# Fractions

## Classification of Fractions and Their Conversion

A **common fraction** is written in the form $\frac{a}{b}$, where *a* and *b* both are integers and $b \neq 0$. Here, *a* is numerator and *b* is denominator. Common fractions are also known as **vulgar or simple fractions**.

These numbers like $\frac{1}{2}$ and $\frac{1}{4}$ etc. are known as **fractions**. Both these fractions have 1 as the numerator. Their denominators are 2 and 4 respectively. Fractions are used to represent a part of a whole.

The fractions can be categorized into 3 types. They are

1. Proper Fraction
2. Improper Fraction
3. Mixed Fraction

**Important points to note**

- If both the numerator and denominator of a fraction are equal, then the value of the fraction is 1. For example, $\frac{9}{9} = 1$.
- We know that an improper fraction is always greater than 1 and a proper fraction is always less than 1. Therefore, we can say that any improper fraction is always greater than any proper fraction. For example, the improper fraction $\frac{11}{9}$ is greater than the proper fraction $\frac{5}{7}$.

**A mixed fraction can be converted into an improper fraction and vice-versa.** Let us start with the conversion of improper fraction into mixed fraction.

It can be easily understood with the help of an example. Let us convert the improper fraction $\frac{34}{15}$ into mixed fraction. For this, we have to follow these steps.

**Step 1:** Divide the numerator by the denominator of the improper fraction to obtain the quotient and remainder.

The numerator and denominator of the fraction $\frac{34}{15}$ are 34 and 15 respectively. Now, the division process can be done as

$$\begin{array}{r|l} & \ \ 2 \\ 15) & 34 \\ & -30 \\ \hline & \ \ 4 \\ \hline \end{array}$$

In the above division process, the quotient = 2 and the remainder = 4.

**Step 2:** The improper fraction can then be expressed as a mixed fraction by writing it in the form of

$$\textbf{Quotient}\frac{\textbf{Remainder}}{\textbf{Denominator}}$$

For the improper fraction $\frac{34}{15}$, we have the denominator as 15, the remainder as 4, and the quotient as 2.

Therefore, we can write the improper fraction $\frac{34}{15}$ as a mixed fraction as $2\frac{4}{15}$.

Let us now try and convert a mixed fraction into an improper fraction.

We know that a mixed fraction is a combination of a whole number and a fraction. Let us consider a mixed fraction of the form of $\left(\text{Whole number}\frac{\text{Numerator}}{\text{Denominator}}\right)$.

The improper fraction of this mixed fraction is written in the form of

$$\frac{(\text{Whole Number} \times \text{Denominator}) + \text{Numerator}}{\text{Denominator}}$$

It can be easily understood with the help of an example.

Previously, we had converted the improper fraction $\frac{34}{15}$ into the mixed fraction $2\frac{4}{15}$. Let us now try to convert the mixed fraction $2\frac{4}{15}$ into its improper fraction form $\frac{34}{15}$.

Now, in the mixed fraction, the whole number is 2, the numerator is 4, and the denominator is 15. Thus, we can convert the mixed fraction as

$$\frac{(\text{Whole Number} \times \text{Denominator}) + \text{Numerator}}{\text{Denominator}} = \frac{2 \times 15 + 4}{15} = \frac{30 + 4}{15} = \frac{34}{15}$$

As we can see, we converted the mixed fraction $2\frac{4}{15}$ back into its improper fraction form.

**It is, however, very important to remember that a proper fraction *cannot* be expressed as an improper or a mixed fraction. *Neither* can an improper or a mixed fraction be expressed as a proper fraction.**

**Example 1:**

**Identify the proper, improper and mixed fractions from the following fractions.**

$$\frac{1}{3}, \frac{2}{5}, \frac{3}{2}, \frac{7}{11}, 1\frac{5}{6}, 3\frac{2}{5}, \frac{22}{21}, \frac{45}{55}, 12\frac{2}{7}$$

**Solution:**

The numerators of the fractions $\frac{1}{3}, \frac{2}{5}, \frac{7}{11}, \text{and } \frac{45}{55}$ are less than their corresponding denominators. Therefore, these fractions are proper fractions.

The numerators of the fractions $\frac{3}{2} \text{ and } \frac{22}{21}$ are greater than their corresponding denominators. Therefore, these fractions are improper fractions.

The fractions $1\frac{5}{6}, 3\frac{2}{5}, \text{ and } 12\frac{2}{7}$ are formed by combining a whole number and a proper fraction. Therefore, these fractions are mixed fractions.

