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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.

 $1 = 1 = 1^3$ $3+5=8=2^{3}$ $7+9+11=27=3^3$ $13 + 15 + 17 + 19 = 64 = 4^3$ $21+23+25+27+29=125=5^3$ 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,

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

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:

a3

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:

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

- \therefore 2 and 3 are occurring in groups of triples.
- \therefore 216 is a perfect cube.



Chapter - 7: Cubes and Cube Roots

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

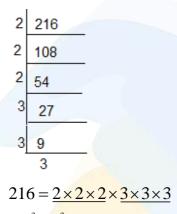
What is unknown?

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.

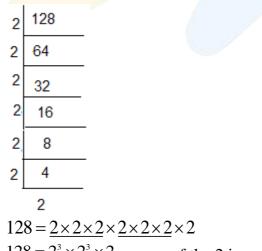
Solution (i)



 $=2^3\times2^3$

: 216 is a perfect cube

Solution (ii)



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

∴ 128 is not a perfect cube.



 \therefore 1000 is a perfect cube.

Solution (iii)

$$2 | 100 | 250 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |$$

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	

 $46656 = \underbrace{2 \times 2 \times 2}_{=2^{3} \times 2^{3} \times 3^{3} \times 3^{3}} \times \underbrace{2 \times 2 \times 2 \times 2}_{=2^{3} \times 2^{3} \times 3^{3} \times 3^{3}} \times \underbrace{3 \times 3 \times 3}_{=2^{3} \times 2^{3} \times 3^{3} \times 3^{3}}$

: 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)

3	243			
3	81			
3	27			
3	9			
	3			
24	3 = 3	3×3	<u>3</u> ×3	×3
24	$3 = 3^{3}$	×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,

$$243 \times 3 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^3 \times 3^3 = 9^3 = 729$$
 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)

$$256 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2 \times 2 \times 2$$
$$256 = \underline{2^3 \times 2^3 \times 2^2}$$

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,

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

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



2 72
2 36
2 18
3 9
3
72 =
$$2 \times 2 \times 2 \times 3 \times 3$$

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.

675		
135		
27	•	
9		
3		
	135 27 9	135 27 [.] 9

Solution (iii)

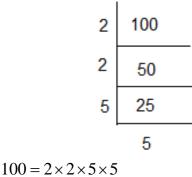
$$675 = 5 \times 5 \times \underline{3 \times 3 \times 3}$$
$$675 = 5^2 \times \underline{3^3}$$

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,

 $675 = 5 \times 5 \times 5 \times 3 \times 3 \times 3 = 5^3 \times 3^3 = 15^3 = 3375$ 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)



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



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,

 $100 = 2 \times 2 \times 2 \times 5 \times 5 \times 5 = 2^3 \times 5^3 = 10^3 = 1000$ is a perfect cube.

Answer 3: Hence, the smallest natural number by which 100 should be multiplied to make a perfect cube is $2 \times 5 = 10$.

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)

$$3 81$$

$$3 27$$

$$3 9$$

$$3$$

$$81 = 3 \times 3 \times 3$$

$$81 = 3^{3} \times 3$$

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

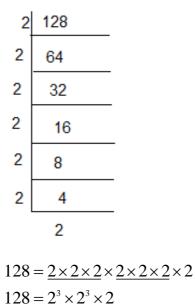
Hence, we divide 81 by 3, so that the obtained number becomes a perfect cube.

Thus,

 $81 \div 3 = 27 = 3^3$ is a perfect cube.

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





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)

$$5 135$$

$$3 27$$

$$3 9$$

$$3$$

$$135 = 5 \times 3 \times 3 \times 3$$

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

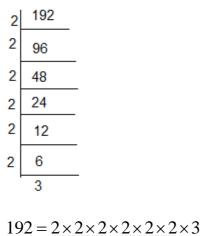
Here, the prime factor 5 is not present as triples.

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.





