पुणा International School
Shree Swaminarayan Gurukul, Zundal

Grade – 8
MATHS
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INDEX

Chapter – 7
Cubes and Cube Root

- **Cube number**: Number obtained when a number is multiplied by itself three times. $2^3 = 2 \times 2 \times 2 = 8$, $3^3 = 3 \times 3 \times 3 = 27$, etc.
- Numbers like 1729, 4104, 13832, are known as Hardy – Ramanujan Numbers. They can be expressed as sum of two cubes in two different ways.
- Numbers obtained when a number is multiplied by itself three times are known as cube numbers. For example 1, 8, 27, etc.
- If in the prime factorisation of any number each factor appears three times, then the number is a perfect cube.
- The symbol $\sqrt[3]{}$ denotes cube root. For example $\sqrt[3]{27} =- 3$
- **Perfect Cube:** A natural number is said to be a perfect cube if it is the cube of some natural number. Example: 8 is perfect cube, because there is a natural number 2 such that $8 = 2^3$, but 18 is not a perfect cube, because there is no natural number whose cube is 18.
- The cube of a negative number is always negative.

Properties of Cube of Number:

- (i) Cubes of even number are even.
  (ii) Cubes of odd numbers are odd.
  (iii) The sum of the cubes of first n natural numbers is equal to the square of their sum.
  (iv) Cubes of the numbers ending with the digits 0, 1, 4, 5, 6 and 9 end with digits 0, 1, 4, 5, 6 and 9 respectively.
  (v) Cube of the number ending in 2 ends in 8 and cube of the number ending in 8 ends in 2.
  (vi) Cube of the number ending in 3 ends in 7 and cube of the number ending in 7 ends in 3.

Chapter – 7
Cubes and Cube Root

Ex : 7.1

1(1). Is 216 a perfect cube?

Sol.

2	216
2	108
2	54
3	27
3	9
3	3
	1

By prime factorisation,

$216 = \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{3} \times\times \underline{3} \times\times \underline{3}$ [grouping the factors in triplets]

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

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

$= 6^3$ which is a perfect cube.

All the terms form triplets

Therefore, 216 is a perfect cube.

1(2). Is 128 a perfect cube?

Sol.

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

By prime factorisation,

$128 = \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times 2$ [grouping the factors in triplets]

$= 2^3 \times 2$

$=- 2^3 \times 2$

In the above factorisation, 2 remains after grouping the 2's in triplets.

Therefore, 128 is not a perfect cube.

1(3). Is 1000 a perfect cube?

Sol.

2	1000
2	500
2	250
5	125
5	25
5	5
	1

By prime factorisation,

$1000 = \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{5} \times\times \underline{5} \times\times \underline{5}$ [grouping the factors in triplets]

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

$= (2 \times\times 5)^3 = (10)^3$, which is a perfect cube

All the terms form triplets

Therefore, 1000 is a perfect cube.

1(4). Is 100 a perfect cube?

Sol.

2	100
2	50
5	25
5	5
	1

By prime factorisation,

100 = 2 ×× 2 ×× 5 ×× 5

In the above factorisation, 2 ×× 2 and 5 ×× 5 remains when try to group the factors in triplets.

Therefore, 100 is NOT a perfect cube.

1(5). Is 46656 a perfect cube?

Sol.

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

By prime factorisation,

46656 = 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 3 ×× 3 ×× 3 ××3 ×× 3 ×× 3 [grouping the factors in triplets]

= 2^3 × 2^3 ×× 3^3 ×× 3^3

= 36^3 which is a perfect cube.

All the terms form triplets

Therefore, 46656 is a perfect cube.

2(1). Find the smallest number by which 243 must be multiplied to obtain a perfect cube.

Sol.

3	243
3	81
3	27
3	9
3	3
	1

By prime factorisation,

243 = 3 ×× 3 ×× 3 ×× 3 ×× 3 [grouping the factors in triplets]

The prime factor 3 does not appear in a group of three.

Therefore, 243 is not a perfect cube. To make it a cube, we need one more 3. In that case

243 ×× 3 = 3 ×× 3 ×× 3 ×× 3 ×× 3 ×× 3

= 729 which is a perfect cube.

Hence, the smallest number 3 that should be multiplied by 243 to make a perfect cube.

