



Mathematics

8th Standard

Based on the Updated New Textbook

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Author :

S. Niranjan, B.Tech., PGDM(IIM)

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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Mathematics Guide** for **Full Year** for **8th Standard**. It is prepared as per the New Syllabus and New Textbook.

This guide encompasses all the requirements of the students to comprehend the text and the evaluation of the textbook.

- ◆ Additional questions have been provided exhaustively for clear understanding of the units under study.
- ◆ Chapter-wise Unit Test are given.

In order to learn effectively, I advise students to learn the subject section-wise and practice the exercises given. It will be a teaching companion to teachers and a learning companion to students.

Though these salient features are available in this Guide, I cannot negate the indispensable role of the teachers in assisting the student to understand the subject thoroughly.

I sincerely believe this guide satisfies the needs of the students and bolsters the teaching methodologies of the teachers.

I pray the almighty to bless the students for consummate success in their examinations.

Subash Raj, B.E., M.S.
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CONTENTS

Unit	Title	Page No.
1.	Numbers	1 - 62
2.	Measurements	63 - 94
3.	Algebra	95 - 173
4.	Life Mathematics	174 - 221
5.	Geometry	222 - 265
6.	Statistics	266 - 287
7.	Information Processing	288 - 322
Common Annual Examination - April 2025 Question Paper with answers		323 - 330

SYLLABUS

MONTH	S.No.	CHAPTER NAME	UNITS
JUNE	1	Numbers	1.1 - 1.9
JULY	2	Measurement	2.1 - 2.4
	5	Geometry	5.10 - 5.11
I MID TERM TEST (June, July)			
AUGUST	3	Algebra	3.1 - 3.4
	5	Geometry	5.1 - 5.4
	7	Instrumental Processing	7.1 - 7.3
SEPTEMBER	3	Algebra	3.9
	4	Life Mathematics	4.1 - 4.4
QUARTERLY EXAM (August, September)			
OCTOBER	3	Algebra	3.5 - 3.8
NOVEMBER	4	Life Mathematics	4.5 - 4.6
	5	Geometry	5.12 - 5.14
	7	Instrumental Processing	7.4 - 7.6
II MID TERM TEST (October, November)			
DECEMBER	5	Geometry	5.5 - 5.9
HALF YEARLY EXAM (June - December)			
JANUARY	3	Algebra	3.10
	6	Statistics	6.1 - 6.3
FEBRUARY	5	Geometry	5.15 - 5.16
	6	Statistics	6.4
	7	Instrumental Processing	7.7 - 7.9
III MID TERM TEST (January, February)			
MARCH	REVISION		
APRIL	ANNUAL EXAM (All Portions)		



NUMBERS

POINTS TO REMEMBER

- ❑ A number that can be expressed in the form $\frac{a}{b}$ where a and b are integers and $b \neq 0$ is called a rational number.
- ❑ All natural numbers, whole numbers, integers and fractions are rational numbers.
- ❑ Every rational number can be represented on a number line.
- ❑ 0 is neither a positive nor a negative rational number.
- ❑ A rational number $\frac{a}{b}$ is said to be in the standard form, if its denominator b is a positive integer and $\text{HCF}(a, b) = 1$.
- ❑ There are unlimited numbers of rational numbers between two rational numbers.
- ❑ Subtracting two rational numbers is the same as adding the additive inverse of the second number to the first rational number.
- ❑ Multiplying two rational numbers is the same as multiplying their numerators and denominators separately and then writing the product in the standard form.
- ❑ Dividing a rational number by another rational number is the same as multiplying the first rational number by the reciprocal of the second rational number.
- ❑ The following table is about the properties of rational numbers($\mathbb{Q}$).

$\mathbb{Q}$	Closure	Commutative	Associative	Multiplication is distributive over $+/-$
+	✓	✓	✓	✓
-	✓	×	×	✓
×	✓	✓	✓	-
÷	×	×	×	-

- ❑ 0 and 1 are respectively the additive and the multiplicative identities of rational numbers.
- ❑ The additive inverse for $\frac{a}{b}$ is $\frac{-a}{b}$ and vice – versa.
- ❑ The reciprocal or the multiplicative inverse of a rational number $\frac{a}{b}$ is $\frac{b}{a}$ since $\frac{a}{b} \times \frac{b}{a} = 1$.
- ❑ A natural number n is called a square number, if we can find another natural number m such that $n = m^2$.
- ❑ The square root of a number n , written as $\sqrt{n}$ (or) $n^{\frac{1}{2}}$, is the number that gives n when multiplied by itself.
- ❑ The number of times a prime factor occurs in the square is equal to twice the number of times it occurs in the prime factorization of the number.
- ❑ For any two positive numbers a and b , we have
 (i) $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ and (ii) $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ ($b \neq 0$)
- ❑ If you multiply a number by itself and then by itself again, the result is a cube number.
- ❑ The cube root of a number is the value that when cubed gives the original number.
- ❑ An expression that represents repeated multiplication of the same factor is called a power.
- ❑ The exponent corresponds to the number of times the base is used as a factor.
- ❑ Laws of Exponents: (i) $a^m \times a^n = a^{m+n}$ (ii) $\frac{a^m}{a^n} = a^{m-n}$ (iii) $(a^m)^n = a^{mn}$
- ❑ Other results: (i) $a^0 = 1$ (ii) $a^{-m} = \frac{1}{a^m}$ (iii) $a^m \times b^m = (ab)^m$ (iv) $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$

RECAP

Page No. 3

1. The simplest form of $\frac{125}{200}$ is _____.

[Ans: $\frac{5}{8}$]

Sol.
$$\frac{125}{200} = \frac{125 \div 25}{200 \div 25} = \frac{5}{8}$$

2. Which of the following is not an equivalent fraction of $\frac{8}{12}$?

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

(B) $\frac{16}{24}$

(C) $\frac{32}{60}$

(D) $\frac{24}{36}$

[Ans: (C) $\frac{32}{60}$]

Sol.
$$\frac{8}{12} = \frac{8 \div 4}{12 \div 4} = \frac{2}{3}$$

$$\frac{8}{12} = \frac{8 \times 2}{12 \times 2} = \frac{16}{24}$$

$$\frac{8}{12} = \frac{8 \times 3}{12 \times 3} = \frac{24}{36}$$

But

$$\frac{32}{60} = \frac{32 \div 5}{60 \div 5} = \frac{6.4}{12}$$

$\therefore \frac{32}{60}$ is not an equivalent fraction of $\frac{8}{12}$.

3. Which is bigger : $\frac{4}{5}$ or $\frac{8}{9}$?

Sol. LCM of 5 and 9 = 45

$$\frac{4}{5} = \frac{4 \times 9}{5 \times 9} = \frac{36}{45}$$

$$\frac{8}{9} = \frac{8 \times 5}{9 \times 5} = \frac{40}{45}$$

$$\therefore \frac{40}{45} > \frac{36}{45}$$

$$\therefore \frac{8}{9} > \frac{4}{5}$$

$\Rightarrow \frac{8}{9}$ is bigger than $\frac{4}{5}$.

4. Add the fractions : $\frac{3}{5} + \frac{5}{8} + \frac{7}{10}$.

Sol.

$$\begin{aligned} \text{LCM of } 5, 8, 10 &= 5 \times 2 \times 4 \\ &= 40 \end{aligned}$$

$$\begin{aligned} \frac{3}{5} + \frac{5}{8} + \frac{7}{10} &= \frac{(3 \times 8) + (5 \times 5) + (7 \times 4)}{40} \\ &= \frac{24 + 25 + 28}{40} \\ &= \frac{77}{40} = 1 \frac{37}{40} \end{aligned}$$

Hint:

5	5, 8, 10
2	1, 8, 2
4	1, 4, 1
	1, 1, 1

5. Simplify : $\frac{1}{8} - \left(\frac{1}{6} - \frac{1}{4} \right)$.

Sol.

$$\begin{aligned} \frac{1}{8} - \left(\frac{1}{6} - \frac{1}{4} \right) &= \frac{1}{8} - \left[\frac{(1 \times 2) - (1 \times 3)}{12} \right] \quad [\because \text{LCM of } 6, 4 = 12] \\ &= \frac{1}{8} - \left(\frac{2-3}{12} \right) \\ &= \frac{1}{8} - \left(-\frac{1}{12} \right) \\ &= \frac{1}{8} + \frac{1}{12} = \frac{(1 \times 3) + (1 \times 2)}{24} \quad [\because \text{LCM of } 8, 12 = 24] \\ &= \frac{3+2}{24} = \frac{5}{24} \end{aligned}$$

6. Multiply : $2\frac{3}{5}$ and $1\frac{4}{7}$.

Sol.

$$2\frac{3}{5} \times 1\frac{4}{7} = \frac{13}{5} \times \frac{11}{7} = \frac{143}{35} = 4\frac{3}{35}$$

7. Divide : $\frac{7}{36}$ by $\frac{35}{81}$.

Sol.

$$\frac{7}{36} \div \frac{35}{81} = \frac{7}{36} \times \frac{81}{35} = \frac{9}{20}$$

8. Fill in the boxes : $\frac{\square}{66} = \frac{70}{\square} = \frac{28}{44} = \frac{\square}{121} = \frac{7}{\square}$.

Sol.

$$\frac{28}{44} = \frac{28 \div 4}{44 \div 4} = \frac{7}{11}$$

$$\frac{7}{11} = \frac{7 \times 4 = 28}{11 \times 4 = 44} = \frac{7 \times 6 = 42}{11 \times 6 = 66} = \frac{7 \times 10 = 70}{11 \times 10 = 110} = \frac{7 \times 11 = 77}{11 \times 11 = 121}$$

$$\therefore \frac{\boxed{42}}{66} = \frac{70}{\boxed{110}} = \frac{28}{44} = \frac{\boxed{77}}{121} = \frac{7}{\boxed{11}}$$

9. In a city $\frac{7}{20}$ of the population are women and $\frac{1}{4}$ are children. Find the fraction of the population of men.

