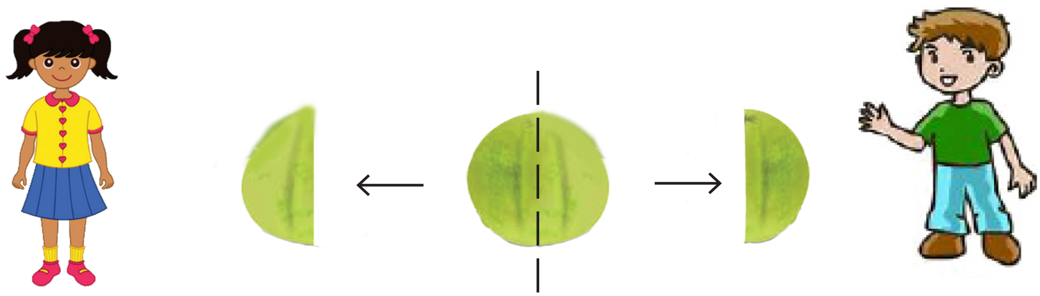
9 Fractions

By studying this lesson, you will be able to,

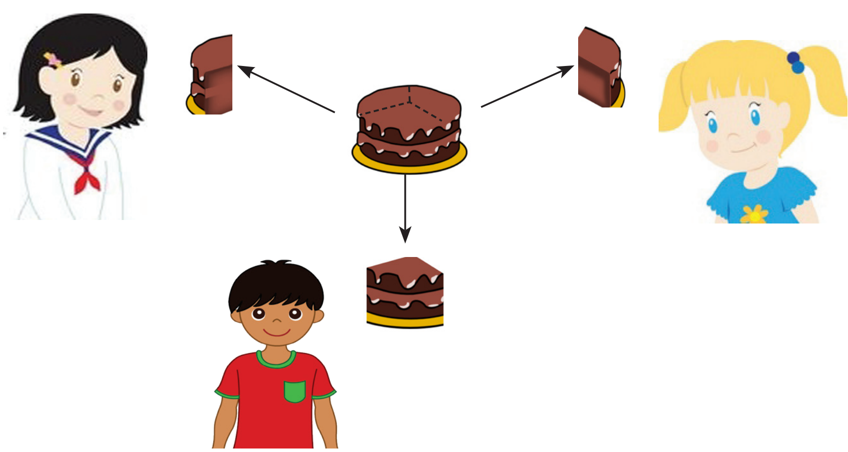
- identify proper fractions, unit fractions and equivalent fractions,
- compare proper fractions and
- add and subtract proper fractions.

9.1 Introduction

The picture below shows how a sister and a brother divided a Guava into two equal parts.



The picture below shows how three people divided a cake into three equal parts.



There are many such situations where a whole unit is divided into equal parts.

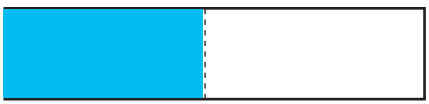
In the first situation, a person received one part out of the two equal parts of the Guava. If we numerically represent the Guava as 1 , then the numerical representation of the part a person receives is $\frac{1}{2}$. This is read as “one half ”.

In the above second situation, a person received one part of the three equal parts the cake was divided. If we numerically represent the cake as 1, then the quantity one person receives is $\frac{1}{3}$. This is read as “one third”.

Let us consider further, the parts obtained by dividing a whole unit into equal parts as shown in the pictures below.

1

Let us take the coloured quantity as one unit , and represent it numerically as one.

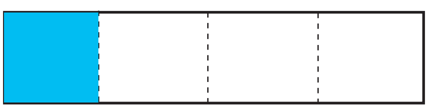


$\frac{1}{2}$

The same unit is now divided into two equal parts , and one part is coloured. The coloured quantity is $\frac{1}{2}$. This is read as “one half ”. There are two $\frac{1}{2}$ quantities in a unit.

$\frac{1}{3}$

The same unit is now divided into three equal parts , and one part is coloured. The coloured quantity is $\frac{1}{3}$. This is read as “one third ”. There are three $\frac{1}{3}$ quantities in a unit.



$\frac{1}{4}$

The same unit is now divided into four equal parts , and one part is coloured. The coloured quantity is $\frac{1}{4}$. This is read as “one fourth ”. There are four $\frac{1}{4}$ quantities in a unit.

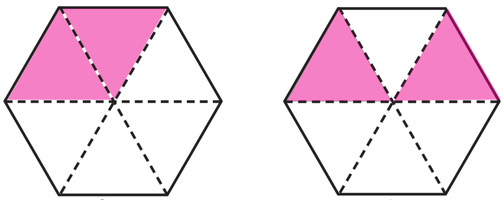
$\frac{2}{3}$

The same unit is now divided into three equal parts, and two parts are coloured. The coloured quantity is $\frac{2}{3}$. This is read as "two thirds ".

