1. Rational Numbers

EXERCISE 1(A)

Question 1.

Add, each pair of rational numbers, given below, and show that their addition (sum) is also a rational number:

(*i*) $\frac{-5}{8}$ and $\frac{3}{8}$ (*ii*) $\frac{-8}{13}$ and $\frac{-4}{13}$

(*iii*) $\frac{6}{11}$ and $\frac{-9}{11}$ (*iv*) $\frac{5}{-26}$ and $\frac{8}{39}$

(*v*) $\frac{5}{-6}$ and $\frac{2}{3}$ (*vi*) -2 and $\frac{2}{5}$

(*vii*) $\frac{9}{-4}$ and $\frac{-3}{8}$ (*viii*) $\frac{7}{-18}$ and $\frac{8}{27}$

Solution:

(*i*) $\frac{-5}{8}$ and $\frac{3}{8}$

$= \frac{-5}{8} + \frac{3}{8}$

(∵ Denominators are same, ∴ LCM = 8)

$= \frac{-5+3}{8}$

$= \frac{-2}{8} = \frac{-1}{4}$

Which is a rational number.

(*ii*) $\frac{-8}{13}$ and $\frac{-4}{13}$

$= \frac{-8}{13} + \left(\frac{-4}{13}\right)$

(∵ LCM of 13 and 13 = 13)

$$= \frac{-8-4}{13} = \frac{-12}{13}$$

Which is a rational number.

(*iii*) $\frac{6}{11}$ and $\frac{-9}{11}$

$$= \frac{6}{11} + \left(\frac{-9}{11}\right)$$

(∵ Denominators are same, ∴ LCM = 11)

$$= \frac{6-9}{11} = \frac{-3}{11}$$

Which is a rational number.

(*iv*) $\frac{5}{-26}$ and $\frac{8}{39}$

$$= \frac{5}{-26} + \frac{8}{39}$$

$$= \frac{-5\times3}{26\times3} + \frac{8\times2}{39\times2}$$

2	26, 39
3	13, 39
13	13, 13
	1, 1

∴ LCM of 26 and 39 = 2 × 3 × 13 = 78

$$= \frac{-15+16}{78} \quad (\because \text{LCM of 26 and 39} = 78)$$

$$= \frac{1}{78}$$

Which is a rational number.

(*v*) $\frac{5}{-6}$ and $\frac{2}{3}$

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

2	6, 3
3	3, 3
	1, 1

$\therefore$ LCM of 6, 3 = 2 × 3 = 6

$= \frac{-5\times1}{6\times1} + \frac{2\times2}{3\times2}$

($\because$ LCM of 6 and 3 = 6)

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

Which is a rational number.

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

$= \frac{-2}{1} + \frac{2}{5}$ ($\because$ LCM of 1 and 5 = 5)

$= \frac{-2\times5}{1\times5} + \frac{2\times1}{5\times1}$

$= \frac{-10+2}{5} = \frac{-8}{5}$

Which is a rational number.

(*vii*) $\frac{9}{-4}$ and $\frac{-3}{8}$

$= \frac{-9}{4} + \left(\frac{-3}{8}\right)$

2	4, 8
2	2, 4
2	2, 2
	1, 1

$\therefore$ LCM of 4 and 8 = 2 × 2 × 2 = 8

$= \frac{-9\times2}{4\times2} - \frac{3\times1}{8\times1}$

($\because$ LCM of 4 and 8 = 8)

$$= \frac{-18-3}{8} = \frac{-21}{8}$$

Which is a rational number.

(viii) $\frac{7}{-18}$ and $\frac{8}{27}$

$$\frac{7}{-18} + \frac{8}{27}$$

$$= \frac{-7\times3}{18\times3} + \frac{8\times2}{27\times2}$$

2	18, 27
3	9, 27
3	3, 9
3	1, 3
	1, 1

∴ LCM of 18 and 27 = 2 × 3 × 3 × 3 = 54

$$= \frac{-21+16}{54} = \frac{-5}{54}$$

Which is a rational number.

Question 2.

Evaluate:

(i) $\frac{5}{9} + \frac{-7}{6}$ (ii) $4 + \frac{3}{-5}$

(iii) $\frac{1}{-15} + \frac{5}{-12}$ (iv) $\frac{5}{9} + \frac{3}{-4}$

(v) $\frac{-8}{9} + \frac{-5}{12}$ (vi) $0 + \frac{-2}{7}$

(vii) $\frac{5}{-11} + 0$ (viii) $2 + \frac{-3}{5}$

(ix) $\frac{4}{-9} + 1$

Solution:

(*i*) $\frac{5}{9} + \frac{-7}{6}$

2	9, 6
3	9, 3
3	3, 1
	1, 1

$\therefore$ LCM of 9 and 6 = $2 \times 3 \times 3 = 18$

$= \frac{5\times2}{9\times2} - \frac{7\times3}{6\times3}$

($\because$ LCM of 9 and 6 = 18)

$= \frac{10-21}{18} = \frac{-11}{8}$

(*ii*) $4 + \frac{3}{-5}$

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

$= \frac{4}{1} - \frac{3}{5}$

$= \frac{4\times5}{1\times5} - \frac{3\times1}{5\times1}$ ($\because$ LCM of 1 and 5 = 5)

$= \frac{20-3}{5} = \frac{17}{5} = 3\frac{2}{5}$

(*iii*) $\frac{1}{-15} + \frac{5}{-12}$

$= \frac{-1}{15} + \left(\frac{5}{-12}\right)$

$= \frac{-1}{15} - \frac{5}{12}$

2	15, 12
2	15, 6
3	15, 3
5	5, 1
	1, 1

$\therefore$ LCM of 15 and 12 = $2 \times 2 \times 3 \times 5 = 60$

$= \frac{-1 \times 4}{15 \times 4} - \frac{5 \times 5}{12 \times 5}$

($\because$ LCM of 15 and 12 = 60)

$= \frac{-4 - 25}{60} = \frac{-29}{60}$

(*iv*) $\frac{5}{9} + \frac{3}{-4}$

$= \frac{5}{9} - \frac{3}{4}$

2	9, 4
2	9, 2
3	9, 1
3	3, 1
	1, 1

(∴ LCM of 9 and 4 = 2 × 2 × 3 × 3 = 36)

$$= \frac{5\times4}{9\times4} - \frac{3\times9}{4\times9}$$

$$= \frac{20-27}{36} = \frac{-7}{36}$$

(∵ LCM of 9 and 4 = 36)

$$= \frac{-7}{36}$$

(v) $\frac{-8}{9} + \frac{-5}{12}$

2	9, 12
2	9, 6
3	9, 3
3	3, 1
	1, 1

∴ LCM of 9, 12 = 2 × 2 × 3 × 3 = 36

$$= \frac{-8\times4}{9\times4} - \frac{5\times3}{12\times3}$$

$$= \frac{-32-15}{36}$$ (∵ LCM of 9 and 12 = 36)

$$= \frac{-47}{36}$$

(vi) $0 + \frac{-2}{7}$

$$= \frac{0\times7}{1\times7} - \frac{2\times1}{7\times1}$$ (∵ LCM of 0 and 7 = 7)

$$= \frac{0-2}{7} = \frac{-2}{7}$$

(vii) $\frac{5}{-11} + 0$

$$= \frac{-5\times1}{11\times1} + \frac{0\times11}{1\times11}$$

(∵ LCM of 0 and 11 = 11)

$$= \frac{-5+0}{11} = \frac{-5}{11}$$

(*viii*) $2 + \frac{-3}{5}$

$= \frac{2}{1} - \frac{3}{5}$ (∵ LCM of 1 and 5 = 5)

$= \frac{2\times5}{1\times5} - \frac{3\times1}{5\times1}$

$= \frac{10-3}{5} = \frac{7}{5} = 1\frac{2}{5}$

(*ix*) $\frac{4}{-9} + 1$

$= \frac{-4}{9} + \frac{1}{1}$ (∵ LCM of 9 and 1 = 9)

$= \frac{-4\times1}{9\times1} + \frac{1\times9}{1\times9}$

$= \frac{-4+9}{9} = \frac{5}{9}$

Question 3.

Evaluate:

(*i*) $\frac{3}{7} + \frac{-4}{9} + \frac{-11}{7} + \frac{7}{9}$

(*ii*) $\frac{2}{3} + \frac{-4}{5} + \frac{1}{3} + \frac{2}{5}$

(*iii*) $\frac{4}{7} + 0 + \frac{-8}{9} + \frac{-13}{7} + \frac{17}{9}$

(*iv*) $\frac{3}{8} + \frac{-5}{12} + \frac{3}{7} + \frac{3}{12} + \frac{-5}{8} + \frac{-2}{7}$

Solution:

(*i*) $\frac{3}{7} + \frac{-4}{9} + \frac{-11}{7} + \frac{7}{9}$

$= \left(\frac{3}{7} + \frac{-11}{7}\right) + \left(\frac{-4}{9} + \frac{7}{9}\right)$

$= \frac{3-11}{7} + \frac{-4+7}{9}$

$= \frac{-8}{7} + \frac{3}{9}$

$= \frac{-8}{7} + \frac{1}{3}$

3	7, 3
7	7, 1
	1, 1

$\therefore$ LCM of 3 and 2 = $3 \times 7 = 21$

$= \frac{-8 \times 3}{7 \times 3} + \frac{1 \times 7}{3 \times 7}$

($\because$ LCM of 7 and 3 = 21)

$= \frac{-24+7}{21} = \frac{-17}{21}$

(*ii*) $\frac{2}{3} + \frac{-4}{5} + \frac{1}{3} + \frac{2}{5}$

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

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

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

3	3, 5
5	1, 5
	1, 1

$\therefore$ LCM of 3 and 5 = 3 × 5 = 15

$= \frac{3\times5}{3\times5} + \frac{-2\times3}{5\times3}$

($\because$ LCM of 3 and 5 = 15)

