1 RATIONAL NUMBERS

TEXT BOOK EXERCISE 1.1

Q. 1. Solve the following :

(*i*) $\frac{-5}{6}+\frac{3}{4}$ (*ii*) $\frac{6}{11}+\left(\frac{-2}{3}\right)$ (*iii*) $\frac{-5}{24}+\frac{7}{12}$ (*iv*) $\frac{-11}{12}+\frac{7}{8}$

(*v*) $\frac{-3}{10}+\left(\frac{-7}{15}\right)$ (*vi*) $\frac{-5}{7}+\frac{3}{14}$ (*vii*) $\frac{7}{6}+\left(\frac{-5}{9}\right)$ (*viii*) $\frac{-11}{15}+\frac{21}{25}$

Solution. (*i*) $\frac{-5}{6}+\frac{3}{4}$

L.C.M. of denominators 6 and 4

2	6, 4
	3, 2

L.C.M. of 6 and $4 = 2 \times 3 \times 2 = 12$

Now, we express $\frac{-5}{6}$ and $\frac{3}{4}$ as rational numbers with same denominators by taking L.C.M.

Now, $\frac{-5}{6} = \frac{-5\times2}{6\times2} = \frac{-10}{12}$

and $\frac{3}{4} = \frac{3\times3}{4\times3} = \frac{9}{12}$

So $\frac{-5}{6}+\frac{3}{4} = \frac{-10}{12}+\frac{9}{12} = \frac{-10+9}{12} = \frac{-1}{12}$ **Ans.**

Alternate method

$$\frac{-5}{6}+\frac{3}{4} = \frac{(-5\times2)+(3\times3)}{12}$$

$12 \div 6 = 2$
$12 \div 4 = 3$

$$= \frac{-10+9}{12} = \frac{-1}{12} \text{ Ans.}$$

(*ii*) $\frac{6}{11}+\left(\frac{-2}{3}\right) = \frac{(6\times3)+(-2\times11)}{11\times3} = \frac{18-22}{33}$

$$= \frac{-4}{33} \text{ Ans.}$$

(iii) $\frac{-5}{24}+\frac{7}{12} = \frac{(-5\times1)+(7\times2)}{24}$

$= \frac{-5+14}{24}$

$= \frac{9}{24} = \frac{3}{8}$ **Ans.**

L.C.M. of denominators 24 and 12

2	24, 12
2	12, 6
3	6, 3
	2, 1

L.C.M. of 24 and 12 = 2 × 2 × 3 × 2 = 24

(iv) $\frac{-11}{12}+\frac{7}{8} = \frac{(-11\times2)+(7\times3)}{24}$

$= \frac{-22+21}{24}$

$= \frac{-1}{24}$ **Ans.**

L.C.M. of denominators 12 and 8

2	12, 8
2	6, 4
	3, 2

L.C.M. of 12 and 8 = 2 × 2 × 3 × 2 = 24

(v) $\frac{-3}{10}+\left(\frac{-7}{15}\right) = \frac{(-3\times3)+(-7\times2)}{30}$

$= \frac{-9-14}{30}$

$= \frac{-23}{30}$ **Ans.**

L.C.M. of denominators 10 and 15

5	10, 15
	2, 3

L.C.M. of 10 and 15 = 5 × 2 × 3 = 30

(vi) $\frac{-5}{7}+\frac{3}{14} = \frac{(-5\times2)+(3\times1)}{14}$

$= \frac{-10+3}{14}$

$= \frac{-7}{14} = \frac{-1}{2}$ **Ans.**

L.C.M. of denominators 7 and 14

7	7, 14
	1, 2

L.C.M. of 7 and 14 = 7 × 2 = 14

(vii) $\frac{7}{6}+\left(\frac{-5}{9}\right) = \frac{(7\times3)+(-5\times2)}{18}$

$= \frac{21-10}{18} = \frac{11}{18}$ **Ans.**

L.C.M. of denominators 6 and 9

3	6, 9
	2, 3

L.C.M. of 6 and 9 = 3 × 2 × 3 = 18

(viii) $\frac{-11}{15}+\frac{21}{25} = \frac{(-11\times5)+(21\times3)}{75}$

$= \frac{-55+63}{75}$

$= \frac{8}{75}$ **Ans.**

L.C.M. of denominators 15 and 25

5	15, 25
	3, 5

L.C.M. of 15 and 25 = 5 × 3 × 5 = 75

Q. 2. Verify commutative property of addition of rational numbers for each of the following :

(*i*) $\frac{-5}{8}$ **and** $\frac{3}{4}$ **(*ii*)** $\frac{-2}{5}$ **and** $\frac{-3}{15}$ **(*iii*)** $\frac{-7}{10}$ **and** $\frac{8}{15}$ **(*iv*)** $\frac{-11}{14}$ **and** $\frac{17}{21}$

