

Exercise 5.1

Q1. Add the following rational numbers:

(i) $\frac{-5}{7}$ and $\frac{3}{7}$

We have,

$$\begin{aligned}\frac{-5}{7} + \frac{3}{7} \\&= \frac{-5+3}{7} \\&= \frac{-2}{7}\end{aligned}$$

(ii) $\frac{15}{4}$ and $\frac{7}{4}$

We have,

$$\begin{aligned}\frac{-15}{4} + \frac{7}{4} \\&= \frac{-15+7}{4} \\&= \frac{-8}{4} \\&= -2\end{aligned}$$

(iii) $\frac{-8}{11}$ and $\frac{-4}{11}$

We have,

$$\begin{aligned}\frac{-8}{11} + \frac{-4}{11} \\&= \frac{-8-4}{11} \\&= \frac{-12}{11}\end{aligned}$$

$$(iv) \frac{6}{13} \text{ and } \frac{-9}{13}$$

We have,

$$\frac{6}{13} + \frac{-9}{13} = \frac{6}{13} - \frac{9}{13}$$

$$= \frac{6-9}{13}$$

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

Q2. Add the following rational numbers:

$$(i) \frac{3}{4} \text{ and } \frac{-3}{5}$$

If $\frac{p}{q}$ and $\frac{r}{s}$ are two rational numbers such that q and s do not have a common factor

$$\frac{p}{q} + \frac{r}{s} = \frac{p \times s + r \times q}{q \times s}$$

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

$$= \frac{15-12}{20}$$

$$= \frac{3}{20}$$

$$(ii) \frac{-3}{1} \text{ and } \frac{3}{5}$$

If $\frac{p}{q}$ and $\frac{r}{s}$ are two rational numbers such that q and s do not have a common factor

$$\frac{p}{q} + \frac{r}{s} = \frac{p \times s + r \times q}{q \times s}$$

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

$$= \frac{-15+3}{5}$$

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

(iii) $\frac{-3}{1}$ and $\frac{3}{5}$

LCM of 27 and 18 is 54

$$\frac{-7}{27} = \frac{-7 \times 2}{27 \times 2} = \frac{-14}{54}$$

$$\frac{11}{18} = \frac{11 \times 3}{18 \times 3} = \frac{33}{54}$$

$$\frac{-7}{27} + \frac{11}{18} = \frac{-14}{54} + \frac{33}{54}$$

$$= \frac{33-14}{54}$$

$$= \frac{19}{54}$$

(iv) $\frac{31}{-4}$ and $\frac{-5}{8}$

LCM of 4 and 8 is 8

$$\frac{31}{-4} = \frac{31 \times 2}{-4 \times 2} = \frac{62}{-8}$$

$$\frac{31}{-4} + \frac{-5}{8} = \frac{62}{-8} + \frac{-5}{8}$$

$$= \frac{-62-5}{8}$$

$$= \frac{-67}{8}$$

Q3. Simplify

(i) $\frac{8}{9} + \frac{-11}{6}$

$$\frac{8}{9} - \frac{11}{6}$$

LCM of 9 and 6 is 18

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

$$\frac{11}{6} = \frac{11 \times 3}{6 \times 3} = \frac{33}{18}$$

$$\frac{8}{9} + \frac{-11}{6} = \frac{16}{18} - \frac{33}{18}$$

$$= \frac{16-33}{18}$$

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

$$(ii) \frac{-5}{16} + \frac{7}{24}$$

LCM of 16 and 24 is 48

$$\frac{-5}{16} = \frac{-5 \times 3}{16 \times 3} = \frac{-15}{48}$$

$$\frac{7}{24} = \frac{7 \times 2}{24 \times 2} = \frac{14}{48}$$

$$\frac{-5}{16} + \frac{7}{24} = \frac{-15}{48} + \frac{14}{48}$$

$$= \frac{14-15}{48}$$

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

$$(iii) \frac{1}{-12} + \frac{2}{-15}$$

$$\frac{-1}{12} - \frac{2}{15}$$

LCM of 12 and 15 is 60

$$\frac{-1}{12} = \frac{-1 \times 5}{12 \times 5} = \frac{-5}{60}$$

$$\frac{-2}{15} = \frac{-2 \times 4}{15 \times 4} = \frac{-8}{60}$$

$$\frac{-1}{12} - \frac{2}{15} = \frac{-5}{60} + \frac{-8}{60}$$

$$= \frac{-5-8}{60}$$

$$= \frac{-13}{60}$$

$$(iv) \frac{-8}{19} + \frac{-4}{57}$$

LCM of 19 and 57 is 57

$$\frac{-8}{19} = \frac{-8 \times 3}{19 \times 3} = \frac{-24}{57}$$

$$\frac{-8}{19} + \frac{-4}{57} = \frac{-24}{57} + \frac{-4}{57}$$

$$= \frac{-24-4}{57}$$

$$= \frac{-28}{57}$$

Q4. Add and express the sum as a mixed fraction:

(i) $\frac{-12}{5} + \frac{43}{10}$

LCM of 5 and 10 is 10

$$\begin{aligned}\frac{-12}{5} &= \frac{-12 \times 2}{5 \times 2} = \frac{-24}{10} \\ \frac{-12}{5} + \frac{43}{10} &= \frac{-24}{10} + \frac{43}{10} \\ &= \frac{-24+43}{10} \\ &= \frac{19}{10} \\ &= 1\frac{9}{10}\end{aligned}$$

(ii) $\frac{24}{7} + \frac{-11}{4}$

LCM of 7 and 4 is 28

$$\begin{aligned}\frac{24}{7} &= \frac{24 \times 4}{7 \times 4} = \frac{96}{28} \\ \frac{-11}{4} &= \frac{-11 \times 7}{4 \times 7} = \frac{-77}{28} \\ \frac{24}{7} + \frac{-11}{4} &= \frac{96}{28} + \frac{-77}{28} \\ &= \frac{96}{28} - \frac{77}{28} \\ &= \frac{96-77}{28} \\ &= \frac{19}{28}\end{aligned}$$

(iii) $\frac{-31}{6} + \frac{-27}{8}$

LCM of 6 and 8 is 24

$$\begin{aligned}\frac{-31}{6} &= \frac{-31 \times 4}{6 \times 4} = \frac{-124}{24} \\ \frac{-27}{8} &= \frac{-27 \times 3}{8 \times 3} = \frac{-81}{24} \\ \frac{-31}{6} + \frac{-27}{8} &= \frac{-124}{24} + \frac{-81}{24} \\ &= \frac{-124}{24} - \frac{81}{24} \\ &= \frac{-124-81}{24} \\ &= \frac{-205}{24} \\ &= -8\frac{13}{24}\end{aligned}$$

Exercise 5.2

Q1. Subtract the first rational number from the second in each of the following:

(i) $\frac{3}{8}, \frac{5}{8}$

$$\begin{aligned}\frac{5}{8} - \frac{3}{8} &= \frac{5-3}{8} \\ &= \frac{2}{8}\end{aligned}$$

(ii) $\frac{-7}{9}, \frac{4}{9}$

$$\begin{aligned}\frac{-7}{9} + \frac{4}{9} &= \frac{4}{9} - \frac{-7}{9} \\ &= \frac{4+7}{9} \\ &= \frac{11}{9}\end{aligned}$$

(iii) $\frac{-2}{11}, \frac{-9}{11}$

$$\begin{aligned}\frac{-2}{11} + \frac{-9}{11} &= \frac{-9}{11} + \frac{2}{11} \\ &= \frac{-9+2}{11} \\ &= \frac{-7}{11}\end{aligned}$$

(iv) $\frac{11}{13}, \frac{-4}{13}$

$$\begin{aligned}\frac{-4}{13} - \frac{11}{13} &= \frac{-4-11}{13} \\ &= \frac{-15}{13}\end{aligned}$$

Q2. Evaluate each of the following:

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

LCM of 3 and 5 is 15

$$\begin{aligned}\frac{2}{3} &= \frac{2 \times 5}{3 \times 5} = \frac{10}{15} \\ \frac{3}{5} &= \frac{3 \times 3}{5 \times 3} = \frac{9}{15} \\ \frac{2}{3} - \frac{3}{5} &= \frac{10}{15} - \frac{9}{15} \\ &= \frac{1}{15}\end{aligned}$$

$$(ii) -\frac{4}{7} - \frac{2}{-3}$$

LCM of 3 and 7 is 21

$$\frac{-4}{7} = \frac{-4 \times 3}{7 \times 3} = \frac{-12}{21}$$

$$\frac{2}{-3} = \frac{2 \times 7}{-3 \times 7} = \frac{14}{21}$$

$$\frac{-4}{7} - \frac{2}{-3} = \frac{-12}{21} - \frac{14}{21}$$

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

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

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

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

$$\frac{4}{7} - \frac{-5}{-7}$$

$$\frac{4}{7} - \frac{5}{7} = \frac{4-5}{7}$$

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

$$(iv) -2 - \frac{5}{9}$$

$$\frac{2}{1} - \frac{-5}{-9}$$

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

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

$$= \frac{-23}{9}$$

Q3. The sum of the two numbers is $\frac{5}{9}$. If one of the numbers is $\frac{1}{3}$, find the other.

