Chapter 5: Operations on Rational Numbers Exercise – 5.1

Question: 1

Add the following rational numbers:

(i)
$$\frac{-5}{7}$$
 and $\frac{3}{7}$
(ii) $\frac{15}{4}$ and $\frac{7}{4}$
(iii) $\frac{-8}{11}$ and $\frac{-4}{11}$
(iv) $\frac{6}{13}$ and $\frac{-9}{13}$

Solution:

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

We have,

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

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

We have,

$$\frac{-15}{4} + \frac{7}{4} = \frac{-15 + 7}{4} = \frac{-8}{4}$$

= -2

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

We have,

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

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

We have,

$$\frac{\frac{6}{13} + \frac{-9}{13}}{\frac{6}{13} - \frac{9}{13}} = \frac{\frac{6-9}{13}}{\frac{-3}{13}}$$

Question: 2

Add the following rational numbers:

(i)
$$\frac{3}{4}$$
 and $\frac{-3}{5}$
(ii) $\frac{-3}{1}$ and $\frac{3}{5}$
(iii) $\frac{-3}{1}$ and $\frac{3}{5}$
(iv) $\frac{31}{-4}$ and $\frac{-5}{8}$

Solution:

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

If p/q and 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 p/q and 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 4

$$\frac{31}{-4} = \frac{31 \times 2}{-4 \times 2} = \frac{62}{-8}$$
$$\frac{31}{-4} + \frac{-5}{8} = \frac{62}{-8} + \frac{-5}{8}$$
$$= \frac{-62 - 5}{8}$$
$$= \frac{-67}{8}$$

Simplify

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

(ii) $\frac{-5}{16} + \frac{7}{24}$
(iii) $\frac{1}{-12} + \frac{2}{-15}$
(iv) $\frac{-8}{19} + \frac{-4}{57}$

Solution:

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

LCM of 5 and 10 is 10

$$\frac{8}{9} = \frac{8 \times 2}{9 \times 2} = \frac{16}{18}$$
$$\frac{11}{6} = \frac{11 \times 3}{6 \times 3} = \frac{33}{18}$$
$$\frac{8}{9} + \frac{-11}{6} = \frac{16}{18} - \frac{33}{18}$$
$$= \frac{16 - 33}{18}$$
$$= \frac{-17}{18}$$
(ii) $\frac{-5}{18} + \frac{7}{18}$

LCM of 16 and 24 is 48

$$\frac{-5}{16} = \frac{-5 \times 3}{16 \times 3} = \frac{-15}{48}$$
$$\frac{7}{24} = \frac{7 \times 2}{24 \times 2} = \frac{14}{48}$$
$$\frac{-5}{16} + \frac{7}{24} = \frac{-15}{48} + \frac{14}{48}$$
$$= \frac{14 - 15}{48}$$
$$(\text{iii}) \frac{1}{-12} + \frac{2}{-15}$$
$$\frac{-1}{12} - \frac{2}{15}$$

LCM of 12 and 15 is 60

$\frac{-1}{12} = \frac{-1 \times 5}{12 \times 5} =$	—5 60
$\frac{-2}{15} = \frac{-2 \times 4}{15 \times 4} =$	$\frac{-8}{60}$
$\frac{-1}{12} - \frac{2}{15} = \frac{-5}{60} + \frac{1}{12} + \frac{1}{12$	$\frac{-8}{60}$
$=\frac{-5-8}{60}$	
$=\frac{-13}{60}$	
(iv) $\frac{-8}{19} + \frac{-4}{57}$	

LCM of 19 and 57 is 57

$$\frac{-8}{19} = \frac{-8 \times 3}{19 \times 3} = \frac{-24}{57}$$
$$\frac{-8}{19} + \frac{-4}{57} = \frac{-24}{57} + \frac{-4}{57}$$
$$= \frac{-24 - 4}{57} = \frac{-28}{57}$$

Question: 4

Add and express the sum as a mixed fraction:

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

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

(iii)
$$\frac{-3}{16} + \frac{-27}{8}$$

Solution:

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

LCM of 5 and 10 is 10

$$\frac{-12}{5} = \frac{-12 \times 2}{5 \times 2} = \frac{-24}{10}$$
$$\frac{-12}{5} + \frac{43}{10} = \frac{-24}{10} + \frac{43}{10}$$
$$= \frac{-24 + 43}{10}$$
$$= \frac{-24 + 43}{10}$$
$$= \frac{19}{10}$$
$$= 1\frac{9}{10}$$
(ii) $\frac{24}{7} + \frac{-11}{4}$