Sol. Let the total population = 1

$$\text{Population of men} = \text{Total population} - \text{Women} - \text{Children}$$

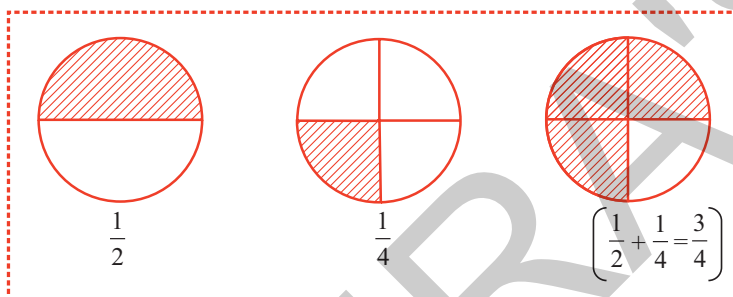
$$= 1 - \frac{7}{20} - \frac{1}{4} = \frac{20}{20} - \frac{7}{20} - \frac{5}{20}$$

$$= \frac{20 - 7 - 5}{20} = \frac{8}{20} = \frac{2}{5}$$

$$\text{Population of men} = \frac{2}{5}$$

10. Represent $\left(\frac{1}{2} + \frac{1}{4}\right)$ by a diagram.

Sol.



TRY THESE

Page No. 3

1. Is the number -7 a rational number? Why?

Sol. Yes -7 is a rational number. Because $-7 = \frac{-14}{2} = \frac{p}{q}$

2. Write any 6 rational numbers between 0 and 1.

Sol. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}$



TRY THESE

Page No. 5

Write the decimal forms of the following rational numbers:

1. $\frac{4}{5}$ 2. $\frac{6}{25}$ 3. $\frac{486}{1000}$ 4. $\frac{1}{9}$ 5. $3\frac{1}{4}$ 6. $-2\frac{3}{5}$

Sol. 1. $\frac{4}{5} = \frac{4 \times 20}{5 \times 20} = \frac{80}{100} = 0.80$

2. $\frac{6}{25} = \frac{6 \times 4}{25 \times 4} = \frac{24}{100} = 0.24$

$$3. \frac{486}{1000} = 0.486$$

$$4. \frac{1}{9} = 0.11...$$

$$\begin{array}{r} 0.11 \\ 9 \overline{) 10} \\ \underline{9} \\ 10 \\ \underline{9} \\ 1 \end{array}$$

$$5. 3\frac{1}{4} = \frac{13}{4} = 3.25$$

$$\begin{array}{r} 3.25 \\ 4 \overline{) 13} \\ \underline{12} \\ 10 \\ \underline{8} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

$$6. -2\frac{3}{5} = \frac{-13}{5} = -2.6$$

$$\begin{array}{r} 2.6 \\ 5 \overline{) 13} \\ \underline{10} \\ 30 \\ \underline{30} \\ 0 \end{array}$$



TRY THESE

Page No. 6

$$1. \frac{7}{3} = \frac{?}{9} = \frac{49}{?} = \frac{-21}{?}$$

$$\frac{7}{3} = \frac{7 \times 3}{3 \times 3} = \frac{21}{9}$$

$$\frac{7}{3} = \frac{7 \times 7}{3 \times 7} = \frac{49}{21}$$

$$\frac{7}{3} = \frac{7 \times (-3)}{3 \times (-3)} = \frac{-21}{-9}$$

$$\therefore \frac{7}{3} = \frac{21}{9} = \frac{49}{21} = \frac{-21}{-9}$$

$$2. \frac{-2}{5} = \frac{?}{10} = \frac{6}{?} = \frac{-8}{?}$$

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

$$\frac{-2}{5} = \frac{-2 \times -3}{5 \times -3} = \frac{6}{-15}$$

$$\frac{-2}{5} = \frac{-2 \times 4}{5 \times 4} = \frac{-8}{20}$$

$$\therefore \frac{-2}{5} = \frac{-4}{10} = \frac{6}{-15} = \frac{-8}{20}$$



TRY THESE

Page No. 7

1. Which of the following pairs represents equivalent rational numbers?

$$(i) \frac{-6}{4}, \frac{18}{-12} \quad (ii) \frac{-4}{-20}, \frac{1}{-5}$$

$$(iii) \frac{-12}{-17}, \frac{60}{85}$$

$$(i) \frac{-6}{4} = \frac{-6 \times -3}{4 \times -3} = \frac{18}{-12}$$

$$\therefore \frac{-6}{4} \text{ equivalent to } \frac{18}{-12}$$

$$(ii) \frac{-4}{-20} = \frac{-4 \div (-4)}{-20 \div (-4)} = \frac{1}{5} \neq -\frac{1}{5}$$

$$\therefore \frac{-4}{-20} \text{ not equivalent to } \frac{1}{-5}$$

$$(iii) \frac{-12}{-17} = \frac{-12 \times -5}{-17 \times -5} = \frac{60}{85}$$

$$\therefore \frac{-12}{-17} \text{ equivalent to } \frac{60}{85}$$

2. Find the standard form of :

$$(i) \frac{36}{-96} \quad (ii) \frac{-56}{-72} \quad (iii) \frac{27}{18}$$

$$(i) \frac{36}{-96} = \frac{36 \div 12}{-96 \div 12} = \frac{3}{-8} = -\frac{3}{8}$$

$$(ii) \frac{-56}{-72} = \frac{-56 \div (-8)}{-72 \div (-8)} = \frac{7}{9}$$

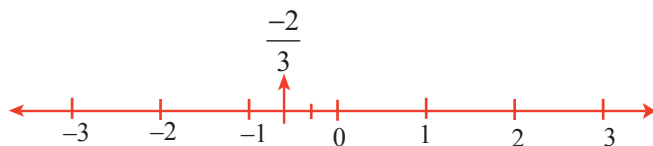
$$(iii) \frac{27}{18} = \frac{27 \div 9}{18 \div 9} = \frac{3}{2}$$

3. Mark the following rational numbers on a number line.

(i) $-\frac{2}{3}$ (ii) $-\frac{8}{5}$ (iii) $\frac{5}{-4}$

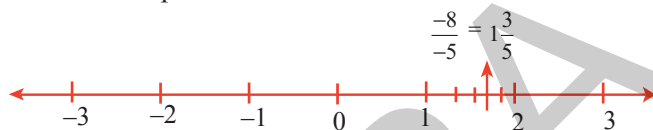
Sol. (i) $-\frac{2}{3} = -0.666\ldots \therefore -\frac{2}{3}$ lies between 0 and -1.

The unit part between 0 and -1 is divided into 3 equal parts and second part is taken.



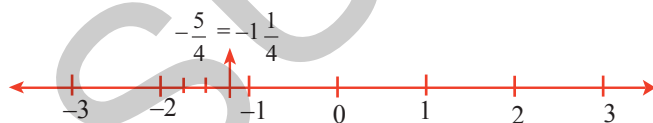
(ii) $-\frac{8}{5} = \frac{8}{5} = 1\frac{3}{5}$

$1\frac{3}{5}$ lies between 1 and 2. The unit part between 1 and 2 is divided into 5 equal parts and the third part is taken.



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

$-1\frac{1}{4}$ lies between -1 and -2. The unit part between -1 and -2 is divided into four equal parts and the first part is taken.



Are there any rational numbers between $-\frac{7}{11}$ and $\frac{6}{-11}$?

Sol. $\frac{-7 \times 10}{11 \times 10} = \frac{-70}{110}; \frac{6 \times 10}{-11 \times 10} = \frac{-60}{110}$

$\therefore \frac{-61}{110}, \frac{-62}{110} \dots \frac{-69}{110}$ are there in between $\frac{-60}{110}$ and $\frac{-69}{110}$

$\therefore$ There are many rational numbers between $-\frac{7}{11}$ and $\frac{6}{-11}$

Exercise 1.1

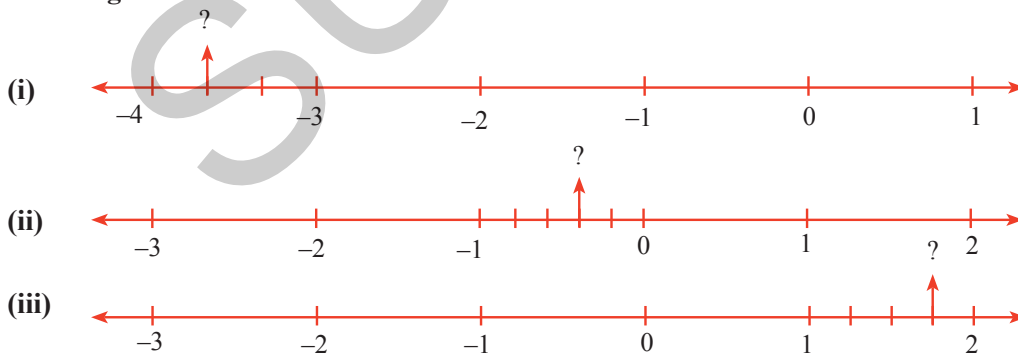
1. Fill in the blanks:

- (i) $\frac{-19}{5}$ lies between the integers _____ and _____. [Ans: -4 and -3]
- (ii) The decimal form of the rational number $\frac{15}{-4}$ is _____. [Ans: -3.75]
- (iii) The rational numbers $\frac{-8}{3}$ and $\frac{8}{3}$ are equidistant from _____. [Ans: 0]
- (iv) The next rational number in the sequence $\frac{-15}{24}, \frac{20}{-32}, \frac{-25}{40}$ is _____. [Ans: $\frac{30}{-48}$]
- (v) The standard form of $\frac{58}{-78}$ is _____. [Ans: $\frac{-29}{39}$] (QY-2023)

2. Say True or False.

- (i) 0 is the smallest rational number. [Ans: False]
- (ii) $\frac{-4}{5}$ lies to the left of $\frac{-3}{4}$. [Ans: True]
- (iii) $\frac{-19}{5}$ is greater than $\frac{15}{-4}$. [Ans: False]
- (iv) The average of two rational numbers lies between them. [Ans: True]
- (v) There are an unlimited number of rational numbers between 10 and 11. [Ans: True]

3. Find the rational numbers represented by each of the question marks marked on the following number lines.



Sol. (i) The number lies between -3 and -4. The unit part between -3 and -4 is divided into 3 equal parts and the second part is taken.

$$\therefore \text{The required number is } -3\frac{2}{3} = -\frac{11}{3}.$$

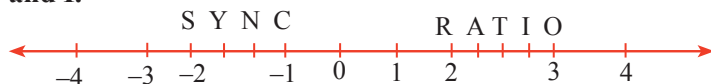
(ii) The required number lies between 0 and -1. The unit part between 0 and -1 is divided into 5 equal parts, and the second part is taken.

$$\therefore \text{The required number is } -\frac{2}{5}$$

- (iii) The required number lies between 1 and 2. The unit part between 1 and 2 is divided into 4 equal parts and the third part is taken.

$$\therefore \text{The required number is } 1\frac{3}{4} = \frac{7}{4}$$

4. The points S, Y, N, C, R, A, T, I and O on the number line are such that $CN=NY=YS$ and $RA=AT=TI=IO$. Find the rational numbers represented by the letters Y, N, A, T and I.



