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Mathematics

8th Standard

Based on the New Syllabus and New Textbook

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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 for the year 2020-21.

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.

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CONTENTS

1 NUMBERS

POINTS TO REMEMBER

- A number that can be expressed in the form $\frac{a}{b}$ where a and b are integers and b≠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 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 & 4

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

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

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

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

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

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

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

Sol.

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

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

Hint:

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

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

Sol.

$$\frac{1}{8}-\left(\frac{1}{6}-\frac{1}{4}\right) = \frac{1}{8}-\left[\frac{(1\times 2)-(1\times 3)}{12}\right] = \frac{1}{8}-\left(\frac{2-3}{12}\right) = \frac{1}{8}-\left(-\frac{1}{12}\right) = \frac{1}{8}+\frac{1}{12} = \frac{(1\times 3)+(1\times 2)}{24} = \frac{3+2}{24} = \frac{5}{24}$$

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.

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

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

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

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

Sol. Let the total population = 1

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

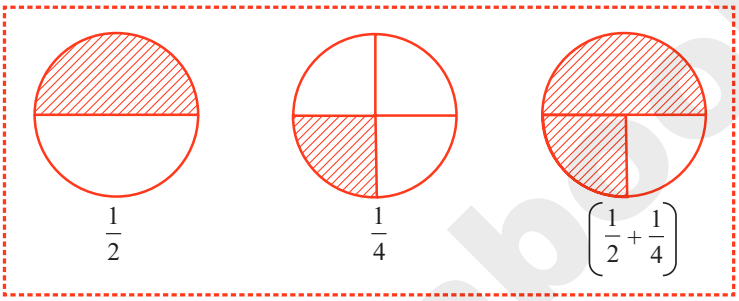
$$= 1 - \frac{7}{20} - \frac{1}{4} = \frac{20}{20} - \frac{7}{20} - \frac{5}{20}$$

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

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

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. 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. 4

Write the decimal forms of the following rational numbers.

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

$$\begin{array}{r|l} & 0.11 \\ 9 & 10 \\ & 9 \\ \hline & 10 \\ & 9 \\ \hline & 1 \end{array}$$

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

$$\begin{array}{r|l} & 3.25 \\ 4 & 13 \\ & 12 \\ \hline & 10 \\ & 8 \\ \hline & 20 \\ & 20 \\ \hline & 0 \end{array}$$

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

$$\begin{array}{r|l} & 2.6 \\ 5 & 13 \\ & 10 \\ \hline & 30 \\ & 30 \\ \hline & 0 \end{array}$$

TRY THESE Page No. 6

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

$$\frac{7}{3} = \frac{7\times3}{3\times3} = \frac{21}{9}$$
$$\frac{7}{3} = \frac{7\times7}{3\times7} = \frac{49}{21}$$
$$\frac{7}{3} = \frac{7\times(-3)}{3\times(-3)} = \frac{-21}{-9}$$
$$\therefore \frac{7}{3} = \frac{21}{9} = \frac{49}{21} = \frac{-21}{-9}$$

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

$$\frac{-2}{5} = \frac{-2\times2}{5\times2} = \frac{-4}{10}$$
$$\frac{-2}{5} = \frac{-2\times-3}{5\times-3} = \frac{6}{-15}$$
$$\frac{-2}{5} = \frac{-2\times4}{5\times4} = \frac{-8}{20}$$
$$\therefore \frac{-2}{5} = \frac{-4}{10} = \frac{6}{-15} = \frac{-8}{20}$$

TRY THESE Page No. 7

1. **Which of the following pairs represent equivalent rational numbers?**

(i) $\frac{-6}{4}, \frac{8}{-12}$ **(ii)** $\frac{-4}{-20}, \frac{1}{-5}$ **(iii)** $\frac{-12}{-17}, \frac{60}{85}$

(i) $\frac{-6}{4} = \frac{-6\times3}{4\times3} = \frac{-18}{12}$

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

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

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

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

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

2. **Find the standard form of**

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

(i) $\frac{36}{-96} = \frac{-36\div12}{96\div12} = \frac{-3}{8}$

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

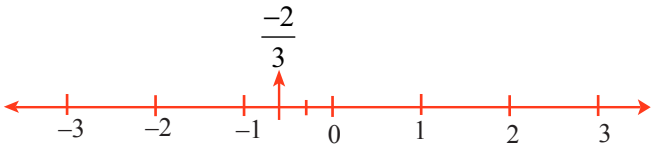
(iii) $\frac{27}{18} = 1\frac{9}{18} = 1\frac{1}{2}$

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

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

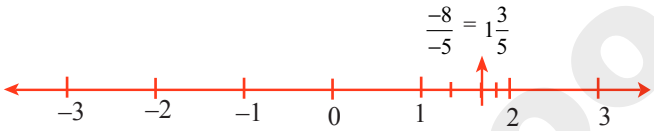
Sol. (i) $\frac{-2}{3}$ lies between 0 and –1.

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



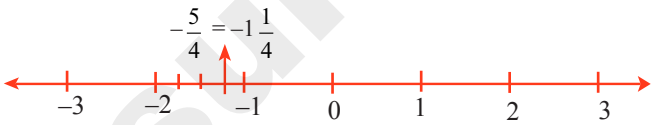
(ii) $\frac{-8}{-5} = 1\frac{3}{5}$

$1\frac{3}{5}$ 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.



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:* $\frac{-29}{39}$]**

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]**

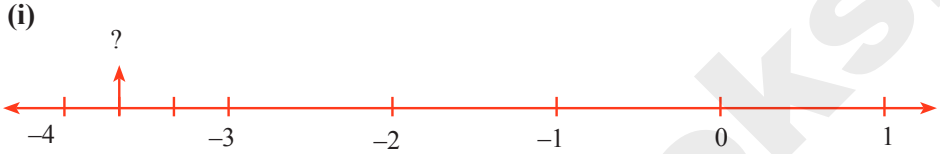
(iii) $\frac{-19}{5}$ is greater than $\frac{15}{-4}$ **[*Ans:* False]**

(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 line.**

(i)



(ii)

(iii)

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 asked.

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

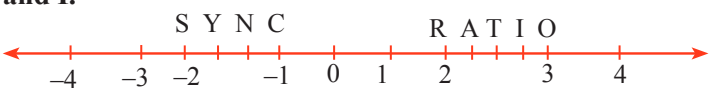
(ii) The required number lies between 0 and –1. The unit part between 0 and –1 is divided into 5 equal parts, and the second part is taken.

$\therefore$ 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.

$\therefore$ 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.

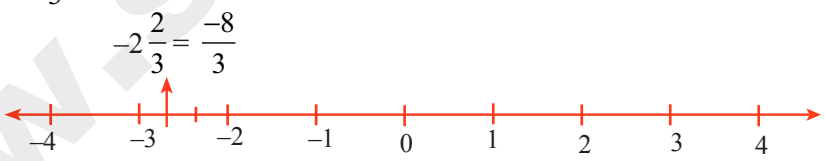
(i) $\frac{9}{4}$ **(ii)** $\frac{-8}{3}$ **(iii)** $\frac{-17}{-5}$ **(iv)** $\frac{-15}{4}$

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

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

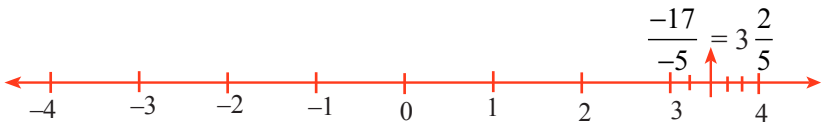
(ii) $\frac{-8}{3} = -2\frac{2}{3}$

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



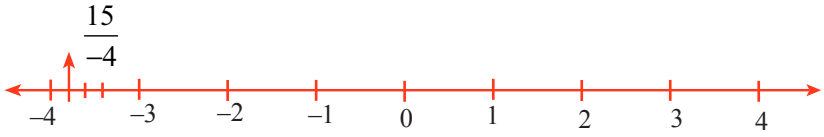
(iii) $\frac{-17}{-5} = 3\frac{2}{5}$

$3\frac{2}{5}$ 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)** $\frac{1}{11} = 0.0909...$

$$\begin{array}{r|l} & 0.0909 \\ 11 & 100 \\ & 99 \\ \hline & 100 \\ & 99 \\ \hline & 1 \end{array}$$

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

$$\begin{array}{r|l} & 3.25 \\ 4 & 13 \\ & 12 \\ \hline & 10 \\ & 8 \\ \hline & 20 \\ & 20 \\ \hline & 0 \end{array}$$

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

$$\begin{array}{r|l} & 2.571428 \\ 7 & 18 \\ & 14 \\ \hline & 40 \\ & 35 \\ \hline & 50 \\ & 49 \\ \hline & 10 \\ & 7 \\ \hline & 30 \\ & 28 \\ \hline & 20 \\ & 14 \\ \hline & 60 \\ & 56 \\ \hline & 4 \end{array}$$

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

$$\begin{array}{r|l} & 1.4 \\ 5 & 7 \\ & 5 \\ \hline & 20 \\ & 20 \\ \hline & 0 \end{array}$$

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

$$2\overline{)\,7}\;3.5$$
$$\underline{6}$$
$$10$$
$$\underline{10}$$
$$0$$

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

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

Sol. **(i)** –2 and 0

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

$$\frac{-2}{1} = \frac{-2\times10}{1\times10} = \frac{-20}{10}$$
$$\frac{0}{1} = \frac{0\times10}{1\times10} = \frac{0}{10}$$

$\therefore$ 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) $\frac{-1}{2}$ and $\frac{3}{5}$

LCM of 2 and 5 = $2 \times 5 = 10$

$$-\frac{1}{2} = \frac{-1\times5}{2\times5} = \frac{-5}{10}$$
$$\frac{3}{5} = \frac{3\times2}{5\times2} = \frac{6}{10}$$

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

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

$$\frac{1}{4} = \frac{1\times15}{4\times15} = \frac{15}{60}$$
$$\frac{7}{20} = \frac{7\times3}{20\times3} = \frac{21}{60}$$

$\therefore$ Five rational numbers between $\frac{1}{4}\left(=\frac{15}{60}\right)$ and $\frac{7}{20}\left(=\frac{21}{60}\right)$ are

$\frac{16}{60}, \frac{17}{60}, \frac{18}{60}, \frac{19}{60}, \frac{20}{60}$

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

$$\frac{-6}{4} = \frac{-6\times5}{4\times5} = \frac{-30}{20}$$
$$\frac{-23}{10} = \frac{23\times2}{10\times2} = \frac{-46}{20}$$

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

8. Use the method of average 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 $C_1 = \frac{1}{2}\left(\frac{14}{5}+\frac{16}{3}\right)$

$$C_1 = \frac{1}{2}\left(\frac{42+80}{15}\right)$$
$$C_1 = \frac{122}{30}$$
$$C_1 = \frac{61}{15}$$
$$\frac{14}{5} < \frac{61}{15} < \frac{16}{3} \quad \text{.....(1)}$$

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

$$C_2 = \frac{1}{2}\times\left(\frac{42+61}{15}\right)$$
$$C_2 = \frac{1}{2}\times\frac{103}{15} = \frac{103}{30}$$
$$\therefore \frac{14}{5} < \frac{103}{30} < \frac{61}{15} \quad \text{....(2)}$$

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

$$\frac{-11}{5} = \frac{-11\times8}{5\times8} = \frac{-88}{40}$$
$$\frac{-21}{8} = \frac{-21\times5}{8\times5} = \frac{-105}{40}$$

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

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

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

LCM of 4 and 2 = 4

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

$$\frac{-1}{2} = \frac{-1\times2}{2\times2} = \frac{-2}{4}$$

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

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

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

LCM of 3 and 5 is 15.

$$\frac{2}{3} = \frac{2\times5}{3\times5} = \frac{10}{15}$$

$$\frac{4}{5} = \frac{4\times3}{5\times3} = \frac{12}{15}$$

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

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

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

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

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 $4 \times 3 \times 2 \times 3 = 72$

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

$$\frac{-5}{12} = \frac{-5\times6}{12\times6} = \frac{-30}{72}$$

$$\frac{-11}{8} = \frac{-11\times9}{8\times9} = \frac{-99}{72}$$

$$\frac{-15}{24} = \frac{-15\times3}{24\times3} = \frac{-45}{72}$$

$$\frac{-7}{-9} = \frac{7\times8}{9\times8} = \frac{56}{72}$$

$$\frac{12}{36} = \frac{12\times2}{36\times2} = \frac{24}{72}$$

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

$\therefore$ 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) $\frac{-17}{10}, \frac{-7}{5}, 0, \frac{-2}{4}, \frac{-19}{20}$

Hint:

5	10, 5, 4, 20
3	2, 1, 4, 4
2	1, 1, 2, 2
	1, 1, 1, 1

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

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

Negative numbers are less then zero.

$\therefore$ Arranging the numerators we get

$-34 < -28 < -19 < -10 < 0$

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

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

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

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:

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

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

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

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

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

(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?

