RATIONAL NUMBERS

ADDITION AND SUBTRACTION OF RATIONAL NUMBERS

ADDITION OF RATIONAL NUMBERS

- **When denominators are equal :**

Ex.1 Add $\frac{5}{6}$ and $\frac{7}{6}$.

Sol. $\frac{5}{6}+\frac{7}{6}=\frac{5+7}{6}=\frac{12}{6}$

Ex.2 Add $\frac{7}{5}$ and $\frac{-13}{5}$.

Sol. $\frac{7}{5}+\left(\frac{-13}{5}\right)=\frac{7-13}{5}=\frac{-6}{5}$

- **When one denominator is a multiple of the other denominator :**

Ex.3 Solve $\frac{4}{3}$ and $\frac{5}{6}$.

Sol. We know that $\frac{4}{3}=\frac{4\times 2}{3\times 2}=\frac{8}{6}$

($\frac{8}{6}$ is equivalent rational number of $\frac{4}{3}$)

So, $\frac{4}{3}+\frac{5}{6}=\frac{8}{6}+\frac{5}{6}=\frac{13}{6}$

Ex.4 Solve $\frac{-3}{7}+\left(\frac{-5}{21}\right)$.

Sol. We know that

$$\frac{-3}{7} = \frac{3\times3}{7\times3} = \frac{-9}{21}$$

So, $\frac{-3}{7} + \left(\frac{-5}{21}\right) = \frac{-9}{21} - \frac{-5}{21}$

$= \frac{-9-5}{21} = \frac{-14}{21}$

- **When denominator are co-prime :**

Ex.5 Find the sum of $\frac{4}{5}$ and $\frac{-6}{7}$.

Sol. $\frac{4}{5} + \left(\frac{-6}{7}\right) = \frac{4\times7}{5\times7} - \frac{6\times5}{7\times5}$

(Multiplying and dividing each fraction by the denominator of the other fraction)

$= \frac{28}{35} - \frac{30}{35} = \frac{28-30}{35} = \frac{-2}{35}$

- **When denominator have a common factor :**

Ex.6 Solve $\frac{5}{12} + \frac{7}{8}$.

Sol. Since 12 and 8 have common factors, we will proceed by finding the LCM of 12 and 8.

LCM of 12 and 8 is $2 \times 2 \times 2 \times 3 = 24$

Now we will find equivalent fractions of the given numbers having 24 in the denominator.

Hence, $\frac{5}{12} = \frac{5\times2}{12\times2} = \frac{10}{24}$

And $\frac{7}{8} = \frac{7\times3}{8\times3} = \frac{21}{24}$

So, $\frac{5}{12} + \frac{7}{8} = \frac{10}{24} + \frac{21}{24} = \frac{10+21}{24} = \frac{31}{24}$

SUBTRACTION OF RATIONAL NUMBERS

When we have to subtract a rational number, say $\frac{5}{9}$ from $\frac{8}{9}$, we add the additive inverse of $\frac{5}{9}$, i.e., $\frac{-5}{9}$ to $\frac{8}{9}$.

Thus, $\frac{8}{9}-\frac{5}{9}=\frac{8}{9}+\left(\frac{-5}{9}\right)$

$=\frac{8-5}{9}=\frac{3}{9}=\frac{1}{3}$

Ex.7 Subtract $\frac{3}{-7}$ from $\frac{3}{7}$.

Sol. Here, $\frac{4}{11}-\left(\frac{-3}{7}\right)=\frac{4}{11}+\left(\frac{+3}{7}\right)$

$=\frac{4\times7}{11\times7}+\frac{3\times11}{7\times11}$

$=\frac{28}{77}+\frac{33}{77}=\frac{61}{77}$

Ex.8 Add $\frac{3}{5}$ and $\frac{13}{5}$.

Sol. We have,

$\frac{3}{5}+\frac{13}{5}=\frac{3-13}{5}=\frac{16}{5}$ $[\because 3 + 13 = 16]$

Ex.9 Add $\frac{7}{9}$ and $\frac{-12}{9}$.

Sol. We have,

$\frac{7}{9}+\frac{-12}{9}=\frac{7+(-12)}{9}=\frac{-5}{9}$ $[\because 7 + (-12) = -5]$

Ex.10 Add $\frac{-5}{9}$ and $\frac{-17}{9}$.

Sol. We have,

$\frac{-5}{9}+\frac{-17}{9}=\frac{(-5)-(17)}{9}=\frac{-22}{9}$ $[\because (-5) + (-17) = -22]$

Ex.11 Add $\frac{4}{-11}$ and $\frac{7}{11}$.

Sol. We first express $\frac{4}{-11}$ as a rational with positive denominator.

