Contents

Chapter 1

Rational Numbers

INTRODUCTION

As learnt in class VII, the sum, the difference and the product of two integers is an integer. What happens if we divide an integer by another integer?

Consider $-3 \div 7 = -\frac{3}{7}$ which is not an integer.

$2 \div -4 = \frac{1}{-2}$ which is not an integer.

Thus, we need to extend our number system to include such numbers. This new system of numbers is called rational numbers. In this chapter, we will study the different properties of rational numbers. These properties are similar to properties of integers which we have learnt in the previous class.

Rational Numbers: A number which is in the form of $\frac{m}{n}$ where $n \neq 0$ and both m and n are integers are called rational numbers. Rational numbers are denoted by Q.
For example :

$\frac{5}{8}, \frac{7}{3}, \frac{-6}{5}, \frac{1}{2}$ are all rational numbers.

0.12 is rational because $0.12 = \frac{12}{100}$.

Hence, all integers and decimal numbers are also rational numbers.
Natural Numbers: The counting numbers 1, 2, 3 ... are called natural numbers.

Whole Numbers: If we include '0' with natural numbers then the set of numbers 0, 1, 2, 3, ... are called whole numbers. It is denoted by (**W**).

Integers: All natural numbers, 0 and negative of natural numbers are called integers . They are denoted by I or Z. Thus ..... –3, –2, –1, 0, 1, 2, 3 ..... etc are all integers.

PROPERTIES OF RATIONAL NUMBERS

Closure

(a) **Addition :** For any two rational numbers, say, $\frac{a}{b}$ and $\frac{c}{d}$; $\left(\frac{a}{b}+\frac{c}{d}\right)$ is also a rational number.

Example : $\left(+\frac{5}{3}\right)+\left(+\frac{1}{6}\right)=\left(+\frac{11}{6}\right)$ which is rational.

(b) **Subtraction :** For any two rational numbers, say, $\frac{a}{b}$ and $\frac{c}{d}$; $\left(\frac{a}{b}-\frac{c}{d}\right)$ is also a rational number.

Example : $\frac{1}{2}-\frac{3}{2}=\frac{-2}{2}=-1$ which is rational.

(c) **Multiplication :** For any two rational numbers, say, $\frac{a}{b}$ and $\frac{c}{d}$; $\left(\frac{a}{b}\times\frac{c}{d}\right)$ is also a rational nmber.

Example : $\frac{1}{2}\times\left(\frac{-1}{10}\right)=\frac{-1}{20}$ which is a rational.

(d) **Division :** For any two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$; $\left[\frac{a}{b}\div\frac{c}{d}\right]$ is also a rational number.

Example : $\frac{2}{3}\div\left(\frac{-5}{9}\right)=\frac{2}{3}\times\left(\frac{-9}{5}\right)=\frac{-6}{5}$ Which is a rational.

Commutativity

(a) **Addition :** For any two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$; $\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$

Example : $\left(+\frac{4}{5}\right)+\left(+\frac{7}{2}\right)=\left(+\frac{7}{2}\right)+\left(+\frac{4}{5}\right)$

(b) Subtraction : Subtraction of rational numbers is not commutative.

Example : $\frac{1}{7}-\frac{1}{5}\neq\frac{1}{5}-\frac{1}{7}$

(c) Multiplication : For any two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$; $\frac{a}{b}\times\frac{c}{d}=\frac{c}{d}\times\frac{a}{b}$.

Example : $\left(\frac{-5}{7}\right)\times\left(\frac{-4}{7}\right)=\left(\frac{-4}{7}\right)\times\left(\frac{-5}{7}\right)$

(d) Division : Division of rational numbrs is not commutative.

Example : $\frac{1}{12}\div\frac{5}{4}\neq\frac{5}{4}\div\frac{1}{12}$

Associativity

(a) Addition : For any three rational numbers $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$; $\frac{a}{b}+\left(\frac{c}{d}+\frac{e}{f}\right)=\left(\frac{a}{b}+\frac{c}{d}\right)+\frac{e}{f}$

Example : $\left(\frac{1}{8}+\frac{3}{7}\right)+\left(\frac{-1}{7}\right)=\frac{1}{8}+\left\{\frac{3}{7}+\left(\frac{-1}{7}\right)\right\}$

(b) Subtraction : Subtraction is not associative.

Example : $\left(\frac{4}{7}-\frac{4}{3}\right)-\frac{4}{5}\neq\frac{4}{7}-\left(\frac{4}{3}-\frac{4}{5}\right)$

(c) Multiplication : For any three rational numbers $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$; $\frac{a}{b}\times\left(\frac{c}{d}\times\frac{e}{f}\right)=\left(\frac{a}{b}\times\frac{c}{d}\right)\times\frac{e}{f}$

Example : $\left(\frac{1}{8}\times\frac{3}{7}\right)\times\left(\frac{-1}{7}\right)=\frac{1}{8}\times\left\{\frac{3}{7}\times\left(\frac{-1}{7}\right)\right\}$

(d) Division : For any three rational numbers $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$, division is not associative, i.e., $\left(\frac{a}{b}\div\frac{c}{d}\right)\div\frac{e}{f}\neq\frac{a}{b}\div\left(\frac{c}{d}\div\frac{e}{f}\right)$

Example : $\left(\frac{1}{2}\div\frac{3}{4}\right)\div\frac{7}{8}\neq\frac{1}{2}\div\left(\frac{3}{4}\div\frac{7}{8}\right)$

ILLUSTRATION : 1

Show that $\left(\frac{1}{5}\div\frac{3}{4}\right)\div\frac{1}{2}\neq\frac{1}{5}\div\left(\frac{3}{4}\div\frac{1}{2}\right)$

SOLUTION :

L.H.S. $\left(\frac{1}{5}\times\frac{4}{3}\right)\div\frac{1}{2}=\frac{4}{15}\div\frac{1}{2}$

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

R.H.S. $\frac{1}{5}\div\left(\frac{3}{4}\times 2\right)=\frac{1}{5}\div\frac{3}{2}$

$=\frac{1}{5}\times\frac{2}{3}=\frac{2}{15}$

So, L.H.S. $\neq$ R. H. S

THE ROLE OF 0

Additive Identity

For every rational number $\frac{a}{b}: \frac{a}{b}+0=0+\frac{a}{b}=\frac{a}{b}$, then 0 is called additive identity.

Example : $\frac{1}{7}+0=0+\frac{1}{7}=\frac{1}{7}$

Additive Inverse

For every rational number $\frac{a}{b}$, we have $\frac{a}{b}+\left(\frac{-a}{b}\right)=0$, then $\frac{a}{b}$ and $\frac{-a}{b}$ are the additive inverse of each other.

Zero Property of Multiplication

For every rational number $\frac{a}{b}$, we have $\frac{a}{b}\times 0=0\times\frac{a}{b}=0$

Example : $\frac{1}{9}\times 0=0$

Division By 0

Division by zero is not defined i.e., $a \div 0 =$ not defined

Example : $\frac{1}{3}\div 0=$ not defined

But for every rational number $\frac{a}{b}, 0\div\frac{a}{b}=0$

Example : $0\div\frac{3}{4}=0$

THE ROLE OF 1

Multiplicative Identity

For every rational number $\frac{a}{b}; \frac{a}{b}\times 1=1\times\frac{a}{b}=\frac{a}{b}$

1 is called the multiplicative identity.

Division By 1

For every rational number $\frac{a}{b}, \frac{a}{b}\div 1=\frac{a}{b}$

Example : $\frac{1}{2}\div 1=\frac{1}{2}$

NEGATIVE OF A NUMBER

For any rational number $\frac{a}{b}$, there is a rational number, $-\left(\frac{a}{b}\right)$ such that $\frac{a}{b}+\left(\frac{-a}{b}\right)=0$.

We say $-\left(\frac{a}{b}\right)$ is the negative of $\frac{a}{b}$ and $\frac{a}{b}$ is called the negative of $-\left(\frac{a}{b}\right)$.

Example : $\frac{5}{7}+\left(\frac{-5}{7}\right)=\frac{5+(-5)}{7}=\frac{0}{7}=0$

MULTIPLICATIVE INVERSE

For any rational number $\frac{a}{b}$, if $\frac{a}{b}\times\frac{b}{a}=1$, then $\frac{a}{b}$ and $\frac{b}{a}$ are the multiplicative inverse of each other and $\frac{b}{a}$ is called the reciprocal of $\frac{a}{b}$.

Therefore, the reciprocal of $\frac{-5}{8}$ is $\frac{8}{-5}$ or $\frac{-8}{5}$.

DISTRIBUTION OF MULTIPLICATION OVER ADDITION

For any three rational numbers, $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$; $\frac{a}{b}\times\left(\frac{c}{d}+\frac{e}{f}\right)=\left(\frac{a}{b}\times\frac{c}{d}\right)+\left(\frac{a}{b}\times\frac{e}{f}\right)$

ILLUSTRATION : 2

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

SOLUTION :

L.H.S. $\frac{2}{3}\left(\frac{5}{4}+\frac{7}{3}\right)=\frac{2}{3}\left(\frac{15+28}{12}\right)=\frac{2}{3}\left(\frac{43}{12}\right)=\frac{43}{18}$

R.H.S $\left(\frac{2}{3}\times\frac{5}{4}\right)+\left(\frac{2}{3}\times\frac{7}{3}\right)=\frac{5}{6}+\frac{14}{9}$

$=\frac{15+28}{18}=\frac{43}{18}$

So, L.H.S = R.H.S.

