

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 $\frac{3}{8}$

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

($\because$ Denominators are same, $\therefore$ LCM = 8)

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

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

Which is a rational number.

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

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

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

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

Which is a rational number.

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

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

($\because$ Denominators are same, $\therefore$ LCM = 11)

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

Which is a rational number.

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

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

$$= \frac{-5 \times 3}{26 \times 3} + \frac{8 \times 2}{39 \times 2}$$

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

$$\therefore \text{ LCM of 26 and 39} = 2 \times 3 \times 13 = 78$$

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

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

Which is a rational number.

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

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

$$\begin{array}{r|l} 2 & 6, 3 \\ 3 & 3, 3 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{LCM of } 6, 3 = 2 \times 3 = 6$$

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

$$(\because \text{LCM of } 6 \text{ and } 3 = 6)$$

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

Which is a rational number.

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

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

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

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

Which is a rational number.

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

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

$$\begin{array}{r|l} 2 & 4, 8 \\ 2 & 2, 4 \\ 2 & 2, 2 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{LCM of } 4 \text{ and } 8 = 2 \times 2 \times 2 = 8$$

$$= \frac{-9 \times 2}{4 \times 2} - \frac{3 \times 1}{8 \times 1}$$

$$(\because \text{LCM of } 4 \text{ and } 8 = 8)$$

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

Which is a rational number.

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

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

$$= \frac{-7 \times 3}{18 \times 3} + \frac{8 \times 2}{27 \times 2}$$

$$\begin{array}{r|l} 2 & 18, 27 \\ 3 & 9, 27 \\ 3 & 3, 9 \\ 3 & 1, 3 \\ & 1, 1 \end{array}$$

$$\therefore \text{LCM of 18 and 27} = 2 \times 3 \times 3 \times 3 = 54$$

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

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:

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

$$\begin{array}{r|l} 2 & 9, 6 \\ 3 & 9, 3 \\ 3 & 3, 1 \\ \hline & 1, 1 \end{array}$$

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

$$= \frac{5 \times 2}{9 \times 2} - \frac{7 \times 3}{6 \times 3}$$

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

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

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

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

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

$$= \frac{4 \times 5}{1 \times 5} - \frac{3 \times 1}{5 \times 1} \quad (\because \text{LCM of 1 and 5} = 5)$$

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

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

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

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

$$\begin{array}{r|l} 2 & 15, 12 \\ \hline 2 & 15, 6 \\ \hline 3 & 15, 3 \\ \hline 5 & 5, 1 \\ \hline & 1, 1 \end{array}$$

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

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

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

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

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

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

$$\begin{array}{r|l} 2 & 9, 4 \\ \hline 2 & 9, 2 \\ \hline 3 & 9, 1 \\ \hline 3 & 3, 1 \\ \hline & 1, 1 \end{array}$$

$$(\therefore \text{LCM of 9 and 4} = 2 \times 2 \times 3 \times 3 = 36)$$

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

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

$$(\therefore \text{LCM of 9 and 4} = 36)$$

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

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

$$\begin{array}{r|l} 2 & 9, 12 \\ \hline 2 & 9, 6 \\ \hline 3 & 9, 3 \\ \hline 3 & 3, 1 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{LCM of 9, 12} = 2 \times 2 \times 3 \times 3 = 36$$

$$= \frac{-8 \times 4}{9 \times 4} - \frac{5 \times 3}{12 \times 3}$$

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

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

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

$$= \frac{0 \times 7}{1 \times 7} - \frac{2 \times 1}{7 \times 1} \quad (\therefore \text{LCM of 0 and 7} = 7)$$

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

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

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

$$(\therefore \text{LCM of 0 and 11} = 11)$$

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

$$\begin{aligned}
 \text{(viii)} \quad & 2 + \frac{-3}{5} \\
 &= \frac{2}{1} - \frac{3}{5} \quad (\because \text{LCM of 1 and 5} = 5) \\
 &= \frac{2 \times 5}{1 \times 5} - \frac{3 \times 1}{5 \times 1} \\
 &= \frac{10 - 3}{5} = \frac{7}{5} = 1\frac{2}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ix)} \quad & \frac{4}{-9} + 1 \\
 &= \frac{-4}{9} + \frac{1}{1} \quad (\because \text{LCM of 9 and 1} = 9) \\
 &= \frac{-4 \times 1}{9 \times 1} + \frac{1 \times 9}{1 \times 9} \\
 &= \frac{-4 + 9}{9} = \frac{5}{9}
 \end{aligned}$$

Question 3.

