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EC MATHEMATICS

8

This special guide is prepared on the basis of New Syllabus

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PREFACE

We all know that the Queen of Science is Mathematics. Such a wonderful subject should be dealt effectively by our students for the first time in VIIIth board examination. For that this book "EC MATHS" paves way to achieve the success of life by engraving the methods in the minds of the students.

- ☺ The teachers who have written this text have been effectively working in schools for many years.
- ☺ They know the mindset as the students very well.
- ☺ They have the experience to make the students learn maths easily and effectively.
- ☺ This book has been designed based on the new syllabus (2020 - 2021).
- ☺ All the exercises are given with the motivation of making the students learn by themselves easily.
- ☺ The additional unit exercises are given solutions along with the diagrams.
- ☺ The solutions for one mark questions are also given
- ☺ It will be helpful for the students to learn easily.
- ☺ I wish all the students who use this book for learning to get more marks and reach the peak as success in life
- ☺ I also appreciate the good hearts who have rendered support to this creation.

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CONTENTS

Unit 1 NUMBERS

SUMMARY

- The rational is in the form of, $\frac{p}{q}$, $q \neq 0$
- Represents the rational numbers on a number line
- Basic operators like addition, subtraction, multiplication and division in Rational numbers.
- Use all the properties like closure, associative, commutative, identity and inverse

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**

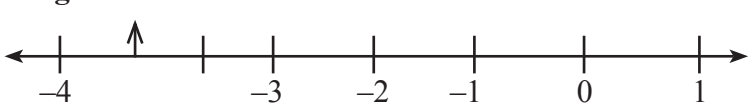
(iii) $\frac{-19}{5}$ is greater than $\frac{15}{-4}$. **Ans: False**

(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 lines.

(i)



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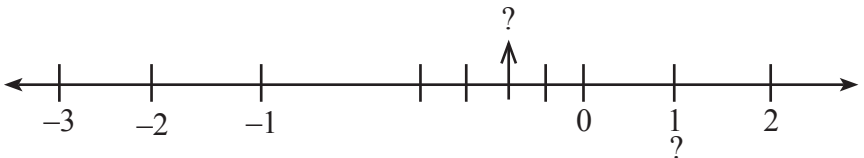

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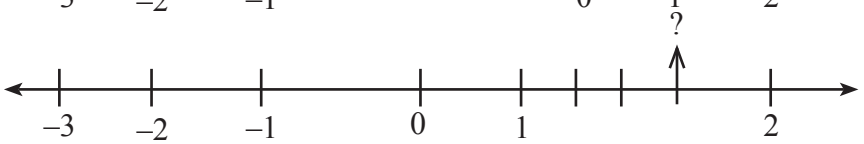
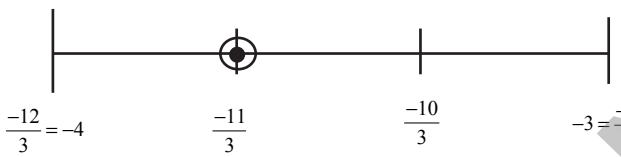


Solution:

(i) $\therefore \frac{-11}{3}$

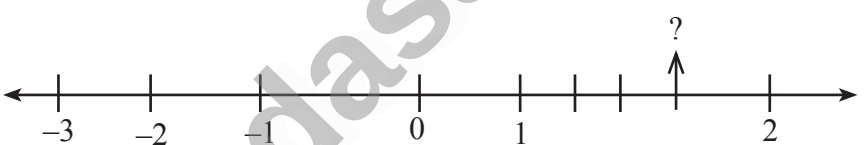


(ii)

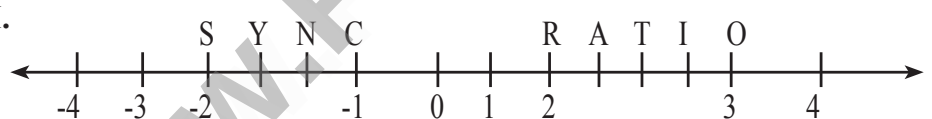
$\frac{-5}{5} = -1$ $\frac{-4}{5}$ $\frac{-3}{5}$ $\frac{-2}{5}$ $\frac{-1}{5}$ $0 = \frac{0}{5}$

$\frac{-2}{5}$

(iii) $\therefore \frac{7}{4}$.



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.



Solution:

$S \Rightarrow \frac{-6}{3} = -2$

$Y \Rightarrow \frac{-5}{3}$

$N \Rightarrow \frac{-4}{3}$

$C \Rightarrow \frac{-3}{2} = -1$

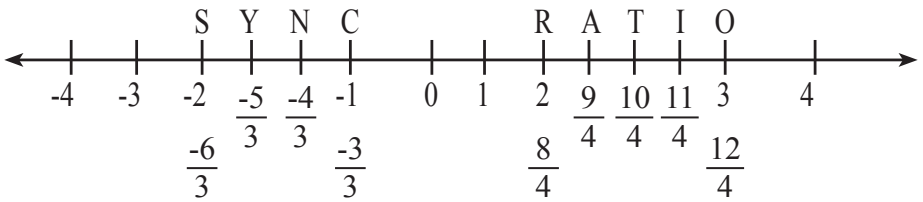
$R \Rightarrow \frac{8}{4} = 2$

$A \Rightarrow \frac{9}{4}$

$T \Rightarrow \frac{10}{4}$

$I \Rightarrow \frac{11}{4}$

$O \Rightarrow \frac{12}{4} = 3$

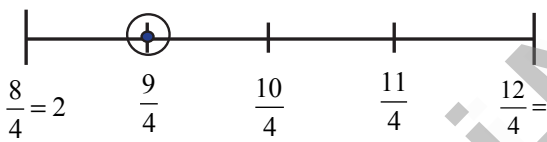


5. Draw the number line and represent the following rational numbers on it.

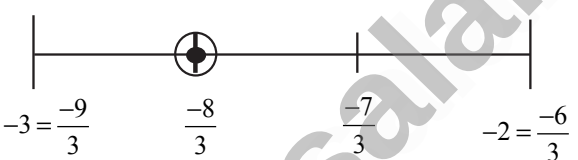
(i) $\frac{9}{4}$ (ii) $\frac{-8}{3}$ (iii) $\frac{-17}{-5}$ (iv) $\frac{15}{-4}$