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

(*iii*) $\frac{4}{7} + 0 + \frac{-8}{9} + \frac{-13}{7} + \frac{17}{9}$

$= \frac{4}{7} + \frac{-8}{9} + \frac{-13}{7} + \frac{17}{9}$

$= \left[\frac{4}{7} + \left(\frac{-13}{7}\right)\right] + \left(\frac{-8}{9} + \frac{17}{9}\right)$

$= \left(\frac{4}{7}\right) - \frac{13}{7} + \left(\frac{-8}{9}\right) + \frac{17}{9}$

$= \frac{-9}{7} + \frac{9}{9} = \frac{-9}{7} + 1$

$= \frac{-9\times1}{7\times1} + \frac{1\times7}{1\times7}$

($\because$ LCM of 1 and 7 = 7)

$= \frac{-9}{7} + \frac{7}{7} = \frac{-2}{7}$

(*iv*) $\frac{3}{8} + \frac{-5}{12} + \frac{3}{7} + \frac{3}{12} + \frac{-5}{8} + \frac{-2}{7}$

$= \left(\frac{3}{8} - \frac{5}{8}\right) + \left(\frac{-5}{12} + \frac{3}{12}\right) + \left(\frac{3}{7} - \frac{2}{7}\right)$

$= \frac{-2}{8} - \frac{2}{12} + \frac{1}{7}$

$= \frac{-1}{4} - \frac{1}{6} + \frac{1}{7}$

2	4, 6, 7
2	2, 3, 7
3	1, 3, 7
7	1, 1, 7
	1, 1, 1

$\therefore$ LCM of 4, 6 and 7 = $2 \times 2 \times 3 \times 7 = 84$

$$= \frac{-1\times 21}{4\times 21} - \frac{1\times 14}{6\times 14} + \frac{1\times 12}{7\times 12}$$

($\because$ LCM of 4, 6 and 7 = 84)

$$= \frac{-21-14+12}{84}$$

$$= \frac{-35+12}{84} = \frac{-23}{84}$$

Question 4.

For each pair of rational numbers, verify commutative property of addition of rational numbers:

(*i*) $\frac{-8}{7}$ and $\frac{5}{14}$ (*ii*) $\frac{5}{9}$ and $\frac{5}{-12}$

(*iii*) $\frac{-4}{5}$ and $\frac{-13}{-15}$ (*iv*) $\frac{2}{-5}$ and $\frac{11}{-15}$

(*v*) 3 and $\frac{-2}{7}$ (*vi*) -2 and $\frac{3}{-5}$

Solution:

(*i*) $\frac{-8}{7}$ and $\frac{5}{14}$

To show that : $\frac{-8}{7} + \frac{5}{14} = \frac{5}{14} + \frac{-8}{7}$

$\because \frac{-8}{7} + \frac{5}{14}$

2	7, 14
7	7, 7
	1, 1

$\therefore$ LCM of 2 and 7 = 14

$= \frac{-8 \times 2}{7 \times 2} + \frac{5 \times 1}{14 \times 1}$

$= \frac{-16+5}{14} = \frac{-11}{14}$

And, $\frac{5}{14} + \frac{-8}{7}$

$= \frac{5 \times 1}{14 \times 1} + \left(\frac{-8 \times 2}{7 \times 2}\right)$

$= \frac{5-16}{14} = \frac{-11}{14}$

$\therefore \frac{-8}{7} + \frac{5}{14} = \frac{5}{14} + \frac{-8}{7}$

This verifies the commutative property for the addition of rational numbers.

(*ii*) $\frac{5}{9}$ and $\frac{5}{-12}$

To show that : $\frac{5}{9} + \frac{5}{-12} = \frac{5}{-12} + \frac{5}{9}$

$\because \frac{5}{9} + \frac{5}{-12}$

2	9, 12
2	9, 6
3	9, 3
3	3, 1
	1, 1

$\therefore$ LCM of 9 and $12 = 2 \times 2 \times 3 \times 3 = 36$

$$= \frac{5\times4}{9\times4} - \frac{5\times3}{12\times3}$$

$$= \frac{20-15}{36} = \frac{5}{36}$$

And, $\frac{5}{-12} + \frac{5}{9}$

$$= \frac{5\times3}{-12\times3} + \frac{5\times4}{9\times4}$$

$$= \frac{-15+20}{36} = \frac{5}{36}$$

$$\therefore \frac{5}{9} + \frac{5}{-12} = \frac{5}{-12} + \frac{5}{9}$$

This verifies the commutative property for the addition of rational numbers.

(*iii*) $\frac{-4}{5}$ and $\frac{-13}{-15}$

To show that :

$$\frac{-4}{5} \text{ and } \frac{-13}{-15} = \frac{-13}{-15} + \left(\frac{-4}{5}\right)$$

$\because \frac{-4}{5} + \frac{13}{15}$

5	5, 15
3	1, 3
	1, 1

$\therefore$ LCM of 5 and $15 = 5 \times 3 = 15$

$$= \frac{-4 \times 3}{5 \times 3} + \frac{13 \times 1}{15 \times 1}$$

$$= \frac{-12 + 13}{15} = \frac{1}{15}$$

And, $\frac{13}{15} + \frac{-4}{5}$

$$= \frac{13 \times 1}{15 \times 1} + \frac{-4 \times 3}{5 \times 3}$$

$$= \frac{13 - 12}{15} = \frac{1}{15}$$

$$\therefore \frac{-4}{5} + \frac{-13}{-15} = \frac{-13}{-15} + \frac{-4}{5}$$

This verifies the commutative property for the addition of rational numbers.

(*iv*) $\frac{2}{-5}$ and $\frac{11}{-15}$

Show that : $\frac{2}{-5} + \frac{11}{-15} = \frac{11}{-15} + \frac{2}{-5}$

$= \frac{2}{-5} + \frac{11}{-15}$

3	5, 15
5	5, 5
	1, 1

$\therefore$ LCM of 5 and 15 = 15

$= \frac{-2\times3}{5\times3} - \frac{11\times1}{15\times1}$

$= \frac{-6-11}{15} = \frac{-17}{15}$

And, $\frac{11}{-15} + \frac{2}{-5}$

$= \frac{-11\times1}{15\times1} - \frac{2\times3}{5\times3} = \frac{-11-6}{15} = \frac{-17}{15}$

$\therefore \frac{2}{-5} + \frac{11}{-15} = \frac{11}{-15} + \frac{2}{-5}$

This verifies the commutative property for the addition of rational numbers.

(v) 3 and $\frac{-2}{7}$

Show that : $\frac{3}{1} + \frac{-2}{7} = \frac{-2}{7} + \frac{3}{1}$

$= \frac{3}{1} + \frac{-2}{7}$ (∵ LCM of 1 and 7= 7)

$= \frac{3\times7}{1\times7} - \frac{2\times1}{7\times1}$

$= \frac{21-2}{7} = \frac{19}{7}$

And, $\frac{-2}{7} + \frac{3}{1}$

$= \frac{-2\times1}{7\times1} + \frac{3\times7}{1\times7}$

$= \frac{-2+21}{7} = \frac{19}{7}$

$\therefore \frac{3}{1} + \frac{-2}{7} = \frac{-2}{7} + \frac{3}{1}$

This verifies the commutative property for the addition of rational numbers.

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

Show that : $\frac{-2}{1} + \frac{-3}{5} = \frac{-3}{5} + \frac{-2}{1}$

$= \frac{-2}{1} + \frac{-3}{5}$ ($\because$ LCM of 1 and 5 = 5)

$= \frac{-2\times5}{1\times5} + \frac{-3\times1}{5\times1}$

$= \frac{-10-3}{5} = \frac{-13}{5}$

And, $\frac{-3}{5} + \frac{-2}{1}$

$= \frac{-3\times1}{5\times1} + \frac{-2\times5}{1\times5}$

$= \frac{-3-10}{5} = \frac{-13}{5}$

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

This verifies the commutative property for the addition of rational numbers.

Question 5.

For each set of rational numbers, given below, verify the associative property of addition of rational numbers:

(*i*) $\frac{1}{2}, \frac{2}{3}$ and $-\frac{1}{6}$ (*ii*) $\frac{-2}{5}, \frac{4}{15}$ and $\frac{-7}{10}$

(*iii*) $\frac{-7}{9}, \frac{2}{-3}$ and $\frac{-5}{18}$ (*iv*) $-1, \frac{5}{6}$ and $\frac{-2}{3}$

Solution:

(*i*) $\frac{1}{2}, \frac{2}{3}$ and $-\frac{1}{6}$

Show that :

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

$\because \frac{1}{2} + \left(\frac{2}{3} + \frac{-1}{6}\right)$

2	3, 6
3	3, 3
	1, 1

$\therefore$ LCM of 3 and 6 = 6

$$= \frac{1}{2} + \left(\frac{2\times2}{3\times2} + \frac{-1\times1}{6\times1}\right)$$

$$= \frac{1}{2} + \left(\frac{4}{6} - \frac{1}{6}\right)$$

$$= \frac{1}{2} + \left(\frac{4-1}{6}\right)$$

$$= \frac{1}{2} + \left(\frac{3}{6}\right)$$

$$= \frac{1\times3}{2\times3} + \frac{3\times1}{6\times1} \quad (\because \text{LCM of 2 and 6} = 3)$$

$$= \frac{3+3}{6} = \frac{6}{6} = 1$$

And, $\left(\frac{1}{2}+\frac{2}{3}\right) + \frac{-1}{6}$

2	2, 3
3	1, 3
	1, 1

$\therefore$ LCM of 2 and 3 = 6

$$= \left(\frac{1\times3}{2\times3}+\frac{2\times2}{3\times2}\right) + \frac{-1}{6}$$

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

$$= \frac{7-1}{6} = \frac{6}{6} = 1$$

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

This verifies associative property of the addition of rational numbers.

