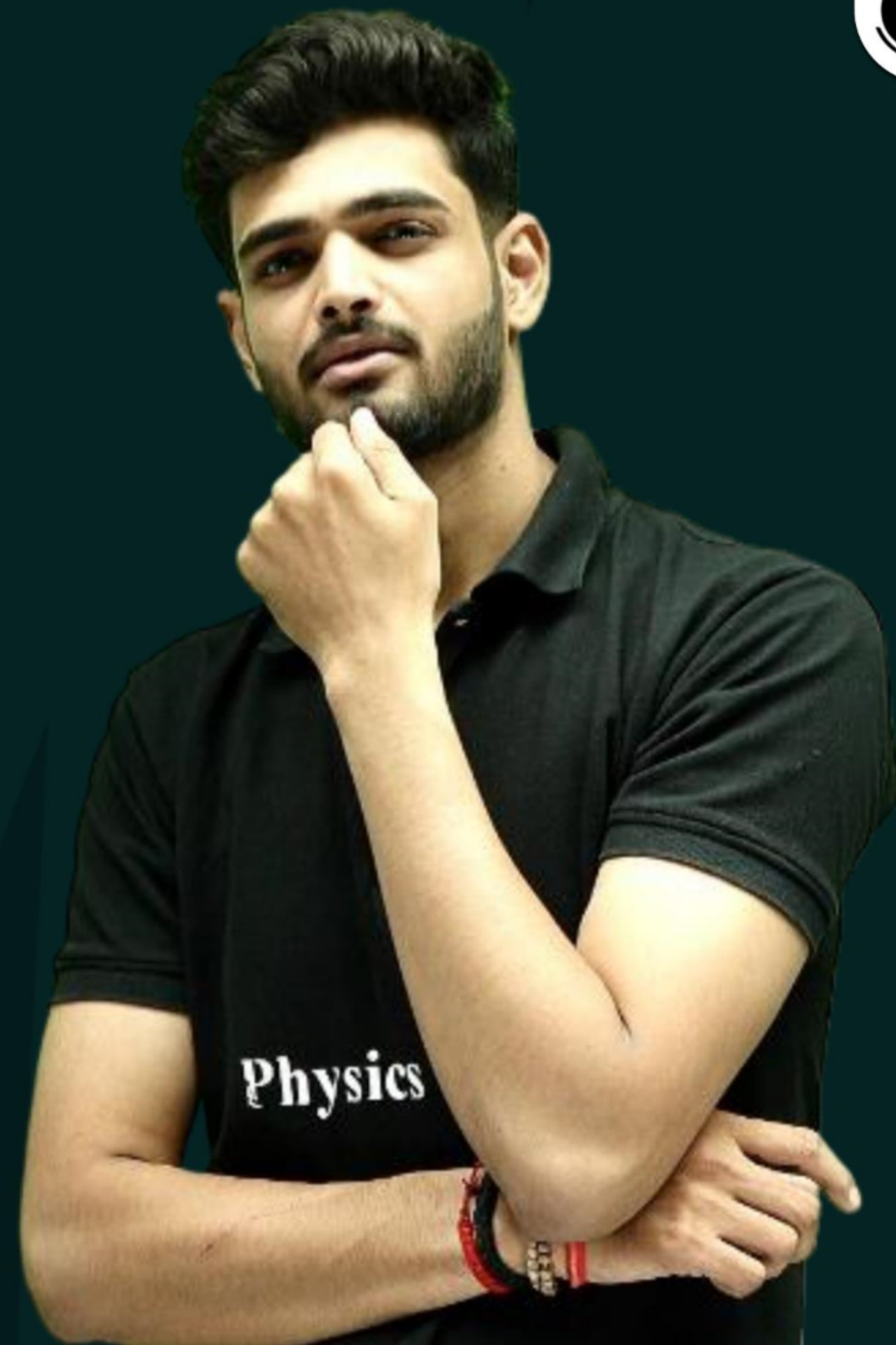




MATHS

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CUBES AND CUBE ROOTS





Topics To Be Covered

1 All Topics in One Short



INTRODUCTION

❖ **Cube:** $x \times x \times x = x^3$
 $7^3 = 7 \times 7 \times 7 = \underline{\underline{343}}$

❖ Perfect Cube Or Cube Numbers: $4^3 = 64$
 $5^3 = 125$ } $\textcircled{81}$

❖ **Is 81 a Perfect Cube?** No



CUBE OF A NUMBER

The cube of a number x is denoted as x^3 (read as x raised to power **3**). For a given number x , we define, cube of $x = x \times x \times x$, denoted by x^3 .

$$1^3 = 1 \times 1 \times 1 = \boxed{1}$$

$$2^3 = 2 \times 2 \times 2 = \boxed{8}$$

$$3^3 = 3 \times 3 \times 3 = \boxed{27}$$

$$4^3 = 4 \times 4 \times 4 = \boxed{64}$$

$$5^3 = 5 \times 5 \times 5 = \boxed{125}$$

perfect
cube



CUBE OF A NUMBER

Hardy – Ramanujan Number

1729 is the smallest Hardy–Ramanujan Number.

