

3. Fractions

Fraction: • A fraction is a number ~~to~~ which represents a part of a whole number.

eg. $\frac{1}{2}$, $\frac{1}{3}$

$\frac{1}{2}$ → Numerator (Dividend)
 2 → Denominator (Divisor)

$$2 \overline{)10} \begin{array}{r} 0.5 \\ 10 \\ \hline 0 \end{array}$$

0.5
⇒ Terminating Decimal numbers

$$3 \overline{)10} \begin{array}{r} 0.33\dots \\ 9 \\ \hline 10 \\ 9 \\ \hline 10 \end{array}$$

0.33333...
⇒ Non terminating decimal number

• $\frac{3}{7}$ (Nu < De) \Rightarrow Proper fraction \Rightarrow Proper fraction is always between 0 & 1.

• $\frac{9}{5}$ (Nu > De) \Rightarrow Improper Fraction \Rightarrow Decimal value is greater than 1.

Mixed Fraction \Rightarrow whole no. (Proper fraction)

eg. $2\frac{3}{5} \Rightarrow \frac{(2 \times 5) + 3}{5} = \frac{13}{5}$ Improper fraction.

Convert $\frac{47}{31} \Rightarrow$ into mixed fraction.

$$1\frac{16}{31}$$

Equivalent fraction

$\Rightarrow \frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$ etc are equivalent fractions.

$$\frac{3}{8} \begin{matrix} \swarrow & \searrow \\ \nwarrow & \nearrow \end{matrix} \frac{4}{8}$$

$$\frac{a}{b} = \frac{c}{d}$$

24 24

$$a \times d = b \times c$$

Fraction in lowest term (Simplest fraction)

$\frac{4}{8}$ they have common factor

$\frac{1}{2}$

No common factor

or

Like Fractions : Fractions having same denominators

eg. $\frac{2}{15}$, $\frac{7}{15}$, $\frac{11}{15}$

Unlike fractions : Fractions with different denominators.

eg. $\frac{2}{15}$, $\frac{7}{24}$, $\frac{9}{125}$

H.W.

Q.

Reduce

$$\frac{144}{180}$$

to its lowest form.

Comparing Fraction

eg. which is larger $\frac{3}{4}$ or $\frac{5}{12}$?

step ① Find the LCM of denominator.

step ② Convert each fraction to its equivalent fraction with denominator equal to LCM, obtained in step ①.

③ Fraction having greater numerator is the greater fraction.

A Short cut method for MCQ.

eg 1.

$$\begin{array}{cc} \text{LHS} & \text{RHS} \\ \frac{3}{4} & \frac{5}{12} \end{array}$$

The diagram shows two fractions, $\frac{3}{4}$ and $\frac{5}{12}$, each enclosed in a large oval. The fraction $\frac{3}{4}$ is labeled "LHS" and the fraction $\frac{5}{12}$ is labeled "RHS".

$$\frac{3 \times 12}{}$$

✓ 36

$$\frac{5 \times 4}{}$$

20

Arrange $\frac{5}{8}$, $\frac{5}{6}$, $\frac{7}{4}$, $\frac{3}{5}$ in ascending order.

$$\frac{3}{5} < \frac{5}{8} < \frac{5}{6} < \frac{7}{4}$$

$$\frac{7}{4} \times \frac{30}{30} = \frac{210}{120}$$

$$\frac{3}{5} \times \frac{24}{24} = \frac{72}{120}$$

$$\frac{24}{120} = \frac{1}{5}$$

$$\frac{30}{120} = \frac{1}{4}$$

Addition and Subtraction of fraction

(1) $\frac{5}{8} + \frac{2}{8} = \frac{7}{8}$ ✓

(11) $\frac{11}{15} - \frac{2}{15} = \frac{9}{15}$

(111) $\frac{16}{5} - \frac{3}{5} + \frac{2}{5} - \frac{9}{5} = \frac{6}{5} = 1\frac{1}{5}$ ✓



Unlike fractions

eg.

(i) $\frac{7}{10} + \frac{2}{15}$

Denominators : 10, 15
LCM (10, 15) = 30

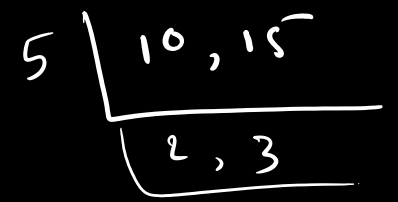
$$\frac{7}{10} = \frac{7 \times 3}{10 \times 3} = \frac{21}{30}$$

$$\frac{2}{15} = \frac{2 \times 2}{15 \times 2} = \frac{4}{30}$$

$$\frac{7}{10} + \frac{2}{15}$$

$$= \frac{21}{30} + \frac{4}{30}$$

$$= \frac{25}{30}$$



$$\frac{7 \times 3}{\textcircled{10}} + \frac{2 \times 2}{\textcircled{15}}$$

$$= \frac{21 + 4}{30}$$

$$= \frac{25}{30}$$

$\sqrt{10, 15}$

Practice Problems (Addition and Subtraction of fractions)

- ① Simplify: $\frac{15}{16} - \frac{11}{12}$
- ② Simplify: $4\frac{5}{6} - 2\frac{3}{8} + 3\frac{7}{12}$
- ③ Find the difference of :
- (i) $\frac{13}{24}$ and $\frac{7}{16}$
- (ii) $\frac{23}{3}$ and 6
- ④ what should be added to $5\frac{3}{7}$ to get 12?

