GOLDEN FUTURE SERIES

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A Course Book of Mathematics

Maths Pool

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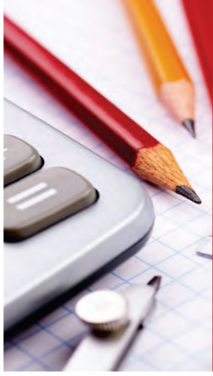


Chapter 1

Rational Numbers

Main Points of the Chapter

✦ Properties of operations on rational numbers ✦ Representation of rational numbers on the number line ✦ Rational numbers between two rational numbers.

The numbers which are expressed in the form of $\frac{p}{q}$, where $q \neq 0$, is called a rational number.

All natural numbers, integers and fractions are rational numbers. 0 is also a rational number because we can write zero as $\frac{0}{1}$, which has the quotient of two whole numbers having denominator as non-zero.

$\frac{2}{5}, \frac{-3}{7}, \frac{4}{-5}$ and $\frac{-3}{-8}$ etc are the examples of rational numbers.

Properties of Operations on Rational Numbers

The rational numbers show the properties of closure, associative and distributive properties, etc. But they show different nature in addition or subtraction with negative numbers.

REMEMBER

- 0 is neither positive nor negative.

Closure Property : Rational numbers hold closure property under addition, subtraction and multiplication. But under division, rational numbers do not hold closure property.

$$\frac{5}{6} + \frac{(-4)}{5} = \frac{25 + (-24)}{30} = \frac{1}{30} \quad \text{(a rational number)}$$

$$\frac{5}{6} - \frac{(-4)}{5} = \frac{25 - (-24)}{30} = \frac{49}{30} \quad \text{(a rational number)}$$

$$\frac{5}{6} \times \frac{(-4)}{5} = \frac{-4}{6} \quad \text{(a rational number)}$$

If we want to get the same rational number from the given rational number then we can add or subtract zero from it. To getting 0 by a rational number, we can multiply that number by zero. But, if we divide a rational number by zero, for example : 7 ÷ 0, then it will be meaningless. So, all rational numbers do not hold closure property under division. But except zero, all rational numbers hold closure property. We know that whole numbers and natural numbers do not hold closure property under subtraction.

Following table shows the comparison.

Number	Closure Property			
	Addition	Subtraction	Multiplication	Division
Rational numbers	Yes	Yes	Yes	No
Integer numbers	Yes	Yes	Yes	No
Whole numbers	Yes	No	Yes	No
Natural numbers	Yes	No	Yes	No

Commutative Property : Addition and multiplication of rational numbers are commutative (It is also true for inteters, whole numbers and natural numbers). On changing the order of two rational numbers, their addition or multiplication remain same.

$$\left(\frac{-3}{8}\right) + \frac{1}{7} = \frac{-13}{56},\ \frac{1}{7} + \left(\frac{-3}{8}\right) = \frac{-13}{56}$$

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

But in subtraction and division if we change the order of given rational numbers then they will give us the different results.

$$\frac{-2}{3} - \frac{5}{4} = \frac{8-15}{12} = \frac{-7}{12},\ \frac{5}{4} - \frac{2}{3} = \frac{15-8}{12} = \frac{7}{12}$$

$$\therefore \quad \frac{2}{3} - \frac{5}{4} \neq \frac{5}{4} - \frac{2}{3}$$

Associative Property : Addition and multiplication of rational numbers are associative. It is also true for integers, whole numbers and natural numbers.

$$\left(\frac{-1}{2}\right) + \left[\frac{3}{7} + \left(\frac{-4}{3}\right)\right] = \left(\frac{-1}{2}\right) + \left(\frac{-19}{21}\right) = \frac{-59}{42}$$

$$\left[\frac{-1}{2} + \frac{3}{7}\right] + \left(\frac{-4}{3}\right) = \left(\frac{-1}{14}\right) + \left(\frac{-4}{3}\right) = \frac{-59}{42}$$

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

and $\frac{2}{3} \times \left(\frac{-6}{7} \times \frac{4}{5}\right) = \frac{2}{3} \times \frac{-24}{35} = \frac{-48}{105}$

$$\left(\frac{2}{3} \times \frac{-6}{7}\right) \times \frac{4}{5} = \frac{-12}{21} \times \frac{4}{5} = \frac{-48}{105}$$

$$\therefore \quad \frac{2}{3} \times \left(\frac{-6}{7} \times \frac{4}{5}\right) = \left(\frac{2}{3} \times \frac{-6}{7}\right) \times \frac{4}{5}$$

But the above laws don't follow for subtraction or division.

REMEMBER

- If we change the order of three rational numbers then there is no effect on their addition or multiplication.

$$\frac{-2}{3} - \left(\frac{-4}{5} - \frac{1}{2}\right) = \frac{-2}{3} - \frac{-13}{10} = \frac{-2}{3} + \frac{13}{10} = \frac{19}{30}$$

$$\left(\frac{-2}{3} - \frac{-4}{5}\right) - \frac{1}{2} = \left(\frac{-2}{3} + \frac{4}{5}\right) - \frac{1}{2} = \frac{2}{15} - \frac{1}{2} = \frac{-11}{30}$$

$$\therefore \quad \frac{-2}{3} - \left(\frac{-4}{5} - \frac{1}{2}\right) \neq \left(\frac{-2}{3} - \frac{-4}{5}\right) - \frac{1}{2}$$

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

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

$$\therefore \quad \frac{1}{2} \div \left(\frac{-1}{3} \div \frac{2}{5}\right) \neq \left(\frac{1}{2} \div \frac{-1}{3}\right) \div \frac{2}{5}$$

Benefits of Commutative and Associative Properties : These properties help to do the fractional calculations easier.

Example 1: Find the value of : $\frac{4}{5}+\left(\frac{-7}{13}\right)+\left(\frac{-6}{25}\right)+\frac{9}{26}$

Solution : $\frac{4}{5}+\frac{-7}{13}+\frac{-6}{25}+\frac{9}{26}$

$$=\left(\frac{4}{5}+\frac{-6}{25}\right)+\left(\frac{-7}{13}+\frac{9}{26}\right)$$

$$=\frac{20+(-6)}{25}+\frac{-14+9}{26}$$

$$=\frac{14}{25}+\frac{-5}{26}=\frac{365-125}{650}=\frac{239}{650}$$

Ans.

Example 2: Find the value of : $\frac{-3}{8}\times\frac{11}{13}\times\frac{16}{21}\times\frac{-26}{33}$

Solution : $\frac{-3}{8}\times\frac{11}{13}\times\frac{16}{21}\times\frac{-26}{33}$

$$=\left(\frac{-3}{8}\times\frac{16}{21}\right)\times\left(\frac{11}{13}\times\frac{-26}{33}\right)$$

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

$$=\frac{-2}{7}\times\frac{-2}{3}=\frac{4}{21}$$

Ans.

Additive Identity of Rational Numbers : 0 is the additive identity of rational numbers because on adding the zero to the rational number, we get the same result.

$\frac{-3}{5}+0=\frac{-3}{5}$ or $0+\frac{-3}{5}=\frac{-3}{5}$

Multiplicative Identity of Rational Numbers : Rational numbers have their multiplicative identity, when we multiply a rational number by 1, we get again same result.

$\frac{-5}{8}\times 1=\frac{-5}{8}$ or $1\times\frac{-5}{8}=\frac{-5}{8}$

Negative or Additive Inverse : Additive inverse is also a rational number. On adding the additive inverse to its rational number, results comes zero.

$\frac{3}{4}+\frac{-3}{4}=0$ or $\frac{-3}{4}+\frac{3}{4}=0$

Hence, $a+(-a)=(-a)+a=0$, where a can be rational number or natural number or whole number or integer.

Reciprocal or Multiplicative Inverse : Multiplicative inverse is also a rational number. On multiplying the rational number by its reciprocal, result comes 1.

$\frac{-9}{13}\times\frac{13}{-9}=1$ or $\frac{13}{-9}\times\frac{-9}{13}=1$

REMEMBER

- Zero don't have any inverse.
- 1 and –1 are the additive inverse of each other.
- The reciprocal of a positive number is always a positive number.

Example 3: Is $\frac{8}{9}$ the multiplicative inverse of $-1\frac{1}{8}$? Why or why not?

Solution: $-1\frac{1}{8} = \frac{-9}{8}$

Now, $\frac{8}{9} \times \frac{-9}{8} = -1$

No, $\frac{8}{9}$ is not a multiplicative inverse of $-1\frac{1}{8}$ because their product is not 1. **Ans.**

Example 4: Is 0.3 the multiplicative inverse of $3\frac{1}{3}$? Why or why not?

Solution: $0.3 = \frac{3}{10}$, $\quad 3\frac{1}{3} = \frac{10}{3}$

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

So, 0.3 is mulplicative inverse of $3\frac{1}{3}$. **Ans.**

Multiplication is distributive on addition for rational numbers.

