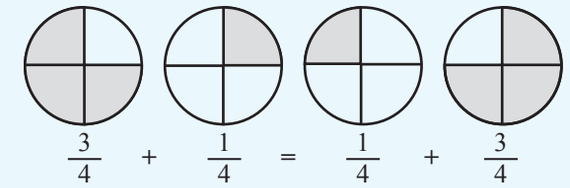
Chapter

1

Rational Numbers

Learning Objectives

- **Rational Numbers**
  - ***Defination***
- **Properties of Rational Numbers**
  - ***Closure Property***
  - ***Commutative Property***
  - ***Associative Property***
  - ***Identity element***
  - ***Inverse element***
- **Distribution of multiplication over addition.**



(Commutative Property)

$\frac{a}{b}$

Additive Identity (0)

Additive Inverse $\frac{-a}{b}$

Exam Mirror

- Distribution of multiplication over addition.

Critical Concepts

- Properties of rational numbers.
- Distribution of multiplication over addition.

INTRODUCTION

Here are a few important definitions:

Natural Numbers: The counting numbers 1, 2, 3 ... are called natural numbers. It is denoted by N.

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.

When we divide two natural numbers we get natural number or a fractional number which are rational numbers.

In the chapter Rational Numbers, we will learn about rational numbers, their properties.

RATIONAL NUMBERS

A number which is in the form of $\frac{m}{n}$ where n ≠ 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. 3 is rational number because $3 = \frac{3}{1}$.

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

Hence, all integers and decimal numbers are also rational numbers.

DID YOU KNOW?

Operation of Rational Numbers.

(i) $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$

(ii) $\frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$

(iii) $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

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

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 : $\frac{5}{3} + \frac{1}{6} = \frac{11}{6}$ which is rational number.

(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 number.

(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 number.

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

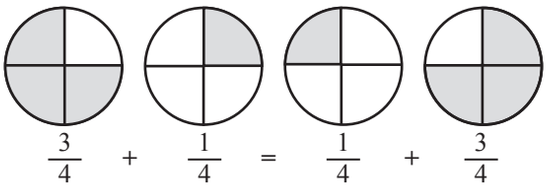
(d) Division : For any two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$; $\left[\frac{a}{b} \div \frac{c}{d}\right]$ is also a rational number.

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 number.

Commutativity

(a) Addition : Addition of any two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$ is commutative. i.e. $\frac{a}{b}+\frac{c}{d}=\frac{c}{d}+\frac{a}{b}$

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



(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 : Multiplication of any two rational numbers $\frac{a}{b}$ and $\frac{c}{d}$ is commutative. i.e. $\frac{a}{b}\times\frac{c}{d}=\frac{c}{d}\times\frac{a}{b}$.

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 : Addition of any three rational numbers $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$ is associative i.e. $\frac{a}{b}+\left(\frac{c}{d}+\frac{e}{f}\right)=\left(\frac{a}{b}+\frac{c}{d}\right)+\frac{e}{f}$

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 : Multiplication of any three rational numbers $\frac{a}{b},\frac{c}{d}$ and $\frac{e}{f}$ is associative i.e. $\frac{a}{b}\times\left(\frac{c}{d}\times\frac{e}{f}\right)=\left(\frac{a}{b}\times\frac{c}{d}\right)\times\frac{e}{f}$

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. $=\left(\frac{1}{5}\times\frac{4}{3}\right)\div\frac{1}{2}=\frac{4}{15}\div\frac{1}{2}=\frac{4}{15}\times2=\frac{8}{15}$.

R.H.S. $=\frac{1}{5}\div\left(\frac{3}{4}\times2\right)=\frac{1}{5}\div\frac{3}{2}=\frac{1}{5}\times\frac{2}{3}=\frac{2}{15}$

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 ÷ 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 : $0\div\frac{3}{4}=0$

DID YOU KNOW?

Equality between Two Rational Numbers

Two rational numbers $\frac{x}{y}$ *and* $\frac{a}{b}$ *are said to be equal if x = a and y = b, as well as xb = ay.*

Order of a Rational Number

A rational number $\frac{a}{b}$ *is said to be greater than* $\frac{x}{y}$ *if and only if ay > bx.*

THE ROLE OF 1

Multiplicative Identity

For every rational number $\frac{a}{b}$, $\frac{a}{b}\times 1=1\times\frac{a}{b}=\frac{a}{b}$, then 1 is called the multiplicative identity.

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

Division By 1

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

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

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 :

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

DID YOU KNOW?

Addition or multiplication properties of rational numbers, will it also hold for whole and integer numbers?

