CHAPTER – 01

RATIONAL NUMBER

Exercise 1.1

1. Add the following:

(i) $\dfrac{4}{7}$ and $\dfrac{5}{7}$

(ii) $\dfrac{7}{-13}$ and $\dfrac{4}{-13}$

Solution:

(i) Given

$\dfrac{4}{7}$ and $\dfrac{5}{7}$

Adding both the numbers

$\dfrac{4}{7} + \dfrac{5}{7} = \dfrac{(4+5)}{7}$

We get,

$= \dfrac{9}{7}$

$\therefore$ The addition of $\dfrac{4}{7}$ and $\dfrac{5}{7}$ is $\dfrac{9}{7}$

(ii) Given

$\dfrac{7}{-13}$ and $\dfrac{4}{-13}$

Consider

$\dfrac{7}{-13} = \dfrac{\{7 \times (-1)\}}{\{-13 \times (-1)\}}$

$= \dfrac{-7}{13}$

Also,

$$\frac{4}{-13} = \frac{\{4 \times (-1)\}}{\{-13 \times (-1)\}}$$

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

Now,

Adding both the numbers

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

We get,

$$= \frac{-11}{13}$$

2. Simplify:

(i) $\frac{5}{11} + 4\frac{3}{9}$

(ii) $\frac{-4}{9} + 2\frac{12}{13}$

Solution:

(i) Given

$$\frac{5}{11} + 4\frac{3}{9}$$

This can be written as,

$$\frac{5}{11} + \frac{39}{9}$$

Taking L.C.M we get,

$$\frac{5}{11} = \frac{(5 \times 9)}{(11 \times 9)}$$

We get,

$$= \frac{45}{99}$$

$$\frac{39}{9} = \frac{(39 \times 11)}{(9 \times 11)}$$

We get,

$$= \frac{429}{99}$$

Now,

Adding both the numbers,

$$\frac{45}{99} + \frac{429}{99} = \frac{(45 + 429)}{99}$$

$$= \frac{474}{99}$$

$$\begin{array}{r|l|l} 99 & 474 & 4 \\ & \underline{396} & \\ & 78 & \end{array}$$

$$= 4\frac{78}{99}$$

Dividing numerator and denominator by 3,

$$= 4\frac{(78 \div 3)}{(99 \div 3)}$$

We get,

$$= 4\frac{26}{33}$$

(ii) Given

$$\frac{-4}{9} + 2\frac{12}{13}$$

This can be written as,

$$\frac{-4}{9} + \frac{38}{13}$$

Taking L.C.M we get,

$$\frac{-4}{9} = \frac{(-4 \times 13)}{(9 \times 13)}$$

We get,

$$= \frac{-52}{117}$$

$$\frac{38}{13} = \frac{(38 \times 9)}{(13 \times 9)}$$

We get,

$$= \frac{342}{117}$$

Now,

Adding both the numbers,

$$\frac{-52}{117} + \frac{342}{117} = \frac{(-52 + 342)}{117}$$

We get,

$$= \frac{290}{117}$$

$$
\begin{array}{r}
117 \overline{\smash{)}290}\,2 \\
234 \\
\hline
56
\end{array}
$$

$$= 2\frac{56}{117}$$

3. Verify commutative property of addition for the following pairs of rational numbers.

(i) $\frac{-4}{3}$ and $\frac{3}{7}$

(ii) $\dfrac{-2}{-5}$ and $\dfrac{1}{3}$

(iii) $\dfrac{9}{11}$ and $\dfrac{2}{13}$

Solution:

(i) $\dfrac{-4}{3}$ and $\dfrac{3}{7}$

Adding both the numbers,

$$= \dfrac{-4}{3} + \dfrac{3}{7}$$

Taking L.C.M. we get,

$$= \dfrac{(-28 + 9)}{21}$$

$$= \dfrac{-19}{21}$$

And

$$\dfrac{3}{7} + \left(\dfrac{-4}{3}\right)$$

Again taking L.C.M. we get,

$$= \dfrac{(9 - 28)}{21}$$

$$= \dfrac{-19}{21}$$

Therefore,

$$\dfrac{-4}{3} + \dfrac{3}{7} = \dfrac{3}{7} + \left(\dfrac{-4}{3}\right)$$

(ii) $\dfrac{-2}{-5}$ and $\dfrac{1}{3}$

Consider,

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

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

Now,

$$\frac{2}{5} + \frac{1}{3}$$

Taking L.C.M. we get,

$$= \frac{(6+5)}{15}$$

$$= \frac{11}{15}$$

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

Again taking L.C.M. we get,

$$= \frac{(5+6)}{15}$$

$$= \frac{11}{15}$$

Therefore,

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

(iii) $\frac{9}{11}$ and $\frac{2}{13}$

Adding both the numbers,

$$= \frac{9}{11} + \frac{2}{13}$$

Taking L.C.M. we get,

$$= \frac{(117+22)}{143}$$

We get,

$$= \frac{139}{143}$$

And $\frac{2}{13} + \frac{9}{11}$

Again taking L.C.M. we get,

$$= \frac{22 + 117}{143}$$

We get,

$$= \frac{139}{143}$$

Therefore,

$$\frac{9}{11} + \frac{2}{13} = \frac{2}{13} + \frac{9}{11}$$

4. Find the additive inverse of the following rational numbers:

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

(ii) $\frac{-7}{-12}$

Solution:

(i) Given

$\frac{2}{-3}$

Additive inverse of

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

We get,

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

(ii) Given

$$\frac{-7}{-12}$$

Additive inverse of

$$\frac{-7}{-12} = -\left(\frac{-7}{-12}\right)$$

We get,

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

5. Verify that – (- x) = x for

(i) $x = \frac{10}{13}$

(ii) $x = \frac{-15}{17}$

Solution:

(i) $x = \frac{10}{13}$

$$- x = \frac{-10}{13}$$

$$- (- x) = -\left(\frac{-10}{13}\right)$$

$$= \frac{10}{13}$$

Hence, – (- x) = x

(ii) $x = \frac{-15}{17}$

$$- x = \frac{15}{17}$$

$$- (- x) = -\left(\frac{15}{17}\right)$$

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

Hence, – (- x) = x

6. Using appropriate properties of addition, find the following:

(i) $\frac{4}{5} + \frac{11}{7} + \left(\frac{-7}{5}\right) + \left(\frac{-2}{7}\right)$

(ii) $\frac{3}{7} + \frac{4}{9} + \left(\frac{-5}{21}\right) + \left(\frac{2}{3}\right)$

Solution:

(i) $\frac{4}{5} + \frac{11}{7} + \left(\frac{-7}{5}\right) + \left(\frac{-2}{7}\right)$

$= \frac{4}{5} + \left(\frac{-7}{5}\right) + \frac{11}{7} + \left(\frac{-2}{7}\right)$

$= \frac{\{4 + (-7)\}}{5} + \frac{\{11 + (-2)\}}{7}$

$= \frac{(4 - 7)}{5} + \frac{(11 - 2)}{7}$

On further calculation, we get,

$= \frac{-3}{5} + \frac{9}{7}$

Now, taking L.C.M. we get,

$= \frac{(-21 + 45)}{35}$

$= \frac{24}{35}$

(ii) $\frac{3}{7} + \frac{4}{9} + \left(\frac{-5}{21}\right) + \frac{2}{3}$

$= \frac{3}{7} + \left(\frac{-5}{21}\right) + \frac{4}{9} + \frac{2}{3}$

On simplifying, we get,

$$= \frac{\{9 + (-5)\}}{21} + \frac{(4+6)}{9}$$

$$= \frac{4}{21} + \frac{10}{9}$$

Taking L.C.M. we get,

$$= \frac{(12+70)}{63}$$

$$= \frac{82}{63}$$

```
63 | 82 | 1
     63
     19
```

$$= 1\frac{19}{63}$$

7. Fill in the blanks:

(i) $\left(\frac{-4}{9}\right) + \left(\frac{2}{7}\right)$ **is a ……….. Number**

(ii) $\left(\frac{43}{89}\right) + \left(\frac{-51}{47}\right) = \text{……..} + \left(\frac{43}{89}\right)$

(iii) $\frac{2}{7} + \text{……} = \frac{2}{7} = 0 + \text{………}$

(iv) $\frac{4}{11} + \left\{\left(\frac{-7}{12}\right) + \frac{9}{10}\right\} = \left\{\left(\frac{4}{11}\right) + \left(\frac{-7}{12}\right)\right\} + \text{…..}$

(v) $\frac{5}{9} + \text{……} = 0 = \left(\frac{-5}{9}\right) + \text{………}$

Solution:

(i) $\left(\frac{-4}{9}\right) + \left(\frac{2}{7}\right)$ is a rational number

(ii) $\left(\frac{43}{89}\right) + \left(\frac{-51}{47}\right) = \left(\frac{-51}{47}\right) + \left(\frac{43}{89}\right)$ (Commutative property)

(iii) $\frac{2}{7} + 0 = \frac{2}{7} = 0 + \frac{2}{7}$ (Commutative property)

(iv) $\frac{4}{11} + \left\{ \left(\frac{-7}{12} \right) + \frac{9}{10} \right\} = \left\{ \left(\frac{4}{11} \right) + \left(\frac{-7}{12} \right) \right\} + \frac{9}{10}$ (Associative property)

(v) $\frac{5}{9} + \left(\frac{-5}{9} \right) = 0 = \left(\frac{-5}{9} \right) + \frac{5}{9}$ (Existance of zero property)

8. If a = $\frac{-11}{27}$, b = $\frac{4}{9}$ and c = $\frac{-5}{18}$, then verify that a + (b + c) = (a + b) + c

Solution:

Given

$a = \frac{-11}{27}$, $b = \frac{4}{9}$ and $c = \frac{-5}{18}$

a + (b + c) = (a + b) + c

Consider,

L.H.S. = a + (b + c)

$= \frac{-11}{27} + \left\{ \frac{4}{9} + \left(\frac{-5}{18} \right) \right\}$

$= \frac{-11}{27} + \left(\frac{4}{9} - \frac{5}{18} \right)$

On simplification, we get

$= \frac{-11}{27} + \frac{(8 - 5)}{18}$

$= \frac{-11}{27} + \frac{3}{18}$

Taking L.C.M. we get,

$= \frac{(-22 + 9)}{54}$

$= \frac{-13}{54}$

R.H.S. = (a + b) + c

$$= \left(\frac{-11}{27} + \frac{4}{9}\right) + \left(\frac{-5}{18}\right)$$

On further calculation, we get

$$= \left\{\frac{(-11 + 12)}{27}\right\} + \left(\frac{-5}{18}\right)$$

$$= \left(\frac{1}{27}\right) + \left(\frac{-5}{18}\right)$$

$$= \frac{(2 - 15)}{54}$$

$$= \frac{-13}{54}$$

Hence,

L.H.S. = R.H.S.

