) Consider the square grid below. The length of a side of a square given in dark lines is 1 cm. Find the perimeter of each of the coloured figures drawn on the grid.

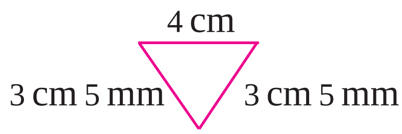


(2) Find the perimeter of each of the figures below.

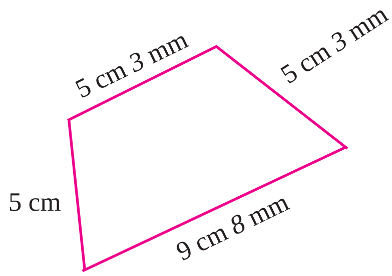
(i)



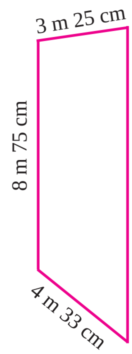
(ii)



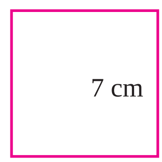
(iii)



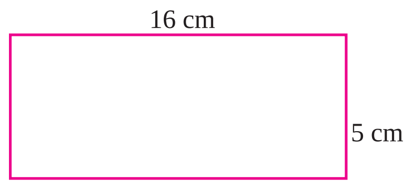
(iv)



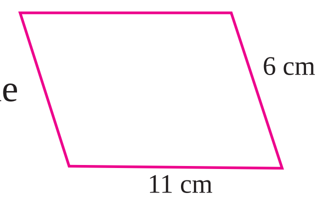
(3) Find the perimeter of the square in the picture.



(4) A rectangle is shown here. Find its perimeter.

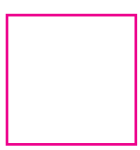


(5) Find the perimeter of the parallelogram in the picture.



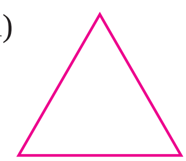
(6) The perimeter of each of the figures below is 24 cm. Find the length of a side of each figure.

(i)



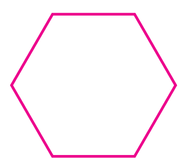
Square

(ii)



The three sides of the triangle are equal.

(iii)



The six sides of this picture is equal.

(7) A rectangular plot of land has a length of 50 m and a width of 45 m. A wire fence is to be put up around it. Find the length of a single strand of wire needed to build the fence.

(8) The length of a rectangle is 7 cm. If it's perimeter is 20 cm then what is it's width?

(9) The rectangular wall hanging shown below is to be decorated by pasting a coloured ribbon around it.

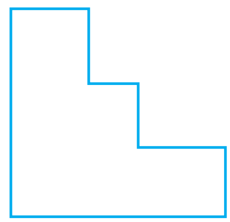
50 cm

30 cm

Chitra says that one and a half metres of coloured ribbon is enough for the decoration. Do you agree with her? Explain your answer.

(10) Find the perimeter of the figure shown here.

10 cm



10 cm

Summary

- Units such as mm, cm, m, km can be used as required to denote lengths.
- 1 cm = 10 mm
  1 m = 100 cm
  1 km = 1000 m
- The perimeter of a plane figure is the sum of the lengths of the sides of that figure.

16 Liquid Measurements

By studying this lesson, you will be able to,
- identify the units used to measure quantities of liquids,
- identify the relationship between millilitres and litres,
- add and subtract measurements of liquid amounts expressed in terms of millilitres and litres and
- estimate quantities of liquids.

16.1 Introduction

The different types of liquids that you bring from the shop are filled in bottles of various sizes. Several such bottles are depicted in the figure. Observe the quantities that are mentioned on the bottles.

The quantity of liquid contained in each bottle has been expressed in millilitres or in litres. Let us write the quantities mentioned on the bottles as follows.

Forty millilitres has been expressed as 40 ml using symbols,
Three hundred and fifty milliliters has been expressed as 350 ml using symbols, and
one litre has been expressed as 1 *l* using symbols.

Litres and millilitres are units used to measure quantities of liquids. The quantity of milk in a milk packet or the quantity of medicinal syrup in a bottle is usually measured in millilitres, while the fuel used in vehicles is measured in litres.

Activity 1

Complete the given table providing the most suitable unit to measure the quantity given in each situation.

Situation	Unit
Household water consumption	
Quantity of fuel pumped into a vehicle	
Quantity of milk given to a child during a meal	
Quantity of milk required for a cup of tea	
Quantity of water that should be drunk by a person during a day	
Quantity of medicinal syrup given to a patient as one dose	
The dose of vaccine administered to a patient	

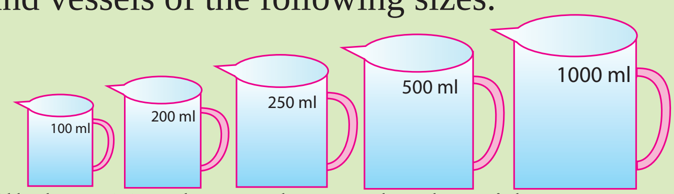
16.2 Relationship between the units used to measure amounts of liquid

We have learnt that the units millilitres (ml) and litres (*l*) are used to measure amounts of liquids. A quantity of 1 litre of a liquid is equal to a quantity of 1000 ml of the liquid.

$$1\ l = 1000 \text{ ml}$$

Activity 2

Step 1- Find vessels of the following sizes.



Step 2 - Fill the 500 ml vessel completely with water and pour it into the 1 *l* vessel. How many times has the 500 ml vessel to be filled completely with water to fill the 1 *l* vessel completely?

Step 3 - Fill the 250 ml vessel completely with water and pour it into the 1 *l* vessel. How many times has the 250 ml vessel to be filled completely with water to fill the 1 *l* vessel completely?

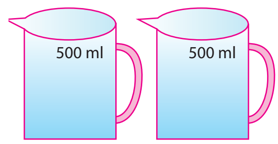
Step 4 - Similarly, how many times must water be poured from a completely filled 200 ml vessel to fill the 1 *l* vessel completely?

Step 5 - How many times must water be poured from a completely filled 100 ml vessel to fill the 1 *l* vessel completely?

The results you will obtain by doing this activity are given below.

- The 1 *l* vessel is filled completely when water is poured into it twice from a completely filled 500 ml vessel. There are two 500 ml amounts in 1 *l*. Accordingly,

  500 ml + 500 ml = 1 *l*
  That is, 1000 ml = 1 *l*

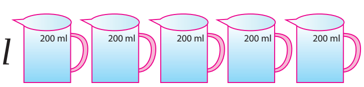


- The 1 *l* vessel is filled completely when water is poured into it four times from a completely filled 250 ml vessel. That is, there are four 250 ml amounts in 1 *l*.

  250 ml + 250 ml + 250 ml + 250 ml = 1 *l*
  That is, 1000 ml = 1 *l*

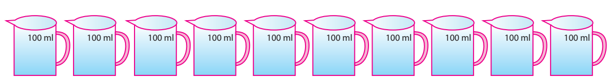
- The 1 *l* vessel is filled completely when water is poured into it five times from a completely filled 200 ml vessel. That is, there are five 200 ml amounts in 1 *l*.

  200 ml + 200 ml + 200 ml + 200 ml + 200 ml = 1 *l*
  That is, 1000 ml = 1 *l*



- The 1 *l* vessel is filled completely when water is poured into it ten times from a completely filled 100 ml vessel. That is, there are ten 100 ml amounts in 1 *l*.

  100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml + 100 ml = 1 *l*
  That is, 1000 ml = 1 *l*



• Representing liquid measurements expressed in litres in terms of millilitres

The amount of millilitres in certain amounts of litres is given below.

Since 1 l = 1000 ml,
2 l = 2000 ml
3 l = 3000 ml

Accordingly, to express a quantity of liquid given in litres, in terms of millilitres, the number of litres has to be multiplied by 1000.

Example 1

Express 12 l in millilitres.

12 l = 12 × 1000 ml
= 12 000 ml

Example 2

Express 1 litre 200 millilitres in millilitres.

1 l 200 ml = 1 l + 200 ml
Since 1 l = 1000 ml,
1 l 200 ml = 1000 ml + 200 ml
= 1200 ml

Example 3

Express 4 l 85 ml in millilitres.

4 l 85 ml = 4 l + 85 ml
Since 1 l = 1000 ml,
4 l 85 ml = 4000 ml + 85 ml
= 4085 ml

Exercise 16.1

(1) Complete the following table.

Quantity of water to be measured	Size of the vessel used to measure the quantity	Number of times the measuring vessel needs to be used
1 litre 500 millilitres	500 millilitres	
1 litre 250 millilitres	250 millilitres	
2 litres	100 millilitres	
4 litres	500 millilitres	
....	250 millilitres	8
3 litres	....	6

(2) Express each of the following liquid measurements in millilitres.

(i) 8 *l* (ii) 1 *l* 100 ml (iii) 5 *l* 10 ml
(iv) 2 *l* 500 ml (v) 3 *l* 100 ml (vi) 3 *l* 250 ml
(vii) 7 *l* 225 ml (viii) 2 *l* 75 ml (ix) 3 *l* 25 ml

- **Representing liquid measurements expressed in millilitres in terms of litres**

The amount of litres in certain amounts of millilitres is given below.

Since 1000 ml = 1 *l*,
2000 ml = 2 *l*
3000 ml = 3 *l*

Accordingly, to represent liquid measurements expressed in millilitres in terms of litres, the amount in millilitres needs to be divided by 1000.

Example 1

Express 2750 millilitres in terms of litres and millilitres.

2750 ml = 2000 ml + 750 ml
Since 1000 ml = 1 *l*, 2000 ml = 2 *l*
2750 ml = 2 *l* + 750 ml
= 2 *l* 750 ml

Accordingly, to express an amount of 1000 millilitres or more, in terms of litres and millilitres, the amount of milliliters is written as lesser than 1000.

Example 2

Fill in the table by representing the liquid measurements expressed in millilitres in terms of litres and millilitres.

ml	*l*	ml
999	0	999
1000	1	000
2075	2	075
3008	3	008

Exercise 16.2

(1) Express each of the following liquid measurements in litres.

(i) 1000 ml (ii) 2000 ml (iii) 3000 ml (iv) 7000 ml
(v) 10 000 ml

(2) Express each of the following liquid measurements in litres and millilitres.

(i) 1300 ml (ii) 1500 ml (iii) 1050 ml (iv) 3252 ml
(v) 7756 ml (vi) 3002 ml (vii) 4103 ml (viii) 10075 ml

16.3 Adding liquid measurements

Let us find out the quantity of drink that is obtained when 350 ml of fruit juice is added to 750 ml of water.

These liquid measurements can easily be added together since they are both expressed in the same units.

Quantity of fruit juice	=	350 ml
Quantity of water	=	750 ml
Total quantity	=	1100 ml

That is, the total quantity of drink is 1 *l* 100 ml.

A producer of cinnamon oil produced 2 *l* 750 ml of oil during the first week and 5 *l* 500 ml of oil during the second week. Let us find out how much oil he produced during the two weeks.

Let us add these measurements by writing the millilitres in one column and the litres in another column, as shown below.

l	ml
2	750
+ 5	500
8	250

Let us add the quantities in the millilitres column.
750 ml + 500 ml = 1250 ml
Since 1250 ml = 1 *l* + 250 ml,
let us keep the 250 millilitres in the millilitres column and carry the 1 litre to the litres column.
Let us add the quantities in the litres column.
We obtain 1 *l* + 2 *l* + 5 *l* = 8 *l*

That is, the quantity of oil that was produced during the two weeks is 8 *l* 250 ml.

The quantity of oil that was produced during the two weeks can also be found in the following manner.

Let us express each quantity in millilitres and add them as follows.

2 *l* 750 ml	=	2750 ml
5 *l* 500 ml	=	5500 ml
		8250 ml

The total quantity of oil is 8250 ml. That is, 8 *l* 250 ml.

Exercise 16.3

(1) Add each of the following liquid measurements.

(i)	(ii)	(iii)	(iv)
ml	ml	ml	ml
350	675	750	803
+ 250	+ 250	+ 350	+ 373

(v)

l	ml
3	150
+ 2	600

(vi)

l	ml
2	75
+ 1	950

(vii)

l	ml
5	624
+ 2	750

(viii)

l	ml
4	305
+ 2	915
1	200

(ix)

l	ml
12	450
+ 10	850
10	900

(x)

l	ml
6	425
+ 12	755
	995

(2) Find the quantity of drink that can be made by adding 3 l 500 ml of water to 750 ml of fruit juice. Express this quantity in litres and millilitres.

(3) There is 4 l 750 ml of petrol in the petrol tank of a vehicle. If another 5 l 750 ml of petrol is pumped in, find the total quantity of petrol in the tank.

(4) There was 3 l 850 ml of water in a basin. 1 l 400 ml of water was added to this. If an amount equal to the total quantity of water in the basin is added again, how much water is there in the basin now?

16.4 Subtracting a liquid measurement from a given liquid measurement

There was 750 ml of water in Sumith's water bottle. He drank 150 ml of it. Let us find how much water there is in the bottle now.

Quantity of water in the bottle initially = 750 ml
Quantity of water Sumith drank = 150 ml
Quantity of water remaining = 750 ml – 150 ml
= 600 ml

The quantity of drink in a bottle in a refrigerator was 2 l and 100 ml. Of this amount, 200 ml was served to a guest. Let us find the amount of drink remaining in the bottle.

Initial quantity of drink = 2 l 100 ml
Quantity served to the guest = 200 ml

Let us subtract the quantity that was served from the quantity that was initially there.

2 *l* 100 ml is equal to 2100 ml. Now let us subtract 200 ml from 2100 ml.

	2100 ml
–	200 ml
	1900 ml

That is, the remaining amount is 1 *l* 900 ml.
The remaining amount can also be found in the following manner.

	l	ml
	2	100
–		200
	1	900

100 is smaller than 200.
Let us carry 1 *l* to the millilitres column. There is 1 *l* remaining in the litres column.
Then there is 1000 ml + 100 ml, that is, 1100 ml in the millilitres column.

1100 ml – 200 ml = 900 ml
Therefore, the remaining amount is 1 *l* 900 ml.

Exercise 16.4

(1) Subtract.

(i)

	ml
	500
–	200

(ii)

	l	ml
	1	500
–		250

(iii)

	l	ml
	1	000
–		250

(iv)

	l	ml
	2	000
–	1	500

(v)

	l	ml
	3	250
–	1	750

(vi)

	l	ml
	5	150
–	2	250

(vii)

	l	ml
	2	50
–	1	750

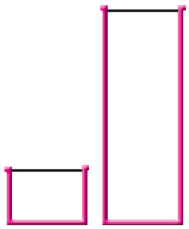
(viii)

	l	ml
	15	105
–	8	250

(2) A trader sells 1 *l* 500 ml of coconut oil from the 10 *l* that he had in store. Express the quantity that is remaining in terms of litres and millilitres.

(3) 15 *l* of fuel can be filled into a certain fuel tank. If the tank contains 8 *l* and 750 ml of fuel at present, how much more fuel is required to fill the tank completely?

16.5 Estimation of liquid amounts



First figure Second figure

The quantity of milk in the vessel in the first figure is approximately 200 ml. Let us estimate the amount of milk there is in the vessel in the second figure.

The quantity of milk in the vessel in the second figure is about four times the quantity of milk in the bottle in the first figure. That is, 4 times 200 ml. Therefore, there is approximately 800 ml of milk in the vessel in the second figure.

Exercise 16.5

(1) Approximately 30 millilitres of oil is required for a clay oil lamp. Estimate the amount of oil that is required for 50 oil lamps in terms of litres and millilitres.

(2) Approximately 500 ml of Kithul honey was required to serve curd to ten guests. Estimate the amount of Kithul honey that is required to serve curd to 15 guests.

(3) There is approximately 650 ml of king coconut water in one king coconut (thambili). Accordingly, estimate the amount of king coconut water there is in a bunch of 10 fruits, in terms of litres and millilitres.

Miscellaneous Exercise

(1) The following table provides information on the quantities of milk collected by a milk collector from three houses during two days.

	Day 1	Day **2**
House *A*	5 *l* 500 ml	6 *l* 250 ml
House *B*	7 *l* 250 ml	5 *l* 750 ml
House *C*	4 *l* 675 ml	5 *l* 500 ml

(i) Express the total quantity of milk that was obtained from house *A* during the two days, in terms of litres and millilitres.

(ii) By what amount was the quantity of milk collected from house *B* on the second day, less than the quantity that was collected on the first day?

(iii) By what amount was the quantity of milk provided by house *C* on the second day, more than the quantity that was provided on the first day?

(iv) Find separately, the total quantity of milk provided by the houses *B* and *C* during the two days.

(v) Accordingly, find the total quantity of milk that the milk collector collected during the two days.

(2) The quantity of acid in a certain vessel in a laboratory was 3 litres. The quantity of acid taken from this vessel for various practical experiments during each day of a certain week is given below.

Day	Quantity of Acid
Monday	750 ml
Tuesday	350 ml
Wednesday	200 ml
Thursday	150 ml
Friday	200 ml

(i) Find the total quantity of acid that was used during the five days.

(ii) What was the quantity of acid remaining in the vessel at the end of the week?

(3) A certain type of paint is marketed in tins of the following sizes; 500 millilitres, 1 litre, 2 litres and 4 litres.

(i) A person wishes to buy one litre of paint. What are the two ways in which he can purchase this?

(ii) The quantities of each type that were sold during a week is given below. Four tins of size 1 litre, three tins of size 2 litres, seven tins of size 500 millilitres. Express the total amount of paint that was sold during that week in terms of litres and millilitres.

(iii) A person who bought a tin of size 4 litres used 2 *l* 700 ml of it. How much paint was left over?

(4) At 8.00 a.m, there was 1500 litres of water in a calibrated water tank. The quantity of water that was used up during the 6 hours from 8.00 a.m. to 2.00 p.m. is given below.

Time				Quantity of water that was used
First hour	: 8.00 a.m.	–	9.00 a.m.	78 l
Second hour	: 9.00 a.m.	–	10.00 a.m.	120 l 750 ml
Third hour	:10.00 a.m.	–	11.00 a.m.	150 l 500 ml
Fourth hour	:11.00 a.m.	–	12.00 noon	400 l 750 ml
Fifth hour	:12.00 noon	–	1.00 p.m.	200 l
Sixth hour	:1.00 p.m.	–	2.00 p.m.	180 l

(i) Show by calculating the amount that by the end of the fourth hour, exactly half the quantity of water in the tank had been used up.

(ii) Find the amount of water remaining in the tank at the end of the six hours.

(iii) By what amount is the quantity that was used in the third hour greater than the quantity that was used in the second hour?

(iv) If the total amount of water that can be filled into the tank is 2000 litres, find how much water has to be added to the water remaining in the tank after the 6 hours, to fill it up completely.

Summary

- Liters and millilitres are two units used to measure quantities of liquids.
- 1000 ml = 1 l
- To convert a quantity expressed in litres into a quantity expressed in millilitres, the quantity in litres is multiplied by 1000.
- To convert a quantity expressed in millilitres into a quantity expressed in litres, the quantity in millilitres is divided by 1000.

