

Square.

ending with -1

$$- 35^2 = \textcircled{1} 5^2 = 25 \textcircled{2} 3 \times 4 = \underline{12}$$

$$\underline{1225}$$

$$- 105^2 = 5^2 = 25 \textcircled{2} 10 \times 11 = 110$$

$$\underline{11025}$$

Starting with 5

$$\textcircled{1} 59^2 = 9^2 = 81. \quad 5^2 = 25 + 9 = 34$$

$$\underline{3481}$$

$$\textcircled{2} 521^2 = 21^2 = 441 \textcircled{2} 5^2 = 25 + 2 = 27.$$

③ write next No. as it - 1

$$\underline{271441}$$

$$\textcircled{3} 525^2 = 25^2 = 625 \textcircled{2} 5^2 = 25 + 2 = 27.$$

③ write next No. as it is - 5

$$\underline{275625}$$

$$\textcircled{4} 5112^2 = 112^2 = 12544$$

$$5^2 = 25 + 1 = 26$$

next No = $12 + 1 = \underline{13}$

$$\underline{26132544}$$

Base Method [10, 100, 1000...]

- ① $98^2 = 9604$ 98 base-100
 $100-98 = 2$
 $2^2 = 04$
 $98-2 = 96$
- ② $97^2 = 9409$ 97-100 base
 $= 100-97 = 3$
 $3^2 = 09$
 $97-3 = 94$
- ③ $9991^2 = 9982081$ 10000-9991 = 9
 $9^2 = 81$
 $9991-9 = 9982$

Base Method (More base No.)

$66^2 =$ Base-60
 $66-6 = 60$
 $6^2 = 36$
 $66+6 = 72$
 $72 \times \text{Base} = 72 \times 6 = 432$

432
3
435

Square [if middle No. 0]

- ① $108^2 =$ $8^2 = 64$ $108^2 = a=1, b=08$
 $1 \mid 16 \mid 64$ $8 \times 1 \times 2 = 16$
1 16 64 $1^2 = 1$
- ② $201^2 =$ $a=2, b=008$
 $4 \mid 32 \mid 64$ $8^2 = 64$
 4032064 $2 \times 8 \times 2 = 32$
 $2^2 = 4$
- ③ $2013^2 = 4052169$
 $13^2 = 169$
 $13 \times 2 \times 2 = 52$
 $4 \mid 52 \mid 169$
4052169

Cube

- 2 digit No.
 - Starting with - 1
 - $12^3 =$ $\textcircled{1} \mid 2 \mid 4 \mid \textcircled{8}$
- | |
|----|
| 1 |
| 7 |
| 28 |
- $12^3 = 1728$
- ① Write the No. as it is
 $12^3 = 12$
 - ② Write the end No. Square
 $2 = 4$
 - ③ Circle the end No. Cube
 $2 = 8$
 - ④ Circle the 1st and last No.
 - ⑤ Remaining No. can multiply by 2
 - ⑥ Do addition by balancing method.

Ending with -1. ① Write the No as it is
21³ = 21 at the end.

* 21³ = $\begin{array}{r} \textcircled{8} \textcircled{4} \textcircled{2} \textcircled{1} \\ + \quad 8 \quad 4 \\ \hline 9 \textcircled{2} \textcircled{6} \textcircled{1} \end{array}$ ② do remaining No square
2 = 4
③ do remaining No cube
2 = 8

21³ = 9261 ④ Circle the 1st and last No
⑤ Remaining No can multiply by 2
⑥ Do addition by balancing method.

* 41³ = $\begin{array}{r} 64 \quad 16 \quad 4 \quad 1 \\ + \quad 4 \quad 32 \quad 8 \\ \hline 68 \quad 9 \quad 2 \quad 1 \end{array}$

41³ = 68921

Same No Cube.

* 22³ = $\begin{array}{r} \textcircled{8} \quad \textcircled{8} \quad \textcircled{8} \quad \textcircled{8} \\ + \quad 16 \quad 16 \\ \hline 10 \quad 6 \quad 4 \quad 8 \end{array}$ ① Take same No. 2 and write the cube of 2 in 4 times

22³ = 10648 ② Circle the 1st and last No
③ Remaining No can multiply by 2
④ Do addition by balancing method

* 66³ = $\begin{array}{r} 216 \quad 216 \quad 216 \quad 216 \\ + \quad 72 \quad 72 \\ \hline 297 \quad 4 \quad 9 \quad 6 \end{array}$

66³ = 287496

* Cube of any 2 digit No.