Required number=

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

LCM of 3 and 9 is 9

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

$$\text{Therefore required number} = \frac{5}{9} - \frac{3}{9}$$

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

Q4. The sum of two numbers is $\frac{-1}{3}$. If one of the numbers is $\frac{-12}{3}$, find the other.

Let the required number be x

$$\frac{-12}{3} + x = \frac{-1}{3}$$

$$x = \frac{-1}{3} - \frac{-12}{3}$$

$$x = \frac{-1+12}{3}$$

$$x = \frac{11}{3}$$

The required number is $\frac{11}{3}$

Q5. The sum of two numbers is $\frac{-4}{3}$. If one of the numbers is -5 , find the other.

Let the required number be x

$$-5 + x = \frac{-4}{3}$$

$$x = \frac{-4}{3} + 5$$

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

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

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

$$x = \frac{11}{3}$$

The required number is $\frac{11}{3}$

Q6. The sum of two rational numbers is -8 . If one of the numbers is $\frac{-15}{7}$, find the other.

Let the required number be x

$$\frac{-15}{7} + x = -8$$

$$x = -8 - \frac{-15}{7}$$

$$x = -8 + \frac{15}{7}$$

$$x = \frac{8 \times 7}{1 \times 7} + \frac{15}{7}$$

$$x = \frac{15-56}{7}$$

$$x = \frac{-41}{7}$$

The required number is $\frac{-41}{7}$

Q7. What should be added to $-\frac{7}{8}$ so as to get $\frac{5}{9}$?

Let the required number be x

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

$$x = \frac{5}{9} - \frac{-7}{8}$$

$$x = \frac{5 \times 8}{9 \times 8} - \frac{-7 \times 9}{8 \times 9}$$

$$x = \frac{40}{72} - \frac{-63}{72}$$

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

$$x = \frac{103}{72}$$

The required number is $\frac{103}{72}$

Q8. What number should be added to $-\frac{5}{11}$ so as to get $\frac{26}{33}$?

Let the required number be x

$$-\frac{5}{11} + x = \frac{26}{33}$$

$$x = \frac{26}{33} - \frac{-5}{11}$$

$$x = \frac{26}{33} - \frac{-5 \times 3}{11 \times 3}$$

$$x = \frac{26}{33} - \frac{-15}{33}$$

$$x = \frac{26+15}{33}$$

$$x = \frac{41}{33}$$

The required number is $\frac{41}{33}$

Q9. What number should be added to $\frac{-5}{7}$ to get $\frac{-2}{3}$?

Let the required number be x

$$\frac{-5}{7} + x = \frac{-2}{3}$$

$$x = \frac{-2}{3} - \frac{-5}{7}$$

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

$$x = \frac{-14}{21} - \frac{-15}{21}$$

$$x = \frac{-14+15}{21}$$

$$x = \frac{1}{21}$$

The required number is $\frac{1}{21}$

Q10. What number should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?

Let the required number be x

$$\frac{-5}{3} - x = \frac{5}{6}$$

$$-x = \frac{5}{6} - \frac{-5}{3}$$

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

$$-x = \frac{5}{6} - \frac{-10}{6}$$

$$-x = \frac{5+10}{6}$$

$$-x = \frac{15}{6}$$

$$x = -\frac{15}{6}$$

The required number is $\frac{15}{6}$

Q11. What number should be subtracted from $\frac{3}{7}$ to get $\frac{5}{4}$?

Let the required number be x

$$\frac{3}{7} - x = \frac{5}{4}$$

$$-x = \frac{5}{4} - \frac{3}{7}$$

$$-x = \frac{5 \times 7}{4 \times 7} - \frac{3 \times 4}{7 \times 4}$$

$$-x = \frac{35}{28} - \frac{12}{28}$$

$$-x = \frac{35-12}{28}$$

$$-x = \frac{23}{28}$$

$$x = -\frac{23}{28}$$

The required number is $\frac{23}{28}$

Q12. What should be added to $\left(\frac{2}{3} + \frac{3}{5}\right)$ to get $\frac{-2}{15}$?

Let the required number be x

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

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

$$\left(\frac{10}{15} + \frac{9}{15}\right) + x = \frac{-2}{15}$$

$$\frac{19}{15} + x = \frac{-2}{15}$$

$$x = \frac{-2}{15} - \frac{19}{15}$$

$$x = \frac{-2-19}{15}$$

$$x = \frac{-21}{15}$$

$$x = \frac{-7}{5}$$

The required number is $\frac{-7}{5}$

Q13. What should be added to $\left(\frac{1}{2} + \frac{1}{3} + \frac{1}{5}\right)$ to get 3?