LCM of 7 and 4 is 28

$\frac{24}{7} = \frac{24 \times 4}{7 \times 4} = \frac{96}{28}$
$\frac{-11}{4} = \frac{-11 \times 7}{4 \times 7} = -\frac{77}{28}$
$\frac{24}{7} + \frac{-11}{4} = \frac{96}{28} + \frac{-77}{28}$
$=\frac{96}{28}-\frac{77}{28}$
$=\frac{96-77}{28}$
$=\frac{19}{28}$
(iii) $\frac{-3}{16} + \frac{-27}{8}$

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

Chapter 5: Operations on Rational Numbers Exercise – 5.5

Question: 1

Find six rational numbers between (-4)/8 and 3/8

Solution:

We know that

- 4, -3, -2, -1, 0, 1, 2, 3

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

	$^{-4}$	3	$^{-3}$	$^{-2}$	$^{-1}$	0	1	2
Hence 6 rational numbers between	and	— are 8	8	8	8	, <u> </u>	8	8

Question: 2

Find 10 rational numbers between 7/13 and (- 4)/13

Solution:

We know that

76543210 -1 -2 -3 -4

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

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

Question: 3

State true or false:

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

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

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

Solution:

(i) False

- (ii) True
- (iii) True

Chapter 5: Operations on Rational Numbers Exercise – 5.4

Question: 1

Divide:

(i) 1 by 12 (ii) 5 by $\frac{-5}{7}$ (iii) $\frac{-3}{4}$ by $\frac{9}{-16}$ (iv) $\frac{-7}{8}$ by $\frac{-21}{16}$ (v) $\frac{7}{-4}$ by $\frac{63}{64}$ (vi) 0 by $\frac{-7}{5}$ (vii) $\frac{-3}{4}$ by -6(viii) $\frac{2}{3}$ by $\frac{-7}{12}$

Solution:

(i) 1 by 12 $1 \div \frac{1}{2}$ $= 1 \times 2$ = 2(ii) 5 by $\frac{-5}{7}$ $5 \div \frac{-5}{7}$ $= 5 \times \frac{-7}{5}$ = -7

(iii)
$$\frac{-3}{4}$$
 by $\frac{9}{-16}$
 $\frac{-3}{4} \div \frac{9}{-16}$
 $= \frac{-3}{4} \div \frac{-9}{16}$
 $= \frac{-3}{4} \div \frac{-9}{16}$
 $= \frac{-4}{-3}$
 $= \frac{4}{3}$
(iv) $\frac{-7}{8}$ by $\frac{-21}{16}$
 $\frac{-7}{8} \div \frac{-21}{16}$
 $= \frac{-7}{8} \div \frac{-21}{16}$
 $= \frac{2}{3}$
(v) $\frac{7}{-4}$ by $\frac{63}{64}$
 $\frac{7}{-4} \div \frac{63}{64}$
 $= \frac{7}{-4} \times \frac{64}{63}$
 $= \frac{-16}{9}$
(vi) 0 by $\frac{-7}{5}$
 $= 0 \times \frac{-5}{7}$
 $= 0$

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

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

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

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

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

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

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

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

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

(i) $\frac{2}{5} \div \frac{26}{15}$ (ii) $\frac{10}{3} \div \frac{-35}{12}$ (iii) $-6 \div \frac{-8}{17}$ (iv) $\frac{40}{98} \div -20$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Solution:

Let the number to be found be \boldsymbol{x}

x ×- 10 = 15

x = 15/(-10)x = 3/(-2)x = (-3)/2Hence the number is x = (-3)/2

Question: 4

The product of two rational numbers is - 8/9. If one of the numbers is - 4/15, find the other.

Solution:

Let the number to be found be x

$$x \times \frac{-4}{15} = \frac{-8}{9}$$
$$x = \frac{-8}{9} \div \frac{-4}{15}$$
$$x = \frac{-8}{9} \times \frac{15}{-4}$$
$$x = \frac{-8 \times 15}{9 \times -4}$$
$$x = \frac{-120}{-36}$$
$$x = \frac{120}{36}$$
$$x = \frac{10}{2}$$

Hence the number is x = 10/3

Question: 5

By what number should we multiply -1/6 so that the product may be -23/9?