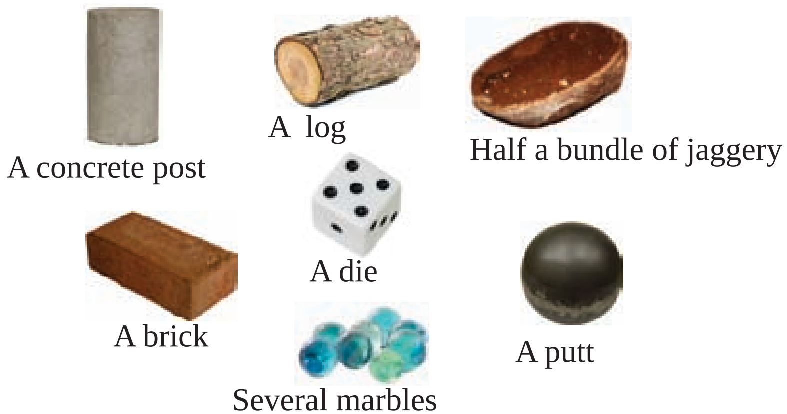
17 Solids

By studying this lesson, you will be able to,

- prepare models of a cube, cuboid and regular tetrahedron,
- identify and state the shapes of the faces of these solids and the number of faces, edges and vertices each solid has, and
- create various nets to prepare models of the above mentioned solids and create new compound solids with these models.

17.1 The surfaces, faces, edges and vertices of solids

The following figure illustrates several items that we see and use in our day to day activities.

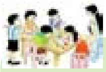


An object of specific shape which occupies a certain amount of space is called a solid object.

Now let us consider the surfaces, faces, edges and vertices of several solids.

Every solid has an outer surface which is called the **“surface”** of the solid.

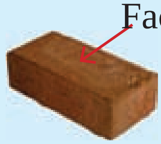
• The faces of solids



Activity 1

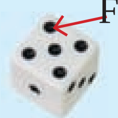
Step 1 - Collect several solid objects that can be found in the classroom.
Step 2 - Examine the surfaces of the objects you collected.
Step 3 - Through this examination, identify the shapes of the different surface parts and see whether they are flat or curved.
Step 4 - What are the other properties you can identify?

You may have realized from the above activity that the outer surface of solids consists of different shaped plane surface parts and/or curved surface parts.



All the surface parts of a brick are plane surfaces. These plane surfaces are called **faces**. That is, a brick has six faces.

The surface of a marble is a curved surface.



The surface of a die consists of six plane surface parts. That is, a die has six faces.

• The edges of solids

A boundary along which two surface parts of a solid meet is called an edge of the solid.

The edges of a brick are rectilinear. Such edges are called **straight edges.**

The concrete post has two edges. These edges are not rectilinear. Edges which are not straight edges are called **curved edges.**

The vertices of solids

Let us consider solids such as a brick or a die. The place where three or more edges of such a solid meet is called a vertex.

The brick has 8 vertices.

The die has 8 vertices.

Example 1

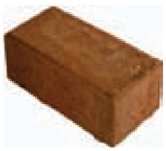
The figure illustrates a part of a log which has been split into two. Write down separately, the number of flat surface parts, curved surface parts, straight edges, curved edges and vertices that it has.

Number of flat surface parts 3.
Number of curved surface parts 1.
Number of straight edges 4.
Number of curved edges 2.
Number of vertices 4.

Exercise 17.1

(1) Complete the following table by considering the number of edges, vertices and surface parts each solid consists of.


(a)


(b)


(c)

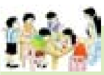

(d)


(e)

Figure	Number of faces	Number of curved surface parts	Number of straight edges	Number of curved edges	Number of vertices
a					
b					
c					
d					
e					

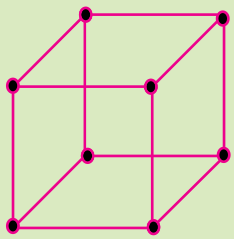
17.2 Cube

All the surface parts of a die are plane surfaces. All its faces take the shape of a square and are of equal size. A solid object such as a die, with all its faces square shaped and of equal size, is said to be the shape of a cube.



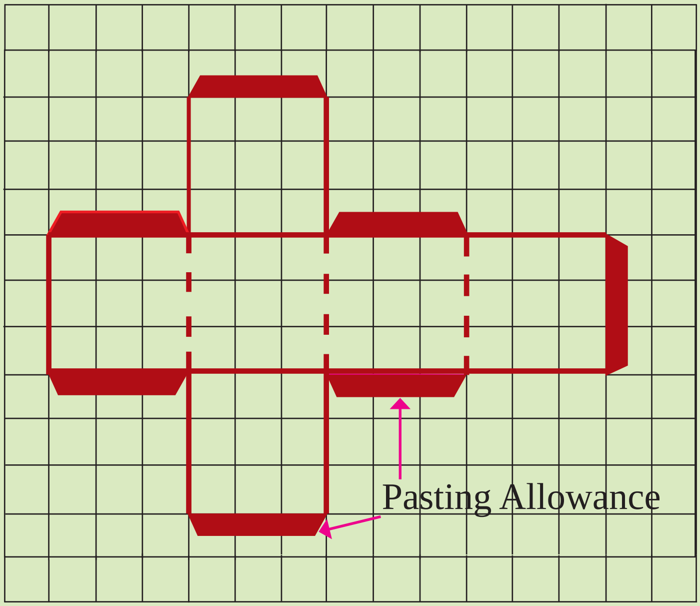
Activity 2

Step 1 - Using equal length pieces of ekel and a suitable substance such as clay to join the pieces together, prepare a framework as shown in the figure.



Step 2 - Cut out sufficient square pieces of Bristol board or some other such thick paper to paste on the framework. Using sellotape, paste the 6 square shaped pieces on the framework and prepare a model of a cube.

Step 3 - Draw the following figure on a square ruled paper.



Step 4 - Cut out the figure that you drew and either copy it or paste it on a thick piece of paper such as a Bristol board.

Step 5 - Cut out the figure on the thick piece of paper and by folding along the relevant lines and pasting down the shaded allowances, prepare a model of a cube.

Step 6 - Examine the shape of a face, and determine the number of faces, the number of edges, the number of vertices and other special properties of the model you prepared. Write down the properties you identified in your exercise book.

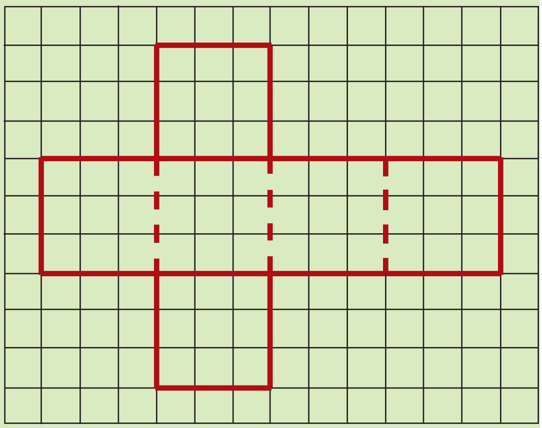


figure 1 - net of the cube

Without the pasting allowances, the above figure which was used to create a model of a cube is a **net of the cube.**

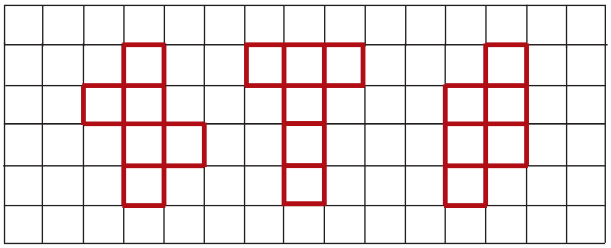
Step 7 - In your square ruled exercise book, draw two other nets that can be used to prepare a model of a cube.

The properties you can identify in a cube.

- A cube has 6 faces. The shape of each face is a square.
- All the faces of a cube are identical to each other.
- A cube has 12 edges. All 12 edges are rectilinear.
- A cube has 8 vertices.

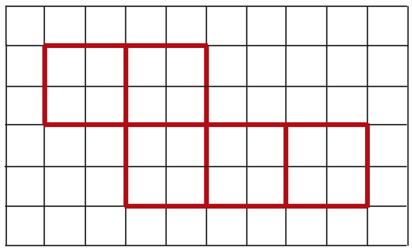
Exercise 17.2

(1) From the following figures, select the nets that can be used to create cubes and draw them in your exercise book.



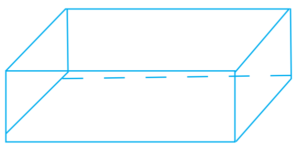
(2) Write down two solid objects which take the shape of a cube.

(3) A portion of a net that can be used to make a cube is given in the figure. Complete the net and draw it in your exercise book.



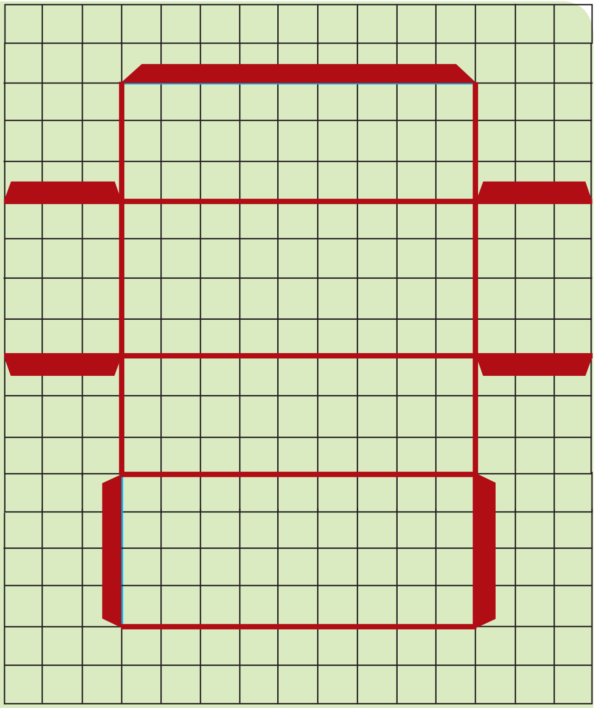
(4) Draw a suitable net to prepare a cube of side length 3 cm.

17.3 Cuboid



A brick is a solid object which takes the shape of a cuboid.

Activity 3



Step 1 – Draw the figure given here on a square ruled piece of paper. Copy or paste this on a piece of Bristol board.

Step 2 – Make a model of a cuboid by cutting the figure on the Bristol board, folding it appropriately and pasting along the allowances.

Step 3 – Measure and write down the length, breadth and height of the model you created.

Step 4 – Examine the model that you made, and identify the shapes of the faces of the cuboid, the number of faces, edges and vertices and any other special properties.

Step 5 – Write down the properties that you identified in your exercise book.

Without the pasting allowances, the above figure which was used to create a model of a cuboid is a net of the cuboid.

Step 6 – In your exercise book, draw another net that can be used to prepare a model of a cuboid.

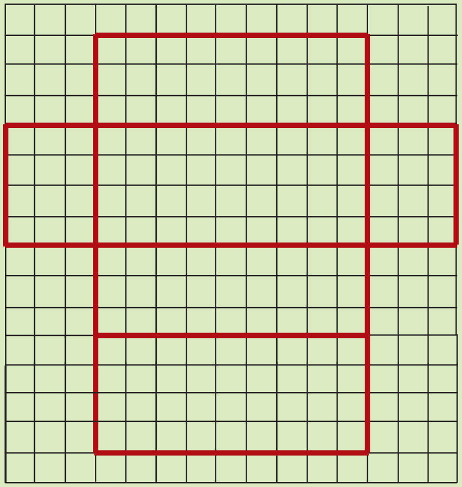


Figure 2 - net of the cuboid

The properties you can identify in a cuboid.

- A cuboid has 6 faces. The faces of a cuboid take the shape of rectangles (some of which may be squares).
- The faces which are opposite each other are equal in size and shape.
- A cuboid has 12 edges. All 12 edges are rectilinear.
- A cuboid has 8 vertices.

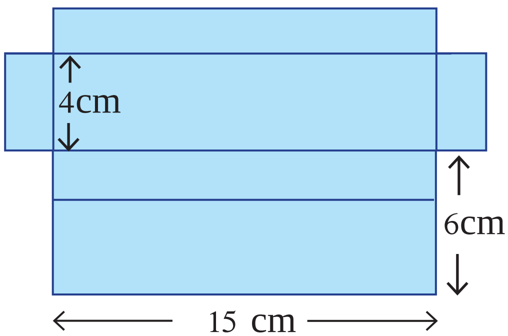
Exercise 17.3

(1) Name five objects that you can observe in your environment which take the shape of a cuboid.

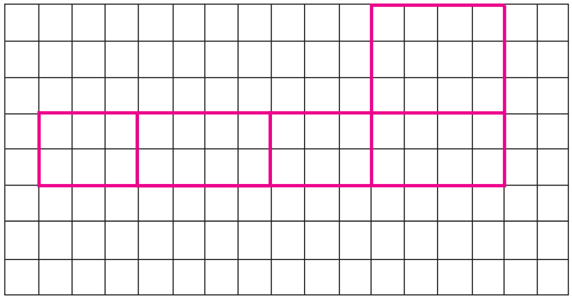
(2) (i) Draw a figure of a cuboid in your square ruled exercise book.

(ii) Measure and write down the length, breadth and height of the cuboid that was drawn.

(3) Write down the length, breadth and height of the cuboid that can be made with the net in the figure.



(4) The figure illustrates a part of a net drawn to make a cuboid. Complete it and draw it in your square ruled exercise book.



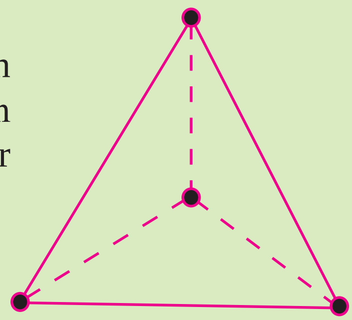
(5) It is required to make a cuboid of length 10 cm, breadth 6 cm and height 4 cm. Draw a net for the above cuboid and mark its measurements, by assuming that the length of 1 square of a square ruled page is 1 cm.

17.4 Regular Tetrahedron

Now let us identify properties of a regular tetrahedron which is a solid object, by doing the following activity.

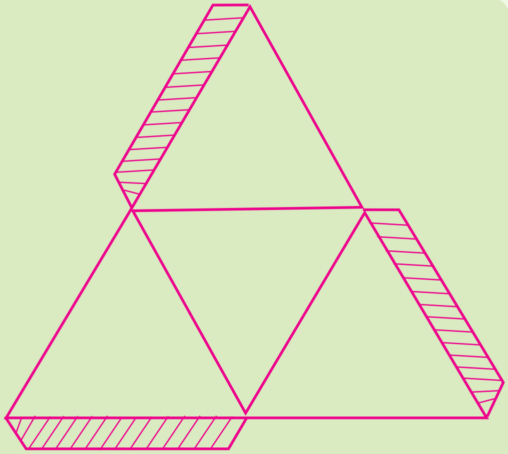
Activity 4

Step 1 - Prepare a framework as shown in the figure by using 6 equal length pieces of ekel or straws and clay, or some other suitable substance.



Step 2 - Cut out sufficient triangular pieces of Bristol board or some other such thick paper to paste on the framework. Using sellotape, paste the 4 triangular shaped pieces on the framework and prepare a model of a regular tetrahedron.

Step 3 - With the aid of a tissue paper, copy the figure given here onto a Bristol board.



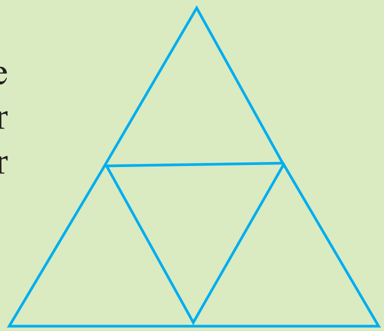
Step 4 - Cut out the figure, fold it appropriately along the straight lines and by pasting down the allowances, make a model of a solid.

Step 5 - Identify the shape of the model, the shape of its faces, the number faces, edges and vertices and any other special properties.

Step 6 - Write down the properties that you identified in your exercise book.

Step 7 - Measure the lengths of the edges of the model.

Without the pasting allowances, the figure used above to prepare a model of a regular tetrahedron is a net of the regular tetrahedron.



Step 8 - Draw another net that can be used to prepare a model of a regular tetrahedron.

What you made in the above activity is a model of a tetrahedron.

All its faces are equal and all its edges too are equal. Therefore it is a regular tetrahedron.

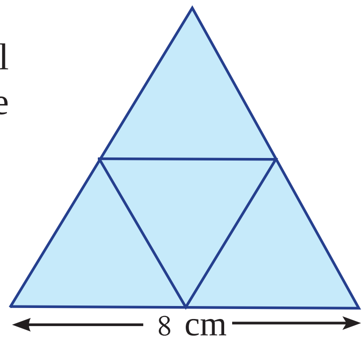
The properties you can identify in a regular tetrahedron.

- The faces of a regular tetrahedron take the shape of a triangle.
- It has 4 faces.
- A regular tetrahedron has 6 edges. All the edges are rectilinear.
- A regular tetrahedron has 4 vertices.

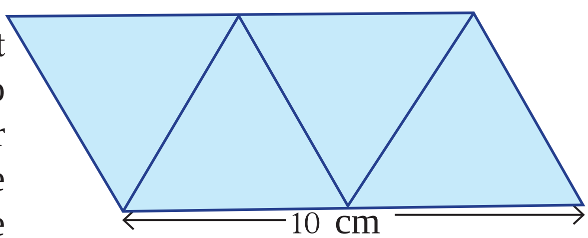
Exercise 17.4

(1) What is the shape of a face of a regular tetrahedron?

(2) What is the length of an edge of the model of a regular tetrahedron that can be made using the net given in the figure?



(3) The figure depicts a net which can be used to make a model of a regular tetrahedron. What is the length of an edge of the regular tetrahedron that can be made using this net?



(4) Draw a suitable net to create a model of a regular tetrahedron with edges of length 6 cm (Draw one triangle of the net on a tissue paper and using it prepare the net).

17.5 Compound Solids

It is possible to construct a compound solid by combining together some of the solids that you have already identified.

Activity 5

Step 1 - Using Bristol board, make models of the following solids, according to the given measurements.

- ⋆ Two cubes with edges of length 6 cm.
- ⋆ Two regular tetrahedrons with edges of length 6 cm.
- ⋆ Two identical cuboids.

Step 2 - By placing the two models of the cube together and pasting them, create a compound solid.

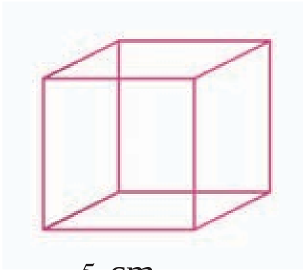
Step 3 - By placing the two regular tetrahedrons together and pasting them, create a compound solid.