(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 × 2 × 3 × 2 = 96

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

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

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

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

$$\frac{-93}{96} < \frac{-84}{96} < \frac{-78}{96} < \frac{-68}{96}$$

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

$\therefore \frac{-17}{24}$ 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 $\frac{112}{528}$**

(A) 4 (B) 5 (C) 6 (D) 7 **[Ans: (C) 6]**

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

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 a national 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) $\frac{-7}{3} \div \frac{35}{62} = \frac{-\cancel{7}}{\cancel{3}} \times \frac{\overset{2}{\cancel{6}}}{\underset{5}{\cancel{35}}} = -\frac{2}{5}$

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. **[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]**

(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**]

(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) $\frac{7}{5}+\frac{5}{7} = \frac{7\times7+5\times5}{35}=\frac{49+25}{35}=\frac{74}{35}$

(iii) $\frac{6}{5}+\left(\frac{-14}{15}\right) = \frac{6\times3+(14)}{15}=\frac{18+(-14)}{5}=\frac{4}{5}$

(iv) $-4\frac{2}{3}+7\frac{5}{12} = \frac{14}{3}+\frac{18}{12}=\frac{-14\times4+89}{12}=\frac{-56+89}{12}=\frac{\overset{11}{\cancel{33}}}{\underset{4}{\cancel{12}}}=\frac{-11}{4}$

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

Sol. $\frac{-17}{11}-\left(\frac{-8}{44}\right) = \frac{-17}{11}+\frac{8}{44}=\frac{-17\times4+8}{44}=\frac{-68+8}{44}=\frac{\overset{15}{\cancel{60}}}{\underset{11}{\cancel{44}}}=\frac{-15}{11}$

5. Evaluate : (i) $\frac{9}{132}\times\frac{-11}{3}$ **(ii)** $\frac{-7}{27}\times\frac{24}{-35}$

Sol. **(i)** $\frac{\overset{3}{\cancel{9}}}{\underset{4}{\cancel{132}}}\times\frac{-\cancel{11}}{\cancel{3}} = \frac{-1}{4}$

(ii) $\frac{-\cancel{7}}{\underset{9}{\cancel{27}}}\times\frac{\overset{8}{\cancel{24}}}{-\underset{5}{\cancel{35}}} = \frac{8}{45}$

6. Divide : (i) $\frac{-21}{5}$ **by** $\frac{-7}{-10}$ **(ii)** $\frac{-3}{13}$ **by** -3 **(iii)** -2 **by** $\frac{-6}{15}$

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

(ii) $\frac{-3}{13}\div-3 = \frac{-3}{13}\times\frac{-1}{3}=\frac{-3\times-1}{13\times3}=\frac{3}{39}$

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

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)**

$$a+b = \frac{1}{2} + \frac{2}{3} = \frac{1\times3 + 2\times2}{6} = \frac{3+4}{6} = \frac{7}{6}$$

$$a-b = \frac{1}{2} - \frac{2}{3} = \frac{1\times3 - 2\times2}{6} = \frac{3-4}{6} = \frac{-1}{6}$$

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

(ii)

$$a+b = \frac{-3}{5} + \frac{2}{15} = \frac{-3\times3 + 2}{15} = \frac{-9+2}{15} = \frac{-7}{15}$$

$$a-b = \frac{-3}{5} - \frac{2}{15} = \frac{-3\times3 - 2}{15} = \frac{-9-2}{15} = \frac{-11}{15}$$

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

8. **Simplify : $\frac{1}{2} + \left(\frac{3}{7} - \frac{2}{5}\right) \div \frac{3}{10} \times 3$ and show that it is a rational number between 11 and 12.**

Sol.

$$\frac{1}{2} + \left(\frac{3}{7} - \frac{2}{5}\right) \div \frac{3}{10} \times 3 = \frac{1}{2} + \left(\frac{15-4}{10}\right) \div \frac{3}{10} \times 3 = \frac{1}{2} + \frac{11}{\cancel{10}} \times \frac{\cancel{10}}{\cancel{3}} \times \cancel{3}$$

$$= \frac{1}{2} + 11 = 11\frac{1}{2} = \frac{23}{2}$$

9. **Simplify :**

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

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

$$= \frac{\cancel{11} \times (-\overset{\cancel{3}}{\cancel{6}})}{\underset{4}{\cancel{8}} \times \underset{\cancel{3}}{\cancel{33}}} + \left[\frac{1}{3} + \left(\frac{\cancel{3}}{\cancel{5}} \times \frac{\overset{4}{\cancel{20}}}{\underset{3}{\cancel{9}}}\right)\right] - \left[\frac{4 \times -\cancel{7}}{\cancel{7} \times 5}\right] = -\frac{1}{4} + \left[\frac{1}{3} + \frac{4}{3}\right] - \left(\frac{-4}{5}\right)$$

$$= -\frac{1}{4} + \frac{5}{3} + \frac{4}{5} = \frac{-15 + 100 + 48}{60} = \frac{133}{60}$$

(ii) $\left[\frac{4}{3} \div \left(\frac{8}{-7}\right)\right] - \left[\frac{3}{4} \times \frac{4}{3}\right] + \left[\frac{4}{3} \times \left(\frac{-1}{4}\right)\right] = \left[\frac{\cancel{4}}{3} \times \frac{-7}{\underset{2}{\cancel{8}}}\right] - \left[\frac{\cancel{3}}{\cancel{4}} \times \frac{\cancel{4}}{\cancel{3}}\right] + \left[\frac{\cancel{4} \times (-1)}{3 \times \cancel{4}}\right]$

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

$$= \frac{-7-6+(-2)}{6} = \frac{-\cancel{15}^{5}}{\cancel{6}_{2}} = \frac{-5}{2}$$

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 $= a$

$$a \times \frac{4}{3} - a \div \frac{4}{3} = 70$$

$$a \times \frac{4}{3} - a \times \frac{3}{4} = 70$$

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

$$a\left[\frac{4\times4-3\times3}{12}\right] = 70$$

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

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

$$a = \cancel{70}^{10} \times \frac{12}{\cancel{7}_{1}} = 120$$

$$a = 120$$

Objective Type Questions

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

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

Hint:

$$\frac{3}{4} + \frac{5}{6} + \left(\frac{-7}{12}\right) = \frac{(3\times3)+(5\times2)+(-7)}{12} = \frac{9+10+(-7)}{12} = \frac{19-7}{12} = \frac{12}{12} = 1$$

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

(A) $\frac{15}{64}$ (B) 1 (C) $\frac{5}{8}$ (D) $\frac{1}{16}$ [*Ans:* **(C) $\frac{5}{8}$**]

Hint:

$$\left(\frac{3}{4} - \frac{5}{8}\right) + \frac{1}{2} = \left(\frac{3\times2-5}{8}\right) + \frac{1}{2} = \frac{6-5}{8} + \frac{1}{2} = \frac{1}{8} + \frac{1}{2}$$

$$= \frac{1+1\times4}{8} = \frac{1+4}{8} = \frac{5}{8}$$

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

(A) $\frac{13}{10}$ (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) $\frac{5}{8}$ [*Ans:* **(B)** $\frac{2}{3}$]

Hint:

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

$$= \frac{3}{4} \div \frac{9}{8} = \frac{\cancel{3}}{\cancel{4}} \times \frac{\cancel{8}^{2}}{\cancel{9}_{3}} = \frac{2}{3}$$

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

(A) $\frac{5}{8}$ (B) $\frac{2}{3}$ (C) $\frac{15}{32}$ (D) $\frac{15}{16}$ [*Ans:* **(D)** $\frac{15}{16}$]

Hint:

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

15. Which of these rational number 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

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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 $0 - \frac{1}{2} = -\frac{1}{2}$ is a rational number

$\therefore$ 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.

$\therefore$ 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. $2\times[3+(-5)]=-4$ $(2\times 3)+[2\times(-5)]$ $=-4$
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. $1\times 7=7$	Does not exist	Not Applicable
Subtraction	$a2\ b$ is in $\mathbb{Z}$ E.g. $7-2=5$	Fails $a-b\neq b-a$ E.g. $7-2\neq 2-7$ $5\neq -5$	Fails $(a-b)-c$ $\neq a-(b-a)$ 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. $7\times(5-2)$ $=(7\times 5)-(7\times 5)$ $7\times 3=35-14$ $21=21$
Division	Fails $a \mid b$ 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

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

Sol.

$$\text{LHS} = \frac{3}{5}\div\frac{7}{8} = \frac{(3\times8)-(7\times5)}{40} = \frac{24-35}{40} = \frac{-11}{40}$$

$$\text{RHS} = \frac{7}{8}-\frac{3}{5} = \frac{(7\times5)-(3\times8)}{40} = \frac{35-24}{40} = \frac{11}{40}$$

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

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

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

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

Sol.

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

$$\text{RHS} = \frac{7}{8}\div\frac{5}{3} = \frac{7}{8}\times\frac{3}{5} = \frac{21}{40}$$

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

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

$\therefore$ Commutative property 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 $\frac{3}{4}$

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

$$\text{LHS} = \left(\frac{2}{3}-\frac{1}{2}\right)-\frac{3}{4} = \left(\frac{(2\times2)-(1\times3)}{6}\right)-\frac{3}{4}$$

$$= \left(\frac{4-3}{6}\right)-\frac{3}{4} = \frac{1}{6}-\frac{3}{4} = \frac{(1\times2)-(3\times3)}{12} = \frac{2-9}{12} = \frac{-7}{12}$$

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

$$= \frac{2}{3}+\frac{1}{4} = \frac{(2\times4)+(1\times3)}{12} = \frac{8+3}{12} = \frac{11}{12}$$

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

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

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

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

$$\text{LHS} = \left(\frac{2}{3}\div\frac{1}{2}\right)\div\frac{3}{4} = \left(\frac{2}{3}\times\frac{2}{1}\right)\div\frac{3}{4}$$

$$= \frac{4}{3}\div\frac{3}{4} = \frac{4}{3}\times\frac{4}{3} = \frac{16}{9}$$

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

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

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

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

$\therefore$ Associative property does not hold for division of rational numbers.

Exercise 1.3

1. Verify the closure property for addition and multiplication of the rational numbers $\frac{-5}{7}$ and $\frac{8}{9}$.

Sol. Closure property for addition.

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

$$a + b = \frac{-5}{7} + \frac{8}{9}$$

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

$$= \frac{-45+56}{63} = \frac{11}{63} \text{ is in Q.}$$

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

$\therefore$ Closure property is true for addition of rational numbers.

Closure property for multiplication

Let $a = \frac{-5}{7}$ and $b = \frac{8}{9}$

$$a \times b = \frac{-5}{7}\times\frac{8}{9} = \frac{-40}{63} \text{ is in Q.}$$

$\therefore$ 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.

$$\text{Now } a+b = \frac{-10}{11}+\left(\frac{-8}{33}\right) = \frac{(-10\times 3)+(-8\times 1)}{33} = \frac{-30+(-8)}{33}$$

$$a+b = \frac{-38}{33} \quad \text{.....(1)}$$

$$b+a = \frac{-8}{33}+\left(\frac{-10}{11}\right) = \frac{(-8\times 1)+((-10)\times 3)}{33} = \frac{-8+(-30)}{33}$$

$$b+a = \frac{-38}{33} \quad \text{....(2)}$$

From (1) and (2)

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

$$\text{Further } a\times b = \frac{-10}{11}\times\left(\frac{-8}{33}\right) = \frac{80}{363}$$

$$a\times b = \frac{80}{363} \quad \text{.....(3)}$$

$$b\times a = \frac{-8}{33}\times\left(\frac{-10}{11}\right) = \frac{80}{363}$$

$$b\times a = \frac{80}{363} \quad \text{.... (4)}$$

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

Hence multiplication is commutative for rational numbers.

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

Sol.

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

$$(a+b)+c = \left(\frac{-7}{9}+\frac{5}{6}\right)+\left(\frac{-4}{3}\right) = \left(\frac{-7\times 2+5\times 3}{18}\right)+\left(\frac{-4}{3}\right)$$

$$= \left(\frac{-14+15}{18}\right)+\left(\frac{-4}{3}\right) = \frac{1}{18}+\left(\frac{-4}{3}\right)$$

$$= \frac{1+(-4)\times 6}{18} = \frac{1+(-24)}{18} = \frac{-23}{18} \quad \text{...(1)}$$

$$a+(b+c) = -\frac{7}{9}+\left(\frac{5}{6}+\frac{(-4)}{3}\right) = \frac{-7}{9}+\left(\frac{5+(-4)2}{6}\right)$$

$$= \frac{-7}{9}+\left(\frac{5+(-8)}{6}\right) = -\frac{7}{9}+\left(\frac{-3}{6}\right) = -\frac{7}{9}+\left(\frac{-1}{2}\right)$$

$$= \frac{-7\times 2+(-1)\times 9}{18} = \frac{-14+(-9)}{18} = \frac{-23}{18} \quad \text{... (2)}$$

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

Now $(a\times b)\times c = \left(\frac{-7}{9}\times\frac{5}{6}\right)\times\left(\frac{-4}{3}\right) = \left(\frac{-7\times5}{9\times6}\right)\times\left(\frac{-4}{3}\right)$

$$= \frac{-35}{54}\times\frac{-4}{3} = \frac{-35\times\cancel{(-4)}^{2}}{\cancel{54}_{27}\times3} = \frac{70}{81} \quad \ldots (1)$$

$$a\times(b\times c) = \frac{-7}{9}\times\left(\frac{5}{\cancel{6}_{3}}\times\frac{\cancel{-4}^{2}}{3}\right) = \frac{-7}{9}\times\frac{5\times(-2)}{3\times3}$$

$$= \frac{-7}{9}\times\frac{(-10)}{9} = \frac{70}{81} \quad \ldots (2)$$

From (1) and (2) $(a\times b)\times c = a\times(b\times c)$ is true for rational numbers.
Thus associative property.

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

$$a\times(b+c) = \frac{-1}{2}\times\left(\frac{2}{3}+\left(\frac{-5}{6}\right)\right) = \frac{-1}{2}\times\left(\frac{(2\times2)+(-5\times1)}{6}\right)$$

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

$$a\times(b+c) = \frac{1}{12} \quad \ldots..(1)$$

$$(a\times b)+(a\times c) = \left(\frac{-1}{2}\times\frac{2}{3}\right)+\left(\frac{-1}{2}\times\left(\frac{-5}{6}\right)\right)$$

$$= \frac{-2}{6}+\frac{5}{12} = \frac{(-2\times2)+5\times1}{12} = \frac{-4+5}{12}$$

$$(a\times b)+(a\times c) = \frac{1}{12} \quad \ldots.(2)$$

From (1) and (2) we have $a\times(b+c) = (a\times b)+(a\times c)$ is true.
Hence multiplication is distributive over addition for rational numbers Q.