(*ii*) $\frac{-2}{5}, \frac{4}{15}$ and $\frac{-7}{10}$

Show that :

$$\frac{-2}{5} + \left(\frac{4}{15}+\frac{-7}{10}\right) = \left(\frac{-2}{5}+\frac{4}{15}\right) + \frac{-7}{10}$$

$\because \frac{-2}{5} + \left(\frac{4}{15}+\frac{-7}{10}\right)$

2	15, 10
3	15, 5
5	5, 5
	1, 1

$\therefore$ LCM of 15, 10 = 2 × 3 × 5 = 30

$$= \frac{-2}{5} + \left(\frac{4\times2}{15\times2}+\frac{-7\times3}{10\times3}\right)$$

($\because$ LCM of 15 and 10 = 30)

$$= \frac{-2}{5} + \left(\frac{8-21}{30}\right)$$

$$= \frac{-2}{5} - \frac{13}{30} = \frac{-2\times6}{5\times6} - \frac{13\times1}{30\times i}$$

$$= \frac{-12-13}{30} = \frac{-25}{30} = \frac{-5}{6}$$

And, $\left(\frac{-2}{5}+\frac{4}{15}\right)+\frac{-7}{10}$

3	5, 15
5	5, 5
	1, 1

$\therefore$ LCM of 5 and $15 = 3 \times 5 = 15$

$$= \left(\frac{-2\times3}{5\times3}+\frac{4\times1}{15\times1}\right)+\frac{-7}{10}$$

$\therefore$ LCM of 5 and 15 = 15

$$= \frac{-6+4}{15} + \frac{-7}{10}$$

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

$$= \frac{-2\times2}{15\times2} - \frac{7\times3}{10\times3}$$

$$= \frac{-4}{30} - \frac{21}{30} = \frac{-25}{30} = \frac{-5}{6}$$

$$\therefore \frac{-2}{5} + \left(\frac{4}{15}+\frac{-7}{10}\right) = \left(\frac{-2}{5}+\frac{4}{15}\right)+\frac{-7}{10}$$

This verifies associative property of the addition of rational numbers.

(*iii*) $\frac{-7}{9}, \frac{2}{-3}$ and $\frac{-5}{18}$

Show that :

$$\frac{-7}{9} + \left(\frac{2}{-3} + \frac{-5}{18}\right) = \left(\frac{-7}{9} + \frac{2}{-3}\right) + \frac{-5}{18}$$

$\because \frac{-7}{9} + \left(\frac{2}{-3} + \frac{-5}{18}\right)$

2	3, 18
3	3, 9
5	3, 3
	1, 1

$\therefore$ LCM of 3 and 18 $= 2 \times 3 \times 3 = 18$

$$= \frac{-7}{9} + \left(\frac{-2\times6}{3\times6} + \frac{-5\times1}{18\times1}\right)$$

($\because$ LCM of 3 and 18 = 18)

$$= \frac{-7}{9} + \left(\frac{-12-5}{18}\right)$$

$$= \frac{-7}{9} + \frac{-17}{18}$$

$$= \frac{-7\times2}{9\times2} - \frac{17\times1}{18\times1}$$

($\because$ LCM of 9 and 18 = 18)

$$= \frac{-14-17}{18} = \frac{-31}{18}$$

And, $\left(\frac{-7}{9} + \frac{2}{-3}\right) + \frac{-5}{18}$

3	3, 9
3	3, 3
	1, 1

$\therefore$ LCM of 3 and 9 = 3

$$= \left(\frac{-7\times1}{9\times1} + \frac{-2\times3}{3\times3}\right) + \frac{-5}{18}$$

($\because$ LCM = 9 and 3 = 9)

$$= \frac{-7-6}{9} + \frac{-5}{18}$$

$$= \frac{-13}{9} + \frac{-5}{18}$$

$$= \frac{-13\times2}{9\times2} + \frac{-5\times1}{18\times1} = \frac{-26-5}{18} = \frac{-31}{18}$$

$$\therefore \quad \frac{-7}{9} + \left(\frac{2}{-3} + \frac{-5}{18}\right) = \left(\frac{-7}{9} + \frac{2}{-3}\right) + \frac{-5}{18}$$

This verifies associative property of the addition of rational numbers.

(*iv*) $-1, \frac{5}{6}$ and $\frac{-2}{3}$

Show that :

This verifies associative property of the addition of rational numbers.

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

$\because \frac{-1}{1} + \left(\frac{5}{6} + \frac{-2}{3}\right)$

2	6, 3
3	3, 3
	1, 1

$\therefore$ LCM of 6 and 3 = 6

$$= \frac{-1}{1} + \left(\frac{5\times1}{6\times1} + \frac{-2\times2}{3\times2}\right)$$

($\because$ LCM of 6 and 3 = 6)

$$= \frac{-1}{1} + \left(\frac{5-4}{6}\right)$$

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

$$= \frac{-1\times6}{1\times6} + \frac{1\times1}{6\times1}$$ ($\because$ LCM of 1 and 6 = 1)

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

And, $\left(\frac{-1}{1} + \frac{5}{6}\right) + \frac{-2}{3}$

$$= \left(\frac{-1\times6}{1\times6} + \frac{5\times1}{6\times1}\right) + \frac{-2}{3}$$

($\because$ LCM of 1 and 6 = 6)

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

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

$$= \frac{-1\times1}{6\times1} + \frac{-2\times2}{3\times2}$$ ($\because$ LCM of 6 and 3 = 6)

$$= \frac{-1-4}{6} = \frac{-5}{6}$$

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

Question 6.

Write the additive inverse (negative) of:

(*i*) $\frac{-3}{8}$ (*ii*) $\frac{4}{-9}$

(*iii*) $\frac{-7}{5}$ (*iv*) $\frac{-4}{-13}$

(*v*) 0 (*vi*) –2

(*vii*) 1 (*viii*) $-\frac{1}{3}$

(*ix*) $\frac{-3}{1}$

Solution:

(*i*) The additive inverse of $\frac{-3}{8} = \frac{3}{8}$

(*ii*) The additive inverse of $\frac{4}{-9} = \frac{4}{9}$

(*iii*) The additive inverse of $\frac{-7}{5} = \frac{7}{5}$

(*iv*) The additive inverse of $\frac{-4}{-13}$ or $\left(\frac{4}{13}\right) = -\frac{4}{13}$

(*v*) The additive inverse of 0 = 0

(*vi*) The additive inverse of –2 = 2

(*vii*) The additive inverse of 1 = –1

(*viii*) The additive inverse of $-\frac{1}{3} = \frac{1}{3}$

(*ix*) The additive inverse of $\frac{-3}{1} = 3$

Question 7.

(*i*) Additive inverse of $\frac{-5}{-12}$ = ...

(*ii*) $\frac{-5}{-12}$ + its additive inverse = ...

(*iii*) If $\frac{a}{b}$ is additive inverse of $\frac{-c}{d}$, then $\frac{-c}{d}$ is additive inverse of ..... .

Also so $\frac{a}{b} + \frac{(-c)}{d} - \frac{(-c)}{d} + \frac{a}{b} =$ ..... .

(*i*) Additive inverse of $\frac{-5}{-12} = -\frac{5}{12}$.

(*ii*) $\frac{-5}{-12}$ + its additive inverse = $\frac{-5}{-15} + \left(-\frac{5}{15}\right)$

$= 0$.

(*iii*) If $\frac{a}{b}$ is additive inverse of $\frac{-c}{d}$, then $\frac{-c}{d}$ is

additive inverse of $\frac{a}{b}$.

Also so $\frac{a}{b} + \frac{(-c)}{d} - \frac{(-c)}{d} + \frac{a}{b} = 0$.

Question 8.

State, true or false:

(*i*) $\frac{7}{9} = \frac{7+5}{9+5}$ (*ii*) $\frac{7}{9} = \frac{7-5}{9-5}$

(*iii*) $\frac{7}{9} = \frac{7\times5}{9\times5}$ (*iv*) $\frac{7}{9} = \frac{7+5}{9+5}$

(*v*) $\frac{-5}{-12}$ is a negative rational number

(*vi*) $\frac{-13}{25}$ is smaller than $\frac{-25}{13}$.

Solution:

(i) False
(ii) False
(iii) True
(iv) True
(v) False
(vi) False

EXERCISE 1(B)

Question 1.
Evaluate:

(*i*) $\frac{2}{3} - \frac{4}{5}$ (*ii*) $\frac{-4}{9} - \frac{2}{-3}$

(*iii*) $-1 - \frac{4}{9}$ (*iv*) $\frac{-2}{7} - \frac{3}{-14}$

(*v*) $\frac{-5}{18} - \frac{-2}{9}$ (*vi*) $\frac{5}{21} - \frac{-13}{42}$

Solution:

(*i*) $\frac{2}{3} - \frac{4}{5}$

3	3, 5
5	1, 5
	1, 1

$\therefore$ LCM of 3 and 5 = 15

$= \frac{2\times5}{3\times5} - \frac{4\times3}{5\times3}$ ($\because$ LCM of 3 and 5 = 15)

$= \frac{10-12}{15} = \frac{-2}{15}$

(*ii*) $\frac{-4}{9} - \frac{2}{-3}$

3	9, 3
5	3, 1
	1, 1

$= \frac{-4\times1}{9\times1} - \frac{(-2\times3)}{3\times3}$

($\because$ LCM of 3 and 9 = 9)

$= \frac{-4+6}{9} = \frac{2}{9}$

(*iii*) $-1 - \frac{4}{9}$

$= \frac{-1\times 9}{1\times 9} - \frac{4\times 1}{9\times 1}$

$= \frac{-9-4}{9} = \frac{-13}{9}$

(*iv*) $\frac{-2}{7} - \frac{3}{-14}$

2	7, 14
7	7, 7
	1, 1

$\therefore$ LCM of 7 and 14 = 14

$= \frac{-2\times 2}{7\times 2} - \frac{(-3\times 1)}{14\times 1}$

($\because$ LCM of 7 and 14 = 14)

$= \frac{-4+3}{14} = \frac{-1}{14}$

(*v*) $\frac{-5}{18} - \frac{-2}{9}$

2	18, 9
2	6, 9
3	3, 9
3	1, 3
	1, 1

$\therefore$ LCM of 9 and 18 = $2 \times 2 \times 3 \times 3 = 36$

$= \frac{-5\times 2}{18\times 2} - \frac{(-2\times 4)}{9\times 4}$

($\because$ LCM of 18 and 9 = 36)

$= \frac{-10+8}{36}$

$= \frac{-2}{36} = \frac{-1}{18}$

(vi) $\frac{5}{21} - \frac{-13}{42}$

2	21, 42
3	21, 21
7	7, 7
	1, 1

$\therefore$ LCM of 21, 42 = $2 \times 3 \times 7 = 42$

$= \frac{5 \times 2}{21 \times 2} - \frac{(-13 \times 1)}{42 \times 1}$

($\because$ LCM of 21 and 42 = 42)

$= \frac{10 + 13}{42} = \frac{23}{42}$

Question 2.