ILLUSTRATION : 3

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

SOLUTION :

$\frac{15}{66}-\frac{36}{36}+\frac{30}{65}=\frac{5}{22}-1+\frac{6}{13}=\frac{-89}{286}$

REPRESENTATION OF RATIONAL NUMBERS ON NUMBER LINE

Representation of Rational Numbers in the Form of $\frac{p}{q}$ on Number Line:

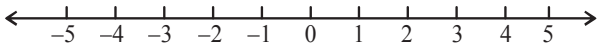
Like whole numbers, integers, rational numbers, in the form of $\frac{p}{q}$ where p and q are integers can be represented on number line.

ILLUSTRATION : 4

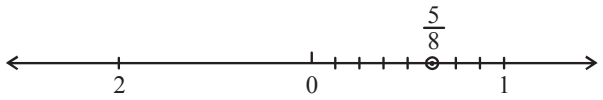
Represent $\frac{5}{8}, \frac{-3}{5}$ and $\frac{8}{3}$ on number line.

SOLUTION :

Draw a number line as shown below:



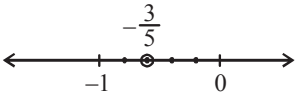
Now in $\frac{5}{8}$, Numerator (5) < Denominator (8) and number is positive. $\frac{5}{8}$ represent a number between 0 and 1. Mark 7(= 8 – 1) points at equal distance which divide the distances between 0 and 1 in 8 (denominator) equal parts, as shown below (Magnified).



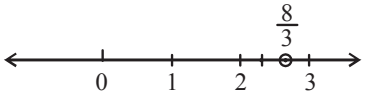
Out of these 7 points the 5th (numerator) point represent the rational number $\frac{5}{8}$.

In $\frac{-3}{5}$, which is a –ve rational number, absolute value of the numerator (3) < denominator (5). So it represent a number between 0 and –1.

To represent it on number line, mark 4 (= 5 – 1) points between 0 and –1 which divide the distance between 0 and 1 in 5 (denominator) equal parts. Out of these 4 points. 3rd (absolute value of the numerator) point from right between 0 and – 1 represents the rational number $-\frac{3}{5}$.



$\frac{8}{3}$ can be written as $2+\frac{2}{3}$. Clearly this number lies between 2 and 3 eg. on the number line. Mark 2 (= 3 – 1) points between 2 and 3, which divides the distance between 2 and 3 in 3 (denominator) equal parts. Of these two points, the 2nd point from left between 2 and 3 represent $8\left(=2+\frac{2}{3}\right)$



RATIONAL NUMBERS BETWEEN TWO RATIONAL NUMBERS

Between two rational numbers, there are infinitely many rational numbers.

Method – 1 : Let a and b be two rational numbers $q_1 = \frac{a+b}{2} \Rightarrow a < q_1 < b$

q_1 is the rational number between a and b.

$q_2 = \frac{a+q_1}{2} \Rightarrow a < q_2 < q_1 < b$

q_2 is the rational number between a and q_1.

$q_3 = \frac{q_1+b}{2} \Rightarrow a < q_2 < q_1 < q_3 < b$

q_3 is the rational number between q_1 and b.

In this manner, we can find infinite rational numbers between two given distinct rational numbers.

Method – 2 : $\frac{a}{b}$ and $\frac{c}{d}$ be two rational numbers.

Step – 1 : Make denominators equal in both rational numbers.

Step – 2 : If we have to find *n* rational numbers between $\frac{ad}{bd}$ and $\frac{cb}{bd}$, then multiply numerators and denominators by such a number so that the difference between the numerators is at least *n*.

ILLUSTRATION : 5

Insert 5 rational numbers between $\frac{1}{5}$ and $\frac{2}{5}$.

SOLUTION :

Since the denominator of $\frac{1}{5}$ and $\frac{2}{5}$ is same and we do not have five integers between 1 and 2, therefore change their denominators such that, there exist at least five integers between numerator part.

Thus,

$$\frac{1}{5} = \frac{1\times 7}{5\times 7} = \frac{7}{35}$$

$$\frac{2}{5} = \frac{2\times 7}{5\times 7} = \frac{14}{35}$$

Now we can write

$$\frac{7}{35} < \frac{8}{35} < \frac{9}{35} < \frac{10}{35} < \frac{11}{35} < \frac{12}{35} < \frac{14}{35}$$

$\therefore$ $\frac{8}{35}, \frac{9}{35}, \frac{10}{35}, \frac{11}{35}, \frac{12}{35}$ lie between $\frac{7}{35}$ and $\frac{14}{35}$.

MISCELLANEOUS SOLVED EXAMPLES

1. The sum of two rational numbers is $\frac{-3}{5}$. If one of the numbers is $\frac{-9}{20}$, find the other.

Sol. It is given that sum of the numbers $= \frac{-3}{5}$ and one of the numbers $= \frac{-9}{20}$

Suppose the other rational number is x. Since the sum is $\frac{-3}{5}$

$\therefore \quad x + \left(\frac{-9}{20}\right) = \frac{-3}{5} \Rightarrow x = \frac{-3}{5} - \left(\frac{-9}{20}\right) \Rightarrow x = \frac{-3}{5} + \frac{9}{20}$ $\qquad \left[-\left(\frac{-9}{20}\right) = \frac{9}{20}\right]$

$\Rightarrow \quad x = \frac{(-3)\times 4 + 9\times 1}{20} \Rightarrow x = \frac{(-3)\times 4 + 9\times 1}{20} = \frac{-12+9}{20} = \frac{-3}{20}$

2. Simplify : $\left(\frac{-7}{18} \times \frac{15}{-7}\right) - \left(1 \times \frac{1}{4}\right) + \left(\frac{1}{2} \times \frac{1}{4}\right)$

Sol. $\left(\frac{-7}{18}\times\frac{15}{-7}\right) - \left(1\times\frac{1}{4}\right) + \left(\frac{1}{2}\times\frac{1}{4}\right) = \left(\frac{-7}{18}\times\frac{15}{-7}\right) - \left(\frac{1}{1}\times\frac{1}{4}\right) + \left(\frac{1}{2}\times\frac{1}{4}\right)$

$= \frac{5}{6} - \frac{1}{4} + \frac{1}{8} = \frac{5}{6} + \frac{-1}{4} + \frac{1}{8} = \frac{5\times 4 + (-1)\times 6 + 1\times 3}{24} = \frac{20 + (-6) + 3}{24} = \frac{17}{24}$

3. Find 10 rational numbers between $\frac{-2}{11}$ and $\frac{9}{11}$.

Sol. The given rational numbers are $\frac{-2}{11}$ and $\frac{9}{11}$. Since the denominators of both the rational numbers are equal and positive. Finding 10 rational numbers between $\frac{-2}{11}$ and $\frac{9}{11}$ is similar to finding 10 integers between – 2 and 9. We know that

$-2 < -1 < 0 < 1 < 2 < 3 < 4 < 5 < 6 < 7 < 8 < 9$

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

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

Sol. Sum of the numbers = 3

One of the numbers $= \left(\frac{1}{2} + \frac{1}{3} - \frac{1}{5}\right) = \frac{15+10-6}{30} = \frac{19}{30}$

The other number = Sum – one number

$= 3 - \frac{19}{30} = \frac{90-19}{30} = \frac{71}{30}$

5. The speed of car is $54\frac{1}{2}$ km per hour. Find the distance travelled in $\frac{7}{2}$ hours and $\frac{35}{2}$ minutes.

Sol. We first calculate the time in hour.

$\frac{35}{2}$ minutes $= \frac{\cancel{35}^{7}}{2\times\cancel{60}_{12}} = \frac{7}{24}$ hour.

Therefore, total time (in hours) $= \frac{7}{2} + \frac{7}{24}$ hour $= \frac{84+7}{24} = \frac{91}{24}$ hours

Distance = Speed × time

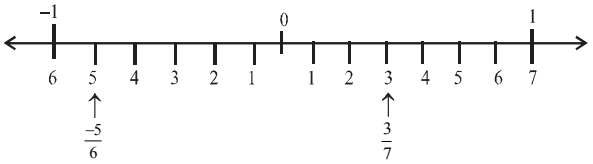
Since, Speed $= 54\frac{1}{2} = \frac{109}{2}$ km / hr

$\Rightarrow$ Distance $= \frac{109}{2} \times \frac{91}{24}$ km $= \frac{9919}{48}$ km

6. Represent the the following on the number line.

(i) $\frac{3}{7}$ **(ii)** $-\frac{5}{6}$

Sol. (i) Since $\frac{3}{7}$ can not be expressed as a mixed fraction, divide the unit part in equal parts, where 3rd part will represent $\frac{3}{7}$ as shown.