Sol.

$$Y = -2 + \frac{1}{3} = \frac{-6+1}{3} = \frac{-5}{3}$$

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

$$RA = AT = TI = IO = \frac{1}{4}$$

$$A = 2 + \frac{1}{4} = \frac{8+1}{4} = \frac{9}{4}$$

$$T = \frac{9}{4} + \frac{1}{4} = \frac{9+1}{4} = \frac{10}{4}$$

$$I = \frac{10}{4} + \frac{1}{4} = \frac{10+1}{4} = \frac{11}{4}$$

5. Draw the number line and represent the following rational numbers on it.

(i) $\frac{9}{4}$

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

(iii) $\frac{-17}{5}$

(iv) $\frac{15}{-4}$

Sol.

(i) $\frac{9}{4} = 2\frac{1}{4}$

$\therefore \frac{9}{4}$ lies between 2 and 3.



(ii) $\frac{-8}{3} = -2\frac{2}{3}$

$-2\frac{2}{3}$ lies between -2 and -3.

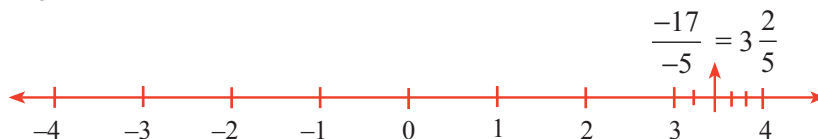
$$-2\frac{2}{3} = \frac{-8}{3}$$



(QY-2023)

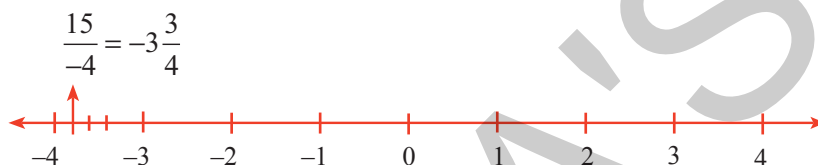
(iii) $\frac{-17}{-5} = 3\frac{2}{5}$

$3\frac{2}{5}$ lies between 3 and 4 in the number line.



(iv) $\frac{15}{-4} = -3\frac{3}{4}$

$-3\frac{3}{4}$ lies between -3 and -4.



6. Write the decimal form of the following rational numbers.

(i) $\frac{1}{11}$

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

(iii) $\frac{-18}{7}$

(iv) $1\frac{2}{5}$

(v) $-3\frac{1}{2}$

Sol. (i) $\frac{1}{11} = 0.0909\dots$

$$\begin{array}{r} 0.0909 \\ 11 \overline{) 100} \\ \underline{99} \\ 100 \\ \underline{99} \\ 1 \end{array}$$

(ii) $\frac{13}{4} = 3.25$

$$\begin{array}{r} 3.25 \\ 4 \overline{) 13} \\ \underline{12} \\ 10 \\ \underline{8} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

$$(iii) \quad \frac{-18}{7} = -2.571428571428...$$

$$\begin{array}{r} 2.571428 \\ 7 \overline{) 18} \\ \underline{14} \\ 40 \\ \underline{35} \\ 50 \\ \underline{49} \\ 10 \\ \underline{7} \\ 30 \\ \underline{28} \\ 20 \\ \underline{14} \\ 60 \\ \underline{56} \\ 4 \end{array}$$

$$(iv) \quad 1\frac{2}{5} = \frac{7}{5} = 1.4$$

(HY-2023)

$$\begin{array}{r} 1.4 \\ 5 \overline{) 7} \\ \underline{5} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

$$(v) \quad -3\frac{1}{2} = -\frac{7}{2} = -3.5$$

$$\begin{array}{r} 3.5 \\ 2 \overline{) 7} \\ \underline{6} \\ 10 \\ \underline{10} \\ 0 \end{array}$$

7. List any five rational numbers between the given rational numbers.

$$(i) \quad -2 \text{ and } 0 \quad (ii) \quad \frac{-1}{2} \text{ and } \frac{3}{5} \quad (iii) \quad \frac{1}{4} \text{ and } \frac{7}{20} \quad (iv) \quad \frac{-6}{4} \text{ and } \frac{-23}{10}$$

Sol. (i) -2 and 0

$$\text{i.e. } \frac{-2}{1} \text{ and } \frac{0}{1}$$

$$\frac{-2}{1} = \frac{-2 \times 10}{1 \times 10} = \frac{-20}{10}$$

$$\frac{0}{1} = \frac{0 \times 10}{1 \times 10} = \frac{0}{10}$$

$\therefore$ Five rational numbers between $\frac{-20}{10} (= -2)$ and $\frac{0}{10} (= 0)$ are

$$\frac{-20}{10}, \frac{-19}{10}, \frac{-18}{10}, \frac{-7}{10}, \frac{-6}{10}, \frac{-5}{10}, \frac{0}{10} (= 0).$$

$$(ii) \quad \frac{-1}{2} \text{ and } \frac{3}{5}$$

$$\text{LCM of } 2 \text{ and } 5 = 2 \times 5 = 10$$

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

$$\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10}$$

∴ Five rational numbers between $\frac{-1}{2} (= \frac{-5}{10})$ and $\frac{3}{5} (= \frac{6}{10})$ are $\frac{-3}{10}, \frac{-1}{10}, 0, \frac{1}{10}, \frac{2}{10}, \frac{5}{10}$

(iii) $\frac{1}{4}$ and $\frac{7}{20}$

$$\frac{1}{4} = \frac{1 \times 15}{4 \times 15} = \frac{15}{60}$$

$$\frac{7}{20} = \frac{7 \times 3}{20 \times 3} = \frac{21}{60}$$

∴ Five rational numbers between $\frac{1}{4} (= \frac{15}{60})$ and $\frac{7}{20} (= \frac{21}{60})$ are $\frac{16}{60}, \frac{17}{60}, \frac{18}{60}, \frac{19}{60}, \frac{20}{60}$

(iv) $\frac{-6}{4}$ and $\frac{-23}{10}$

$$\frac{-6}{4} = \frac{-6 \times 5}{4 \times 5} = \frac{-30}{20}$$

$$\frac{-23}{10} = \frac{-23 \times 2}{10 \times 2} = \frac{-46}{20}$$

∴ Five rational numbers between $\frac{-6}{4} (= \frac{-30}{20})$ and $\frac{-23}{10} (= \frac{-46}{20})$ are $\frac{-31}{20}, \frac{-32}{20}, \frac{-33}{20}, \frac{-34}{20}, \frac{-35}{20}$.

8. Use the method of averages to write 2 rational numbers between $\frac{14}{5}$ and $\frac{16}{3}$.

Sol. The average of a and b is $\frac{1}{2}(a+b)$

The average of $\frac{14}{5}$ and $\frac{16}{3}$ is $C_1 = \frac{1}{2} \left(\frac{14}{5} + \frac{16}{3} \right)$

$$C_1 = \frac{1}{2} \left(\frac{42+80}{15} \right)$$

$$C_1 = \frac{122}{30}$$

$$C_1 = \frac{61}{15}$$

$$\therefore \frac{14}{5} < \frac{61}{15} < \frac{16}{3} \quad \dots(1)$$

The average of $\frac{14}{5}$ and $\frac{61}{15}$ is $C_2 = \frac{1}{2} \left(\frac{14}{5} + \frac{61}{15} \right)$

$$C_2 = \frac{1}{2} \times \left(\frac{42+61}{15} \right)$$

$$C_2 = \frac{1}{2} \times \frac{103}{15} = \frac{103}{30}$$

$$\therefore \frac{14}{5} < \frac{103}{30} < \frac{61}{15} \quad \dots(2)$$

From (1), (2) we get, $\frac{14}{5} < \frac{103}{30} < \frac{61}{15} < \frac{16}{3}$

9. Compare the following pairs of rational numbers.

(i) $\frac{-11}{5}, \frac{-21}{8}$ (ii) $\frac{3}{-4}, \frac{-1}{2}$ (iii) $\frac{2}{3}, \frac{4}{5}$

Sol. (i) $\frac{-11}{5}, \frac{-21}{8}$

LCM of 5, 8 is 40

$$\frac{-11}{5} = \frac{-11 \times 8}{5 \times 8} = \frac{-88}{40}$$

$$\frac{-21}{8} = \frac{-21 \times 5}{8 \times 5} = \frac{-105}{40}$$

$$\frac{-105}{40} < \frac{-88}{40}$$

$$\therefore \frac{-21}{8} < \frac{-11}{5}$$

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

LCM of 4 and 2 = 4

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

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

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

$$\therefore \frac{3}{-4} < \frac{-1}{2}$$

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

LCM of 3 and 5 is 15.