(*v*) -5 **and** $\frac{2}{3}$

Solution. (*i*) We have : $\frac{-5}{8}$ and $\frac{3}{4}$

Firstly, $\frac{-5}{8}+\frac{3}{4} = \frac{(-5\times1)+(3\times2)}{8}$

$= \frac{-5+6}{8} = \frac{1}{8}$

and $\frac{3}{4}+\left(\frac{-5}{8}\right) = \frac{(3\times2)+(-5\times1)}{8}$

$= \frac{6-5}{8} = \frac{1}{8}$

$\therefore \quad \frac{-5}{8}+\frac{3}{4} = \frac{3}{4}+\left(\frac{-5}{8}\right)$

Thus, commutative property under addition holds.

L.C.M. of denominators 8 and 4

2	8, 4
2	4, 2
	2, 1

L.C.M. of 8 and 4 = 2 × 2 × 2 = 8

(*ii*) We have : $\frac{-2}{5}$ and $\frac{-3}{15}$

Firstly, $\left(\frac{-2}{5}\right)+\left(\frac{-3}{15}\right)$

$= \frac{(-2\times3)+(-3\times1)}{15}$

$= \frac{(-6)+(-3)}{15} = \frac{-9}{15} = \frac{-3}{5}$

and $\left(\frac{-3}{15}\right)+\left(\frac{-2}{5}\right) = \frac{(-3\times1)+(-2\times3)}{15}$

$= \frac{(-3)+(-6)}{15} = \frac{-9}{15} = \frac{-3}{5}$

$\therefore \quad \left(\frac{-2}{5}\right)+\left(\frac{-3}{15}\right) = \left(\frac{-3}{15}\right)+\left(\frac{-2}{5}\right)$

Thus, commutative property under addition holds.

L.C.M. of denominators 5 and 15

5	5, 15
	1, 3

L.C.M. of 5 and 15 = 5 × 3 = 15

(*iii*) We have : $\frac{-7}{10}$ and $\frac{8}{15}$

Firstly, $\frac{-7}{10}+\frac{8}{15}$

$$= \frac{(-7\times 3)+(8\times 2)}{30}$$

$$= \frac{(-21)+(16)}{30} = \frac{-5}{30} = \frac{-1}{6}$$

and $$\frac{8}{15}+\left(\frac{-7}{10}\right) = \frac{(8\times 2)+(-7\times 3)}{30} = \frac{16-21}{30} = \frac{-5}{30} = \frac{-1}{6}.$$

$$\therefore \quad \frac{-7}{10}+\frac{8}{15} = \frac{8}{15}+\left(\frac{-7}{10}\right)$$

Thus, commutative property under addition holds.

L.C.M. of denominators 10 and 15

5	10,15
	2, 3

L.C.M. of 10 and 15 = 5 × 2 × 3 = 30

(*iv*) We have : $\frac{-11}{14}$ and $\frac{17}{21}$

Firstly, $\frac{-11}{14}+\frac{17}{21} = \frac{(-11\times 3)+(17\times 2)}{42}$

$$= \frac{-33+34}{42} = \frac{1}{42}$$

and $$\frac{17}{21}+\left(\frac{-11}{14}\right) = \frac{(17\times 2)+(-11\times 3)}{42} = \frac{34-33}{42} = \frac{1}{42}$$

$$\therefore \quad \frac{-11}{14}+\frac{17}{21} = \frac{17}{21}+\left(-\frac{11}{14}\right)$$

Thus, commutative property under addition holds.