Illustration 4 :

Find the value of $\left(1\frac{3}{5}-\frac{2}{3}\div\frac{12}{13}+\frac{7}{5}\times\frac{1}{3}\right)$.

Solution :

$\left(\frac{8}{5}-\frac{2}{3}\times\frac{13}{12}+\frac{7}{15}\right)=\frac{8}{5}-\frac{13}{18}+\frac{7}{15}$

$\frac{144-65+42}{90}=\frac{121}{90}=1\frac{31}{90}$

Illustration 5 :

What is the percentage of least number in the greatest number if $\frac{3}{5}, \frac{9}{5}, \frac{1}{5}, \frac{7}{5}$ are arranged in ascending or descending order?

Solution :

The given numbers can be arranged in the ascending order as :

$\frac{1}{5} > \frac{3}{5} > \frac{7}{5} > \frac{9}{5}$

Greatest number = $\frac{9}{5}$; Least number = $\frac{1}{5}$

We have $\frac{9}{5} \times \frac{x}{100} = \frac{1}{5} \Rightarrow x = \frac{100}{9} = 11\frac{1}{9}\%$

Let's Do Activity

- *Take a die and throw it 3 times.*
- *Denote the outcomes as x, y, z.*
- $\frac{x}{8}, \frac{y}{8}$ *and* $\frac{z}{8}$ *are 3 rational numbers.*
- *Calculate* $\frac{x}{8} + \frac{y}{8}$. *Then add* $\frac{z}{8}$ *to the result. Let the final result by A.*
- *Calculate* $\left(\frac{y}{8} + \frac{z}{8}\right)$. *Add to it* $\frac{x}{8}$. *Denote the result obtained by B.*
- *Is A = B. If yes then name the property.*

CHECK POINT-1

1. The largest rational number among the following rational numbers is

(a) $\frac{44}{34}$ (b) $\frac{55}{85}$ (c) $\frac{76}{68}$ (d) $\frac{98}{102}$

2. Ramesh bought shirts of different colours out of which $\frac{2}{19}$ are of blue colour, $\frac{3}{19}$ are of pink colour, $\frac{4}{19}$ are of red colour and the rest are of white colour. How many shirts are of white colour, if he bought 342 shirts in total?

(a) 136 (b) 54 (c) 72 (d) 180

3. $1\frac{1}{2} + 1\frac{2}{3} \div \left(\frac{6}{7} - \frac{5}{6}\right) = ?$

(a) 71.5 (b) 133 (c) $\frac{19}{252}$ (d) $\frac{19}{180}$

4. Roller Coaster at an amusement park is $\frac{2}{3}$ m high. If a new roller coaster is built that is $\frac{3}{5}$ times the height of the existing coaster, what will be the height of the new roller coaster?

(a) $\frac{1}{6}$ m (b) $\frac{2}{3}$ m (c) $\frac{4}{5}$ m (d) $\frac{2}{5}$ m

Solutions:

1. (a) **2. (d)** **3. (a)** **4. (d)**

CASE STUDY

CASE STUDY : Distribution of multiplication over addition

CASE-I : For any four rational numbers $\frac{a}{b},\frac{c}{d},\frac{e}{f},\frac{g}{h}$

$$\left(\frac{a}{b}+\frac{c}{d}\right)\left(\frac{e}{f}+\frac{g}{h}\right)=\frac{e}{f}\left(\frac{a}{b}+\frac{c}{d}\right)+\frac{g}{h}\left(\frac{a}{b}+\frac{c}{d}\right)=\frac{ae}{bf}+\frac{ec}{fd}+\frac{ga}{bh}+\frac{gc}{gh}$$

Let us understand the above concept in a better way through illustrative example.

Illustration: *Find the value of* $\left(\frac{1}{2}+\frac{2}{3}\right)\times\left(\frac{3}{4}+\frac{4}{5}\right)$

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

$$=\frac{3}{8}+\frac{1}{2}+\frac{4}{10}+\frac{8}{15}=\frac{(45+60+48+64)}{120}=\frac{217}{120}$$

Think Out of the Box

Q.1 Find the value of $\left(\frac{5}{6}+\frac{7}{8}\right)\left(\frac{1}{2}+\frac{3}{4}\right)$

[**Hint :** Using distribution of multiplication over addition

Ans. $\frac{205}{96}$]

Q.2 Find the value of $\left(\frac{5}{6}+\frac{8}{3}\right)\left(\frac{1}{2}+\frac{4}{10}+\frac{6}{11}\right)$

[**Hint :** Using distribution of multiplication over addition

Ans. $\left(\frac{1113}{220}\right)$]

CASE-II : For any five rational numbers $\frac{a}{b},\frac{c}{d},\frac{e}{f},\frac{g}{h},\frac{i}{j}$

$$\left(\frac{a}{b}+\frac{c}{d}\right)\left(\frac{e}{f}+\frac{g}{h}+\frac{i}{j}\right)$$

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

$$=\frac{ae}{bf}+\frac{ag}{bh}+\frac{ai}{bj}+\frac{ec}{df}+\frac{gc}{dh}+\frac{ic}{dj}$$

Let us understand the above concept in a better way through illustrative example.

