Chapter - 2
Cube and Cube roots

Cube of a number is product of number multiplied by itself 3 times

n	n^3
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729
10	1000

Properties of Cube Numbers

I. The cube of an even number is always even, whereas the cube of an odd number is always odd.

II. The cube of any multiple of 2 is divisible by 8
$(4)^3 = 64$ which is divisible by 8
$(12)^3 = 1728$ which is divisible by 8

III. The cube of any multiple of 3 is divisible by 27
$(9)^3 = 729$ which is divisible by 27

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$(12)^3 = 1728$ which is divisible by 27

IV. The cube of a negative number is alway negative

$(-2)^3 = (-2) \times (-2) \times (-2) = -8$, $4 \times (-2) = -8$

$(-5)^3 = (-5) \times (-5) \times (-5) = -125$, $25 \times (-5) = -125$

V. The cube of positive number is always positive.

VI The cube of a rational number is equal to the cube of its numerator divided by the cube of its denominator $\left(\frac{3}{5}\right)^3 = \frac{27}{125}$

W.S-1

Q1 Find the cubes of :

(i) $8^3 = 8 \times 8 \times 8$
$= 512$

(ii) $13^3 = 13 \times 13 \times 13$
$= 2197$

(iii) $17^3 = 17 \times 17 \times 17$
$= 4913$

(VI) $0.4^3 = 0.4 \times 0.4 \times 0.4$
$= 0.064$

(IV) $1.3^3 = 1.3 \times 1.3 \times 1.3$
$= 2.197$

(IX) $-9^3 = (-9) \times (-9) \times (-9)$
-729

(V) $0.06^3 = 0.06 \times 0.06 \times 0.06$
$= 0.000216$

(X) $-12^3 = (-12) \times (-12) \times (-12)$
-1728

(VII) $\frac{2}{3} = \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$

$= \frac{8}{27}$

(VIII) $(-7)^3 = (-7) \times (-7) \times (-7)$
$= -343$

Q2: Which of the following are perfect cubes:

(i) 4096

$4096 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{2\times2\times2}$

Since prime factors of 4096 can be grouped in triplets and no factor is left out so it is perfect cube.

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

(IV) -27000

$-27000 = -\overline{2\times2\times2} \times \overline{3\times3\times3} \times \overline{5\times5\times5}$

Since prime factor of -27000 can be grouped into triplets no factor is left out so it is a perfect cube.

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

(v) $\frac{-64}{131}$

$$-\frac{\overline{2\times2\times2}\times\overline{2\times2\times2}}{11\times11\times11}$$

Since prime factor of $\frac{-64}{131}$ can be grouped into triplets no factor is left out so it is a perfect cube.

Q3: Given no. = 2560

$2560 = \overline{2\times2\times2}\times\overline{2\times2\times2}\times\overline{2\times2\times2}\times5$

On writing the prime factor of 2560 in triplets ~~no~~ factor 5 is left out so it ~~is a perfect square cube~~ not a perfect cube

$5\times5 = 25$

$2560\times25 = 64000$

2	2560
2	1280
2	640
2	320
2	160
2	80
2	40
2	20
2	10
5	5
	1

Q4: Given no. = 8788

$8788 = 2\times2\times\overline{13\times13\times13}$

On writing the triplets of prime factor we are left out with $2\times2=4$, so req. no. is 4

2	8788
2	4394
13	2197
13	169
13	13
	1

WS-1 (HW)

Q2: (ii) 108

$108 = \overline{2 \times 2} \times \overline{3 \times 3 \times 3}$

2	108
2	54
3	27
3	9
3	3
	1

Since prime factor of 108 can't be grouped into triplets as factor 2×2 is left out so it is not a perfect ~~square~~ cube

(iii) 392

$392 = \overline{2 \times 2 \times 2} \times \overline{7 \times 7}$

2	392
2	196
2	98
7	49
7	7
	1

Since prime factor of 392 can't be grouped into triplets as factor 2×7 is left out so it is not a perfect cube.