(ii) Since $\frac{-5}{6}$ can not be expressed as a mixed fraction therefore, divide the unit part into 6 equal parts, where 5th part on the left of origin will represent $\frac{-5}{6}$ as shown above.

7. A farmer has one piece of rectangular land measuring $\frac{50000}{13}$ m length and $\frac{30000}{11}$ m breadth. If he distributes his land among his 5 children, how much area will each child get?

Sol. Length of land $= \frac{50000}{13}$ m

Breadth of land $= \frac{30000}{11}$ m

Area of land $= \frac{50000}{13} \times \frac{30000}{11} = \frac{1500000000}{143}$ m^2

Area of one piece of land when it is distributed among 5 children $= \frac{1500000000}{143} \div 5$

$= \frac{1500000000}{143} \times \frac{1}{5} = \frac{300000000}{143}$ m^2

8. The perimeter of a square is $\frac{24}{10}$ cm. Find the side of the square.

Sol. The perimeter of the square $= \frac{24}{10}$ cm

But the perimeter of square = 4 × side

$4 \times \text{side} = \frac{24}{10}$ cm

Thus, side $= \frac{24}{10} \div 4 = \frac{24}{10} \times \frac{1}{4} = \frac{3}{5}$ cm

The side of the square is $\frac{3}{5}$ cm.

1 EXERCISE

Fill in the Blanks :

DIRECTIONS : *Complete the following statements with an appropriate word / term to be filled in the blank space(s).*

1. The product of two positive rational numbers is always ..... .
2. The product of two negative rational numbers is always..... .
3. $\frac{1}{2}\times\left(\frac{3}{4}+\frac{-5}{12}\right)=\frac{1}{2}\times.....+.....\times\frac{-5}{12}$
4. If a is reciprocal of b, then the reciprocal of b is .....
5. The number 0 is ..... the reciprocal of any number.
6. A rational number between $\frac{1}{5}$ and $\frac{2}{5}$ is .....
7. The denominator of a rational number cannot be .....
8. If $\frac{-2}{5}=\frac{13}{x}$, then x = ...
9. For any rational number a ($a\neq 0$), $a\div(-a)=$ .....
10. A rational number between $\frac{1}{2}$ and $\frac{-1}{3}$ is .....

True / False :

DIRECTIONS : *Read the following statements and write your answer as true or false.*

1. The rational number $\frac{11}{15}$ lies on the left of zero on the number line.
2. The rational numbers $\frac{1}{3}$ and $\frac{-5}{2}$ are on opposite sides of 0 on the number line.
3. Every whole number is a rational number.
4. If $\frac{x}{y}$ is a rational number, then y is always a whole number.
5. Every integer is a rational number.
6. All rational numbers can be represented on a number line.

Match the Columns :

DIRECTIONS : *Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in column-I have to be matched with statements (p, q, r, s) in column-II.*

1.

	Column-I		Column-II
(A)	Distributive law	(p)	If a & b are rational number, then a + b is rational
(B)	Commutative law	(q)	If a & b are rational numbers, then a + b = b + a
(C)	Associative law	(r)	If a, b & c are rational numbers, then a + (b + c) = (a + b) + c
(D)	Closure law	(s)	If a, b & c are ratioanl numbers, then a × (b + c) = ab + ac

2.

	Column-I		Column-II
A.	Distributive property of multiplication over addition is	(p)	rational numbers
B.	A rational number which lies between any two rational numbers a and b is	(q)	For any three rational numbers a, b, and c; we have a(b + c) = ab + ac
C.	All integers numbers are	(r)	irrational
D.	Square root of all positive prime numbers are	(s)	$\frac{a+b}{2}$

Very Short Answer Questions:

DIRECTIONS : *Give answer in one word or one sentence.*

1. Express $\frac{4}{-14}$ rational number with positive denominator.
2. Fill in blank : $\frac{-9}{14}+.....=-1$
3. Simplify : $\frac{-5}{9}\times\left(\frac{-10}{13}\right)\times\left(\frac{21}{11}\right)\times(-7)$
4. The cost of $7\frac{2}{3}$ metres of rope is ₹ $12\frac{3}{4}$, find its cost per metre.
5. Find three rational numbers between 0 and 0.2

6. (i) $\frac{1}{2}\times\left(\frac{3}{4}+\frac{-5}{12}\right)=\frac{1}{2}\times\ldots\ldots+\ldots\ldots\times\frac{-5}{12}$

(ii) $\frac{-4}{5}\times\left(\frac{5}{7}+\frac{-8}{9}\right)=\left(\frac{-4}{5}\times\ldots\ldots\right)+\frac{-4}{5}\times\frac{-8}{9}$

7. (i) $\frac{-7}{9}+\ldots\ldots=3$

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

8. Write the additive inverse of each of the following rational numbers :

(i) $\frac{4}{9}$ (ii) $\frac{-13}{7}$

(iii) $\frac{5}{-11}$ (iv) $\frac{-11}{-14}$

Short Answer Questions :

DIRECTIONS : *Give answer in 2-3 sentences.*

1. The product of two rational numbers is $\frac{63}{40}$. If one of the number is $\left(\frac{-7}{5}\right)$, find the other number.

2. Evaluate : $\frac{11}{14}+\frac{19}{10}+\frac{-9}{5}+0+\frac{-7}{4}$

3. If $\frac{3}{5}$ of a number exceeds its $\frac{2}{7}$ by 44, find the number.

4. Find a rational number between $\frac{-2}{3}$ and $\frac{1}{4}$.

5. Insert three rational numbers between $\frac{1}{3}$ and $\frac{1}{2}$.

6. Represent $3\frac{2}{7}$ on the number line.

7. Find : $\frac{-7}{4}+\frac{5}{3}+\frac{-5}{6}+\frac{1}{3}+\frac{-1}{2}$

8. Simplify:

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

9. Write any three rational numbers between -2 and 0.

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

(i) $\frac{-12}{5}$ and $\frac{43}{10}$ (ii) $\frac{101}{6}$ and $\frac{7}{8}$

11. Use the distributivity of multiplication of rational numbers over their addition to simplify :

(i) $\frac{3}{5}\times\left(\frac{35}{24}+\frac{10}{1}\right)$ (ii) $\frac{3}{4}\times\left(\frac{8}{9}-40\right)$

12. Simplify: $\frac{3}{8}+\frac{7}{2}+\frac{-3}{5}+\frac{9}{8}+\frac{-3}{2}+\frac{6}{5}$.

13. $\frac{1}{15}\div\left(\frac{4}{15}+\frac{1}{3}-\frac{3}{45}\right)$ is equal to

Long Answer Questions :

DIRECTIONS : *Give answer in four to five sentences.*

1. Simplify $\left[\frac{3}{11}\times\frac{5}{6}\right]-\left[\frac{9}{12}\times\frac{4}{3}\right]+\left[\frac{5}{13}\times\frac{6}{15}\right]$

2. Simplify $\left(\frac{1}{4}\times\frac{2}{7}\right)-\left(\frac{5}{14}\times\frac{-2}{3}\right)+\left(\frac{3}{7}\times\frac{9}{2}\right)$

3. Find four rational numbers between $\frac{2}{3}$ and $\frac{4}{5}$

4. For $x=\frac{1}{2}$ and $y=\frac{2}{3}$ verify that $-(x+y)=(-x)+(-y)$

5. If $x=\frac{1}{2}, y=\frac{4}{3}, z=\frac{-3}{5}$, then verify

$x\times(y-z)=(x\times y)-(x\times z)$

6. By what number should we multiply $\frac{3}{-14}$, so that the product may be $\frac{5}{12}$.

7. The value of $4-\cfrac{5}{1+\cfrac{1}{3+\cfrac{1}{2+\frac{1}{4}}}}$ is

8. Find ten rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

9. Verify the property : $x\times(y+z)=x\times y+x\times z$ by taking:

$x=\frac{-12}{5}, y=\frac{-15}{4}, z=\frac{8}{3}$

2 EXERCISE

Text-Book Exercise :

1. Find $\frac{3}{7}+\left(\frac{-6}{11}\right)+\left(\frac{-8}{21}\right)+\left(\frac{5}{22}\right)$

2. Find $\frac{-4}{5}\times\frac{3}{7}\times\frac{15}{16}\times\left(\frac{-14}{9}\right)$

3. Using appropriate properties, find.

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

(ii) $\frac{2}{5}\times\left(-\frac{3}{7}\right)-\frac{1}{6}\times\frac{3}{2}+\frac{1}{14}\times\frac{2}{5}$

4. Find the multiplicative inverse of the following.

(i) $\frac{-5}{8}\times\frac{-3}{7}$ (ii) -1

5. Multiply $\frac{6}{13}$ by the reciprocal of $\frac{-7}{16}$.

6. Is $\frac{8}{9}$ the multiplicative inverse of $-1\frac{1}{8}$? Why or why not?

7. Find any ten rational numbers between $\frac{-5}{6}$ and $\frac{5}{8}$.

8. Represent $\frac{-2}{11},\frac{-5}{11},\frac{-9}{11}$ on the number line.

9. Find five rational numbers between .

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

(iii) $\frac{1}{4}$ and $\frac{1}{2}$

10. Find ten rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.

Exemplar Questions :

1. Find $\frac{4}{7}\times\frac{14}{3}\div\frac{2}{3}$.

2. Using appropriate properties, find

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

3. Let O, P and Z represent the numbers 0, 3 and –5 respectively on the number line. choose a point T between Z and O so that ZT = TO. Which rational number does T represent?

