Chapter - 7: Cubes and Cube Roots

Cube

Concept Sheet:

- Cube is a 3-dimensional geometrical shape having all its sides equal.
- Numbers 1, 8, 27 are called cubes or cube numbers, since each number is obtained when a number is multiplied by itself three times.
- There are only ten perfect cubes from 1 to 1000.

Verification:

Table 1

Number	Cube
1	$1^3 = 1$
2	$2^3 = 8$
3	$3^3 = 27$
4	$4^3 = 64$
5	$5^3 = 125$
6	$6^3 = 216$
7	$7^3 = 343$
8	$8^3 = 512$
9	$9^3 = 729$
10	$10^3 = 1000$

Notation:

a^3 is called cube of 'a' number. Cube of an EVEN number is EVEN, and cube of an ODD number is ODD.

Some interesting patterns:

Observe the following pattern of sums of odd numbers.

$$1 = 1 = 1^3$$

$$3 + 5 = 8 = 2^3$$

$$7 + 9 + 11 = 27 = 3^3$$

$$13 + 15 + 17 + 19 = 64 = 4^3$$

$$21 + 23 + 25 + 27 + 29 = 125 = 5^3 \quad \text{and so on}$$

Finding the difference between cubes of consecutive number:

$$5^3 - 4^3 = 125 - 64$$

$$= 61$$

$$(a+1)^3 - a^3 = a^3 + 3a^2 + 3a + 1 - a^3$$

$$(a+1)^3 - a^3 = 1 + 3a(a+1)$$

Using the above simplified formulas, we can easily find the difference between cubes of consecutive numbers with little calculation and not by actually finding cubes.

Example: $83^3 - 82^3 = ?$

We know,

$$(a+1)^3 - a^3 = 1 + 3a(a+1)$$
$$\text{let } a = 82$$
$$So, (82+1)^3 - 82^3 = 1 + 3 * 82(82+1)$$
$$83^3 - 82^3 = 1 + 3(82)(83)$$
$$= 1 + 20418$$
$$83^3 - 82^3 = 20419$$

Actual Method

$$83^3 = 83 \times 83 \times 83$$
$$82^3 = 82 \times 82 \times 82$$
$$83^3 = 571787$$
$$82^3 = 551368$$
$$83^3 - 82^3 = 571787 - 551368$$
$$= 20419$$

To find whether a number is a perfect cube:

The prime factorization of the number should have its prime factors grouped in triple.

Example: Is 216 a cube?

Reasoning

A number is a cube only when each factor in the prime factorization is grouped in triple.

Solution:

2	216
2	108
2	54
3	27
3	9
	3

$$216 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$$
$$= 2^3 \times 2^3$$
$$= (2 \times 3)^3$$
$$= 6^3$$

$\therefore$ 2 and 3 are occurring in groups of triples.

$\therefore$ 216 is a perfect cube.

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Exercise 7.1 (Page 114 of Grade 8 NCERT)

Q1. Which of the following numbers are not perfect cubes?

(i) 216 (ii) 128 (iii) 1000 (iv) 100 (v) 46656

Difficulty Level: Easy

What is unknown?

To find the numbers which are not perfect cubes.

Reasoning

A number is a perfect cube only when each factor in the prime factorization is grouped in triples.

Solution (i)

2	216
2	108
2	54
3	27
3	9
	3

$$216 = \underline{2\times 2\times 2}\times \underline{3\times 3\times 3}$$

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

$\therefore$ 216 is a perfect cube

Solution (ii)

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

$$128 = \underline{2\times 2\times 2}\times \underline{2\times 2\times 2}\times 2$$

$128 = 2^3 \times 2^3 \times 2$ -> one of the 2 is not grouped in triples.

$\therefore$ 128 is not a perfect cube.

Solution (iii)

2	1000
2	500
2	250
2	125
5	25
	5

$$1000 = \underline{2\times2\times2}\times\underline{5\times5\times5}$$

$$1000 = 2^3\times5^3$$

$\therefore$ 1000 is a perfect cube.

Solution (iii)

2	100
2	50
5	25
	5

$$100 = 2\times2\times5\times5$$

$$= 2^2\times5^2$$

Both 2 and 5 are not grouped in triples.

$\therefore$ 100 is not a perfect cube.