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

Sol.

$$\frac{15}{19}+0 = \frac{15}{19}+\frac{0}{19} = \frac{15+0}{19} = \frac{15}{19}$$

$$\frac{-18}{25}+0 = \frac{-18}{25}+\frac{0}{25} = \frac{-18+0}{25} = \frac{-18}{25}$$

Identify property for addition verified.

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

Identify property for multiplication 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 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 verified.

Objective Type Questions

7. Closure property is not true for division of rational numbers because of the number

(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 _____ law 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. Bu 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.

$$256 = 16^2$$
$$576 = 24^2$$
$$4096 = 64^2$$

$\therefore$ 256, 576 and 4096 are perfect squares

2. One can judge just by look, that the each of the following numbers (82, 113, 2057, 24353, 8888, 1972) 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? Find how many non-square numbers are there i) between 4 and 9? ii) between 49 and 64? and verify the claim.

Sol.

	Consecutive square numbers	Non-square numbers between two consecutive square numbers	Number of non-square numbers
	$1^2, 2^2 = 1, 4$	2, 3	$2 = 2 \times 1$
(i)	$2^2, 3^2 = 4, 9$	5, 6, 7, 8	$4 = 2 \times 2$
	$3^2, 4^2 = 9, 16$	10, 11, 12, 13, 14, 15	$6 = 2 \times 3$
	$4^2, 5^2 = 16, 25$	17, 18, 19, 20, 21, 22, 23, 24	$8 = 2 \times 4$
	$5^2, 6^2 = 25, 36$	26, 27, 28, 29, 3, 31, 32, 33, 34, 35	$10 = 2 \times 5$
	$6^2, 7^2 = 36, 49$	37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48,	$12 = 2 \times 6$
(ii)	$7^2, 8^2 = 49, 64$	50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63	$14 = 2 \times 7$
	$n^2, (n+1)^2$	$n^2 + 1, n^2 + 2, \ldots\ldots, n^2 + 2n$	$2n = 2 \times n$

Therefore we conclude that there are $2n$ non-square numbers between two consecutive square numbers.

THINK

Page No. 30

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

If we multiply the factors by 2, 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.

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

$\therefore$ We have to multiply or divide 108 by 3 to get a perfect square.

TRY THESE

Page No. 32

Find the square root by long division method.

(i) 400 (ii) 1764 (iii) 9801

Sol. (i) 400

		2	0
×2	2	4	00
		4	↓
	40	0	00
		0	00
			0

$\sqrt{400} = 20$

(ii) 1764

		4	2
×2	4	17	64
		16	↓
	82	1	64
		1	64
			0

$\sqrt{1764} = 42$

(iii) 9801

		9	9
×2	9	98	01
		81	↓
	189	17	01
		17	01
			0

$\sqrt{9801} = 66$

TRY THESE

Page No. 32

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

Sol. (i) $\sqrt{14400} = \sqrt{144 \times 100} = \sqrt{144} \times \sqrt{100}$

Sol. $= 12 \times 10 = 120.$

(ii) $\sqrt{390625} = \sqrt{25 \times 25 \times 25 \times 25}$

$= \sqrt{25 \times 25} \times \sqrt{25 \times 25} = 25 \times 25 = 625$

(iii) $\sqrt{100000000} = \sqrt{10000 \times 10000}$

$= \sqrt{10000} \times \sqrt{10000}$

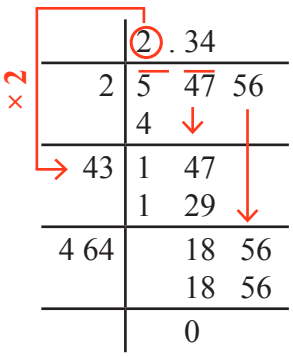
$= 100 \times 100 = 10{,}000$

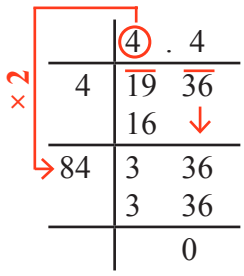
TRY THESE

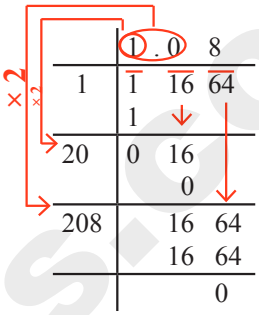
Page No. 33

1. Find the square root of

Sol. **(i) 5.4756** **(ii) 19.36** **(iii) 116.64**







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

TRY THESE

Page No. 34

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

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

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

TRY THESE

Page No. 14

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

Sol. (i) 4, $\sqrt{14}$, 5

Squaring all the numbers we get 4^2, $(\sqrt{14})^2$, $5^2 \Rightarrow 16, 14, 25$

$\therefore$ Ascending order : 14, 16, 25

Ascending order : $\sqrt{14}$, 4, 5

(ii) 7, $\sqrt{65}$, 8

Squaring 7, $\sqrt{65}$ and 8 we get 7^2, $(\sqrt{65})^2$, $8^2 \Rightarrow 49, 65, 64$

Ascending order : 49, 64, 65

Ascending order : 7, 8, $\sqrt{65}$

Exercise 1.4

1. Fill in the blanks:

(i) The ones digit in the square of 77 is _____ . **[Ans: 9]**

(ii) The number of non-square numbers between 242 and 252 is _____ . **[Ans: 48]**

(iii) The number of perfect square numbers between 300 and 500 is _____ . **[Ans: 5]**

(iv) If a number has 5 or 6 digits in it, then its square root will have _____ digits. **[Ans: 3]**

(v) The value of 180 lies between integers _____ and _____ . **[Ans: 13, 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]**

3. Find the square of the following numbers.

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

Sol.

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

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

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

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.

5	725
5	145
29	29
	1

(ii) 190

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

Here the factors 2, 5 and 9 does not have pairs.
Hence 190 is not a perfect square number.

2	190
5	95
	19

(iii) 841

$$841 = 29 \times 29$$

Hence 841 is a perfect square

(vi) 1089

$$1089 = 3 \times 3 \times 11 \times 11 = 33 \times 33$$

Hence 1089 is a perfect square

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

Sol. (i) 144

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

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

2	144
2	72
2	36
2	18
3	9
	3

(ii) 256

$256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$\sqrt{256} = 2 \times 2 \times 2 \times 2 = 16$

2	256
2	128
2	64
2	32
2	16
2	8
2	4
	2

(iii) 784

$784 = 2 \times 2 \times 2 \times 2 \times 7 \times 7$

$\sqrt{784} = 2 \times 2 \times 2 \times 2 \times 7 \times 7 = 28$

2	784
2	392
2	196
2	98
7	49
	7

(iv) 1156

$1156 = 2 \times 2 \times 17 \times 17$

$1156 = 2^2 \times 17^2$

$1156 = (2 \times 17)^2$

$\therefore \sqrt{1156} = \sqrt{(2 \times 17)^2} = 2 \times 17 = 34$

$\therefore \sqrt{1156} = 34$

2	1156
2	578
17	289
17	17
	1

(v) 4761

$4761 = 3 \times 3 \times 23 \times 23$

$4761 = 3^2 \times 23^2$

$4761 = (3 \times 23)^2$

$\sqrt{4761} = \sqrt{(3 \times 23)^2}$

$\sqrt{4761} = 3 \times 23$

$\sqrt{4761} = 69$

3	4761
3	1587
23	529
23	23
	1

(vi) 9025

$9025 = 5 \times 5 \times 19 \times 19$

$9025 = 5^2 \times 19^2$

$9025 = (5 \times 19)^2$

$\sqrt{925} = \sqrt{(5 \times 19)^2} = 5 \times 19 = 95$

5	9025
5	1805
19	361
19	19
	1

6. **Find the square root by long division method.**

(i) 1764 (ii) 6889 (iii) 11025 (iv) 17956 (v) 418609

Sol. (i) 1764

	4	2
4	17	64
	16	↓
82	1	64
	1	64
		0

$\sqrt{1764} = 42$

(ii) 6889

	8	3
8	68	89
	64	↓
163	4	89
	4	89
		0

$\sqrt{6889} = 83$

(iii) 11025

	1	0	5
1	1	10	25
	1	↓	
20	0	10	
		0	
205		10	25
		10	25
			0

$\sqrt{11025} = 105$

(iv) 17956

	1	3	4
1	1	79	56
	1	↓	
23	0	79	
		69	
264		10	56
		10	56
			0

$\sqrt{17956} = 134$

(v) 418609

	6	4	7	
6	41	86	09	
	36	↓		
124	5	86		
	4	96		
1287		90	09	
		90	09	
			0	

$\sqrt{418609} = 647$

7. **Estimate the value of the following square roots to the nearest whole number:**

(i) $\sqrt{440}$ (ii) $\sqrt{800}$ (iii) $\sqrt{1020}$

Sol. (i) We have $20^2 = 400$

$21^2 = 441$

$\therefore \sqrt{440} \simeq 21$

(ii) We have $28^2 = 784$

$29^2 = 841$

$\therefore \sqrt{800} \simeq 28$

(iii) We have $31^2 = 961$

$32^2 = 1024$

$\therefore \sqrt{1020} \simeq 32.$

8. **Find the square root of the following decimal numbers and fractions.**

(i) 2.89 **(ii) 67.24** **(iii) 2.0164** **(iv) $\frac{144}{225}$** **(v) $7\frac{18}{49}$**

Sol. (i) 2.89

$$\begin{array}{r|l} & 1\ .\ 7 \\ \hline 1 & \overline{2}.\ \overline{89} \\ & 1 \quad \downarrow \\ \hline 27 & 1\ 89 \\ & 1\ 89 \\ \hline & 0 \end{array}$$

$\sqrt{2.89} = 1.7$

(ii) 67.24

$$\begin{array}{r|l} & 8\ .\ 2 \\ \hline 8 & \overline{67}.\ \overline{24} \\ & 64 \quad \downarrow \\ \hline 162 & 3\ 24 \\ & 3\ 24 \\ \hline & 0 \end{array}$$

$\sqrt{67.24} = 8.2$

(iii) 2.0164

$$\begin{array}{r|l} & 1\ .4\ \ 2 \\ \hline 1 & 2.\ \overline{01}\ \overline{64} \\ & 1 \quad \downarrow \\ \hline 24 & 1\ \ 01 \\ & \quad 96 \quad \downarrow \\ \hline 282 & \quad 5\ 64 \\ & \quad 5\ 64 \\ \hline & \quad\ \ 0 \end{array}$$

$\sqrt{2.0164} = 1.42$

(iv) $\frac{144}{225} = \sqrt{\frac{144}{225}} = \sqrt{\frac{144}{225}} = \frac{12}{15}$

(v) $7\frac{18}{49} = \sqrt{\frac{361}{49}} = \frac{\sqrt{361}}{\sqrt{49}} = \frac{\sqrt{19^2}}{\sqrt{7^2}} = \frac{19}{7}$ $\left[\because \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} (b \neq 0)\right]$

$= \frac{19}{7} = 2\frac{5}{7}$

$\sqrt{7\frac{18}{49}} = 2\frac{5}{7}$

$$\begin{array}{r} 49 \times \\ 7 \\ \hline 343 + \\ 18 \\ \hline 361 \end{array}$$

9. **Find the least number that must be subtracted to 6666 so that it becomes a perfect square. Also, find the square root of the perfect square thus obtained.**

Sol. Let us work out the process of finding the square root of 6666 by long division method.

$$\begin{array}{r|l} & 8\ \ 1 \\ \hline 8 & \overline{66}\ \overline{66} \\ & 64 \quad \downarrow \\ \hline 161 & 2\ 66 \\ & 1\ 61 \\ \hline & 1\ 05 \end{array}$$

The remainder in the last step is 105. Is if 105 be subtracted from the given number the remainder will be zero and the new number will be a perfect square.

$\therefore$ The required number is 105. The square number is 6666 – 105 = 6561.

10. **Find the least number by which 1800 should be multiplied so that it becomes a perfect square. Also, find the square root of the perfect square thus obtained.**

Sol. We find $1800 = 2 \times 2 \times 3 \times 3 \times 5 \times 5 \times 2$

$= 2^2 \times 3^2 \times 5^2 \times 2$

Here the last factor 2 has no pair. So if we multiply 1800 by 2, then the number becomes a perfect square.

$\therefore 1800 \times 2 = 3600$ is the required perfect square number.

$\therefore 3600 = 1800 \times 2$

$3600 = 2^2 \times 3^2 \times 5^2 \times 2 \times 2$

$3600 = 2^2 \times 3^2 \times 5^2 \times 2^2$

$= (2 \times 3 \times 5 \times 2)^2$

$\sqrt{3600} = \sqrt{(2 \times 3 \times 5 \times 2)^2}$

$= 2 \times 3 \times 5 \times 2 = 60$

$\therefore \sqrt{3600} = 60.$

2	1800
2	900
3	450
3	150
5	50
5	10
2	2
	1

Objective Type Questions

11. The square of 43 ends with the digit _____ .

(A) 9 (B) 6 (C) 4 (D) 3 **[Ans: (A) 9]**

Hint: Ones digit = $3 \times 3 = 9$

12. _____ is added to 24^2 to get 25^2.

