

Rational Numbers Ex.A

RATIONAL NUMBERS

A rational number is a number that can be expressed as a fraction (ratio) in the form $\frac{a}{b}$, where a and b are integers and b is not zero.

Examples: $\frac{1}{2}$, 8 , $\frac{5}{3}$, $\sqrt{4}$, $7\frac{1}{9}$, -12 , 6.25 , $0.3\overline{11}$

When a rational number fraction is divided to form a decimal value, it becomes a terminating or repeating decimal.

$\frac{2}{5}$ can be represented as $2 \overline{)5.0}$ which is a terminating decimal.

$\frac{1}{3}$ can be represented as $1 \overline{)3.0}$ which is a repeating decimal.

A number of the form $\frac{p}{q}$, where 'p', 'q' are integers and $q \neq 0$.



Property	Operations on Rational Numbers			
Name	Addition	Subtraction	Multiplication	Division*
Closure	$a + b \in \mathbb{Q}$	$a - b \in \mathbb{Q}$	$a \times b \in \mathbb{Q}$	$a \div b \in \mathbb{Q}$
Commutative	$a + b = b + a$	$a - b \neq b - a$	$a \times b = b \times a$	$a \div b \neq b \div a$
Associative	$(a + b) + c = a + (b + c)$	$(a - b) - c \neq a - (b - c)$	$(a \times b) \times c = a \times (b \times c)$	$(a \div b) \div c \neq a \div (b \div c)$
Distributive	$a \times (b + c) = ab + ac$	$a \times (b - c) = ab - ac$	Not applicable	Not applicable

Where $a, b, c \in \mathbb{Q}$ (set of rational numbers), $*b$ is a non-zero rational number

Q1.

Answer :

If $\frac{a}{b}$ is a fraction and m is a non-zero integer, then $\frac{a}{b} = \frac{a \times m}{b \times m}$.

Now,

$$(i) \frac{-3}{5} = \frac{-3 \times 4}{5 \times 4} = \frac{-12}{20}$$

$$(ii) \frac{-3}{5} = \frac{-3 \times -6}{5 \times -6} = \frac{18}{-30}$$

$$(iii) \frac{-3}{5} = \frac{-3 \times 7}{5 \times 7} = \frac{-21}{35}$$

$$(iv) \frac{-3}{5} = \frac{-3 \times -8}{5 \times -8} = \frac{24}{-40}$$

Q2.

Answer :

If $\frac{a}{b}$ is a rational number and m is a common divisor of a and b , then $\frac{a}{b} = \frac{a \div m}{b \div m}$.

$$\therefore \frac{-42}{98} = \frac{-42 \div 14}{98 \div 14} = \frac{-3}{7}$$

Q3.

Answer :

If $\frac{a}{b}$ is a rational integer and m is a common divisor of a and b , then $\frac{a}{b} = \frac{a \div m}{b \div m}$.

$$\therefore \frac{-48}{60} = \frac{-48 \div 12}{60 \div 12} = \frac{-4}{5}$$

Q4.

Answer :

A rational number $\frac{a}{b}$ is said to be in the standard form if a and b have no common divisor other than unity and $b > 0$.

Thus,

(i) The greatest common divisor of 12 and 30 is 6.

$$\therefore \frac{-12}{30} = \frac{-12 \div 6}{30 \div 6} = \frac{-2}{5} \text{ (In the standard form)}$$

(ii) The greatest common divisor of 14 and 49 is 7.

$$\therefore \frac{-14}{49} = \frac{-14 \div 7}{49 \div 7} = \frac{-2}{7} \text{ (In the standard form)}$$

$$(iii) \frac{24}{-64} = \frac{24 \times (-1)}{-64 \times -1} = \frac{-24}{64}$$

The greatest common divisor of 24 and 64 is 8.

$$\therefore \frac{-24}{64} = \frac{-24 \div 8}{64 \div 8} = \frac{-3}{8} \text{ (In the standard form)}$$

$$(iv) \frac{-36}{-63} = \frac{-36 \times (-1)}{-63 \times -1} = \frac{36}{63}$$

The greatest common divisor of 36 and 63 is 9.

$$\therefore \frac{36}{63} = \frac{36 \div 9}{63 \div 9} = \frac{4}{7} \text{ (In the standard form)}$$

Q5.

Answer :

We know:

(i) Every positive rational number is greater than 0.

(ii) Every negative rational number is less than 0.

Thus, we have:

(i) $\frac{3}{8}$ is a positive rational number.

$$\therefore \frac{3}{8} > 0$$

(ii) $\frac{-2}{9}$ is a negative rational number.

$$\therefore \frac{-2}{9} < 0$$

(iii) $\frac{-3}{4}$ is a negative rational number.

$$\therefore \frac{-3}{4} < 0$$

Also,

$\frac{1}{4}$ is a positive rational number.

$$\therefore \frac{1}{4} > 0$$

Combining the two inequalities, we get:

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

(iv) Both $\frac{-5}{7}$ and $\frac{-4}{7}$ have the same denominator, that is, 7.
So, we can directly compare the numerators.

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

(v) The two rational numbers are $\frac{2}{3}$ and $\frac{3}{4}$.

The LCM of the denominators 3 and 4 is 12.

Now,

$$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

Also,

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

Further

$$\frac{8}{12} < \frac{9}{12}$$

$$\therefore \frac{2}{3} < \frac{3}{4}$$

(vi) The two rational numbers are $\frac{-1}{2}$ and -1 .

We can write $-1 = \frac{-1}{1}$.

The LCM of the denominators 2 and 1 is 2.

Now,

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

Also,

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

$$\therefore \frac{-2}{2} < \frac{-1}{2}$$

$$\therefore -1 < \frac{-1}{2}$$

Q6.

Answer :

1. The two rational numbers are $\frac{-4}{3}$ and $\frac{-8}{7}$.

The LCM of the denominators 3 and 7 is 21.

Now,

$$\frac{-4}{3} = \frac{-4 \times 7}{3 \times 7} = \frac{-28}{21}$$

Also,

$$\frac{-8}{7} = \frac{-8 \times 3}{7 \times 3} = \frac{-24}{21}$$

Further,

$$\frac{-28}{21} < \frac{-24}{21}$$

$$\therefore \frac{-4}{3} < \frac{-8}{7}$$

2. The two rational numbers are $\frac{7}{-9}$ and $\frac{-5}{8}$.

The first fraction can be expressed as $\frac{7}{-9} = \frac{7 \times -1}{-9 \times -1} = \frac{-7}{9}$.

The LCM of the denominators 9 and 8 is 72.

Now,

$$\frac{-7}{9} = \frac{-7 \times 8}{9 \times 8} = \frac{-56}{72}$$

Also,

$$\frac{-5}{8} = \frac{-5 \times 9}{8 \times 9} = \frac{-45}{72}$$

Further,

$$\frac{-56}{72} < \frac{-45}{72}$$

$$\therefore \frac{7}{-9} < \frac{-5}{8}$$

3. The two rational numbers are $\frac{-1}{3}$ and $\frac{4}{-5}$.

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

The LCM of the denominators 3 and 5 is 15.

Now,

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

Also,

$$\frac{-4}{5} = \frac{-4 \times 3}{5 \times 3} = \frac{-12}{15}$$

Further,

$$\frac{-12}{15} < \frac{-5}{15}$$

$$\therefore \frac{4}{-5} < \frac{-1}{3}$$

4. The two rational numbers are $\frac{9}{-13}$ and $\frac{7}{-12}$.

Now, $\frac{9}{-13} = \frac{9 \times -1}{-13 \times -1} = \frac{-9}{13}$ and $\frac{7}{-12} = \frac{7 \times -1}{-12 \times -1} = \frac{-7}{12}$

The LCM of the denominators 13 and 12 is 156.

Now,

$$\frac{-9}{13} = \frac{-9 \times 12}{13 \times 12} = \frac{-108}{156}$$

Also,

$$\frac{-7}{12} = \frac{-7 \times 13}{12 \times 13} = \frac{-91}{156}$$

Further,

$$\frac{-108}{156} < \frac{-91}{156}$$

$$\therefore \frac{9}{-13} < \frac{7}{-12}$$

5. The two rational numbers are $\frac{4}{-5}$ and $\frac{-7}{10}$.

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

The LCM of the denominators 5 and 10 is 10.

Now,

$$\frac{-4}{5} = \frac{-4 \times 2}{5 \times 2} = \frac{-8}{10}$$

Also,

$$\frac{-7}{10} = \frac{-7 \times 1}{10 \times 1} = \frac{-7}{10}$$

Further,

$$\frac{-8}{10} < \frac{-7}{10}$$

$$\therefore \frac{-4}{5} < \frac{-7}{10}, \text{ or, } \frac{4}{-5} < \frac{-7}{10}$$

6. The two rational numbers are $\frac{-12}{5}$ and -3 .
 -3 can be written as $\frac{-3}{1}$.

The LCM of the denominators is 5.

Now,

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

Because $\frac{-15}{5} < \frac{-12}{5}$, we can conclude that $-3 < \frac{-12}{5}$.

Q7.

Thus,

$$\frac{-3}{7} > \frac{6}{-13}$$

(ii) We will write each of the given numbers with positive denominators.

$$\text{One number} = \frac{5}{-13} = \frac{5 \times (-1)}{-13 \times (-1)} = \frac{-5}{13}$$

$$\text{Other number} = \frac{-35}{91}$$

LCM of 13 and 91 = 91

$$\therefore \frac{-5}{13} = \frac{-5 \times 7}{13 \times 7} = \frac{-35}{91} \text{ and } \frac{-35}{91}$$

Clearly,

$$-35 = -35$$

$$\therefore \frac{-35}{91} = \frac{-35}{91}$$

Thus,

$$\frac{-5}{13} = \frac{-35}{91}$$

(iii) We will write each of the given numbers with positive denominators.

One number = -2

We can write -2 as $-\frac{2}{1}$.

Other number = $-\frac{13}{5}$

LCM of 1 and 5 = 5

$$\therefore \frac{-2}{1} = \frac{-2 \times 5}{1 \times 5} = \frac{-10}{5} \text{ and } \frac{-13}{5} = \frac{-13 \times 1}{5 \times 1} = \frac{-13}{5}$$

Clearly,

$$-10 > -13$$

$$\therefore \frac{-10}{5} > \frac{-13}{5}$$

Thus,

$$\frac{-2}{1} > \frac{-13}{5}$$

$$-2 > \frac{-13}{5}$$

(iv) We will write each of the given numbers with positive denominators.

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

Other number = $-\frac{5}{8} = \frac{5 \times (-1)}{-8 \times (-1)} = \frac{-5}{8}$

LCM of 3 and 8 = 24

$$\therefore \frac{-2}{3} = \frac{-2 \times 8}{3 \times 8} = \frac{-16}{24} \text{ and } \frac{-5}{8} = \frac{-5 \times 3}{8 \times 3} = \frac{-15}{24}$$

Clearly,

$$-16 < -15$$

$$\therefore \frac{-16}{24} < \frac{-15}{24}$$

Thus,

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

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

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

$\frac{3}{5}$ is a positive number.

Because every positive rational number is greater than 0, $\frac{3}{5} > 0 \Rightarrow 0 < \frac{3}{5}$.

(vi) We will write each of the given numbers with positive denominators.

One number = $-\frac{8}{9}$

Other number = $-\frac{9}{10}$

LCM of 9 and 10 = 90

$$\therefore \frac{-8}{9} = \frac{-8 \times 10}{9 \times 10} = \frac{-80}{90} \text{ and } \frac{-9}{10} = \frac{-9 \times 9}{10 \times 9} = \frac{-81}{90}$$

Clearly,

$$-81 < -80$$

$$\therefore \frac{-81}{90} < \frac{-80}{90}$$

Thus,

$$\frac{-9}{10} < \frac{-8}{9}$$

Q8.

Answer :

(i) We will write each of the given numbers with positive denominators.

We have:

$$\frac{4}{-9} = \frac{4 \times (-1)}{-9 \times (-1)} = \frac{-4}{9} \text{ and } \frac{7}{-18} = \frac{7 \times (-1)}{-18 \times (-1)} = \frac{-7}{18}$$

Thus, the given numbers are $\frac{-4}{9}$, $\frac{-5}{12}$, $\frac{-7}{18}$ and $\frac{-2}{3}$.

LCM of 9, 12, 18 and 3 is 36.

Now,

$$\frac{-4}{9} = \frac{-4 \times 4}{9 \times 4} = \frac{-16}{36}$$

$$\frac{-5}{12} = \frac{-5 \times 3}{12 \times 3} = \frac{-15}{36}$$

$$\frac{-7}{18} = \frac{-7 \times 2}{18 \times 2} = \frac{-14}{36}$$

$$\frac{-2}{3} = \frac{-2 \times 12}{3 \times 12} = \frac{-24}{36}$$

Clearly,

$$\frac{-24}{36} < \frac{-16}{36} < \frac{-15}{36} < \frac{-14}{36}$$

$$\therefore \frac{-2}{3} < \frac{-4}{9} < \frac{-5}{12} < \frac{-7}{18}$$

That is

$$\frac{-2}{3} < \frac{-4}{9} < \frac{-5}{12} < \frac{-7}{18}$$

(ii) We will write each of the given numbers with positive denominators.

We have:

$$\frac{5}{-12} = \frac{5 \times (-1)}{-12 \times (-1)} = \frac{-5}{12} \text{ and } \frac{9}{-24} = \frac{9 \times (-1)}{-24 \times (-1)} = \frac{-9}{24}$$

Thus, the given numbers are $\frac{-3}{4}$, $\frac{-5}{12}$, $\frac{-7}{16}$ and $\frac{-9}{24}$.

LCM of 4, 12, 16 and 24 is 48.