Solution (iv)

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

$$46656 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$$

$$= 2^3\times2^3\times3^3\times3^3$$

$\therefore$ 46656 is a perfect cube.

Q2. Find the smallest number by which each of the following numbers must be multiplied to obtain a perfect cube.

(i) 243 (ii) 256 (iii) 72 (iv) 675 (v) 100

Difficulty Level: Easy

What is unknown?

To find the smallest number by which the given number must be multiplied to obtain a perfect cube.

Reasoning

A number is a perfect cube only when each factor in the prime factorization is grouped in triples. Using this concept, the smallest number can be identified.

Solution (i)

$$\begin{array}{r|l} 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline & 3 \end{array}$$

$$243 = \underline{3 \times 3 \times 3} \times 3 \times 3$$

$$243 = 3^3 \times 3$$

Here, one of the 3's is not a triplet. To make it as a triplet, we need to multiply by 3.

In that case,

$$243 \times 3 = \underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3} = 3^3 \times 3^3 = 9^3 = 729 \text{ is a perfect cube.}$$

Answer: Hence, the smallest natural number by which 243 should be multiplied to make a perfect cube is 3.

Solution (ii)

$$256 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2 \times 2$$

$$256 = 2^3 \times 2^3 \times 2^2$$

Here, one of the 2’s is not a triplet. To make it as a triplet, we need to multiply by 2.

In that case,

$$256 \times 2 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} = 2^3 \times 2^3 \times 2^3 = 8^3 = 512 \text{ is a perfect cube.}$$

Answer: Hence, the smallest natural number by which 256 should be multiplied to make a perfect cube is 2.

Solution (iii)

2	72
2	36
2	18
3	9
	3

$72 = \underline{2 \times 2 \times 2} \times 3 \times 3$

$72 = 2^3 \times 3^2$

Here, one of the 3's is not a triplet. To make it as a triplet, we need to multiply by 3.
In that case,

$72 \times 3 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} = 2^3 \times 3^3 = 6^3 = 216$ is a perfect cube.

Answer: Hence, the smallest natural number by which 72 should be multiplied to make a perfect cube is 3.

5	675
5	135
3	27
3	9
	3

Solution (iii)

$675 = 5 \times 5 \times \underline{3 \times 3 \times 3}$

$675 = 5^2 \times 3^3$

Here, one of the 5's is not a triplet. To make it as a triplet, we need to multiply by 5.
In that case,

$675 = \underline{5 \times 5 \times 5} \times \underline{3 \times 3 \times 3} = 5^3 \times 3^3 = 15^3 = 3375$ is a perfect cube.

Answer: Hence, the smallest natural number by which 675 should be multiplied to make a perfect cube is 5.

Solution (iv)

2	100
2	50
5	25
	5

$100 = 2 \times 2 \times 5 \times 5$

$100 = 2^2 \times 5^2$

Here both the prime factors are not triplets. To make them triplets we need to multiply by one more 2 and 5.

In that case,

$$100 = \underline{2\times2\times2}\times\underline{5\times5\times5} = 2^3\times5^3 = 10^3 = 1000 \text{ is a perfect cube.}$$

Answer 3: Hence, the smallest natural number by which 100 should be multiplied to make a perfect cube is $2\times5=10$.

Q3. Find the smallest number by which each of the following numbers must be divided to obtain a perfect cube.

(i) 81 (ii) 128 (iii) 135 (iv) 192 (v) 704

Difficulty Level: Easy

What is unknown?

To find the smallest number by which a given number must be divided to obtain a perfect cube.

Reasoning

A number is a perfect cube only when each factor in the prime factorization is grouped in triples. Using this concept smallest number to be multiplied can be obtained.

Solution (i)

3	81
3	27
3	9
	3

$$81 = \underline{3\times3\times3}\times3$$

$$81 = 3^3\times3$$

Here, the prime factor 3 is not present as triples.

Hence, we divide 81 by 3, so that the obtained number becomes a perfect cube.

Thus,

$$81\div3 = 27 = 3^3 \text{ is a perfect cube.}$$

Answer: Hence the smallest number by which 81 should be divided to make a perfect cube is 3.

Solution (ii)

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

$$128 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2$$

$$128 = 2^3 \times 2^3 \times 2$$

Here, the prime factor 2 is not present as triples.
Hence, we divide 128 by 2, so that the obtained number becomes a perfect cube.

