3

Fractions

Fractions

Fractions represent parts of a whole. For example, if an apple is divided into four equal parts, each part is called one fourth, and is denoted by $\frac{1}{4}$. The line separating 1 and 4 indicates division. $\frac{1}{4}$ is a fraction. Similarly, $\frac{1}{2}, \frac{2}{3}, \frac{3}{7}, \frac{9}{11}$ and $\frac{15}{19}$ are also fractions. In any fraction $\frac{a}{b}$, a is called the numerator and b is called the denominator. For example, in the fraction $\frac{5}{9}$, the numerator = 5 and the denominator = 9.

Classification of fractions

Common (or simple or vulgar) fraction

The numerator is any integer and the denominator is a nonzero integer other than 10, 100, 1000, etc., in a common fraction. $\frac{1}{8}, \frac{3}{7}$ and $\frac{10}{77}$ are some common fractions.

Decimal fraction

The denominator is some power of ten such as 10, 100, 1000, etc., in a decimal fraction. $\frac{3}{10}, \frac{17}{100}$ and $\frac{1}{1000}$ are some decimal fractions.

Complex fraction

A fraction in which the numerator or denominator or both contain fractions is called a complex fraction. $\frac{\frac{2}{7}}{3}, \frac{9}{\frac{8}{25}}$ and $\frac{\frac{7}{11}}{\frac{9}{37}}$ are some complex fractions.

Proper fraction

The numerator is less than the denominator in a proper fraction. $\frac{1}{4}, \frac{11}{38}$ and $\frac{125}{1373}$ are some proper fractions.

Improper fraction

The numerator is equal to or greater than the denominator in an improper fraction. $\frac{3}{3}, \frac{125}{77}$ and $\frac{1435}{389}$ are some improper fractions.

Mixed fraction (or number)

An integer together with a proper fraction is called a mixed fraction. $3\frac{5}{7}, 8\frac{9}{25}$ and $14\frac{17}{31}$ are some mixed fractions. In $3\frac{5}{7}$, 3 is called the integral part and $\frac{5}{7}$ is called the fractional part.

Mixed fractions can be written as improper fractions.

Examples (i) $3\frac{5}{7} = \frac{3\times7+5}{7} = \frac{26}{7}$. (ii) $8\frac{9}{25} = \frac{8\times25+9}{25} = \frac{209}{25}$.

(iii) $14\frac{17}{31} = \frac{14\times31+17}{31} = \frac{451}{31}$.

Improper fractions can be written as mixed fractions.

Examples (i) $\frac{23}{4} = 5+\frac{3}{4} = 5\frac{3}{4}$ because $23 \div 4$ gives quotient 5 and remainder 3.

(ii) $\frac{25}{12} = 2+\frac{1}{12} = 2\frac{1}{12}$ because $25 \div 12$ gives quotient 2 and remainder 1.

Equivalent (or equal) fractions

If the numerator and the denominator of a fraction are multiplied or divided by the same nonzero number, we get an equivalent fraction. The value of the fraction remains unchanged.

Examples (i) $\frac{2}{3} = \frac{2\times2}{3\times2} = \frac{4}{6}$, $\frac{2}{3} = \frac{2\times5}{3\times5} = \frac{10}{15}$, $\frac{2}{3} = \frac{2\times7}{3\times7} = \frac{14}{21}$, etc.

$\therefore \quad \frac{2}{3} = \frac{4}{6} = \frac{10}{15} = \frac{14}{21} = \ldots$.

(ii) $\frac{18}{24} = \frac{18\div2}{24\div2} = \frac{9}{12}$, $\frac{18}{24} = \frac{18\div3}{24\div3} = \frac{6}{8}$, $\frac{18}{24} = \frac{18\div6}{24\div6} = \frac{3}{4}$.

Thus, $\frac{18}{24} = \frac{9}{12} = \frac{6}{8} = \frac{3}{4}$ are equivalent fractions.