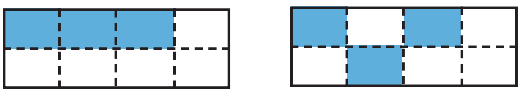
Note

In general use, we read $\frac{1}{2}$ as **half**, $\frac{1}{4}$ as **quarter** and $\frac{3}{4}$ as **three quarters.**

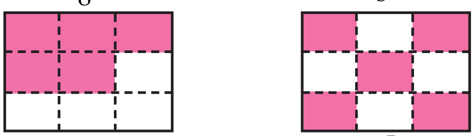
If we consider each of the figures below as a whole unit, and numerically represent each figure as 1, then the coloured quantities are $\frac{2}{6}$, $\frac{2}{6}$, $\frac{3}{8}$, $\frac{3}{8}$, $\frac{5}{9}$, and $\frac{5}{9}$ respectively.



$\frac{2}{6}$ $\frac{2}{6}$



$\frac{3}{8}$ $\frac{3}{8}$



$\frac{5}{9}$ $\frac{5}{9}$

What we have done so far is to,

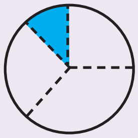
- numerically represent the quantity shown by a unit as 1.
- divide that unit into equal parts.
- numerically represent the quantity shown by one or several of those parts.

The numbers, which are less than one and greater than zero represented in this manner are known as **proper fractions.**

Some examples of proper fractions are $\frac{1}{2}$, $\frac{1}{4}$, $\frac{2}{3}$ and $\frac{3}{8}$.

Note

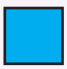
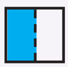
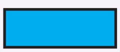
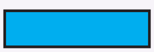
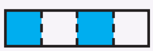
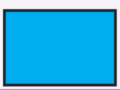
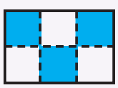
There are fractions which are greater than one as well. You will be able to learn those in a higher grade.



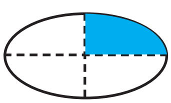
This picture has been divided into four parts. But, the coloured part is not $\frac{1}{4}$ of the whole unit.

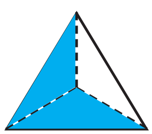
Exercise 9.1

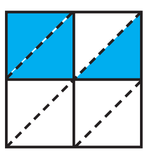
(1) Fill in the blanks given in the table.

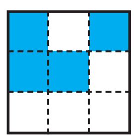
Unit	Represented quantity	Number of parts divided equally	Number of coloured parts	Quantity of the coloured part as a fraction	The way of reading
		2	1	$\frac{1}{2}$	One half
		3	....	....	....
		....	....	....	....
		....	....	....	....

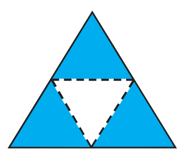
(2) Consider each of the figures below as a whole unit. Now write down the coloured quantity as a fraction.


(i)

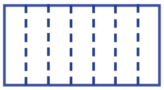

(ii)


(iii)

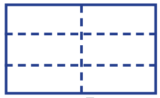

(iv)


(v)

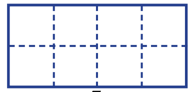
(3) Copy each of the pictures below and colour the quantity indicated by the fraction.

(i) 

$\frac{3}{7}$

(ii) 

$\frac{5}{6}$

(iii) 

$\frac{5}{8}$

9.2 The denominator and the numerator of a fraction

Consider the fraction $\frac{4}{7}$.

Here, 7 is the number of parts a whole unit is divided equally into. We call it the **denominator** of the fraction. It is written below the line of the fraction.

4 is the number of parts considered. We call it the **numerator** of the fraction. It is written above the line of the fraction.

$$\frac{4}{7}\begin{array}{l}\longleftarrow \text{numerator}\\ \longleftarrow \text{denominator}\end{array}$$

When we write a fraction numerically in this manner,

- the number written below the line is defined as the **denominator** of the fraction.
- the number written above the line is defined as the **numerator** of the fraction.

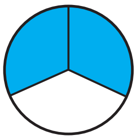
In a proper fraction, the numerator is always less than its denominator.

Consider the fractions such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{5}$, where the numerator is one. Such fractions are called **unit fractions.**

Such a fraction indicates the quantity of one part by dividing a whole unit into equal parts. These fraction are important because they can be used to explain other fractions.

Let us now explain $\frac{2}{3}$ in terms of $\frac{1}{3}$.

Let us represent this by a figure.



This picture is divided into three equal parts. One part is $\frac{1}{3}$ of the whole unit. The coloured quantity, that is, $\frac{2}{3}$ is two such parts.

That is $\frac{2}{3}$ is two $\frac{1}{3}$s.

Similarly,

$\frac{3}{4}$ is, three $\frac{1}{4}$s, $\frac{5}{7}$ is five $\frac{1}{7}$s and three $\frac{1}{5}$ s is $\frac{3}{5}$.

Exercise 9.2

(1) Fill in the blanks using the words "denominator" and "numerator" appropriately.

(i) The .... of $\frac{3}{8}$ is 8. (ii) The .... of $\frac{5}{11}$ is 5.

(2) Write down the fraction with denominator 5 and numerator 2.

(3) Out of the proper fractions given below, choose and write down the unit fractions.