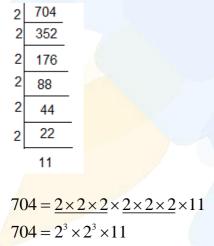
 $192 = 2^3 \times 2^3 \times 3$

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)



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

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

Solution

Volume of cuboid = length × breadth × height = $5 \times 2 \times 5$ = $5^2 \times 2^1 \text{ cm}^3$

To make the volume of cuboid as a cube number we need to multiply it by $5 \times 2 \times 2$ Newly formed cube = $5^2 \times 2^1 \times 5 \times 2 \times 2$

$$= 5^{3} \times 2^{3} \text{ cm}^{3}$$
Number of cuboids required
$$= \frac{5^{3} \times 2^{3}}{5^{2} \times 2}$$

$$= \frac{5 \times \cancel{3} \times \cancel{3} \times \cancel{2} \times 2 \times 2}{\cancel{3} \times \cancel{3} \times \cancel{2}}$$

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

$$= 20$$

 \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: ∛1, ∛2, ∛3, ∛4, ∛5, ∛6, ∛7, ∛8, ∛9, ∛10

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

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	$7^3 = 343$	3√7 = 7
8	$8^3 = 512$	$\sqrt[3]{8} = 8$
9	$9^3 = 729$	$\sqrt[3]{9} = 9$
10	$10^3 = 1000$	$\sqrt[3]{10} = 10$

Table 7.2:

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.

 $26\underline{1} =$ 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

 $\underline{658} = \text{Group } 2 \qquad \underline{503} = \text{Group } 1$

Step 2: From group 1, which is 503 503 =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:

5 <u> 3375</u>
5 <mark>675</mark>
5 135
3 27
3 9
3 3
1/1
$3375 = \underline{5 \times 5 \times 5} \times \underline{3 \times 3 \times 3} = 5^3 \times 3^3$
∛ <mark>3375 = 5×3</mark>
<mark>∛3375 =</mark> 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
- (v) 13025 (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)

264	
2 32	
2 16	
2 <u> 8</u>	
2 <u>4</u>	
2 2	
1[1	
$64 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2}$	2×2
$=2^3 \times 2^3$	
$\sqrt[3]{64} = 2 \times 2 = 4$	



2 <u>512</u>
2 256
2 128
264
2 32
2 16
2 <u>8</u>
24
2[2
1[1
$512 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$
$= 2^3 \times 2^3 \times 2^3$
$\sqrt[3]{512} = 2 \times 2 \times 2 = 8$

Solution (iii)

2|10648 2|5324 2|2662 11|1331 11|121 11|11 11|11 11

```
10648 = \underbrace{2 \times 2 \times 2}_{3} \times \underbrace{11 \times 11 \times 11}_{3}= 2^{3} \times 11^{3}\underbrace{\sqrt[3]{10648}}_{3} = 2 \times 11 = 22
```

Solution (iv)

2|27000 2|13500 2|6750 5|3375 5|675 5|135 3|27 3|9 3|3 1|1



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

Solution (v)

5 15625
5 <u>3125</u>
5 <u>625</u>
5 125
5 25
5 <u>5</u>
1[1
$15625 = \underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}$
$=5^3 \times 5^3$
$\sqrt[3]{15625} = 5 \times 5 = 25$

Solution (vi)

2 13824			
26912			
2 3456			
2 1728			
2864			
2 432			
2 216			
2 <u>108</u>			
2 <u> 54</u>			
3 <u>27</u>			
3 <mark>9</mark>			
3 3			
11			

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



 $110592 = \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$ $= 2^3 \times 2^3 \times 2^3 \times 2^3 \times 3^3$

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

Solution (viii)

2 <u>46656</u>
2 23328
2 <u>11664</u>
2 <mark> 5832</mark>
2 29 <mark>16</mark>
2 <mark>1458</mark>
3 <mark>729</mark>
3 243
381
3 27
3 <u>9</u>
3 <u> 3</u>
1 1
$46656 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3}$ $= 2^3 \times 2^3 \times 2^3 \times 3^3 \times 3^3$
$\sqrt[3]{46656} = 2 \times 2 \times 3 \times 3 = 36$



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

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

Solution (x)



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 $33\underline{1} = \text{Group } 1$

- 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. $91\underline{3} =$ 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. $16\underline{7} = \text{One's digit is 7}$

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. 768 =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 $\sqrt[3]{32768} = 32$.



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