4. A farmer has a field of area $49\frac{4}{5}$ ha . He wants to divide it equally among his one son and two daughters. Find the area of each one's share

(ha means hecta re ; 1 hectare = 10.000 m^2)

5. Let a, b, c, be the three rational numbers where $a=\frac{2}{3}, b=\frac{4}{5}$ and $c=-\frac{5}{6}$

(i) a + (b + c) = (a + b) + c (Associative property of addition)

(ii) a × (b × c) = (a × b) × c (Associatative property of multiplication)

6. Identify the rational number which is different from the other three : $\frac{2}{3},\frac{-4}{5},\frac{1}{2},\frac{1}{3}$. Explain your reasoning.

7. The product of two rational numbers is –7. If one of the number us –10, find the other.

8. Tell which property allows you to compute

$\frac{1}{5}\times\left[\frac{5}{6}\times\frac{7}{9}\right]$ as $\left[\frac{1}{5}\times\frac{5}{6}\right]\times\frac{7}{9}$

9. Verify the property x × (y × z) = (x × y) × z of rational numbers by using

$x=\frac{-2}{7}, y=\frac{-5}{6}$ and $z=\frac{1}{4}$

10. Use the distributivity of multiplication of rational numbers over addition to simplify

(i) $\frac{3}{5}\times\left[\frac{35}{24}+\frac{10}{1}\right]$ (ii) $\frac{-5}{4}\times\left[\frac{8}{5}+\frac{16}{15}\right]$

(iii) $\frac{2}{7}\times\left[\frac{7}{16}-\frac{21}{4}\right]$ (iv) $\frac{3}{4}\times\left[\frac{8}{9}-40\right]$

11. Simplify

(i) $\frac{32}{5}+\frac{23}{11}\times\frac{22}{15}$ (ii) $\frac{3}{7}\times\frac{28}{15}\div\frac{14}{5}$

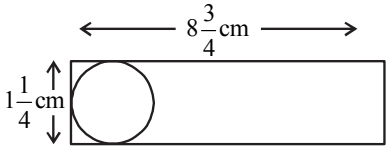
(iii) $\frac{3}{7}+\frac{-2}{21}\times\frac{-5}{6}$ (iv) $\frac{7}{8}+\frac{1}{16}-\frac{1}{12}$

12. A $117\frac{1}{3}$ m long rope is cut into equal pieces measuring $7\frac{1}{3}$ m each. How many such small pieces are these?

13. Riya, Reena and Seema received a total of Rs. 2,016 as monthly allowance from their mother such that Seema gets $\frac{1}{2}$ of what Riya get and Reena gets $1\frac{2}{3}$ times Seema's share. How much money do the three sisters get individually?

14. On a winter day the temperature at a place in Himachal Pradesh was – 16° C. Convert it in degree Fahrenheit (°F) by using the formula. $\frac{C}{5}=\frac{F-32}{9}$

15. Shalini has to cut out circles of diameter $1\frac{1}{4}$ cm from an aluminium strip of dimensions $8\frac{3}{4}$ cm by $1\frac{1}{4}$ cm. How many full circles can Shalini cut?



HOTS Questions :

1. Find the value of $\frac{(-2)}{3}\times\frac{3}{2}+\frac{5}{2}-\frac{3}{5}\times\frac{1}{6}$

2. The speed of car is $54\frac{1}{2}$ km per hour. What is the distance travelled in $\frac{7}{2}$ hours and $\frac{35}{2}$ minutes?

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

4. One fruit salad recipe requires $\frac{1}{2}$ cup of sugar. Another recipe for the same fruit salad requires 2 tablespoons of suger. If 1 tablespoon is equivalent to $\frac{1}{16}$ cup, how much more sugar does the first recipe require?

3 EXERCISE

Single Option Correct :

DIRECTIONS : *This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONLY ONE is correct.*

1. The standard form of $\frac{192}{-168}$ is

(a) $\frac{-2}{3}$ (b) $\frac{-8}{7}$

(c) $\frac{-1}{7}$ (d) $\frac{-6}{7}$

2. The number which is subtracted from $\frac{27}{13}$ to get $\frac{-3}{7}$ is

(a) $\frac{228}{91}$ (b) $\frac{1}{91}$

(c) $\frac{200}{91}$ (d) $\frac{198}{91}$

3. A rational number between $\frac{1}{4}$ and $\frac{1}{3}$ is

(a) $\frac{7}{24}$ (b) 0.29

(c) $\frac{13}{48}$ (d) All of these

4. Which of the following statements is TRUE?

(a) $\frac{5}{7}<\frac{7}{9}<\frac{9}{11}<\frac{11}{13}$ (b) $\frac{11}{13}<\frac{9}{11}<\frac{7}{9}<\frac{5}{7}$

(c) $\frac{5}{7}<\frac{11}{13}<\frac{7}{9}<\frac{9}{11}$ (d) $\frac{5}{7}<\frac{9}{11}<\frac{11}{13}<\frac{7}{9}$

5. If $\frac{3}{7}+x+\left(\frac{-8}{21}\right)+\frac{5}{22}=\frac{-125}{462}$, then x is

(a) $\frac{6}{11}$ (b) $\frac{-5}{11}$

(c) $\frac{-6}{11}$ (d) $\frac{5}{11}$

6. What number should be added to $\frac{7}{12}$ to get $\frac{4}{15}$?

(a) $-\frac{19}{60}$ (b) $-\frac{11}{30}$

(c) $\frac{51}{60}$ (d) $\frac{1}{20}$

7. Choose the rational number which does not lie between rational numbers $-\frac{2}{5}$ and $-\frac{1}{5}$:

(a) $-\frac{1}{4}$ (b) $-\frac{3}{10}$

(c) $\frac{3}{10}$ (d) $-\frac{7}{20}$

8. The product of two numbers is $-\frac{28}{27}$. If one of the numbers is $\left(-\frac{4}{9}\right)$, then the other number is ____.

(a) $\frac{5}{2}$ (b) $\frac{7}{3}$

(c) $\frac{1}{3}$ (d) $\frac{2}{7}$

9. The sum of the additive inverse and multiplicative inverse of 2 is:

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

(c) $\frac{1}{2}$ (d) $\frac{-1}{2}$

10. Which of the following is false?

(a) $\frac{-4}{-5}+0=\frac{4}{5}$

(b) $\frac{-5}{6}+\frac{-7}{12}=\frac{-7}{12}+\frac{-5}{6}$

(c) $\frac{8}{9}+\left(\frac{11}{3}+\frac{-2}{3}\right)=\left(\frac{8}{9}+\frac{11}{3}\right)+\frac{-2}{3}$

(d) $\frac{8}{9}-\frac{7}{11}=\frac{7}{11}-\frac{8}{9}$

11. Value of $13\frac{1}{2}-[4\frac{1}{2}-\{3-(2-\frac{1}{2})\}]$ will be –

(a) $9\frac{1}{2}$ (b) $10\frac{1}{2}$

(c) $8\frac{1}{2}$ (d) $11\frac{1}{2}$

More Than One Option Correct :

DIRECTIONS : *This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which ONE or MORE may be correct.*

1. Which of the following forms a pair of equivalent rational numbers?

(a) $\frac{14}{35}$ and $\frac{21}{45}$ (b) $\frac{-12}{26}$ and $\frac{-18}{39}$

(c) $\frac{-3}{7}$ and $\frac{-21}{56}$ (d) $\frac{-7}{28}$ and $\frac{-5}{20}$

2. The value of $\left(-\frac{5}{9}\div\frac{2}{3}\right)$ is

(a) $-\frac{5}{2}$ (b) $-\frac{5}{6}$

(c) $-\frac{10}{12}$ (d) $-\frac{6}{5}$

3. Which of the following rational numbers is in the standard form?

(a) $\frac{-12}{26}$ (b) $\frac{-49}{91}$

(c) $\frac{-9}{16}$ (d) $\frac{-4}{15}$

4. The product of two number is $-\frac{16}{35}$. If one of the numbers is $-\frac{15}{14}$, find the other.

(a) $\frac{-2}{5}$ (b) $\frac{-32}{-75}$

(c) $\frac{32}{75}$ (d) $-\frac{8}{3}$

5. $\left|\frac{2}{3}-\frac{3}{4}\right|$ is not equal to

(a) $\frac{-7}{12}$ (b) $-\frac{1}{12}$

(c) $\frac{1}{12}$ (d) $\frac{17}{12}$

6. The additive inverse of $\frac{-6}{-17}$ is not equal to

(a) $\frac{6}{17}$ (b) $\frac{-6}{17}$

(c) $\frac{-17}{-6}$ (d) $\frac{-17}{6}$

Passage Based Questions :