$\frac{3}{5}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{1}{7}$, $\frac{4}{11}$, $\frac{7}{10}$, $\frac{1}{15}$, $\frac{1}{27}$

(4) Choose the appropriate value from the brackets and fill in the blanks.

(i) $\frac{2}{5}$ is.... $\frac{1}{5}$s. (one, two, three) (ii) $\frac{4}{7}$ is.... $\frac{1}{7}$s. (eight, seven, four)

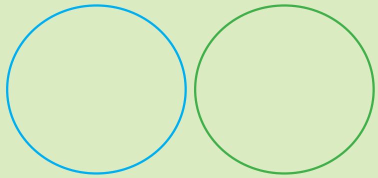
(iii) $\frac{2}{3}$ is two............s. ($\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{6}$) (iv) $\frac{3}{4}$ is three........s. ($\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{4}$)

(v) Three..........is $\frac{3}{5}$. ($\frac{1}{3}$s, $\frac{1}{5}$s, $\frac{1}{4}$s) (vi) Five.............is $\frac{5}{8}$. ($\frac{1}{7}$s, $\frac{1}{8}$s, $\frac{1}{12}$s)

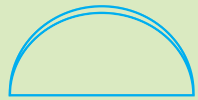
9.3 Equivalent fractions

Activity 1

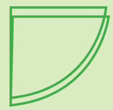
Take two white circular shaped cards, of the same size.



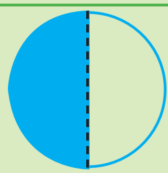
Step 1 - Fold the first circular card once, so that it is divided into two equal parts.



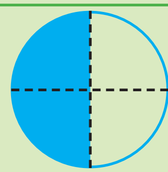
Step 2 - Fold the second circular card twice, so that it is divided into four equal parts.



Step 3 - Unfold both cards and colour half of each of them. Then we obtain the following figure.



The coloured portion of this card is $\frac{1}{2}$ of the entire card.



The coloured portion of this card is $\frac{2}{4}$ of the entire card.

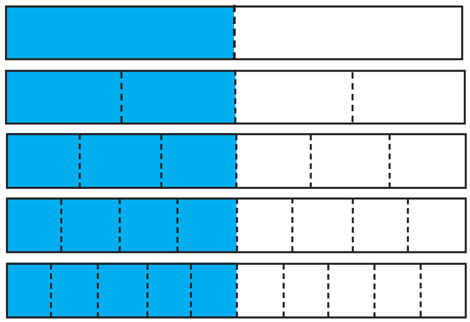
The coloured quantity of the entire card is the same in both cards. Therefore, the numbers represented by $\frac{1}{2}$ and $\frac{2}{4}$ are the same.

Accordingly, $\frac{1}{2} = \frac{2}{4}$

Such fractions which represent the same value although they have different denominators and different numerators, are known as **equivalent fractions.**

Accordingly, $\frac{1}{2}$ and $\frac{2}{4}$ are equivalent fractions.

Let us consider equivalent fractions further.



$\frac{1}{2}$ $\frac{2}{4}$ $\frac{3}{6}$ $\frac{4}{8}$ $\frac{5}{10}$

The shaded quantities in each of the figures above are the same.

Therefore, the fractions $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}, \frac{4}{8}$ and $\frac{5}{10}$ represented by them are equal. Therefore, these fractions are equivalent fractions.

Let us consider two other methods of obtaining these equivalent fractions.

Method 1

$\frac{1}{2} = \frac{1\times 2}{2\times 2} = \frac{2}{4}$, Here, the denominator and the numerator are multiplied by 2.

$\frac{1}{2} = \frac{1\times 3}{2\times 3} = \frac{3}{6}$, Here, the denominator and the numerator are multiplied by 3.

$\frac{1}{2} = \frac{1\times 4}{2\times 4} = \frac{4}{8}$, Here, the denominator and the numerator are multiplied by 4.

$\frac{1}{2} = \frac{1\times 5}{2\times 5} = \frac{5}{10}$, Here, the denominator and the numerator are multiplied by 5.

This shows that, by multiplying both the numerator and the denominator of a fraction by the same whole number (except zero), a fraction which is equivalent to the first fraction can be obtained.

Method 2

$\frac{2}{4}=\frac{2\div 2}{4\div 2}=\frac{1}{2}$, Here, both the denominator and the numerator are divided by 2

$\frac{3}{6}=\frac{3\div 3}{6\div 3}=\frac{1}{2}$, Here, both the denominator and the numerator are divided by 3

$\frac{4}{8}=\frac{4\div 4}{8\div 4}=\frac{1}{2}$, Here, both the denominator and the numerator are divided by 4

This shows that, by dividing both the numerator and the denominator of a fraction by the same whole number (where the division gives zero remainder), a fraction which is equivalent to the first fraction can be obtained.

Example 1

Write down two fractions equivalent to $\frac{2}{10}$.

$\frac{2}{10}=\frac{2\times 3}{10\times 3}=\frac{6}{30}$

$\frac{2}{10}=\frac{2\div 2}{10\div 2}=\frac{1}{5}$

$\frac{6}{30}$ and $\frac{1}{5}$ are equivalent to $\frac{2}{10}$.