If $\frac{-2}{3}$, $\frac{3}{4}$ and $\frac{-5}{6}$ are three rational numbers.

$$\frac{-2}{3} \times \left\{\frac{3}{4} + \left(\frac{-5}{6}\right)\right\} = \frac{-2}{3} \times \left\{\frac{9 + (-10)}{12}\right\} = \frac{-2}{3} \times \frac{-1}{12} = \frac{1}{18}$$

$$\frac{-2}{3} \times \frac{3}{4} = \frac{-1}{2}$$

$$\frac{-2}{3} \times \frac{-5}{6} = \frac{5}{9}$$

So, $\frac{-2}{3} \times \frac{3}{4} + \frac{-2}{3} \times \frac{-5}{6} = \frac{-1}{2} + \frac{5}{9} = \frac{-9 + 10}{18} = \frac{1}{18}$

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

Example 5: Solve the following by using the suitable property :

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

Solution:

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

$$= \frac{2}{5} \times \left(\frac{-3}{7}\right) - \frac{1}{6} \times \frac{3}{2} + \frac{2}{5} \times \frac{1}{14}$$ (Using commutative law)

$$= \frac{2}{5} \times \left(\frac{-3}{7}\right) + \frac{2}{5} \times \frac{1}{14} - \frac{1}{6} \times \frac{3}{2}$$ (Using associative law)

$$= \frac{2}{5} \times \left[\left(\frac{-3}{7}\right) + \frac{1}{14}\right] - \frac{1}{6} \times \frac{3}{2}$$ (Using distributive law)

$$= \frac{2}{5} \times \left[\frac{-6 + 1}{14}\right] - \frac{1}{6} \times \frac{3}{2}$$

$$= \frac{2}{5} \times \frac{-5}{14} - \frac{1}{6} \times \frac{3}{2}$$

$$= \frac{-1}{7} - \frac{1}{4} = \frac{-4 - 7}{28} = \frac{-11}{28}$$ **Ans.**

Exercise 1.1

1. Write the additive inverse of :

   (a) $\frac{3}{7}$ (b) $\frac{-4}{11}$ (c) $\frac{-3}{-5}$ (d) $\frac{8}{-27}$ (e) $\frac{17}{-10}$

2. Find the solution by using suitable property :

   (a) $\frac{3}{7}+\left(\frac{-6}{11}\right)+\left(\frac{-8}{21}\right)+\frac{5}{22}$ (b) $\left(\frac{-4}{15}\right)\times\frac{3}{7}\times\frac{15}{16}\times\left(\frac{-14}{9}\right)$

3. Write the multiplicative inverse of :

   (a) -1 (b) -17 (c) $\frac{1}{3}$ (d) $\frac{-9}{13}$ (e) $\frac{3}{-7}$

4. Write the name of property used :

   (a) $\frac{-5}{7}\times\frac{-3}{11}=\frac{-3}{11}\times\frac{-5}{7}$ (b) $\frac{-6}{13}\times 1=1\times\frac{-6}{13}=\frac{-6}{13}$

5. Is 0.7 the multiplicative inverse of $1\frac{3}{5}$? Why or why not?

6. Is $\frac{5}{8}$ the multiplicative inverse of $-1\frac{3}{5}$? Why or why not?

7. Solve by using associative property :

   (a) $\left\{\frac{7}{5}\times\left(\frac{-3}{12}\right)\right\}+\left(\frac{7}{5}\times\frac{5}{12}\right)$ (b) $\left(\frac{9}{16}\times\frac{4}{12}\right)+\left(\frac{-3}{9}\times\frac{9}{16}\right)$

8. Find the solution by using suitable property :

   $\frac{2}{5}\times\frac{-3}{7}-\frac{1}{14}-\frac{3}{7}\times\frac{3}{5}$

Representation of Rational Numbers on the Number Line

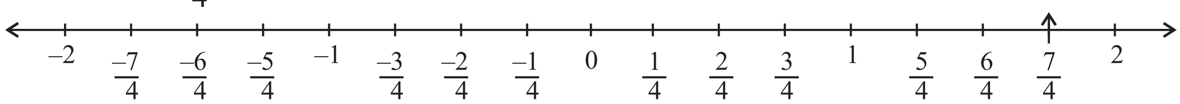
We take a suitable distance between two consecutive numbers on a number line. There is no integer between two consecutive numbers but we can fill some rational numbers between them.

If we divide the number line in different parts then each number will represent the equal gap between two consecutive rational numbers. Lets take $\frac{7}{4}$ and it will lie between the 1 and 2, so we will divide the distance between 1 and 2 into 4 equal parts. Now follow the rules :

Rule :

1. Draw a number line.
2. Divide a part of number line according to the given denominator of number.

   We can represent $\frac{7}{4}$ on the number line as follows :



So, we can show any rational number on number line.

Rational Numbers between Two Rational Numbers

No number occurs between two consecutive numbers but we can find many rational numbers between two consecutive numbers.

Let two numbers be $\frac{2}{5}$ and $\frac{1}{2}$. We can find many rational numbers between them. First of all, we change $\frac{2}{5}$ and $\frac{1}{2}$ into into rational number having same denominator.

$$\frac{2\times 2}{5\times 2}=\frac{4}{10} \text{ and } \frac{1\times 5}{2\times 5}=\frac{5}{10}$$

Again with $\frac{4}{10}$ and $\frac{5}{10}$, we will follow the same procedure.

But $\frac{4}{10}$ is $\frac{40}{100}$ and $\frac{5}{10}$ is $\frac{50}{100}$.

Now, number between $\frac{4}{10}$ and $\frac{5}{10}$ are $\frac{41}{100}, \frac{42}{100}$ ...... $\frac{48}{100}, \frac{49}{100}$. These are 9 number.

Now, $\frac{4}{10}$ is $\frac{400}{1000}$ and $\frac{5}{10}$ is $\frac{500}{1000}$. Now, rational numbers $\frac{401}{1000}, \frac{402}{1000}$ ...... $\frac{498}{1000}, \frac{499}{1000}$ lie between $\frac{4}{10}$ and $\frac{5}{10}$.

These are 99 numbers.

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

Solution : By changing $\frac{-2}{5}$ and $\frac{1}{2}$ into rational number having same denominator,

$$\frac{-2}{5} = \frac{-2 \times 2}{5 \times 2} = \frac{-4}{10} \text{ and } \frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10}$$

We can see eight rational numbers between $\frac{-2}{5}$ and $\frac{1}{2}$.

But, we need ten rational numbers.

So, we multiply the numerator and denominator of $\frac{-4}{10}$ and $\frac{5}{10}$ by 2.

$$\frac{-4}{10} = \frac{-4 \times 2}{10 \times 2} = \frac{-8}{20} \text{ and } \frac{5}{10} = \frac{5 \times 2}{10 \times 2} = \frac{10}{20}$$

Now we have seventeen rational numbers between, $\frac{-8}{20}$ and $\frac{10}{20}$ or $\frac{-2}{5}$ and $\frac{-1}{2}$. **Ans.**

$$\frac{-7}{20}, \frac{-6}{20}, \frac{-5}{20}, \frac{-4}{20}, \frac{-3}{20}, \frac{-2}{20}, \frac{-1}{20}, \frac{0}{20}, \frac{1}{20}, \frac{2}{20}$$

Use of medium to know mean rational number between two given rational numbers :

Example 2: Find out three rational numbers between $\frac{1}{4}$ and $\frac{1}{2}$.

Solution : First we calculate the mean of the given numbers.

$$\text{Mean of } \frac{1}{4} \text{ and } \frac{1}{2} = \left(\frac{1}{4} + \frac{1}{2}\right) \div 2$$

$$= \frac{3}{4} \div 2 = \frac{3}{8}$$

$$\text{Mean of } \frac{1}{4} \text{ and } \frac{3}{8} = \left(\frac{1}{4} + \frac{3}{8}\right) \div 2 = \frac{5}{8} \div 2 = \frac{5}{16}$$

$$\text{Mean of } \frac{3}{8} \text{ and } \frac{1}{2} = \left(\frac{3}{8} + \frac{1}{2}\right) \div 2 = \frac{7}{8} \div 2 = \frac{7}{16}$$

Thus, there are three rational numbers $\frac{5}{16}, \frac{3}{8}, \frac{7}{16}$ between $\frac{1}{4}$ and $\frac{1}{2}$.

Similarly, we can find more and more rational numbers between two given numbers.

Example 3: Find out five rational numbers between –2 and –1.

Solution : Given difference $= -1 - (-2) = -1 + 2 = 1$

The different for five rational numbers should be $(5 + 1) = 6$.

So, we put $\frac{-2 \times 6}{6} = \frac{-12}{6}$ and $\frac{-1 \times 6}{6} = \frac{-6}{6}$

Five rational numbers between $\frac{-12}{6}$ and $\frac{-6}{6}$ or –2 and –1 are $\frac{-11}{6}, \frac{-10}{6}, \frac{-9}{6}, \frac{-8}{6}, \frac{-7}{6}$.

If we want to put 10 rational numbers between –2 and –1, than the difference should be 1 more than 10 that 10 + 1 = 11.

So, we put –2 and –1 as $\frac{-2\times 11}{11} = \frac{-22}{11}$ and $\frac{-1\times 11}{11} = \frac{-11}{11}$ respectively.

The rational number between $\frac{-22}{11}$ and $\frac{-11}{11}$ are $\frac{-21}{11}, \frac{-20}{11}, \frac{-19}{11}$ .... $\frac{-13}{11}, \frac{-12}{11}$. **Ans.**

Exercise 1.2

1. Show the numbers $\frac{9}{5}$ and $\frac{-7}{8}$ on number line.
2. Show the numbers $\frac{-4}{9}, \frac{-5}{9}, \frac{-7}{9}$ on number line.
3. Find one rational number between :
   (a) $\frac{-1}{2}$ and $\frac{1}{2}$ (b) $\frac{1}{5}$ and $\frac{1}{2}$
   (c) $\frac{-5}{7}$ and $\frac{-2}{5}$ (d) –2 and 2
4. Find two rational numbers between –1 and 1.
5. Find three rational numbers between –1 and 0.
6. Find five rational numbers between :
   (a) $\frac{2}{3}$ and $\frac{4}{5}$ (b) $\frac{-3}{2}$ and $\frac{5}{3}$
7. Find 10 rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$.
8. Between $\frac{-7}{9}$ and $\frac{4}{9}$, find the following :
   (a) 10 rational numbers (b) 100 rational numbers (c) 1000 rational numbers

SUMMARY

- The numbers which are expressed in the *p*/*q* form, where *q* is not equal to zero, is called a rational number.
- Rational numbers follow the commutative and associative and properties for addition and multiplication.
- Rational numbers do not follow the commutative and associative properties for subtraction and division.
- 0 is the additive identity and 1 is the multiplicative identity.
- The additive identity 0 is the number formed by adding a rational number with its negative form.
- The multiplicative identity 1 is the number formed by multiplying a rational number with its reciprocal.
- The multiplication and addition are distributive for rational numbers.
- We can find infinite rational numbers between two given rational numbers.