Evaluate:

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

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

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

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

Solution:

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

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

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

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

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

$$\begin{array}{r|l} 3 & 7, 3 \\ 7 & 7, 1 \\ \hline & 1, 1 \end{array}$$

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

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

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

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

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

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

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

$$= \frac{3}{3} + \left(\frac{-2}{5} \right) \qquad \begin{array}{r|l} 3 & 3, 5 \\ 5 & 1, 5 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{LCM of 3 and 5} = 3 \times 5 = 15$$

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

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

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

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

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

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

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

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

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

$$(\because \text{LCM of 1 and 7} = 7)$$

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

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

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

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

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

$$\begin{array}{r|l}
 2 & 4, 6, 7 \\
 2 & 2, 3, 7 \\
 3 & 1, 3, 7 \\
 7 & 1, 1, 7 \\
 \hline
 & 1, 1, 1
 \end{array}$$

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

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

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

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

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

Question 4.

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

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

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

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

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

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

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

Solution:

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

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

$$\therefore \frac{-8}{7} + \frac{5}{14} \qquad \begin{array}{r|l} 2 & 7, 14 \\ \hline 7 & 7, 7 \\ \hline & 1, 1 \end{array}$$

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

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

$$\begin{array}{r|l} 2 & 9, 12 \\ \hline 2 & 9, 6 \\ \hline 3 & 9, 3 \\ \hline 3 & 3, 1 \\ \hline & 1, 1 \end{array}$$

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

$$= \frac{5 \times 4}{9 \times 4} - \frac{5 \times 3}{12 \times 3}$$

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

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

$$= \frac{5 \times 3}{-12 \times 3} + \frac{5 \times 4}{9 \times 4}$$

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

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

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

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

To show that :

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

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

$$\begin{array}{r|l} 5 & 5, 15 \\ 3 & 1, 3 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{LCM of 5 and 15} = 5 \times 3 = 15$$

$$\begin{aligned} &= \frac{-4 \times 3}{5 \times 3} + \frac{13 \times 1}{15 \times 1} \\ &= \frac{-12 + 13}{15} = \frac{1}{15} \end{aligned}$$

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

$$\begin{aligned} &= \frac{13 \times 1}{15 \times 1} + \frac{-4 \times 3}{5 \times 3} \\ &= \frac{13 - 12}{15} = \frac{1}{15} \end{aligned}$$

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

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

$$= \frac{-2 \times 3}{5 \times 3} - \frac{11 \times 1}{15 \times 1}$$

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

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

$$= \frac{-11 \times 1}{15 \times 1} - \frac{2 \times 3}{5 \times 3} = \frac{-11 - 6}{15} = \frac{-17}{15}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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:

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

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

Solution:

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

Show that :

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

$$\therefore \frac{1}{2} + \left(\frac{2}{3} + \frac{-1}{6} \right) \qquad \begin{array}{r|l} 2 & 3, 6 \\ 3 & 3, 3 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 3 and 6 = 6

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

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

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

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

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

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

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

$$\begin{array}{r|l} 2 & 2, 3 \\ 3 & 1, 3 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 2 and 3 = 6

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

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

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

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

This verifies associative property of the addition of rational numbers.

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

Show that :

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

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

$$\begin{array}{r|l} 2 & 15, 10 \\ 3 & 15, 5 \\ 5 & 5, 5 \\ \hline & 1, 1 \end{array}$$

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

$$= \frac{-2}{5} + \left(\frac{4 \times 2}{15 \times 2} + \frac{-7 \times 3}{10 \times 3} \right)$$

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

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

$$= \frac{-2}{5} - \frac{13}{30} = \frac{-2 \times 6}{5 \times 6} - \frac{13 \times 1}{30 \times 1}$$

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

$$\text{And, } \left(\frac{-2}{5} + \frac{4}{15} \right) + \frac{-7}{10} \quad \begin{array}{r|l} 3 & 5, 15 \\ 5 & 5, 5 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{ LCM of 5 and 15} = 3 \times 5 = 15$$

$$= \left(\frac{-2 \times 3}{5 \times 3} + \frac{4 \times 1}{15 \times 1} \right) + \frac{-7}{10}$$

$$\therefore \text{ LCM of 5 and 15} = 15$$

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

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

$$= \frac{-2 \times 2}{15 \times 2} - \frac{7 \times 3}{10 \times 3}$$

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

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

This verifies associative property of the addition of rational numbers.