L.C.M. of denominators 14 and 21

7	14, 21
	2, 3

L.C.M. of 14 and 21 = 7 × 2 × 3 = 42

(*v*) We have : – 5 and $\frac{2}{3}$

Firstly, $$-5+\frac{2}{3} = \frac{-5}{1}+\frac{2}{3} = \frac{-5\times 3+2\times 1}{3}$$

$$= \frac{-15+2}{3} = \frac{-13}{3}$$

and $$\frac{2}{3}+(-5) = \frac{2}{3}+\frac{-5}{1} = \frac{2\times 1+(-5\times 3)}{3}$$

$$= \frac{2-15}{3} = \frac{-13}{3}$$

$$\therefore \quad -5+\frac{2}{3} = \frac{2}{3}+(-5)$$

Thus, commutative property under addition holds.

Q. 3. Verify associative property of addition of rational numbers i.e. $(x + y) + z = x + (y + z)$:

(i) $x = \frac{-2}{3}, y = \frac{1}{2}, z = \frac{5}{6}$ **(ii)** $x = \frac{-3}{4}, y = \frac{1}{6}, z = \frac{5}{8}$ **(iii)** $x = 2, y = \frac{-5}{12}, z = \frac{-3}{8}$

Solution. (*i*) We have : $x = \frac{-2}{3}, y = \frac{1}{2}, z = \frac{5}{6}$

Firstly, $(x + y) + z = \left[\left(\frac{-2}{3}\right) + \frac{1}{2}\right] + \frac{5}{6}$

$$= \left[\frac{(-2 \times 2) + 1 \times 3}{3 \times 2}\right] + \frac{5}{6} = \left[\frac{-4 + 3}{6}\right] + \frac{5}{6}$$

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

And $x + (y + z) = \frac{-2}{3} + \left(\frac{1}{2} + \frac{5}{6}\right) = \frac{-2}{3} + \left(\frac{1 \times 3 + 5 \times 1}{6}\right)$

$$= \frac{-2}{3} + \left(\frac{3 + 5}{6}\right)$$

$$= \frac{-2}{3} + \frac{8}{6} = \frac{-2}{3} + \frac{4}{3}$$

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

L.C.M. of 2 and 6

2	2, 6
	1, 3

L.C.M. of 2, 6 = 2 × 3 = 6

$\therefore \left[\left(\frac{-2}{3}\right) + \frac{1}{2}\right] + \frac{5}{6} = \frac{-2}{3} + \left(\frac{1}{2} + \frac{5}{6}\right)$

$\therefore (x + y) + z = x + (y + z)$

Thus, associative property under addition holds.

(*ii*) We have : $x = \frac{-3}{4}, y = \frac{1}{6}, z = \frac{5}{8}$

Firstly, $(x + y) + z = \left[\left(-\frac{3}{4}\right) + \frac{1}{6}\right] + \frac{5}{8} = \left[\frac{-3 \times 3 + 1 \times 2}{12}\right] + \frac{5}{8}$

$$= \left[\frac{-9 + 2}{12}\right] + \frac{5}{8} = \frac{-7}{12} + \frac{5}{8} = \frac{-7 \times 2 + 5 \times 3}{24}$$

$$= \frac{-14 + 15}{24} = \frac{1}{24}$$

2	4, 6
	2, 3

L.C.M. of 4 and 6
= 2 × 2 × 3 = 12

2	12, 8
2	6, 4
	3, 2

L.C.M. of 12 and 8
= 2 × 2 × 3 × 2 = 24

and $x + (y + z) = \frac{-3}{4} + \left(\frac{1}{6} + \frac{5}{8}\right)$

$= \frac{-3}{4} + \left(\frac{1\times4+5\times3}{24}\right)$

$= \frac{-3}{4} + \left(\frac{4+15}{24}\right) = \frac{-3}{4} + \frac{19}{24}$

$= \frac{-3\times6+19\times1}{24} = \frac{-18+19}{24} = \frac{1}{24}$

$\therefore\ (x + y) + z = x + (y + z)$

Thus, associative property under addition holds.