2(2). Find the smallest number by which 256 must be multiplied to obtain a perfect cube.

Sol.

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

By prime factorisation,

256 = 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 [grouping the factors in triplets]

In the above factorisation, 2 remains after grouping 2's in triplets. Therefore, 128 is not a perfect cube. To make it a cube, we need one 2's more. In that case,

256 ×× 2 = 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2

= 2^3 ×× 2^3 ×× 2^3

= (2 ×× 2 ×× 2)^3

= 8^3 = 512 which is a perfect cube.

Hence, the smallest number by which 256 must be multiplied to obtain a perfect cube is 2.

The resulting perfect cube is 512 (= 8^3).

2(3). Find the smallest number by which 72 must be multiplied to obtain a perfect cube.

Sol.

2	72
2	36
2	18
3	9
3	3
	1

By prime factorisation,

72 = 2 ×× 2 ×× 2 ×× 3 ×× 3 [grouping the factors in triplets]

The prime factor 3 does not appear in a group of three.

Therefore, 72 is not a perfect cube. To make it a cube, we need one more 3. In that case

72 ×× 3 = 2 ×× 2 ×× 2 ×× 3 ×× 3 ×× 3

= 2^3 ×× 3^3

= (2 ×× 3)^3

= 6^3 which is a perfect cube.

Hence, the smallest number by which 72 must be multiplied to obtain a perfect cube is 3.

2(4). Find the smallest number by which 675 must be multiplied to obtain a perfect cube.

Sol.

3	675
3	225
3	75
5	25
5	5
	1

By prime factorisation,

$675 = \underline{3} \times\times \underline{3} \times\times \underline{3} \times\times 5 \times\times 5$ [grouping the factors in triplets]

The prime factor 5 does not appear in a group of three.

Therefore, 675 is not a perfect cube. To make it a cube, we need one more 5. In that case,

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

$3375 = 3^3 \times\times 5^3$

$= (3 \times\times 5)^3$

$= 15^3$ which is a perfect cube.

Hence, the smallest number by which 675 must be multiplied to obtain a perfect cube is 5.

The resulting perfect cube is 3375 (= 15^3).

2(5). Find the smallest number by which of 100 must be multiplied to obtain a perfect cube.

Sol.

2	100
2	50
5	25
5	5
	1

Prime factors of 100 = $2\times2\times5\times5 2\times2\times5\times5$

Here factor 2 and 5 both do not appear in 3's group.

Therefore 100 must be multiplied by $2\times5 2\times5$ = 10 to make it a perfect cube.

3(1). Find the smallest number by which 81 must be divided to obtain a perfect cube.

Sol.

3	81
3	27
3	9
3	3
	1

By prime factorisation,

81 = $\underline{3}$ ×× $\underline{3}$ ×× $\underline{3}$ ×× 3 [grouping the factors in triplets]

In the above factorisation 3 remains after grouping the 3's in triplets. Therefore, 81 is not a perfect cube. If

we divide the number by 3, then in the prime factorisation of the quotient, this 3 will not remain. In that case,

81 ÷÷ 3 = $\underline{3}$ ×× $\underline{3}$ ×× $\underline{3}$

27 = 3^3 which is a perfect cube.

Hence, the smallest whole number by which 81 must be divided to obtain a perfect cube is 3.

3(2). Find the smallest number by which 128 must be divided to obtain a perfect cube.

Sol.

2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

By prime factorisation,

128 = $\underline{2}$ ×× $\underline{2}$ ×× $\underline{2}$ ×× $\underline{2}$ ×× $\underline{2}$ ×× $\underline{2}$ ×× 2 [grouping the factors in triplets]

In the above factorisation, 2 remains after grouping the 2's in triplets. Therefore, 128 is not a perfect cube.

If we divide the number by 2, then in the prime factorisation of the quotient, this 2 will not remain. In that case,

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

$64 = 2^3 \times 2^3$

$= (2 \times 2)^3$

$= 4^3$ which is a perfect cube.

Hence, the smallest whole number by which 128 must be divided to obtain a perfect cube is 2.

3(3). Find the smallest number by which 135 must be divided to obtain a perfect cube.

Sol.