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

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

$$\frac{10}{15} < \frac{12}{15}$$

$$\therefore \frac{2}{3} < \frac{4}{5}$$

(April-2023)

10. Arrange the following rational numbers in ascending and descending order.

(i) $\frac{-5}{12}, \frac{-11}{8}, \frac{-15}{24}, \frac{-7}{9}, \frac{12}{36}$ (April-2024) (ii) $\frac{-17}{10}, \frac{-7}{5}, 0, \frac{-2}{4}, \frac{-19}{20}$ (HY-2023)

Sol. (i) $\frac{-5}{12}, \frac{-11}{8}, \frac{-15}{24}, \frac{-7}{9}, \frac{12}{36}$

LCM of 12, 8, 24, 9, 36 is $4 \times 3 \times 2 \times 3 = 72$

$$\begin{aligned}\frac{-5}{12} &= \frac{-5 \times 6}{12 \times 6} = \frac{-30}{72} \\ \frac{-11}{8} &= \frac{-11 \times 9}{8 \times 9} = \frac{-99}{72} \\ \frac{-15}{24} &= \frac{-15 \times 3}{24 \times 3} = \frac{-45}{72} \\ \frac{-7}{9} &= \frac{7 \times 8}{9 \times 8} = \frac{56}{72} \\ \frac{12}{36} &= \frac{12 \times 2}{36 \times 2} = \frac{24}{72}\end{aligned}$$

Now comparing the numerators $-30, -99, -45, 56, 24$ we get $56 > 24 > -30 > -45 > -99$

i.e. $\frac{56}{72} > \frac{24}{72} > \frac{-30}{72} > \frac{-45}{72} > \frac{-99}{72}$ and so $\frac{-7}{9} > \frac{12}{36} > \frac{-5}{12} > \frac{-15}{24} > \frac{-11}{8}$

∴ Descending order $\frac{-7}{9} > \frac{12}{36} > \frac{-5}{12} > \frac{-15}{24} > \frac{-11}{8}$

∴ Ascending order $\frac{-11}{8} < \frac{-15}{24} < \frac{-5}{12} < \frac{12}{36} < \frac{-7}{9}$

(ii) $\frac{-17}{10}, \frac{-7}{5}, 0, \frac{-2}{4}, \frac{-19}{20}$ (QY-2023)

LCM of 10, 5, 4, 20 is $5 \times 2 \times 2 = 20$

$$\begin{aligned}\frac{-17}{10} &= \frac{-17 \times 2}{10 \times 2} = \frac{-34}{20} \\ \frac{-7}{5} &= \frac{-7 \times 4}{5 \times 4} = \frac{-28}{20} \\ \frac{-2}{4} &= \frac{-2 \times 5}{4 \times 5} = \frac{-10}{20} \\ \frac{-19}{20} &= \frac{-19}{20}\end{aligned}$$

Negative numbers are less than zero.

∴ Arranging the numerators we get $-34 < -28 < -19 < -10 < 0$

∴ $\frac{-34}{20} < \frac{-28}{20} < \frac{-19}{20} < \frac{-10}{20} < 0$

∴ Ascending order = $\frac{-17}{10} < \frac{-7}{5} < \frac{-19}{20} < \frac{-2}{4} < 0$

∴ Descending order = $0 > \frac{-2}{4} > \frac{-19}{20} > \frac{-7}{5} > \frac{-17}{10}$

Hint:

4	12, 8, 24, 9, 36
3	3, 2, 6, 9, 9
2	1, 2, 2, 3, 3
3	1, 1, 1, 3, 3
	1, 1, 1, 1, 1

Hint:

5	10, 5, 4, 20
2	2, 1, 4, 4
2	1, 1, 2, 2
	1, 1, 1, 1

OBJECTIVE TYPE QUESTIONS

11. The number which is subtracted from $\frac{-6}{11}$ to get $\frac{8}{9}$ is _____.

(A) $\frac{34}{99}$

(B) $\frac{-142}{99}$

(C) $\frac{142}{99}$

(D) $\frac{-34}{99}$

Hint:

[Ans: (B) $\frac{-142}{99}$]Let x be the number to be subtracted

$$\frac{-6}{11} - x = \frac{8}{9}$$

$$\frac{-6}{11} - \frac{8}{9} = x$$

$$x = \frac{(-6 \times 9) + (-8 \times 11)}{11 \times 9} = \frac{-54 + (-88)}{99} = \frac{-142}{99}$$

12. Which of the following pairs is equivalent?

(A) $\frac{-20}{12}, \frac{5}{3}$

(B) $\frac{16}{-30}, \frac{-8}{15}$

(C) $\frac{-18}{36}, \frac{-20}{44}$

(D) $\frac{7}{-5}, \frac{-5}{7}$

[Ans: (B) $\frac{16}{-30}, \frac{-8}{15}$]

Hint:

$$\frac{-20}{12} = \frac{-20 \div 4}{12 \div 4} = \frac{-5}{3} \neq \frac{5}{3}$$

$$\frac{16}{-30} = \frac{-16 \div 2}{30 \div 2} = \frac{-8}{15}$$

$$\frac{-18}{36} = \frac{-18 \div 9}{36 \div 9} = \frac{-2}{4} = \frac{-2 \times 11}{4 \times 11} = \frac{-22}{44} \neq \frac{-20}{44}$$

$$\frac{7}{-5} = \frac{-7 \times 7}{5 \times 7} = \frac{-49}{35}$$

$$\frac{-5}{7} = \frac{-5 \times 5}{7 \times 5} = \frac{-25}{35} \therefore \frac{-49}{35} \neq \frac{-25}{35}$$

$\therefore \frac{16}{-30}$ and $\frac{-8}{15}$ are equivalent fraction.

13. $\frac{-5}{4}$ is a rational number which lies between _____.

(April-2024)

(A) 0 and $\frac{-5}{4}$

(B) -1 and 0

(C) -1 and -2

(D) -4 and -5

[Ans: (C) -1 and -2]

Hint:

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

$\therefore \frac{-5}{4}$ lies between -1 and -2.

14. Which of the following rational numbers is the greatest?

(April-2025)

(A) $\frac{-17}{24}$

(B) $\frac{-13}{16}$

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

(D) $\frac{-31}{32}$

[Ans: (A) $\frac{-17}{24}$]

Hint: LCM of 24, 16, 8, 32 = $8 \times 2 \times 3 \times 2 = 96$

$$\frac{-17}{24} = \frac{-17 \times 4}{24 \times 4} = \frac{-68}{96}$$

$$\frac{-13}{16} = \frac{-13 \times 6}{16 \times 6} = \frac{-78}{96}$$

$$\frac{7}{-8} = \frac{-7 \times 12}{8 \times 12} = \frac{-84}{96}$$

$$\frac{-31}{32} = \frac{-31 \times 3}{32 \times 3} = \frac{-93}{96}$$

Arranging in ascending order $\left\{ \begin{array}{l} \frac{-93}{96} < \frac{-84}{96} < \frac{-78}{96} < \frac{-68}{96} \end{array} \right.$

$$\Rightarrow \frac{-31}{32} < \frac{7}{-8} < \frac{-13}{16} < \frac{-17}{24}$$

$\therefore \frac{-17}{24}$ is the greatest number.

8	24, 16, 8, 32
2	3, 2, 1, 4
3	3, 1, 1, 2
2	1, 1, 1, 2
	1, 1, 1, 1

15. The sum of the digits of the denominator in the simplest form of $\frac{112}{528}$ is ____.

(A) 4

(B) 5

(C) 6

(D) 7 **[Ans: (C) 6]**

Hint:

$$\frac{112}{528} = \frac{112 \div 8}{528 \div 8} = \frac{14}{66} = \frac{14 \div 2}{66 \div 2} = \frac{7}{33}$$

(April, QY -2023)

Sum of digits in the denominator = $3 + 3 = 6$



THINK

Page No. 15 & 16

Is zero a rational number? If so, what is its additive inverse?

Sol. Yes, zero is a rational number. Additive inverse of zero is zero.

What is the multiplicative inverse of 1 and -1?

Sol. Multiplicative inverse of 1 is 1 and -1 is -1.



TRY THESE

Page No. 16

Divide : (i) $\frac{-7}{3}$ by 5 (ii) 5 by $\frac{-7}{3}$ (iii) $\frac{-7}{3}$ by $\frac{35}{6}$

Sol. (i) $\frac{-7}{3} \div 5 = \frac{-7}{3} \div \frac{5}{1} = \frac{-7}{3} \times \frac{1}{5} = \frac{-7}{15}$

(ii) $5 \div \left(\frac{-7}{3}\right) = \frac{5}{1} \times \frac{3}{-7} = \frac{15}{-7} = -2\frac{1}{7}$

(iii) $\frac{-7}{3} \div \frac{35}{6} = \frac{-7}{3} \times \frac{6}{35} = \frac{-2}{5}$

Exercise 1.2

1. Fill in the blanks:

(i) The value of $\frac{-5}{12} + \frac{7}{15} =$ _____. [Ans: $\frac{1}{20}$]

(ii) The value of $\left(\frac{-3}{6}\right) \times \left(\frac{18}{-9}\right)$ is _____. [Ans: 1]

(iii) The value of $\left(\frac{-15}{23}\right) \div \left(\frac{30}{-46}\right)$ is _____. [Ans: 1]

(iv) The rational number _____ does not have a reciprocal. (April-2024) [Ans: 0]

(v) The multiplicative inverse of -1 is _____. [Ans: -1]

2. Say True or False.

(i) All rational numbers have an additive inverse. [Ans: True] (QY-2023)

(ii) The rational numbers that are equal to their additive inverses are 0 and -1 . [Ans: False]

(iii) The additive inverse of $\frac{-11}{-17}$ is $\frac{11}{17}$. [Ans: False]

(iv) The rational number which is its own reciprocal is -1 . [Ans: True] (April-2023)

(v) The multiplicative inverse exists for all rational numbers. [Ans: False]

3. Find the sum :

(i) $\frac{7}{5} + \frac{3}{5}$ (ii) $\frac{7}{5} + \frac{5}{7}$ (iii) $\frac{6}{5} + \left(\frac{-14}{15}\right)$ (iv) $-4\frac{2}{3} + 7\frac{5}{12}$

Sol. (i) $\frac{7}{5} + \frac{3}{5} = \frac{7+3}{5} = \frac{10}{5} = 2$

(ii) $\frac{7}{5} + \frac{5}{7} = \frac{(7 \times 7) + (5 \times 5)}{35} = \frac{49 + 25}{35} = \frac{74}{35}$