> Two fractions $\frac{a}{b}$ and $\frac{c}{d}$ are equivalent if $ad = bc$.

The fractions $\frac{7}{9}$ and $\frac{20}{27}$ are not equivalent fractions because $7\times27 \neq 9\times20$.

Simplest form of a fraction

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

Examples $\frac{1}{2}, \frac{32}{79}, \frac{99}{211}, \frac{157}{371}$ are some fractions in the simplest form.

$\frac{3}{12}, \frac{30}{135}, \frac{125}{625}$ are some fractions which are not in the simplest form.

A fraction can be reduced to its simplest form just by cancelling out the common factors in the numerator and the denominator.

Examples (i) $\frac{3}{12} = \frac{\cancel{3} \times 1}{\cancel{3} \times 4} = \frac{1}{4}$. (ii) $\frac{30}{135} = \frac{2 \times \cancel{3} \times \cancel{5}}{\cancel{3} \times \cancel{5} \times 9} = \frac{2}{9}$.

Like and unlike fractions

Fractions with the same denominator are called like fractions.

$\frac{3}{7}, \frac{1}{7}, \frac{5}{7}$ are like fractions.

Fractions with different denominators are called unlike fractions.

$\frac{2}{11}, \frac{5}{7}, \frac{5}{17}$ are unlike fractions.

Conversion of unlike fractions into like fractions

Steps 1. Find the LCM of the denominators of the fractions.

2. Divide the LCM by the respective denominators.

3. Multiply the numerator and the denominator of each fraction by the corresponding quotient obtained in Step 2.

EXAMPLE **Convert $\frac{11}{16}, \frac{13}{20}$ and $\frac{19}{25}$ into like fractions.**

Solution First, we find the LCM of the denominators.

2	16, 20, 25
2	8, 10, 25
5	4, 5, 25
	4, 1, 5

$\therefore$ LCM $= 2 \times 2 \times 5 \times 4 \times 5 = 400$.

Now, $400 \div 16 = 25$, $400 \div 20 = 20$, $400 \div 25 = 16$.

$\therefore \frac{11}{16} = \frac{11 \times 25}{16 \times 25} = \frac{275}{400}$, $\frac{13}{20} = \frac{13 \times 20}{20 \times 20} = \frac{260}{400}$ and $\frac{19}{25} = \frac{19 \times 16}{25 \times 16} = \frac{304}{400}$.

Hence, $\frac{275}{400}, \frac{260}{400}$ and $\frac{304}{400}$ are the required like fractions.

Comparison of fractions

Among like fractions, the fraction with the greatest numerator is the greatest.

To compare unlike fractions, we first convert them into like fractions and then compare their numerators.

EXAMPLE **Arrange the fractions $\frac{17}{25}, \frac{5}{12}, \frac{13}{18}$ and $\frac{11}{15}$ in ascending order.**

Solution To change the fractions into like fractions, we find the LCM of the denominators.

LCM of the denominators 25, 12, 18 and 15

$= 2 \times 3 \times 5 \times 5 \times 2 \times 3 = 900.$

2	25, 12, 18, 15
3	25, 6, 9, 15
5	25, 2, 3, 5
	5, 2, 3, 1

Now, $900 \div 25 = 36, 900 \div 12 = 75, 900 \div 18 = 50$ and $900 \div 15 = 60$.

$\therefore \quad \frac{17}{25} = \frac{17 \times 36}{25 \times 36} = \frac{612}{900}, \quad \frac{5}{12} = \frac{5 \times 75}{12 \times 75} = \frac{375}{900}, \quad \frac{13}{18} = \frac{13 \times 50}{18 \times 50} = \frac{650}{900}$

and $\frac{11}{15} = \frac{11 \times 60}{15 \times 60} = \frac{660}{900}$.

$\because \quad 375 < 612 < 650 < 660, \quad \frac{375}{900} < \frac{612}{900} < \frac{650}{900} < \frac{660}{900}$. So, $\frac{5}{12} < \frac{17}{25} < \frac{13}{18} < \frac{11}{15}$.