$128 \div 2 = 64 = 2^3 \times 2^3 = 4^3$ is a perfect cube.

Answer: Hence the smallest number by which 128 should be divided to make a perfect cube is 2.

Solution (iii)

5	135
3	27
3	9
	3

$$135 = 5 \times \underline{3 \times 3 \times 3}$$

$$135 = 5^1 \times 3^3$$

Here, the prime factor 5 is not present as triples.
Hence , we divide 135 by 5, so that the obtained number becomes a perfect cube.

$135 \div 5 = 27 = 3^3$ is a perfect cube.

Answer: Hence the smallest number by which 135 should be divided to make a perfect cube is 5.

Solution (iv)

2	192
2	96
2	48
2	24
2	12
2	6
	3

$$192 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 3$$

$$192 = 2^3 \times 2^3 \times 3$$

Here, the prime factor 3 is not present as triples.
Hence, we divide 192 by 3, so that the obtained number becomes a perfect cube.

$192 \div 3 = 64 = 2^3 \times 2^3 = 4^3$ is a perfect cube.

Answer: Hence the smallest number by which 192 should be divided to make a perfect cube is 3.

Solution (v)

2	704
2	352
2	176
2	88
2	44
2	22
	11

$$704 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 11$$

$$704 = 2^3 \times 2^3 \times 11$$

Here, the prime factor 11 is not present as triples.
Hence, we divide 704 by 11, so that the obtained number becomes a perfect cube.

$704 \div 11 = 64 = 2^3 \times 2^3 = 4^3$ is a perfect cube.

Answer: Hence the smallest number by which 704 should be divided to make a perfect cube is 11.

Q4. Parikshit makes a cuboid of plasticine of sides 5 cm, 2 cm, 5 cm. How many such cuboids will he need to form a cube?

Difficulty Level: Medium

What is known/given?
Dimensions of cuboid $5\,\text{cm}\times 2\,\text{cm}\times 5\,\text{cm}$.

What is unknown?
To find out the number of cuboids to form a cube.

Reasoning

$$\text{Number of cuboids required} = \frac{\text{Volume of cube}}{\text{Volume of cuboid}}$$

Solution

$$\begin{aligned}\text{Volume of cuboid} &= \text{length}\times\text{breadth}\times\text{height}\\ &= 5\times 2\times 5\\ &= 5^2\times 2^1\,\text{cm}^3\end{aligned}$$

To make the volume of cuboid as a cube number we need to multiply it by $5\times 2\times 2$

$$\begin{aligned}\text{Newly formed cube} &= 5^2\times 2^1\times 5\times 2\times 2\\ &= 5^3\times 2^3\,\text{cm}^3\end{aligned}$$

$$\begin{aligned}\text{Number of cuboids required} &= \frac{5^3\times 2^3}{5^2\times 2}\\ &= \frac{5\times \cancel{5}\times \cancel{5}\times \cancel{2}\times 2\times 2}{\cancel{5}\times \cancel{5}\times \cancel{2}}\\ &= 5\times 2\times 2\\ &= 20\end{aligned}$$

$\therefore$ Number of cuboids required to make a cube = 20

Answer: 20 cuboids required

Chapter - 7: Cubes and Cube Roots

Cube

Concept Sheet:

Cube refers to the geometrical shape of cube. Cube roots refers the side of Cube.

CUBE ROOT = Root – The origin, which results in cube.
As square root is the inverse operation of squaring, finding cube root is the inverse operation of finding cube.

Cube of 2 = $2^3 = 8$

Cube root of 8 = $\sqrt[3]{8} = 2$

NOTATION: $\sqrt[3]{1}, \sqrt[3]{2}, \sqrt[3]{3}, \sqrt[3]{4}, \sqrt[3]{5}, \sqrt[3]{6}, \sqrt[3]{7}, \sqrt[3]{8}, \sqrt[3]{9}, \sqrt[3]{10}$

$\sqrt[3]{\ }$ denote cube roots

Table 7.2:

CUBE ROOT		INFERENCE
1	$1^3 = 1$	$\sqrt[3]{1} = 1$
2	$2^3 = 8$	$\sqrt[3]{2} = 2$
3	$3^3 = 21$	$\sqrt[3]{3} = 3$
4	$4^3 = 64$	$\sqrt[3]{4} = 4$
5	$5^3 = 125$	$\sqrt[3]{5} = 5$
6	$6^3 = 216$	$\sqrt[3]{6} = 6$
7	$7^3 = 343$	$\sqrt[3]{7} = 7$
8	$8^3 = 512$	$\sqrt[3]{8} = 8$
9	$9^3 = 729$	$\sqrt[3]{9} = 9$
10	$10^3 = 1000$	$\sqrt[3]{10} = 10$

Using the table7.2, cube roots ’ones’ digit can be determined by looking at the ones digit of cube.

Example 1: 17576 is a cube number: Cube’s one’s digit is 6. This is possible only when cube roots’ one’s digit is 6.

Example 2: 21952 is a cube number: Cubes’ one’s digit is 2. This is possible only when cube roots’ one’s digit is 8.

Elaborating a bit more using the above concept, cube roots of a perfect cube numbers can be easily guessed, without much calculation.

Example 3:
Find the cube root of 9261.

Unknown:
Cube Root

Known:
Cube number 9261

Reasoning:
Since the given number is a perfect cube, cube root exists. By guessing one's digits of cube root and with bit more calculation, cube root can be identified.

Solution:
Step1: Start making groups of three digits starting from the right most digit of the number (cube)

9 = Group 2 261 = Group 1

Step 2: From group 1, one's digit of the cube root can be identified.

26<u>1</u> = One's digit is 1

We know that 1 comes at the one's place of a number only when it's cube root ends in 1. So, we get 1 at the one's place of the cube root.(Refer table 7.2 INFERENCE)

Step 3: From group 2, which is 9

$8 < 9 < 27$

$2^3 < 9 < 3^3$ (Group 2 lies between two perfect cubes)

Taking the lower limit, ten's digit of cube root is 2.

So, we get $\sqrt[3]{9261} = 21$.

Example 4:
Find cube root of the perfect cube number 658503

Step 1: Group Formation

<u>658</u> = Group 2 <u>503</u> = Group 1

Step 2: From group 1, which is 503

50<u>3</u> = One's digit is 3

We know that 3 comes at the one's place of a number only when it's cube root ends in 7. So, we get 7 at the one's place of the cube root .(Refer table 7.2 INFERENCE)

Step 3: Digits of group-2 lies between the perfect cubes-

$$512 < 658 < 729$$
$$8^3 < 658 < 9^3$$

Taking the lower limit, tens digit of cube root is 8.

So, we get $\sqrt[3]{658503} = 87$.

Limitation 1:
Using the above method, we can easily find cube roots up to 2 digits maximum.
We should remember table 7.2 to find the cube root through prime factorization method.

Example 5:
Find the cube root of 3375

Difficulty Level: Easy

Reasoning
By grouping the factors in prime factorization as triplet.

Solution:

$$\begin{array}{l|l} 5 & 3375 \\ 5 & 675 \\ 5 & 135 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ 1 & 1 \end{array}$$

$$3375 = \underline{5 \times 5 \times 5} \times \underline{3 \times 3 \times 3} = 5^3 \times 3^3$$
$$\sqrt[3]{3375} = 5 \times 3$$
$$\sqrt[3]{3375} = 15$$

Chapter - 7: Cubes and Cube Roots

Exercise 7.2 (Page 116 of Grade 8 NCERT)

Q1. Find the cube root of each of the following numbers by prime factorization method.

(i) 64
(ii) 512
(iii) 10648
(iv) 27000
(v) 15625
(vi) 13824
(vii) 110592
(viii) 46656
(ix) 175616
(x) 91125

Difficulty Level: Easy

Reasoning:
Factors in the prime factorization of cube should be grouped as triplets.

