1. Fractions



Key Concepts

- 1. Equivalent fractions and simplification of fractions
- 2. Conversion of unlike fractions to like fractions
- 3. Comparing and ordering fractions
- 4. Addition of fractions
- 5. Subtraction of fractions
- 6. Multiplication of fractions
- 7. Division of fractions



Why should I read this chapter?

When we are concerned with a part of a whole, we need fractions to describe them. Fractions are used to understand how we can equally distribute objects among a group.



1. Circle the like fractions.

(a.)
$$\frac{2}{5}$$
, $\frac{3}{7}$, $\frac{8}{9}$, $\frac{1}{5}$, $\frac{6}{5}$

$$(b.) \quad \frac{3}{8}, \frac{9}{2}, \frac{1}{4}, \frac{6}{7}, \frac{2}{8}$$

2. Classify the following as proper, improper or mixed fractions.

$$\frac{1}{7}$$
, $\frac{3}{8}$, $3\frac{2}{7}$, $\frac{4}{3}$, $6\frac{4}{5}$, $\frac{1}{9}$, $\frac{6}{2}$, $1\frac{6}{9}$, $4\frac{8}{9}$, $\frac{7}{5}$

3. Which of the following pairs of fractions are equivalent?

(a.)
$$\frac{2}{3}$$
 and $\frac{4}{6}$ (b.) $\frac{4}{5}$ and $\frac{8}{15}$ (c.) $\frac{12}{16}$ and $\frac{3}{4}$ (d.) $\frac{1}{5}$ and $\frac{3}{15}$

(b.)
$$\frac{4}{5}$$
 and $\frac{8}{15}$

(c.)
$$\frac{12}{16}$$
 and $\frac{3}{4}$

(d.)
$$\frac{1}{5}$$
 and $\frac{3}{15}$

Arrange the given fractions in ascending and descending orders. 4.

$$\frac{8}{17}$$
, $\frac{3}{17}$, $\frac{9}{17}$, $\frac{1}{17}$, $\frac{7}{17}$

Solve the following. **5.**

(a.)
$$\frac{12}{15} + \frac{3}{15}$$
 (b.) $\frac{4}{9} + \frac{8}{9}$ (c.) $\frac{11}{14} - \frac{2}{14}$ (d.) $\frac{6}{8} - \frac{1}{8}$

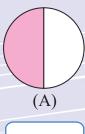
b.
$$\frac{4}{9} + \frac{8}{9}$$

$$\frac{11}{14} - \frac{2}{14}$$

(d.)
$$\frac{6}{8} - \frac{1}{8}$$

Prep-up

Write the fractions represented by the shaded parts of the given figures.







(B)





(C)



Are the fractions equal?



Equivalent fractions and simplification of fractions

Rohan bought two bars of chocolate, one for himself and the other for his best friend Sonia.





Each bar comprises 18 cubes of chocolate.

Rohan ate $\frac{1}{2}$ of his chocolate.







Sonia ate 9 cubes from her bar of chocolate. What fraction of the chocolate

bar did Sonia eat?

Although the fractions look different, both the friends ate the same amount of chocolate. Therefore, these **fractions are equal**. Such fractions are called **equivalent fractions**.

Fractions that have different numerators and denominators but represent the same value are called **equivalent fractions**.

Finding equivalent fractions

Using multiplication

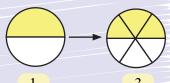
Example 1: Find an equivalent fraction of $\frac{1}{2}$ by multiplication.

Solution: Take any number of your choice and multiply it with both the numerator and the denominator of the given fraction.

Let us multiply the numerator and the denominator with 3.

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

Therefore, $\frac{3}{6}$ is an equivalent fraction of $\frac{1}{2}$



Example 2: Find any three equivalent

fractions of $\frac{3}{5}$ by multiplication.

Solution:
$$\frac{3}{5} = \frac{3 \times 3}{5 \times 3} = \frac{9}{15}$$

$$\frac{3}{5} = \frac{3 \times 8}{5 \times 8} = \frac{24}{40}$$

$$\frac{3}{5} = \frac{3 \times 5}{5 \times 5} = \frac{15}{25}$$

Therefore, $\frac{9}{15}$, $\frac{24}{40}$ and $\frac{15}{25}$ are equivalent

fractions of $\frac{3}{5}$.

Using division

Example 3: Find an equivalent fraction of $\frac{4}{9}$ by multiplication.

Solution:

$$\frac{4}{9} = \frac{4 \times \boxed{}}{9 \times \boxed{}} = \boxed{}$$

Therefore,

is an equivalent fraction

of $\frac{4}{9}$.

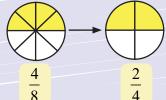
Example 4: Find an equivalent fraction of
$$\frac{4}{8}$$
 by division.

Solution:

Take a number that is a factor of both the numerator and the denominator of the given fraction and divide them by that number. Here, we will divide both the numerator and the denominator by 2, as 2 is a factor of both.

$$\frac{4}{8} = \frac{4 \div 2}{8 \div 2} = \frac{2}{4}$$

Therefore, $\frac{2}{4}$ is an equivalent fraction of $\frac{4}{8}$.



Example 5: Find any three equivalent fractions

of
$$\frac{16}{24}$$
 by division.

Solution:
$$\frac{16}{24} = \frac{16 \div 2}{24 \div 2} = \frac{8}{12}$$

$$\frac{16}{24} = \frac{16 \div 4}{24 \div 4} = \frac{4}{6}$$

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

Therefore, $\frac{8}{12}$, $\frac{4}{6}$ and $\frac{2}{3}$ are equivalent fractions of $\frac{16}{24}$

Example 6: Find an equivalent fraction

of
$$\frac{10}{20}$$
 by division.

Solution:
$$\frac{10}{20} = \frac{10 \div }{20 \div } = \boxed{}$$

is an equivalent fraction Therefore,

of
$$\frac{10}{20}$$
.

Checking equivalent fractions

To check whether two fractions are equivalent or not, we need to multiply the numerator and the denominator of the fractions, as shown below.

