

Square Root and Cube Root.

Square

If a number is multiplied by itself, then the result of its multiplication

Example

$$6^2 = 6 \times 6 = 36$$

Method to find square

• Multiplication Method

• Algebraic Method

$$(a+b)^2 = a^2 + b^2 + 2ab$$

$$\begin{aligned} 34^2 &= (30+4)^2 = 30^2 + 4^2 + 2 \times 30 \times 4 \\ &= 900 + 16 + 240 \\ &= 1156 \end{aligned}$$

1. Square of unit digit

- ten's digits as carry.

2. $2 \times$ Ten's digit \times unit's digits + carry (step 1)
(~~step~~ ~~carry~~)

3. Ten's digit 2 + carry. (-from step 2).

4. Arrange the numbers

Step 3, step 2 & step 1 unit's place value.

Eg:- 74^2

1. $4^2 = 16$ (Carry = 1)

2. $2 \times 7 \times 4 + 1 = 14 \times 4 + 1 = 56 + 1 = 57$ (Carry 5)

3. $7^2 + 5 = 49 + 5 = 54$

Ans 5476

Square of Decimal Numbers

$$(3.5)^2 = ? \quad 12.25$$

$$(35)^2 = 1225$$

Methods of finding Square Roots

1. Prime factorisation Method.

Eg:-

Find the square root of 1089

$$\begin{array}{r} 3 \overline{) 1089} \\ \underline{363} \\ 121 \\ \underline{11} \\ 11 \\ \underline{11} \\ 0 \end{array}$$

$$\sqrt{1089} = \sqrt{3 \times 3 \times 11 \times 11}$$

$$= \sqrt{3^2 \times 11^2}$$

$$= 3 \times 11$$

$$= 33$$

89

81

$$2) 2 \times 8 \times 9 + 8$$

152

$$3) (8) + 5$$

Square root of 1024

$$\begin{array}{r} 2 \overline{) 1024} \\ \underline{512} \\ 256 \\ \underline{128} \\ 64 \\ \underline{32} \\ 16 \\ \underline{8} \\ 4 \\ \underline{2} \\ 0 \end{array}$$

$$\sqrt{1024} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$$

$$= \sqrt{2^{10}}$$

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

$$= 4 \times 4 \times 2$$

$$= 16 \times 2$$

$$= 32$$

2. Division Method

Shortcut Methods

1) 4624

$$46 \overline{) 24} = \underline{6} \quad \underline{2/8} = 68$$

↓
Where it falls in
balls in square
- take least

46 -

Falls between 6 and 7

Take 6 -
Next to 6

$$6 \times 7 = 42$$

$$46 \geq 42 \rightarrow \text{take greater}$$

Part of second on square of any number

So, it take 8

Number	Square	Last digits
1	1	1
2	4	4
3	9	9
4	16	6
5	25	5
6	36	6
7	49	9
8	64	4
9	81	1

2. $79 \overline{) 21} = \underline{8} \quad \underline{1/9} = 89$

$$79 = 8$$

$$8 \times 9 = 72$$

$$79 \geq 72$$

3) $12 \overline{) 96} = \underline{3} \quad \underline{4/6} = 36$

$$12 = 3 \times 4 = 12$$

$$12 \geq 12 = \text{Highest}$$

\geq - highest (larger) Number

$<$ - Least Number Small Number

Formula

1. In a given number, the total number of digits are 'n'

n is even = square root = $\frac{n}{2}$ digits

n is odd = square root = $\frac{n+1}{2}$

Q. How many digits are there in square root of 1838736

Sol

$$n = 7$$

$$\text{Odd Number} = \frac{n+1}{2} = \frac{7+1}{2} = \frac{8}{2} = 4 \text{ digits.}$$

2. If any number has 5 in Unit's Place, then its square can be calculated as

$$(A \cdot 5)^2 = A \times (A+1) \cdot 25$$

Q. Find the square of 125

$$(125)^2 = 12 \times (12+1) \cdot 25$$

$$= 12 \times 13 \cdot 25$$

$$= 15625$$

$$3. \sqrt{x} \sqrt{x} \sqrt{x} \dots n = x \cdot 2^n$$

Q. Find the value of $\sqrt{2\sqrt{2\sqrt{2\sqrt{2\sqrt{2}}}}}$

$$\text{Here } n = 5$$

$$= 2^{\frac{2^5 - 1}{2^5}} = 2^{\frac{32 - 1}{32}} = 2^{\frac{31}{32}}$$

4. $\sqrt{x\sqrt{x\sqrt{x\sqrt{x\sqrt{x\cdots}}}}} = x$

Q. Find the value of $\sqrt{7\sqrt{7\sqrt{7\cdots}}}$
 $= 7$

5. To find the value of $\sqrt{x+\sqrt{x+\sqrt{x+\cdots}}}$, find the factors of x , such that the difference between the factors is 1, then the larger factor will be result.

Q1. Find the value of $\sqrt{12+\sqrt{12+\sqrt{12+\cdots}}}$

The factor $12 = 4 \times 3 \times 1$

Difference between factors = 1.

Then the result is largest factor = 4.

2	12
2	6
3	3
	1

6. The value of $\sqrt{x-\sqrt{x-\sqrt{x-\cdots}}}$, find the factor of x , such that the difference between the factors is 1, the smaller factor will be the result.

Q. Find the value of $\sqrt{30-\sqrt{30-\sqrt{30-\cdots}}}$

The factor of 30 is ~~2x3x5~~ 6x5

Result = 5

2	30
3	15
5	5
	1