Step 4 - By placing the two cuboids together and pasting them, create a compound solid.

Step 5 - Examine and compare the properties of the compound solids that were created with the properties of the solids that were used to create them.

Exercise 17.5

(1) A compound solid is made by placing the cube in the figure on an identical cube, such that two of the faces coincide, and then pasting them together.



5 cm

(i) What is the name of the solid that is made?
(ii) Write down the measurements of the solid.

(2) A solid has been made by placing two identical regular tetrahedrons together, such that two of their faces coincide, and then pasting these two faces together. For this compound figure, write down

(i) the number of faces.
(ii) the number edges.
(iii) the number of vertices.

Summary

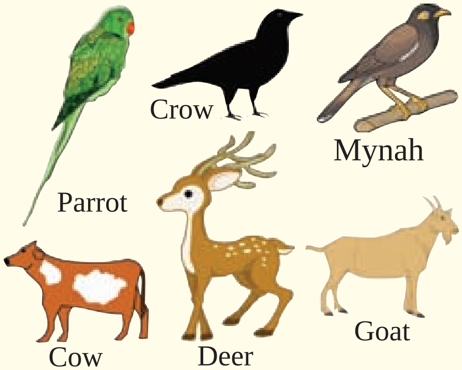
An object of specific shape which occupies a certain amount of space is called a solid.

Solid \ Property	Shape of a face	Number of faces	Number of edges	Number of vertices
Cube	Square	6	12	8
Cuboid	Rectangle	6	12	8
Regular Tetrahedron	Triangle	4	6	4

Revision Exercise - 2

(1) (i) Separate the collection of animals given here into two groups based on their common characteristics.

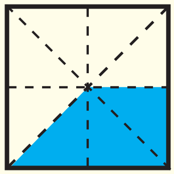
(ii) Write a suitable name for each group.



(2) (i) In the pattern of triangular numbers written in ascending order as 1, 3, 6, 10, ... write down the next two terms.

(ii) In the pattern of the multiples of 5 written in ascending order as 5, 10, 15, 20,... which term is 50?

(3) (i) Write down the shaded part in the figure as a fraction by taking the whole figure as a unit.



(ii) Find the value.

(a) $\frac{1}{5} + \frac{1}{10}$ (b) $\frac{1}{2} + \frac{2}{3}$ (c) $\frac{3}{8} + \frac{1}{4}$ (d) $\frac{4}{7} - \frac{3}{14}$ (e) $\frac{7}{12} - \frac{1}{3}$

(4) Find the value.

(i) $0.5 + 0.65$ (ii) $2.76 + 1.44$ (iii) $1.71 - 0.9$ (iv) $2.13 - 1.89$

(5) (i) Write down all the multiples of nine, which are greater than 0 and less than 90.

(ii) Write down the factors of 84.

(6) A person sold $\frac{3}{10}$ of his land and handed over $\frac{1}{5}$ to his son.

(i) Choose and write the false statement regarding the above two fractions.

(a) Both the fractions are proper fractions.

(b) Both the fractions are unit fractions.

(c) Only one fraction is a unit fraction.

(ii) Write the relevant values in the boxes.

$$\frac{1}{5} = \frac{1 \times 2}{5 \times \square} = \frac{2}{\square}$$

(iii) Find the fraction that results when $\frac{1}{5}$ and $\frac{3}{10}$ are added.

(iv) Show that the person is now left with half the land.

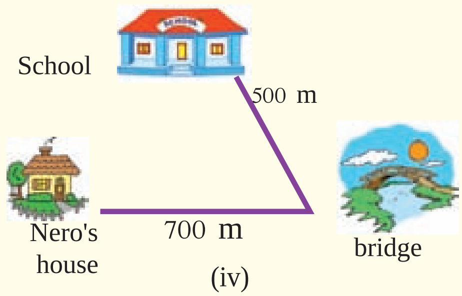
(v) The part remaining which is rectangular in shape is of length 50 m 40 cm. The width is 20 m 75 cm.

(a) How much greater is the length than the width in metres?

(b) Find the sum of the lengths of the all the sides of the remaining plot of land.

(7) (i) The length of a rectangular blackboard is 1 m and 50 cm. The width is 80 cm. Find the sum of the lengths of the four sides of the blackboard?

(ii) When one goes to the school from Nero's house across the bridge, express the distance in kilometres that one has to travel.



(8)

(i)

	m	cm
	5	75
+	2	45

(ii)

	km	m
	10	660
+	3	890

(iii)

	l	ml
	4	750
+	2	350

(iv)

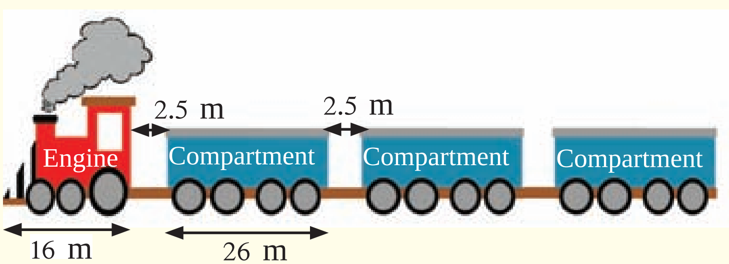
	l	ml
	5	000
−	2	050

(9) Write the given numbers in ascending order in each of the following cases.

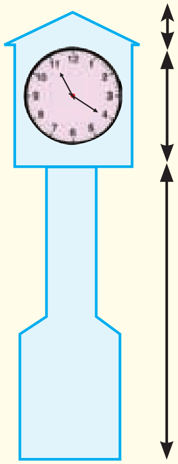
(i) $\frac{1}{12}, \frac{5}{6}, 1$ (ii) 1, 1.1, 0.1, 0.2, 0.3

(10) (i) The length of a train engine is 16 m. The length of a compartment is 26 m. The gap between two compartments when joined is 2.5 m.

What is the length of a train with an engine and three compartments?



(ii)



The illustration shows you a clock tower in a town. Express its total height in metres?

(11) (a) From among the six numbers,

675, 908, 993, 1970, 2435, 3800

(i) select and write down the numbers which are divisible by 2.

(ii) select and write down the numbers which are divisible by 5.

(iii) how many numbers are there which are divisible by both 2 and 5 ?

(b) (i) Fill in the blanks using suitable whole numbers.

$1 \times \square = 12$, $2 \times \square = 12$, $3 \times \square = 12$

(ii) Hence or otherwise, find the factors of 12.

(iii) In the same manner, find the factors of 18.

(iv) According to the above results, find the factors which are common to both the numbers 12 and 18.

(12) (i) Write down solids in which each of the following rectilinear plane figures can be observed.

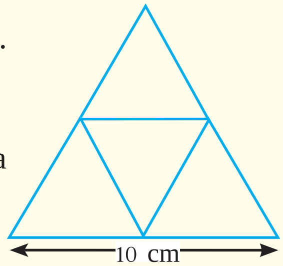
Rectangle -
Square -
Triangle -

(ii) Write down 2 characteristics observed in a square and a trapezium.

(iii) A net of a regular tetrahedron is shown in the figure.

(a) What is the shape of a face of a regular tetrahedron?

(b) What is the length of an edge of the model of a tetrahedron that can be made using this net?



(13)

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

(i) Write down all the even numbers among the ten whole numbers given above.

(ii) Write down the least odd number and the greatest odd number among the ten whole numbers given above.

(iii) Write down all the prime numbers that lie between 20 and 30.

(14) (i) Several measuring units used in day to day life are given below.

metres, millilitres, centimetres, litres, kilometres

(a) Separate these measuring units into two groups having common characteristics.

(b) Write a suitable name for each group.

(c) Write down each of these measuring units along with its symbol.

(d) Write down the relationships between the measuring units in each of the groups.

(15) (i) (a) Express the amount 1 *l* 50 ml of liquid in millilitres.

(b) Express 2035 litres in terms of litres and millilitres.

(c) When 150 millilitres of water per glass is poured from one litre into 6 glasses, what is the remaining amount of water?

(ii) From 5 metres of white material, 2.5 metres are cut for a frock and 1.75 metres are cut for a shirt. Express the length of the remaining material in centimetres.

(16) (i) Write down the names of two objects which take the shape of a cuboid.

(ii) Draw a net to make a box having the shape of a cuboid.

(iii) Write down the number of faces, number of vertices and number of edges of a cuboid.

18 Algebraic Symbols

By studying this lesson, you will be able to,

- identify known terms, unknown terms and variables.

18.1 Symbols used in maths

There are many symbols which are used in mathematics that you are aware of. For example, 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are ten symbols that you know very well. These symbols of the Hindu Arabic System are defined as digits. All the numbers are written using these ten digits.

Several numerals that can be written using only the digits 1 and 2 are given below. For example, twenty two is denoted by 22 and two hundred and twenty one is denoted by 221.

1, 11, 12, 21, 22, 111, 112, 121, 122, 211, 212, 221, 222

Several other symbols which are used in mathematics are given below.

Mathematical operation	Symbol
Addition	$+$
Subtraction	$-$
Multiplication	$\times$
Division	$\div$

Mathematical expressions can be written using symbols such as 1, 2, 3, +, – , ×, ÷, =.

For example, the statement that thirteen is obtained by adding five to eight can be expressed using symbols as $8 + 5 = 13$.

The statement "three twos is six" can be expressed as $2 \times 3 = 6$ and "two threes is six" can be expressed as $3 \times 2 = 6$ using symbols.

Example 1

Let us find the total number of litres of milk that are purchased during a week by a household which purchases two litres of milk each day.

The solution to this problem can be expressed as $2 \times 7 = 14$ using symbols.
That is, the quantity of milk purchased during a week by the household is 14 *l*.

Symbols are used when solving a problem with the knowledge of mathematics. In this case, it is necessary to translate statements which have been expressed in words into mathematical statements using symbols before the problem is solved.

18.2 Symbols used to denote known and unknown terms

We know that there are seven days in a week. This is also written as "7 days in a week".

In this example, the symbol 7 has been used to express the fact that a week has seven days. This is a constant number which we know. Therefore it is defined as a known term.

A known constant value can be expressed using a symbol as above. These constant values are called known terms.

In mathematics, a constant value which is known, that is a **known term**, is expressed by a number.

Suppose a certain household buys the same amount of milk each day. If this amount is not known, we cannot express it using a number. Such constant values which are not known are defined as **unknowns.**

An unknown term in a mathematical expression is most often represented by a simple letter of the English alphabet. Accordingly, since the amount of milk purchased each day is an unknown constant value, we can denote it using the letter a.

Look at the way Nimal and Sita show us how many olives they each have in their hand.

The number of olives that are in Sita's hand can be written using the numerical symbol "3". It is a known number. However we cannot say definitely how many olives there are in Nimal's hand. This is an unknown constant value. That is, it is an unknown term.

Accordingly, let us take the number of olives that are in Nimal's hand to be b. Note that we may use any other letter we like as well, instead of b.

The symbols used to denote unknown terms as above are algebraic symbols.

Several instances when algebraic symbols are used to denote unknown constants are given below.

- The length of your classroom is l metres.
- The number of books in your school library is n.
- The height of the flag pole is h metres.

Exercise 18.1

(1) (i) Write down in the 2nd column of the following table whether each of the expressions given in the table states a known constant or an unknown constant.

(ii) In the 3rd column write down its value by digits if it is a known constant and a suitable algebraic symbol if it is an unknown constant.

Expression	Known/ Unknown	
❖ The number of days in January ❖ The number of books in Nimal's school bag ❖ The number of millilitres in one litre ❖ The number of words in the Grade 6 mathematics textbook. ❖ The number of times you took a breath yesterday.		

18.3 Variables

It should be clear to you from the above figure, that there are coconuts of various prices to be sold at the market. Therefore, since the selling price of a coconut does not take a fixed value, we say that the price of a coconut is a **variable.**

Such variables are denoted using English letters such as x, y, z, … These too are **algebraic symbols**.

Example 1

The daily revenue of a certain shop is Rs x.
The distance a vehicle travels during an hour is y km.
The distance travelled by a vehicle on one litre of petrol is x km.
The number of days in the month of February is n.

Exercise 18.2

(1) Write down whether each of the following is a constant value or a variable.

(i) The number of players in a netball team
(ii) The number of bananas in the first comb of a cluster of bananas
(iii) The time taken for a jet to travel from the Katunayake International airport to the New Delhi airport
(iv) The number of sides of a square
(v) The number of centimetres in a metre
(vi) The number of limes in one kilogramme of limes
(vii) The distance travelled by a vehicle on one litre of petrol
(viii) The time taken by a student to travel from home to school
(ix) The daily rainfall
(x) The price of one pound of gold in rupees
(xi) The price of one US dollar in rupees
(xii) The number of days in a year
(xiii) The daily attendance of the children in a particular school

Summary

- Constant values which are known are defined as known terms.
- Constant values which are not known are defined as unknown terms. (Unknowns)

19 Constructing Algebraic Expressions and Substitution

By studying this lesson, you will be able to,

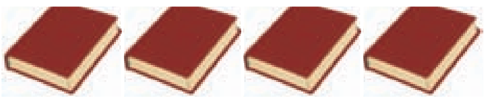
- construct algebraic expressions using algebraic symbols,
- find the value of an algebraic expression containing one unknown of coefficient 1, by substituting a whole number for the unknown term.

19.1 Constructing algebraic expressions

Sunimal has 5 exercise books and Chathura has 4 exercise books. Let us find the number of exercise books that the two of them together have.

The number of exercise books the two of them together have is $5 + 4$; that is 9.

Chalani had 4 exercise books. She received a parcel containing exercise books from her uncle. Now let us find the amount of exercise books she has.



Four books

Parcel

Since the number of books in the parcel is not known, it is an unknown constant. Let us represent the number of books in the parcel by n.

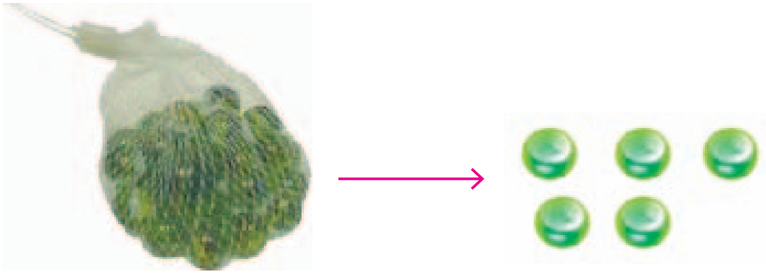
The number of books that Chalani originally possessed $= 4$
The number of books in the parcel she received from her uncle $= n$
The total number of books Chalani now possesses $= 4 + n$

"The total number of books Chalani now possesses" is written as $4 + n$. This can also be written as $n + 4$.

Expressions such as the above which contain an algebraic symbol are called **algebraic expressions.**

Let us construct an algebraic expression for another situation.

5 marbles are removed from a bag of marbles. Now let us construct an algebraic expression for the number of marbles that are remaining in the bag.



Number of marbles is a

Let us take the number of marbles that were in the bag to be a. This is an unknown constant.

Number of marbles that were in the bag	=	a
Number of marbles that were taken out of the bag	=	5
Number of marbles remaining in the bag	=	$a - 5$

An algebraic expression denoting the number of marbles remaining in the bag is $a - 5$.

Example 1

There are 45 students in a class. If the number of boys in the class is taken to be m, construct an algebraic expression for the number of girls in the class.

To find the number of girls in the class, the number of boys in the class needs to be subtracted from the total number of students in the class.

Total number of students in the class	=	45
Number of boys in the class	=	m
Number of girls in the class	=	$45 - m$

Exercise 19.1

(1) Complete the following table.

First Term	Second Term	The algebraic expression obtained by adding the first and second terms
x	10	
3	9	
15	x	
y	4	
n	7	
p	5	
6	....	$6 + y$
....	d	$25 + d$

(2) Complete the following table.

First Term	Second Term	The algebraic expression obtained by subtracting the second term from the first term
x	2	
100	9	
y	45	
p	100	
32	x	
m	8	

(3) The number of teachers in the teaching staff of a certain school was p. Two new teachers joined the school. Represent the number of teachers in the school now by an algebraic expression.

(4) A past pupil of a certain school donated 100 books to the school library. By taking the number of books that were earlier in the library to be x, construct an algebraic expression for the number of books there are in the library now.

(5) From the money I had in hand, I gave Rs 10 to a derelict. Represent the amount I have remaining by an algebraic expression.

(6) Nimal's father's daily income is Rs 750. His mother earns an income of Rs x a day through her sales. Find his parents total daily income.

(7) It is 10 minutes since Ruvan arrived at the bus halt. The bus he travels in will arrive t minutes from now. How much time does he have to spend in total at the bus halt?

(8) The price of a coconut is Rs x. A mother has Rs 150 in her hand. If the price of a coconut is less than the amount in her hand she buys a coconut how much money will be remaining?

19.2 Substitution

Let us consider the algebraic expression $x + 6$. Here, x represents a number.

Suppose $x = 2$.

Then $x + 6 = 2 + 6$

$x + 6 = 8$

When $x = 2$, the value of the algebraic expression $x + 6$ is 8.

Assigning a numerical value to an unknown term or a variable in an algebraic expression is called **substitution**. By substitution, an algebraic expression receives a numerical value.

Now, let us find the values that the algebraic expression $x + 6$ takes when we substitute various values for x.

When $x = 2$, $x + 6 = 2 + 6$,
$= 8$

When $x = 4$, $x + 6 = 4 + 6$,
$= 10$

When $x = 8$, $x + 6 = 8 + 6$,
$= 14$

The following table shows how the values of various algebraic expressions are obtained after substituting a numerical value for the unknown term in the expression.

Algebraic Expression	Value that is substituted for the unknown term in the algebraic expression	Expression after substituting the value	Value of the expression
$x + 7$	3	$3 + 7$	10
$y + 50$	14	$14 + 50$	64
$a - 3$	8	$8 - 3$	5
$p - 14$	20	$20 - 14$	6

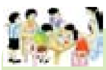
Example 1

Find the value of the expression $x - 4$ when $x = 5$.

When $x = 5$,

$$x - 4 = 5 - 4$$

$$= \underline{\underline{1}}$$



Activity 1

Copy the following table and complete it.

Algebraic Expression	The unknown term or variable term in the expression	Value to be substituted	Numerical value of the expression after substitution
$x + 6$		5	
$y + 5$		14	
$a - 8$		12	
$p - 10$		20	
$15 - n$		6	

Exercise 19.2

(1) Find the value of each of the following algebraic expressions when $x = 10$.

(i) $x + 5$ (ii) $x + 8$ (iii) $25 - x$

(2) Find separately the value of each of the following algebraic expressions when $y = 25$.

(i) $y + 5$ (ii) $y - 10$ (iii) $y - 20$

(3) Find separately the value of each of the following algebraic expressions when $a = 8$.

(i) $20 - a$ (ii) $15 - a$ (iii) $35 - a$

(4) The price of a coconut is Rs x and the price of a kilogramme of sugar is Rs 110. Write down an algebraic expression for the total cost of a coconut and a kilogramme of sugar. If the price of a coconut is Rs 35, find the value of the algebraic expression.

