5. Operations on Rational Numbers

Practice Set

1. Carry out the following additions of rational numbers.

(i) $\frac{5}{36} + \frac{6}{42}$

Solution : $\frac{5}{36} + \frac{6}{42}$

We find the first LCM of denominators

2	36	42
3	18	21
	6	7

LCM of 36 and 42 $= 2 \times 3 \times 6 \times 7 = 252$

$\frac{5}{36} = \frac{5 \times 7}{36 \times 7} = \frac{35}{252}$ and $\frac{6}{42} = \frac{6 \times 6}{42 \times 6} = \frac{36}{252}$

$\therefore \frac{5}{36} + \frac{6}{42} = \frac{35}{252} + \frac{36}{252}$

$= \frac{35 + 36}{252}$

$$= \frac{71}{252}$$

$$\therefore \frac{5}{36} + \frac{6}{42} = \frac{71}{252}$$

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

Solution :

$$1\frac{2}{3} + 2\frac{4}{5} = \frac{(1 \times 3) + 2}{3} + \frac{(2 \times 5) + 4}{5}$$

$$= \frac{5}{3} + \frac{14}{5}$$

$$= \frac{(5 \times 5) + (14 \times 3)}{3 \times 5}$$

$$= \frac{25 + 42}{15}$$

$$= \frac{67}{15}$$

$$\therefore 1\frac{2}{3} + 2\frac{4}{5} = \frac{67}{15}$$

(iii) $\frac{11}{17} + \frac{13}{19}$

Solution :

$$\frac{11}{17} + \frac{13}{19} = \frac{11 \times 19 + 13 \times 17}{17 \times 19}$$

$$= \frac{209 + 221}{323}$$

$$= \frac{430}{323}$$

$$\therefore \frac{11}{17} + \frac{13}{19} = \frac{430}{323}$$

(iv) $2\frac{3}{11} + 1\frac{3}{77}$

Solution :

$$2\frac{3}{11} + 1\frac{3}{77} = (2 + 1) + \left[\frac{3}{11} + \frac{3}{77}\right]$$

$$= 3 + \left[\frac{(3 \times 7) + 3}{77}\right]$$

$$= 3 + \left[\frac{21 + 3}{77}\right]$$

$$= 3 + \frac{24}{77}$$

$$= \frac{(3 \times 77) + 24}{77}$$

$$= \frac{231 + 24}{77}$$

$$= \frac{255}{77}$$

$\therefore\ 2\ \frac{3}{11}\ +\ 1\frac{3}{77} =\ \ \frac{255}{77}$

2. Carry out the following subtractions involving rational numbers.

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

Solution :

$$\frac{7}{11} - \frac{3}{7} = \frac{7 \times 7}{11 \times 7}\ -\ \frac{3 \times 11}{7 \times 11}$$

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

$$= \frac{49 - 33}{77}$$

$$= \frac{16}{77}$$

$\therefore\ \frac{7}{11} - \frac{3}{7}\ = \frac{16}{77}$

ii) $\frac{13}{36} - \frac{2}{40}$

Solution :

$$\frac{13}{36} - \frac{2}{40}\ = \frac{13}{36} - \frac{1}{20}$$

$36 = 2 \times 2 \times 3 \times 3$; $20 = 2 \times 2 \times 5$

$\therefore$ LCM of 36 and 20 $= 2 \times 2 \times 5 \times 3 \times 3 = 180$

$\frac{13}{36} = \frac{13 \times 5}{36 \times 5} = \frac{65}{180}$ and $\frac{1}{20} = \frac{1 \times 9}{20 \times 9} = \frac{9}{180}$

$\therefore \frac{13}{36} - \frac{1}{20} = \frac{65}{180} - \frac{9}{180}$

$= \frac{65 - 9}{180}$

$= \frac{56}{180}$

$= \frac{14}{45}$

$\therefore \frac{13}{36} - \frac{2}{40} = \frac{14}{45}$

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

Solution :