DIRECTIONS : *Study the given paragraph(s) and answer the following questions.*

PASSAGE - I

Properties of Addition of Rational Numbers

(i) **Commutative property:** The addition of rational numbers is commutative i.e., if $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers, then

$$\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$$

(ii) **Associative Proporties:** The addition of Rational numbers is associative i.e. if $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$ are any three rational numbers, then

$$\frac{a}{b}+\left(\frac{c}{d}+\frac{e}{f}\right)=\left(\frac{a}{b}+\frac{c}{d}\right)+\frac{e}{f}$$

1. Using above properties of addition of rational numbers, express the following as a rational numbers $\frac{3}{5}+\frac{-7}{6}+\frac{2}{5}$

(a) $\frac{-1}{6}$ (b) $\frac{1}{30}$

(c) $\frac{1}{6}$ (d) $\frac{-1}{30}$

2. Using above properties of addition of rational numbers, express the following as a rational number: $\frac{7}{3}+\frac{11}{2}+\frac{5}{3}$

(a) $\frac{-19}{6}$ (b) $\frac{19}{2}$

(c) $\frac{19}{6}$ (d) $\frac{-19}{3}$

3. Using above properties of addition of rational numbers, express the following as a rational number: $\frac{-5}{7}+3+\frac{2}{7}$

(a) $\frac{-18}{7}$ (b) $\frac{24}{7}$

(c) $\frac{-24}{7}$ (d) $\frac{18}{7}$

PASSAGE - II

If $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$ are any three rational numbers, then

$$\frac{a}{b}\times\left(\frac{c}{d}+\frac{e}{f}\right)=\frac{a}{b}\times\frac{c}{d}+\frac{a}{b}\times\frac{e}{f}$$

4. $\frac{2}{3}\times\frac{-7}{10}+\frac{-2}{3}\times\frac{8}{9}=\ ?\times\left[\frac{-7}{10}+?\right]$

(a) $\frac{2}{3},\frac{8}{9}$ (b) $\frac{-2}{3},\frac{-8}{9}$

(c) $\frac{2}{3},\frac{-8}{-9}$ (d) $\frac{+2}{3},\frac{-8}{9}$

5. Name the property used above.

(a) Commutativity of multiplication over addition

(b) Communtativity of addition over multiplication

(c) Distributivity of multiplication over addition

(d) Distributivity of addition over multiplication

6. $\frac{2}{5}\times\frac{-8}{9}+?\times\frac{5}{9}=\frac{2}{5}\times[?+?]$

(a) $\frac{2}{5},\frac{-8}{9},\frac{5}{9}$ (b) $\frac{2}{5},\frac{8}{9},\frac{-5}{9}$

(c) $\frac{-2}{5},\frac{-8}{9},\frac{-5}{9}$ (d) $\frac{-2}{5},\frac{-8}{9},\frac{5}{9}$

Assertion & Reason :

DIRECTIONS : *Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.*

(a) If both **Assertion** and **Reason** are **correct** and Reason is the **correct explanation** of Assertion.

(b) If both **Assertion** and **Reason** are correct, but Reason is **not the correct explanation** of Assertion.

(c) If **Assertion** is **correct** but **Reason** is **incorrect**.

(d) If **Assertion** is **incorrect** but **Reason** is **correct**.

1. **Assertion :** Zero is a rational number.

Reason : Each rational number is a quotient of any two integers, while its divisor should not be zero. Thus, a number of the form $\frac{p}{q}$ where p and q are integers and $q \neq 0$ is a rational number.

2. **Assertion :** If x, y, z be rational numbers such that $x > y$ and $y > z$, then $x > z$

   Reason : The sum of two rational numbers is always greater than third rational numbers.

3. **Assertion :** One of the rational between $\frac{1}{4}$ and $\frac{1}{3}$ is $\frac{7}{24}$

   Reason : If x and y are any two rational numbers such that $x < y$, then $\frac{1}{2}(x+y)$ is a rational number between x and y such that $x < \frac{1}{2}(x+y) < y$.

Multiple Matching Question :

DIRECTIONS : *Following question has four statements (A, B, C and D) given in Column-I and four statements (p, q, r, s) in Column-II. Any given statement in Column-I can have correct matching with one or more statement(s) given in Column-II.*

1. Match the following

Column-I	Column-II
(A) Associative law is satisfied by	(p) Addition of rational numnbers
(B) Commutative law is satisfied by	(q) Subtraction of rational numbers
(C) Closure law is satisfied by	(r) Multiplication of rational number
(D) Distributive law of multiplication is satisfied by	(s) Division of rational number

Integer Type Questions :

DIRECTIONS : *Answer the following questions. The answer to each of the question is a single digit integer, ranging from 0 to 9.*

1. Verify the distributive property $x \times (y+z) = xy + xz$ where $x = \frac{-4}{3}, y = \frac{1}{2}, z = \frac{-7}{5}$ and write the denominator of $(x+y) \times z$.
2. Find the sum of digits of numerator and denominator of reciprocal of rational number $\left(\frac{2}{5} + \frac{5}{4}\right)$.
3. $\frac{1}{2}$ can't be expressed as rational number having denominator 5 beacuse 5 is not the multiple of ———.
4. The product of two numbers is $\frac{45}{56}$. If one of them is 9/7, then denominator of other number is ———.
5. On simplifying $\left(\frac{-4}{3} \times \frac{12}{-5}\right) + \left(\frac{3}{7} \times \frac{21}{15}\right)$ we get $\frac{19}{k}$. Find the value of k.
6. The sum of two rational numbers is $\frac{-3}{5}$. If one of the number is $\frac{-9}{20}$, than the other, number is $\frac{-k}{20}$. Find the value of k.

SOLUTIONS

Brief Explanations of Selected Questions

1 EXERCISE

Fill in the Blanks :

1. Positive
2. Positive
3. $\frac{3}{4}, \frac{1}{2}$
4. a
5. not
6. $\frac{3}{10}$
7. Zero
8. $\frac{-65}{2}$
9. -1
10. $\frac{1}{12}$

True / False :

1. False : $\frac{11}{15}$ lies on the right of zero on the number line. (+ve) rational numbers lies right of zero on the number line.
2. True
3. True
4. False; If $\frac{x}{y}$ is a rational number, x and y must be integers.
5. True
6. True

Match the Columns :

1. (A) → (s); (B) → (q); (C) → (r); (D) → (p)
2. (A) → (q); (B) → (s); (C) → (p); (D) → (r)

Very Short Answer Questions :

1. $\frac{4}{-14} = \frac{4\times(-1)}{-14\times(-1)} = \frac{-4}{14}$
2. $\frac{-9}{14} + x = -1$

   $\Rightarrow \quad x = -1 + \frac{9}{14} = \frac{-14+9}{14} = \frac{-5}{14}$
3. We have

   $\frac{-5}{9}\times\left(\frac{-10}{13}\right)\times\left(\frac{21}{11}\right)\times(-7)$

   $= \frac{(-5)\times(-10)\times21\times(-7)}{9\times13\times11} = \frac{-7350}{1287}$
4. The cost of $\frac{23}{3}$ metres of rope $= ₹\ \frac{51}{4}$

   So, the cost of 1 metre $= \frac{51}{4}\div\frac{23}{3}$

   $= \frac{51}{4}\times\frac{3}{23} = \frac{153}{92} = ₹1\frac{61}{92}$
5. Rational numbers between 0 and 0.2

   $\Rightarrow$ 0.1, 0.12, 0.13

   $\Rightarrow \quad \frac{1}{10}, \frac{12}{10}$ and $\frac{13}{10}$
6. (i) $\frac{1}{2}\times\frac{3}{4} + \frac{1}{2}\times\frac{-5}{12}$ (ii) $\frac{5}{7}$
7. (i) $\frac{34}{9}$ (ii) $\frac{77}{23}$
8. (i) $-\frac{4}{9}$ (ii) $\frac{13}{7}$

   (iii) $\frac{5}{11}$ (iv) $\frac{-11}{4}$

Short Answer Questions :

1. Let the other number be x.

   Now, $x\times\left(\frac{-7}{5}\right) = \frac{63}{40}$

   $\Rightarrow \quad \frac{-7x}{5} = \frac{63}{40} \Rightarrow -7x\times40 = 63\times5$

   $\Rightarrow \quad -x = \frac{63\times5}{7\times40} \Rightarrow -x = \frac{9}{8}$

   $\Rightarrow \quad x = -\frac{9}{8}$

   The other number $= \frac{-9}{8}$
2. $\frac{11}{14} + \frac{19}{10} - \frac{9}{5} + \left(\frac{-7}{4}\right) - \left[\frac{11}{14} + \frac{19}{10}\right] + \left[\frac{-9}{5} - \frac{7}{4}\right]$

   $= \left(\frac{55+133}{70}\right) + \left[\frac{-36-35}{20}\right] = \frac{188}{70} + \left(\frac{-71}{20}\right)$

   $= \frac{376+(-497)}{140} = \frac{-121}{140}$

3. Let the number be x.

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

$\Rightarrow \quad \frac{21x-10x}{35}=44 \Rightarrow \frac{11x}{35}=44$

$\Rightarrow \quad x=\frac{35\times 44}{11}=140$

The number is 140.

