Cubes and Cube Roots: Exercise 7.2

Q.1 Find the cube root of each of the following numbers by prime factorisation method.

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

Sol. **(i)** Cube root of 64 by using prime factorising method:

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

So, prime factors of 64 = 2 x 2 x 2 x 2 x 2 x 2

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$

Cube root of 64 = 2 × 2

So, $\sqrt[3]{64} = 4$

(ii) Cube root of 512 by using prime factorising method:

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

So, prime factors of 512 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2}$

Cube root of 512 = 2 × 2 × 2

So, $\sqrt[3]{512} = 8$

(iii) Cube root of 10648 by using prime factorising method:

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

Prime factors of 10648 = 2 x 2 x 2 x 11 x 11 x 11

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{11 \times 11 \times 11}$

Cube root of 10648 = 2 × 11

So, $\sqrt[3]{10648} = 22$

(iv) Cube root of 27000 by using prime factorising method:

$$\begin{array}{r|l} 2 & 27000 \\ \hline 2 & 13500 \\ \hline 2 & 6750 \\ \hline 3 & 3375 \\ \hline 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

So, prime factors of 27000 = 2 x 2 x 2 x 3 x 3 x 3 x 5 x 5 x 5

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$

Cube root of 27000 = 2 × 3 × 5

Thus, $\sqrt[3]{27000} = 30$

(v) Cube root of 15625 by using prime factorising method:

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

So, prime factors of 15625 = 5 x 5 x 5 x 5 x 5 x 5

Now, make the triplet form of prime factors = $\underline{5 \times 5 \times 5} \times \underline{5 \times 5 \times 5}$

Cube root of 15625 = 5 × 5

Thus, $\sqrt[3]{15625} = 30$

(vi) Cube root of 13824 by using prime factorising method:

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

So, prime factors of 13824 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 3 x 3 x 3

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$

Cube root of 13824 = 2 x 2 x 2 x 3

Thus, $\sqrt[3]{13824} = 24$

(vii) Cube root of 110592 by using prime factorising method:

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

So, prime factors of 110592 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 3 x 3 x 3

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}$

Cube root of 110592 = 2 x 2 x 2 x 2 x 3

Thus, $\sqrt[3]{110592} = 48$

(viii) Cube root of 46656 by using prime factorising method:

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

So, prime factors of 46656 = 2 x 2 x 2 x 2 x 2 x 2 x 3 x 3 x 3 x 3 x 3 x 3

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3}$

=So, cube root of 46656 = 2 x 2 x 3 x 3

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

(ix) Cube root of 175616 by using prime factorising method:

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

So, prime factors of 175616 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 7 x 7 x 7

Now, make the triplet form of prime factors = $\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{7 \times 7 \times 7}$

Cube root of 175616 = 2 x 2 x 2 x 7

So, $\sqrt[3]{175616} = 56$

(x) Cube root of 91125 by using prime factorising method:

$$\begin{array}{r|l} 3 & 91125 \\ \hline 3 & 30375 \\ \hline 3 & 10125 \\ \hline 3 & 3375 \\ \hline 3 & 1125 \\ \hline 3 & 375 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

So, prime factors of 91125 = 3 x 3 x 3 x 3 x 3 x 3 x 5 x 5 x 5
Now, make the triplet form of prime factors = $\underline{3 \times 3 \times 3} \times \underline{3 \times 3 \times 3} \times \underline{5 \times 5 \times 5}$
Cube root of 91125 = 3 x 3 x 5
Thus, $\sqrt[3]{91125} = 45$

Q.2 State true or false.
(i) Cube of any odd number is even.
(ii) A perfect cube does not end with two zeros.
(iii) If square of a number ends with 5, then its cube ends with 25.
(iv) There is no perfect cube which ends with 8.
(v) The cube of a two digit number may be a three digit number.
(vi) The cube of a two digit number may have seven or more digits.
(vii) The cube of a single digit number may be a single digit number.
Sol. (i) Cube of any odd number is even. - **False**
(ii) A perfect cube does not end with two zeros. - **True**
(iii) If square of a number ends with 5, then its cube ends with 25. - **False**
(iv) There is no perfect cube which ends with 8. - **False**
(v) The cube of a two digit number may be a three digit number. - **False**
(vi) The cube of a two digit number may have seven or more digits.- **False**
(vii) The cube of a single digit number may be a single digit number. –**True**

Q.3 You are told that 1,331 is a perfect cube. Can you guess without factorisation what is its cube root? Similarly, guess the cube roots of 4913, 12167, 32768.
Sol. In the estimation method, firstly make group of three digits starting from the rightmost side.
(i) Now for 1331, there are two groups as indicated by bars $\overline{1}\ \overline{331}$.
in first group 331, the last digit is 1. Since, if a perfect cube number ends with 1, then its cube root will have 1 at its unit place.
So, the only possibility at unit's place is 1.

Now in second group 1, the cube root of 1 is 1. So, the only possibility at ten's place will be 1.
So, cube root of 1331, $\sqrt[3]{1331}$ = 11.

(ii) For 4913, there are two groups as indicated by bars $\overline{4}\ \overline{913}$.

In first group 913, the last digit is 3. Since, if a perfect cube number ends with 3, then its cube root will have 7 at its unit place.
So, the only possibility at unit's place is 7.
In second group 4, $1^3 = 1$ and $2^3 = 8$, $(1 < 4 < 8)$
So, 1 is taken as the ten's place.
Thus, possible value at ten's place = 1
Finally, cube root of 4913, $\sqrt[3]{4913} = 17$.

(iii) For 12167, there are two groups as indicated by bars $\overline{12}\ \overline{167}$.
In first group 167, the last digit is 7. Since, if a perfect cube number ends with 7, then its cube root will have 3 at its unit place.
So, the only possibility at unit's place is 3.
In second group 12, $2^3 = 8$ and $3^3=27$, $(8 < 12 < 27)$
So, 2 is taken as the ten's place.
Thus, possible value at ten's place = 2
Finally, cube root of 12167, $\sqrt[3]{12167} = 23$

(iv) For 32768, there are two groups as indicated by bars $\overline{32}\ \overline{768}$.
In first group 768, the last digit is 8. Since, if a perfect cube number ends with 8, then its cube root will have 2 at its unit place.
So, the only possibility at unit's place is 2.
In second group 32, $3^3 = 27$ and $4^3 = 64$, $(27 < 32 < 64)$
So, 3 is taken as the ten's place.
Finally, cube root of 32768, $\sqrt[3]{32768} = 32$