Government of Karnataka

MATHEMATICS

6

Sixth Standard

Part-II

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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Fractions

Chapter 7

7.1 Introduction

Subhash had learnt about fractions in Classes IV and V, so whenever possible he would try to use fractions. One occasion was when he forgot his lunch at home. His friend Farida invited him to share her lunch. She had five pooris in her lunch box. So, Subhash and Farida took two pooris each. Then Farida made two equal halves of the fifth poori and gave one-half to Subhash and took the other half herself. Thus, both Subhash and Farida had 2 full pooris and one-half poori.

2 pooris + half-poori–Subhash
2 pooris + half-poori–Farida

Where do you come across situations with fractions in your life?

Subhash knew that one-half is written as $\frac{1}{2}$. While eating he further divided his half poori into two equal parts and asked Farida what fraction of the whole poori was that piece? (Fig 7.1)

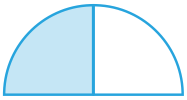


Fig 7.1

Without answering, Farida also divided her portion of the half puri into two equal parts and kept them beside Subhash's shares. She said that these four equal parts together make

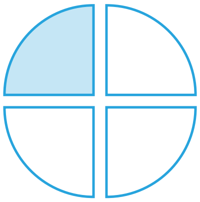


Fig 7.2

one whole (Fig 7.2). So, each equal part is one-fourth of one whole poori and 4 parts together will be $\frac{4}{4}$ or 1 whole poori.

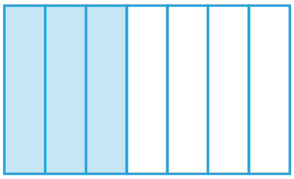


Fig 7.3

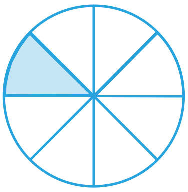


Fig 7.4

When they ate, they discussed what they had learnt earlier. Three parts out of 4 equal parts is $\frac{3}{4}$. Similarly, $\frac{3}{7}$ is obtained when we divide a whole into seven equal parts and take three parts (Fig 7.3). For $\frac{1}{8}$, we divide a whole into eight equal parts and take one part out of it (Fig 7.4).

Farida said that we have learnt that **a fraction is a number representing part of a whole. The whole may be a single object or a group of objects.** Subhash observed that **the parts have to be equal.**

7.2 A Fraction

Let us recapitulate the discussion.
A fraction means a part of a group or of a region.

$\frac{5}{12}$ is a fraction. We read it as "five-twelfths".

What does "12" stand for? It is the number of equal parts into which the whole has been divided.

What does "5" stand for? It is the number of equal parts which have been taken out.

Here 5 is called the numerator and 12 is called the denominator.

Name the numerator of $\frac{3}{7}$ and the denominator of $\frac{4}{15}$.

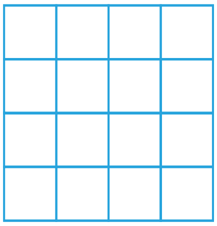
Play this Game

You can play this game with your friends.

Take many copies of the grid as shown here.

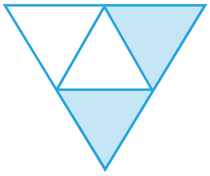
Consider any fraction, say $\frac{1}{2}$.

Each one of you should shade $\frac{1}{2}$ of the grid.

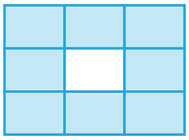


EXERCISE 7.1

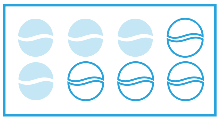
1. Write the fraction representing the shaded portion.



(i)

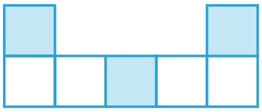


(ii)

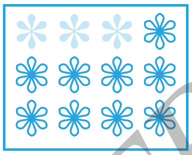


(iii)

(iv)



(v)



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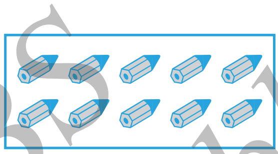

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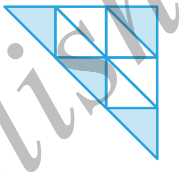

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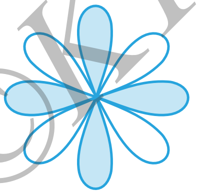

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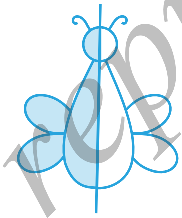
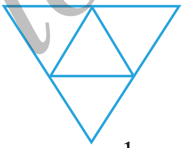


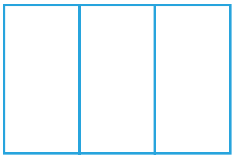
(x)

2. Colour the part according to the given fraction.

(i) $\frac{1}{6}$

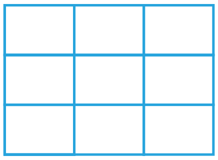


(ii) $\frac{1}{4}$



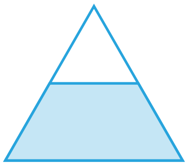
(iii) $\frac{1}{3}$

(iv) $\frac{3}{4}$

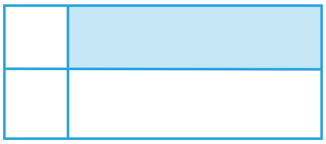


(v) $\frac{4}{9}$

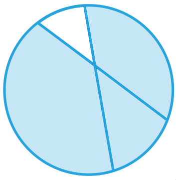
3. Identify the error, if any.



This is $\frac{1}{2}$



This is $\frac{1}{4}$

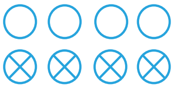


This is $\frac{3}{4}$

4. What fraction of a day is 8 hours?
5. What fraction of an hour is 40 minutes?
6. Arya, Abhimanyu, and Vivek shared lunch. Arya has brought two sandwiches, one made of vegetable and one of jam. The other two boys forgot to bring their lunch. Arya agreed to share his sandwiches so that each person will have an equal share of each sandwich.

   (a) How can Arya divide his sandwiches so that each person has an equal share?

   (b) What part of a sandwich will each boy receive?
7. Kanchan dyes dresses. She had to dye 30 dresses. She has so far finished 20 dresses. What fraction of dresses has she finished?
8. Write the natural numbers from 2 to 12. What fraction of them are prime numbers?
9. Write the natural numbers from 102 to 113. What fraction of them are prime numbers?
10. What fraction of these circles have X's in them?



11. Kristin received a CD player for her birthday. She bought 3 CDs and received 5 others as gifts. What fraction of her total CDs did she buy and what fraction did she receive as gifts?

7.3 Fraction on the Number Line

You have learnt to show whole numbers like 0,1,2... on a number line.

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

We know that $\frac{1}{2}$ is greater than 0 and less than 1, so it should lie between 0 and 1.

Since we have to show $\frac{1}{2}$, we divide the gap between 0 and 1 into two equal parts and show 1 part as $\frac{1}{2}$ (as shown in the Fig 7.5).

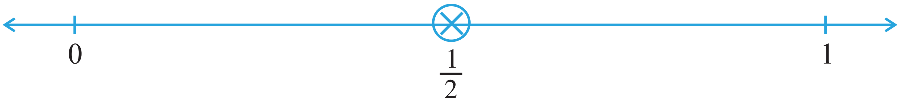


Fig 7.5

Suppose we want to show $\frac{1}{3}$ on a number line. Into how many equal parts should the length between 0 and 1 be divided? We divide the length between 0 and 1 into 3 equal parts and show one part as $\frac{1}{3}$ (as shown in the Fig 7.6)

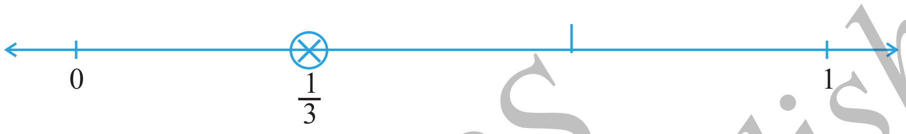


Fig 7.6

Can we show $\frac{2}{3}$ on this number line? $\frac{2}{3}$ means 2 parts out of 3 parts as shown (Fig 7.7).

Fig 7.7

Similarly, how would you show $\frac{0}{3}$ and $\frac{3}{3}$ on this number line?

$\frac{0}{3}$ is the point zero whereas since $\frac{3}{3}$ is 1 whole, it can be shown by the point 1 (as shown in Fig 7.7)

So if we have to show $\frac{3}{7}$ on a number line, then, into how many equal parts should the length between 0 and 1 be divided? If P shows $\frac{3}{7}$ then how many equal divisions lie between 0 and P? Where do $\frac{0}{7}$ and $\frac{7}{7}$ lie?

Try These

1. Show $\frac{3}{5}$ on a number line.
2. Show $\frac{1}{10}$, $\frac{0}{10}$, $\frac{5}{10}$ and $\frac{10}{10}$ on a number line.
3. Can you show any other fraction between 0 and 1?
   Write five more fractions that you can show and depict them on the number line.
4. How many fractions lie between 0 and 1? Think, discuss and write your answer?

7.4 Proper Fractions

You have now learnt how to locate fractions on a number line. Locate the fractions $\frac{3}{4}, \frac{1}{2}, \frac{9}{10}, \frac{0}{3}, \frac{5}{8}$ on separate number lines.

Does any one of the fractions lie beyond 1?

All these fractions lie to the left of 1as they are less than 1.

In fact, all the fractions we have learnt so far are less than 1. These are **proper fractions**. A proper fraction as Farida said (Sec. 7.1), is a number representing part of a whole. In a proper fraction the denominator shows the number of parts into which the whole is divided and the numerator shows the number of parts which have been considered. Therefore, in a proper fraction the numerator is always less than the denominator.

Try These

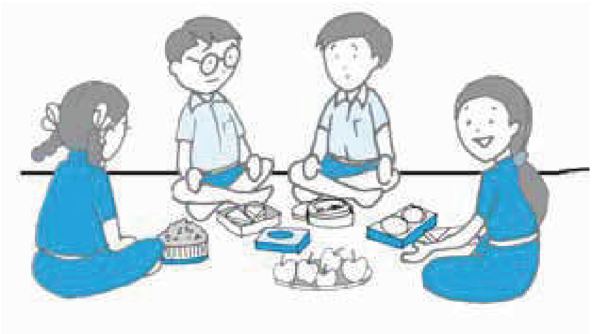
1. Give a proper fraction :
   (a) whose numerator is 5 and denominator is 7.
   (b) whose denominator is 9 and numerator is 5.
   (c) whose numerator and denominator add up to 10. How many fractions of this kind can you make?
   (d) whose denominator is 4 more than the numerator.
   (Give any five. How many more can you make?)
2. A fraction is given.
   How will you decide, by just looking at it, whether, the fraction is
   (a) less than 1?
   (b) equal to 1?
3. Fill up using one of these : '>', '<' or '='

   (a) $\frac{1}{2} \square 1$ (b) $\frac{3}{5} \square 1$ (c) $1 \square \frac{7}{8}$ (d) $\frac{4}{4} \square 1$ (e) $\frac{2005}{2005} \square 1$

7.5 Improper and Mixed Fractions

Anagha, Ravi, Reshma and John shared their tiffin. Along with their food, they had also, brought 5 apples. After eating the other food, the four friends wanted to eat apples.

How can they share five apples among four of them?



Anagha said, 'Let each of us have one full apple and a quarter of the fifth apple.'

Reshma said, 'That is fine, but we can also divide each of the five apples into 4 equal parts and take one-quarter from each apple.'

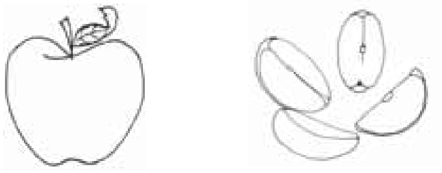
Ravi said, 'In both the ways of sharing each of us would get the same share, i.e., 5 quarters. Since 4 quarters make one whole, we can also say that each of us would get 1 whole and one quarter. The value of each share would be five divided by four. Is it written as $5 \div 4$?' John said, 'Yes the same as $\frac{5}{4}$'. Reshma added that in $\frac{5}{4}$, the numerator is bigger than the denominator. The fractions, where the numerator is bigger than the denominator are called **improper fractions.**

Thus, fractions like $\frac{3}{2}, \frac{12}{7}, \frac{18}{5}$ are all improper fractions.

1. Write five improper fractions with denominator 7.
2. Write five improper fractions with numerator 11.

Ravi reminded John, 'What is the other way of writing the share? Does it follow from Anagha's way of dividing 5 apples?'

John nodded, 'Yes, It indeed follows from Anagha's way. In her way, each share is one whole and one quarter. It is $1+\frac{1}{4}$ and written in short as $1\frac{1}{4}$. Remember, $1\frac{1}{4}$ is the same as $\frac{5}{4}$'.


This is 1 (one)

Each of these is $\frac{1}{4}$ (one-fourth)

Fig 7.8

Recall the pooris eaten by Farida. She got $2\frac{1}{2}$ poories (Fig 7.9), i.e.

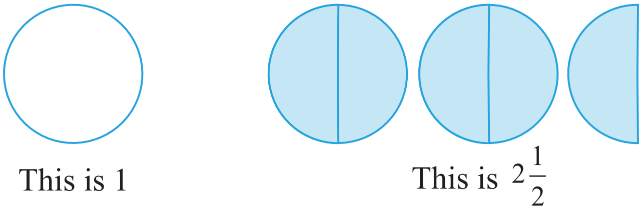


Fig 7.9

How many shaded halves are there in $2\frac{1}{2}$? There are 5 shaded halves.

So, the fraction can also be written as $\frac{5}{2}$. $2\frac{1}{2}$ is the same as $\frac{5}{2}$.

Fractions such as $1\frac{1}{4}$ and $2\frac{1}{2}$ are called **Mixed Fractions**. A mixed fraction has a combination of a whole and a part.

Do you know?

The grip-sizes of tennis racquets are often in mixed numbers. For example one size is '$3\frac{7}{8}$ inches' and '$4\frac{3}{8}$ inches' is another.

Where do you come across mixed fractions? Give some examples.

Example 1 : Express the following as mixed fractions :

(a) $\frac{17}{4}$ (b) $\frac{11}{3}$ (c) $\frac{27}{5}$ (d) $\frac{7}{3}$

Solution : (a) $\frac{17}{4}$

$$\begin{array}{r|l} & 4 \\ 4 & 17 \\ - & 16 \\ \hline & 1 \\ \hline \end{array}$$

i.e. 4 whole and $\frac{1}{4}$ more, or $4\frac{1}{4}$

(b) $\frac{11}{3}$

$$\begin{array}{r|l} & 3 \\ 3 & 11 \\ - & 9 \\ \hline & 2 \\ \hline \end{array}$$

i.e. 3 whole and $\frac{2}{3}$ more, or $3\frac{2}{3}$

$$\left[\textit{Alternatively}, \frac{11}{3} = \frac{9+2}{3} = \frac{9}{3} + \frac{2}{3} = 3 + \frac{2}{3} = 3\frac{2}{3}\right]$$

Try (c) and (d) using both the methods for yourself.

Thus, we can express an improper fraction as a mixed fraction by dividing the numerator by denominator to obtain the quotient and the remainder. Then the mixed fraction will be written as $\text{Quotient}\dfrac{\text{Remainder}}{\text{Divisor}}$.

Example 2 : Express the following mixed fractions as improper fractions:

(a) $2\frac{3}{4}$ (b) $7\frac{1}{9}$ (c) $5\frac{3}{7}$

Solution : (a) $2\frac{3}{4} = 2 + \frac{3}{4} = \frac{2 \times 4}{4} + \frac{3}{4} = \frac{11}{4}$

(b) $7\frac{1}{9} = \frac{(7 \times 9) + 1}{9} = \frac{64}{9}$

(c) $5\frac{3}{7} = \frac{(5 \times 7) + 3}{7} = \frac{38}{7}$

Thus, we can express a mixed fraction as an improper fraction as $\dfrac{(\text{Whole} \times \text{Denominator}) + \text{Numerator}}{\text{Denominator}}$.

EXERCISE 7.2

1. Draw number lines and locate the points on them :

(a) $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{4}{4}$ (b) $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{7}{8}$ (c) $\frac{2}{5}, \frac{3}{5}, \frac{8}{5}, \frac{4}{5}$

2. Express the following as mixed fractions :

(a) $\frac{20}{3}$ (b) $\frac{11}{5}$ (c) $\frac{17}{7}$

(d) $\frac{28}{5}$ (e) $\frac{19}{6}$ (f) $\frac{35}{9}$

3. Express the following as improper fractions :

(a) $7\frac{3}{4}$ (b) $5\frac{6}{7}$ (c) $2\frac{5}{6}$ (d) $10\frac{3}{5}$ (e) $9\frac{3}{7}$ (f) $8\frac{4}{9}$

7.6 Equivalent Fractions

Look at all these representations of fraction (Fig 7.10).

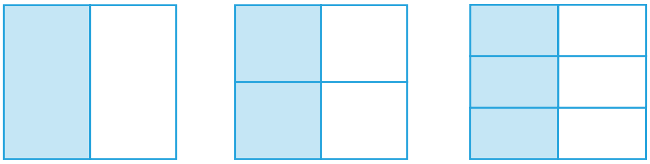
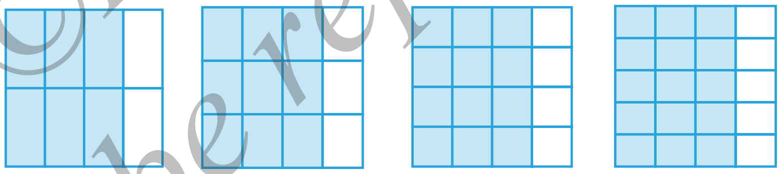


Fig 7.10

These fractions are $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}$, representing the parts taken from the total number of parts. If we place the pictorial representation of one over the other they are found to be equal. Do you agree?

Try These

1. Are $\frac{1}{3}$ and $\frac{2}{7}$; $\frac{2}{5}$ and $\frac{2}{7}$; $\frac{2}{9}$ and $\frac{6}{27}$ equivalent? Give reason.
2. Give example of four equivalent fractions.
3. Identify the fractions in each. Are these fractions equivalent?



These fractions are called **equivalent fractions**. Think of three more fractions that are equivalent to the above fractions.

Understanding equivalent fractions

$\frac{1}{2}, \frac{2}{4}, \frac{3}{6}, \ldots, \frac{36}{72}, \ldots$, are all equivalent fractions. They represent the same part of a whole.

Think, discuss and write

Why do the equivalent fractions represent the same part of a whole? How can we obtain one from the other?

We note $\frac{1}{2} = \frac{2}{4} = \frac{1 \times 2}{2 \times 2}$. Similarly, $\frac{1}{2} = \frac{3}{6} = \frac{1 \times 3}{2 \times 3} = \frac{1}{2}$ and $\frac{1}{2} = \frac{4}{8} = \frac{1 \times 4}{2 \times 4}$

To find an equivalent fraction of a given fraction, you may multiply both the numerator and the denominator of the given fraction by the same number.

Rajni says that equivalent fractions of $\frac{1}{3}$ are :

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

Do you agree with her? Explain.

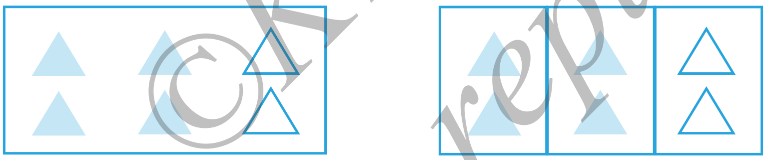
Try These

1. Find five equivalent fractions of each of the following:

   (i) $\frac{2}{3}$ (ii) $\frac{1}{5}$ (iii) $\frac{3}{5}$ (iv) $\frac{5}{9}$

Another way

Is there any other way to obtain equivalent fractions? Look at Fig 7.11.



$\frac{4}{6}$ is shaded here. $\frac{2}{3}$ is shaded here.

Fig 7.11

These include equal number of shaded things i.e. $\frac{4}{6}=\frac{2}{3}=\frac{4\div2}{6\div2}$

To find an equivalent fraction, we may divide both the numerator and the denominator by the same number.

One equivalent fraction of $\frac{12}{15}$ is $\frac{12\div3}{15\div3}=\frac{4}{5}$

Can you find an equivalent fraction of $\frac{9}{15}$ having denominator 5 ?

Example 3 : Find the equivalent fraction of $\frac{2}{5}$ with numerator 6.

Solution : We know 2 × 3 = 6. This means we need to multiply both the numerator and the denominator by 3 to get the equivalent fraction.

Hence, $\frac{2}{5}=\frac{2\times3}{5\times3}=\frac{6}{15}$; $\frac{6}{15}$ is the required equivalent fraction.

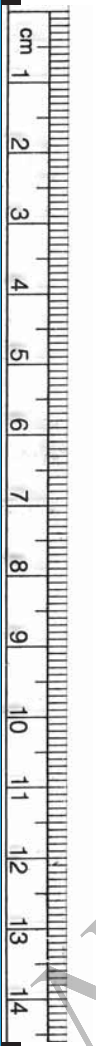
Can you show this pictorially?

Example 4 : Find the equivalent fraction of $\frac{15}{35}$ with denominator 7.

Solution : We have $\frac{15}{35}=\frac{\square}{7}$

We observe the denominator and find 35 ÷ 5 = 7. We, therefore, divide both the numerator and the denominator of $\frac{15}{35}$ by 5.

Thus, $\frac{15}{35}=\frac{15\div5}{35\div5}=\frac{3}{7}$.



An interesting fact

Let us now note an interesting fact about equivalent fractions. For this, complete the given table. The first two rows have already been completed for you.