2	6, 8
	3, 4

L.C.M. of 6 and 8 = 2 × 3 × 4 = 24

2	4, 24
2	2, 12
	1, 6

L.C.M. of 4 and 24
= 2 × 2 × 6 = 24

(*iii*) We have : $x = 2,\ y = \frac{-5}{12},\ z = \frac{-3}{8}$

Firstly, $(x + y) + z = \left[2 + \left(\frac{-5}{12}\right)\right] + \frac{-3}{8}$

$= \left(\frac{2\times12-5}{12}\right) + \left(\frac{-3}{8}\right) = \left(\frac{24-5}{12}\right) + \left(\frac{-3}{8}\right) = \frac{19}{12} - \frac{3}{8}$

$= \frac{(19\times2-3\times3)}{24} = \frac{38-9}{24} = \frac{29}{24}$

and $x + (y + z) = 2 + \left[\left(\frac{-5}{12}\right) + \left(\frac{-3}{8}\right)\right]$

$= 2 + \left[\frac{(-5\times2)+(-3)\times3}{24}\right]$

$= 2 + \left[\frac{-10-9}{24}\right] = \frac{2}{1} + \left(\frac{-19}{24}\right) = \frac{(2\times24)+(-19\times1)}{24}$

$= \frac{48-19}{24} = \frac{29}{24}$

2	12, 8
2	6, 4
	3, 2

L.C.M. of 12 and 8
= 2 × 2 × 3 × 2 = 24

$\therefore\ (x + y) + z = x + (y + z)$

Thus, associative property under addition holds.

Q. 4. Write the additive inverse of the following :

(*i*) $\frac{-5}{11}$ **(*ii*)** $\frac{8}{9}$ **(*iii*)** $\frac{-15}{13}$ **(*iv*)** $\frac{-2}{-9}$

(*v*) $\frac{3}{-8}$ **(*vi*)** $\frac{2}{-7}$ **(*vii*)** $\frac{-18}{-11}$ **(*viii*) 0.**

Solution. (*i*) Additive inverse of $\frac{-5}{11}$

$$= -\left[\frac{-5}{11}\right] = \frac{5}{11} \text{ Ans.}$$

(*ii*) Additive inverse of $\frac{8}{9}$

$$= -\left[\frac{8}{9}\right] = \frac{-8}{9} \text{ Ans.}$$

(*iii*) Additive inverse of $\frac{-15}{13}$

$$= -\left[\frac{-15}{13}\right] = \frac{15}{13} \text{ Ans.}$$

(*iv*) Additive inverse of $\frac{-2}{-9}$

$$= -\left[\frac{-2}{-9}\right] = -\left[\frac{2}{9}\right] = \frac{-2}{9} \text{ Ans.}$$

(*v*) Additive inverse of $\frac{3}{-8}$

$$= -\left[\frac{3}{-8}\right] = -\left[\frac{-3}{8}\right] = \frac{3}{8} \text{ Ans.}$$

(*vi*) Additive inverse of $\frac{2}{-7}$

$$= -\left[\frac{2}{-7}\right] = -\left[\frac{-2}{7}\right] = \frac{2}{7} \text{ Ans.}$$

(*vii*) Additive inverse of $\frac{-18}{-11}$

$$= -\left[\frac{-18}{-11}\right] = -\left[\frac{18}{11}\right] = \frac{-18}{11} \text{ Ans.}$$

(*viii*) Additive inverse of 0 = − [0] = 0 **Ans.**

Q. 5. Rearrange and Regroup the rational numbers and solve :

(*i*) $\frac{2}{5}+\left(\frac{-7}{3}\right)+\frac{4}{5}+\frac{1}{3}$

(*ii*) $\left(\frac{-3}{8}\right)+\frac{4}{7}+\frac{2}{8}+\left(\frac{-3}{7}\right)$

(*iii*) $\left(\frac{-6}{7}\right)+\left(\frac{-4}{9}\right)+\left(\frac{-15}{7}\right)+\left(\frac{-5}{6}\right)$

(*iv*) $\frac{2}{3}+\left(\frac{-4}{5}\right)+\frac{3}{10}+\frac{1}{3}$

(*v*) $\left(\frac{-1}{8}\right)+\frac{5}{12}+\frac{2}{7}+\frac{5}{7}+\left(\frac{-5}{16}\right)$.

Solution. (*i*) Rearranging and regrouping the numbers in pairs in such a way that each group contain rational numbers with equal denominators