Subtract:

(i) $\frac{5}{8}$ from $\frac{-3}{8}$ (ii) $\frac{-8}{11}$ from $\frac{4}{11}$

(iii) $\frac{4}{9}$ from $\frac{-5}{9}$ (iv) $\frac{1}{4}$ from $\frac{-3}{8}$

(v) $\frac{-5}{8}$ from $\frac{-13}{16}$ (vi) $\frac{-9}{22}$ from $\frac{5}{33}$

Solution:

(*i*) $\frac{5}{8}$ from $\frac{-3}{8}$

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

$= \frac{-3\times1}{8\times1} - \frac{5\times1}{8\times1}$

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

(*ii*) $\frac{-8}{11}$ from $\frac{4}{11}$

$= \frac{4}{11} - \left(\frac{-8}{11}\right)$

$= \frac{4+8}{11} = \frac{12}{11} = 1\frac{1}{11}$

(*iii*) $\frac{4}{9}$ from $\frac{-5}{9}$

$= \frac{-5}{9} - \frac{4}{9}$

$= \frac{-5-4}{9} = \frac{-9}{9} = -1$

(*iv*) $\frac{1}{4}$ from $\frac{-3}{8}$

2	4, 8
2	2, 4
2	1, 2
	1, 1

$\therefore$ LCM of 4, 8 = 2 × 2 × 2 = 8

$= \frac{-3}{8} - \frac{1}{4}$ ($\because$ LCM of 8 and 4 = 8)

$= \frac{-3\times1}{8\times1} - \frac{1\times2}{4\times2}$

$= \frac{-3-2}{8} = \frac{-5}{8}$

(v) $\frac{-5}{8}$ from $\frac{-13}{16}$

2	8, 16
2	4, 8
2	2, 4
2	1, 2
	1, 1

$\therefore$ LCM of 8 and 16 = 16

$$= \frac{-13}{16} - \left(\frac{-5}{8}\right)$$

$$= \frac{-13\times1}{16\times1} + \frac{5\times2}{8\times2}$$

($\because$ LCM of 8 and 16 = 16)

$$= \frac{-13+10}{16} = \frac{-3}{16}$$

(vi) $\frac{-9}{22}$ from $\frac{5}{33}$

2	22, 33
3	11, 33
11	1, 11
	1, 1

$\therefore$ LCM of 22 and 33 = $2 \times 3 \times 11 = 66$

$$= \frac{5}{33} - \left(\frac{-9}{22}\right)$$

$$= \frac{5\times2}{33\times2} + \frac{9\times3}{22\times3}$$

($\because$ LCM of 22 and 33 = 66)

$$= \frac{10+27}{66} = \frac{37}{66}$$

Question 3.

The sum of two rational numbers is $\frac{9}{20}$. If one of them is $\frac{2}{5}$, find the other.

The sum of two rational numbers = $\frac{9}{20}$

$\frac{2}{5}$

$\because$ The sum of two rational numbers $= \frac{-2}{3}$

And, one of the numbers $= \frac{-8}{15}$

$\therefore$ The other rational number

$= \frac{-2}{3} - \frac{-8}{15}$

3	3, 15
5	1, 5
	1, 1

$\therefore$ LCM of 3 and 15 = 15

$= \frac{-2\times5}{3\times5} + \frac{8\times1}{15\times1}$

($\because$ LCM of 3 and 15 = 15)

$= \frac{-10+8}{15} = \frac{-2}{15}$

Question 5.

The sum of the two rational numbers is -6. If one of them is $\frac{-8}{5}$, find the other.

Solution:

$\because$ The sum of two rational numbers $= -6$

And, one of the numbers $= \frac{-8}{5}$

$\therefore$ The other rational number

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

$= \frac{-6\times5}{1\times5} + \frac{8\times1}{5\times1}$

$= \frac{-30+8}{5} = \frac{-22}{5}$

Question 6.

Which rational number should be added to $\frac{-7}{8}$ to get $\frac{5}{9}$?

Solution:

$$\text{Required rational number} = \frac{5}{9} - \left(\frac{-7}{8}\right)$$

$$= \frac{5}{9} + \frac{7}{8}$$

2	9, 8
2	9, 4
2	9, 2
3	9, 1
3	3, 1
	1, 1

$\therefore$ LCM of 9 and $8 = 2 \times 2 \times 2 \times 3 \times 3 = 72$

$$= \frac{5\times8}{9\times8} + \frac{7\times9}{8\times9}$$

($\because$ LCM of 9 and 8 = 72)

$$= \frac{40}{72} + \frac{63}{72}$$

$$= \frac{40+63}{72} = \frac{103}{72} = 1\frac{31}{72}$$

Question 7.

Which rational number should be added to $\frac{-5}{9}$ to get $\frac{-2}{3}$?

Solution:

Required rational number

$$= \frac{-2}{3} - \left(\frac{-5}{9}\right)$$

$$= \frac{-2}{3} + \frac{5}{9}$$

3	3, 9
3	1, 3
	1, 1

$\therefore$ LCM of 3 and 9 = 9

$$= \frac{-2\times3}{3\times3} + \frac{5\times1}{9\times1}$$

($\because$ LCM of 3 and 9 = 9)

$$= \frac{-6+5}{9} = \frac{-1}{9}$$

Question 8.

Which rational number should be subtracted from $\frac{-5}{6}$ to get $\frac{4}{9}$?

Solution:

Required rational number = $\frac{-5}{6} - \frac{4}{9}$

2	6, 9
3	3, 9
3	1, 3
	1, 1

$\therefore$ LCM of 6 and 9 = 18

$$= \frac{-5\times3}{6\times3} - \frac{4\times2}{9\times2}$$

($\because$ LCM of 6 and 9 = 18)

$$= \frac{-15}{18} - \frac{8}{18}$$

$$= \frac{-15-8}{18} = \frac{-23}{18} = -1\frac{5}{18}$$

Question 9.

(i) What should be subtracted from -2 to get $\frac{3}{8}$

(ii) What should be added to -2 to get $\frac{3}{8}$

Solution:

(*i*) Set the required number be = x

According to the condition,

$$-2 - x = \frac{3}{8}$$

$$\Rightarrow -x = \frac{3}{8} + 2$$

$$\Rightarrow -x = \frac{3+16}{8}$$

$$\Rightarrow x = \frac{-19}{8}$$

$$\therefore \text{ The required number } = \frac{-19}{8}$$

(*ii*) Let the required number be = x

According to the question,

$$-2 + x = \frac{3}{8}$$

$$\Rightarrow x = \frac{3}{8} + 2$$

$$\Rightarrow x = \frac{3+16}{8} = \frac{19}{8} = 2\frac{3}{8}$$

$$\therefore \text{ The required number } = \frac{19}{8} = 2\frac{3}{8}$$

Question 10.

Evaluate:

$(i)\ \frac{3}{7}+\frac{-4}{9}-\frac{-11}{7}-\frac{7}{9}$

$(ii)\ \frac{2}{3}+\frac{-4}{5}-\frac{1}{3}-\frac{2}{5}$

$(iii)\ \frac{4}{7}-\frac{-8}{9}-\frac{-13}{7}+\frac{17}{9}$

solution

$$(i)\ \frac{3}{7}+\frac{-4}{9}-\frac{-11}{7}-\frac{7}{9}$$

$$\Rightarrow \left(\frac{3}{7}-\frac{-11}{7}\right)+\left(\frac{-4}{9}-\frac{7}{9}\right)$$

$$\Rightarrow \left(\frac{3}{7}+\frac{11}{7}\right)+\left(\frac{-4}{9}-\frac{7}{9}\right)$$

$$\Rightarrow \frac{14}{7}+\frac{-11}{9}$$

$$\Rightarrow 2-\frac{11}{9}$$

$$\Rightarrow \frac{2\times 9-11}{9} \Rightarrow \frac{18-11}{9} \Rightarrow \frac{7}{9}$$

(*ii*) $\frac{2}{3}+\frac{-4}{5}-\frac{1}{3}-\frac{2}{5}$

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

$\Rightarrow \frac{1}{3}+\frac{-6}{5}$

$\Rightarrow \frac{1}{3}-\frac{6}{5}$

$\Rightarrow \frac{(1\times 5)-(6\times 3)}{15}$ ($\because$ LCM of 3 and 5 = 15)

$\Rightarrow \frac{5-18}{15} \Rightarrow -\frac{13}{15}$

(*iii*) $\frac{4}{7}-\frac{-8}{9}-\frac{-13}{7}+\frac{17}{9}$

$\Rightarrow \left(\frac{4}{7}-\frac{-13}{7}\right)-\left(\frac{-8}{9}-\frac{17}{9}\right)$

$\Rightarrow \left(\frac{4}{7}+\frac{13}{7}\right)-\left(\frac{-8}{9}-\frac{17}{9}\right)$

$\Rightarrow \frac{17}{7}-\left(\frac{-25}{9}\right)$

$\Rightarrow \frac{17}{7}+\frac{25}{9}$ ($\because$ LCM of 7 and 9 = 63)

$\Rightarrow \frac{17\times 9+25\times 7}{63}$

$\Rightarrow \frac{153+175}{63} \Rightarrow \frac{328}{63} \Rightarrow 5\frac{13}{63}$

EXERCISE 1(C)

Question 1.