(5) The daily income of both the father and the mother of a certain family is Rs $850 + x$. Here, Rs 850 is the father's daily income and x represents the mother's daily income. On five days of a certain week, the mother's daily income was Rs 600, Rs 550, Rs 435, Rs 525 and Rs 515 respectively. Find separately the total income of the family on each of the five days.

Summary

- Algebraic expressions are expressions which contain algebraic terms.
- Substitution is assigning a numerical value to an unknown term or a variable term in an algebraic expression.

20 Mass

By studying this lesson, you will be able to,
- identify the units used to measure mass,
- identify the relationship between the different units of mass and
- add and subtract masses given in terms of these units.

20.1 Introduction

The following figure depicts packets of tea leaves of different quantities which are found in the market. Observe the quantity that is written on each of the packets.

You may notice that the amount of tea leaves in each packet has been given in grammes (g) or kilogrammes (kg).

These quantities can be described as follows.

- The quantity of tea leaves in the first packet is 50 grammes.
  50 grammes has been denoted by 50 g.
- The quantity of tea leaves in the second packet is 500 grammes.
  500 grammes has been denoted by 500 g.
- The quantity of tea leaves in the third packet is 1 kilogramme.
  1 kilogramme has been denoted by 1 kg.

Now let us investigate the meaning of mass.
The mass of an object is a measure of the amount of matter in the object. Accordingly, the mass of the tea leaves in the packet with 50 g written on it is 50 g. Similarly the mass of the tea leaves in the other two packets are 500 g and 1 kg respectively.

The mass of the bag of rice is 50 kilogrammes; that is, 50 kg.

Grammes and kilogrammes are two units that are used to measure mass.

When we purchase items from the market, most often the quantities we buy are measured in grammes and kilogrammes.

The following figure depicts several standard weights and a balance scale which are used to measure mass.

A balance scale (weighing scale) is used to measure the mass of an object by comparing it with the mass of one or more standard weights.

How 1 kg of potatoes is measured using a 1 kg standard weight is shown below. The standard weight that is used to measure the quantity is placed in one of the pans while the object is placed in the other pan.

Quantity of potatoes is less than 1 kg

Quantity of potatoes is more than 1 kg

When the beam of the scale is horizontal, the scale is balanced. Then the mass of potatoes in the pan is 1 kg.

Two 200 g standard weights can be used to measure 400 g of flour.

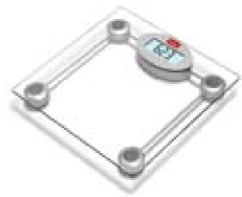
When a 500 g standard weight and a 100 g standard weight are available, 400 g of flour can be measured as depicted in the following figure.

20.2 Various instruments that are used to measure mass

When a balance scale and standard weights are used, most often, amounts which are equal in mass to one or more standard weights are measured. The balance scale and standard weights shown on page 102 cannot be used to find the actual mass of an item such as a pumpkin of mass 425g.

In such a situation one of the instruments shown here can be used.

Two instruments that can be used to measure a mass such as your body mass are given here. When you stand on the instrument, the indicator shows what your mass is.



Exercise 20.1

State whether the mass of the matter in each of the following instances is more than 400 g, less than 400 g or equal to 400 g.

(i)

(ii)

(iii)

20.3 Relationship between different units of measuring mass

We have learnt that grammes and kilogrammes are two units that are used to measure mass.

The relationship between grammes and kilogrammes is given below.

$$1000 \text{ g} = 1 \text{ kg}$$

The standard unit of measuring mass is the kilogramme.

Activity 1

A 1 kg standard weight has been placed in the left side pan of each of the following balance scales and the scale has been balanced by placing wooden blocks of equal mass in the right side pan. Write down the mass of a wooden block in each scale.

There are two wooden blocks.
Mass of a wooden block = ……

There are 4 wooden blocks.
Mass of a wooden block = ….

There are 10 wooden blocks.
Mass of a wooden block =…………

Let us see whether the masses you obtained are correct.

(i) Since 1 kg is 1000 g, the mass of the 2 wooden blocks is 1000 g. Therefore, the mass of one block is 500 g.

(ii) Since 1 kg is 1000 g, the mass of the 4 wooden blocks is 1000 g. Therefore, the mass of one block is 250 g.

(iii) Since 1 kg is 1000 g, the mass of the 10 wooden blocks is 1000 g. Therefore, the mass of one block is 100 g.

- **Express a mass given in kilogrammes in terms of grammes.**

Now let us consider how we express the mass of an object which has been given in kilogrammes, in terms of grammes.

Since 1 kg = 1000 g,
2 kg = 2000 g
3 kg = 3000 g

Accordingly, to express a mass given in kilogrammes, in terms of grammes, the given number of kilogrammes needs to be multiplied by 1000.

Example 1

Express 7 kg in grammes.

Since 1 kg = 1000 g,
7 kg = 7×1000 g
= 7000 g

Example 2

Express 1 kg 250 g in grammes.

Since 1 kg = 1000 g,
1 kg 250 g = 1000 g + 250 g
= 1250 g

Exercise 20.2

(1) Fill in the blanks.

(i) The number of 500 g amounts in 1 kg is ....
(ii) The number of 200 g amounts in 1 kg is ....
(iii) The number of 100 g amounts in 1 kg is ....
(iv) The number of 250 g amounts in 1 kg is ....
(v) The number of 125 g amounts in 1 kg is ....

(2) Fill in the blanks in each of the following parts by writing the appropriate mass in grammes.

(i) 1 kg = 250 g + 100 g + 100 g + 50 g + ... g
(ii) 1 kg = 150 g + 250 g + 100 g + ... g
(iii) 1 kg = $4 \times$ ...... g (iv) 1 kg = $8 \times$ ...... g
(v) 1 kg = $2 \times$ ...... g (vi) 1 kg = $1 \times$ ...... g

(3) Fill in the blanks with a suitable value.

(i) 500 g = 1 kg – ...... g (ii) 250 g = 1 kg – ...... g

(4) Express the following masses in grammes.

(i) 6 kg (ii) 2 kg 500 g (iii) 4 kg 150 g
(iv) 1 kg 25g (v) 15 kg 202 g (vi) 6 kg 666 g

• Express a mass given in grammes in terms of kilogrammes.

Now let us express a mass given in grammes, in terms of kilogrammes.

Since 1000 g = 1 kg,
2000 g = 2 kg
3000 g = 3 kg

Accordingly, to express a mass given in grammes in terms of kilogrammes, the given number of grammes needs to be divided by 1000.

Example 1

Express 9000 g in kilogrammes.

Since 1000 g = 1 kg,

$$9000\text{ g} = \frac{9000}{1000}\text{ kg}$$
$$= 9\text{ kg}$$

Example 2

Express 2750 g in kilogrammes and grammes.

2750 g = 2000 g + 750 g
Since 1000 g = 1 kg,
2750 g = 2 kg + 750 g
2750 g = 2 kg 750 g

Accordingly, to express an amount of 1000 grammes or more, in terms of kilogrammes and grammes the amount of grammes is written as lesser than 1000.

Example 3

Complete the following table by expressing the masses given in grammes, in terms of kilogrammes and grammes.

g	kg	g
999	0	999
1000	1	000
6075	6	075
7009	7	009

Exercise 20.3

(1) Express each of the following masses given in grammes, in terms of kilogrammes.

(i) 2000 g (ii) 5000 g (iii) 8000 g (iv) 12 000 g

(2) Express each of the following masses given in grammes, in terms of kilogrammes and grammes.

(i) 3500 g (ii) 2065 g (iii) 4005 g (iv) 3250 g (v) 10 050 g

(3) Complete the following table by expressing the masses given in grammes, in terms of kilogrammes and grammes.

g	kg	g
875	....	....
1035	....	....
....	1	005
3015	3	....
4380	....	....
....	8	150
12565	....	565

20. 4 Adding masses

Let us find the mass of the mixture that is obtained when 250 g of sugar is added to 500 g of “Thriposha”.

Both the masses have been given in grammes. Since both masses have been given in the same unit let us add them as shown here.

$$\begin{array}{r} 500\text{ g} \\ 250\text{ g} \\ \hline 750\text{ g} \\ \hline \end{array}$$

The mass of the mixture is 750 g.
1 kg 500 g of flour, 1 kg 250 g of sugar and 1 kg 500 g of margarine are mixed together to prepare a cake.

Let us find out what the mass of the mixture is.

When adding these masses which have been given in terms of kilogrammes and grammes, it is necessary to write the kilogrammes in one column and the grammes in a different column.

	kg	g
	1	500
	1	250
+	1	500
	4	250

Let us add the values in the grammes column.
500 g + 250 g + 500 g = 1250 g
1250 g = 1000 g + 250 g
Since 1000 g = 1 kg, 1250 g = 1 kg + 250 g
Let us write the 250 g in the grammes column.
Let us carry the 1 kg to the kilogrammes column.
Then the sum of the values in the kilogrammes column is,
1 + 1 + 1 + 1 , which is 4. That is, 4 kg.
Therefore, the answer is 4 kg 250 g.

Example 1

	kg	g
	2	750
+	1	450
	4	200

Let us add the amounts in the grammes column.
750 g + 450 g = 1200 g
1200 g is 1 kg and 200 g.
Let us write the 200 g in the grammes column.
Let us carry the 1 kg to the kilogrammes column.
Then the sum of the values in the kilogrammes column is,
1 + 2 + 1, which is 4.
Therefore, the answer is 4 kg 200 g.

Exercise 20.4

(1) Write down the answers to each of the following in terms of kilogrammes and grammes.

(i)

	kg	g
	2	750
+	1	250

(ii)

	kg	g
	3	65
+	2	150

(iii)

	kg	g
	5	623
+	3	750

(iv)

kg	g
3	150
2	750
+ 1	400

(v)

kg	g
1	75
2	250
+ 1	800

(vi)

kg	g
1	50
2	250
+ 1	850

(2) Find the total mass of 2 kg of rice, 1 kg of sugar, 250 g of tea leaves, 500 g of flour and 250 g of red onions that were bought at a market.

(3) The mass of an empty gas cylinder is 3kg 750 g. If gas of mass 12 kg 500 g has been filled into the cylinder, what is the mass of the cylinder with the gas?

(4) A parcel of dry rations given to a family affected by floods contained the following quantities of the given items.

5 kg of rice	500 g of dry fish	500 g of flour
1 kg of sugar	2 kg 500 g of lentils	250 g of tea leaves

Find the total mass of these items.

(5) A piece of pumpkin of mass 1 kg 350 g was cut from a whole fruit and sold. The mass of the remaining portion was 2 kg 850 g. Find the mass of the whole fruit.

(6) The masses of two pumpkins that grew on the same creeper were 2.35 kg and 3.8 kg respectively. What is the total mass of the two fruits?

20.5 Subtracting masses

A housewife left 2 kg 750 g of black peppers that she had obtained from her garden, out in the sun to dry for several days. When she weighed it again she found that the mass had reduced to 1 kg 200 g. Let us find the quantity by which the mass had reduced during the drying process.

To find the amount by which the mass had reduced during the drying process, the mass of the dried peppers has to be subtracted from the mass of the fresh peppers. To do this, let us write them one below the other, such that the gramme values are in one column and the kilogramme values are in another column.

	kg	g
	2	750
–	1	200
	1	550

By subtracting we obtain 1 kg 550 g. Therefore, the mass of the peppers has reduced by 1 kg 550 g during the drying process.

Example 1

The mass of a box containing biscuits is 2kg 250 g. If the mass of the empty box is 750 g, find the mass of the biscuits in the box.

	kg	g
	2	250
–	0	750
	1	500

Since 750 g cannot be subtracted from 250 g, let us convert 1 kg into grammes and add it to the 250 g.
Then 1000 g + 250 g = 1250 g
Now, 1250 g – 750 g = 500 g
There is only 1 kg remaining in the kilogramme column now. Therefore, the mass of the biscuits in the box is 1 kg 500 g.

Exercise 20.5

(1) Subtract the following.

(i)

	kg	g
	3	200
–	1	100

(ii)

	kg	g
	2	750
–		500

(iii)

	kg	g
	4	000
–	2	500

(iv)

	kg	g
	3	250
–	1	500

(v)

	kg	g
	4	050
–	2	200

(vi)

	kg	g
	6	025
–	2	250

(2) The water in 1 kg of tea leaves was removed by drying the leaves. The mass of the dried tea leaves was 180 g. What is the mass of the water that was removed?

(3) The edible portion of a jackfruit of mass 3 kg was of mass 1 kg 650 g. What was the mass of the portion of the fruit that was discarded?

(4) The quantity of sugar in Nimal's house on Monday morning was 1 kg 500 g. On Tuesday morning, there was 800 g remaining. What was the mass of sugar that was consumed during this period?

(5) From the 12 kg 750 g stock of lentils that was in a shop one morning, 8 kg 250 g remained at the end of the day. Find the mass of lentils that was sold during that day.

(6) The mass of a gas cylinder with the gas is 13 kg 250 g. The mass of the empty gas cylinder is 2 kg 450 g. Find the mass of the gas that is in the cylinder.

(7) There was 5.85 kg of rice in a bag. If 2.17 kg of this quantity was used for a meal, how many kilogrammes of rice was left over?

Miscellaneous Exercises

(1) Fill in the blanks.

(i)

	kg	g
	2	250
+	☐	☐
	4	75

(ii)

	kg	g
	3	500
−	☐	☐
	1	750

(2) The masses of three parcels that were brought to a post office were respectively 2 kg 500 g, 3 kg and 1 kg 750 g. Express the total mass of the three parcels in kilogrammes and grammes.

(3) The masses of the items in a student's school bag are given below.

Mass of the textbooks	=	4 kg 750 g
Mass of the exercise books	=	2 kg 400 g
Mass of the lunch packet	=	550 g
Mass of the water bottle	=	375 g

The student says that the total mass of the items in his school bag does not exceed 10 kg. Show with reasons whether this statement is true or false.

(4) The mass of a bag of rice is 5.35 kg. If the mass of the empty bag is 0.75 kg, find the mass of the rice in the bag.

(5) An aircraft passenger is allowed to carry a bag of personal items of mass 30 kg at no extra cost. If a person has bought items of total mass 14 kg 750 g to be taken on an aircraft, what is the mass of items he can buy to make up his quota of 30 kg ?

Summary

- Most often, grammes and kilogrammes are used to measure mass.
  1000 g = 1 kg
- To express a mass given in kilogrammes in terms of grammes, the mass in kilogrammes is multiplied by 1000.
- To express a mass given in grammes in terms of kilogrammes, the mass in grammes is divided by 1000.

21 Ratio

By studying this lesson, you will be able to,
- understand the concept of a ratio of two quantities,
- write ratios equivalent to a given ratio,
- write a ratio in its simplest form and
- understand the difference between ratio and rate.

21.1 Introduction to ratio

Fruit juice Water

Shown above is a label of a fruit juice bottle. It illustrates that a certain amount of fruit juice should be mixed with five equal amounts of water. Accordingly, six bottles of fruit drinks can be prepared by mixing one part of fruit juice with five parts of water.

The number of male workers and female workers who work in an office can be compared numerically.

There are many instances where we have to compare the quantities of certain things or to compare the amounts of several quantities.

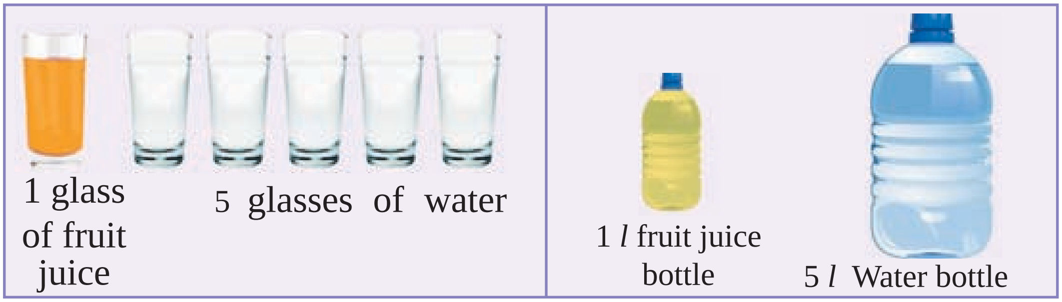
The following are some examples.

- A cement mixture is made by mixing certain amounts of cement and sand.
- When making cakes, flour and sugar are mixed together.
- To make a concrete mixture, metal, sand and cement have to be mixed together.
- The number of girls and boys in a school can also be considered.

Let us consider a mixture that we make by mixing several ingredients together.

Irrespective of the amount of the mixture, very often we have to maintain its composition throughout the mixture. In such instances we have to know the relationship between the quantities of ingredients we have to mix. For this reason it is necessary to express all ingredients using the same unit.

The same mixture of the above mentioned fruit juice can also be prepared in the following ways.



In this instance though the unit used to measure the quantities is bottle or glass or litre, one unit of fruit juice has been mixed with five units of water.

A **ratio** is a numerical relationship between the amounts of two or more quantities that have been represented using the same unit (as in the above case). Further, a ratio is also a numerical relationship between the amounts in two groups which are being compared.

Accordingly, the ratio of the above fruit juice to water is said to be one to five. This can be symbolically expressed as 1 : 5. Here " : " is known as the symbol of ratio. 1 and 5 are the terms. When written as 1 : 5, the first term is 1 and the second is 5. As a ratio does not change with the units used to measure the quantities, it is not necessary to indicate the unit here.

Now let us consider another example.

A person spends 7 rupees and saves 3 rupees from each 10 rupees of his earnings. Let us find the ratio of what he spends to what he saves. Here the quantities are savings and spendings that are expressed in the same unit, rupees. Accordingly, the ratio of spendings to savings is 7 : 1.

Another example is that of making paint of a certain colour by mixing paints of different colours.

Let us consider making light blue paint by mixing one part of dark blue paint with two parts of white paint .
Accordingly, the ratio of the amounts of dark blue to white paint is 1:2.

The following table shows how to make light blue paint by mixing different quantities of white and dark blue paint in the ratio 1 : 2.

Quantity of dark blue paint	Quantity of white paint	Quantity of light blue paint once paints are mixed
1 *l*	2 *l*	3 *l*
2 *l*	4 *l*	6 *l*
3 *l*	6 *l*	9 *l*
5 *l*	10 *l*	15 *l*

To prepare less than 3 *l* of light blue paint, dark blue and white paint can be mixed as follows.

Quantity of dark blue paint	Quantity of white paint	Quantity of light blue paint once paints are mixed
200 ml	400 ml	600 ml
400 ml	800 ml	1200 ml

Example 1

The length of a rectangle is 12 cm and the breadth is 7 cm. Find the ratio of the length to the breadth of the rectangle.

Length of the rectangle = 12 cm
Breadth of the rectangle = 7 cm

The ratio of the length to the breadth of the rectangle is 12 : 7.

Example 2

Three boys and two girls are in a debating team. Find the ratio of the number of boys to the number of girls in the team.