There are an infinitely many such numbers.

Few are $\boxed{4104}$ (2, 16; 9, 15),

$\boxed{13832}$ (18, 20; 2, 24)

$$\boxed{1729} = 12^3 + 1^3 = 1728 + 1 = \underline{1729}$$

$$10^3 + 9^3 = 1000 + 729 = \underline{1729}$$



PROPERTIES OF PERFECT CUBE



All these cube numbers end with 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9 at units place.

Number	Cube
1	$1^3 = 1$
2	$2^3 = 8$
3	$3^3 = 27$
4	$4^3 = 64$
5	$5^3 = \underline{125}$
6	$6^3 = \underline{216}$
7	$7^3 = \underline{343}$
8	$8^3 = \underline{512}$
9	$9^3 = \underline{729}$
10	$10^3 = \underline{1000}$

1, 4, 5, 6, 9

$$2^3 = 8$$

$$12^3 = 1728$$

$$8^3 = 512$$

$$3^3 = 27$$

$$7^3 = 343$$

Find the one's digit of the cube of each of the following numbers.

(i) $333\underline{1} = \underline{1}^3 = \underline{1}$

(ii) $\underline{8888} = 8^3 = 512 = \underline{2}$

(iii) $14\underline{9} = \underline{9}$

(iv) $100\underline{5} = \underline{5}$

(v) $102\underline{4} = \underline{4}$

(vi) $\underline{77} = \underline{3}$

(vii) $502\underline{2} = \underline{8}$

(viii) $\underline{53} = \underline{7}$



PROPERTIES OF PERFECT CUBE

If a number has even number at units place, then it's cube ends with always even number. If unit digit of that number is odd then it's cube must ends with odd number only.

$$\begin{aligned} 2^3 &= 8 \\ 4^3 &= 64 \\ 6^3 &= 216 \\ 8^3 &= 512 \end{aligned}$$

$$\begin{aligned} 3^3 &= 27 \\ 5^3 &= 125 \\ 7^3 &= 343 \\ 9^3 &= 729 \\ 11^3 &= 1331 \end{aligned}$$

We are even, so
are our cubes

We are odd so
are our cubes

Number	Cube
11	1331
12	1728
13	2197
14	2744
15	3375
16	4096
17	4913
18	5832
19	6859
20	8000



SOME PATTERNS IN CUBE NUMBERS

PATTERN 1

- Adding consecutive odd numbers

$$\begin{aligned}
 1 &= 1^3 \\
 3 + 5 &= 8 = 2^3 \\
 7 + 9 + 11 &= 27 = 3^3 \\
 13 + 15 + 17 + 19 &= 64 = 4^3 \\
 21 + 23 + 25 + 27 + 29 &= 125 = 5^3 \\
 &\vdots
 \end{aligned}$$



SOME PATTERNS IN CUBE NUMBERS

Consider the following pattern.

$$\begin{aligned}2^3 - 1^3 &= 1 + \underline{2 \times 1} \times 3 \\3^3 - 2^3 &= 1 + \underline{3 \times 2} \times 3 \\4^3 - 3^3 &= 1 + \underline{4 \times 3} \times 3\end{aligned}$$

Using the above pattern, find the value of the following.

$$\begin{aligned} \text{(i) } 7^3 - 6^3 &= 1 + 7 \times 6 \times 3 \\ &= 1 + 42 \times 3 \\ &= 1 + 126 \\ &= \underline{\underline{127}} \end{aligned}$$

$$\begin{aligned} \text{(ii) } 12^3 - 11^3 &= 1 + \underline{12 \times 11 \times 3} \\ &= 1 + 132 \times 3 \\ &= 1 + 396 \\ &= \underline{\underline{397}} \end{aligned}$$



SOME PATTERNS IN CUBE NUMBERS

PATTERN 2

$$21 = 3 \times 7$$

$$21^3 = \underline{3 \times 3 \times 3} \times \underline{7 \times 7 \times 7}$$