Multiple Choice Questions (MCQs)

1. What is the additive identity :
   (a) 1 ☐ (b) 0 ☐ (c) –1 ☐ (d) –0 ☐
2. If $\frac{a}{b}$ is a rational number then what will be its additive inverse?
   (a) ab ☐ (b) $\frac{-a}{b}$ ☐ (c) $\frac{-b}{a}$ ☐ (d) $\frac{b}{a}$ ☐
3. What is the multiplicative identity :
   (a) 10 ☐ (b) 0 ☐ (c) 1 ☐ (d) –1 ☐
4. What is the inverse of 1 :
   (a) 1 ☐ (b) –1 ☐ (c) 0 ☐ (d) 10 ☐

MENTAL MATHS

Fill in the blanks :

(a) $\frac{-2}{5} + \square = \frac{-2}{5}$

(b) $\frac{3}{7} - \square = \frac{3}{7}$

(c) $\frac{-5}{9} \times \square = \frac{-5}{9}$

(d) $\frac{3}{4} \div 1 = \square$

(e) $\frac{2}{3} \div \frac{2}{3} = \square$

(f) $\frac{4}{11} \times \frac{11}{4} = \square$

LAB ACTIVITY

Aim : To understand the multiplication property of rational numbers.

Materials Required : White chart paper, Geometry box, Pens of different colours.

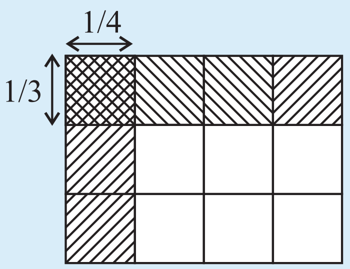
Procedure : (a) Lets find the product of $\frac{1}{4}$ and $\frac{1}{3}$.

(b) Cut a rectangle of 4 cm long and 3 cm wide from the chart paper.

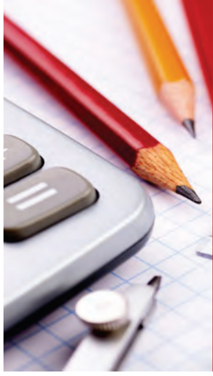
(c) Divide the strip into 4 equal parts according to the length. Each part will show $\frac{1}{4}$ th part.

(d) Now, divide the breadth part into 3 equal parts. Each part will show $\frac{1}{3}$ rd part.

(e) Likewise, we have divided the whole sheet into different $\frac{1}{12}$ parts. In the figure, there are different shades used for various parts. Here, double shaded area is showing the product of $\frac{1}{4}$ and $\frac{1}{3}$, which is exactly $\frac{1}{12}$ th part of rectangle.



$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$



Chapter 2

Square and Square Roots

Main Points of the Chapter

✦ Square ✦ Perfect square ✦ Properties of squares of natural numbers ✦ Square roots ✦ Square roots of fractions ✦ Square roots of decimal fractions ✦ To find the square root of perfect square by the method of long division ✦ To find the square roots of fraction by the long division method ✦ Finding the square root of decimal number by the long division method.

Square

If a number is multiplied by itself then it gives its square.

Example : $2 \times 2 = 2^2 = 4$ It means, 4 is square of 2.

$5 \times 5 = 5^2 = 25$ It means, 25 is square of 5.

Perfect Square

A natural number is called a perfect square if it is formed by multiplying a natural number two times.

Example :

2's square is 4. So, 4 is a perfect square.

5's square is 25. So, 25 is a perfect square.

So, we can say that 4 and 25 are perfect squares.

Example 1 : Is 144 a perfect square?

Solution: On doing the prime factors of 144

$144 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3}$

Here, all pairs are formed.

So, 144 is a perfect square. **Ans.**

Example 2 : Is 450 a perfect square?

Solution : On doing the prime factors of 450

$450 = 2 \times \underline{3 \times 3} \times \underline{5 \times 5}$

Here all pairs are not formed and 2 is left.

So, 450 is not a perfect square. **Ans.**

Properties of Squares of Natural Numbers

1. The numbers ending with 2,3,7,8 cannot be a perfect square.
   For example : 42, 218, 337, 533 etc are not perfect squares.
2. The numbers ending with odd number of zeroes cannot be a perfect square.
   For example : 160, 45000, 3530, etc are not perfect squares.
3. Even numbers have even squares.
   Example : $2^2 = 4$, $4^2 = 16$, $6^2 = 36$
   4, 16 and 36, all are even numbers.

4. Odd numbers have odd squares.

Example : $1^2 = 1,$ $3^2 = 9,$ $5^2 = 25$

1, 9 and 25, all are odd numbers.

5. A square of natural number can be expressed as a sum of odd numbers.

Example : $1^2 = 1,$ $2^2 = 1 + 3,$ $3^2 = 1 + 3 + 5$

6. Three numbers are called Pythogorean triplets, if

For a natural number $m > 1$

$2m, m^2 - 1, m^2 + 1$ are Pythagorean triplets.

Example : If $m = 3$, then

6, 8, 10 are Pythagorean triplets.

7. For natural number n,

$(n+1)^2 - n^2 = (n+1+n)(n+1-n) = (n+1) + n$

Example :

$9^2 - 8^2 = 9 + 8 = 17$

$17^2 - 16^2 = 17 + 16 = 33$

Exercise 2.1

1. Find the perfect squares from :

   11, 12, 16, 32, 36

2. Which of the following is the square of an even number :

   121, 225, 256, 1296, 6561

3. Which of the following is a perfect square :

   100, 1000, 330550, 12345600000

4. Which of the following is a perfect square :

   22,121, 343, 373758, 22034087

5. Fill in the blanks :

   (a) $23^2 - 22^2$ = ____________ (b) $101^2 - 100^2$ = ____________

   (c) $551^2 - 550^2$ = ____________

6. Write the correct number in boxes :

   (a) 65^2 = [ ] (b) 75^2 = [ ]

7. Which of the following are Pythagorean triplets :

   (1, 2, 3), (3, 4, 5), (6, 8, 10), (1, 1, 1), (2, 2, 3)

Square Roots

We know, 4 is the square of 2 and 2 is the square root of 4. So, the square root of 16 is 4 and the square root of 36 is 6.

Finding the square root of a number is the inverse operation of squaring that number. The perfect squares are the squares of the whole numbers. The square root of a number n is, written as $\sqrt{n}$. $\sqrt{\ }$ is the sign of square root.

For example : The square root of 4 is 2. So, if we multiply 2 by 2 then we get 4. Hence, 2 is the square root of 4.

REMEMBER

- Square root is shown by '$\sqrt{\ }$' sign. A negative number does not have its square root.

Exercise 2.2

Find the square root of the following numbers :

1. 25	2. 64	3. 36	4. 49	5. 81
6. 100	7. 225	8. 4900	9. 37×37	10. 325×325

To find the square root of a number by prime factorization method :

Example 1: Find the square root of 1296.

Solution : Prime factors of 1296 are :

2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

$1296 = \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3}$

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

$= 36$ **Ans.**

Example 2: Find the smallest number which must be multiplied by 180 to get a perfect square. Also find its square root.

Solution : Prime factors of 180 are

2	180
2	90
3	45
3	15
5	5
	1

$180 = \underline{2 \times 2} \times \underline{3 \times 3} \times 5$

We see that 5 is left in the pairs.

So, it will be multiplied by 5 to make a perfect square.

$= \underline{2 \times 2} \times \underline{3 \times 3} \times \underline{5 \times 5}$

$= 2 \times 3 \times 5 = 30$ **Ans.**

Example 3: Find the smallest number by which 3645 must be divided to get a perfect square. Also find its square root.

Solution : Prime factors of 3645 are :

$3645 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 5$

We see that 3645 is left in the pairs.

So, it will be divided by 5 to make a perfect square.

$$= \frac{3645}{5}$$

$$= \underline{3 \times 3} \times \underline{3 \times 3} \times \underline{3 \times 3}$$

$$= 3 \times 3 \times 3 = 27$$

Ans.

3	3645
3	1215
3	405
3	135
3	45
3	15
5	5
	1

Example 4: We have to keep 225 apples in a box. Apples are arranged in a way such that the number of rows in the box becomes equal to the number of apples in each row. Find the number of rows and number of apples in each row.

Solution : Let, there are x rows in box and each row consists x apples.

$$\text{No. of apples} = x \times x$$

$$= x^2$$

$$x^2 = 225$$

$$x = \sqrt{225}$$

$$x = \sqrt{3 \times 3 \times 5 \times 5}$$

$$x = 3 \times 5 = 15$$

3	225
3	75
5	25
5	5
	1

So, number of rows in box = 15
And, number of apples in each row = 15 **Ans.**

Exercise 2.3

1. Find the square roots of the following :

   (a) 16 (b) 121 (c) 196 (d) 529

   (e) 400 (f) 1764 (g) 4096 (h) 4900

2. Find the smallest number which must be multiplied by 360 to get a perfect square. Also find its square root.
3. Find the smallest number by which 9408 must be divided to get a perfect square. Also find its square root.
4. A school collected the fund of ₹ 2304 for flood victims. The money contributed by per student is equal to the number of students. Find the total number of students.

Square Roots of Fractions

To find the square root of fractions, we will find the square root of numerator and denominator individual.

(a) If p and q are any two whole numbers and $q \neq 0$, then $\sqrt{\frac{p}{q}} = \frac{\sqrt{p}}{\sqrt{q}}$.

(b) If p and q are any two whole numbers, then $\sqrt{pq} = \sqrt{p} \times \sqrt{q}$.

Square Roots of Decimal Fractions

To find the square root of decimal fraction, we will follow the given method :

(a) If the number is given in the decimal form then we make different pairs with the decimal.

(b) If the pair is not formed properly in the decimal part then we add suitable zeroes to it to form the pairs.

(c) To make this process easier, we change the number into fractional form and then find its square root.