Number of boys = 3
Number of girls = 2

The ratio of the number of boys to the number of girls is 3 : 2.

Example 3

The price of a small envelope is 50 cents and that of a large envelope is Rs. 2. Find the ratio of the price of a small envelope to the price of a large envelope.

Price of a small envelope = 50 cents
Price of a large envelope = Rs. 2

Price of a large envelope should be written in cents, since the units of the given envelopes are not the same.

Price of a large envelope = Rs. 2 = 200 cents

The ratio of the price of a small envelope to the price of a large envelope is 50 : 200.

Example 4

To make an orange drink, two equal quantities of orange juice and three equal quantities of water are mixed together.

(i) Find the ratio of orange juice to water in a glass of orange drink.

(ii) How many litres of water do you need to prepare an orange drink which has four litres of orange juice?

(i) The ratio of orange juice to water is 2 : 3.

(ii) Quantity of water which is mixed with two litres of orange juice } = 3 litres

Quantity of water which is required for four litres of orange juice } = 3 × 2 litres

= 6 litres

Exercise 21.1

(1) Select and write down the statements that denote a ratio.

(i) To make milk tea, three tea-spoons of milk powder and two tea - spoons of sugar should be used.

(ii) Sunil is taller than Sarath.

(iii) A rectangular land has a width of 80 m and a length of 117 m.

(iv) To make a cake 250 g of sugar and 500 g of flour are needed.

(v) Sarath has got more marks than Malidu for Mathematics.

(2) Write down how you read the following ratios.

(i) 1 : 2 (ii) 2 : 3 (iii) 10 : 8 (iv) 8 : 7 (v) 9 : 13

(3) Write down the following ratios in symbolic form.

(i) The ratio one to three. (ii) The ratio two to seven.

(iii) The ratio three to fifteen. (iv) The ratio eight to one.

(v) The ratio one to one.

(4) A boy has five olives and his sister has seven olives. Find the ratio of the number of olives the boy has to the number the sister has.

(5) The mass of an apple is 200 g and that of an orange is 200 g. Find the ratio of the mass of an apple to the mass of an orange.

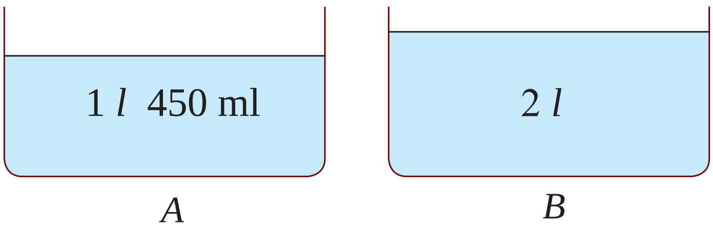
(6) A rectangular shaped land has a length of 75 m and a width of 37 m. Find the ratio of the length to the width.

(7) Mother and father bought 500 g and 2 kg of dhal respectively. Find the ratio of the weights of dhal bought by both.

(8) The distance from school to Priyantha's house is 700 m and the distance from school to Lasantha's house is 1 km 300 m. Find the ratio of the distances.

(9) Rajitha has 8 rupees and Vijitha has 5 rupees and 50 cents. Find the ratio of the money that the two have.

(10)



Find the ratio of the amount of water in container *A* to the amount in container *B*.

(11) The time spent by a motor bike to go to Galle from Matara was 1 hour and 10 minutes while a car spent 1 hour. Find the ratio of the time spent by the two vehicles.

(12) The ratio of the number of olives that Nimali has to the number that Amal has is 3:5. If Nimali has only one olive, find the number of olives that Amal has.

(13) To make a cement mixture, two pans of cement and twelve pans of sand are mixed together. Find the ratio of the cement to the sand in this mixture.

   (i) How many pans of cement are needed to be mixed with one pan of sand to make this mixture ?

   (ii) Find the number of cement pans and sand pans that are required to make 28 pans of the mixture.

21.2 Equivalent ratios

A concrete mixture is made with cement and sand according to the ratio 1 : 3. Accordingly, the number of parts of sand that should be used when the number of parts of cement is changed is shown in the table below.

Cement	Sand	Ratios
1	3	1 : 3
2	6	2 : 6 (1 : 3 is multiplied by 2)
3	9	3 : 9 (1 : 3 is multiplied by 3)
4	12	4 : 12 (1 : 3 is multiplied by 4)
5	15	5 : 15 (1 : 3 is multiplied by 5)

The table shows,

$$1 : 3 = 2 : 6 = 3 : 9 = 4 : 12 = 5 : 15$$

In the above example, the ratio of sand to cement can be written in any one of the forms 1 : 3, 2 : 6, 3 : 9. All these are **equivalent ratios.**

Accordingly, a ratio equivalent to a given ratio can be obtained by multiplying each term of the ratio by the same number (greater than zero).

Example 1

Write down two ratios equivalent to 2 : 5.

Multiplying the terms of the ratio by 2,

$2 : 5 = 2 \times 2 : 5 \times 2 = 4 : 10$

Multiplying the terms of the ratio by 3,

$2 : 5 = 2 \times 3 : 5 \times 3 = 6 : 15$

$2 : 5 = 4 : 10 = 6 : 15$

4 : 10 and 6 : 15 are two other ratios equivalent to 2 : 5.

● Another method for finding equivalent ratios

Let us consider a mixture made of 2 *l* of lime juice mixed with 4 *l* of water. In this mixture, the ratio of lime juice to water is 2 : 4.
The same composition can be obtained by mixing 1 *l* of lime juice with 2 *l* of water.

Hence the ratios 2 : 4 and 1 : 2 are equivalent ratios.

The ratio 1 : 2 can be obtained by dividing the terms of 2 : 4 by 2.
Hence $2:4 = \frac{2}{2} : \frac{4}{2} = 1:2$

Accordingly, a ratio equivalent to a given ratio can be obtained by dividing each term of the ratio by the same number (except zero).

21.3 Writing a ratio in its simplest form

Let us consider some ratios equivalent to each other.
8 : 12 = 4 : 6 = 2 : 3 = 6 : 9 = 10 : 15

A ratio is in its simplest form when both terms are whole numbers and there is no whole number which both terms can be divided by.

So 2 : 3 is the simplest form of the ratio 8 : 12.
The ratio 2 : 3 is the simplest form of 4 : 6, 6: 9 and 10 : 15 as well.

To write in its simplest form, keep dividing both sides of the ratio by the same number until you can't go any further without going into decimals.

Example 1

Write the ratio 9 : 15 in its simplest form.

$9 : 15 = 9 \div 3 : 15 \div 3$
$= 3 : 5$

Example 2

Write the ratio 18 : 24 in its simplest form.

$18 : 24 = 18 \div 2 : 24 \div 2$
$= 9 : 12$
$= 9 \div 3 : 12 \div 3 = 3 : 4$

Example 3

The breadth of a blackboard is 50 cm. The length is 1 m 25 cm. Find the ratio of the breadth to the length of the blackboard.

1 m 25 cm = 125 cm
$50 : 125 = 50 \div 5 : 125 \div 5$
$= 10 : 25$
$= 10 \div 5 : 25 \div 5$
$= 2 : 5$

Exercise 21.2

(1) For each ratio given below, write down an equivalent ratio.
(i) 2 : 7 (ii) 10 : 30 (iii) 50 : 45

(2) Write each of the ratios given below in its simplest form.
(i) 40 : 70 (ii) 30 : 35 (iii) 56 : 21 (iv) 63 : 45 (v) 60 : 150

(3) The length of a rectangle is 15 cm and its breadth is 10 cm. Find the ratio of the length to the breadth of the rectangle.

(4) There are 96 boys and 112 girls in a primary school. Write the ratio of the boys to the girls.

(5) There are 12 red flags and 8 blue flags. Write the ratio of the red flags to the blue flags in its simplest form.

(6) Write 6 : 15 and 14 : 35 in their simplest forms. Show that they are equivalent ratios.

21.4 Rate

The picture shows that two table - spoons of milk powder have to be added to make a cup of tea. Here, as the amount of tea and milk powder that should be added cannot be expressed in the same unit, the amounts of tea and milk powder to be mixed cannot be expressed as a ratio. Consider the following.

- 10 eggs are used to make 1 kg of cake.
- A vehicle can travel 12 km on 1 *l* of oil.
- The price of 10 guavas is Rs. 100.

The two quantities in each of the above situations are measured in different units. **Rate** is a relationship between such quantities.

Let us consider some other instances where rate is used.

(1) Price of a pencil is Rs. 10.

(2) Rs. 40 is charged to travel 1 km in a vehicle.

(3) Students present at a function received 3 biscuits each during the interval.

(4) The price of a match box is Rs. 50.

The relationship between two currencies of different countries is a rate. The value of a United States dollar in Sri Lanka was Rs. 130.54 on 11.03.2014. Such a relationship between different currencies is called exchange rate. Since the exchange rate changes daily, we need to write the date when mentioning the exchange rate.

The following table gives the exchange rate of foreign currencies rounded off to the nearest whole number on a particular day.

Name of Currency	Sri Lankan Rupees
1 US Dollar	131
1 Sterling pound	217
1 Euro	181
100 Japanese yen	125
1 Bahrain dinar	346

Example 1

The price of an exercise book is Rs. 20. Find the price of 4 such books.

Price of an exercise book = Rs. 20
Price of 4 such books = Rs. 20×4
= Rs. 80

Example 2

If the price of 5 pencils is Rs. 100, find the price of 2 pencils.

Price of 5 pencils = Rs. 100
Price of a pencil = Rs. $100 \div 5$ = Rs. 20
Price of 2 pencils = Rs. 20×2 = Rs. 40

Example 3

The value of a present sent by a friend who is working abroad to his friend who is living in Sri Lanka was 25 US dollars. Express its value in Sri Lankan rupees.

That day, the exchange rate of 1 USD was Sri Lankan Rupees 131.

Value of 1 Dollar = Rs. 131
Value of 25 USD = Rs. 131×25
= Rs. 3275

Exercise 21.3

(1) If the price of a pen is Rs. 12, what is the price of 5 such pens?

(2) If a vehicle travels 75 km in 2 hours, what is the distance it travels in 4 hours?

(3) A vehicle travelled 20 km on 1 l of fuel. How many litres of fuel are required to travel 120 km?

(4) 1 kg of sugar is sufficient to make 40 cups of tea. How much sugar is required to make 240 cups of tea?

(5) If the value of a Sterling pound was Rs. 217 on a certain day, what was the value of 8 Sterling Pounds on that day?

(6) If the price of a television set imported from Japan is 10 000 Yen, what is its price in Sri Lankan Rupees? (Use the exchange rate table in page 124)

(7) The value of 1 US Dollar is 130 Sri Lankan Rupees. What is the value of Sri Lankan Rupees 26 000 in US Dollars?

Summary

- A ratio equivalent to a given ratio can be obtained by dividing each term of the ratio by the same number (greater than zero).
- A ratio equivalent to a given ratio can be obtained by multiplying each term of the ratio by the same number (greater than zero).
- A ratio is in its simplest form when both terms are whole numbers and there is no whole number which both terms can be divided by.

22 Data Collection and Representation

By studying this lesson, you will be able to,
- collect data using tally marks and
- represent data in tables and picture graphs.

22.1 Collecting data using tally marks

With the intention of preparing a plan for a parking lot, Pradeepa and Dileepa were handed over to find the different types and corresponding numbers of vehicles that arrive on a normal day to a certain office.

Each time a vehicle arrived, to represent the type and the arrival, a segment of a line (/) is marked as shown in the tables, to the right of the type of vehicle. The symbol "/" is called a **tally mark.**

The leaflet prepared by Pradeepa is given below.

Type of Vehicle	Number of vehicles represented by tally marks
Car	///////////////
Van	////
Motorcycle	//////////////////////////////// //////////
Bicycle	////////////////////////////

Complete the following table by counting the number of line segments there are to the right of each type of vehicle in the above leaflet.

Type of Vehicle	Number of Vehicles
Car	
Van	
Motorcycle	
Bicycle	

The leaflet prepared by Dileepa is given below.

Type of Vehicle	Number of vehicles represented by tally marks
Car Van Motorcycle Bicycle	𝍸 𝍸 𝍸 //// 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 // 𝍸 𝍸 𝍸 𝍸 𝍸 ///

As shown in the above table, Dileepa has marked the 5th vehicle of each type that arrived by drawing the 5th tally mark across the four tally marks that had been marked before. Therefore 𝍸 represents 5 vehicles.

Find the number of vehicles of each type that arrived by counting the groups of 5 and remaining line segments in the above leaflet, and complete the following table.

Type of Vehicle	Number of Vehicles
Car Van Motorcycle Bicycle	

Which of the two leaflets did you find it easier to use when you were completing the table?

It is easier and quicker to count the tally marks that have been separated into groups of five in Dileepa's leaflet than to count the tally marks one by one in Pradeepa's leaflet.

Accordingly, the leaflet prepared with the number of vehicles of each type that arrived at the office included in it, based on what Dileepa had noted down is given below.

Type of Vehicle	Tally Marks	Number of Vehicles
Car	𝍸 𝍸 𝍸	15
Van	////	4
Motorcycle	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 //	42
Bicycle	𝍸 𝍸 𝍸 𝍸 𝍸 ///	28

Information that can be represented by numbers as above is considered as **data**.

Information such as the daily attendance of students in a school and the number of births recorded in a hospital are presented as data.

Exercise 22.1

(1) The number of child births recorded during the first five months of the year in a certain hospital is given in the tally chart given below. Complete the table by writing down the number of child births that occurred during each month.

Month	Child births denoted by tally marks	Number of child births
January	𝍸 𝍸 //	
February	𝍸 𝍸 𝍸 ////	
March	𝍸 𝍸 𝍸 𝍸	
April	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 /	
May	𝍸 𝍸 𝍸 ////	

(2) The number of family members belonging to the families of the thirty six Grade 6 students in a certain class is given below.

3 4 5 5 6 3 4 5 5 6 2 3

5 4 3 5 5 6 5 4 3 6 3 2

4 5 6 4 5 6 6 5 5 6 2 2

Copy the following table and represent this data in it.

Number of family members	Families denoted by tally marks	Number of families
2		
3		
4		
5		
6		

(3) The marks received for a test by thirty five students in a class is given below (The maximum marks that a student could receive for this test is 10).

Marks Received	Number of students who received the relevant mark, denoted by tally marks
10	𝍸 𝍸 //
9	𝍸
8	𝍸 ///
7	////
Less than 7	𝍸 /

(i) How many students received 10 marks?

(ii) Are there more students who received more than 8 marks or less than or equal to 8 marks? Give reasons for your answer.

(4) The marks received by forty students for a science test is given below (The maximum marks that a student could receive for this test is 15).

3	2	4	1	2	9	4	13	8	5
10	11	12	13	13	8	15	14	9	9
15	13	3	5	6	9	7	11	8	13
11	13	15	15	9	15	14	14	8	9

Represent this data in the following table using tally marks.

Marks	The students who obtained the marks in the first column, denoted by tally marks	The number of students
1, 2, 3		
4, 5, 6		
7, 8, 9		
10, 11, 12		
13, 14, 15		

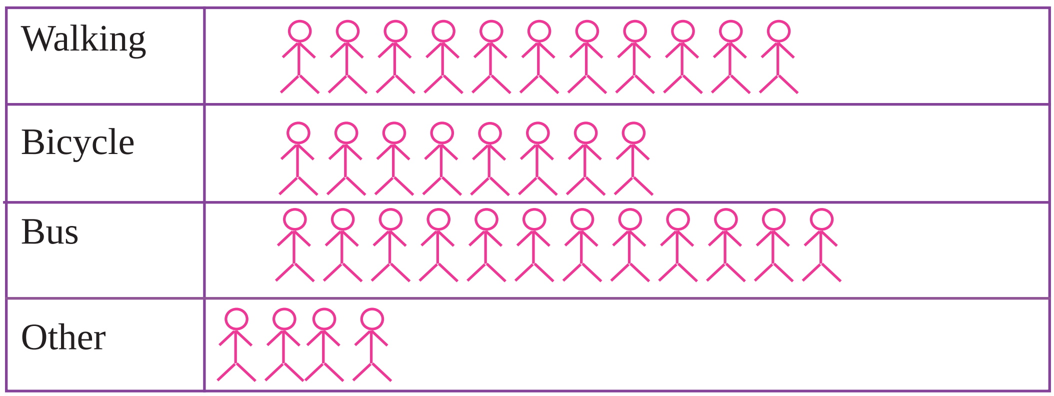
How many students received less than 10 marks ?

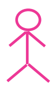
22.2 Representing data using picture graphs

The different ways in which 35 grade 6 students of a certain school travel to school are given in the following table.

Method of travelling to school	Number of students
Walking	11
Bicycle	8
Bus	12
Other	4

This data has been represented in another way below.



Each student has been represented by the symbol  .

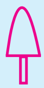
A representation of data such as the above is called as a **picture graph. Number of data represented by a symbol in the picture graph should be indicated.**

Example 1

The number of popsicles sold by an ice cream seller on 5 days of a certain week is given in the following table. Represent this data by a picture graph.

Day	Number of popsicles
Monday	72
Tuesday	120
Wednesday	144
Thursday	60
Friday	132

Let us consider how this data can be represented in a picture graph. Initially, a suitable symbol should be selected, and the number of popsicles each symbol represents has to be decided.

Let us select the symbol  . Next, let us decide how many popsicles this symbol represents.

If one popsicle is represented by the symbol , we would have to draw 144 of these symbols to denote 144 popsicles. Since this is not possible, we represent several popsicles by one symbol.

Let us consider the numbers which divide each of the above numbers without remainder. The above numbers are divisible by 2, 3, 4, 6 and 12. If 2 popsicles are represented by one symbol, 72 symbols have to be drawn to denote 144 popsicles. This too is not possible. It is more appropriate to represent 12 popsicles by , since a large value can then be represented by a small number of symbols.

To find the number of symbols required to denote the number of popsicles sold each day, the number of popsicles sold each day has to be divided by 12.

Accordingly,

the number of symbols required to denote the sales on Monday $\}$ $= 72 \div 12 = 6$

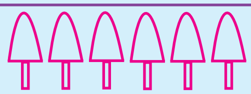
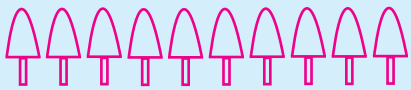
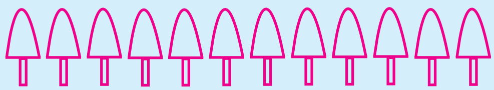
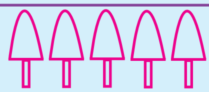
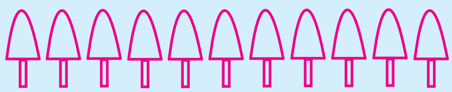
the number of symbols required to denote the sales on Tuesday $\}$ $= 120 \div 12 = 10$

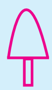
the number of symbols required to denote the sales on Wednesday $\}$ $= 144 \div 12 = 12$

the number of symbols required to denote the sales on Thursday $\}$ $= 60 \div 12 = 5$

the number of symbols required to denote the sales on Friday $\}$ $= 132 \div 12 = 11$

Now let us represent the above data in a picture graph.