(iii) $\frac{6}{5} + \left(\frac{-14}{15}\right) = \frac{(6 \times 3) + (-14)}{15} = \frac{18 + (-14)}{5} = \frac{4}{5}$

(iv) $-4\frac{2}{3} + 7\frac{5}{12} = \frac{14}{3} + \frac{89}{12} = \frac{(-14 \times 4) + 89}{12} = \frac{-56 + 89}{12} = \frac{33}{12} = \frac{11}{4} = 2\frac{3}{4}$

4. Subtract : $\frac{-8}{44}$ from $\frac{-17}{11}$.

Sol. $\frac{-17}{11} - \left(\frac{-8}{44}\right) = \frac{-17}{11} + \frac{8}{44} = \frac{(-17 \times 4) + 8}{44} = \frac{-68 + 8}{44} = \frac{-60}{44} = \frac{-15}{11}$

5. Evaluate : (i) $\frac{9}{132} \times \frac{-11}{3}$

(ii) $\frac{-7}{27} \times \frac{24}{-35}$

Sol. (i) $\frac{\cancel{9}^3}{\cancel{132}^{\cancel{44}_4}} \times \frac{-\cancel{11}}{\cancel{3}} = \frac{-1}{4}$

(ii) $\frac{-\cancel{7}}{\cancel{27}_9} \times \frac{\cancel{24}^8}{-\cancel{35}_5} = \frac{8}{45}$

6. Divide : (i) $\frac{-21}{5}$ by $\frac{-7}{-10}$

(ii) $\frac{-3}{13}$ by -3

(iii) -2 by $\frac{-6}{15}$

Sol. (i) $\frac{-21}{5} \div \frac{-7}{-10} = \frac{\cancel{-21}^3}{\cancel{5}} \times \frac{\cancel{10}^2}{\cancel{7}} = -6$

(QY, HY-2023)

(ii) $\frac{-3}{13} \div -3 = \frac{-3}{13} \times \frac{-1}{3} = \frac{-3 \times -1}{13 \times 3} = \frac{\cancel{3}^1}{\cancel{39}_{13}} = \frac{1}{13}$

(iii) $-2 \div \frac{-6}{15} = -2 \times \frac{15}{-6} = \frac{-2 \times 15}{-6} = \frac{\cancel{-30}^5}{\cancel{-6}} = 5$

7. Find $(a + b) \div (a - b)$ if (i) $a = \frac{1}{2}, b = \frac{2}{3}$ (ii) $a = \frac{-3}{5}, b = \frac{2}{15}$

Sol. (i) $a + b = \frac{1}{2} + \frac{2}{3} = \frac{(1 \times 3) + (2 \times 2)}{6} = \frac{3 + 4}{6} = \frac{7}{6}$

$a - b = \frac{1}{2} - \frac{2}{3} = \frac{(1 \times 3) - (2 \times 2)}{6} = \frac{3 - 4}{6} = \frac{-1}{6}$

$\therefore (a + b) \div (a - b) = \frac{7}{6} \div \frac{-1}{6} = \frac{7}{\cancel{6}} \times \frac{\cancel{6}}{-1} = -7$

(ii) $a + b = \frac{-3}{5} + \frac{2}{15} = \frac{(-3 \times 3) + 2}{15} = \frac{-9 + 2}{15} = \frac{-7}{15}$

$a - b = \frac{-3}{5} - \frac{2}{15} = \frac{(-3 \times 3) - 2}{15} = \frac{-9 - 2}{15} = \frac{-11}{15}$

$\therefore (a + b) \div (a - b) = \frac{-7}{15} \div \frac{-11}{15} = \frac{-7}{\cancel{15}} \times \frac{\cancel{15}}{-11} = \frac{7}{11}$

8. Simplify : $\frac{1}{2} + \left(\frac{3}{2} - \frac{2}{5} \right) \div \frac{3}{10} \times 3$ and show that it is a rational number between 11 and 12.

Sol. $\frac{1}{2} + \left(\frac{3}{2} - \frac{2}{5} \right) \div \frac{3}{10} \times 3 = \frac{1}{2} + \left(\frac{15 - 4}{10} \right) \div \frac{3}{10} \times 3 = \frac{1}{2} + \frac{11}{\cancel{10}} \times \frac{\cancel{10}}{\cancel{3}} \times \cancel{3}$
 $= \frac{1}{2} + 11 = 11\frac{1}{2} = \frac{23}{2}$

The average of 11 and 12 is $\frac{11 + 12}{2} = \frac{23}{2}$

$\Rightarrow \frac{23}{2}$ is a rational number between 11 and 12

9. Simplify :

$$(i) \left[\frac{11}{8} \times \left(\frac{-6}{33} \right) \right] + \left[\frac{1}{3} + \left(\frac{3}{5} \div \frac{9}{20} \right) \right] - \left[\frac{4}{7} \times \frac{-7}{5} \right] \quad (ii) \left[\frac{4}{3} \div \left(\frac{8}{-7} \right) \right] - \left[\frac{3}{4} \times \frac{4}{3} \right] + \left[\frac{4}{3} \times \left(\frac{-1}{4} \right) \right]$$

Sol. (i) $\left[\frac{11}{8} \times \left(\frac{-6}{33} \right) \right] + \left[\frac{1}{3} + \left(\frac{3}{5} \div \frac{9}{20} \right) \right] - \left[\frac{4}{7} \times \frac{-7}{5} \right] = \frac{11 \times (-6)}{8 \times 33} + \left[\frac{1}{3} + \left(\frac{3}{5} \times \frac{20}{9} \right) \right] - \left[\frac{4 \times -7}{7 \times 5} \right]$

$$= -\frac{1}{4} + \left[\frac{1}{3} + \frac{4}{3} \right] - \left(\frac{-4}{5} \right) = -\frac{1}{4} + \frac{5}{3} + \frac{4}{5} = \frac{-15 + 100 + 48}{60} = \frac{133}{60}$$

(ii) $\left[\frac{4}{3} \div \left(\frac{8}{-7} \right) \right] - \left[\frac{3}{4} \times \frac{4}{3} \right] + \left[\frac{4}{3} \times \left(\frac{-1}{4} \right) \right] = \left[\frac{4}{3} \times \frac{-7}{8} \right] - \left[\frac{3}{4} \times \frac{4}{3} \right] + \left[\frac{4 \times (-1)}{3 \times 4} \right]$

$$= \left(\frac{-7}{6} \right) - 1 + \left(\frac{-1}{3} \right) = \frac{-7 - 6 + (-2)}{6} = \frac{-15}{6} = \frac{-5}{2}$$

10. A student had multiplied a number by $\frac{4}{3}$ instead of dividing it by $\frac{4}{3}$ and got 70 more than the correct answer. Find the number.

Sol.

Let the number be a

$$\left(a \times \frac{4}{3} \right) - \left(a \div \frac{4}{3} \right) = 70$$

$$\left(a \times \frac{4}{3} \right) - \left(a \times \frac{3}{4} \right) = 70$$

$$a \left[\frac{4}{3} - \frac{3}{4} \right] = 70$$

$$a \left[\frac{4 \times 4 - 3 \times 3}{12} \right] = 70$$

$$a \left[\frac{16 - 9}{12} \right] = 70$$

$$a \left[\frac{7}{12} \right] = 70$$

$$a = 70 \times \frac{12}{7} = 120$$

$$a = 120$$

∴ The number is 120.

OBJECTIVE TYPE QUESTIONS

11. The standard form of the sum $\frac{3}{4} + \frac{5}{6} + \left(\frac{-7}{12} \right)$ is _____. (HY-2023)

- (A) 1 (B) $\frac{-1}{2}$ (C) $\frac{1}{12}$ (D) $\frac{1}{22}$ **[Ans: (A) 1]**

Hint:

$$\frac{3}{4} + \frac{5}{6} + \left(\frac{-7}{12} \right) = \frac{(3 \times 3) + (5 \times 2) + (-7)}{12} = \frac{9 + 10 + (-7)}{12} = \frac{19 - 7}{12} = \frac{12}{12} = 1$$

12. $\left(\frac{3}{4} - \frac{5}{8}\right) + \frac{1}{2} = \underline{\hspace{2cm}}.$

(A) $\frac{15}{64}$

(B) 1

(C) $\frac{5}{8}$

(D) $\frac{1}{16}$ [Ans: (C) $\frac{5}{8}$]

Hint:

$$\begin{aligned}\left(\frac{3}{4} - \frac{5}{8}\right) + \frac{1}{2} &= \left(\frac{(3 \times 2) - 5}{8}\right) + \frac{1}{2} = \frac{6-5}{8} + \frac{1}{2} = \frac{1}{8} + \frac{1}{2} \\ &= \frac{1+(1 \times 4)}{8} = \frac{1+4}{8} = \frac{5}{8}\end{aligned}$$

13. $\frac{3}{4} \div \left(\frac{5}{8} + \frac{1}{2}\right) = \underline{\hspace{2cm}}.$

(A) $\frac{13}{10}$

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

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

(D) $\frac{5}{8}$ [Ans: (B) $\frac{2}{3}$]

Hint:

$$\frac{3}{4} \div \left(\frac{5}{8} + \frac{1}{2}\right) = \frac{3}{4} \div \left(\frac{5+(1 \times 4)}{8}\right) = \frac{3}{4} \div \left(\frac{5+4}{8}\right) = \frac{3}{4} \div \frac{9}{8} = \frac{3}{4} \times \frac{8}{9} = \frac{2}{3}$$

14. $\frac{3}{4} \times \left(\frac{5}{8} \div \frac{1}{2}\right) = \underline{\hspace{2cm}}.$

(A) $\frac{5}{8}$

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

(C) $\frac{15}{32}$

(D) $\frac{15}{16}$ [Ans: (D) $\frac{15}{16}$]

Hint:

$$\frac{3}{4} \times \left(\frac{5}{8} \div \frac{1}{2}\right) = \frac{3}{4} \times \left(\frac{5}{8} \times \frac{2}{1}\right) = \frac{3}{4} \times \frac{5}{4} = \frac{3 \times 5}{4 \times 4} = \frac{15}{16}$$

15. Which of these rational numbers which have additive inverse?

(A) 7

(B) $-\frac{5}{7}$

(C) 0

(D) all of these

[Ans: (D) all of these]

Hint:

Additive inverse of 7 is -7.