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

$$= \frac{5}{3} - \frac{23}{6}$$

$$= \frac{(5 \times 2) - (23 \times 1)}{6}$$

$$= \frac{10 - 23}{6}$$

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

$$\therefore 1\ \frac{2}{3} - 3\frac{5}{6} = \frac{-13}{6}$$

(iv) $4\ \frac{1}{2} - 3\ \frac{1}{3}$

Solution :

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

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

$$= \frac{9}{2} - \frac{10}{3}$$

$$= \frac{(9 \times 3) - (10 \times 2)}{2 \times 3}$$

$$= \frac{27 - 20}{6}$$

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

$\therefore 4\frac{1}{2} - 3\frac{1}{3} = \frac{7}{6}$

3. Multiply the following rational numbers.

(i) $\frac{3}{11} \times \frac{2}{5}$

Solution :

$\frac{3}{11} \times \frac{2}{5} = \frac{3 \times 2}{11 \times 5}$

$$= \frac{6}{55}$$

$$\therefore \frac{3}{11} \times \frac{2}{5} = \frac{6}{55}$$

(ii) $\frac{12}{5} \times \frac{4}{15}$

Solution :

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

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

$$= \frac{16}{25}$$

$$\therefore \frac{12}{5} \times \frac{4}{15} = \frac{16}{25}$$

(iii) $\frac{(-8)}{9} \times \frac{3}{4}$

Solution :

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

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

$\therefore \frac{(-8)}{9} \times \frac{3}{4} = \frac{-2}{3}$

(iv) $\frac{0}{6} \times \frac{3}{4}$

Solution :

$\frac{0}{6} \times \frac{3}{4} = 0 \times \frac{3}{4}$

$= 0$

$\therefore \frac{0}{6} \times \frac{3}{4} = 0$

4. Write the multiplicative inverse.

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

Ans.: The multiplicative inverse of $\frac{2}{5}$ is $\frac{5}{2}$.

(ii) $\frac{-3}{8}$

Ans.: The multiplicative inverse of $\frac{-3}{8}$ is $\frac{8}{-3}$.

(iii) $\frac{-17}{39}$

Ans.: The multiplicative inverse of $\frac{-17}{39}$ is $\frac{39}{-17}$.

(iv) **7**

Ans.: The multiplicative inverse of 7 is $\frac{1}{7}$.

(v) $-7\frac{1}{3}$

Ans.: $-7\frac{1}{3} = -\frac{22}{3}$

$\therefore$ The multiplicative inverse of $-7\frac{1}{3}$ is $-\frac{3}{22}$.

5. Carry out the divisions of rational numbers.

(i) $\frac{40}{12} \div \frac{10}{4}$

(ii) $\frac{-10}{11} \div \frac{-11}{10}$

Solution:

Solution:

$\frac{40}{12} \div \frac{10}{4}$

$\frac{-10}{11} \div \frac{-11}{10}$

$= \frac{40}{12} \times \frac{4}{10}$

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

$= \frac{40 \times 4}{12 \times 10}$

$=$

$\frac{(-10) \times 10}{11 \times (-11)}$

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

$= \frac{-100}{-121}$

$= \frac{4}{3}$

$= \frac{100}{121}$

(iii) $\frac{-7}{8} \div \frac{-3}{6}$

(iv) $\frac{2}{3} \div (-4)$

Solution:

Solution:

$\frac{-7}{8} \div \frac{-3}{6}$

$\frac{2}{3} \div (-4)$

$= \frac{-7}{8} \times \frac{6}{-3}$

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

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

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

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

(v) $2\frac{1}{5} \div 5\frac{3}{6}$

Solution:

$2\frac{1}{5} \div 5\frac{3}{6}$

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

$= \frac{10 + 1}{5} \div \frac{30 + 3}{6}$

$= \frac{(-5) \times 26}{13 \times 7}$

(vi) $\frac{-5}{13} \div \frac{7}{26}$

Solution:

$\frac{-5}{13} \div \frac{7}{26}$

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

$=$

$\frac{-5}{13} \times \frac{26}{7}$

$= \frac{11}{5} \div \frac{33}{6}$

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

$= \frac{11}{5} \times \frac{6}{33} \quad = \frac{2}{5}$

$= \frac{-10}{7}$

(vii) $\frac{9}{11} \div (-8)$

Solution:

$\frac{9}{11} \div (-8)$

$= \frac{9}{11} \times \frac{-1}{8}$

$= \frac{9 \times (-1)}{11 \times 8}$

$= -\frac{9}{88}$

(viii) $5 \div \frac{2}{5}$

Solution:

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

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

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

$= \frac{25}{2}$

Practice

1.Write three rational numbers that lie between the two given numbers.

(i) $\frac{2}{7}, \frac{6}{7}$

Solution : The denominators of given rational numbers are same i. e. 7.

The integers between 2 and 6 are 3, 4, 5.

So taking these numbers and writing denominator as 7.

$\therefore$ The rational numbers in between $\frac{2}{7}$ and $\frac{6}{7}$ are $\frac{3}{7}, \frac{4}{7}, \frac{5}{7}$.

(ii) $\frac{4}{5}, \frac{2}{3}$

Solution : Let us convert $\frac{4}{5}$ and $\frac{2}{3}$ into fractions with equal denominators.

$\frac{4 \times 3}{5 \times 3} = \frac{12}{15}$; $\frac{2 \times 5}{3 \times 5} = \frac{10}{15}$

(a) $\frac{1}{2}\left(\frac{12}{15} + \frac{10}{15}\right) = \frac{1}{2}\left(\frac{12+10}{15}\right) = \frac{1}{2} \times \frac{22}{15} = \frac{11}{15}$

or $\frac{22}{30}$

(b) $\frac{1}{2}\left(\frac{12}{15} + \frac{11}{15}\right) = \frac{1}{2}\left(\frac{12+11}{15}\right) = \frac{1}{2} \times \frac{23}{15} = \frac{23}{30}$

(c) $\frac{1}{2}\left(\frac{10}{15}+\frac{11}{15}\right)=\frac{1}{2}\left(\frac{10+11}{15}\right)=\frac{1}{2}\times\frac{21}{15}=\frac{21}{30}$

∴ The rational numbers in between $\frac{4}{5}$ and $\frac{2}{3}$ are $\frac{22}{30}$, $\frac{23}{30}$, $\frac{21}{30}$.

(iii) $-\frac{2}{3}, \frac{4}{5}$

Solution : Let us convert $\frac{-2}{3}$ and $\frac{4}{5}$ into fractions with equal denominators.

$\frac{-2\times5}{3\times5}=\frac{-10}{15}$; $\frac{4\times3}{5\times3}=\frac{12}{15}$

The integers between -10 and 12 are -9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6 , 7, 8, 9,10,11.

So taking any of these numbers and writing denominator as 15.

∴ rational numbers between $\frac{-10}{15}$ and $\frac{12}{15}$ are $\frac{-9}{15}, \frac{-8}{15}, \frac{-7}{15}, \frac{-6}{15}, \frac{-5}{15}, \frac{-4}{15}, \frac{-3}{15}, \frac{-2}{15}, \frac{-1}{15}, 0, \frac{1}{15}, \frac{2}{15}, \frac{3}{15}, \frac{4}{15}, \frac{5}{15}, \frac{6}{15}, \frac{7}{15}, \frac{8}{15}, \frac{9}{15}, \frac{10}{15}, \frac{11}{15}$.

∴ Any three rational numbers between $\frac{-10}{15}$ and $\frac{12}{15}$ are

$\frac{-9}{15}, \frac{-7}{15}, \frac{4}{15}$.

∴ The rational numbers in between $\frac{-2}{3}$ and $\frac{4}{5}$ are $\frac{-9}{15}, \frac{-7}{15}, \frac{4}{15}$.

(iv) $\frac{7}{9}, \frac{-5}{9}$

Solution :

The integers between -5 and 7 are -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6.