Example 1: Find the square root of the given numbers :

(a) $\frac{25}{49}$ (b) $\frac{25}{121}$

Solution : (a) $\sqrt{\frac{25}{49}} = \frac{\sqrt{25}}{\sqrt{49}} = \frac{\sqrt{5\times5}}{\sqrt{7\times7}} = \frac{5}{7}$ **Ans.**

(b) $\sqrt{\frac{25}{121}} = \frac{\sqrt{25}}{\sqrt{121}} = \frac{\sqrt{5\times5}}{\sqrt{11\times11}} = \frac{5}{11}$ **Ans.**

Example 2: Find the square root of the given numbers :

(a) 0.16 (b) 0.0025

Solution : (a) $\sqrt{0.16} = \sqrt{\frac{16}{100}} = \frac{\sqrt{16}}{\sqrt{100}} = \frac{\sqrt{2\times2\times2\times2}}{\sqrt{2\times2\times5\times5}} = \frac{2\times2}{2\times5} = \frac{4}{10} = 0.4$ **Ans.**

(b) $\sqrt{0.0025} = \sqrt{\frac{25}{10000}} = \frac{\sqrt{25}}{\sqrt{10000}} = \frac{\sqrt{5\times5}}{\sqrt{2\times2\times2\times2\times5\times5\times5\times5}}$

$= \frac{5}{2\times2\times5\times5} = \frac{5}{100} = 0.05$ **Ans.**

Exercise 2.4

Find the square roots of the following numbers :

1. $\frac{1}{4}$
2. $\frac{16}{49}$
3. $\frac{169}{289}$
4. $\frac{121}{10000}$
5. 0.09
6. 0.0004
7. 0.0625
8. 0.0324

Remember

- We can find the square root of mixed fractions by changing them into the improper fractions.

Finding Square Root of Perfect Square by the Method of Long Division

We can apply this trick to find the square root of those numbers whose factors cannot be determined or if the number is larger.

We follow these rules for this :

(a) Group the digits in pairs, starting with the digit in the units place. Each pair and the remaining digit (if any) is called a period.

(b) Think of the largest number whose square is equal to or just less than the first period. Take this number as the divisor and also as the quotient.

(c) Subtract the product of the divisor and the quotient from the first period and bring down the next period to the right of the remainder. This becomes the new dividend.

(d) Now, the new divisor is obtained by taking two times the quotient and annexing with it a suitable digit which is also taken as the next digit of the quotient, chosen in such a way that the product of the new divisor and this digit is equal to or just less than the new dividend.

(e) Repeat steps (b), (c) and (d) till all the periods have been taken up. Now, the quotient so obtained is the required square root of the given number.

Example 1: Find the square root of 390625.

Solution :

	625
6	$\overline{39}\,\overline{06}\,\overline{25}$
	–36
122	306
	–244
1245	6225
	–6225
	×

$\therefore \sqrt{390625} = 625$ **Ans.**

Example 2 : What smallest number must be subtracted from 4401625 to get a perfect square?

Solution :

	2098
2	$\overline{4}\,\overline{40}\,\overline{16}\,\overline{25}$
	–4
40	40
	–00
409	4016
	–3681
4188	33525
	–33504
	21

Remainder = 21. So, if we subtract 21 from 4401625 then we get 441604 and square root will be 2098. **Ans.**

Example 3: Find the largest four digit number which is a perfect square.

Solution : Largest four digit number = 9999

	99
9	$\overline{99}\,\overline{99}$
	–81
189	1899
	–1701
	198

If we subtract 198 from 9999 then,

$\therefore$ 9999 – 198 = 9801 **Ans.**

Exercise 2.5

1. Find the square roots of the given numbers :

(a) 2304 (b) 4489 (c) 3481 (d) 9801 (e) 44100

(f) 27225 (g) 54756 (h) 49284 (i) 119025 (j) 193600

2. What smallest number must be subtracted from 2361 to get a perfect square?

3. Find the smallest number which must be added to 4931 to get a perfect square.
4. What smallest number must be subtracted from 18265 to get a perfect square?
5. Find the largest six digit number which is a perfect square.

To Find the Square Roots of Fraction by Long Division Method

Example : Find the square root of : $332\frac{61}{169}$

Solution : $332\frac{61}{169} = \frac{56169}{169} = \sqrt{\frac{56169}{169}} = \frac{\sqrt{56169}}{\sqrt{169}}$

	237
2	$\overline{5}\ \overline{61}\ \overline{69}$
	−4
43	161
	−129
467	3269
	3269
	×

1	13
1	$\overline{1}\ \overline{69}$
	−1
23	69
	−69
	×

$\therefore \sqrt{\frac{56169}{169}} = \frac{237}{13} = 18\frac{3}{13}$ **Ans.**

To Find the Square Root of Decimal Number by Long Division Method

(a) When we find the square root of any decimal number then decimal digits will becomes half of that number in result.

Example : $= \sqrt{0.01} = 0.1 \quad \because\ 0.1 \times 0.1 = 0.01$

(b) When number is given in decimal form, starting from decimal, we will make the periods of number as left to right.

(c) The periods of number before decimal are made right to left and the periods of number after decimal are made left to right.

(d) If, there is no period obtained of last digit in decimal part, then we put zero on the right side of decimal part.

Example : Find the square root of 9998.0001.

Solution :

	99.99
9	$\overline{99}\,\overline{98}.\overline{00}\,\overline{01}$
	−81
189	1898
	−1701
1989	19700
	−17901
19989	179901
	−179901
	×

$\therefore \sqrt{9998.0001} = 99.99$ **Ans.**

Exercise 2.6

Find the square root of the given numbers :

1. $\frac{361}{625}$
2. $5\frac{19}{25}$
3. $34\frac{15}{49}$
4. $84\frac{37}{121}$
5. $21\frac{51}{169}$
6. $23\frac{394}{729}$
7. $10\frac{151}{225}$
8. $332\frac{61}{169}$
9. 7.29
10. 16.81
11. 9.3025
12. 0.00008281
13. 150.0625
14. 225.6004
15. 0.053361

Example : Find the value of square root of $\sqrt{2}$ till two decimal places.

Solution : We will find the value of $\sqrt{2}$ till 4 decimal places.

	1.4142
1	$2.\overline{00}\,\overline{00}\,\overline{00}\,\overline{00}$
	–1
24	100
	–96
281	400
	–281
2824	11900
	–11296
28282	60400
	–56564
	3836

$\sqrt{2}$ = 1.4142 up to 4 decimal place.

So, the required value up to 3 decimal places will be 1.414. **Ans.**

Note : If the fourth place after the decimal has 5 or the greater than 5 then we add 1 to it and transform the value. If, it is less than 5, there will be no change.

Exercise 2.7

Find the square root of the following till three decimal places :

1. 7
2. 66
3. 11
4. $\frac{7}{8}$
5. $\frac{5}{12}$
6. $2\frac{1}{12}$
7. $287\frac{5}{8}$
8. 1.7
9. 23.1
10. 0.1
11. 0.016
12. 2.5
13. 0.9
14. 20
15. 15.3215

SUMMARY

- If a number x is multiplied by itself then it gives its square (x^2). Here, x is called square root of x^2.
- A natural number is called a perfect square if it is formed by multiplying a natural number two times.
- Even numbers have even squares.
- Odd numbers have odd squares.
- (m, n, p) is a Pythagorean triplet, if $m^2 + n^2 = p^2$.
- The numbers ending with 2,3,7,8 cannot be a perfect square.
- The numbers ending with odd number of zeroes cannot be a perfect square.
- If p and q are two whole numbers and $q \neq 0$, then

  (a) $\sqrt{pq} = \sqrt{p} \times \sqrt{q}$ (b) $\sqrt{\frac{p}{q}} = \frac{\sqrt{p}}{\sqrt{q}}$ (c) $\sqrt{p+q} \neq \sqrt{p} + \sqrt{q}$ (d) $\sqrt{p-q} \neq \sqrt{p} - \sqrt{q}$

Multiple Choice Questions (MCQs)

1. Which of the following has an even square :

   (a) 5 ☐ (b) 11 ☐ (c) 14 ☐ (d) 17 ☐

2. Which of the following has an odd square :

   (a) 22 ☐ (b) 71 ☐ (c) 66 ☐ (d) 32 ☐

3. The square root of 0.81 is :

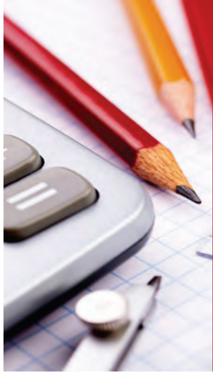
   (a) 9 ☐ (b) 0.9 ☐ (c) 0.09 ☐ (d) 0.009 ☐

4. $\sqrt{0.09} \times \sqrt{0.16} = ?$

   (a) 0.12 ☐ (b) 1 .2 ☐ (c) 12 ☐ (d) 0.0144 ☐

MENTAL MATHS

Find the value of $\sqrt{7 + \sqrt{70 + \sqrt{121}}}$.



Chapter 3

Cube and Cube Roots

Main Points of the Chapter

✦ Cube ✦ Perfect cube ✦ Verifying of a perfect cube ✦ Properties of cubes of numbers ✦ Cube roots ✦ To find the cube root of a perfect cube by prime factorization method ✦ Cube root of a negative perfect cube ✦ Cube root of product of integers ✦ Cube of rational numbers ✦ Cube roots of rational numbers.

Cube

When we multiply any number to it three times then we get its cube. For example :

$2^3 = 2 \times 2 \times 2 = 8$

$3^3 = 3 \times 3 \times 3 = 27$

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

The numbers 8,27,64 are called the cubes of 2,3,4 respectively.

Perfect Cube

A natural number n is called a perfect cube if it is formed by multiplying a natural number three times.

$$n = x \times x \times x = x^3$$

Numbers 1, 8, 27, 64 are perfect cubes.

Verifying of a Perfect Cube

To find that given number is a perfect cube or not, we apply the following process :

(a) Find the prime factors of the given number.

(b) Arrange them into a set of three.

(c) If any factor is left after making sets then it is not a perfect cube.

Example 1: Is 27000 a perfect cube?

Solution : Prime factors of 27000

$27000 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$

Here, no factor is left after making pairs.

So, 27000 is a perfect cube. **Ans.**

Example 2: Is 1024 a perfect cube?

Solution : Prime factors of 1024

$1024 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2$

2 is left after making pairs.

So, 1024 is not a perfect cube. **Ans.**

Example 3: Find the smallest number that must be multiplied by 35721 to get a perfect cube.