Solution:

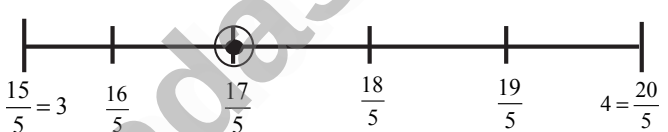
(i) $\frac{9}{4}$



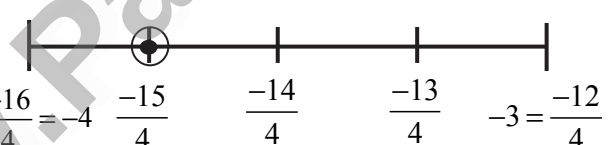
(ii) $\frac{-8}{3}$



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



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



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

(i) $\frac{1}{11} = 0.090909.....$

(ii) $\frac{13}{4} = \frac{13}{4} \times \frac{25}{25} = \frac{325}{100} = 3.25$

(iii) $\frac{-18}{7} = -2.5714285714$

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

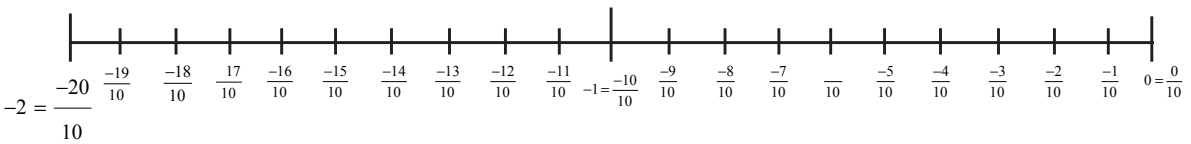
(v) $-3\frac{1}{2} = \frac{-7}{2} = -3.5$

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 $\frac{-23}{10}$

Solution:

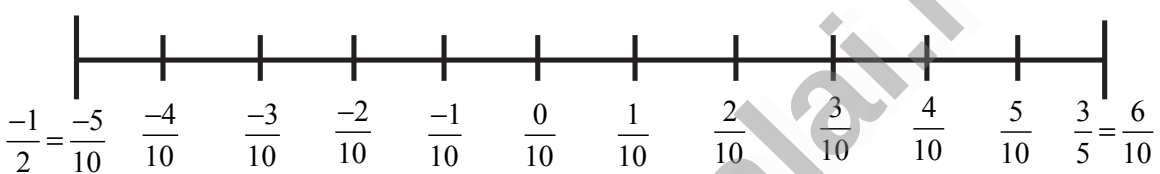
(i) –2 and 0



We can take any five numbers from this I choose,

$\frac{-19}{10}, \frac{-18}{10}, \frac{-7}{10}, \frac{-6}{10}, \frac{-5}{10}$

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



LCM of 2 and 5 is 10

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

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

we can take any five numbers from this

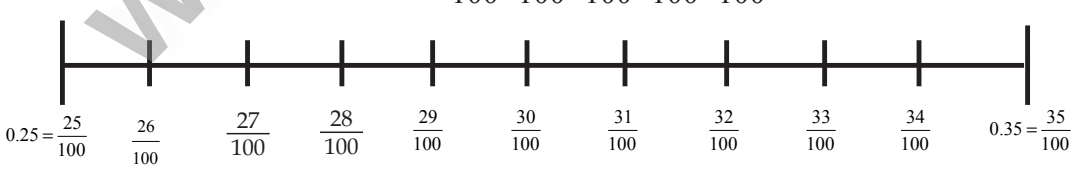
I choose $\frac{-3}{10}, \frac{-1}{10}, \frac{0}{10}, \frac{1}{10}, \frac{2}{10}, \frac{5}{10}$

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

$$\frac{1}{4}=\frac{1}{4}\times\frac{25}{25}=\frac{25}{100}$$

$$\frac{7}{20}=\frac{7}{20}\times\frac{5}{5}=\frac{35}{100}$$

The five rational numbers are $\frac{26}{100}, \frac{27}{100}, \frac{30}{100}, \frac{32}{100}, \frac{33}{100}$

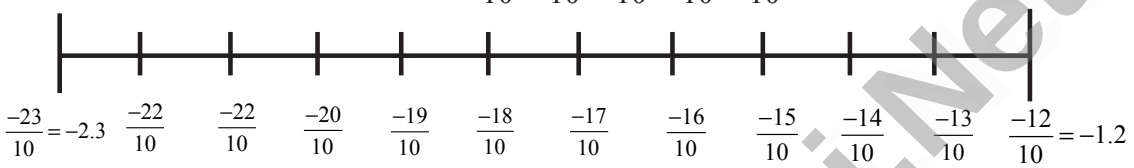


(iv) $\frac{-6}{4}$ and $\frac{-23}{10}$

$\frac{-6}{4} = \frac{-3}{2} \times \frac{5}{5} = \frac{-15}{10}$

$\frac{-23}{10} = \frac{-23}{10}$

The five rational numbers are $\frac{-21}{10}, \frac{-20}{10}, \frac{-15}{10}, \frac{-14}{10}, \frac{-13}{10}$



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

Solution:

The average q $\frac{14}{5}$ and $\frac{16}{3}$ is C_1

$= \frac{1}{2}\left(\frac{14}{5} + \frac{16}{3}\right)$

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

$= \frac{1}{2}\left(\frac{122}{15}\right)$

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

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

The average of $\frac{14}{5}$ and $\frac{61}{15}$ is

$C_2 = \frac{1}{2}\left(\frac{14}{5} + \frac{61}{15}\right)$

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

$= \frac{1}{2}\left(\frac{103}{15}\right)$

$= \frac{103}{30}$

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

The average of $\frac{14}{5}$ and $\frac{103}{30}$ in

$C_3 = \frac{1}{2}\left(\frac{14}{5} + \frac{103}{30}\right)$

$= \frac{1}{2}\left(\frac{84+103}{30}\right); = \frac{1}{2}\left(\frac{187}{30}\right); = \frac{187}{60}$

$\therefore \frac{14}{5} < \frac{187}{60} < \frac{103}{30}$

$\therefore$ The rational numbers between $\frac{14}{5}$ and $\frac{16}{3}$ are $\frac{61}{15}, \frac{103}{30}$ and $\frac{187}{60}$ (or) any 3 of your choice.

9. Compare the following pairs of rational numbers.

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

Solution:

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

LCM of the denominator 5, 8, in 40.

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

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

$\frac{-105}{40} < \frac{-88}{40}$; $\frac{-21}{8} < \frac{-11}{5}$

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

LCM of the denominator 4 and 2 is 4

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

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

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

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

LCM of the denominator 3 and 5 in 15

$\frac{2}{3} \times \frac{5}{5} = \frac{10}{15}$; $\frac{4}{5} \times \frac{3}{3} = \frac{12}{15}$

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

$\Rightarrow \frac{2}{3} < \frac{4}{5}$.

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

Solution:

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

$\Rightarrow \frac{-5}{12}, \frac{-11}{8}, \frac{-5}{8}, \frac{7}{9}, \frac{1}{3}$.

LCM of the denominator 12, 8, 9, 3 is 72.

$\frac{-5}{12} \times \frac{6}{6} = \frac{-30}{72}$

$\frac{-11}{8} \times \frac{9}{9} = \frac{-99}{72}$

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

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

$\frac{1}{3} \times \frac{24}{24} = \frac{24}{72}$

Ascending order is

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

Descending order is

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

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

LCM of the denominator 10, 5, 4, 20, is 20.

$\frac{-17}{10} \times \frac{2}{2} = \frac{-34}{20}$

$\frac{-7}{5} \times \frac{4}{4} = \frac{-28}{20}$

$0 \times \frac{20}{20} = \frac{0}{20}$

$\frac{-2}{4} \times \frac{5}{5} = \frac{-10}{20}$

$\frac{-19}{20} \times \frac{1}{1} = \frac{-19}{20}$

Ascending order is

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

Descending order is

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

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

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

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

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

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

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

(A) 4 (B) 5

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

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) $-4\frac{2}{3}+7\frac{5}{12}$

Solution: (i) $\frac{7}{5}+\frac{3}{5}=\frac{7+3}{5}=\frac{10}{5}=2$

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

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

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

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

Solution:

Given $\left(\frac{-17}{11}\right)-\left(\frac{-8}{44}\right)=\frac{-17}{11}+\frac{2}{11}=\frac{-17+2}{11}=\frac{-15}{11}$.

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

Solution:

(i) $\frac{\cancel{9}^{3}}{1\cancel{32}_{12}}\times\frac{\cancel{-11}^{1}}{\cancel{3}}=\frac{-\cancel{3}^{1}}{\cancel{12}_{4}}=\frac{-1}{4}$

(ii) $\frac{\cancel{-7}^{1}}{\cancel{27}_{9}}\times\frac{\cancel{24}^{8}}{\cancel{-35}_{5}}=\frac{8}{45}$

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

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

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

Solution:

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

(ii) $\frac{-\cancel{3}}{13} \times \frac{1}{-\cancel{3}} = \frac{1}{13}$

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

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

7. Find (a + b) ÷ (a – b) if

(i) $a = \frac{1}{2}, b = \frac{2}{3}$ (ii) $a = \frac{-3}{5}, b = \frac{2}{15}$

Solution: (i) $a = \frac{1}{2}, b = \frac{2}{3}$

$$\frac{(a+b)}{(a-b)} = \frac{\frac{1}{2}+\frac{2}{3}}{\frac{1}{2}-\frac{2}{3}} = \frac{\frac{1(3)+2(2)}{2(3)}}{\frac{1(3)-2(2)}{2(3)}}$$

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

$$= \frac{7}{\cancel{6}} \times \frac{\cancel{6}}{-1} = \frac{7}{-1}$$

$$= -7$$

(ii) $a = \frac{-3}{5}, b = \frac{2}{15}$

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

$$= \frac{\frac{-9+2}{15}}{\frac{-9-2}{15}}$$

$$= \frac{\frac{-7}{15}}{\frac{-11}{15}} = \frac{-7}{\cancel{15}} \times \frac{\cancel{-15}}{-11}$$

$$= \frac{7}{11}$$

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

Solution:

$$\frac{1}{2}+\left(\frac{3}{2}-\frac{2}{5}\right) \div \frac{3}{10} \times 3$$

$$= \frac{1}{2}+\left(\frac{3(5)-2(2)}{2(5)}\right) \div \frac{3}{10} \times 3$$

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

$$= \frac{1}{2}+\frac{11}{10} \div \frac{3}{10} \times 3$$

$$= \frac{1}{2}+\frac{11}{\cancel{10}} \times \frac{\cancel{10}}{\cancel{3}} \times \cancel{3}$$

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

$$= 0.5+11=11.5$$

Yes, This number 11.5 is between 11 and 12

9. Simplify :

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

Solution:

(i) $\left[\frac{\cancel{11}}{\cancel{8}_{4}}\times\frac{\cancel{-6}^{\cancel{2}}}{\cancel{33}_{\cancel{3}}}\right]+\left[\frac{1}{3}+\left(\frac{3}{5}\div\frac{9}{20}\right)\right]-\left[\frac{4}{\cancel{7}}\times\frac{\cancel{-7}}{5}\right]$

$=\left[\frac{-1}{4}\right]+\left[\frac{1}{3}+\left(\frac{\cancel{3}}{\cancel{5}}\times\frac{\cancel{20}^{4}}{\cancel{9}_{3}}\right)\right]-\left[\frac{-4}{5}\right]$

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

$=\frac{-1}{4}+\frac{5}{3}+\frac{4}{5}=\frac{15(-1)+5(20)+4(12)}{60}$

$=\frac{15+100+48}{60}=\frac{133}{60}$

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

$=\left[\frac{\cancel{4}}{3}\times\frac{-7}{\cancel{8}_{2}}\right]-[1]+\left[\frac{-1}{3}\right]$

$=\left[\frac{-7}{6}\right]-1+\left[\frac{-1}{3}\right]$

$=\frac{-7}{6}-1-\frac{1}{3}=\frac{-7-6-2}{6}$

$=\frac{-\cancel{15}^{5}}{\cancel{6}_{2}}=\frac{-5}{2}$

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.

Solution:

Let x be the number and y be its value

$\therefore\quad \frac{4x}{3}=y+70$ .....(1)

$\frac{x}{\left(\frac{4}{3}\right)}=y\Rightarrow\frac{3x}{4}=y$ .....(2)

Solve (1) & (2)

$\frac{4x}{3}=y+70$

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

$(2)-(1)\Rightarrow\frac{4x}{3}-\frac{3x}{4}=70$

$\frac{16x-9x}{12}=70\quad ;\ \frac{7x}{12}=70$

$7x=70\times12$

$x=\frac{\cancel{70}^{10}\times12}{\cancel{7}}$

$x=120$

$\therefore$ The number is 120

OBJECTIVE TYPE QUESTIONS

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

(A) 1 (B) $\frac{-1}{2}$ (C) $\frac{1}{12}$ (D) $\frac{1}{22}$ **Ans: (A) 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) $\frac{5}{8}$**

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) $\frac{2}{3}$**

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) $\frac{15}{16}$**

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

(A) 7 (B) $\frac{-5}{7}$ (C) 0 (D) all of these

Ans: (D) all of these

EXERCISE 1.3

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

Solution: $a=\frac{-5}{7}$ $b=\frac{5}{6}$

$$a+b=\frac{-5}{7}+\frac{8}{9}=\frac{-45+56}{63}=\frac{11}{63} \text{ is in Q.}$$

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

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

Solution: **Commutative property for addition**

a + b = b + a

LHS $\Rightarrow$ a + b

$$\left(\frac{-10}{11}\right)+\left(\frac{-8}{33}\right)=\frac{(-30)+(-8)}{33}=\frac{-38}{33}$$

RHS $\Rightarrow$ b + a

$$=\left(\frac{-8}{33}\right)+\left(\frac{-10}{11}\right)=\frac{(-8)+(-30)}{33}=\frac{-38}{33}$$

Commutative property for multiplication

$$a\times b = b\times a$$

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

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

LHS = RHS

Hence Verified.

---

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

Solution:

Let $a=\frac{-7}{9}$, $b=\frac{5}{6}$, $c=\frac{-4}{3}$

Associative property for addition

a + (b+c) = (a+b) + c

LHS $\Rightarrow$ b+c

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

a+ (b+c)

$$=\left(\frac{-7}{9}\right)+\left(\frac{-1}{2}\right)=\frac{(-14)+(-9)}{18}=\frac{-23}{18}\ldots..(1)$$

RHS $\Rightarrow$ a+b

$$=\frac{-7}{9}+\frac{5}{6}=\frac{(-14)+(15)}{18}=\frac{1}{18}$$

(a+b) +c

$$=\left(\frac{1}{18}\right)+\left(\frac{-4}{3}\right)=\frac{1+(-24)}{18}=\frac{-23}{18}\ldots..(2)$$

From (1) and (2)

a+ (b+c) = (a+b)+c

LHS = RHS

Associative property for Multiplication.

a × (b×c) = (a×b) × c

LHS $\Rightarrow$ $b\times c=\frac{5}{6}\times\frac{-4}{3}=\frac{-10}{9}$

$$a\times(b\times c)=\left(\frac{-7}{9}\right)\times\left(\frac{-10}{9}\right)=\frac{70}{81}\ldots..(1)$$

RHS $\Rightarrow$ $a\times b=\left(\frac{-7}{9}\right)\times\left(\frac{5}{6}\right)=\frac{-35}{54}$

$$(a\times b)\times c=\left(\frac{-35}{\cancel{54}_{27}}\right)\times\left(\frac{\cancel{-4}^{2}}{3}\right)=\frac{70}{81}\quad\ldots..(2)$$

From (1) and (2) $a\times(b\times c)=(a\times b)\times c$

LHS = RHS

Hence Verified.

---

4. Verify the distributive Property a × (b + c)= (a × b) + (a + c) for the rational numbers $a=\frac{-1}{2}$, $b=\frac{2}{3}$, and $c=\frac{-5}{6}$.

Solution:

Distributive property

a × (b + c) = (a × b) + (a × c)

LHS $\Rightarrow$ $b+c=\frac{2}{3}+\frac{(-5)}{6}=\frac{4+(-5)}{6}=\frac{-1}{6}$

$$a \times (b+c) = \left(\frac{-1}{2}\right) \times \left(\frac{-1}{6}\right) = \frac{1}{12}$$

$$\text{RHS} \Rightarrow a \times b = \left(\frac{-1}{\cancel{2}}\right) \times \frac{\cancel{2}}{3} = \frac{-1}{3}$$

$$a \times c = \left(\frac{-1}{2}\right) \times \left(\frac{-5}{6}\right) = \frac{5}{12}$$

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

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

LHS = RHS

Hence Verified.