Illustration : *Find the value of* $\left(\frac{1}{2}+\frac{3}{4}\right)\left(\frac{2}{3}+\frac{4}{3}+\frac{1}{5}\right)$

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

$$=\frac{1}{3}+\frac{2}{3}+\frac{1}{10}+\frac{1}{2}+\frac{1}{1}+\frac{3}{20}$$

$$=\frac{20+40+6+30+60+9}{60}=\frac{165}{60}=\frac{33}{20}$$

Walk Through the Chapter

Rational Numbers

A number of the form $\frac{p}{p}$ where p and q are integers. $q \neq 0$ Eg.- 3, $\frac{1}{3}$, $\frac{2}{3}$ etc.

Addition

(i) **Closure:** Addition of 2 rational numbers is also a rational number.

(ii) Is commutative

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

(iii) Is associative

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

(iv) $\frac{a}{b}+0=\frac{a}{b}=0+\frac{a}{b}$

0 is additive identity

(v) $\frac{a}{b}+\left(\frac{-a}{b}\right)=0$

$\frac{-a}{b}$ is additive inverse of $\frac{a}{b}$

Subtraction

(i) **Closure:** Subtraction of 2 rational numbers is also a rational number.

(ii) Subtraction of rational number is not commutative.

$$\frac{a}{b}-\frac{c}{d}\neq\frac{c}{d}-\frac{a}{b}$$

(iii) Subtraction is not associative.

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

Multiplication

(i) **Closure:** Multiplication of two rational numbers is also a rational number.

(ii) Is commutative

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

(iii) Is associative

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

(iv) 1 is the multiplication identify.

(v) $\frac{a}{b}$ & $\frac{b}{a}$ are multiplicative inverse of each other.

(vi) $\frac{a}{b}\times\left(\frac{c}{d}+\frac{e}{f}\right)=\frac{ac}{bd}+\frac{ae}{bf}$

Division

(i) **Closure:** Division of 2 rational numbers is also a rational number.

(ii) $\frac{a}{b}\div\frac{c}{d}\neq\frac{c}{d}\div\frac{a}{b}$

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

(iv) Division by 0 is not defined.

Let's Revise Through FIB & T/F

1. The product of two positive rational numbers is always _____.
2. The product of two negative rational numbers is always _____.
3. Every whole number is a rational number. **(T/F)**
4. If $\frac{x}{y}$ is a rational number, then y is always a whole number. **(T/F)**
5. Every integer is a rational number. **(T/F)**
6. The denominator of a rational number cannot be _____
7. For any rational number a $(a \neq 0)$, $a \div (-a) =$ _____.
8. If $\frac{-2}{5} = \frac{13}{x}$, then $x =$ _____.
9. $\frac{1}{2} \times \left(\frac{3}{4} + \frac{-5}{12}\right) = \frac{1}{2} \times$ _____ + _____ $\times \frac{-5}{12}$