Exercise 1.2

1. Subtract:

(i) $2\frac{3}{5}$ From $\frac{-3}{7}$

(ii) $\frac{-4}{9}$ From $3\frac{5}{8}$

(iii) $-3\frac{1}{5}$ From $-4\frac{7}{9}$

Solution:

(i)

$2\frac{3}{5}$ From $\frac{-3}{7}$

$= \frac{-3}{7} - \left(\frac{13}{5}\right)$

Taking L.C.M. we get,

$= \frac{(-15 - 91)}{35}$

$= \frac{-106}{35}$

$$
\begin{array}{r}
35 \,\boxed{106}\, 3 \\
105 \\
\hline
1
\end{array}
$$

$= -3\frac{1}{35}$

Hence, the subtraction of $2\frac{3}{5}$ from $\frac{-3}{7}$ is $-3\frac{1}{35}$

(ii) $\dfrac{-4}{9}$ From $3\dfrac{5}{8}$

This can be written as,

$\dfrac{-4}{9}$ From $\dfrac{29}{8}$

$= \dfrac{29}{8} - \left(\dfrac{-4}{9}\right)$

$= \dfrac{29}{8} + \dfrac{4}{9}$

Taking L.C.M. we get,

$= \dfrac{(261 + 32)}{72}$

$= \dfrac{293}{72}$

$$\begin{array}{r} 72 \;\boxed{293}\; 4 \\ \underline{288} \\ 5 \end{array}$$

$= 4\dfrac{5}{72}$

(iii) $3\dfrac{1}{5}$ From $-4\dfrac{7}{9}$

This can be written as,

$= \dfrac{-16}{5}$ from $\dfrac{-43}{9}$

$= \dfrac{-43}{9} - \left(\dfrac{-16}{5}\right)$

$= \dfrac{-43}{9} + \dfrac{16}{5}$

Taking L.C.M. we get,

$$= \frac{(-215 + 144)}{45}$$

We get,

$$= \frac{-71}{45}$$

$$\begin{array}{r|l|l} 45 & 71 & 1 \\ & 45 & \\ \hline & 26 & \end{array}$$

$$= -1\frac{26}{45}$$

2. Sum of two rational numbers is. $\frac{3}{5}$. If one of them is. $\frac{-2}{7}$, find the other.

Solution:

Given

Sum of two rational numbers is $\frac{3}{5}$

One of the number is $\frac{-2}{7}$

Hence, the other number is calculated as follows:

Other number $= \frac{3}{5} - \left(\frac{-2}{7}\right)$

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

Taking L.C.M. we get,

$$= \frac{(21 + 10)}{35}$$

$$= \frac{31}{35}$$

Therefore, the other number is $\frac{31}{35}$

3. What rational number should be added to $\frac{-5}{11}$ to get $\frac{-7}{8}$?

Solution:

Given

According to the statement,

Sum of two numbers $= \dfrac{-7}{8}$

One number $= \dfrac{-5}{11}$

Hence, the other number is calculated as below:

Other number $= \dfrac{-7}{8} - \left(\dfrac{-5}{11}\right)$

$= \dfrac{-7}{8} + \dfrac{5}{11}$

Taking L.C.M. we get,

$= \dfrac{(-77 + 40)}{88}$

$= \dfrac{-37}{88}$

Therefore, the other number is $\dfrac{-37}{88}$

4. What rational number should be subtracted from $-4\frac{3}{5}$ to get $-3\frac{1}{2}$?

Solution:

The required number can be calculated as follows:

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

This can be written as,

$$\left(-\frac{23}{5}\right) + \left(\frac{7}{2}\right)$$

On further calculation, we get

$$= \frac{(-46 + 35)}{10}$$

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

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

Therefore, the required number is $-1\frac{1}{10}$

5. Subtract the sum of $\frac{-5}{7}$ and $\frac{-8}{3}$ from the sum of $\frac{5}{2}$ and $\frac{-11}{12}$.

Solution:

Sum of $\frac{-5}{7}$ and $\frac{-8}{3}$ can be calculated as,

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

On further calculation, we get

$$= \frac{(-15 - 56)}{21}$$

$$= \frac{-71}{21}$$

Now,

Sum of $\frac{5}{2}$ and $\frac{-11}{12}$ can be calculated as,

$$\frac{5}{2} + \left(\frac{-11}{12}\right) = \frac{5}{2} - \frac{11}{12}$$

On simplification, we get,

$$= \frac{(30 - 11)}{12}$$

$$= \frac{19}{12}$$

Now,

$$\frac{19}{12} - \left(\frac{-71}{21}\right)$$

$$= \frac{19}{12} + \frac{71}{21}$$

Taking L.C.M. we get,

$$= \frac{(133 + 284)}{84}$$

$$= \frac{417}{84}$$

$$
\begin{array}{r}
84 \overline{\smash{\big)}\, 417} \, 4 \\
\underline{336} \\
81
\end{array}
$$

$$= 4\frac{81}{84}$$

$$= 4\frac{27}{28}$$

6. If $x = \frac{-4}{7}$ and $y = \frac{2}{5}$, then verify that x − y ≠ y − x

Solution:

Given

$x = \frac{-4}{7}$ and $y = \frac{2}{5}$

Now,

$$x - y = \frac{-4}{7} - \left(\frac{2}{5}\right)$$

$$= \frac{-4}{7} - \frac{2}{5}$$

Taking L.C.M. we get,

$$= \frac{(-20 - 14)}{35}$$

$$= \frac{-34}{35}$$

And

$$y - x = \frac{2}{5} - \left(\frac{-4}{7}\right)$$

$$= \frac{2}{5} + \frac{4}{7}$$

Taking L.C.M. we get,

$$= \frac{(14 + 20)}{35}$$

$$= \frac{34}{35}$$

Therefore, $x - y \neq y - x$

7. If $x = \frac{4}{9}$, $y = \frac{-7}{12}$ and $z = \frac{-2}{3}$, then verify that $x - (y - z) \neq (x - y) - z$

Solution:

Given

$x = \frac{4}{9}$, $y = \frac{-7}{12}$ and $z = \frac{-2}{3}$

$x - (y - z) \neq (x - y) - z$

L.H.S. $= x - (y - z)$

$$= \frac{4}{9} - \left\{\frac{-7}{12} - \left(\frac{-2}{3}\right)\right\}$$

$$= \frac{4}{9} - \left(\frac{-7}{12} + \frac{2}{3} \right)$$

On further calculation, we get

$$= \frac{4}{9} - \left\{ \frac{(-7+8)}{12} \right\}$$

$$= \frac{4}{9} - \left(\frac{1}{12} \right)$$

$$= \frac{4}{9} - \frac{1}{12}$$

Taking L.C.M. we get,

$$= \frac{(16-3)}{36}$$

$$= \frac{13}{36}$$

Now,

R.H.S $= (x - y) - z$

$$= \left\{ \frac{4}{9} - \left(\frac{-7}{12} \right) \right\} - \left(\frac{-7}{12} \right)$$

$$= \left(\frac{4}{9} + \frac{7}{12} \right) + \frac{7}{12}$$

On further calculation, we get

$$= \left\{ \frac{(16+21)}{36} \right\} + \frac{7}{12}$$

$$= \frac{37}{36} + \frac{7}{12}$$

Again taking L.C.M. we get,

$$= \frac{(37+21)}{36}$$

$$= \frac{58}{36}$$

Therefore, $x - (y - z) \neq (x - y) - z$

8. Which of the following statement is true / false?

(i) $\frac{2}{3} - \frac{4}{5}$ is not a rational number.

(ii) $\frac{-5}{7}$ is the additive inverse of $\frac{5}{7}$.

(iii) 0 is the additive inverse of its own.

(iv) Commutative property holds for subtraction of rational numbers.

(v) Associative property does not hold for subtraction of rational numbers.

(vi) 0 is the identity element for subtraction of rational numbers.

Solution:

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

Taking L.C.M

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

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

Is a rational number

Hence, the given statement is **false**

(ii) The given statement is **true**

(iii) The given statement is **true**

(iv) Let us take,

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

We know that,

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

$$\frac{2}{4} \neq \frac{-2}{4}$$

Therefore, the given statement is **false**

(v) The given statement is **true**

(vi) Let us take,

$$\frac{7}{8} - 0 = \frac{7}{8}$$

But $0 - \frac{7}{8} = \frac{-7}{8}$

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

Therefore, the given statement is **false**

Exercise 1.3

1. Multiply and express the result in the lowest form:

(i) $\dfrac{6}{-7} \times \dfrac{14}{30}$

(ii) $6\dfrac{2}{3} \times 1\dfrac{2}{7}$

(iii) $\dfrac{25}{-9} \times \dfrac{-3}{10}$

Solution:

(i) $\dfrac{6}{-7} \times \dfrac{14}{30}$

$= \dfrac{(6 \times 14)}{(-7 \times 30)}$

We get,

$= \dfrac{84}{-210}$

$= \dfrac{(84 \div 42)}{(-210 \div 42)}$

$\because$ HCF of 84, 210 = 42

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

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

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

(ii) $6\dfrac{2}{3} \times 1\dfrac{2}{7}$

This can be written as,

$$= \frac{20}{3} \times \frac{9}{7}$$

$$= \frac{(20 \times 9)}{(3 \times 7)}$$

$$= \frac{180}{21}$$

$$= \frac{(180 \div 3)}{(21 \div 3)}$$

$\because$ HCF of 180, 21 = 3

We get,

$$= \frac{60}{7}$$

$$= 8\frac{4}{7}$$

(iii) $\frac{25}{-9} \times \frac{-3}{10}$

$$= \frac{\{25 \times (-3)\}}{\{(-9) \times 10\}}$$

$$= \frac{-75}{-90}$$

$$= \frac{\{-75 \div (-15)\}}{\{-90 \div (-15)\}}$$

$\because$ HCF of 75, 90 = 15

We get,

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

2. Verify commutative property of multiplication for the following pairs of rational numbers:

(i) $\frac{4}{5}$ and $\frac{-7}{8}$

(ii) $13\frac{1}{8}$ and $1\frac{1}{8}$

(iii) $\frac{-7}{-20}$ and $\frac{5}{-14}$

Solution:

(i) $\frac{4}{5}$ and $\frac{-7}{8}$

Now,

$\frac{4}{5} \times \frac{-7}{8}$

$= \frac{\{4 \times (-7)\}}{5} \times 8$

We get,

$= \frac{-28}{40}$

And

$\frac{-7}{8} \times \frac{4}{5}$

$= \frac{(-7 \times 4)}{(8 \times 5)}$

We get,

$= \frac{-28}{40}$

Therefore, $\frac{4}{5} \times \left(\frac{-7}{8}\right) = \frac{-7}{8} \times \frac{4}{5}$

(ii) $13\frac{1}{8}$ and $1\frac{1}{8}$

This can be written as,

$\frac{40}{3}$ and $\frac{9}{8}$

Now,

$\frac{40}{3} \times \frac{9}{8}$

$= \frac{(40 \times 9)}{(3 \times 8)}$

$= \frac{360}{24}$

We get,

$= 15$

And

$\frac{9}{8} \times \frac{40}{3}$

$= \frac{(9 \times 40)}{(8 \times 3)}$

$= \frac{360}{24}$

We get,

$= 15$

Therefore, $\frac{40}{3} \times \frac{9}{8} = \frac{9}{8} \times \frac{40}{3}$

(iii) $\frac{-7}{-20}$ and $\frac{5}{-14}$

$\frac{-7}{-20} = \frac{\{-7 \times (-1)\}}{\{-20 \times (-1)\}}$

$= \frac{7}{20}$

Now, $\frac{7}{20}$ and $\frac{5}{-14}$

$$\frac{7}{20} \times \frac{5}{-14}$$

$$= \frac{(7 \times 5)}{20} \times (-14)$$

$$= \frac{35}{-280}$$

and

$$\frac{5}{-14} \times \frac{7}{20}$$

$$= \frac{(5 \times 7)}{(-14 \times 20)}$$

$$= \frac{35}{-280}$$

Therefore, $\dfrac{7}{20} \times \dfrac{5}{-14} = \dfrac{5}{-14} \times \dfrac{7}{20}$