Hence, the fractions in ascending order are $\frac{5}{12}, \frac{17}{25}, \frac{13}{18}, \frac{11}{15}$.

HCF of two or more fractions

The HCF of two or more fractions in the simplest form is the greatest fraction which exactly divides each of the given fractions.

$$\text{HCF of two or more fractions in the simplest form} = \frac{\text{HCF of the numerators of all the fractions}}{\text{LCM of the denominators of all the fractions}}$$

EXAMPLE **Find the HCF of $\frac{3}{8}, \frac{1}{2}$ and $\frac{5}{18}$.**

Solution $\text{HCF} = \frac{\text{HCF of 3, 1 and 5}}{\text{LCM of 8, 2 and 18}} = \frac{1}{72}$.

LCM of two or more fractions

The LCM of two or more fractions in the simplest form is the least fraction which is exactly divisible by each of the given fractions.

$$\text{LCM of two or more fractions in the simplest form} = \frac{\text{LCM of the numerators of all the fractions}}{\text{HCF of the denominators of all the fractions}}$$

EXAMPLE **Find the LCM of $\frac{3}{8}, \frac{1}{2}$ and $\frac{5}{18}$.**

Solution $\text{LCM} = \frac{\text{LCM of 3, 1 and 5}}{\text{HCF of 8, 2 and 18}} = \frac{15}{2}$.

Insertion of fractions between two given fractions

A fraction between $\frac{a}{b}$ and $\frac{c}{d}$ is $\frac{a+c}{b+d}$. For example, a fraction between $\frac{1}{2}$ and $\frac{3}{5}$ is $\frac{1+3}{2+5}$, that is, $\frac{4}{7}$.

A fraction between $\frac{a}{b}$ and $\frac{a+c}{b+d}$ is $\frac{a+(a+c)}{b+(b+d)}$, that is, $\frac{2a+c}{2b+d}$.

A fraction between $\frac{a}{b}$ and $\frac{2a+c}{2b+d}$ is $\frac{a+(2a+c)}{b+(2b+d)}$, that is, $\frac{3a+c}{3b+d}$.

Similarly, a fraction between $\frac{a+c}{b+d}$ and $\frac{c}{d}$ is $\frac{(a+c)+c}{(b+d)+d}$, that is, $\frac{a+2c}{b+2d}$.

A fraction between $\frac{a+2c}{b+2d}$ and $\frac{c}{d}$ is $\frac{(a+2c)+c}{(b+2d)+d}$, that is, $\frac{a+3c}{b+3d}$.

Thus, some of the fractions lying between $\frac{a}{b}$ and $\frac{c}{d}$ are

$$\frac{3a+c}{3b+d},\ \frac{2a+c}{2b+d},\ \frac{a+c}{b+d},\ \frac{a+2c}{b+2d},\ \frac{a+3c}{b+3d}.$$

There are an infinite number of fractions between any two fractions.

EXAMPLE **Insert three fractions between $\frac{2}{9}$ and $\frac{3}{7}$.**

Solution Three fractions between $\frac{2}{9}$ and $\frac{3}{7}$ are $\frac{2+3}{9+7}=\frac{5}{16}$, $\frac{2+5}{9+16}=\frac{7}{25}$ and $\frac{5+3}{16+7}=\frac{8}{23}$.

Thus, the three required fractions between $\frac{2}{9}$ and $\frac{3}{7}$ can be taken as $\frac{7}{25}$, $\frac{5}{16}$ and $\frac{8}{23}$.

Another method

We convert the fractions into like fractions.

The LCM of 9 and 7 = 63.

Now, $\frac{2}{9}=\frac{2\times7}{9\times7}=\frac{14}{63}$ and $\frac{3}{7}=\frac{3\times9}{7\times9}=\frac{27}{63}$.

