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Cube Root of a Number: Definition and Cube Root by Prime Factorization Method (For CBSE, ICSE, IAS, NET, NRA 2022)

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Cube root of a number can be found by a very simple method which is the prime factorization method. Cube root is denoted by ' $\sqrt[3]{-}$ ' symbol. Example:

$\sqrt[3]{8} = \sqrt[3]{(2 \times 2 \times 2)} = 2$. Since 8 is a perfect cube number, it is easy to find the cube root of a number.

To find the cube root of any number, we need to find a number which when multiplied three times by itself gives the original number.

Let find cube root using prime factorization method and solved examples. Also, find the cubes and cube roots of 1 to 15 numbers here in the table given.

Definition

The cube root of any number says 'a' is the number say 'b' which satisfy the equation given below:

$$b^3 = a$$

This can be represented as:

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

How to Find Cube Root of a Number

Cube root is the inverse process of calculating the cube of a number. It is denoted by the symbol $\sqrt[3]{-}$. Let us see some examples here now.

To find the cube root of a number 27, we want a number which when multiplied thrice with itself shall give 27. We can write,

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

Taking cubic root on both the sides,

$$\text{or } \sqrt[3]{27} = \sqrt[3]{3^3}$$

Therefore, cube-root of 27 is 3 .

Please note that we will only consider the positive values cube roots of the natural numbers.

Cube Root of 2

Let us consider another example of number 2. Since 2 is not a **perfect cube** number. It is not easy to find the cube root of 2. With the help of the long division method, it is possible to find the cube roots for non-perfect cube numbers. The approximate value of the $\sqrt[3]{2}$ is **1.260**.

We can estimate the $\sqrt[3]{2}$ by using the trick here.

Since, $2 = 1 \times 1 \times 2$

Cube root of 2 is approximately equal to $\frac{1 + 1 + 2}{3} = \frac{4}{3} = 1.333 \dots$

Cube Root of 4

Again 4 is a number, which is not a perfect cube. If we factorize it, we get: Hence, we can see, we cannot find the cube root by simple factorization here. Again, if we use the shortcut method, we get: $\sqrt[3]{4}$ is equal to $\frac{2 + 2 + 1}{3} = \frac{5}{3} = 1.67$ The actual value of $\sqrt[3]{4}$ is 1.587, which is approximately equal to 1.67.

$$4 = 2 \times 2 \times 1$$

Cubes and Cube Roots List of 1 to 15

Number	Cube	Cube Root $\sqrt[3]{a}$
1	1	1.000
2	8	1.260
3	27	1.442
4	64	1.587
5	125	1.710
6	216	1.817
7	343	1.913
8	512	2.000
9	729	2.080
10	1000	2.154
11	1331	2.224
12	1728	2.289

13	2197	2.351
14	2744	2.410
15	3375	2.466
<i>Cubes and Cube Roots List of 1 to 15</i>		

Cube Root by Prime Factorization Method

We can find the cube-root of a number by the method of prime factorization. Consider the following example for a clear understanding:

$$2744 = 2 \times 2 \times 2 \times 7 \times 7 \times 7 = (2 \times 7)^3$$

Therefore, the cube root of $2744 = \sqrt[3]{2744} = 2 \times 7 = 14$

Cube Root of 64

Since, 64 is perfect cube of 4, therefore, it is easy to find its cube-root by prime factorization method.

$$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \sqrt[3]{64} = \sqrt[3]{(2 \times 2 \times 2 \times 2 \times 2 \times 2)} = 2 \times 2 = 4$$

Cube Root of 216

Since, 216 is perfect cube of 6, hence we can find the cube root of 216 by factorization.

$$216 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \sqrt[3]{216} = \sqrt[3]{(2 \times 2 \times 2 \times 3 \times 3 \times 3)}$$

$$\sqrt[3]{216} = 2 \times 3 \sqrt[3]{216} = 6$$

Cube Root of 343

Let us find the cube root of 343 with the help of the prime factorization method.

Dividing 343 by smallest prime factor, till we get the remainder as 1. Follow the below steps;

$$\begin{array}{r|l} 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

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Therefore, $343 = 7 \times 7 \times 7$

And, $\sqrt[3]{343} = 7$

Cube Root of 512

To find the cube root of 512 we have to factorise it first. The prime factorization of 512 can be written as: Taking the cube roots both the sides, we get;

$$512 = 2 \times 2$$

$$\sqrt[3]{512} = \sqrt[3]{(2 \times 2 \times 2)} \sqrt[3]{512} = 2 \times 2 \times 2 \sqrt[3]{512} = 8$$

Cube Root of 729

Now, let's find the cubic root of 729.

$$\begin{array}{r|l} 3 & 729 \\ \hline 3 & 243 \\ \hline 3 & 81 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

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$$729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 9 \times 9 \times 9$$

Therefore, the cube root of 729 i.e.. $\sqrt[3]{729} = 9$

Cube Root Questions

Question 1: Solve: $\sqrt[3]{24389}$

Solution:

Prime factors = $29 \times 29 \times 29 = 293$ Therefore $\sqrt[3]{24389} = 29$.

Question 2: Find $\sqrt[3]{46656}$ by the method of prime factorization.

Solution:

Let us first find the prime factors:

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

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$$\begin{aligned}\sqrt[3]{46656} &= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \\ &= 2^3 \times 2^3 \times 3^3 \times 3^3 \\ &= (2 \times 2 \times 3 \times 3)^3\end{aligned}$$

Therefore, $\sqrt[3]{46656} = 36$.

Frequently Asked Questions

What is the Cube Root of a Number?

The cube root of a number is defined as the number which results in the original number when cubed. For example, for 8, the cube root will be 2 as $2 \times 2 \times 2 = 8$.

What is the Easiest Method to Find the Cube Root of a Number?

The cube root of perfect cubes can be easily found out by using prime factorization method as explained in this lesson.

What is a Perfect Cube?

A perfect cube is defined as any number which is the cube of an integer.

How to Know if a Number is a Perfect Cube?

To check whether a number is a perfect cube, factorize the number first. If the factors of the number can be equally grouped in triples, the number is a perfect cube.

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