3. Verify the following and name the property also:

(i) $\dfrac{3}{5} \times \left(\dfrac{-4}{7} \times \dfrac{-8}{9}\right) = \left(\dfrac{3}{5} \times \dfrac{-4}{7}\right) \times \dfrac{-8}{9}$

(ii) $\dfrac{5}{9} \times \left(\dfrac{-3}{2} + \dfrac{7}{5}\right) = \dfrac{5}{9} \times \dfrac{-3}{2} + \dfrac{5}{9} \times \dfrac{7}{5}$

Solution:

(i) $\dfrac{3}{5} \times \left(\dfrac{-4}{7} \times \dfrac{-8}{9}\right) = \left(\dfrac{3}{5} \times \dfrac{-4}{7}\right) \times \dfrac{-8}{9}$

L.H.S. $= \dfrac{3}{5} \times \left(\dfrac{-4}{7} \times \dfrac{-8}{9}\right)$

$$= \frac{3}{5} \times \frac{(-4 \times -8)}{7 \times 9}$$

$$= \frac{3}{5} \times \frac{32}{63}$$

$$= \frac{3 \times 32}{5 \times 63}$$

We get,

$$= \frac{96}{315}$$

R.H.S. $= \left(\frac{3}{5} \times \frac{-4}{7}\right) \times \frac{-8}{9}$

$$= \frac{-12}{35} \times \frac{-8}{9}$$

$$= \frac{\{-12 \times (-8)\}}{(35 \times 9)}$$

We get,

$$= \frac{96}{315}$$

Hence, $\frac{3}{5} \times \left(\frac{-4}{7} \times \frac{-8}{9}\right) = \left(\frac{3}{5} \times \frac{-4}{7}\right) \times \frac{-8}{9}$

The name of the property is Associative property of multiplication

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

L.H.S $= \frac{5}{9} \times \left(\frac{-3}{2} + \frac{7}{5}\right)$

$$= \frac{5}{9} \times \left\{\frac{(-15 + 14)}{10}\right\}$$

We get,

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

$$= \frac{-5}{90}$$

$$= \frac{(-5 \div 5)}{(90 \div 5)}$$

We get,

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

R.H.S. $= \frac{5}{9} \times \frac{-3}{2} + \frac{5}{9} \times \frac{7}{5}$

On further calculation, we get,

$$= \frac{-15}{18} + \frac{35}{45}$$

Taking L.C.M. we get,

$$= \frac{(-75 + 70)}{90}$$

$$= \frac{-5}{90}$$

$$= \frac{(-5 \div 5)}{(90 \div 5)}$$

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

Hence, L.H.S. = R.H.S.

4. Find the multiplication inverse of the following:

(i) 12

(ii) $\frac{2}{3}$

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

(iv) $\frac{-3}{8} \times \left(\frac{-7}{13} \right)$

Solution:

(i) The multiplication inverse of 12 is $\frac{1}{12}$

(ii) The multiplication inverse of $\frac{2}{3}$ is $\frac{3}{2}$

(iii) The multiplication inverse of $\frac{-4}{7}$ is $\frac{7}{-4}$

(iv) $\frac{-3}{8} \times \left(\frac{-7}{13}\right) = \frac{21}{104}$

The multiplication inverse of $\frac{21}{104}$ is $\frac{104}{21} = 4\frac{20}{21}$

5. Using the appropriate properties of operations of rational numbers, evaluate the following:

(i) $\frac{2}{5} \times \frac{-3}{7} - \frac{1}{14} - \frac{3}{7} \times \frac{3}{5}$

(ii) $\frac{8}{9} \times \frac{4}{5} + \frac{5}{6} - \frac{9}{5} \times \frac{8}{9}$

(iii) $\frac{-3}{7} \times \frac{14}{15} \times \frac{7}{12} \times \left(-\frac{30}{35}\right)$

Solution:

(i) $\frac{2}{5} \times \frac{-3}{7} - \frac{1}{14} - \frac{3}{7} \times \frac{3}{5}$

$= \frac{2}{5} \times \frac{-3}{7} - \frac{3}{7} \times \frac{3}{5} - \frac{1}{14}$

Taking common term, we get

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

$= \frac{-3}{7} \times \frac{(2+3)}{5} - \frac{1}{14}$

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

$= \frac{-3}{7} - \frac{1}{14}$

Taking L.C.M. we get,

$= \frac{(-6-1)}{14}$

$$= \frac{-7}{14}$$

$$= \frac{(-7 \div 7)}{(14 \div 7)}$$

We get,

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

(ii) $\frac{8}{9} \times \frac{4}{5} + \frac{5}{6} - \frac{9}{5} \times \frac{8}{9}$

$$= \frac{8}{9} \times \frac{4}{5} - \frac{9}{5} \times \frac{8}{9} + \frac{5}{6}$$

Taking common terms, we get,

$$= \frac{8}{9} \left(\frac{4}{5} - \frac{9}{5} \right) + \frac{5}{6}$$

$$= \frac{8}{9} \left\{ \frac{(4-9)}{5} \right\} + \frac{5}{6}$$

$$= \frac{8}{9} \times \frac{-5}{5} + \frac{5}{6}$$

$$= \frac{8}{9} \times (-1) + \frac{5}{6}$$

On further calculation, we get

$$= \frac{-8}{9} + \frac{5}{6}$$

Taking L.C.M. we get,

$$= \frac{(-16+15)}{18}$$

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

(iii) $\frac{-3}{7} \times \frac{14}{15} \times \frac{7}{12} \times \left(-\frac{30}{35} \right)$

$$= \left(\frac{-3}{7} \times \frac{14}{15}\right) \times \left(\frac{7}{12} \times \frac{-30}{35}\right)$$

On further calculation, we get

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

We get,

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

6. If $p = \frac{-8}{27}$, $q = \frac{3}{4}$ and $r = \frac{-12}{15}$, then verify that

(i) $p \times (q \times r) = (p \times q) \times r$

(ii) $p \times (q - r) = p \times q - p \times r$

Solution:

Given

$p = \frac{-8}{27}$, $q = \frac{3}{4}$ and $r = \frac{-12}{15}$

(i) $p \times (q \times r) = (p \times q) \times r$

L.H.S. $= p \times (q \times r)$

$$= \frac{-8}{27} \times \left(\frac{3}{4} \times \frac{-12}{15}\right)$$

$$= \frac{-8}{27} \times \frac{-3}{5}$$

On further calculation, we get,

$$= \frac{\{(-8) \times (-3)\}}{(27 \times 5)}$$

$$= \frac{24}{(27 \times 5)}$$

We get,

$$= \frac{8}{45}$$

Now,

R.H.S. $= (p \times q) \times r$

$$= \left(\frac{-8}{27} \times \frac{3}{4} \right) \times \frac{-12}{15}$$

$$= \frac{-2}{9} \times \frac{-12}{15}$$

We get,

$$= \frac{8}{45}$$

Therefore, L.H.S. = R.H.S.

(ii) $p \times (q - r) = p \times q - p \times r$

L.H.S. $= p \times (q - r)$

$$= \frac{-8}{27} \times \left\{ \left(\frac{3}{4} \right) - \left(-\frac{12}{5} \right) \right\}$$

Taking L.C.M. we get,

$$= \frac{-8}{27} \times \left\{ \frac{(45 + 48)}{60} \right\}$$

$$= \frac{-8}{27} \times \frac{93}{60}$$

We get,

$$= \frac{-62}{135}$$

R.H.S. $= p \times q - p \times r$

$$= \frac{-8}{27} \times \frac{3}{4} - \left(\frac{8}{27} \times \frac{-12}{15} \right)$$

$$= \frac{-2}{9} - \frac{32}{135}$$

$$= \frac{(-30 - 32)}{135}$$

We get,

$$= \frac{-62}{135}$$

Therefore, L.H.S. = R.H.S.

7. Fill in the following blanks:

(i) $\frac{2}{3} \times -\frac{4}{5}$ is a …… number.

(ii) $\frac{54}{81} \times \frac{-63}{108} = \text{………} \times \frac{54}{81}$

(iii) $\frac{4}{5} \times 1 = \text{……} = 1 \times \text{……}$

(iv) $\frac{5}{-12} \times \text{……} = 1 = \frac{-12}{5} \times \text{……}$

(v) $\frac{3}{7} \times \left(\frac{-2}{8} \times \text{…} \right) = \left(\frac{3}{7} \times \frac{-2}{8} \right) \times \frac{5}{9}$

(vi) $\frac{-8}{9} \times \left\{ \frac{4}{13} + \frac{5}{17} \right\} = \frac{-8}{9} \times \frac{4}{13} + \text{… … …}$

(vii) $\frac{-6}{13} \times \left\{ \frac{8}{9} - \frac{4}{7} \right\} = \frac{-6}{13} \times \text{… ….} - \left(\frac{-6}{13} \right) \times \left(\frac{4}{7} \right)$

(viii) $\frac{16}{23} \times \text{………} = 0$

(ix) The reciprocal of 0 is ………..

(x) The numbers …… and …… are their own reciprocals.

(xi) If y be the reciprocal of x, then the reciprocal of y^2 in terms of x will be ……

(xii) The product of a non-zero rational number and its reciprocal is ………..

(xiii) The reciprocal of a negative rational number is ……….

Solution:

(i) $\frac{2}{3} \times -\frac{4}{5}$ is a rational number.

(ii) $\frac{54}{81} \times \frac{-63}{108} = \ldots\ldots\ldots \times \frac{54}{81}$

$\frac{54}{81} \times \frac{-63}{108} = \frac{-63}{108} \times \frac{54}{81}$

(iii) $\frac{4}{5} \times 1 = \ldots\ldots = 1 \times \ldots\ldots$

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

(iv) $\frac{5}{-12} \times \ldots\ldots = 1 = \frac{-12}{5} \times \ldots\ldots$

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

(v) $\frac{3}{7} \times \left(\frac{-2}{8} \times \ldots \right) = \left(\frac{3}{7} \times \frac{-2}{8} \right) \times \frac{5}{9}$

$\frac{3}{7} \times \left(\frac{-2}{8} \times \frac{5}{9} \right) = \left(\frac{3}{7} \times \frac{-2}{8} \right) \times \frac{5}{9}$

(vi) $\frac{-8}{9} \times \left(\frac{4}{13} + \frac{5}{17} \right) = \frac{-8}{9} \times \frac{4}{13} + \ldots\ldots$

$\frac{-8}{9} \times \left(\frac{4}{13} + \frac{5}{17} \right) = \frac{-8}{9} \times \frac{4}{13} + \frac{-8}{9} \times \frac{5}{17}$

(vii) $\frac{-6}{13} \times \left(\frac{8}{9} - \frac{4}{7} \right) = \frac{-6}{13} \times \ldots - \left(\frac{-6}{13} \right) \times \left(\frac{4}{7} \right)$

$\frac{-6}{13} \times \left(\frac{8}{9} - \frac{4}{7} \right) = \frac{-6}{13} \times \frac{8}{9} - \left(\frac{-6}{13} \right) \times \left(\frac{4}{7} \right)$