Evaluate:

$(i)\ \frac{-14}{5} \times \frac{-6}{7}$ $(ii)\ \frac{7}{6} \times \frac{-18}{91}$

$(iii)\ \frac{-125}{72} \times \frac{9}{-5}$ $(iv)\ \frac{-11}{9} \times \frac{-51}{-44}$

$(v)\ -\frac{16}{5} \times \frac{20}{8}$

Solution:

$(i)\ \frac{-14}{5} \times \frac{-6}{7}$

$= \frac{(-14)\times(-6)}{5\times7} = \frac{(-2)\times(-6)}{5\times1}$

$= \frac{12}{5} = 2\frac{2}{5}$

$(ii)\ \frac{7}{6} \times \frac{-18}{91}$

$= \frac{7\times(-18)}{6\times91} = \frac{1\times(-3)}{1\times13} = \frac{-3}{13}$

$(iii)\ \frac{-125}{72} \times \frac{9}{-5}$

$= \frac{(-125)\times9}{72\times-5} = \frac{25\times1}{8\times1}$

$= \frac{25}{8} = 3\frac{1}{8}$

$(iv)\ \frac{-11}{9} \times \frac{-51}{-44}$

$= \frac{(-11)\times(-51)}{9\times(-44)} = \frac{1\times(-51)}{9\times4}$

$= \frac{-51}{36} = \frac{-17}{12}$

$(v)\ -\frac{16}{5} \times \frac{20}{8}$

$= \frac{(-16)\times20}{5\times8} = \frac{(-2)\times4}{1\times1} = -8$

Question 2.

Multiply:

(i) $\frac{5}{6}$ and $\frac{8}{9}$ (ii) $\frac{2}{7}$ and $\frac{-14}{9}$

(iii) $\frac{-7}{8}$ and 4 (iv) $\frac{36}{-7}$ and $\frac{-9}{28}$

(v) $\frac{-7}{10}$ and $\frac{-8}{15}$ (vi) $\frac{3}{-2}$ and $\frac{-7}{3}$

Solution:

(i) $\frac{5}{6}$ and $\frac{8}{9}$

$= \frac{5\times8}{6\times9} = \frac{5\times4}{3\times9} = \frac{20}{27}$

(ii) $\frac{2}{7}$ and $\frac{-14}{9}$

$= \frac{2\times(-14)}{7\times9} = \frac{2\times(-2)}{1\times9} = \frac{-4}{9}$

(iii) $\frac{-7}{8}$ and 4

$= \frac{(-7)\times4}{8\times1} = \frac{(-7)\times1}{2\times1} = \frac{-7}{2} = 3\frac{1}{2}$

(iv) $\frac{36}{-7}$ and $\frac{-9}{28}$

$= \frac{36\times(-9)}{(-7)\times28} = \frac{9\times(-9)}{(-7)\times7}$

$= \frac{-81}{-49} = \frac{81}{49} = 1\frac{32}{49}$

(v) $\frac{-7}{10}$ and $\frac{-8}{15}$

$= \frac{(-7)\times(-8)}{10\times15} = \frac{(-7)\times(-4)}{5\times15} = \frac{28}{75}$

(vi) $\frac{3}{-2}$ and $\frac{-7}{3}$

$= \frac{3\times(-7)}{(-2)\times3} = \frac{1\times(-7)}{(-2)\times1}$

$= \frac{-7}{-2} = \frac{7}{2} = 3\frac{1}{2}$

Question 3.

Evaluate:

$(i)\ \left(\frac{2}{-3}\times\frac{5}{4}\right)+\left(\frac{5}{9}\times\frac{3}{-10}\right)$

$(ii)\ \left(2\times\frac{1}{4}\right)-\left(\frac{-18}{7}\times\frac{-7}{15}\right)$

$(iii)\ \left(-5\times\frac{2}{15}\right)-\left(-6\times\frac{2}{9}\right)$

$(iv)\ \left(\frac{8}{5}\times\frac{-3}{2}\right)+\left(\frac{-3}{10}\times\frac{9}{16}\right)$

Solution:

$(i)\ \left(\frac{2}{-3}\times\frac{5}{4}\right)+\left(\frac{5}{9}\times\frac{3}{-10}\right)$

$=\left(\frac{2\times5}{(-3)\times4}\right)+\left(\frac{5\times3}{9\times(-10)}\right)$

$=\left(\frac{1\times5}{(-3)\times2}\right)+\left(\frac{1\times1}{3\times(-2)}\right)$

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

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

(*ii*) $\left(2 \times \frac{1}{4}\right) - \left(\frac{-18}{7} \times \frac{-7}{15}\right)$

$$= \left(\frac{2 \times 1}{1 \times 4}\right) - \left(\frac{(-18) \times (-7)}{7 \times 15}\right)$$

$$= \left(\frac{1 \times 1}{1 \times 2}\right) - \left(\frac{(-18) \times (-1)}{1 \times 15}\right)$$

$$= \frac{1}{2} - \frac{18}{15}$$

2	2, 15
3	1, 15
5	1, 5
	1, 1

$\therefore$ LCM of 2 and 15 is $2 \times 3 \times 5 = 30$

$$= \frac{1 \times 15}{2 \times 15} - \frac{18 \times 2}{15 \times 2}$$

($\because$ LCM of 2 and 15 = 30)

$$= \frac{15-36}{30} = \frac{-21}{30} = \frac{-7}{10}$$

(*iii*) $\left(-5 \times \frac{2}{15}\right) - \left(-6 \times \frac{2}{9}\right)$

$$= \left(\frac{(-5) \times 2}{1 \times 15}\right) - \left(\frac{(-6) \times 2}{1 \times 9}\right)$$

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

$$= \frac{-2}{3} - \left(\frac{-4}{3}\right)$$

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

(*iv*) $\left(\frac{8}{5} \times \frac{-3}{2}\right) + \left(\frac{-3}{10} \times \frac{9}{16}\right)$

$$= \left(\frac{8 \times (-3)}{5 \times 2}\right) + \left(\frac{(-3) \times 9}{10 \times 16}\right)$$

$$= \left(\frac{4\times(-3)}{5\times1}\right) + \left(\frac{(-3)\times9}{10\times16}\right)$$

$$= \frac{-12}{5} + \left(\frac{-27}{160}\right)$$

2	160, 5
2	80, 5
2	40, 5
2	20, 5
2	10, 5
5	5, 5
	1

$\therefore$ LCM of 5 and 160 = 160

$$= \frac{(-12)\times32}{5\times32} + \frac{(-27)\times1}{160\times1}$$

$$= \frac{-384-27}{160} = \frac{-411}{160}$$

Question 4.

Multiply each rational number, given below, by one (1):

(*i*) $\frac{7}{-5}$ (*ii*) $\frac{-3}{-4}$

(*iii*) 0 (*iv*) $\frac{-8}{13}$

(*v*) $\frac{-6}{-7}$

Solution:

(*i*) $\frac{7}{-5}$

$= \frac{7}{-5} \times 1 = 1 \times \left(\frac{7}{-5}\right) = \frac{7}{-5}$

(*ii*) $\frac{-3}{-4}$

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

(*iii*) 0

$= 0 \times 1 = 1 \times 0 = 0$

(*iv*) $\frac{-8}{13}$

$= \frac{-8}{13} \times 1 = 1 \times \left(\frac{-8}{13}\right) = \frac{-8}{13}$

(*v*) $\frac{-6}{-7}$

$= \frac{-6}{-7} \times 1 = 1 \times \left(\frac{-6}{-7}\right) = \frac{6}{7}$

Question 5.

For each pair of rational numbers, given below, verify that the multiplication is commutative:

(*i*) $\frac{-1}{5}$ and $\frac{2}{9}$ (*ii*) $\frac{5}{-3}$ and $\frac{13}{-11}$

(*iii*) 3 and $\frac{-8}{9}$ (*iv*) 0 and $\frac{-12}{17}$

Solution:

(*i*) $\frac{-1}{5}$ and $\frac{2}{9}$

$= \frac{-1}{5} \times \frac{2}{9} = \frac{(-1)\times 2}{5\times 9} = \frac{-2}{45}$

And, $\frac{2}{9} \times \left(\frac{-1}{5}\right) = \frac{2\times(-1)}{9\times 5} = \frac{-2}{45}$

$\therefore \frac{-1}{5} \times \frac{2}{9} = \frac{2}{9} \times \frac{-1}{5}$

(*ii*) $\frac{5}{-3}$ and $\frac{13}{-11}$

$= \frac{5}{-3} \times \frac{13}{-11} = \frac{5\times 13}{(-3)\times(-11)} = \frac{65}{33}$

And, $\frac{13}{-11} \times \frac{5}{-3} = \frac{13\times 5}{(-3)\times(-11)} = \frac{65}{33}$

$\therefore \frac{5}{-3} \times \frac{13}{-11} = \frac{13}{-11} \times \frac{5}{-3}$

(*iii*) 3 and $\frac{-8}{9}$

$= \frac{3}{1} \times \frac{-8}{9} = \frac{1\times(-8)}{1\times 3} = \frac{-8}{3}$

And, $\frac{-8}{9} \times \frac{3}{1} = \frac{(-8)\times 1}{3\times 1} = \frac{-8}{3}$

$\therefore\ 3 \times \frac{-8}{9} = \frac{-8}{9} \times 3$

(*iv*) 0 and $\frac{-12}{17}$

$= 0 \times \frac{-12}{17} = \frac{0\times(-12)}{1\times 17} = 0$

And $\frac{-12}{17} \times 0 = \frac{(-12)\times 0}{17\times 1} = 0$

$\therefore\ 0 \times \frac{(-12)}{17} = \frac{(-12)}{17} \times 0$

Question 6.