Equivalent fractions	Product of the numerator of the 1st and the denominator of the 2nd	Product of the numerator of the 2nd and the denominator of the 1st	Are the products equal?
$\frac{1}{3}=\frac{3}{9}$	1 × 9 = 9	3 × 3 = 9	Yes
$\frac{4}{5}=\frac{28}{35}$	4 × 35 = 140	5 × 28 = 140	Yes
$\frac{1}{4}=\frac{4}{16}$			
$\frac{2}{3}=\frac{10}{15}$			
$\frac{3}{7}=\frac{24}{56}$			

What do we infer? The product of the numerator of the first and the denominator of the second is equal to the product of denominator of the first and the numerator of the second in all these cases. These two products are called cross products. Work out the cross products for other pairs of equivalent fractions. Do you find any pair of fractions for which cross products are not equal? This rule is helpful in finding equivalent fractions.

Example 5 : Find the equivalent fraction of $\frac{2}{9}$ with denominator 63.

Solution : We have $\frac{2}{9} = \frac{\square}{63}$

For this, we should have, $9 \times \square = 2 \times 63$.

But $63 = 7 \times 9$, so $9 \times \square = 2 \times 7 \times 9 = 14 \times 9 = 9 \times 14$

or $9 \times \square = 9 \times 14$

By comparison, $\square = 14$. Therefore, $\frac{2}{9} = \frac{14}{63}$.

7.7 Simplest Form of a Fraction

Given the fraction $\frac{36}{54}$, let us try to get an equivalent fraction in which the numerator and the denominator have no common factor except 1.

How do we do it? We see that both 36 and 54 are divisible by 2.

$$\frac{36}{54} = \frac{36 \div 2}{54 \div 2} = \frac{18}{27}$$

But 18 and 27 also have common factors other than one.

The common factors are 1, 3, 9; the highest is 9.

Therefore, $\frac{18}{27} = \frac{18 \div 9}{27 \div 9} = \frac{2}{3}$

Now 2 and 3 have no common factor except 1; we say that the fraction $\frac{2}{3}$ is in the simplest form.

A fraction is said to be in the simplest (or lowest) form if its numerator and denominator have no common factor except 1.

The shortest way

The shortest way to find the equivalent fraction in the simplest form is to find the HCF of the numerator and denominator, and then divide both of them by the HCF.

A Game

The equivalent fractions given here are quite interesting. Each one of them uses all the digits from 1 to 9 once!

$$\frac{2}{6} = \frac{3}{9} = \frac{58}{174}$$

$$\frac{2}{4} = \frac{3}{6} = \frac{79}{158}$$

Try to find two more such equivalent fractions.

Consider $\frac{36}{24}$.

The HCF of 36 and 24 is 12.

Therefore, $\frac{36}{24} = \frac{36 \div 12}{24 \div 12} = \frac{3}{2}$. The fraction $\frac{3}{2}$ is in the lowest form.

Thus, HCF helps us to reduce a fraction to its lowest form.

Try These

1. Write the simplest form of :

   (i) $\frac{15}{75}$ (ii) $\frac{16}{72}$

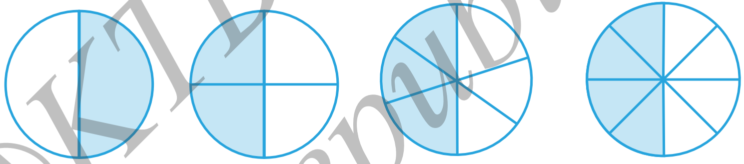
   (iii) $\frac{17}{51}$ (iv) $\frac{42}{28}$ (v) $\frac{80}{24}$

2. Is $\frac{49}{64}$ in its simplest form?

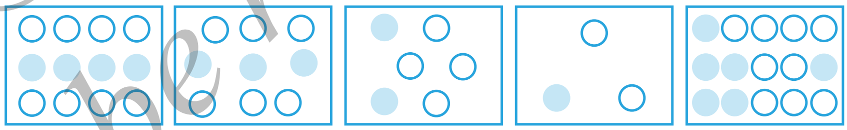
EXERCISE 7.3

1. Write the fractions. Are all these fractions equivalent?

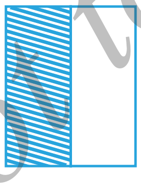
(a)



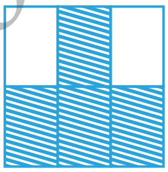
(b)



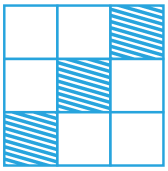
2. Write the fractions and pair up the equivalent fractions from each row.



(a)



(b)



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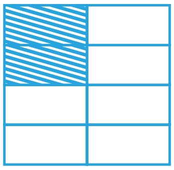
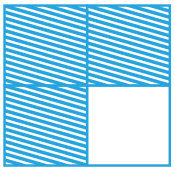
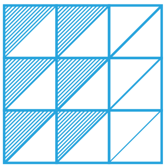


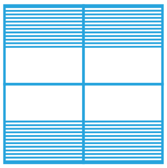
(d)



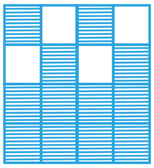
(e)



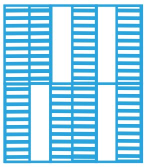
(i)



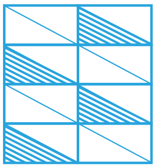
(ii)



(iii)



(iv)



(v)

3. Replace $\square$ in each of the following by the correct number :

(a) $\frac{2}{7} = \frac{8}{\square}$ (b) $\frac{5}{8} = \frac{10}{\square}$ (c) $\frac{3}{5} = \frac{\square}{20}$ (d) $\frac{45}{60} = \frac{15}{\square}$ (e) $\frac{18}{24} = \frac{\square}{4}$

4. Find the equivalent fraction of $\frac{3}{5}$ having

(a) denominator 20 (b) numerator 9

(c) denominator 30 (d) numerator 27

5. Find the equivalent fraction of $\frac{36}{48}$ with

(a) numerator 9 (b) denominator 4

6. Check whether the given fractions are equivalent :

(a) $\frac{5}{9}, \frac{30}{54}$ (b) $\frac{3}{10}, \frac{12}{50}$ (c) $\frac{7}{13}, \frac{5}{11}$

7. Reduce the following fractions to simplest form :

(a) $\frac{48}{60}$ (b) $\frac{150}{60}$ (c) $\frac{84}{98}$ (d) $\frac{12}{52}$ (e) $\frac{7}{28}$

8. Ramesh had 20 pencils, Sheelu had 50 pencils and Jamaal had 80 pencils. After 4 months, Ramesh used up 10 pencils, Sheelu used up 25 pencils and Jamaal used up 40 pencils. What fraction did each use up? Check if each has used up an equal fraction of her/his pencils?

9. Match the equivalent fractions and write two more for each.

(i) $\frac{250}{400}$	(a) $\frac{2}{3}$	(iv) $\frac{180}{360}$	(d) $\frac{5}{8}$
(ii) $\frac{180}{200}$	(b) $\frac{2}{5}$	(v) $\frac{220}{550}$	(e) $\frac{9}{10}$
(iii) $\frac{660}{990}$	(c) $\frac{1}{2}$		

7.8 Like Fractions

Fractions with same denominators are called **like fractions**.

Thus, $\frac{1}{15}, \frac{2}{15}, \frac{3}{15}, \frac{8}{15}$ are all like fractions. Are $\frac{7}{27}$ and $\frac{7}{28}$ like fractions?

Their denominators are different. Therefore, they are not like fractions. They are called **unlike fractions**.

Write five pairs of like fractions and five pairs of unlike fractions.

7.9 Comparing Fractions

Sohni has $3\frac{1}{2}$ rotis in her plate and Rita has $2\frac{3}{4}$ rotis in her plate. Who has more rotis in her plate? Clearly, Sohni has 3 full rotis and more and Rita has less than 3 rotis. So, Sohni has more rotis.

Consider $\frac{1}{2}$ and $\frac{1}{3}$ as shown in Fig. 7.12. The portion of the whole corresponding to $\frac{1}{2}$ is clearly larger than the portion of the same whole corresponding to $\frac{1}{3}$.

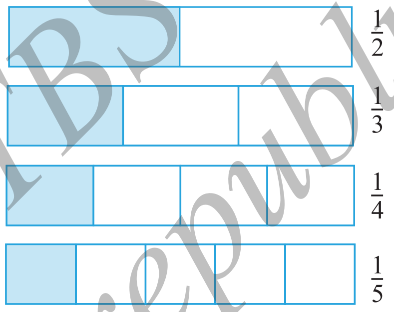


Fig 7.12

So $\frac{1}{2}$ is greater than $\frac{1}{3}$.

But often it is not easy to say which one out of a pair of fractions is larger. For example, which is greater, $\frac{1}{4}$ or $\frac{3}{10}$? For this, we may wish to show the fractions using figures (as in fig. 7.12), but drawing figures may not be easy especially with denominators like 13. We should therefore like to have a systematic procedure to compare fractions. It is particularly easy to compare like fractions. We do this first.

Try These

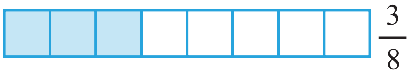
1. You get one-fifth of a bottle of juice and your sister gets one-third of the same size of a bottle of juice. Who gets more?

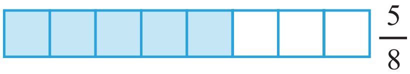
7.9.1 Comparing like fractions

Like fractions are fractions with the same denominator. Which of these are like fractions?

$\frac{2}{5}, \frac{3}{4}, \frac{1}{5}, \frac{7}{2}, \frac{3}{5}, \frac{4}{5}, \frac{4}{7}$

Let us compare two like fractions: $\frac{3}{8}$ and $\frac{5}{8}$.





In both the fractions the whole is divided into 8 equal parts. For $\frac{3}{8}$ and $\frac{5}{8}$, we take 3 and 5 parts respectively out of the 8 equal parts. Clearly, out of 8 equal parts, the portion corresponding to 5 parts is larger than the portion corresponding to 3 parts. Hence, $\frac{5}{8} > \frac{3}{8}$. Note the number of the parts taken is given by the numerator. It is, therefore, clear that for two fractions with the same denominator, the fraction with the greater numerator is greater. Between $\frac{4}{5}$ and $\frac{3}{5}$, $\frac{4}{5}$ is greater. Between $\frac{11}{20}$ and $\frac{13}{20}$, $\frac{13}{20}$ is greater and so on.

Try These

1. Which is the larger fraction?

   (i) $\frac{7}{10}$ or $\frac{8}{10}$ (ii) $\frac{11}{24}$ or $\frac{13}{24}$ (iii) $\frac{17}{102}$ or $\frac{12}{102}$

   Why are these comparisons easy to make?

2. Write these in ascending and also in descending order.

   (a) $\frac{1}{8}, \frac{5}{8}, \frac{3}{8}$ (b) $\frac{1}{5}, \frac{11}{5}, \frac{4}{5}, \frac{3}{5}, \frac{7}{5}$ (c) $\frac{1}{7}, \frac{3}{7}, \frac{13}{7}, \frac{11}{7}, \frac{7}{7}$

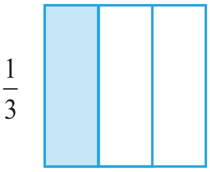
7.9.2 Comparing unlike fractions

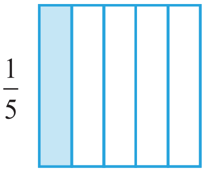
Two fractions are unlike if they have different denominators. For example, $\frac{1}{3}$ and $\frac{1}{5}$ are unlike fractions. So are $\frac{2}{3}$ and $\frac{3}{5}$.

Unlike fractions with the same numerator :

Consider a pair of unlike fractions $\frac{1}{3}$ and $\frac{1}{5}$, in which the numerator is the same.

Which is greater $\frac{1}{3}$ or $\frac{1}{5}$?





In $\frac{1}{3}$, we divide the whole into 3 equal parts and take one. In $\frac{1}{5}$, we divide the whole into 5 equal parts and take one. Note that in $\frac{1}{3}$, the whole is divided into a smaller number of parts than in $\frac{1}{5}$. The equal part that we get in $\frac{1}{3}$ is, therefore, larger than the equal part we get in $\frac{1}{5}$. Since in both cases we take the same number of parts (i.e. one), the portion of the whole showing $\frac{1}{3}$ is larger than the portion showing $\frac{1}{5}$, and therfore $\frac{1}{3} > \frac{1}{5}$.

In the same way we can say $\frac{2}{3} > \frac{2}{5}$. In this case, the situation is the same as in the case above, except that the common numerator is 2, not 1. The whole is divided into a large number of equal parts for $\frac{2}{5}$ than for $\frac{2}{3}$. Therefore, each equal part of the whole in case of $\frac{2}{3}$ is larger than that in case of $\frac{2}{5}$. Therefore, the portion of the whole showing $\frac{2}{3}$ is larger than the portion showing $\frac{2}{5}$ and hence, $\frac{2}{3} > \frac{2}{5}$.

We can see from the above example that **if the numerator is the same in two fractions, the fraction with the smaller denominator is greater of the two**.

Thus, $\frac{1}{8} > \frac{1}{10}$, $\frac{3}{5} > \frac{3}{7}$, $\frac{4}{9} > \frac{4}{11}$ and so on.

Let us arrange $\frac{2}{1}, \frac{2}{13}, \frac{2}{9}, \frac{2}{5}, \frac{2}{7}$ in increasing order. All these fractions are unlike, but their numerator is the same. Hence, in such case, the larger the denominator, the smaller is the fraction. The smallest is $\frac{2}{13}$, as it has the largest denominator. The next three fractions in order are $\frac{2}{9}, \frac{2}{7}, \frac{2}{5}$. The greatest fraction is $\frac{2}{1}$ (It is with the smallest denominator). The arrangement in increasing order, therefore, is $\frac{2}{13}, \frac{2}{9}, \frac{2}{7}, \frac{2}{5}, \frac{2}{1}$.

Try These

1. Arrange the following in ascending and descending order :

   (a) $\frac{1}{12}, \frac{1}{23}, \frac{1}{5}, \frac{1}{7}, \frac{1}{50}, \frac{1}{9}, \frac{1}{17}$

   (b) $\frac{3}{7}, \frac{3}{11}, \frac{3}{5}, \frac{3}{2}, \frac{3}{13}, \frac{3}{4}, \frac{3}{17}$

   (c) Write 3 more similar examples and arrange them in ascending and descending order.

Suppose we want to compare $\frac{2}{3}$ and $\frac{3}{4}$. Their numerators are different and so are their denominators. We know how to compare like fractions, i.e. fractions with the same denominator. We should, therefore, try to change the denominators of the given fractions, so that they become equal. For this purpose, we can use the method of equivalent fractions which we already know. Using this method we can change the denominator of a fraction without changing its value.

Let us find equivalent fractions of both $\frac{2}{3}$ and $\frac{3}{4}$.

$\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15} = ...$ Similarly, $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{12}{16} = ...$

The equivalent fractions of $\frac{2}{3}$ and $\frac{3}{4}$ with the same denominator 12 are $\frac{8}{12}$ and $\frac{9}{12}$ repectively.

i.e. $\frac{2}{3} = \frac{8}{12}$ and $\frac{3}{4} = \frac{9}{12}$. Since, $\frac{9}{12} > \frac{8}{12}$ we have, $\frac{3}{4} > \frac{2}{3}$.

Example 6 : Compare $\frac{4}{5}$ and $\frac{5}{6}$.

Solution : The fractions are unlike fractions. Their numerators are different too. Let us write their equivalent fractions.

$$\frac{4}{5} = \frac{8}{10} = \frac{12}{15} = \frac{16}{20} = \frac{20}{25} = \frac{24}{30} = \frac{28}{35} = ...$$

and $\frac{5}{6} = \frac{10}{12} = \frac{15}{18} = \frac{20}{24} = \frac{25}{30} = \frac{30}{36} = ...$

The equivalent fractions with the same denominator are :

$$\frac{4}{5}=\frac{24}{30} \text{ and } \frac{5}{6}=\frac{25}{30}$$

Since, $\frac{25}{30}>\frac{24}{30}$ so, $\frac{5}{6}>\frac{4}{5}$

Note that the common denominator of the equivalent fractions is 30 which is 5 × 6. It is a common multiple of both 5 and 6.

So, when we compare two unlike fractions, we first get their equivalent fractions with a denominator which is a common multiple of the denominators of both the fractions.

Example 7 : Compare $\frac{5}{6}$ and $\frac{13}{15}$.

Solution : The fractions are unlike. We should first get their equivalent fractions with a denominator which is a common multiple of 6 and 15.

Now, $\frac{5\times5}{6\times5}=\frac{25}{30}, \frac{13\times2}{15\times2}=\frac{26}{30}$

Since $\frac{26}{30}>\frac{25}{30}$ we have $\frac{13}{15}>\frac{5}{6}$.

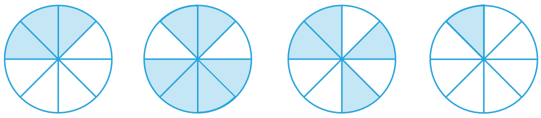
Why LCM?

The product of 6 and 15 is 90; obviously 90 is also a common multiple of 6 and 15. We may use 90 instead of 30; it will not be wrong. But we know that it is easier and more convenient to work with smaller numbers. So the common multiple that we take is as small as possible. This is why the LCM of the denominators of the fractions is preferred as the common denominator.

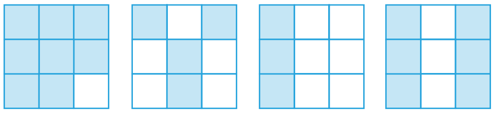
EXERCISE 7.4

1. Write shaded portion as fraction. Arrange them in ascending and descending order using correct sign '<', '=', '>' between the fractions:

(a)



(b)



(c) Show $\frac{2}{6}$, $\frac{4}{6}$, $\frac{8}{6}$ and $\frac{6}{6}$ on the number line. Put appropriate signs between the fractions given.

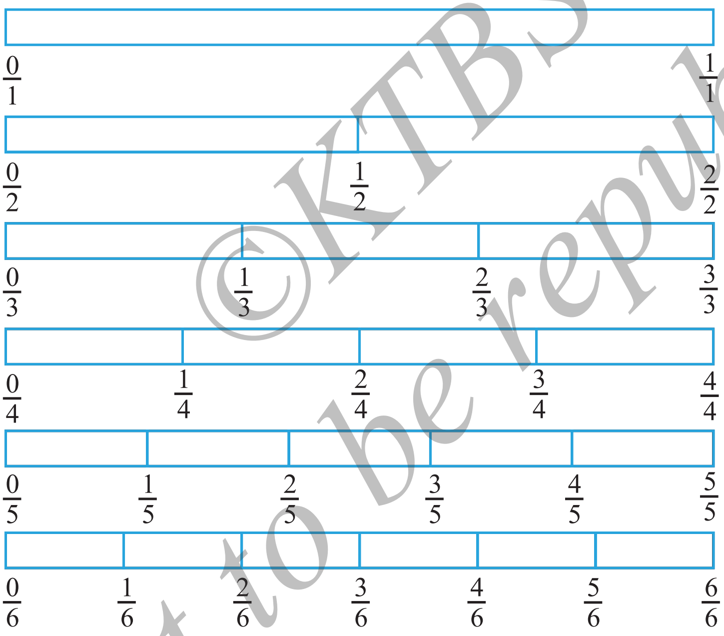
$\frac{5}{6}\square\frac{2}{6}$, $\frac{3}{6}\square 0$, $\frac{1}{6}\square\frac{6}{6}$, $\frac{8}{6}\square\frac{5}{6}$

2. Compare the fractions and put an appropriate sign.

(a) $\frac{3}{6}\square\frac{5}{6}$ (b) $\frac{1}{7}\square\frac{1}{4}$ (c) $\frac{4}{5}\square\frac{5}{5}$ (d) $\frac{3}{5}\square\frac{3}{7}$

3. Make five more such pairs and put appropriate signs.

4. Look at the figures and write '<' or '>', '=' between the given pairs of fractions.



(a) $\frac{1}{6}\square\frac{1}{3}$ (b) $\frac{3}{4}\square\frac{2}{6}$ (c) $\frac{2}{3}\square\frac{2}{4}$ (d) $\frac{6}{6}\square\frac{3}{3}$ (e) $\frac{5}{6}\square\frac{5}{5}$

Make five more such problems and solve them with your friends.

5. How quickly can you do this? Fill appropriate sign. ('<', '=', '>')

(a) $\frac{1}{2}\square\frac{1}{5}$, (b) $\frac{2}{4}\square\frac{3}{6}$, (c) $\frac{3}{5}\square\frac{2}{3}$

(d) $\frac{3}{4}\square\frac{2}{8}$, (e) $\frac{3}{5}\square\frac{6}{5}$, (f) $\frac{7}{9}\square\frac{3}{9}$

(g) $\frac{1}{4}\square\frac{2}{8}$, (h) $\frac{6}{10}\square\frac{4}{5}$, (i) $\frac{3}{4}\square\frac{7}{8}$

(j) $\frac{6}{10}\square\frac{3}{5}$, (k) $\frac{5}{7}\square\frac{15}{21}$

6. The following fractions represent just three different numbers. Separate them into three groups of equivalent fractions, by changing each one to its simplest form.