(A) 4^2 (B) 5^2 (C) 6^2 (D) 7^2 **[Ans: (A) 7^2]**

Hint: $25^2 = 25 \times 25 = 625$

$24^2 = 24 \times 24 = 576$

$625 - 576 = 49$

$49 = 7^2$

13. $\sqrt{48}$ is approximately equal to

(a) 5 (b) 6 (c) 7 (d) 8 **[Ans: (c) 7]**

Hint: $\sqrt{49} = 7$

14. $\sqrt{128} - \sqrt{98} + \sqrt{18} =$

(a) $\sqrt{2}$ (b) $\sqrt{8}$ (c) $\sqrt{48}$ (d) $\sqrt{32}$ **[Ans: (d) $\sqrt{32}$]**

15. The number of digits in the square root of 123454321 is

(a) 4 (b) 5 (c) 6 (d) 7 **[Ans: (b) 5]**

Hint: $= \frac{n+1}{2} = \frac{10}{2} = 5$

Try These

Page No. 37

Find the ones digit in the cubes of each of the following numbers.

(i) 12 (ii) 27 (iii) 38 (iv) 53 (v) 71 (vi) 84

Sol. (i) 12

12 ends with 2, so its cube ends with 8 i.e, ones digit in 12^3 is 8.

(iii) 27

27 ends with 7, so its cube end with 3. i.e., ones digit in 27^3 is 3.

(iii) 38

38 ends with 8, so its cube ends with 2 i.e, ones digit in 38^3 is 2.

(iv) 53

53 ends with 3, so its cube ends with 7. i.e, ones digit in 53^3 is 7.

(v) 71

71 ends with 1, so its cube ends with 1. i.e, ones digit in 71^3 is 1

(vi) 84

84 ends with 4, so its cube ends with 4. i.e, ones digit in 84^3 is 4.

Exercise 1.5

1. Fill in the blanks:

(i) The ones digits in the cube of 73 is_____. **[Ans: 7]**

(ii) The maximum number of digits in the cube of a two digit number is _____. **[Ans: 6]**

(iii) The smallest number to be added to 3333 to make it a perfect cube is _____. **[Ans: 42]**

(iv) The cube root of 540 × 50 is _____. **[Ans: 30]**

(v) The cube root of 0.000004913 is _____. **[Ans: 0.017]**

2. Say True or False.

(i) The cube of 24 ends with the digit 4. **[Ans: True]**

(ii) Subtracting 103 from 1729 gives 93. **[Ans: True]**

(iii) The cube of 0.0012 is 0.000001728. **[Ans: False]**

(iv) 79570 is not a perfect cube. **[Ans: True]**

(v) The cube root of 250047 is 63. **[Ans: True]**

3. Show that 1944 is not a perfect cube.

Sol.

$$1994 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3$$
$$= \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times 3 \times 3$$
$$= 2^3 \times 3^3 \times 3 \times 3$$

2	1944
2	972
2	486
3	243
3	81
3	27
3	9
3	3
	1

There are two triplets to make further triplets we need one more 3.

∴ 1944 is not a perfect cube.

4. Find the smallest number by which 10985 should be divided so that the quotient is a perfect cube.

Sol.

$$\text{We have } 10985 = 5 \times 13 \times 13 \times 13$$
$$= 5 \times 13 \times 13 \times 13$$

5	10985
13	2197
13	169
13	13
	1

Here we have a triplet of 13 and we are left over with 5.

If we divide 10985 by 5, the new number will be a perfect cube.

∴ The required number is 5.

5. Find the smallest number by which 200 should be multiplied to make it a perfect cube.

Sol. We find $200 = \overline{2 \times 2 \times 2} \times 5 \times 5$

Grouping the prime factors of 200 as triplets, we are left with 5×5

We need one more 5 to make it a perfect cube.

So to make 200 a perfect cube multiply both sides by 5.

$$200 \times 5 = (\overline{2 \times 2 \times 2} \times 5 \times 5) \times 5$$
$$1000 = 2 \times 2 \times 2 \times 5 \times 5 \times 5$$

Now 1000 is a perfect cube.

$\therefore$ The required number is 5.

2	200
2	100
2	50
5	25
5	5
	1

6. Find the cube root of $24 \times 36 \times 80 \times 25$.

Sol.
$$24 = 2 \times 2 \times 2 \times 3$$
$$36 = 2 \times 2 \times 3 \times 3$$
$$80 = 2 \times 2 \times 2 \times 2 \times 5$$
$$25 = 5 \times 5$$
$$24 \times 36 \times 80 \times 25 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{2 \times 2 \times 2} \times \overline{5 \times 5 \times 5}$$
$$\sqrt[3]{24 \times 36 \times 80 \times 25} = 2 \times 2 \times 3 \times 2 \times 5 = 120$$

2	24
2	12
2	6
3	3
	1

2	36
2	18
3	9
3	3
	1

2	80
2	40
2	20
2	10
5	5
	1

7. Find the cube root of 729 and 6859 by prime factorisation.

Sol. (i) $\sqrt[3]{729} = \sqrt[3]{\overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}}$

$$= 3 \times 3$$
$$\sqrt[3]{729} = 9$$

3	729
3	243
3	81
3	27
3	9
3	3
	1

(ii) $\sqrt[3]{6859} = \sqrt[3]{19 \times 19 \times 19}$

$$\sqrt[3]{6859} = 19$$

19	6859
19	361
19	19
	1

8. What is the square root of cube root of 46656?

Sol. We have to find out $\sqrt{(\sqrt[3]{46656})}$

First we will find $\sqrt[3]{46656}$

$$\sqrt[3]{46656} = (\overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3})^{\frac{1}{3}}$$
$$\sqrt[3]{46656} = 2 \times 2 \times 3 \times 3$$
$$\sqrt[3]{46656} = 2^2 \times 3^2 = 36$$
$$\text{Now } \sqrt{(\sqrt[3]{46656})} = \sqrt{36} = \sqrt{2^2 \times 3^2} = 2 \times 3 = 6$$

$\therefore$ The required number is 6.

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

9. If the cube of a squared number is 729, find the square root of that number.

Sol.

$$729 = \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}$$

$$(729)^{\frac{1}{3}} = 3 \times 3 = 9$$

$\therefore$ The cube of 9 is 729.

$$9 = 3 \times 3 \text{ [ie 3 is squared to get 9]}$$

	1 . 7	3	2	0
1	3 . 00	00	00	00
	1			
27	2 00			
	1 89			
343	11	00		
	10	29		
3462	0	71	00	
		69	24	
34640		1	76	00
				0
		1	76	00

We have to find out $\sqrt{3}$, $\sqrt{3} = 1.732$

10. Find two smallest perfect square numbers which when multiplied together gives a perfect cube number.

Sol. Consider the numbers 2^2 and 4^2

The numbers are 4 and 16.

Their product $4 \times 16 = 64$

$$64 = 4 \times 4 \times 4$$

$\therefore$ The required square numbers are 4 and 16

TRY THESE

Page No. 41

Expand the following numbers using exponents:

i) 8120 ii) 20,305 iii) 3652.01 iv) 9426.521

Sol. (i) $8120 = (8 \times 1000) + (1 \times 100) + (2 \times 10) + 0 \times 1$

$$= (8 \times 10^3) + (1 \times 10^2) + (2 \times 10^1)$$

(ii) $20305 = (2 \times 10000) + (0 \times 1000) + (3 \times 100) + (0 \times 10) + (5 \times 1)$

$$= (2 \times 10^4) + (3 \times 10^2) + 5$$

(iii) $3652.01 = 3000 + 600 + 50 + 2 + \frac{0}{10} + \frac{1}{100}$

$$= (3 \times 1000) + (6 \times 100) + (5 \times 10) + (2 \times 1) + (1 \times \frac{1}{100})$$

$$= (3 \times 10^3) + (6 \times 10^2) + (5 \times 10^1) + 2 + (1 \times 10^{-2})$$

(iv) $9426.521 = (9 \times 1000) + (4 \times 100) + (2 \times 10) + (6 \times 1)$

$$+ \left(\frac{5}{10}\right) + \left(\frac{2}{100}\right) + \left(\frac{1}{1000}\right)$$

$$= (9 \times 10^3) + (4 \times 10^2) + (2 \times 10^1) + 6 + (5 \times 10^{-1}) + (2 \times 10^{-2}) + (1 \times 10^{-3})$$

TRY THESE

Page No. 42

Verify the following laws (as we did above). Here, *a, b* are non-zero integers and *m, n* are any integers.

1. Product of same powers to power of product rule: $a^m \times b^m = (ab)^m$
2. Quotient of same powers to power of quotient rule: $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$
3. Zero exponent rule: $a^0 = 1$.

Verification:

Let $a = 2$; $b = 3$; $m = 2$

1. $a^m \times b^m = 2^2 \times 3^2 = 4 \times 9 = 36 = (2 \times 3)^2$
2. $\frac{a^m}{b^m} = \frac{2^2}{3^2} = \frac{4}{9} = \left(\frac{2}{3}\right)^2$
3. $a^0 = 2^0 = 1$.

TRY THESE

Page No. 44

1. Write in standard form: Mass of planet Uranus = 8.68×10^{25} kg.

Sol. Mass of Planet Uranus = 86800000000000000000000000 kg
[23 zeros after 868]

2. Write in scientific form: (i) 0.000012005 (ii) 4312.345 (iii) 0.10524
(iv) The distance between the Sun and the planet Saturn 1.4335×10^{12} miles.

Sol. (i) $0.000012005 = 1.2005 \times 10^{-5}$

(ii) $4312.345 = 4.312345 \times 10^3$

(iii) $0.1524 = 1.0524 \times 10^{-1}$

(iv) The distance between Sun and the planet Saturn is 1.4335×10^{12} miles

Exercise 1.6

1. Fill in the blanks:

(i) $(-1)^{\text{even integer}}$ is _____. **[Ans: 1]**

(ii) For $a \neq 0$, a^0 is _____. **[Ans: 1]**

(iii) $4^{-3} \times 5^{-3} =$ _____. **[Ans: 20^{-3}]**

(iv) $(-2)^7 =$ _____. **[Ans: $\frac{-1}{128}$]**

(v) $\left(-\frac{1}{3}\right)^{-5} =$ _____. **[Ans: – 243]**

2. Say True or False:

(i) If $8^x = \frac{1}{64}$, the value of x is -2. **[Ans:** True]

(ii) The simplified form of $(256)^{\frac{-1}{4}}$ is $\frac{1}{4}$. **[Ans:** True]

(iii) The standard form of 2×10^{-4} is 0.0002. **[Ans:** True]

(iv) The scientific form of 123.456 is 1.23456×10^{-2}. **[Ans:** False]

(v) The multiplicative inverse of $(3)^{-7}$ is 3^7. **[Ans:** True]

3. Evaluate :

(i) $\left(\frac{1}{2}\right)^3$

Sol.

$$\left(\frac{1}{2}\right)^3 = \frac{1^3}{2^3} = \frac{1}{2\times2\times2} = \frac{1}{8}$$

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

Sol.

$$\left(\frac{1}{2}\right)^{-5} = \frac{1^{-5}}{2^{-5}} = \frac{1}{2^{-5}} = 2^5 = 2\times2\times2\times2\times2 = 32$$

(iii) $\left(\frac{-5}{6}\right)^{-3}$

Sol.

$$\left(\frac{-5}{6}\right)^{-3} = \frac{(-5)^{-3}}{6^{-3}} = \frac{6^3}{(-5)^3} = \left(\frac{(-5\times-5\times-5)}{(6\times6\times6)}\right) = -\frac{216}{125}$$

(iv) $(2^{-5} \times 2^7) \div 2^{-2}$

Sol.

$$\begin{aligned}(2^{-5} \times 2^7) \div 2^{-2} &= (2^{-5+7}) \div 2^{-2}\\ &= 2^2 \div 2^{-2}\\ &= 2^{2+2}\\ &= 2^4 = 16\end{aligned}$$

(v) $(2^{-1} \times 3^{-1}) \div 6^{-2}$

Sol.

$$\begin{aligned}(2^{-1} \times 3^{-1}) \div 6^{-2} &= (2\times3)^{-1} \div 6^{-2}\\ &= (6)^{-1} \div 6^{-2}\\ &= 6^{(-1)-(-2)} = 6^1 = 6\end{aligned}$$

4. Evaluate : (i) $\left(\frac{2}{5}\right)^4 \times \left(\frac{5}{2}\right)^{-2}$

Sol.

$$\left(\frac{2}{5}\right)^4 \times \left(\frac{2}{5}\right)^2 = \left(\frac{2}{5}\right)^{4+2} = \left(\frac{2}{5}\right)^6$$

(ii) $\left(\frac{4}{5}\right)^{-2} \div \left(\frac{4}{5}\right)^{-3}$

Sol.

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

(iii) $2^7 \times \left(\frac{1}{2}\right)^{-3}$

$= 2^7 \times 2^3 = 2^{7+3} = 2^{10}$

5. Evaluate : (i) $(5^0 + 6^{-1}) \times 3^3$

Sol.

$(5^0 + 6^{-1}) \times 3^3 = (5^0 \times 3^3) + (6^{-1} \times 3^3) = (1 \times 27) + \left(\frac{1}{2 \times 3} \times 3^3\right)$

$= 27 + \left(\frac{1}{2} \times 3^{3-1}\right) = 27 + \left(\frac{1}{2} \times 3^2\right)$

$= 27 + \frac{9}{2} = \frac{54+9}{2} = \frac{63}{2}$

(ii) $(2^{-1} + 3^{-1}) \div 6^{-1}$

Sol.

$(2^{-1} + 3^{-1}) \div 6^{-1} = \left(\frac{1}{2} + \frac{1}{3}\right) \div 6^{-1}$

$= \left(\frac{3+2}{6}\right) \div 6^{-1} = \left(\frac{5}{6}\right) \div 6^{-1} = \frac{5}{6} \times 6 = 5$

(iii) $(3^{-1} + 4^{-2} + 5^{-3})^0$

Sol.