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

Show that :

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

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

$$\begin{array}{r|l} 2 & 3, 18 \\ \hline 3 & 3, 9 \\ \hline 5 & 3, 3 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{LCM of 3 and 18} = 2 \times 3 \times 3 = 18$$

$$= \frac{-7}{9} + \left(\frac{-2 \times 6}{3 \times 6} + \frac{-5 \times 1}{18 \times 1} \right)$$

$$(\because \text{LCM of 3 and 18} = 18)$$

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

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

$$= \frac{-7 \times 2}{9 \times 2} - \frac{17 \times 1}{18 \times 1}$$

$$(\because \text{LCM of 9 and 18} = 18)$$

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

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

$$\begin{array}{r|l} 3 & 3, 9 \\ \hline 3 & 3, 3 \\ \hline & 1, 1 \end{array}$$

∴ LCM of 3 and 9 = 9

$$= \left(\frac{-7 \times 1}{9 \times 1} + \frac{-2 \times 3}{3 \times 3} \right) + \frac{-5}{18}$$

(∵ LCM = 9 and 3 = 9)

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

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

$$= \frac{-13 \times 2}{9 \times 2} + \frac{-5 \times 1}{18 \times 1} = \frac{-26-5}{18} = \frac{-31}{18}$$

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

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.

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

$$\therefore \frac{-1}{1} + \left(\frac{5}{6} + \frac{-2}{3}\right) \qquad \begin{array}{r|l} 2 & 6, 3 \\ \hline 3 & 3, 3 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 6 and 3 = 6

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

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

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

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

$$= \frac{-1 \times 6}{1 \times 6} + \frac{1 \times 1}{6 \times 1} \quad (\because \text{LCM of 1 and 6} = 6)$$

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

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

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

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

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

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

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

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

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

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 $\frac{-5}{-12} = \dots\dots\dots$

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

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

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

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

(ii) $\frac{-5}{-12} + \text{its additive inverse} = \frac{-5}{-12} + \left(-\frac{5}{12}\right)$
 $= 0$.

(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) $\frac{7}{9} = \frac{7 \times 5}{9 \times 5}$ (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

$$= \frac{2 \times 5}{3 \times 5} - \frac{4 \times 3}{5 \times 3} \quad (\because \text{LCM of 3 and 5} = 15)$$

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

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

3	9, 3
5	3, 1
	1, 1

$$= \frac{-4 \times 1}{9 \times 1} - \frac{(-2 \times 3)}{3 \times 3}$$

 $(\because \text{LCM of 3 and 9} = 9)$

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

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

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

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

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

$$\begin{array}{r|l} 2 & 7, 14 \\ 7 & 7, 7 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 7 and 14 = 14

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

$(\because \text{LCM of 7 and 14} = 14)$

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

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

$$\begin{array}{r|l} 2 & 18, 9 \\ 2 & 6, 9 \\ 3 & 3, 9 \\ 3 & 1, 3 \\ \hline & 1, 1 \end{array}$$

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

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

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

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

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

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

$$\begin{array}{r|l} 2 & 21, 42 \\ 3 & 21, 21 \\ 7 & 7, 7 \\ \hline & 1, 1 \end{array}$$

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

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

$$(\because \text{LCM of } 21 \text{ and } 42 = 42)$$

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

Question 2.

Subtract:

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

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

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

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

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

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

Solution:

$$\begin{aligned}
 (i) \quad & \frac{5}{8} \text{ from } \frac{-3}{8} \\
 &= \frac{-3}{8} - \frac{5}{8} \\
 &= \frac{-3 \times 1}{8 \times 1} - \frac{5 \times 1}{8 \times 1} \\
 &= \frac{-3-5}{8} = \frac{-8}{8} = -1
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & \frac{-8}{11} \text{ from } \frac{4}{11} \\
 &= \frac{4}{11} - \left(\frac{-8}{11} \right) \\
 &= \frac{4+8}{11} = \frac{12}{11} = 1 \frac{1}{11}
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad & \frac{4}{9} \text{ from } \frac{-5}{9} \\
 &= \frac{-5}{9} - \frac{4}{9} \\
 &= \frac{-5-4}{9} = \frac{-9}{9} = -1
 \end{aligned}$$