So taking any of these numbers and writing denominator as 9.

∴ rational numbers between $\frac{7}{9}$ and $-\frac{5}{9}$ are

$\frac{-4}{9}, \frac{-3}{9}, \frac{-2}{9}, \frac{-1}{9}, 0, \frac{1}{9}, \frac{2}{9}, \frac{3}{9}, \frac{4}{9}, \frac{5}{9}, \frac{6}{9}$.

∴ Any three rational numbers between $\frac{7}{9}$ and $-\frac{5}{9}$ are

$\frac{6}{9}, 0, -\frac{4}{9}$.

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

Solution :

The integers between -3 and $+5$ are $-2, -1, 0, 1, 2, 3, 4$.

So taking any of these numbers and writing denominator as 4.

$\therefore$ rational numbers between $\frac{-3}{4}$ and $\frac{+5}{4}$ are

$\frac{-2}{4}, \frac{-1}{4}, 0, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}$.

$\therefore$ Any three rational numbers between $\frac{-3}{4}$ and $\frac{+5}{4}$ are

$\frac{-2}{4}, \frac{-1}{4}, \frac{3}{4}$.

(vi) $\frac{7}{8}, \frac{-5}{3}$

Solution : Let us convert $\frac{7}{8}$ and $\frac{-5}{3}$ into fractions with equal denominators.

$\frac{7\times3}{8\times3}=\frac{21}{24}$; $\frac{-5\times8}{3\times8}=\frac{-40}{24}$

Take any integers between -40 and 21 and take the denominator as 24.

∴ The rational numbers that lie in between $\frac{7}{8}$ and $\frac{-5}{3}$ are

$\frac{17}{24}, \frac{11}{24}, \frac{-13}{24}$.

(vii) $\frac{5}{7}, \frac{11}{7}$

Solution :

The integers between 5 and 11 are 6, 7, 8, 9, 10.

So taking any of these numbers and writing denominator as 7.

∴ rational numbers between $\frac{5}{7}$ and $\frac{11}{7}$ are $\frac{6}{7}$, $\frac{7}{7}, \frac{8}{7}, \frac{9}{7}, \frac{10}{7}$.

$\therefore$ Any three rational numbers between $\frac{5}{7}$ and $\frac{11}{7}$ are $\frac{6}{7}, \frac{8}{7}, \frac{9}{7}$.

(viii) 0, $-\frac{3}{4}$.

Solution :

The denominator of any number can be increased .Then the numerator also increases the same number of times.

$\therefore \frac{-3 \times 10}{4 \times 10}$

.....(Multiplying the numerator and denominator by 10)

$= \frac{-30}{40}$

$= \frac{-6}{8}$ .....(Dividing the numerator and denominator by 5)

The integers between -6 and 0 are $-5, -4, -3, -2, -1$.

So taking any of these numbers and writing denominator as 8.

$\therefore$ rational numbers between 0 and $\frac{-6}{8}$ are

$-\frac{5}{8}, -\frac{4}{8}, -\frac{3}{8},$

$-\frac{2}{8}, -\frac{1}{8}.$

$\therefore$ Any three rational numbers between 0 and $-\frac{3}{4}$ are $-\frac{1}{8}, -\frac{2}{8}, -\frac{5}{7}.$

Practice Set 24

1. Write the following rational numbers in decimal form.

(i) $\frac{13}{4}$

Solution :

$$
\begin{array}{r}
3.25 \\
4\overline{)13.00} \\
-12 \\
\hline
10 \\
-8 \\
\hline
20 \\
-20 \\
\hline
00
\end{array}
$$

$\therefore \frac{13}{4} = 3.25.$

(ii) $-\frac{7}{8}$

Solution :

$$
\begin{array}{r}
0.875 \\
8\overline{)7.000} \\
-0 \\
\hline
70 \\
-64 \\
\hline
60 \\
-56 \\
\hline
40 \\
-40 \\
\hline
00
\end{array}
$$