**Example 2:**

**Express the mixed fraction $9\frac{3}{5}$ as an improper fraction. Then convert the improper fraction so obtained back into its mixed fraction equivalent to verify your answer.**

**Solution:**

The mixed fraction $9\frac{3}{5}$ has 9 as the whole number, 3 as the numerator and 5 as the denominator. This fraction can be expressed as an improper fraction as

$$\frac{(\text{Whole Number} \times \text{Denominator}) + \text{Numerator}}{\text{Denominator}} = \frac{(9 \times 5) + 3}{5} = \frac{45 + 3}{5} = \frac{48}{5}$$

The improper fraction, thus obtained, is $\frac{48}{5}$. This fraction has 48 as its numerator and 5 as its denominator. We first need to divide the numerator (48) by the denominator (5), which can be done as:

$$\begin{array}{r} 9 \\ 5\overline{)\ 48} \\ -45 \\ \hline 3 \\ \hline \end{array}$$

We, thus, obtain 9 as the quotient and 3 as the remainder. We know that we can express an improper fraction as $\text{Quotient}\frac{\text{Remainder}}{\text{Denominator}}$. Thus, we can express the improper fraction $\frac{48}{5}$ as $9\frac{3}{5}$. We again obtained the same mixed fraction that we started off with. This verifies our calculations.

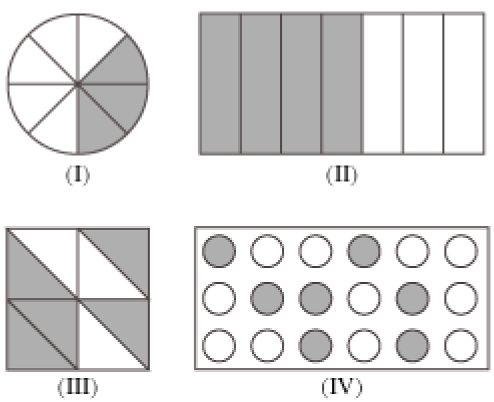
## Finding Fractions Represented by Given Figures and Vice-versa

Fractions are numbers which represent part of a whole. Fractions can be represented by shading a part of a figure.

Let us now look at some more examples to understand this concept of fractions.

**Example 1:**

**Identify the fractions represented through the shaded portion of the following figures.**




**Solution:**

1. In the given figure, 3 parts are shaded out of 8 equal parts. Therefore, the fraction represented by the shaded portion of this figure is $\frac{3}{8}$.
2. In the given figure, 4 parts are shaded out of 7 equal parts. Therefore, the fraction represented by the shaded portion is $\frac{4}{7}$.

3. In the given figure, 5 parts are shaded out of 8 equal parts. Therefore, the fraction represented by the shaded portion is $\frac{5}{8}$.

4. In the given figure, 7 parts are shaded out of 18 equal parts. Therefore, the fraction represented by the shaded portion is $\frac{7}{18}$.

**Example 2:**

**Represent the following fractions by suitable figures.**

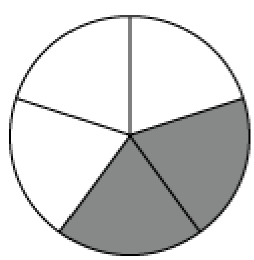
**(i)** $\frac{2}{5}$

**(ii)** $\frac{7}{10}$

**Solution:**

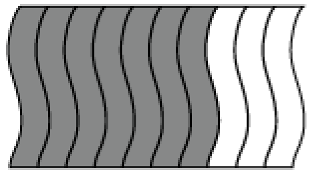
(i) $\frac{2}{5}$

The fraction $\frac{2}{5}$ means 2 parts out of 5 equal parts. It can be represented as follows.



(ii) $\frac{7}{10}$

The fraction $\frac{7}{10}$ means 7 parts out of 10 equal parts. It can be represented as follows.



## Finding Fractions in Given Situations

Suppose Supriya buys a pizza. There are six slices in it. Supriya gives one slice to each of her four friends and keeps two slices for herself.

**Can we find what fraction of pizza does Supriya have?**

Let us now consider one more situation.

Suppose Aakarsh has 10 apples with him. Out of these, three apples were rotten. **Can you say what fraction of fresh apples does Aakarsh have?**

Let us find it out.

Aakarsh has 10 apples out of which 3 were rotten. Thus, the number of fresh apples is 7. Hence, the fraction of fresh apples left with Aakarsh is $\frac{7}{10}$.

In this way, we can find fractions representing a given situation.

Let us now look at some more examples to understand this concept better.

**Example 1:**

**What fraction of numbers is odd when the numbers are counted from 10 to 20?**

**Solution:**

There are 11 numbers from 10 to 20.

The odd numbers lying between 10 and 20 are 11, 13, 15, 17, and 19.

Thus, 5 odd numbers lie from 10 to 20.

Therefore, the fraction of odd numbers is $\frac{5}{11}$.

**Example 2:**

**Sonu invited ten of his friends on his birthday party. All his friends gave him gifts except two of them who did not. What fraction of gifts did he receive?**

**Solution:**

It is given that ten friends of Sonu came to the party. Two of them did not give him any gift. This means he received gifts from eight of his friends i.e., he received eight gifts.