   (a) $\frac{2}{12}$ (b) $\frac{3}{15}$ (c) $\frac{8}{50}$ (d) $\frac{16}{100}$ (e) $\frac{10}{60}$ (f) $\frac{15}{75}$

   (g) $\frac{12}{60}$ (h) $\frac{16}{96}$ (i) $\frac{12}{75}$ (j) $\frac{12}{72}$ (k) $\frac{3}{18}$ (l) $\frac{4}{25}$

7. Find answers to the following. Write and indicate how you solved them.

   (a) Is $\frac{5}{9}$ equal to $\frac{4}{5}$? (b) Is $\frac{9}{16}$ equal to $\frac{5}{9}$?

   (c) Is $\frac{4}{5}$ equal to $\frac{16}{20}$? (d) Is $\frac{1}{15}$ equal to $\frac{4}{30}$?

8. Ila read 25 pages of a book containing 100 pages. Lalita read $\frac{2}{5}$ of the same book. Who read less?

9. Rafiq exercised for $\frac{3}{6}$ of an hour, while Rohit exercised for $\frac{3}{4}$ of an hour. Who exercised for a longer time?

10. In a class A of 25 students, 20 passed with 60% or more marks; in another class B of 30 students, 24 passed with 60% or more marks. In which class was a greater fraction of students getting with 60% or more marks?

7.10 Addition and Subtraction of Fractions

So far in our study we have learnt about natural numbers, whole numbers and then integers. In the present chapter, we are learning about fractions, a different type of numbers.

Whenever we come across new type of numbers, we want to know how to operate with them. Can we combine and add them? If so, how? Can we take away some number from another? i.e., can we subtract one from the other? and so on. Which of the properties learnt earlier about the numbers hold now? Which are the new properties? We also see how these help us deal with our daily life situations.

Try These

1. My mother divided an apple into 4 equal parts. She gave me two parts and my brother one part. How much apple did she give to both of us together?
2. Mother asked Neelu and her brother to pick stones from the wheat. Neelu picked one fourth of the total stones in it and her brother also picked up one fourth of the stones. What fraction of the stones did both pick up together?
3. Sohan was putting covers on his note books. He put one fourth of the covers on Monday. He put another one fourth on Tuesday and the remaining on Wednesday. What fraction of the covers did he put on Wednesday?

Look at the following examples: A tea stall owner consumes in her shop $2\frac{1}{2}$ litres of milk in the morning and $1\frac{1}{2}$ litres of milk in the evening in preparing tea. What is the total amount of milk she uses in the stall?

Or Shekhar ate 2 chapatis for lunch and $1\frac{1}{2}$ chapatis for dinner. What is the total number of chapatis he ate?

Clearly, both the situations require the fractions to be added. Some of these additions can be done orally and the sum can be found quite easily.

Do This

Make five such problems with your friends and solve them.

7.10.1 Adding or subtracting like fractions

All fractions cannot be added orally. We need to know how they can be added in different situations and learn the procedure for it. We begin by looking at addition of like fractions.

Take a 7 × 4 grid sheet (Fig 7.13). The sheet has seven boxes in each row and four boxes in each column.

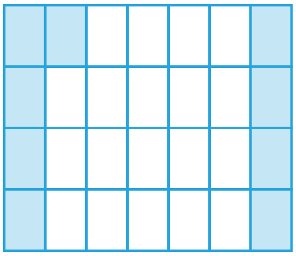


Fig 7.13

How many boxes are there in total?

Colour five of its boxes in green.

What fraction of the whole is the green region?

Now colour another four of its boxes in yellow.

What fraction of the whole is this yellow region?

What fraction of the whole is coloured altogether?

Does this explain that $\frac{5}{28} + \frac{4}{28} = \frac{9}{28}$?

Look at more examples

In Fig 7.14 (i) we have 2 quarter parts of the figure shaded. This means we have 2 parts out of 4 shaded or $\frac{1}{2}$ of the figure shaded.

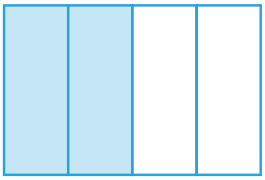


Fig. 7.14 (i)

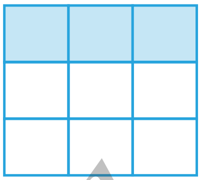


Fig. 7.14 (ii)

That is, $\frac{1}{4}+\frac{1}{4}=\frac{1+1}{4}=\frac{2}{4}=\frac{1}{2}$.

Look at Fig 7.14 (ii)

Fig 7.14 (ii) demonstrates $\frac{1}{9}+\frac{1}{9}+\frac{1}{9}=\frac{1+1+1}{9}=\frac{3}{9}=\frac{1}{3}$.

What do we learn from the above examples? The sum of two or more like fractions can be obtained as follows :

Step 1 Add the numerators.

Step 2 Retain the (common) denominator.

Step 3 Write the fraction as : $\frac{\text{Result of Step 1}}{\text{Result of Step 2}}$

Try These

1. Add with the help of a diagram.
   (i) $\frac{1}{8}+\frac{1}{8}$ (ii) $\frac{2}{5}+\frac{3}{5}$ (iii) $\frac{1}{6}+\frac{1}{6}+\frac{1}{6}$
2. Add $\frac{1}{12}+\frac{1}{12}$. How will we show this pictorially? Using paper folding?
3. Make 5 more examples of problems given in 1 and 2 above.
   Solve them with your friends.

Let us, thus, add $\frac{3}{5}$ and $\frac{1}{5}$.

We have $\frac{3}{5}+\frac{1}{5}=\frac{3+1}{5}=\frac{4}{5}$

So, what will be the sum of $\frac{7}{12}$ and $\frac{3}{12}$?

Finding the balance

Sharmila had $\frac{5}{6}$ of a cake. She gave $\frac{2}{6}$ out of that to her younger brother. How much cake is left with her?

A diagram can explain the situation (Fig 7.15). (Note that, here the given fractions are like fractions).

We find that $\frac{5}{6}-\frac{2}{6}=\frac{5-2}{6}=\frac{3}{6}$ or $\frac{1}{2}$

Fig 7.15

(Is this not similar to the method of adding like fractions?)

Thus, we can say that the difference of two like fractions can be obtained as follows:

Step 1 Subtract the smaller numerator from the bigger numerator.

Step 2 Retain the (common) denominator.

Step 3 Write the fraction as : $\dfrac{\text{Result of Step 1}}{\text{Result of Step 2}}$

Can we now subtract $\dfrac{3}{10}$ from $\dfrac{8}{10}$?

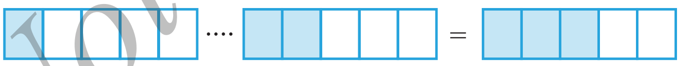
Try These

1. Find the difference between $\dfrac{7}{8}$ and $\dfrac{3}{8}$.
2. Mother made a gud patti in a round shape. She divided it into 5 parts. Seema ate one piece from it. If I eat another piece then how much would be left?
3. My elder sister divided the watermelon into 16 parts. I ate 7 out them. My friend ate 4. How much did we eat between us? How much more of the watermelon did I eat than my friend? What portion of the watermelon remained?
4. Make five problems of this type and solve them with your friends.

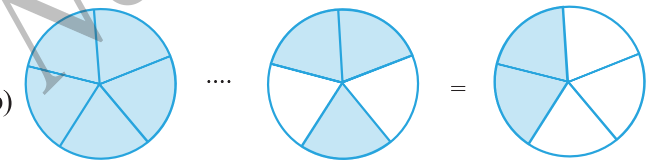
EXERCISE 7.5

1. Write these fractions appropriately as additions or subtractions :

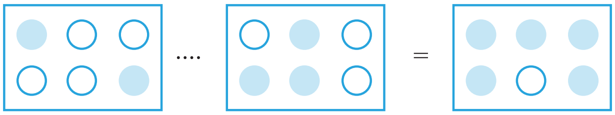
(a)



(b)



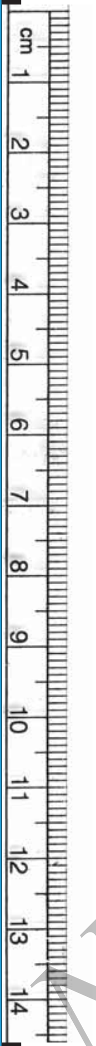
(c)



2. Solve :

(a) $\frac{1}{18}+\frac{1}{18}$ (b) $\frac{8}{15}+\frac{3}{15}$ (c) $\frac{7}{7}-\frac{5}{7}$ (d) $\frac{1}{22}+\frac{21}{22}$ (e) $\frac{12}{15}-\frac{7}{15}$

(f) $\frac{5}{8}+\frac{3}{8}$ (g) $1-\frac{2}{3}\left(1=\frac{3}{3}\right)$ (h) $\frac{1}{4}+\frac{0}{4}$ (i)



3. Shubham painted $\frac{2}{3}$ of the wall space in his room. His sister Madhavi helped and painted $\frac{1}{3}$ of the wall space. How much did they paint together?

4. Fill in the missing fractions.

(a) $\frac{7}{10}-\square=\frac{3}{10}$ (b) $\square-\frac{3}{21}=\frac{5}{21}$ (c) $\square-\frac{3}{6}=\frac{3}{6}$ (d) $\square+\frac{5}{27}=\frac{12}{27}$

5. Javed was given $\frac{5}{7}$ of a basket of oranges. What fraction of oranges was left in the basket?

7.10.2 Adding and subtracting fractions

We have learnt to add and subtract like fractions. It is also not very difficult to add fractions that do not have the same denominator. When we have to add or subtract fractions we first find equivalent fractions with the same denominator and then proceed.

What added to $\frac{1}{5}$ gives $\frac{1}{2}$? This means subtract $\frac{1}{5}$ from $\frac{1}{2}$ to get the required number.

Since $\frac{1}{5}$ and $\frac{1}{2}$ are unlike fractions, in order to subtract them, we first find their equivalent fractions with the same denominator. These are $\frac{2}{10}$ and $\frac{5}{10}$ respectively.

This is because $\frac{1}{2}=\frac{1\times5}{2\times5}=\frac{5}{10}$ and $\frac{1}{5}=\frac{1\times2}{5\times2}=\frac{2}{10}$

Therefore, $\frac{1}{2}-\frac{1}{5}=\frac{5}{10}-\frac{2}{10}=\frac{5-2}{10}=\frac{3}{10}$

Note that 10 is the least common multiple (LCM) of 2 and 5.

Example 8 : Subtract $\frac{3}{4}$ from $\frac{5}{6}$.

Solution : We need to find equivalent fractions of $\frac{3}{4}$ and $\frac{5}{6}$, which have the same denominator. This denominator is given by the LCM of 4 and 6. The required LCM is 12.

Therefore, $\frac{5}{6}-\frac{3}{4}=\frac{5\times 2}{6\times 2}-\frac{3\times 3}{4\times 3}=\frac{10}{12}-\frac{9}{12}=\frac{1}{12}$

Example 9 : Add $\frac{2}{5}$ to $\frac{1}{3}$.

Solution : The LCM of 5 and 3 is 15.

Therefore, $\frac{2}{5}+\frac{1}{3}=\frac{2\times 3}{5\times 3}+\frac{1\times 5}{3\times 5}=\frac{6}{15}+\frac{5}{15}=\frac{11}{15}$

Example 10 : Simplify $\frac{3}{5}-\frac{7}{20}$

Solution : The LCM of 5 and 20 is 20.

Therefore, $\frac{3}{5}-\frac{7}{20}=\frac{3\times 4}{5\times 4}-\frac{7}{20}=\frac{12}{20}-\frac{7}{20}$

$=\frac{12-7}{20}=\frac{5}{20}=\frac{1}{4}$

Try These

1. Add $\frac{2}{5}$ and $\frac{3}{7}$.
2. Subtract $\frac{2}{5}$ from $\frac{5}{7}$.

How do we add or subtract mixed fractions?

Mixed fractions can be written either as a whole part plus a proper fraction or entirely as an improper fraction. One way to add (or subtract) mixed fractions is to do the operation seperately for the whole parts and the other way is to write the mixed fractions as improper fractions and then directly add (or subtract) them.

Example 11 : Add $2\frac{4}{5}$ and $3\frac{5}{6}$

Solution : $2\frac{4}{5}+3\frac{5}{6}=2+\frac{4}{5}+3+\frac{5}{6}=5+\frac{4}{5}+\frac{5}{6}$

Now $\frac{4}{5}+\frac{5}{6}=\frac{4\times 6}{5\times 6}+\frac{5\times 5}{6\times 5}$ (Since LCM of 5 and 6 = 30)

$=\frac{24}{30}+\frac{25}{30}=\frac{49}{30}=\frac{30+19}{30}=1+\frac{19}{30}$

Thus, $5+\frac{4}{5}+\frac{5}{6}=5+1+\frac{19}{30}=6+\frac{19}{30}=6\frac{19}{30}$

And, therefore, $2\frac{4}{5}+3\frac{5}{6}=6\frac{19}{30}$

Think, discuss and write

Can you find the other way of doing this sum?

Example 12 : Find $4\frac{2}{5}-2\frac{1}{5}$

Solution : The whole numbers 4 and 2 and the fractional numbers $\frac{2}{5}$ and $\frac{1}{5}$ can be subtracted separately. (Note that $4 > 2$ and $\frac{2}{5} > \frac{1}{5}$)

$$\text{So, } 4\frac{2}{5}-2\frac{1}{5}=(4-2)+\left(\frac{2}{5}-\frac{1}{5}\right)=2+\frac{1}{5}=2\frac{1}{5}$$

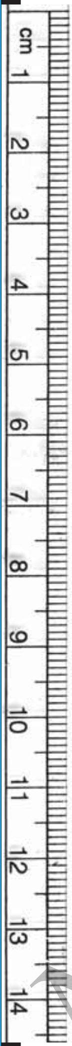
Example 13 : Simplify: $8\frac{1}{4}-2\frac{5}{6}$

Solution : Here $8 > 2$ but $\frac{1}{4} < \frac{5}{6}$. We proceed as follows:

$$8\frac{1}{4}=\frac{(8\times4)+1}{4}=\frac{33}{4} \text{ and } 2\frac{5}{6}=\frac{2\times6+5}{6}=\frac{17}{6}$$

$$\text{Now, } \frac{33}{4}-\frac{17}{6}=\frac{33\times3}{12}-\frac{17\times2}{12} \quad \text{(Since LCM of 4 and 6 = 12)}$$

$$=\frac{99-34}{12}=\frac{65}{12}=5\frac{5}{12}$$



EXERCISE 7.6

1. Solve

(a) $\frac{2}{3}+\frac{1}{7}$ (b) $\frac{3}{10}+\frac{7}{15}$ (c) $\frac{4}{9}+\frac{2}{7}$ (d) $\frac{5}{7}+\frac{1}{3}$ (e) $\frac{2}{5}+\frac{1}{6}$

(f) $\frac{4}{5}+\frac{2}{3}$ (g) $\frac{3}{4}-\frac{1}{3}$ (h) $\frac{5}{6}-\frac{1}{3}$ (i) $\frac{2}{3}+\frac{3}{4}+\frac{1}{2}$ (j) $\frac{1}{2}+\frac{1}{3}+\frac{1}{6}$

(k) $1\frac{1}{3}+3\frac{2}{3}$ (l) $4\frac{2}{3}+3\frac{1}{4}$ (m) $\frac{16}{5}-\frac{7}{5}$ (n) $\frac{4}{3}-\frac{1}{2}$

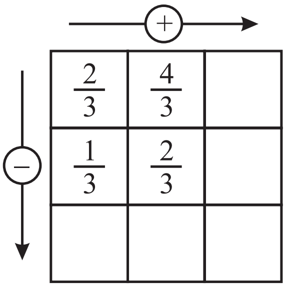
2. Sarita bought $\frac{2}{5}$ metre of ribbon and Lalita $\frac{3}{4}$ metre of ribbon. What is the total length of the ribbon they bought?

3. Naina was given $1\frac{1}{2}$ piece of cake and Najma was given $1\frac{1}{3}$ piece of cake. Find the total amount of cake was given to both of them.

4. Fill in the boxes : (a) $\square - \frac{5}{8} = \frac{1}{4}$ (b) $\square - \frac{1}{5} = \frac{1}{2}$ (c) $\frac{1}{2} - \square = \frac{1}{6}$

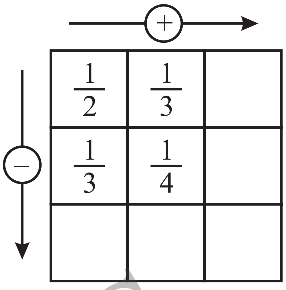
5. Complete the addition-subtraction box.

(a)



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

(b)



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

6. A piece of wire $\frac{7}{8}$ metre long broke into two pieces. One piece was $\frac{1}{4}$ metre long. How long is the other piece?

7. Nandini's house is $\frac{9}{10}$ km from her school. She walked some distance and then took a bus for $\frac{1}{2}$ km to reach the school. How far did she walk?

8. Asha and Samuel have bookshelves of the same size partly filled with books. Asha's shelf is $\frac{5}{6}$th full and Samuel's shelf is $\frac{2}{5}$th full. Whose bookshelf is more full? By what fraction?

9. Jaidev takes $2\frac{1}{5}$ minutes to walk across the school ground. Rahul takes $\frac{7}{4}$ minutes to do the same. Who takes less time and by what fraction?

What have we discussed?

1. (a) A fraction is a number representing a part of a whole. The whole may be a single object or a group of objects.
   (b) When expressing a situation of counting parts to write a fraction, it must be ensured that all parts are equal.

2. In $\frac{5}{7}$, 5 is called the numerator and 7 is called the denominator.

3. Fractions can be shown on a number line. Every fraction has a point associated with it on the number line.

4. In a proper fraction, the numerator is less than the denominator. The fractions, where the numerator is greater than the denominator are called improper fractions. An improper fraction can be written as a combination of a whole and a part, and such fraction then called mixed fractions.

5. Each proper or improper fraction has many equivalent fractions. To find an equivalent fraction of a given fraction, we may multiply or divide both the numerator and the denominator of the given fraction by the same number.

6. A fraction is said to be in the simplest (or lowest) form if its numerator and the denominator have no common factor except 1.

Note

Decimals

Chapter 8

8.1 Introduction

Savita and Shama were going to market to buy some stationary items. Savita said, “I have 5 rupees and 75 paise”. Shama said, “I have 7 rupees and 50 paise”.

They knew how to write rupees and paise using decimals.

So Savita said, I have ₹ 5.75 and Shama said, “I have ₹ 7.50”.

Have they written correctly?

We know that the dot represents a decimal point.

In this chapter, we will learn more about working with decimals.

8.2 Tenths

Ravi and Raju measured the lengths of their pencils. Ravi’s pencil was 7 cm 5mm long and Raju’s pencil was 8 cm 3 mm long. Can you express these lengths in centimetre using decimals?

We know that 10 mm = 1 cm

Therefore, $1 \text{ mm} = \frac{1}{10}$ cm or one-tenth cm = 0.1 cm

Now, length of Ravi’s pencil = 7cm 5mm

$= 7\frac{5}{10}$ cm i.e. 7cm and 5 tenths of a cm

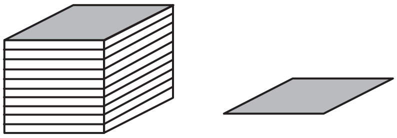
= 7.5cm

The length of Raju’s pencil = 8 cm 3 mm

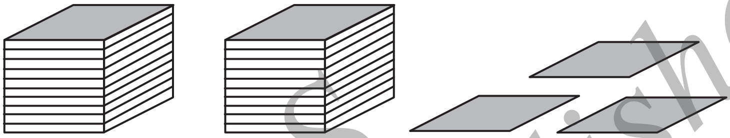
$= 8\frac{3}{10}$ cm i.e. 8 cm and 3 tenths of a cm

= 8.3 cm

Let us recall what we have learnt earlier. If we show units by blocks then one unit is one block, two units are two blocks and so on. One block divided into 10 equal parts means each part is $\frac{1}{10}$ (one-tenth) of a unit, 2 parts show 2 tenths and 5 parts show 5 tenths and so on. A combination of 2 blocks and 3 parts (tenths) will be recorded as :

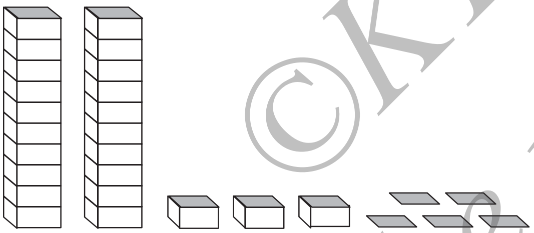


Ones	Tenths
(1)	$(\frac{1}{10})$
2	3



It can be written as 2.3 and read as two point three.

Let us look at another example where we have more than 'ones'. Each tower represents 10 units. So, the number shown here is :



Tens	Ones	Tenths
(10)	(1)	$(\frac{1}{10})$
2	3	5

i.e. $20 + 3 + \frac{5}{10} = 23.5$

This is read as 'twenty three point five'.

Try These

1. Can you now write the following as decimals?

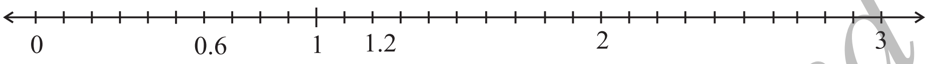
Hundreds (100)	Tens (10)	Ones (1)	Tenths $(\frac{1}{10})$
5	3	8	1
2	7	3	4
3	5	4	6

2. Write the lengths of Ravi's and Raju's pencils in 'cm' using decimals.
3. Make three more examples similar to the one given in question 1 and solve them.

Representing Decimals on number line

We represented fractions on a number line. Let us now represent decimals too on a number line. Let us represent 0.6 on a number line.