Example 2

Determine whether $\frac{2}{10}$ and $\frac{3}{15}$ are equivalent fractions.

$\frac{2}{10}=\frac{2\div 2}{10\div 2}=\frac{1}{5}$

$\frac{3}{15}=\frac{3\div 3}{15\div 3}=\frac{1}{5}$

Accordingly, $\frac{2}{10}=\frac{3}{15}$.

Therefore, $\frac{2}{10}$ and $\frac{3}{15}$ are equivalent fractions.

Exercise 9.3

(1) Fill in the blanks so that you obtain fractions that are equivalent to the first fraction.

(i) $\frac{1}{3}=\frac{1\times 2}{3\times\square}=\frac{2}{6}$ (ii) $\frac{3}{4}=\frac{3\times\square}{4\times 3}=\frac{\square}{\square}$

(iii) $\frac{8}{12}=\frac{8\div\square}{12\div 4}=\frac{\square}{\square}$ (iv) $\frac{10}{20}=\frac{10\div\square}{20\div\square}=\frac{\square}{2}$

(v) $\frac{4}{9}=\frac{8}{\square}=\frac{\square}{36}=\frac{\square}{\square}$ (vi) $\frac{4}{8}=\frac{4\div 2}{8\div\square}=\frac{\square}{\square}$

(vii) $\frac{2}{7}=\frac{2\times\square}{7\times\square}=\frac{\square}{14}$ (viii) $\frac{4}{5}=\frac{\square}{10}=\frac{\square}{15}$

(2) For each fraction below, write down two equivalent fractions.

(i) $\frac{1}{4}$ (ii) $\frac{3}{5}$ (iii) $\frac{7}{8}$

(iv) $\frac{6}{12}$ (v) $\frac{8}{10}$ (vi) $\frac{2}{7}$

(3) (i) Determine whether $\frac{2}{4}$ and $\frac{6}{12}$ are equivalent fractions.

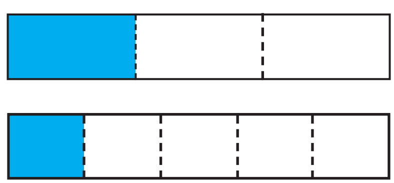
(ii) Determine whether $\frac{1}{6}$ and $\frac{3}{12}$ are equivalent fractions.

(4) Write down a fraction having denominator 6, which is equivalent to $\frac{1}{2}$ and a fraction having denominator 6, which is equivalent to $\frac{2}{3}$.

9.4 Comparison of fractions

Comparison of fractions having the numerator as 1

The figures below represent the fractions $\frac{1}{3}$ and $\frac{1}{5}$.



$\frac{1}{3}$

$\frac{1}{5}$

According to the figures above, it is clear that $\frac{1}{3}$ is greater than $\frac{1}{5}$. We write this symbolically as $\frac{1}{3} > \frac{1}{5}$.

Out of $\frac{1}{3}$ and $\frac{1}{5}$, the fraction with the smaller denominator is $\frac{1}{3}$.

In this manner, out of two unit fractions, the larger fraction is the fraction with the smaller denominator.

• Comparison of fractions having the same numerator

Compare the fractions $\frac{2}{3}$ and $\frac{2}{5}$.

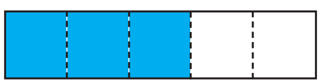
We learnt that, $\frac{2}{3}$ is two $\frac{1}{3}$s and $\frac{2}{5}$ is two $\frac{1}{5}$s.

Since $\frac{1}{3} > \frac{1}{5}$, we have $\frac{2}{3} > \frac{2}{5}$.

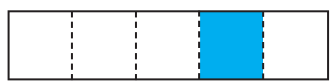
In this manner, out of two fractions having the same numerator, the larger fraction is the fraction with the smaller denominator.

• Comparison of fractions having the same denominator

Suppose a cake is cut into five equal parts and brother took three parts while sister took one part. Here, brother has taken a larger portion of the cake. Let us represent this by a figure.



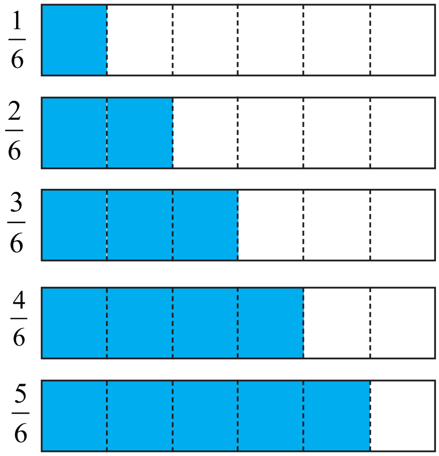
The portion that brother has taken is $\frac{3}{5}$.



The portion that sister has taken is $\frac{1}{5}$.

Accordingly, $\frac{3}{5} > \frac{1}{5}$. We can also write this as $\frac{1}{5} < \frac{3}{5}$.

Let us consider another example.
Fractions having 6 as their denominator are represented in the figure below.