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

$$\begin{array}{r|l}
 2 & 4, 8 \\
 \hline
 2 & 2, 4 \\
 \hline
 2 & 1, 2 \\
 \hline
 & 1, 1
 \end{array}$$

$$\therefore \text{LCM of } 4, 8 = 2 \times 2 \times 2 = 8$$

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

$$= \frac{-3 \times 1}{8 \times 1} - \frac{1 \times 2}{4 \times 2}$$

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

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

$$\begin{array}{r|l} 2 & 8, 16 \\ \hline 2 & 4, 8 \\ \hline 2 & 2, 4 \\ \hline 2 & 1, 2 \\ \hline & 1, 1 \end{array}$$

$$\therefore \text{ LCM of 8 and 16} = 16$$

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

$$= \frac{-13 \times 1}{16 \times 1} + \frac{5 \times 2}{8 \times 2}$$

$$(\because \text{ LCM of 8 and 16} = 16)$$

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

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

$$\begin{array}{r|l} 2 & 22, 33 \\ \hline 3 & 11, 33 \\ \hline 11 & 1, 11 \\ \hline & 1, 1 \end{array}$$

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

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

$$= \frac{5 \times 2}{33 \times 2} + \frac{9 \times 3}{22 \times 3}$$

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

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

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 = $\frac{9}{20}$
 $\frac{2}{5}$

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

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

$\therefore$ The other rational number

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

$$\begin{array}{r|l} 3 & 3, 15 \\ 5 & 1, 5 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 3 and 15 = 15

$$= \frac{-2 \times 5}{3 \times 5} + \frac{8 \times 1}{15 \times 1}$$

($\because$ 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:

$$\therefore \text{The sum of two rational numbers} = -6$$

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

$\therefore$ The other rational number

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

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

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

Question 6.

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

Solution:

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

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

$$\begin{array}{r|l} 2 & 9, 8 \\ \hline 2 & 9, 4 \\ \hline 2 & 9, 2 \\ \hline 3 & 9, 1 \\ \hline 3 & 3, 1 \\ \hline & 1, 1 \end{array}$$

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

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

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

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

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

Question 7.

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

Solution:

Required rational number

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

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

$$\begin{array}{r|l} 3 & 3, 9 \\ \hline 3 & 1, 3 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 3 and 9 = 9

$$= \frac{-2 \times 3}{3 \times 3} + \frac{5 \times 1}{9 \times 1}$$

($\because$ 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:

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

$$\begin{array}{r|l} 2 & 6, 9 \\ \hline 3 & 3, 9 \\ \hline 3 & 1, 3 \\ \hline & 1, 1 \end{array}$$

$\therefore$ LCM of 6 and 9 = 18

$$= \frac{-5 \times 3}{6 \times 3} - \frac{4 \times 2}{9 \times 2}$$

($\because$ 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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

EXERCISE 1(C)

Question 1.

Evaluate:

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

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

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

Solution:

$$\begin{aligned}(i) \quad & \frac{-14}{5} \times \frac{-6}{7} \\& = \frac{(-14) \times (-6)}{5 \times 7} = \frac{(-2) \times (-6)}{5 \times 1} \\& = \frac{12}{5} = 2\frac{2}{5}\end{aligned}$$

$$\begin{aligned}(ii) \quad & \frac{7}{6} \times \frac{-18}{91} \\& = \frac{7 \times (-18)}{6 \times 91} = \frac{1 \times (-3)}{1 \times 13} = \frac{-3}{13}\end{aligned}$$

$$\begin{aligned}(iii) \quad & \frac{-125}{72} \times \frac{9}{-5} \\& = \frac{(-125) \times 9}{72 \times -5} = \frac{25 \times 1}{8 \times 1} \\& = \frac{25}{8} = 3\frac{1}{8}\end{aligned}$$

$$\begin{aligned}(iv) \quad & \frac{-11}{9} \times \frac{-51}{-44} \\& = \frac{(-11) \times (-51)}{9 \times (-44)} = \frac{1 \times (-51)}{9 \times 4} \\& = \frac{-51}{36} = \frac{-17}{12}\end{aligned}$$

$$\begin{aligned}(v) \quad & -\frac{16}{5} \times \frac{20}{8} \\& = \frac{(-16) \times 20}{5 \times 8} = \frac{(-2) \times 4}{1 \times 1} = -8\end{aligned}$$

Question 2.