$\therefore\quad \frac{14}{63}<\frac{27}{63} \Rightarrow \frac{14}{63}<\frac{15}{63}<\frac{16}{63}<\frac{17}{63}<\frac{27}{63} \Rightarrow \frac{2}{9}<\frac{5}{21}<\frac{16}{63}<\frac{17}{63}<\frac{3}{7}$.

Note • This method helps us to write a number of fractions lying between two given fractions in one step.

- To write fractions between $\frac{3}{7}$ and $\frac{4}{7}$ by this method, we first change the given fractions into fractions with non-consecutive integers as numerators.

  So, $\frac{3}{7}=\frac{3\times4}{7\times4}=\frac{12}{28}$ and $\frac{4}{7}=\frac{4\times4}{7\times4}=\frac{16}{28}$.

- $\therefore\quad \frac{12}{28}<\frac{13}{28}<\frac{14}{28}<\frac{15}{28}<\frac{16}{28}$, that is, $\frac{3}{7}<\frac{13}{28}<\frac{1}{2}<\frac{15}{28}<\frac{4}{7}$.

  Thus, $\frac{13}{28}$, $\frac{1}{2}$ and $\frac{15}{28}$ are some fractions lying between $\frac{3}{7}$ and $\frac{4}{7}$.

Simplification

You are already familiar with the four fundamental operations (addition, subtraction, multiplication and division) on fractions.

You know that $\frac{a}{b}+\frac{c}{d}=\frac{a\times\{(\text{LCM of } b,d)\div b\}+c\times\{(\text{LCM of } b,d)\div d\}}{\text{LCM of } b,d}$

$$\frac{a}{b}-\frac{c}{d}=\frac{a\times\{(\text{LCM of } b,d)\div b\}-c\times\{(\text{LCM of } b,d)\div d\}}{\text{LCM of } b,d}$$

$$\frac{a}{b}\times\frac{c}{d}=\frac{a\times c}{b\times d}=\frac{ac}{bd}. \qquad \frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\times\frac{d}{c}=\frac{ad}{bc}.$$

Like directed numbers, or integers, we have positive fractions as well as negative fractions.

1, 2, 3, 4, etc., are positive integers. The corresponding negative integers are $-1, -2, -3, -4$, etc., such that $1+(-1)=0$, $2+(-2)=0$, $3+(-3)=0$, $4+(-4)=0$, etc.

Similarly, $\frac{1}{2}, \frac{3}{5}, \frac{7}{4}$, etc., are positive fractions. And, the corresponding negative fractions are $-\frac{1}{2}, \frac{-3}{5}, \frac{-7}{4}$, etc., such that $\frac{1}{2}+\left(\frac{-1}{2}\right)=0, \frac{3}{5}+\left(\frac{-3}{5}\right)=0, \frac{7}{4}+\left(-\frac{7}{4}\right)=0$, etc.

An expression involving fractions is simplified by following the rule of BODMAS. Brackets are removed in the order: line bracket, first brackets, second brackets, third brackets.

EXAMPLE **Simplify** $\frac{1}{2}-\left[\frac{5}{12}-\left\{3\frac{1}{6}\div\left(\frac{3}{7}\times\frac{4}{5}-\frac{2}{3}\right)\right\}\right]$.

Solution The given expression $=\frac{1}{2}-\left[\frac{5}{12}-\left\{\frac{19}{6}\div\left(\frac{3}{7}\times\frac{4\times3-5\times2}{5\times3}\right)\right\}\right]$

$=\frac{1}{2}-\left[\frac{5}{12}-\left\{\frac{19}{6}\div\left(\frac{\cancel{3}^{1}}{7}\times\frac{2}{\cancel{15}_{5}}\right)\right\}\right]=\frac{1}{2}-\left[\frac{5}{12}-\left\{\frac{19}{6}\div\frac{2}{35}\right\}\right]$

$=\frac{1}{2}-\left[\frac{5}{12}-\left\{\frac{19}{6}\times\frac{35}{2}\right\}\right]=\frac{1}{2}-\left[\frac{5}{12}-\frac{665}{12}\right]=\frac{1}{2}+\frac{\cancel{660}^{55}}{\cancel{12}_{1}}=55\frac{1}{2}$.