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

$$\Rightarrow \frac{8^{\textcircled{\times 2}}}{3} - \frac{7^{\textcircled{\times 3}}}{2}$$

$$\Rightarrow \frac{16 - 21}{6} \quad \checkmark$$

$$\Rightarrow \frac{-5}{6}$$

$$\textcircled{II} \quad \frac{9}{11} - \frac{4}{15}$$

$$\Rightarrow \frac{9 \times 15 - 4 \times 11}{11 \times 15}$$

$$\Rightarrow \frac{135 - 44}{165}$$

$$\Rightarrow \frac{91}{165} \quad \checkmark$$

$$\frac{110}{55}$$

$$\textcircled{iii} \left(\frac{-2}{7} \right) - \left(\frac{-5}{9} \right) \checkmark$$

$$\frac{-5}{-10} = \frac{+1}{+2} = \frac{1}{2}$$

$$\Rightarrow \frac{-2}{7} + \frac{5}{9}$$

$$\Rightarrow \frac{-2(9) + 5(7)}{7 \times 9}$$

$$\Rightarrow \frac{-18 + 35}{63}$$

$$\Rightarrow \frac{17}{63}$$

Simplify : $3\frac{2}{3} - 7\frac{3}{4} + 2\frac{5}{6}$

$$\Rightarrow \frac{11}{3} - \frac{31}{4} + \frac{17}{6}$$

$$\Rightarrow \frac{(11 \times 4) - (31 \times 3) + (17 \times 2)}{12}$$

$$\Rightarrow \frac{44 - 93 + 34}{12}$$

method 2
 \Rightarrow

$$\Rightarrow \frac{44 + 34 - 93}{12}$$

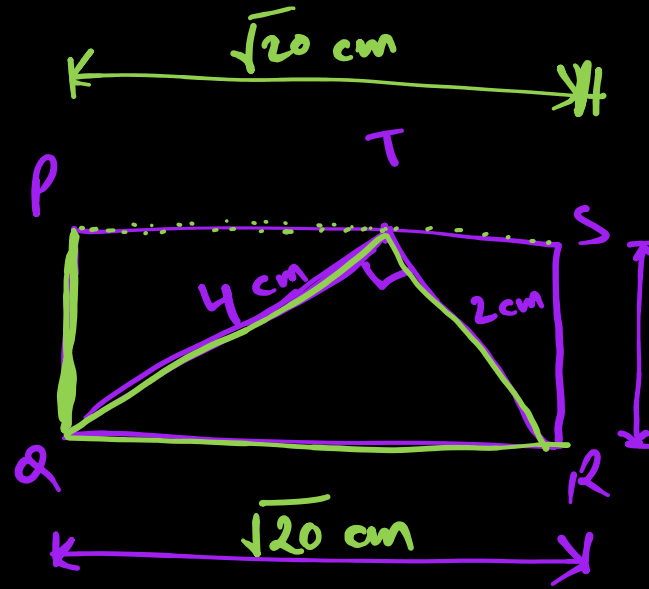
$$\Rightarrow \frac{78 - 93}{12} \Rightarrow \frac{-15}{12} \Rightarrow \frac{-5}{4}$$

Multiplication of fractions

eg. $\frac{3}{7} \times \frac{4}{5} \Rightarrow$

$$\frac{2}{3} \times \frac{7}{3} \Rightarrow \frac{2 \times 7}{3 \times 3}$$

$$\begin{aligned} \sqrt{20} &= \sqrt{2 \times 2 \times 5} \\ &= \sqrt{2^2 \times 5} \\ &= 2\sqrt{5} \end{aligned}$$



$\triangle QTR$

By Pythagoras theorem.