$(3^{-1} + 4^{-2} + 5^{-3})^0 = 1$ [$\because a^0 = 1$ where $a \neq 0$]

6. Simplify: (i) $(3^2)^3 \times (2 \times 3^5)^{-2} \times (18)^2$

Sol.

$(3^2)^3 \times (2 \times 3^5)^{-2} \times (18)^2 = 3^{2\times3} \times \frac{1}{(2 \times 3^5)^2} \times 18^2$

$= 3^6 \times \frac{1}{2^2 \times (3^5)^2} \times 18^2 = 3^6 \times \frac{1}{2^2 \times 3^{10}} \times (2 \times 3^2)^2$

$= 3^6 \times \frac{1}{2^2 \times 3^{10}} \times 2^2 \times 3^{2\times2} = 3^6 \times \frac{1}{2^2 \times 3^{10}} \times 2^2 \times 3^4$

$= \frac{3^{6+4} \times 2^2}{2^2 \times 3^{10}} = \frac{3^{10} \times 2^2}{2^2 \times 3^{10}} = 1$

(ii) $\frac{9^2 \times 7^3 \times 2^5}{84^3}$

$\frac{9^2 \times 7^3 \times 2^5}{84^3} = \frac{(3^2)^2 \times 7^3 \times 2^5}{(2^2 \times 3 \times 7)^3} = \frac{3^{2\times2} \times 7^3 \times 2^5}{2^{2\times3} \times 3^3 \times 7^3} = \frac{3^4 \times 7^3 \times 2^5}{2^6 \times 3^3 \times 7^3}$

$= 3^{4-3} \times 7^{3-3} \times 2^{5-6} = 3^1 \times 7^0 \times 2^{-1}$

$= 3 \times 1 \times 2^{-1} = 3 \times \frac{1}{2} = \frac{3}{2}$

(iii) $\dfrac{2^8 \times 2187}{3^5 \times 3^2}$

3	2187
3	729
3	243
3	81
3	27
3	9
	3

Sol.

$$\frac{2^8 \times 2187}{3^5 \times 3^2} = \frac{2^8 \times 3^7}{3^5 \times 2^5}$$
$$= 2^{8-5} \times 3^{7-5}$$
$$= 2^3 \times 3^2 = 8 \times 9 = 72$$

7. Solve for x :

(i) $\dfrac{2^{2x-1}}{2^{x+2}} = 4$

Sol.

$$2^{2x-1-(x+2)} = 2^2$$
$$2^{2x-1-x-2} = 2^2$$
$$2^{x-3} = 2^2$$

Equating the powers of the same base 2.

$$x - 3 = 2$$
$$x - 3 + 3 = 2 + 3$$
$$x = 5$$

(ii) $\dfrac{5^5 \times 5^{-4} \times 5^x}{5^{12}} = 5^{-5}$

$$\frac{5^5 \times 5^{-4} \times 5^x}{5^{12}} = 5^{-5} \Rightarrow \frac{5^{5-4+x}}{5^{12}} = 5^{-5}$$
$$\Rightarrow \frac{5^{1+x}}{5^{12}} = 5^{-5}$$
$$\Rightarrow 5^{1+x-12} = 5^{-5}$$
$$\Rightarrow 5^{x-11} = 5^{-5}$$

Equating the powers of same base 5.

$$x - 11 = -5$$
$$x - 11 + 11 = -5 + 11$$
$$x = 6$$

8. Expand using exponents: (i) 6054.321 (ii) 897.14

Sol. (i) $6054.321 = (6 \times 1000) + (0 \times 100) + (5 \times 10) + (4 \times 10^0) + \dfrac{3}{10} + \dfrac{2}{100} + \dfrac{1}{1000}$

$$= (6 \times 10^3) + (5 \times 10^1) + (4 \times 10^0) + \left(3 \times \frac{1}{10}\right) + \left(2 \times \frac{1}{100}\right) + \left(1 \times \frac{1}{1000}\right)$$
$$= (6 \times 10^3) + (5 \times 10^1) + (4 \times 10^0) + (3 \times 10^{-1}) + (2 \times 10^{-2}) + (1 \times 10^{-3})$$

(ii) $897.14 = (8 \times 100) + (9 \times 10) + (7 \times 10^0) + \dfrac{1}{10} + \dfrac{4}{100}$

$$= (8 \times 10^2) + (9 \times 10^1) + (7 \times 10^0) + \left(1 \times \frac{1}{10}\right) + \left(4 \times \frac{1}{100}\right)$$
$$= (8 \times 10^2) + (9 \times 10^1) + (7 \times 10^0) + (1 \times 10^{-1}) + (4 \times 10^{-2})$$

9. Find the number is standard form:

(i) $8 \times 10^4 + 7 \times 10^3 + 6 \times 10^2 + 5 \times 10^1 + 2 \times 1 + 4 \times 10^{-2} + 7 \times 10^{-4}$

Sol. $8 \times 10^4 + 7 \times 10^3 + 6 \times 10^2 + 5 \times 10^1 + 2 \times 1 + 4 \times 10^{-2} + 7 \times 10^{-4}$

$= 8 \times 10000 + 7 \times 1000 + 6 \times 100 + 5 \times 10 + 2 \times 1 + 4 \times \frac{1}{100} + 7 \times \frac{1}{10000}$

$= 80000 + 7000 + 600 + 50 + 2 + \frac{4}{100} + \frac{7}{10000}$

$= 87652.0407$

(ii) $5 \times 10^3 + 5 \times 10^1 + 5 \times 10^{-1} + 5 \times 10^{-3}$

Sol. $5 \times 10^3 + 5 \times 10^1 + 5 \times 10^{-1} + 5 \times 10^{-3}$

$= 5 \times 1000 + 5 \times 10 + 5 \times \frac{1}{10} + 5 \times \frac{1}{1000}$

$= 5000 + 50 + \frac{5}{10} + \frac{5}{1000} = 5050.505$

(iii) The radius of a hydrogen atom is 2.5×10^{-11} m.

Sol. Radius of a hydrogen atom $= 2.5 \times 10^{-11}$ m

$= 2.5 \times \frac{1}{10^{11}}$ m $= \frac{2.5}{10^{11}}$ m $= 0.000000000025$ m

10. Write each number in scientific notation:

(i) 467800000000 **(ii) 0.000001972** **(iii) 1642.398**

(iv) Earth's volume is about 1,083,000,000,000 cubic kilometers.

(v) If you fill a bucket with dirt, the portion of the whole Earth that is in the bucket will be 0.00000000000000000000000016 kg.

Sol. (i) $467800000000.0 = 4.678 \times 10^{11}$

(ii) $0.000001972 = 1.972 \times 10^{-6}$

(iii) $1642.398 = 1.642398 \times 10^3$

(iv) $1,083,000,000,000.0$

Earth's volume $= 1.083 \times 10^{12}$ cubic kilometers.

(v) Portion of earth in the bucket $= 0.00000000000000000000000016$ kg

$= 1.6 \times 10^{-24}$ kg.

Objective Type Questions

11. By what number should $(-4)^{-1}$ be multiplied so that the product becomes 10^{-1}?

(A) $\frac{2}{3}$ (B) $\frac{-2}{5}$ (C) $\frac{5}{2}$ (D) $\frac{-5}{2}$ **[Ans: (B) $\frac{-2}{5}$]**

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

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

$$\frac{-1}{4} \times x = \frac{1}{10}$$

$$x = \frac{-\cancel{4}^{2}}{\cancel{10}_{5}} = \frac{-2}{5}$$

12. $(-2)^{-3} \times (-2)^{-2}$ **is**

(A) $\frac{-1}{32}$ (B) $\frac{1}{32}$ (C) 32 (D) -32 **[Ans: (A)** $\frac{-1}{32}$**]**

13. Which is not correct?

(A) $\left(\frac{-1}{4}\right)^2 = 4^{-2}$ (B) $\left(\frac{-1}{4}\right)^2 = \left(\frac{1}{2}\right)^4$

(C) $\left(\frac{-1}{4}\right)^2 = 16^{-1}$ (D) $-\left(\frac{1}{4}\right)^2 = 16^{-1}$ **[Ans: (D)** $-\left(\frac{1}{4}\right)^2 = 16^{-1}$**]**

Hint: $(-2) - 3 \times (-2) - 2 = (-2) - 3 - 2 = (-2) - 5\ (-\frac{1}{2})5 = -\frac{1}{32}$

14. If $\frac{10^x}{10^{-3}} = 10^9$**, then** x **is** _____ .

(A) 4 (B) 5 (C) 6 (D) 7

15. 0.0000000002020 in scientific form is

(a) 2.02×10^{9} (b) 2.02×10^{-9} (c) 2.02×10^{-8} (d) 2.02×10^{-10}

Hint: 0.0000000002020 **[Ans: (d)** 2.02×10^{-10}**]**

Exercise 1.7

Miscellaneous Practice Problems

1. If $\frac{3}{4}$ **of a box of apples weighs 3 kg and 225 gm, how much does a full box of apples weigh?**

Let the total weight of a box of apple = x kg.

Weight of $\frac{3}{4}$ of a box apples = 3 kg 225 gm.

$$= 3.225 \text{ kg}$$

$$\frac{3}{4} \times x = 3225$$

$$x = \frac{3.225 \times 4}{3} \text{ kg} = 1.075 \times 4 \text{ kg} = 4.3 \text{ kg}$$

$$= 4 \text{ kg } 300 \text{ gm}$$

Weight of the box of apples = 4 kg 300 gm.

2. **Mangalam buys a water jug of capacity $3\frac{4}{5}$ litres. If she buys another jug which is $2\frac{2}{3}$ times as large as the smaller jug, how many litres can the larger one hold?**

Sol. Capacity of the small water jug $= 3\frac{4}{5}$ litres.

Capacity of the big jug $= 2\frac{2}{3}$ times the small one.

$= 2\frac{2}{3} \times 3\frac{4}{5} = \frac{8}{3} \times \frac{19}{5} = \frac{152}{15}$

$= 10\frac{2}{15}$ litres

Capacity of the large jug $= 10\frac{2}{15}$ litres.

3. **Ravi multiplied $\frac{25}{8}$ and $\frac{16}{15}$ to obtain $\frac{400}{120}$. He says that the simplest form of this product is $\frac{10}{3}$ and Chandru says the answer in the simplest form is $3\frac{1}{3}$. Who is correct? or Are they both correct? Explain.**

Sol. Product of $\frac{25}{8}$ and $\frac{16}{15}$ $= \frac{\cancel{25}^{5}}{\cancel{8}} \times \frac{\cancel{16}^{2}}{\cancel{15}_{3}}$

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

Answer obtained $= \frac{400}{120}$

$= \frac{400 \div 40}{120 \div 40} = \frac{10}{3} = 3\frac{1}{3}$

$\therefore$ The product is $\frac{400}{120}$ and its simplest form improper fraction is $\frac{10}{3}$.

And mixed fraction is $3\frac{1}{3}$.

$\therefore$ Both are correct.

4. **Find the length of a room whose area is $\frac{153}{10}$ sq.m and whose breadth is $2\frac{11}{20}$ m.**

Sol. Length of the room $\times$ Breadth $=$ Area of the room

Breadth of the room $= 2\frac{11}{20}$ m

Area of the room $= \frac{153}{10}$ sq.m

Length $\times 2\frac{11}{20} = \frac{153}{10}$

$$\text{Length} = \frac{153}{10} \div 2\frac{11}{20} = \frac{153}{10} \div \frac{51}{20} = \frac{\cancel{153}^{3}}{\cancel{10}_{1}} \times \frac{\cancel{20}^{2}}{\cancel{51}_{1}} = 6 \text{ m}$$

Length of the room = 6 m

5. There is a large square portrait of a leader that covers an area of 4489 cm^2. If each side has a 2 cm liner, what would be its area?

67	4489
67	67
	0

Sol.

Area of the square = 4489 cm^2

$(\text{side})^2$ = 4489 cm^2

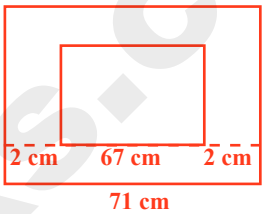
$(\text{side})^2 = 67 \times 67$

$\text{side}^2 = 67^2$

Length of a side = 67

Length of a side with liner = 67 + 2 + 2 cm

= 71 cm



Area of the larger square = 71 × 71 cm^2

= 5041 cm^2

Area of the liner = Area of big square – Area of small square

= (5041 – 4489) cm^2

= 552 cm^2

6. A greeting card has an area 90 cm^2. Between what two whole numbers is the length of its side?

1	90
5	45
3	9
3	3
	1

Sol.

Area of the greeting card = 90 cm^2

$(\text{side})^2$ = 90 cm^2

$(\text{side})^2 = 2 \times 5 \times 3 \times 3 = 2 \times 5 \times 3^2$

$\sqrt{(\text{side})^2} = \sqrt{2 \times 5 \times 3^2}$

$\text{Side} = 3\sqrt{2 \times 5}$

$\text{side} = 3\sqrt{10}$ cm

side = 3 × 3.2 cm

side = 9.6 cm

	3 . 1 6
3	10 00 00
	9 ↓
61	1 00
	61 ↓
626	39 00
	37 56
	144

∴ Side lies between the whole numbers 9 and 10.

7. 225 square shaped mosaic tiles, each of area 1 square decimetre exactly cover a square shaped verandah. How long is each side of the square shaped verandah?

Sol.

Area of one tile = 1 sq.decimeter

Area of 225 tiles = 225 sq.decimeter

225 square tiles exactly covers the square shaped verandah.