According to the figures, it is clear that,

$$\frac{1}{6} < \frac{2}{6} < \frac{3}{6} < \frac{4}{6} < \frac{5}{6} < 1.$$

We can also write this as,

$$1 > \frac{5}{6} > \frac{4}{6} > \frac{3}{6} > \frac{2}{6} > \frac{1}{6}.$$

Out of two fractions having the same denominator, the larger fraction is the fraction with the larger numerator.

Example 1

Arrange the fractions $\frac{4}{5}, \frac{1}{5}, \frac{2}{5}$ in ascending order.

$\frac{1}{5} < \frac{2}{5} < \frac{4}{5}$. The ascending order of these fractions is $\frac{1}{5}, \frac{2}{5}, \frac{4}{5}$.

● More on comparison of fractions

Let us consider the comparison of fractions such as $\frac{1}{6}$ and $\frac{5}{12}$, where the numerators and denominators are not equal.

Let us write these fractions as fractions having the same denominator using equivalent fractions.
Thereafter, we can identify the larger fraction as in the earlier situation.

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

$\frac{5}{12}$ is greater than $\frac{2}{12}$.

That is, $\frac{5}{12} > \frac{2}{12}$. Accordingly, $\frac{5}{12} > \frac{1}{6}$.

Example 1

Select the larger fraction out of $\frac{1}{2}$ and $\frac{3}{4}$.

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

Since $\frac{3}{4} > \frac{2}{4}$, we have $\frac{3}{4} > \frac{1}{2}$. Therefore, the larger fraction is $\frac{3}{4}$.

Exercise 9.4

(1) Find the largest fraction out of the fractions in each of the following parts.

(i) $\frac{1}{6}, \frac{1}{2}$ (ii) $\frac{1}{11}, \frac{1}{15}$ (iii) $\frac{1}{8}, \frac{1}{3}$

(iv) $\frac{1}{5}, \frac{1}{3}, \frac{1}{7}$ (v) $\frac{1}{12}, \frac{1}{5}, \frac{1}{6}$ (vi) $\frac{2}{3}, \frac{2}{5}$

(vii) $\frac{5}{7}, \frac{5}{6}$ (viii) $\frac{3}{4}, \frac{3}{8}$ (ix) $\frac{4}{9}, \frac{4}{5}, \frac{4}{7}$

(x) $\frac{6}{11}, \frac{6}{17}, \frac{6}{13}$

(2) Fill in the blanks by inserting one of the symbols $<$, $>$ or $=$ appropriately.

(i) $\frac{1}{5} \ldots\ldots \frac{3}{5}$ (ii) $\frac{8}{13} \ldots\ldots \frac{5}{13}$ (iii) $\frac{1}{6} \ldots\ldots \frac{1}{2}$

(iv) $\frac{5}{7}$ .... $\frac{5}{11}$ (v) $\frac{4}{9}$ .... $\frac{4}{7}$ (vi) $\frac{1}{3}$ .... $\frac{5}{6}$

(vii) $\frac{6}{10}$ .... $\frac{3}{5}$ (viii) $\frac{7}{18}$ .... $\frac{2}{3}$ (ix) $\frac{3}{4}$ .... $\frac{9}{12}$

(x) $\frac{2}{5}$ .... $\frac{1}{2}$ (xi) $\frac{2}{10}$ .... $\frac{1}{9}$ (xii) $\frac{1}{2}$ .... $\frac{7}{11}$

(3) Write down the fractions in each of the following parts in ascending order.

(i) $\frac{1}{7}, \frac{1}{4}, \frac{1}{9}$ (ii) $\frac{4}{5}, \frac{4}{11}, \frac{4}{7}$ (iii) $\frac{3}{8}, \frac{5}{8}, \frac{1}{8}$

(iv) $\frac{7}{12}, \frac{11}{12}, \frac{5}{12}$ (v) $\frac{11}{12}, \frac{5}{6}, \frac{7}{12}$ (vi) $\frac{7}{10}, \frac{7}{11}, \frac{13}{22}$

(4) Write down two fractions less than $\frac{1}{2}$ and having different denominators to each other.

9.5 Addition and subtraction of fractions

- Addtion and subtraction of fractions having the same denominator.

A cake was brought home. Mother divided it into 8 equal parts. Then one part is $\frac{1}{8}$ of the whole cake.

Damith ate 2 parts, that is $\frac{2}{8}$ of the cake at tea time. His sister ate another part, that is $\frac{1}{8}$ of the cake at tea time. The total amount Damith and his sister ate is three $\frac{1}{8}$s. That is, $\frac{3}{8}$.

Therefore, when a quantity of $\frac{2}{8}$ is added to a quantity of $\frac{1}{8}$, the total quantity is $\frac{3}{8}$.

Let us show this symbolically.

$$\frac{2}{8}+\frac{1}{8}=\frac{3}{8}$$

In this manner, when adding two fractions having the same denominator, the denominator of the answer is the same as the denominators of the added fractions. The numerator of the answer is the addition of the numerators of the added fractions.

Example 1

Add $\frac{2}{4}$ to $\frac{1}{4}$.