Thus, the fraction of gifts he received is $\frac{8}{10}$.

## Locating Fractions on Number Line

We know how to represent whole numbers on the number line. However, if we have to represent a fraction on the number line, then **how will we do that?**

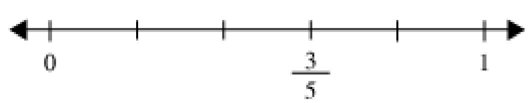
Let us now look at some examples to understand the concept better.

**Example 1:**

**Represent the fraction $\frac{3}{5}$ on a number line.**

**Solution:**

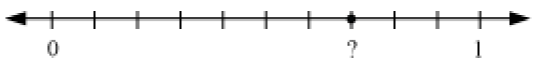
To represent $\frac{3}{5}$ on the number line, we divide the portion of the number line between 0 and 1 into five equal parts. The fraction $\frac{3}{5}$ can be represented as follows.



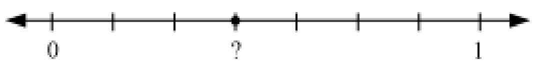
**Example 2:**

**Which fractions are represented by the points on the following number lines?**

1.




2.




**Solution:**

1. In the given number line, the gap between 0 and 1 is divided into 10 equal parts.

   If we count from 0, then clearly, the point represents the fraction $\frac{7}{10}$.

2. In the given number line, the gap between 0 and 1 is divided into 7 equal parts.

   Thus, the point on the number line represents the fraction $\frac{3}{7}$.

## Equivalent Fractions

Look at the fractions $\frac{1}{2}, \frac{2}{4}, \frac{3}{6}, \frac{4}{8}$. They seem to represent different fractions. However, do they represent the same or different quantities?

But the question that arises here is that if we are given a fraction, then **how will we find equivalent fractions of that fraction?**

We can find equivalent fraction by the following way.

**An equivalent fraction of the given fraction can be found out by multiplying both the numerator and the denominator of the given fraction by the same number.**

**An equivalent fraction of a given number can also be found out by dividing both the numerator and the denominator of the given fraction by the same number.**

For example, let us find an equivalent fraction of $\frac{2}{5}$ and $\frac{16}{32}$.

We can find an equivalent fraction of $\frac{2}{5}$ by multiplying the numerator and the denominator by the same number.

Therefore, an equivalent fraction of $\frac{2}{5}$ is $\frac{2\times 2}{5\times 2}=\frac{4}{10}$.

A fraction can have many equivalent fractions. For example, $\frac{6}{15},\frac{8}{20},\frac{10}{25}$ are also equivalent fractions of $\frac{2}{5}$.

An equivalent fraction of $\frac{16}{32}$ is $\frac{16\div 16}{32\div 16}=\frac{1}{2}$.

Observe that in order to find an equivalent fraction of the fraction $\frac{16}{32}$, we preferred division of both the numerator and the denominator by the same number rather than multiplication. This is because if we multiply it by the same number, then the calculations will be more complex. That is why we preferred division in this case.

**Another way to check whether the fractions are equivalent or not**

If the cross products of the terms of two fractions are equal, then the two fractions are equivalent.

Consider the fractions $\frac{2}{5}$ and $\frac{6}{15}$.

$\frac{2}{5} \quad \frac{6}{15}$

2 × 15 = 5 × 6     (By cross multiplication)

30 = 30

∴ $\frac{2}{5} = \frac{6}{15}$

Hence, the fractions $\frac{2}{5}$ and $\frac{6}{15}$ are equivalent.

Let us now look at some more examples to understand this concept better.

**Example 1:**

**Find three equivalent fractions of the following fractions.**

1. $\frac{3}{5}$
2. $\frac{36}{42}$

**Solution:**

1. By multiplying both the numerator and the denominator of a given fraction by the same number, an equivalent fraction of the given number can be found out. Therefore,

$$\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10}$$
$$\frac{3}{5} = \frac{3 \times 3}{5 \times 3} = \frac{9}{15}$$
$$\frac{3}{5} = \frac{3 \times 4}{5 \times 4} = \frac{12}{20}$$

Thus, three equivalent fractions of $\frac{3}{5}$ are $\frac{6}{10}, \frac{9}{15}$, and $\frac{12}{20}$.

2. We can find equivalent fractions of the given fractions by dividing the numerator and the denominator by the same number.

$$\frac{36}{42} = \frac{36 \div 2}{42 \div 2} = \frac{18}{21}$$
$$\frac{36}{42} = \frac{36 \div 3}{42 \div 3} = \frac{12}{14}$$
$$\frac{36}{42} = \frac{36 \div 6}{42 \div 6} = \frac{6}{7}$$

Thus, three equivalent fractions of $\frac{36}{42}$ are $\frac{18}{21}, \frac{12}{14}$, and $\frac{6}{7}$.