3	135
3	45
3	15
5	5
	1

By prime factorisation,

$135 = \underline{3} \times \underline{3} \times \underline{3} \times 5$ [grouping the factors in triplets]

The prime factor 5 does not appear in a group of three. So 135 is not a perfect cube. In the factorisation 5 appears only once. If we divide 135 by 5, then prime factorisation of the quotient will not contain 5. In that case,

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

$27 = 3^3$ which is a perfect cube.

Hence, the smallest whole number by which 135 must be divided to obtain a perfect cube is 5.

The resulting perfect cube is 27 (= 3^3).

3(4). Find the smallest number by which 192 must be divided to obtain a perfect cube.

Sol.

2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

By prime factorisation,

192 = $\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times 3$ [grouping the factors in triplets]

The prime factor 3 does not appear in a group of three. So 192 is not a perfect cube. In the factorisation 192, 3 appears only ones. So If we divide the number by 3, then the prime factorisation of the quotient will not contain 3. In that case,

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

64= $2^3 \times\times 2^3$

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

= 4^3 which is a perfect cube.

Hence, the smallest whole number by which 192 must be divided to obtain a perfect cube is 3.

The resulting perfect cube is 64 (= 4^3).

3(5). Find the smallest number by which 704 must be divided to obtain a perfect cube.

Sol.

2	704
2	352
2	176
2	88
2	44
2	22
11	11
	1

By prime factorisation,

704 = 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 2 ×× 11 [grouping the factors in triplets]

The prime factor 11 does not appear in a group of three. So 704 is not a perfect cube. In the factorisation 11 appears only ones time. So if we divide 704 by 11, then the prime factorisation of the quotient will not contain 11. In that case,

704 ÷÷ 11 = 2 ×× 2 ×× 2 × 2 ×× 2 ×× 2

64 = 2^3 ×× 2^3 [by laws of exponent]

= 4^3

= 4 ×× 4 ×× 4

= 64 which is a perfect cube.

Hence, the smallest whole number by which 704 must be divided to obtain a perfect cube is 11. The resulting perfect cube is 64 (= 4^3).

4. 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?

Sol.

Given numbers = 5×2×5

Since factors of 5 and 2 both are not in a group of three.

Therefore, the number must be multiplied by 2×5×2 = 20 to make it a perfect cube.

Hence, he needs 20 cuboids.

Ex : 7.2

1(1). Find the cube root of 64 by prime factorisation method.

Sol.

2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factorisation of 64 is

$\underline{2 \times\times 2 \times\times 2} \times\times \underline{2 \times\times 2 \times\times 2}$ [grouping the factors in triplets]

$= 2^3 \times\times 2^3 = (2 \times\times 2)^3 = 4^3$

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

1(2). Find the cube root of 512 by prime factorisation method.

Sol.

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Prime factorisation of 512 is

$\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2}$ [grouping the factors in triplets]

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

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

1(3). Find the cube root of 10648 by prime factorisation method.

Sol.

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

Prime factorisation of 10648 is

$\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{11} \times\times \underline{11} \times\times \underline{11}$ [grouping the factors in triplets]

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

Therefore, 10648———√3=2×11=22106483=2×11=22

1(4). Find the cube root of 27000 by prime factorisation method.

Sol.

2	27000
2	13500
2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

Prime factorisation of 27000 is

2 ×× 2 ×× 2 ×× 3 ×× 3 ×× 3 ×× 5 ×× 5 ×× 5 [grouping the factors in triplets]

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

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

1(5). Find the cube root of 15625 by prime factorisation method.

Sol.

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

Prime factorisation of 15625 is

$\underline{5 \times\times 5 \times\times 5} \times\times \underline{5 \times\times 5 \times\times 5}$ [grouping the factors in triplets]

$= 5^3 \times\times 5^3 = (5 \times\times 5)^3 = 25^3$

Therefore, $\sqrt[3]{15625} = 5\times5$ 156253=5×5= 25.

1(6). Find the cube root of 13824 by prime factorisation method.

Sol.

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

Prime factorisation of 13824 is

$\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{3} \times\times \underline{3} \times\times \underline{3}$ [grouping the factors in triplets]

$= 2^3 \times\times 2^3 \times\times 2^3 \times\times 3^3 = (2 \times\times 2 \times\times 2 \times\times 3)^3 = 24^3$

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

1(7). Find the cube root of 110592 by prime factorisation method.

Sol.