Let the required number be x

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

$$\left(\frac{1 \times 15}{2 \times 15} + \frac{1 \times 10}{3 \times 10} + \frac{1 \times 6}{5 \times 6}\right) + x = 3$$

$$\left(\frac{15+10+6}{30}\right) + x = 3$$

$$\frac{31}{30} + x = 3$$

$$x = 3 - \frac{31}{30}$$

$$x = \frac{3 \times 30}{1 \times 30} - \frac{31}{30}$$

$$x = \frac{90}{30} - \frac{31}{30}$$

$$x = \frac{59}{30}$$

The required number is $\frac{59}{30}$

Q14. What should be subtracted from $\left(\frac{3}{4} - \frac{2}{3}\right)$ to get $\frac{-1}{6}$?

Let the required number be x

$$\left(\frac{3}{4} - \frac{2}{3}\right) - x = \frac{-1}{6}$$

$$\left(\frac{3 \times 3}{4 \times 3} - \frac{2 \times 4}{3 \times 4}\right) - x = \frac{-1}{6}$$

$$\left(\frac{9}{12} - \frac{8}{12}\right) - x = \frac{-1}{6}$$

$$\frac{1}{12} - x = \frac{-1}{6}$$

$$-x = \frac{-1}{6} - \frac{1}{12}$$

$$-x = \frac{-1 \times 2}{6 \times 2} - \frac{1}{12}$$

$$-x = \frac{-2}{12} - \frac{1}{12}$$

$$-x = \frac{-2-1}{12}$$

$$-x = \frac{-3}{12}$$

$$x = \frac{3}{12}$$

$$x = \frac{1}{4}$$

The required number is $\frac{1}{4}$

Q15. Simplify:

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

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

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

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

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

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

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

$$= -2$$

$$(ii) \left(\frac{5}{3} - \frac{7}{6} + \frac{-2}{3} \right)$$

$$\left(\frac{5}{3} - \frac{7}{6} + \frac{-2}{3} \right)$$

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

$$= \left(\frac{10}{6} - \frac{7}{6} + \frac{-4}{6} \right)$$

$$= \left(\frac{10-7-4}{6} \right)$$

$$= \left(\frac{10-11}{6} \right)$$

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

$$(iii) \left(\frac{5}{4} - \frac{7}{6} - \frac{-2}{3} \right)$$

$$\left(\frac{5}{4} - \frac{7}{6} - \frac{-2}{3} \right)$$

$$= \left(\frac{5 \times 3}{4 \times 3} - \frac{7 \times 2}{6 \times 2} - \frac{-2 \times 4}{3 \times 4} \right)$$

$$= \left(\frac{15}{12} - \frac{14}{12} - \frac{-8}{12} \right)$$

$$= \left(\frac{15-14+8}{12} \right)$$

$$= \left(\frac{9}{12} \right)$$

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

$$(iv) \left(\frac{-2}{5} - \frac{-3}{10} - \frac{-4}{7} \right)$$

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

$$\left(\frac{-2 \times 14}{5 \times 14} - \frac{-3 \times 7}{10 \times 7} - \frac{-4 \times 10}{7 \times 10} \right)$$

$$\left(\frac{-28}{70} - \frac{-21}{70} - \frac{-40}{70} \right)$$

$$\left(\frac{-28+21+40}{70} \right)$$

$$\left(\frac{33}{70} \right)$$

Q16. Fill in the blanks:

$$(i) \frac{-4}{13} - \frac{-3}{26} = \dots$$

$$\frac{-4}{13} - \frac{-3}{26} = \frac{-4 \times 2}{13 \times 2} - \frac{-3}{26}$$

$$= \frac{-8+3}{26}$$

$$= \frac{-5}{26}$$

$$\frac{-4}{13} - \frac{-3}{26} = \frac{-5}{26}$$

$$(ii) \frac{-9}{14} + \dots = -1$$

$$\frac{-9}{14} + x = -1$$

$$x = -1 - \left(\frac{-9}{14} \right)$$

$$x = -\frac{1 \times 14}{1 \times 14} - \left(\frac{-9}{14} \right)$$

$$x = -\frac{14}{14} - \left(\frac{-9}{14} \right)$$

$$x = \frac{-14+9}{14}$$

$$x = \frac{-5}{14}$$

$$\frac{-9}{14} + \frac{-5}{14} = -1$$

$$(iii) \frac{-7}{9} + \dots = 3$$

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

$$x = 3 - \frac{-7}{9}$$

$$x = \frac{3 \times 9}{1 \times 9} - \frac{-7}{9}$$

$$x = \frac{27}{9} - \frac{-7}{9}$$

$$x = \frac{27+7}{9}$$

$$x = \frac{34}{9}$$

$$\frac{-7}{9} + \frac{34}{9} = 3$$

$$(iv) \dots + \frac{15}{23} = 4$$

$$x + \frac{15}{23} = 4$$

$$x = 4 - \frac{15}{23}$$

$$x = \frac{4 \times 23}{1 \times 23} - \frac{15}{23}$$

$$x = \frac{92}{23} - \frac{15}{23}$$

$$x = \frac{92-15}{23}$$

$$x = \frac{77}{23}$$

$$\frac{77}{23} + \frac{15}{23} = 4$$

Exercise 5.3

Q1. Multiply:

(i) $\frac{7}{11}$ by $\frac{5}{4}$

$$\frac{7}{11} \times \frac{5}{4}$$

$$= \frac{35}{44}$$

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

$$\frac{5}{7} \times \frac{-3}{4}$$

$$= \frac{-15}{28}$$

(iii) $\frac{-2}{9}$ by $\frac{5}{11}$

$$\frac{-2}{9} \times \frac{5}{11}$$

$$= \frac{-10}{99}$$

(iv) $\frac{-3}{17}$ by $\frac{-5}{-4}$

$$\frac{-3}{17} \times \frac{-5}{-4}$$

$$= \frac{15}{-68}$$

$$= \frac{-15}{68}$$

Q2. Multiply:

(i) $\frac{-5}{17}$ by $\frac{51}{-60}$

$$\frac{-5}{17} \times \frac{51}{-60}$$

$$= \frac{-255}{-1020}$$

$$= \frac{255}{1020}$$

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

(ii) $\frac{-6}{11}$ by $\frac{-55}{36}$

$$\frac{-6}{11} \times \frac{51}{-60}$$

$$= \frac{-255}{-1020}$$

$$= \frac{255}{1020}$$

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

(iii) $\frac{-8}{25}$ by $\frac{-5}{16}$

$$\frac{-8}{25} \times \frac{-5}{16}$$

$$= \frac{40}{400}$$

$$= \frac{1}{10}$$

(iv) $\frac{6}{7}$ by $\frac{-49}{36}$

$$\frac{6}{7} \times \frac{-49}{36}$$

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

Q3. Simplify each of the following and express the result as a rational number in standard form:

(i) $\frac{-16}{21} \times \frac{14}{5}$

$$\frac{-16}{21} \times \frac{14}{5}$$

$$= \frac{-224}{105}$$

$$= \frac{-32}{15}$$

(ii) $\frac{7}{6} \times \frac{-3}{28}$

$$\frac{7}{6} \times \frac{-3}{28}$$

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

(iii) $\frac{-19}{36} \times 16$

$$\frac{-19}{36} \times 16$$

$$= \frac{-304}{36}$$

$$= \frac{-76}{9}$$

(iv) $\frac{-13}{9} \times \frac{27}{-26}$

$$\frac{-13}{9} \times \frac{27}{-26}$$

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

Q4. Simplify:

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

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

$$= \frac{-10}{15} - \left(\frac{-12}{9}\right)$$

$$= \frac{-10 \times 3}{15 \times 3} - \left(\frac{-12 \times 5}{9 \times 5}\right)$$

$$= \frac{-30}{45} - \left(\frac{-60}{45}\right)$$

$$= \frac{-30+60}{45}$$

$$= \frac{30}{45}$$

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

$$(ii) \left(\frac{-9}{4} \times \frac{5}{3} \right) + \left(\frac{13}{2} \times \frac{5}{6} \right)$$

$$\left(\frac{-9}{4} \times \frac{5}{3} \right) + \left(\frac{13}{2} \times \frac{5}{6} \right)$$

$$= \left(\frac{-3}{4} \times 5 \right) + \left(\frac{65}{12} \right)$$

$$= \left(\frac{-15}{4} \right) + \left(\frac{65}{12} \right)$$

$$= \frac{-15 \times 3}{4 \times 3} + \frac{65}{12}$$

$$= \frac{-45}{12} + \frac{65}{12}$$

$$= \frac{-45+65}{12}$$

$$= \frac{20}{12}$$

$$= \frac{10}{6}$$

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

Q5. Simplify:

$$(i) \left(\frac{13}{9} \times \frac{-15}{2} \right) + \left(\frac{7}{3} \times \frac{8}{5} \right) - \left(\frac{3}{5} \times \frac{1}{2} \right)$$

$$\left(\frac{13}{9} \times \frac{-15}{2} \right) + \left(\frac{7}{3} \times \frac{8}{5} \right) + \left(\frac{3}{5} \times \frac{1}{2} \right)$$

