A fraction is a number representing a part of a whole. The whole may be a single object or a group of objects.





- A common fraction is written in the form \overline{b} , where a and b both are integers and $b \neq a$ 0. Here, *a* is numerator and *b* is denominator. Common fractions are also known as **vulgar** or **simple fractions**.
- While expressing a situation where parts have to be counted to write a fraction, it must • be ensured that all parts are equal.
- For a fraction $\frac{2}{13}$, ² is called its numerator and 13 is called its denominator.
- Fractions are categorized into three types: proper, improper, and mixed fraction.
- **Proper fractions** are those fractions in which the numerator is less than the denominator. These fractions are always less than 1.
- For example, $\frac{17}{24}$ is a proper fraction since the numerator, 17, is less than the denominator, 24.
- **Improper fractions** are those fractions in which the numerator is greater than the denominator. These fractions are always greater than 1.
- For example, $\frac{15}{7}$ is an improper fraction since the numerator (15) > denominator (7).
- A **mixed fraction** is a combination of a whole number and a part.

• For example,
$$9\frac{5}{13} = 9 + \frac{5}{13}$$

- If numerator and denominator of a fraction are equal, then the fraction is 1.
- For example, $\frac{5}{5} = 1$
- A mixed fraction can be converted into an improper fraction (Whole × Denominator) + Numerator Denominator For example, $8\frac{2}{23} = \frac{(8\times23)+2}{23} = \frac{184+2}{23} = \frac{186}{23}$

• To convert an improper fraction into a mixed fraction, first of all, the quotient and remainder are obtained by just dividing the numerator by the denominator. Then, the mixed fraction corresponding to the given improper fraction is written as

Quotient $\frac{\text{Remainder}}{\text{Divisor(Denominator)}}$ For example, to find the mixed fraction corresponding to the improper fraction $\frac{182}{7}$ first of all, 182 is divided by 17. Here, divisor = 17, quotient = 10, and remainder = 12 $\therefore \frac{182}{17} = 10\frac{12}{17}$

• To represent a proper fraction in the form of a figure, an object or a group of objects are divided into equal number of parts related to the denominator. The parts equal to the numerator are shaded.

Example: $\frac{3}{5}$ can be represented as:



• To represent a mixed fraction in the form of a figure, both the figures denoting whole part and the proper fraction part are shaded.

Example: $2\frac{1}{4}$ can be represented as:



• To represent an improper fraction in the form of a figure, firstly, it is converted into mixed fraction and then the same procedure is followed as above.





• We can find fractions representing a given situation.

For example, Aakash has 12 marbles, out of which 5 are blue and rest are red. Hence, the fraction of blue marbles is $\frac{5}{12}$.

• A fraction can be represented on a number line.

For example, to represent $\frac{2}{7}$ on the number line, first of all, the gap between 0 and 1 is divided into 7 equal parts. Then, each part represents the fraction $\frac{1}{7}$. Therefore, $\frac{2}{7}$ can be easily represented on the number line as:

L							
						1	
$0 = \frac{0}{100}$	1	2	3	4	5	6	$1 = \frac{7}{1}$
7	7	7	7	7	7	7	7

• To find an equivalent fraction of a given fraction, both the numerator and denominator of the given fraction are multiplied or divided by the same number.

Example:

ample: $\frac{12}{18} = \frac{12 \times 2}{18 \times 2} = \frac{24}{26}, \frac{12}{18} = \frac{12 \times 5}{18 \times 5} = \frac{60}{90}$ $\frac{12}{18} = \frac{12 \div 2}{18 \div 2} = \frac{6}{9}, \frac{12}{18} = \frac{12 \div 3}{18 \div 3} = \frac{4}{6}$ $\therefore \frac{12}{18} = \frac{24}{36} = \frac{60}{90} = \frac{6}{9} = \frac{4}{6}$

• Two fractions are equivalent, if the product of the numerator of the first fraction and the denominator of the second fraction is equal to the product of the numerator of the second fraction and the denominator of the first fraction.

Example: To check the equivalence of $\frac{3}{5}$ and $\frac{18}{30}$, the following calculation is carried out.

 $3 \times 30 = 90$ and $5 \times 18 = 90$

Since,
$$3 \times 30 = 5 \times 18$$

 $\Rightarrow \frac{3}{5} = \frac{18}{30}$

• A fraction is said to be in its **simplest or lowest form**, if its numerator and denominator have no common factor other than 1.