32³ = $\begin{array}{r} 27 \quad 18 \quad 12 \quad 8 \\ + \quad 36 \quad 24 \\ \hline 5 \quad 13 \\ 32 = 7 \quad 6 \quad 8 \end{array}$ Step
3³ = 27
3² × 2 = 9 × 2 = 18
2² × 3 = 4 × 3 = 12
2³ = 8

32³ = 32768

* 59³ = $\begin{array}{r} 125 \quad 225 \quad 405 \quad 729 \\ \quad 80 \quad 128 \quad 72 \\ \hline 205 \quad 3 \quad 7 \quad 9 \end{array}$

59³ = 205379

* Middle No is 0

① 106³ = $\begin{array}{r} 1 \quad 18 \quad 108 \quad 216 \\ \quad 1 \quad 2 \\ \hline 119 \quad 0 \quad 16 \end{array}$ 1³ = 1
1² × 3 × 6 = 18
6² × 3 × 1 = 108
6³ = 216

② 2015³ = $\begin{array}{r} 8 \quad 180 \quad 1350 \\ \quad 15^2 \times 3 \times 2 = 1350 \\ \hline 8 \quad 180 \quad 1350 \end{array}$ 2³ = 8
2² × 15 × 3 = 180
15² × 3 × 2 = 1350
15³ = 3375

8/180/1350/3375
8181353375

* If your Square Cube of 4 digit No, take 3 digit as it is and remain carried forward
3375 = 375 as it is and 3 add in a 1350 =

★ Base Method. (Below Base)

① $998^3 = \text{Base} - 1000$

$$\begin{array}{r} 998 - -2 \\ 998 - -2 \\ 998 - -2 \\ \hline (998-4) (6x-2) (008) \\ 994 \quad 12 \quad 992 \\ \hline \underline{994011992} \end{array}$$

$$\begin{array}{r} 2^3 = (-008) \\ -2 + -2 + -2 = -6x-2 \\ 998 - 2 - 2 \\ \hline 998 - 4 \\ \hline -008 \text{ is a vinculum No} \\ \text{So convert into positive No} \\ 12 - (-) = 12 = 011 \end{array}$$

② $997^3 =$

$$\begin{array}{r} 997 - -3 \\ 997 - -3 \quad -6 \\ 997 - -3 \quad -6 \\ \hline (997-6) (C-9x-3) \quad -3^3 \\ 991 \quad 27 \quad -027 \\ \hline \underline{99126973} \end{array}$$

★ Above Base

$1012^3 = \text{Base} - 1000$

$$\begin{array}{r} 1012 - +12 \\ 1012 - +12 \\ 1012 - +12 \\ \hline (1012+24) (36x+12) \quad 12^3 \\ 1036 \quad 432 \quad 1728 \\ \hline \underline{1036433728} \end{array}$$

Cube Root (विलोकनम्) Perfect Cube

Step 1

- 1) Divide the No in 2 parts, after last 3 digit No divide the No.
- 2) Find out the ending No Cube Root.
- 3) Find out the No which is come in two middle No.
- 4) Take a smaller No.

① $12/167$

2	3 = 23
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② $970/299$

9	9 = 99
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③ $614/125$

8	5 = 85
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0-0	11-1331
1-1	12-1728
2-8	13-2197
3-27	14-2744
4-64	15-3375
5-125	16-4096
6-216	17-4913
7-343	18-5832
8-512	19-6859
9-729	20-8000
10-1000	

④ $6434/856$

18	6 = 186
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⑤ $3307/949$

14	9
= 149	

⑥ $7189/057$

19	3 = 193
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* Square Root

No - Square Root	1 - 1	11 - 121
1 - 1 OR 9	2 - 4	12 - 144
4 - 2 OR 8	3 - 9	13 - 169
9 - 3 OR 7	4 - 16	14 - 196
6 - 4 OR 6	5 - 25	15 - 225
5 - 5	6 - 36	16 - 256
0 - 0	7 - 49	17 - 289
	8 - 64	18 - 324
	9 - 81	19 - 361
	10 - 100	20 - 400

① divide the No after 2 digit No

① $841 \leftarrow \begin{matrix} 21 \\ 29 \end{matrix}$ ② Find out the last digit No Square Root.
1 - 1 OR - 9.

③ ~~841 is in 400 and 900~~

④ 8 is in between in 6 and 9
 $6^2 = 36$ $9^2 = 81$

⑤

2 is a smaller No.
21/29

⑥ 8 is a nearest by 9. So square root of 841 is 29

② $3721 \leftarrow \begin{matrix} 61 \\ 69 \end{matrix}$

③ $7744 \leftarrow \begin{matrix} 82 \\ 88 \end{matrix}$

2nd method - For Square Root

① $1849 \leftarrow \begin{matrix} 43 \\ 47 \end{matrix}$ * 1st Find out 9 square root 3 OR 7

20 | $\rightarrow 18$ is 9 between 16 and 25.