**Example 2:**

**Check whether $\frac{5}{7}$ and $\frac{40}{56}$ are equivalent fractions.**

**Solution:**

The given fractions are $\frac{5}{7}$ and $\frac{40}{56}$.

We know that 7 × 8 = 56. Now, we multiply both the numerator and the denominator of the fraction $\frac{5}{7}$ by 8.

$$\frac{5 \times 8}{7 \times 8} = \frac{40}{56}$$

Therefore, $\frac{5}{7}$ and $\frac{40}{56}$ are equivalent fractions.

**Example 3:**

**Check whether $\frac{2}{5}$ and $\frac{36}{60}$ are equivalent.**

**Solution:**

The given fractions are $\frac{2}{5}$ and $\frac{36}{60}$.

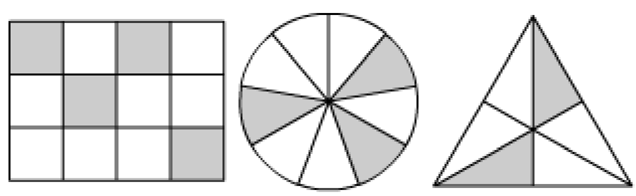
We know that 60 ÷ 12 = 5. Now, we divide both the numerator and the denominator of the fraction $\frac{36}{60}$ by 12.

$$\frac{36 \div 12}{60 \div 12} = \frac{3}{5} \neq \frac{2}{5}$$

Therefore, $\frac{2}{5}$ and $\frac{36}{60}$ are not equivalent.

**Example 4:**

**Are the following fractions equivalent?**



**Solution:**

The fraction represented by the first figure is $\frac{4}{12}$.

The fraction represented by the second figure is $\frac{3}{9}$.

The fraction represented by the third figure is $\frac{2}{6}$.

Now, $\frac{4}{12} = \frac{4 \div 4}{12 \div 4} = \frac{1}{3}$

$$\frac{3}{9} = \frac{3 \div 3}{9 \div 3} = \frac{1}{3}$$

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

$$\therefore \frac{4}{12} = \frac{3}{9} = \frac{2}{6}$$

Thus, the above figures represent equivalent fractions.

## Simplest Form of Fractions

Consider the fraction $\frac{105}{45}$. We know that equivalent fractions of this fraction can be obtained by dividing the numerator and the denominator by the same number.

Thus, an equivalent fraction of $\frac{105}{45}$ is

$$\frac{105 \div 5}{45 \div 5} = \frac{21}{9}$$

Now, can we further divide the fraction $\frac{21}{9}$ to find its equivalent fraction?

Let us now try to find an equivalent fraction of this fraction.

The fraction $\frac{21}{9}$ can be written as $\frac{21 \div 3}{9 \div 3} = \frac{7}{3}$.

Now, can we find the equivalent fraction of $\frac{7}{3}$ by division?

In the fraction $\frac{7}{3}$, the numerator and the denominator have no common factor other than 1.

The fraction $\frac{7}{3}$ is the simplest form of the given fraction $\frac{105}{45}$.

**"In the simplest form of a fraction, its numerator and denominator have 1 as the only common factor".**

Observe that **if we divide the numerator and the denominator of a fraction by their highest common factor, then the fraction obtained is the simplest form of the given fraction.**

For example, let us again consider the fraction $\frac{105}{45}$.

The highest common factor of 105 and 45 is 15. Therefore, when we divide the numerator and denominator of the fraction $\frac{105}{45}$ by 15, we obtain the simplest form of this fraction.

Thus, the simplest form of the fraction $\frac{105}{45}$ is $\frac{105 \div 15}{45 \div 15} = \frac{7}{3}$.

Let us now look at some more examples to understand this concept better.

**Example 1:**

**Reduce $\frac{48}{64}$ into its simplest form.**

**Solution:**

The common factors of 48 and 64 are 1, 2, 4, 8, and 16. The highest common factor (HCF) is 16.

Now, $\frac{48}{64} = \frac{48 \div 16}{64 \div 16} = \frac{3}{4}$

3 and 4 have no common factor except 1.

Thus, the simplest form of $\frac{48}{64}$ is $\frac{3}{4}$.

**Example 2:**

**Obtain the simplest form of the fraction $\frac{275}{125}$.**

**Solution:**

The highest common factor of 275 and 125 is 25.

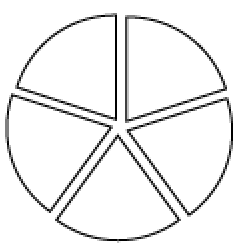
On dividing the numerator and the denominator by 25, we obtain

$$\frac{275 \div 25}{125 \div 25} = \frac{11}{5}$$

Thus, $\frac{11}{5}$ is the simplest form of the given fraction since the numerator and the denominator have no common factor other than 1.