WS-2

Q1: Find the cube root

(i) 5832

$5832 = \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3} \times \overline{3 \times 3 \times 3}$

$\sqrt[3]{5832} = 2 \times 3 \times 3$

$= 18$

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

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(iii) 216000

2	216000
2	108000
2	54000
2	27000
2	13500
2	6750
3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$216000 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{3\times3\times3} \times \overline{5\times5\times5}$

$\sqrt[3]{216000} = 2\times2\times3\times5 = 60$

Q2: Find the cube root

(ii) -2744000

2	-2744000
2	1372000
2	686000
2	343000
2	171500
2	85750
5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

$2744000 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{5\times5\times5} \times \overline{7\times7\times7}$

$\sqrt[3]{2744000} = 2\times2\times5\times7 = 140$

$\sqrt[3]{-2744000} = -140$

(iii) -474552

$474552 = \overline{2\times2\times2} \times \overline{3\times3\times3} \times \overline{13\times13\times13}$

$\sqrt[3]{474552} = 2\times3\times13 = 78$

$\therefore 474552 = -78$

2	474552
2	237276
2	118638
3	59319
3	19773
3	6591
13	2197
13	169
13	13
	1

Q3 Evaluate

(i) $\sqrt[3]{8\times125}$

$\sqrt[3]{2^3\times5^3}$

$\sqrt[3]{(2\times5)^3}$

$= 10$

(ii) $\sqrt[3]{3375\times(-729)}$

$\sqrt[3]{3\times3\times3\times5\times5\times5\times3\times3\times3\times3\times3\times3}$

$\sqrt[3]{3^3\times5^3\times3^3\times3^3}$

$\sqrt[3]{(3\times5\times3\times3)^3} = -135$

(iii) $\sqrt[3]{4^3 \times 5^3}$

$\sqrt[3]{(4\times5)^3}$

$= 20$

Q4: Find the cube root

(i) $\sqrt[3]{\frac{4913}{3375}}$

$\frac{\sqrt[3]{4913}}{\sqrt[3]{3375}}$

$\frac{\sqrt[3]{17^3}}{\sqrt[3]{15^3}}$

$= \frac{17}{15} = 1\frac{2}{15}$

(ii) $-\sqrt[3]{\frac{512}{343}}$

$\sqrt[3]{\frac{8^3}{7^3}}$

$-\sqrt[3]{\left(\frac{8}{7}\right)^3}$

$= -\frac{8}{7} = -1\frac{1}{7}$

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(iii) $\sqrt[3]{343}$ $\sqrt[3]{1331}$

$\sqrt[3]{7^3}$ $\sqrt[3]{11^3}$

$\sqrt[3]{\left(\frac{7}{11}\right)^3} = \frac{7}{11}$

Q5: given no. = 5400

$5400 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5$

on making the triplets of prime factors we are left out with 5×5 so req. no is 5

2	5400
2	2700
2	1350
3	675
3	225
3	75
5	25
5	5
	1

WS-2 (HW)

Q1(ii) 1728

$1728 = \overline{2 \times 2 \times 2} \times \overline{2 \times 2 \times 2} \times \overline{3 \times 3 \times 3}$

$\sqrt[3]{1728} = 2 \times 2 \times 3 = 12$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(IV) $\sqrt[3]{21952}$

$21952 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{7\times7\times7}$

$\sqrt[3]{21952} = 2\times2\times7$

$= 28$

2	21952
2	10976
2	5488
2	2744
2	1372
2	686
7	343
7	49
7	7
	1

Q2: Find the cube root

(i) -1728

$-1728 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{3\times3\times3}$

$-\sqrt[3]{1728} = 2\times2\times3$

$= -12$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(IV) -5832

$-5832 = \overline{2\times2\times2} \times \overline{3\times3\times3} \times \overline{3\times3\times3}$

$-\sqrt[3]{5832} = 2\times3\times3$

$= -18$

2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

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Q6: Given no. = 16384

$16384 = \overline{2\times2\times2} \times 2\times\overline{2\times2\times2}\times\overline{2\times2\times2}\times$
$\overline{2\times2\times2}\times\overline{2\times2}$

On making the triplets of prime factors we are left out with 2×2 so required no. is 4

2	16384
2	8192
2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Q7: Find the cube root

(i) 10648

10 | 648
II I

$8^3 = 5(2)$

Since 2 is at once place so 2 will be at ones place of req. cube root

$8 < 10 < 27$

$2^3 < 10 < 3^3$

Since $2 < 3$

So 2 will be at tens place

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

(ii) 15625

15 625
II I

$5^3 = 125$

Since 5 is at tens place of req. cube root

$8 < 15 < 27$

$2^3 < 15 < 3^3$

Since $2 < 3$ at tens place

So 2 is at tens place of req. cube root

$\sqrt[3]{15625} = 25$

(iii) 110592

110 592
II I

$2^3 = 8$

Since 8 is at ones place

So 8 will be at ones place of req. cube root.

$64 < 110 < 125$

$4^3 < 100 < 5^3$

Since $4 < 5$

So 4 is at tens place of req. cube root.