Solution : Prime factors of 35721

$35721 = \underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3} \times 7 \times 7$

After making pairs, 7×7 remains left.

So, on multiplying by 7. **Ans.**

Example 4: Find the smallest number by which 1600 must be divided to get a perfect cube.

Solution : On doing prime factors of 1600

$1600 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 5 \times 5$

After making pairs, 5×5 remains left.

So, if we divide it be 25, the remainder will be a perfect square. **Ans.**

Properties of Cubes of Numbers

1. Even numbers have even cubes.

   Example : $6^3 = 6 \times 6 \times 6 = 216$

   Cube of 6 = 216, is an even number.

2. Odd numbers have odd cubes.

   Example : $5^3 = 5 \times 5 \times 5 = 125$

   Cube of 5 = 125, is an odd number.

3. Negative numbers have negative cubes.

   Example : $(-2)^3 = (-2) \times (-2) \times (-2) = -8$

4. Fractional numbers have fractional cubes.

   Example : $\left(\frac{2}{3}\right)^3 = \frac{2\times2\times2}{3\times3\times3} = \frac{8}{27} = \frac{2^3}{3^3}$

Exercise 3.1

1. Find the cubes of the following numbers :

   5, 11, 21, 100, 300

2. Which of the following numbers are perfect cubes :

   64, 216, 243, 1728, 106480

3. Find the smallest number that must be multiplied by 392 to get a perfect cube.
4. Find the smallest number by which 8640 must be divided to get a perfect cube.
5. Write the cubes of all the numbers between 1 to 20 and verify the following statements :

   (a) The cubes of even numbers are even.

   (b) The cubes of odd numbers are odd.

Cube Roots

If n is the cube root of m, then $n = m^3$.

For example : If the cube of 2 is 8 then the cube root of 8 is 2.

Cube root is represented by '$\sqrt[3]{\ }$' sign.

Example : $\sqrt[3]{8} = 2$, $\sqrt[3]{27} = 3$ etc.

To Find the Cube Root of a Perfect Cube by Prime Factorization Method

In this method, we use the following steps :

(a) Find the prime factors of given number.

(b) Arrange them in the pairs of three.

(c) Take one digit from each pair, and then multiply them.

(d) This multiplication will be required cube root.

Example 1: Find the cube root of 1728.

Solution :

$$1728 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$$

$$\sqrt[3]{1728} = 2 \times 2 \times 3$$

$$= 12$$

Ans.

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

Example 2 : Find the smallest number by which 210125 be multiplied to get a perfect cube. Find its cube root also.

Solution : Prime factors of 210125

$$210125 = \underline{5 \times 5 \times 5} \times 41 \times 41$$

Here, 41 did not come 3 times. So, 210125 be multiplied by 41 to get a perfect cube.

$$210125 \times 41 = 8615125$$

$$8615125 = \underline{5 \times 5 \times 5} \times \underline{41 \times 41 \times 41}$$

$$\sqrt[3]{8615125} = 5 \times 41 = 205$$

Ans.

5	210125
5	42025
5	8405
41	1681
41	41
	1

Exercise 3.2

1. Find the cube roots of :

   (a) 512 (b) 1000 (c) 1331 (d) 3375 (e) 8000

2. Find the cube roots of :

   (a) 48228544 (b) 74088000 (c) 134217728

3. Find the smallest number by which 137592 be multiplied to get a perfect cube. Find its cube root also.

4. Find the smallest number by which 26244 be divided to get a perfect cube. Find its cube root also.

Cube Root of a Negative Perfect Cube

If a is a positive number then $-a$ is a negative number. So,

$$(-a)^3 = -a \times -a \times -a = -a^3$$

$$\sqrt[3]{-a} = -\sqrt[3]{a}$$

The cube root of a negative number is always negative.

Example 1: Find the cube root of -1331.

Solution : $\sqrt[3]{-1331} = -\sqrt[3]{1331}$

Prime factors of 1331

11	1331
11	121
11	11
	1

$1331 = 11 \times 11 \times 11$

$\sqrt[3]{1331} = 11$

$\sqrt[3]{-1331} = -\sqrt[3]{1331} = -11$ **Ans.**

Cube Root of Product of Integers

If x and y are two perfect cubes

Then $\sqrt[3]{xy} = \sqrt[3]{x} \cdot \sqrt[3]{y}$

Example 2: Find the cube root of 3375×512.

Solution : $\sqrt[3]{3375 \times 512} = \sqrt[3]{3375} \times \sqrt[3]{512}$

Prime factors of 3375 and 512

$3375 \times 512 = \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$

$\sqrt[3]{3375 \times 512} = 3 \times 5 \times 2 \times 2 \times 2$

$= 120$ **Ans.**

Example 3: Find the cube root of -27×2744.

Solution : $\sqrt[3]{-27 \times 2744} = \sqrt[3]{-27} \times \sqrt[3]{2744}$

Prime factors of 27 and 2744

$27 \times 2744 = \underline{3 \times 3 \times 3} \times \underline{2 \times 2 \times 2} \times \underline{7 \times 7 \times 7}$

$\sqrt[3]{-27} \times \sqrt[3]{2744} = -3 \times 2 \times 7$

$\sqrt[3]{-27 \times 2744} = -42$ **Ans.**

Exercise 3.3

1. Which of the following is the cube of a negative number :
   (a) -64 (b) -2197 (c) -1056 (d) -3888
2. Find the cube root of :
   (a) -125 (b) -5832 (c) -17576 (d) -2744000
3. Find the cube root of :
   (a) 8×64 (b) $(-216) \times 1728$ (c) $64 \times (-2744)$ (d) 729×15625
   (e) $(-125) \times (-3375)$ (f) -456533 (g) -474552 (h) -5832000

Cube of Rational Numbers

If $\frac{p}{q}$ is a rational number then $\left(\frac{p}{q}\right)^3 = \frac{p^3}{q^3}$.

Example 1: Find the cube of $\frac{3}{5}$.

Solution : $\left(\frac{3}{5}\right)^3 = \frac{3^3}{5^3} = \frac{3\times3\times3}{5\times5\times5} = \frac{27}{125}$ **Ans.**

Example 2: Find the cube of $\frac{-2}{3}$.

Solution : $\left(\frac{-2}{3}\right)^3 = \frac{(-2)^3}{(3)^3} = \frac{(-2)\times(-2)\times(-2)}{3\times3\times3} = \frac{-8}{27}$ **Ans.**

Example 3: Find the cube of 1.5.

Solution : $1.5 = \frac{15}{10}$

$$\left(\frac{15}{10}\right)^3 = \frac{15^3}{10^3} = \frac{15\times15\times15}{10\times10\times10}$$

$$= \frac{3375}{1000} = 3.375$$ **Ans.**

Cube Roots of Rational Numbers

If p and q are two integers then $\left(\frac{p}{q}\right)^3 = \frac{p^3}{q^3}$.

Similarly, $\sqrt[3]{\frac{p}{q}} = \frac{\sqrt[3]{p}}{\sqrt[3]{q}}$

Example 1: Find the cube root of $\frac{729}{1331}$.

Solution : $\sqrt[3]{\frac{729}{1331}} = \frac{\sqrt[3]{729}}{\sqrt[3]{1331}}$

Prime factors of 729 and 1331

$$\frac{729}{1331} = \frac{\underline{3\times3\times3}\times\underline{3\times3\times3}}{\underline{11\times11\times11}}$$

$$\sqrt[3]{\frac{729}{1331}} = \frac{\sqrt[3]{729}}{\sqrt[3]{1331}} = \frac{3\times3}{11} = \frac{9}{11}$$ **Ans.**

Example 2: Find the cube root of -1.331.

Solution : $\sqrt[3]{-1.331} = -\sqrt[3]{1.331} = -\sqrt{\frac{1331}{1000}}$

Prime factors of 1331 and 1000

$$\frac{1331}{1000} = \frac{11\times11\times11}{\underline{2\times2\times2}\times\underline{5\times5\times5}}$$

$$-\frac{\sqrt[3]{1331}}{\sqrt[3]{1000}} = \frac{-11}{2\times5} = \frac{-11}{10} = -1.1$$ **Ans.**

Example 3: The volume of a cubical box is 13.824 meter cube. Find its side.

Solution : Let the length of box = a meter

Volume of box = a meter cube

Volume of box = 13.824 meter cube

$$\therefore \quad a^3 = 13.824$$

$$a = \sqrt[3]{13.824}$$

$$a = \sqrt[3]{\frac{13824}{1000}} = \frac{\sqrt[3]{13824}}{\sqrt[3]{1000}}$$

Prime factors of 13824 and 1000

$$\frac{13824}{1000} = \frac{2\times2\times2\times2\times2\times2\times2\times2\times2\times3\times3\times3}{2\times2\times2\times5\times5\times5}$$

$$a = \sqrt[3]{\frac{13824}{1000}} = \frac{2\times2\times2\times3}{2\times5} = \frac{24}{10}$$

$$a = 2.4 \text{ meter}$$

Ans.

Exercise 3.4

1. Find the cubes of :

   (a) $\frac{7}{9}$ (b) $\frac{-8}{11}$ (c) $\frac{12}{7}$ (d) $\frac{-13}{8}$ (e) $2\frac{3}{5}$

2. Find the cubes of :

   (a) 0.3 (b) 1.5 (c) 0.08 (d) 2.1

3. Which of the following is the cube of natural numbers :

   (a) $\frac{27}{64}$ (b) $\frac{125}{128}$ (c) 0.001331 (d) 0.04

4. Find the cube root of :

   (a) $\frac{8}{125}$ (b) $\frac{-64}{1331}$ (c) $\frac{27}{-4096}$ (d) $\frac{-2197}{-9261}$

5. The volume of a cubical box is 32.768 meter cube. Find its side.

SUMMARY

- Cube of a number is formed by power three of that number.
- Negative numbers have negative cubes.
- The cube of rational number $\frac{p}{q}$ will be $\frac{p^3}{q^3} = \left(\frac{p}{q}\right)^3$
- Even numbers have even cubes.
- Odd numbers have odd cubes.
- We know that for a negative integer a : $\sqrt[3]{-a} = -\sqrt[3]{a}$
- $\sqrt[3]{xy} = \sqrt[3]{x} \times \sqrt[3]{y}$

- If n is the cube root of a number m, then $n^3 = m$.
- The cube root of rational number $\frac{p}{q}$ is $\sqrt[3]{\frac{p}{q}} = \frac{\sqrt[3]{p}}{\sqrt[3]{q}}$.