EXERCISE -1 Master Board

Multiple Choice Questions

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. Madhavi eats one full bar of chocolate. Then she divides another one into 5 equal parts and eats 3 of those parts. The total number of chocolates that she has eaten is
   (a) $\frac{4}{5}$ (b) $\frac{3}{5}$ (c) $\frac{8}{5}$ (d) $\frac{8}{10}$
2. π is
   (a) rational (b) irrational
   (c) imaginary (d) an integer
3. The absolute value of
   $25 - (25 + 10) + 25 \div 125 \times 25$ is
   (a) –5 (b) 3 (c) 15 (d) 5
4. If $15\frac{2}{3} \times 3\frac{1}{6} + 6\frac{1}{3} = 11\frac{7}{8} + x$, then the value of x is
   (a) $39\frac{5}{9}$ (b) $137\frac{4}{9}$ (c) $29\frac{7}{9}$ (d) $44\frac{5}{72}$
5. Arrange $\frac{4}{5}, \frac{7}{10}$ and $\frac{13}{20}$ in ascending order :
   (a) $\frac{4}{5} < \frac{7}{10} < \frac{13}{20}$ (b) $\frac{7}{10} < \frac{13}{20} < \frac{4}{5}$
   (c) $\frac{7}{10} < \frac{4}{5} < \frac{13}{20}$ (d) $\frac{13}{20} < \frac{7}{10} < \frac{4}{5}$
6. What is the percentage of least number in the greatest number if $\frac{3}{5}, \frac{9}{5}, \frac{1}{5}, \frac{7}{5}$ are arranged in ascending or descending order?
   (a) $11\frac{1}{9}\%$ (b) 10% (c) 20% (d) 25%
7. The value of the given expression
   $\left[\frac{156}{24} + \left\{\frac{-24}{56} + \frac{26}{112}\right\} \times \frac{112}{44}\right]$ is given by:
   (a) $\frac{1}{6}$ (b) $\frac{2}{5}$ (c) $\frac{36}{6}$ (d) 216
8. Which one of the following rational numbers has no reciprocal?
   (a) $\frac{4}{7}$ (b) $\frac{9}{3}$ (c) 0 (d) $\frac{5}{9}$
9. If $15\frac{2}{3} \times 3\frac{1}{6} + 6\frac{1}{3} = 11\frac{7}{8} + x$, then the value of x is
   (a) $39\frac{5}{9}$ (b) $137\frac{4}{9}$ (c) $29\frac{7}{9}$ (d) $44\frac{5}{72}$
10. Sunil noticed that $\frac{3}{4}$ of a chocolate was already eaten. If he then eats $\frac{2}{3}$ of what was remaining, then how much portion of the chocolate is left?
    (a) $\frac{1}{12}$ (b) $\frac{5}{6}$ (c) $\frac{7}{12}$ (d) $\frac{7}{9}$

Assertion & Reason Questions

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

   Reason : Multiplication is distributive over addition.

2. **Assertion :** $\frac{1}{0}$ is undefined.

   Reason : Division of integer by 0 is undefined

Very Short Answer Questions

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

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

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

   (i) $\frac{4}{9}$ (ii) $\frac{-13}{7}$ (iii) $\frac{5}{-11}$ (iv) $\frac{-11}{-14}$

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

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

9. Using appropriate properties, find.

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

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

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

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

Short Answer Questions

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

5. Simplify:

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

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

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

7. 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) $\frac{3}{4}\times\left(\frac{8}{9}-40\right)$

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

9. 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? **[Reasoning]**

10. 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.

    [Reasoning]

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

12. 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.

Long Answer Questions

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

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

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

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

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

7. Find the average of the middle two rational numbers if $\frac{4}{7},\frac{1}{3},\frac{2}{5},\frac{5}{9}$ are arranged in ascending order.

[Reasoning]

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

HOTS Questions

1. A mother and her two daughters got a room constructed for ₹ 60,000. The elder daughter contributes – 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?

2. 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. 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?

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

EXERCISE -2 NCERT Questions

Text-book Questions

1. Name the property under multiplication used in each of the following.

   (i) $\frac{-4}{5}\times 1=1\times\frac{-4}{5}=-\frac{4}{5}$ **(ii)** $-\frac{13}{17}\times\frac{-2}{7}=\frac{-2}{7}\times\frac{-13}{17}$

   (iii) $\frac{-19}{29}\times\frac{29}{-19}=1$

2. Tell what property allows you to compute $\frac{1}{3}\times\left(6\times\frac{4}{3}\right)as\left(\frac{1}{3}\times 6\right)\times\frac{4}{3}$.

3. The product of two rational numbers is always a _____.

Exemplar Questions

1. A number which can be expressed as $\frac{p}{q}$ where p and q are integers and q ≠ 0 is

   (a) natural number (b) whole number

   (c) integer (d) rational number

2. A number of the form $\frac{p}{q}$ is said to be a rational number if

   (a) p and q are integers

   (b) p and q are integers and $q \neq 0$

   (c) p and q are integers and p ≠ 0

   (d) p and q are integers and p ≠ 0 also q ≠ 0.

3. The numerical expression $\frac{3}{8}+\frac{(-5)}{7}=\frac{-19}{56}$ shows that

   (a) rational numbers are closed under addition.

   (b) rational numbers are not closed under addition.

   (c) rational numbers are closed under multiplication.

   (d) addition of rational numbers is not commutative.

4. Which of the following is not true?

   (a) rational numbers are closed under addition.

   (b) rational numbers are closed under subtraction.

   (c) rational numbers are closed under multiplication.

   (d) rational numbers are closed under division.

5. $-\frac{3}{8}+\frac{1}{7}=\frac{1}{7}+\left(\frac{-3}{8}\right)$ is an example to show that

   (a) addition of rational numbers is commutative.

   (b) rational numbers are closed under addition.

   (c) addition of rational number is associative.

   (d) rational numbers are distributive under addition.