We know that 0.6 is more than zero but less than one. There are 6 tenths in it. Divide the unit length between 0 and 1 into 10 equal parts and take 6 parts as shown below :



Write five numbers between 0 and 1 and show them on the number line.

Can you now represent 2.3 on a number line? Check, how many ones and tenths are there in 2.3. Where will it lie on the number line?

Show 1.4 on the number line.

Example 1 : Write the following numbers in the place value table : (a) 20.5 (b) 4.2

Solution : Let us make a common place value table, assigning appropriate place value to the digits in the given numbers. We have,

	Tens (10)	Ones (1)	Tenths $\left(\frac{1}{10}\right)$
20.5	2	0	5
4.2	0	4	2

Example 2 : Write each of the following as decimals : (a) Two ones and five-tenths (b) Thirty and one-tenth

Solution : (a) Two ones and five-tenths = $2 + \frac{5}{10} = 2.5$

(b) Thirty and one-tenth = $30 + \frac{1}{10} = 30.1$

Example 3 : Write each of the following as decimals :

(a) $30 + 6 + \frac{2}{10}$ (b) $600 + 2 + \frac{8}{10}$

Solution : (a) $30 + 6 + \frac{2}{10}$

How many tens, ones and tenths are there in this number? We have 3 tens, 6 ones and 2 tenths.

Therefore, the decimal representation is 36.2.

(b) $600 + 2 + \frac{8}{10}$

Note that it has 6 hundreds, no tens, 2 ones and 8 tenths.

Therefore, the decimal representation is 602.8

Fractions as decimals

We have already seen how a fraction with denominator 10 can be represented using decimals.

Let us now try to find decimal representation of (a) $\frac{11}{5}$ (b) $\frac{1}{2}$

(a) We know that $\frac{11}{5} = \frac{22}{10} = \frac{20+2}{10} = \frac{20}{10} + \frac{2}{10} = 2 + \frac{2}{10} = 2.2$

Therefore, $\frac{22}{10} = 2.2$ (in decimal notation.)

(b) In $\frac{1}{2}$, the denominator is 2. For writing in decimal notation, the denominator should be 10. We already know how to make an equivalent fraction. So, $\frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10} = 0.5$

Try These

Write $\frac{3}{2}, \frac{4}{5}, \frac{8}{5}$ in decimal notation.

Therefore, $\frac{1}{2}$ is 0.5 in decimal notation.

Decimals as fractions

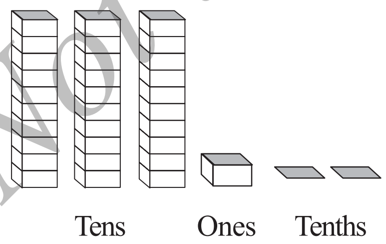
Till now we have learnt how to write fractions with denominators 10, 2 or 5 as decimals. Can we write a decimal number like 1.2 as a fraction?

Let us see $1.2 = 1 + \frac{2}{10} = \frac{10}{10} + \frac{2}{10} = \frac{12}{10}$

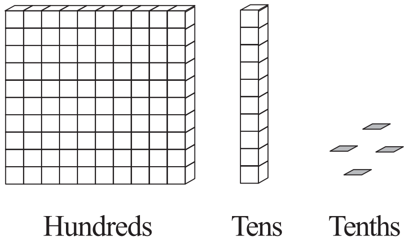
EXERCISE 8.1

1. Write the following as numbers in the given table.

(a)



(b)



Hundreds (100)	Tens (10)	Ones (1)	Tenths $(\frac{1}{10})$

2. Write the following decimals in the place value table.

   (a) 19.4 (b) 0.3 (c) 10.6 (d) 205.9

3. Write each of the following as decimals :

   (a) Seven-tenths (b) Two tens and nine-tenths

   (c) Fourteen point six (d) One hundred and two ones

   (e) Six hundred point eight

4. Write each of the following as decimals:

   (a) $\frac{5}{10}$ (b) $3 + \frac{7}{10}$ (c) $200 + 60 + 5 + \frac{1}{10}$ (d) $70 + \frac{8}{10}$ (e) $\frac{88}{10}$

   (f) $4\frac{2}{10}$ (g) $\frac{3}{2}$ (h) $\frac{2}{5}$ (i) $\frac{12}{5}$ (j) $3\frac{3}{5}$ (k) $4\frac{1}{2}$

5. Write the following decimals as fractions. Reduce the fractions to lowest form.

   (a) 0.6 (b) 2.5 (c) 1.0 (d) 3.8 (e) 13.7 (f) 21.2 (g) 6.4

6. Express the following as cm using decimals.

   (a) 2 mm (b) 30 mm (c) 116 mm (d) 4 cm 2 mm (e) 162 mm

   (f) 83 mm

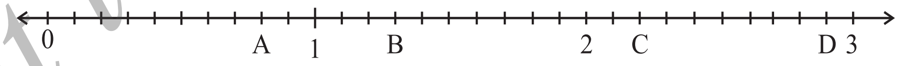
7. Between which two whole numbers on the number line are the given numbers lie? Which of these whole numbers is nearer the number?

   (a) 0.8 (b) 5.1 (c) 2.6 (d) 6.4 (e) 9.1 (f) 4.9

8. Show the following numbers on the number line.

   (a) 0.2 (b) 1.9 (c) 1.1 (d) 2.5

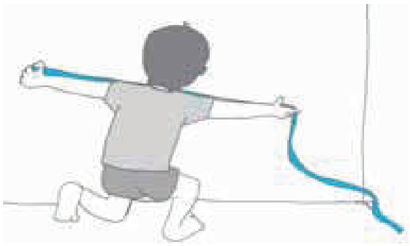
9. Write the decimal number represented by the points A, B, C, D on the given number line.



10. (a) The length of Ramesh's notebook is 9 cm 5 mm. What will be its length in cm?

    (b) The length of a young gram plant is 65 mm. Express its length in cm.

8.3 Hundredths



David was measuring the length of his room. He found that the length of his room is 4 m and 25 cm.

He wanted to write the length in metres. Can you help him? What part of a metre will be one centimetre?

1 cm = $(\frac{1}{100})$ m or one-hundredth of a metre.

This means 25 cm = $\frac{25}{100}$ m

Now $(\frac{1}{100})$ means 1 part out of 100 parts of a whole. As we have done for $\frac{1}{10}$, let us try to show this pictorially.

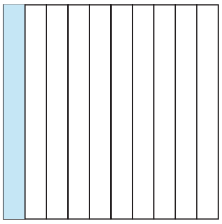


Fig (i)

Take a square and divide it into ten equal parts. What part is the shaded rectangle of this square?

It is $\frac{1}{10}$ or one-tenth or 0.1, see Fig (i).

Now divide each such rectangle into ten equal parts.

We get 100 small squares as shown in Fig (ii).

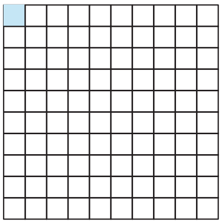


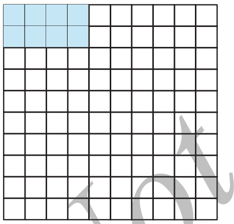
Fig (ii)

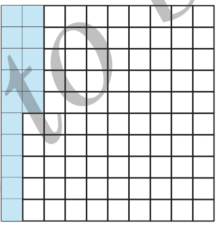
Then what fraction is each small square of the whole square?

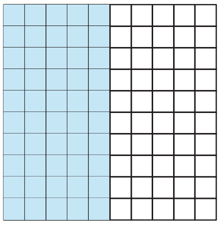
Each small square is $(\frac{1}{100})$ or one-hundredth of the whole square. In decimal notation, we write $(\frac{1}{100}) = 0.01$ and read it as zero point zero one.

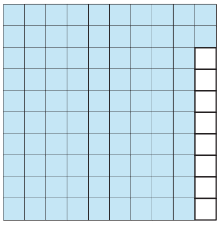
What part of the whole square is the shaded portion, if we shade 8 squares, 15 squares, 50 squares, 92 squares of the whole square?

Take the help of following figures to answer.









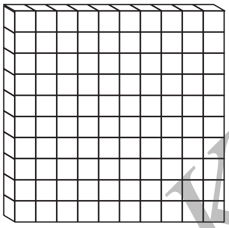
Shaded portions	Ordinary fraction	Decimal number
8 squares	$\frac{8}{100}$	0.08
15 squares	$\frac{15}{100}$	0.15
50 squares	________	________
92 squares	________	________

Let us look at some more place value tables.

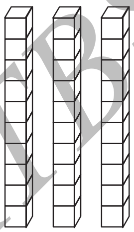
Ones (1)	Tenths $\left(\frac{1}{10}\right)$	Hundredths $\left(\frac{1}{100}\right)$
2	4	3

The number shown in the table above is $2 + \frac{4}{10} + \frac{3}{100}$. In decimals, it is written as 2.43, which is read as 'two point four three'.

Example 4 : Fill the blanks in the table using 'block' information given below and write the corresponding number in decimal form.



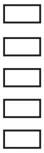
1 hundred blocks



3 ten blocks

2 unit blocks

1 tenth blocks



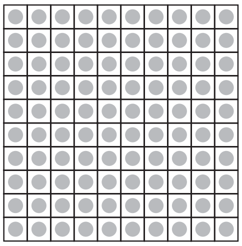
5 hundredth blocks

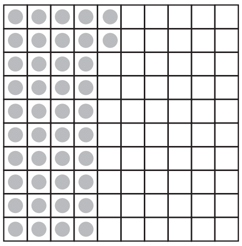
Solution :

Hundreds (100)	Tens (10)	Ones (1)	Tenths $\left(\frac{1}{10}\right)$	Hundredths $\left(\frac{1}{100}\right)$
1	3	2	1	5

The number is $100 + 30 + 2 + \frac{1}{10} + \frac{5}{100} = 132.15$

Example 5 : Fill the blanks in the table and write the corresponding number in decimal form using 'block' information given below.





Ones (1)	Tenths $\left(\frac{1}{10}\right)$	Hundredths $\left(\frac{1}{100}\right)$

Solution :

Ones (1)	Tenths $(\frac{1}{10})$	Hundredths $(\frac{1}{100})$
1	4	2

Therefore, the number is 1.42.

Example 6 : Given the place value table, write the number in decimal form.

Hundreds (100)	Tens (10)	Ones (1)	Tenths $(\frac{1}{10})$	Hundredths $(\frac{1}{100})$
2	4	3	2	5

Solution : The number is $2 \times 100 + 4 \times 10 + 3 \times 1 + 2 \times \frac{1}{10} + 5 \times (\frac{1}{100})$

$$= 200 + 40 + 3 + \frac{2}{10} + \frac{5}{100} = 243.25$$

We can see that as we go from left to right, at every step the multiplying factor becomes $\frac{1}{10}$ of the previous factor.

The first digit 2 is multiplied by 100; the next digit 4 is multiplied by 10 i.e. $(\frac{1}{10}$ of 100); the next digit 3 is multiplied by 1. After this, the next multipling factor is $\frac{1}{10}$; and then it is $\frac{1}{100}$ i.e. $(\frac{1}{10}$ of $\frac{1}{10})$.

The decimal point comes between ones place and tenths place in a decimal number.

It is now natural to extend the place value table further, from hundredths to $\frac{1}{10}$ of hundredths i.e. thousandths.

Let us solve some examples.

Example 7 : Write as decimals. (a) $\frac{4}{5}$ (b) $\frac{3}{4}$ (c) $\frac{7}{1000}$

Solution : (a) We have to find a fraction equivalent to $\frac{4}{5}$ whose denominator is 10.

$$\frac{4}{5} = \frac{4 \times 2}{5 \times 2} = \frac{8}{10} = 0.8$$

(b) Here, we have to find a fraction equivalent to $\frac{3}{4}$ with denominator 10 or 100. There is no whole number that gives 10 on multiplying by 4, therefore, we make the demominator 100 and we have,

$$\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 0.75$$

(c) Here, since the tenth and the hundredth place is zero.

Therefore, we write $\frac{7}{1000} = 0.007$

Example 8 : Write as fractions in lowest terms.

(a) 0.04 (b) 2.34 (c) 0.342

Solution : (a) $0.04 = \frac{4}{100} = \frac{1}{25}$

(b) $2.34 = 2 + \frac{34}{100} = 2 + \frac{34 \div 2}{100 \div 2} = 2 + \frac{17}{50} = 2\frac{17}{50}$

(c) $0.342 = \frac{342}{1000} = \frac{342 \div 2}{1000 \div 2} = \frac{171}{500}$

Example 9 : Write each of the following as a decimal.

(a) $200 + 30 + 5 + \frac{2}{10} + \frac{9}{100}$ (b) $50 + \frac{1}{10} + \frac{6}{100}$

(c) $16 + \frac{3}{10} + \frac{5}{1000}$

Solution : (a) $200 + 30 + 5 + \frac{2}{10} + \frac{9}{100} = 235 + 2 \times \frac{1}{10} + 9 \times \frac{1}{100} = 235.29$

(b) $50 + \frac{1}{10} + \frac{6}{100} = 50 + 1 \times \frac{1}{10} + 6 \times \frac{1}{100} = 50.16$

(c) $16 + \frac{3}{10} + \frac{5}{1000} = 16 + \frac{3}{10} + \frac{0}{100} + \frac{5}{1000}$

$$= 16 + 3 \times \frac{1}{10} + 0 \times \frac{1}{100} + 5 \times \frac{1}{1000} = 16.305$$

Example 10 : Write each of the following as a decimal.

(a) Three hundred six and seven-hundredths

(b) Eleven point two three five

(c) Nine and twenty five thousandths

Solution : (a) Three hundred six and seven-hundredths

$$= 306 + \frac{7}{100} = 306 + 0 \times \frac{1}{10} + 7 \times \frac{1}{100} = 306.07$$

(b) Eleven point two three five = 11.235

(c) Nine and twenty five thousandths $= 9 + \frac{25}{1000}$

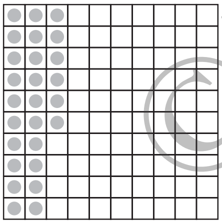
$$= 9 + \frac{0}{10} + \frac{2}{100} + \frac{5}{1000} = 9.025$$

Since, 25 thousandths $= \frac{25}{1000} = \frac{20}{1000} + \frac{5}{1000} = \frac{2}{100} + \frac{5}{1000}$

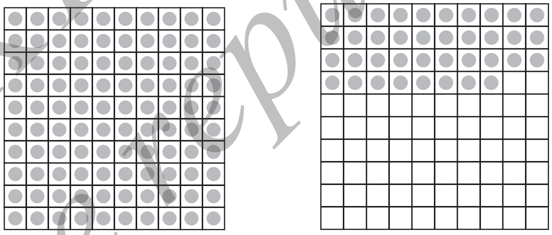
EXERCISE 8.2

1. Complete the table with the help of these boxes and use decimals to write the number.

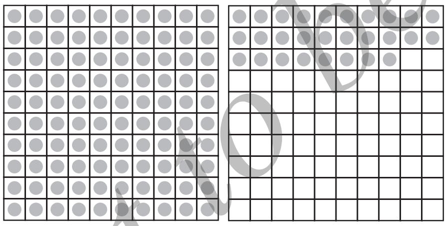
(a)



(b)



(c)



	Ones	Tenths	Hundredths	Number
(a)				
(b)				
(c)				

2. Write the numbers given in the following place value table in decimal form.

	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
	100	10	1	$\frac{1}{10}$	$(\frac{1}{100})$	$\frac{1}{1000}$
(a)	0	0	3	2	5	0
(b)	1	0	2	6	3	0
(c)	0	3	0	0	2	5
(d)	2	1	1	9	0	2
(e)	0	1	2	2	4	1

3. Write the following decimals in the place value table.

   (a) 0.29 (b) 2.08 (c) 19.60 (d) 148.32 (e) 200.812

4. Write each of the following as decimals.

   (a) $20+9+\frac{4}{10}+\frac{1}{100}$ (b) $137+\frac{5}{100}$ (c) $\frac{7}{10}+\frac{6}{100}+\frac{4}{1000}$

   (d) $23+\frac{2}{10}+\frac{6}{1000}$ (e) $700+20+5+\frac{9}{100}$

5. Write each of the following decimals in words.

   (a) 0.03 (b) 1.20 (c) 108.56 (d) 10.07 (e) 0.032 (f) 5.008

6. Between which two numbers in tenths place on the number line does each of the given number lie?

   (a) 0.06 (b) 0.45 (c) 0.19 (d) 0.66 (e) 0.92 (f) 0.57

7. Write as fractions in lowest terms.

   (a) 0.60 (b) 0.05 (c) 0.75 (d) 0.18 (e) 0.25 (f) 0.125

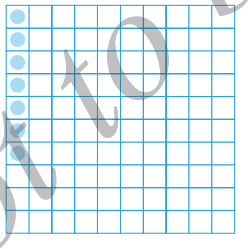
   (g) 0.066

8.4 Comparing Decimals

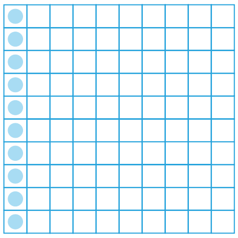
Can you tell which is greater, 0.07 or 0.1?

Take two pieces of square papers of the same size. Divide them into 100 equal parts. For 0.07 we have to shade 7 parts out of 100.

Now, $0.1 = \frac{1}{10} = \frac{10}{100}$, so, for 0.1, shade 10 parts out 100.



$0.07 = \frac{7}{100}$



$0.1 = \frac{1}{10} = \frac{10}{100}$

This means 0.1>0.07

Let us now compare the numbers 32.55 and 32.5. In this case , we first compare the whole part. We see that the whole part for both the nunbers is 32 and, hence, equal.

We, however, know that the two numbers are not equal. So, we now compare the tenth part. We find that for 32.55 and 32.5, the tenth part is also equal, then we compare the hundredth part.

We find,

$32.55 = 32 + \frac{5}{10} + \frac{5}{100}$ and $32.5 = 32 + \frac{5}{10} + \frac{0}{100}$, therefore, $32.55 > 32.5$ as the hundredth part of 32.55 is more.

Example 11 : Which is greater?

(a) 1 or 0.99 (b) 1.09 or 1.093

Solution : (a) $1 = 1 + \frac{0}{10} + \frac{0}{100}$; $0.99 = 0 + \frac{9}{10} + \frac{9}{100}$

The whole part of 1 is greater than that of 0.99.
Therefore, $1 > 0.99$

(b) $1.09 = 1 + \frac{0}{10} + \frac{9}{100} + \frac{0}{1000}$; $1.093 = 1 + \frac{0}{10} + \frac{9}{100} + \frac{3}{1000}$

In this case, the two numbers have same parts upto hundredth.

But the thousandths part of 1.093 is greater than that of 1.09.

Therefore, $1.093 > 1.09$.

EXERCISE 8.3

1. Which is greater?

   (a) 0.3 or 0.4 (b) 0.07 or 0.02 (c) 3 or 0.8 (d) 0.5 or 0.05
   (e) 1.23 or 1.2 (f) 0.099 or 0.19 (g) 1.5 or 1.50 (h) 1.431 or 1.490
   (i) 3.3 or 3.300 (j) 5.64 or 5.603

2. Make five more examples and find the greater number from them.

Try These

(i) Write 2 rupees 5 paise and 2 rupees 50 paise in decimals.

(ii) Write 20 rupees 7 paise and 21 rupees 75 paise in decimals?

8.5 Using Decimals

8.5.1 Money

We know that 100 paise = ₹1

Therefore, 1 paise $= ₹\frac{1}{100} = ₹\,0.01$

So, 65 paise $= ₹\frac{65}{100} = ₹0.65$

and 5 paise $= ₹\frac{5}{100} = ₹0.05$

What is 105 paise? It is ₹1 and 5 paise = ₹1.05

8.5.2 Length

Mahesh wanted to measure the length of his table top in metres. He had a 50 cm scale. He found that the length of the table top was 156 cm. What will be its length in metres?

Mahesh knew that

$$1 \text{ cm} = \frac{1}{100} \text{ m} \quad \text{or} \quad 0.01 \text{ m}$$

$$\text{Therefore, } 56 \text{ cm} = \frac{56}{100} \text{ m} = 0.56 \text{ m}$$

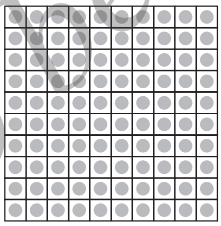
Thus, the length of the table top is 156 cm = 100 cm + 56 cm

$$= 1 \text{ m} + \frac{56}{100} \text{ m} = 1.56 \text{ m.}$$

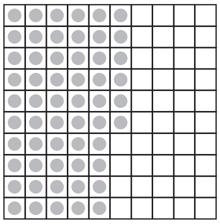
Mahesh also wants to represent this length pictorially. He took squared papers of equal size and divided them into 100 equal parts. He considered each small square as one cm.

Try These

1. Can you write 4 mm in 'cm' using decimals?
2. How will you write 7cm 5 mm in 'cm' using decimals?
3. Can you now write 52 m as 'km' using decimals? How will you write 340 m as 'km' using decimals? How will you write 2008 m in 'km'?



100 cm



56 cm

8.5.3 Weight

Nandu bought 500g potatoes, 250g capsicum, 700g onions, 500g tomatoes, 100g ginger and 300g radish. What is the total weight of the vegetables in the bag? Let us add the weight of all the vegetables in the bag.