Solution (i)

$$\begin{array}{r|l} 2 & 64 \\ 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ 1 & 1 \end{array}$$

$$64 = \underline{2\times2\times2}\times\underline{2\times2\times2}$$
$$= 2^3 \times 2^3$$
$$\sqrt[3]{64} = 2\times2 = 4$$

Solution (ii)

$$\begin{array}{r|l} 2 & 512 \\ 2 & 256 \\ 2 & 128 \\ 2 & 64 \\ 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ 1 & 1 \end{array}$$

$$512 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}$$
$$= 2^3\times2^3\times2^3$$
$$\sqrt[3]{512} = 2\times2\times2 = 8$$

Solution (iii)

$$\begin{array}{r|l} 2 & 10648 \\ 2 & 5324 \\ 2 & 2662 \\ 11 & 1331 \\ 11 & 121 \\ 11 & 11 \\ 1 & 1 \end{array}$$

$$10648 = \underline{2\times2\times2}\times\underline{11\times11\times11}$$
$$= 2^3\times11^3$$
$$\sqrt[3]{10648} = 2\times11 = 22$$

Solution (iv)

$$\begin{array}{r|l} 2 & 27000 \\ 2 & 13500 \\ 2 & 6750 \\ 5 & 3375 \\ 5 & 675 \\ 5 & 135 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ 1 & 1 \end{array}$$

$$27000 = \underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{5\times5\times5}$$
$$= 2^3\times3^3\times5^3$$
$$\sqrt[3]{27000} = 2\times3\times5 = 30$$

Solution (v)

$$\begin{array}{r|l} 5 & 15625 \\ 5 & 3125 \\ 5 & 625 \\ 5 & 125 \\ 5 & 25 \\ 5 & 5 \\ 1 & 1 \end{array}$$

$$15625 = \underline{5\times5\times5}\times\underline{5\times5\times5}$$
$$= 5^3\times5^3$$
$$\sqrt[3]{15625} = 5\times5 = 25$$

Solution (vi)

$$\begin{array}{r|l} 2 & 13824 \\ 2 & 6912 \\ 2 & 3456 \\ 2 & 1728 \\ 2 & 864 \\ 2 & 432 \\ 2 & 216 \\ 2 & 108 \\ 2 & 54 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ 1 & 1 \end{array}$$

$$13824 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}$$
$$= 2^3\times2^3\times2^3\times3^3$$
$$\sqrt[3]{13824} = 2\times2\times2\times3 = 24$$

Solution (vii)

$$\begin{array}{l|l} 2 & \underline{110592} \\ 2 & \underline{55296} \\ 2 & \underline{27648} \\ 2 & \underline{13824} \\ 2 & \underline{6912} \\ 2 & \underline{3456} \\ 2 & \underline{1728} \\ 2 & \underline{864} \\ 2 & \underline{432} \\ 2 & \underline{216} \\ 2 & \underline{108} \\ 2 & \underline{54} \\ 3 & \underline{27} \\ 3 & \underline{9} \\ 3 & \underline{3} \\ 1 & \underline{1} \end{array}$$

$$\begin{aligned} 110592 &= \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3} \\ &= 2^3\times2^3\times2^3\times2^3\times3^3 \end{aligned}$$

$$\sqrt[3]{110592} = 2\times2\times2\times2\times3 = 48$$

Solution (viii)

$$\begin{array}{l|l} 2 & \underline{46656} \\ 2 & \underline{23328} \\ 2 & \underline{11664} \\ 2 & \underline{5832} \\ 2 & \underline{2916} \\ 2 & \underline{1458} \\ 3 & \underline{729} \\ 3 & \underline{243} \\ 3 & \underline{81} \\ 3 & \underline{27} \\ 3 & \underline{9} \\ 3 & \underline{3} \\ 1 & \underline{1} \end{array}$$

$$\begin{aligned} 46656 &= \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3} \\ &= 2^3\times2^3\times2^3\times3^3\times3^3 \end{aligned}$$

$$\sqrt[3]{46656} = 2\times2\times3\times3 = 36$$

Solution (ix)

$$\begin{array}{l|l} 2 & 175616 \\ 2 & 87808 \\ 2 & 43904 \\ 2 & 21952 \\ 2 & 10976 \\ 2 & 5488 \\ 2 & 2744 \\ 2 & 1372 \\ 2 & 686 \\ 7 & 343 \\ 7 & 49 \\ 7 & 7 \\ 1 & 1 \end{array}$$

$$175616 = \underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{7\times7\times7}$$
$$= 2^3\times2^3\times2^3\times7^3$$
$$\sqrt[3]{175616} = 2\times2\times2\times7 = 56$$

Solution (x)

$$\begin{array}{l|l} 5 & 91125 \\ 5 & 18225 \\ 5 & 3645 \\ 3 & 729 \\ 3 & 243 \\ 3 & 81 \\ 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ 1 & 1 \end{array}$$

$$91125 = \underline{5\times5\times5}\times\underline{3\times3\times3}\times\underline{3\times3\times3}$$
$$= 5^3\times3^3\times3^3$$
$$\sqrt[3]{91125} = 5\times3\times3 = 45$$

Q2. State true or false:

(i). Cube of any odd number is even.
Ans. False

Reasoning:
Cubes of odd numbers are odd.
Cubes of even numbers are even.