4. The rational number $\left(\frac{-2}{3}+\frac{1}{4}\right)\div 2$ lies between

$\frac{-2}{3}$ and $\frac{1}{4}$

$\Rightarrow \quad \left(\frac{-2}{3}+\frac{1}{4}\right)=\frac{(-2)\times 4+3\times 1}{12}=\frac{-8+3}{12}=\frac{-5}{12}$

$\Rightarrow \quad \left(\frac{-2}{3}+\frac{1}{4}\right)\div 2=\frac{-5}{12}\div 2=\frac{-5}{12}\times\frac{1}{2}=\frac{-5}{24}$

Thus, the required rational number is $\frac{-5}{24}$

i.e., $\frac{-2}{3}<\frac{-5}{24}<\frac{1}{4}$

5. A rational number between $\frac{1}{3}$ and $\frac{1}{2}$ is $\frac{1}{2}\left(\frac{1}{3}+\frac{1}{2}\right)=\frac{5}{12}$

We have, $\frac{1}{3}<\frac{5}{12}<\frac{1}{2}$

A rational number between $\frac{1}{3}$ and $\frac{5}{12}$ is $\frac{1}{2}\left(\frac{1}{3}+\frac{5}{12}\right)=\frac{3}{8}$

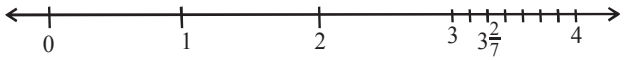
A rational number between $\frac{5}{12}$ and $\frac{1}{2}$ is $\frac{1}{2}\left(\frac{5}{12}+\frac{1}{2}\right)=\frac{11}{24}$

Clearly, we have $\frac{1}{3}<\frac{3}{8}<\frac{5}{12}<\frac{11}{24}<\frac{1}{2}$

Hence, three rational numbers between $\frac{1}{3}$ and $\frac{1}{2}$ are $\frac{3}{8},\frac{5}{12}$ and $\frac{11}{24}$.

6. In order to represent $3\frac{2}{7}$ on the number line, take 3 unit lengths between 0 and 3 and divide the unit length between 3 and 4 into seven equal parts and take the end of 2nd part on it.

This point represents the rational number $3\frac{2}{7}$.



7. LCM of 4, 3, 6, 3 and 2 is 12

2	4, 3, 6, 2
2	2, 3, 3, 1
3	1, 3, 3, 1
	1, 1, 1, 1

$\therefore$ LCM of 4, 3, 6, 3, 2 is $2\times 2\times 3=12$

$\therefore \quad \frac{-7}{4}+\frac{5}{3}+\frac{-5}{6}+\frac{1}{3}+\frac{-1}{2}$

$=\frac{((-7)\times 3)+(5\times 4)+((-5)\times 2)+(1\times 4)+((-1)\times 6)}{12}$

$=\frac{(-21)+20+(-10)+4+(-6)}{12}$

$=\frac{(-37)+24}{12}=\frac{-13}{12}$

8. $\frac{-102}{15}$

9. We can write

$-2=\frac{-2}{1}=\frac{-2\times 5}{1\times 5}=\frac{-10}{5}$ and $0=\frac{0}{5}$

integers between –10 and 0 are –9, –8, –7, –6, –5,....., –1.

$\therefore \quad \frac{-9}{5},\frac{-8}{5},\frac{-7}{5},.....,\frac{-2}{5},\frac{-1}{5}$ are rational numbers between –2 and 0.

We can choose any three of these rational numbers.

10. (i) $1\frac{9}{10}$ (ii) $17\frac{17}{24}$

11. (i) $\frac{55}{8}$ (ii) $\frac{-88}{3}$

12. $\frac{3}{8}+\frac{7}{2}+\frac{(-3)}{5}+\frac{9}{8}+\frac{(-3)}{2}+\frac{6}{5}$

$\frac{15+140-24+45-60+48}{40}$

$\frac{248-84}{40}=\frac{164}{40}=\frac{41}{10}$

13. $\frac{1}{15}\div\left(\frac{4}{15}+\frac{1}{3}-\frac{3}{45}\right)$

$=\frac{1}{15}\div\left(\frac{12+15-3}{45}\right)$

$=\frac{1}{15}\div\left(\frac{24}{45}\right)$

$=\frac{1}{15}\times\frac{45}{24}$

$=\frac{1}{8}$

Long Answer Questions :

1. $\left(\frac{3}{11}\times\frac{5}{6}\right)-\left(\frac{3}{4}\times\frac{4}{3}\right)+\left(\frac{5}{13}\times\frac{2}{5}\right)$

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

$=\frac{5}{22}-1+\frac{2}{13}$

$=\frac{65-286+44}{286}\left(\text{L.C.M. of }(13,22)=286\right)$

$=\frac{109-286}{286}=\frac{-177}{286}$

2. $\left(\frac{1}{4}\times\frac{2}{7}\right)-\left(\frac{5}{14}\times\frac{-2}{3}\right)+\left(\frac{3}{7}\times\frac{9}{2}\right)$

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

$=\frac{1}{14}-\left(\frac{-5}{21}\right)+\left(\frac{27}{14}\right)=\frac{1}{14}+\frac{5}{21}+\frac{27}{14}$

$=\frac{3+10+81}{42}\left(\text{L.C.M of }(14,21,14)=42\right)$

$=\frac{13+81}{42}=\frac{94}{42}=\frac{47}{21}$

3. First we covert given rational numbers to rational numbers with the same denominator equal to the LCM of their denominators. The LCM of denominators 3 and 5 is 15.

$\therefore\quad \frac{2}{3}=\frac{2\times5}{3\times5}=\frac{10}{15}$ and $\frac{4}{5}=\frac{4\times3}{5\times3}=\frac{12}{15}$

Between the numerators 10 and 12 of these equivalent rational numbers there is only one integer. So, we replace these numbers by equivalent rational numbers having a sufficiently large common denominator.

$\frac{2}{3}=\frac{10}{15}=\frac{40}{60}$ and $\frac{4}{5}=\frac{12}{15}=\frac{48}{60}$

Between 40 and 48 there are seven integers 41, 42, 43, ...47.

Therefore, $\frac{41}{60},\frac{42}{60},\ldots\ldots,\frac{47}{60}$ are seven rational numbers between

$\frac{40}{60}\left(=\frac{2}{3}\right)$ and $\frac{48}{60}\left(=\frac{4}{5}\right)$ We can take any four of these rational numbers.

4. For $x=\frac{1}{2}$ and $y=\frac{2}{3}$

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

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

$=(-x)+(-y)=\left(\frac{-1}{2}\right)+\left(\frac{-2}{3}\right)=\frac{-3-4}{6}=\frac{-7}{6}$

So, $-(x+y)=(-x)+(-y)$

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

$=\frac{1}{2}\times\left[\frac{4}{3}-\left(\frac{-3}{5}\right)\right]=\frac{1}{2}\times\left[\frac{4}{3}+\frac{3}{5}\right]$

$=\frac{1}{2}\times\left[\frac{20+9}{15}\right]=\frac{1}{2}\times\frac{29}{15}=\frac{29}{30}$

R.H.S. $=(x\times y)=\left(\frac{1}{2}\times\frac{4}{3}\right)=\frac{4}{6}=\frac{2}{3}$

$(x\times z)=\left[\frac{1}{2}\times\left(\frac{-3}{5}\right)\right]=\frac{-3}{10}$

$(x\times y)-(x\times z)=\frac{2}{3}-\left(\frac{-3}{10}\right)=\frac{2}{3}+\frac{3}{10}$

$=\frac{20+9}{30}=\frac{29}{30}$

$\therefore$ L.H.S. = R.H.S.

6. We have,

Product of two numbers $=\frac{5}{12}$, One number $=\frac{3}{-14}$

$\therefore$ The other number $x=\frac{5}{12}\div\frac{3}{-14}$

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

$=\frac{5\times(-14)}{12\times3}=\frac{-(5\times14)}{12\times3}=\frac{-(5\times7)}{6\times3}=\frac{-35}{18}$

7. $4-\frac{5}{1+\frac{1}{3+\frac{1}{2+\frac{1}{4}}}}=4-\frac{5}{1+\frac{1}{\frac{31}{9}}}=4-\frac{155}{40}=\frac{1}{8}$

8. $\frac{-7}{20},\frac{-6}{20},\frac{-5}{20},\ldots\ldots,\frac{9}{20}$

9. $x\times(y+z)=x\times y+x\times z$

When $x=\frac{-12}{5}$, $y=\frac{-15}{4}$, $z=\frac{8}{3}$

$\frac{-12}{5}\times\left[\frac{-15}{4}+\frac{8}{3}\right]=\left(\frac{-12}{5}\right)\times\left(\frac{-15}{4}\right)+\left(\frac{-12}{5}\right)\times\left(\frac{8}{3}\right)$

$\frac{-12}{5}\times\left[\frac{-13}{12}\right]=\left(\frac{180}{20}\right)+\left(\frac{-96}{15}\right)$

$\frac{13}{5}=9-\frac{32}{5}$

$\frac{13}{15}=\frac{45-32}{5}$

$\frac{13}{5}=\frac{13}{5}$

2 EXERCISE

Text-Book Exercise :