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

Value Based

Q1 a) Side of cube = 65 cm

Volume of cube = Side x Side x Side

$65 \times 65 \times 65\ cm^3$

(i) Volume of 6 cartons = $6 \times 65 \times 65 \times 65$

$= 1647750\ cm^3$

(ii) Helpful, caring, kind

Q2: Let no. of prizes of discipline be x

Let no. of prizes for cleanliness be 2x

Let no. of prizes for regulations be 3x

ATQ

$x \times 2x \times 3x = 162$

$6x^3 = 162$

$x^3 = \frac{162}{6}$ $\quad 27$

$x = \sqrt[3]{27}$

$x = 3$

No. of prizes for discipline = 3

No. of prizes for cleanliness = $2 \times 3 = 6$

No. of prizes for regularity = $3 \times 3 = 9$

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b) ∓ Truthfulness, Respectfull, Honesty

Brain Teasers

Q1(B) Answer the following

a) 1728

$1728 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{3\times3\times3}$

$\sqrt[3]{1728} = 2\times2\times3$

$= 12$

2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

b) $\sqrt[3]{216 \times (-125)}$

$= -\sqrt[3]{6^3 \times 5^3}$

$-\sqrt[3]{(6\times5)^3}$

$= -30$

c) $\sqrt[3]{0.000001}$

$= \sqrt[3]{(0.1)^3}$

$= 0.1$

e) $\sqrt[3]{\frac{0.512}{0.343}}$

$= \sqrt[3]{\frac{0.512}{0.343}}$

$= \sqrt[3]{\frac{0.8^3}{0.7^3}}$

$= \sqrt[3]{\left(\frac{0.8}{0.7}\right)^3} = \frac{0.8}{0.7}$

$= \frac{8}{10} \times \frac{10}{7}$

$= \frac{8}{7} = 1\frac{1}{7}$

Q4: Find the cubes of

(i) $0.63 =$ ~~0.612~~ 0.216

(ii) $(-3.1) = (-3.1) \times (-3.1) \times (-3.1)$

$= -29.791$

(iii) $(-0.01) = (-0.01) \times (-0.01) \times (-0.01)$

$= 0.000001$

Q5: Find the value

(i) $\sqrt[3]{0.008}$

$= \sqrt[3]{(0.2)^3}$

$= 0.2$

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(ii) $\sqrt[3]{\frac{-64}{1331}}$

$= -\sqrt[3]{\left(\frac{4}{11}\right)^3} = \frac{-4}{11}$

(iii) $\sqrt[3]{27 \times 2744}$

$= \sqrt[3]{\overline{3\times3\times3} \times \overline{2\times2\times2} \times \overline{7\times7\times7}}$

$= 3 \times 2 \times 7 = 42$

Q6: Given no. = 3600

2	3600
2	1800
2	900
2	450
3	225
3	75
5	25
5	5

$3600 = \overline{2\times2\times2} \times 2 \times \overline{3\times3} \times 5 \times 5$

On making the prime factor of 3600 in triplet we came to know $2\times2\times3\times5 = 60$ is to be multiplied by 3600 to make it perfect cube

$3600 \times 60 = \overline{2\times2\times2} \times \overline{2\times2\times2} \times \overline{3\times3\times3} \times \overline{5\times5\times5}$

$\sqrt[3]{216000} = 2 \times 2 \times 3 \times 5 = 60$

Q7 $\sqrt[3]{\frac{0.027}{0.008}} \div \sqrt[3]{\frac{0.09}{0.04}} - 1$

$= \sqrt[3]{\frac{(0.3)^3}{(0.2)^3}} \div \sqrt{\frac{(0.3)^2}{(0.2)^2}} - 1$

$= \sqrt[3]{\left(\frac{0.3}{0.2}\right)^3} \div \sqrt{\left(\frac{0.3}{0.2}\right)^2} - 1$

$= \frac{0.3}{0.2} \div \frac{0.3}{0.2}$

$= \frac{0.3}{0.2} \times \frac{0.2}{0.3} - 1$

$= 1 - 1 = 0$

Q8: Estimate (WS-2)

(i) 10648

done by mistake

10 648
II I

$8^3 = 512$

So 2 is at ones place.

Since 2 will be at ones place of the req. cube root

$8 < 10 < 27$

$2^3 < 10 < 3^3$

Since $2 < 3$

So 2 will be at tens place

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

Q8 Estimate

(i) 6859

$\underset{II}{6} \quad \underset{I}{859}$

$9^3 = 729$

Since 9 is at ones place
So 9 will be at ones place of req. cube root.