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

Solution:

$a = \frac{15}{19}$, $b = \frac{-18}{25}$.

Identity property:

For addition:

a + 0 = 0 + a = a

b + 0 = 0 + b = b

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

$$\frac{-18}{25} + 0 = 0 + \left(\frac{-18}{25}\right) = \frac{-18}{25}$$

For multiplication:

a × 1 = 1 × a = a

b × 1 = 1 × b = b

$$\frac{15}{19} \times 1 = 1 \times \frac{15}{19} = \frac{15}{19}$$

$$\frac{-18}{25} \times 1 = 1 \times \left(\frac{-18}{25}\right) = \frac{-18}{25}$$

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

Solution:

Inverse property:

For addition:

a + (–a) = (–a) + a = 0

b + (–b) = (–b) + b = 0

$$\left(\frac{-7}{17}\right) + \left(\frac{7}{17}\right) = \left(\frac{7}{17}\right) + \left(\frac{-7}{17}\right) = 0$$

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

For multiplication:

$$\mathbf{a \times \frac{1}{a} = \frac{1}{a} \times a = 1}$$

$$\mathbf{b \times \frac{1}{b} = \frac{1}{b} \times b = 1}$$

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

$$\left(\frac{17}{27}\right) \times \frac{1}{\left(\frac{17}{27}\right)} = \frac{1}{\left(\frac{17}{27}\right)} \times \left(\frac{17}{27}\right) = 1$$

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 _____ property for rational numbers.

(A) Commutative (B) Closure
(C) distributive (D) associative
Ans: (D) associative

9. Which of the following illustrates the inverse property for addition?

(A) $\frac{1}{8}-\frac{1}{8}=0$ (B) $\frac{1}{8}+\frac{1}{8}=\frac{1}{4}$

(C) $\frac{1}{8}+0=\frac{1}{8}$ (D) $\frac{1}{8}-0=\frac{1}{8}$

Ans: (A) $\frac{1}{8}-\frac{1}{8}=0$

10. $\frac{3}{4}\times\left(\frac{1}{2}-\frac{1}{4}\right)=\frac{3}{4}\times\frac{1}{2}-\frac{3}{4}\times\frac{1}{4}$ **illustrates that multiplication is distributive over**

(A) addition (B) subtraction
(C) multiplication (D) division
Ans: (B) subtraction

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 24^2 and 25^2 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 $\sqrt{180}$ 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 961000 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

(i) 17^2 = 289

(ii) 203^2 = 41209

(iii) 1098^2 = 1205604

4. Examine if each of the following is a perfect square:

(i) 725 (ii) 190
(iii) 841 (iv) 1089

Solution:

(i) $725 = 5 \times 5 \times 29$
$= 5^2 \times 29$

5	725
5	145
	29

The second prime factor 29 does not have a pair.
∴ 725 is not a perfect square.

(ii) $190 = 2 \times 5 \times 19$
The prime factors do not have a pairs.
∴ 190 is not a perfect square.

2	190
5	95
19	19
	1

(iii) $841 = 29 \times 29$
$= 29^2$
∴ 841 is a perfect square.

29	841
29	29
	1

(iii) $1089 = 3 \times 3 \times 11 \times 11$
$= 3^2 \times 11^2$
∴ 1089 is a perfect square.

3	1089
3	363
11	121
11	11
	1

5. Find the square root by prime factorisation method.

(i) 144 (ii) 256 (iii) 784
(iv) 1156 (v) 4761 (vi) 9025

Solution:

(i) $\sqrt{144} = \sqrt{2 \times 2 \times 2 \times 2 \times 3 \times 3}$
$= 2 \times 2 \times 3 = 12$

2	144
2	72
2	36
2	18
3	9
	3

(ii) $\sqrt{256} = \sqrt{2\times2\times2\times2\times2\times2\times2\times2}$
$= 2 \times 2 \times 2 \times 2 = 16$

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

(iii) $\sqrt{784} = \sqrt{2 \times 2 \times 2 \times 2 \times 7 \times 7}$
$= 2 \times 2 \times 7 = 28$

2	784
2	392
2	196
2	98
7	49
7	7
	1

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

2	1156
2	578
17	289
17	17
	1

(v) $\sqrt{4761} = \sqrt{3 \times 3 \times 23 \times 23}$
$= 3 \times 23 = 69$

3	4761
3	1587
23	529
23	23
	1

(vi) $\sqrt{9025} = \sqrt{5 \times 5 \times 19 \times 19}$
$= 5 \times 19 = 95$

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

Solution:

i) $\sqrt{1764} = 42$

		42
4	1764	
	16	
82	164	
	164	
	0	

ii) $\sqrt{6889} = 83$

		83
8	6889	
	64	
163	489	
	489	
	0	

iii) $\sqrt{11025} = 105$

		105
1	11025	
	1	
20	10	
	0	
205	1025	
	1025	
	0	

iv) $\sqrt{17956} = 134$

		134
1	17956	
	1	
23	79	
	69	
264	1056	
	1056	
	0	

v) $\sqrt{418609} = 647$

		647
6	418609	
	36	
124	586	
	496	
1287	9009	
	9009	
	0	

7. Estimate the value of the following square roots to the nearest whole number.
i) $\sqrt{440}$ ii) $\sqrt{800}$ iii) $\sqrt{1020}$

Solution:

(i) $\sqrt{440} \simeq 21$

∴ The nearest whole number is 21.

		20.9
2	440	
	4	
40	40	
	0	
409	4000	
	3681	

(ii) $\sqrt{800} \simeq 28$

∴ The nearest whole number is 28.