∴ Area of 225 tiles = Area of the verandah

Area of the verandah = 225 sq.decimeter

side × side = 15 × 15 sq.decimeter

side = 15 decimeters

Length of each side of verandah = 15 decimeters.

8. **If $\sqrt[3]{1906624} \times \sqrt{x} = 3100$, find x.**

Sol.

$$\sqrt[3]{1906624} \times \sqrt{x} = 3100$$

$$\sqrt[3]{2\times2\times2\times2\times2\times2\times31\times31\times31} \times \sqrt{x} = 3100$$

$$\sqrt[3]{2^3 \times 2^3 \times 31^3} \times \sqrt{x} = 3100$$

$$2 \times 2 \times 31 \times \sqrt{x} = 3100$$

$$\sqrt{x} = \frac{3100}{2\times2\times31} = \frac{\cancel{3100}^{\cancel{50}^{\cancel{100}^{25}}}}{\cancel{2}\times\cancel{2}\times\cancel{31}_{1}}$$

$$\sqrt{x} = 25$$

Squaring on both sides

$$(\sqrt{x})^2 = 25^2$$

$$x = 625$$

9. **If $2^{m-1} + 2^{m+1} = 640$, then find 'm'**

Sol.

Given $2^{m-1} + 2^{m+1} = 640$

$2^{m-1} + 2^{m+1} = 128 + 512$ [consecutive powers of 2]

$2^{m-1} + 2^{m+1} = 2^7 + 2^9$

$m - 1 = 7$

$m = 7 + 1$

$m = 8$

Powers of 2
2, 4, 8, 16, 32, 64, 128, 256, 512, ...

10. **Give the answer in scientific notation:**
A human heart beats at an average of 80 beats per minute. How many times does it beat in i) an hour? ii) a day? iii) a year? iv) 100 years?

Heart beat per minute = 80 beats

(i) an hour

One hour = 60 minutes

Heart beat in an hour = 60×80

$= 4800 = 4.8 \times 10^3$

(ii) In a day

One day = 24 hours = 24×60 minutes

$\therefore$ Heart beat in one day = $24 \times 60 \times 80 = 24 \times 4800 = 115200$

$= 1.152 \times 10^5$

(iii) a year

One year = 365 days = 365×24 hours = $365 \times 24 \times 60$ minutes

$\therefore$ Heart beats in a year = $365 \times 24 \times 60 \times 80$

$= 42048000 = 4.2048 \times 10^7$

(iv) 100 years

Heart beats in one year = 4.2048×10^7

Heart beats in 100 years = $4.2048 \times 10^7 \times 100 = 4.2048 \times 10^7 \times 10^2$

$= 4.2048 \times 10^9$

CHALLENGING PROBLEMS

11. In a map, if 1 inch refers to 120 km, then find the distance between two cities B and C which are $4\frac{1}{6}$ inches and $3\frac{1}{3}$ inches from the city A which is in between the cities B and C.

Sol. 1 inch = 120 km

Distance between A and B $= 4\frac{1}{6}$ inches

Distance between A and C $= 3\frac{1}{3}$ inches

$\therefore$ Distance between B and C $= 4\frac{1}{6} + 3\frac{1}{3}$ inches

$$= \frac{25}{6} + \frac{10}{3} = \frac{25}{6} + \frac{20}{6} = \frac{25+20}{6} = \frac{45}{6} \text{ inches}$$

$$1 \text{ inch} = 120 \text{ km}$$

$$\therefore \quad \frac{45}{6} \text{ inches} = \frac{45}{6} \times 120 \text{ km} = 900 \text{ km}$$

Distance between B and C = 900 km

12. Give an example for each of the following statements.

(i) The collection of all non-zero rational numbers is closed under division.

(ii) Subtraction is not commutative for rational numbers.

(iii) Division is not associative for rational numbers.

(iv) Distributive of multiplication over subtraction is true for rational numbers, that is $a\,(b-c) = ab - ac$.

(v) The mean of two rational numbers is rational and lies between them.

Sol. (i) Let $a = \frac{5}{6}$ and $b = \frac{-4}{3}$ be two non zero rational numbers.

$$a \div b = \frac{5}{6} \div \frac{-4}{3} = \frac{5}{6} \times \frac{3}{-4} = \frac{5}{-8} \text{ is in Q}$$

$\therefore$ Collection of non-zero rational numbers are closed under division.

(ii) Let $a = \frac{1}{2}$ and $b = -\frac{5}{6}$ be two rational numbers.

$$a - b = \frac{1}{2} - \left(-\frac{5}{6}\right) = \frac{1}{2} + \left(+\frac{5}{6}\right) = \frac{3}{6} + \frac{5}{6} = \frac{3+5}{6} = \frac{8}{6}$$

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

$$b - a = -\frac{5}{6} - \frac{1}{2} = -\frac{5}{6} - \frac{3}{6} = \frac{-5-3}{6} = \frac{-8}{6} = -1\frac{1}{3}$$

$$a - b \neq b - a$$

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

(iii) Let $a = \frac{2}{5}, b = \frac{6}{5}, c = \frac{3}{5}$ be three rational numbers.

$$a \div (b \div c) = \frac{2}{5} \div \left(\frac{6}{5} \div \frac{3}{5}\right) = \frac{2}{5} \div \left(\frac{6}{5} \times \frac{5}{3}\right)$$

$$= \frac{2}{5} \div \frac{2}{1} = \frac{2}{5} \times \frac{1}{2} = \frac{1}{5} \quad \ldots(1)$$

$$(a \div b) \div c = \left(\frac{2}{5} \div \frac{6}{5}\right) \div \frac{3}{5}$$

$$= \left(\frac{2}{5} \times \frac{5}{6}\right) \div \frac{3}{5} = \frac{1}{3} \div \frac{3}{5} = \frac{1}{3} \times \frac{5}{3} = \frac{5}{9} \quad \ldots(2)$$

From (1) and (2) $\frac{1}{5} \neq \frac{5}{9}$

$$a \div (b \div c) \neq (a \div b) \div c$$

$\therefore$ Division is not associative for rational numbers.

(iv) Let $a = \frac{2}{9}, b = \frac{3}{6}, c = \frac{1}{3}$ be three rational numbers

To prove $a \times (b - c) = ab - ac$

$$a \times (b - c) = \frac{2}{9} \times \left(\frac{3}{6} - \frac{1}{3}\right)$$

$$= \frac{2}{9} \times \left(\frac{3 - (1 \times 2)}{6}\right) = \frac{2}{9} \times \frac{(3-2)}{6}$$

$$= \frac{2}{9} \times \frac{1}{6} = \frac{1}{27} \quad \ldots(1)$$

$$ab - ac = \left(\frac{2}{9} \times \frac{3}{6}\right) - \left(\frac{2}{9} \times \frac{1}{3}\right) = \frac{1}{9} - \frac{2}{27}$$

$$= \frac{(1 \times 3) - 2}{27} = \frac{3-2}{27} = \frac{1}{27} \quad \ldots(2)$$

$\therefore$ From (1) and (2)

$$a \times (b - c) = ab - ac$$

$\therefore$ Distributivity of multiplication over subtraction is true for rational numbers.

(v) Let $a = \frac{2}{11}$ and $b = \frac{5}{6}$ be two rational numbers.

Mean of a and b is $c = \frac{1}{2}(a + b) = \frac{1}{2}\left(\frac{2}{11} + \frac{5}{6}\right) = \frac{1}{2}\left(\frac{(2 \times 6) + (5 \times 11)}{66}\right)$

$$= \frac{1}{2} \times \left(\frac{12 + 55}{66}\right) = \frac{1}{2} \times \frac{67}{66} = \frac{67}{132} \text{ is in Q.}$$

Also $\frac{2}{11} = \frac{2 \times 12}{11 \times 12} = \frac{24}{132}$

$\frac{5}{6} = \frac{5 \times 22}{6 \times 22} = \frac{110}{132}$

$\therefore \frac{24}{132} < \frac{67}{132} < \frac{110}{132}$

$\therefore$ The mean lies between the given rational numbers $\frac{2}{11}$ and $\frac{5}{6}$.

13. If $\frac{1}{4}$ of a ragi adai weighs 120 grams, what will be the weight of $\frac{2}{3}$ of the same ragi adai?

Sol. Let the weight of 1 ragi adai = x grams

given $\frac{1}{4}$ of x = 120 gm

$\frac{1}{4} \times x = 120$

$x = 120 \times 4$

$x = 480$ gm

$\therefore \frac{2}{3}$ of the adai = $\frac{2}{3} \times 480$ gm $= 2 \times 160$ gm $= 320$ gm

$\frac{2}{3}$ of the weight of adai = 320 gm

14. If $p + 2q = 18$ and $pq = 40$, find $\frac{2}{p} + \frac{1}{q}$

Sol. Given $p + 2q = 18$ ....(1)

$pq = 40$ ....(2)

$\frac{2}{p} + \frac{1}{q} = \frac{(2 \times q) + (1 \times p)}{pq} = \frac{2q + p}{pq} = \frac{18}{40}$ [$\because$ from (1) and (2)]

$\frac{2}{p} + \frac{1}{q} = \frac{9}{20}$

15. Find 'x' if $5\frac{x}{5} \times 3\frac{3}{4} = 21$.

Sol.

$5\frac{x}{5} \times 3\frac{3}{4} = 21$

$\frac{25 + x}{5} \times \frac{15}{4} = 21$

$\frac{25 + x}{5} = 21 \div \frac{15}{4}$

$\frac{25 + x}{5} = 21 \times \frac{4}{15}$

$\frac{25 + x}{5} = \frac{28}{5}$

$25 + x = \frac{28 \times 5}{5}$

$25 + x = 28$

$x = 28 - 25$

$x = 3$

16. **By how much does $\frac{1}{\frac{10}{11}}$ exceed $\frac{\frac{1}{10}}{11}$?**

Sol. The difference $= \frac{1}{\frac{10}{11}} - \frac{\frac{1}{10}}{11} = \left(\frac{1}{1} \times \frac{11}{10}\right) - \left(\frac{1}{10} \times \frac{1}{11}\right) = \frac{11}{10} - \frac{1}{110} = \frac{121-1}{110} = \frac{120}{110} = \frac{12}{11}$

$\frac{1}{\frac{10}{11}}$ exceed $\frac{\frac{1}{10}}{11}$ by $\frac{12}{11}$

17. **A group of 1536 cadets wanted to have a parade forming a square design. Is it possible? If it is not possible how many more cadets would be required?**

Sol. Number of cadets to form square design

$$1536 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times 2 \times 3$$

2	1536
2	768
2	384
2	192
2	96
2	48
2	24
2	12
2	6
	3

The numbers 2 and 3 are unpaired

$\therefore$ It is impossible to have the parade forming square design with 1536 cadets.

	3 9
3	15 36
	9
61	6 36
	6 21
	15

$$39 \times 39 = 1521$$

$$\text{Also } 40 \times 40 = 1600$$

$\therefore$ We have to add $(1600 - 1536) = 64$ to make 1536 a perfect square.

$\therefore$ 64 more cadets would be required to form the square design.

18. **Evaluate: $\sqrt{286225}$ and use it to compute $\sqrt{2862.25} + \sqrt{28.6225}$.**

Sol.

	5 3 5
3	28 62 25
	25
103	3 62
	3 09
1065	53 25
	53 25
	0

$$\therefore \sqrt{286225} = 535$$

$$\sqrt{2862.25} = \sqrt{\frac{286225}{100}} = \frac{\sqrt{286225}}{100} = \frac{535}{10} = 53.5$$

$$\sqrt{28.6225} = \sqrt{\frac{286225}{1000}} = \frac{\sqrt{286225}}{10000} = \frac{535}{100} = 5.35$$

53.5
5.35
58.85

$$\therefore \sqrt{2862.25} + \sqrt{28.6225} = 53.5 + 5.35 = 58.85$$

19. **Simplify : $(3.769 \times 10^5) + (4.21 \times 10^5)$**

Sol. $(3.769 \times 10^5) + (4.21 \times 10^5) = 3,76,900 + 4,21,000$

$= 7,97,900 = 7.979 \times 10^5$

7,97,900.0
7.979×10^5

20. **Order the following from the least to the greatest: $16^{25}, 8^{100}, 3^{500}, 4^{400}, 2^{600}$**

Sol.

$16^{25} = (2^4)^{25} = 2^{100}$

$8^{100} = (2^3)^{100} = 2^{300}$

$4^{400} = (2^2)^{400} = 2^{800}$

$2^{600} = 2^{600}$

Comparing the powers we have.