$1 < 6 < 8$
$1^3 < 6 < 2^3$
$1^3 < 6 < 2^3$
since $1 < 2$
so 1 will be at tens place

$\sqrt[3]{6859} = 19$

(ii) 12167

$\underset{II}{12} \quad \underset{I}{167}$

$7^3 = 343$

Since 3 is at ones place
So 3 will be at ones place of the req. cube root.

$8 < 12 < 27$
$2^3 < 12 < 3^3$
Since $2 < 3$
So 2 will be at tens place

$\sqrt[3]{12167} = 32$

(iii) 32768

32 | 768
II | I

$8^3 = 512$

Since 2 is at ones place
So 2 will be at ones place of the req. cube root.

$27 < 32 < 64$
$3^3 < 32 < 4^3$

Since $3 < 4$
So 3 will be at tens place

$\sqrt[3]{38768} = 32$

HW

Q 1(B) d) Given no. = 1715

5	1715
7	343
7	49
7	7
	1

$1715 = 5 \times 7 \times 7 \times 7$

On making the triplets of prime factors we are left out with 5
∴ So required no. is 5

Q 7 Estimation (HW)
(iv) 91125

91 | 125
II | I

$5^3 = 125$

Since 5 is at ones place

So 5 will be at ones place of the req. cube root.

$64 < 91 < 125$

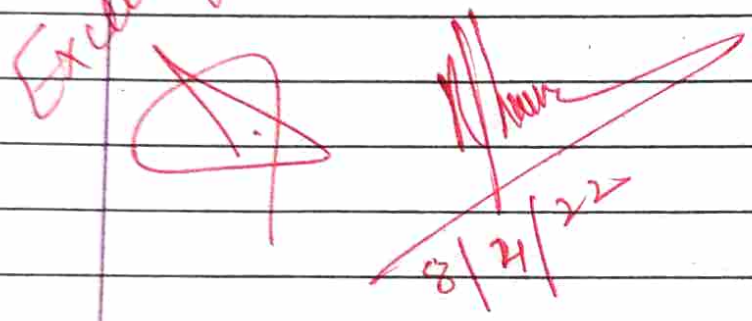
$4^3 < 91 < 5^3$

since $4 < 5$

so 4 will be at tens place of the req. cube root.

$\sqrt[3]{91125} = 45$

Excellent work.



Q2: Let given no. be x

Cube of $x = x^3$

When no. is tripled

new no. $= 3x$

Cube of new no. $= (3x)^3$

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

Since $27x^3 = 27 \times x^3$

So if a no. is tripled its cube become 27 times

Q3 $2^3 = 8$

$3^3 = 27$

$4^3 = 64$

$5^3 = 125$

$6^3 = 216$

$7^3 = 343$

$8^3 = 512$

$9^3 = 729$

It is observed that cube of even no. is even and cube of odd no. is odd

HOTS

1. $\sqrt[3]{288\sqrt[3]{72\sqrt[3]{27}}}$

$= \sqrt[3]{288\sqrt[3]{72\sqrt[3]{(3)^3}}}$

$= \sqrt[3]{288\sqrt[3]{72 \times 3}}$

$= \sqrt[3]{288\sqrt[3]{216}}$

$= \sqrt[3]{288\sqrt[3]{(6)^3}}$

$= \sqrt[3]{288 \times 6}$

$= \sqrt[3]{1728}$

$= \sqrt[3]{(12)^3}$

$= 12$

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Q2: Let req. no. be $2x, 3x, 4x$

ATQ

$$(2x)^3 + (3x)^3 + (4x)^3 = 33957$$

$$8x^3 + 27x^3 + 64x^3 = 33957$$

$$99x^3 = 33957$$

$$x^3 = \frac{33957}{99} = 343$$

$$x = \sqrt[3]{343}$$

$$x = 7$$

So req. no. are:

$2 \times 7 = 14$

$3 \times 7 = 21$

$4 \times 7 = 28$

Enrichment Questions

1. 4741632

4741 (II) 632 (I)

$2^3 = 8$

So 8 will be at ones place of req. cube root.

$4096 < 4741 < 4913$

$16^3 < 4741 < 17^3$

$16 < 17$

So 1, 6 will be at tens place and hundreds place

$$\sqrt[3]{4741632} = 168$$

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2. Surface area of cube = 150 cm^2

$6\ side^2 = 150$

$side^2 = \frac{150}{6}\ 25$

$side^2 = 25$

$side = 5$

Volume of cube = $side^3$

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

$= 125\ cm^3$