6. Which of the following expressions shows that rational numbers are associative under multiplication.

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

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

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

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

7. Zero (0) is

(a) the identity for addition of rational numbers.

(b) the identity for subtraction of rational numbers.

(c) the identity for multiplication of rational numbers.

(d) the identity for division of rational numbers.

8. One (1) is

(a) the identity for addition of rational numbers.

(b) the identity for subtraction of rational numbers.

(c) the identity for multiplication of rational numbers.

(d) the identity for division of rational numbers.

9. The additive inverse of $\frac{-7}{19}$ is

(a) $\frac{-7}{19}$ (b) $\frac{7}{19}$ (c) $\frac{19}{7}$ (d) $\frac{-19}{7}$

10. Which of the following is an example of distributive property of multiplication over addition for rational numbers.

(a) $-\frac{1}{4}\times\left\{\frac{2}{3}+\left(\frac{-4}{7}\right)\right\}=\left[-\frac{1}{4}\times\frac{2}{3}\right]+\left[-\frac{1}{4}\times\left(\frac{-4}{7}\right)\right]$

(b) $-\frac{1}{4}\times\left\{\frac{2}{3}+\left(\frac{-4}{7}\right)\right\}=\left[\frac{1}{4}\times\frac{2}{3}\right]-\left(\frac{-4}{7}\right)$

(c) $-\frac{1}{4}\times\left\{\frac{2}{3}+\left(\frac{-4}{7}\right)\right\}=\frac{2}{3}+\left(-\frac{1}{4}\right)\times\frac{-4}{7}$

(d) $-\frac{1}{4}\times\left\{\frac{2}{3}+\left(\frac{-4}{7}\right)\right\}=\left\{\frac{2}{3}+\left(\frac{-4}{7}\right)\right\}-\frac{1}{4}$

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

12. Using appropriate properties, find

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

13. 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 hectare ; 1 hectare = 10,000 m^2)

14. Tell which property allows you to compute

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

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

(i) $\frac{-5}{4}\times\left[\frac{8}{5}+\frac{16}{15}\right]$ (ii) $\frac{2}{7}\times\left[\frac{7}{16}-\frac{21}{4}\right]$

16. 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) $\frac{7}{8}+\frac{1}{16}-\frac{1}{12}$

17. 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?

18. Riya, Reena and Seema received a total of ₹ 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?

19. 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. $\frac{C}{5}=\frac{F-32}{9}$

EXERCISE -3 Foundation Builder

Multiple Choice Questions

DIRECTIONS: *This section contains multiple choice questions. Each questions 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. 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) $\frac{5}{7}<\frac{9}{11}<\frac{11}{13}<\frac{7}{9}$

4. 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) $\frac{5}{11}$

5. 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) $\frac{1}{20}$

6. 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) $\frac{2}{7}$

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

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

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

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

9. When simplified the product $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right).....\left(1+\frac{1}{n}\right)$ becomes **[NTSE]**

(a) n (b) $\frac{n-1}{2}$

(c) $\frac{n+1}{2}$ (d) $\frac{n}{2}$

10. If the radius of a circle is a rational number, then its area is given by a number which is: **[NTSE]**

(a) rational (b) irrational

(c) integral (d) a perfect square

11. The sum of rational and irrational number is: **[NTSE]**

(a) Rational (b) Irrational

(c) Zero (d) Integers

12. Dividing the sum of $\frac{7}{8},\frac{15}{4},\frac{1}{12}$ by their multiplication gives _____. **[JSTSE]**

(a) $17\frac{22}{105}$ (b) $\frac{944}{105}$

(c) $16\frac{23}{105}$ (d) $17\frac{23}{105}$

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/Case Based Questions

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

Passage - I

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

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

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) Commutativity 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 Questions

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.

Numeric/Integer Type Questions

DIRECTIONS : *Following are integer/numeric value type questions. Each question, when worked out will result in an integer/numeric value.*

1. If $x = \frac{-4}{3}, y = \frac{1}{2}, z = \frac{-7}{5}$ then 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

Let's Revise Through FIB & T/F

1. Positive **2.** Positive **3.** True **4.** False **5.** True

6. Zero **7.** –1 **8.** $\frac{-65}{2}$ **9.** $\frac{3}{4}, \frac{1}{2}$

EXERCISE-1 **Master Board**

Multiple Choice Questions

1. **(c)** $1+\frac{3}{5}=\frac{5+3}{5}=\frac{8}{5}$

2. **(b)** π is irrational.