Now,

$$\frac{-3}{4} = \frac{-3 \times 12}{4 \times 12} = \frac{-36}{48}$$

$$\frac{-5}{12} = \frac{-5 \times 4}{12 \times 4} = \frac{-20}{48}$$

$$\frac{-7}{16} = \frac{-7 \times 3}{16 \times 3} = \frac{-21}{48}$$

$$\frac{-9}{24} = \frac{-9 \times 2}{24 \times 2} = \frac{-18}{48}$$

Clearly,

$$\frac{-36}{48} < \frac{-21}{48} < \frac{-20}{48} < \frac{-18}{48}$$

$$\therefore \frac{-3}{4} < \frac{-7}{16} < \frac{-5}{12} < \frac{-9}{24}$$

That is

$$\frac{-3}{4} < \frac{-7}{16} < \frac{-5}{12} < \frac{-9}{24}$$

(iii) We will write each of the given numbers with positive denominators.

We have:

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

Thus, the given numbers are $\frac{-3}{5}$, $\frac{-7}{10}$, $\frac{-11}{15}$ and $\frac{-13}{20}$.

LCM of 5, 10, 15 and 20 is 60.

Now,

$$\frac{-3}{5} = \frac{-3 \times 12}{5 \times 12} = \frac{-36}{60}$$

$$\frac{-7}{10} = \frac{-7 \times 6}{10 \times 6} = \frac{-42}{60}$$

$$\frac{-11}{15} = \frac{-11 \times 4}{15 \times 4} = \frac{-44}{60}$$

$$\frac{-13}{20} = \frac{-13 \times 3}{20 \times 3} = \frac{-39}{60}$$

Clearly,

$$\frac{-44}{60} < \frac{-42}{60} < \frac{-39}{60} < \frac{-36}{60}$$

$$\therefore \frac{-11}{15} < \frac{-7}{10} < \frac{-13}{20} < \frac{-3}{5}$$

That is

$$\frac{-11}{15} < \frac{-7}{10} < \frac{-13}{20} < \frac{-3}{5}$$

(iv) We will write each of the given numbers with positive denominators.

We have:

$$\frac{13}{-28} = \frac{13 \times (-1)}{-28 \times (-1)} = \frac{-13}{28}$$

Thus, the given numbers are $\frac{-4}{7}$, $\frac{-9}{14}$, $\frac{-13}{28}$ and $\frac{-23}{42}$.

LCM of 7, 14, 28 and 42 is 84.

Now,

$$\frac{-4}{7} = \frac{-4 \times 12}{7 \times 12} = \frac{-48}{84}$$

$$\frac{-9}{14} = \frac{-9 \times 6}{14 \times 6} = \frac{-54}{84}$$

$$\frac{-13}{28} = \frac{-13 \times 3}{28 \times 3} = \frac{-39}{84}$$

$$\frac{-23}{42} = \frac{-23 \times 2}{42 \times 2} = \frac{-46}{84}$$

Clearly,

$$\frac{-54}{84} < \frac{-48}{84} < \frac{-46}{84} < \frac{-39}{84}$$

$$\therefore \frac{-9}{14} < \frac{-4}{7} < \frac{-23}{42} < \frac{-13}{28}$$

That is

$$\frac{-9}{14} < \frac{-4}{7} < \frac{-23}{42} < \frac{13}{-28}$$

Q9.

Answer :

(i) We will first write each of the given numbers with positive denominators. We have:

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

Thus, the given numbers are -2 , $\frac{-13}{6}$, $\frac{-8}{3}$ and $\frac{1}{3}$

LCM of 1, 6, 3 and 3 is 6

Now,

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

$$\frac{-13}{6} = \frac{-13 \times 1}{6 \times 1} = \frac{-13}{6}$$

$$\frac{-8}{3} = \frac{-8 \times 2}{3 \times 2} = \frac{-16}{6}$$

and

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

Clearly, Thus,

$$\frac{2}{6} > \frac{-12}{6} > \frac{-13}{6} > \frac{-16}{6}$$

$$\therefore \frac{1}{3} > -2 > \frac{-13}{6} > \frac{-8}{3} \text{ i.e } \frac{1}{3} > -2 > \frac{-13}{6} > \frac{8}{-3}$$

(ii) We will first write each of the given numbers with positive denominators. We have:

$$\frac{7}{-15} = \frac{7 \times (-1)}{-15 \times (-1)} = \frac{-7}{15} \text{ and } \frac{17}{-30} = \frac{17 \times (-1)}{-30 \times (-1)} = \frac{-17}{30}$$

Thus, the given numbers are $\frac{-3}{10}$, $\frac{-7}{15}$, $\frac{-11}{20}$ and $\frac{-17}{30}$

LCM of 10, 15, 20 and 30 is 60

Now,

$$\frac{-3}{10} = \frac{-3 \times 6}{10 \times 6} = \frac{-18}{60}$$

$$\frac{-7}{15} = \frac{-7 \times 4}{15 \times 4} = \frac{-28}{60}$$

$$\frac{-11}{20} = \frac{-11 \times 3}{20 \times 3} = \frac{-33}{60}$$

and

$$\frac{-17}{30} = \frac{-17 \times 2}{30 \times 2} = \frac{-34}{60}$$

Clearly,

$$\frac{-18}{60} > \frac{-28}{60} > \frac{-33}{60} > \frac{-34}{60}$$

$$\therefore \frac{-3}{10} > \frac{-7}{15} > \frac{-11}{20} > \frac{-17}{30} \text{ i.e } \frac{-3}{10} > \frac{-7}{15} > \frac{-11}{20} > \frac{-17}{30}$$

(iii) We will first write each of the given numbers with positive denominators. We have:

$$\frac{23}{-24} = \frac{23 \times (-1)}{-24 \times (-1)} = \frac{-23}{24}$$

Thus, the given numbers are $\frac{-5}{6}$, $\frac{-7}{12}$, $\frac{-13}{18}$ and $\frac{-23}{24}$

LCM of 6, 12, 18 and 24 is 72

Now,

Now,

$$\frac{-5}{6} = \frac{-5 \times 12}{6 \times 12} = \frac{-60}{72}$$

$$\frac{-7}{12} = \frac{-7 \times 6}{12 \times 6} = \frac{-42}{72}$$

$$\frac{-13}{18} = \frac{-13 \times 4}{18 \times 4} = \frac{-52}{72}$$

and

$$\frac{-23}{24} = \frac{-23 \times 3}{24 \times 3} = \frac{-69}{72}$$

Clearly,

$$\frac{-42}{72} > \frac{-52}{72} > \frac{-60}{72} > \frac{-69}{72}$$

$$\therefore \frac{-7}{12} > \frac{-13}{18} > \frac{-5}{6} > \frac{-23}{24} \text{ i.e } \frac{-7}{12} > \frac{-13}{18} > \frac{-5}{6} > \frac{-23}{24}$$

(iv) The given numbers are $\frac{-10}{11}$, $\frac{-19}{22}$, $\frac{-23}{33}$ and $\frac{-39}{44}$

LCM of 11, 22, 33 and 44 is 132

Now,

$$\frac{-10}{11} = \frac{-10 \times 12}{11 \times 12} = \frac{-120}{132}$$

$$\frac{-19}{22} = \frac{-19 \times 6}{22 \times 6} = \frac{-114}{132}$$

$$\frac{-23}{33} = \frac{-23 \times 4}{33 \times 4} = \frac{-92}{132}$$

and

$$\frac{-39}{44} = \frac{-39 \times 3}{44 \times 3} = \frac{-117}{132}$$

Clearly,

$$\frac{-92}{132} > \frac{-114}{132} > \frac{-117}{132} > \frac{-120}{132}$$

Q10.

Answer :

1. True

A whole number can be expressed as $\frac{a}{b}$, with $b = 1$ and $a \geq 0$. Thus, every whole number is rational.

2. True

Every integer is a rational number because any integer can be expressed as $\frac{a}{b}$, with $b = 1$ and $0 > a \geq 0$. Thus, every integer is a rational number.

3. False

$0 = \frac{a}{b}$, for $a = 0$ and $b \neq 0$. Thus, 0 is a rational and whole number.

Rational Numbers

Ex 1B

Q3.

Answer :

(i) True

A negative number always lies to the left of 0 on the number line.

(ii) False

A negative number always lies to the left of 0 on the number line.

(iii) True

Negative and positive numbers always lie on the opposite sides of 0 on the number line.

(iv) False

The negative sign cancels off and the number becomes $\frac{18}{13}$; it lies to the right of 0 on the number line.

Rational Numbers

Ex 1C

Q1.

Answer :

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

$$2. \frac{-6}{11} + \frac{-4}{11} = \frac{-6+(-4)}{11} = \frac{-6-4}{11} = \frac{-10}{11}$$

$$3. \frac{-11}{8} + \frac{5}{8} = \frac{-11+5}{8} = \frac{-6}{8} = \frac{-3 \times 2}{4 \times 2} = \frac{-3}{4}$$

$$4. \frac{-7}{3} + \frac{1}{3} = \frac{-7+1}{3} = \frac{-6}{3} = \frac{-3 \times 2}{3} = -2$$

$$5. \frac{5}{6} + \frac{-1}{6} = \frac{5+(-1)}{6} = \frac{4}{6} = \frac{2 \times 2}{3 \times 2} = \frac{2}{3}$$

$$6. \frac{-17}{15} + \frac{-1}{15} = \frac{-17+(-1)}{15} = \frac{-17-1}{15} = \frac{-18}{15} = \frac{-6 \times 3}{5 \times 3} = \frac{-6}{5}$$

Q2.

Answer :

1. The denominators of the given rational numbers are 4 and 5.

LCM of 4 and 5 is 20.

Now,

$$\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20} \text{ and } \frac{-3}{5} = \frac{-3 \times 4}{5 \times 4} = \frac{-12}{20}$$

$$\therefore \frac{3}{4} + \frac{-3}{5} = \frac{15}{20} + \frac{-12}{20} = \frac{15 + (-12)}{20} = \frac{15-12}{20} = \frac{3}{20}$$

2. The denominators of the given rational numbers are 8 and 12.

LCM of 8 and 12 is 24.

Now,

$$\frac{5}{8} = \frac{5 \times 3}{8 \times 3} = \frac{15}{24} \text{ and } \frac{-7}{12} = \frac{-7 \times 2}{12 \times 2} = \frac{-14}{24}$$

$$\therefore \frac{5}{8} + \frac{-7}{12} = \frac{15}{24} + \frac{-14}{24} = \frac{15 + (-14)}{24} = \frac{15-14}{24} = \frac{1}{24}$$

3. The denominators of the given rational numbers are 9 and 6.

LCM of 9 and 6 is 18.

Now,

$$\frac{-8}{9} = \frac{-8 \times 2}{9 \times 2} = \frac{-16}{18} \text{ and } \frac{11}{6} = \frac{11 \times 3}{6 \times 3} = \frac{33}{18}$$

$$\therefore \frac{-8}{9} + \frac{11}{6} = \frac{-16}{18} + \frac{33}{18} = \frac{-16+33}{18} = \frac{-16+33}{18} = \frac{17}{18}$$

4. The denominators of the given rational numbers are 16 and 24.

LCM of 16 and 24 is 48.

Now,

$$\frac{-5}{16} = \frac{-5 \times 3}{16 \times 3} = \frac{-15}{48} \text{ and } \frac{7}{24} = \frac{7 \times 2}{24 \times 2} = \frac{14}{48}$$

$$\therefore \frac{-5}{16} + \frac{7}{24} = \frac{-15}{48} + \frac{14}{48} = \frac{-15+14}{48} = \frac{-1}{48}$$

5. We will first write each of the given numbers with positive denominators.

$$\frac{7}{-18} = \frac{7 \times (-1)}{-18 \times (-1)} = \frac{-7}{18}$$

The denominators of the given rational numbers are 18 and 27.

LCM of 18 and 27 is 54.

Now,

$$\frac{-7}{18} = \frac{-7 \times 3}{18 \times 3} = \frac{-21}{54} \text{ and } \frac{8}{27} = \frac{8 \times 2}{27 \times 2} = \frac{16}{54}$$

$$\therefore \frac{7}{-18} + \frac{8}{27} = \frac{-21}{54} + \frac{16}{54} = \frac{-21+16}{54} = \frac{-5}{54}$$

6. We will first write each of the given numbers with positive denominators.

$$\frac{1}{-12} = \frac{1 \times (-1)}{-12 \times (-1)} = \frac{-1}{12} \text{ and } \frac{2}{-15} = \frac{2 \times (-1)}{-15 \times (-1)} = \frac{-2}{15}$$

The denominators of the given rational numbers are 12 and 15.

LCM of 12 and 15 is 60.

Now,

$$\frac{-1}{12} = \frac{-1 \times 5}{12 \times 5} = \frac{-5}{60} \text{ and } \frac{-2}{15} = \frac{-2 \times 4}{15 \times 4} = \frac{-8}{60}$$

$$\therefore \frac{-1}{12} + \frac{-2}{15} = \frac{-5}{60} + \frac{-8}{60} = \frac{-5+(-8)}{60} = \frac{-5-8}{60} = \frac{-13}{60}$$

7. We can write -1 as $\frac{-1}{1}$.

The denominators of the given rational numbers are 1 and 4.

LCM of 1 and 4 is 4.

Now,

$$\frac{-1}{1} = \frac{-1 \times 4}{1 \times 4} = \frac{-4}{4} \text{ and } \frac{3}{4} = \frac{3 \times 1}{4 \times 1} = \frac{3}{4}$$

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

8. We can write 2 as $\frac{2}{1}$.

The denominators of the given rational numbers are 1 and 4.

LCM of 1 and 4 is 4.

Now,

$$\frac{2}{1} = \frac{2 \times 4}{1 \times 4} = \frac{8}{4} \text{ and } \frac{-5}{4} = \frac{-5 \times 1}{4 \times 1} = \frac{-5}{4}$$

$$\therefore 2 + \frac{(-5)}{4} = \frac{8}{4} + \frac{(-5)}{4} = \frac{8+(-5)}{4} = \frac{8-5}{4} = \frac{3}{4}$$

9. We can write 0 as $\frac{0}{1}$.

The denominators of the given rational numbers are 1 and 5.

LCM of 1 and 5 is 5, that is, (1×5) .

Now,

$$\frac{0}{1} = \frac{0 \times 5}{1 \times 5} = \frac{0}{5} = 0 \text{ and } \frac{-2}{5} = \frac{-2 \times 1}{5 \times 1} = \frac{-2}{5}$$

$$\therefore 0 + \frac{(-2)}{5} = \frac{0}{5} + \frac{(-2)}{5} = \frac{0+(-2)}{5} = \frac{0-2}{5} = \frac{-2}{5}$$

Q3.