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

Example 2

Find the value of $\frac{2}{9}+\frac{5}{9}$.

$$\frac{2}{9}+\frac{5}{9}=\frac{2+5}{9}$$
$$=\underline{\underline{\frac{7}{9}}}$$

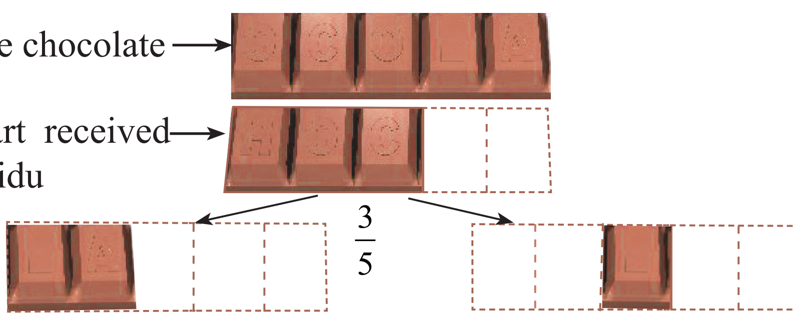
• Subtraction of fractions having the same denominator

Lakindu received $\frac{3}{5}$ of a chocolate that can be divided into 5 equal parts. A part equal to $\frac{1}{5}$ of the entire chocolate was given to Sakindu, from the part $\frac{3}{5}$ that Lakindu recieved.

Then, Lakindu was left with $\frac{2}{5}$ of the entire chocolate.

The entire chocolate →

The part received → by Lakidu



The part remaining with Lakidu $\frac{2}{5}$.   The part given to Sakidu $\frac{1}{5}$.

Let us represent this symbolically.

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

When subtracting fractions having the same denominator, the denominator of the answer is same as the denominator of those fractions. The numerator of the answer is the value that is obtained by subtracting the numerator of the second fraction from the numerator of the first fraction.

Example 1

Find the value of $\frac{5}{7}-\frac{2}{7}$

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

Example 2

Find the value of $\frac{10}{13}-\frac{4}{13}$

$$\frac{10}{13}-\frac{4}{13}=\frac{10-4}{13}$$
$$=\frac{6}{13}$$

Example 3

Find the value of $\frac{7}{15}-\frac{2}{15}$

$$\frac{7}{15}-\frac{2}{15}=\frac{7-2}{15}=\frac{5}{15}$$

If it is necessary, the following equivalent fraction can also be obtained.

$$=\frac{5\div 5}{15\div 5}$$
$$=\frac{1}{3}$$

Exercise 9.5

(1) Simplify the following.

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

(d) $\frac{1}{6}+\frac{2}{6}$ (e) $\frac{1}{4}+\frac{2}{4}$ (f) $\frac{5}{11}+\frac{1}{11}$

(g) $\frac{3}{5}+\frac{1}{5}$ (h) $\frac{3}{8}+\frac{5}{8}$ (i) $\frac{7}{12}+\frac{5}{12}$

(j) $\frac{4}{7}+\frac{2}{7}$ (k) $\frac{3}{10}+\frac{3}{10}$ (l) $\frac{4}{8}+\frac{3}{8}$

(m) $\frac{2}{6}+\frac{3}{6}$ (n) $\frac{7}{15}+\frac{3}{15}$ (o) $\frac{2}{7}+\frac{1}{7}+\frac{3}{7}$

(p) $\frac{2}{8}+\frac{3}{8}+\frac{1}{8}$ (q) $\frac{3}{10}+\frac{4}{10}+\frac{2}{10}$ (r) $\frac{3}{9}+\frac{1}{9}+\frac{2}{9}$

(s) $\frac{1}{6}+\frac{2}{6}+\frac{3}{6}$ (t) $\frac{7}{15}+\frac{6}{15}+\frac{2}{15}$

(2) Write the relevant values in the boxes.

(a) $\frac{7}{9}-\frac{2}{9}=\frac{7-\square}{9}=\frac{\square}{9}$ (b) $\frac{5}{7}-\frac{2}{7}\ \frac{\square-2}{7}=\frac{\square}{7}$

(c) $\frac{7}{10}-\frac{3}{10}=\frac{\square-\square}{10}=\frac{\square}{10}$ (d) $\frac{7}{8}-\frac{4}{8}=\frac{\square-\square}{\square}=\frac{\square}{\square}$

(e) $\frac{8}{15}-\frac{7}{15}=\frac{\square-\square}{\square}=\frac{\square}{\square}$

(3) Simplify the following.

(a) $\frac{2}{3}-\frac{1}{3}$ (b) $\frac{3}{5}-\frac{1}{5}$ (c) $\frac{9}{10}-\frac{1}{10}$

(d) $\frac{3}{4}-\frac{1}{4}$ (e) $\frac{6}{8}-\frac{1}{8}$ (f) $\frac{7}{8}-\frac{3}{8}$

(g) $\frac{6}{11}-\frac{5}{11}$ (h) $\frac{5}{9}-\frac{4}{9}$ (i) $\frac{6}{7}-\frac{1}{7}$

(j) $\frac{5}{6}-\frac{4}{6}$ (k) $\frac{11}{15}-\frac{4}{15}$ (l) $\frac{9}{13}-\frac{4}{13}$

(m) $\frac{5}{8}-\frac{3}{8}$ (n) $\frac{7}{9}-\frac{6}{9}$ (o) $\frac{17}{20}-\frac{7}{20}$

(4) Write the relevant values in the boxes.