3. **(a)** $25-(25+10)+25\div 125\times 25$

$= 25-35+\frac{1}{5}\times 25$

$= -10+5=(-5)$

4. **(d)** $15\frac{2}{3}\times 3\frac{1}{6}+6\frac{1}{3}=11\frac{7}{8}+x$

$\frac{47}{3}\times\frac{19}{6}+\frac{19}{3}=\frac{95}{8}+x$

$\Rightarrow \frac{47\times 19}{18}+\frac{19}{3}-\frac{95}{8} \Rightarrow x=\frac{47\times 19+19\times 6}{18}-\frac{95}{8}$

$\Rightarrow \frac{19(47+6)}{18}-\frac{95}{8}=x \Rightarrow x=\frac{19\times 53}{18}-\frac{95}{8}$

$\Rightarrow x=\frac{(4\times 19\times 53)-(95\times 9)}{72}$

$\Rightarrow x=\frac{4028-855}{72}=\frac{3173}{72}=44\frac{5}{72}$

5. **(d)**

6. **(a)** The given numbers can be arranged in the ascending order as :

$\frac{1}{5}>\frac{3}{5}>\frac{7}{9}>\frac{9}{5}$

Greatest number $=\frac{9}{5}$;

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

We have $\frac{9}{5}\times\frac{x}{100}=\frac{1}{5}\Rightarrow x=\frac{100}{9}=11\frac{1}{9}\%$

7. **(c)** $\left[\frac{156}{24}+\left\{\frac{-24}{56}+\frac{26}{112}\right\}\times\frac{112}{44}\right]$

$=\left[\frac{\cancel{156}}{\cancel{24}}+\left\{\frac{-48+26}{112}\right\}\times\frac{28}{11}\right]$

$=\frac{13}{2}-\frac{22}{\cancel{112}_{4}}\times\frac{\cancel{28}}{11}$

$=\frac{13}{2}-\frac{\cancel{11}}{\cancel{11}}\times\frac{\cancel{2}}{\cancel{2}}=\frac{13}{2}-\frac{1}{2}=\frac{13-1}{2}=\frac{\overset{6}{\cancel{12}}}{\cancel{2}}=6$

8. **(c)** 0 has no reciprocal.

9. **(d)** $15\frac{2}{3}\times 3\frac{1}{6}+6\frac{1}{3}=11\frac{7}{8}+x$

$\frac{47}{3}\times\frac{19}{6}+\frac{19}{3}=\frac{95}{8}+x$

$\Rightarrow\frac{47\times 19}{18}+\frac{19}{3}-\frac{95}{8}$

$\Rightarrow x=\frac{47\times 19+19\times 6}{18}-\frac{95}{8}$

$\Rightarrow \frac{19(47+6)}{18}-\frac{95}{8}=x$

$\Rightarrow x=\frac{19\times 53}{18}-\frac{95}{8}$

$\Rightarrow x=\frac{(4\times 19\times 53)-(95\times 9)}{72}$

$\Rightarrow x=\frac{4028-855}{72}=\frac{3173}{72}=44\frac{5}{72}$

10. **(a)** Sunil have remaining chocolate $=1-\frac{3}{4}=\frac{1}{4}$

Now, he eats $\frac{2}{3}\times\frac{1}{4}=\frac{1}{6}$ part

Remaining portion $\Rightarrow\frac{1}{4}-\frac{1}{6}=\frac{3-2}{12}=\frac{1}{12}$

Assertion & Reason Questions

1. **(a)** **2.** **(a)**

Very Short Answer Questions

1. $\frac{4}{-14}=\frac{4\times(-1)}{-14\times(-1)}=\frac{-4}{14}$

2. $\frac{-9}{14}+x=-1 \Rightarrow x=\frac{-5}{14}$

3. We have

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

$= \frac{(-5)\times(-10)\times 21\times(-7)}{9\times 13\times 11} = \frac{-7350}{1287} = \frac{-2450}{429}$

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. **(i)** $\frac{34}{9}$ **(ii)** $\frac{77}{23}$

6. **(i)** $-\frac{4}{9}$ **(ii)** $\frac{13}{7}$ **(iii)** $\frac{5}{11}$ **(iv)** $\frac{-11}{4}$

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

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

(by using commutativity and associativity)

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

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

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

(Using commutativity and associativity)

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

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

10. 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 $\frac{-3}{5}$

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

$\left[-\left(\frac{-9}{20}\right) = \frac{9}{20}\right]$

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

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

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

$= \frac{5}{6}-\frac{1}{4}+\frac{1}{8} = \frac{5}{6}+\frac{-1}{4}+\frac{1}{8}$

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

Short Answer Questions

1. Let the other number be x.

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

$\Rightarrow \quad \frac{-7x}{5} = \frac{63}{40} \Rightarrow -7x\times 40 = 63\times 5 \quad \Rightarrow \quad x = -\frac{9}{8}$