Do you remember that in Example 1, we got $\frac{1}{2}$ and $\frac{3}{6}$ as equivalent fractions?

Let us now multiply the numerator of one of the fractions with the denominator of the other fraction.



This method is called **cross multiplication**.

$$1 \times 6 = 6; 2 \times 3 = 6$$

We can see that both products are equal. Hence, the fractions are equivalent fractions. Check the answers that you got in examples 3 and 6 using this method.

Simplification of fractions

Let us take a fraction, say $\frac{4}{5}$

Here, numerator = and denominator =

Write the common factor(s) of the numerator and the denominator

We see that 1 is the only common factor of the numerator and the denominator of $\frac{4}{5}$. Hence, $\frac{4}{5}$ is said to be in its **simplest form** or **lowest term**.

If the numerator and the denominator of a fraction have 1 as their only common factor, then the fraction is said to be in its simplest form or lowest term.

Example 7: Simplify $\frac{4}{6}$ to its lowest term.

Solution: factors of 4: 1, 2 and 4

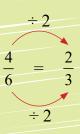
factors of 6: 1, 2, 3 and 6

HCF of 4 and 6 = 2

Dividing the numerator and the denominator by their HCF,

we get $4 \div 2 = 2$ and $6 \div 2 = 3$.

Hence, the lowest term of $\frac{4}{6}$ is $\frac{2}{3}$.



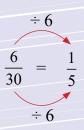
Example 8: There are 30 animals in a zoo, of which 6 are tigers. What fraction of the animals in the zoo are tigers? Simplify the fraction.

Solution: In the zoo, 6 out of 30 animals are tigers.

Fraction of tigers in the zoo is

HCF of 6 and 30 =

Therefore, $\frac{6}{30}$ in the lowest terms is $\frac{1}{5}$.



Progress Meter 1

1. Check if the following pairs of fractions are equivalent or not.

- (a.) $\frac{2}{3}$ and $\frac{10}{15}$ (b.) $\frac{1}{8}$ and $\frac{8}{56}$ (c.) $\frac{3}{4}$ and $\frac{12}{16}$ (d.) $\frac{4}{7}$ and $\frac{20}{28}$ (e.) $\frac{4}{16}$ and $\frac{1}{4}$

2. Write any two equivalent fractions of the following.

- (b) $\frac{12}{15}$ (c) $\frac{2}{8}$ (d) $\frac{5}{7}$

Simplify the following fractions to their lowest terms. **3.**

- (b) $\frac{8}{16}$ (c) $\frac{15}{25}$ (d) $\frac{18}{36}$

Read the information given below and answer by simplifying the fractions. 4.

On a Saturday, 100 students went on a trip to a botanical garden. Out of them, 25 students were from Mrs. Joshi's class and 30 students were from Mrs. Khan's class.

- What fraction of the students were from Mrs. Joshi's class? (a.)
- What fraction of the students were from Mrs. Khan's class?
- What fraction of the students were from Mrs. Joshi's and Mrs. Khan's classes in total?

5. Observe the fractions written on the jars below. Sort the equivalent fractions (of the given fractions) from the grid and write beside the respective jars.















Conversion of unlike fractions to like fractions

We have already learnt what like and unlike fractions are. We will now learn to convert two unlike fractions to like fractions.

Example 9: Convert $\frac{1}{3}$ and $\frac{1}{2}$ to like fractions.

Solution: The denominators of the two fractions are 3 and 2, respectively.

LCM of 3 and
$$2 = 6$$

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

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

Convert the given fractions to equivalent fractions so that both have the same denominator as their LCM.



Therefore, $\frac{2}{6}$ and $\frac{3}{6}$ are the required like fractions.

Example 10: Convert $\frac{6}{7}$ and $\frac{3}{5}$ to like fractions.

Solution: The denominators of the given fractions are 7 and 5, respectively.

LCM of the denominators =

$$\frac{6}{7} = \frac{6 \times }{7 \times } =$$

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

Therefore, and are the required like fractions.



Progress Meter 2

- Convert the following pairs of unlike fractions to like fractions.

- (a.) $\frac{1}{5}$ and $\frac{2}{7}$ (b.) $\frac{2}{4}$ and $\frac{3}{5}$ (c.) $\frac{3}{9}$ and $\frac{1}{8}$ (d.) $\frac{2}{3}$ and $\frac{4}{6}$ (e.) $\frac{3}{7}$ and $\frac{1}{4}$
- (f.) $\frac{2}{6}$ and $\frac{1}{4}$ (g.) $\frac{5}{6}$ and $\frac{1}{3}$ (h.) $\frac{4}{7}$ and $\frac{2}{6}$ (i.) $\frac{1}{7}$ and $\frac{2}{8}$ (j.) $\frac{4}{8}$ and $\frac{3}{9}$

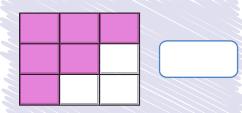


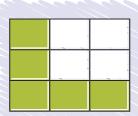
Comparing and ordering fractions

Comparing like fractions

Write the fractions for the shaded parts of the figures given below.









Which fraction has a greater numerator?



When we have two like fractions, the one with the greater numerator is the greater fraction.

Example 11: Compare $\frac{4}{7}$ and $\frac{2}{7}$.

Solution: The given fractions are like fractions having the numerators 4 and 2, respectively. We know that 4 > 2.

Hence,
$$\frac{4}{7} > \frac{2}{7}$$
.

Comparing unlike fractions

Unlike fractions having the same numerator

Write the fractions represented by the shaded parts of the following figures.









Observe the figures carefully. Which fraction has a greater shaded part?



When two unlike fractions have the same numerator, the one with the smaller denominator is greater.

Example 12: Compare $\frac{3}{5}$ and $\frac{3}{8}$.

Solution: The given fractions are unlike fractions having the same numerator.

The denominators of the two fractions are 5 and 8, respectively.

We know that 5 < 8.

Hence,
$$\frac{3}{5} > \frac{3}{8}$$
.

Unlike fractions having different numerators

Example 13: Compare $\frac{2}{6}$ and $\frac{3}{4}$.