500 g + 250 g + 700 g + 500 g + 100 g + 300 g

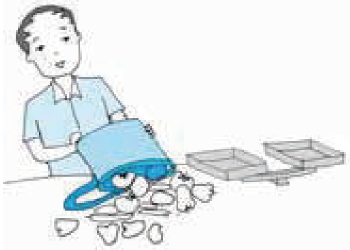
= 2350 g

Try These

1. Can you now write 456g as 'kg' using decimals?
2. How will you write 2kg 9g in 'kg' using decimals?

We know that 1000 g = 1 kg

Therefore, $1 \text{ g} = \frac{1}{1000} \text{ kg} = 0.001 \text{ kg}$



$$\begin{aligned} \text{Thus, } 2350 \text{ g} &= 2000 \text{ g} + 350 \text{ g} \\ &= \frac{2000}{1000} \text{ kg} + \frac{350}{1000} \text{ kg} \\ &= 2 \text{ kg} + 0.350 \text{ kg} = 2.350 \text{ kg} \\ \text{i.e. } 2350 \text{ g} &= 2 \text{ kg } 350 \text{ g} = 2.350 \text{ kg} \end{aligned}$$

Thus, the weight of vegetables in Nandu's bag is 2.350 kg.

EXERCISE 8.4

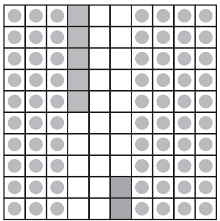
1. Express as rupees using decimals.
   (a) 5 paise (b) 75 paise (c) 20 paise
   (d) 50 rupees 90 paise (e) 725 paise
2. Express as metres using decimals.
   (a) 15 cm (b) 6 cm (c) 2 m 45 cm
   (d) 9 m 7 cm (e) 419 cm
3. Express as cm using decimals.
   (a) 5 mm (b) 60 mm (c) 164 mm
   (d) 9 cm 8 mm (e) 93 mm
4. Express as km using decimals.
   (a) 8 m (b) 88 m (c) 8888 m
   (d) 70 km 5 m
5. Express as kg using decimals.
   (a) 2 g (b) 100 g (c) 3750 g
   (d) 5 kg 8 g (e) 26 kg 50 g

8.6 Addition of Numbers with Decimals

Do This

Add 0.35 and 0.42.

Take a square and divide it into 100 equal parts.



Mark 0.35 in this square by shading 3 tenths and colouring 5 hundredths.

Mark 0.42 in this square by shading 4 tenths and colouring 2 hundredths.

Now count the total number of tenths in the square and the total number of hundredths in the square.

	Ones	Tenths	Hundredths
	0	3	5
+	0	4	2
	0	7	7

Therefore, 0.35 + 0.42 = 0.77

Thus, we can add decimals in the same way as whole numbers.

Can you now add 0.68 and 0.54?

Try These

Find

(i) 0.29 + 0.36 (ii) 0.7 + 0.08

(iii) 1.54 + 1.80 (iv) 2.66 + 1.85

	Ones	Tenths	Hundredths
	0	6	8
+	0	5	4
	1	2	2

Thus, 0.68 + 0.54 = 1.22

Example 12 : Lata spent ₹ 9.50 for buying a pen and ₹ 2.50 for one pencil. How much money did she spend?

Solution : Money spent for pen = ₹ 9.50

Money spent for pencil = ₹ 2.50

Total money spent = ₹ 9.50 + ₹ 2.50

Total money spent = ₹ 12.00

Example 13 : Samson travelled 5 km 52 m by bus, 2 km 265 m by car and the rest 1km 30 m he walked. How much distance did he travel in all?

Solution: Distance travelled by bus = 5 km 52 m = 5.052 km

Distance travelled by car = 2 km 265 m = 2.265 km

Distance travelled on foot = 1 km 30 m = 1.030 km

Therefore, total distance travelled is

$$\begin{array}{r} 5.052 \text{ km} \\ 2.265 \text{ km} \\ + \quad 1.030 \text{ km} \\ \hline 8.347 \text{ km} \\ \hline \end{array}$$

Therefore, total distance travelled = 8.347 km

Example 14 : Rahul bought 4 kg 90 g of apples, 2 kg 60 g of grapes and 5 kg 300 g of mangoes. Find the total weight of all the fruits he bought.

Solution : Weight of apples = 4 kg 90 g = 4.090 kg

Weight of grapes = 2 kg 60 g = 2.060 kg

Weight of mangoes = 5 kg 300 g = 5.300 kg

Therefore, the total weight of the fruits bought is

$$\begin{array}{r} 4.090 \text{ kg} \\ 2.060 \text{ kg} \\ + \quad 5.300 \text{ kg} \\ \hline 11.450 \text{ kg} \\ \hline \end{array}$$

Total weight of the fruits bought = 11.450 kg.

EXERCISE 8.5

1. Find the sum in each of the following :
   (a) 0.007 + 8.5 + 30.08
   (b) 15 + 0.632 + 13.8
   (c) 27.076 + 0.55 + 0.004
   (d) 25.65 + 9.005 + 3.7
   (e) 0.75 + 10.425 + 2
   (f) 280.69 + 25.2 + 38
2. Rashid spent ₹ 35.75 for Maths book and ₹ 32.60 for Science book. Find the total amount spent by Rashid.
3. Radhika's mother gave her ₹ 10.50 and her father gave her ₹ 15.80, find the total amount given to Radhika by the parents.
4. Nasreen bought 3 m 20 cm cloth for her shirt and 2 m 5 cm cloth for her trouser. Find the total length of cloth bought by her.
5. Naresh walked 2 km 35 m in the morning and 1 km 7 m in the evening. How much distance did he walk in all?

6. Sunita travelled 15 km 268 m by bus, 7 km 7 m by car and 500 m on foot in order to reach her school. How far is her school from her residence?
7. Ravi purchased 5 kg 400 g rice, 2 kg 20 g sugar and 10 kg 850g flour. Find the total weight of his purchases.

8.7 Subtraction of Decimals

Do This

Subtract 1.32 from 2.58

This can be shown by the table.

	Ones	Tenths	Hundredths
	2	5	8
–	1	3	2
	1	2	6

Thus, 2.58 – 1.32 = 1.26

Therefore, we can say that, subtraction of decimals can be done by subtracting hundredths from hundredths, tenths from tenths, ones from ones and so on, just as we did in addition.

Sometimes while subtracting decimals, we may need to regroup like we did in addition.

Let us subtract 1.74 from 3.5.

	Ones	Tenths	Hundredths
	3	5	0
–	1	7	4
	1	7	6

Subtract in the hundredth place.

Can't subtract !

so regroup

$$\begin{array}{rcccc} & \overset{2}{\cancel{3}} & . & \overset{14}{\cancel{5}} & \overset{10}{0} \\ - & 1 & . & 7 & 4 \\ \hline & 1 & . & 7 & 6 \\ \hline \end{array}$$

Thus, 3.5 – 1.74 = 1.76

Try These

1. Subtract 1.85 from 5.46 ;
2. Subtract 5.25 from 8.28 ;
3. Subtract 0.95 from 2.29 ;
4. Subtract 2.25 from 5.68.

Example 15 : Abhishek had ₹ 7.45. He bought toffees for ₹ 5.30. Find the balance amount left with Abhishek.

Solution : Total amount of money = ₹ 7.45

Amount spent on toffees = ₹ 5.30

Balance amount of money = ₹ 7.45 – ₹ 5.30 = ₹ 2.15

Example 16 : Urmila's school is at a distance of 5 km 350 m from her house. She travels 1 km 70 m on foot and the rest by bus. How much distance does she travel by bus?

Solution : Total distance of school from the house = 5.350 km

Distance travelled on foot = 1.070 km

Therefore, distance travelled by bus = 5.350 km – 1.070 km

= 4.280 km

Thus, distance travelled by bus = 4.280 km or 4 km 280 m

Example 17 : Kanchan bought a watermelon weighing 5 kg 200 g. Out of this she gave 2 kg 750 g to her neighbour. What is the weight of the watermelon left with Kanchan?

Solution : Total weight of the watermelon = 5.200 kg

Watermelon given to the neighbour = 2.750 kg

Therefore, weight of the remaining watermelon

= 5.200 kg – 2.750 kg = 2.450 kg

EXERCISE 8.6

1. Subtract :
   (a) ₹ 18.25 from ₹ 20.75
   (b) 202.54 m from 250 m
   (c) ₹ 5.36 from ₹ 8.40
   (d) 2.051 km from 5.206 km
   (e) 0.314 kg from 2.107 kg

2. Find the value of :
   (a) 9.756 – 6.28
   (b) 21.05 – 15.27
   (c) 18.5 – 6.79
   (d) 11.6 – 9.847

3. Raju bought a book for ₹ 35.65. He gave ₹ 50 to the shopkeeper. How much money did he get back from the shopkeeper?
4. Rani had ₹ 18.50. She bought one ice-cream for ₹ 11.75. How much money does she have now?
5. Tina had 20 m 5 cm long cloth. She cuts 4 m 50 cm length of cloth from this for making a curtain. How much cloth is left with her?

6. Namita travels 20 km 50 m every day. Out of this she travels 10 km 200 m by bus and the rest by auto. How much distance does she travel by auto?

7. Aakash bought vegetables weighing 10 kg. Out of this, 3 kg 500 g is onions, 2 kg 75 g is tomatoes and the rest is potatoes. What is the weight of the potatoes?

What have we discussed?

1. To understand the parts of one whole (i.e. a unit) we represent a unit by a block. One block divided into 10 equal parts means each part is $\frac{1}{10}$ (one-tenth) of a unit. It can be written as 0.1 in decimal notation. The dot represents the decimal point and it comes between the units place and the tenths place.
2. Every fraction with denominator 10 can be written in decimal notation and vice-versa.
3. One block divided into 100 equal parts means each part is $(\frac{1}{100})$ (one-hundredth) of a unit. It can be written as 0.01 in decimal notation.
4. Every fraction with denominator 100 can be written in decimal notation and vice-versa.
5. In the place value table, as we go from left to the right, the multiplying factor becomes $\frac{1}{10}$ of the previous factor.

The place value table can be further extended from hundredths to $\frac{1}{10}$ of hundredths i.e. thousandths ($\frac{1}{1000}$), which is written as 0.001 in decimal notation.

6. All decimals can also be represented on a number line.
7. Every decimal can be written as a fraction.
8. Any two decimal numbers can be compared among themselves. The comparison can start with the whole part. If the whole parts are equal then the tenth parts can be compared and so on.
9. Decimals are used in many ways in our lives. For example, in representing units of money, length and weight.

Data Handling

Chapter 9

9.1 Introduction

You must have observed your teacher recording the attendance of students in your class everyday, or recording marks obtained by you after every test or examination. Similarly, you must have also seen a cricket score board. Two score boards have been illustrated here :

Name of the bowlers	Overs	Maiden overs	Runs given	Wickets taken
A	10	2	40	3
B	10	1	30	2
C	10	2	20	1
D	10	1	50	4

Name of the batsmen	Runs	Balls faced	Time (in min.)
E	45	62	75
F	55	70	81
G	37	53	67
H	22	41	55

You know that in a game of cricket the information recorded is not simply about who won and who lost. In the score board, you will also find some equally important information about the game. For instance, you may find out the time taken and number of balls faced by the highest run-scorer.

Similarly, in your day to day life, you must have seen several kinds of tables consisting of numbers, figures, names etc.

These tables provide 'Data'. *A data is a collection of numbers gathered to give some information.*

9.2 Recording Data

Let us take an example of a class which is preparing to go for a picnic. The teacher asked the students to give their choice of fruits out of banana, apple, orange or guava. Uma is asked to prepare the list. She prepared a list of all the children and wrote the choice of fruit against each name. This list would help the teacher to distribute fruits according to the choice.

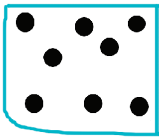
Raghav	—	Banana	Bhawana	—	Apple
Preeti	—	Apple	Manoj	—	Banana
Amar	—	Guava	Donald	—	Apple
Fatima	—	Orange	Maria	—	Banana
Amita	—	Apple	Uma	—	Orange
Raman	—	Banana	Akhtar	—	Guava
Radha	—	Orange	Ritu	—	Apple
Farida	—	Guava	Salma	—	Banana
Anuradha	—	Banana	Kavita	—	Guava
Rati	—	Banana	Javed	—	Banana

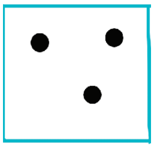
If the teacher wants to know the number of bananas required for the class, she has to read the names in the list one by one and count the total number of bananas required. To know the number of apples, guavas and oranges separately she has to repeat the same process for each of these fruits. How tedious and time consuming it is! It might become more tedious if the list has, say, 50 students.

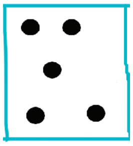
So, Uma writes only the names of these fruits one by one like, banana, apple, guava, orange, apple, banana, orange, guava, banana, banana, apple, banana, apple, banana, orange, guava, apple, banana, guava, banana.

Do you think this makes the teacher's work easier? She still has to count the fruits in the list one by one as she did earlier.

Salma has another idea. She makes four squares on the floor. Every square is kept for fruit of one kind only. She asks the students to put one pebble in the square which matches their


Banana


Orange

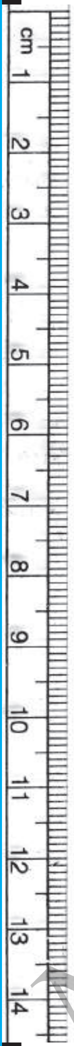

Apple

Guava

choices. i.e. a student opting for banana will put a pebble in the square marked for banana and so on.

By counting the pebbles in each square, Salma can quickly tell the number of each kind of fruit required. She can get the required information quickly by systematically placing the pebbles in different squares.

Try to perform this activity for 40 students and with names of any four fruits. Instead of pebbles you can also use bottle caps or some other tokens.



9.3 Organisation of Data

To get the same information which Salma got, Ronald needs only a pen and a paper. He does not need pebbles. He also does not ask students to come and place the pebbles. He prepares the following table.

Banana	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	8
Orange	✓ ✓ ✓	3
Apple	✓ ✓ ✓ ✓ ✓	5
Guava	✓ ✓ ✓ ✓	4

Do you understand Ronald's table?

What does one (✓) mark indicate?

Four students preferred guava. How many (✓) marks are there against guava?

How many students were there in the class? Find all this information.

Discuss about these methods. Which is the best? Why? Which method is more useful when information from a much larger data is required?

Example 1 : A teacher wants to know the choice of food of each student as part of the mid-day meal programme. The teacher assigns the task of collecting this information to Maria. Maria does so using a paper and a pencil. After arranging the choices in a column, she puts against a choice of food one (|) mark for every student making that choice.

<table>
<tr><th>Choice</th><th>Number of students</th></tr>
<tr><td>Rice only</td><td>| | | | | | | | | | | | | | | | |</td></tr>
<tr><td>Chapati only</td><td>| | | | | | | | | | | | |</td></tr>
<tr><td>Both rice and chapati</td><td>| | | | | | | | | | | | | | | | | | | |</td></tr>
</table>

Umesh, after seeing the table suggested a better method to count the students. He asked Maria to organise the marks (|) in a group of ten as shown below :

Choice	Tally marks	Number of students
Rice only	(||||||||||) |||||||	17
Chapati only	(||||||||||) |||	13
Both rice and chapati	(||||||||||) (||||||||||)	20

Rajan made it simpler by asking her to make groups of five instead of ten, as shown below :

Choice	Tally marks	Number of students
Rice only	(|||||) (|||||) (|||||) ||	17
Chapati only	(|||||) (|||||) |||	13
Both rice and chapati	(|||||) (|||||) (|||||) (|||||)	20

Teacher suggested that the fifth mark in a group of five marks should be used as a cross, as shown by '𝍸 '. These are **tally marks**. Thus, 𝍸 || shows the count to be five plus two (i.e. seven) and 𝍸 𝍸 shows five plus five (i.e. ten).

With this, the table looks like :

Choice	Tally marks	Number of students
Rice only	𝍸 𝍸 𝍸 ||	17
Chapati only	𝍸 𝍸 |||	13
Both rice and chapati	𝍸 𝍸 𝍸 𝍸	20

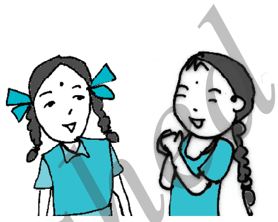
Example 2 : Ekta is asked to collect data for size of shoes of students in her Class VI. Her finding are recorded in the manner shown below :

5	4	7	5	6	7	6	5	6	6	5
4	5	6	8	7	4	6	5	6	4	6
5	7	6	7	5	7	6	4	8	7	

Javed wanted to know (i) the size of shoes worn by the maximum number of students. (ii) the size of shoes worn by the minimum number of students. Can you find this information?

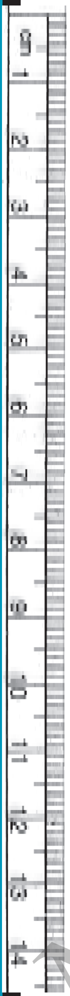
Ekta prepared a table using tally marks.

Shoe size	Tally marks	Number of students
4	𝍸	5
5	𝍸 |||	8
6	𝍸 𝍸	10
7	𝍸 ||	7
8	||	2



Now the questions asked earlier could be answered easily.

You may also do some such activity in your class using tally marks.



Do This

1. Collect information regarding the number of family members of your classmates and represent it in the form of a table. Find to which category most students belong.

Number of family members	Tally marks	Number of students with that many family members

Make a table and enter the data using tally marks. Find the number that appeared

(a) the minimum number of times? (b) the maximum number of times?

(c) same number of times?

9.4 Pictograph

A cupboard has five compartments. In each compartment a row of books is arranged.

The details are indicated in the adjoining table :

Rows	Number of books (📘 - 1 Book)
Row 1	📘 📘 📘 📘
Row 2	📘 📘 📘 📘 📘
Row 3	📘 📘
Row 4	📘 📘 📘 📘 📘 📘 📘 📘
Row 5	📘 📘 📘

Which row has the greatest number of books? Which row has the least number of books? Is there any row which does not have books?

You can answer these questions by just studying the diagram. The picture visually helps you to understand the data. It is a **pictograph**.

A pictograph represents data through pictures of objects. It helps answer the questions on the data at a glance.

Do This

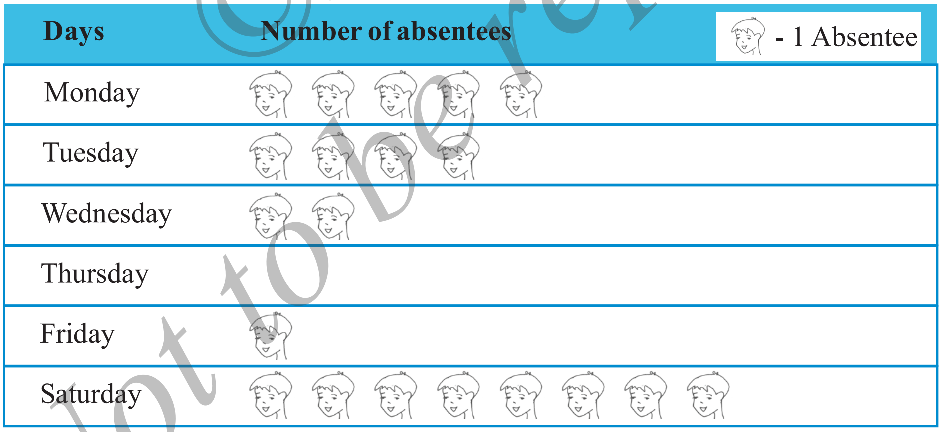
Pictographs are often used by dailies and magazines to attract readers attention.

Collect one or two such published pictographs and display them in your class. Try to understand what they say.

It requires some practice to understand the information given by a pictograph.

9.5 Interpretation of a Pictograph

Example 3 : The following pictograph shows the number of absentees in a class of 30 students during the previous week :



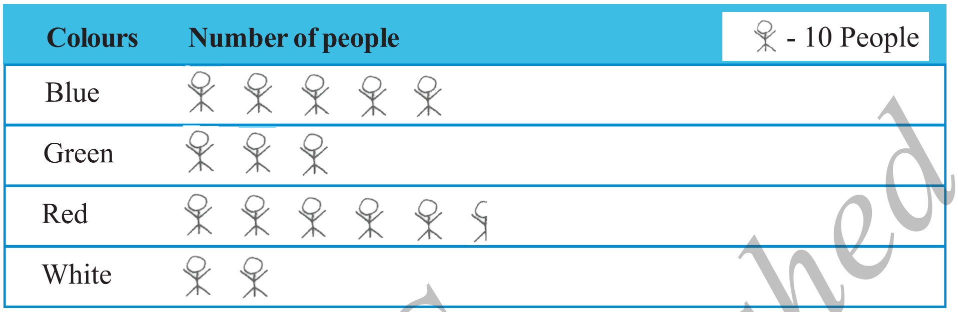
(a) On which day were the maximum number of students absent?
(b) Which day had full attendance?
(c) What was the total number of absentees in that week?

Solution : (a) Maximum absentees were on saturday. (There are 8 pictures in the row for saturday; on all other days, the number of pictures are less).

(b) Against thursday, there is no picture, i.e. no one is absent. Thus, on that day the class had full attendance.

(c) There are 20 pictures in all. So, the total number of absentees in that week was 20.

Example 4 : The colours of fridges preferred by people living in a locality are shown by the following pictograph :



(a) Find the number of people preferring blue colour.

(b) How many people liked red colour?

Solution : (a) Blue colour is preferred by 50 people.

[🧍 = 10, so 5 pictures indicate 5 × 10 people].

(b) Deciding the number of people liking red colour needs more care.

For 5 complete pictures, we get 5 × 10 = 50 people.

For the last incomplete picture, we may roughly take it as 5.