Write the reciprocal (multiplicative inverse) of each rational number, given below :

(*i*) 5 (*ii*) –3

(*iii*) $\frac{5}{11}$ (*iv*) $\frac{-7}{-8}$

(*v*) $\frac{-7}{-8}$ (*vi*) $\frac{15}{-17}$

Solution:

(*i*) $5 = \frac{1}{5}$

(*ii*) $-3 = \frac{1}{-3}$

(*iii*) $\frac{5}{11} = \frac{11}{5} = 2\frac{1}{5}$

(*iv*) $\frac{-7}{-8} = \frac{8}{7} = 1\frac{1}{7}$

(*v*) $\frac{-7}{-8} = \frac{8}{7} = 1\frac{1}{7}$

(*vi*) $\frac{15}{-17} = \frac{-17}{15} = 1\frac{2}{15}$

Question 7.

Find the reciprocal (multiplicative inverse) of:

(*i*) $\frac{3}{5} \times \frac{2}{3}$

(*ii*) $\frac{-8}{3} \times \frac{13}{-7}$

(*iii*) $\frac{-3}{5} \times \frac{-1}{13}$

Solution:

$$(i)\ \frac{3}{5} \times \frac{2}{3} = \frac{3\times 2}{5\times 3}$$

$$= \frac{1\times 2}{5\times 1} = \frac{2}{5} = \frac{5}{2}$$

$$(ii)\ \frac{-8}{3} \times \frac{13}{-7} = \frac{(-8)\times 13}{3\times(-7)}$$

$$= \frac{-104}{-21} = \frac{21}{104}$$

$$(iii)\ \frac{-3}{5} \times \frac{-1}{13} = \frac{(-3)\times(-1)}{5\times 13}$$

$$= \frac{3}{65} = \frac{65}{3} = 21\frac{2}{3}$$

Question 8.

Verify that $(x + y) \times z = x \times z + y \times z$, if

$(i)\ x = \frac{4}{5}, y = \frac{-2}{3}$ and $z = -4$

$(ii)\ x = 2, y = \frac{4}{5}$ and $z = \frac{3}{-10}$

Solution:

(*i*) $x = \frac{4}{5}, y = \frac{-2}{3}$ and $z = -4$

Using, $(x + y) \times z = x \times z + y \times z$

$$\Rightarrow \left(\frac{4}{5}+\frac{-2}{3}\right) \times -4 = \frac{4}{5} \times -4 + \frac{-2}{3} \times -4$$

$$\Rightarrow \left(\frac{4\times3}{5\times3}-\frac{2\times5}{3\times5}\right) \times -4 = \frac{-16}{5} + \frac{8}{3}$$

$$\Rightarrow \frac{12-10}{15} \times -4 = \frac{-48+40}{15}$$

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

(*ii*) $x = 2, y = \frac{4}{5}$ and $z = \frac{3}{-10}$

Using, $(x + y) \times z = x \times z + y \times z$

$$\Rightarrow \left(\frac{2}{1}+\frac{4}{5}\right) \times \frac{3}{-10} = 2 \times \frac{3}{-10} + \frac{4}{5} \times \frac{3}{-10}$$

$$\Rightarrow \left(\frac{2\times5}{1\times5}+\frac{4\times1}{5\times1}\right) \times \frac{3}{-10} = \frac{3}{-5} + \frac{6}{-25}$$

$$\Rightarrow \left(\frac{10+4}{5}\right) \times \frac{3}{-10} = \frac{-3\times5}{5\times5} + \frac{-6\times1}{5\times5}$$

$$\Rightarrow \frac{14}{5} \times \frac{3}{-10} = \frac{-15-6}{25}$$

$$\Rightarrow \frac{-21}{25} = \frac{-21}{25}$$

Hence proved.

Question 9.

Verify that $x \times (y - z) = x \times y - x \times z$, if

(*i*) $x = \frac{4}{5}, y = -\frac{7}{4}$ and $z = 3$

(*ii*) $x = \frac{3}{4}, y = \frac{8}{9}$ and $z = -5$

Solution:

(*i*) $x = \frac{4}{5}, y = -\frac{7}{4}$ and $z = 3$

Using, $x \times (y - z) = x \times y - x \times z$

$$\Rightarrow \frac{4}{5} \times \left(\frac{-7}{4} - 3\right) = \frac{4}{5} \times \frac{-7}{4} - \frac{4}{5} \times 3$$

$$\Rightarrow \frac{4}{5} \times \left(\frac{-7 \times 1 - 3 \times 4}{4}\right) = \frac{-7}{5} - \frac{12}{5}$$

$$\Rightarrow \frac{4}{5} \times \left(\frac{-7 - 12}{4}\right) = \frac{-7 - 12}{5}$$

$$\Rightarrow \frac{4}{5} \times \frac{-19}{4} \Rightarrow \frac{-19}{5} = \frac{-19}{5}$$

(*ii*) $x = \frac{3}{4}, y = \frac{8}{9}$ and $z = -5$

Using, $x \times (y - z) = x \times y - x \times z$

$$\Rightarrow \frac{3}{4} \times \left(\frac{8}{9} - (-5)\right) = \frac{3}{4} \times \frac{8}{9} - \frac{3}{4} \times (-5)$$

$$\Rightarrow \frac{3}{4} \times \left(\frac{8 \times 1}{9 \times 1} + \frac{5 \times 9}{1 \times 9}\right) = \frac{2}{3} + \frac{15}{4}$$

$$\Rightarrow \frac{3}{4} \times \left(\frac{8 + 45}{9}\right) = \frac{2 \times 4}{3 \times 4} + \frac{15 \times 3}{4 \times 3}$$

$$\Rightarrow \frac{3}{4} \times \frac{53}{9} = \frac{8 + 45}{12}$$

$$\Rightarrow \frac{53}{12} = \frac{53}{12}$$

Question 10.

Name the multiplication property of rational numbers shown below :

(i) $\frac{3}{5} \times \frac{-8}{9} = \frac{-8}{9} \times \frac{3}{5}$

(ii) $\frac{-3}{4} \times \left(\frac{5}{7} \times \frac{-8}{15}\right) = \left(\frac{-3}{4} \times \frac{5}{7}\right) \times \frac{-8}{15}$

(iii) $\frac{4}{5} \times \left(\frac{3}{-8} + \frac{-4}{7}\right) = \frac{4}{5} \times \frac{3}{-8} + \frac{4}{5} \times \frac{-4}{7}$

(iv) $\frac{-7}{5} \times \frac{5}{-7} = 1$

(v) $\frac{8}{-9} \times 1 = 1 \times \frac{8}{-9} = \frac{8}{-9}$

(vi) $\frac{-3}{4} \times 0 = 0$

Solution:

(i) Commutativity property.
(ii) Associativity property.
(iii) Distributivity property.
(iv) Existence of inverse.
(v) Existence of identity.
(vi) Existence of inverse.

Question 11.

Fill in the blanks:

(i) The product of two positive rational numbers is always ……
(ii) The product of two negative rational numbers is always ……
(iii) If two rational numbers have opposite signs then their product is always ……..
(iv) The reciprocal of a positive rational number is ……. and the reciprocal of a negative raitonal number is ……
(v) Rational number 0 has …….. reciprocal.
(vi) The product of a rational number and its reciprocal is ……..
(vii) The numbers …….. and …….. are their own reciprocals.
(viii) If m is reciprocal of n, then the reciprocal of n is ……

Solution:

(i) The product of two positive rational numbers is always **positive.**
(ii) The product of two negative rational numbers is always **positive.**
(iii) If two rational numbers have opposite signs then their product is always **negative.**
(iv) The reciprocal of a positive rational number is **positive** and the reciprocal of a negative raitonal number is **negative**.
(v) Rational number 0 has **no** reciprocal.

(vi) The product of a rational number and its reciprocal is **1.**
(vii) The numbers **1** and **-1** are their own reciprocals.
(viii)If m is reciprocal of n, then the reciprocal of n is **m**.