Answer :

$$1. \text{ LHS} = \frac{-12}{5} + \frac{2}{7}$$

LCM of 5 and 7 is 35.

$$\frac{-12 \times 7}{5 \times 7} + \frac{2 \times 5}{7 \times 5} = \frac{-84}{35} + \frac{10}{35} = \frac{-84+10}{35} = \frac{-74}{35}$$

$$\text{RHS} = \frac{2}{7} + \frac{-12}{5}$$

LCM of 5 and 7 is 35.

$$\frac{2 \times 5}{7 \times 5} + \frac{-12 \times 7}{5 \times 7} = \frac{10}{35} + \frac{-84}{35} = \frac{10-84}{35} = \frac{-74}{35}$$

$$\therefore \frac{-12}{5} + \frac{2}{7} = \frac{2}{7} + \frac{-12}{5}$$

$$2. \text{ LHS} = \frac{-5}{8} + \frac{-9}{13}$$

LCM of 8 and 13 is 104.

$$\frac{-5 \times 13}{8 \times 13} + \frac{-9 \times 8}{13 \times 8} = \frac{-65}{104} + \frac{-72}{104} = \frac{-65+(-72)}{104} = \frac{-65-72}{104} = \frac{-137}{104}$$

$$\text{RHS} = \frac{-9}{13} + \frac{-5}{8}$$

LCM of 13 and 8 is 104.

$$\frac{-9 \times 8}{13 \times 8} + \frac{-5 \times 13}{8 \times 13} = \frac{-72}{104} + \frac{-65}{104} = \frac{-72-65}{104} = \frac{-137}{104}$$

$$\therefore \frac{-5}{8} + \frac{-9}{13} = \frac{-9}{13} + \frac{-5}{8}$$

$$3. \text{ LHS} = \frac{3}{1} + \frac{-7}{12}$$

LCM of 1 and 12 is 12.

$$\frac{3 \times 12}{1 \times 12} + \frac{-7 \times 1}{12 \times 1} = \frac{36}{12} + \frac{-7}{12} = \frac{36+(-7)}{12} = \frac{36-7}{12} = \frac{29}{12}$$

$$\text{RHS} = \frac{-7}{12} + \frac{3}{1}$$

LCM of 12 and 1 is 12.

$$\frac{-7 \times 1}{12 \times 1} + \frac{3 \times 12}{1 \times 12} = \frac{-7}{12} + \frac{36}{12} = \frac{-7+36}{12} = \frac{29}{12}$$

$$\therefore 3 + \frac{-7}{12} = \frac{-7}{12} + 3$$

$$4. \text{ LHS} = \frac{2}{-7} + \frac{12}{-35}$$

We will write the given numbers with positive denominators.

$$\frac{2}{-7} = \frac{2 \times (-1)}{-7 \times (-1)} = \frac{-2}{7} \text{ and } \frac{12}{-35} = \frac{12 \times (-1)}{-35 \times (-1)} = \frac{-12}{35}$$

LCM of 7 and 35 is 35.

$$\frac{-2 \times 5}{7 \times 5} + \frac{-12 \times 1}{35 \times 1} = \frac{-10}{35} + \frac{-12}{35} = \frac{-10 + (-12)}{35} = \frac{-10 - 12}{35} = \frac{-22}{35}$$

$$\text{RHS} = \frac{12}{-35} + \frac{2}{-7}$$

We will write the given numbers with positive denominators.

$$\frac{12}{-35} = \frac{12 \times (-1)}{-35 \times (-1)} = \frac{-12}{35} \text{ and } \frac{2}{-7} = \frac{2 \times (-1)}{-7 \times (-1)} = \frac{-2}{7}$$

LCM of 35 and 7 is 35.

$$\frac{-2 \times 5}{7 \times 5} + \frac{-12 \times 1}{35 \times 1} = \frac{-10}{35} + \frac{-12}{35} = \frac{-10 + (-12)}{35} = \frac{-10 - 12}{35} = \frac{-22}{35}$$

$$\therefore \frac{2}{-7} + \frac{12}{-35} = \frac{12}{-35} + \frac{2}{-7}$$

Q4.

Answer :

1.

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

$$\left\{ \left(\frac{15-8}{20} \right) + \frac{-7}{10} \right\} = \left(\frac{7}{20} + \frac{-7}{10} \right) = \left(\frac{7}{20} + \frac{-14}{20} \right) = \left(\frac{7+(-14)}{20} \right) = \frac{-7}{20}$$

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

$$\left\{ \frac{3}{4} + \left(\frac{-4}{10} + \frac{-7}{10} \right) \right\} = \left\{ \frac{3}{4} + \left(\frac{-4-7}{10} \right) \right\} = \left\{ \frac{3}{4} + \left(\frac{-11}{10} \right) \right\} = \left(\frac{3}{4} + \frac{-11}{10} \right) \\ = \left(\frac{15}{20} + \frac{-22}{20} \right) = \left(\frac{15-22}{20} \right) = \frac{-7}{20}$$

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

2.

$$\text{LHS} = \left\{ \left(\frac{-7}{11} + \frac{2}{-5} \right) + \frac{-13}{22} \right\}$$

We will first make the denominator positive.

$$\begin{aligned} \left\{ \left(\frac{-7}{11} + \frac{2 \times (-1)}{-5 \times (-1)} \right) + \frac{-13}{22} \right\} &= \left\{ \left(\frac{-7}{11} + \frac{-2}{5} \right) + \frac{-13}{22} \right\} \\ \left\{ \left(\frac{-7}{11} + \frac{-2}{5} \right) + \frac{-13}{22} \right\} &= \left\{ \left(\frac{-35}{55} + \frac{-22}{55} \right) + \frac{-13}{22} \right\} = \left\{ \left(\frac{-35-22}{55} \right) + \frac{-13}{22} \right\} \\ &= \left(\frac{-57}{55} + \frac{-13}{22} \right) = \frac{-114}{110} + \frac{-65}{110} = \frac{-114-65}{110} = \frac{-179}{110} \\ \text{RHS} &= \left\{ \frac{-7}{11} + \left(\frac{2}{-5} + \frac{-13}{22} \right) \right\} \end{aligned}$$

We will first make the denominator positive.

$$\begin{aligned} \left\{ \frac{-7}{11} + \left(\frac{2 \times (-1)}{-5 \times (-1)} + \frac{-13}{22} \right) \right\} &= \left\{ \frac{-7}{11} + \left(\frac{-2}{5} + \frac{-13}{22} \right) \right\} \\ \left\{ \frac{-7}{11} + \left(\frac{-2}{5} + \frac{-13}{22} \right) \right\} &= \left\{ \frac{-7}{11} + \left(\frac{-44}{110} + \frac{-65}{110} \right) \right\} = \left\{ \frac{-7}{11} + \left(\frac{-44+(-65)}{110} \right) \right\} \\ &= \frac{-7}{11} + \frac{-109}{110} = \frac{-70}{110} + \frac{-109}{110} = \frac{-70-109}{110} = \frac{-179}{110} \\ \therefore \left(\frac{-7}{11} + \frac{2}{-5} \right) + \frac{-13}{22} &= \frac{-7}{11} + \left(\frac{2}{-5} + \frac{-13}{22} \right) \end{aligned}$$

3.

$$\begin{aligned} \text{LHS} &= -1 + \left(\frac{-2}{3} + \frac{-3}{4} \right) \\ \left\{ \frac{-1}{1} + \left(\frac{-2}{3} + \frac{-3}{4} \right) \right\} &= \left\{ \frac{-1}{1} + \left(\frac{-8}{12} + \frac{-9}{12} \right) \right\} = \left\{ \frac{-1}{1} + \left(\frac{-8-9}{12} \right) \right\} \\ &= \left\{ \frac{-1}{1} + \left(\frac{-17}{12} \right) \right\} = \left(\frac{-1}{1} + \frac{-17}{12} \right) = \left(\frac{-1 \times 12}{1 \times 12} + \frac{-17 \times 1}{12 \times 1} \right) = \left(\frac{-12+(-17)}{12} \right) \\ &= \left(\frac{-12-17}{12} \right) = \frac{-29}{12} \\ \text{RHS} &= \left\{ \left(-1 + \frac{-2}{3} \right) + \frac{-3}{4} \right\} \\ \text{RHS} &= \left\{ \left(-1 + \frac{-2}{3} \right) + \frac{-3}{4} \right\} \\ \left\{ \left(\frac{-1}{1} + \frac{-2}{3} \right) + \frac{-3}{4} \right\} &= \left\{ \left(\frac{-3}{3} + \frac{-2}{3} \right) + \frac{-3}{4} \right\} = \left\{ \left(\frac{-3-2}{3} \right) + \frac{-3}{4} \right\} \\ &= \left\{ \left(\frac{-5}{3} \right) + \frac{-3}{4} \right\} = \left(\frac{-5}{3} + \frac{-3}{4} \right) = \left(\frac{-20}{12} + \frac{-9}{12} \right) = \left(\frac{-20-9}{12} \right) = \frac{-29}{12} \\ \therefore -1 + \left(\frac{-2}{3} + \frac{-3}{4} \right) &= \left(-1 + \frac{-2}{3} \right) + \frac{-3}{4} \end{aligned}$$

Q5.

Answer :

(i) Addition is commutative, that is, $a + b = b + a$.

$$\text{Hence, the required solution is } \left(\frac{-3}{17}\right) + \left(\frac{-12}{5}\right) = \left(\frac{-12}{5}\right) + \boxed{\left(\frac{-3}{7}\right)}.$$

(ii) Addition is commutative, that is, $a + b = b + a$.

$$\text{Hence, the required solution is } -9 + \frac{-21}{8} = \frac{-21}{8} + \boxed{-9}.$$

(iii) Addition is associative, that is, $(a + b) + c = a + (b + c)$.

$$\text{Hence, the required solution is } \left(\frac{-8}{13} + \frac{3}{7}\right) + \left(\frac{-13}{4}\right) = \boxed{\left(\frac{-8}{13}\right)} + \left[\frac{3}{7} + \left(\frac{-13}{4}\right)\right].$$

(iv) Addition is associative, that is, $(a + b) + c = a + (b + c)$.

$$\text{Hence, the required solution is } -12 + \left(\frac{7}{12} + \frac{-9}{11}\right) = \left(-12 + \frac{7}{12}\right) + \frac{-9}{11}.$$

(iv) Addition is associative, that is, $(a + b) + c = a + (b + c)$.

$$\text{Hence, the required solution is } -12 + \left(\frac{7}{12} + \frac{-9}{11}\right) = \left(-12 + \frac{7}{12}\right) + \frac{-9}{11}.$$

(v) Addition is associative, that is, $(a + b) + c = a + (b + c)$.

$$\text{Hence, the required solution is } \frac{19}{-5} + \left(\frac{-3}{11} + \frac{-7}{8}\right) = \left\{\frac{19}{-5} + \boxed{\left(\frac{-3}{11}\right)}\right\} + \frac{-7}{8}.$$

(vi) 0 is the additive identity, that is, $0 + a = a$.

$$\text{Hence, the required solution is } \frac{-16}{7} + \boxed{0} = \boxed{0} + \frac{-16}{7} = \frac{-16}{7}.$$

Q6.

Answer :

The additive inverse of $\frac{a}{b}$ is $\frac{-a}{b}$. Therefore, $\frac{a}{b} + \left(\frac{-a}{b}\right) = 0$

(i) Additive inverse of $\frac{1}{3}$ is $\frac{-1}{3}$.

(ii) Additive inverse of $\frac{23}{9}$ is $\frac{-23}{9}$.

(iii) Additive inverse of -18 is 18.

(iv) Additive inverse of $\frac{-17}{8}$ is $\frac{17}{8}$.

(v) In the standard form, we write $\frac{15}{-4}$ as $\frac{-15}{4}$.

Hence, its additive inverse is $\frac{15}{4}$.

(vi) We can write:

$$\frac{-16}{-5} = \frac{-16 \times (-1)}{-5 \times (-1)} = \frac{16}{5}$$

Hence, its additive inverse is $\frac{-16}{5}$.

(vii) Additive inverse of $\frac{-3}{11}$ is $\frac{3}{11}$.

(viii) Additive inverse of 0 is 0.

(ix) In the standard form, we write $\frac{19}{-6}$ as $\frac{-19}{6}$.

Hence, its additive inverse is $\frac{19}{6}$.

(x) We can write:

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

Hence, its additive inverse is $\frac{-8}{7}$.

Q7.