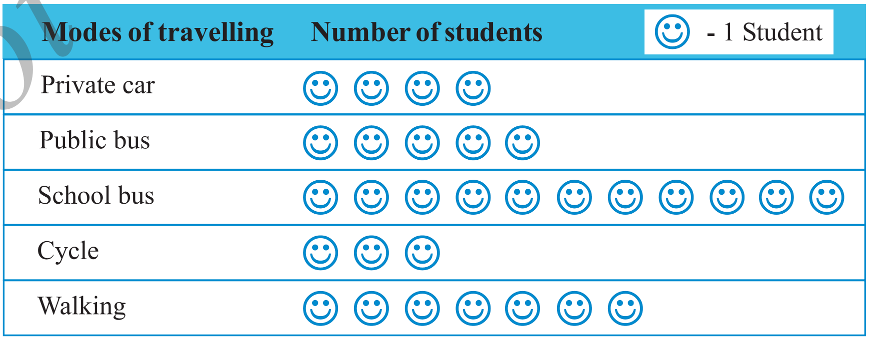
So, number of people preferring red colour is nearly 55.

Think, discuss and write

In the above example, the number of people who like red colour was taken as 50 + 5. If your friend wishes to take it as 50 + 8, is it acceptable?

Example 5 : A survey was carried out on 30 students of class VI in a school. Data about the different modes of transport used by them to travel to school was displayed as pictograph.

What can you conclude from the pictograph?



Solution : From the pictograph we find that:

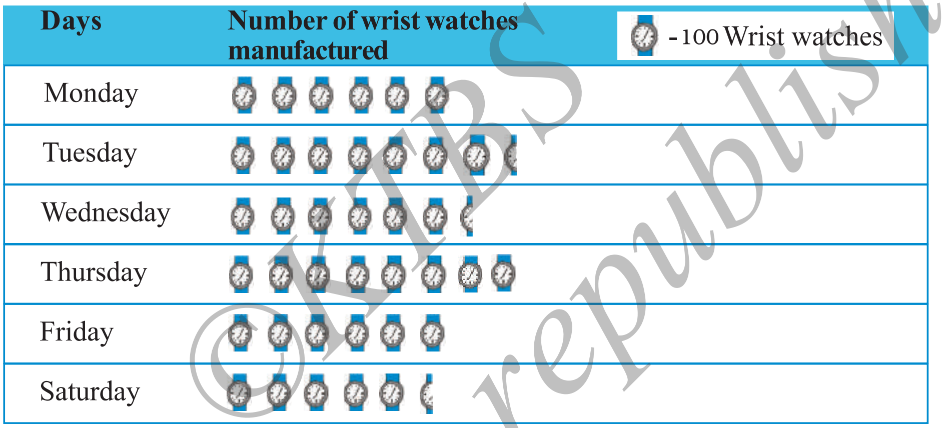
(a) The number of students coming by private car is 4.

(b) Maximum number of students use the school bus. This is the most popular way.

(c) Cycle is used by only three students.

(d) The number of students using the other modes can be similarly found.

Example 6 : Following is the pictograph of the number of wrist watches manufactured by a factory in a particular week.



(a) On which day were the least number of wrist watches manufactured?

(b) On which day were the maximum number of wrist watches manufactured?

(c) Find out the approximate number of wrist watches manufactured in the particular week?

Solution : We can complete the following table and find the answers.

Days	Number of wrist watches manufactured
Monday	600
Tuesday	More than 700 and less than 800
Wednesday	....
Thursday	....
Friday	....
Saturday	....

EXERCISE 9.1

1. In a Mathematics test, the following marks were obtained by 40 students. Arrange these marks in a table using tally marks.

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

(a) Find how many students obtained marks equal to or more than 7.

(b) How many students obtained marks below 4?

2. Following is the choice of sweets of 30 students of Class VI.

Ladoo, Barfi, Ladoo, Jalebi, Ladoo, Rasgulla, Jalebi, Ladoo, Barfi, Rasgulla, Ladoo, Jalebi, Jalebi, Rasgulla, Ladoo, Rasgulla, Jalebi, Ladoo, Rasgulla, Ladoo, Ladoo, Barfi, Rasgulla, Rasgulla, Jalebi, Rasgulla, Ladoo, Rasgulla, Jalebi, Ladoo.

(a) Arrange the names of sweets in a table using tally marks.

(b) Which sweet is preferred by most of the students?

3. Catherine threw a dice 40 times and noted the number appearing each time as shown below :

1	3	5	6	6	3	5	4	1	6
2	5	3	4	6	1	5	5	6	1
1	2	2	3	5	2	4	5	5	6
5	1	6	2	3	5	2	4	1	5

Make a table and enter the data using tally marks. Find the number that appeared.

(a) The minimum number of times (b) The maximum number of times

(c) Find those numbers that appear an equal number of times.

4. Following pictograph shows the number of tractors in five villages.

Viilages	Number of tractors 🚜 - 1 Tractor
Village A	🚜 🚜 🚜 🚜 🚜 🚜
Village B	🚜 🚜 🚜 🚜 🚜
Village C	🚜 🚜 🚜 🚜 🚜 🚜 🚜 🚜
Village D	🚜 🚜 🚜
Village E	🚜 🚜 🚜 🚜 🚜 🚜

Observe the pictograph and answer the following questions.

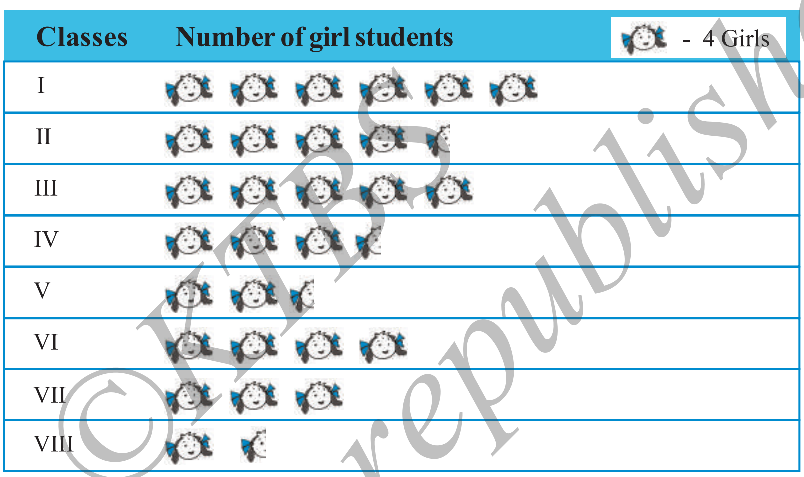
(i) Which village has the minimum number of tractors?

(ii) Which village has the maximum number of tractors?

(iii) How many more tractors village C has as compared to village B.

(iv) What is the total number of tractors in all the five villages?

5. The number of girl students in each class of a co-educational middle school is depicted by the pictograph :



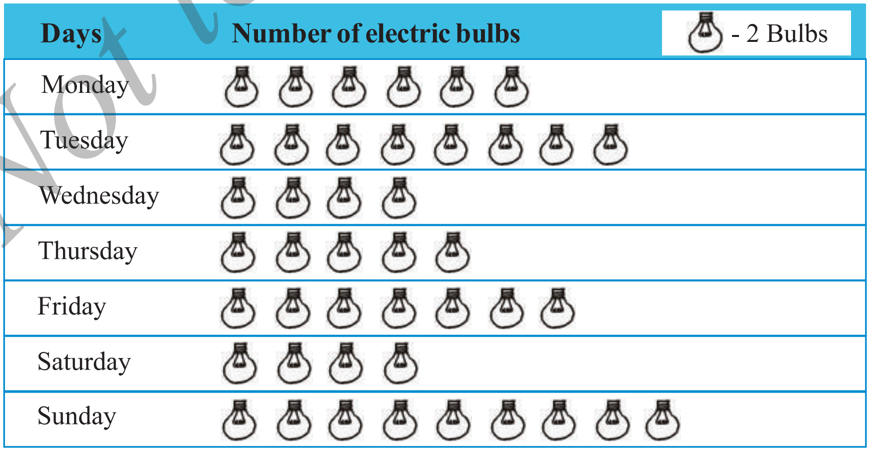
Observe this pictograph and answer the following questions :

(a) Which class has the minimum number of girl students?

(b) Is the number of girls in Class VI less than the number of girls in Class V?

(c) How many girls are there in Class VII?

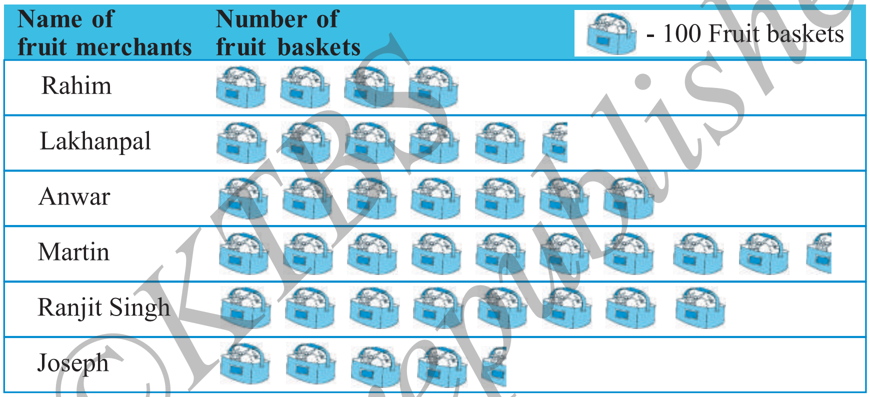
6. The sale of electric bulbs on different days of a week is shown below :



Observe the pictograph and answer the following questions :

(a) How many bulbs were sold on Friday?
(b) On which day were the maximum number of bulbs sold?
(c) On which of the days same number of bulbs were sold?
(d) On which of the days minimum number of bulbs were sold?
(e) If one big carton can hold 9 bulbs. How many cartons were needed in the given week?

7. In a village six fruit merchants sold the following number of fruit baskets in a particular season :



Observe this pictograph and answer the following questions :

(a) Which merchant sold the maximum number of baskets?
(b) How many fruit baskets were sold by Anwar?
(c) The merchants who have sold 600 or more number of baskets are planning to buy a godown for the next season. Can you name them?

9.6 Drawing a Pictograph

Drawing a pictograph is interesting. But sometimes, a symbol like  (which was used in one of the previous examples) may represent multiple units and may be difficult to draw. Instead of it we can use simpler symbols. If  represents say 5 students, how will you represent, say, 4 or 3 students?

We can solve such a situation by making an assumption that —

 represents 5 students,  represents 4 students,
 represents 3 students,  represents 2 students,  represents 1 student, and then start the task of representation.

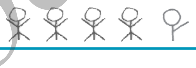
Example 7 : The following are the details of number of students present in a class of 30 during a week. Represent it by a pictograph.

Days	Number of students present
Monday	24
Tuesday	26
Wednesday	28
Thursday	30
Friday	29
Saturday	22

Solution : With the assumptions we have made earlier,

24 may be represented by 

26 may be represented by  and so on.
Thus, the pictograph would be

Days	Number of students present
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	

We had some sort of agreement over how to represent 'less than 5' by a picture. Such a sort of splitting the pictures may not be always possible. In such cases what shall we do?

Study the following example.

Example 8 : The following are the number of electric bulbs purchased for a lodging house during the first four months of a year.

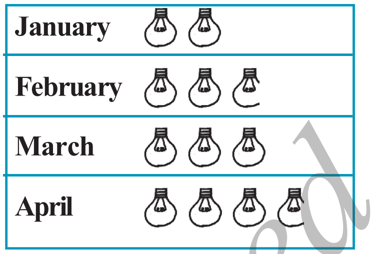
Months	Number of bulbs
January	20
February	26
March	30
April	34

Represent the details by a pictograph.

Solution : Picturising for January and March is not difficult. But representing 26 and 34 with the pictures is not easy.

We may round off 26 to nearest 5 i.e. to 25 and 34 to 35. We then show two and a half bulbs for February and three and a half for April.

Let 💡 represent 10 bulbs.



EXERCISE 9.2

1. Total number of animals in five villages are as follows :

Village A	:	80	Village B	:	120
Village C	:	90	Village D	:	40
Village E	:	60			

Prepare a pictograph of these animals using one symbol ⊗ to represent 10 animals and answer the following questions :

(a) How many symbols represent animals of village E?

(b) Which village has the maximum number of animals?

(c) Which village has more animals : village A or village C?

2. Total number of students of a school in different years is shown in the following table

Years	Number of students
1996	400
1998	535
2000	472
2002	600
2004	623

A. Prepare a pictograph of students using one symbol 🧍 to represent 100 students and answer the following questions:

(a) How many symbols represent total number of students in the year 2002?

(b) How many symbols represent total number of students for the year 1998?

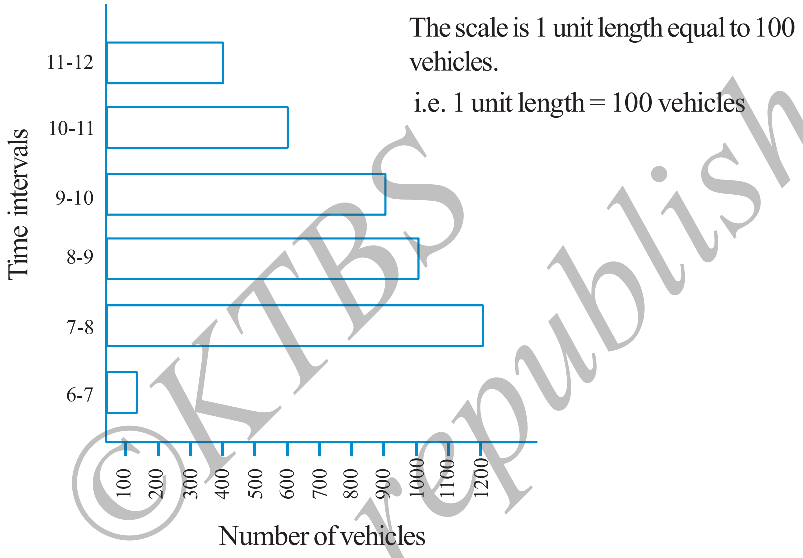
B. Prepare another pictograph of students using any other symbol each representing 50 students. Which pictograph do you find more informative?

9.7 A Bar Graph

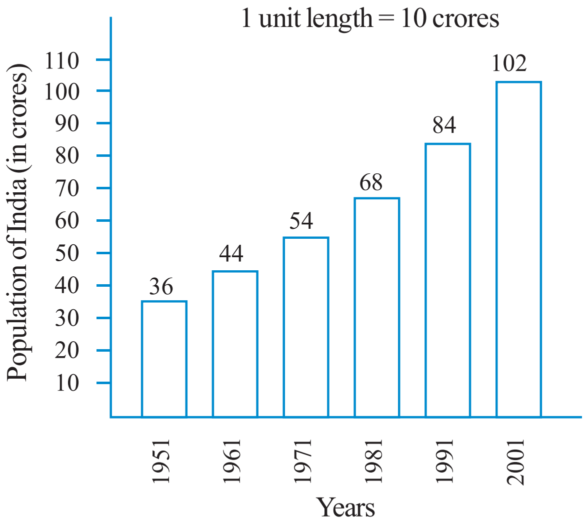
Representing data by pictograph is not only time consuming but at times difficult too. Let us see some other way of representing data visually. Bars of *uniform width* can be drawn horizontally or vertically with *equal spacing* between them and then the length of each bar represents the given number. Such method of representing data is called a *bar diagram* or a *bar graph*.

9.7.1 Interpretation of a bar graph

Let us look at the example of vehicular traffic at a busy road crossing in Delhi, which was studied by the traffic police on a particular day. The number of vehicles passing through the crossing every hour from 6 a.m. to 12.00 noon is shown in the bar graph. One unit of length stands for 100 vehicles.



We can see that maximum traffic is shown by the longest bar (i.e. 1200 vehicles) for the time interval 7-8 a.m. The second longer bar is for 8-9 a.m. Similarly, minimum traffic is shown by the smallest bar (i.e. 100 vehicles) for the time interval 6-7 a.m. The bar just longer than the smallest bar is between 11 a.m. - 12 noon.



The total traffic during the two peak hours (8.00-10.00 am) as shown by the two long bars is 1000+900 = 1900 vehicles.

If the numbers in the data are large, then you may need a different scale. For example, take the case of the growth of the population of India. The numbers are in crores. So, if you take 1 unit length to be one person, drawing the bars will not be possible. Therefore, choose the scale as 1 unit to represents 10 crores. The bar graph for this case is shown in the figure.

So, the bar of length 5 units represents 50 crores and of 8 units represents 80 crores.

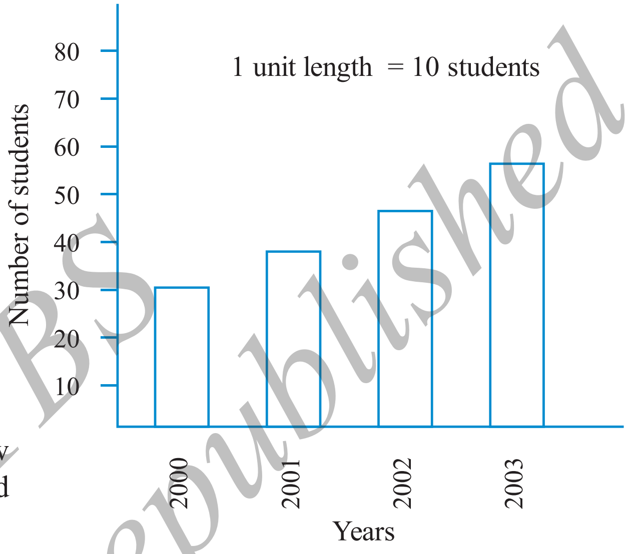
Example 9 : Read the adjoining bar graph showing the number of students in a particular class of a school.

Answer the following questions :

(a) What is the scale of this graph?

(b) How many new students are added every year?

(c) Is the number of students in the year 2003 twice that in the year 2000?



Solution : (a) The scale is 1 unit length equals 10 students.

Try (b) and (c) for yourself.

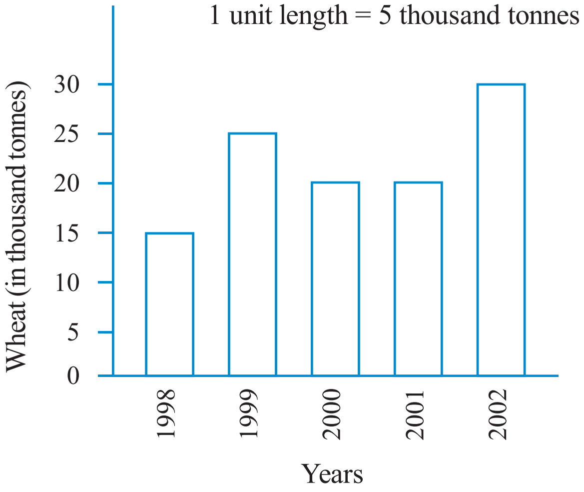
EXERCISE 9.3

1. The bar graph given alongside shows the amount of wheat purchased by government during the year 1998-2002.

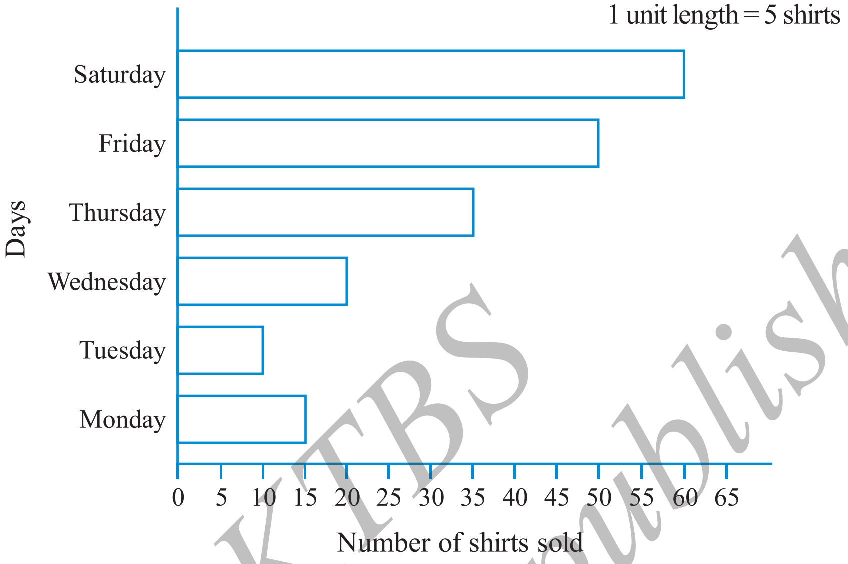
Read the bar graph and write down your observations. In which year was

(a) the wheat production maximum?

(b) the wheat production minimum?



2. Observe this bar graph which is showing the sale of shirts in a ready made shop from Monday to Saturday.



Now answer the following questions :

(a) What information does the above bar graph give?

(b) What is the scale chosen on the horizontal line representing number of shirts?

(c) On which day were the maximum number of shirts sold? How many shirts were sold on that day?

(d) On which day were the minimum number of shirts sold?

(e) How many shirts were sold on Thursday?

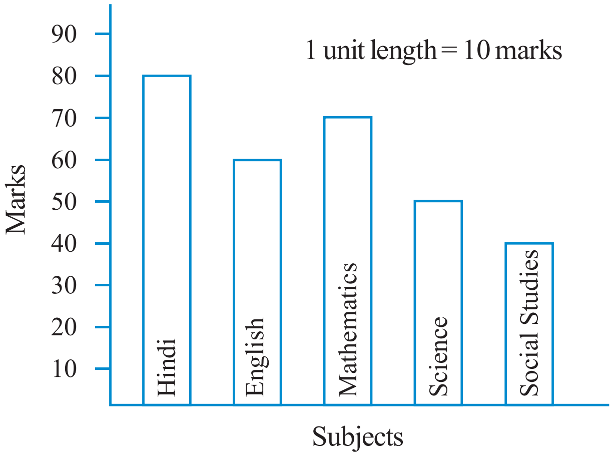
3. Observe this bar graph which shows the marks obtained by Aziz in half-yearly examination in different subjects.