(*i*) $\frac{2}{5}+\left(\frac{-7}{3}\right)+\frac{4}{5}+\frac{1}{3}$

$$= \left[\frac{2}{5}+\frac{4}{5}\right]+\left[\frac{-7}{3}+\frac{1}{3}\right]$$

$$= \frac{2+4}{5}+\left[\frac{-7+1}{3}\right] = \frac{6}{5}+\left(\frac{-6}{3}\right)$$

$$= \frac{6\times3+(-6\times5)}{5\times3} = \frac{18-30}{15}$$

$$= \frac{-12}{15} \text{ Ans.}$$

(*ii*) $\left(\frac{-3}{8}\right)+\frac{4}{7}+\frac{2}{8}+\left[\frac{-3}{7}\right]$

$$= \left[\left(\frac{-3}{8}\right)+\frac{2}{8}\right]+\left[\frac{4}{7}+\left(\frac{-3}{7}\right)\right]$$

$$= \left[\frac{-3+2}{8}\right]+\left[\frac{4-3}{7}\right]$$

$$= \frac{-1}{8}+\frac{1}{7} = \frac{-1\times7+1\times8}{8\times7}$$

$$= \frac{-7+8}{56} = \frac{1}{56} \text{ Ans.}$$

(iii) $\left(\frac{-6}{7}\right)+\left(\frac{-4}{9}\right)+\left(\frac{-15}{7}\right)+\left(\frac{-5}{6}\right)$

$= \left[\left(\frac{-6}{7}\right)+\left(\frac{-15}{7}\right)\right]+\left[\left(\frac{-4}{9}\right)+\left(\frac{-5}{6}\right)\right]$

$= \left[\frac{-6-15}{7}\right]+\left[\frac{(-4\times2)+(-5\times3)}{18}\right] = \frac{-21}{7}+\left[\frac{-8-15}{18}\right]$

$= \left(\frac{-3}{1}\right)+\left(\frac{-23}{18}\right) = \frac{(-3\times18)+(-23\times1)}{18} = \frac{-54-23}{18} = \frac{-77}{18}$ **Ans.**

3	9, 6
	3, 2

L.C.M. of 9 and 6 = 3 × 3 × 2 = 18

(iv) $\frac{2}{3}+\left(\frac{-4}{5}\right)+\frac{3}{10}+\frac{1}{3} = \left(\frac{2}{3}+\frac{1}{3}\right)+\left[\left(\frac{-4}{5}\right)+\frac{3}{10}\right]$

$= \left(\frac{2+1}{3}\right)+\frac{2\times(-4)+3}{10}$

$= \frac{3}{3}+\left(\frac{-8+3}{10}\right) = 1+\left(\frac{-5}{10}\right) = 1-\frac{1}{2} = \frac{2-1}{2} = \frac{1}{2}$ **Ans.**

5	5, 10
	1, 2

L.C.M. of 5 and 10 = 5 × 2 = 10

(v) $\left(\frac{-1}{8}\right)+\frac{5}{12}+\frac{2}{7}+\frac{5}{7}+\left(\frac{-5}{16}\right) = \left(\frac{-1}{8}\right)+\left(\frac{-5}{16}\right)+\frac{5}{12}+\left(\frac{2}{7}+\frac{5}{7}\right)$

$= \frac{-1\times6+(-5)\times3+5\times4}{48}+\left(\frac{2+5}{7}\right)$

$= \frac{-6-15+20}{48}+\frac{7}{7} = \frac{-1}{48}+1$

$= \frac{-1+48}{48}$

$= \frac{47}{18}$ **Ans.**

2	8, 16, 12
2	4, 8, 6
2	2, 4, 3
	1, 2, 3

L.C.M. of 8, 16 and 12
= 2 × 2 × 2 × 2 × 3 = 48

Q. 6. Multiple Choice Questions :

(i) Which of the following is commutative property for addition ?

(a) $x \times y = y \times x$

(b) $(x + y) = (y + x)$

(c) $(x + y) + z = x + (y + z)$

(d) $(x - y) \neq (y - x)$.

(ii) Which of the following is associative property for addition ?

(a) $x \times y = y \times x$

(b) $x + y = y + x$

(c) $(x + y) + z = x + (y + z)$

(d) $x - y = y - x$.

(iii) The additive inverse of $\frac{-5}{-9}$ is :

(a) $\frac{5}{9}$ (b) $\frac{5}{-9}$

(c) 0 (d) $\frac{2}{-3}$.

(iv) The additive identity of $\frac{2}{3}$ is :

(a) 0 (b) $\frac{-2}{3}$.

(c) $\frac{-2}{-3}$ (d) $\frac{3}{2}$.

Ans. (i) (b) $(x + y) = (y + x)$

(ii) (c) $(x + y) + z = x + (y + z)$

(iii) (b) $\frac{5}{-9}$

(iv) (a) 0.