Answer :

$$\begin{aligned} \text{(i)} \left(\frac{1}{3} - \frac{3}{4} \right) &= \frac{1}{3} + \left(\text{Additive inverse of } \frac{3}{4} \right) \\ &= \left(\frac{1}{3} + \frac{-3}{4} \right) = \left(\frac{4}{12} + \frac{-9}{12} \right) = \left(\frac{4-9}{12} \right) = \frac{-5}{12} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \left(\frac{1}{3} - \frac{-5}{6} \right) &= \frac{1}{3} + \left(\text{Additive inverse of } \frac{-5}{6} \right) \\ &= \left(\frac{1}{3} + \frac{5}{6} \right) \text{ (Because the additive inverse of } \frac{-5}{6} \text{ is } \frac{5}{6} \text{)} \\ &= \left(\frac{2}{6} + \frac{5}{6} \right) = \left(\frac{2+5}{6} \right) = \frac{7}{6} \end{aligned}$$

$$\begin{aligned} \text{(iii)} \left(\frac{-3}{5} - \frac{-8}{9} \right) &= \frac{-3}{5} + \left(\text{Additive inverse of } \frac{-8}{9} \right) \\ &= \left(\frac{-3}{5} + \frac{8}{9} \right) \text{ (Because the additive inverse of } \frac{-8}{9} \text{ is } \frac{8}{9} \text{)} \\ &= \left(\frac{-27}{45} + \frac{40}{45} \right) = \left(\frac{-27+40}{45} \right) = \frac{13}{45} \end{aligned}$$

$$\begin{aligned} \text{(iv)} \left(-1 - \frac{-9}{7} \right) &= -1 + \left(\text{Additive inverse of } \frac{-9}{7} \right) \\ &= \left(\frac{-1}{1} + \frac{9}{7} \right) \text{ (Because the additive inverse of } \frac{-9}{7} \text{ is } \frac{9}{7} \text{)} \\ &= \left(\frac{-7}{7} + \frac{9}{7} \right) = \left(\frac{-7+9}{7} \right) = \frac{2}{7} \end{aligned}$$

$$\begin{aligned} \text{(v)} \left(1 - \frac{-18}{11} \right) &= 1 + \left(\text{Additive inverse of } \frac{-18}{11} \right) \\ &= \left(\frac{1}{1} + \frac{18}{11} \right) \text{ (Because the additive inverse of } \frac{-18}{11} \text{ is } \frac{18}{11} \text{)} \\ &= \left(\frac{11}{11} + \frac{18}{11} \right) = \left(\frac{11+18}{11} \right) = \frac{29}{11} \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad \left(0 - \frac{-13}{9}\right) &= 0 + \left(\text{Additive inverse of } \frac{-13}{9}\right) \\
 &= \left(0 + \frac{13}{9}\right) \text{ (Because the additive inverse of } \frac{-13}{9} \text{ is } \frac{13}{9}) \\
 &= \frac{13}{9}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vii)} \quad \left(\frac{-6}{5} - \frac{-32}{13}\right) &= \frac{-6}{5} + \left(\text{Additive inverse of } \frac{-32}{13}\right) \\
 &= \left(\frac{-6}{5} + \frac{32}{13}\right) \text{ (Because the additive inverse of } \frac{-32}{13} \text{ is } \frac{32}{13}) \\
 &= \left(\frac{-78}{65} + \frac{160}{65}\right) = \left(\frac{-78+160}{65}\right) = \frac{82}{65}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad \left(0 - \frac{-13}{9}\right) &= 0 + \left(\text{Additive inverse of } \frac{-13}{9}\right) \\
 &= \left(0 + \frac{13}{9}\right) \text{ (Because the additive inverse of } \frac{-13}{9} \text{ is } \frac{13}{9}) \\
 &= \frac{13}{9}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vii)} \quad \left(\frac{-6}{5} - \frac{-32}{13}\right) &= \frac{-6}{5} + \left(\text{Additive inverse of } \frac{-32}{13}\right) \\
 &= \left(\frac{-6}{5} + \frac{32}{13}\right) \text{ (Because the additive inverse of } \frac{-32}{13} \text{ is } \frac{32}{13}) \\
 &= \left(\frac{-78}{65} + \frac{160}{65}\right) = \left(\frac{-78+160}{65}\right) = \frac{82}{65}
 \end{aligned}$$

Q8.

Answer :

$$\begin{aligned}
 \text{(i)} \quad &\left(\frac{4}{3} + \frac{-2}{3}\right) + \left(\frac{3}{5} + \frac{-11}{5}\right) \\
 &= \left(\frac{4-2}{3}\right) + \left(\frac{3-11}{5}\right) \\
 &= \left(\frac{2}{3} + \frac{-8}{5}\right) \\
 &= \left(\frac{10}{15} + \frac{-24}{15}\right) \\
 &= \left(\frac{10-24}{15}\right) \\
 &= \frac{-14}{15}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad &\left(\frac{-8}{3} + \frac{-11}{6}\right) + \left(\frac{-1}{4} + \frac{3}{8}\right) \\
 &= \left(\frac{-16}{6} + \frac{-11}{6}\right) + \left(\frac{-2}{8} + \frac{3}{8}\right)
 \end{aligned}$$

$$= \left(\frac{-16-11}{6} \right) + \left(\frac{-2+3}{8} \right)$$

$$= \left(\frac{-27}{6} + \frac{1}{8} \right)$$

$$= \left(\frac{-108}{24} + \frac{3}{24} \right)$$

$$= \frac{-105}{24}$$

$$= \frac{35}{8}$$

(iii)

$$\left(\frac{-13}{20} + \frac{7}{10} \right) + \left(\frac{11}{14} + \frac{-5}{7} \right)$$

$$= \left(\frac{-13}{20} + \frac{14}{20} \right) + \left(\frac{11}{14} + \frac{-10}{14} \right)$$

$$= \left(\frac{-13+14}{20} \right) + \left(\frac{11-10}{14} \right)$$

$$= \left(\frac{1}{20} + \frac{1}{14} \right)$$

$$= \left(\frac{7}{140} + \frac{10}{140} \right)$$

$$= \left(\frac{7+10}{140} \right)$$

$$= \left(\frac{17}{140} \right)$$

$$= \frac{17}{140}$$

(iv)

$$\left(\frac{-6}{7} + \frac{-15}{7} \right) + \left(\frac{-5}{6} + \frac{-4}{9} \right)$$

$$= \left(\frac{-6}{7} + \frac{-15}{7} \right) + \left(\frac{-15}{18} + \frac{-8}{18} \right)$$

$$= \left(\frac{-6-15}{7} \right) + \left(\frac{-15-8}{18} \right)$$

$$= \left(\frac{-21}{7} + \frac{-23}{18} \right)$$

$$= \left(\frac{-3}{1} + \frac{-23}{18} \right)$$

$$= \left(\frac{-54}{18} + \frac{-23}{18} \right)$$

$$= \left(\frac{-54-23}{18} \right)$$

Q9.

Answer :

Let the other number be x .

Now,

$$\Rightarrow x + \frac{-14}{5} = -2$$

$$\Rightarrow x - \frac{14}{5} = -2$$

$$\Rightarrow x = -2 + \frac{14}{5}$$

$$\Rightarrow x = \frac{(-2) \times 5 + 14}{5}$$

$$\Rightarrow x = \frac{-10+14}{5}$$

$$\Rightarrow x = \frac{4}{5}$$

Q10.

Answer :

Let the other number be x .

Now,

$$\begin{aligned}x + \frac{5}{6} &= \frac{-1}{2} \\ \Rightarrow x &= -\frac{1}{2} - \frac{5}{6} \\ \Rightarrow x &= \frac{-3-5}{6} \\ \Rightarrow x &= \frac{-8}{6} \\ \Rightarrow x &= \frac{-4}{3}\end{aligned}$$

Q11.

Answer :

Let the required number be x .

Now,

$$\begin{aligned}\frac{-5}{8} + x &= \frac{-3}{2} \\ \Rightarrow \frac{-5}{8} + x + \frac{5}{8} &= \frac{-3}{2} + \frac{5}{8} \quad \left(\text{Adding } \frac{5}{8} \text{ to both the sides}\right) \\ \Rightarrow x &= \left(\frac{-3}{2} + \frac{5}{8}\right) \\ \Rightarrow x &= \left(\frac{-12}{8} + \frac{5}{8}\right) \\ \Rightarrow x &= \left(\frac{-12+5}{8}\right) \\ \Rightarrow x &= \frac{-7}{8}\end{aligned}$$

Hence, the required number is $\frac{-7}{8}$.

Q12.

Answer :

Let the required number be x .

Now,

$$\begin{aligned}-1 + x &= \frac{5}{7} \\ \Rightarrow -1 + x + 1 &= \frac{5}{7} + 1 \quad \left(\text{Adding } 1 \text{ to both the sides}\right) \\ \Rightarrow x &= \left(\frac{5+7}{7}\right) \\ \Rightarrow x &= \frac{12}{7} \\ \text{Hence, the required number is } \frac{12}{7}.\end{aligned}$$

Q13.

Answer :

Let the required number be x .

Now,

$$\begin{aligned}\frac{-2}{3} - x &= \frac{-1}{6} \\ \Rightarrow \frac{-2}{3} - x + x &= \frac{-1}{6} + x \quad (\text{Adding } x \text{ to both the sides}) \\ \Rightarrow \frac{-2}{3} &= \frac{-1}{6} + x \\ \Rightarrow \frac{-2}{3} + \frac{1}{6} &= \frac{-1}{6} + x + \frac{1}{6} \quad (\text{Adding } \frac{1}{6} \text{ to both the sides}) \\ \Rightarrow \left(\frac{-4}{6} + \frac{1}{6} \right) &= x \\ \Rightarrow \left(\frac{-4+1}{6} \right) &= x \\ \Rightarrow \frac{-3}{6} &= x \\ \Rightarrow \frac{-1 \times 3}{2 \times 3} &= x \\ \Rightarrow \frac{-1}{2} &= x\end{aligned}$$

Hence, the required number is $\frac{-1}{2}$.

Q14.

Answer :

1. Zero is a rational number that is its own additive inverse.

2. Yes

Consider $ab-cd$ (with a, b, c and d as integers), where b and d are not equal to 0.

$ab-cd$ implies $adbd-bcbd$ implies $ad-bcbd$

Since ad, bc and bd are integers since integers are closed under the operation of multiplication and $ad-bc$ is an integer since integers are closed under the operation of subtraction, then $ad-bcbd$

since it is in the form of one integer divided by another and the denominator is not equal to 0

Since, b and d were not equal to 0

Thus, $ab-cd$ is a rational number.

3. Yes, rational numbers are commutative under addition. If a and b are rational numbers, then the commutative law under addition is $a+b=b+a$.

4. Yes, rational numbers are associative under addition. If a, b and c are rational numbers, then the associative law under addition is $a+(b+c)=(a+b)+c$.

5. No, subtraction is not commutative on rational numbers. In general, for any two rational numbers, $(a-b) \neq (b-a)$.

6. Rational numbers are not associative under subtraction. Therefore,
 $a-(b-c) \neq (a-b)-c$.

7. Negative of a negative rational number is a positive rational number.

Rational Numbers

Ex 1D

Q1.

Answer :

(i)

$$\begin{aligned}\frac{3}{5} \times \frac{-7}{8} \\&= \frac{3 \times (-7)}{5 \times 8} \\&= -\frac{21}{40}\end{aligned}$$

(ii)

$$\begin{aligned}\frac{-9}{2} \times \frac{5}{4} \\&= \frac{(-9) \times 5}{2 \times 4} \\&= \frac{-45}{8}\end{aligned}$$

(iii)

$$\begin{aligned}\frac{-6}{11} \times \frac{-5}{3} \\&= \frac{(-6) \times (-5)}{11 \times 3} \\&= \frac{30}{33}\end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{30}{33} = \frac{30 \div 3}{33 \div 3} = \frac{10}{11}$$

(iv)

$$\begin{aligned} & \frac{-2}{3} \times \frac{6}{7} \\ &= \frac{(-2) \times 6}{3 \times 7} \\ &= \frac{-12}{21} \end{aligned}$$

Simplifying the above rational number, we get:

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

(v)

$$\begin{aligned} & \frac{-12}{5} \times \frac{10}{-3} \\ &= \frac{(-12) \times 10}{5 \times (-3)} \\ &= \frac{-120}{-15} \\ &= \frac{120}{15} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{120}{15} = \frac{120 \div 3}{15 \div 3} = \frac{40}{5} = 8$$

(vi)

$$\begin{aligned} & \frac{25}{-9} \times \frac{3}{-10} \\ &= \frac{25 \times 3}{(-9) \times (-10)} \\ &= \frac{75}{90} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{75}{90} = \frac{75 \div 15}{90 \div 15} = \frac{5}{6}$$

(vii)

$$\begin{aligned} & \frac{5}{-18} \times \frac{-9}{20} \\ &= \frac{5 \times (-9)}{-18 \times 20} \\ &= \frac{-45}{-360} \\ &= \frac{45}{360} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{45}{360} = \frac{45 \div 45}{360 \div 45} = \frac{1}{8}$$

(viii)

$$\begin{aligned} & \frac{-13}{15} \times \frac{-25}{26} \\ &= \frac{(-13) \times (-25)}{15 \times 26} \\ &= \frac{325}{390} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{325}{390} = \frac{325 \div 5}{390 \div 5} = \frac{65}{78} = \frac{65 \div 13}{78 \div 13} = \frac{5}{6}$$

(ix)

$$\begin{aligned} & \frac{16}{-21} \times \frac{14}{5} \\ &= \frac{16 \times 14}{(-21) \times 5} \\ &= \frac{224}{-105} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{224}{-105} = \frac{224 \div 7}{(-105) \div 7} = \frac{32}{-15} = \frac{32 \times -1}{-15 \times -1} = \frac{-32}{15}$$

(x)

$$\begin{aligned} & \frac{-7}{6} \times 24 \\ &= \frac{(-7) \times 24}{6} \\ &= \frac{-168}{6} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{-168}{6} = \frac{(-168) \div 2}{6 \div 2} = \frac{84}{3} = \frac{-84 \div 3}{3 \div 3} = -28$$

(xi)

$$\begin{aligned} & \frac{7}{24} \times (-48) \\ &= \frac{7 \times (-48)}{24} = -\frac{336}{24} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{-336}{24} = \frac{-336 \div 24}{24 \div 24} = -14$$

(xii)

$$\begin{aligned} & \frac{-13}{5} \times (-10) \\ &= \frac{(-13) \times (-10)}{5} \\ &= \frac{130}{5} \end{aligned}$$

Simplifying the above rational number, we get:

$$\frac{130}{5} = \frac{130 \div 5}{5 \div 5} = 26$$

Q2.