Solution: The denominators of the given fractions are 6 and 4, respectively.

LCM of 6 and 4 = 12

$$\frac{2}{6} = \frac{2 \times 2}{6 \times 2} = \frac{4}{12}$$

$$\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$$

The fractions $\frac{4}{12}$ and $\frac{9}{12}$ are like fractions with numerators 4 and 9, respectively.

We know that 4 < 9.

Therefore,
$$\frac{4}{12} < \frac{9}{12}$$
, and hence $\frac{2}{6} < \frac{3}{4}$.

First, convert the unlike fractions to like fractions.

Then, compare the like fractions.

Example 14: On Sunday, Rohan played football for $\frac{3}{5}$ of an hour and cricket for – of an hour. Which game did Rohan play for a longer duration?

Solution: Rohan played football for $\frac{3}{5}$ of an hour.

He played cricket for $\frac{1}{3}$ of an hour.

LCM of 5 and 3 =

$$\frac{3}{5} = \frac{3 \times 3}{5 \times 3} = \boxed{}$$

$$\frac{1}{3} = \frac{1 \times 5}{3 \times 5} = \boxed{}$$

We know that

Hence, Rohan played for a longer duration.



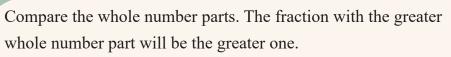
Comparing mixed fractions

Fractions having different whole number parts

Write the mixed fractions represented by the shaded parts of the following figures.



Observe the figures carefully. Which fraction looks greater?





Example 15: Compare $3\frac{2}{3}$ and $4\frac{1}{5}$.

Solution: The whole number parts are 3 and 4, respectively.

We know that 3 < 4.

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

Fractions having the same whole number parts

Example 16: Compare $1\frac{1}{3}$ and $1\frac{2}{5}$.

Solution: First, convert the mixed fractions to improper fractions.

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

$$1\frac{1}{3} = \frac{1 \times 3 + 1}{3} = \frac{4}{3}$$
 $1\frac{2}{5} = \frac{1 \times 5 + 2}{5} = \frac{7}{5}$

The improper fractions obtained are unlike fractions. Convert these unlike fractions to like fractions.

Here, the denominators of the two unlike fractions are 3 and 5, respectively.

LCM of 3 and 5 = 15

$$\frac{4}{3} = \frac{4 \times 5}{3 \times 5} = \frac{20}{15}$$

$$\frac{4}{3} = \frac{4 \times 5}{3 \times 5} = \frac{20}{15}$$
 $\frac{7}{5} = \frac{7 \times 3}{5 \times 3} = \frac{21}{15}$

On comparing the numerators, we see that 20 < 21.

Therefore, $\frac{20}{15} < \frac{21}{15}$, and hence $1\frac{1}{3} < 1\frac{2}{5}$.

If we compare only the fractional parts of the given mixed fractions, we will get the same result.

Ordering fractions

Like whole numbers, fractions can also be arranged in ascending or descending order.

Example 17: Arrange $\frac{2}{5}$, $\frac{1}{4}$ and $\frac{7}{6}$ in ascending order.

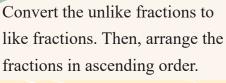
Solution: The denominators of the given fractions are 5, 4 and 6, respectively.

LCM of 5, 4 and 6 = 60

$$\frac{2}{5} = \frac{2 \times 12}{5 \times 12} = \frac{24}{60}$$

$$\frac{1}{4} = \frac{1 \times 15}{4 \times 15} = \frac{15}{60}$$

$$\frac{7}{6} = \frac{7 \times 10}{6 \times 10} = \frac{70}{60}$$





When we arrange the numerators in ascending order, we see that 15 < 24 < 70.

Therefore,
$$\frac{15}{60} < \frac{24}{60} < \frac{70}{60}$$
, and hence $\frac{1}{4} < \frac{2}{5} < \frac{7}{6}$.

Example 18: Arrange $\frac{3}{8}$, $\frac{2}{8}$ and $\frac{3}{4}$ in descending order.

Solution: The denominators of the given fractions are 8, 8 and 4, respectively.

$$\frac{3}{8} = \frac{3 \times }{8 \times } =$$

$$\frac{2}{8} = \frac{2 \times 1}{8 \times 1} = 1$$

$$\frac{3}{4} = \frac{3 \times 1}{4 \times 1} = \frac{3}{4}$$

Convert the unlike fractions to like fractions. Then, arrange the fractions in descending order.



When we arrange the numerators in descending order, we see that | > |



Progress Meter 3

- Compare the fractions using <, > or =.

- (a) $\frac{3}{8} \square \frac{1}{8}$ (b) $\frac{9}{10} \square \frac{8}{7}$ (c) $\frac{1}{2} \square \frac{4}{8}$ (d) $\frac{7}{16} \square \frac{7}{20}$

- (e. $\frac{2}{9}$) $\frac{2}{3}$ (f. $\frac{2}{10}$) $\frac{1}{5}$ (g. $3\frac{1}{8}$) $4\frac{1}{2}$ (h. $1\frac{4}{5}$) $1\frac{1}{4}$
- Arrange the following fractions in ascending order.
 - (a.) $\frac{9}{11}$, $\frac{6}{11}$ and $\frac{3}{11}$ (b.) $\frac{7}{9}$, $\frac{3}{9}$ and $\frac{8}{9}$ (c.) $\frac{1}{2}$, $\frac{6}{11}$ and $\frac{3}{9}$ (d.) $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ (e.) $2\frac{3}{4}$, $\frac{5}{7}$ and $\frac{7}{9}$

- Arrange the following fractions in descending order.
 - (a.) $\frac{3}{13}$, $\frac{6}{13}$ and $\frac{5}{13}$ (b.) $\frac{5}{8}$, $\frac{3}{8}$ and $\frac{7}{8}$ (c.) $\frac{3}{4}$, $\frac{4}{11}$ and $\frac{2}{5}$ (d.) $\frac{1}{2}$, $\frac{1}{5}$ and $\frac{1}{7}$ (e.) $\frac{1}{4}$, $3\frac{3}{5}$ and $\frac{5}{7}$

- Solve the following word problems.
 - Rohan ate $\frac{3}{5}$ and Sonia ate $\frac{3}{10}$ of a watermelon. (a.) Who ate a larger portion of the watermelon?