(viii) $\frac{16}{23} \times \ldots = 0$

$\frac{16}{23} \times 0 = 0$

(ix) The reciprocal of 0 is not defined

(x) The numbers 1 and – 1 are their own reciprocals

(xi) If y be the reciprocal of x, then the reciprocal of y^2 in terms of x will be x^2

(xii) The product of a non-zero rational number and its reciprocal is 1

(xiii) The reciprocal of a negative rational number is a negative rational number

8. If $\frac{4}{5}$ the multiplicative inverse of $-1\frac{1}{4}$? Why or why not?

Solution:

No, the multiplicative inverse of $\frac{4}{5}$ is not $\frac{-5}{4}$

The multiplicative inverse of $\frac{4}{5}$ is $\frac{5}{4}$

9. Using distributive, find

(i) $\left\{\frac{7}{5} \times \left(\frac{-3}{12}\right)\right\} + \left\{\frac{7}{5} + \frac{5}{12}\right\}$

(ii) $\left\{\frac{9}{16} \times \frac{4}{12}\right\} + \left\{\frac{9}{16} \times \left(\frac{-3}{9}\right)\right\}$

Solution:

(i) $\left\{\frac{7}{5} \times \left(\frac{-3}{12}\right)\right\} + \left\{\frac{7}{5} + \frac{5}{12}\right\}$

Taking common factor, we get

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

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

$= \frac{7}{5} \times \frac{2}{12}$

We get,

$= \dfrac{7}{30}$

(ii) $\left\{ \dfrac{9}{16} \times \dfrac{4}{12} \right\} + \left\{ \dfrac{9}{16} \times \left(\dfrac{-3}{9} \right) \right\}$

Taking common factor, we get

$= \dfrac{9}{16} \times \left\{ \dfrac{4}{12} + \left(\dfrac{-3}{9} \right) \right\}$

$= \dfrac{9}{16} \times \left(\dfrac{1}{3} - \dfrac{1}{3} \right)$

We get,

$= \dfrac{9}{16} \times 0$

$= 0$

10. Find the sum of additive inverse and multiplication inverse of 9.

Solution:

The additive inverse of 9 is -9

The multiplicative inverse of 9 is $\dfrac{1}{9}$

Hence,

$-9 + \dfrac{1}{9} = \dfrac{(-81 + 1)}{9}$

We get,

$= \dfrac{-80}{9}$

$= -8\dfrac{8}{9}$

11. Find the product of additive inverse and multiplicative inverse of $\frac{-3}{7}$

Solution:

The additive inverse of $\frac{-3}{7}$ is $\frac{3}{7}$

The multiplicative inverse of $\frac{-3}{7}$ is $\frac{-7}{3}$

Therefore,

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

Exercise 1.4

1. Find the value of the following:

(i) $\dfrac{-3}{7} \div 4$

(ii) $4\dfrac{5}{8} \div \left(\dfrac{-4}{9}\right)$

(iii) $\dfrac{-8}{9} \div \dfrac{-3}{5}$

Solution:

(i) $\dfrac{-3}{7} \div 4$

$= \dfrac{-3}{7} \times \dfrac{1}{4}$

We get,

$= \dfrac{-3}{28}$

Hence, the value of $\dfrac{-3}{7} \div 4 = \dfrac{-3}{28}$

(ii) $4\dfrac{5}{8} \div \left(\dfrac{-4}{9}\right)$

This can be written as,

$= \dfrac{37}{8} \div \left(\dfrac{-4}{9}\right)$

$= \dfrac{37}{8} \times \dfrac{9}{-4}$

We get,

$= \dfrac{333}{-32}$

$$= \frac{\{333 \times (-1)\}}{\{-32 \times (-1)\}}$$

$$= \frac{-333}{32}$$

$$= -10\frac{13}{32}$$

(iii) $-\dfrac{8}{9} \div -\dfrac{3}{5}$

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

$$= \frac{-40}{-27}$$

$$= \frac{\{-40 \times (-1)\}}{\{-27 \times (-1)\}}$$

We get,

$$= \frac{40}{27}$$

$$= 1\frac{13}{27}$$

2. State whether the following statements are true or false:

(i) $\dfrac{-9}{13} \div \dfrac{2}{7}$ is a rational number.

(ii) $\dfrac{4}{13} \div \dfrac{11}{12} = \dfrac{11}{12} \div \dfrac{4}{13}$

(iii) $\dfrac{-3}{4} \div \left(\dfrac{5}{9} \div \dfrac{-4}{11}\right) = \left(\dfrac{-3}{4} \div \dfrac{5}{9}\right) \div \dfrac{-4}{11}$

(iv) $\dfrac{13}{14} \div \dfrac{-5}{7} \neq \dfrac{-5}{7} \div \dfrac{13}{14}$

(v) $\left(-7 \div \dfrac{4}{5}\right) \div \dfrac{-9}{10} \neq -7 \div \left(\dfrac{4}{5} \div \dfrac{-9}{10}\right)$

(vi) $\frac{-7}{24} \div \frac{6}{11}$ **is not a rational number.**

Solution:

(i) The given statement is **true**

(ii) The given statement is **false**

Correct: Commutative property is not true for the division

(iii) The given statement is **false**

Correct: Associative in division is not **true**

(iv) The given statement is **true**

(v) The given statement is **true**

(vi) The given statement is **false**

Correct: It is a rational number

3. The product of two rational numbers is $\frac{-11}{12}$. If one of them is $\frac{4}{9}$, find the other.

Solution:

Given

Product of two rational numbers $= \frac{-11}{12}$

One of the number $= 2\frac{4}{9} = \frac{22}{9}$

The other number is calculated as below

$\frac{-11}{12} \div \frac{22}{9}$

$= \frac{-11}{12} \times \frac{9}{22}$

We get,

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

Therefore, the other number is $\frac{-3}{8}$

4. By what rational number should $\frac{-7}{12}$ be multiplied to get the product as $\frac{5}{14}$?

Solution:

Given

Product $= \frac{5}{14}$

The required number can be calculated as below

$$\frac{5}{14} \div \frac{-7}{12}$$

$$= \frac{5}{14} \times \frac{12}{-7}$$

We get,

$$= \frac{30}{-49}$$

$$= \frac{\{30 \times (-1)\}}{\{-49 \times (-1)\}}$$

$$= \frac{-30}{49}$$

Hence, the required number is $\frac{-30}{49}$

5. By what rational number should -3 is divided to get $\frac{-9}{13}$?

Solution:

The required number can be calculated as follows:

$$-3 \div \frac{-9}{13}$$

$$= -3 \times \frac{13}{-9}$$

We get,

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

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

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

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

Therefore, the required number is $4\frac{1}{3}$.

6. Divide the sum of $\frac{-13}{8}$ and $\frac{5}{12}$ by their difference.

Solution:

Given

Sum of $\frac{-13}{8}$ and $\frac{5}{12}$ is calculated as,

$$= \frac{-13}{8} + \frac{5}{12}$$

On further calculation, we get

$$= \frac{(-39 + 10)}{24}$$

We get,

$$= \frac{-29}{24}$$

Now,

Difference of $\frac{-13}{8}$ and $\frac{5}{12}$ is calculated as,

$$= \frac{-13}{8} - \frac{5}{12}$$

We get,

$$= \frac{(-39 - 10)}{24}$$

$$= \frac{-49}{24}$$

Now,

$$\frac{-29}{24} \div \frac{-49}{24}$$

$$= \frac{-29}{24} \times \frac{24}{-49}$$

$$= \frac{-29}{-49}$$

$$= \frac{\{-29 \times (-1)\}}{\{-49 \times (-1)\}}$$

We get,

$$= \frac{29}{49}$$

7. Divide the sum of $\frac{8}{3}$ and $\frac{4}{7}$ by the product of $\frac{-3}{7}$ and $\frac{14}{9}$.

Solution:

Sum of $\frac{8}{3}$ and $\frac{4}{7}$ is calculated as below

$$\frac{8}{3} + \frac{4}{7} = \frac{(56 + 12)}{21}$$

We get,

$$= \frac{68}{21}$$

Product of $\frac{-3}{7}$ and $\frac{14}{9}$ is calculated as follows:

$$\frac{-3}{7} \times \frac{14}{9} = \frac{-2}{3}$$

Hence,

$$\frac{68}{21} \div \frac{-2}{3} = \frac{68}{21} \times \frac{3}{-2}$$

We get,

$$= \frac{34}{-7}$$

$$= \frac{\{34 \times (-1)\}}{\{-7 \times (-1)\}}$$

$$= \frac{-34}{7}$$

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

8. If $p = \frac{-3}{2}$, $q = \frac{4}{5}$ and $r = \frac{-7}{12}$, then verify that $(p \div q) \div r \neq p \div (q \div r)$

Solution:

Given

$p = \frac{-3}{2}$, $q = \frac{4}{5}$ and $r = \frac{-7}{12}$

$(p \div q) \div r \neq p \div (q \div r)$

LHS $= (p \div q) \div r$

$$= \left(\frac{-3}{2} \div \frac{4}{5}\right) \div \left(\frac{-7}{12}\right)$$

$$= \left(\frac{-3}{2} \div \frac{5}{4}\right) \div \left(\frac{-7}{12}\right)$$

$$= \frac{-15}{8} \div \frac{-7}{12}$$

$$= \frac{-15}{8} \times \frac{12}{-7}$$

We get,

$$= \frac{-45}{-14}$$

$$= \frac{\{-45 \times (-1)\}}{\{-14 \times (-1)\}}$$

$$= \frac{45}{14}$$

Now,

RHS = p ÷ (q ÷ r)

$$= \frac{-3}{2} \div \left(\frac{4}{5}\right) \div \left(\frac{-7}{12}\right)$$

$$= \frac{-3}{2} \div \left(\frac{4}{5} \times \frac{12}{-7}\right)$$

We get,

$$= \frac{-3}{2} \div \frac{48}{-35}$$

$$= \frac{-3}{2} \times \frac{-35}{48}$$

We get,

$$= \frac{35}{32}$$

Therefore, LHS ≠ RHS

Exercise 1. 5

1. Represent the following rational numbers on the number line.
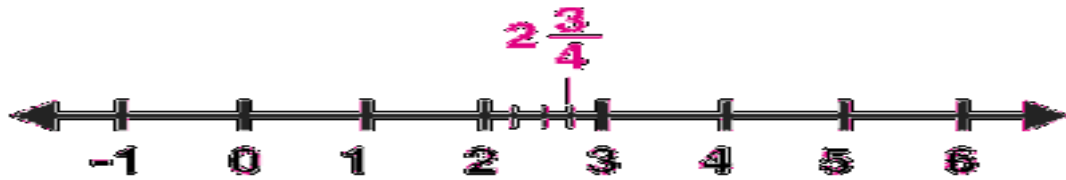
(i) $\dfrac{11}{4}$

(ii) $4\dfrac{3}{5}$

(iii) $\dfrac{-9}{7}$

(iv) $\dfrac{-2}{-5}$

Solution:

(i) $\dfrac{11}{4} = 2\dfrac{3}{4}$

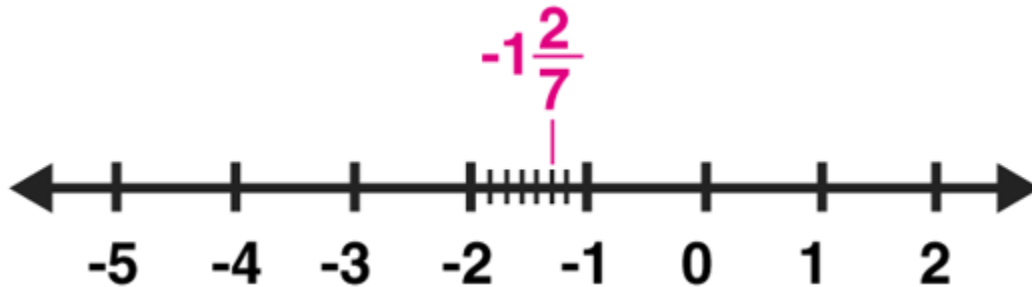The given rational number on the number line is shown as below:

(ii) $4\dfrac{3}{5}$

The given rational number on the number line is shown as below

(iii) $\dfrac{-9}{7} = -1\dfrac{2}{7}$

The given rational number on the number line is shown as below

$-1\dfrac{2}{7}$

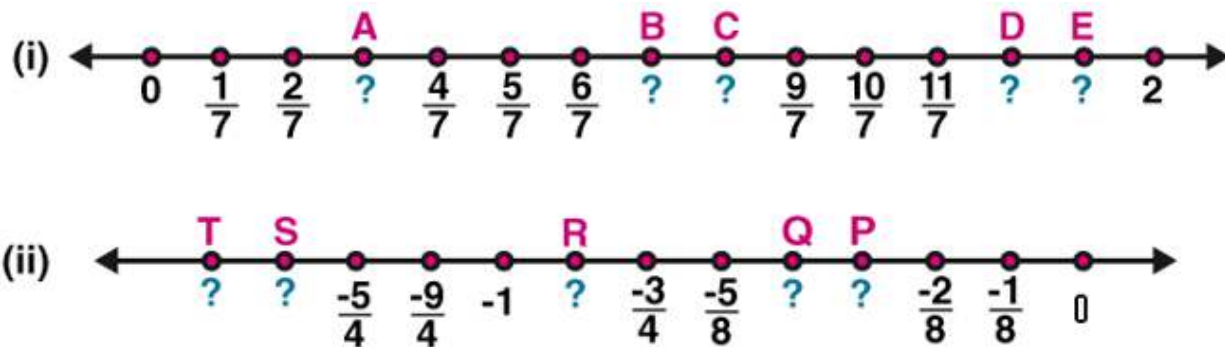(iv) $\dfrac{-2}{-5} = -2 \times \dfrac{(-1)}{-5} \times (-1)$

We get,

$= \dfrac{2}{5}$

The given rational number on the number line is shown as below

$\dfrac{2}{5}$

2. Write the rational numbers for each point labeled with a letter:

(i)

(ii)

Solution:

(i) The rational numbers for each point labeled with a letter are as follows:

$A = \dfrac{3}{7}$

$B = \dfrac{7}{7} = 1$

$C = \dfrac{8}{7} = 1\dfrac{1}{7}$

$D = \dfrac{12}{7} = 1\dfrac{5}{7}$

$E = \dfrac{13}{7} = 1\dfrac{6}{7}$

(ii) The rational numbers for each point labeled with a letter are as follows:

$P = -\dfrac{3}{8}$

$Q = -\dfrac{4}{8}$ or $-\dfrac{1}{2}$

$R = -\dfrac{7}{8}$

$S = -\dfrac{11}{8}$

$T = -\dfrac{12}{8}$ or $-\dfrac{3}{2}$

3. Find twenty rational numbers between $-\frac{3}{7}$ and $\frac{2}{3}$

Solution:

Twenty rational numbers between $-\frac{3}{7}$ and $\frac{2}{3}$ can be calculated as follows:

We know that,

LCM of 7, 3 = 21

Hence,

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

We get,

$$= -\frac{9}{21}$$

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

We get,

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

Now, twenty rational numbers between $-\frac{9}{21}$ and $\frac{14}{21}$ are,

$$-\frac{8}{21}, -\frac{7}{21}, -\frac{6}{21}, -\frac{5}{21}, -\frac{4}{21}, -\frac{3}{21}, -\frac{2}{21}, -\frac{1}{21}, 0, \frac{1}{21}, \frac{2}{21}, \frac{3}{21}, \frac{4}{21}, \frac{5}{21}, \frac{6}{21}, \frac{7}{21}, \frac{8}{21}, \frac{9}{21}, \frac{10}{21},$$

$$\frac{11}{21}, \frac{12}{21} \text{ and } \frac{13}{21}$$

4. Find six rational numbers between $\frac{-1}{2}$ and $\frac{5}{4}$

Solution:

Six rational numbers between $\frac{-1}{2}$ and $\frac{5}{4}$ can be calculated as below

LCM of 2, 4 = 4

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

We get,

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

Now, six rational numbers between $\frac{-1}{2}$ and $\frac{5}{4}$ are as follows:

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

5. Find three rational numbers between – 2 and – 1

Solution:

Three rational numbers between – 2 and – 1 can be calculated as below:

First rational number $= \frac{1}{2}(-1 - 2)$

We get,

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

Second rational number – 2 and $\frac{-3}{2}$

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

$$= \frac{1}{2}\left(\frac{-7}{2}\right)$$

We get,

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

Third rational number between $\frac{-3}{2}$ and – 1

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

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

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

We get,

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

Therefore, three rational numbers are $\frac{-7}{4}, \frac{-3}{2}, \frac{-5}{4}$

6. Write ten rational numbers which are greater than 0.

Solution:

Ten rational numbers which are greater than 0

There can be the finite number of a rational number greater than 1.

Here, we shall take only 10 rational numbers.

The numbers are as follows:

$\left(\frac{1}{2}\right), 1, \left(\frac{3}{2}\right), 2, \left(\frac{5}{2}\right), 3, \left(\frac{7}{2}\right), 4, \left(\frac{9}{2}\right), 5$ etc.

7. Write five rational numbers which are smaller than – 4

Solution:

Five rational numbers which are smaller than – 4

These can be finite number of rational numbers smaller than – 4

Here, we shall take only 5 rational numbers.

The numbers are as follows:

$\left(-\frac{9}{2}\right), -5, \left(-\frac{11}{2}\right), -6, \left(-\frac{13}{2}\right),$ etc.

8. Identify the rational number which is different from the other three. Explain your reasoning

$\left(-\frac{5}{11}\right), \left(-\frac{1}{2}\right), \left(-\frac{4}{9}\right), \left(-\frac{7}{3}\right)$

Solution:

Given four rational number are,

$\left(-\frac{5}{11}\right), \left(-\frac{1}{2}\right), \left(-\frac{4}{9}\right), \left(-\frac{7}{3}\right)$

Among the given numbers,

$-\frac{7}{3}$ is different from the other three numbers.

Because in $-\frac{7}{3}$ its denominator is less than its numerator

In other numbers, denominators are greater than their numerators respectively.

Exercise 1.6

1. In a bag, there are 20 kg of fruits. If $7\frac{1}{6}$ kg of these fruits be oranges and $8\frac{2}{3}$ kg of these are apples and rest are grapes. Find the mass of the grapes in the bag.

Solution:

Given

Total fruits in a bag = 20 kg

Oranges = $7\frac{1}{6}$ kg i.e. $\frac{43}{6}$ kg

Apples = $8\frac{2}{3}$ kg i.e. $\frac{26}{3}$ kg

Remaining fruits in a bag = $20 - \left\{\left(\frac{43}{6}\right) + \left(\frac{26}{3}\right)\right\}$ kg

$= 20 - \left\{\frac{43 + 52}{6}\right\}$

On further calculation, we get

$= 20 - \left(\frac{95}{6}\right)$

$= \frac{(120 - 95)}{6}$

$= \frac{25}{6}$

$= 4\frac{1}{6}$ kg

Therefore, the mass of the grapes in the bag is $4\frac{1}{6}$ kg.

2. The population of a city is 6, 63,432. If $\frac{1}{2}$ of the population are adult males and $\frac{1}{3}$ of the population are adult females, then find the number of children in the city.

Solution:

Given

Population of a city = 6, 63,432

Population of adult males = $\left(\frac{1}{2}\right)$ of 6,63,432

= 3,31,716

Population of adult females = $\left(\frac{1}{3}\right)$ of 6,63,432

= 2,21,144

Remaining population can be calculated as below

Remaining population = 6,63,432 – (3,31,716 + 2,21,144)

= 6,63,432 – 5,52,860

We get,

= 1,10,572

Therefore, number of children in a city are 1,10,572

3. In an election of housing society, there are 30 voters. Each of them gives the vote. Three persons X, Y and Z are standing for the post of Secretary. If Mr. X got $\frac{2}{5}$ of the total votes and Mr. Z got $\frac{1}{3}$ of the total votes, then find the number of votes which Mr. Y got.

Solution:

Given

Number of votes = 30

Number of person for election = X, Y, Z

X got $\left(\frac{2}{5}\right)$ of total votes = $\left(\frac{2}{5}\right)$ of 30

$= \left(\frac{2}{5}\right) \times 30$

$= 12$

Z got $\frac{1}{3}$ of total votes $= \frac{1}{3}$ of 30

$= \left(\frac{1}{3}\right) \times 30$

$= 10$

Remaining votes can be calculated as below

$= 30 - (12 + 10)$

$= 30 - 22$

We get,

$= 8$

Therefore, Mr. Y got 8 votes

4. A person earns Rs 100 in a day. If he spent Rs $14\frac{2}{7}$ on food and Rs. $30\frac{2}{3}$ on petrol. How much did he save on that day?

Solution:

Given

A person's earning in a day = Rs 100

Money spent on food = Rs $14\frac{2}{7}$ = Rs $\frac{100}{7}$

Money spent on petrol = Rs. $30\frac{2}{3}$ = Rs $\frac{92}{3}$

The savings of a person is calculated as follows:

Savings = Rs $100 - \left\{\left(\frac{100}{7} + \frac{92}{3}\right)\right\}$

= Rs $100 - \left\{\frac{(300 + 644)}{21}\right\}$

On further calculation, we get

= Rs $100 - \left(\frac{944}{21}\right)$

= $\frac{(2100 - 944)}{21}$

= Rs $\frac{1156}{21}$

= Rs. $55\frac{1}{21}$

Hence, a person saved Rs. $55\frac{1}{21}$ on that day.

5. In an examination, 400 students appeared. If $\frac{2}{3}$ of the boys and all 130 girls passed in the examination, then find how many boys failed in an examination?

Solution:

Given

Number of students appeared exams = 400

$\left(\frac{2}{3}\right)$ of total boys and all 130 girls passed in the examination

Hence,

Number of total boys = 400 − 130

= 270

Number of boys passed = $\left(\frac{2}{3}\right)$ of 270

= $\left(\frac{2}{3}\right) \times 270$

= 180

So, number of boys failed = 270 – 180

= 90

Hence, 90 boys failed in an examination.