Answer :

(i)

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

$$\begin{aligned}\text{LHS} &= \frac{3 \times (-5)}{7 \times 9} \\ &= -\frac{15}{63}\end{aligned}$$

Simplifying, we get:

$$\begin{aligned}-\frac{15}{63} &= -\frac{15 \div 3}{63 \div 3} \\ &= -\frac{5}{21}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= \frac{-5}{9} \times \frac{3}{7} \\ &= \frac{(-5) \times 3}{9 \times 7} \\ &= \frac{-15}{63}\end{aligned}$$

Simplifying, we get:

$$\begin{aligned}&= \frac{-15 \div 3}{63 \div 3} \\ &= -\frac{5}{21}\end{aligned}$$

$$\text{LHS} = \text{RHS}$$

(ii)

$$\frac{-8}{7} \times \frac{13}{9} = \frac{13}{9} \times \frac{-8}{7}$$

$$\text{LHS} = \frac{-8}{7} \times \frac{13}{9} = \frac{(-8) \times 13}{7 \times 9} = -\frac{104}{63} \quad \text{RHS} = \frac{13}{9} \times \frac{-8}{7} = \frac{13 \times (-8)}{9 \times 7} = -\frac{104}{63} \quad \text{LHS} = \text{RHS}$$

(iii)

$$\frac{-12}{5} \times \frac{7}{-36} = \frac{7}{-36} \times \frac{-12}{5}$$

$$\begin{aligned}\text{LHS} &= \frac{-12}{5} \times \frac{7}{-36} \\ &= \frac{(-12) \times 7}{5 \times (-36)} \\ &= \frac{84}{180}\end{aligned}$$

Simplifying, we get:

$$\begin{aligned}&= \frac{84 \div 12}{180 \div 12} \\ &= \frac{7}{15}\end{aligned}$$

$$\text{RHS} = \frac{7}{-36} \times \frac{-12}{5}$$

$$= \frac{7 \times (-12)}{(-36) \times 5}$$

$$= \frac{84}{180}$$

Simplifying, we get:

$$= \frac{84 \div 12}{180 \div 12}$$

$$= \frac{7}{15}$$

$$\text{LHS} = \text{RHS}$$

(iv)

$$-8 \times \frac{-13}{12} = \frac{-13}{12} \times (-8)$$

$$\text{LHS} = -8 \times \frac{-13}{12}$$

$$= \frac{(-8) \times (-13)}{12}$$

$$= \frac{104}{12}$$

Simplifying, we get:

$$= \frac{104 \div 4}{12 \div 4}$$

$$= \frac{26}{3}$$

$$\text{RHS} = \frac{-13}{12} \times (-8)$$

$$= \frac{(-13) \times (-8)}{12}$$

$$= \frac{104}{12}$$

Simplifying, we get:

$$= \frac{104 \div 4}{12 \div 4}$$

$$= \frac{26}{3}$$

$$\text{LHS} = \text{RHS}$$

Q3.

Answer :

(i)

$$\left(\frac{5}{7} \times \frac{12}{13} \right) \times \frac{7}{18} = \frac{5}{7} \times \left(\frac{12}{13} \times \frac{7}{18} \right)$$

$$\text{LHS} = \left(\frac{5}{7} \times \frac{12}{13} \right) \times \frac{7}{18}$$

$$= \frac{5 \times 12}{7 \times 13} \times \frac{7}{18}$$

$$= \frac{60}{91} \times \frac{7}{18}$$

$$= \frac{420}{1638}$$

$$= \frac{10}{39}$$

$$\text{RHS} = \frac{5}{7} \times \left(\frac{12}{13} \times \frac{7}{18} \right)$$

$$= \frac{5}{7} \times \frac{12 \times 7}{13 \times 18}$$

$$= \frac{5}{7} \times \frac{84}{234}$$

$$= \frac{420}{1638}$$

$$= \frac{10}{39}$$

$$\therefore \left(\frac{5}{7} \times \frac{12}{13} \right) \times \frac{7}{18} = \frac{5}{7} \times \left(\frac{12}{13} \times \frac{7}{18} \right)$$

(ii)

$$\frac{-13}{24} \times \left(\frac{-12}{5} \times \frac{35}{36} \right) = \left(\frac{-13}{24} \times \frac{-12}{5} \right) \times \frac{35}{36}$$

$$\begin{aligned} \text{LHS} &= \frac{-13}{24} \times \left(\frac{-12}{5} \times \frac{35}{36} \right) \\ &= \frac{-13}{24} \times \frac{(-12) \times 35}{5 \times 36} \\ &= \frac{-13}{24} \times \frac{-420}{180} \\ &= \frac{5460}{4320} \\ &= \frac{91}{72} \end{aligned}$$

$$\begin{aligned} \text{RHS} &= \left(\frac{-13}{24} \times \frac{-12}{5} \right) \times \frac{35}{36} \\ &= \frac{(-13) \times (-12)}{24 \times 5} \times \frac{35}{36} \\ &= \frac{156}{120} \times \frac{35}{36} \\ &= \frac{156 \times 35}{120 \times 36} \\ &= \frac{5460}{4320} \\ &= \frac{91}{72} \end{aligned}$$

$$\therefore \frac{-13}{24} \times \left(\frac{-12}{5} \times \frac{35}{36} \right) = \left(\frac{-13}{24} \times \frac{-12}{5} \right) \times \frac{35}{36}$$

(iii)

$$\left(\frac{-9}{5} \times \frac{-10}{3} \right) \times \frac{21}{-4} = \frac{-9}{5} \times \left(\frac{-10}{3} \times \frac{21}{-4} \right)$$

$$\begin{aligned} \text{LHS} &= \left(\frac{-9}{5} \times \frac{-10}{3} \right) \times \frac{21}{-4} \\ &= \frac{(-9) \times (-10)}{5 \times 3} \times \frac{21}{-4} \\ &= \frac{90}{15} \times \frac{21}{-4} \\ &= \frac{90 \times 21}{15 \times (-4)} \\ &= -\frac{1890}{60} \\ &= -\frac{63}{2} \end{aligned}$$

$$\begin{aligned} \text{RHS} &= \frac{-9}{5} \times \left(\frac{-10}{3} \times \frac{21}{-4} \right) \\ &= \frac{-9}{5} \times \frac{(-10) \times 21}{3 \times (-4)} \\ &= \frac{-9}{5} \times \frac{210}{12} \\ &= \frac{(-9) \times 210}{5 \times 12} \\ &= -\frac{1890}{60} \\ &= -\frac{63}{2} \end{aligned}$$

$$\therefore \left(\frac{-9}{5} \times \frac{-10}{3} \right) \times \frac{21}{-4} = \frac{-9}{5} \times \left(\frac{-10}{3} \times \frac{21}{-4} \right)$$

Q4.

Answer :

(i)

$$\frac{-23}{17} \times \frac{18}{35} = \frac{18}{35} \times \boxed{\frac{-23}{17}} \quad \left(\because a \times b = b \times a \right)$$

(ii)

$$-38 \times \frac{-7}{9} = \frac{-7}{9} \times \boxed{-38} \quad \left(\because a \times b = b \times a \right)$$

(iii)

$$\left(\frac{15}{7} \times \frac{-21}{10} \right) \times \frac{-5}{6} = \boxed{\frac{15}{7}} \times \left(\frac{-21}{10} \times \frac{-5}{6} \right) \quad \left[\because a \times (b \times c) = (a \times b) \times c \right]$$

(iv)

$$\frac{-12}{5} \times \left(\frac{4}{15} \times \frac{25}{-16} \right) = \left(\frac{-12}{5} \times \frac{4}{15} \right) \times \boxed{\frac{25}{-16}} \quad \left[\because a \times (b \times c) = (a \times b) \times c \right]$$

Q5.

Answer :

(i)

Reciprocal of $\frac{13}{25}$ is $\frac{25}{13}$.

(ii)

Reciprocal of $\frac{-17}{12}$ is $\frac{12}{-17}$, that is, $\frac{-12}{17}$.

(iii)

Reciprocal of $\frac{-7}{24}$ is $\frac{24}{-7}$, that is, $\frac{-24}{7}$.

(iv)

Reciprocal of 18 is $\frac{1}{18}$.

(v)

Reciprocal of -16 is $\frac{1}{-16}$, that is, $\frac{-1}{16}$.

(vi)

Reciprocal of $\frac{-3}{-5}$ is $\frac{-5}{-3}$, that is, $\frac{5}{3}$.

(vii)

Reciprocal of -1 is -1 .

(viii)

Reciprocal of $\frac{0}{2}$ does not exist as $\frac{2}{0} = \infty$.

(ix)

Reciprocal of $\frac{2}{-5}$ is $\frac{-5}{2}$.

(x)

Reciprocal of $\frac{-1}{8}$ is -8 .

Q6.

Answer :

We know that $a^{-1} = \frac{1}{a}$ or $a^{-1} \times a = 1$

(i)

$$\left(\frac{5}{8}\right)^{-1} = \frac{8}{5}$$

$$\therefore \frac{5}{8} \times \left(\frac{5}{8}\right)^{-1} = 1$$

(ii)

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

$$\therefore \frac{-4}{9} \times \left(\frac{-4}{9}\right)^{-1} = 1$$

(iii)

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

$$\therefore -7 \times \left(-7\right)^{-1} = 1$$

$$\text{(iv) } (-3)^{-1}$$

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

$$\therefore (-3)^{-1} \times (-3) = 1$$

Q7.

Answer :

(i)

$$\text{LHS} = \frac{3}{7} \times \left(\frac{5}{6} + \frac{12}{13}\right)$$

$$= \frac{3}{7} \times \left(\frac{65+72}{78}\right)$$

$$= \frac{3}{7} \times \frac{137}{78}$$

$$= \frac{137}{182}$$

$$\text{RHS} = \left(\frac{3}{7} \times \frac{5}{6}\right) + \left(\frac{12}{13} \times \frac{3}{7}\right)$$

$$= \frac{3 \times 5}{7 \times 6} + \frac{12 \times 3}{13 \times 7}$$

$$= \frac{15}{42} + \frac{36}{91}$$

$$= \frac{195+216}{546}$$

$$= \frac{411}{546}$$

$$= \frac{137}{182}$$

$$\therefore \frac{3}{7} \times \left(\frac{5}{6} + \frac{12}{13}\right) = \left(\frac{3}{7} \times \frac{5}{6}\right) + \left(\frac{3}{7} \times \frac{12}{13}\right)$$

(ii)

$$\begin{aligned}\text{LHS} &= \frac{-15}{4} \times \left(\frac{3}{7} + \frac{-12}{5} \right) \\&= \frac{-15}{4} \times \left(\frac{15-84}{35} \right) \\&= \frac{-15}{4} \times \frac{-69}{35} \\&= \frac{(-15) \times (-69)}{140} \\&= \frac{1035}{140} \\&= \frac{207}{28} \\ \text{RHS} &= \left(\frac{-15}{4} \times \frac{3}{7} \right) + \left(\frac{-15}{4} \times \frac{-12}{5} \right) \\&= \frac{(-15) \times 3}{4 \times 7} + \frac{(-15) \times (-12)}{4 \times 5} \\&= \frac{-45}{28} + \frac{180}{20} \\&= \frac{-225+1260}{140} \\&= \frac{1035}{140} \\&= \frac{207}{28}\end{aligned}$$

$$\therefore \frac{-15}{4} \times \left(\frac{3}{7} + \frac{-12}{5} \right) = \left(\frac{-15}{4} \times \frac{3}{7} \right) + \left(\frac{-15}{4} \times \frac{-12}{5} \right)$$

(iii)

$$\begin{aligned}&\left(\frac{-8}{3} + \frac{-13}{12} \right) \times \frac{5}{6} = \left(\frac{-8}{3} \times \frac{5}{6} \right) + \left(\frac{-13}{12} \times \frac{5}{6} \right) \\ \text{LHS} &= \left(\frac{-8}{3} + \frac{-13}{12} \right) \times \frac{5}{6} \\&= \frac{-32-13}{12} \times \frac{5}{6} \\&= \frac{-45}{12} \times \frac{5}{6} \\&= \frac{-45 \times 5}{12 \times 6} \\&= \frac{-225}{72} \\&= \frac{-225 \div 9}{72 \div 9} \\&= -\frac{25}{8} \\ \text{RHS} &= \left(\frac{-8}{3} \times \frac{5}{6} \right) + \left(\frac{-13}{12} \times \frac{5}{6} \right) \\&= \frac{-8 \times 5}{3 \times 6} + \frac{(-13) \times 5}{12 \times 6} \\&= \frac{-40}{18} + \frac{-65}{72} \\&= \frac{-160-65}{72} \\&= \frac{-225}{72} \\&= \frac{-225 \div 9}{72 \div 9} \\&= -\frac{25}{8} \\ \therefore &\left(\frac{-8}{3} + \frac{-13}{12} \right) \times \frac{5}{6} = \left(\frac{-8}{3} \times \frac{5}{6} \right) + \left(\frac{-13}{12} \times \frac{5}{6} \right)\end{aligned}$$

(iv)

$$\begin{aligned}&\frac{-16}{7} \times \left(\frac{-8}{9} + \frac{-7}{6} \right) = \left(\frac{-16}{7} \times \frac{-8}{9} \right) + \left(\frac{-16}{7} \times \frac{-7}{6} \right) \\ \text{LHS} &= \frac{-16}{7} \times \left(\frac{-8}{9} + \frac{-7}{6} \right) \\&= \frac{-16}{7} \times \left(\frac{-16-21}{18} \right) \\&= \frac{-16}{7} \times \frac{-37}{18} \\&= \frac{592}{126} \\&= \frac{296}{63} \\ \text{RHS} &= \left(\frac{-16}{7} \times \frac{-8}{9} \right) + \left(\frac{-16}{7} \times \frac{-7}{6} \right) \\&= \frac{128}{63} + \frac{112}{42} \\&= \frac{256+336}{126}\end{aligned}$$

$$= \frac{592}{126}$$

$$= \frac{296}{63}$$

$$\therefore \frac{-16}{7} \times \left(\frac{-8}{9} + \frac{-7}{6} \right) = \left(\frac{-16}{7} \times \frac{-8}{9} \right) + \left(\frac{-16}{7} \times \frac{-7}{6} \right)$$

Q8.

Answer :

Commutative property
 Associative property
 Distributive property
 Property of multiplicative identity
 Property of multiplicative inverse
 Multiplicative property of 0

Q9.

Answer :

- (i) 1
- (ii) no
- (iii) 1; -1
- (iv) not
- (v) 1a
- (vi) a
- (vii) positive
- (viii) negative

Rational Numbers

Ex 1E

Q1.