- The students of Grade 5 went to the zoo. Out of them, $\frac{4}{11}$ of the students went to see the giraffe and $\frac{2}{5}$ of the students went to see the elephant. A greater fraction of the students went to see which of the two animals?
- Rohan cycled for $\frac{1}{2}$ km on Friday. He cycled for $\frac{5}{8}$ km on Saturday. On which day did he ride farther?





Rohan reads $\frac{1}{9}$ of a book every day and Sonia reads $\frac{3}{9}$ of the same book. Who reads more?



Addition of fractions

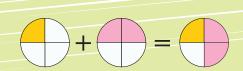
Addition of like fractions

Example 19: Add $\frac{1}{4}$ with $\frac{2}{4}$.

Solution: $\frac{1}{4} + \frac{2}{4}$

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

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



For like fractions, add the numerators keeping the denominator same.



Addition of unlike fractions

Example 20: Add $\frac{1}{3}$ with $\frac{1}{2}$.

Solution: The denominators of the given fractions are 3 and 2, respectively.

LCM of 3 and 2 = 6

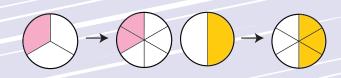
$$\frac{1}{3} + \frac{1}{2}$$

$$=\frac{1\times2}{3\times2}+\frac{1\times3}{2\times3}$$

$$=\frac{2}{6}+\frac{3}{6}$$

$$=\frac{2+3}{6}$$

$$=\frac{5}{6}$$



First, convert the unlike fractions to like fractions and (then add them.



Addition of mixed fractions

Example 21: Add $1\frac{1}{3}$ with $1\frac{2}{3}$.

Solution: We can find this sum in two ways.

Method 1

$$1\frac{1}{3} + 1\frac{2}{3}$$
= 1+1+\frac{1}{3} + \frac{2}{3}
= 2+\frac{1+2}{3}
= 2+\frac{3}{3}
= 2+1 \quad \text{(in the simplest form)}
= 3

Add the whole number parts and then the fractional parts.



Method 2

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

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

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

$$=\frac{9}{3}$$

= 3 (in the simplest form)

Convert the mixed fractions to improper fractions and then add them.



Example 22: Rohan mixed $2\frac{2}{5}$ cups of sugar with $3\frac{1}{4}$ cups of flour to bake a cake. How many cups of sugar and flour did he use altogether?

Solution: number of cups of sugar used =

number of cups of flour used =

total number of cups of sugar and flour used

$$= 2\frac{2}{5} + 3\frac{1}{4}$$

$$= \frac{2 \times 5 + 2}{5} + \frac{3 \times 4 + 1}{4}$$

$$= \frac{12}{5} + \frac{13}{4}$$

The denominators are 5 and 4. LCM of 5 and 4 = 20

$$=\frac{12\times4}{5\times4}+\frac{13\times5}{4\times5}$$

$$=\frac{48+65}{20}$$

$$= 5\frac{13}{20}$$
 (converting to mixed fraction)

Rohan used $5\frac{13}{20}$ cups of sugar and flour to bake the cake.

Progress Meter 4

Add the following fractions. 1.

(a.)
$$\frac{8}{12} + \frac{3}{12}$$
 (b.) $\frac{1}{14} + \frac{9}{14}$ (c.) $\frac{1}{2} + \frac{1}{5}$ (d.) $\frac{2}{9} + \frac{4}{12}$

$$\frac{1}{14} + \frac{9}{14}$$

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

$$\frac{2}{9} + \frac{4}{12}$$

(e.)
$$3\frac{2}{6} + 4\frac{2}{8}$$

(f.)
$$5\frac{3}{7} + 5\frac{1}{9}$$

(g.)
$$8\frac{5}{11} + 8\frac{4}{7}$$

(e.
$$3\frac{2}{6} + 4\frac{2}{8}$$
 (f. $5\frac{3}{7} + 5\frac{1}{9}$ (g. $8\frac{5}{11} + 8\frac{4}{7}$ (h. $3\frac{2}{4} + 1\frac{3}{7}$

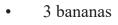
2. The ingredients required to make a chocolate chips cake are given below. Based on the information, answer the questions that follow.



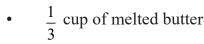
$2\frac{1}{2}$ cups of flour	$\frac{1}{2}$ tsp baking soda	$\frac{1}{4}$ tsp salt	$3\frac{1}{4}$ tsp butter
$\frac{6}{7}$ cups of sugar	$\frac{3}{4}$ tsp vanilla extract	$\frac{8}{4}$ eggs	$\frac{4}{5}$ cups of chocolate chips

- Find the total number of cups of flour and sugar needed.
- Find the total quantity of chocolate chips and flour required.
- Find the total quantity of baking soda and salt required.
- How many teaspoons of salt, vanilla extract and butter are required?

Following are the ingredients required to make banana bread. Based on the information given, answer the questions that follow.



• $\frac{1}{2}$ cup of egg mix



 $\frac{1}{3}$ cup of melted butter $\frac{9}{12}$ cup of vanilla extract

 $\frac{4}{6}$ cup of sugar

• $1\frac{1}{2}$ cups of flour

What is the total quantity of melted butter and sugar required?

Find the total quantity of vanilla extract and sugar required.

How many cups of flour and melted butter are needed?

Find the total quantity of egg mix and flour required.

- 4. Solve the following number stories.
 - Rohan and Sonia ordered a pizza. Rohan had $\frac{3}{8}$ (a.) and Sonia had $\frac{1}{4}$ of the pizza. What fraction of the pizza did they eat in all?





- In a garden, $\frac{2}{5}$ of the plants are marigolds and $\frac{3}{7}$ of the plants are roses. What fraction of the plants are (b.) marigolds and roses?
- A man bought $2\frac{2}{3}$ kg and $2\frac{1}{4}$ kg of rice in two weeks. Find the quantity of rice he bought in all.