Multiply:

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

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

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

Solution:

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

$$= \frac{5 \times 8}{6 \times 9} = \frac{5 \times 4}{3 \times 9} = \frac{20}{27}$$

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

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

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

$$= \frac{(-7) \times 4}{8 \times 1} = \frac{(-7) \times 1}{2 \times 1} = \frac{-7}{2} = 3 \frac{1}{2}$$

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

$$= \frac{36 \times (-9)}{(-7) \times 28} = \frac{9 \times (-9)}{(-7) \times 7}$$

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

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

$$= \frac{(-7) \times (-8)}{10 \times 15} = \frac{(-7) \times (-4)}{5 \times 15} = \frac{28}{75}$$

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

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

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

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:

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

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

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

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

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

$$\begin{aligned} (ii) \quad & \left(2 \times \frac{1}{4}\right) - \left(\frac{-18}{7} \times \frac{-7}{15}\right) \\ &= \left(\frac{2 \times 1}{1 \times 4}\right) - \left(\frac{(-18) \times (-7)}{7 \times 15}\right) \\ &= \left(\frac{1 \times 1}{1 \times 2}\right) - \left(\frac{(-18) \times (-1)}{1 \times 15}\right) \end{aligned}$$

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

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

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

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

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

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

$$\begin{aligned} (iii) \quad & \left(-5 \times \frac{2}{15}\right) - \left(-6 \times \frac{2}{9}\right) \\ &= \left(\frac{(-5) \times 2}{1 \times 15}\right) - \left(\frac{(-6) \times 2}{1 \times 9}\right) \\ &= \left(\frac{(-1) \times 2}{1 \times 3}\right) - \left(\frac{(-2) \times 2}{1 \times 3}\right) \\ &= \frac{-2}{3} - \left(\frac{-4}{3}\right) \\ &= \frac{-2+4}{3} = \frac{2}{3} \end{aligned}$$

$$\begin{aligned} (iv) \quad & \left(\frac{8}{5} \times \frac{-3}{2}\right) + \left(\frac{-3}{10} \times \frac{9}{16}\right) \\ &= \left(\frac{8 \times (-3)}{5 \times 2}\right) + \left(\frac{(-3) \times 9}{10 \times 16}\right) \end{aligned}$$

$$= \left(\frac{4 \times (-3)}{5 \times 1} \right) + \left(\frac{(-3) \times 9}{10 \times 16} \right)$$

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

$$\begin{array}{r|l} 2 & 160, 5 \\ \hline 2 & 80, 5 \\ \hline 2 & 40, 5 \\ \hline 2 & 20, 5 \\ \hline 2 & 10, 5 \\ \hline 5 & 5, 5 \\ \hline & 1 \end{array}$$

$\therefore$ LCM of 5 and 160 = 160

$$= \frac{(-12) \times 32}{5 \times 32} + \frac{(-27) \times 1}{160 \times 1}$$

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

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:

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

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

Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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:

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

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

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

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

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

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

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

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

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

Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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 rational 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 rational 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:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= \frac{2 \times 5}{(-1) \times 6} = \frac{1 \times 5}{(-1) \times 3} = \frac{-5}{3}$$

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

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

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

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

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

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

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

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

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

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

$$= \frac{(-7) \times 4}{1 \times (-3)} = \frac{28}{3} = 9\frac{1}{3}$$

Question 2.

Divide:

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

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

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

Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Question 3.

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

Solution:

$\therefore$ 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:

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

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

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

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

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

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:

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

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

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

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

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

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

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

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

Question 6.

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

Solution:

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

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

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

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

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

Question 7.

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

Solution:

$\therefore$ 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:

Given, Cost of $3\frac{1}{2}$ or $\frac{7}{2}$ 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?

Given, Cost of $3\frac{2}{5}$ or $\frac{17}{5}$ 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:

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

$$\therefore \text{LCM of 7 and 14} = 14$$

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

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

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

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

Question 11.