Answer :

(i)

$$\begin{aligned}\frac{4}{9} \div \frac{-5}{12} \\&= \frac{4}{9} \times \frac{12}{-5} \\&= \frac{4 \times 12}{9 \times -5} \\&= \frac{48}{-45} \\&= \frac{-48}{45} \\&= \frac{-16}{15}\end{aligned}$$

(ii)

$$\begin{aligned}-8 \div \frac{-7}{16} \\&= -8 \times \frac{16}{-7} \\&= \frac{8 \times 16}{7} \\&= \frac{128}{7}\end{aligned}$$

(iii)

$$\begin{aligned}\frac{-12}{7} \div (-18) \\&= \frac{-12}{7} \times \frac{1}{-18}\end{aligned}$$

$$\begin{aligned}
 &= \frac{12}{126} \\
 &= \frac{12 \div 3}{126 \div 3} \\
 &= \frac{4}{42} \\
 &= \frac{4 \div 2}{42 \div 2} \\
 &= \frac{2}{21}
 \end{aligned}$$

(iv)

$$\begin{aligned}
 &\frac{-1}{10} \div \frac{-8}{5} \\
 &= \frac{-1}{10} \times \frac{5}{-8} \\
 &= \frac{5}{80} \\
 &= \frac{5 \div 5}{80 \div 5} \\
 &= \frac{1}{16}
 \end{aligned}$$

(v)

$$\begin{aligned}
 &\frac{-16}{35} \div \frac{-15}{14} \\
 &= \frac{-16}{35} \times \frac{14}{-15} \\
 &= \frac{224}{525}
 \end{aligned}$$

(vi)

$$\begin{aligned}
 &\frac{-65}{14} \div \frac{13}{7} \\
 &= \frac{-65}{14} \times \frac{7}{13} \\
 &= \frac{-5}{2}
 \end{aligned}$$

Q2.

Answer :

(i)

$$\frac{13}{5} \div \frac{26}{10} = \frac{26}{10} \div \frac{13}{5}$$

LHS

$$\begin{aligned}
 &\frac{13}{5} \div \frac{26}{10} \\
 &= \frac{13}{5} \times \frac{10}{26} \\
 &= \frac{130}{130} \\
 &= 1
 \end{aligned}$$

RHS

$$\begin{aligned}
 &\frac{26}{10} \div \frac{13}{5} \\
 &= \frac{26}{10} \times \frac{5}{13} \\
 &= \frac{130}{130} \\
 &= 1
 \end{aligned}$$

TRUE

$$(ii) -9 \div \frac{3}{4} = \frac{3}{4} \div (-9) \text{ LHS } -9 \div \frac{3}{4} = -9 \times \frac{4}{3} = \frac{-36}{3} = -12 \text{ RHS } \frac{3}{4} \div (-9) = \frac{3}{4} \times \frac{1}{-9}$$

$$= \frac{3}{-36} = \frac{-1}{12} \text{ FALSE } (iii) \frac{-8}{9} \div \frac{-4}{3} = \frac{-4}{3} \div \frac{-8}{9} \text{ LHS } \frac{-8}{9} \div \frac{-4}{3}$$

$$= \frac{-8}{9} \times \frac{3}{-4} = \frac{24}{36} = \frac{2}{3} \text{ RHS } \frac{-4}{3} \div \frac{-8}{9} = \frac{-4}{3} \times \frac{9}{-8} = \frac{36}{24}$$

$$= \frac{3}{2} \text{ FALSE } (iv) \frac{-7}{24} \div \frac{3}{-16} = \frac{3}{-16} \div \frac{-7}{24} \text{ LHS } \frac{-7}{24} \times \frac{-16}{3}$$

$$= \frac{112}{72} \text{ RHS } \frac{3}{-16} \div \frac{-7}{24} = \frac{3}{-16} \times \frac{24}{-7} = \frac{72}{112} \text{ FALSE}$$

Q3.

Answer :

(i)

$$\left(\frac{5}{9} \div \frac{1}{3}\right) \div \frac{5}{2} = \frac{5}{9} \div \left(\frac{1}{3} \div \frac{5}{2}\right)$$

LHS

$$\begin{aligned} &\left(\frac{5}{9} \div \frac{1}{3}\right) \div \frac{5}{2} \\ &= \left(\frac{5}{9} \times \frac{3}{1}\right) \times \frac{2}{5} \\ &= \frac{5 \times 3 \times 2}{9 \times 1 \times 5} \\ &= \frac{30}{45} \\ &= \frac{2}{3} \end{aligned}$$

RHS

$$\begin{aligned} &\frac{5}{9} \div \left(\frac{1}{3} \div \frac{5}{2}\right) \\ &= \frac{5}{9} \div \left(\frac{1}{3} \times \frac{2}{5}\right) \\ &= \frac{5}{9} \div \left(\frac{2}{15}\right) \\ &= \frac{5}{9} \times \left(\frac{15}{2}\right) = \frac{75}{18} \\ &= \frac{25}{6} \end{aligned}$$

LHS \neq RHS

FALSE

(ii)

$$\left[\left(-16\right) \div \frac{6}{5}\right] \div \frac{-9}{10} = \left(-16\right) \div \left[\frac{6}{5} \div \frac{-9}{10}\right]$$

LHS

$$\begin{aligned} &= \left[\left(-16\right) \div \frac{6}{5}\right] \div \frac{-9}{10} \\ &= \left[\left(-16\right) \times \frac{5}{6}\right] \times \frac{10}{-9} \\ &= \frac{(-16) \times 5 \times 10}{6 \times (-9)} \\ &= \frac{800}{54} \\ &= \frac{400}{27} \end{aligned}$$

RHS

$$\begin{aligned} &\left(-16\right) \div \left(\frac{6}{5} \div \frac{-9}{10}\right) \\ &= \left(-16\right) \div \left(\frac{6}{5} \times \frac{10}{-9}\right) \\ &= -16 \div \left\{\frac{-60}{45}\right\} \\ &= -16 \times \left(\frac{-45}{60}\right) \end{aligned}$$

$$= \frac{48}{4}$$

$$= 12$$

LHS \neq RHS

FALSE

(iii)

$$\left(\frac{-3}{5} \div \frac{-12}{35} \right) \div \frac{1}{14} = \frac{-3}{5} \div \left(\frac{-12}{35} \div \frac{1}{4} \right)$$

LHS

$$= \left(\frac{-3}{5} \times \frac{35}{-12} \right) \times 14$$

$$= \frac{(-3) \times 35 \times 14}{5 \times (-12)}$$

$$= \frac{1470}{60}$$

$$= \frac{49}{2}$$

RHS

$$= \frac{-3}{5} \div \left(\frac{-12}{35} \div \frac{1}{4} \right)$$

$$= \frac{-3}{5} \div \left(\frac{-12}{35} \times \frac{4}{1} \right)$$

$$= \frac{-3}{5} \div \left(\frac{-12 \times 4}{35} \right)$$

$$= \frac{-3}{5} \div \left(\frac{-12 \times 4}{35} \right)$$

$$= \frac{-3}{5} \div \left(\frac{-48}{35} \right)$$

$$= \frac{-3}{5} \times \frac{35}{-48}$$

$$= \frac{3 \times 35}{5 \times 48}$$

$$= \frac{105}{240}$$

$$= \frac{7}{16}$$

LHS \neq RHS

FALSE

Q4.

Answer :

Let the number be x.

Now,

$$x \times (-12) = -9$$

$$\Rightarrow x = -9 \div (-12)$$

$$\Rightarrow x = (-9) \times \frac{1}{-12}$$

$$\Rightarrow x = \frac{-9}{-12}$$

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

Q5.

Answer :

Let the number be x. .

Now,

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

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

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

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

$$\Rightarrow x = \frac{48}{36}$$

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

Q6.

Answer :

Let the number be x.

Now,

$$\begin{aligned}x \times \frac{-15}{50} &= \frac{-5}{7} \\ \Rightarrow x &= \frac{-5}{7} \div \frac{-15}{50} \\ \Rightarrow x &= \frac{-5}{7} \times \frac{50}{-15} \\ \Rightarrow x &= \frac{280}{105} \\ \Rightarrow x &= \frac{280 \div 5}{105 \div 5} \\ \Rightarrow x &= \frac{56}{21} \\ \Rightarrow x &= \frac{56 \div 7}{21 \div 7} \\ \Rightarrow x &= \frac{8}{3}\end{aligned}$$

Q7.

Answer :

Let the number be x.

Now,

$$\begin{aligned}x \times \frac{-8}{39} &= \frac{1}{26} \\ \Rightarrow x &= \frac{1}{26} \div \frac{-8}{39} \\ \Rightarrow x &= \frac{1}{26} \times \frac{39}{-8} \\ \Rightarrow x &= \frac{39}{-208} \\ \Rightarrow x &= \frac{39 \times -1}{-208 \times -1} \\ \Rightarrow x &= \frac{-39}{208} \\ \Rightarrow x &= \frac{-39 \div 13}{208 \div 13} \\ \Rightarrow x &= \frac{-3}{16}\end{aligned}$$

Q8.

Answer :

Let the number be x.

Now,

$$\begin{aligned}\frac{-33}{8} \div x &= \frac{-11}{2} \\ \Rightarrow \frac{-33}{8} \times \frac{1}{x} &= \frac{-11}{2} \\ \Rightarrow \frac{1}{x} &= \frac{-11}{2} \div \frac{-33}{8} \\ \Rightarrow \frac{1}{x} &= \frac{-11}{2} \times \frac{8}{-33} \\ \Rightarrow \frac{1}{x} &= \frac{88}{66} \\ \Rightarrow \frac{1}{x} &= \frac{4}{3} \\ \Rightarrow x &= \frac{3}{4} \quad \left(\text{Reciprocal of } \frac{4}{3} \right)\end{aligned}$$

Q9.

Answer :

$$\begin{aligned}\left(\frac{13}{5} + \frac{-12}{7} \right) \div \left(\frac{-31}{7} \times \frac{1}{-2} \right) \\ = \left(\frac{91-60}{35} \right) \div \left(\frac{-31}{-14} \right) \\ = \left(\frac{31}{35} \right) \div \left(\frac{31}{14} \right) \\ = \left(\frac{31}{35} \right) \times \left(\frac{14}{31} \right) \\ = \frac{14}{35} \\ = \frac{14 \div 7}{35 \div 7} \\ = \frac{2}{5}\end{aligned}$$

Q10.

Answer :

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

Q11.

Answer :

(i)

$$\begin{aligned}& \text{Let } \frac{9}{8} \div x = \frac{-3}{2} \\& \Rightarrow \frac{9}{8} \times \frac{1}{x} = \frac{-3}{2} \\& \Rightarrow \frac{1}{x} = \frac{-3}{2} \div \frac{9}{8} \\& \Rightarrow \frac{1}{x} = \frac{-3}{2} \times \frac{8}{9} \\& \Rightarrow \frac{1}{x} = \frac{-24}{18} \\& \Rightarrow \frac{1}{x} = \frac{-4}{3} \\& \Rightarrow x = \frac{-3}{4} \quad \left[\text{Reciprocal of } \frac{-4}{3} \right]\end{aligned}$$

(ii)

$$\begin{aligned}& \text{Let } x \div \left(\frac{-7}{5} \right) = \frac{10}{19} \\& \Rightarrow x \times \left(\frac{5}{-7} \right) = \frac{10}{19} \\& \Rightarrow x = \left(\frac{10}{19} \right) \div \left(\frac{5}{-7} \right) \\& \Rightarrow x = \frac{10}{19} \times \frac{-7}{5} \\& \Rightarrow x = \frac{-14}{19}\end{aligned}$$

(iii)

$$\begin{aligned}& \text{Let } x \div (-3) = \frac{-4}{15} \\& \Rightarrow x \times \left(\frac{1}{-3} \right) = \frac{-4}{15} \\& \Rightarrow x = \frac{-4}{15} \times (-3) \\& \Rightarrow x = \frac{12}{15} \\& \Rightarrow x = \frac{4}{5}\end{aligned}$$

(iv)

$$\begin{aligned}& \text{Let } (-12) \div x = \frac{-6}{5} \\& \Rightarrow (-12) \times \frac{1}{x} = \frac{-6}{5} \\& \Rightarrow \frac{1}{x} = \frac{-6}{5} \div (-12) \\& \Rightarrow \frac{1}{x} = \frac{-6}{5} \times \frac{1}{-12} \\& \Rightarrow \frac{1}{x} = \frac{1}{10} \\& \Rightarrow x = 10\end{aligned}$$

Q12.

Answer :

(i) No, rational numbers are not closed under division in general.

$\frac{a}{0} = \infty$; it is not a rational number.

(ii) No

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

Also,

$$\frac{c}{d} \div \frac{a}{b} = \frac{c}{d} \times \frac{b}{a} = \frac{cb}{da} \text{ Thus, } \frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b}$$

Therefore, division is not commutative.

(iii) No, rational numbers are not associative under division.

$$\frac{a}{b} \div \left(\frac{c}{d} \div \frac{e}{f} \right) \neq \left(\frac{a}{b} \div \frac{c}{d} \right) \div \frac{e}{f}$$

(iv) No, we cannot divide 1 by 0. The answer will be ∞ , which is not defined.

Rational Numbers

Ex 1F

Q1.

Answer :

$$\begin{aligned}\text{Required number} &= \frac{1}{2} \left(\frac{1}{4} + \frac{1}{3} \right) \\ &= \frac{1}{2} \left(\frac{3+4}{12} \right) \\ &= \left(\frac{1}{2} \times \frac{7}{12} \right) \\ &= \frac{7}{24}\end{aligned}$$

Q2.

Answer :

$$\begin{aligned}\text{Required Number} &= \frac{1}{2} \times (2 + 3) \\ &= \frac{5}{2}\end{aligned}$$

Q3.

Answer :

$$\begin{aligned}\text{Required number} &= \frac{1}{2} \times \left(\frac{-1}{3} + \frac{1}{2} \right) \\ &= \frac{1}{2} \times \left(\frac{-2+3}{6} \right) \\ &= \frac{1}{2} \times \frac{1}{6} \\ &= \frac{1}{12}\end{aligned}$$

-

Q4.