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

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

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

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

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

5. $\frac{-34}{5}$

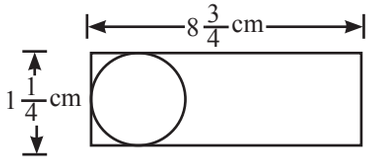
6. **(i)** $1\frac{9}{10}$ **(ii)** $17\frac{17}{24}$

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

8. $\frac{1}{15}\div\left(\frac{4}{15}+\frac{1}{3}-\frac{3}{45}\right) = \frac{1}{15}\div\left(\frac{12+15-3}{45}\right)$

$= \frac{1}{15}\div\left(\frac{24}{45}\right) = \frac{1}{15}\times\frac{45}{24} = \frac{1}{8}$

9. Since breadth of strip is equal to diameter of circle. So divide length of strip by diameter of circle and take quotient as answer.



$8\frac{3}{4} \div 1\frac{1}{4}$

$\frac{35}{4} \div \frac{5}{4} = \frac{35}{4} \times \frac{4}{5} = 7$

Shalini cuts 7 full circles.

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

11. 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

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

12. We first calculate the time in hour.

$\frac{35}{2}\text{minutes} = \frac{35}{2\times 60} = \frac{7}{24}\text{hour}$

Therefore, total time (in hours)

$= \frac{7}{2} + \frac{7}{24}\text{hour} = \frac{84+7}{24} = \frac{91}{24}\text{hours}$

Distance = Speed × Time

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

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

Long Answer Questions

1. $\left(\frac{3}{11}\times\frac{5}{6}\right) - \left(\frac{3}{4}\times\frac{4}{3}\right) + \left(\frac{5}{13}\times\frac{2}{5}\right) = \frac{5}{22} - 1 + \frac{2}{13}$

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

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

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

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

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

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

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

L.H.S. $= -(x+y) = -\left(\frac{1}{2} + \frac{2}{3}\right) = \frac{-7}{6}$

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

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

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

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

R.H.S. $= \frac{1}{2}\times\frac{4}{3} - \frac{1}{2}\times\frac{-3}{5} = \frac{2}{3} + \frac{3}{10} = \frac{29}{30}$

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

5. We have,

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

$\therefore$ The other number $x = \frac{5}{12} \div \frac{3}{-14} = \frac{5}{12}\times\frac{-14}{3} = \frac{-35}{18}$

6. $4 - \cfrac{5}{1+\cfrac{1}{3+\cfrac{1}{2+\frac{1}{4}}}} = 4 - \cfrac{5}{1+\cfrac{1}{\frac{31}{9}}} = 4 - \frac{155}{40} = \frac{1}{8}$

7. $\frac{4}{7}, \frac{1}{3}, \frac{2}{5}, \frac{5}{9}$

The above numbers in ascending order are:

$\frac{1}{3} < \frac{2}{5} < \frac{5}{9} < \frac{4}{7}$

Middle two numbers are $\frac{2}{5}$ and $\frac{5}{9}$.

$\therefore$ Average $= \frac{\frac{2}{5}+\frac{5}{9}}{2} = \frac{43}{90}$

8. Let the total number of students in the school = x

Students that come to school by car $= \frac{2}{5}\times x$

Students that come to school by bus $= \frac{1}{4}\times x$

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

Now, students walk on their own $= \frac{1}{3}\left(x - \frac{2}{5}x - \frac{1}{4}x\right)$

$224 = \frac{1}{3}\left(x - \frac{2}{5}x - \frac{1}{4}x\right)$

$224 \times 3 = \frac{20x - 8x - 5x}{20}$

$672 = \frac{7x}{20} \Rightarrow 672 \times 20 = 7x$

$x = \frac{672 \times 20}{7} \Rightarrow = 1920$

So, 1920 students study in the school.

HOTS Questions

1. ₹ 32,000, ₹ 12,000, ₹ 16,000
2. $\frac{3}{8}$cup
3. 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
4. The perimeter of the square $= \frac{24}{10}$cm

   But the perimeter of square = 4 × 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.