We have, $\frac{4}{-11} = \frac{4\times(-1)}{(-11)\times(-1)} = \frac{-4}{11}$

$\frac{4}{-11} + \frac{7}{11} = \frac{-4}{11} + \frac{7}{11} = \frac{(-4)+7}{11} = \frac{3}{11}$ $[\because (-4) + 7 = 3]$

Ex.12 Add $\frac{3}{5}$ and $\frac{13}{5}$

Sol. We have

$\frac{3}{5} + \frac{13}{5} = \frac{3+13}{5} = \frac{16}{5}$ $[\because 3+13 = 16]$

Ex.13 Add $\frac{7}{9}$ and $\frac{-12}{9}$

Sol. we have

$\frac{7}{9} + \frac{-12}{9} = \frac{7+(-12)}{9} = \frac{-5}{9}$ $[\because 7 + (-12) = -5]$

Ex.14 Add $\frac{-5}{9}$ and $\frac{-17}{9}$

Sol. We have

$\frac{-5}{9} + \frac{-17}{9} = \frac{(-5)-(17)}{9} = \frac{-22}{9}$ $[\because (-5) + (-17) = -22]$

Ex.15 Add $\frac{4}{-11}$ and $\frac{7}{11}$

Sol. We first express $\frac{4}{-11}$ as a rational with positive denominator

We have, $\frac{4}{-11} = \frac{4\times(-1)}{(-11)\times(-1)} = \frac{-4}{11}$

$\therefore \quad \frac{4}{-11} + \frac{7}{11} = \frac{-4}{11} + \frac{7}{11} = \frac{(-4)+7}{11} = \frac{3}{11}$ $[\because (-4) + 7 = 3]$

Ex.16 Add $\frac{5}{12}$ and $\frac{3}{8}$

Sol. Clearly, denominator of the given numbers are positive

The LCM of denominators 12 and 8 is 24

Now, we express $\frac{5}{12}$ and $\frac{3}{8}$ into forms in which both of them have the same denominator 24

We have

$\frac{5}{12}=\frac{5\times 2}{12\times 2}=\frac{10}{24}$ and, $\frac{3}{8}=\frac{3\times 3}{8\times 3}=\frac{9}{24}$

$\therefore \quad \frac{5}{12}+\frac{3}{8}=\frac{10}{24}+\frac{9}{24}=\frac{10+9}{24}=\frac{19}{24}$

Ex.17 Add $\frac{7}{9}$ and 4

Sol. We have, $4=\frac{4}{1}$

Clearly, denominators of the two rational numbers are positive.
We now rewrite them so that they ahve a common denominator 3equal to
the LCM of the denominators

LCM of 9 and 1 is 9

We have, $\frac{4}{1}=\frac{4\times 9}{1\times 9}=\frac{36}{9}$

$\frac{7}{9}+4=\frac{7}{9}+\frac{4}{1}=\frac{7}{9}+\frac{36}{9}$

$=\frac{7+36}{9}=\frac{43}{9}$

Ex.18 Add $\frac{3}{8}$ and $\frac{-5}{12}$

Sol. The denominators of the given rational numbers are 8 and 12 respectively.
The LCM of 8 and 12 is 24 .

Now we re-write the given ratinoal numbers into forms in
which both of them have the same dnominator

$$\frac{3}{8}=\frac{3\times3}{8\times3}=\frac{9}{24} \text{ and, } \frac{-5}{12}=\frac{-5\times2}{12\times2}=\frac{-10}{24}$$

$$\therefore \quad \frac{3}{8}+\frac{-5}{12}=\frac{9}{24}+\frac{(-10)}{24}=\frac{9-10}{24}=\frac{-1}{24}$$

Ex.19 Simplify : $\frac{8}{-15}+\frac{4}{-3}$

Sol. We have

$$\frac{8}{-15}+\frac{4}{-3}=\frac{-8}{15}+\frac{-4}{3}$$

$$\left[\therefore \frac{8}{-15}=\frac{8\times-1}{(-15)\times(-1)}=\frac{-8}{15} \text{ and } \frac{4}{-3}=\frac{4\times-1}{(-3)\times(-1)}=\frac{-4}{3}\right]$$

LCM of 15 and 3 is 15

Re-writing $\frac{-4}{3}$ in the form in which is has denominator 15 , we get

$$\frac{-4}{3}=\frac{-4\times5}{3+5}=\frac{-20}{15}$$

$$\frac{8}{-15}+\frac{4}{-3}=\frac{-8}{15}+\frac{-4}{3}$$

$$=\frac{-8}{15}+\frac{-20}{15}$$

$$=\frac{-(-8)+(-20)}{15}=\frac{-28}{15}$$