## Comparing and Ordering Like and Unlike Fractions

Suppose you invite two of your friends over to your house. You buy a pizza and cut it into five equal parts to divide it among yourselves. The pizza will look as follows:



Now, let us suppose you eat one slice of pizza and your friends eat two slices each. Now, how will you determine the exact quantity of pizza eaten by you?

There were five equal slices of pizza in the beginning. You ate one slice of it. You can say that you ate one out of five slices of pizza. This is represented by $\frac{1}{5}$.

Similarly, each of your friends ate two slices, i.e., $\frac{2}{5}$ of the pizza. These types of numbers are known as **fractions.** Here, we will learn about **like** and **unlike fractions,** and how to compare them.

Let us first learn about like and unlike fractions.

**Like Fraction**

The fractions whose denominators are same are called like fractions.

For example: $\frac{2}{13}, \frac{5}{13}, \frac{7}{13}, \frac{8}{13}$ etc.

**Unlike Fraction**

Unlike fractions are the fractions whose denominators are different.

For example: $\frac{7}{9}, \frac{4}{7}, \frac{15}{20}, \frac{16}{21}$ etc.

Let us consider some examples based on like and unlike fractions.

**Example 1:**

**Separate like and unlike fractions from the following fractions.**

$\frac{5}{19}, \frac{5}{25}, \frac{17}{27}, \frac{10}{38}, \frac{10}{13}, \frac{5}{26}, \frac{8}{19}, \frac{19}{13}, \frac{11}{19}, \frac{10}{18}, \frac{7}{14}, \frac{18}{19}, \frac{2}{13}$

**Solution:**

Like fractions: $\frac{5}{19}, \frac{8}{19}, \frac{11}{19}, \frac{18}{19}$

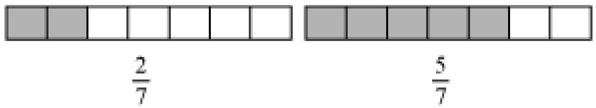
Like fractions: $\frac{10}{13}, \frac{2}{13}, \frac{19}{13}$

Unlike fractions: $\frac{5}{25}, \frac{17}{27}, \frac{10}{38}, \frac{5}{26}, \frac{10}{18}, \frac{7}{14}$

Now, that we know what like and unlike fractions are, let us now learn how to compare and order them.

**Comparing and ordering of like fractions:**

Let us compare two like fractions $\frac{2}{7}$ and $\frac{5}{7}$. We can represent them as:




In both the fractions, the whole is divided into 7 equal parts. To represent $\frac{2}{7}$, we shade 2 parts out of the 7 equal parts; and to represent $\frac{5}{7}$, we shade 5 parts out of the 7 equal parts. Clearly, out of the 7 equal parts in the two figures, more portions have been shaded in the figure corresponding to 5 parts than that in the figure corresponding to 2 parts.

$\therefore \frac{5}{7} > \frac{2}{7}$

We can generalise this as: "**Out of two like fractions, the fraction with the greater numerator is greater.**"

For example, among the like fractions $\frac{6}{8}, \frac{9}{8}$ and $\frac{4}{8}$:

$\frac{9}{8} > \frac{6}{8} > \frac{4}{8}$ as 9 > 6 > 4.

Let us discuss some examples keeping the above fact in mind.

**Example 2:**

**Arrange the following fractions in ascending order.**

$\frac{5}{18}, \frac{11}{18}, \frac{3}{18}, \frac{17}{18}, \frac{9}{18}, \frac{16}{18}$ **and** $\frac{14}{18}$

**Solution**:

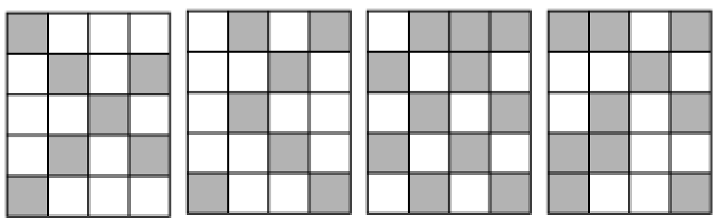
The fractions $\frac{5}{18}, \frac{11}{18}, \frac{3}{18}, \frac{17}{18}, \frac{9}{18}, \frac{16}{18}$ and $\frac{14}{18}$ are like fractions as the fractions have the same denominator.

If we arrange the numerator in ascending order we have 3, 5, 9, 11, 14, 16, and 17.

Hence, the arrangement of the given fractions in ascending order is $\frac{3}{18}, \frac{5}{18}, \frac{9}{18}, \frac{11}{18}, \frac{14}{18}, \frac{16}{18}, \frac{17}{18}$.