6. A car is moving at the speed of $40\frac{2}{3}$ km / h. Find how much distance will it cover in $\frac{9}{10}$ hrs.

Solution:

Given

Speed of a car = $40\frac{2}{3}$ km / h = $\frac{122}{3}$ km / h

Distance covered in $\frac{9}{10}$ hour can be calculated as follows:

Distance = $\left(\frac{122}{3}\right) \times \left(\frac{9}{10}\right)$

= $\frac{366}{10}$

We get,

= 36.6 km

= $36\frac{3}{5}$ km

Therefore, the distance covered by the car in $\frac{9}{10}$ hours is $36\frac{3}{5}$ km

7. Find the area of a square lawn whose one side is $5\frac{7}{9}$ m long.

Solution:

Given

One side of a square lawn $= 5\frac{7}{9}$ m $= \frac{52}{9}$ m

The area of a square lawn can be calculated as follows:

Area $= (\text{side})^2$

$= \left(\frac{52}{9}\right)^2$

We get,

$= \frac{2704}{81}$ sq. m

$= 33\frac{31}{81}$ sq. m

Therefore, the area of a square lawn is $33\frac{31}{81}$ sq. m

8. Perimeter of a rectangle is $15\frac{3}{7}$ m. If the length is $4\frac{2}{7}$ m, find its breadth.

Solution:

Given

Perimeter of a rectangle $= 15\frac{3}{7}$ m

$= \frac{108}{7}$ m

So,

Length + Breadth $= \left(\frac{108}{7}\right) \div 2$

$$= \left(\frac{108}{7}\right) \times \left(\frac{1}{2}\right)$$

We get,

$$= \frac{54}{7} \text{ m}$$

Given length $= 4\frac{2}{7}$

$$= \frac{30}{7} \text{ m}$$

Hence, breadth of a rectangle can be calculated as,

$$\text{Breadth} = \left(\frac{54}{7}\right) - \left(\frac{30}{7}\right)$$

$$= \frac{24}{7}$$

$$= 3\frac{3}{7} \text{ m}$$

Therefore, the breadth of a rectangle is $3\frac{3}{7}$ m

9. Rahul had a rope of $325\frac{4}{5}$ m long. He cut off a $150\frac{3}{5}$ m long piece, then he divided the rest of the rope into 3 parts of equal length. Find the length of each part.

Solution:

Given

Length of a rope $= 325\frac{4}{5}$ m

Length of one piece of rope after cut off $= 150\frac{3}{5}$ m

Remaining length of a rope can be calculated as below

$$= 325\frac{4}{5} - 150\frac{3}{5}$$

We get,

$$= 175\frac{1}{5} \text{ m}$$

$$= \frac{876}{5} \text{ m}$$

This length divided into three equal parts

So, length of each part can be calculated as follows:

Length of each part $= \left(\frac{876}{5}\right) \div 3$

$$= \left(\frac{876}{5}\right) \times \left(\frac{1}{3}\right)$$

We get,

$$= \frac{292}{5} \text{ m}$$

$$= 58\frac{2}{5} \text{ m}$$

Therefore, the length of each part of a rope is $58\frac{2}{5} \text{ m}$

10. If $3\frac{1}{2}$ litre of petrol costs Rs. $270\frac{3}{8}$ then find the cost of 4 litre of petrol.

Solution:

Given

Cost of $3\frac{1}{2}$ litre $= \frac{7}{2}$ litre of petrol $=$ Rs. $270\frac{3}{8}$

$$= \text{Rs } \frac{2163}{8}$$

Hence, the cost of one litre can be calculated as below:

Cost of one litre $= \text{Rs } \frac{(2163 \times 2)}{(8 \times 7)}$

The cost of 4 litre of petrol can be calculated as below

Cost of 4 litre = Rs $\frac{(2163 \times 2 \times 4)}{(8 \times 7)}$

We get,

= Rs 309

Therefore, the cost of 4 litre of petrol is Rs 309

11. Ramesh earns Rs 40,000 per month. He spends $\frac{3}{8}$ of the income on food, $\frac{1}{5}$ of the remaining on LIC premium and then $\frac{1}{2}$ of the remaining on other expenses. Find how much money is left with him?

Solution:

Ramesh earnings per month = Rs 40,000

Expenditure on food = $\left(\frac{3}{8}\right)$ of Rs 40, 000 = Rs 15,000

Remaining amount = 40,000 – 15,000 = Rs 25,000

Expenditure on LIC premium = $\left(\frac{1}{5}\right)$ of Rs 25,000 = Rs 5000

Remaining amount = Rs 25000 – Rs 5000 = Rs 20,000

Expenditure on other expenses = $\left(\frac{1}{2}\right)$ of Rs 20,000 = Rs 10,000

Remaining amount left = Rs 20,000 – Rs 10,000 = Rs 10,000

Therefore, the remaining amount left with Ramesh is Rs 10,000

12. A, B, C, D and E went to a restaurant for dinner. A paid $\frac{1}{2}$ of the bill, B paid $\frac{1}{5}$ of the bill and rest of the bill was shared equally by C, D and E. What fractions of the bill was paid by each?

Solution:

Let us consider the total bill of the restaurant $= 1$

Bill paid by A $= \frac{1}{2}$

Bill paid by B $= \frac{1}{5}$

Remaining bill can be calculated as below:

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

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

$= 1 - \left(\frac{7}{10} \right)$

We get,

$= \frac{3}{10}$

Shares of the three persons $= \left(\frac{3}{10} \right) \div 3$

$= \left(\frac{3}{10} \right) \times \left(\frac{1}{3} \right)$

$= \frac{1}{10}$

Therefore, each paid $\left(\frac{1}{10} \right)$ of the bill.

13. $\frac{2}{5}$ **of total number of students of a school come by car while** $\frac{1}{4}$ **of students come by bus to school. All the other students walk to school of which** $\frac{1}{3}$ **walk on their own and the rest are escorted by their parents. If 224 students come to school walking on their own, how many students study in the school?**

Solution:

Let total number of students be 1

Students who come by car $= \frac{2}{5}$

Students who come by bus $= \frac{1}{4}$

Students who come by walking $= \frac{1}{3}$ of remaining

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

$= 1 - \frac{(8 + 5)}{20}$

$= 1 - \left(\frac{13}{20} \right)$

We get,

$= \frac{7}{20}$

Number of students who come by walking can be calculated as below

Number of students who come by walking $= \frac{1}{3}$ of $\frac{7}{20} = \frac{7}{60}$

Now, $\frac{7}{60}$ of total students $= 224$

Total students $= \frac{(224 \times 60)}{7}$

$= 32 \times 60$

= 1920

Hence, 1920 students study in the school

14. A mother and her two sons got a room constructed for Rs 60,000. The elder son contributes $\frac{3}{8}$ of his mother's contribution while the younger son contributes $\frac{1}{2}$ of his mother's share. How much do the three contribute individually?

Solution:

The cost of a room = Rs 60,000

Elder son contribution = $\frac{3}{8}$ of his mother's contribution

Younger son contribution = $\frac{1}{2}$ of his mother's share

Let the mother contribution be 1

Elder son's contribution = $\frac{3}{8}$

Younger son's contribution = $\frac{1}{2}$

Now,

Ratios in their share = $1 : \left(\frac{3}{8}\right) : \left(\frac{1}{2}\right) = 8 : 3 : 4$

Sum of ratios = 8 + 3 + 4 = 15

Therefore,

Mother's share = $\frac{(60000 \times 8)}{15}$ = Rs 32000

Elder son's share = $\frac{(60000 \times 3)}{15}$ = Rs 12000

Younger son's share = $\frac{(60000 \times 4)}{15}$ = Rs 16000

15. In a class of 56 students, the number of boys is $\frac{2}{5}$ th of the number of girls. Find the number of boys and girls.

Solution:

Total number of students in a class = 56

Let the number of girls be 1

Then number of boys will be $= \frac{2}{5}$ of $1 = \frac{2}{5}$

Ratios in girls and boys $= 1 : \left(\frac{2}{5}\right) = 5 : 2$

Number of girls $= \left\{\frac{56}{(5 + 2)}\right\} \times 5$

$= \left(\frac{56}{7}\right) \times 5 = 40$

And number of boys $= \left(\frac{56}{7}\right) \times 2 = 16$

Therefore, number of boys = 16 and number of girls = 40

16. A man donated $\frac{1}{10}$ of his money to a school, $\frac{1}{6}$ th of the remaining to a church and the remaining money he distributed equally among his three children. If each child gets Rs 50000, how much money did the man originally have?

Solution:

Let the money of a man be 1

Money donated to a school $= \frac{1}{10}$

Remaining money $= 1 - \left(\frac{1}{10}\right) = \frac{9}{10}$

Money donated to a church $= \frac{1}{6}$ of $\frac{9}{10} = \frac{3}{20}$

Hence, remaining money $= \left(\frac{9}{10}\right) - \left(\frac{3}{20}\right)$

$= \frac{(18-3)}{20} = \frac{15}{20}$

A man divides equally to his three children

Hence,

Share of each child $= \left(\frac{15}{20}\right) \div 3$

$= \left(\frac{15}{20}\right) \times \left(\frac{1}{3}\right) = \frac{1}{4}$

Here, each child gets Rs 50000

Therefore, his total money $=$ Rs 50000 $\times \left(\frac{4}{1}\right) =$ Rs 200000

17. If $\frac{1}{4}$ of a number is added to $\frac{1}{3}$ of that number, the result is 15 greater than half of that number. Find the number.

Solution:

Let us consider the number as x

Then as per the condition,

$\left(\frac{1}{4}\right)x + \left(\frac{1}{3}\right)x - \left(\frac{1}{2}\right)x = 15$

$\frac{(3x + 4x - 6x)}{12} = 15$

$\left(\frac{1}{12}\right)x$ of a number $= 15$

$x = 15 \times \frac{12}{1}$

$x = 180$

Therefore, the required number is 180

18. A student was asked to multiply a given number by $\frac{4}{5}$. By mistake, he divided the given number by $\frac{4}{5}$. His answer was 36 more than the correct answer. What was the given number?

Solution:

Let the given number be x

According to the condition,

$$x \times \frac{4}{5} = \left(\frac{4}{5}\right) x$$

But by mistake a student divides the given number

Then,

$$x \div \frac{4}{5} = x \times \frac{5}{4} = \left(\frac{5}{4}\right) x$$

Hence,

$$\left(\frac{5}{4}\right) x - \left(\frac{4}{5}\right) x = 36$$

$$\frac{(25x - 16x)}{20} = 36$$

$$\frac{9x}{20} = 36$$

$$9x = 36 \times 20$$

$$x = \frac{(36 \times 20)}{9}$$

We get,

x = 80

Therefore, the given number is 80

Mental Maths

Question 1.
Fill in the blanks:
(i) The product of two rational numbers is a ……….
(ii) Subtraction of rational numbers is …….. Commutative.
(iii) The rational number $\frac{-7}{4}$ lies ……. of zero on the number line.
(iv) Division of rational numbers is ……… associative.
(v) $\frac{p}{q} \div 0$ is ……..
(vi) Negative of a rational number is called its ………
(vii) Multiplicative identity of rational numbers is ……….
(viii) Multiplication of rational numbers is ……. over addition.
(ix) Division of a rational number by a non-zero rational number is a ……….
(x) The rational number which is additive inverse of itself is ……..
Solution:
(i) The product of two rational numbers is a rational number.
(ii) Subtraction of rational numbers is not commutative.

(iii) The rational number $\frac{-7}{4}$ lies left side of zero on the number line.

(iv) Division of rational numbers is not associative.

(v) $\frac{p}{q} \div 0$ is not defined.

(vi) Negative of a rational number is called its additive inverse.
(vii) Multiplicative identity of rational numbers is 1.
(viii) Multiplication of rational numbers is distributive over addition.
(ix) Division of a rational number by a non-zero rational number is a rational number.
(x) The rational number which is additive inverse of itself is 0.