Additive inverse of $-\frac{5}{7}$ is $\frac{5}{7}$.

Additive inverse of 0 is 0.



TRY THESE

Page No. 20

The closure property on integers holds for subtraction and not for division. What about rational numbers? Verify.

Sol. Let 0 and $\frac{1}{2}$ be two rational numbers. Then, $0 - \frac{1}{2} = -\frac{1}{2}$ is a rational number

∴ Closure property for subtraction holds for rational numbers.

But consider the two rational number $\frac{5}{2}$ and 0.

$$\frac{5}{2} \div 0 = \frac{5}{2 \times 0} = \frac{5}{0}$$

Here denominator = 0 and it is not a rational number.

∴ Closure property is not true for division of rational numbers.

Operations	Fill in the blanks in the table given below of properties of Integers. (If a, b, c are integers, then $-a, -b, -c$ are also integers)					
	Closure	Commutative	Associative	Identity	Inverse	Distributive
Addition	$a+b$ is in $\mathbb{Z}$ E.g. $5+(-3)=2$ $\Rightarrow 2$ is in $\mathbb{Z}$	$a+b=b+a$ E.g. $5+(-3)=(-3)+5$ $\Rightarrow 2=2$	$(a+b)+c$ $=a+(b+c)$ E.g. $(2+3)+(-4)=1$ $2+[3+(-4)]=1$	$a+0$ $=0+a=a$ E.g. $(-4)+0$ $=0+(-4)=-4$	$a+(-a)$ $=(-a)+a=0$ E.g. $5+(-5)$ $=(-5)+5=0$	$a \times (b+c)$ $= (a \times b) + (a \times c)$ E.g. $2 \times [3+(-5)] = -4$ $(2 \times 3) + [2 \times (-5)]$ $= 6-10 = -4$
Multiplication	ab is in $\mathbb{Z}$ E.g. $2 \times 3 = 6$ $\Rightarrow 6$ is in $\mathbb{Z}$	$a \times b = b \times a$ E.g. $2 \times 3 = 3 \times 2$ $\Rightarrow 6 = 6$	$(a \times b) \times c$ $= a \times (b \times c)$ E.g. $(2 \times 3) \times (-6) = -36$ $2 \times [3 \times (-6)] = -36$	$a \times 1$ $= 1 \times a = a$ E.g. $1 \times 7 = 7$ $7 \times 1 = 7$	Does not exist	Not Applicable
Subtraction	$a-b$ is in $\mathbb{Z}$ E.g. $7-2=5$ $\Rightarrow 5$ is in $\mathbb{Z}$	Fails $a-b \neq b-a$ E.g. $7-2 \neq 2-7$ $5 \neq -5$	Fails $(a-b)-c$ $\neq a-(b-c)$ E.g. $(7-2)-5 \neq 7-(2-5)$ $5-5 \neq 7-(-3)$ $0 \neq 10$	Fails $a-0 \neq 0-a$ E.g. $5-0 = 0-5$ $5 = -5$ $5 \neq -5$	Fails $a - (-a)$ $\neq (-a) - a$ E.g. $2 - (-2) = 4$ $(-2) - 2 = -4$ $4 \neq -4$	$a \times (b-c)$ $= (a \times b) - (a \times c)$ E.g. $7 \times (5-2)$ $(7 \times 5) - (7 \times 2)$ $= 35 - 14$ $= 21$ $7 \times (5-2) = 7 \times 3 = 21$
Division	Fails $a \div b$ is not in $\mathbb{Z}$ E.g. $3 \div 5 = \frac{3}{5}$ does not belong to $\mathbb{Z}$	Fails	Fails	Fails	Fails	Not applicable



TRY THESE

Page No. 22

(i) Is $\frac{3}{5} - \frac{7}{8} = \frac{7}{8} - \frac{3}{5}$?

Sol.

$$\text{LHS} = \frac{3}{5} - \frac{7}{8} = \frac{(3 \times 8) - (7 \times 5)}{40} = \frac{24 - 35}{40} = \frac{-11}{40}$$

$$\text{RHS} = \frac{7}{8} - \frac{3}{5} = \frac{(7 \times 5) - (3 \times 8)}{40} = \frac{35 - 24}{40} = \frac{11}{40}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

$$\therefore \frac{3}{5} - \frac{7}{8} \neq \frac{7}{8} - \frac{3}{5}$$

$\therefore$ Subtraction of rational numbers is not commutative.

(ii) Is $\frac{3}{5} \div \frac{7}{8} = \frac{7}{8} \div \frac{3}{5}$? So, what do you conclude?

Sol.

$$\text{LHS} = \frac{3}{5} \div \frac{7}{8} = \frac{3}{5} \times \frac{8}{7} = \frac{24}{35}$$

$$\text{RHS} = \frac{7}{8} \div \frac{3}{5} = \frac{7}{8} \times \frac{5}{3} = \frac{35}{24}$$

$$\Rightarrow \text{LHS} \neq \text{RHS}$$

$$\therefore \frac{3}{5} \div \frac{7}{8} \neq \frac{7}{8} \div \frac{3}{5}$$

$\therefore \Rightarrow$ Commutative property does not hold good for division of rational numbers.

Check whether associative property holds for subtraction and division.

Sol. Consider the rational numbers $\frac{2}{3}, \frac{1}{2}$ and $\frac{3}{4}$

$$\text{To verify } \left(\frac{2}{3} - \frac{1}{2} \right) - \frac{3}{4} = \frac{2}{3} - \left(\frac{1}{2} - \frac{3}{4} \right)$$

$$\begin{aligned} \text{LHS} &= \left(\frac{2}{3} - \frac{1}{2} \right) - \frac{3}{4} = \left(\frac{(2 \times 2) - (1 \times 3)}{6} \right) - \frac{3}{4} \\ &= \left(\frac{4 - 3}{6} \right) - \frac{3}{4} = \frac{1}{6} - \frac{3}{4} = \frac{(1 \times 2) - (3 \times 3)}{12} = \frac{2 - 9}{12} = \frac{-7}{12} \end{aligned}$$

$$\begin{aligned} \text{RHS} &= \frac{2}{3} - \left(\frac{1}{2} - \frac{3}{4} \right) = \frac{2}{3} - \left(\frac{2 - 3}{4} \right) = \left(\frac{2}{3} - \left(\frac{-1}{4} \right) \right) \\ &= \frac{2}{3} + \frac{1}{4} = \frac{(2 \times 4) + (1 \times 3)}{12} = \frac{8 + 3}{12} = \frac{11}{12} \end{aligned}$$

$$\text{LHS} \neq \text{RHS}$$

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

$\therefore$ Associative property not holds for subtraction of rational numbers

$$\text{Also to verify } \left(\frac{2}{3} \div \frac{1}{2} \right) \div \frac{3}{4} = \frac{2}{3} \div \left(\frac{1}{2} \div \frac{3}{4} \right)$$

$$\begin{aligned}\text{LHS} &= \left(\frac{2}{3} \div \frac{1}{2}\right) \div \frac{3}{4} = \left(\frac{2}{3} \times \frac{2}{1}\right) \div \frac{3}{4} \\ &= \frac{4}{3} \div \frac{3}{4} = \frac{4}{3} \times \frac{4}{3} = \frac{16}{9}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= \frac{2}{3} \div \left(\frac{1}{2} \div \frac{3}{4}\right) = \frac{2}{3} \div \left(\frac{1}{2} \times \frac{4}{3}\right) = \frac{2}{3} \div \left(\frac{2}{3}\right) \\ &= \frac{2}{3} \times \frac{3}{2} = 1\end{aligned}$$

$$\text{LHS} \neq \text{RHS}$$

$$\text{i.e.} \quad \left(\frac{2}{3} \div \frac{1}{2}\right) \div \frac{3}{4} \neq \frac{2}{3} \div \left(\frac{1}{2} \div \frac{3}{4}\right)$$

∴ Associative property does not hold good for division of rational numbers.

Exercise 1.3

1. Verify the closure property for addition and multiplication for the rational numbers

$$\frac{-5}{7} \text{ and } \frac{8}{9}.$$

Sol. Closure property for addition.

Let $a = \frac{-5}{7}$ and $b = \frac{8}{9}$ be the given rational numbers.

$$\begin{aligned}a + b &= \frac{-5}{7} + \frac{8}{9} \\ &= \frac{(-5 \times 9) + (8 \times 7)}{7 \times 9} \\ &= \frac{-45 + 56}{63} = \frac{11}{63} \text{ is in } \mathbb{Q}.\end{aligned}$$

$$\text{i.e.} \quad a + b = \frac{-5}{7} + \frac{8}{9} = \frac{11}{63} \text{ is in } \mathbb{Q}.$$

∴ Closure property is true for addition of rational numbers.

Closure property for multiplication

$$\begin{aligned}\text{Let } a &= \frac{-5}{7} \text{ and } b = \frac{8}{9} \\ a \times b &= \frac{-5}{7} \times \frac{8}{9} = \frac{-40}{63} \text{ is in } \mathbb{Q}.\end{aligned}$$

∴ Closure property is true for multiplication of rational numbers.

2. Verify the commutative property for addition and multiplication for the rational numbers $\frac{-10}{11}$ and $\frac{-8}{33}$.