**Example 3:**

**Write the fractions corresponding to each figure drawn below. Compare the fractions using the correct sign ‘<’, ‘=’, ‘>’ between the fractions.**



**Solution:**

The fractions represented by the given figures are respectively $\frac{7}{20}, \frac{7}{20}, \frac{11}{20}$ and $\frac{10}{20}$.

We can now arrange the fractions in ascending order as $\frac{7}{20} = \frac{7}{20} < \frac{10}{20} < \frac{11}{20}$.

**Example 4:**

**Math Olympiad was conducted in Delhi, Mumbai and Hyderabad. 200, 300, and 450 candidates were supposed to appear for the test in Delhi, Mumbai and Hyderabad respectively. But due to certain reasons only 180, 90, and 315 candidates appeared for the test in the above cities respectively. Which city has the**

**(a) greatest fraction of candidates who appeared for the test?**

**(b) least fraction of candidates who appeared for the test?**

**Solution:**

In **Delhi,** 180 candidates appeared for the test out of 200 candidates.

Hence, fraction of candidates who appeared for the test in Delhi

= $\frac{180}{200} = \frac{180 \div 20}{200 \div 20} = \frac{9}{10}$

In **Mumbai,** 90 candidates appeared for the test out of 300 candidates.

Hence, fraction of candidates who appeared for the test in Mumbai =

$\frac{90}{300} = \frac{90 \div 30}{300 \div 30} = \frac{3}{10}$

In **Hyderabad,** 315 candidates appeared for the test out of 450 candidates.

Hence, fraction of candidates who appeared for the test in Hyderabad =

$\frac{315}{450} = \frac{315 \div 45}{450 \div 45} = \frac{7}{10}$

The fraction of candidates who appeared for the test in Delhi, Mumbai and Hyderabad are $\frac{9}{10}$, $\frac{3}{10}$, and $\frac{7}{10}$ respectively.

These fractions are like fractions (same denominator).

Comparing the numerators, we will obtain 9 > 7 > 3.

Hence, $\frac{9}{10} > \frac{7}{10} > \frac{3}{10}$.

1. Since the fraction $\frac{9}{10}$ is the greatest among the other fractions, Delhi is the city where the greatest fraction of candidates appeared for the test.
2. Since the fraction $\frac{3}{10}$ is the smallest among all, Mumbai is the city where least fraction of candidates appeared for the test.

So far we have learnt comparing and ordering of like fractions. Let us know how we can compare and order unlike fractions.

**Comparing and ordering of unlike fractions:**

Unlike fractions are of two types:

1. Unlike fractions with same numerator; and
2. Unlike fractions with different numerators

3. Let us discuss some more examples based on comparison and ordering of unlike fractions.
4. **Example 5:**
5. **Arrange the following unlike fractions in descending order.**
6. $\frac{17}{5}, \frac{17}{19}, \frac{17}{1}, \frac{17}{45}, \frac{17}{18}$ and $\frac{17}{22}$
7. **Solution:**
8. The fractions $\frac{17}{5}, \frac{17}{19}, \frac{17}{1}, \frac{17}{45}, \frac{17}{18}$ and $\frac{17}{22}$ are unlike fractions with the same numerator.
9. We can arrange the denominators of these fractions in ascending order as:
10. $1 < 5 < 18 < 19 < 22 < 45$
11. Hence, the given fractions in descending order are $\frac{17}{1}, \frac{17}{5}, \frac{17}{18}, \frac{17}{19}, \frac{17}{22}, \frac{17}{45}$.
12. **Example 6:**
13. **Arrange the following fractions in descending order.**
14. $\frac{2}{5}, \frac{4}{7}, \frac{1}{2}$ and $\frac{5}{4}$
15. **Solution:**
16. The fractions $\frac{2}{5}, \frac{4}{7}, \frac{1}{2}$ and $\frac{5}{4}$ are unlike fractions with different denominators.
17. Now, we can find the LCM of 5, 7, 2, and 4 as:
18. $$\begin{array}{r|l} 2 & 5,\ 7,\ 2,\ 4 \\ \hline 2 & 5,\ 7,\ 1,\ 2 \\ \hline 5 & 5,\ 7,\ 1,\ 1 \\ \hline 7 & 1,\ 7,\ 1,\ 1 \\ \hline & 1,\ 1,\ 1,\ 1 \end{array}$$
19. Hence, LCM = $2 \times 2 \times 5 \times 7 = 140$

20.Now, we can convert the denominator of each fraction to 140 as:

$$\frac{2}{5} = \frac{2 \times 28}{5 \times 28} = \frac{56}{140}$$

$$\frac{4}{7} = \frac{4 \times 20}{7 \times 20} = \frac{80}{140}$$

$$\frac{1}{2} = \frac{1 \times 70}{2 \times 70} = \frac{70}{140}$$

21. $\frac{5}{4} = \frac{5 \times 35}{4 \times 35} = \frac{175}{140}$

22.If we arrange the numerator in descending order, we obtain 175 > 80 > 70 > 56.