Question 2: State whether the following statements are true (T) or false (F):

(i) $\frac{-5}{9}$ is the additive inverse of $\frac{5}{9}$.

(ii) Every integer is a rational number.

(iii) Zero has its multiplicative inverse.

(iv) Every rational number is an integer.

(v) Division of two rational numbers is always closed.

(vi) Non-terminating, non-recurring decimal numbers are rational numbers.

(vii) 0 is the multiplicative identity of rational numbers.

(viii) Non-terminating recurring decimal numbers are not rational numbers.

(ix) Subtraction of two rational numbers is not associative.

(x) Reciprocal of 1 is 1.

(xi) The multiplicative inverse is also called a reciprocal.

(xii) Between two different rational numbers, there are infinitely many number of rational numbers.

Solution:

(i) $\frac{-5}{9}$ is the additive inverse of $\frac{5}{9}$. (True)

(ii) Every integer is a rational number. (True)

(iii) Zero has its multiplicative inverse. (False)

Correct:

Zero has no multiplicative inverse.

(iv) Every rational number is an integer. (False)

Correct:

Rational numbers are not integers.

(v) Division of two rational numbers is always closed. (False)

Correct:

Division by zero is not defined.

(vi) Non-terminating, non-recurring decimal numbers are rational numbers. (False)

Correct:

Non-terminating, recurring numbers are rationales.

(vii) 0 is the multiplicative identity of rational numbers. (False)
Correct:
1 is the multiplicative identity.
(viii) Non-terminating recurring decimal numbers are not rational numbers. (False)
Correct:
These are rational numbers.
(ix) Subtraction of two rational numbers is no associative. (True)
(x) Reciprocal of 1 is 1. (True)
(xi) The multiplicative inverse is also called a reciprocal. (True)
(xii) Between two different rational numbers,
there is infinitely many numbers of rational numbers. (True)

Multiple Choice Questions

Choose the correct answer from the given four options (3 to 18):

Question 3: Additive inverse of $\frac{-2}{-5}$ is

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

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

(c) $\frac{2}{-5}$

(d) $\frac{-2}{5}$

Solution:
Additive inverse of $\frac{-2}{-5}$ is $\frac{2}{-5}$. (c)

Question 4: Multiplicative inverse of $\frac{-3}{7}$ is

(a) $\frac{7}{3}$

(b) $\frac{-7}{3}$

(c) $\frac{3}{7}$

(d) None of these

Solution:

Multiplicative inverse of $\frac{-3}{7}$ is $\frac{-7}{3}$. (b)

Question 5: Sum of a rational number and its additive inverse is

(a) 1

(b) 0

(c) -1

(d) None of these

Solution:

Sum of a rational number and its additive inverse is 0. (b)

Question 6: Rational numbers are not closed under

(a) addition

(b) subtraction

(c) multiplication

(d) division

Solution:

Rational numbers are not closed under division. (d)

Question 7: $0 \div \frac{2}{3}$ is equal to

(a) $\frac{2}{3}$

(b) $\frac{3}{2}$

(c) 0

(d) not defined

Solution:

$0 \div \frac{2}{3}$ is equal to 0. (c)

Question 8: $\frac{2}{3} \div 0$ **is equal to**

(a) $\frac{2}{3}$

(b) $\frac{3}{2}$

(c) 0

(d) not defined

Solution:

$\frac{2}{3} \div 0$ is equal to 0. (c)

Question 9: $\frac{p}{q} + \left(\frac{r}{s} + \frac{t}{u}\right) = \left(\frac{p}{q} + \frac{r}{s}\right) + \frac{t}{u}$ **is called**

(a) commutative property

(b) associative property

(c) distributive property

(d) None of these

Solution:

$\frac{p}{q} + \left(\frac{r}{s} + \frac{t}{u}\right) = \left(\frac{p}{q} + \frac{r}{s}\right) + \frac{t}{u}$ is called associative property. (b)

Question 10: Multiplication of a non-zero rational number and its reciprocal is

(a) 0

(b) 1

(c) -1

(d) None of these

Solution:

Multiplication of a non-zero rational number and its reciprocal is 1. (b)

Question 11: Product of rational number $\frac{-2}{5}$ and its additive inverse is

(a) 0

(b) 1

(c) $\frac{-4}{25}$

(d) $\frac{-5}{2}$

Solution:

Product of a rational number $\frac{-2}{5}$ and its additive inverse is $\frac{-4}{25}$. (c)

Question 12: Sum of rational number $\frac{4}{7}$ and its reciprocal is

(a) $\frac{28}{65}$

(b) $\frac{65}{28}$

(c) $\frac{-28}{65}$

(d) $\frac{-65}{28}$

Solution:

Sum of rational number $\frac{4}{7}$ and its reciprocal is $\frac{65}{28}$. (b)

Question 13: Sum of two rational numbers is 0, if one of them is $\frac{-4}{5}$, then other is

(a) $\frac{5}{4}$

(b) $\frac{4}{5}$

(c) $\frac{-5}{4}$

(d) $\frac{-4}{5}$

Solution:

Sum of two rational numbers is 0, if one of them is $\frac{-4}{5}$, then other will be $\frac{4}{5}$. (b)

Question 14: Product of two rational numbers is 1, if one of them is $\frac{10}{3}$, then other is

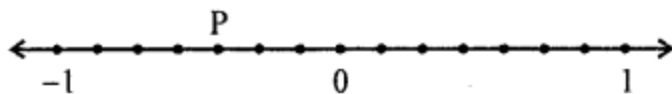(a) $\frac{3}{10}$

(b) $\frac{-3}{10}$

(c) $\frac{10}{3}$

(d) None of these

Solution:

Product of two rational numbers is 1.

If one of them is $\frac{10}{3}$, then the other is $\frac{3}{10}$. (a)

Question 15: Rational number represented by the point P on the number line is

(a) $\frac{-5}{7}$

(b) $\frac{-3}{7}$

(c) $\frac{-5}{8}$

(d) $\frac{-4}{8}$

Solution:

Rational number represented by the point P

on the given number line is $\frac{-3}{7}$ (b)

Question 16: What should be subtracted from $\frac{-5}{3}$ to get $\frac{-2}{7}$?

(a) $\frac{29}{21}$

(b) $\frac{-21}{29}$

(c) $\frac{-29}{21}$

(d) $\frac{21}{29}$

Solution:

Required number $= \frac{-5}{3} - \left(\frac{-2}{7}\right) = \frac{-35+6}{21} = \frac{-29}{21}$ (c)

Question 17: Reciprocal of a negative number is
(a) positive
(b) negative
(c) cannot say
(d) does not exist
Solution:
Reciprocal of a negative number is negative. (b)

Question 18: Which of the following statement is true?

(a) $\frac{-4}{5} \div \frac{3}{11} = \frac{3}{11} \div \frac{-4}{5}$

(b) $\frac{2}{3} \div \left(\frac{5}{8} \div \frac{-4}{7}\right) = \left(\frac{2}{3} \div \frac{5}{8}\right) \div \frac{-4}{7}$

(c) $\frac{-3}{17} \div \left(\frac{4}{5} + \frac{-2}{3}\right) = \left(\frac{-3}{17} \div \frac{4}{5}\right) + \left(\frac{-3}{17} \div \frac{-2}{3}\right)$

(d) $\left(\frac{4}{5} + \frac{-2}{3}\right) \div \frac{-3}{17} = \left(\frac{4}{5} + \frac{-3}{17}\right) + \left(\frac{-2}{3} \div \frac{-3}{17}\right)$

Solution:

$$\left(\frac{4}{5} + \frac{-2}{3}\right) \div \frac{-3}{17} = \left(\frac{4}{5} + \frac{-3}{17}\right) + \left(\frac{-2}{3} \div \frac{-3}{17}\right) \text{ is true. (d)}$$

Value Based Questions

Question 1: Ram donated $\frac{1}{10}$ of his salary to an orphanage, $\frac{1}{3}$ of his salary spent on food, $\frac{1}{4}$ of salary on rent and electricity and $\frac{1}{20}$ of his salary on telephone. This month he donated ₹ 5000 in Prime Minister Relief fund for Uttarakhand victims. He was left with ₹ 3000 with him, find his monthly salary. Should we donate the money for needy people? What values are being promoted?

Solution:

Let Ram's salary = x

Then donation to orphanage $= x \times \dfrac{1}{10} = \dfrac{x}{10}$

Amount spent on food $= \dfrac{x}{3}$

Spend on rent and electricity $= \dfrac{x}{4}$

Spent on telephone $= \dfrac{x}{20}$

Amount left $= x - \left(\dfrac{x}{10} + \dfrac{x}{3} + \dfrac{x}{4}\right) + \dfrac{x}{20}$

$= \dfrac{60x - (6x + 20x + 15x + 3x)}{60}$

$= \dfrac{60x - 44x}{60} = \dfrac{16}{20}x$

Amount given to PM relief fund = ₹5000

And amount left = ₹3000

$\therefore \dfrac{16}{20}x = 5000 + 3000 = 8000$

$x = \frac{8000 \times 60}{16} = 30{,}000$

Donation to a needy institution is good,
also donation to PM relief fund is an act of kindness.

Question 2: In an Examination $\frac{1}{3}$ of the total students used unfair means and out of which $\frac{1}{4}$ caught red handed while cheating. If 5 students caught red handed then find the total number of students appeared in exam.

Why should we not use unfair means in an examination?

What values are being promoted?

Solution:
Let total number of students who appeared in the exam = x

Number of students who cheat = $\frac{x}{3}$

Number of students who were caught red handed = $\frac{x}{3} \times \frac{x}{4} = \frac{x}{12}$

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

x = 12 × 5 = 60

Total number of students = 60

Cheating in the examination is a bad babbit
and its ruins the life of a student. So, it should be avoided.

Higher Order Thinking Skills (HOTS)

Question 1: Area of a square is 4 sq. in more than $\frac{2}{3}$ of the area of a rectangle. If the area of square is 64 sq. m, then find the dimensions of rectangle, given that breadth is $\frac{2}{5}$ of length.

Solution:

Area of a square = 64 sq. m

Area of rectangle = 64 – 4

$= 60 \times \frac{3}{2} = 90$ sq. m

Breadth $= \frac{2}{5}$ of length

Let length = x m

then breadth $= \frac{2}{5}x$

Area $= x \times \frac{2}{5}x = 90$

$\Rightarrow \frac{2}{5}x^2 = 90$

$\Rightarrow x^2 = 90 \times \frac{5}{2} = 225 = (15)^2$

$\Rightarrow x = 15$

Length = 15 m

and breadth $= \frac{2}{5} \times 15 = 6m$

Hence, length of rectangle = 15 m

and breadth = 6 m

Question 2: Rahul can do $\frac{2}{7}$ of a certain work in 6 days while Suresh can do $\frac{3}{5}$ of the same work in 9 days. They started work together but after 7 days Rahul left the work. Find in how many days Suresh can complete the remaining work?

Solution:

Rahul's 6 days' work $= \frac{2}{7}$

His 1 day's work $= \frac{2}{7 \times 6} = \frac{2}{42} = \frac{1}{21}$

Suresh's 1 day's work $= \frac{3}{5} \times \frac{1}{9} = \frac{1}{15}$

Both's 1 day work $= \frac{1}{21} + \frac{1}{15}$

$= \frac{5+7}{105} = \frac{12}{105}$

Both's 7 day's work $= \frac{12}{105} \times 7 = \frac{4}{5}$

Remaining work $= 1 - \frac{4}{5} = \frac{1}{5}$

Suresh will do $\frac{1}{5}$ of work in $= \frac{15}{1} \times \frac{1}{5} = 3$ days.