EXERCISE-2 NCERT Questions

Text-book Questions

1. (i) 1 is the multiplicative identity
   (ii) Commutativity
   (iii) Multiplicative inverse
2. Associative property of Multiplication
3. Rational number

Exemplar Questions

1. (d) 2. (b) 3. (a) 4. (d)
5. (a) 6. (a) 7. (a) 8. (c)
9. (b) 10. (a)
11. $\frac{4}{7} \times \frac{14}{3} \div \frac{2}{3} = \frac{4}{7} \times \left(\frac{14}{3} \times \frac{3}{2}\right) = \frac{4}{7} \times 7 = 4$
12. $\frac{2}{3} \times \left(\frac{-5}{7}\right) + \frac{7}{3} + \frac{2}{3} \times \left(\frac{-2}{7}\right) = \frac{-5}{7} \times \frac{2}{3} - \frac{2}{7} \times \frac{2}{3} + \frac{7}{3}$

    $= \left(\frac{-5}{7} - \frac{2}{7}\right) \times \frac{2}{3} + \frac{7}{3} = -\frac{2}{3} + \frac{7}{3} = \frac{5}{3}$
13. $49\frac{4}{5}$ha $= \frac{249}{5}$ha

    Each share $= \frac{1}{3} \times \frac{249}{5}$ha $= \frac{83}{5}$ha $= 16\frac{3}{5}$ha
14. Associative property
15. (i) $-3\frac{1}{3}$ (ii) $-1\frac{3}{8}$
16. (i) $\frac{142}{15}$ or $9\frac{7}{15}$ (ii) $\frac{2}{7}$

    (iii) $\frac{32}{63}$ (iv) $\frac{41}{48}$
17. 16 pieces.
18. ₹ 864, ₹ 720, ₹ 432
19. 3.2 ° F

EXERCISE-3 Foundation Builder

Multiple Choice Questions

1. (b)
2. (a) We have $\frac{27}{13} - x = \frac{-3}{7} \Rightarrow x = \frac{228}{91}$.
3. (a) L.C.M. of 13, 11, 9, 7 = 117 × 77 = 9009

   $\frac{6435}{9009} < \frac{7007}{9009} < \frac{7371}{9009} < \frac{7623}{9009}$ or $\frac{5}{7} < \frac{7}{9} < \frac{9}{11} < \frac{11}{13}$.
4. (c) $\frac{3}{7} + x + \left(\frac{-8}{21}\right) + \left(\frac{5}{22}\right) = -\frac{125}{462}$

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

   $\Rightarrow \frac{21x + 1}{21} = \frac{-(125 + 105)}{462} \Rightarrow x = \frac{-6}{11}$
5. (a) $\frac{7}{12} + x = \frac{4}{15} \Rightarrow x = \frac{-19}{60}$
6. (b) $\left(-\frac{4}{9}\right) \times x = \frac{-28}{27} \Rightarrow x = \frac{7}{3}$
7. (d)
8. (b) $\frac{27}{2} - \left[\frac{9}{2} - \left\{3 - \left(\frac{4-1}{2}\right)\right\}\right]$

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

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

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

9. **(c)** $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right)....\left(1+\frac{1}{n}\right)$

$$= \left(\frac{3}{2}\right)\left(\frac{4}{3}\right)\left(\frac{5}{4}\right)....\left(\frac{n+1}{n}\right) = \frac{n+1}{2}$$

10. **(b)** Radius (r) of the circle is rational

Area of a circle = πr^2

$$r^2 = r \times r,$$

So, r^2 is a rational number because it is the product of two rational numbers.

$\pi = \frac{22}{7}$, which is an irrational number.

So, $A = \pi r^2$ is irrational because it is the product of an irrational number and a rational number.

11. **(b)** Irrational

12. **(d)** $\frac{\frac{7}{8}+\frac{15}{4}+\frac{1}{12}}{\frac{7}{8}\times\frac{15}{4}\times\frac{1}{12}} = \frac{21+90+2}{\frac{7}{8}\times\frac{15}{4}\times\frac{1}{12}}$

$$\Rightarrow \frac{113}{24}\times\frac{8}{7}\times\frac{4}{15}\times\frac{12}{1} \Rightarrow \frac{1808}{105} = 17\frac{23}{105}$$

More Than One Option Correct

1. **(b, d)**

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)**

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

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

Passage/Case Based Questions

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

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

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

$$= 4+\frac{11}{2} = \frac{8+11}{2} = \frac{19}{2}$$

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

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

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

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 Questions

1. **(a)** Assertion is true reason is true and reason is correct explanation of assertion.

2. **(c)** Assertion if true and reason is false.

Numeric/Integer Type Questions

1. **Ans : 6**

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

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

2. **Ans : 8**

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

$\therefore \quad 2+0+3+3 = 8$

3. **Ans : 2**

Because 5 is not the multiple of 2.

4. **Ans : 5**

$$\frac{45}{56}\times x = \frac{9}{7} \Rightarrow x = \frac{8}{5}$$

5. **Ans : 5**

$$\left(\frac{-4}{3}\times\frac{12}{-5}\right)+\left(\frac{3}{7}\times\frac{21}{15}\right) = \frac{16}{5}+\frac{3}{5} = \frac{19}{5}$$

6. **Ans : 3**

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