23.So, $\frac{175}{140} > \frac{80}{140} > \frac{70}{140} > \frac{56}{140}$.

24.Hence, the given fractions in decreasing order are $\frac{5}{4} > \frac{4}{7} > \frac{1}{2} > \frac{2}{5}$.

25.**Example 7:**

26.**In class A of 92 students, 69 got scholarship; in class B of 80 students, 64 got scholarship and in another class C of 99 students, 66 got scholarship. In which class did a greater fraction of students get scholarship?**

27.**Solution:**

28.In class A of 92 students, 69 got scholarship.

29.So, fraction of the students who got scholarship in class A

$= \frac{69}{92} = \frac{69 \div 23}{92 \div 23} = \frac{3}{4}$

30.(HCF of 69 and 92 is 23)

31.In class B of 80 students, 64 got scholarship.

32.So, fraction of the students who got scholarship in class B

$= \frac{64}{80} = \frac{64 \div 16}{80 \div 16} = \frac{4}{5}$

33.(HCF of 64 and 80 is 16)

34.In class C of 99 students, 66 got scholarship.

35.So, fraction of the students who got scholarship in class C

$= \frac{66}{99} = \frac{66 \div 33}{99 \div 33} = \frac{2}{3}$

36.(HCF of 66 and 99 is 33)

37.We have 3 fractions $\frac{2}{3}, \frac{3}{4}$ and $\frac{4}{5}$.

38.
$$\begin{array}{r|l} 3 & 3, 4, 5 \\ \hline 4 & 1, 4, 5 \\ \hline 5 & 1, 1, 5 \\ \hline & 1, 1, 1 \end{array}$$

39.LCM = 3 × 4 × 5 = 60

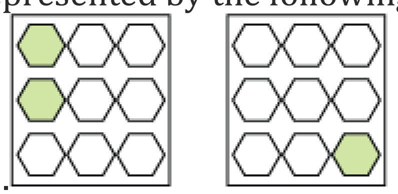
40.
$$\frac{2}{3}=\frac{2\times 20}{3\times 20}=\frac{40}{60}$$
$$\frac{3}{4}=\frac{3\times 15}{4\times 15}=\frac{45}{60}$$
$$\frac{4}{5}=\frac{4\times 12}{5\times 12}=\frac{48}{60}$$

41.Clearly $\frac{4}{5}$ is the greatest among all.

42.Hence, the students of class B got a greater fraction of scholarship.

43.Addition and Subtraction of Like and Unlike Fractions

44.Consider the fractions represented by the following figures.

45.

46.The fractions represented by these figures are $\frac{2}{9}$ and $\frac{1}{9}$.

47.**What will happen if we combine these two fractions?**

48.Combining these two fractions means adding the two fractions.

Let us now see how to add and subtract mixed fractions.

In case of mixed fractions, we can add or subtract the whole part and the fraction part separately.

For example, let us add $7\frac{5}{9}$ to $2\frac{3}{4}$.

$$2\frac{3}{4}+7\frac{5}{9}$$

$$=2+\frac{3}{4}+7+\frac{5}{9}$$

$$=(2+7)+\left(\frac{3}{4}+\frac{5}{9}\right)$$

$$=9+\left(\frac{3}{4}+\frac{5}{9}\right)$$

$$=9+\left(\frac{3\times 9}{4\times 9}+\frac{5\times 4}{9\times 4}\right) \qquad (\because \text{The L.C.M. of 4 and 9 is 36})$$

$$=9+\left(\frac{27}{36}+\frac{20}{36}\right)$$

$$=9+\left(\frac{47}{36}\right)$$

$$=9+\left(\frac{36+11}{36}\right)$$

$$=9+\left(1+\frac{11}{36}\right)=10+\frac{11}{36}=10\frac{11}{36}$$

Another way of adding or subtracting mixed fractions is to convert the mixed fractions into improper fractions. Now, these improper fractions can be added in the usual manner.

Let us find the value of $3\frac{4}{5}-2\frac{1}{6}$.

$$3\frac{4}{5}-2\frac{1}{6}$$

$$=\frac{(3\times5)+4}{5}-\frac{(2\times6)+1}{6}$$

$$=\frac{19}{5}-\frac{13}{6}$$

$$=\frac{19\times6}{5\times6}-\frac{13\times5}{6\times5} \qquad (\text{The L.C.M. of 5 and 6 is 30})$$

$$=\frac{114}{30}-\frac{65}{30}$$

$$=\frac{114-65}{30}$$

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

Let us now look at some more examples to understand the concept better.