Answer the given questions.

(a) What information does the bar graph give?

(b) Name the subject in which Aziz scored maximum marks.

(c) Name the subject in which he has scored minimum marks.



(d) State the name of the subjects and marks obtained in each of them.

9.7.2 Drawing a bar graph

Recall the example where Ronald (section 9.3) had prepared a table representing choice of fruits made by his classmates. Let us draw a bar graph for this data.

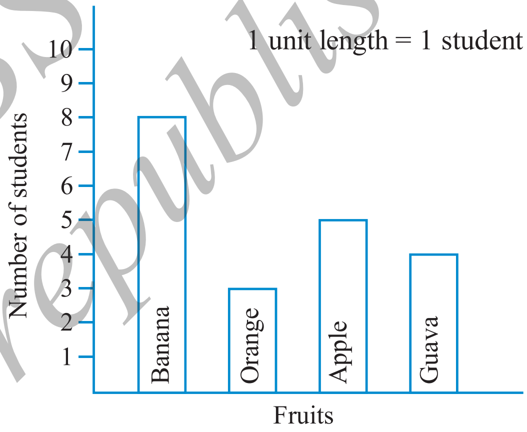
Name of fruits	Banana	Orange	Apple	Guava
Number of students	8	3	5	4

First of all draw a horizontal line and a vertical line. On the horizontal line we will draw bars representing each fruit and on vertical line we will write numerals representing number of students.

Let us choose a scale. It means we first decide how many students will be represented by unit length of a bar.

Here, we take 1 unit length to represent 1 student only.

We get a bar graph as shown in adjoining figure.



Example 10 : Following table shows the monthly expenditure of Imran's family on various items.

Items	**Expenditure (in ₹)**
House rent	3000
Food	3400
Education	800
Electricity	400
Transport	600
Miscellaneous	1200

To represent this data in the form of a bar diagram, here are the steps.

(a) Draw two perpendicular lines, one vertical and one horizontal.

(b) Along the horizontal line, mark the 'items' and along the vertical line, mark the corresponding expenditure.

(c) Take bars of same width keeping uniform gap between them.

(d) Choose suitable scale along the vertical line. Let 1 unit length = ₹ 200 and then mark the corresponding values.

Calculate the heights of the bars for various items as shown below.

House rent : 3000 ÷ 200 = 15 units

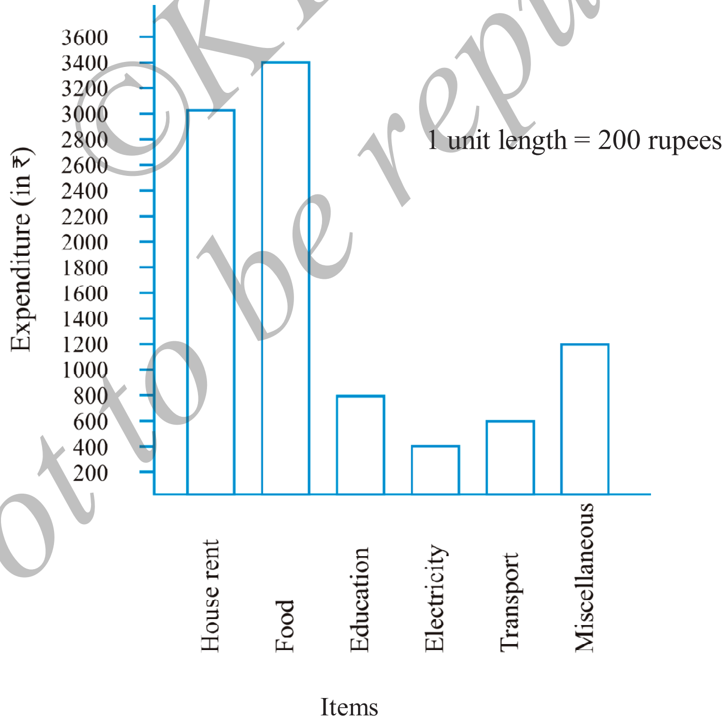
Food : 3400 ÷ 200 = 17 units

Education : 800 ÷ 200 = 4 units

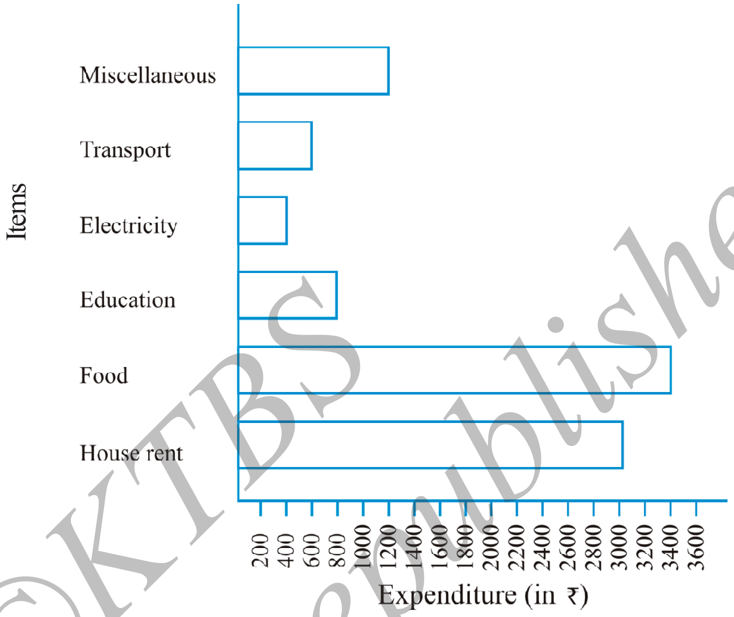
Electricity : 400 ÷ 200 = 2 units

Transport : 600 ÷ 200 = 3 units

Miscellaneous : 1200 ÷ 200 = 6 units



Same data can be represented by interchanging positions of items and expenditure as shown below :



Do This

1. Along with your friends, think of five more situations where we can have data.
   For this data, construct the tables and represent them using bar graphs.

EXERCISE 9.4

1. A survey of 120 school students was done to find which activity they prefer to do in their free time.

Preferred activity	Number of students
Playing	45
Reading story books	30
Watching TV	20
Listening to music	10
Painting	15

Draw a bar graph to illustrate the above data taking scale of 1 unit length = 5 students.

Which activity is preferred by most of the students other than playing?

2. The number of Mathematics books sold by a shopkeeper on six consecutive days is shown below :

Days	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Number of books sold	65	40	30	50	20	70

Draw a bar graph to represent the above information choosing the scale of your choice.

3. Following table shows the number of bicycles manufactured in a factory during the years 1998 to 2002. Illustrate this data using a bar graph. Choose a scale of your choice.

Years	**Number of bicycles manufactured**
1998	800
1999	600
2000	900
2001	1100
2002	1200

(a) In which year were the maximum number of bicycles manufactured?

(b) In which year were the minimum number of bicycles manufactured?

4. Number of persons in various age groups in a town is given in the following table.

Age group (in years)	1-14	15-29	30-44	45-59	60-74	75 and above
Number of persons	2 lakhs	1 lakh 60 thousands	1 lakh 20 thousands	1 lakh 20 thousands	80 thousands	40 thousands

Draw a bar graph to represent the above information and answer the following questions. (take 1 unit length = 20 thousands)

(a) Which two age groups have same population?

(b) All persons in the age group of 60 and above are called senior citizens. How many senior citizens are there in the town?

What have we discussed?

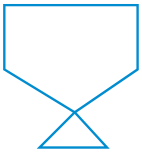
1. We have seen that data is a collection of numbers gathered to give some information.
2. To get a particular information from the given data quickly, the data can be arranged in a tabular form using tally marks.
3. We learnt how a pictograph represents data in the form of pictures, objects or parts of objects. We have also seen how to interpret a pictograph and answer the related questions. We have drawn pictographs using symbols to represent a certain number of items or things. For example,  = 100 books.
4. We have discussed how to represent data by using a bar diagram or a bar graph. In a bar graph, bars of uniform width are drawn horizontally or vertically with equal spacing between them. The length of each bar gives the required information.
5. To do this we also discussed the process of choosing a scale for the graph. For example, 1 unit = 100 students. We have also practised reading a given bar graph. We have seen how interpretations from the same can be made.

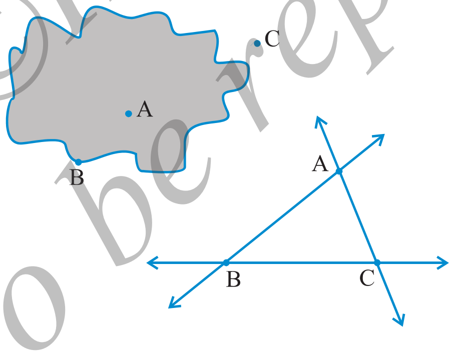
Mensuration

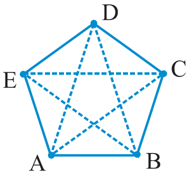
Chapter 10

10.1 Introduction

When we talk about some plane figures as shown below we think of their regions and their boundaries. We need some measures to compare them. We look into these now.



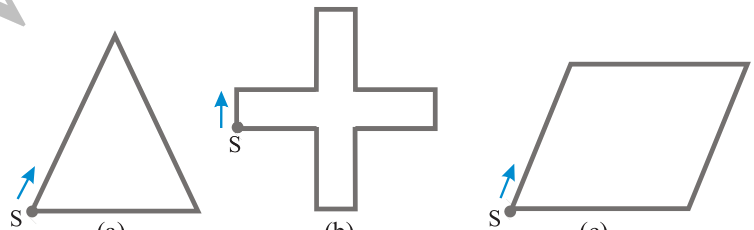




10.2 Perimeter

Look at the following figures (Fig. 10.1). You can make them with a wire or a string.

If you start from the point S in each case and move along the line segments then you again reach the point S. You have made a complete round of the



(a) (b) (c)

Fig 10.1

shape in each case (a), (b) & (c). The distance covered is equal to the length of wire used to draw the figure.

This distance is known as the **perimeter** of the closed figure. It is the length of the wire needed to form the figures.

The idea of perimeter is widely used in our daily life.

- A farmer who wants to fence his field.
- An engineer who plans to build a compound wall on all sides of a house.
- A person preparing a track to conduct sports.

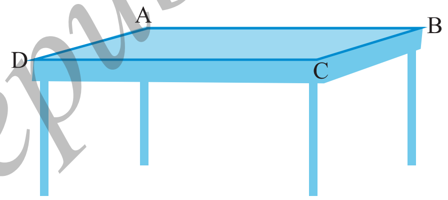
All these people use the idea of 'perimeter'.

Give five examples of situations where you need to know the perimeter.

Perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.

Try These

1. Measure and write the length of the four sides of the top of your study table.



AB = _____ cm

BC = _____ cm

CD = _____ cm

DA = _____ cm

Now, the sum of the lengths of the four sides

= AB + BC + CD + DA

= ___ cm + ___ cm + ___ cm + ___ cm

= ______ cm

What is the perimeter?

2. Measure and write the lengths of the four sides of a page of your notebook. The sum of the lengths of the four sides

= AB + BC + CD + DA

= ___ cm + ___ cm + ___ cm + ___ cm

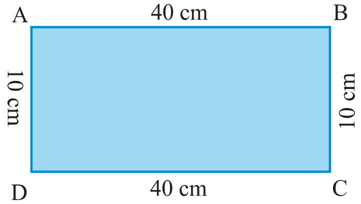
= ______ cm

What is the perimeter of the page?

3. Meera went to a park 150 m long and 80 m wide. She took one complete round on its boundary. What is the distance covered by her?

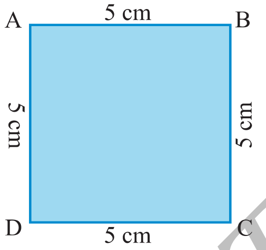
4. Find the perimeter of the following figures:

(a)



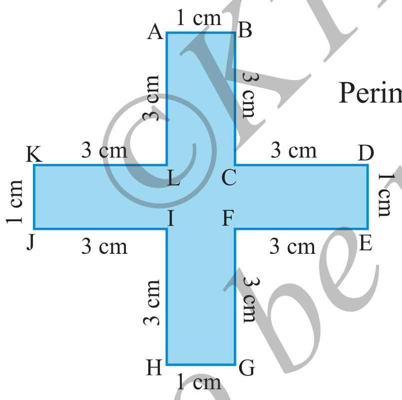
Perimeter = AB + BC + CD + DA
= ___+___+___+___
= _______

(b)



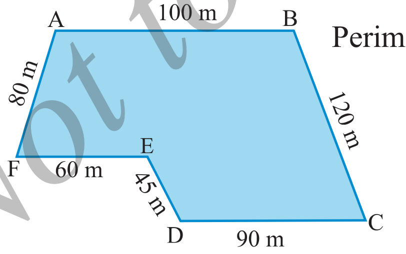
Perimeter = AB + BC + CD + DA
= ___ + ___ + ___+ ___
= _______

(c)

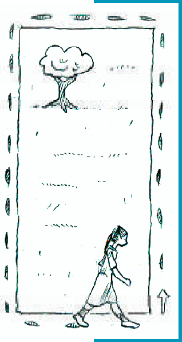


Perimeter = AB + BC + CD + DE
+ EF + FG + GH +HI
+ IJ + JK + KL + LA
= ___ + ___ +___ + ___ + ___ +
___ + ___ + ___ +___+ ___
+ ___ + ___
= _______

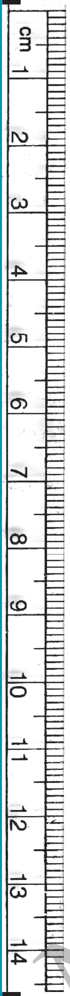
(d)



Perimeter = AB + BC + CD + DE + EF
+ FA
= ___ + ___ + ___ + ___ + ___ + ___
= _______



So, how will you find the perimeter of any closed figure made up entirely of line segments? Simply find the sum of the lengths of all the sides (which are line segments).



10.2.1 Perimeter of a rectangle

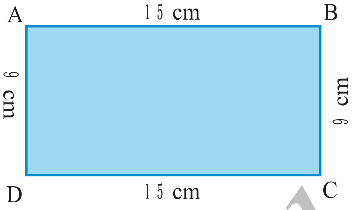
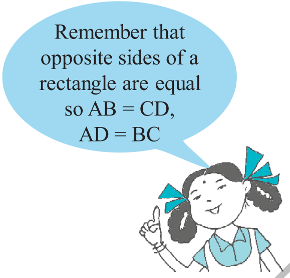


Fig 10.2

Let us consider a rectangle ABCD (Fig 10.2) whose length and breadth are 15 cm and 9 cm respectively. What will be its perimeter?

Perimeter of the rectangle = Sum of the lengths of its four sides.



$$= AB + BC + CD + DA$$
$$= AB + BC + AB + BC$$
$$= 2 \times AB + 2 \times BC$$
$$= 2 \times (AB + BC)$$
$$= 2 \times (15\text{cm} + 9\text{cm})$$
$$= 2 \times (24\text{cm})$$
$$= 48 \text{ cm}$$

Try These

Find the perimeter of the following rectangles:

Length of rectangle	Breadth of rectangle	Perimeter by adding all the sides	Perimeter by 2 × (Length + Breadth)
25 cm	12 cm	= 25 cm + 12 cm + 25 cm + 12 cm = 74 cm	= 2 ×(25 cm + 12 cm) = 2 × (37 cm) = 74 cm
0.5 m	0.25 m		
18 cm	15 cm		
10.5 cm	8.5 cm		

Hence, from the said example, we notice that

Perimeter of a rectangle = length + breadth + length + breadth

i.e. **Perimeter of a rectangle = 2 × (length + breadth)**

Let us now see practical applications of this idea :

Example 1 : Shabana wants to put a lace border all around a rectangular table cover (Fig 10.3), 3 m long and 2 m wide. Find the length of the lace required by Shabana.

Solution : Length of the rectangular table cover = 3 m

Breadth of the rectangular table cover = 2 m

Shabana wants to put a lace border all around the table cover. Therefore, the length of the lace required will be equal to the perimeter of the rectangular table cover.

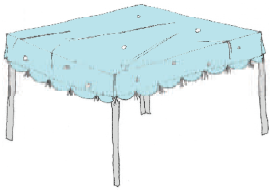


Fig 10.3

Now, perimeter of the rectangular table cover
= 2 × (length + breadth) = 2 × (3 m + 2 m) = 2 × 5 m = 10 m
So, length of the lace required is 10 m.

Example 2 : An athlete takes 10 rounds of a rectangular park, 50 m long and 25 m wide. Find the total distance covered by him.

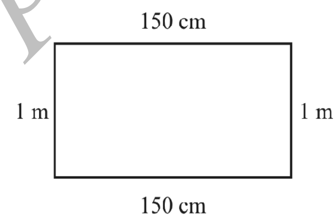
Solution : Length of the rectangular park = 50 m
Breadth of the rectangular park = 25 m

Total distance covered by the athlete in one round will be the perimeter of the park.

Now, perimeter of the rectangular park
= 2 × (length + breadth)= 2 × (50 m + 25 m)
= 2 × 75 m = 150 m
So, the distance covered by the athlete in one round is 150 m.
Therefore, distance covered in 10 rounds = 10 × 150 m = 1500m
The total distance covered by the athlete is 1500 m.

Example 3 : Find the perimeter of a rectangle whose length and breadth are 150 cm and 1 m respectively.

Solution : Length = 150 cm
Breadth = 1m = 100 cm
Perimeter of the rectangle
= 2 × (length + breadth)
= 2 × (150 cm + 100 cm)
= 2 × (250 cm) = 500 cm = 5 m



Example 4 : A farmer has a rectangular field of length and breadth 240 m and 180 m respectively. He wants to fence it with 3 rounds of rope as shown in figure 10.4. What is the total length of rope he must use?

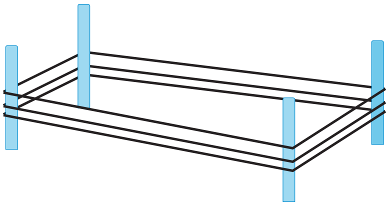


Fig 10.4

Solution : The farmer has to cover three times the perimeter of that field. Therefore, total length of rope required is thrice its perimeter.

Perimeter of the field = 2 × (length + breadth)
= 2 × (240 m + 180 m)
= 2 × 420 m = 840 m

Total length of rope required = 3 × 840 m = 2520 m

Example 5 : Find the cost of fencing a rectangular park of length 250 m and breadth 175 m at the rate of ₹ 12 per metre.

Solution : Length of the rectangular park = 250 m

Breadth of the rectangular park = 175 m

To calculate the cost of fencing we require perimeter.

Perimeter of the rectangle $= 2 \times (\text{length} + \text{breadth})$

$= 2 \times (250 \text{ m} + 175 \text{ m})$

$= 2 \times (425 \text{ m}) = 850 \text{ m}$

Cost of fencing 1m of park = ₹ 12

Therefore, the total cost of fencing the park

= ₹ 12 × 850 = ₹ 10200

10.2.2 Perimeter of regular shapes

Consider this example.

Biswamitra wants to put coloured tape all around a square picture (Fig 10.5) of side 1m as shown. What will be the length of the coloured tape he requires?

Since Biswamitra wants to put the coloured tape all around the square picture, he needs to find the perimeter of the picture frame.

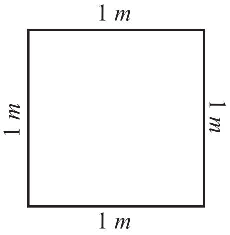


Fig 10.5

Thus, the length of the tape required

= Perimeter of square = 1m + 1 m + 1 m + 1 m = 4 m

Now, we know that all the four sides of a square are equal, therefore, in place of adding it four times, we can multiply the length of one side by 4. Thus, the length of the tape required = 4 × 1 m = 4 m

From this example, we see that

Perimeter of a square = 4 × length of a side

Draw more such squares and find the perimeters.

Now, look at equilateral triangle (Fig 10.6) with each side equal to 4 cm. Can we find its perimeter?

Perimeter of this equilateral triangle = 4 + 4 + 4 cm

= 3 × 4 cm = 12 cm

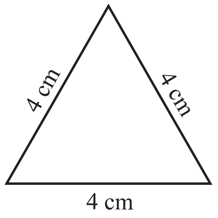


Fig 10.6

So, we find that

Perimeter of an equilateral triangle = 3 × length of a side

What is similar between a square and an equilateral triangle? They are figures having all the sides of equal length and all the angles of equal measure. Such

Try These

Find various objects from your surroundings which have regular shapes and find their perimeters.

figures are known as *regular closed figures*. Thus, a square and an equilateral triangle are regular closed figures.

You found that,

Perimeter of a square = 4 × length of one side

Perimeter of an equilateral triangle = 3 × length of one side

So, what will be the perimeter of a regular pentagon?

A regular pentagon has five equal sides.

Therefore, perimeter of a regular pentagon = 5 × length of one side and the perimeter of a regular hexagon will be _______ and of an octagon will be ______.

Example 6 : Find the distance travelled by Shaina if she takes three rounds of a square park of side 70 m.