Application of fractions

Fractions are useful in daily life, as is evident from the following example.

EXAMPLE **Satish had a packet of 24 pens. He gave $\frac{1}{4}$ to Nupur and $\frac{1}{6}$ of the remaining to Ananya. Of the rest, he gave $\frac{1}{3}$ to Krishna. Find the number of pens finally left with him. What fraction of the packet was left with him?**

Solution The number of pens given to Nupur $=\frac{1}{4}$ of $24=6$.

$\therefore$ the number of pens left $=24-6=18$.

The number of pens given to Ananya $=\frac{1}{6}$ of $18=3$.

Now, the number of pens left $=18-3=15$.

The number of pens Krishna got $=\frac{1}{3}$ of $15=5$.

So, the number of pens left finally $=15-5=10$.

Hence, the required fraction $=\frac{10}{24}=\frac{5}{12}$.

Solved Examples

EXAMPLE 1 **Simplify** $2\frac{3}{4}\div\left(2\frac{1}{2}+3\frac{1}{4}\right)$.

Solution The given expression $=\frac{11}{4}\div\left(\frac{5}{2}+\frac{13}{4}\right)=\frac{11}{4}\div\frac{5\times(4\div2)+13\times(4\div4)}{4}$

$=\frac{11}{4}\div\left(\frac{5\times2+13\times1}{4}\right)=\frac{11}{4}\div\frac{23}{4}=\frac{11}{4}\times\frac{4}{23}=\frac{11}{23}$.

EXAMPLE 2 **Simplify** $\dfrac{\dfrac{1}{1-\dfrac{1}{2}}}{2\times\left(1-\dfrac{4}{7}\right)}+\dfrac{\dfrac{3\times\dfrac{6}{7}}{5}}{7\dfrac{1}{6}\times 1\dfrac{1}{2}}\div\dfrac{18}{77}$.

Solution The given expression $=\dfrac{\dfrac{1}{\dfrac{1}{2}}}{2\times\dfrac{3}{7}}+\dfrac{3\times\dfrac{6}{7}\times\dfrac{1}{5}}{\dfrac{43}{6}\times\dfrac{3}{2}}\div\dfrac{18}{77}=\dfrac{2}{\dfrac{6}{7}}+\dfrac{\dfrac{18}{35}}{\dfrac{43}{4}}\div\dfrac{18}{77}$

$=2\times\dfrac{7}{6}+\dfrac{18}{35}\times\dfrac{4}{43}\div\dfrac{18}{77}=\dfrac{7}{3}+\dfrac{18\times 4}{35\times 43}\times\dfrac{77}{18}$

$=\dfrac{7}{3}+\dfrac{44}{5\times 43}=\dfrac{7\times 5\times 43+3\times 44}{3\times 5\times 43}$

$=\dfrac{1505+132}{645}=\dfrac{1637}{645}=2\dfrac{347}{645}$.

EXAMPLE 3 **Simplify** $\dfrac{\dfrac{1}{2}\div\dfrac{1}{4}\text{ of }\dfrac{1}{6}}{\dfrac{1}{2}\div\dfrac{1}{4}\times\dfrac{1}{6}}+\dfrac{\dfrac{1}{2}-\dfrac{1}{4}\times\dfrac{1}{6}}{\left(\dfrac{1}{2}-\dfrac{1}{4}\right)\times\dfrac{1}{6}}$.