$$= \left(\frac{13}{3} \times \frac{-5}{2} \right) + \left(\frac{56}{15} \right) + \left(\frac{3}{10} \right)$$

$$= \left(\frac{-65}{6} \right) + \left(\frac{56}{15} \right) + \left(\frac{3}{10} \right)$$

$$= \left(\frac{-65 \times 5}{6 \times 5} \right) + \left(\frac{56 \times 2}{15 \times 2} \right) + \left(\frac{3 \times 3}{10 \times 3} \right)$$

$$= \left(\frac{-325}{30} \right) + \left(\frac{112}{30} \right) + \left(\frac{9}{30} \right)$$

$$= \left(\frac{-325}{30} \right) + \left(\frac{112}{30} \right) + \left(\frac{9}{30} \right)$$

$$= \left(\frac{-204}{30} \right)$$

$$= \left(\frac{-34}{5} \right)$$

$$(ii) \left(\frac{3}{11} \times \frac{5}{6} \right) - \left(\frac{9}{12} \times \frac{4}{3} \right) + \left(\frac{5}{13} \times \frac{6}{15} \right)$$

$$\left(\frac{3}{11} \times \frac{5}{6} \right) - \left(\frac{9}{12} \times \frac{4}{3} \right) + \left(\frac{5}{13} \times \frac{6}{15} \right)$$

$$= \left(\frac{1}{11} \times \frac{5}{2} \right) - \left(\frac{3}{3} \times \frac{1}{1} \right) + \left(\frac{1}{13} \times \frac{6}{3} \right)$$

$$= \left(\frac{1}{11} \times \frac{5}{2} \right) - \left(\frac{3}{3} \times \frac{1}{1} \right) + \left(\frac{1}{13} \times \frac{2}{1} \right)$$

$$= \left(\frac{5}{22} \right) - (1) + \left(\frac{2}{13} \right)$$

$$= \left(\frac{5 \times 13}{22 \times 13} \right) - \left(\frac{1 \times 286}{1 \times 286} \right) + \left(\frac{2 \times 22}{13 \times 22} \right)$$

$$= \left(\frac{65}{286} \right) - \left(\frac{286}{286} \right) + \left(\frac{44}{286} \right)$$

$$= \left(\frac{65 - 286 + 44}{286} \right)$$

$$= \left(\frac{-177}{286} \right)$$

Exercise 5.4

Q1. Divide:

(i) 1 by $\frac{1}{2}$

$$1 \div \frac{1}{2}$$

$$= 1 \times 2$$

$$= 2$$

(ii) 5 by $\frac{-5}{7}$

$$5 \div \frac{-5}{7}$$

$$= 5 \times \frac{-7}{5}$$

$$= -7$$

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

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

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

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

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

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

(iv) $\frac{-7}{8}$ by $\frac{-21}{16}$

$$\frac{-7}{8} \div \frac{-21}{16}$$

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

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

$$(v) \frac{7}{-4} \text{ by } \frac{63}{64}$$

$$\frac{7}{-4} \div \frac{63}{64}$$

$$= \frac{7}{-4} \times \frac{64}{63}$$

$$= \frac{-16}{9}$$

$$(vi) 0 \text{ by } \frac{-7}{5}$$

$$0 \div \frac{-7}{5}$$

$$= 0 \times \frac{-5}{7}$$

$$= 0$$

$$(vii) \frac{-3}{4} \text{ by } -6$$

$$\frac{-3}{4} \div -6$$

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

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

$$(viii) \frac{2}{3} \text{ by } \frac{-7}{12}$$

$$\frac{2}{3} \div \frac{-7}{12}$$

$$= \frac{2}{3} \times \frac{-12}{7}$$

$$= \frac{-8}{7}$$

Q2. Find the value and express as a rational number in standard form:

$$(i) \frac{2}{5} \div \frac{26}{15}$$

$$\frac{2}{5} \div \frac{26}{15}$$

$$= \frac{2}{5} \times \frac{15}{26}$$

$$= \frac{3}{13}$$

$$(ii) \frac{10}{3} \div \frac{-35}{12}$$

$$\frac{10}{3} \div \frac{-35}{12}$$

$$\frac{10}{3} \times \frac{-12}{35}$$

$$= \frac{-40}{35}$$

$$= \frac{-8}{7}$$

$$(iii) -6 \div \frac{-8}{17}$$

$$-6 \div \frac{-8}{17}$$

$$= -6 \times \frac{-17}{8}$$

$$= \frac{102}{8}$$

$$= \frac{51}{4}$$

$$(iv) \frac{40}{98} \div -20$$

$$\frac{40}{98} \div -20$$

$$= \frac{40}{98} \times \frac{-1}{20}$$

$$= \frac{-2}{98}$$

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

Q3. The product of two rational numbers is 15. If one of the numbers is -10, find the other.