Solution:

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 = 46/3

Question: 6

By what number should we multiply -15/28 so that the product may be -5/7?

Solution:

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 = 4/3

Question: 7

By what number should we multiply -8/13 so that the product may be 24?

Solution:

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

Question: 8

By what number should -3/4 be multiplied in order to produce -2/3?

Solution:

Let the number to be found be x

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

x = 8/9

Hence the number is x = 8/9

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

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

(ii) $x = \frac{2}{5} y = \frac{1}{2}$
(iii) $x = \frac{5}{4} y = \frac{-1}{3}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

 $(x + y) \div (x - y)$
 $= \left(\frac{5}{4} + \frac{-1}{3}\right) \div \left(\frac{5}{4} - \frac{-1}{3}\right)$
 $= \left(\frac{5 \times 3 - 1 \times 4}{12}\right) \div \left(\frac{5 \times 3 + 1 \times 4}{12}\right)$
 $= \left(\frac{5 \times 3 - 1 \times 4}{12}\right) \times \left(\frac{12}{5 \times 3 + 1 \times 4}\right)$
 $= \left(\frac{5 \times 3 - 1 \times 4}{5 \times 3 + 1 \times 4}\right)$
 $= \left(\frac{11}{19}\right)$

The cost of 7(2/3) metres of rope is Rs. 12(3/4). Find its cost per metre. 7(2/3) metres of rope cost = Rs. 12(3/4).

Solution:

 $= \text{Rs.} \frac{51}{4}$ $7\frac{2}{3} = \frac{23}{3}$

 $\text{Cost per metre} = \frac{51}{4} \div \frac{23}{3}$

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

 $=\frac{153}{92}$

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

Question: 11

The cost of 2(1/3) metres of cloth is Rs.75 1/4. Find the cost of cloth per metre. 2(1/3) metres of rope cost = Rs. 75(1/4)

 $= \operatorname{Rs.} \frac{301}{4}$ $2\frac{1}{3} = \frac{7}{3}$ Cost per metre $= \frac{301}{4} \div \frac{7}{3}$ $= \frac{301}{4} \times \frac{3}{7}$ $= \frac{43 \times 3}{4}$ $= \frac{129}{4}$ $= \operatorname{Rs.} 32\frac{1}{4}$

Question: 12

By what number should (-33)/16 be divided to get (-11)/4?

Solution:

 $\frac{-33}{16} \div x = \frac{-11}{4}$ $x = \frac{-33}{16} \div \frac{-11}{4}$ $x = -\frac{33}{16} \times \frac{4}{-11}$ x = 3/4

The number is x = 3/4

Question: 13

Divide the sum of (-13)/5 and 12/7 by the product of (-31)/7 and (-1)/2

$$\begin{pmatrix} -\frac{13}{5} + \frac{12}{7} \\ \frac{-13}{5} + \frac{12}{7} \\ \frac{-13}{7} \times \frac{-1}{2} \\ \frac{-13}{5} \times 7 \\ \frac{-12}{7} \times \frac{-1}{7} \\ \frac{-12}{7} \times \frac{-1}{2} \\ \frac{-12}{7} \\ \frac{-91}{35} \\ \frac{-91}{35} \\ \frac{-91}{5} \\ \frac{-91}{35} \\ \frac{-91}{5} \\ \frac{-91}{14} \\ \frac{-91}{35} \\ \frac{-14}{35} \\ \frac{-14}{35} \\ \frac{-2}{5} \\ \frac{-2}{5}$$

Divide the sum of 65/12 and 8/3 by their difference.

Solution:

$$\begin{pmatrix} \frac{65}{12} + \frac{8}{3} \end{pmatrix} \div \begin{pmatrix} \frac{65}{12} - \frac{8}{3} \end{pmatrix}$$

$$= \begin{pmatrix} \frac{65}{12} + \frac{8 \times 4}{3 \times 4} \end{pmatrix} \div \begin{pmatrix} \frac{65}{12} - \frac{8 \times 4}{3 \times 4} \end{pmatrix}$$

$$= \begin{pmatrix} \frac{65}{12} + \frac{32}{12} \end{pmatrix} \div \begin{pmatrix} \frac{65}{12} - \frac{32}{12} \end{pmatrix}$$

$$= \begin{pmatrix} \frac{65 + 32}{12} \end{pmatrix} \div \begin{pmatrix} \frac{65 - 32}{12} \end{pmatrix}$$

$$= \begin{pmatrix} \frac{65 + 32}{12} \end{pmatrix} \times \begin{pmatrix} \frac{12}{65 - 32} \end{pmatrix}$$

$$= \frac{\frac{65 + 32}{65 - 32}$$

$$= \frac{97}{33}$$

Question: 15

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

Solution:

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

= 54/24

= 9/4 metres

9/4 metres of cloth is required to make each trouser

Chapter 5: Operations on Rational Numbers Exercise – 5.3

Question: 1

Multiply:

(i)
$$\frac{7}{11}$$
 by $\frac{5}{4}$
(ii) $\frac{5}{7}$ by $\frac{-3}{4}$
(iii) $\frac{-2}{9}$ by $\frac{5}{11}$
(iv) $\frac{-3}{17}$ by $\frac{-5}{-4}$

Solution:

(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 $\frac{-5}{-4}$ $\frac{-3}{17} \times \frac{-5}{-4}$ $= \frac{15}{-68}$ $= \frac{-15}{-68}$

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Question: 2

Multiply:

Questions on Rational
Numbers Exercise 5.1Questions on Rational
Numbers Exercise 5.1(ii)
$$\frac{-6}{11}$$
 by $\frac{-55}{36}$ (iii) $\frac{-6}{11}$ by $\frac{-55}{-56}$ (iii) $\frac{-5}{17}$ by $\frac{-51}{-60}$ Solution:
 $(0) \frac{-5}{17}$ by $\frac{-51}{-60}$ (iii) $\frac{-5}{17} \times \frac{51}{-60}$ (iii) $\frac{-255}{-1020}$ $= \frac{255}{-1020}$ $= \frac{255}{1020}$ (iii) $\frac{-6}{11}$ by $\frac{-55}{-56}$ $= \frac{1}{4}$ (iii) $\frac{-6}{11}$ by $\frac{-55}{-56}$ $= \frac{-255}{1020}$ $= \frac{1}{4}$ $= \frac{-255}{1020}$ $= \frac{-255}{-1020}$ $= \frac{-255}{1020}$ $= \frac{255}{-1020}$ $= \frac{-255}{2020}$ $= \frac{-255}{-1020}$ $= \frac{-255}{1020}$ $= \frac{1}{4}$ (iii) $\frac{-6}{21}$ by $\frac{-5}{16}$ $= \frac{1}{4}$ (iii) $\frac{-8}{25}$ by $\frac{-5}{16}$ $= \frac{1}{4}$ (iii) $\frac{-8}{25}$ by $\frac{-5}{16}$ $= \frac{40}{400}$ (iii) $\frac{-8}{400}$ (iii) $\frac{-8}{400}$

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

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

 $=\frac{1}{10}$

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

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

(ii) $\frac{7}{6} \times \frac{-3}{28}$
(iii) $\frac{-19}{36} \times 16$
(iv) $\frac{-13}{9} \times \frac{27}{-26}$

Solution:

(i) $\frac{-16}{21} \times \frac{14}{5}$ $\frac{-16}{21} \times \frac{14}{5}$ $=\frac{-224}{105}$ $=\frac{-32}{15}$ (ii) $\frac{7}{6} \times \frac{-3}{28}$ $\frac{7}{6} \times \frac{-3}{28}$ $=\frac{-1}{8}$ $(iii) \ \frac{-19}{36} \times 16$ $\frac{-19}{36} \times 16$ $=\frac{-304}{36}$ $=\frac{-76}{9}$ $(iv) \frac{-13}{9} \times \frac{27}{-26}$ $\frac{-13}{9} \times \frac{27}{-26}$ $=\frac{3}{2}$

Question: 4

Simplify:

(i) $\left(-5 \times \frac{2}{15}\right) - \left(-6 \times \frac{2}{9}\right)$ (ii) $\left(-\frac{9}{4} \times \frac{5}{3}\right) + \left(\frac{13}{2} \times \frac{5}{6}\right)$

Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Question: 5

Simplify:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Chapter 5: Operations on Rational Numbers Exercise – 5.2

Question: 1

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

(i) $\frac{3}{8}, \frac{5}{8}$ (ii) $-\frac{7}{9}, \frac{4}{9}$ (iii) $\frac{-2}{11}, \frac{-9}{11}$ (iv) $\frac{11}{13}, \frac{-4}{13}$