EXERCISE 1(D)

Question 1.
Evaluate:

$(i)\ 1 \div \frac{1}{3}$ $(ii)\ 3 \div \frac{3}{5}$

$(iii)\ -\frac{5}{12} \div \frac{1}{16}$ $(iv)\ -\frac{21}{16} \div \left(\frac{-7}{8}\right)$

$(v)\ 0 \div \left(-\frac{4}{7}\right)$ $(vi)\ \frac{8}{-5} \div \frac{24}{25}$

$(vii)\ -\frac{3}{4} \div (-9)$ $(viii)\ \frac{3}{4} \div \left(-\frac{5}{12}\right)$

$(ix)\ -5 \div \left(-\frac{10}{11}\right)$ $(x)\ \frac{-7}{11} \div \left(\frac{-3}{44}\right)$

Solution:

(*i*) $1 \div \frac{1}{3}$

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

(*ii*) $3 \div \frac{3}{5}$

$= 3 \times \frac{5}{3} = \frac{1 \times 5}{1 \times 1} = 5$

(*iii*) $-\frac{5}{12} \div \frac{1}{16}$

$= -\frac{5}{12} \times \frac{16}{1}$

$= \frac{-5 \times 4}{3 \times 1} = \frac{-20}{3} = -5\frac{5}{3}$

(*iv*) $-\frac{21}{16} \div \left(\frac{-7}{8}\right)$

$= -\frac{21}{16} \times \frac{8}{-7}$

$= \frac{3 \times 1}{2 \times 1} = \frac{3}{2} = 1\frac{1}{2}$

(*v*) $0 \div \left(-\frac{4}{7}\right)$

$= 0 \times \left(-\frac{7}{4}\right) = 0$

(*vi*) $\frac{8}{-5} \div \frac{24}{25}$

$= \frac{8}{-5} \times \frac{25}{24}$

$$= \frac{2\times5}{(-1)\times6} = \frac{1\times5}{(-1)\times3} = \frac{-5}{3}$$

(*vii*) $-\frac{3}{4} \div (-9)$

$$= -\frac{3}{4} \times \frac{1}{-9} = \frac{(-1)\times1}{4\times(-3)} = \frac{1}{12}$$

(*viii*) $\frac{3}{4} \div \left(-\frac{5}{12}\right)$

$$= \frac{3}{4} \times \left(-\frac{12}{5}\right)$$

$$= \frac{3\times3}{1\times(-5)} = -\frac{9}{5}$$

(*ix*) $-5 \div \left(-\frac{10}{11}\right)$

$$= -5 \times \frac{11}{-10}$$

$$= \frac{1\times11}{1\times2} = \frac{11}{2} = 5\frac{1}{2}$$

(*x*) $\frac{-7}{11} \div \left(\frac{-3}{44}\right)$

$$= \frac{-7}{11} \times \left(\frac{44}{-3}\right)$$

$$= \frac{(-7)\times4}{1\times(-3)} = \frac{28}{3} = 9\frac{1}{3}$$

Question 2.
Divide:

(*i*) 3 by $\frac{1}{3}$ (*ii*) -2 by $\left(-\frac{1}{2}\right)$

(*iii*) 0 by $\frac{7}{-9}$ (*iv*) $\frac{-5}{8}$ by $\frac{1}{4}$

(*v*) $-\frac{3}{4}$ by $-\frac{9}{16}$

Solution:

(*i*) 3 by $\frac{1}{3}$

$= 3 \div \frac{1}{3} = 3 \times \frac{3}{1} = 9$

(*ii*) -2 by $\left(-\frac{1}{2}\right)$

$= -2 \div \left(-\frac{1}{2}\right)$

$= -2 \times \frac{2}{-1} = 4$

(*iii*) 0 by $\frac{7}{-9}$

$= 0 \div \frac{7}{-9}$

$= 0 \times \frac{-9}{7} = 0$

(iv) $\frac{-5}{8}$ by $\frac{1}{4}$

$= \frac{-5}{8} \div \frac{1}{4}$

$= \frac{-5}{8} \times \frac{4}{1}$

$= \frac{-5 \times 1}{2 \times 1} = \frac{-5}{2}$

(v) $-\frac{3}{4}$ by $-\frac{9}{16}$

$= -\frac{3}{4} \div -\frac{9}{16}$

$= -\frac{3}{4} \times -\frac{16}{9} = \frac{(-1) \times 4}{1 \times (-3)}$

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

Question 3.

The product of two rational numbers is -2. If one of them is $\frac{4}{7}$, find the other.

Solution:

$\because$ The product of two numbers is = –2

And, one of them is $\frac{4}{7}$

$\therefore$ The other number = $-2 \div \frac{4}{7}$

$= -2 \times \frac{7}{4}$

$= \frac{-1 \times 7}{1 \times 2} = \frac{-7}{2}$

Question 4.

The product of two numbers is $\frac{-4}{9}$. If one of them is $\frac{-2}{27}$, find the other.

Solution:

$\because$ The product of two numbers is $= -\frac{4}{9}$

And, one of them is $= \frac{-2}{27}$

$\therefore$ The other number $= -\frac{4}{9} \div \left(\frac{-2}{27}\right)$

$= -\frac{4}{9} \times \frac{27}{-2}$

$= \frac{2 \times 3}{1 \times 1} = 6$

Question 5.

m and n are two rational numbers such that

$m \times n = -\frac{25}{9}$.

(*i*) if $m = \frac{5}{3}$, find n,

(*ii*) if $n = -\frac{10}{9}$, find m.

Solution:

$$\because m \times n = -\frac{25}{9}$$

$$(i)\ m = \frac{5}{3}$$

$$\therefore \frac{5}{3} \times n = \frac{-25}{9}$$

$$n = \frac{-25}{9} \times \frac{3}{5}$$

$$n = \frac{-5 \times 1}{3 \times 1} = \frac{-5}{3}$$

$$(ii)\ m \times -\frac{10}{9} = \frac{-25}{9}$$

$$m = \frac{-25}{9} \times \frac{9}{-10}$$

$$m = \frac{5 \times 1}{1 \times 2} = \frac{5}{2} = 2\frac{1}{2}$$

Question 6.

By what number must $\frac{-3}{4}$ be multiplied so that the product is $\frac{-9}{16}$?

Solution:

$$\because \text{The product of two numbers is} = -\frac{9}{16}$$

$$\text{And, one of them is} = -\frac{3}{4}$$

$$\therefore \text{The other number} = -\frac{9}{16} \div \left(-\frac{3}{4}\right)$$

$$= -\frac{9}{16} \times \left(-\frac{4}{3}\right)$$

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

Question 7.

By what number should $\frac{-8}{13}$ be multiplied to get 16?

Solution:

$\because$ Required number

$$= 16 \div \left(\frac{-8}{13}\right)$$

$$= 16 \times \left(\frac{13}{-8}\right)$$

$$= (-2) \times 13 = 26$$

Question 8.

If $3\frac{1}{2}$ litres of milk costs ₹49, find the cost of one litre of milk?

Solution:

$$\text{Given, Cost of } 3\frac{1}{2} \text{ or } \frac{7}{2} \text{ litres} = ₹49$$

$$\therefore \text{ Value of one litre milk} = ₹49 \div \frac{7}{2}$$

$$= ₹49 \times \frac{2}{7}$$

$$= ₹7 \times 2 = ₹14$$

Question 9.

Cost of $3\frac{2}{5}$ metre of cloth is ₹$88\frac{1}{2}$. What is the cost of 1 metre of cloth?

$$\text{Given, Cost of } 3\frac{2}{5} \text{ or } \frac{17}{5} \text{ metre cloth or}$$

$$= ₹88\frac{1}{2} = ₹\frac{177}{2}$$

$$\therefore \text{ Cost of one metre cloth} = \frac{177}{2} \div \frac{17}{5}$$

$$= \frac{177}{2} \times \frac{5}{17} = ₹\frac{885}{34} = ₹26\frac{1}{34}$$

Question 10.

Divide the sum of $\frac{3}{7}$ and $\frac{-5}{14}$ by $\frac{-1}{2}$.

Solution:

$$\left[\frac{3}{7}+\left(\frac{-5}{14}\right)\right] \div \frac{-1}{2}$$

$\therefore$ LCM of 7 and 14 = 14

$$= \left[\frac{3}{7}\times\frac{2}{2}-\frac{5}{14}\right] \div \frac{-1}{2}$$

$$= \left[\frac{6-5}{14}\right] \div \frac{-1}{2}$$

$$= \frac{1}{14} \times \frac{-2}{1}$$

$$= \frac{1\times(-1)}{7\times1} = \frac{-1}{7}$$

Question 11.

Find $(m + n) \div (m - n)$, if :

(*i*) $m = \frac{2}{3}$ and $n = \frac{3}{2}$

(*ii*) $m = \frac{3}{4}$ and $n = \frac{4}{3}$

(*iii*) $m = \frac{4}{5}$ and $n = -\frac{3}{10}$

(*i*) $m = \frac{2}{3}$ and $n = \frac{3}{2}$

Using formula $(m + n) \div (m - n)$

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

$$= \left(\frac{2\times 2}{3\times 2}+\frac{3\times 3}{2\times 3}\right) \div \left(\frac{2\times 2}{3\times 2}-\frac{3\times 3}{2\times 3}\right)$$

($\because$ LCM of 3 and 2 = 6)

$$= \left(\frac{4+9}{6}\right) \div \left(\frac{4-9}{6}\right)$$

$$= \frac{13}{6} \div \left(\frac{-5}{6}\right)$$

$$= \frac{13}{6} \times \frac{6}{-5} = -\frac{13}{5}$$

(*ii*) $m = \frac{3}{4}$ and $n = \frac{4}{3}$

Using formula $(m + n) \div (m - n)$

$$= \left(\frac{3}{4}+\frac{4}{3}\right) \div \left(\frac{3}{4}-\frac{4}{3}\right)$$

$$= \left(\frac{3\times 3}{4\times 3}+\frac{4\times 4}{3\times 4}\right) \div \left(\frac{3\times 3}{4\times 3}-\frac{4\times 4}{3\times 4}\right)$$

($\because$ LCM of 3 and 4 = 12)

$$= \left(\frac{9+16}{12}\right) \div \left(\frac{9-16}{12}\right)$$

$$= \frac{25}{12} \div -\frac{7}{12}$$

$$= \frac{25}{12} \times -\frac{12}{7} = -\frac{25}{7}$$

(iii) $m = \frac{4}{5}$ and $n = -\frac{3}{10}$

Using formula $= (m + n) \div (m - n)$

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

$$= \left(\frac{4\times2}{5\times2} - \frac{3\times1}{10\times1}\right) \div \left(\frac{4\times2}{5\times2} + \frac{3\times1}{10\times1}\right)$$

($\because$ LCM of 5 and 10 = 10)

$$= \left(\frac{8-3}{10}\right) \div \left(\frac{8+3}{10}\right)$$

$$= \frac{5}{10} \div \frac{11}{10}$$

$$= \frac{1}{2} \times \frac{10}{11} = \frac{5}{11}$$

Question 12.