		28
2	800	
	4	
48	400	
	384	
	16	

(iii) $\sqrt{1020} \simeq 32$

∴ The nearest whole number is 32.

		31.9
3	1020	
	9	
61	120	
	61	
629	5900	
	5661	

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) $7\frac{18}{49}$

Solution:

(i) $\sqrt{2.89} = 1.7$

	1.7
1	2.89
	1
27	189
	189
	0

(ii) $\sqrt{67.24} = 8.2$

	8.2
8	67.24
	64
162	324
	324
	0

(iii) $\sqrt{2.0164} = 1.42$

	3.74
3	13.9870
	9
67	498
	469
744	2970
	2976
	0

iv) $\frac{144}{225} = \sqrt{\frac{144}{225}} = \frac{\sqrt{144}}{\sqrt{225}} = \frac{\sqrt{12^2}}{\sqrt{15^2}} = \frac{12}{15}$

v) $7\frac{18}{49}$

$$\sqrt{7\frac{18}{49}} = \sqrt{\frac{361}{49}} = \frac{\sqrt{361}}{\sqrt{49}} = \frac{19}{7} = 2\frac{5}{7}$$

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.

Solution:

	81
8	6666
	64
161	266
	161
	105

6666 - 105 = 6561 is a perfect square number

$\therefore \sqrt{6561} = \mathbf{81}$

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.

Solution:

$1800 = 2 \times 2 \times 2 \times 5 \times 5 \times 3 \times 3$

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

The prime factor 2 does not have a pair.

$\therefore$ We can multiply 1800 by 2.

$\therefore$ If we multiply 1800 by 2 = 3600

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

$= 6^2 \times 10^2 = 60^2$

Square root of 3600 is 60.

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

2	1800
2	900
2	450
5	225
5	45
3	9
3	3
	1

OBJECTIVE TYPE QUESTIONS

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

(A) 9 (B) 6 (C) 4 (D) 3

Ans: (A) 9

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

(A) 4^2 (B) 5^2 (C) 6^2 (D) 7^2

Ans: (D) 7^2

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

(A) 5 (B) 6 (C) 7 (D) 8

Ans: (C) 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

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 10^3 from 1729 gives 9^3. **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.

Solution:

$1944 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3$

We need one more 3 to get triplet.

∴ 1944 is not a perfect cube.

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

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

Solution:

$10985 = 13 \times 13 \times 13 \times 5$

5 is the smallest number which is divided 10985 by 5 to get the perfect cube.

5	10985
13	2197
13	169
13	13
	1

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

Solution:

$200 = 2 \times 2 \times 2 \times 5 \times 5$

We need one more 5 to get a perfect cube.

2	200
2	100
2	50
5	25
5	5
	1

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

Solution:

$= \sqrt[3]{24 \times 36 \times 80 \times 25}$

2	24	2	36	2	80	5	25
2	12	2	18	2	40	5	5
2	6	3	9	2	20		1
3	3	3	3	2	10		
	1		1	5	5		
					1		

$= \sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5}$

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

$= 12 \times 10$

$= 120$

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

Solution:

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

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

$= 3 \times 3 = 9$

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

19	6859
19	361
19	19
	1

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

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

Solution:

$$\sqrt{\sqrt[3]{46656}} = \sqrt{\sqrt[3]{2\times2\times2\times2\times2\times2\times3\times3\times3\times3\times3\times3}}$$

$$= \sqrt{2\times2\times3\times3}$$

$$= 2\times3$$

$$= 6$$

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

Solution:

Let x in the number

$(x^2)^3 = 729$

$x^6 = 729$

$= 3\times3\times3\times3\times3\times3$

$x^6 = 3^6$

$\therefore x = 3$

$\therefore \sqrt{3} = 1.732$

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

	1.732
1	3.000000
	1
27	200
	189
343	1100
	1029
3462	7100
	6924
	176

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

Solution:

$1 = 1^2$

$4 = 2^2$

$9 = 3^2$

$16 = 4^2$

$25 = 5^2$

$2^2 \times 4^2 = 4 \times 16 = 64 = 4^3$

$\therefore$ The numbers are 4 and 16.

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 $(256)^{\frac{-1}{4}} \times 4^2$ is $\frac{1}{4}$.

Ans: False

iii) Using the power rule, $(3^7)^{-2} = 3^5$.

Ans: False

iv) The standard form of 2×10^{-4} is 0.0002.

Ans: True

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

3. Evaluate :

i) $\left(\frac{1}{2}\right)^3$ **ii)** $\left(\frac{1}{2}\right)^{-5}$ **iii)** $\left(\frac{-5}{6}\right)^{-3}$

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

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

Solution:

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

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

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

iv) $(2^{-5} \times 2^7) \div 2^{-2} = (2^{-5+7}) \div 2^{-2} = 2^2 \div 2^{-2}$
$= 2^{2+2} = 2^4 = 16$

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

4. Evaluate:

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

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

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

Solution:

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

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

$= \frac{2\times2\times2\times2\times2\times2}{5\times5\times5\times5\times5\times5}$

$= \frac{64}{15625}$

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

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

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

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

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

$= 2\times2\times2\times2\times2\times2\times2\times2\times2\times2$

$= 1024$

5. Evaluate : (i) $(5^0 + 6^{-1}) \times 3^2$

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

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

Solution:

i) $(5^0 + 6^{-1})3^2$

$= \left(1 + \frac{1}{6}\right) \times 9 = \left(\frac{6+1}{6}\right) \times 9 = \frac{7}{\cancel{6}_2} \times \frac{\overset{3}{\cancel{9}}}{1} = \frac{21}{2}$

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

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

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

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

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

(ii) $\frac{9^2 \times 7^3 \times 2^5}{84^3}$ (iii) $\frac{2^8 \times 2187}{3^5 \times 32}$