Multiple Choice Questions (MCQs)

1. $3^3 + 3^3 + 3^3 = ?$
   (a) 3^4 ☐ (b) 9^3 ☐ (c) 3^9 ☐ (d) 27^3 ☐
2. Which of the following is not a perfect cube :
   (a) 27 ☐ (b) 125 ☐ (c) 216 ☐ (d) 100 ☐
3. Which of the following is a perfect cube :
   (a) 80 ☐ (b) 800 ☐ (c) 8000 ☐ (d) None of these ☐
4. The cube root of 0.000008 is :
   (a) 2 ☐ (b) 0.2 ☐ (c) 0.02 ☐ (d) 0.008 ☐

MENTAL MATHS

Find the value of $\sqrt[3]{\sqrt{15625}}$.

ANSWER SHEET

Chapter-1

Exercise 1.1

1. (a) $\frac{-3}{7}$ (b) $\frac{4}{11}$ (c) $\frac{-3}{5}$ (d) $\frac{8}{27}$ (e) $\frac{17}{10}$ 2. (a) $\frac{-125}{462}$ (b) $\frac{1}{2}$
3. (a) -1 (b) $\frac{-1}{17}$ (c) 3 (d) $\frac{-13}{9}$ (e) $\frac{-7}{3}$ 4. (a) commutative (b) multiplicative inverse 5. Yes, $0.7 \times 1\frac{3}{7} = \frac{7}{10} \times \frac{10}{7} = 1$ 6. No, $\frac{5}{8} \times \left(-1\frac{3}{5}\right) = \frac{5}{8} \times \frac{-8}{5} = -$ (1 No) 7. (a) $\frac{7}{30}$ (b) 0 8. $\frac{-1}{2}$

Exercise 1.2

1. Do yourself 2. Do yourself 3. (a) 0 (b) $\frac{7}{20}$ (c) $\frac{-39}{70}$ (d) 0 4. $\frac{-1}{2}$, $\frac{1}{2}$ 5. $\frac{-3}{4}, \frac{-2}{4}, \frac{-1}{4}$ 6. (a) $\frac{31}{45}, \frac{32}{45}, \frac{33}{45}, \frac{34}{45}, \frac{35}{45}$ (b) $\frac{-8}{6}, \frac{-7}{6}, \frac{-6}{6}, \frac{-5}{6}, \ldots\ldots, \frac{9}{6}$ 7. $\frac{49}{80}, \frac{50}{80}, \frac{51}{80}, \frac{52}{80}, \frac{53}{80}, \frac{54}{80}, \frac{55}{80}, \frac{56}{80}, \frac{57}{80}, \frac{58}{80}$
8. (a) $\frac{-6}{9}, \frac{-5}{9}, \frac{-4}{9}, \frac{-3}{9}, \frac{-2}{9}, \frac{-1}{9}, \frac{0}{9}, \frac{1}{9}, \frac{2}{9}, \frac{3}{9}$ (b) $\frac{-69}{90}, \frac{-68}{90}, \frac{-67}{90}, \ldots, \frac{30}{90}, \frac{31}{90}$ (c) $\frac{-699}{900}, \frac{-698}{900}, \frac{-697}{900}, \ldots\ldots, \frac{299}{900}, \frac{300}{900}, \frac{301}{900}$

M.C.Q.

1. (b) 2. (b) 3. (c) 4. (a)

MENTAL MATHS

(a) 0 (b) 0 (c) 1 (d) $\frac{3}{4}$ (e) 1 (f) 1

Chapter-2

Exercise 2.1

1. 16, 32 2. 256, 1296 3. 100 4. 121 5. (a) 45 (b) 201 (c) 1101
6. (a) 4225 (b) 5625 7. (3,4,5), (6,8,10)

Exercise 2.2

1. 5 2. 8 3. 6 4. 7 5. 9 6. 10 7. 15 8. 70 9. 37 10. 325

Exercise 2.3

1. (a) 4 (b) 11 (c) 14 (d) 23 (e) 20 (f) 42 (g) 64 (h) 70 2. 10, 60 3. 3, 56
4. 48

Exercise 2.4

1. $\frac{1}{2}$ 2. $\frac{4}{7}$ 3. $\frac{13}{17}$ 4. $\frac{11}{100}$ 5. 0.3 6. 0.02 7. 0.25 8. 0.18

Exercise 2.5

1. (a) 48 (b) 67 (c) 59 (d) 99 (e) 210 (f) 165 (g) 234 (h) 222 (i) 345 (j) 440 2. 57 3. 110 4. 40 5. 998001

Exercise 2.6

1. $\frac{19}{25}$ 2. $2\frac{2}{5}$ 3. $5\frac{6}{7}$ 4. $9\frac{2}{11}$ 5. $4\frac{8}{13}$ 6. $4\frac{23}{27}$ 7. $3\frac{4}{15}$ 8. $18\frac{3}{13}$ 9. 2.7
10. 4.1 11. 3.05 12. 0.00091 13. 12.25 14. 15.02 15. 0.231

Exercise 2.7

1. 2.646 2. 8.124 3. 3.317 4. 0.935 5. 0.645 6. 1.443 7. 16.960
8. 1.304 9. 4.806 10. 0.316 11. 0.126 12. 1.581 13. 0.949 14. 4.472
15. 3.914

M.C.Q.

1. (c) 2. (b) 3. (b) 4. (a)

MENTAL MATHS

4

Chapter-3

Exercise 3.1

1. (a) 125, 1331, 9261, 1000000, 27000000 2. 64, 216, 1728 3. 7 4. 5
5. Do yourself

Exercise 3.2

1. (a) 8 (b) 10 (c) 11 (d) 15 (e) 20 2. (a) 364 (b) 420 (c) 512 3. 1183, 546 4. 36, 9

Exercise 3.3

1. (a) and (b) 2. (a) –5 (b) –18 (c) –26 (d) –140 3. (a) 8 (b) –72 (c) –56 (d) 225 (e) 75 (f) –77 (g) –78 (h) –180

Exercise 3.4

1. (a) $\frac{343}{729}$ (b) $\frac{-512}{1331}$ (c) $\frac{1728}{343}$ (d) $\frac{-2197}{512}$ (e) $\frac{2197}{125}$

2. (a) 0.027 (b) 3.375 (c) 0.000512 (d) 9.261 3. (a) and (c)

4. (a) $\frac{2}{5}$ (b) $\frac{-4}{11}$ (c) $\frac{-3}{16}$ (d) $\frac{13}{21}$ 5. 3.2 m

M.C.Q.

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

MENTAL MATHS

5

Chapter-4

Exercise 4.1

1. (a) $(-3)\times(-3)\times(-3)\times(-3)\times(-3)$ (b) $5\times5\times5$ (c) $\left(\frac{-2}{5}\right)\times\left(\frac{-2}{5}\right)\times\left(\frac{-2}{5}\right)$ (d) $\left(\frac{2}{-3}\right)\times\left(\frac{2}{-3}\right)\times\left(\frac{2}{-3}\right)\times\left(\frac{2}{-3}\right)$ (e) $\frac{3}{7}\times\frac{3}{7}\times\frac{3}{7}\times\frac{3}{7}\times\frac{3}{7}\times\frac{3}{7}$

2. (a) $\left(\frac{-2}{7}\right)^5$ (b) $\left(\frac{-11}{25}\right)^4$ 3. (a) $\frac{125}{729}$ (b) $\frac{-1}{1024}$ (c) $\frac{-1}{243}$ (d) $\frac{4}{49}$ (e) $\frac{343}{-729}$ 4. (a) $\left(\frac{1}{2}\right)^6$ (b) $\left(\frac{4}{7}\right)^2$ (c) $\left(\frac{11}{12}\right)^2$ (d) $\left(\frac{-1}{3}\right)^5$ (e) $\left(\frac{-3}{5}\right)^4$

5. (a) $\left(\frac{1}{2}\right)^4$ (b) $\left(\frac{-1}{3}\right)^5$ (c) $\left(\frac{-5}{4}\right)^6$ (d) $\left(\frac{-9}{5}\right)^{29}$ (e) $(-5)^3$ 6. (a) $\frac{-81}{224}$ (b) $\frac{1}{25}$ 7. (a) $\left(\frac{21}{50}\right)^4$ (b) $\left(\frac{-7}{5}\right)^3$ (c) $\left(\frac{-2}{5}\right)^8$ (d) $\left(\frac{-2}{3}\right)^9$ (e) $\left(\frac{-3}{7}\right)^{10}$

8. (a) $\left(\frac{-5}{4}\right)$ (b) $\left(\frac{16}{81}\right)$ (c) $\left(\frac{49}{36}\right)$ (d) $\left(\frac{1}{64}\right)$

Exercise 4.2

1. (a) $\frac{1}{16}$ (b) $\frac{1}{81}$ (c) 729 (d) 64 (e) $-\frac{1}{56}$ 2. (a) $-\frac{1}{5^3}$ (b) 1 (c) -7^3 (d) $\frac{1}{2^6}$ 3. (a) $\left(\frac{3}{2}\right)^{-6}$ (b) $\left(\frac{1}{3}\right)^{-4}$ (c) $\left(\frac{19}{17}\right)^{-3}$ (d) $\left(\frac{3}{2}\right)^{-12}$ 4. (a) $\frac{243}{8}$ (b) $\frac{8}{15}$ (c) 29 (d) 250 (e) $\frac{256}{81}$ (f) 1 5. $x=2$

Exercise 4.3

1. (a) 1.0×10^{-6}m (b) 1.6×10^{-19} coulomb (c) 5×10^{-7}m (d) 3×10^{-6}m (e) 6.95×10^{6}m (f) 3.84467×10^{8} m (g) 1.496×10^{11}m 2. (a) 12756000 m (b) 0.00007 m (c) 0.000003 m (d) 0.000007 m (e) 0.00001275 m

M.C.Q.