Solution The given expression $=\dfrac{\dfrac{1}{2}\div\left(\dfrac{1}{4}\times\dfrac{1}{6}\right)}{\dfrac{1}{2}\times\dfrac{4}{1}\times\dfrac{1}{6}}+\dfrac{\dfrac{1}{2}-\dfrac{1}{24}}{\left(\dfrac{2-1}{4}\right)\times\dfrac{1}{6}}=\dfrac{\dfrac{1}{2}\div\dfrac{1}{4\times 6}}{\dfrac{1}{3}}+\dfrac{\dfrac{12-1}{24}}{\dfrac{1}{4}\times\dfrac{1}{6}}$

$=\dfrac{\dfrac{1}{2}\times\dfrac{4\times 6}{1}}{\dfrac{1}{3}}+\dfrac{\dfrac{11}{24}}{\dfrac{1}{24}}=12\times 3+\dfrac{11}{24}\times 24=36+11=47.$

EXAMPLE 4 **Simplify** $1\dfrac{3}{4}\text{ of}\left(1\dfrac{1}{18}-\dfrac{5}{9}\right)\div\dfrac{1}{2}+3\times\left[7\dfrac{5}{6}-\left\{2\dfrac{3}{5}-\left(5-\overline{3\dfrac{1}{8}-3\dfrac{1}{12}}\right)\right\}\right]$.

Solution The given expression $=\left\{\dfrac{7}{4}\times\left(\dfrac{19}{18}-\dfrac{5}{9}\right)\right\}\div\dfrac{1}{2}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{13}{5}-\left(5-\overline{\dfrac{25}{8}-\dfrac{37}{12}}\right)\right\}\right]$

$=\left\{\dfrac{7}{4}\times\left(\dfrac{19-5\times 2}{18}\right)\right\}\div\dfrac{1}{2}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{13}{5}-\left(5-\dfrac{25\times 3-37\times 2}{24}\right)\right\}\right]$

$=\dfrac{7}{4}\times\dfrac{9}{18}\times\dfrac{2}{1}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{13}{5}-\left(5-\dfrac{1}{24}\right)\right\}\right]$

$=\dfrac{7}{4}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{13}{5}-\dfrac{5\times 24-1}{24}\right\}\right]=\dfrac{7}{4}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{13}{5}-\dfrac{119}{24}\right\}\right]$

$=\dfrac{7}{4}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{13\times 24-119\times 5}{5\times 24}\right\}\right]$

$=\dfrac{7}{4}+3\times\left[\dfrac{47}{6}-\left\{\dfrac{312-595}{5\times 24}\right\}\right]=\dfrac{7}{4}+3\times\left[\dfrac{47}{6}-\left(\dfrac{-283}{5\times 24}\right)\right]$

$$= \frac{7}{4} + 3 \times \left[\frac{47}{6} + \frac{283}{5 \times 24}\right] = \frac{7}{4} + 3 \times \left[\frac{47 \times 20 + 283}{5 \times 24}\right]$$

$$= \frac{7}{4} + \frac{1223}{40} = \frac{70 + 1223}{40} = \frac{1293}{40} = 32\frac{13}{40}.$$

EXAMPLE 5 **$\frac{7}{11}$ of a number exceeds $\frac{2}{5}$ of the number by 91. Find the number.**

Solution Let the required number be x.

Given that $\frac{7x}{11} - \frac{2x}{5} = 91 \Rightarrow \frac{5 \times 7x - 11 \times 2x}{55} = 91.$

$\therefore \quad \frac{13x}{55} = 91 \Rightarrow x = \frac{55}{13} \times 91 = 55 \times 7 = 385.$

Hence, the required number = 385.

EXAMPLE 6 **John's monthly salary is Rs 35,000. He pays $\frac{1}{10}$ of his salary as tax and spends $\frac{8}{45}$ of the remaining on the education of his children. $\frac{1}{5}$ of the rest is paid as the rent of the house and Rs 10,000 is spent on food and conveyance. Find John's monthly saving.**

Solution The amount paid as tax = $\frac{1}{10}$ of Rs 35000 = Rs 3500.