Solution:

(i) $(3^2)^3 \times (2 \times 3^5)^{-2} \times (18)^2$

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

$= 3^6 \times 2^{-2} \times 3^{-10} \times 2^2 \times 3^4$

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

$= 3^0 \times 2^0 = 1 \times 1 = 1$

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

2	84
2	42
3	21
	7

$= \frac{3^4 \times 7^3 \times 2^5}{(2^2)^3 \times 7^3 \times 3^3}$

$= \frac{3^4 \times 7^3 \times 2^5}{2^6 \times 7^3 \times 3^3}$

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

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

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

iii) $\frac{2^8 \times 2187}{3^5 \times 32}$

2	32
2	16
2	8
2	4
2	2
	1

3	2187
3	729
3	243
3	81
3	29
3	9
3	3
	1

$= \frac{2^8 \times 3^7}{3^5 \times 2^5}$

$= 2^{8-5} \times 3^{7-5}$

$= 2^3 \times 3^2$

$= 8 \times 9 = 72$

7. Solve for x :

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

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

Solution:

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

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

$2^{2x-1-x-2} = 2^2$

$2^{x-3} = 2^2$

$x - 3 = 2$

$x = 2 + 3$

$\boxed{x = 5}$

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

$5^{+5-4+x-12} = 5^{-5}$

$5^{5-16+x} = 5^{-5}$

$5^{-11+x} = 5^{-5}$

$-11 + x = -5$

$x = -5 + 11$

$\boxed{x = 6}$

8. Expand using exponents :

(i) 6054.321 (ii) 897.14

Solution:

(i) 6054.321

$= 6 \times 1000 + 0 \times 100 + 5 \times 10 + 4 \times 1 + 3 \times 10^{-1} + 2 \times 10^{-2} + 1 \times 10^{-3}$

$= 6 \times 10^3 + 5 \times 10^1 + 4 \times 10^0 + 3 \times 10^{-1} + 2 \times 10^{-2} + 1 \times 10^{-3}$

(ii) $897.14 = 8 \times 10^2 + 9 \times 10^1 + 7 \times 10^0 + 1 \times 10^{-1} + 4 \times 10^{-2}$.

9. Find the number in standard form for the following expansions.

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

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

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

Solution:

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

$= 87652.0407$

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

$= 5050.505$

(iii) $2.5 \times 10^{-11} = 0.000000000025$

$= 0.000000000025$

10. Write the following numbers in scientific notation:

(i) 467800000000

(ii) 0.000001972

(iii) 1642.398

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

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

Solution:

(i) $467800000000 = 4.678 \times 10^{11}$

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

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

(iv) 1,083,000,000,000
$= 1.083 \times 10^{12}$ cubic km.

(v) 0.000000000000000000000000016
$= 1.6 \times 10^{-24}$

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) $\frac{-2}{5}$**

12. $(-2)^{-3} \times (-2)^{-2} =$ _____.

(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) $-\left(\frac{1}{4}\right)^2 = 16^{-1}$

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

(A) 4 (B) 5

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

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}

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 225gm, how much does a full box of apples weigh?

Solution:

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

$\frac{1}{4}$ of a box of apples = $\frac{3kg\,225gm}{3}$

= 1 kg 75 gm.

~ A Full box of apples weigh = $\frac{3}{4}$ of a box + $\frac{1}{4}$ of a box of apples

= 3 Kg 225 gm + 1 kg 75 gm.

= 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?

Solution:

Mangalam buys a water jug capacity $= 3\frac{4}{5}$ litre.

another jug capacity $= 2\frac{2}{3} \times 3\frac{4}{5}$

$= \frac{8}{3} \times \frac{19}{5}$

$= \frac{152}{15} = 10\frac{2}{15}$ *litres*

3. Ravi multiplied $\frac{25}{8}$ and $\frac{16}{15}$ and 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.

Solution:

$\frac{25}{8} \times \frac{16}{15} = \frac{40\cancel{0}}{12\cancel{0}}$

$= \frac{40}{12} = \frac{10}{3}$

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

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.

Solution:

given, area $= \frac{153}{10}$ sq. m

breadth $= 2\frac{11}{20}$ m $= \frac{51}{20}$ m.

length × breadth = Area

length $\times \frac{51}{20} = \frac{153}{10}$

length $= \frac{\cancel{153}^{3}}{\cancel{10}1} \times \frac{\cancel{20}}{\cancel{1}}$

= 6m.

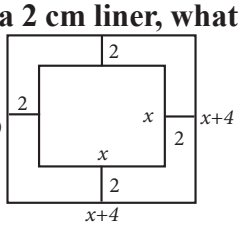
5. There is a large square portrait of a leader that covers an area of 4489 cm². If each side has a 2 cm liner, what would be its area?

Solution:

Area of portrait = x^2sp units = 4489 sp units

$x^2 = 4489 = 672$

$\boxed{x = 67 \text{ cm}}$



Side of new square = 67+4

= 71 cm

Area of new square = 71 × 71

= 5041 cm²

Area = 5041 - 4889

= 552 sq cm

6. A greeting card has an area 90 cm². Between what two whole numbers is the length of its side?

Solution:

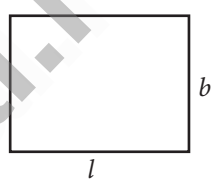
Area of the card = 90cm²

= 2 × 3 × 3 × 5

= 3 × 3 × 2 × 5

= 9 × 10

2	90
3	45
3	15
	5

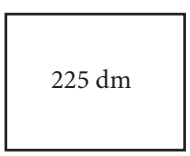


∴ The lengths its sides 9cm and 10cm.

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?

Solution:

Area mosaic tiles = 225 sq. decimetre



$a^2 = 225$

$a^2 = 15^2$

$\Rightarrow \boxed{a = 15 \text{ decimetre}}$

Side of a verandah is 15 decimetre.