**Example 1:**

**Solve the following:**

1. $\mathbf{\frac{3}{4}+\frac{5}{6}}$
2. $\mathbf{\frac{31}{6}+3\frac{9}{16}-\frac{5}{18}}$

**Solution:**

1. $\frac{3}{4}+\frac{5}{6}$

| | | |
|---|---|---|
| 2 | 4 | 6 |
| 2 | 2 | 3 |
| 3 | 1 | 3 |
| | 1 | 1 |

The LCM of 4 and 6 = 2 ×2 ×3 = 12

$$\frac{3}{4}+\frac{5}{6}=\frac{3\times 3}{4\times 3}+\frac{5\times 2}{6\times 2}$$
$$=\frac{9}{12}+\frac{10}{12}=\frac{9+10}{12}=\frac{19}{12}$$

2. $\frac{31}{6}+3\frac{9}{16}-\frac{5}{18}$

$$=\frac{31}{6}+\frac{(3\times 16)+9}{16}-\frac{5}{18}$$
$$=\frac{31}{6}+\frac{57}{16}-\frac{5}{18}$$

| | | | |
|---|---|---|---|
| 2 | 6 | 16 | 18 |
| 2 | 3 | 8 | 9 |
| 2 | 3 | 4 | 9 |
| 2 | 3 | 2 | 9 |
| 3 | 3 | 1 | 9 |
| 3 | 1 | 1 | 3 |
| | 1 | 1 | 1 |

The LCM of 6, 16, and 18 = 2 ×2 ×2 ×2 ×3 ×3 = 144

$$\frac{31}{6}+\frac{57}{16}-\frac{5}{18}$$
$$=\frac{31\times 24}{6\times 24}+\frac{57\times 9}{16\times 9}-\frac{5\times 8}{18\times 8}$$
$$=\frac{744}{144}+\frac{513}{144}-\frac{40}{144}$$
$$=\frac{744+513-40}{144}$$
$$=\frac{1217}{144}$$
$$=\frac{(8\times 144)+65}{144}$$
$$=8+\frac{65}{144}$$
$$=8\frac{65}{144}$$

**Example 2:**

**Sonu walked $\frac{3}{7}$ of a kilometre. After that, he ran for $\frac{2}{7}$ of a kilometre. How much distance did he cover?**

**Solution:**

Total distance travelled = $\frac{3}{7}+\frac{2}{7}=\frac{3+2}{7}$ of a kilometre

$=\frac{5}{7}$ of a kilometre

**Example 3:**

**Isha bought $\frac{1}{2}$ kg of mangoes. If she ate $\frac{1}{6}$ kg of it, then how much is left with her?**

**Solution:**

Weight of mangoes left = $\frac{1}{2}-\frac{1}{6}$

$=\frac{1\times 3}{2\times 3}-\frac{1\times 1}{6\times 1}$ $(\because \text{L.C.M. of 2 and 6 is 6})$

$=\frac{3}{6}-\frac{1}{6}=\frac{3-1}{6}=\frac{2}{6}=\frac{1}{3}$ kg

**Example 4:**

**Sumit bought $3\frac{3}{4}$ litres of milk. Later he went out and bought $2\frac{1}{2}$ litres more. How much milk did he buy?**

**Solution:**

Milk bought by Sumit = $3\frac{3}{4}+2\frac{1}{2}$

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

$$= \frac{15}{4} + \frac{5}{2}$$

$$= \frac{15\times 1}{4\times 1} + \frac{5\times 2}{2\times 2} \qquad \text{(The L.C.M. of 4 and 2 is 4)}$$

$$= \frac{15}{4} + \frac{10}{4}$$

$$= \frac{15+10}{4}$$

$$= \frac{25}{4}$$

$$= \frac{(6\times 4)+1}{4}$$

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

$$= 6\frac{1}{4}$$

Thus, Sumit bought $6\frac{1}{4}$ litres of milk.

**Example 5:**

Seema bought 18 kg of oranges. She gave $4\frac{1}{2}$ kg, $3\frac{1}{4}$ kg, $3\frac{3}{4}$ kg and 3 kg to her four friends. Find the weight of the oranges left with Seema.

**Solution:**
Total weight of total oranges = 18 kg

Weight of oranges given to friends

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

$$= \frac{9}{2} + \frac{13}{4} + \frac{15}{4} + 3$$

$$= \frac{18+13+15+12}{4}$$

$$= \frac{58}{4} \text{ kg}$$

Weight of remaining oranges

$= 18 - \frac{58}{4}$

$= \frac{72 - 58}{4}$

$= \frac{14}{4} = \frac{7}{2}$

$= 3\frac{1}{2}\text{ kg}$

Thus, $3\frac{1}{2}\text{ kg}$ of oranges is left with Seema .