Monday	
Tuesday	
Wednesday	
Thursday	
Friday	

12 popsicles are denoted by the symbol  .

Example 2

The number of children training for several events to be held at a certain school inter-house sports competition is given below.

Event	Number of Children
Track	144
Field	90
Netball	60
Volleyball	42
Cricket	48

Represent this data in a picture graph.

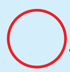
We need to first decide on a suitable symbol to represent this data, as well as to decide on the number of children each symbol represents.

First, let us decide on the number of children that are to be represented by one symbol, and then decide on a picture accordingly.

From these numbers, the numbers 144, 60 and 48 are divisible by 4, 6 and 12. Let us consider whether it is suitable to select the largest of these numbers which is 12.

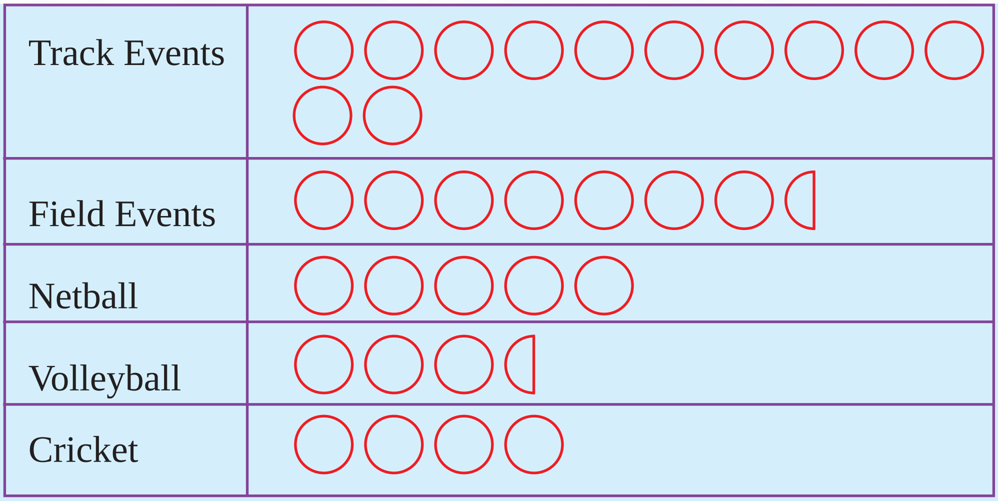
- The number of symbols required to denote track games $= 144 \div 12 = 12$
- The number of symbols required to denote field games $= 90 \div 12 = 7$ with a remainder of 6. Here 6 is exactly half of 12.
- The number of symbols required to denote netball $= 60 \div 12 = 5$
- The number of symbols required to denote volleyball $= 42 \div 12 = 3$ with a remainder of 6. Here 6 is exactly half of 12.
- The number of symbols required to denote cricket $= 48 \div 12 = 4$

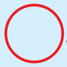
Accordingly, a suitable symbol should be used so that $\frac{1}{2}$ the symbol too can easily be represented.

Let us represent 12 children by the symbol .

Let us represent 6 children by half the above symbol, that is .

Now let us represent the above information in a picture graph.



12 students are represented by .

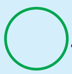
Example 3

The number of students enrolled in a certain Montessori during the past five years is given in the following table. Represent this data in a picture graph.

Year	Number of Students
2009	20
2010	18
2011	21
2012	26
2013	27

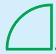
To represent this data in the table by a picture graph, let us first find out how many students should be represented by one symbol.

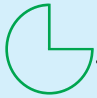
For this, let us select a simple symbol. It is given below.

Let us represent 4 students by a full circle .

Accordingly, half a circle $\left(\frac{1}{2}\right)$ can be used to represent 2 students and a quarter of a circle $\left(\frac{1}{4}\right)$ can be used to represent 1 student.

Thus, 2 students are represented by .

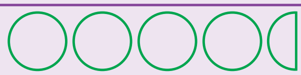
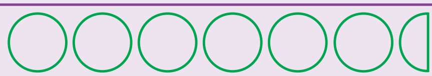
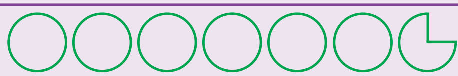
One student is represented by .

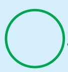
Three students are represented by .

Accordingly, let us find the number of figures that are required to represent the number of students enrolled each year, in the following manner.

Year	Number of Symbols
2009	Since $20 \div 4 = 5$, 5 complete circles.
2010	Since $18 \div 4 = 4$ with a remainder of 2, 4 complete circles and half a circle.
2011	Since $21 \div 4 = 5$ with a remainder of 1, 5 complete circles and a quarter of a circle.
2012	Since $26 \div 4 = 6$ with a remainder of 2, 6 complete circles and half a circle.
2013	Since $27 \div 4 = 6$ with a remainder of 3, 6 complete circles and three quarter of a circle.

Now let us represent this data in the given table in a picture graph using the above symbols.

Year	Number of students
2009	
2010	
2011	
2012	
2013	

4 students are represented by .

Exercise 22.2

(1) The number of registered letters that a post office had to send out during the 5 week days of a certain week is given in the following table.

Day	Number of letters
Monday	20
Tuesday	26
Wednesday	32
Thursday	30
Friday	42

Denote 8 letters by a suitable symbol and represent this data in a picture graph.

(2) The number of customers that arrived at a certain bank during the working hours of a week day to carry out transactions is given in the following table.

Time	Number of customers	
	To withdraw money	To deposit money
9.00 a.m. – 10.00 a.m.	18	12
10.00 a.m. – 11.00 a.m.	30	6
11.00 a.m. – Noon	24	15
Noon – 1.00 p.m.	48	42
1.00 p.m. – 2.00 p.m.	36	54

(i) If six customers are represented by  draw a picture graph of the number of customers who arrived at the bank to withdraw money.

(ii) Is the symbol  alone sufficient to denote the number of customers who arrived at the bank to deposit money? Give reasons for your answer.

(iii) Draw a picture graph to represent the number of customers who arrived at the bank to deposit money by using the above figure and if necessary, a half of it.

(3) A record of the arrival times of the employees of a certain office is given in the following table.

Arrival Time	Number of Employees
7.50 a.m. – 8.00 a.m.	24
8.00 a.m. – 8.10 a.m.	20
8.10 a.m. – 8.20 a.m.	58
8.20 a.m. – 8.30 a.m.	46

(a) Select a suitable symbol to represent this data in a picture graph.

(b) Write down the number of employees represented by

(i) the whole figure you selected.
(ii) half the figure you selected.
(iii) three quarters of the figure you selected.
(iv) a quarter of the figure you selected.

(3) Using this symbol, represent the above information in a picture graph.

Summary

- One method of collecting data is using tally marks.
- Collected data can be represented by using tables or picture graphs.

23

Data Interpretation

By studying this lesson, you will be able to,

- interpret the data represented in picture graphs and tables.

23.1 Interpreting data represented in tables

We learnt how data is represented in picture graphs and tables in the lesson on Data Collection and Representation.

Drawing various information from the data represented in picture graphs and tables is known as data interpretation.

Let us consider the data represented in tables.

The following table provides data on the sales of 175 ml bottles of fruit juice marketed by a company during the first five months of the year 2014.

Month	Number of Bottles
January	30 000
February	32 100
March	31 500
April	34 800
May	33 000

To draw various conclusions regarding these sales, let us answer the following questions according to the above table.

(i) How many more bottles were sold in February than in January?

Number of bottles sold in February = 32 100

Number of bottles sold in January = 30 000

Therefore the number of extra bottles sold in February } = 32 100 – 30 000

= 2 100

(ii) Considering the months of March and April, what was the total sales during these two months?

Number of bottles sold in March = 31 500
Number of bottles sold in April = 34 800
Total number of bottles = 31 500 + 34 800
= 66 300

(iii) Considering these five months, during which month were sales highest and during which month were sales lowest? What was the quantity of sales during these two months?

Sales were highest in April. The number of bottles sold during this month was 34 800.

Sales were lowest in January. The number of bottles sold during this month was 30 000.

(iv) Write down the ratio of the number of bottles sold in January to the number sold in May in its simplest form.

Number of bottles sold in January = 30 000
Number of bottles sold in May = 33 000

Ratio of the number of bottles sold in January to the number sold in May } = 30 000 : 33 000
= 30 000 ÷ 1000 : 33 000 ÷ 1000
= 30 : 33
= 30 ÷ 3 : 33 ÷ 3
= 10 : 11

Exercise 23.1

(1) The following table provides the number of trishaws that were registered in a certain province during the last 5 years.

Year	Number of Trishaws
2009	930
2010	1215
2011	1630
2012	1982
2013	2240

Answer the following questions based on the table.

(i) In which year was the least number of trishaws registered?

(ii) In which year was the most number of trishaws registered?

(iii) How many more trishaws were registered in 2013 than in 2009?

(iv) Write down any special fact that can be stated according to the given data, regarding the registration of trishaws in this province.

(2) The number of kilogrammes of Bombay onions sold during the first six months of the year by a certain wholesale dealer is given in the following table.

Month	Amount (kg)
January	21 700
February	22 450
March	21 850
April	27 200
May	25 950
June	23 000

Answer the following questions based on the data in the table.

(i) In which month was the greatest quantity of Bombay onions sold? How much was sold during this month?

(ii) The wholesale dealer claims that the quantity of Bombay onions sold each month at his shopping centre is more than 22 000 kg. Write down your views regarding this statement.

(iii) How many more kilogrammes of Bombay onions were sold in April than in March?

(iv) An employee of this shopping centre states that the quantity of Bombay onions sold during the months of April and May exceeds 53 000 kg. Show that this statement is true.

(v) Write down a probable reason why the sales during the months of April and May exceed the sales during the other months.

(3) A certain news item that appeared in a well known newspaper in year 2014 is given in the following box.

> The quantity of fresh milk that is produced in several Sri Lankan districts has gradually increased during the past several years.

(i) Based on the data in the following table, determine whether the above news item is true.

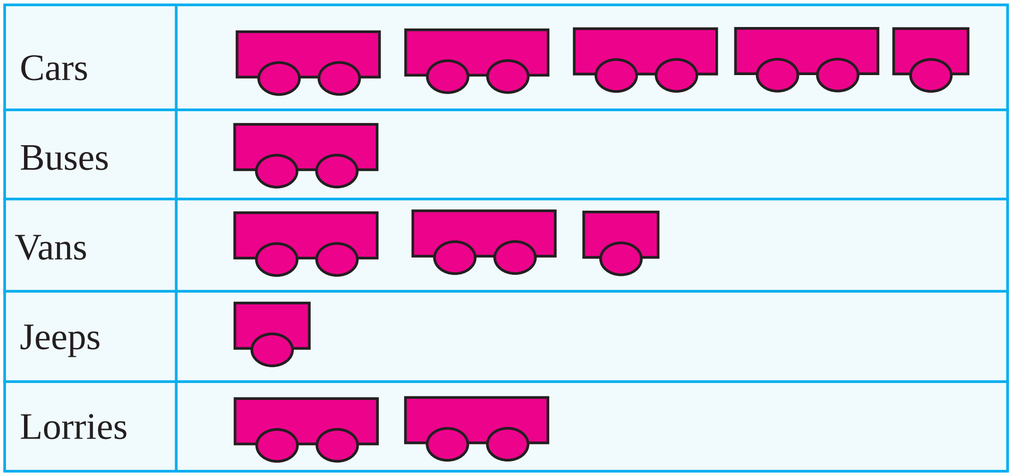
(ii) What is the total production of fresh milk in litres during the given four years?

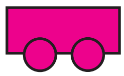
(iii) Is the milk production of year 2013 more than twice the milk production of year 2010?

Year	Milk production in litres
2010	163 100
2011	190 600
2012	201 400
2013	290 700

23.2 Interpretation of data represented in picture graphs

The data on the vehicles that joined a highway during a certain hour through a certain entry point is represented in the following picture graph.



10 vehicles are represented by the symbol  .

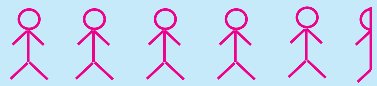
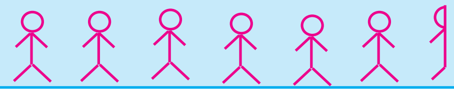
We can present several interpretations based on this picture graph.

- The type of vehicle that joined the highway at this entry point most during this hour is cars.
- The type of vehicle that joined the highway at this entry point least during this hour is jeeps.
- The number of lorries that joined the highway at this entry point during this hour is 20.
- The total number of vehicles that joined the highway at this entry point during this hour is 105.

- The number of vehicles other than lorries that joined the highway at this entry point during this hour is 85.
- The number of vans that joined the highway at this entry point during this hour is five times the number of jeeps.

Exercise 23.2

(1) The number of child entry tickets that were issued by the Zoo on the four Sundays of the month of January is represented in the following picture graph.

First Sunday of the month	
Second Sunday of the month	
Third Sunday of the month	
Fourth Sunday of the month	

100 child entry tickets are represented by the symbol .

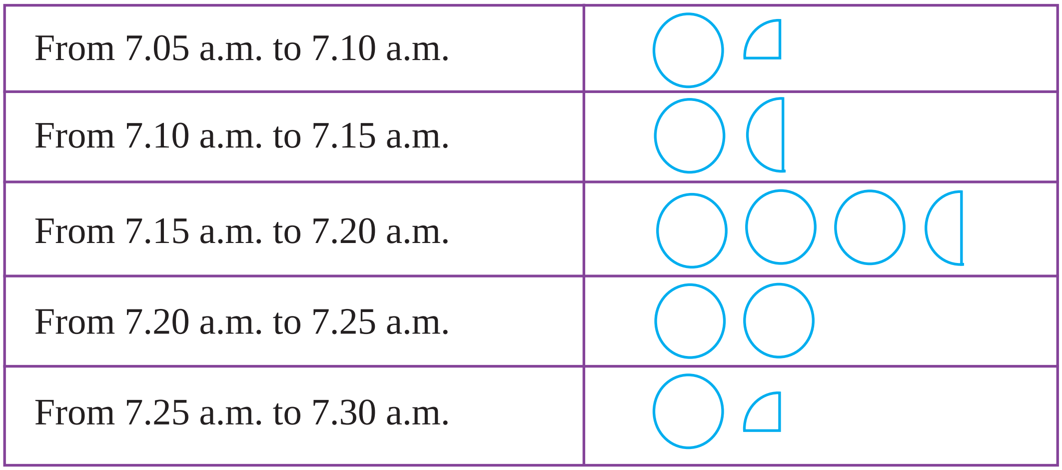
(i) On which Sunday of the month has the most number of child entry tickets been issued ?

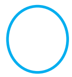
(ii) On which Sunday of the month has the least number of child entry tickets been issued ?

(iii) How many child entry tickets were issued on the third Sunday of the month ?

(iv) How many child entry tickets were issued in total during the four Sundays in the month of January ?

(2) The time of arrival on a certain day, of the grade 6 students of a certain class is represented in the following picture graph.



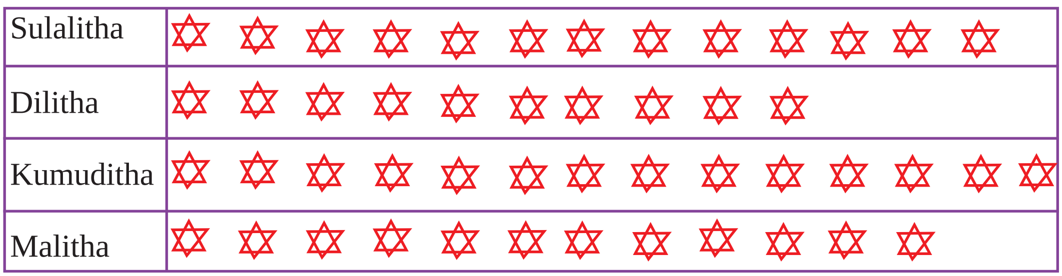
Four students are represented by the symbol  .

(i) How many students arrived during the period from 7.05 a.m. to 7.10 a.m.?

(ii) How many students arrived during the period from 7.15 a.m. to 7.30 a.m.?

(iii) On that day, no student arrived before 7.05 a.m. and by 7.30 a.m. all the students were present in the class. How many students are there in total in the class?

(3) When a grade 6 student is present in class on all 5 days of a week, he is awarded one star. The following picture graph represents the number of stars that four friends received for their attendance during the 14 weeks of the first term. (A star is not received when the attendance during a week is less than 5 days)



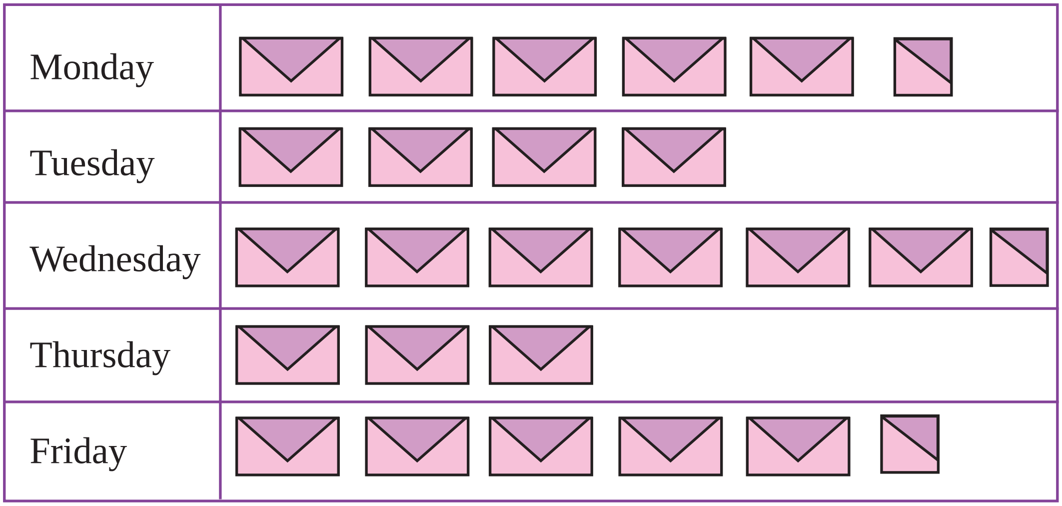
5 days are represented by the symbol  .

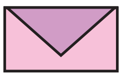
(i) Of these four friends, who received stars for attending school on all five days of each of the fourteen weeks?

(ii) During how many weeks did Malitha attend school on all 5 days?

(iii) If a student attended school on 69 days, how many stars should be drawn to represent his attendance?

(4) The number of registered letters received by a certain post office to be posted during the 5 days of a certain week is represented in the following picture graph.



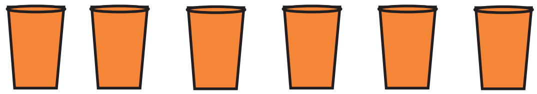
6 letters are represented by the symbol  .