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

Solution:

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

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

$2 \times 2 \times 31 \times x^{\frac{1}{2}} = 3100$

$x^{\frac{1}{2}} = \frac{\overset{25}{\cancel{100}}}{\cancel{4} \times \cancel{31}}$

$x^{\frac{1}{2}} = 25$

Square on both sides $(x^{\frac{1}{2}})^2 = 25^2$

$\boxed{x = 625}$

2	1906624
2	953312
2	476656
2	238328
2	119164
2	59582
31	29791
31	961
31	31
	1

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

Solution:

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

$2^m \times 2^{-1} + 2^m \times 2^1 = 640$

$2^m (2^{-1} + 2^1) = 640$

$2^m \left(\frac{1}{2} + 2\right) = 640$

$2^m \left(\frac{1+4}{2}\right) = 640$

$2^m \times \frac{5}{2} = 640$

$2^m = \frac{\overset{128}{\cancel{640}} \times 2}{5}$

$2^m = 128 \times 2$

$2^m = 2^7 \times 2^1$

$2^m = 2^8$

$\boxed{m = 8}$

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

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?

Solution:

Per minute 80 beats.

i) an hour = 60 minutes

= 60 × 80 beats

= 4800

= 4.8×10^3 beats

ii) a day = 24 hours

= 24 × 60 minutes

= 24 × 60 × 80 beats

= 115200

= 1.152×10^5 beats

iii) a year = 365 days

= 365 × 115200

= 42048000 = 4.2048×10^7 beats

iv) 100 years = 100 × 42048000

= 4204800000

= 4.2048×10^9 beats.

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 lies between the cities B and C.

Solution:

city B = $4\frac{1}{6}$ inches

= $\frac{25}{6} \times 120$ km = 500 km.

city C = $3\frac{1}{3}$ inches

= $\frac{10}{3} \times 120$ km = 400 km

Distance = city B + city C

= 500+ 400 =900 km.

12. Give an example and verify 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 property 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.

Solution:

(i) $\frac{2}{3} \div \frac{4}{7} = \frac{\cancel{2}}{3} \times \frac{7}{\cancel{4}^{2}} = \frac{7}{6}$ is a rational number

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

$LHS = \frac{1}{2} - \frac{2}{3} = \frac{3-4}{6} = \frac{-1}{6}$

$RHS = \frac{2}{3} - \frac{1}{3} = \frac{4-3}{6} = \frac{1}{6}$

$LHS \neq RHS$

(iii) $\frac{1}{2} \div \left(\frac{2}{3} \div \frac{3}{4}\right) \neq \left(\frac{1}{2} \div \frac{2}{3}\right) \div \frac{3}{4}$

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

$= \frac{1}{2} \div \left(\frac{8}{9}\right) = \frac{1}{2} \times \frac{9}{8} = \frac{9}{16}$

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

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

$LHS = RHS$

(iv) $a = \frac{1}{2}$ $b = \frac{2}{3}$ $c = \frac{1}{3}$

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

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

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

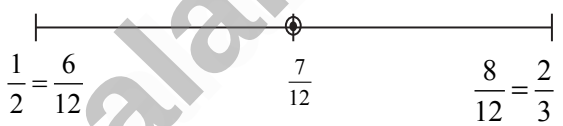
$RHS = ab - ac = \left(\frac{1}{2} \times \frac{2}{3}\right) - \left(\frac{1}{2} \times \frac{1}{3}\right)$

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

$LHS = RHS$

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

$Mean = \frac{\frac{1}{2} + \frac{2}{3}}{2} = \frac{3+4}{6} \times \frac{1}{2} = \frac{7}{12}$



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?

Solution:

$\frac{1}{4}$ of a ragi adai = 120 grams.

full of ragi adai = 120 × 4 = 480 grams.

$\frac{2}{3}$ of the ragi adai = $\frac{2}{3}$ × 480 grams.

= 320 grams.

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

Solution:

$\frac{2}{p} + \frac{1}{q} = \frac{2q + p}{pq}$

$= \frac{18}{40} = \frac{9}{20}$

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

Solution:

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

$\frac{25+x}{\cancel{5}}\times\frac{\overset{3}{\cancel{15}}}{4}=21$

$(25+x)\times\frac{3}{4}=21$

$25+x=\overset{7}{\cancel{21}}\times\frac{4}{\cancel{3}}$

25 + x = 28

x = 28 – 25

x = 3

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

Solution:

$x+\frac{1/10}{11}=\frac{1}{10/11}\Rightarrow x+\frac{1}{110}=\frac{11}{10}$

$x=\frac{11}{10}-\frac{1}{110}=\frac{121-1}{110}=\frac{120}{110}=\frac{12}{11}$

$x=\frac{12}{11}$

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?

Solution:

1600 – 1536 = 64

∴ 1600 is the perfect square number.

64 more cadets would be required.

	39
3	153600
	9
69	636
	621
78	2500

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

Solution:

$\sqrt{286225}=535$

	535
5	286225
	25
103	362
	309
1065	5325
	5325
	0

$\sqrt{2862.25}=53.5$

$\sqrt{28.6225}=5.35$

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

$=58.85$

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

Solution:

$(3.769\times 10^5)+(4.21\times 10^5)$

$=(3.769+4.210)\times 10^5$

$=7.979\times 10^5$

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

Solution:

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

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

(iii) $3^{500}=(3^5)^{100}$

(iv) $4^{400}=(2^2)^{400}=2^{800}=(2^8)^{100}$

(v) $2^{600}=(2^6)^{100}$

$2^{100}, (2^3)^{100}, (2^6)^{100}, (3^5)^{100}, (2^8)^{100}$

$16^{25}, 8^{100}, 2^{600}, 3^{500}, 4^{400}$

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