Let the number to be found be x

$$x \times -10 = 15$$

$$x = \frac{15}{-10}$$

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

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

Hence the number is

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

Q4. The product of two rational numbers is $\frac{-8}{9}$. If one of the numbers is $\frac{-4}{15}$, find the other.

Let the number to be found be x

$$x \times \frac{-4}{15} = \frac{-8}{9}$$

$$x = \frac{-8}{9} \div \frac{-4}{15}$$

$$x = \frac{-8}{9} \times \frac{15}{-4}$$

$$x = \frac{-8 \times 15}{9 \times -4}$$

$$x = \frac{-120}{-36}$$

$$x = \frac{120}{36}$$

$$x = \frac{10}{3}$$

Hence the number is

$$x = \frac{10}{3}$$

Q5. By what number should we multiply $\frac{-1}{6}$ so that the product may be $\frac{-23}{9}$?

Let the number to be found be x

$$x \times \frac{-1}{6} = \frac{-23}{9}$$

$$-x = \frac{-23}{9} \times 6$$

$$-x = \frac{-23 \times 6}{9}$$

$$-x = \frac{-138}{9}$$

$$x = \frac{138}{9}$$

$$x = \frac{46}{3}$$

Hence the number is $x = \frac{46}{3}$

Q6. By what number should we multiply $\frac{-15}{28}$ so that the product may be $\frac{-5}{7}$?

Let the number to be found be x

$$x \times \frac{-15}{28} = \frac{-5}{7}$$

$$x = \frac{-5}{7} \div \frac{-15}{28}$$

$$x = \frac{-5}{7} \times \frac{-28}{15}$$

$$x = \frac{-8}{9} \times \frac{15}{-4}$$

$$x = \frac{4}{3}$$

Hence the number is $x = \frac{4}{3}$

Q7. By what number should we multiply $\frac{-8}{13}$ so that the product may be 24?

Let the number to be found be x

$$x \times \frac{-8}{13} = 24$$

$$x = 24 \div \frac{-8}{13}$$

$$x = 24 \times \frac{13}{-8}$$

$$x = -3 \times 13$$

$$x = -39$$

Hence the number is $x = -39$

Q8. By what number should $\frac{-3}{4}$ be multiplied in order to produce $\frac{-2}{3}$?

Let the number to be found be x

$$x \times \frac{-8}{13} = 24$$

$$x = 24 \div \frac{-8}{13}$$

$$x = 24 \times \frac{13}{-8}$$

$$x = -3 \times 13$$

$$x = -39$$

Hence the number is $x = -39$

Q9. Find $(x + y) \div (x - y)$, if

(i) $x = \frac{2}{3}$ $y = \frac{3}{2}$

$$(x + y) \div (x - y)$$

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

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

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

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

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

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

$$(ii) \ x = \frac{2}{5} \ y = \frac{1}{2}$$

$$(x + y) \div (x - y)$$

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

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

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

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

$$= \left(\frac{9}{-1} \right)$$

$$= \left(\frac{-9}{1} \right)$$

$$= 9$$

$$(iii) \ x = \frac{5}{4} \ y = \frac{-1}{3}$$

$$(x + y) \div (x - y)$$

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

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

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

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

$$= \left(\frac{11}{19} \right)$$

Q10. The cost of $7\frac{2}{3}$ metres of rope is Rs. $12\frac{3}{4}$. Find its cost per metre.

$$7\frac{2}{3} \text{ metres of rope cost} = \text{Rs. } 12\frac{3}{4}$$

$$= \text{Rs. } \frac{51}{4}$$

$$7\frac{2}{3} = \frac{23}{3}$$

Cost per metre =

$$\frac{51}{4} \div \frac{23}{3}$$

$$= \frac{51}{4} \times \frac{3}{23}$$

$$= \frac{153}{92}$$

$$= \text{Rs. } 1\frac{61}{92}$$

Q11. The cost of $2\frac{1}{3}$ metres of cloth is Rs. $75\frac{1}{4}$. Find the cost of cloth per metre.

$$2\frac{1}{3} \text{ metres of rope cost} = \text{Rs. } 75\frac{1}{4}$$

$$= \text{Rs. } \frac{301}{4}$$

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

Cost per metre =

$$\frac{301}{4} \div \frac{7}{3}$$

$$= \frac{301}{4} \times \frac{3}{7}$$

$$= \frac{43 \times 3}{4}$$

$$= \frac{129}{4}$$

$$= \text{Rs. } 32\frac{1}{4}$$

Q12. By what number should $\frac{-33}{16}$ be divided to get $\frac{-11}{4}$?