1. $\frac{3}{7}+\left(\frac{-6}{11}\right)+\left(\frac{-8}{21}\right)+\frac{5}{22}$

$=\left[\frac{3}{7}+\left(\frac{-8}{21}\right)\right]+\left[\frac{-6}{11}+\frac{5}{22}\right]$

(by using commutativity and associativity)

$=\left[\frac{9+(-8)}{21}\right]+\left[\frac{-12+5}{22}\right]$

(LCM of 7 and 21 is 21; LCM of 11 and 22 is 22)

$=\frac{1}{21}+\left(\frac{-7}{22}\right)=\frac{22-147}{462}=\frac{-125}{462}$

2. $\frac{-4}{5}\times\frac{3}{7}\times\frac{15}{16}\times\left(\frac{-14}{9}\right)$

$=\left(\frac{-4}{5}\times\frac{15}{16}\right)\times\left[\frac{3}{7}\times\left(\frac{-14}{9}\right)\right]$

(Using commutativity and associativity)

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

3. (i) 2 (ii) $\frac{-11}{28}$

4. (i) $\frac{56}{15}$ (ii) -1

5. $\frac{-96}{91}$

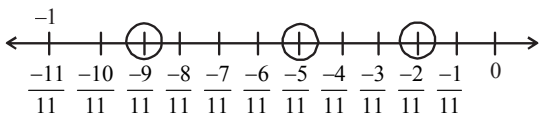
6. No, because the product is not 1.

7. We first convert $\frac{-5}{6}$ and $\frac{5}{8}$ to rational numbers with the same denominators.

$\frac{-5\times4}{6\times4}=\frac{-20}{24}$ and $\frac{5\times3}{8\times3}=\frac{15}{24}$

Thus we have $\frac{-19}{24},\frac{-18}{24},\frac{-17}{24},\ldots\ldots\frac{14}{24}$ as the rational numbers between $\frac{-20}{24}$ and $\frac{15}{24}$. You can take any ten of these.

8.



9. (i) $\frac{41}{60},\frac{42}{60},\frac{43}{60},\frac{44}{60},\frac{45}{60}$ (ii) $\frac{-8}{9},\frac{-7}{6},0,\frac{1}{6},\frac{2}{6}$

(iii) $\frac{9}{32},\frac{10}{32},\frac{11}{32},\frac{12}{32},\frac{13}{32}$

(There can be many more such rational numbers)

10. $\frac{97}{160},\frac{98}{160},\frac{99}{160},\frac{100}{160},\frac{101}{160},\frac{102}{160},\frac{103}{160},\frac{104}{160},\frac{105}{160},\frac{106}{160}$

(There can be many more such rational numbers)

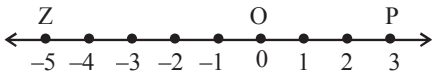
Exemplar Questions :

1. $\frac{4}{7}\times\frac{14}{3}\div\frac{2}{3}=\frac{4}{7}\times\left(\frac{14}{3}\times\frac{3}{2}\right)=\frac{4}{7}\times7=4$

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

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

3.



So, T is the mid-point of OZ, i.e.

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

4. $49\frac{4}{5}\text{ ha}=\frac{249}{5}\text{ ha}$

Each share $=\frac{1}{3}\times\frac{249}{5}\text{ ha}=\frac{83}{5}\text{ ha}=16\frac{3}{5}\text{ ha}$

5. (i) L.H.S $=a+(b+c)$

$=\frac{2}{3}+\left[\frac{4}{5}+\left(\frac{-5}{6}\right)\right]=\frac{2}{3}+\left[\frac{24-25}{30}\right]$

$=\frac{2}{3}+\left(\frac{-1}{30}\right)=\frac{20-1}{30}=\frac{19}{30}$

R.H.S. of (i) $=(a+b)+c$

$=\left(\frac{2}{3}+\frac{4}{5}\right)+\left(\frac{-5}{6}\right)=\left(\frac{10+12}{15}\right)+\left(\frac{-5}{6}\right)$

$=\frac{22}{15}-\frac{5}{6}=\frac{44-25}{30}=\frac{19}{30}$

So, $\frac{2}{3}+\left[\frac{4}{5}+\left(\frac{-5}{2}\right)\right]=\left(\frac{2}{4}+\frac{4}{5}\right)+\left(\frac{-5}{6}\right)$

Hence verified.

(ii) L.H.S = $a \times (b \times c)$

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

$$= \frac{2}{3} - \left(\frac{-20}{30}\right) = \frac{2}{3} \times \left(\frac{-2}{3}\right)$$

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

$= (a \times b) \times c$

R.H.S. $= (a \times b) \times c$

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

$$= \frac{8}{15} \times \left(\frac{-5}{6}\right) = \frac{8 \times (-5)}{15 \times 6} = \frac{-40}{90} = \frac{-4}{9}$$

So, $\frac{2}{3} \times \left[\frac{4}{5} \times \left(\frac{-5}{6}\right)\right] = \left[\frac{2}{3} \times \frac{4}{5}\right] \times \left(\frac{-5}{6}\right)$

6. $\frac{-4}{5}$ lies on the left side of zero while others lie on the right side of zero on the number line.

7. Let the other rational number be x

$-10 \times x = -7$

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

Check

$-10 \times \frac{7}{10} = -7$. Hence, the result is correct.

8. Associative property

9. $x \times (y \times z) = (x \times y) \times z$

$x = -\frac{2}{7}, y = -\frac{5}{6}, z = \frac{1}{4}$

$$-\frac{2}{7}\left[\left(\frac{-5}{6}\right) \times \left(\frac{1}{4}\right)\right] = \left[\left(\frac{2}{7}\right) \times \left(\frac{-5}{6}\right)\right] \times \frac{1}{4}$$

$$-\frac{2}{7}\left(\frac{-5}{24}\right) = \left(\frac{10}{42}\right) \times \frac{1}{4}$$

$\frac{10}{168} = \frac{10}{168}$ (Hence verified).

10. (i) $6\frac{7}{8}$ (ii) $3\frac{1}{3}$

(iii) $\frac{11}{8}$ or $1\frac{3}{8}$ (iv) $\frac{88}{3}$ or $29\frac{1}{3}$

11. (i) $\frac{142}{15}$ or $9\frac{7}{15}$ (ii) $\frac{2}{7}$

(iii) $\frac{32}{63}$ (iv) $\frac{41}{48}$

12. 16 pieces.

13. ₹ 864, ₹ 720, ₹ 432

14. 3.2 ° F

15. 7

HOTS Questions :

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

$$= -\frac{1}{1} + \frac{5}{2} - \frac{3}{30} = \frac{-30 + 5 \times 15 - 3}{30}$$

$$= \frac{-30 + 75 - 3}{30} = \frac{42}{30} = \frac{7}{5}$$

2. Speed $= \frac{\text{distance}}{\text{time}}$

1 min. $= \frac{1}{60}$ hrs.

$\frac{35}{2}$ min s. $= \frac{35}{2} \times \frac{1}{60}$ hrs $= \frac{35}{120}$ hrs.

$\therefore$ Total time taken $= \left(\frac{7}{2} + \frac{35}{120}\right)$ hrs.

$= \left(\frac{7 \times 60 + 35}{120}\right)$ hrs.

$= \frac{455}{120}$ hrs $= \frac{131}{24}$ hrs.

Speed $= \frac{109}{2}$ km / hr

Distance $= \frac{109}{2} \times \frac{131}{24}$ km $= \frac{14279}{48}$

3. ₹ 32,000, ₹ 12,000, ₹ 16,000

4. $\frac{3}{8}$ cup

3 EXERCISE

Single Option Correct :

1. **(b)** $\frac{192}{-168}=\frac{-192}{168}=\frac{-192\div 4}{168\div 4}$

$=\frac{-48}{42}=\frac{-48\div 6}{42\div 6}=\frac{-8}{7}$

2. **(a)** We have $\frac{27}{13}-x=\frac{-3}{7}$

$x=\frac{27}{13}+\frac{3}{7}\Rightarrow x=\frac{189+39}{91}\Rightarrow x=\frac{228}{91}$.

3. **(d)** $\frac{1}{4}=0.25,\frac{1}{3}=0.33.....$

(a) $\frac{\frac{1}{4}+\frac{1}{3}}{2}=\frac{7}{12\times 2}=\frac{7}{24}$

$\frac{1}{4}<\frac{7}{24}<\frac{1}{3}$,

(b) $0.25<0.29<0.33$ .....

(c) $\frac{\frac{1}{4}+\frac{7}{24}}{2}=\frac{6+7}{24\times 2}=\frac{13}{48}$

$\therefore$ all are correct.

4. **(a)** L.C.M. of $13, 11, 9, 7 = 117\times 77 = 9009$

$\frac{11}{13}\times\frac{693}{693}=\frac{7623}{9009},\frac{9}{11}\times\frac{819}{819}=\frac{7371}{9009}$

$\frac{7}{9}\times\frac{1001}{1001}=\frac{7007}{9009},\frac{5}{7}\times\frac{1287}{1287}=\frac{6435}{9009}$

$\frac{6435}{9009}<\frac{7007}{9009}<\frac{7371}{9009}<\frac{7623}{9009}$ or $\frac{5}{7}<\frac{7}{9}<\frac{9}{11}<\frac{11}{13}$.