$\therefore -\frac{7}{8} = -0.875.$

(iii) $7\frac{3}{5}$

Solution : $7\frac{3}{5} = \frac{35+3}{5} = \frac{38}{5}$

$$
\begin{array}{r}
7.6 \\
5\overline{)\,38.0} \\
-\,35 \\
\hline
30 \\
-\,30 \\
\hline
00
\end{array}
$$

$\therefore 7\frac{3}{5} = 7.6.$

(iv) $\frac{5}{12}$

Solution :

$$
\begin{array}{r}
0.4166 \\
12\overline{)\,5.0000} \\
-0 \\
\hline
50 \\
-48 \\
\hline
20 \\
-12 \\
\hline
80 \\
-72 \\
\hline
080 \\
-72 \\
\hline
08
\end{array}
$$

$\therefore \frac{5}{12} = 0.4166 = 0.416$

(v) $\frac{22}{7}$

Solution :

$$
\begin{array}{r}
3.142857 \\
7\overline{)22.000} \\
-21 \\
\hline
10 \\
-7 \\
\hline
30 \\
-28 \\
\hline
20 \\
-14 \\
\hline
60 \\
-56 \\
\hline
40 \\
-35 \\
\hline
50 \\
-49 \\
\hline
1
\end{array}
$$

$\therefore \frac{22}{7} = 3.\overline{142857}.$

(vi) $\frac{4}{3}$

Solution :

$$
\begin{array}{r}
1.333 \\
3\overline{)\,4.000} \\
-3 \\
\hline
10 \\
-9 \\
\hline
10 \\
-9 \\
\hline
10 \\
-9 \\
\hline
1
\end{array}
$$

$\therefore \frac{4}{3} = 1.\dot{3}$

(vii) $\frac{7}{9}$

Solution :

$$
\begin{array}{r}
0.777 \\
9\overline{)7.000} \\
-0 \\
\hline
70 \\
-63 \\
\hline
70 \\
-63 \\
\hline
70 \\
-\ 63 \\
\hline
7
\end{array}
$$

$\therefore \frac{7}{9} = 0.777 = 0.\dot{7}$

Practice Set 25

1. Simplify the following expressions.

1. $50 \times 5 \div 2 + 24$

Solution :

50 × 5 ÷ 2 + 24

= 250 ÷ 2 + 24 ... (Multiplication first)

= 125 + 24 ... (Division)

= 149

2. (13 × 4) ÷ 2 − 26

Solution :

(13 × 4) ÷ 2 - 26

= 52 ÷ 2 − 26 ... (Multiplication first)

= 26 - 26 ... (Division)

= 0

3. $140 \div [(-11) \times (-3) - (-42) \div 14 - 1]$

Solution :

$140 \div [(-11) \times (-3) - (-42) \div 14 - 1]$

$= 140 \div [33 + 42 \div 14 - 1]$ ...(Simplifying brackets)

$= 140 \div [33 + 3 - 1]$ ...(Division)

$= 140 \div [36 - 1]$ ...(Addition)

$= 140 \div 35$ (Subtraction in brackets)

$= 4$

4. $\{(220 - 140) + [10 \times 9 + (-2 \times 5)]\} - 100$

Solution :

$\{(220 - 140) + [10 \times 9 + (-2 \times 5)]\} - 100$

$= \{80 + [10 \times 9 + (-10)]\} - 100$

...(Simplifying first round bracket)

$= \{80 + [90 - 10]\} - 100$

$= \{80 + 80\} - 100$

$= 160 - 100$

$= 60$

5. $\frac{3}{5} + \frac{3}{8} \div \frac{6}{4}$

Solution :

$\because \frac{3}{5} + \frac{3}{8} \div \frac{6}{4}$

$= \frac{3}{5} + \frac{3}{8} \times \frac{4}{6}$

$= \frac{3}{5} + \frac{3 \times 4}{2 \times 4 \times 2 \times 3}$

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

$= \frac{(3 \times 4) + (1 \times 5)}{20}$

$= \frac{12 + 5}{20}$

$= \frac{17}{20}$