The product of two rational numbers is -5. If one of these numbers is $\frac{-7}{15}$, find the other.

Solution:

Let the required rational number be $= x$

Other number $= \frac{-7}{15}$

Product of rational numbers $= -5$

$$\Rightarrow \frac{-7}{15} \times x = -5$$

$$\Rightarrow -7x = -5 \times 15$$

$$\Rightarrow x = \frac{-75}{-7} = \frac{75}{7}$$

$\therefore$ The required rational number $= \frac{75}{7}$

Question 13.

Divide the sum of $\frac{5}{8}$ and $\frac{-11}{12}$ by the difference of $\frac{3}{7}$ and $\frac{5}{14}$.

Solution:

Sum of $\frac{5}{8}$ and $\frac{-11}{12} = \frac{5}{8} + \left(\frac{-11}{12}\right)$

$= \frac{5}{8} - \frac{11}{12}$

$= \frac{(5\times3)-(11\times2)}{24}$

($\because$ LCM of 8 and 12 is 24)

$= \frac{15-22}{24} = \frac{-7}{24}$

Now, difference of $\frac{3}{7}$ and $\frac{5}{14}$

$= \frac{3}{7} - \frac{5}{14}$ or $\frac{5}{14} - \frac{3}{7}$

$= \frac{(3\times2)-(5\times1)}{14}$ or $\frac{5-(3\times2)}{14}$

($\because$ LCM of 7 and 13 = 14)

$= \frac{6-5}{14}$ or $\frac{5-6}{14} = \frac{1}{14}$ or $\frac{-1}{14}$

Now, divide $\frac{-7}{24}$ by $\frac{1}{14}$ or $\frac{-1}{14}$

$= \frac{\frac{-7}{24}}{\frac{1}{14}}$ or $\frac{\frac{-7}{24}}{\frac{-1}{14}}$

$= \frac{-7}{24} \times \frac{14}{1}$ or $\frac{-7}{24} \times \frac{-14}{1}$

$= \frac{-49}{12}$ or $\frac{49}{12} = -4\frac{1}{12}$ or $4\frac{1}{12}$

EXERCISE 1(E)

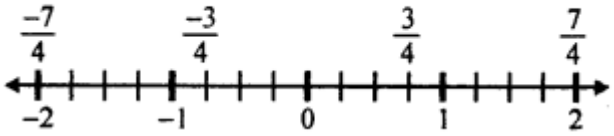
Question 1.

Draw a number line and mark

$\frac{3}{4}, \frac{7}{4}, \frac{-3}{4}$ and $\frac{-7}{4}$ on it.

Solution:

Draw a number line as shown below :



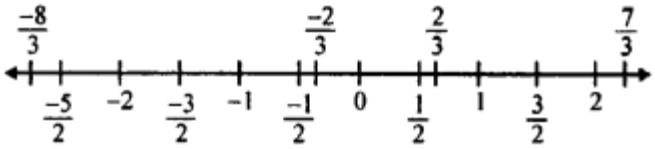
Question 2.

On a number line mark the points

$\frac{2}{3}, \frac{-8}{3}, \frac{7}{3}, \frac{-2}{3}$ and -2.

Solution:

Draw a number line as shown below :



Question 3.

Insert one rational number between (0 7 and 8 (ii) 3.5 and 5

(i) 2 and 3.2

(ii) 3.5 and 5

(iii) 2 and 3.2

(iv) 4.2 and 3.6

(v) $\frac{1}{2}$ and 2

Solution:

(*i*) The rational number between 7 and 8

$$= \frac{7+8}{2} = \frac{15}{2} = 7.5$$

(*ii*) The rational number between 3.5 and 5

$$= \frac{3.5+5}{2} = \frac{8.5}{2} = 4.25$$

(*iii*) The rational number between 2 and 3.2

$$= \frac{2+3.2}{2} = \frac{5.2}{2} = 2.6$$

(*iv*) The rational number between 4.2 and 3.6

$$= \frac{4.2+3.6}{2} = \frac{7.8}{2} = 3.9$$

(*v*) The rational number between $\frac{1}{2}$ and 2

$$= \frac{1+2}{2\times 2} = \frac{3}{4} = 1.25$$

Question 4.

Insert two rational numbers between

(i) 6 and 7

(ii) 4.8 and 6

(iii) 2.7 and 6.3

Solution:

(*i*) 6 and 7

Given numbers = 6 and 7

$= 6, \frac{6+7}{2}, 7$

(Inserting one rational number between 6 and 7)

$= 6, \frac{13}{2}, 7$

$= 6, 6.5, 7$

$= 6, \frac{6+6.5}{2}, 6.5, 7$

$= 6, 6.25, 6.5, 7$

$\therefore$ Required rational numbers between 6 and 7 are = 6.25 and 6.5

(*ii*) 4.8 and 6

Given numbers = 4.8 and 6

$= 4.8, \frac{4.8+6}{2}, 6$

$= 4.8, 5.4, 6$

(Insert one rational number 4.8 and 6)

$= 4.8, \frac{4.8+5.4}{2}, 5.4, 6$

$= 4.8, 5.1, 5.4, 6$

$\therefore$ Required rational numbers between 4.8 and 6 are = 5.1 and 5.4

(*iii*) 2.7 and 6.3

Given numbers = 2.7 and 6.3

$= 2.7, \frac{2.7+6.3}{2}, 6.3$

$= 2.7, 4.5, 6.3$

$= 2.7, 4.5, \frac{4.5+6.3}{2}, 4.5, 6.3$

$= 2.7, 4.5, 5.4, 6.3$

∴ Required rational numbers between 2.7 and 6.3 are 4.5 and 5.4

Question 5.

Insert three rational numbers between
(i) 3 and 4
(ii) 10 and 12

Solution:

(*i*) 3 and 4

Given numbers = 3 and 4

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

$= 3, 3.5, 4$

$= 3, \frac{3+3.5}{2}, 3.5, \frac{3.5+4}{2}, 4$

$= 3, 3.25, 3.5, 3.75, 4$

Required rational numbers between 3 and 4 are

= 3.25, 3.5 and 3.75

(*ii*) 10 and 12

Given numbers = 10 and 12

$= 10, \frac{10+12}{2}, 12$

$= 10, 11, 12$

$= 10, \frac{10+11}{2}, 11, \frac{11+12}{2}, 2$

$= 10, 10.5, 11, 11.5, 12$

Required rational numbers between 10 and 12 are

= 10.5, 11, 11.5

Question 6.

Insert five rational numbers between $\frac{3}{5}$ and $\frac{2}{5}$

LCM of denominators 5 and 3 is 15

Make, denominator of each given rational number equal to 15 *i.e.*, the LCM

$$\frac{3}{5} = \frac{3\times3}{5\times3} = \frac{9}{15} \text{ and}$$

$$\frac{2}{3} = \frac{2\times5}{3\times5} = \frac{10}{15}$$

Since, five rational numbers are required, multiply the numerator and denominator of each rational number by 5 + 1 = 6

$$\therefore \frac{9}{15} = \frac{9\times6}{15\times6} = \frac{54}{90} \text{ and}$$

$$\frac{10}{15} = \frac{10\times6}{15\times6} = \frac{60}{90}$$

$\therefore$ Required rational numbers between $\frac{3}{5}$ and $\frac{2}{3}$ are $= \frac{55}{90}, \frac{56}{90}, \frac{57}{90}, \frac{58}{90}$ and $\frac{59}{90}$

$$= \frac{11}{18}, \frac{28}{45}, \frac{19}{35}, \frac{29}{45} \text{ and } \frac{59}{90}$$

Question 7.

Insert six rational numbers between $\frac{5}{6}$ and $\frac{8}{9}$

LCM of denominators 6 and 9 is 18

Make, denominator of each given rational number equal to 18 *i.e.*, the LCM

$$\frac{5}{6} = \frac{5\times3}{6\times3} = \frac{15}{18} \text{ and}$$

$$\frac{8}{9} = \frac{8\times2}{9\times2} = \frac{16}{18}$$

Since, six rational numbers are required, multiply the numerator and denominator of each rational number by 6 + 1 = 7

$$\therefore \frac{15}{18} = \frac{15\times7}{18\times7} = \frac{105}{126} \text{ and}$$

$$\frac{16}{18} = \frac{16\times7}{18\times7} = \frac{112}{126}$$

$\therefore$ Required rational numbers between $\frac{5}{6}$ and $\frac{8}{9}$ are $= \frac{106}{126}, \frac{107}{126}, \frac{108}{126}, \frac{109}{126}, \frac{110}{126}, \frac{111}{126}$

$$= \frac{53}{63}, \frac{107}{126}, \frac{6}{7}, \frac{109}{126}, \frac{55}{63}, \frac{37}{42}$$

Question 8.

Insert seven rational numbers between 2 and 3.

Solution:

As, we have to find 7 rational numbers between 2 and 3, we multiply the numbers by $\frac{8}{8}$

$\therefore\ 2 = 2 \times \frac{8}{8} = \frac{16}{8}$

and $3 = 3 \times \frac{8}{8} = \frac{24}{8}$

Thus, 7 rational numbers between 2 and 3 $\left(i.e., \frac{16}{8} \text{ and } \frac{24}{8}\right)$ are =

$$\frac{17}{8}, \frac{18}{8}, \frac{19}{8}, \frac{20}{8}, \frac{21}{8}, \frac{22}{8}, \frac{23}{8}$$

$$= \frac{17}{8}, \frac{9}{4}, \frac{19}{8}, \frac{5}{2}, \frac{21}{8}, \frac{11}{4}, \frac{23}{8}$$

$$= 2\frac{1}{8}, 2\frac{1}{4}, 2\frac{3}{8}, 2\frac{1}{2}, 2\frac{5}{8}, 2\frac{3}{4} \text{ and } 2\frac{7}{8}$$