$\therefore$ the remaining amount = Rs (35000 – 3500) = Rs 31500.

The amount spent on the education of children = $\frac{8}{45}$ of Rs 31500 = Rs 5600.

$\therefore$ the remaining amount = Rs (31500 – 5600) = Rs 25900.

Rent of the house = $\frac{1}{5}$ of Rs 25900 = Rs 5180 and the amount spent on food and conveyance = Rs 10000.

Thus, the sum of money finally left = Rs [25900 – (5180 + 10000)] = Rs 10720.

$\therefore$ John's monthly saving is Rs 10,720.

EXERCISE 3

1. Express the following as mixed fractions.

(i) $\frac{49}{5}$ (ii) $\frac{172}{13}$ (iii) $\frac{271}{14}$ (iv) $\frac{845}{37}$

2. Express the following as improper fractions.

(i) $5\frac{7}{9}$ (ii) $12\frac{15}{19}$ (iii) $28\frac{5}{39}$ (iv) $14\frac{117}{131}$

3. Write the following fractions in the simplest form.

(i) $\frac{72}{108}$ (ii) $\frac{168}{294}$ (iii) $\frac{252}{612}$ (iv) $\frac{693}{819}$

4. Arrange the fractions in descending order in each of the following.

(i) $\frac{5}{12}, \frac{3}{8}, \frac{7}{16}$ (ii) $\frac{2}{9}, \frac{7}{15}, \frac{17}{72}, \frac{13}{60}$

5. Arrange the fractions in ascending order in each of the following.

(i) $\frac{7}{36}, \frac{2}{11}, \frac{13}{66}$ (ii) $\frac{1}{3}, \frac{7}{24}, \frac{2}{7}, \frac{9}{28}$

6. Find the HCF and the LCM of the following.

(i) $\frac{2}{3}$ and $\frac{4}{9}$ (ii) $\frac{4}{3}, \frac{16}{27}$ and $\frac{8}{63}$ (iii) $\frac{2}{7}, \frac{4}{15}$ and $\frac{6}{55}$

7. (i) Insert a fraction between $\frac{3}{11}$ and $\frac{15}{17}$.

(ii) Insert two fractions between $\frac{4}{9}$ and $\frac{16}{25}$.

(iii) Insert three fractions between $\frac{2}{5}$ and $\frac{4}{11}$.

8. Find the following.

(i) $2\frac{5}{12} - 1\frac{19}{60} + 2\frac{11}{40}$ (ii) $5\frac{3}{4} - 2\frac{5}{6} - 1\frac{8}{15} + 4\frac{7}{20}$

(iii) $2\frac{5}{14} \times 12\frac{3}{5} \div 13\frac{1}{5} + \frac{1}{4}$ (iv) $\frac{1}{8} + 5\frac{1}{3} \times 4\frac{1}{2} - 3\frac{1}{4} \times 3\frac{5}{6}$

9. Find the values of the following.

(i) $1\frac{1}{4} \times 7 \div \left(12\frac{7}{12} - 11\frac{1}{3}\right)$ (ii) $\left(\frac{1}{4} - \frac{1}{9}\right) \div \left(\frac{1}{2} + \frac{1}{4} \div \frac{1}{3}\right)$

(iii) $8\frac{1}{2} - 4\frac{2}{3} - 1\frac{1}{6} \times \frac{2}{5} + \frac{6}{35} \div \frac{2}{7}$ (iv) $2\frac{1}{3} - \frac{1}{3} \times 3\frac{1}{2} + 1\frac{7}{8} \div 1\frac{1}{4} - 3 \div \left(\frac{3}{4} \times 1\frac{1}{2}\right)$

10. Simplify the following.

(i) $\dfrac{3\frac{1}{4} - \frac{4}{5} \text{ of } \frac{5}{6}}{4\frac{1}{3} \div \frac{1}{5} - \left(\frac{3}{10} + 21\frac{1}{5}\right)}$ (ii) $\dfrac{2\frac{3}{4} - 1\frac{7}{8}}{1\frac{1}{3} + 2\frac{1}{2}} \times 7\frac{2}{3}$