Example: The fraction, $\frac{2}{9}$, is in its simplest form since 1 is the only common factor of 2 and 9. The fraction, $\frac{6}{15}$, is not in its simplest form as the common factor of 6 and 15, other than 1, is 3.

• A fraction can be reduced to its simplest form or lowest form by dividing both numerator and denominator by the HCF of the numerator and denominator.

Example:Convert $\frac{49}{91}$ into its simplest form.

Solution: HCF of 49 and 91 is 7

 $\therefore \frac{49}{91} = \frac{49 \div 7}{91 \div 7} = \frac{7}{13}$ Therefore, $\frac{7}{13}$ is the simplest form of $\frac{49}{91}$.

• Fractions with same denominators are called like fractions.

For example, $\frac{9}{5}$, $\frac{2}{5}$, $\frac{11}{5}$, $\frac{7}{5}$ are like fractions.

• Fractions with different denominators are called unlike fractions.

For example, $\frac{9}{8}$, $\frac{11}{3}$, $\frac{12}{7}$ are unlike fractions.

• If two or more fractions are like fractions, then greater the numerator, greater is the fraction.

For example, among the fractions, $\frac{9}{17}$, $\frac{25}{17}$, $\frac{21}{17}$, and $\frac{6}{17}$, it can be observed that, 25 > 21 > 9 > 6 $\therefore \frac{25}{17} > \frac{21}{17} > \frac{9}{17} > \frac{6}{17}$

• If two or more fractions have the same numerator, then smaller the denominator, greater is the fraction.

For example, among the fractions, $\frac{17}{6}$, $\frac{17}{3}$, and $\frac{17}{11}$, it can be observed that, 3 < 5 < 11 $\therefore \frac{17}{3} > \frac{17}{5} > \frac{17}{11}$

• To compare two unlike fractions (without same numerator), first of all, these fractions are converted into their equivalent fractions of same denominator, which is the LCM of the denominators of the fractions. Then, like fractions are obtained, which can be compared easily.

For example, $\frac{5}{6}$ and $\frac{20}{21}$ can be compared as: LCM of 6 and 21 = 42 $\therefore \frac{5}{6} = \frac{5 \times 7}{6 \times 7} = \frac{35}{42}, \frac{20}{21} = \frac{20 \times 2}{21 \times 2} = \frac{40}{42}$

Here, $\frac{35}{42}$ and $\frac{40}{42}$ are like fractions.

Since $\frac{40}{42} > \frac{35}{42}$, we obtain $\frac{20}{21} > \frac{5}{6}$

• Addition of two like fractions can be performed just by adding the numerators and retaining the denominator of the fractions.

For example, $\frac{17}{25} + \frac{3}{25} = \frac{17+3}{25} = \frac{20}{25} = \frac{20 \div 5}{25 \div 5} = \frac{4}{5}$

• Subtraction of two like fractions can be performed just by subtracting the numerators and retaining the denominator of the fractions.

For example, $\frac{31}{15} - \frac{4}{15} = \frac{31-4}{15} = \frac{27}{15} = \frac{27 \div 3}{15 \div 3} = \frac{9}{5}$

• To perform the addition and subtraction of unlike fractions, first of all, they are converted into their equivalent fractions with the denominator as the LCM of their denominators. Then, addition or subtraction can be performed easily.

Example: Find the sum of $\frac{4}{3}$ and $\frac{5}{12}$. Solution: LCM of 3 and 12 = 12 $\therefore \frac{4}{3} + \frac{5}{12} = \frac{4 \times 4}{3 \times 4} + \frac{5 \times 1}{12 \times 1} = \frac{16}{12} + \frac{5}{12} = \frac{21}{12} = \frac{21 \div 3}{12 \div 3} = \frac{7}{4}$ Example: Subtract $\frac{4}{33}$ from $\frac{3}{22}$. Solution: LCM of 33 and 22 = 66

:.322-433=3×322×3-4×233×2=966-866=166::322-433=3×322×3-4×233×2=966-866=166

• To add or subtract mixed fractions, first of all, they are converted into improper fractions. Then, they can be added or subtracted easily.

For example,

$$7\frac{2}{5} + 3\frac{4}{9} = \frac{37}{5} + \frac{31}{9}$$

 $= \frac{37 \times 9}{5 \times 9} + \frac{31 \times 5}{9 \times 5}$ (LCM of 5 and 9 is 45)
 $= \frac{333}{45} + \frac{155}{45}$
 $= \frac{333 + 155}{45}$
 $= \frac{448}{45}$
 $= 10\frac{38}{45}$