1. (c) 2. (b) 3. (a) 4. (a)

MENTAL MATHS

1. 3125 2. $\frac{1}{16}$

Chapter-5

Exercise 5.1

1. 6 2. 63 3. 36 4. 45 5. 8

Exercise 5.2

1. Divisible by 2 : 48, 72, 126, 972, 720, 450, 336, 572; Divisible by 3 : 48, 72, 75, 126, 441,972, 720,450, 336, 315; Divisible by 5: 75, 720, 450, 315 2. Divisible by 9: 18, 36, 90, 108, 810, 720, 450, 999, 900; Divisible by 10: 70, 90, 210, 810, 720, 450, 820, 900

Exercise 5.3

Do yourself

M.C.Q.

1. (a) 2. (c) 3. (b) 4. (d)

MENTAL MATHS

1. $x=2$ 2. $x=0$

Chapter-6

Exercise 6.1

1. (a) $y^2-11y+18$ (b) $p^2-7p-18$ (c) $z^2-8z+15$ (d) $x^2+6x-16$ (e) $y^2+12y+35$ (f) $x^2+11x+18$ 2. (a) 10609 (b) 11021 (c) 10812 (d) 9888 (e) 9215 (f) 2915

Exercise 6.2

1. $25x^4+y^2+z^2+10x^2y+2yz+10x^2z$ 2. $9x^2+\frac{1}{4}p^2+4q^2-3xp-2pq+12xq$ 3. $9m^2+25n^2+4p^2+30mn-20np-12mp$ 4. $81x^2+4y^2+9z^2-36xy+12yz-54xz$ 5. $x^2+25y^2+4z^2+10xy-20yz+4xz$ 6. $p^2+9q^2+4z^2-6pq+12qz-4pz$ 7. $4p^2+4q^2+9r^2+8pq-12qr-12pr$ 8. $x^2+y^2+4z^2+2xy-4yz-4xz$ 9. $x^2+4y^2+9z^2+4xy+12yz+6xz$ 10. (a) $8px-8cx$ (b) $2x^2+2y^2+2z^2+4xy$

Exercise 6.3

1. (a) $\frac{8}{27}x^3-\frac{125}{27}z^3-\frac{20}{9}x^2z+\frac{50}{9}xz^2$ (b) $8z^3-343y^3-84yz^2+294y^2z$ (c) $343x^3+729y^3+1323x^2y+1701xy^2$ (d) $8x^3-y^6-12x^2y^2+6xy^4$ (e) $x^6+y^3+3x^4y+3x^2y^2$ (f) $p^3x^3+8z^3+6p^2x^2z+12pxz^2$ (g) $27x^3-8y^3-54x^2y+36xy^2$ (h) $x^3+27y^3+9x^2y+27xy^2$

2. 728 3. $\frac{5050}{729}$ 4. 15616 5. (a) $\frac{2y^3}{125}+\frac{2}{15}x^2y$ (b) $16x^3+12xz^2$ (c) $16p^3+12x^2p$ (d) $16x^3+108xp^2$ 6. (a) 65450827 (b) 214921799 (c) 217081801 (d) 997002999 (e) 1015075125 (f) 128787625 (g) 970299 (h) 1157.625

Exercise 6.4

1. $1-x^3$ 2. x^3+8 3. $343y^3-125z^3$ 4. $27x^3+125$ 5. $0.729a^3+0.343b^3$ 6. $\frac{8a^3}{125}-\frac{27b^3}{343}$ 7. $\frac{-127}{9261}$ 8. -7

Exercise 6.5

1. (a) $(m+9n)(m+2n)$ (b) $(m-5)(m+3)$ (c) $(p+9q)(p-4q)$ (d) $(z+4)(z-3)$ 2. (a) $\left(p+\frac{q}{2}+1\right)^2$ (b) $(2x-y-3z)^2$ (c) $(2p+3q+2r)^2$ (d) $(x+2y-z)^2$ 3. (a) $(x+5z)^3$ (b) $(2y-5z)^3$ (c) $(x+4y)^3$ (d) $(3x-2y)^3$ 4. (a) $(2xy+3z)(4x^2y^2-6xyz+9z^2)$ (b) $(1-3z)(1+3z+9z^2)$ (c) $(y+5)(y^2-5y+25)$ (d) $(p+3)(p^2-3p+9)$ 5. (a) $(p-2q)(p+2q)(p^2+4q^2+2pq)(p^2+4q^2-2pq)$ (b) $4(2p+3q)(4p^2-6pq+9q^2)$ (c) $2x^3y(3x+y)(9x^2-3xy+y^2)$ (d) $10xy(y-x)(y^2+x^2+yx)$

Exercise 6.6

1. (a) $(-3x+y-z)(9x^2+y^2+z^2+3xy+yz-3xz)$ (b) $(l+m-n)(l^2+m^2+n^2-lm+mn+ln)$ (c) $(2x-3y+z)(4x^2+9y^2+z^2+6xy+3yz-2xz)$ (d) $(p+2q+4r)(p^2+4q^2+16r^2-2pq-8qr-4pr)$ 2. (a) $3(5x-6p)(7z-5x)(6p-7z)$ (b) $3(p-3q)(3q-7r)(7r-9)$ 3. (a) 14.256 (b) -498.33 (c) -310764 (d) 123750

Exercise 6.7

1. (a) $3y^2+3y+2$ (b) $3m^2-2m+9$ (c) $-8z^2-12z+2$ (d) $2y+\frac{1}{2}$ (e) $x+4$ (f) $3m^3+4m^2-2$ 2. (a) $5y^3-2y^2+\frac{5}{3}y$, Remainder $=6$ (b) $-4x^3+2x^2-8x+30$, Remainder $=-285$ (c) $3y^3-5y+\frac{3}{2}$ (d) $5z^2+\frac{10}{3}z+11$, Remainder $=54$ (e) $2x+3$, Remainder $=-3$

M.C.Q.

1. (b) 2. (b) 3. (c) 4. (b)

MENTAL MATHS

Yes, $(x+6)$ is a factor of (x^2-x-42).

Chapter-7

Exercise 7.1

1. $\frac{-23}{5}$ 2. -1 3. $\frac{-19}{3}$ 4. $\frac{27}{29}$ 5. $\frac{-29}{19}$ 6. $\frac{17}{21}$ 7. 0 8. $\frac{-3}{11}$ 9. 1 10. $\frac{15}{17}$

Exercise 7.2

1. 21, 24 2. $\frac{1}{4}$ 3. 57 4. 62 5. Ranjana = 10 years, Mother = 40 years 6. 18 km/hr 7. 75 km/hr, 80 km/hr 8. length = 14 cm, breadth = 10 cm 9. 40°, 50°, 90° 10. base = 12 cm, height = 20 cm

M.C.Q.

1. (c) 2. (c) 3. (b) 4. (b)

MENTAL MATHS

Age of husband = 54 years, Age of wife = 45 years

Chapter-8

Exercise 8.1

1. (a) 30% (b) 1.5% (c) $16\frac{2}{3}$% (d) 67% (e) $33\frac{1}{3}$% (f) 75% 2. (a) $\frac{5}{6}$ (b) $83\frac{1}{3}$% 3. 6.25% 4. 6.25% (a) 4.84 hour (b) 91.8 kg (c) 62.5 m (d) 3.6 km (e) 325 (f) 99.20 5. 1275persons 6. 1190 bikes

Exercise 8.2

1. 630 2. 135 3. 140 4. 2405. ₹ 228.80 6. ₹ 25,84,000 7. ₹ 15,840 8. ₹ 65 9. 5.4 m 10. ₹ 3,02,400

M.C.Q.

1. (c) 2. (a) 3. (b) 4. (a)

MENTAL MATHS

1. 200 2. 14%

Chapter-9

Exercise 9.1

1. ₹ 1500 2. ₹ 3000 3. ₹ 1478.40 4. profit, 4% 5. ₹ 54.05 6. ₹ 3000 7. profit, 15% 8. 10%, ₹ 1.35 9. 25% 10. $33\frac{1}{3}$ % 11. 25% 12. ₹ 600 13. ₹ 2500 14. profit, 10% 15. ₹ 60

Exercise 9.2

1. (a) ₹ 841.50 (b) ₹ 68 2. (a) ₹ 1100 (b) ₹ 2000 3. (a) 16% (b) 15% 4. ₹ 8050 5. 10% 6. ₹ 864 7. no profit, no loss 8. ₹ 4400 9. 20% 10. ₹ 675.84

Exercise 9.3

1. (a) ₹ 12600 (b) ₹ 1890 (c) ₹ 52.50 (d) ₹ 3465 2. 8% 3. ₹ 30,000 4. (a) ₹ 3000 5. ₹ 200

M.C. Q.

1. (b) 2. (d) 3. (b) 4. (d)

MENTAL MATHS

₹150

Chapter-10

Exercise 10.1

1. Interest = ₹ 72, Amount = ₹ 2472 2. $12\frac{1}{2}$ years 3. Principle = ₹ 1250, Rate = 10% 4. ₹ 3800 5. ₹ 307.50 6. ₹ 331.00 7. ₹ 1747.20 8. ₹ 1261

Exercise 10.2

1. ₹ 4202.50 2. ₹ 9261 3. ₹ 3307.50, ₹ 307.50 4. ₹ 6050, ₹ 1050 5. ₹ 2249.73, ₹ 249.73 6. ₹ 12167, ₹ 4167 7. ₹ 630.50 8. ₹ 8268.75 9. ₹ 49130 10. ₹ 4921

Exercise 10.3

1. ₹ 1000 2. ₹ 4096 3. 2 years 4. $1\frac{1}{2}$ years 5. 10% 6. 20%

Exercise 10.4

1. 1,15,763 2. 57,600 3. 14,06,250 4. ₹ 5620 5. ₹ 14,440 6. ₹ 72,900 7. 1,32,651

M.C.Q.