(a) $\frac{7}{15}+\frac{\square}{15}=\frac{12}{15}$ (b) $\frac{\square}{6}+\frac{3}{6}=\frac{5}{6}$ (c) $\frac{6}{8}+\frac{\square}{8}=\frac{7}{8}$

(d) $\frac{2}{7}+\frac{\square}{7}=\frac{6}{7}$

• More on addition of fractions

Let us consider fractions such as $\frac{3}{10}$ and $\frac{2}{5}$, where the denominators are different.

Let us add $\frac{3}{10}$ to $\frac{2}{5}$.

Find the fraction having denominator 10, which is equivalent to $\frac{2}{5}$.

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

Therefore $\frac{3}{10}+\frac{2}{5}=\frac{3}{10}+\frac{4}{10}=\frac{7}{10}$

First, fractions having the same denominator, and which are equal to the given fractions are obtained in terms of equivalent fractions. Thereafter, the addition is carried out.

Example 1

Find the value of $\frac{1}{2}+\frac{1}{4}$.

$$\frac{1}{2}+\frac{1}{4}=\frac{1\times 2}{2\times 2}+\frac{1}{4}$$
$$=\frac{2}{4}+\frac{1}{4}$$
$$=\frac{2+1}{4}$$
$$=\underline{\underline{\frac{3}{4}}}$$

Example 2

Find the value of $\frac{2}{3}+\frac{1}{15}$.

$$\frac{2}{3}+\frac{1}{15}=\frac{2\times 5}{3\times 5}+\frac{1}{15}$$
$$=\frac{10}{15}+\frac{1}{15}$$
$$=\frac{10+1}{15}$$
$$=\underline{\underline{\frac{11}{15}}}$$

More on subtraction of fractions

Let us consider about subtracting $\frac{1}{4}$ from $\frac{1}{2}$, where the fractions have different denominators.

Let us write the fraction equivalent to $\frac{1}{2}$ having 4 as the denominator.

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

Then,

$$\frac{1}{2}-\frac{1}{4}=\frac{2}{4}-\frac{1}{4}$$
$$=\frac{2-1}{4}$$
$$=\underline{\underline{\frac{1}{4}}}$$

Here also, subtraction is carried out by obtaining fractions equivalent to the given fractions with the same denominator.

Example 1

Find the value of $\frac{7}{10}-\frac{2}{5}$.

$$\frac{7}{10}-\frac{2}{5}=\frac{7}{10}-\frac{2\times2}{5\times2}$$
$$=\frac{7}{10}-\frac{4}{10}$$
$$=\underline{\underline{\frac{3}{10}}}$$

Example 2

Find the value of $\frac{2}{3}-\frac{3}{12}$.

$$\frac{2}{3}-\frac{3}{12}=\frac{2\times4}{3\times4}-\frac{3}{12}$$
$$=\frac{8}{12}-\frac{3}{12}$$
$$=\frac{8-3}{12}$$
$$=\underline{\underline{\frac{5}{12}}}$$

Exercise 9.6

(1) Simplify the following.

(a) $\frac{1}{3}+\frac{1}{6}$ (b) $\frac{1}{4}+\frac{1}{2}$ (c) $\frac{3}{10}+\frac{3}{5}$

(d) $\frac{1}{4}+\frac{3}{8}$ (e) $\frac{2}{9}+\frac{2}{3}$ (f) $\frac{2}{7}+\frac{4}{21}$

(g) $\frac{3}{12}+\frac{2}{3}$ (h) $\frac{2}{5}+\frac{11}{20}$ (i) $\frac{2}{15}+\frac{2}{3}$

(j) $\frac{3}{4}+\frac{3}{20}$ (k) $\frac{3}{18}+\frac{2}{3}$ (l) $\frac{1}{4}+\frac{11}{24}$

(m) $\frac{7}{30}+\frac{2}{3}$ (n) $\frac{1}{2}+\frac{5}{16}$ (o) $\frac{5}{21}+\frac{2}{3}$

(2) Simplify the following.

(a) $\frac{1}{3}-\frac{1}{6}$ (b) $\frac{3}{4}-\frac{1}{2}$ (c) $\frac{3}{5}-\frac{3}{10}$

(d) $\frac{5}{6}-\frac{2}{3}$ (e) $\frac{8}{15}-\frac{2}{5}$ (f) $\frac{3}{4}-\frac{5}{12}$

(g) $\frac{17}{18}-\frac{5}{6}$ (h) $\frac{4}{5}-\frac{7}{20}$ (i) $\frac{13}{15}-\frac{2}{3}$

(j) $\frac{2}{3}-\frac{5}{12}$ (k) $\frac{19}{20}-\frac{3}{4}$ (l) $\frac{27}{30}-\frac{5}{6}$

(m) $\frac{3}{4}-\frac{17}{24}$ (n) $\frac{1}{2}-\frac{5}{16}$ (o) $\frac{2}{3}-\frac{9}{21}$

(3) On Monday Amal read $\frac{1}{2}$ of a story book. On Tuesday he read another $\frac{1}{4}$ of the book .What fraction of the book was read in total by Amal on the two days?