Sol. Let $a = \frac{-10}{11}$ and $b = \frac{-8}{33}$ be the given rational numbers.

$$\begin{aligned}\text{Now } a + b &= \frac{-10}{11} + \left(\frac{-8}{33}\right) = \frac{(-10 \times 3) + (-8 \times 1)}{33} = \frac{-30 + (-8)}{33} \\ \therefore a + b &= \frac{-38}{33} \quad \dots(1)\end{aligned}$$

$$\begin{aligned}b + a &= \frac{-8}{33} + \left(\frac{-10}{11}\right) = \frac{(-8 \times 1) + ((-10) \times 3)}{33} = \frac{-8 + (-30)}{33} \\ \therefore b + a &= \frac{-38}{33} \quad \dots(2)\end{aligned}$$

From (1) and (2)

$a + b = b + a$ and hence addition is commutative for rational numbers.

$$\begin{aligned}\text{Further } a \times b &= \frac{-10}{11} \times \left(\frac{-8}{33}\right) = \frac{80}{363} \\ \therefore a \times b &= \frac{80}{363} \quad \dots(3)\end{aligned}$$

$$\begin{aligned}b \times a &= \frac{-8}{33} \times \left(\frac{-10}{11}\right) = \frac{80}{363} \\ \therefore b \times a &= \frac{80}{363} \quad \dots(4)\end{aligned}$$

From (3) and (4) $a \times b = b \times a$

Hence multiplication is commutative for rational numbers.

3. Verify the associative property for addition and multiplication for the rational numbers $\frac{-7}{9}$, $\frac{5}{6}$ and $\frac{-4}{3}$.

Sol. Let $a = \frac{-7}{9}$, $b = \frac{5}{6}$, $c = \frac{-4}{3}$ be the given rational numbers.

$$\begin{aligned}(a + b) + c &= \left(\frac{-7}{9} + \frac{5}{6}\right) + \left(\frac{-4}{3}\right) = \left(\frac{(-7 \times 2) + (5 \times 3)}{18}\right) + \left(\frac{-4}{3}\right) \\ &= \left(\frac{-14 + 15}{18}\right) + \left(\frac{-4}{3}\right) = \frac{1}{18} + \left(\frac{-4}{3}\right) \\ &= \frac{1 + ((-4) \times 6)}{18} = \frac{1 + (-24)}{18} = \frac{-23}{18} \quad \dots(1)\end{aligned}$$

$$\begin{aligned}a + (b + c) &= \frac{-7}{9} + \left(\frac{5}{6} + \frac{-4}{3}\right) = \frac{-7}{9} + \left(\frac{5 + ((-4) \times 2)}{6}\right) \\ &= \frac{-7}{9} + \left(\frac{5 + (-8)}{6}\right) = \frac{-7}{9} + \left(\frac{-3}{6}\right) = \frac{-7}{9} + \left(\frac{-1}{2}\right) \\ &= \frac{(-7 \times 2) + ((-1) \times 9)}{18} = \frac{-14 + (-9)}{18} = \frac{-23}{18} \quad \dots(2)\end{aligned}$$

From (1) and (2), $(a + b) + c = a + (b + c)$ is true for rational numbers.

$$\begin{aligned} \text{Now } (a \times b) \times c &= \left(\frac{-7}{9} \times \frac{5}{6} \right) \times \left(\frac{-4}{3} \right) = \left(\frac{-7 \times 5}{9 \times 6} \right) \times \left(\frac{-4}{3} \right) \\ &= \frac{-35}{54} \times \frac{-4}{3} = \frac{-35 \times \cancel{4}^2}{\cancel{54}^{27} \times 3} = \frac{70}{81} \end{aligned} \quad \dots (3)$$

$$\begin{aligned} a \times (b \times c) &= \frac{-7}{9} \times \left(\frac{5}{\cancel{6}_3} \times \frac{\cancel{4}^2}{3} \right) = \frac{-7}{9} \times \frac{5 \times (-2)}{3 \times 3} \\ &= \frac{-7}{9} \times \frac{(-10)}{9} = \frac{70}{81} \end{aligned} \quad \dots (4)$$

From (3) and (4) $(a \times b) \times c = a \times (b \times c)$ is true for rational numbers.

Thus associative property holds true for addition and multiplication for the rational numbers.

4. Verify the distributive property $a \times (b + c) = (a \times b) + (a \times c)$ for the rational numbers

$a = \frac{-1}{2}, b = \frac{2}{3}$ and $c = \frac{-5}{6}$.

Sol. Given the rational number $a = \frac{-1}{2}$; $b = \frac{2}{3}$ and $c = \frac{-5}{6}$

$$\begin{aligned} a \times (b + c) &= \frac{-1}{2} \times \left(\frac{2}{3} + \left(\frac{-5}{6} \right) \right) = \frac{-1}{2} \times \left(\frac{(2 \times 2) + (-5 \times 1)}{6} \right) \\ &= \frac{-1}{2} \times \left(\frac{4 + (-5)}{6} \right) = \frac{-1}{2} \times \left(\frac{-1}{6} \right) \\ a \times (b + c) &= \frac{1}{12} \end{aligned} \quad \dots (1)$$

$$\begin{aligned} (a \times b) + (a \times c) &= \left(\frac{-1}{2} \times \frac{2}{3} \right) + \left(\frac{-1}{2} \times \left(\frac{-5}{6} \right) \right) \\ &= \frac{-2}{6} + \frac{5}{12} = \frac{(-2 \times 2) + (5 \times 1)}{12} = \frac{-4 + 5}{12} \\ (a \times b) + (a \times c) &= \frac{1}{12} \end{aligned} \quad \dots (2)$$

From (1) and (2) we have $a \times (b + c) = (a \times b) + (a \times c)$.

Hence multiplication is distributive over addition for rational numbers.

5. Verify the identity property for addition and multiplication for the rational numbers $\frac{15}{19}$ and $\frac{-18}{25}$.

Sol.

$$\begin{aligned} \frac{15}{19} + 0 &= \frac{15}{19} + \frac{0}{19} = \frac{15+0}{19} = \frac{15}{19} \\ \frac{-18}{25} + 0 &= \frac{-18}{25} + \frac{0}{25} = \frac{-18+0}{25} = \frac{-18}{25} \end{aligned}$$

Identify property for addition of rational numbers are verified.

$$\frac{15}{19} \times 1 = \frac{15 \times 1}{19} = \frac{15}{19}; \quad \frac{-18}{25} \times 1 = \frac{-18 \times 1}{25} = \frac{-18}{25}$$

Identify property for multiplication of rational numbers are verified.

6. Verify the additive and multiplicative inverse property for the rational numbers $\frac{-7}{17}$ and $\frac{17}{27}$.

Sol.

$$\frac{-7}{17} + \frac{7}{17} = \frac{-7+7}{17} = \frac{0}{17} = 0$$

$$\frac{17}{27} + \left(-\frac{17}{27}\right) = \frac{17+(-17)}{27} = \frac{0}{27} = 0$$

∴ Additive inverse for rational numbers are verified.

$$\frac{-7}{17} \times \frac{17}{-7} = \frac{\cancel{-7} \times \cancel{17}}{\cancel{17} \times (\cancel{-7})} = 1$$

$$\frac{17}{27} \times \frac{27}{17} = \frac{\cancel{17} \times \cancel{27}}{\cancel{27} \times \cancel{17}} = 1$$

∴ Multiplicative inverse for rational numbers are verified.

OBJECTIVE TYPE QUESTIONS

7. Closure property is not true for division of rational numbers because of the number (QY-2023)
- (A) 1 (B) -1 (C) 0 (D) $\frac{1}{2}$ **[Ans: (C) 0]**
8. $\frac{1}{2} - \left(\frac{3}{4} - \frac{5}{6}\right) \neq \left(\frac{1}{2} - \frac{3}{4}\right) - \frac{5}{6}$ illustrates that subtraction does not satisfy the _____ property for rational numbers.
- (A) commutative (B) closure (C) distributive (D) associative **[Ans: (D) associative]**
9. Which of the following illustrates the inverse property for addition?
- (A) $\frac{1}{8} - \frac{1}{8} = 0$ (B) $\frac{1}{8} + \frac{1}{8} = \frac{1}{4}$ (C) $\frac{1}{8} + 0 = \frac{1}{8}$ (D) $\frac{1}{8} - 0 = \frac{1}{8}$ **[Ans: (A) $\frac{1}{8} - \frac{1}{8} = 0$]**
10. $\frac{3}{4} \times \left(\frac{1}{2} - \frac{1}{4}\right) = \frac{3}{4} \times \frac{1}{2} - \frac{3}{4} \times \frac{1}{4}$ illustrates that multiplication is distributive over.
- (A) addition (B) subtraction (C) multiplication (D) division **[Ans: (B) subtraction]**

THINK

Page No. 25

1. Observe that, $\frac{1}{1.2} + \frac{1}{2.3} = \frac{2}{3}$; $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} = \frac{3}{4}$; $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \frac{1}{4.5} = \frac{4}{5}$. Use your reasoning skills, to find the sum of the first 7 numbers in the pattern given above.

Sol. $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \frac{1}{4.5} + \frac{1}{5.6} + \frac{1}{6.7} + \frac{1}{7.8} = \frac{7}{8}$

? THINK

Page No. 26

1. Is the square of a prime number, prime?

Sol. No, the square of a prime number 'P' has at least 3 divisors 1, P and P^2 . But a prime number is a number which has only two divisors, 1 and the number itself. So square of a prime number is not prime.

2. Will the sum of two perfect squares always be a perfect square? What about their difference and their product?

Sol. The sum of two perfect squares, need not be always a perfect square. Also the difference of two perfect squares need not be always a perfect square. But the product of two perfect square is a perfect square.

**TRY THESE**

Page No. 26

1. Which among 256, 576, 960, 1025, 4096 are perfect square numbers? (Hint: Try to extend the table of squares already seen).

Sol.

$$\begin{aligned} 256 &= (16)^2 \\ 576 &= (24)^2 \\ 4096 &= (64)^2 \end{aligned}$$

∴ 256, 576 and 4096 are perfect squares

2. One can judge just by look, that each of the following numbers 82, 113, 1972, 2057, 8888, 24353 is not a perfect square. Explain why?

Sol. Because the unit digit of a perfect square will be 0, 1, 4, 5, 6, 9. But the given numbers have unit digits 2, 3, 7, 8. So they are not perfect squares.

? THINK

Page No. 27

1. Consider the claim: "Between the squares of the consecutive numbers n and (n+1), there are 2n non-square numbers". Can it be true? How many non-square numbers are there between 2500 and 2601? Verify the claim.