Solution:

(i) $\frac{3}{8}, \frac{5}{8}$ $\frac{5}{8} - \frac{3}{8} = \frac{5-3}{8}$ $= \frac{2}{8}$ (ii) $-\frac{7}{9}, \frac{4}{9}$ $-\frac{7}{9} + \frac{4}{9} = \frac{4}{9} - \frac{-7}{9}$ $= \frac{4+7}{9}$ $= \frac{11}{9}$

$$(\text{iii}) \frac{-2}{11}, \frac{-9}{11}$$
$$\frac{-2}{11} + \frac{-9}{11} = \frac{-9}{11} + \frac{2}{11}$$
$$= \frac{-9+2}{11}$$
$$= -\frac{7}{11}$$
$$(\text{iv}) \frac{11}{13}, \frac{-4}{13}$$
$$\frac{-4}{13} - \frac{11}{13} = \frac{-4-11}{13}$$
$$= \frac{-15}{13}$$

Evaluate each of the following:

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

(ii) $\frac{-4}{7} - \frac{2}{-3}$
(iii) $\frac{4}{7} - \frac{-5}{-7}$
(iv) $-2 - \frac{5}{9}$

Solution:

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

LCM of 3 and 5 is 15

$\frac{2}{3}$ =	$=\frac{2\times}{3\times}$	$\frac{5}{5} =$	10 15
$\frac{3}{5}$ =	$=\frac{3\times}{5\times}$	$\frac{3}{3} =$	9 15
$\frac{2}{3}$	$-\frac{3}{5} =$	$\frac{10}{15}$	$\frac{9}{15}$
= -	1 15		
(ii)	$\frac{-4}{7}$	$\frac{2}{-3}$	

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

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

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

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

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

$$= \frac{2}{21}$$
(iii) $\frac{4}{7} - \frac{-5}{-7}$

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

$$= \frac{-1}{7}$$
(iv) $-2 - \frac{5}{9}$

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

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

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

The sum of the two numbers is 5/9. If one of the numbers is 1/3, find the other.

Solution:

Required number $=\frac{5}{9}-\frac{1}{3}$

LCM of 3 and 9 is 9

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

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

 $=\frac{2}{9}$

The sum of two numbers is -1/3. If one of the numbers is -12/3, find the other.

Solution:

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 11/3

Question: 5

The sum of two numbers is -4/3. If one of the numbers is -5, find the other.

Solution:

Let the required number be x

$$-5 + x = \frac{-4}{3}$$
$$x = \frac{-4}{3} + 5$$
$$x = \frac{-4}{3} + \frac{5 \times 3}{1 \times 3}$$
$$x = \frac{-4}{3} + \frac{15}{3}$$
$$x = \frac{-4 + 15}{3}$$
$$y = \frac{11}{3}$$

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

The required number is 11/3

Question: 6

The sum of two rational numbers is - 8. If one of the numbers is -(15/7), find the other.

Solution:

$$\frac{-15}{7} + x = -8$$
$$x = -8 - \frac{-15}{7}$$
$$x = -8 + \frac{15}{7}$$
$$x = \frac{8 \times 7}{1 \times 7} + \frac{15}{7}$$
$$x = \frac{15 - 56}{7}$$
$$x = -\frac{41}{7}$$

The required number is -(41/7)

Question: 7

What should be added to -(7/8) so as to get 5/9?

Solution:

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 103/72

Question: 8

What number should be added to (-5)/11 so as to get 26/33?

Solution:

$$-\frac{5}{11} + x = \frac{26}{33}$$
$$x = \frac{26}{33} - \frac{-5}{11}$$
$$x = \frac{26}{33} - \frac{5 \times 3}{11 \times 3}$$
$$x = \frac{26}{33} - \frac{15}{33}$$
$$x = \frac{26 + 15}{33}$$
$$x = \frac{41}{33}$$

The required number is 41/33

Question: 9

What number should be added to (-5)/7 to get (-2)/3?

Solution:

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 1/21

Question: 10

What number should be subtracted from -5/3 to get 5/6?