5. **(c)** $\frac{3}{7}+x+\left(\frac{-8}{21}\right)+\left(\frac{5}{22}\right)=-\frac{125}{462}$

$\Rightarrow \frac{9+21x-8}{21}=\frac{-125}{462}-\frac{5}{22}$

$\Rightarrow \frac{21x+1}{21}=\frac{-(125+105)}{462}$

$\Rightarrow \frac{21x+1}{21}=\frac{-(230)}{462}\Rightarrow\frac{21x+1}{21}=\frac{-(230)}{462}$

$\Rightarrow 21x+1=\frac{-230}{22}\Rightarrow 21x=\frac{-230}{22}-1$

$\Rightarrow 21x=\frac{-252}{22}$

$\Rightarrow x=\frac{-252}{22\times 21}=\frac{-6}{11}$

6. **(a)** Let the number to be added be x

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

$x=\frac{4}{15}-\frac{7}{12}=\frac{16-35}{60}=\frac{-19}{60}$

7. **(c)** $\frac{3}{10}>-\frac{2}{5}$ and $\frac{3}{10}>-\frac{1}{5}$

8. **(b)** Let us consider first rational number be x.

Now, from the equation, $\left(-\frac{4}{9}\right)\times x=\frac{-28}{27}$

$x=\left(-\frac{28}{27}\right)\div\left(-\frac{4}{9}\right)=\left(-\frac{28}{27}\right)\times\left(\frac{-9}{4}\right)=\frac{7}{3}$

9. **(b)** $-2+\frac{1}{2}=\frac{-3}{2}$

10. **(d)** $\frac{8}{9}-\frac{7}{11}=\frac{88-63}{99}=\frac{25}{99}$

$\frac{7}{11}-\frac{8}{9}=\frac{63-88}{99}=\frac{-25}{99}$

$\therefore \frac{8}{9}-\frac{7}{11}\neq\frac{7}{11}-\frac{8}{9}$

11. **(b)** $13\frac{1}{2}-\left[4\frac{1}{2}-\left\{3-\left(2-\frac{1}{2}\right)\right\}\right]$

$=\frac{27}{2}-\left[\frac{9}{2}-\left\{3-\left(\frac{4-1}{2}\right)\right\}\right]$

$=\frac{27}{2}-\left[\frac{9}{2}-\left\{3-\frac{3}{2}\right\}\right]$

$=\frac{27}{2}-\left[\frac{9}{2}-\left(\frac{6-3}{2}\right)\right]$

$=\frac{27}{2}-\left[\frac{9}{2}-\frac{3}{2}\right]=\frac{27}{2}-\left[\frac{6}{2}\right]$

$=\frac{21}{2}=10\frac{1}{2}$

More Than One Option Correct :

1. **(b,d)** Because $\frac{-12}{26}=\frac{-6}{13}$ is its simplest form

$\frac{-6}{13}=\frac{-12}{26}=\frac{-18}{39}$ and $\frac{-7}{28}=\frac{-5}{20}$

Because $\frac{-1}{4}$ is simplest form of $\frac{-7}{28}$ & $\frac{-5}{20}$

2. **(b,c)** $\left(\frac{-5}{9}\div\frac{2}{3}\right)=\frac{-5}{9}\times\frac{3}{2}=\frac{-5}{6}=-\frac{10}{12}$

3. **(c,d)**

4. **(b, d)** Let the other number be x

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

$x=\frac{-16}{35}\div\left(\frac{-15}{14}\right)\Rightarrow x=\frac{-16}{35}\times\frac{-14}{15}$

$x=\frac{-16}{5}\times\frac{-2}{15}=\frac{32}{75}$

5. **(a, b and d)**

6. **(a, c and d)**

Passage Based Questions :

1. **(a)** $\frac{3}{5}+\frac{-7}{6}+\frac{2}{5}=\frac{3}{5}+\frac{2}{5}+\frac{-7}{6}$ [Commutative Property]

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

[Associative Property]

$=1+\frac{-7}{6}=\frac{6+(-7)}{6}=\frac{-1}{6}$

2. **(b)** $\frac{7}{3}+\frac{11}{2}+\frac{5}{3}=\frac{7}{3}+\frac{5}{3}+\frac{11}{2}$

[Commutative Properties]

$=\left(\frac{7}{3}+\frac{5}{3}\right)+\frac{11}{2}$ [Associative Property]

$=\left(\frac{7+5}{3}\right)+\frac{11}{2}=4+\frac{11}{2}=\frac{8+11}{2}=\frac{19}{2}$

3. **(d)** $\frac{-5}{7}+3+\frac{2}{7}=\frac{-5}{7}+\frac{2}{7}+3$ [Commutative property]

$=\left(\frac{-5}{7}+\frac{2}{7}\right)+3$ [Associative Property]

$=\frac{-5+2}{7}+3=\frac{-3}{7}+3=\frac{-3+21}{7}=\frac{18}{7}$

4. **(b)** $\frac{2}{3}\times\frac{-7}{10}+\frac{-2}{3}\times\frac{8}{9}=\frac{2}{3}\times\left[\frac{-7}{10}+\left(\frac{-8}{9}\right)\right]$

5. **(c)** Distributivity of Multiplication over Addition.

6. **(a)** $\frac{2}{5}\times\frac{-8}{9}+\frac{2}{5}\times\frac{5}{9}=\frac{2}{5}\times\left(\frac{-8}{9}+\frac{5}{9}\right)$

Assertion & Reason :

1. **(a)** **Assertion :** True, **Reason :** True.

2. **(d)** **Assertion :** True, **Reason :** Fasle.

3. **(a)** **Assertion :** True, **Reason :** True.

$4>5\Rightarrow\frac{1}{4}<\frac{1}{5}\Rightarrow\frac{1}{4}<\frac{9}{40}<\frac{1}{5}$

Multiple Matching Questions :

1. (A) $\rightarrow$ (p, r); (B) $\rightarrow$ (p, r); (C) $\rightarrow$ (p, q, r, s); (D) $\rightarrow$ (p, r)

Integer Type Questions :

1. **(6)** $x\times(y+z)=xy+xz$

L.H.S. $x\times(y+z)=\frac{-4}{3}\times\left(\frac{1}{2}+\left(\frac{-7}{5}\right)\right)$

$=\frac{-4}{3}\times\left(\frac{1}{2}-\frac{7}{5}\right)=\frac{-4}{3}\left(\frac{5-14}{10}\right)$

$=\frac{-4}{3}\times\frac{-9}{10}=\frac{6}{5}$

R.H.S. $xy+xz=\frac{-4}{3}\times\frac{1}{2}+\frac{-4}{3}\times\left(\frac{-7}{5}\right)$

$=\frac{-2}{3}+\frac{2}{15}=\frac{-10+28}{15}=\frac{18}{15}=\frac{6}{5}$

Denominator of $(x+y)\times z=\left(\frac{-4}{3}+\frac{1}{2}\right)\times\left(\frac{-7}{5}\right)$

$=\left(\frac{-8+3}{6}\right)\times\left(\frac{-7}{5}\right)=\frac{-5}{6}\times\frac{-7}{5}=\frac{7}{6}$

$\therefore$ unit digit = 6

2. **(8)** $\left(\frac{2}{5}+\frac{5}{4}\right)=\frac{8+25}{20}=\frac{33}{20}$

Reciprocal of $\frac{33}{20}=\frac{20}{33}$

Sum of digits of numerator and denominator of $\frac{20}{33}$

$=2+0+3+3=8$

3. **(2)** Because 5 is not the multiple of 2.

4. **(5)** Product of two numbers $=\frac{45}{56}$

One of them $=\frac{9}{7}$

Let other be x, $\frac{45}{56}\times x=\frac{9}{7}$

$x=\frac{9}{7}\div\frac{45}{56}=\frac{9}{7}\times\frac{56}{45}$

Other number = 8/5. Denominator = 5.

5. **(5)** $\left(\frac{-4}{3}\times\frac{12}{-5}\right)+\left(\frac{3}{7}\times\frac{21}{15}\right)=\frac{16}{5}+\frac{3}{5}$

$=\frac{19}{5}$

So, k = 5

6. **(3)** It is given that,

Sum of the numbers $=\frac{-3}{5}$ and, One of the numbers $\frac{-9}{20}$

Suppose the other rational number is x. Since the sum is $\frac{-3}{5}$

$\therefore \quad x+\left(\frac{-9}{20}\right)=\frac{-3}{5}$

$\Rightarrow \quad x=\frac{-3}{5}-\left(\frac{-9}{20}\right)$

$\Rightarrow \quad x=\frac{-3}{5}+\frac{9}{20} \qquad \left[\because -\left(\frac{-9}{20}\right)=\frac{9}{20}\right]$

$\Rightarrow \quad x=\frac{(-3)\times 4+9\times 1}{20}$

$\Rightarrow \quad x=\frac{(-3)\times 4+9\times 1}{20}=\frac{-12+9}{20}=\frac{-3}{20}$

k = 3