(i) If the cost of registering a letter is Rs 30, what is the income received by the post office on Monday as registration fees?

(ii) Name the day on which the income from registering letters was highest, and find the relevant income.

(iii) How much did the post office earn during the five days by registering letters?

(5) The number of glasses of fruit drink sold at a certain stall on a certain day, is represented in the following picture graph.

Mango	
Water melon	
Orange	
Wood apple	
Avocado	

4 glasses of fruit drink are represented by the symbol  .

(i) Which type of drink has been sold the most?

(ii) If the price of a glass of wood apple drink is Rs. 12.00 and a glass of avocado drink is also Rs. 12.00, how much more was earned from wood apple drinks than from avocado drinks?

(iii) If 40 glasses of each type of drink had been prepared that day, find the number of glasses of drink of each type that remained unsold at the end of the day. Represent this information in a table.

Summary

- When data are given numerically in a table, data interpretation can be done in terms of these numbers.
- When the data are represented by picture graphs, data interpretation corresponding to the comparison of data can be done more conveniently.

24 Indices

By studying this lesson, you will be able to,

- recognize the index notation
- write a number as a power of another number and
- expand a power and write its value.

24.1 Index notation

In mathematics there are instances when a number has to be multiplied repeatedly and written.

In the lesson on factors you wrote $16 = 4 \times 4$
In the same manner we can write $16 = 2 \times 2 \times 2 \times 2$

There is a method of writing a number which is multiplied repeatedly as above in a concise way.

Activity 1

In the following table the first few examples show how a number which is multiplied repeatedly is written in a concise way. After understanding the method, fill in the blanks in the other examples.

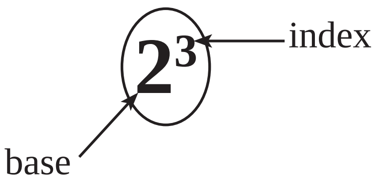
Product	Written concisely
$2 \times 2 \times 2$	2^3
3×3	3^2
2×2	2^2
4×4	....
$5 \times 5 \times 5$	....
....	6^2
....	7^3
$3 \times 3 \times 3 \times 3 \times 3$	....

When a number which is multiplied repeatedly is written in the above manner in a concise way, we say that it is written using indices or that it is written in index form.

$2 \times 2 \times 2$ is written using indices as 2^3.

The fact that 2 is multiplied three times over in this product is indicated by the small digit 3 written at the top, on the right hand side of 2.

In 2^3, 2 is defined as the base and 3 is defined as the index. This is read as two to the power three (or two to the power of three).



The value of 2^3 is equal to the value of $2 \times 2 \times 2$. That is, its value is 8.

A number to the power two is also called the square of the number.
Example: Five to the power two, or 5^2, is also five squared.

A number to the power three is also called the cube of the number.
Example: Eight to the power three, or 8^3, is also eight cubed.

Activity 2

For each of the numbers given below in index form, write down the base, the index, and how it is read.

Number	Written using index notation	Base	Index	How it is read
25	5^2	5	2	Five to the power two
81	3^4	....	....	....
64	2^6	....	....	....
1000	10^3	....	....	....
243	....	3	5	....
625	....	....	....	Five to the power four

Example 1

Write $3 \times 3 \times 3 \times 3$ using index notation.

$3 \times 3 \times 3 \times 3 = \underline{\underline{3^4}}$

Example 2

Find the value of 2^6.

$2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = \underline{\underline{64}}$

Example 3

Write $2 \times 2 \times 2 \times 5 \times 5$ using indices.

$2 \times 2 \times 2 \times 5 \times 5 = \underline{\underline{2^3 \times 5^2}}$

Example 4

Find the value of $5^2 \times 7^3$.

$5^2 \times 7^3 = 5 \times 5 \times 7 \times 7 \times 7 = \underline{\underline{8575}}$

Example 5

Find the value of $2^4 \times 3^2$.

$2^4 \times 3^2 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 = \underline{\underline{144}}$

Exercise 24.1

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

Product	Index Form	Base	Index	Value of the Product
7×7	7^2	7	2	49
$4 \times 4 \times 4$	....	4	....	64
$5 \times 5 \times 5 \times 5$	....	....	....	625
....	2^3	....	....	....
....	....	2	2	....
....	5^3	....	....	....

(2) Write down using index notation, each of the following numbers which has been expressed as a product. Find also the value of each product.

(i) 5×5 (ii) $10 \times 10 \times 10$
(iii) $3 \times 3 \times 3$ (iv) $1 \times 1 \times 1$
(v) $1 \times 1 \times 1 \times 1 \times 1$ (vi) $7 \times 7 \times 7 \times 7$
(vii) $5 \times 5 \times 7 \times 3 \times 3$ (viii) $6 \times 3 \times 3 \times 3 \times 4 \times 4$

(3) Write each of the following numbers which has been expressed in words, in index form and as a product, and then write down its value.

(i) Two to the power two (ii) Four cubed
(iii) Six squared (iv) Three to the power four
(v) Two to the power six (vi) Three cubed

(4) Evaluate:

(i) $2^2 \times 3$ (ii) $2^3 \times 3$ (iii) $2^2 \times 3^2$
(iv) 3^4 (v) $2^2 \times 3^2 \times 4^2$

24.2 Representing a number as a power of a given number

To express the number 16 as a power of 2, it is necessary to know how many times 2 should be multiplied by itself to obtain the value 16.

$$16 = 2 \times 2 \times 2 \times 2$$

That is, $16 = 2 \times 2 \times 2 \times 2 = 2^4$

It is easy to use division to find the number of times a particular number should be multiplied to obtain a given number. In the above example, when the base is identified as 2, to find the index, the number 16 should be divided repeatedly by 2.

2 | 16
2 | 8
2 | 4
2 | 2
  1

$16 = 2 \times 2 \times 2 \times 2 = \underline{\underline{2^4}}$

Example 1

Express 81 as a power of 3.

3	81
3	27
3	9
3	3
	1

$81 = 3 \times 3 \times 3 \times 3 = 3^4$

Example 2

Express 125 as a power of 5.

5	125
5	25
5	5
	1

$125 = 5 \times 5 \times 5 = 5^3$

Exercise 24.2

(1) (i) What is two times 5 equal to?
(ii) What is 5 to the power two equal to?

(2) (i) What is three times 4 equal to?
(ii) What is 4 to the power three equal to?

(3) Write 32 as a power of 2.

(4) Write 144 as a power of 12.

(5) Write down 64

(i) as a power of 2. (ii) as a power of 4.
(iii) as a power of 8.

(6) Write down 81

(i) as a power of 3. (ii) as a power of 9.

(7) Indicate the truth/falsehood of the following statements.

(i) $2^3 = 8$ (ii) $3^2 = 6$ (iii) $3^2 = 8$ (iv) $5^2 = 10$
(v) $2^5 = 32$ (vi) $3^2 = 9$ (vii) $2^4 = 4^2$ (viii) $2^4 = 8$
(ix) $7^3 = 21$ (x) $5^3 = 15$ (xi) $3^5 = 243$

Miscellaneous Exercises

(1) What are the base and the index of 7^2?

(2) Write down the following products using index notation.

(i) $5 \times 5 \times 5 \times 5$ (ii) $4 \times 4 \times 7 \times 7 \times 7$

(iii) $3 \times 3 \times 3 \times 3 \times 3 \times 8$ (iv) $2 \times 2 \times 2 \times 3 \times 3 \times 5$

(v) $4 \times 4 \times 4 \times 5 \times 7 \times 7 \times 7 \times 7$ (vi) $2 \times 3 \times 3 \times 2 \times 5 \times 2 \times 3 \times 5$

(3) Find the value of each of the following expressions.

(i) $2^4 \times 5^2$ (ii) $3^2 \times 7^2$ (iii) $11^2 \times 10^2$

(iv) $2^3 \times 5^2 \times 7$ (v) $2^2 \times 3^3 \times 5^2$

(4) Fill in the blanks.

(i) $36 = 6^{\square}$ (ii) $8 = 2^{\square}$ (iii) $125 = 5^{\square}$

(iv) $\square = 10^2$ (v) $\square = 3^4$

(5) Write down 256

(i) as a power of 2. (ii) as a power of 4. (iii) as a power of 16.

(6) Write down 729

(i) as a power of 3. (ii) as a power of 9. (iii) as a power of 27.

(7) Fill in the blanks appropriately with either the symbol "<" or the symbol ">".

(i) 2^3 ...... 3^2 (ii) 3^4 ...... 4^3 (iii) 2^4 ...... 4^2

(iv) 8^1 ...... 1^8 (v) 2^4 ...... 4^2 (vi) 3^2 6

Summary

- To represent a number using index notation is to write a repeated product of a number in a concise way.

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

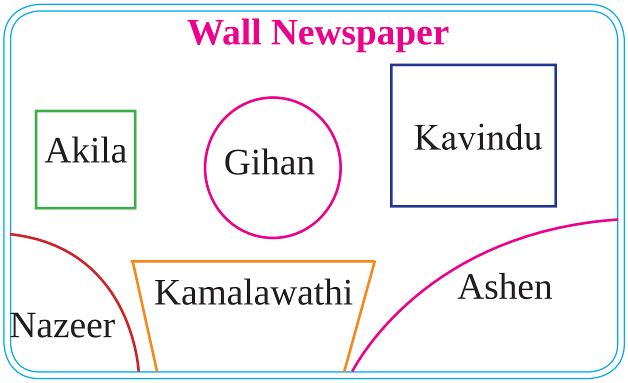
- In the expression 2^5, the base is 2 and the index is 5.
- A number can be written as a power of a given number.
- Division is used to find the index when expressing a number as a power of another number.

25 Area

By studying this lesson, you will be able to,
- identify the amount of space occupied by a surface as its area,
- measure the area using arbitrary units,
- recognize cm^2 as a unit of measurement of area,
- measure the areas of squares and rectangles using a 1 cm × 1 cm square grid and
- create figures of given area using 1 cm^2 square laminas.

25.1 Identifying what area is

The space allocated for six students to display their creations on a wall newspaper is shown in the figure.



The space allocated to each student can be identified as a surface which is bounded by line segments. The space occupied by a surface is known as its **area**.
Observe the amount of space each student has been allocated.

We can easily say that the space allocated to Kavindu on the wall newspaper is more than the space allocated to Akila because both have been allocated similar shaped spaces.

That is, Kavindu has been allocated a space with a larger area than the area of the space Akila has been allocated.

25.2 Measuring the area using arbitrary units

Activity 1

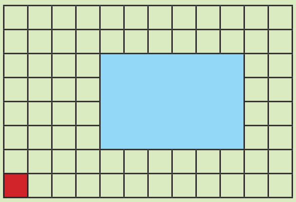
Step 1 - Cut out a square shaped lamina of side length 6 cm from a piece of cardboard.

Step 2 - By taking the area of the lamina to be 1 unit, determine how many units the area of the following surfaces are by placing the lamina on each of them.

1. The front page of your mathematics textbook.
2. The front page of your mathematics exercise book.
3. The top surface of your desk.

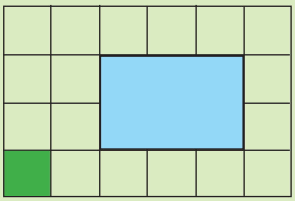
Step 3 - Cut out a rectangular shaped lamina of length 8 cm and breadth 3 cm from a piece of cardboard.

Step 4 - As before, find the area of the above surfaces using this lamina.



The figure illustrates how a student has placed a rectangular shaped lamina on a page of his mathematics exercise book to determine the area of the lamina.

Let us take the area of the square which has been shaded in red as one unit. Then the area of the rectangular lamina is 24 of these units.

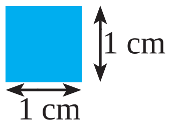


This figure illustrates how another student has placed the same rectangular lamina on a new square grid of a different size to find its area.

Let us take the area of the square which is shaded green as 1 unit. Then the area of the rectangular lamina is 6 of these units.

Two values which are numerically different to each other and which depend on the unit that has been used, are obtained for the area of one and the same rectangular lamina, namely 24 units of the red square and 6 units of the green square. Therefore, when the area is given, the unit used to measure the area too has to be mentioned.

1cm × 1cm square lamina

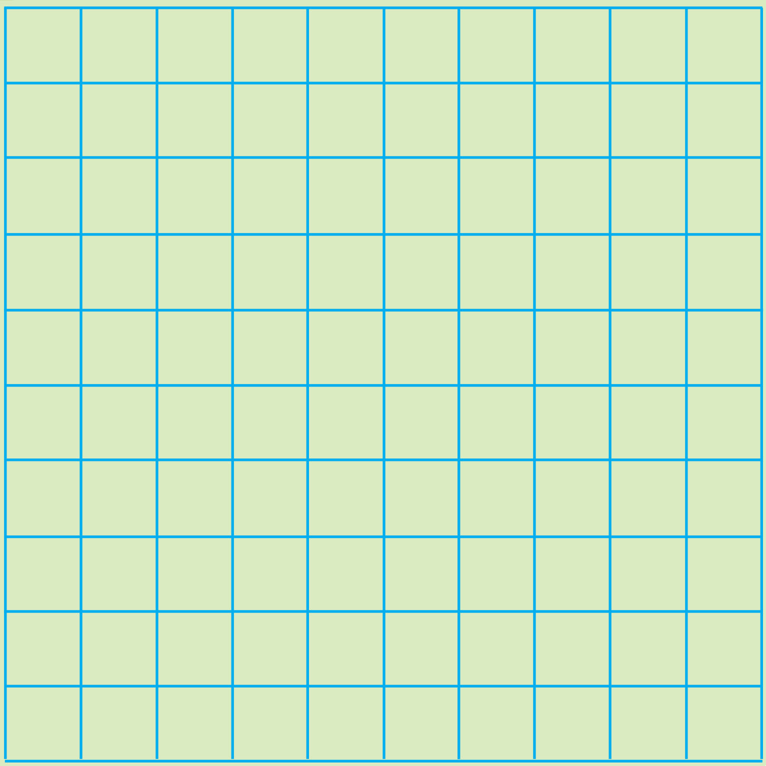


Area of lamina $= 1\ \text{cm}^2$

The area of a square lamina of side length 1 cm is used as a standard unit to measure the area of surfaces. It is defined as one square centimetre and is denoted by $1\ \text{cm}^2$.

Activity 2

Step 1 -
On a tissue paper, draw a 1 cm × 1 cm square grid as shown in the figure. (Supply yourself with a transparent sheet of paper on which a 1 cm × 1 cm square grid has been printed)



Step 2 - Draw figures of squares and rectangles of the following dimensions on a suitable piece of paper.

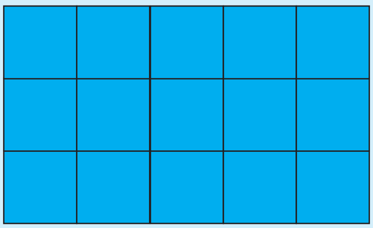
Squares of side length 3 cm/ 5 cm/ 10 cm and rectangles of length 3cm and breadth 2 cm/ length 6 cm and breadth 4 cm/ length 10 cm and breadth 6 cm

Step 3 - Place the square grid that you prepared on each of the above drawn plane figures and find the area of each figure by counting the squares.

Step 4 - Write down the area you found out beside each figure.

Example 1

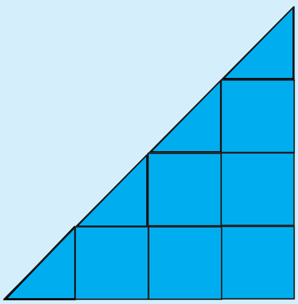
Find the area of the following figure by counting the squares. Take the area of each small square as 1 cm^2.



Number of squares in the figure = 15
Area of a square is 1cm^2.
Therefore, Area of the figure = 15 cm^2

Example 2

Find the area of the following figure by counting the squares. Take the area of each small square as 1 cm^2.

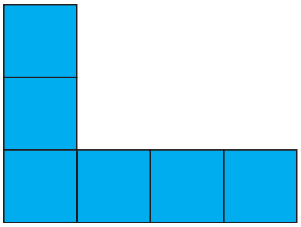


In this figure there are 6 small squares and four parts which are half a square each. Since these four parts together make up two squares, the total area is 8 cm^2.

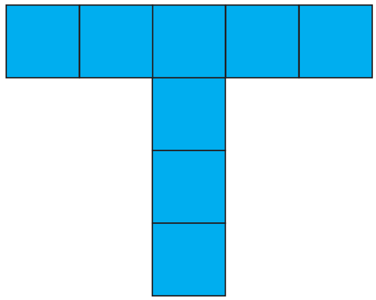
Exercise 25.1

(1) By taking the area of each small square as 1 cm^2, find the area of each of the following figures by counting the squares.