$2^{100} < 2^{300} < 2^{600} < 2^{800}$

$\therefore$ The required order : $16^{25}, 8^{100}, 2^{600}, 3^{500}, 4^{400}$

Additional Questions and Answers

Very Short Answers (2 Marks)

1. **Add $\frac{3}{5}$ and $\frac{13}{5}$**

Sol. $\frac{3}{5}+\frac{13}{5} = \frac{3+13}{5} = \frac{16}{5} = 3\frac{1}{5}$

2. **Add $\frac{7}{9}$ and $\frac{-12}{9}$.**

Sol. $\frac{7}{9}+\frac{(-12)}{9} = \frac{7+(-12)}{9} = \frac{-5}{9}$

3. **Add $\frac{-3}{7}$ and $\frac{-17}{7}$.**

Sol. $\frac{-3}{7}+\left(\frac{-17}{7}\right) = \frac{(-3)+(-17)}{7}$

$= \frac{-20}{7} = -2\frac{6}{7}$

4. **Add $\frac{4}{-13}$ and $\frac{7}{13}$.**

Sol. $\frac{4}{-13}+\frac{7}{13} = \frac{-4}{13}+\frac{7}{13} = \frac{(-4)+7}{13} = \frac{3}{13}$

5. **Subtract $\frac{3}{4}$ from $\frac{7}{4}$.**

Sol. $\frac{7}{4}-\frac{3}{4} = \frac{7-3}{4} = \frac{4}{4} = 1$

6. **Subtract $\frac{6}{17}$ from $\frac{7}{17}$.**

Sol.
$$\frac{7}{17}-\frac{6}{17} = \frac{7-6}{17} = \frac{1}{17}$$

7. **Multiply $\frac{3}{4}$ by $\frac{5}{7}$.**

Sol.
$$\frac{3}{4}\times\frac{5}{7} = \frac{3\times5}{4\times7} = \frac{15}{28}$$

8. **Divide 1 by $\frac{1}{2}$.**

Sol.
$$1\div\frac{1}{2} = \frac{1}{1}\times\frac{2}{1} = \frac{1\times2}{1\times1} = 2$$

9. **Divide $\frac{2}{3}$ by $\frac{-7}{12}$.**

Sol.
$$\frac{2}{3}\div\frac{-7}{12} = \frac{2}{3}\times\frac{12}{-7} = \frac{2\times12}{3\times-7} = \frac{24}{-21} = -1\frac{\cancel{3}}{\cancel{21}_{7}} = -1\frac{1}{7}$$

10. **$\frac{-22}{27}\div\frac{-110}{18}$ = ?**

Sol.
$$\frac{-22}{27}\div\frac{-110}{18} = \frac{-22}{\cancel{27}_{3}}\times\frac{\cancel{18}^{2}}{\cancel{-110}_{55}} = \frac{22}{165}$$

11. **Verify addition of rational numbers is closed using $\frac{1}{4}$ and $\frac{2}{3}$.**

Sol. Let $a = \frac{1}{4}$ and $b = \frac{2}{3}$

$$a+b = \frac{1}{4}+\frac{2}{3} = \frac{(1\times3)+(2\times4)}{3\times4} = \frac{3+8}{12} = \frac{11}{12}$$ is in Q.

$\therefore$ Addition of rational numbers is closed.

12. **Is subtraction is commutative for rational numbers. Give an example.**

Sol. No, subtraction is not commutative for rational numbers.

Example: Let $a = \frac{1}{2}$ and $b = \frac{5}{6}$

$$a-b = \frac{1}{2}-\frac{5}{6} = \frac{(1\times3)-5}{6} = \frac{3-5}{6} = \frac{-2}{6} = \frac{-1}{3} \quad \text{....(1)}$$

$$b-a = \frac{5}{6}-\frac{1}{2} = \frac{5}{6}-\frac{3}{6} = \frac{5-3}{6} = \frac{2}{6} = \frac{1}{3} \quad \text{....(2)}$$

From (1) and (2) $a-b \neq b-a$ for rational numbers

13. **Show that multiplication of rational numbers is commutative for $a = \frac{3}{2}$ and $b = \frac{5}{7}$.**

Sol.
$$a\times b = \frac{3}{2}\times\frac{5}{7} = \frac{15}{14}$$

$$b\times a = \frac{5}{7}\times\frac{3}{2} = \frac{15}{14}$$

$\therefore$ $a\times b = b\times a$ for rational numbers.

$\therefore$ Multiplication of rational numbers is commutative.

14. Is division of rational numbers satisfy closure property? Why? What is the condition for the set to satisfy closure property?

Sol. Division of rational numbers is not closed always. Because division by 0 is not possible. So if we take the set of all non-zero rational numbers, then the set satisfy the closure property.

Eg. Let $a = \frac{1}{3}$, $b = -\frac{2}{3}$

$$a \div b = \frac{1}{3} \div -\frac{2}{3} = \frac{1}{3} \times \frac{3}{-2} = -\frac{1}{2} \text{ is in Q.}$$

15. Write the distributive law for rational numbers of multiplication over addition.

Sol. If a, b and c be three rational numbers, then $a \times (b + c) = (a \times b) + (a \times c)$ is the distributive property of multiplication over addition.

16. State the associative property for addition of rational numbers.

Sol. If a, b and c be three rational numbers then $(a + b) + c = a + (b + c)$.

17. Verify $x \times y = y \times x$ for $x = \frac{-1}{3}, y = \frac{2}{7}$.

Sol.

$$x \times y = \frac{-1}{3} \times \frac{2}{7} = \frac{-2}{21} \quad \text{...(1)}$$

$$y \times x = \frac{2}{7} \times \frac{-1}{3} = \frac{-2}{21} \quad \text{....(2)}$$

From (1) and (2), we have

$$x \times y = y \times x$$

18. Verify commutative property of addition for $x = \frac{1}{3}, y = \frac{-7}{9}$.

Sol. Given $x = \frac{1}{3}, y = \frac{-7}{9}$

$$x + y = \frac{1}{3} + \frac{-7}{9} = \frac{(1 \times 3) + (-7 \times 1)}{9} = \frac{3 + (-7)}{9} = \frac{-4}{9} \quad \text{....(1)}$$

$$y + x = \frac{-7}{9} + \frac{1}{3} = \frac{-7 + (1 \times 3)}{9}$$

$$= \frac{-7 + 3}{9} = \frac{-4}{9} \quad \text{....(2)}$$

From (1) and (2)

$x + y = y + x$, i.e commutative property is true.

Short Answers (3 Marks)

1. Add $\frac{4}{-3}$ and $\frac{8}{15}$.

Sol.

$$\frac{4}{-3} + \frac{8}{15} = \frac{-4}{3} + \frac{8}{15}$$

LCM of 3 and 15 is 15

$$\frac{(-4 \times 5) + (8 \times 1)}{15} = \frac{-20 + 8}{15} = \frac{-12^{4}}{15_{5}} = \frac{-4}{5}$$

2. **Simplify** $\frac{9}{-27}+\frac{18}{39}$.

Sol.

$$\frac{9}{-27}+\frac{18}{39} = \frac{-\cancel{9}}{\cancel{27}_{3}}+\frac{{}^{6}\cancel{18}}{\cancel{39}_{13}}$$

$$= \frac{-1}{3}+\frac{6}{13}=\frac{(-1\times13)+(6\times3)}{3\times13} = \frac{-13+18}{39}=\frac{5}{39}$$

3. **What number should be added to** $\frac{-7}{8}$ **to get** $\frac{5}{9}$**?**

Sol. Let the number to be added be x

$$\frac{-7}{8}+x = \frac{5}{9}$$

$$x = \frac{5}{9}+\frac{7}{8}=\frac{(5\times8)+(7\times9)}{9\times8} = \frac{40+63}{72}=\frac{103}{72}$$

$$x = 1\frac{31}{72}$$

$\therefore \frac{103}{72}$ should be added to get $\frac{5}{9}$.

4. **What number should be subtracted from** $\frac{7}{3}$ **to get** $\frac{5}{4}$**?**

Sol. Let the number to be subtracted $= x$

$$\frac{7}{3}-x = \frac{5}{4}$$

$$\frac{7}{3}-\frac{5}{4} = x$$

$$x = \frac{(7\times4)-(5\times3)}{3\times4}=\frac{28-15}{12} = \frac{13}{12}=1\frac{1}{12}$$

$\frac{13}{12}$ should be subtracted.

5. **Simplify** $\left(\frac{-16}{5}\times\frac{20}{8}\right)-\left(\frac{15}{5}\times\frac{-35}{3}\right)$.

Sol. $\left(\frac{-16}{5}\times\frac{20}{8}\right)-\left(\frac{15}{5}\times\frac{-35}{3}\right) = \left(\frac{-2}{1}\times\frac{4}{1}\right)-\left(\frac{1}{1}\times\frac{-35}{1}\right) = -8-(-35) = -8+(+35) = 27$

6. **The product of two rational numbers is** $\frac{-28}{81}$**. If one of the number is** $\frac{14}{27}$**. find the other number.**

Sol. Let the other number be x

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

$$x = \frac{-28}{81}\div\frac{14}{27} = \frac{-28}{81}\times\frac{27}{14} = \frac{-2}{3}\times\frac{1}{1} = \frac{-2}{3}$$

$\therefore$ Other number $= \frac{-2}{3}$

7. **Find the least number by which 1100 must be multiplied so that the product becomes a perfect square. Also, in each case find the square root of the perfect square so obtained.**

Sol. We find 1100 $= 2 \times 2 \times 5 \times 5 \times 11 = 2^2 \times 5^2 \times 11$

$\therefore$ The prime factor 11 has no pair.

$\therefore$ If we multiply 1100 by 11, then the product becomes a perfect square.

2	1100
2	550
5	275
5	55
11	11
	1

$\therefore$ New number $= 1100 \times 11 = 12100$

$12100 = 2^2 \times 5^2 \times 11^2$

$\sqrt{12100} = 2 \times 5 \times 11 = 110$

Square root of the new number $= 110$

8. **Find the square of 509 using $(a + b)^2 = a^2 + 2ab + b^2$**

Sol. $509^2 = (500 + 9)^2$

$= 500^2 + 2 \times 500 \times 9 + 9^2$

$= 250000 + 9000 + 81$

$509^2 = 259081$

9. **Find the sum without adding**
$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$

Sol. Given sum is the sum of first 12 odd natural numbers.

Sum of first n odd natural numbers is n^2.

$\therefore 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 = 12^2 = 144$

Long Answers (5 Marks)

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

Sol. Let the number to be multiplied by x.

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

$x = \frac{5}{12} \div \frac{3}{-14} = \frac{5}{\cancel{12}_{6}} \times \frac{-\cancel{14}^{7}}{3} = \frac{5}{6} \times \frac{-7}{3} = \frac{-35}{18}$

$\therefore$ The number to be multiplied $= \frac{-35}{18}$.

2. **Simplify $\left(\frac{-16}{5} \times \frac{20}{8}\right) - \left(\frac{15}{5} \times \frac{-35}{3}\right) \div \left(\frac{11}{16} + \frac{4}{8}\right)$.**

Sol. $= \left(\frac{-16}{5} \times \frac{20}{8}\right) - \left(\frac{15}{5} \times \frac{-35}{3}\right) \div \left(\frac{11 + (4 \times 2)}{16}\right)$

$= \left(\frac{-16}{5} \times \frac{20}{8}\right) - \left(\frac{15}{5} \times \frac{-35}{3}\right) \div \left(\frac{11 + 8}{16}\right)$

$$= \left(\frac{-16^{2}}{5} \times \frac{{}^{4}20}{8}\right) - \left(\frac{15^{3}}{5} \times \frac{-35}{7}\right) \div \frac{19}{16}$$

$$= -8 - (-35) \times \frac{16}{19}$$

$$= (-8) - (-35) \times \frac{16}{19}$$

$$= -8 - \left(-\frac{560}{19}\right) = -8 + \frac{560}{19}$$

$$= \frac{(-8 \times 19) + 560}{19} = \frac{-152 + 560}{19} = \frac{408}{19} = 21\frac{9}{19}$$

3. **Simplify** $\left(\frac{-3}{2} \times \frac{4}{5}\right) + \left(\frac{9}{5} \times \frac{-10}{3}\right) - \left(\frac{1}{2} \times \frac{3}{4}\right)$.

Sol.

$$= \frac{-12}{10} + \left(\frac{-90}{15}\right) - \left(\frac{3}{8}\right)$$

Hint:

2	10, 15, 8
5	5, 15, 4
	1, 3, 4

LCM of 10, 15, 8 $= 2 \times 5 \times 3 \times 4 = 120$

$$= \frac{(-12 \times 12) + (-90 \times 8) - (3 \times 15)}{120}$$

$$= \frac{-144 + (-720) - 45}{120} = \frac{-864 - 45}{120}$$

$$= \frac{-864 + (-45)}{120} = \frac{-909}{120} = \frac{-303}{40}$$

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

Sol. $\left(\frac{-7}{18} \times \frac{15}{-7}\right) - \left(1 \times \frac{1}{4}\right) + \left(\frac{1}{2} \times \frac{1}{4}\right) = \left(\frac{-7 \times 15}{18 \times -7}\right) - \left(\frac{1 \times 1}{1 \times 4}\right) + \left(\frac{1 \times 1}{2 \times 4}\right) = \left(\frac{1 \times 15}{18 \times 1}\right) - \left(\frac{1}{4}\right) + \left(\frac{1}{8}\right)$

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

$$= \frac{20 - 6 + 3}{24} = \frac{14 + 3}{24} = \frac{17}{24}$$

5. **Evaluate** $\frac{6}{7} - 2 + \frac{-7}{9} + \frac{19}{21}$.

Sol.

$$\frac{6}{7} - 2 + \frac{-7}{9} + \frac{19}{21} = \frac{6}{7} - \frac{2}{1} + \frac{-7}{9} + \frac{19}{21}$$

$$= \frac{(6 \times 9) - (2 \times 63) + (-7 \times 7) + (19 \times 3)}{63}$$

$$= \frac{54-126+(-49)+57}{63} = \frac{54-126-49+57}{63}$$

$$= \frac{-72-49+57}{63} = \frac{-121+57}{63} = \frac{-64}{63} = -1\frac{1}{63}$$

6. **Simplify** $\frac{5}{12}+\frac{-5}{18}-\frac{7}{24}$.

Hint:

2	12, 18, 24
3	6, 9, 12
2	2, 3, 4
	1, 3, 2

Sol.

$$\frac{5}{12}+\frac{-5}{18}-\frac{7}{24} = \frac{(5\times6)+(-5\times4)-(7\times3)}{72}$$

$$= \frac{30+(-20)-(21)}{72} = \frac{10-21}{72}$$

$$= \frac{-11}{72}$$

Hint:
$= 2 \times 3 \times 2 \times 3 \times 2$
$= 72$

7. **Verify associative property for addition of rational numbers for** $a = \frac{5}{6}, b = \frac{-3}{4}, c = \frac{4}{7}$.