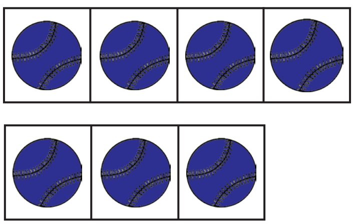
(4) Father spends $\frac{1}{4}$ of his monthly salary on his children's clothes and $\frac{1}{12}$ of his salary on books.

(i) What is the total amount spent as a fraction of the monthly salary?

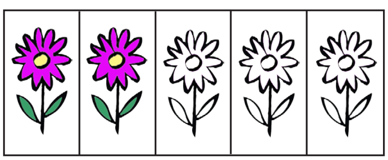
(ii) How much more is spent on clothes than on books as a fraction of the monthly salary?

9.5 A fraction of a homogeneous collection

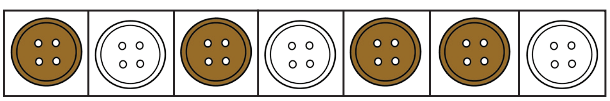
We already know to express parts of a whole unit as fractions. Now, let us express a part of a collection as a fraction.



Let us take a collection of four balls as a unit. Remove one of it. Then, the amount of balls remaining is $\frac{3}{4}$ as a fraction of the collection.



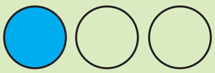
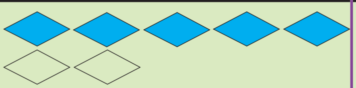
From a collection of five flowers, the amonut of purple flowers is $\frac{2}{5}$ as a fraction of the collection.



From a collection of seven buttons, the amount of brown buttons is $\frac{4}{7}$ as a fraction of the collection.

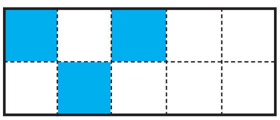
Activity 2

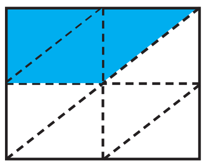
Fill in the blanks in the table given below.

Collection	Total number of parts in the collection	Number of coloured parts	Coloured quantity as a fraction of the total quantity
	2	1	$\frac{1}{2}$
	3	....	....
	....	....	....
	....	....	....

Miscellaneous Exercises

(1) Write down the coloured part as a fraction of each unit given below.

(i) 

(ii) 

(2) Consider a suitable figure as a unit and represent each fraction given below.

(i) $\frac{1}{5}$ (ii) $\frac{4}{7}$ (iii) $\frac{3}{8}$ (iv) $\frac{5}{6}$ (v) $\frac{7}{9}$

(3) For each fraction given below, write down two equivalent fractions.

(i) $\frac{5}{6}$ (ii) $\frac{3}{4}$ (iii) $\frac{1}{7}$ (iv) $\frac{10}{15}$ (v) $\frac{8}{12}$

(4) Write down the fractions $\frac{8}{15}, \frac{4}{15}, \frac{2}{3}$ and $\frac{3}{5}$, in ascending order.

(5) Write down the fractions $\frac{1}{2}, \frac{2}{3}, \frac{2}{9}$ and $\frac{7}{18}$, in descending order.

(6) Find the value of the following.

(i) $\frac{1}{2}+\frac{2}{10}$ (ii) $\frac{7}{8}-\frac{1}{4}$ (iii) $\frac{10}{13}-\frac{4}{13}$ (iv) $\frac{4}{5}-\frac{7}{15}$

(v) $\frac{1}{2}+\frac{1}{6}+\frac{1}{6}$ (vi) $\frac{1}{2}+\frac{1}{5}+\frac{2}{10}$ (vii) $\frac{1}{12}+\frac{1}{6}+\frac{1}{2}$ (viii) $\frac{1}{2}+\frac{2}{12}+\frac{1}{24}$

(ix) $\frac{1}{16}+\frac{5}{8}+\frac{1}{4}$ (x) $\frac{1}{10}+\frac{2}{5}+\frac{1}{20}$

(7) Father distributed $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{12}$ of his money among his three children.

(i) What is the total amount given to the children as a fraction of the father's money ?

(ii) What is the difference between the greatest amount and the least amount received as a fraction of the father's money?

Summary

- Fractions with numerator equal to one are known as unit fractions.
- Fractions which are less than one and greater than zero are known as proper fractions.
- By multiplying or dividing both the numerator and the denominator of a fraction by the same whole number (except zero), a fraction which is equivalent to the first fraction can be obtained.
- The answers obtained by adding or subtracting fractions which have the same denominator also have the same denominator.
- In adding fractions having the same denominator, the numerator of the answer is obtained by adding the numerators.
- In subtracting fractions having the same denominator, the numerator of the answer is obtained by subtracting the numerators.