Solution:

$$\frac{-5}{3} - x = \frac{5}{6}$$
$$-x = \frac{5}{6} - \frac{5}{3}$$
$$-x = \frac{5}{6} - \frac{-5 \times 2}{3 \times 2}$$
$$-x = \frac{5}{6} - \frac{-10}{6}$$
$$-x = \frac{5+10}{6}$$
$$-x = \frac{15}{6}$$
$$x = -\frac{15}{6}$$

The required number is 15/6

Question: 11

What number should be subtracted from 3/7 to get 5/4?

Solution:

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 23/28

Question: 12

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

Solution:

$$\begin{pmatrix} \frac{2}{3} + \frac{3}{5} \end{pmatrix} + x = \frac{-2}{15} \\ \begin{pmatrix} \frac{2 \times 5}{3 \times 5} + \frac{3 \times 3}{5 \times 3} \end{pmatrix} + x = \frac{-2}{15} \\ \begin{pmatrix} \frac{10}{15} + \frac{9}{15} \end{pmatrix} + x = \frac{-2}{15} \\ \frac{19}{15} + x = \frac{-2}{15} \\ x = \frac{-2}{15} - \frac{19}{15} \\ x = \frac{-2 - 19}{15} \\ x = \frac{-21}{15} \\ x = \frac{-7}{5}$$

The required number is (-7)/5

Question: 13

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

Solution:

Let the required number be \boldsymbol{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 59/30

Question: 14

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

Solution:

Let the required number be x

$$\begin{pmatrix} \frac{3}{4} - \frac{2}{3} \end{pmatrix} - x = \frac{-1}{6} \\ \begin{pmatrix} \frac{3 \times 3}{4 \times 3} - \frac{2 \times 4}{3 \times 4} \end{pmatrix} - x = -\frac{1}{6} \\ \begin{pmatrix} \frac{9}{12} - \frac{8}{12} \end{pmatrix} - x = \frac{-1}{6} \\ \frac{1}{12} - x = \frac{-1}{6} \\ -x = -\frac{1}{6} - \frac{1}{12} \\ -x = -\frac{1}{6} - \frac{1}{12} \\ -x = \frac{-1 \times 2}{6 \times 2} - \frac{1}{12} \\ -x = \frac{-2}{12} - \frac{1}{12} \\ -x = -\frac{2}{12} - \frac{1}{12} \\ -x = -\frac{3}{12} \\ x = \frac{3}{12}$$

x = 1/4

The required number is 1/4

Question: 15

Simplify:

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

(ii) $\left(\frac{5}{3} - \frac{7}{6} + \frac{-2}{3}\right)$
(iii) $\left(\frac{5}{4} - \frac{7}{6} - \frac{-2}{3}\right)$
(iv) $\left(\frac{-2}{5} - \frac{-3}{10} - \frac{-4}{7}\right)$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$(iv)\left(\frac{-2}{5} - \frac{-3}{10} - \frac{-4}{7}\right)$$
$$\left(\frac{-2}{5} - \frac{-3}{10} - \frac{-4}{7}\right)$$
$$\left(\frac{-2 \times 14}{5 \times 14} - \frac{-3 \times 7}{10 \times 7} - \frac{-4 \times 10}{7 \times 10}\right)$$
$$\left(\frac{-28}{70} - \frac{-21}{70} - \frac{-40}{70}\right)$$
$$\left(\frac{-28 + 21 + 40}{70}\right)$$
$$\left(\frac{33}{70}\right)$$

Fill in the blanks:

(i)
$$\frac{-4}{13} - \frac{-3}{26} = \cdots$$
.
(ii) $\frac{-9}{14} + \cdots = -1$
(iii) $\frac{-7}{9} + \cdots = 3$

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

Solution:

(i) $\frac{-4}{13} - \frac{-3}{26} = \cdots$. $-\frac{4}{13} - \frac{-3}{26} = \frac{-4 \times 2}{13 \times 2} - \frac{-3}{26}$ $= \frac{-8 + 3}{26}$ $= \frac{-5}{26}$ $\frac{-4}{13} - \frac{-3}{26} = \frac{-5}{26}$

(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) $+\frac{15}{23} = 4$
$x + \frac{15}{23} = 4$
$x = 4 - \frac{15}{23}$
$\mathbf{x} = \frac{4 \times 23}{1 \times 23} - \frac{15}{23}$
$x = \frac{92}{23} - \frac{15}{23}$
$x = \frac{92 - 15}{23}$
$x = \frac{77}{23}$
$\frac{77}{23} + \frac{15}{23} = 4 <$