Subtraction of fractions

Subtraction of like fractions

Example 23: Subtract $\frac{1}{4}$ from $\frac{3}{4}$.

Solution: $\frac{3}{4} - \frac{1}{4}$ $= \frac{3-1}{4}$

 $=\frac{2}{4}$

 $=\frac{1}{2}$ (in the simplest form)

For like fractions, subtract the numerators keeping the denominator same.



Subtraction of unlike fractions

Example 24: Subtract $\frac{1}{4}$ from $\frac{1}{2}$.

Solution: The denominators are 4 and 2.

LCM of 4 and 2 = 4

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

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

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

First, convert the unlike fractions to like fractions and then subtract them.



Subtraction of mixed fractions

Example 25: Subtract $1\frac{1}{3}$ from $1\frac{1}{2}$.

Solution: The denominators of the given fractions are 3 and 2, respectively.

LCM of 3 and 2 =

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

$$= \frac{1 \times 2 + 1}{2} - \frac{1 \times 3 + 1}{3}$$

$$= \frac{3}{2} - \frac{4}{3}$$

$$= \frac{3 \times 3}{2 \times 3} - \frac{4 \times 2}{3 \times 2}$$

Convert the mixed fractions to improper fractions and then subtract them.



 $=\frac{9-8}{1}$

Example 26: In a long-jump competition, Candidate A jumped a distance of $4\frac{1}{7}$ m and Candidate B jumped a distance of $3\frac{2}{9}$ m. Who covered a longer distance and by how much?

Solution: Candidate A jumped = m



Candidate A jumped more than Candidate B by

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

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

$$= \boxed{ - \boxed{ }}$$

$$= \frac{29 \times 9}{7 \times 9} - \frac{29 \times 7}{9 \times 7}$$

$$= \boxed{ - \boxed{ }}$$

m

Candidate A jumped m more than Candidate B.



Progress Meter 5

Subtract the following fractions.

(a.)
$$\frac{8}{9} - \frac{3}{9}$$

(b.)
$$\frac{3}{4} - \frac{3}{5}$$

(a.)
$$\frac{8}{9} - \frac{3}{9}$$
 (b.) $\frac{3}{4} - \frac{3}{5}$ (c.) $\frac{9}{10} - \frac{1}{15}$ (d.) $\frac{5}{9} - \frac{2}{5}$

$$\frac{5}{9} - \frac{2}{5}$$

(e.)
$$\frac{1}{2} - \frac{1}{3}$$

(f.)
$$9\frac{1}{2} - 1\frac{1}{3}$$

(g.)
$$8\frac{8}{12} - 5\frac{5}{6}$$

(e.)
$$\frac{1}{2} - \frac{1}{3}$$
 (f.) $9\frac{1}{2} - 1\frac{1}{3}$ (g.) $8\frac{8}{12} - 5\frac{5}{6}$ (h.) $10\frac{5}{8} - 4\frac{2}{3}$

The following table shows the marksheet of four students. Observe the table and 2. answer the questions given below.

Name	Mathematics	English	Science
Aditi	$\frac{88}{100}$	$\frac{75}{80}$	$\frac{49}{60}$
Rahul	$\frac{95}{100}$	$\frac{73}{80}$	$\frac{55}{60}$
Smitha	$\frac{73}{100}$	$\frac{69}{80}$	$\frac{58}{60}$
Mohit	$\frac{86}{100}$	$\frac{68}{80}$	$\frac{44}{60}$

- Find the difference in the fraction of marks scored by Aditi in Mathematics and (a.) Science.
- What fraction of marks did Rahul get more than Smitha in English?
- What fraction of marks did Mohit score less than Smitha in Science?
- Subtract the fraction of marks scored by Aditi in Science from the fraction of marks scored by her in English.

20

3. Solve the following word problems.

A box of sweets weighs $1\frac{3}{5}$ kg. From there, $\frac{7}{15}$ kg (a.) of sweets are taken out. What amount of sweets are left in the box?





- (b.) A long rope of length 25 m is cut into two pieces. The length of one of the pieces is $13\frac{6}{8}$ m. What is the length of the other piece?
- C. Rohan bought a pizza. He ate $\frac{2}{9}$ of it. What fraction of the pizza is left?



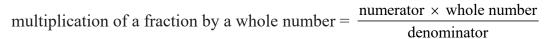


d. A baker needs $5\frac{1}{2}$ cups of flour to make a loaf of bread. He poured 3 cups of flour in the bowl. How much more flour will he need to make the bread?



Multiplication of fractions

Multiplication of a fraction by a whole number





Example 27: Multiply $\frac{5}{6}$ with 2.

Solution:
$$\frac{5}{6} \times 2$$

$$= \frac{5 \times 2}{6}$$

$$=\frac{10}{6}$$

$$=\frac{5}{3}$$
 (in the simplest form)

Multiply only the numerator with the whole number.



Multiplication of a fraction by another fraction

 $product of two fractions = \frac{product of the numerators}{product of the denominators}$

Example 28: Multiply $\frac{2}{5}$ with $\frac{5}{3}$.

Solution:
$$\frac{2}{5} \times \frac{5}{3}$$

$$= \frac{2 \times 5}{5 \times 3}$$

$$= \frac{10}{15}$$

$$= \frac{2}{3} \quad \text{(in the simplest form)}$$

Multiply the numerators and the denominators, respectively.



Example 29: Siya plans to write $8\frac{5}{6}$ pages every week for $2\frac{1}{7}$ weeks.



How many pages is she planning to write altogether? **Solution:** number of pages Siya is planning to write every week =

number of pages shy is planning to write every week

number of weeks she is planning to write =

total number of pages she plans to write

$$=8\frac{5}{6} \times 2\frac{1}{7}$$

$$=\frac{8 \times 6 + 5}{6} \times \frac{2 \times 7 + 1}{7}$$

$$=\frac{53}{6} \times \frac{15}{7}$$

$$=\frac{53 \times 15}{6 \times 7}$$

First, convert the mixed fractions to improper fractions, and then multiply the numerators and the denominators, respectively, to get the product.