Answer :

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

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

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

We know :

$$-3 < \frac{-5}{2} < -2$$

$$\text{Rational number between } -3 \text{ and } \frac{-5}{2} = \frac{1}{2} \times \left(-3 - \frac{5}{2}\right)$$

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

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

$$= \frac{-11}{4}$$

Thus, the required numbers are $\frac{-5}{2}$ and $\frac{-11}{4}$.

Q5.

Answer :

Rational number between 4 and 5 :

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

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

Rational number between 4 and $\frac{9}{2}$:

$$\frac{1}{2}\left(4 + \frac{9}{2}\right)$$

$$= \frac{1}{2}\left(\frac{8+9}{2}\right)$$

$$= \frac{1}{2}\left(\frac{17}{2}\right)$$

$$= \frac{17}{4}$$

Rational number between $\frac{9}{2}$ and 5 :

$$\frac{1}{2}\left(\frac{9}{2} + 5\right)$$

$$= \frac{1}{2}\left(\frac{9+10}{2}\right)$$

$$= \frac{19}{4}$$

We know :

$$4 < \frac{17}{4} < \frac{9}{2} < \frac{19}{4} < 5$$

Q6.

Answer :

Rational number between $\frac{2}{3}$ and $\frac{3}{4}$:

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

$$= \frac{1}{2}\left(\frac{8+9}{12}\right)$$

$$= \frac{17}{24}$$

We know :

$$\frac{2}{3} < \frac{17}{24} < \frac{3}{4}$$

Rational number between $\frac{2}{3}$ and $\frac{17}{24}$:

$$\frac{1}{2}\left(\frac{2}{3} + \frac{17}{24}\right)$$

$$= \frac{1}{2}\left(\frac{16+17}{24}\right)$$

$$= \frac{1}{2}\left(\frac{33}{24}\right)$$

$$= \frac{33}{48} = \frac{33 \div 3}{48 \div 3} = \frac{11}{16}$$

Rational number between $\frac{17}{24}$ and $\frac{3}{4}$:

$$\frac{1}{2}\left(\frac{17}{24} + \frac{3}{4}\right)$$

$$= \frac{1}{2}\left(\frac{17+18}{24}\right)$$

$$= \frac{1}{2} \left(\frac{35}{24} \right)$$

$$= \frac{35}{48}$$

We know :

$$\frac{2}{3} < \frac{11}{16} < \frac{17}{24} < \frac{35}{48} < \frac{3}{4}$$

Thus, the three rational numbers are $\frac{11}{16}$, $\frac{17}{24}$ and $\frac{35}{48}$.

Q8.

Answer :

We may write :

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

and

$$2 = \frac{20}{10}$$

Rational numbers between -1 and 2 :

$$\frac{-9}{10}, \frac{-8}{10}, \frac{-7}{10}, \frac{-6}{10}, \frac{-5}{10}, \frac{-4}{10}, \dots, \frac{14}{10}, \frac{15}{10}, \frac{16}{10}, \frac{17}{10}, \frac{18}{10} \text{ and } \frac{19}{10}$$

We can take any 12 numbers out of these.

Rational Numbers

Ex 1G

Q1.

Answer :

Length of the rope when two pieces of lengths $2\frac{3}{5}$ m and $3\frac{3}{10}$ m are cut off = Total length of the rope - Length of the two cut off pieces

$$\therefore 11 - \left(2\frac{3}{5} + 3\frac{3}{10}\right)$$

Now,

$$2\frac{3}{5} + 3\frac{3}{10} \Rightarrow \left(2 + \frac{3}{5}\right) + \left(3 + \frac{3}{10}\right) \\ = \frac{13}{5} + \frac{33}{10}$$

LCM of 5 and 10 is 10, i.e., $(5 \times 1 \times 2)$.

We have :

$$\frac{(13 \times 2) + (33 \times 1)}{10} \\ = \frac{26 + 33}{10} \\ = \frac{59}{10}$$

$$\therefore 2\frac{3}{5} + 3\frac{3}{10} = \frac{59}{10}$$

$$\text{Length of the remaining rope} = 11 - \frac{59}{10}$$

$$= \frac{110 - 59}{10}$$

$$= \frac{51}{10}$$

$$= 5\frac{1}{10} \text{ m}$$

Therefore, the length of the remaining rope is $5\frac{1}{10}$ m.

Q2.

Answer :

Weight of rice in the drum = Weight of the drum full of rice - Weight of the empty drum

$$\begin{aligned} &= 40\frac{1}{6} - 13\frac{3}{4} \\ &= \left(40 + \frac{1}{6}\right) - \left(13 + \frac{3}{4}\right) \\ &= \frac{241}{6} - \frac{55}{4} \\ &= \frac{241}{6} + \left(\text{Additive inverse of } \frac{55}{4}\right) \\ &= \frac{482-165}{12} \\ &= \frac{317}{12} \\ &= 26\frac{5}{12} \text{ kg} \end{aligned}$$

Therefore, the weight of rice in the drum is $26\frac{5}{12}$ kg.

Q3.

Answer :

Weight of pears in the basket = Weight of the basket containing three types of fruits - (Weight of apples + Weight of oranges)

$$= 19\frac{1}{3} - \left(8\frac{1}{9} + 3\frac{1}{6}\right)$$

Now,

$$\begin{aligned} \left(8\frac{1}{9} + 3\frac{1}{6}\right) &\Rightarrow \left(8 + \frac{1}{9}\right) + \left(3 + \frac{1}{6}\right) \\ &= \frac{73}{9} + \frac{19}{6} \end{aligned}$$

LCM of 9 and 6 is 18, that is, $(3 \times 3 \times 2)$.

We have :

$$\begin{aligned} &\frac{(73 \times 2) + (19 \times 3)}{18} \\ &= \frac{146 + 57}{18} \\ &= \frac{203}{18} \end{aligned}$$

$$\therefore 8\frac{1}{9} + 3\frac{1}{6} = \frac{203}{18}$$

$$\begin{aligned} \text{Weight of pears in the basket} &= 19\frac{1}{3} - \frac{203}{18} \\ &= \left(19 + \frac{1}{3}\right) - \frac{203}{18} \\ &= \frac{58}{3} - \frac{203}{18} \\ &= \frac{58}{3} + \left(\text{Additive inverse of } \frac{203}{18}\right) \\ &= \frac{348-203}{18} \\ &= \frac{145}{18} \\ &= 8\frac{1}{18} \text{ kg} \end{aligned}$$

Therefore, the weight of the pears in the basket is $8\frac{1}{18}$ kg.

Q4.

Answer :

Money saved by the rickshaw puller = Total money earned - (Earnings spent on tea and snacks + Earnings spent on food + Earnings spent on repairs)

$$\begin{aligned} &= 80 - \left(13\frac{3}{5} + 25\frac{1}{2} + 4\frac{2}{5}\right) \\ &= 80 - \left(\left(13 + \frac{3}{5}\right) + \left(25 + \frac{1}{2}\right) + \left(4 + \frac{2}{5}\right)\right) \\ &= 80 - \left(\frac{68}{5} + \frac{51}{2} + \frac{22}{5}\right) \end{aligned}$$

Now,

$$\begin{aligned} \frac{68}{5} + \frac{51}{2} + \frac{22}{5} &= \frac{(68 \times 2) + (51 \times 5) + (22 \times 2)}{10} \\ &= \frac{136 + 255 + 44}{10} \\ &= \frac{435}{10} \\ &= \frac{87}{2} \end{aligned}$$

$$\therefore \frac{68}{5} + \frac{51}{2} + \frac{22}{5} = \frac{87}{2}$$

$$\begin{aligned}
 \text{Money saved by the rickshaw puller} &= 80 - \frac{87}{2} \\
 &= 80 + \left(\text{Additive inverse of } \frac{87}{2} \right) \\
 &= \frac{160-87}{2} \\
 &= \frac{73}{2} \\
 &= \text{Rs } 36 \frac{1}{2}
 \end{aligned}$$

Therefore, the amount of money saved by the rickshaw puller is Rs $36 \frac{1}{2}$.

Q5.

Answer :

$$\begin{aligned}
 \text{Cost of } 3 \frac{2}{5} \text{ m cloth} &= 3 \frac{2}{5} \times 36 \frac{3}{4} \\
 &= \left(3 + \frac{2}{5} \right) \times \left(36 + \frac{3}{4} \right) \\
 &= \frac{17}{5} \times \frac{147}{4} \\
 &= \frac{17 \times 147}{5 \times 4} \\
 &= \frac{2499}{20} \\
 &= \text{Rs } 124 \frac{19}{20}
 \end{aligned}$$

Therefore, the cost of $3 \frac{2}{5}$ m cloth is Rs $124 \frac{19}{20}$.

Q6.

Answer :

Distance covered by the car in $7 \frac{1}{2}$ hours = $7 \frac{1}{2} \times 40 \frac{2}{5}$ [Distance = Speed \times Time]

$$\begin{aligned}
 &= \left(7 + \frac{1}{2} \right) \times \left(40 + \frac{2}{5} \right) \\
 &= \frac{15}{2} \times \frac{202}{5} \\
 &= \frac{15 \times 202}{10} \\
 &= \frac{3030}{10} \\
 &= 303 \text{ km}
 \end{aligned}$$

Therefore, distance covered by the car is 303 km.

Q7.

Answer :

Area of the rectangular park = Length of the park \times Breadth of the park (\because Area of rectangle = Length \times Breadth)

$$\begin{aligned}
 &= 36 \frac{3}{5} \times 16 \frac{2}{3} \\
 &= \left(36 + \frac{3}{5} \right) \times \left(16 + \frac{2}{3} \right) \\
 &= \frac{183}{5} \times \frac{50}{3} \\
 &= \frac{183 \times 50}{5 \times 3} \\
 &= \frac{9150}{15} \\
 &= 610 \text{ m}^2
 \end{aligned}$$

Therefore, the area of the rectangular park is 610 m^2 .

Q8.

Answer :

Area of the square plot = Side \times Side = $(\text{Side})^2 = a^2$ (Because the area of the square is a^2 , where a is the side of the square)

$$\begin{aligned} &= 8\frac{1}{2} \times 8\frac{1}{2} \\ &= \left(8 + \frac{1}{2}\right) \times \left(8 + \frac{1}{2}\right) \\ &= \frac{17}{2} \times \frac{17}{2} \\ &= \frac{17 \times 17}{2 \times 2} \\ &= \frac{289}{4} \\ &= 72\frac{1}{4} \text{ m}^2 \end{aligned}$$

Therefore, the area of the square plot is $72\frac{1}{4} \text{ m}^2$.

Q10.

Answer :

$$\begin{aligned} \text{Distance covered by the aeroplane in } 4\frac{1}{6} \text{ hours} &= 4\frac{1}{6} \times 1020 \\ &= \left(4 + \frac{1}{6}\right) \times 1020 \\ &= \frac{25}{6} \times 1020 \\ &= \frac{25}{6} \times \frac{1020}{1} \\ &= \frac{25 \times 1020}{6 \times 1} \\ &= \frac{25500}{6} \\ &= 4250 \text{ km} \end{aligned}$$

Therefore, the distance covered by the aeroplane is **4250 km**.

Q11.

Answer :

$$\begin{aligned} \text{Cost of one metre of cloth} &= 57\frac{3}{4} \div 3\frac{1}{2} \\ &= \left(57 + \frac{3}{4}\right) \div \left(3 + \frac{1}{2}\right) \\ &= \frac{231}{4} \div \frac{7}{2} \\ &= \frac{231}{4} \times \frac{2}{7} \\ &= \frac{231 \times 2}{4 \times 7} \\ &= \frac{462}{28} \\ &= 16\frac{14}{28} \\ &= \text{Rs } 16\frac{1}{2} \end{aligned}$$

Therefore, the cost of one metre of cloth is Rs $16\frac{1}{2}$.

Q12.

Answer :

$$\begin{aligned} \text{Length of each piece of the cord} &= 71\frac{1}{2} \div 26 \\ &= \left(71 + \frac{1}{2}\right) \div 26 \\ &= \frac{143}{2} \div 26 \\ &= \frac{143}{2} \div \frac{26}{1} \\ &= \frac{143}{2} \times \frac{1}{26} \\ &= \frac{143 \times 1}{2 \times 26} \\ &= \frac{143}{52} \\ &= \frac{9}{4} \\ &= 2\frac{3}{4} \text{ m} \end{aligned}$$

Hence, the length of each piece of the cord is $2\frac{3}{4}$ metres.

Q13.

Answer :

Area of a room = Length \times Breadth

Thus, we have:

$$65\frac{1}{4} = \text{Length} \times 5\frac{7}{16}$$

$$\text{Length} = 65\frac{1}{4} \div 5\frac{7}{16}$$

$$\begin{aligned} &= \left(65 + \frac{1}{4}\right) \div \left(5 + \frac{7}{16}\right) \\ &= \frac{261}{4} \div \frac{87}{16} \\ &= \frac{261}{4} \times \frac{16}{87} \\ &= \frac{261 \times 16}{4 \times 87} \\ &= \frac{4176}{348} \\ &= 12 \text{ m} \end{aligned}$$

Hence, the length of the room is 12 metres.

Q14.

Answer :

Let the other fraction be x .

Now, we have:

$$\begin{aligned} 9\frac{3}{7} \times x &= 9\frac{3}{5} \\ \Rightarrow x &= 9\frac{3}{5} \div 9\frac{3}{7} \\ &= \left(9 + \frac{3}{5}\right) \div \left(9 + \frac{3}{7}\right) \\ &= \frac{48}{5} \div \frac{66}{7} \\ &= \frac{48}{5} \times \frac{7}{66} \\ &= \frac{48 \times 7}{5 \times 66} \\ &= \frac{336}{330} \\ &= \frac{56}{55} \\ &= 1\frac{1}{55} \end{aligned}$$

Hence, the other fraction is $1\frac{1}{55}$.

Q15.

Answer :

If $\frac{5}{8}$ of the students are boys, then the ratio of girls is $1 - \frac{5}{8}$, that is, $\frac{3}{8}$.

Now, let x be the total number of students.

Thus, we have:

$$\begin{aligned} \frac{3}{8}x &= 240 \\ \Rightarrow x &= 240 \div \frac{3}{8} \\ &= 240 \times \frac{8}{3} \\ &= \frac{240}{1} \times \frac{8}{3} \\ &= \frac{240 \times 8}{1 \times 3} \\ &= \frac{1920}{3} \\ &= 640 \end{aligned}$$

Hence, the total number of students is 640.