$$QR^2 = QT^2 + TR^2$$

$$QR^2 = 20$$

$$QR = \sqrt{20} = 2\sqrt{5}$$

$$\sqrt{4} = 2$$

Multiplication of fractions

① Multiply $\frac{2}{9}$ by $\frac{4}{5}$

$$\Rightarrow \frac{2}{9} \times \frac{4}{5}$$

$$\Rightarrow \frac{2 \times 4}{9 \times 5}$$

$$\Rightarrow \frac{8}{45}$$

② $\frac{3}{5}$ by 12

$$\Rightarrow \frac{3}{5} \times \frac{12}{1}$$

$$\Rightarrow \frac{3 \times 12}{5 \times 1}$$

$$\Rightarrow \frac{36}{5} \checkmark \text{ (Not wrong.)}$$

$$\Rightarrow 7\frac{1}{5} \checkmark \checkmark \text{ (Best way of writing improper fractions)}$$

$$\textcircled{\text{III}} \quad 2\frac{1}{3} \text{ by } \frac{2}{5}$$

$$\Rightarrow \frac{7}{3} \times \frac{2}{5}$$

$$\Rightarrow \frac{14}{15}$$

Q. "Multiply and reduce to lowest form" (if any)

$$\textcircled{\text{I}} \quad \frac{2}{3} \times \frac{5}{4} = \frac{1 \times 5}{3 \times 2} = \frac{5}{6}$$

$$\textcircled{\text{II}} \quad \frac{1}{3} \times \frac{5}{8} = \frac{5}{24}$$

$$\frac{15}{24}$$

$$\textcircled{14} \quad \frac{4}{5} \times \frac{12}{7} = 1 \frac{13}{35}$$

Q. Simplify

$$\textcircled{1} \quad 5 \times \frac{3}{20} \times \frac{2}{15}$$

$$\Rightarrow \frac{\cancel{5}^1}{1} \times \frac{\cancel{3}^1}{\cancel{20}^2} \times \frac{\cancel{2}^1}{\cancel{15}^5}$$

$$\Rightarrow \frac{1}{10}$$

$$\frac{\cancel{5}^1}{1} \times \frac{\cancel{3}^1}{\cancel{20}^2} \times \frac{\cancel{2}^1}{\cancel{15}^5}$$
$$= \frac{1}{10}$$

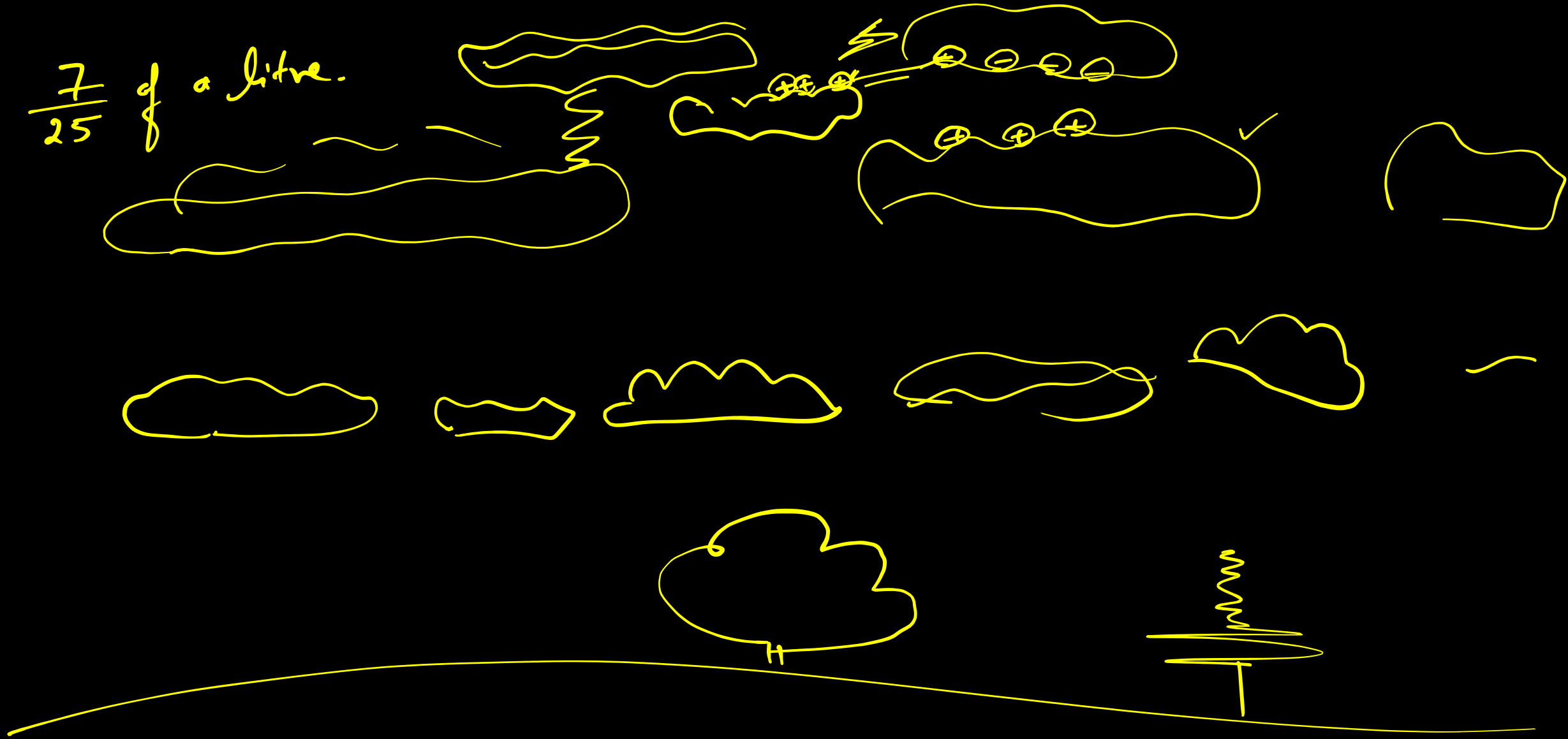
$$\textcircled{11} \quad \frac{\textcircled{2}}{\frac{\cancel{14}}{\cancel{25}} \times 5} \times \frac{\cancel{1}^{\cancel{7}}}{\cancel{35} \times 51} \times \frac{\textcircled{34}}{\cancel{49} \times 7}$$