= (converting to mixed fraction)

Siya plans to write pages altogether.



Progress Meter 6

Multiply the following. 1.

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

(b.)
$$1\frac{3}{7} \times 9$$

(c.)
$$2\frac{4}{9} \times 3$$

(d.)
$$5\frac{3}{7} \times 2$$

(e.)
$$4\frac{7}{9} \times \frac{2}{3}$$

(f.)
$$9\frac{3}{4} \times \frac{2}{9}$$

(g.)
$$9\frac{3}{7} \times 2\frac{2}{7}$$

(e.)
$$4\frac{7}{9} \times \frac{2}{3}$$
 (f.) $9\frac{3}{4} \times \frac{2}{9}$ (g.) $9\frac{3}{7} \times 2\frac{2}{7}$ (h.) $1\frac{1}{7} \times 2\frac{2}{5}$

2. Solve the following word problems.

Rahul swims for $\frac{2}{7}$ of an hour each day. What fraction of hours will he swim in 3 days?





- A vehicle uses $2\frac{1}{5}$ litres of petrol to run for an hour. If it uses the same amount of petrol each hour, how many litres of petrol will be required to run the vehicle for $42\frac{1}{2}$ hours?
- The cost of a metre of cloth is $31\frac{1}{2}$. Find the cost of $5\frac{1}{3}$ m cloth.





- A bundle of sheets weighs $3\frac{4}{6}$ kg. If a vendor puts $2\frac{1}{5}$ bundles on a scale, how much will they weigh?
- Rohan collected $5\frac{3}{8}$ kilograms of batteries for a recycling drive. Sonia collected $8\frac{1}{2}$ times as much batteries as Rohan did. How many kilograms of batteries did Sonia collect?





- f. The duration of a class is $1\frac{3}{7}$ hours. What will be the total duration of 7 such classes?
- g. In an army camp, $8\frac{3}{5}$ kilograms of rice are required each day. Find the quantity of rice required for 4 days.





Division of fractions

Reciprocal of a fraction

In the fraction $\frac{5}{9}$, numerator = and denominator =

Let us interchange the numerator and the denominator.

Then, the new numerator = 9 and the new denominator = 5.

Thus, the new fraction obtained is $\frac{9}{5}$.

When we interchange the numerator and the denominator of a fraction, we get a new fraction, which is called the **reciprocal** of the given fraction.

Example 30: Write the reciprocal of (i) $\frac{3}{6}$, (ii) $\frac{8}{5}$ and (iii) 7.

Solution: (i) In $\frac{3}{6}$, numerator = 3

denominator = 6

reciprocal of the fraction = $\frac{6}{3}$

The number 0 has no reciprocal.



- (ii) reciprocal of $\frac{8}{5}$ =
- (iii) All whole numbers are fractions having 1 as the denominator. For example, 7 can be written as $\frac{7}{1}$.

Hence, the reciprocal of $7 = \frac{1}{7}$.

Example 31: Find the product of $\frac{6}{7}$ and its reciprocal.

Solution: the reciprocal of
$$\frac{6}{7} = \frac{7}{6}$$

product of the two fractions =
$$\frac{6}{7} \times \frac{7}{6}$$

= $\frac{42}{42}$
= 1 (in the simplest form)

The product of a number and its reciprocal is 1.

Also, we know that division is the inverse operation of multiplication.

Thus,
$$\frac{6}{7} \times \frac{7}{6} = 1$$
 gives $1 \div \frac{6}{7} = \frac{7}{6}$.

Thus, 1 divided by any fraction gives the reciprocal of the fraction.

Division of fractions

To divide a number by a fraction, we have to multiply the first number (dividend) by the reciprocal of the second number (divisor).

Example 32: Divide
$$\frac{2}{7}$$
 by $\frac{3}{4}$.

Solution: The divisor is
$$\frac{3}{4}$$
.

The reciprocal of
$$\frac{3}{4}$$
 is $\frac{4}{3}$.

$$= \frac{2}{7} \div \frac{3}{4}$$

$$= \frac{2}{7} \times \frac{4}{3}$$

$$= \frac{2 \times 4}{7 \times 3}$$

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

Example 33: Divide
$$\frac{16}{9}$$
 by 4.

The reciprocal of 4 is
$$\frac{1}{4}$$
.

$$\frac{16}{9} \div 4$$

$$= \frac{16}{9} \times \frac{1}{4}$$

$$= \frac{16 \times 1}{9 \times 4}$$

$$= \frac{16}{36}$$

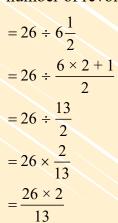
$$= \frac{4}{9} \text{ (in the simplest form)}$$

Example 34: A satellite revolves around the Earth 26 times in $6\frac{1}{2}$ days. If it completes the same number of revolutions each day, how many revolutions does it make in a day?

Solution: number of revolutions made =

number of days =

number of revolutions made in a day



The satellite makes revolutions in a day.



Progress Meter 7

- Write the reciprocals of the given fractions. 1.
 - (a.) $\frac{7}{24}$
- (b.) $\frac{2}{5}$
- $\frac{1}{2}$
- (d.) 40

- Divide the following. 2.

 - (a.) $\frac{4}{5} \div \frac{3}{25}$ (b.) $6\frac{5}{11} \div \frac{4}{121}$ (c.) $4 \div 4\frac{1}{3}$ (d.) $2\frac{7}{8} \div 5\frac{1}{2}$
- Divide the following numbers by their reciprocals. 3.
- (a.) $\frac{1}{16}$ (b.) $\frac{2}{9}$ (c.) $\frac{37}{3}$ (d.) $\frac{4}{15}$

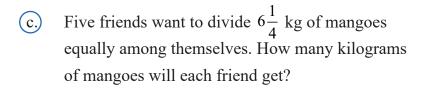
4. Solve the following word problems.

(a.) A carpenter has a piece of wood, which is $\frac{3}{4}$ m in length. He needs to cut it into equal pieces of $\frac{1}{16}$ m each. How many pieces of wood will he get?