Check Your Progress

Question 1: Evaluate the following:

(i) $4\frac{2}{5} + 3\frac{7}{8}$

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

(iii) $6\frac{8}{5} - \left(\frac{-7}{3}\right)$

(iv) $\left(-16\frac{2}{3}\right) \times 14\frac{1}{2}$

(v) $\frac{-7}{8} \div 15\frac{3}{4}$

(vi) $\frac{-12}{13} \times 1$

(vii) $\frac{4}{9} \times 0$

(viii) $0 \div \left(-4\frac{7}{10}\right)$

Solution:

(i) $4\frac{2}{5} + 3\frac{7}{8}$

$= \frac{22}{5} + \frac{31}{8}$

$= \frac{176+155}{40}$　　　　　(LCM of 5, 8 = 40)

$= \frac{331}{40} = 8\frac{11}{40}$

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

$= \frac{31}{4} - \frac{23}{5}$

$= \frac{155-92}{20}$　　　　　(LCM of 4, 5 = 20)

$= \frac{63}{20} = 3\frac{3}{20}$

(iii) $6\frac{8}{5} - \left(\frac{-7}{3}\right)$

$$= \frac{62}{9} + \frac{7}{3}$$

$$= \frac{62+21}{9} = \frac{83}{9} = 9\frac{2}{9}$$

(iv) $\left(-16\frac{2}{3}\right) \times 14\frac{1}{2}$

$$= \frac{-50}{3} \times \frac{29}{2} = \frac{-25 \times 29}{3 \times 1}$$

$$= \frac{-725}{3} = -241\frac{2}{3}$$

(v) $\frac{-7}{8} \div 15\frac{3}{4}$

$$= \frac{-7}{8} \div \frac{63}{4}$$

$$= \frac{7}{8} \times \frac{4}{63} = \frac{-1}{18}$$

(vi) $\frac{-12}{13} \times 1 = \frac{-12}{13}$

(vii) $\frac{4}{9} \times 0 = 0$

(viii) $0 \div \left(-4\frac{7}{10}\right) = 0$

Question 2: What number should be added to $\frac{-4}{11}$ to get $\frac{-3}{8}$?

Solution:

Required number $= \frac{-3}{8} - \frac{-4}{11}$

$$= \frac{-3}{8} + \frac{4}{11}$$

$$= \frac{-33+32}{88} = \frac{-1}{88}$$

Question 3: What rational number should be subtracted from the sum of $\frac{3}{14}$ and $\frac{-4}{7}$ to get $\frac{13}{21}$?

Solution:

Sum of $\frac{3}{14}$ and $\frac{-4}{7} = \frac{3}{14} + \frac{-4}{7}$

$= \frac{3-8}{14} = \frac{-5}{14}$

$\therefore$ Required number $= \frac{-5}{14} - \frac{31}{21}$

$= \frac{-15-26}{42} = \frac{-41}{42}$

Question 4: If the product of two rational numbers is $\frac{25}{42}$ and one of them $-2\frac{6}{7}$, find the other.

Solution:

Product of two numbers $= \frac{25}{42}$

One number $= -2\frac{6}{7} = \frac{-20}{7}$

Then second number $= \frac{25}{42} \div \left(\frac{-20}{7}\right)$

$= \frac{25}{42} \times \frac{7}{-20} = \frac{5}{-24}$

$= \frac{5 \times (-1)}{-24 \times (-1)} = \frac{-5}{24}$

Question 5: Divide the sum of $\frac{4}{13}$ and $\frac{-3}{2}$ by their product.

Solution:

Sum of $\frac{4}{13}$ and $\frac{-3}{2} = \frac{4}{13} + \left(\frac{-3}{2}\right)$

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

$$= \frac{8-39}{26} = \frac{-31}{26}$$

And product $= \frac{4}{13} + \left(\frac{-3}{2}\right) = \frac{-6}{13}$

$$\therefore \frac{-31}{26} \div \left(\frac{-6}{13}\right) = \frac{-31}{26} \times \frac{13}{-6}$$

$$= \frac{-31}{-2} = \frac{-31 \times (-1)}{-2 \times (-1)} = \frac{31}{12} = 2\frac{7}{12}$$

Question 6: Using the appropriate properties of operations of rational numbers, evaluate the following:

(i) $\frac{3}{13} \times \frac{4}{5} - \frac{7}{5} - \frac{4}{5} \times \frac{5}{13}$

(ii) $\frac{5}{7} + \frac{2}{11} + \frac{-8}{7} + \frac{6}{11}$

Solution:

(i) $\frac{3}{13} \times \frac{4}{5} - \frac{7}{5} - \frac{4}{5} \times \frac{5}{13}$

$$= \frac{12}{65} - \frac{7}{5} - \frac{4}{13}$$

$$= \frac{12-91-20}{65} = \frac{12-111}{65}$$

$$= \frac{-99}{65} = -1\frac{34}{65}$$

(ii) $\frac{5}{7} + \frac{2}{11} + \frac{-8}{7} + \frac{6}{11}$

$$= \left(\frac{5}{7} + \frac{-8}{7}\right) + \left(\frac{2}{11} + \frac{6}{11}\right)$$

Question 7: Find the additive inverse of the following:

(i) $-13\dfrac{7}{8}$

(ii) $4\dfrac{3}{6}$

Solution:

(i) Additive inverse of $-13\dfrac{7}{8}$ is $13\dfrac{7}{8}$.

(ii) Additive inverse of $4\dfrac{3}{6}$ is $-4\dfrac{3}{6}$.

Question 8: Find the multiplicative inverse of the following:

(i) $\dfrac{-23}{46}$

(ii) 0

Solution:

(i) Multiplicative inverse of $\dfrac{-23}{46}$ is $\dfrac{-46}{23} = -2$.
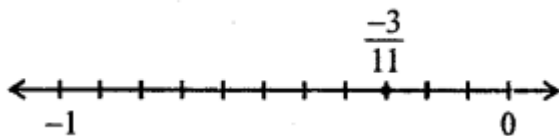
(ii) Multiplicative inverse of 0 is not defined.

Question 9: Represent the following rational numbers on the number line:
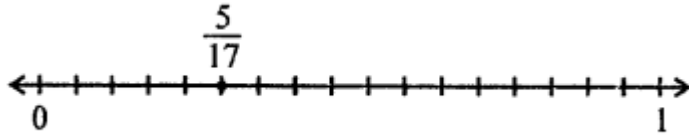
(i) $\dfrac{-3}{11}$

(ii) $\dfrac{5}{17}$

Solution:

(i) $\dfrac{-3}{11}$

(ii) $\frac{5}{17}$

Question 10: Insert five rational numbers between $\frac{-3}{7}$ and $\frac{2}{5}$

Solution:

5 rational numbers between $\frac{-3}{7}$ and $\frac{2}{5}$

LCM of 7, 5 = 35

$$\therefore \frac{-3}{7} = \frac{-3 \times 5}{7 \times 5} = \frac{-15}{35}$$

$$\frac{2}{5} = \frac{2 \times 7}{5 \times 7} = \frac{14}{35}$$

Now, 5 rational numbers will be

$$\frac{-14}{35}, \frac{-13}{35}, \dots, 0, \frac{-1}{35}, \frac{2}{35}, \dots \dots$$

Question 11: If p = $\frac{-4}{9}$, q = $\frac{2}{3}$ and r = $\frac{-8}{11}$, then verily the foflowing:

(i) p + (q + r) = (p + q) + r
(ii) p × q = q × p
(iii) p × (q + r) = p × q + p × r
(iv) (p + q) ÷ r = p ÷ r + q ÷ r.

Solution:

$p = \frac{-4}{9}$, $q = \frac{2}{3}$ and $r = \frac{-8}{11}$

(i) p + (q + r) = (p + q) + r

L.H.S. $= p + (q + r) = \frac{-4}{9} + \left(\frac{2}{3} + \frac{-8}{11} \right)$

$$= \frac{-4}{9} + \left(\frac{22-24}{33}\right) = \frac{-4}{9} - \frac{2}{33}$$

$$= \frac{-44-6}{99} = \frac{-50}{99}$$

R.H.S. = (p + q) + r

$$= \left(\frac{-4}{9} + \frac{2}{3}\right) + \frac{-8}{11}$$

$$= \left(\frac{-4+6}{9}\right) + \frac{-8}{11}$$

$$= \frac{2}{9} + \frac{-8}{11}$$

$$= \frac{22-72}{99} = \frac{-50}{99}$$

∴ LHS = RHS

(ii) p × q = q × p

L.H.S. = p × q = $\frac{-4}{9} \times \frac{2}{3} = \frac{-8}{27}$

R.H.S. = q × p = $\frac{2}{3} \times \frac{-4}{9} = \frac{-8}{27}$

∴ LHS = RHS

(iii) p × (q + r) = p × q + p × r

L.H.S. = p × (q + r) = $\frac{-4}{9} \times \left(\frac{2}{3} + \frac{-8}{11}\right)$

$$= \frac{-4}{9} \times \left(\frac{22-24}{33}\right)$$

$$= \frac{-4}{9} \times \left(\frac{-2}{33}\right) = \frac{8}{297}$$

R.H.S. = p × q + p × r

$$= \frac{-4}{9} \times \frac{2}{3} + \frac{-4}{9} \times \frac{-8}{11}$$

$$= \frac{-8}{27} + \frac{32}{99}$$

$$= \frac{-88+96}{297} = \frac{8}{297}$$

∴ LHS = RHS

(iv) $(p + q) \div r = p \div r + q \div r$.

L.H.S. $= \left(\frac{-4}{9} + \frac{2}{3} \right) \div \frac{-8}{11}$

$$= \frac{-4+6}{9} \div \frac{-8}{11}$$

$$= \frac{2}{9} \div \frac{-8}{11} = \frac{2}{9} \times \frac{11}{-8}$$

$$= \frac{11}{-36} = \frac{-11}{36}$$

R.H.S. $= p \div r + q \div r$

$$= \frac{-4}{9} \div \frac{-8}{11} + \frac{-4}{9} \div \frac{-8}{11}$$

$$= \frac{-4}{9} \div \frac{11}{-8} + \frac{-4}{9} \div \frac{11}{-8}$$

$$= \frac{11}{18} + \frac{11}{-12}$$

$$= \frac{22-33}{36} = \frac{-11}{36}$$

∴ LHS = RHS

Question 12: A wedding cake weighed 8 kg. If $\frac{2}{5}$ th of its weight was flour, $\frac{5}{6}$ th was sugar, $\frac{1}{4}$ th was cream and the rest were nuts, find the weight of nuts.

Solution:
Weight of a wedding cake = 8 kg

Weight of Hour in it $= \frac{2}{5}$ th of 8 kg $= \frac{16}{5}$ kg

Sugar $= \frac{5}{16}$ of 8 $= \frac{5}{2}$ kg

Cream $= \frac{1}{4}$ of 8 $= 2$ kg

Nuts $=$ Rest

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

$= 8 - \left(\frac{32+25+20}{10} \right)$

$= \frac{8}{1} - \frac{77}{10}$

$= \frac{80-77}{10} = \frac{3}{10}$ kg $= 300$ grams