(ii). A perfect cube does not end with two zeros.
Ans. True

Reasoning:
Perfect cube may end with 3 zeros (or) groups of 3 zeros.

(iii). If square of a number ends with 5, then its cube ends with 25.
Ans. False

Reasoning:
It is not always necessary that if the square of a number ends with 5, then its cube will end with 25.

For example, the square of 5 is 25 and 25 has its unit digit as 5. The cube of 5 is 125. However, the square of 15 is 225 and also has its unit place digit as 5 but the cube of 15 is 3375 which does not end with 25.

(iv). There is no perfect cube which ends with 8.
Ans. False

Reasoning:
The cubes of all the numbers having their unit place digit as 2 will end with 8.
The cube of 12 is 1728 and the cube of 22 is 10648.

(v). The cube of a 2-digit number may be a 3-digit number.
Ans. False

Reasoning:
Cube of a 1-digit number may have 1-digit to 3-digits.
Cube of a 2-digit number may have 4-digits to maximum 6-digits.

(vi). The cube of a 2-digit number may have seven or more digits.
Ans. False

Reasoning
Cube of a 1-digit number may have 1-digit to 3-digits.
Cube of a 2-digit number may have 4-digits to maximum 6-digits.

(vii). The cube of a single digit number may be a single digit number.
Ans. True

Reasoning

Some examples

$$1^3 = 1$$

$$2^3 = 8$$

Q3. You are told that 1,331 is a perfect cube. Can you guess without factorization what its cube root is? Similarly, guess the cube roots of 4913, 12167, 32768.

Difficulty Level: Medium

Reasoning:
By grouping the digits of cube into 3 and using Table 7.2

Solution (i)
1331

Step 1:

1 = Group 2
33<u>1</u> = Group 1

Step 2: From group 1, one's digit of the cube root can be identified.
33<u>1</u>= One's digit is 1
Hence cube root's one's digit is 1.

Step 3: From group 2, which is 1 only.
Hence cube root's ten's digit is 1.

So, we get $\sqrt[3]{1331} = 11$.

Solution (ii)
4913

Step 1:

4 = Group 2
91<u>3</u> = Group 1

Step 2: From group 1, which is 913.
91<u>3</u> = One's digit is 3

We know that 3 comes at the one's place of a number only when it's cube root ends in 7. So, we get 7 at the one's place of the cube root. (Refer table 7.2 INFERENCE)

Step 3: From Group 2, which is 4.

$1^3 < 4 < 2^3$

Taking lower limit. Therefore, ten's digit of cube root is 1.

So, we get $\sqrt[3]{4913} = 17$.

Solution (iii)

12167

Step 1:

12 = Group 2

16<u>7</u> = Group 1

Step 2: From group 1, which is 167.

16<u>7</u> = One's digit is 7

We know that 7 comes at the one's place of a number only when it's cube root ends in 3. So, we get 3 at the one's place of the cube root. (Refer table 7.2 INFERENCE)

Step 3: From Group 2, which is 12.

$2^3 < 12 < 3^3$

Taking the lower limit. Therefore, ten's digit of cube root is 2.

So, we get $\sqrt[3]{12167} = 23$.

Solution (iv)

32768

Step 1:

32 = Group 2

76<u>8</u> = Group 1

Step 2: From group 1, which is 768.

76<u>8</u> = One's digit is 8

We know that 8 comes at the one's place of a number only when it's cube root ends in 2. So, we get 2 at the one's place of the cube root. (Refer table 7.2 INFERENCE)

Step 3: From Group 2, which is 32.

$3^3 < 32 < 4^3$

Taking lower limit. Therefore, ten's digit of cube root is 3.

So, we get $\sqrt[3]{32768} = 32$.