(iii) $7\frac{1}{2} - \left[2\frac{1}{4} \div \left\{1\frac{1}{4} - \frac{1}{2}\left(1\frac{1}{2} - \frac{1}{3} - \frac{1}{6}\right)\right\}\right]$ (iv) $\frac{1}{3} \text{ of } \left[3\frac{1}{4} \div \left\{1\frac{1}{4} - \frac{1}{2}\left(2\frac{1}{2} - \overline{\frac{1}{4} - \frac{1}{6}}\right)\right\}\right]$

11. Dolly spent $\frac{2}{5}$ of her money on food and $\frac{1}{3}$ on films.

(i) What fraction did she spend altogether?

(ii) What fraction was she left with?

(iii) If she had Rs 6000 initially, how much was left with her?

12. A group of people travelled to a tourist place. $\frac{1}{20}$ travelled by aeroplane, $\frac{1}{12}$ by train, $\frac{2}{5}$ by bus and the rest, by car. What fraction travelled by car?

13. By how much does $\frac{7}{11}$ of 242 exceed $\frac{5}{8}$ of 224?

14. $\frac{1}{4}$ of the length of a pencil is black, half of the rest is blue and the remaining part is white. If the pencil is 24 cm long, find the length of the white part of the pencil.

15. $\frac{1}{8}$ of the length of a log is damaged. A man cuts off $\frac{3}{4}$ of the sound part. If the log is 16 m long, find the length of sound log left.

16. A man spends $\frac{1}{4}$ of his salary on the rent of his house, $\frac{1}{3}$ of the remaining on food and ₹ 3000 on the education of his children. If his salary is ₹ 24,000, find the sum of money still left with him.

ANSWERS

1. (i) $9\frac{4}{5}$ (ii) $13\frac{3}{13}$ (iii) $19\frac{5}{14}$ (iv) $22\frac{31}{37}$

2. (i) $\frac{52}{9}$ (ii) $\frac{243}{19}$ (iii) $\frac{1097}{39}$ (iv) $\frac{1951}{131}$

3. (i) $\frac{2}{3}$ (ii) $\frac{4}{7}$ (iii) $\frac{7}{17}$ (iv) $\frac{11}{13}$

4. (i) $\frac{7}{16}, \frac{5}{12}, \frac{3}{8}$ (ii) $\frac{7}{15}, \frac{17}{72}, \frac{2}{9}, \frac{13}{60}$

5. (i) $\frac{2}{11}, \frac{7}{36}, \frac{13}{66}$ (ii) $\frac{2}{7}, \frac{7}{24}, \frac{9}{28}, \frac{1}{3}$

6. (i) $\frac{2}{9}, \frac{4}{3}$ (ii) $\frac{4}{189}, \frac{16}{3}$ (iii) $\frac{2}{1155}, 12$

7. (i) $\frac{9}{14}$ (ii) $\frac{10}{17}, \frac{13}{21}$ (iii) $\frac{5}{13}, \frac{3}{8}, \frac{7}{19}$ [**Note:** Other solutions are also possible.]

8. (i) $3\frac{3}{8}$ (ii) $5\frac{11}{15}$ (iii) $2\frac{1}{2}$ (iv) $11\frac{2}{3}$

9. (i) 7 (ii) $\frac{1}{9}$ (iii) $3\frac{29}{30}$ (iv) 0

10. (i) $15\frac{1}{2}$ (ii) $1\frac{3}{4}$ (iii) $4\frac{1}{2}$ (iv) 26

11. (i) $\frac{11}{15}$ (ii) $\frac{4}{15}$ (iii) Rs 1600

12. $\frac{7}{15}$

13. 14

14. 9 cm

15. $3\frac{1}{2}$ m

16. ₹ 9000

❖