$\rightarrow 16$ is a smaller No, so 16 square Root is 4

* multiply by smaller No to next smaller No

$8 \times 4 = 32 = 20$

* 18 is a smaller than 20
So take a smaller No - 63

~~$1849 \div 59 = 1849 = 43$~~


② $2116 \leftarrow \begin{matrix} 44 \\ 46 \end{matrix}$
 $\times 25 = 20$

③ $338156 \leftarrow \begin{matrix} 184 \\ 186 \end{matrix}$
 $\frac{342}{(18 \times 19)}$

④ $38416 \leftarrow \begin{matrix} 194 \\ 196 \end{matrix}$
 $\frac{380}{(19 \times 20)}$


* Pythagorean Value


(For odd No)

①  $a=3, b=4, c=5$
Square it - $3^2 = 3^2 = 9$

Divided by 2 = $\frac{9}{2} = 4.5$


Rounded off $b=4, c=5$
 $a=3, b=4, 5=5$

②  $a=9, 9^2=81$
Divided by 2 = $\frac{81}{2} = 40.5$
Rounded off = 40, 41.

③  $a=15$
 $15^2 = 225$
Divided by 2 = $\frac{225}{2} = 112.5$
Rounded off = 112, 113.

$a=15, b=112, c=113$

[For even No]


①  $a=4, b=3, c=5$
 $a^2 = 4^2 = 16$

Divided by 4 = $\frac{16}{4} = 4$

$4-1 = 4-1 = 3, 4+1 = 5$

$a=4, b=3, c=5$

$c^2 = a^2 + b^2 = 5^2 = 4^2 + 3^2$
 $25 = 16 + 9$
 $25 = 25$

②  $a=24$
 $24^2 = 576$
Divided by 4 = $\frac{576}{4} = 144$

$144+1 = 145 = c$
 $144-1 = 143 = b$

$a=24, b=143, c=145$

$c^2 = a^2 + b^2$
 $145^2 = 24^2 + 143^2$

$21025 = 576 + 20449$

$21025 = 21025$

Equations. [Linear Equation]

① $5x + 3 = 3x + 11$
 $\begin{matrix} a & b & c & d \end{matrix}$

$$x = \frac{d-b}{a-c} = \frac{11-3}{5-3} = \frac{8}{2} = \underline{4}$$

② $9x + 5 = 3x + 23$
 $\begin{matrix} a & b & c & d \end{matrix}$

$$x = \frac{d-b}{a-c} = \frac{23-5}{9-3} = \frac{18}{6} = \underline{3}$$

* Simultaneous Equation.

$$\begin{aligned} 2x + 3y &= 8 \\ 4x + 5y &= 14. \end{aligned}$$

First Find out x value

$$\begin{aligned} x &= \frac{(b \times c_2) - (c \times b_1)}{(b \times a_1) - (a \times b_2)} \\ &= \frac{(3 \times 14) - (8 \times 5)}{(3 \times 4) - (2 \times 5)} \end{aligned}$$

$$x = \frac{42 - 40}{12 - 10} = \frac{2}{2} = \underline{1}$$

$x = 1$

Find out the y value.

$$\begin{aligned} 2x + 3y &= 8 \\ 2(1) + 3y &= 8 \\ 2 + 3y &= 8 \\ 3y &= 8 - 2 \end{aligned}$$

$$y = \frac{6}{3}$$

$$y = \underline{2}$$

$$\begin{aligned} 2x + 3y &= 8 \\ 2(1) + 3(2) &= 8 \\ 2 + 6 &= 8 \\ \underline{8} &= 8 \end{aligned}$$

$$2) \begin{cases} 2x + y = 5 \\ 3x - 4y = 2 \end{cases}$$

$$x = \frac{(1 \times 2) - (-4 \times 5)}{(1 \times 3) - (2 \times -4)}$$

$$\frac{2 + 20}{3 + 8} = \frac{22}{11} = \underline{\underline{2}}$$

$$\begin{aligned} 2x + y &= 5 \\ 2(2) + y &= 5 \\ y &= 5 - 4 \\ y &= \underline{\underline{1}} \end{aligned}$$

$$\begin{aligned} 2x + y &= 5 \\ 2(2) + 1 &= 5 \\ 4 + 1 &= 5 \\ 5 &= 5 \end{aligned}$$

L.C.M [least common factor]

① 5, 10, 25, 50

Take h^o higher N^o

$$50 = \text{LCM} = \underline{\underline{50}}$$

② 72, 39, 57

$$3 [24, 13, 19]$$

$$19 \times 24 = 456 \times 13$$

$$= 5928 \times 3 \\ = \underline{\underline{17,784}}$$

③ 140, 280, 490

$$70 [2, 4, 7]$$

$$7 \times 2 = 14 \times 4 = 56 \times 70 = \underline{\underline{3920}}$$

$$\text{LCM} = \underline{\underline{3920}}$$

④ 360, 420, 540

$$60 [6, 7, 9]$$

$$60 \times 126$$

$$= \underline{\underline{7560}} \text{ LCM.}$$

⑤ 48, 56, 72

$$8 [6, 7, 9]$$

$$9 \times 9 \times 2 = 18 \times 7 = 126$$

$$126 \times 8 = \underline{\underline{1008}}$$