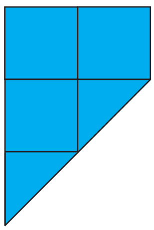
(i)



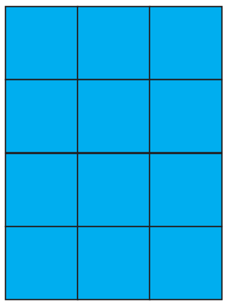
(ii)



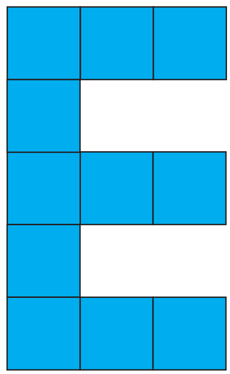
(iii)



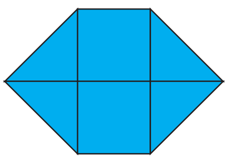
(iv)



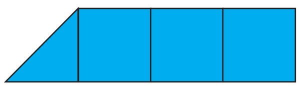
(v)



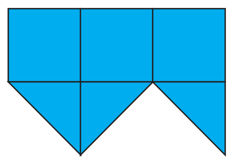
(vi)



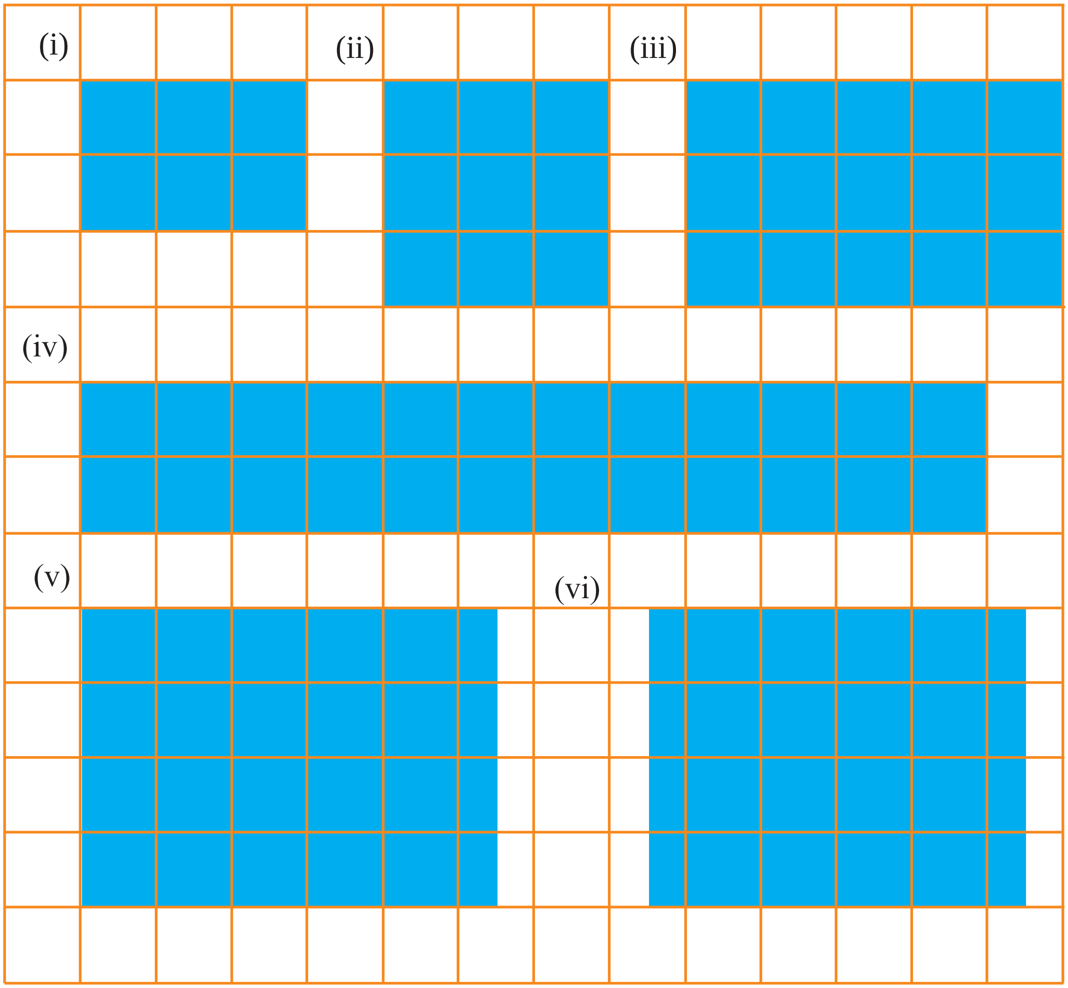
(vii)



(viii)

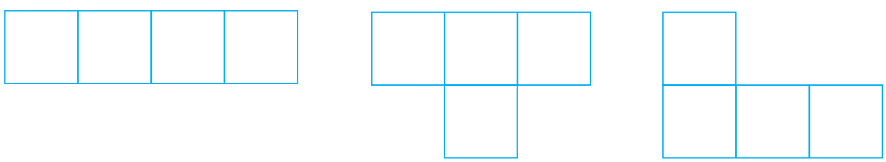


(2) Find the area of each of the following figures which have been drawn on a 1 cm × 1 cm square grid.



25.3 Constructing plane figures using 1 cm² laminas

Cut out 4 square laminas of area 1 cm² each. Illustrated below are various composite figures that have been created by joining together such laminas. What can you say about the area of each figure?

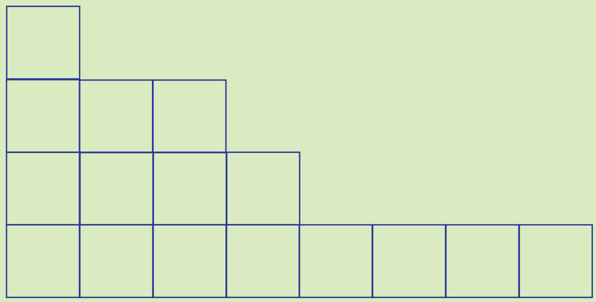


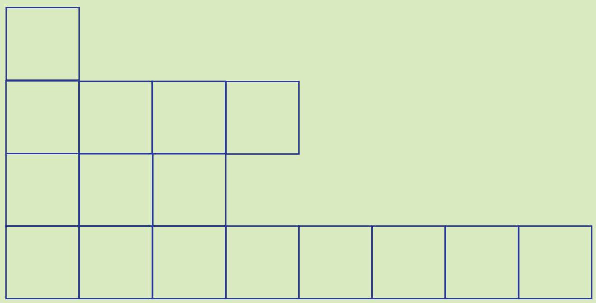
You may have noticed that although the shapes of the above laminas are different to each other, the area of each lamina is 4 cm^2.

Activity 3

Step 1 - Cut out 16 square laminas of area 1 cm^2 each.

Step 2 - Create various plane figures by joining all of these laminas together. Some plane figures which have been created in this manner are shown below.





Find the area of these two figures by counting the squares.

What can you say about the area of each of the figures?

Step 3 - Create squares of side length 2 cm, 3 cm and 4 cm respectively, and find the area of each of these squares by counting the number of 1 cm^2 squares that are in them.

Activity 4

Step 1 - Cut out about 100 square laminas of area 1 cm^2 each from various coloured paper.

Step 2 - Using the laminas that have been cut out, create the following figures and paste them in your exercise book.

(i) A square figure of area equal to 25 cm^2.
(ii) A rectangular figure of area equal to 24 cm^2.
(iii) A rectangular figure of length 5 cm and breadth 4 cm.

Step 3 - Create meaningful figures that you desire and paste them in your book. Next to each figure, write down the area and the name of the figure.

Summary

- The space occupied by a surface is known as its area.
- An arbitrary unit can be used to measure area.
- When the area is given, the unit used to measure the area too has to be mentioned.
- cm^2 is a unit that is used to measure area.
- Measuring the area of a given figure and creating figures of a given area can be carried out using square laminas of area 1 cm^2 each.

Revision Exercise - 3

(1) What is the number represented by  ?

(2) Find the value of the algebraic expression $x - 2$ when $x = 14$.

(3) Write 2085 g in grammes and kilogrammes.

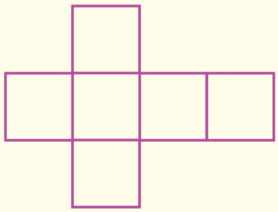
(4) Write two ratios that are equivalent to 2 : 7.

(5) If the price of 6 mangoes is Rs. 72, what is the price of 3 mangoes?

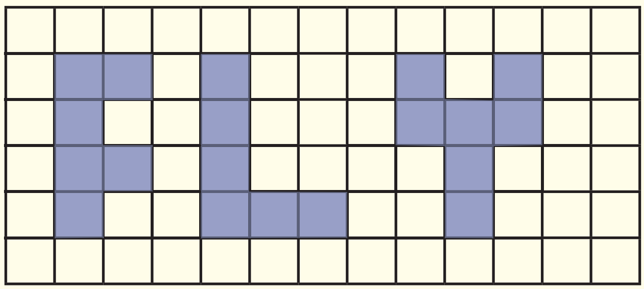
(6) Find the value of $2^3 \times 3^2$.

(7) Write 81 as a power of 3.

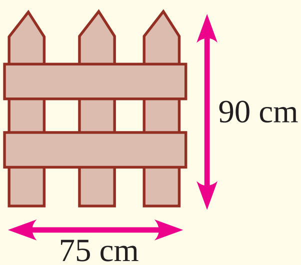
(8) (i) The following is a net of 1 cm × 1 cm squares that can be used to make a cube. What is the area of all the faces of the cube made with this net?



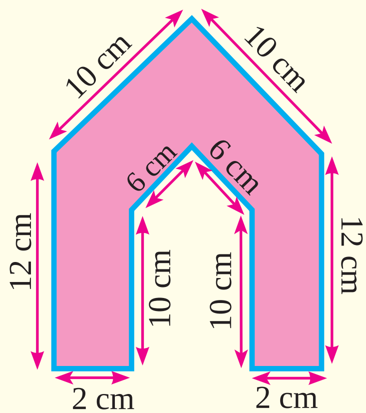
(ii) A board with the word "Fly" is shown here. If each small square is 1cm × 1 cm, what is the total area of the letters in cm^2?



(9) (i) A panel of a small gate is made of wooden planks. Indicate the total length of the wooden planks used to make the gate in metres and centimetres.



(ii) Find the perimeter of the following figure.



(10) (i)

	kg	g
	2	750
+	3	475

(ii)

	kg	g
	6	600
−	3	799

(11) It is required to prepare a mixed fruit drink for a party. 3 bottles of orange juice having 1 litre each, 2 bottles of pineapple juice having 1 litre each and 500 ml of lemon juice are mixed for this purpose.

(i) What is the amount of orange juice mixed in millilitres?

(ii) What is the amount of pineapple juice mixed in millilitres?

(iii) If 4 litres of water is added to the mixture, express the total amount of mixed drink in litres and millilitres.

(iv) Find the ratio of the amount of orange juice to the amount of pineapple juice in the mixture.

(v) Find the ratio of the amount of orange juice to the amount of lemon juice in the mixture. Express this ratio in the simplest form.

(vi) If 38 persons participate in the party, find out whether this amount of drink is adequate to serve 250 millilitres each.

(12) The price of a petrol litre is x rupees.

(i) If the price of a petrol litre is increased by 12 rupees, write down an expression in terms of x for the price of a petrol litre after the increase in price.

(ii) Write down an expression in terms of x for the balance that a person receives after purchasing a petrol litre before the increase in price, by giving 200 rupees.

(iii) A vehicle can travel y kilometres with a petrol litre. If the vehicle travels 10 kilometres after pumping one petrol litre, write down the number of kilometres in terms of y, that the vehicle can travel further by using the remaining petrol.

(iv) If $y = 14$, find the value of the expression obtained in (iii).

(v) If $x = 160$, find the values of the expressions obtained in (i) and (ii) separately.

(13)

Sugar 750 g

Margarine 750 g

Flour 1 kg

A certain type of sweet is prepared by mixing the items given above and then adding water.

(i) Express the total mass of the items mixed other than water in kilogrammes and grammes.

(ii) The mass of the mixture after adding water is 3 kg 75 g. What is the mass of the added water?

(iii) Sudeepa says that the number of sweets made will exceed 200, if a mass of 15 g is used from the mixture (with water) to prepare one sweet. Show that her statement is true.

(14) The marks received by 30 students in an evaluation which carried 10 marks are given below.

3	6	5	7	1	8	6	7	8	4
7	8	3	0	9	7	2	3	5	6
5	9	7	8	10	4	1	6	7	6

(i) Represent this data in the following table by using tally marks.

Marks	The number of students who obtained the marks in the first column denoted by tally marks	The number of students
0, 1, 2, 3, 4		
5, 6, 7		
8, 9, 10		

(ii) Represent this data by a picture graph.

(iii) How many students obtained 5 marks or higher?

(iv) If the students are categorized as,

8 - 10 marks : Reached the competency level

5 - 7 marks : Approaching the competency level

0 - 4 marks : Direct to remedial learning

Write the number of students that belong to each category separately.

(15) (i) If $16 = 2^{\square} = 4^{\square}$, write the suitable numbers in the boxes.

(ii) Expand $3^2 \times 2^2$ and find its value.

(iii) Write suitable numbers in the boxes.

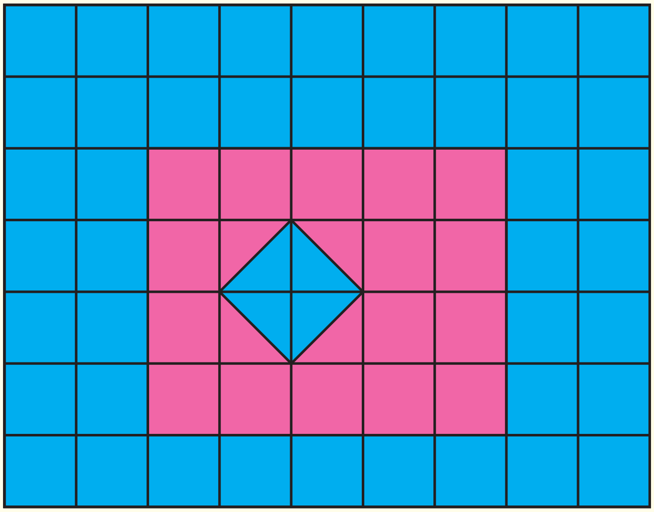
(a) $64 = 2^{\square}$ (b) $64 = 4^{\square}$ (c) $64 = 8^{\square}$

(iv) Write 1024 as,

(a) a power of 2. (b) a power of 4.

(v) Find the larger number from 2^6 and 6^2.

(16) A cushion cover is made of 1 cm × 1 cm squares in the two colours red and blue as follows.

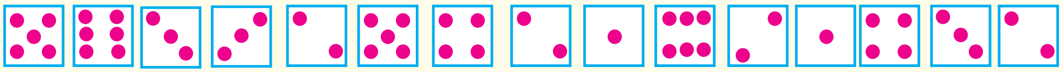


(i) What is the total area of the parts coloured in blue in cm^2?

(ii) What is the total area of the parts coloured in red in cm^2?

(iii) Find the ratio of the total red area to the total blue area.

(17) The results that were obtained when a cubic die was thrown 15 times are shown in the following figure.



(i) Express the number of occurrences of the numbers of each of the following types as a fraction of the total number of occurrences.

(a) Even numbers (b) Odd numbers (c) Prime numbers
(d) Composite numbers (e) Triangular numbers (f) Square numbers

(ii) The fractions relevant to which two types of numbers when added results in the sum $\frac{14}{15}$?

(iii) Show that the fraction resulting from subtracting the fraction relevant to composite numbers from the fraction relevant to odd numbers is equivalent to $\frac{14}{15}$.

Glossary

Algebraic	වීජීය	அட்சரகணித
Algebraic expressions	වීජීය ප්‍රකාශන	அட்சரகணிதக் கோவை
Area	වර්ගඵලය	பரப்பளவு
Base	පාදය	அடி
Capacity	ධාරිතාව	கொள்ளளவு
Closed figures	සංවෘත රූප	மூடிய உருக்கள்
Coefficient	සංගුණකය	குணகம்
Composite Numbers	සංයුත සංඛ්‍යා	சேர்த்தி எண்கள்
Compound Solids	සංයුක්ත ඝන වස්තු	கூட்டுத்திண்மம்
Constant	නියත පදය	ஒருமை உறுப்பு
Cube	ඝනකය	சதுரமுகி
Cuboid	ඝනකාභය	கனவுரு
Data	දත්ත	தரவு
Data Collection	දත්ත රැස් කිරීම	தரவுகளைச் சேகரித்தல்
Data Representation	දත්ත නිරූපණය	தரவுகளை வகைகுறித்தல்
Decimals	දශම	தசமம்
Decimal point	දශම තිත	தசமபுள்ளி
Depth	ගැඹුර	ஆழம்
Edge	දාරය	விளிம்பு
Estimation	නිමානය	மதிப்பிடல்
Even Numbers	ඉරට්ට සංඛ්‍යා	இரட்டை எண்கள்
Face	මුහුණත	முகம்
Factors	සාධක	காரணி
Grid with Squares	කොටු ජාලය	சதுரச் சட்டகம்
Height	උස	உயரம்
Hundredths	සියයෙන් පංගු	நூறின் கூறுகள
Index (exponent)	දර්ශකය	சுட்டி
Index Notation	දර්ශක අංකනය	சுட்டிக் குறிப்பீடு
Interpretation	අර්ථකථනය	விளக்கமளித்தல்
Lamina	ආස්තරය	அடர்
Length	දිග	நீளம்
Line segment	රේඛා ඛණ්ඩය	நேர்கோட்டுத்துண்டம்
Liquid Measurements	ද්‍රව මිනුම්	திரவ அளவீடுகள்

Litre	ලීටර	லீற்றர்
Mass	ස්කන්ධය	திணிவு
Millilitre	මිලිලීටර	மில்லிலீற்றர்
Odd Numbers	ඔත්තේ සංඛ්‍යා	ஒற்றை எண்கள்
Parallelogram	සමාන්තරාස්‍රය	இணைகரம்
Picture Graphs	චිත්‍ර ප්‍රස්තාර	படவரைபு
Place value	ස්ථානීය අගය	இடப்பெறுமானம்
Plane figures	තල රූප	தளஉரு
Power	බලය	வலு
Prime Numbers	ප්‍රථමක සංඛ්‍යා	முதன்மை எண்கள்
Rates	අනුපාතික	வீதங்கள்
Ratio	අනුපාතය	விகிதம்
Rectangle	සෘජුකෝණාස්‍රය	செவ்வகம்
Regular tetrahedron	සවිධි චතුස්තලය	ஒழுங்கான நான்முகி
Simplest form	සරල ම ආකාරය	எளிய வடிவம்
Solids	ඝන වස්තු	திண்மம்
Space	ඉඩ ප්‍රමාණය	இடத்தின் அளவு
Square	සමචතුරස්‍රය	சதுரம்
Straight line	සරල රේඛාව	நேர்கோடு
Symbols	සංකේත	குறியீடுகள்
Tables	වගු	அட்டவணை
Tally Mark	ප්‍රගණන ලකුණ	வரவுக்குறி
Tenths	දහයෙන් පංගු	த்தின் கூறுகள்
Thickness	ඝනකම	தடிப்பு
Trapezium	trapeziumය	சரிவகம்
Triangle	ත්‍රිකෝණය	முக்கோணி
Triangular Numbers	ත්‍රිකෝණ සංඛ්‍යා	முக்கோணி எண்கள்
Units	ඒකක	அலகு
Unknown	අඥාතයක්	தெரியாக்கணியம்
Unknown term	අඥාත පදය	தெரியாத உறுப்பு
Variables	විචල්‍ය	மாறிகள்
Vertex	ශීර්ෂය	உச்சி
Whole Numbers	පූර්ණ සංඛ්‍යා	முழு எண்கள்
Width	පළල	அகலம்

Lesson Sequence

Content	Number of periods	Competency levels
Term 1		
1. Circles 2. Place Value 3. Mathematical Operations on whole numbers 4. Time 5. Number Line 6. Estimation and Rounding off 7. Angles 8. Directions	03 06 10 06 11 08 04 05	24.1 1.1 1.4, 1.5 12.1, 12.2 1.2, 1.3 1.8, 1.9 21.1 13.1
	53	
Term 2		
9. Fractions 10. Selecting 11. Factors and Multiples 12. Rectilinear plane Figures 13. Decimals 14.Types of Numbers and Number Patterns 15. Length 16. Liquid Measurements 17. Solids	12 04 09 04 06 10 08 04 08	3.1, 3.2, 3.3, 3.4 30.1 1.6, 1.7 23.1 3.5, 3.6 2.1, 2.2 7.1, 7.2 11.1 22.1
	65	
Term 3		
18. Algebraic Symbols 19.Constructing Algebraic Expressions and Substitution 20.Mass 21.Ratio 22.Data Collection and Representation 23.Data Interpretation 24.Indices 25.Area	04 04 05 06 06 05 04 05	14.1 14.2 9.1 4.1 28.1 29.1 6.1 8.1
	39	
TOTAL	157	