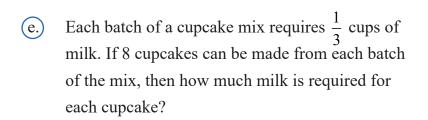
b. Rohan wants to pour $32-\frac{1}{7}$ litres of milk into identical containers such that each container will have $2\frac{1}{7}$ litres of milk. Find the number of containers he will require.







d. Rohan's uncle bought $5\frac{7}{9}$ kg of vegetables, which lasted for 13 days. If he consumed the same weight of vegetables every day, then find the weight of vegetables he had in a day.







1. Fill in the boxes.

- (a.) $\frac{3}{5}$ = $\frac{1}{5}$
- (b.) $+\frac{2}{9} = \frac{7}{9}$
- $\boxed{\text{C.}} \qquad \frac{7}{5} \times \frac{5}{7} = \boxed{}$
- (d.) $1 \div \frac{2}{5} =$

- (g.) $\frac{5}{15} +$ = 1
- (h.) $-\frac{2}{10} = 0$



Maths Connect

For proper digestion of food, it must be broken down into smaller pieces before it can be swallowed. This is carried out by hard, calcified structures called teeth. An adult human has 32 teeth: 8 incisors, 4 canines, 8 premolars and 12 molars. A tooth has three parts: crown, neck and root.



- 1. What fraction of the teeth are premolars?
- 2. Premolars and molars are used for grinding food. What fraction of the teeth are used for grinding food?
- 3. What fraction of the teeth are not used for grinding food?



1. Check if the following pairs of fractions are equivalent.

(a.) $\frac{3}{5}$ and $\frac{30}{50}$ (b.) $\frac{1}{7}$ and $\frac{7}{35}$ (c.) $\frac{3}{4}$ and $\frac{21}{24}$ (d.) $\frac{4}{7}$ and $\frac{24}{42}$ (e.) $\frac{3}{9}$ and $\frac{15}{45}$

2. Observe the numbers written on the jars below. Then, find the equivalent fractions (of the given fractions) from the grid and write beside the respective jars.











2		
16		

2 12 18

18

2 20

3 24 24 40 32

3 27

3. Simplify the following fractions to the lowest terms.

 $\frac{42}{66}$

Convert the following pairs of unlike fractions to like fractions. 4.

(a.) $\frac{1}{6}$ and $\frac{8}{5}$ (b.) $\frac{2}{7}$ and $\frac{3}{4}$ (c.) $\frac{11}{12}$ and $\frac{1}{8}$ (d.) $\frac{1}{4}$ and $\frac{5}{9}$

Compare the fractions using <, > or =. **5.**

(a.) $\frac{2}{5}$ $\left(\frac{1}{6} \right)$

(b.) $\frac{1}{4}$ $\left(\frac{3}{11} \right)$

(c. $3\frac{1}{9}$) $3\frac{5}{9}$

(d.) $2\frac{5}{8}$ 6

(e) $\frac{6}{5}$ $1\frac{2}{10}$

(f.) $\frac{16}{7}$ $\frac{14}{5}$

6. Arrange the fractions in ascending order.

(a.) $\frac{2}{3}$, $\frac{5}{3}$ and $\frac{1}{3}$ (b.) $\frac{9}{8}$, $\frac{1}{8}$ and $\frac{7}{8}$ (c.) $\frac{4}{5}$, $\frac{2}{12}$ and $\frac{5}{4}$ (d.) $\frac{4}{7}$, $\frac{1}{6}$ and $\frac{1}{3}$ (e.) $\frac{1}{2}$, $2\frac{2}{5}$ and $\frac{4}{9}$

Arrange the fractions in descending order.

(a.) $\frac{1}{5}$, $\frac{3}{5}$ and $\frac{2}{5}$ (b.) $\frac{3}{4}$, $\frac{1}{8}$ and $\frac{3}{5}$ (c.) $\frac{4}{7}$, $\frac{1}{3}$ and $\frac{5}{6}$ (d.) $\frac{5}{7}$, $\frac{3}{5}$ and $\frac{1}{10}$ (e.) $\frac{1}{4}$, $1\frac{2}{3}$ and $\frac{4}{5}$

Add the following. 8.

(a.)
$$\frac{9}{13} + \frac{6}{13}$$

(b.)
$$\frac{5}{7} + \frac{2}{11}$$

$$\frac{1}{4} + 3\frac{1}{6}$$

(a.)
$$\frac{9}{13} + \frac{6}{13}$$
 (b.) $\frac{5}{7} + \frac{2}{11}$ (c.) $1\frac{2}{4} + 3\frac{1}{6}$ (d.) $8\frac{4}{9} + 1\frac{6}{11}$

9. Subtract the following.

(a.)
$$\frac{7}{8} - \frac{2}{8}$$

(b.)
$$\frac{4}{5} - \frac{3}{4}$$

(c.)
$$4\frac{1}{2} - 2\frac{3}{4}$$

(a.)
$$\frac{7}{8} - \frac{2}{8}$$
 (b.) $\frac{4}{5} - \frac{3}{4}$ (c.) $4\frac{1}{2} - 2\frac{3}{4}$ (d.) $20\frac{2}{4} - 19\frac{7}{10}$

Multiply the following. **10.**

(a.)
$$3\frac{6}{8} \times 2$$

(b.)
$$6 \times 4\frac{5}{9}$$

(c.)
$$1\frac{2}{3} \times \frac{1}{7}$$

(a.)
$$3\frac{6}{8} \times 2$$
 (b.) $6 \times 4\frac{5}{9}$ (c.) $1\frac{2}{3} \times \frac{1}{7}$ (d.) $5\frac{2}{9} \times 3\frac{1}{7}$

Write the reciprocal of the following.

$$a. \frac{1}{4}$$

(b.) 7 (c.)
$$\frac{20}{7}$$
 (d.) $\frac{4}{11}$ (e.) $\frac{2}{9}$

$$\frac{4}{11}$$

(e.)
$$\frac{2}{9}$$

Divide the following.