Solution : Perimeter of the square park = 4 × length of a side = 4 × 70 m = 280 m

Distance covered in one round = 280 m

Therefore, distance travelled in three rounds = 3 × 280m = 840m

Example 7 : Pinky runs around a square field of side 75 m, Bob runs around a rectangular field with length 160 m and breadth 105 m. Who covers more distance and by how much?

Solution : Distance covered by Pinky in one round = Perimeter of the square
= 4 × length of a side
= 4 × 75 m = 300 m

Distance covered by Bob in one round = Perimeter of the rectangle
= 2 × (length + breadth)
= 2 × (160 m + 105 m)
= 2 × 265 m = 530 m

Difference in the distance covered = 530 m – 300 m = 230 m.

Therefore, Bob covers more distance by 230 m.

Example 8 : Find the perimeter of a regular pentagon with each side measuring 3 cm.

Solution : This regular closed figure has 5 sides, each with a length of 3 cm. Thus, we get

Perimeter of the regular pentagon = 5 × 3 cm = 15 cm

Example 9 : The perimeter of a regular hexagon is 18 cm. How long is its one side?

Solution : Perimeter = 18 cm

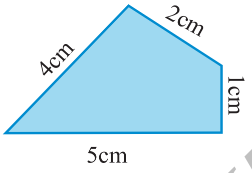
A regular hexagon has 6 sides, so we can divide the perimeter by 6 to get the length of one side.

One side of the hexagon = 18 cm ÷ 6 = 3 cm

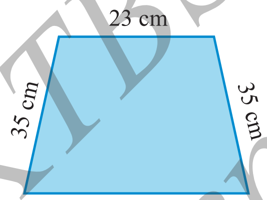
Therefore, length of each side of the regular hexagon is 3 cm.

EXERCISE 10.1

1. Find the perimeter of each of the following figures :



(a)



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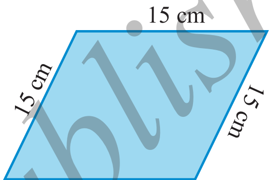
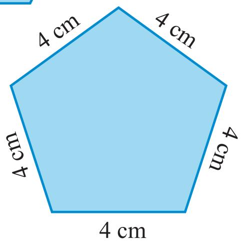
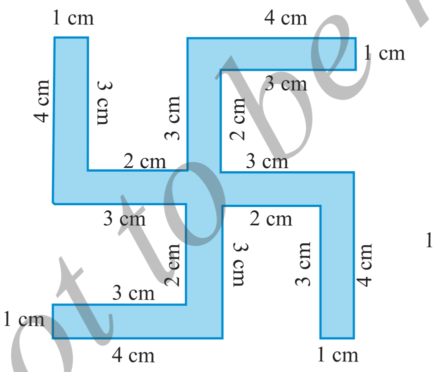


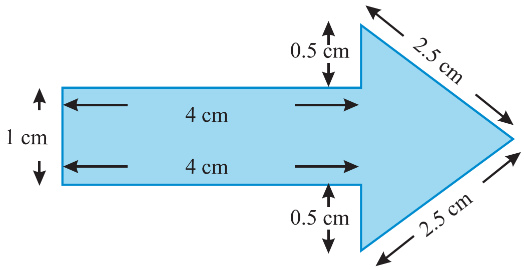
(c)



(d)



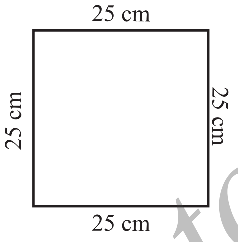
(f)



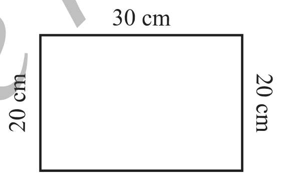
(e)

2. The lid of a rectangular box of sides 40 cm by 10 cm is sealed all round with tape. What is the length of the tape required?
3. A table-top measures 2 m 25 cm by 1 m 50 cm. What is the perimeter of the table-top?
4. What is the length of the wooden strip required to frame a photograph of length and breadth 32 cm and 21 cm respectively?
5. A rectangular piece of land measures 0.7 km by 0.5 km. Each side is to be fenced with 4 rows of wires. What is the length of the wire needed?

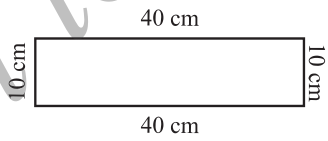
6. Find the perimeter of each of the following shapes :
   (a) A triangle of sides 3 cm, 4 cm and 5 cm.
   (b) An equilateral triangle of side 9 cm.
   (c) An isosceles triangle with equal sides 8 cm each and third side 6 cm.
7. Find the perimeter of a triangle with sides measuring 10 cm, 14 cm and 15 cm.
8. Find the perimeter of a regular hexagon with each side measuring 8 m.
9. Find the side of the square whose perimeter is 20 m.
10. The perimeter of a regular pentagon is 100 cm. How long is its each side?
11. A piece of string is 30 cm long. What will be the length of each side if the string is used to form :
    (a) a square? (b) an equilateral triangle? (c) a regular hexagon?
12. Two sides of a triangle are 12 cm and 14 cm. The perimeter of the triangle is 36 cm. What is its third side?
13. Find the cost of fencing a square park of side 250 m at the rate of ₹ 20 per metre.
14. Find the cost of fencing a rectangular park of length 175 m and breadth 125 m at the rate of ₹ 12 per metre.
15. Sweety runs around a square park of side 75 m. Bulbul runs around a rectangular park with length 60 m and breadth 45 m. Who covers less distance?
16. What is the perimeter of each of the following figures? What do you infer from the answers?



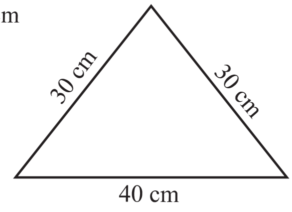
(a)



(c)



(b)



(d)

17. Avneet buys 9 square paving slabs, each with a side of $\frac{1}{2}$ m. He lays them in the form of a square.
    (a) What is the perimeter of his arrangement [Fig 10.7(i)]?

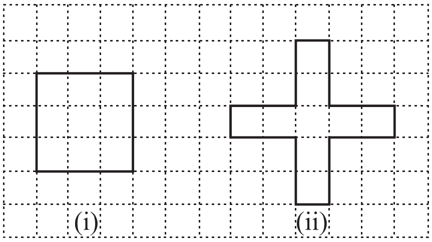


Fig 10.7

(b) Shari does not like his arrangement. She gets him to lay them out like a cross. What is the perimeter of her arrangement [(Fig 10.7 (ii)]?

(c) Which has greater perimeter?

(d) Avneet wonders if there is a way of getting an even greater perimeter. Can you find a way of doing this? (The paving slabs must meet along complete edges i.e. they cannot be broken.)

10.3 Area

Look at the closed figures (Fig 10.8) given below. All of them occupy some region of a flat surface. Can you tell which one occupies more region?

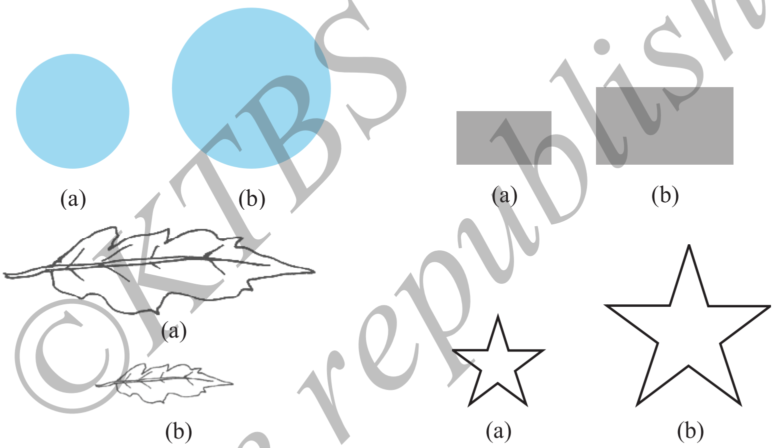


Fig 10.8

The amount of surface enclosed by a closed figure is called its **area**.

So, can you tell, which of the above figures has more area?

Now, look at the adjoining figures of Fig 10.9 :

Which one of these has larger area? It is difficult to tell just by looking at these figures. So, what do you do?

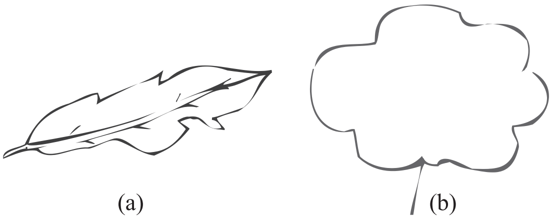


Fig 10.9

Place them on a squared paper or graph paper where every square measures 1 cm × 1 cm.

Make an outline of the figure.

Look at the squares enclosed by the figure. Some of them are completely enclosed, some half, some less than half and some more than half.

The area is the number of centimetre squares that are needed to cover it.

But there is a small problem : the squares do not always fit exactly into the area you measure. We get over this difficulty by adopting a convention :

- The area of one full square is taken as 1 sq unit. If it is a centimetre square sheet, then area of one full square will be 1 sq cm.
- Ignore portions of the area that are less than half a square.
- If more than half of a square is in a region, just count it as one square.
- If exactly half the square is counted, take its area as $\frac{1}{2}$ sq unit.

Such a convention gives a fair estimate of the desired area.

Example 10 : Find the area of the shape shown in the figure 10.10.

Solution : This figure is made up of line-segments. Moreover, it is covered by full squares and half squares only. This makes our job simple.

(i) Fully-filled squares = 3

(ii) Half-filled squares = 3

Area covered by full squares

= 3 × 1 sq units = 3 sq units

Total area = $4\frac{1}{2}$ sq units.

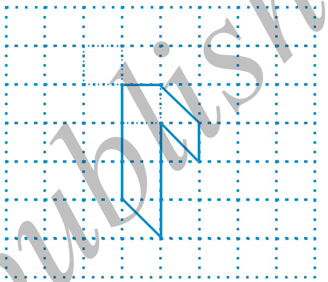


Fig 10.10

Example 11 : By counting squares, estimate the area of the figure 10.9 b.

Soultion : Make an outline of the figure on a graph sheet. (Fig 10.11)

Covered area	Number	Area estimate (sq units)
(i) Fully-filled squares	11	11
(ii) Half-filled squares	3	$3 \times \frac{1}{2}$
(iii) More than half-filled squares	7	7
(iv) Less than half-filled squares	5	0

Total area = $11 + 3 \times \frac{1}{2} + 7 = 19\frac{1}{2}$ sq units.

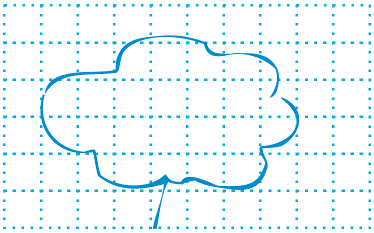


Fig 10.11

How do the squares cover it?

Example 12 : By counting squares, estimate the area of the figure 10.9 a.

Soultion : Make an outline of the figure on a graph sheet. This is how the squares cover the figure (Fig 10.12).

Try These

1. Draw any circle on a graph sheet. Count the squares and use them to estimate the area of the circular region.
2. Trace shapes of leaves, flower petals and other such objects on the graph paper and find their areas.

Covered area	Number	Area estimate (sq units)
(i) Fully-filled squares	1	1
(ii) Half-filled squares	–	–
(iii) More than half-filled squares	7	7
(iv) Less than half-filled squares	9	0

Total area = 1 + 7 = 8 sq units.

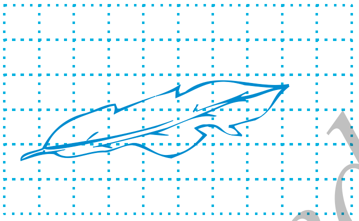
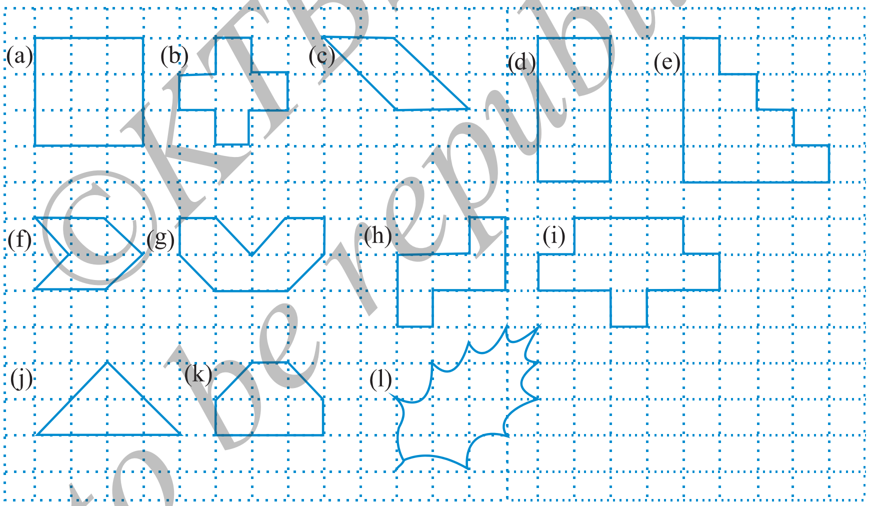
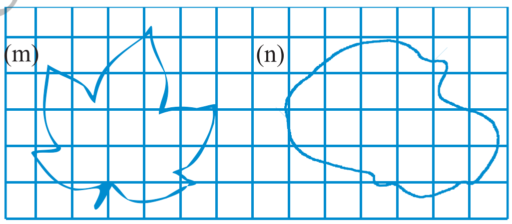


Fig 10.12

EXERCISE 10.2

1. Find the areas of the following figures by counting square:





10.3.1 Area of a rectangle

With the help of the squared paper, can we tell, what will be the area of a rectangle whose length is 5 cm and breadth is 3 cm?

Draw the rectangle on a graph paper having 1 cm × 1 cm squares (Fig 10.13). The rectangle covers 15 squares completely.

The area of the rectangle = 15 sq cm which can be written as 5 × 3 sq cm i.e. (length × breadth).

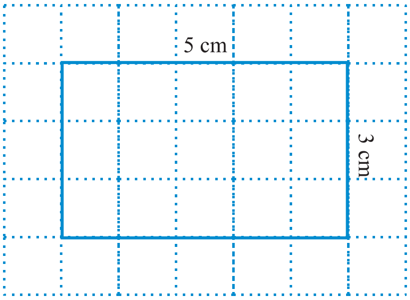


Fig 10.13

The measures of the sides of some of the rectangles are given. Find their areas by placing them on a graph paper and counting the number of square.

Length	Breadth	Area
3 cm	4 cm	----------
7 cm	5 cm	----------
5 cm	3 cm	----------

What do we infer from this?

We find,

Area of a rectangle = (length × breadth)

Without using the graph paper, can we find the area of a rectangle whose length is 6 cm and breadth is 4cm?

Yes, it is possible.

What do we infer from this?

We find that,

Area of the rectangle = length × breadth = 6 cm × 4 cm = 24 sq cm.

Try These

1. Find the area of the floor of your classroom.
2. Find the area of any one door in your house.

10.3.2 Area of a square

Let us now consider a square of side 4 cm (Fig 10.14).

What will be its area?

If we place it on a centimetre graph paper, then what do we observe?

It covers 16 squares i.e. the area of the square = 16 sq cm = 4 × 4 sq cm

Calculate areas of few squares by assuring length of one side of squares by yourself.

Find their areas using graph papers.

What do we infer from this?

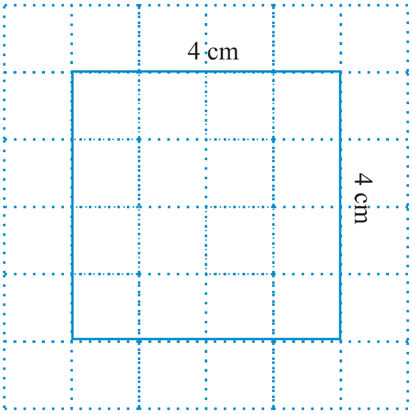


Fig 10.14

We find that in each case,

Area of the square = side × side

You may use this as a formula in doing problems.

Example 13 : Find the area of a rectangle whose length and breadth are 12 cm and 4 cm respectively.

Solution : Length of the rectangle = 12 cm

Breadth of the rectangle = 4 cm

Area of the rectangle = length × breadth

= 12 cm × 4 cm = 48 sq cm.

Example 14 : Find the area of a square plot of side 8 m.

Solution : Side of the square = 8 m

Area of the square = side × side

= 8 m × 8 m = 64 sq m.

Example 15 : The area of a rectangular piece of cardboard is 36 sq cm and its length is 9 cm. What is the width of the cardboard?

Solution : Area of the rectangle = 36 sq cm

Length = 9 cm

Width = ?

Area of a rectangle = length × width

So, width $= \frac{\text{Area}}{\text{Length}} = \frac{36}{9} = 4$ cm

Thus, the width of the rectangular cardboard is 4 cm.

Example 16 : Bob wants to cover the floor of a room 3 m wide and 4 m long by squared tiles. If each square tile is of side 0.5 m, then find the number of tiles required to cover the floor of the room.

Solution : Total area of tiles must be equal to the area of the floor of the room.

Length of the room = 4 m

Breadth of the room = 3 m

Area of the floor = length × breadth

= 4 m × 3 m = 12 sq m

Area of one square tile = side × side

= 0.5 m × 0.5 m

= 0.25 sq m

Number of tiles required = $\frac{\text{Area of the floor}}{\text{Area of one tile}} = \frac{12}{0.25} \quad \frac{1200}{25} \quad$ 48 tiles.

Example 17 : Find the area in square metre of a piece of cloth 1m 25 cm wide and 2 m long.

Solution : Length of the cloth = 2 m

Breadth of the cloth = 1 m 25 cm = 1 m + 0. 25 m = 1.25 m

(since 25 cm = 0.25m)

Area of the cloth = length of the cloth × breadth of the cloth

= 2 m × 1.25 m = 2.50 sq m

EXERCISE 10.3

1. Find the areas of the rectangles whose sides are :

   (a) 3 cm and 4 cm (b) 12 m and 21 m (c) 2 km and 3 km (d) 2 m and 70 cm

2. Find the areas of the squares whose sides are :

   (a) 10 cm (b) 14 cm (c) 5 m

3. The length and breadth of three rectangles are as given below :

   (a) 9 m and 6 m (b) 17 m and 3 m (c) 4 m and 14 m

   Which one has the largest area and which one has the smallest?

4. The area of a rectangular garden 50 m long is 300 sq m. Find the width of the garden.

5. What is the cost of tiling a rectangular plot of land 500 m long and 200 m wide at the rate of ₹ 8 per hundred sq m.?

6. A table-top measures 2 m by 1 m 50 cm. What is its area in square metres?

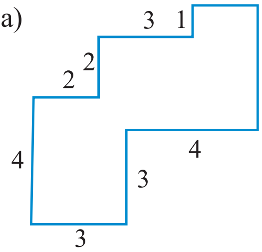
7. A room is 4 m long and 3 m 50 cm wide. How many square metres of carpet is needed to cover the floor of the room?

8. A floor is 5 m long and 4 m wide. A square carpet of sides 3 m is laid on the floor. Find the area of the floor that is not carpeted.

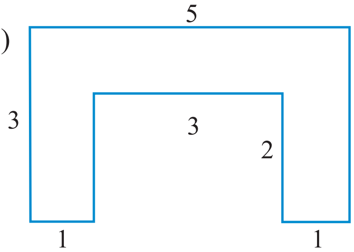
9. Five square flower beds each of sides 1 m are dug on a piece of land 5 m long and 4 m wide. What is the area of the remaining part of the land?

10. By splitting the following figures into rectangles, find their areas (The measures are given in centimetres).

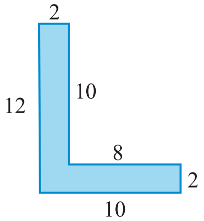
(a)



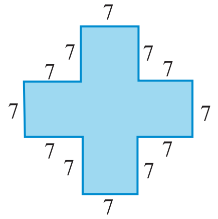
(b)



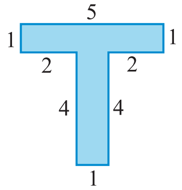
11. Split the following shapes into rectangles and find their areas. (The measures are given in centimetres)



(a)



(b)



(c)

12. How many tiles whose length and breadth are 12 cm and 5 cm respectively will be needed to fit in a rectangular region whose length and breadth are respectively:
    (a) 100 cm and 144 cm (b) 70 cm and 36 cm.

A challenge!

On a centimetre squared paper, make as many rectangles as you can, such that the area of the rectangle is 16 sq cm (consider only natural number lengths).

(a) Which rectangle has the greatest perimeter?

(b) Which rectangle has the least perimeter?

If you take a rectangle of area 24 sq cm, what will be your answers?

Given any area, is it possible to predict the shape of the rectangle with the greatest perimeter? With the least perimeter? Give example and reason.

What have we discussed?

1. Perimeter is the distance covered along the boundary forming a closed figure when you go round the figure once.
2. (a) Perimeter of a rectangle = 2 × (length + breadth)
   (b) Perimeter of a square = 4 × length of its side
   (c) Perimeter of an equilateral triangle = 3 × length of a side
3. Figures in which all sides and angles are equal are called regular closed figures.
4. The amount of surface enclosed by a closed figure is called its area.
5. To calculate the area of a figure using a squared paper, the following conventions are adopted :
   (a) Ignore portions of the area that are less than half a square.
   (b) If more than half a square is in a region. Count it as one square.
   (c) If exactly half the square is counted, take its area as $\frac{1}{2}$ sq units.
6. (a) Area of a rectangle = length × breadth
   (b) Area of a square = side × side