Sol. Given $a = \frac{5}{6}, b = \frac{-3}{4}, c = \frac{4}{7}$

To verify $(a + b) + c = a + (b + c)$

$$\text{Let } a+b = \frac{5}{6}+\frac{-3}{4} = \frac{(5\times2)+(-3\times3)}{12} = \frac{10+(-9)}{12}$$

$$a+b = \frac{1}{12}$$

$$\text{Now } (a+b)+c = \frac{1}{12}+\frac{4}{7} = \frac{(1\times7)+(4\times12)}{84} = \frac{7+48}{84} = \frac{55}{84}$$

$$\therefore (a+b)+c = \frac{55}{84} \quad \ldots(1)$$

$$\text{Now } b+c = \frac{-3}{4}+\frac{4}{7} = \frac{(-3\times7)+(4\times4)}{28} = \frac{-21+16}{28} = \frac{-5}{28}$$

$$a+(b+c) = \frac{5}{6}+\left(\frac{-5}{28}\right) = \frac{(5\times14)+(-5\times3)}{84} = \frac{70+(-15)}{84}$$

$$a+(b+c) = \frac{55}{84} \quad \ldots(2)$$

From (1) and (2) we have $(a + b) + c = a + (b + c)$.
$\therefore$ Associative property is true for addition of rational numbers.

8. **Verify distributive property of multiplication over addition for the rational numbers** $a = \frac{3}{4}, b = \frac{-2}{3}, c = \frac{3}{7}$.

Sol. Given $a = \frac{3}{4}, b = \frac{-2}{3}, c = \frac{3}{7}$

To verify $a \times (b + c) = (a \times b) + (a \times c)$

$$\text{Let } a\times(b+c) = \frac{3}{4}\times\left(\frac{-2}{3}+\frac{3}{7}\right)$$

$$= \frac{3}{4} \times \left[\frac{(-2\times 7)+(3\times 3)}{21}\right] = \frac{3}{4} \times \left[\frac{-14+9}{21}\right]$$

$$= \frac{\cancel{3}}{4} \times \frac{-5}{\cancel{21}_{7}} = \frac{-5}{4\times 7}$$

$$a \times (b + c) = \frac{-5}{28} \quad \ldots.(1)$$

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

$$= \frac{-6}{12}+\frac{9}{28} = \frac{(-6\times 7)+(9\times 3)}{84} = \frac{-42+27}{84} = \frac{-\cancel{15}^{5}}{\cancel{84}_{28}}$$

$$(a \times b) + (a \times c) = \frac{-5}{28} \quad \ldots.(2)$$

From (1) and (2)

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

$\therefore$ Distributive property of multiplication over addition is true for the given rational numbers.

9. Rearrange suitably and apply the properties to simplify $\left(\frac{6}{7}\times\frac{2}{3}\right)+\left(\frac{9}{11}+\frac{2}{3}\right)+\left(\frac{2}{3}\times\frac{4}{9}\right)$.

Sol. $\left(\frac{6}{7}\times\frac{2}{3}\right)+\left(\frac{9}{11}+\frac{2}{3}\right)+\left(\frac{2}{3}\times\frac{4}{9}\right) = \left\{\left(\frac{6}{7}\times\frac{2}{3}\right)+\left(\frac{9}{11}+\frac{2}{3}\right)\right\} + \left\{\frac{2}{3}\times\frac{4}{9}\right\}$ [$\because$ Associativity of addition]

$= \left\{\left(\frac{9}{11}+\frac{2}{3}\right)+\left(\frac{6}{7}\times\frac{2}{3}\right)\right\} + \left\{\frac{2}{3}\times\frac{4}{9}\right\}$ [$\because$ Addition is commutative]

$= \left\{\frac{9}{11}+\frac{2}{3}\right\} + \left\{\left(\frac{6}{7}\times\frac{2}{3}\right)+\left(\frac{2}{3}\times\frac{4}{9}\right)\right\}$ [$\because$ Addition is associative]

$= \left\{\frac{(9\times 3)+(2\times 11)}{33}\right\} + \left\{\left(\frac{2}{3}+\frac{6}{7}\right)+\left(\frac{2}{3}\times\frac{4}{9}\right)\right\}$

$= \frac{27+22}{33} + \left\{\frac{2}{3}\times\left[\frac{6}{7}+\frac{4}{9}\right]\right\}$ [$\because$ Multiplication is commutative]

$= \frac{49}{33} + \left\{\frac{2}{3}\times\left[\frac{(6\times 9)+(4\times 7)}{63}\right]\right\}$ [$\because$ Distributive property of multiplication over addition]

$= \frac{49}{33}+\left\{\frac{2}{3}\times\left[\frac{54+28}{63}\right]\right\} = \frac{49}{33} + \left\{\frac{2}{3}\times\frac{82}{63}\right\}$

$= \frac{49}{33}+\frac{164}{189} = \frac{(49\times 63)+(164\times 11)}{2079} = \frac{3087+1804}{2079}$

$= \frac{4891}{2079}$

10. Write a Pythagorean triplet whose one number is 110

Sol.

$$\begin{aligned} \text{Here let } 2m &= 110 \\ m &= 55 \\ m^2 - 1 &= 55^2 - 1 \\ &= 3025 - 1 = 3024 \\ m^2 + 1 &= 55^2 + 1 \\ &= 3025 + 1 \\ &= 3026 \end{aligned}$$

$\therefore$ Pythagorean triplet is 110, 3024, 3026.

55
55
275
275
3025

11. Find the square root of $10\frac{2}{3}$ correct to three places of decimal.

Sol.

$$10\frac{2}{3} = 10.6666.....$$

```
    3 . 2  6  5  9
  ---------------------
3 | 10 . 66 66 66 66
    9   ↓
  ---------------------
62  1  66
    1  24   ↓
  ---------------------
646    42 66
       38 76   ↓
  ---------------------
6525   3 90 66
       3 26 25   ↓
  ---------------------
65309     64 41 66
          58 77 81
  ---------------------
             5 63 85
```

$\sqrt{10\frac{2}{3}} = 3.2659 \Rightarrow \sqrt{10\frac{2}{3}} = 3.266$ correct to three places of decimal.

12. Find the square root of 0.053361

Sol.

```
    0 . 2  3  1
  ---------------
2 | 0 . 05 33 61
      04   ↓
  ---------------
43    1  33   ↓
      1  29
  ---------------
461      4  61
         4  61
  ---------------
            0
```

$\sqrt{0.053361} = 0.231$

13. Three numbers are in the ratio 2:3:4. The sum of their cubes is 33957. Find the numbers.

Sol. Let the numbers be $2x$, $3x$ and $4x$.

$$(2x)^3 + (3x)^3 + (4x)^3 = 33957$$

$$8x^3 + 27x^3 + 64x^3 = 33957$$
$$99x^3 = 33957$$
$$x^3 = \frac{33957}{99}$$
$$x^3 = 343$$
$$x^3 = 7 \times 7 \times 7$$
$$x^3 = 7^3$$
$$x = 7$$
$$\therefore \text{ The numbers are } 2x = 2 \times 7 = 14$$
$$3x = 3 \times 7 = 21$$
$$4x = 4 \times 7 = 28$$

14. The volume of a cube is 9261000 m^3. Find the side of the cube?

Sol.

$$\text{Volume of the cube} = \text{side} \times \text{side} \times \text{side}$$
$$\text{side} \times \text{side} \times \text{side} = 9261000$$
$$\text{side} = \sqrt[3]{9261 \times 1000} = \sqrt[3]{9261} \times \sqrt[3]{1000}$$
$$= \sqrt[3]{3^3 \times 7^3} \times \sqrt[3]{10 \times 10 \times 10} = 3 \times 7 \times 10 = 210$$
$$\therefore \text{ Side of the cube} = 210 \text{ m}$$

15. If the diameters of the sun and Earth are 1.4×10^9 m and 1.275×10^7 m respectively. Compare these two.

Sol.

$$\frac{\text{Diameter of the Sun}}{\text{Diameter of the Earth}} = \frac{1.4 \times 10^9}{1.275 \times 10^7}$$
$$= \frac{1.4 \times 10^2 \times 10^7}{1.275 \times 10^7} = \frac{1.4}{1.275} \times 100$$
$$= \frac{1.4}{1.3} \times 100 \simeq 100$$

So the diameter of the Sun is about 100 times the diameter of the Earth.

16. The size of a red blood cell is 0.000007 m and that of a plant cell is 0.00001275 m. Compare these two.

Sol.

$$\frac{\text{Size of blood cell}}{\text{Size of plant cell}} = \frac{0.000007\text{m}}{0.00001275\text{m}} = \frac{7 \times 10^{-6}}{1.275 \times 10^{-5}}$$
$$= \frac{7 \times 10^{6+5}}{1.275} = \frac{7 \times 10^{-1}}{1.275} = \frac{0.7}{1.275} = \frac{0.7}{1.3} = \frac{1}{2}$$

$\therefore$ RBC size if half the size of a plant cell.

UNIT TEST

TIME: 2.15 HRS **MAX MARKS : 50**

I. Fill in the blanks. 5 × 1 = 5

1. The additive inverse of –2 is _____.
2. Multiplicative inverse of $-\frac{1}{4}$ is _____.
3. The property illustrated in $\frac{2}{13} \times 0 = 0 = 0 \times \frac{2}{13}$ is _____.
4. If a number ends with 5 or 0 its square ends with _____ respectively.
5. Cube root of $15 \times 75 \times 3$ = _____.

II. Choose the best answer from the options given below. 5 × 1 = 5

6. $\frac{1}{2}+\frac{6}{4}$ is

   (a) $\frac{6}{6}$ (b) $\frac{6}{4}$ (c) $\frac{2}{1}$ (d) None of these

7. $\frac{5}{6} \div \frac{6}{2}$ is

   (a) $\frac{5}{2}$ (b) $\frac{2}{5}$ (c) $\frac{5}{18}$ (d) $\frac{30}{12}$

8. $\frac{1}{2} \times \left(\frac{2}{3}+\frac{4}{6}\right) = \left(\frac{1}{2} \times \frac{2}{3}\right) + \left(\frac{1}{2} \times \_\_\right)$

   (a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{4}{6}$ (d) 0

9. $\frac{1}{2}+\left(\frac{1}{3}+\frac{1}{4}\right) = \left(\frac{1}{2}+\frac{1}{3}\right)+\frac{1}{4}$. The property stated is

   (a) Closure property (b) Associative property
   (c) Distributive property (d) Commutative property

10. Multiplicative identity is _____.

    (a) 1 (b) 0
    (c) the given number itself (d) reciprocal of the given number

III. Say True or False. 5 × 1 = 5

11. Division of rational numbers is commutative.
12. Division of rational numbers is not always closed.
13. Multiplication of rational numbers does not satisfy associative property.
14. $\frac{5}{6}-\frac{11}{12}=\frac{-1}{12}$.
15. $\frac{4}{3} \times \frac{3}{11} = \frac{12}{11}$.

IV. Answer any fifteen of the following questions. 15 × 2 = 30

16. $\frac{-8}{11}+\frac{-4}{11}$ Simplify.
17. Add $\frac{31}{-4}$ and $\frac{-5}{8}$
18. $\frac{8}{9}+\frac{-11}{6}$.
19. Verify commutativity for addition $a=\frac{-11}{5}, b=\frac{4}{5}$.
20. Subtract $\frac{-2}{3}$ from $\frac{5}{6}$.
21. Evaluate $\frac{-6}{13}-\frac{-7}{13}$.
22. Multiply $\frac{9}{-7}$ by $\frac{36}{-11}$.
23. Multiply $\frac{-11}{13}$ by $\frac{-21}{7}$.
24. Multiply $\frac{-3}{5}$ by $\frac{-4}{7}$.
25. Verify $x \times y = y \times x$ for $x = 2, y = \frac{7}{-8}$.
26. What should we multiply with $\frac{-1}{6}$ to get $\frac{-23}{9}$?
27. What should we multiply with $\frac{-15}{28}$ to get $\frac{-5}{7}$
28. Find $(x+y) \div (x-y)$ if $x=\frac{1}{4}; y=\frac{3}{2}$.
29. Find $\sqrt[3]{13824}$
30. If 256 a perfect cube. If not to make it a perfect cube what number should be multiplied?
31. Find the square root of 3.1428
32. Compute the square root of 2. Correct to 3 places of decimals.
33. Simplify : $\left(\frac{1}{4}\right)^{-2}+\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-2}$

V. Answer any one of the following questions. 1 × 5 = 5

34. A decimal fraction is multiplied by itself. If the product is 251953.8025, find the fraction.
35. Find the length of a cube whose volume is 32.768 m^3.

Answers

I. 1. +2 2. $\frac{-4}{1}$ 3. Multiplication by 0 4. 5 or 0 5. 15

II. 6. (c) $\frac{2}{1}$ 7. (c) $\frac{5}{18}$ 8. (c) $\frac{4}{6}$ 9. (b) associative property 10. (a) 1

III. 11. False 12. True 13. False 14. True 15. False

IV. 16. $\frac{-12}{11}$ 17. $\frac{-67}{8}$ 18. $\frac{-17}{18}$ 19. Hence it is verified
20. $\frac{3}{2}$ 21. $\frac{1}{13}$ 22. $\frac{324}{77}$ 23. $\frac{33}{13}$ 24. $\frac{12}{35}$
25. Hence it is verified 26. $\frac{46}{3}$ 27. $\frac{4}{3}$ 28. $\frac{-7}{5}$
29. 24 30. No.3 31. 7.97769
32. 1.414 33. 29

V. 34. 501.95 35. 3.2 m