1. (b) 2. (d). 3. (b) 4. (b)

MENTAL MATHS

₹ 7938.00

Chapter-11

Exercise 11.1

1. ₹ 689 2. ₹ 72,000 3. 512 km 4. 1568 kg 5. 154 days 6. 4.8 hecktare 7. 455 m^3 8. 1 hour 40 minutes 9. 120 km 10. 250 words

Exercise 11.2

1. 4 days 2. $1\frac{1}{2}$ hours 3. 49 labours 4. 40 cows 5. 28 days 6. 8 hrs/day 7. 180 persons 8. 16 km/hr 9. $5\frac{1}{3}$ hours 10. 29 kg

M.C.Q.

1. (d) 2. (b) 3. (b) 4. (d)

MENTAL MATHS

1. 18 m 2. 15 boxes

Chapter-12

Exercise 12

1. 4 cm, 6 cm 2. 13 cm 3. 10 cm 4. 130°, 50°, 130° 5. 75°, 105°, 75°, 105° 6. 34 cm 7. 40°, 60°, 100°, 160° 8. 100°, 80°, 100°

M.C.Q.

1. (a) 2. (c) 3. (a) 4. (b)

Chapter-13

Exercise 13.1

1-4. Do yourself. 5. Quadrilateral cannot be formed because $PQ + SP = QS$.

Exercise 13.2

1-5. Do yourself.

Exercise 13.3

1-5. Do yourself.

Exercise 13.4

1. Quadrilateral cannot be formed. 2-4. Do yourself.

Exercise 13.5

1-4. Do yourself.

M.C.Q.

1. (b) 2. (b) 3. (a) 4. (b)

Chapter-14

Exercise 14.1

1. (a) 6 (b) 5 (c) 4 2. (a) 8 (b) 5 (c) 4 3. (a) 12 (b) 9 (c) 8 (d) 6 4. The main difference between square pyramid and rectangular pyramid is their base. The base of square pyramid is square while the base of rectangular pyramid is rectangle. 5. The base surface of cube is square and the base surface of cuboid is rectangle.

Exercise 14.2

1. Yes, 7 + 10 = 15 + 2 2. 12 3. 30 4. Surfaces = 8, Vertices = 6, Edges =30

M.C.Q.

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

MENTAL MATHS

Do yourself.

Chapter-15

Exercise 15.1

1. 4 cm 2. 1.7 cm 3. 14 cm^2 4. 12 cm^2 5. 32 m 6. 17 cm, 9 cm 7. 28 m^2 8. 227.2 m^2 9. 192 cm^2 10. 8 cm, 128 cm^2

Exercise 15.2

1. 204 cm^2 2. 120 cm^2 3. 48 cm^2 4. 62.35 cm^2 (approx.) 5. 15 cm 6. 6 cm^2

Exercise 15.3

1. 11000 m^3 2. 3409 m^2 3. 7525 m^2 4. 58550 m^2 5. 27200 m^2

M.C.Q.

1. (b) 2. (a) 3. (b) 4. (b)

Chapter-16

Exercise 16.1

1. (a) $d = 2.45$ m, $r = 1.225$ m (b) $c = 17.6$ m, $d = 5.6$ m (c) $r = 2.1$ m, $c = 13.2$ m 2. (a) 22 cm (b) 13.2 m (c) 35.2 km 3. (a) 44 cm (b) $\frac{220}{7}$ m (c) $\frac{88}{7}$ km 4. (a) 4.2 cm (b) 5.57 m (c) 1.05 km 5. (a) 2 cm (b) 14 m (c) 1.75 km 6. 5280 cm 7. 3 : 2 8. 6.3 cm 9. 44 cm 10. 8400 cm or 84 m

Exercise 16.2

1. (a) 1 cm (b) 4.2 m (c) 0.7 km 2. (a) 38.5 cm^2 (b) 55.44 m^2 (c)154 km^2 3. (a) 13.86 cm^2 (b) 98.56 m^2 (c) 9.625 km^2 4. (a) $r = 0.5$ m, A = 0.785 m^2 (b) $r = 4$ m, $c = 25.12$ m (c) $c = 15.7$ m, A = 19.625 m^2 5. 44 m 6. 19.625 cm^2 7. 26 cm 8. circle, 33 cm^2 9. 411.84 cm^2 10. 37.71 cm^2

Exercise 16.3

1. (a) 56cm^2 (b) $\left(\frac{308}{3} - 49\sqrt{3}\right)$ cm^2 (c) $\left(\frac{616}{3} - 49\sqrt{3}\right)$ cm^2 2. (a) 4.4 cm (b) 6.6 cm (c) $11\frac{11}{15}$ cm 3. (a) $6\frac{5}{12}$ cm^2 (b) $4\frac{13}{16}$ cm^2 (c) $12\frac{5}{6}$ cm^2 4. 2.2 cm 5. 440 m 6. 36° 7. 11 cm^2 8. circle, whose radius is 10 cm. 9. 2346 m^2 10. 52.38 m^2

M.C.Q.

1. (a) 2. (c) 3. (b) 4. (d)

MENTAL MATHS

9.63 cm^2

Chapter-17

Exercise 17.1

1. (a) 2160 mm^3, 1284 mm^2 (b) 8 cm, 158 cm^2 (c) 8 m, 432 m^2 (d) 5 cm, 540 cm^3 2. (a) 69300 *l* (b) 33345 *l* (c) 6.84 *l* (d) 35.568 *l* 3. 96 cm^2 4. 702 5. (a) 4 times (b) 8 times

Exercise 17.2

1. (a) 2310 cm^3 (b) 369.6 m^3 2. (a) 6930 cm^3 (b) 462 m^3 3. 2310 cm^3 4. cylinder B has larger volume 5. 34650 cm^3 6. 5720 cm^3 7. circular base, 85 cm^3 8. 2.5 m

Exercise 17.3

1. 15972 cm^2 2. 150.86 cm^2 (approx.) 3. 628.57 cm^2 (approx.) 4. 1.76 m^2 5. ₹ 6.88 (approx.) 6. ₹ 330 7. ₹ 440 8. 1848 m^2

Exercise 17.4

1. 314.29 cm^3 (approx.) 2. 9 cm 3. 154 m^3 4. 301.71 cm^3 (approx.) 5. 1570 cm^3 6. 15 cm

Exercise 17.5

1. 4714.29 cm^2 (approx.) 2. 198 cm^2 3. 157.14 cm^2 (approx.) 4. $88\sqrt{58}$ cm^2 5. 282.86 m^2 (approx.) 6. 251.43 m 7. 26 m, ₹ 29417 (approx.) 8. ₹ 27.50 9. 55.5 m, 10147.5 m^2 10. (a) 78.57 cm^2 (approx.) (b) 235.71 cm^2 (approx.) (c) 314.28 cm^2 (approx.)

Exercise 17.6

1. (a) 33.52 cm^3 (approx.) (b) 179.67 cm^3 (approx.) 2. (a) 1437.33 cm^3 (approx.) (b) 4.851 m^3 3. 367.96 cm^3 (approx.) 4. 45995 *l* (approx.) 5. 11.5 kg (approx.) 6. 77.616 kg

Exercise 17.7

1. (a) 707.14 cm^2 (approx.) (b) 1386 m^2 2. (a) 1808.64 cm^2 (b) 314 m^2 3. 179.67 cm^2 (approx.) 4. 1 : 4 5. ₹ 6.93 6. ₹ 498.96 7. 52 paise (approx.)

M.C.Q.

1. (c) 2. (d) 3. (b) 4. (c)

MENTAL MATHS

90 persons

Chapter-18

Exercise 18.1

1. Dogs : 10, Cats : 10, Fishes : 3, Rabbits : 4, Cow : 1 (draw table and bar graph yourself.) 2. 30-35 : 3, 35-40 : 4, 40-45 : 4, 45-50 : 5, 50-55 : 1, 55-60 : 1, 60-65 : 1, 65-70 : 1 (draw histogram yourself.) (a) 45-50 (b) 4 students (c) 16 students 3. (a) 5 teachers (b) 15

teachers 4. (draw histogram yourself.) (a) 20-30 (b) 8 students (c) 26 students (d) 33 students 5. 0-5 : 6, 5-10 : 36, 10-15 : 45, 15-20 : 13 (draw histogram yourself.) (a) 10-15 (b) 58 students (c) 42 students 6. (a) 4-5 hours (b) 14 persons (c) 34 persons

Exercise 18.2

1. Rainy : 120°, Winter : 150°, Summer : 90°(draw pie chart yourself.) 2. (draw pie chart yourself.) 3. (draw pie chart yourself.) 4. (draw pie chart yourself.) 5. (a) entertainment : 55% (b) sports : 25%, news : 10%, information : 10%, entertainment : 55%, 6. (a) western music (b) 200 peoples (c) western music : 400 CDs, folk music : 300 CDs, classical music : 100 CDs, co-classical music : 200 CDs

Exercise 18.3

1. (a) $\frac{1}{6}$ (b) $\frac{2}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{3}$ 2. (a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ 3. (a) $\frac{3}{8}$ (b) $\frac{3}{8}$ 4. (a) $\frac{5}{12}$ (b) $\frac{1}{12}$ (c) $\frac{1}{6}$ (d) $\frac{1}{3}$ 5. (a) $\frac{1}{2}$ (b) $\frac{1}{26}$ (c) $\frac{3}{26}$ (d) $\frac{1}{26}$

M.C.Q.

1. (b) 2. (d) 3. (a) 4. (c)

MENTAL MATHS

Probability of getting green ball = $\frac{5}{8}$, Probability of getting green ball is more.

Chapter-19

Exercise 19

1. (a) 0 (b) 5 (c) 7 (d) 8 2. (a) (0, 5) (b) (3, 0) 3. (a) First quadrant (b) Fourth quadrant (c) Second quadrant (d) Third quadrant (Locate points on graph paper yourself.) 4. (a) Do yourself. (b) 39°C, 38°C 5. (a) Do yourself. (b) 16 litres 6. (a) 14 tonnes (b) 4 tonnes (c) 55 tonnes

M.C.Q.

1. (a) 2. (c) 3. (b) 4. (d)

MENTAL MATHS

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