(a.)
$$1\frac{2}{7} \div 5$$

(b.)
$$5\frac{1}{2} \div 3$$

(a.)
$$1\frac{2}{7} \div 5$$
 (b.) $5\frac{1}{2} \div 3$ (c.) $6\frac{2}{3} \div 1\frac{1}{3}$ (d.) $8\frac{3}{4} \div 2\frac{5}{8}$

(d.)
$$8\frac{3}{4} \div 2\frac{5}{8}$$

Read the information given below and answer the questions by simplifying the fractions. **13.**

There are 150 farmers in a village. Among them, 30 farmers produce wheat, 40 farmers produce cotton, 25 farmers produce sugarcane and 55 farmers produce rice.

- What fraction of the total number of farmers produce wheat? (a.)
- (b.) What fraction of the total number of farmers produce cotton?
- (c.) What fraction of the total number of farmers produce sugarcane?
- (d.) What fraction of the total number of farmers produce rice?

Solve the following.

Rohan ran $\frac{3}{5}$ km and Sonia ran $\frac{1}{3}$ km. Who ran a (a.) greater distance?





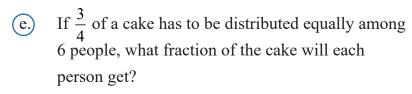
(b) A recipe requires $\frac{2}{6}$ cups of white sugar and $\frac{6}{7}$ cups of brown sugar. How much sugar is required altogether for the recipe?

A tailor has $3\frac{3}{4}$ m of cloth. She uses $1\frac{1}{4}$ m of the cloth to make a pillow case. How many metres of cloth are left with her?





d) A lady buys $\frac{9}{6}$ litres of milk each day. How much milk will she buy in 3 days?



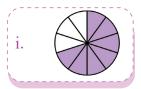


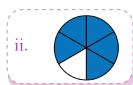


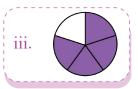
Sonia bought $3\frac{1}{2}$ kg of chocolates and packed them (f.)into boxes, each of which weighs $\frac{1}{4}$ kg. How many boxes did she pack the chocolates into?

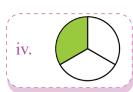
Choose the correct options. **15.**

Which of the following figures has the greatest fraction of shaded areas? (a.)









(b.) Which of the following fractions is given in the simplest form?

- iii.

iv
$$\frac{21}{27}$$

(c) Which of the following is NOT correct?

- (i. $\frac{3}{5} \times \frac{1}{3} = \frac{3}{15}$) (ii. $\frac{6}{7} \times \frac{2}{5} = \frac{4}{7} \times \frac{3}{5}$) (iii. $\frac{1}{3} \times \frac{1}{3} = \frac{1}{6}$) (iv. $9 \times \frac{1}{3} = 3$)

(d.) Fill in the missing number. $\frac{6}{9} - \frac{2}{4} = \frac{1}{\square}$

(i. 24

(ii. 6

iii. 36

(iv. 9

(e.) Which of the following fractions is in its simplest form?

i. $\frac{4}{12}$

 $\left(\text{ii. } \frac{3}{4}\right)$

 $\left\{ \text{iii.} \quad \frac{2}{6} \right\}$

iv. $\frac{3}{9}$

(f.) Which of the following is true?

i. $\frac{1}{3} = \frac{6}{9}$

(ii. $\frac{3}{4} = \frac{15}{20}$)

 $\left(\text{iii.} \quad \frac{5}{6} = \frac{11}{12} \right)$

 $\frac{3}{5} = \frac{6}{11}$

(g.) Solve the following.

 $\frac{4}{5} + \frac{4}{5} + \frac{2}{5}$

i. $\frac{1}{2}$

 $\left(\text{ii.} \quad \frac{5}{10}\right)$

 $\begin{cases} iii. & \frac{32}{125} \end{cases}$

iv. 2

(h.) Multiply the following.

 $\frac{2}{3} \times 54$

i. 12

ii. 36

iii. 18

iv. 24

(i.) Divide the following.

 $\frac{1}{4} \div \frac{3}{16}$

i. $\frac{16}{3}$

(ii. $\frac{4}{3}$

iii. $\frac{1}{3}$

iv. $\frac{2}{3}$

(j.) The cost of 6 pens is ≥ 14 . If each pen costs the same, then find the cost of 1 such pen.

i. $\frac{7}{3}$

(ii. $₹\frac{4}{3}$

iii. $₹\frac{4}{7}$

iv. $\ge \frac{7}{6}$

Think Class





Rohan's grandfather, a retired scientist, built a robot. The robot wanted to test Rohan's understanding of fractions and asked him a few questions. Can you help Rohan solve the questions?



Match the locks with the equivalent keys.















$$\begin{array}{c} 2 \\ 0 \\ \hline \end{array}$$

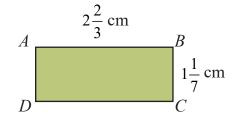
Find the missing numbers. 2.

(a.)
$$\frac{2}{9} \times 21 =$$
 $\times \frac{7}{3}$

(a.)
$$\frac{2}{9} \times 21 =$$
 (b.) $\frac{5}{4} \div$ (c.) $= \frac{1}{6} \times \frac{3}{2}$

The radius of the sun is approximately 7,00,000 km and the radius of the Earth is approximately 6,000 km. What fraction of the radius of the sun is as long as the radius of the Earth?

Find the area of the given rectangle. [Hint: area of a rectangle = length × breadth]





5. The members of the Elite School Reading Club wanted to set up a library. They bought various books for their library. The list below gives the fraction of books they bought. Based on the given information, answer the following questions.

Genres	fiction	biography	non-fiction	comic books	history	novels
Fractions of books	$\frac{3}{15}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{2}{8}$

- (a.) Find the total fraction of fiction and non-fiction books they bought.
- **b.** Find the difference between the fraction of history books and novels.
- (c.) If the number of comic books are doubled, what will be their fraction?
- d. If $\frac{1}{10}$ of the fiction books were returned, what fraction of the fiction books is left in the library?