Sol. If $n = 50 \Rightarrow n^2 = (50)^2 = 2500$

$$n + 1 = 51 \Rightarrow (n + 1)^2 = (51)^2 = 2601$$

$$\text{Non-square numbers of } 2500 \text{ and } 2601 = 100 = 2 \times 50 = 2n$$

So it is true that between the classes of successive numbers n , $n + 1$, there are non-square numbers of $2n$.

? THINK

Page No. 29

1. In this case, if we want to find the smallest factor with which we can multiply or divide 108 to get a square number, what should we do?

Sol. $108 = 2 \times 2 \times 3 \times 3 \times 3 = 2^2 \times 3^2 \times 3$

If we multiply the factors by 3, then we get

$$2^2 \times 3^2 \times 3 \times 3 \Rightarrow 2^2 \times 3^2 \times 3^2 = (2 \times 3 \times 3)^2$$

Which is perfect square.

∴ Again if we divide by 3 then we get $2^2 \times 3^2 \Rightarrow (2 \times 3)^2$, a perfect square.

∴ We have to multiply or divide 108 by 3 to get a perfect square.

2	108
2	54
3	27
3	9
3	3
1	



TRY THESE

Page No. 32

Find the square root by long division method.

(1) 400

(2) 1764

(3) 9801

Sol. (1) 400

$$\begin{array}{r}
 \textcircled{2} \quad 0 \\
 \times 2 \quad \begin{array}{r} 2 \overline{) 400} \\ \underline{4} \\ 0 \\ \underline{0} \\ 0 \\ \underline{0} \\ 0 \end{array} \\
 \hline
 \end{array}$$

$\sqrt{400} = 20$

(2) 1764

$$\begin{array}{r}
 \textcircled{4} \quad 2 \\
 \times 2 \quad \begin{array}{r} 4 \overline{) 1764} \\ \underline{8} \\ 17 \\ \underline{16} \\ 1 \\ \underline{1} \\ 0 \end{array} \\
 \hline
 \end{array}$$

$\sqrt{1764} = 42$

(3) 9801

$$\begin{array}{r}
 \textcircled{9} \quad 9 \\
 \times 2 \quad \begin{array}{r} 9 \overline{) 9801} \\ \underline{18} \\ 81 \\ \underline{81} \\ 0 \end{array} \\
 \hline
 \end{array}$$

$\sqrt{9801} = 99$



TRY THESE

Page No. 32

1. Without calculating the square root, guess the number of digits in the square root of the following numbers: (1) 14400 (2) 390625 (3) 100000000

Sol. (1) $\sqrt{14400} = \sqrt{1 \ 44 \ 00} = 3$ bars have used

$\therefore$ No. of digits in $\sqrt{14400} = 3$

(2) $\sqrt{390625} = \sqrt{39 \ 06 \ 25} = 3$ bars have used

$\therefore$ No. of digits in $\sqrt{390625} = 3$

(3) $\sqrt{100000000} = \sqrt{1 \ 00 \ 00 \ 00 \ 00} = 5$ bars have used

$\therefore$ No. of digits in $\sqrt{100000000} = 5$



TRY THESE

Page No. 33

1. Find the square root of

Sol. (1) 5.4756

$$\begin{array}{r}
 \textcircled{2} \ . \textcircled{3} \ 4 \\
 \times 2 \quad \begin{array}{r} 2 \overline{) 5.4756} \\ \underline{4} \\ 1 \\ \underline{1} \\ 0 \end{array} \\
 \hline
 \end{array}$$

$\therefore \sqrt{5.4756} = 2.34$

(2) 19.36

$$\begin{array}{r}
 \textcircled{4} \ . \ 4 \\
 \times 2 \quad \begin{array}{r} 4 \overline{) 19.36} \\ \underline{8} \\ 19 \\ \underline{16} \\ 3 \\ \underline{3} \\ 0 \end{array} \\
 \hline
 \end{array}$$

$\therefore \sqrt{19.36} = 4.4$

(3) 116.64

$$\begin{array}{r}
 \textcircled{1} \ 0 \ . \ 8 \\
 \times 2 \quad \begin{array}{r} 1 \overline{) 116.64} \\ \underline{1} \\ 16 \\ \underline{16} \\ 0 \end{array} \\
 \hline
 \end{array}$$

$\therefore \sqrt{116.64} = 10.8$

THINK

Page No. 33

Try to fill in the blanks using $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$.

$\sqrt{36} = 6$	$\sqrt{9} \times \sqrt{4}$ $= 3 \times 2 = 6$	Is $\sqrt{36} = \sqrt{9} \times \sqrt{4}$? Yes	$\sqrt{81} = 9$	$\sqrt{9} \times \sqrt{9}$ $= 3 \times 3 = 9$	Is $\sqrt{81} = \sqrt{9} \times \sqrt{9}$? Yes
$\sqrt{144} = 12$	$\sqrt{9} \times \sqrt{16}$ $= 3 \times 4 = 12$	Is $\sqrt{144} = \sqrt{9} \times \sqrt{16}$? Yes	$\sqrt{144} = 12$	$\sqrt{36} \times \sqrt{4}$ $= 6 \times 2 = 12$	Is $\sqrt{144} = \sqrt{36} \times \sqrt{4}$? Yes
$\sqrt{100} = 10$	$\sqrt{25} \times \sqrt{4}$ $= 5 \times 2 = 10$	Is $\sqrt{100} = \sqrt{25} \times \sqrt{4}$? Yes	$\sqrt{1225} = 35$	$\sqrt{25} \times \sqrt{49}$ $= 5 \times 7 = 35$	Is $\sqrt{1225} = \sqrt{25} \times \sqrt{49}$? Yes

TRY THESE

Page No. 34

Using this method, find the square root of the numbers 1.2321 and 11.9025.

Sol. (i) $\sqrt{1.2321} = \sqrt{\frac{12321}{10000}} = \frac{111}{100} = 1.11$

(ii) $\sqrt{11.9025} = \sqrt{\frac{119025}{10000}} = \frac{345}{100} = 3.45$

TRY THESE

Page No. 34

Write the numbers in ascending order (1) 4, $\sqrt{14}$, 5 (2) 7, $\sqrt{65}$, 8

- Sol.** (i) 4, $\sqrt{14}$, 5
Squaring all the numbers we get, 4^2 , $(\sqrt{14})^2$, $5^2 = 16, 14, 25$
 $\therefore$ Ascending order : 14, 16, 25
 $\therefore$ Ascending order : $\sqrt{14}$, 4, 5
- (ii) 7, $\sqrt{65}$, 8
Squaring 7, $\sqrt{65}$ and 8 we get, 7^2 , $(\sqrt{65})^2$, $8^2 = 49, 65, 64$
 $\therefore$ Ascending order : 49, 64, 65
 $\therefore$ Ascending order : 7, 8, $\sqrt{65}$

Exercise 1.4**1. Fill in the blanks:**

- (i) The ones digit in the square of 77 is _____. (April-2024) **[Ans: 9]**
- (ii) The number of non-square numbers between 24^2 and 25^2 is _____. **[Ans: 48]**
- (iii) The number of perfect square numbers between 300 and 500 is _____. **[Ans: 5]**
Hint: [$18^2 = 324$, $19^2 = 361$; $20^2 = 400$, $21^2 = 441$; $22^2 = 484$]
- (iv) If a number has 5 or 6 digits in it, then its square root will have _____ digits. **[Ans: 3]**
- (v) The value of $\sqrt{180}$ lies between integers _____ and _____. **[Ans: 13, 14]**
Hint: $\sqrt{180} = \sqrt{2 \times 2 \times 3 \times 3 \times 5} = 6\sqrt{5} = 6 \times 2.236 = 13.41$ (April-2023)
 $\therefore \sqrt{180}$ lies between 13 and 14

2. Say True or False:

- (i) When a square number ends in 6, its square root will have 6 in the unit's place. **[Ans: True]**
 (ii) A square number will not have odd number of zeros at the end. **[Ans: True]**
 (iii) The number of zeros in the square of 91000 is 9. **[Ans: False]**
 (iv) The square of 75 is 4925. **[Ans: False]**
 (v) The square root of 225 is 15. **[Ans: True] (HY-2023)**

3. Find the square of the following numbers.

(April-2023)

(i) 17**(ii) 203****(iii) 1098**

Sol. (i)
$$\begin{array}{r} 17 \times 17 \\ 119 \\ 17 \\ \hline 289 \end{array}$$

(ii)
$$\begin{array}{r} 203 \times 203 \\ 609 \\ 000 \\ 406 \\ \hline 41209 \end{array}$$

(iii)
$$\begin{array}{r} 1098 \times 1098 \\ 8784 \\ 9882 \\ 10980 \\ \hline 1205604 \end{array}$$

4. Examine if each of the following is a perfect square.**(i) 725****(ii) 190****(iii) 841****(iv) 1089****Sol.** (i) 725

$$725 = 5 \times 5 \times 29 = 5^2 \times 29$$

Here the second prime factor 29 does not have a pair.
Hence 725 is not a perfect square number.

(ii) 190

$$190 = 2 \times 5 \times 19$$

Here the factors 2, 5 and 19 does not have pairs.
Hence 190 is not a perfect square number.

(iii) 841

$$841 = 29 \times 29$$

$$\therefore \sqrt{841} = 29$$

Hence 841 is a perfect square

(iv) 1089

$$1089 = 3 \times 3 \times 11 \times 11$$

$$1089 = 3^2 \times 11^2$$

$$\sqrt{1089} = 3 \times 11 = 33$$

Hence 1089 is a perfect square

5	725
5	145
29	29
	1

2	190
5	95
	19

3	1089
3	363
11	121
	11

5. Find the square root by prime factorisation method.**(i) 144 (ii) 256 (iii) 784 (iv) 1156 (v) 4761 (vi) 9025****Sol.** (i) 144

$$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

$$\therefore \sqrt{144} = 2 \times 2 \times 3 = 12$$

2	144
2	72
2	36
2	18
3	9
	3