- Cubes and their prime factors

$$6^3 = (2 \times 3)^3$$

$$6^3 = 216$$

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

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

$$8^3 = 512$$

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

$$10^3 = (2 \times 5)^3$$

$$10^3 = 1000$$

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



CUBE ROOT



$$2^3 = 8$$

$$\begin{aligned}\sqrt[3]{8} &= 8^{\frac{1}{3}} \\ &= (2 \times 2 \times 2)^{\frac{1}{3}} \\ &= (2^3)^{\frac{1}{3}} \\ &= 2^{3 \times \frac{1}{3}} \\ &= \textcircled{2}\end{aligned}$$

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

Question



Is 256 a Perfect Cube? No

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

$$\sqrt[3]{\underbrace{2 \times 2 \times 2 \times 2 \times 2 \times 2}_{\text{perfect cube}} \times \underbrace{2 \times 2}_{\text{not a perfect cube}}}$$

Question



Is 53240 a perfect cube? If not, then by which smallest natural number should 53240 be divided so that the quotient is a perfect cube?

$$\begin{array}{r|l} 2 & 53240 \\ \hline 2 & 26620 \\ \hline 2 & 13310 \\ \hline 5 & 6655 \\ \hline 11 & 1331 \\ \hline 11 & 121 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

$$\sqrt[3]{\frac{2 \times 2 \times 2 \times \cancel{5} \times 11 \times 11 \times 11}{\cancel{5}}}$$

Question



Is 68600 a perfect cube? If not, find the smallest number by which 68600 must be multiplied to get a perfect cube.

5

$$686 \times 100$$

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

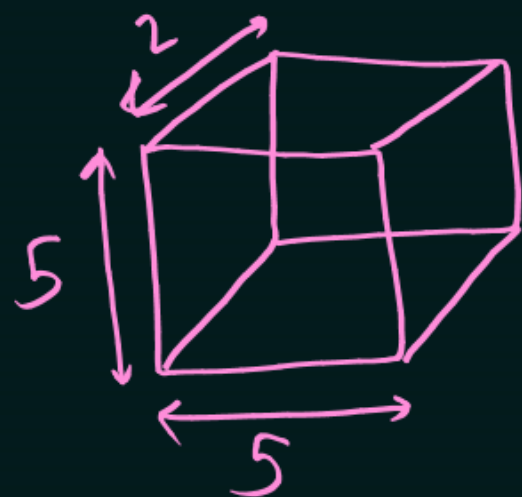
2	686
7	343
7	49
7	7
	1

$$\sqrt{2 \times 2 \times 2 \times 7 \times 7 \times 7 \times 5 \times 5 \times 5}$$

Question



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?



Vol. of cuboid \times No. of Boxes = Volume of cube

$$l \times b \times h \times n = a^3$$

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

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

$$n = 20$$

Question



Is 3375 a Perfect cube ? If so, find the number whose Cube is 3375.

$$\begin{array}{r|l} 5 & 3375 \\ \hline 5 & 675 \\ \hline 5 & 135 \\ \hline 3 & 27 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$$\sqrt[3]{\underbrace{5 \times 5 \times 5} \times \underbrace{3 \times 3 \times 3}}$$

$$= 5 \times 3$$

$$= \textcircled{15}$$

$$\sqrt[3]{3375} = \underline{\underline{15}}$$

Question



Is 175616 a Perfect cube? If so, find the number whose Cube is 175616.

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

$$\begin{array}{r|l} 2 & 686 \\ \hline 7 & 343 \\ \hline 7 & 49 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

$$\begin{aligned} & \sqrt[3]{\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{7 \times 7 \times 7}} \\ &= \underline{2 \times 2 \times 2} \times 7 \\ &= 8 \times 7 \\ &= \underline{56} \end{aligned}$$

Question



Is 110592 a Perfect cube ? If so, find the number whose Cube is 110592 .

HALWA. QUE - 1.

State true or false.

(i) Cube of any odd number is even. False.

(ii) A perfect cube does not end with two zeros. True

Perfect cube
↓
3 zeros

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

$$(15)^2 = 225$$

(iv) There is no perfect cube which ends with 8. False

$$(15)^3 = 3375$$

$$2^3 = 8$$

$$12^3 = 1728$$

State true or false.

(v) The cube of a two digit number may be a three digit number. $10^3 = \underline{\underline{1000}}$ 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

$$\begin{array}{l} 1^3 = 1 \\ 2^3 = 8 \end{array}$$



Thank
You