Now,

Number of boys = Total number of students - Number of girls

$$\begin{aligned} &= 640 - 240 \\ &= 400 \end{aligned}$$

Q16.

Answer :

$$\text{Ratio of the read book} = \frac{7}{9}$$

$$\text{Ratio of the unread book} = 1 - \frac{7}{9}$$

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

Let x be the total number of pages in the book.

Thus, we have:

$$\frac{2}{9} \times x = 40$$

$$\Rightarrow x = 40 \div \frac{2}{9}$$

$$= 40 \times \frac{9}{2}$$

$$= \frac{40}{1} \times \frac{9}{2}$$

$$= \frac{40 \times 9}{1 \times 2}$$

$$= \frac{360}{2}$$

$$= 180$$

Hence, the total number of pages in the book is 180.

Q17.

Answer :

$$\text{Amount of money spent on notebooks} = 300 \times \frac{1}{3}$$

$$= \frac{300}{1} \times \frac{1}{3}$$

$$= \frac{300}{3}$$

$$= 100$$

$$\begin{aligned}\therefore \text{Money left after spending on notebooks} &= 300 - 100 \\ &= 200\end{aligned}$$

$$\text{Amount of money spent on stationery items from the remainder} = 200 \times \frac{1}{4}$$

$$= \frac{200}{1} \times \frac{1}{4}$$

$$= \frac{200}{4}$$

$$= 50$$

$$\begin{aligned}\therefore \text{Amount of money left with Rita} &= 200 - 50 \\ &= \text{Rs } 150\end{aligned}$$

Q18.

Answer :

$$\text{Total amount of money Amit earns} = \text{Rs } 16000$$

$$\text{Amount of money spent on food} = 16000 \times \frac{1}{4}$$

$$= \frac{16000}{1} \times \frac{1}{4}$$

$$= \frac{16000}{4}$$

$$= \text{Rs } 4000$$

$$\begin{aligned}\therefore \text{Amount of money left after spending on food} &= 16000 - 4000 \\ &= \text{Rs } 12000\end{aligned}$$

$$\text{Amount of money spent on house rent from the remainder} = 12000 \times \frac{3}{10}$$

$$= \frac{12000}{1} \times \frac{3}{10}$$

$$= \frac{12000 \times 3}{1 \times 10}$$

$$= \frac{36000}{10}$$

$$= \text{Rs } 3600$$

$$\therefore \text{Amount of money left after spending on food and house rent} = 12000 - 3600$$

$$= \text{Rs } 8400$$

$$\text{Amount of money spent on children's education from the remainder} = 8400 \times \frac{5}{21}$$

$$= \frac{8400}{1} \times \frac{5}{21}$$

$$= \frac{42000}{21}$$

$$= \text{Rs } 2000$$

$$\therefore \text{Amount of money left} = 8400 - 2000$$

$$= \text{Rs } 6400$$

Hence, the amount of money left with Amit is Rs 6400.

Q19.

Answer :

Let x be the required number.

We know that $\frac{3}{5}$ of the number exceeds its $\frac{2}{7}$ by 44.

That is,

$$\frac{3}{5} \times x = \frac{2}{7} \times x + 44$$

$$\frac{3}{5} \times x - \frac{2}{7} \times x = 44$$

$$\left(\frac{3}{5} - \frac{2}{7} \right) \times x = 44$$

$$\left(\frac{3}{5} + \text{Additive inverse of } \frac{2}{7} \right) \times x = 44$$

$$\left(\frac{21-10}{35} \right) \times x = 44$$

$$\frac{11}{35} \times x = 44$$

$$x = 44 \div \frac{11}{35}$$

$$= 44 \times \frac{35}{11}$$

$$= \frac{44}{1} \times \frac{35}{11}$$

$$= \frac{44 \times 35}{1 \times 11}$$

$$= \frac{1540}{11}$$

$$= 140$$

Q20.

Answer :

$$\text{Ratio of spectators in the open} = 1 - \frac{2}{7}$$

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

Total number of spectators in the open = x

$$\text{Then, } \frac{5}{7} \times x = 15000$$

$$\Rightarrow x = 15000 \div \frac{5}{7}$$

$$= 15000 \times \frac{7}{5}$$

$$= \frac{15000}{1} \times \frac{7}{5}$$

$$= \frac{15000 \times 7}{1 \times 5}$$

$$= \frac{105000}{5}$$

$$= 21000$$

Hence, the total number of spectators is 21,000

Rational Numbers

Ex 1H

Q2.

Answer :

$$(b) \frac{-28}{15}$$
$$\frac{8}{-15} = \frac{-8}{15} \text{ and } \frac{4}{-3} = \frac{-4}{3}$$

Now, we have:

$$\left(\frac{8}{-15} + \frac{4}{-3} \right) = \left(\frac{-8}{15} + \frac{-4}{3} \right)$$

LCM of 15 and 3 is $(3 \times 5 \times 1)$, that is, 15

$$\begin{aligned} \frac{-8}{15} + \frac{-4}{3} &= \frac{1 \times (-8) + 5 \times (-4)}{15} \\ &= \frac{(-8) + (-20)}{15} \\ &= \frac{-28}{15} \end{aligned}$$

Q3.

Answer :

$$\frac{7}{-26} = \frac{-7}{26}$$

Now, we have:

$$\left(\frac{7}{-26} + \frac{16}{39} \right) = \left(\frac{-7}{26} + \frac{16}{39} \right)$$

LCM of 26 and 39 is 1014, that is, $(29 \times 1 \times 36)$.

$$\begin{aligned} (a) \frac{11}{78} \\ \left(\frac{-7}{26} + \frac{16}{39} \right) &= \frac{39 \times (-7) + 26 \times 16}{1014} \\ &= \frac{(-273) + 416}{1014} \\ &= \frac{143}{1014} \\ &= \frac{11}{78} \end{aligned}$$

Q4.

Answer :

(b) $\frac{16}{7}$

$$3 = \frac{3}{1} \text{ and } \frac{5}{-7} = \frac{-5}{7}$$

Now, we have:

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

LCM of 1 and 7 is 7

$$\begin{aligned}\left(\frac{3}{1} + \frac{-5}{7}\right) &= \frac{7 \times 3 + 1 \times (-5)}{7} \\ &= \frac{21 + (-5)}{7} \\ &= \frac{16}{7}\end{aligned}$$

Q5.

Answer :

(d) $\frac{-67}{8}$
 $\frac{31}{-4} = \frac{-31}{4}$

We have:

$$\left(\frac{31}{-4} + \frac{-5}{8}\right) = \left(\frac{-31}{4} + \frac{-5}{8}\right)$$

LCM of 4 and 8 is 8, that is, $(4 \times 1 \times 2)$.

$$\begin{aligned}\left(\frac{-31}{4} + \frac{-5}{8}\right) &= \frac{2 \times (-31) + 1 \times (-5)}{8} \\ &= \frac{(-62) + (-5)}{8} \\ &= \frac{-67}{8}\end{aligned}$$

Q6.

Answer :

(b) $\frac{-17}{20}$

Let the required number be x .

Now,

$$\frac{7}{12} + x = \frac{-4}{15}$$

$$\Rightarrow x = \left(\frac{-4}{15} + \frac{-7}{12}\right)$$

$$\begin{aligned}&= \frac{4 \times (-4) + 5 \times (-7)}{60} \\ &= \frac{(-16) + (-35)}{60} \\ &= \frac{-51}{60} \\ &= \frac{-17}{20}\end{aligned}$$

Q7.

Answer :

(c) $\frac{-13}{60}$

Using the commutative and associative laws, we can arrange the terms in any suitable manner. Using this rearrangement property, we have:

$$\begin{aligned}\frac{2}{3} + \frac{-4}{5} + \frac{7}{15} + \frac{-11}{20} &= \left(\frac{2}{3} + \frac{7}{15}\right) + \left(\frac{-4}{5} + \frac{-11}{20}\right) \\ &= \frac{(10+7)}{15} + \frac{[(-16)+(-11)]}{20} \\ &= \left(\frac{17}{15} + \frac{-27}{20}\right) \\ &= \frac{[68+(-81)]}{60} \\ &= \frac{-13}{60}\end{aligned}$$

Q8.

Answer :

(b) $\frac{11}{3}$

Let the other number be x .

Now,

$$\begin{aligned}x + (-5) &= \frac{-4}{3} \\ \Rightarrow x &= \frac{-4}{3} + (\text{Additive inverse of } -5) \\ \Rightarrow x &= \frac{-4}{3} + 5 \\ &= \frac{-4}{3} + \frac{5}{1} \\ &= \frac{(-4)+15}{3} \\ &= \frac{11}{3}\end{aligned}$$

Q9.

Answer :

(c) $\frac{1}{21}$

Let the required number be x .

Now,

$$\begin{aligned}\frac{-5}{7} + x &= \frac{-2}{3} \\ \Rightarrow x &= \frac{-2}{3} + (\text{Additive inverse of } \frac{-5}{7}) \\ \Rightarrow x &= \left(\frac{-2}{3} + \frac{5}{7}\right) \\ &= \frac{(-14)+15}{21} \\ &= \frac{1}{21}\end{aligned}$$

Q10.

Answer :

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

Let the required number be x .

Now,

$$\begin{aligned}\frac{-5}{3} - x &= \frac{5}{6} \\ \Rightarrow x &= \left(\frac{-5}{3} - \frac{5}{6}\right) \\ &= \frac{-10-5}{6} \\ &= \frac{-15}{6} \\ &= \frac{-5}{2}\end{aligned}$$

Thus, the required number is $\frac{-5}{2}$

Q11.

Answer :

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

$$\left(-\frac{3}{7}\right)^{-1} \Rightarrow \text{Reciprocal of } \frac{-3}{7}$$

The reciprocal of $\frac{-3}{7}$ is $\frac{7}{-3}$, i.e., $\frac{-7}{3}$

Q12.

Answer :

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

Let the other number be x .

Now,

$$x \times \frac{14}{27} = \frac{-28}{81}$$

$$\Rightarrow x = \frac{-28}{81} \div \frac{14}{27}$$

$$= \frac{-28}{81} \times \frac{27}{14}$$

$$= \frac{(-28) \times 27}{81 \times 14}$$

$$= \frac{-(28 \times 27)}{81 \times 14}$$

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

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

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

Thus, the other number is $\frac{-2}{3}$

Q13.

Answer :

(c) $\frac{32}{75}$

Let the other number be x .

Now,

$$x \times \frac{-15}{4} = \frac{-16}{35}$$

$$\Rightarrow x = \frac{-16}{35} \div \frac{-15}{14}$$

$$= \frac{-16}{35} \times \frac{14}{-15}$$

$$= \frac{-(16 \times 14)}{-(35 \times 15)}$$

$$= \frac{16 \times 14}{35 \times 15} = \frac{224}{525} = \frac{32}{75}$$

Thus, the other number is $\frac{32}{75}$

Q14.

Answer :

(d) $\frac{7}{5}$

Let the required number be x .

Now,

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

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

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

$$\Rightarrow x = \frac{(-3+10)}{5}$$

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

Thus, the required number is $\frac{7}{5}$

Q15.

Answer :

(c) $\frac{1}{3}$

Let the other number be x .

Now,

$$\begin{aligned}x + \left(-\frac{10}{3}\right) &= -3 \\ \Rightarrow x &= -3 + \left(\text{Additive inverse of } -\frac{10}{3}\right) \\ \Rightarrow x &= \left(-3 + \frac{10}{3}\right) \\ &= \frac{-3}{1} + \frac{10}{3} \\ &= \frac{(-9+10)}{3} \\ &= \frac{1}{3}\end{aligned}$$

Thus, the other number is $\frac{1}{3}$

Q16.

Answer :

(b) $\frac{-49}{71}$ and (c) $\frac{-9}{16}$

The numbers $\frac{-49}{71}$ and $\frac{-9}{16}$ are in the standard form because they have no common divisor other than 1 and their denominators are positive.

Q17.

Answer :

(a) $\frac{-3}{10}$

$$\begin{aligned}\left(\frac{-9}{16} \times \frac{8}{15}\right) &= \frac{-9 \times 8}{16 \times 15} \\ &= \frac{-72}{240} \\ &= \frac{-3}{10}\end{aligned}$$

Q18.

Answer :

(d) $\frac{5}{6}$

$$\begin{aligned}\frac{-5}{9} \div \frac{2}{3} &= \frac{-5}{9} \times \frac{3}{2} \\ &= \frac{-5 \times 3}{9 \times 2} \\ &= \frac{-15}{18} \\ &= \frac{-5}{6}\end{aligned}$$

Q19.

Answer :

(d) $\frac{-5}{6}$

Let $\frac{4}{9} \div \frac{a}{b} = \frac{-8}{15}$

Now,

$$\frac{4}{9} \times \frac{b}{a} = \frac{-8}{15}$$
$$\Rightarrow \frac{b}{a} = \frac{-8}{15} \times \frac{9}{4}$$

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

$$\Rightarrow \frac{a}{b} = \frac{5}{-6}$$

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

Hence, the missing number is $\frac{-5}{6}$.

Q20.

Answer :

(c) $\frac{5}{9}$

Additive inverse of $\frac{-5}{9}$ is $\frac{5}{9}$.

Q21.

Answer :

(c) $\frac{-4}{3}$

Reciprocal of $\frac{-3}{4}$ is $\frac{4}{-3}$, i.e., $\frac{-4}{3}$.

Q22.

Answer :

(d) $\frac{-5}{24}$

Rational number between $\frac{-2}{3}$ and $\frac{1}{4} = \frac{1}{2} \left(\frac{-2}{3} + \frac{1}{4} \right)$

$$= \frac{1}{2} \left(\frac{-8+3}{12} \right)$$
$$= \frac{1}{2} \times \frac{-5}{12}$$
$$= \frac{-5}{24}$$

Q23.

Answer :

(b) is a negative rational number

The reciprocal of a negative rational number is a negative rational number.