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

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

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

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

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

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)

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

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

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

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

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)

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

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

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

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

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

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

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

($\because$ 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 $= x$

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

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:

$$\begin{aligned}\text{Sum of } \frac{5}{8} \text{ and } \frac{-11}{12} &= \frac{5}{8} + \left(\frac{-11}{12}\right) \\&= \frac{5}{8} - \frac{11}{12} \\&= \frac{(5 \times 3) - (11 \times 2)}{24} \\&\quad (\because \text{LCM of 8 and 12 is 24}) \\&= \frac{15 - 22}{24} = \frac{-7}{24}\end{aligned}$$

$$\begin{aligned}\text{Now, difference of } \frac{3}{7} \text{ and } \frac{5}{14} \\&= \frac{3}{7} - \frac{5}{14} \text{ or } \frac{5}{14} - \frac{3}{7} \\&= \frac{(3 \times 2) - (5 \times 1)}{14} \text{ or } \frac{5 - (3 \times 2)}{14} \\&\quad (\because \text{LCM of 7 and 13} = 14) \\&= \frac{6 - 5}{14} \text{ or } \frac{5 - 6}{14} = \frac{1}{14} \text{ or } \frac{-1}{14}\end{aligned}$$

$$\begin{aligned}\text{Now, divide } \frac{-7}{24} \text{ by } \frac{1}{14} \text{ or } \frac{-1}{14} \\&= \frac{\frac{-7}{24}}{\frac{1}{14}} \text{ or } \frac{\frac{-7}{24}}{\frac{-1}{14}} \\&= \frac{-7}{24} \times \frac{14}{1} \text{ or } \frac{-7}{24} \times \frac{-14}{1} \\&= \frac{-49}{12} \text{ or } \frac{49}{12} = -4\frac{1}{12} \text{ or } 4\frac{1}{12}\end{aligned}$$

EXERCISE 1(E)

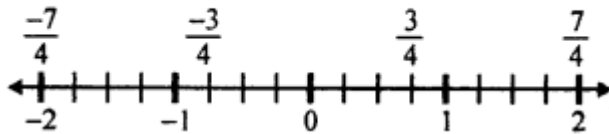
Question 1.

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 :



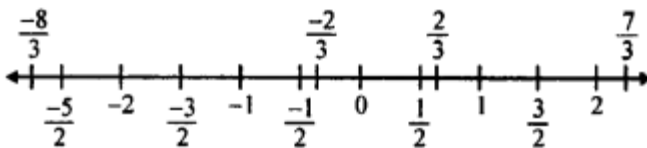
Question 2.

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 (i) 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)

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

$$= 6, 6.5, 7$$

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

$$= 6, 6.25, 6.5, 7$$

∴ 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)

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

$$= 4.8, 5.1, 5.4, 6$$

∴ 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

$$= 3.25, 3.5 \text{ and } 3.75$$

(ii) 10 and 12

Given numbers = 10 and 12

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

$$= 10, 11, 12$$

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

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

Required rational numbers between 10 and 12 are

$$= 10.5, 11, 11.5$$

Question 6.

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

LCM of denominators 5 and 3 is 15

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

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

$$\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

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

$$\therefore \frac{9}{15} = \frac{9 \times 6}{15 \times 6} = \frac{54}{90} \text{ and}$$

$$\frac{10}{15} = \frac{10 \times 6}{15 \times 6} = \frac{60}{90}$$

$\therefore$ Required rational numbers between $\frac{3}{5}$ and

$$\frac{2}{3} \text{ are } = \frac{55}{90}, \frac{56}{90}, \frac{57}{90}, \frac{58}{90} \text{ and } \frac{59}{90}$$

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

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

$$\frac{5}{6} = \frac{5 \times 3}{6 \times 3} = \frac{15}{18} \text{ and}$$

$$\frac{8}{9} = \frac{8 \times 2}{9 \times 2} = \frac{16}{18}$$

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

$$\therefore \frac{15}{18} = \frac{15 \times 7}{18 \times 7} = \frac{105}{126} \text{ and}$$

$$\frac{16}{18} = \frac{16 \times 7}{18 \times 7} = \frac{112}{126}$$

$\therefore$ Required rational numbers between $\frac{5}{6}$ and

$$\frac{8}{9} \text{ are } = \frac{106}{126}, \frac{107}{126}, \frac{108}{126}, \frac{109}{126}, \frac{110}{126},$$

$$\frac{111}{126}$$

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

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 $\frac{8}{8}$

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

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

Thus, 7 rational numbers between 2 and 3

$\left(\text{i.e., } \frac{16}{8} \text{ and } \frac{24}{8} \right)$ are =

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

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

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