$$\Rightarrow \frac{2}{5} \times \frac{1}{\cancel{51}_3} \times \frac{\cancel{34}^2}{1}$$

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

$$\Rightarrow \frac{4}{15}$$

① $\frac{7}{25}$ of a litre.



Q. Sugar is sold at ₹ $17\frac{3}{4}$ per kg. Find the cost of $8\frac{1}{2}$ kg of sugar.

$$\text{Cost of 1 kg sugar} = ₹ 17\frac{3}{4} = ₹ \frac{71}{4}$$

$$\text{Cost of } 8\frac{1}{2} \text{ kg Sugar} = ₹ \left(\frac{71}{4} \times 8\frac{1}{2} \right)$$

$$= ₹ \left(\frac{71}{4} \times \frac{17}{2} \right)$$

$$= ₹ \left(\frac{1207}{8} \right)$$

$$\begin{array}{r} 71 \\ \times 17 \\ \hline 7507 \\ \hline \boxed{1207} \end{array}$$

Q. Priya spends $\frac{3}{5}$ of her income on household expenses and $\frac{1}{7}$ of her income on personal expenses. If her monthly ^{income} is \$ 35000, find her monthly savings.

$$\text{Total monthly income} = \$ 35000$$

$$\text{Monthly expenditure} = \$ \left(\frac{3}{5} \times 35000 \right) + \$ \left(\frac{1}{7} \times 35000 \right)$$

$$= \$ (3 \times 7000) + \$ (1 \times 5000)$$

$$= \$ 21000 + \$ 5000$$

$$= \$ 26000$$

$$\begin{array}{r} 7000 \\ 35000 \\ \hline 5 \end{array}$$

$$\begin{aligned}\text{Monthly Savings} &= \text{Total income} - \text{monthly expenditure} \\ &= \$35000 - \$26000 \\ &= \underline{\underline{\$9000}}\end{aligned}$$

Division of fractions

eg:

$$\frac{3}{5} \div \frac{9}{35}$$

$$\frac{\overset{1}{\cancel{3}}}{\cancel{5}} \times \frac{\overset{7}{\cancel{35}}}{\underset{3}{\cancel{9}}} = \frac{1 \times 7}{1 \times 3} = \frac{7}{3} = \underline{\underline{2\frac{1}{3}}}$$

Reciprocal of a fraction (Multiplicative inverse)

$\frac{3}{4}$ its reciprocal is $\frac{4}{3}$

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

multiplicative
inverse

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

$$a^2 + b^2 + a^2 + c^2 + a^1$$

$$2a^2 + b^2 + c^2 + a$$

$$a^2 \times a = a^3$$

$$\textcircled{i} \quad \frac{3}{5} \div \frac{5}{9} = \frac{3}{5} \times \frac{9}{5} = \frac{27}{25} = 1\frac{2}{25}$$

$$\textcircled{ii} \quad \frac{3}{5} \div 9 = \frac{3}{5} \div \frac{9}{1} = \frac{3}{5} \times \frac{1}{9} = \frac{1}{15}$$

\textcircled{iii} Product of two numbers is $20\frac{5}{7}$. If one of the numbers is $6\frac{2}{3}$, find the other number.

$$\begin{aligned} \text{Other number} &= \frac{\text{Product of numbers}}{\text{One of the number}} \\ &= \frac{20\frac{5}{7}}{6\frac{2}{3}} \\ &= \frac{145}{7} \div \frac{20}{3} = \frac{145}{7} \times \frac{3}{20} = \frac{29}{7} \times \frac{3}{4} \\ &= \frac{87}{28} = 3\frac{3}{28} \end{aligned}$$

End of the chapter