$$\frac{-33}{16} \div x = \frac{-11}{4}$$

$$x = \frac{-33}{16} \div \frac{-11}{4}$$

$$x = \frac{-33}{16} \times \frac{4}{-11}$$

$$x = \frac{3}{4}$$

The number is

$$x = \frac{3}{4}$$

Q13. Divide the sum of $\frac{-13}{5}$ and $\frac{12}{7}$ by the product of $\frac{-31}{7}$ and $\frac{-1}{2}$

$$\left(\frac{-13}{5} + \frac{12}{7} \right) \div \left(\frac{-31}{7} \times \frac{-1}{2} \right)$$

$$= \left(\frac{-13 \times 7}{5 \times 7} + \frac{12 \times 5}{7 \times 5} \right) \div \left(\frac{-31}{7} \times \frac{-1}{2} \right)$$

$$= \left(\frac{-91}{35} + \frac{60}{35} \right) \div \left(\frac{31}{14} \right)$$

$$= \left(\frac{-91+60}{35} \right) \div \left(\frac{31}{14} \right)$$

$$= \left(\frac{-31}{35} \right) \div \left(\frac{31}{14} \right)$$

$$= \left(\frac{-31}{35} \right) \times \left(\frac{14}{31} \right)$$

$$= \frac{-14}{35}$$

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

Q14. Divide the sum of $\frac{65}{12}$ and $\frac{8}{3}$ by their difference.

$$\begin{aligned}& \left(\frac{65}{12} + \frac{8}{3} \right) \div \left(\frac{65}{12} - \frac{8}{3} \right) \\&= \left(\frac{65}{12} + \frac{8 \times 4}{3 \times 4} \right) \div \left(\frac{65}{12} - \frac{8 \times 4}{3 \times 4} \right) \\&= \left(\frac{65}{12} + \frac{32}{12} \right) \div \left(\frac{65}{12} - \frac{32}{12} \right) \\&= \left(\frac{65+32}{12} \right) \div \left(\frac{65-32}{12} \right) \\&= \left(\frac{65+32}{12} \right) \times \left(\frac{12}{65-32} \right) \\&= \frac{65+32}{65-32} \\&= \frac{97}{33}\end{aligned}$$

Q15. If 24 trousers of equal size can be prepared in 54 metres of cloth, what length of cloth is required for each trouser?

$$\text{Length of cloth required for each trouser} = \frac{\text{Total length of cloth}}{\text{number of trousers}}$$

$$\begin{aligned}&= \frac{54}{24} \\&= \frac{9}{4} \text{ metres} \\&\frac{9}{4} \text{ metres of cloth is required to make each trouser}\end{aligned}$$

Exercise 5.5

Q1. Find six rational numbers between $-\frac{4}{8}$ and $\frac{3}{8}$

We know that

$$-4 < -3 < -2 < -1 < 0 < 1 < 2 < 3$$

$$\text{Therefore } -\frac{4}{8} < -\frac{3}{8} < -\frac{2}{8} < -\frac{1}{8} < \frac{0}{8} < \frac{1}{8} < \frac{2}{8} < \frac{3}{8}$$

Hence 6 rational numbers between $-\frac{4}{8}$ and $\frac{3}{8}$ are $-\frac{3}{8}, -\frac{2}{8}, -\frac{1}{8}, \frac{0}{8}, \frac{1}{8}, \frac{2}{8}$

Q2. Find 10 rational numbers between $\frac{7}{13}$ and $-\frac{4}{13}$

We know that

$$7 > 6 > 5 > 4 > 3 > 2 > 1 > 0 > -1 > -2 > -3 > -4$$

$$\text{Therefore } \frac{7}{13} > \frac{6}{13} > \frac{5}{13} > \frac{4}{13} > \frac{3}{13} > \frac{2}{13} > \frac{1}{13} > \frac{0}{13} > \frac{-1}{13} > \frac{-2}{13} > \frac{-3}{13} > \frac{-4}{13}$$

Hence the 10 rational numbers between $\frac{7}{13}$ and $-\frac{4}{13}$ are

$$\frac{-3}{13}, \frac{-2}{13}, \frac{-1}{13}, \frac{0}{13}, \frac{1}{13}, \frac{2}{13}, \frac{3}{13}, \frac{4}{13}, \frac{5}{13}, \frac{6}{13}, \frac{7}{13},$$

Q3. State true or false:

(i) Between any two distinct integers there is always an integer.

FALSE

(ii) Between any two distinct rational numbers there is always a rational number.

TRUE

(iii) Between any two distinct rational numbers there are infinitely many rational numbers.

TRUE