2	110592
2	55296
2	27648
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

Prime factorisation of 110592 is

$\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \times\times \underline{3} \times\times \underline{3} \times\times \underline{3}$ [grouping the factors in triplets]

$= 2^3 \times\times 2^3 \times\times 2^3 \times\times 2^3 \times\times 3^3 = (2 \times\times 2 \times\times 2 \times\times 2 \times\times 3)^3 = 24^3$

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

1(8). Find the cube root of 46656 by prime factorisation method.

Sol.

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

Prime factorisation of 46656 is

$\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{3} \times\times \underline{3} \times\times \underline{3} \times\times \underline{3} \times\times \underline{3} \times\times \underline{3}$ [grouping the factors in triplets]

$= 2^3 \times\times 2^3 \times\times 3^3 \times\times 3^3 = (2 \times\times 2 \times\times 3 \times\times 3)^3 = 36^3$ [by laws of exponents]

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

1(9). Find the cube root of 175616 by prime factorisation method.

Sol.

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

Prime factorisation of 175616 is

$\underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{2} \times\times \underline{7} \times\times \underline{7} \times\times \underline{7}$ [grouping the factors in triplets]

$= 2^3 \times\times 2^3 \times\times 2^3 \times\times 7^3 = (2 \times\times 2 \times\times 2 \times\times 7)^3 = 56^3$

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

1(10). Find the cube root of 91125 by prime factorisation method.

Sol.

3	91125
3	30375
3	10125
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

Prime factorisation of 91125 is

$\underline{3 \times\times 3 \times\times 3} \times\times \underline{3 \times\times 3 \times\times 3} \times\times \underline{5 \times\times 5 \times\times 5}$ [grouping the factors in triplets]

$= 3^3 \times\times 3^3 \times\times 5^3 = (3 \times\times 3 \times\times 5)^3 = 45^3$

Therefore, $\sqrt[3]{91125} = 45$.

2(1). Cube of any odd number is even.
1) True
2) False

Sol. 2) False

False, We know that the cube of an odd number is always an odd number, e.g. 3 is an odd number.
Then, $3^3 = 3 \times\times 3 \times\times 3 = 27$ Clearly, 27 is not an even number.

2(2). A perfect cube does not end with two zeros.
1) True
2) False

Sol. 1) True

True, Perfect cube number ends with zeros multiple of three.

2(3). If square of a number ends with 5, then its cube ends with 25.

1) True
2) False

Sol. 2) False

False

2(4). There is no perfect cube which ends with 8.
1) True
2) False

Sol. 2) False

False, eg. 1728 is a perfect cube which ends in 8. (1728 = 12^3)

2(5). The cube of a 2-digit number may be a 3-digit number.
1) True
2) False

Sol. 2) False

False

2(6). The cube of a two digit number may have seven or more digits.
1) True
2) False

Sol. 2) False
False
2(7). The cube of a single digit number may be a single digit number.
1) True
2) False

Sol. 1) True
True

Worksheet-1
Class 08 - Mathematics (Cube and cube roots)

General Instructions: All questions are compulsory.

Q.1 to Q.2 carries one mark each.

Q.3 to Q.7 carries two marks each.

Q.8 and Q.9 carries three marks each.

Q.10 to Q.12 carries four marks each.S

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1. What is the value of 10^3 - 9^3?
2. What is cube of 0.3?
3. **State whether the following statements are True or False:**
   a. Each prime factor appears 3 times in its cube.
   b. The cube of a negative number is always positive.
   c. The cube of 0.4 is 0.064.
   d. The cube root of 8000 is 200.
4. **Fill in the blanks.**

   a. The next two numbers in the pattern: 1, 8, 27, 64, 125, ___, ____.
   b. The cube of an odd number is always ______.
   c. The cube of a negative integer is _______.
   d. The last digit of a number which has 3 as last digit in its cube is ______.
5. Find the value of the following: $7^3 – 6^3$
6. Find if 15625 is a perfect cube ?
7. Find the smallest number by which 675 must be multiplied to obtain a perfect cube.
8. Find the cube root 4913 without factorisation.
9. The difference of two perfect cubes is 189. If the cube root of the smaller of the two numbers is 3, find the cube root of the larger number.
10. Find the cube root of 166375 by estimation method with steps.
11. Shyamala grew 400 plants in her garden. How many more plants should she grow, so that the total number is a perfect cube?