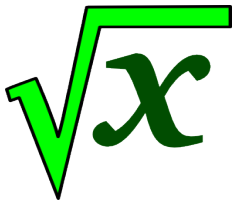


# METHODS OF FINDING SQUARE ROOT

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## Introduction

[Square root](#) is the inverse operation of squaring a number. Square root of a number is denoted by the symbol  $\sqrt{\quad}$ .



We can find square root of a number using any of the following three [methods](#):

- [Prime Factorization](#) Method
- Long Division Method
- Estimation

We will discuss all the above mentioned methods in detail.

## Prime Factorization Method

To find the square root by prime factorization method, we follow the following steps:

Step I: Find the [prime factors](#) of the given number.

Step II: Form pairs of prime factors.

Step III: Take one prime factor from each pair of prime factors of the given number.

Step IV: Find the product of these prime factors to get the square root of the given number.

If prime factors of a number do not occur in pairs, the given number is not a perfect square.

Example: Find the square root of 1600

Solution:

Step I: Find the prime factors of the given number.

$$1600 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$$

Step II: Form pairs of prime factors.

$$\overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{5 \times 5}$$

Step III: Take one prime factor from each pair of prime factors of the given number.

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

Step IV: Find the product of these prime factors to get the square root of the given number.

$$2 \times 2 \times 2 \times 5 = 40$$

Hence, Square root of 1600 is 40

### Try this:

Find  $\sqrt{900}$ .

(Answer: 30)

## Long Division Method

We follow the following steps to find the square root of a number by [Long Division Method](#):

Step I: Make pairs of digits from the right that is from one's place and put bars over every pair.

Step II: Find the nearest or exact square root for the first two digits from the left.

Step III: On the top of the line we will get the square root and in the line we have Radicand.

Step IV: Write the number above the Radicand and record the square of the number underneath the first pair of digits, do the subtraction, and then carry down the next pair of digits.

Step V: To find the next divisor, double the digit of the root and write it on the left.

Step VI: Repeat the above steps till we are left with no pair of digits.

Example: Find the square root of the number 4096 using long division method.

Solution:

Step I: Make pairs of digits from the right.

$$\begin{array}{r} \phantom{00} \\ \hline 40\bar{9}6 \end{array}$$

Step II: Find the nearest or exact square root for the first two digits from the left.

$$\begin{array}{r|l} 6 & 4096 \\ \hline 6 & 4096 \\ - & 36 \\ \hline \end{array}$$

Step III: On the top of the line we will get the square root and in the line we have Radicand.

$$\begin{array}{r|l} 6 & 4096 \\ \hline 6 & 4096 \\ - & 36 \\ \hline \end{array}$$

Step IV: Write the number above the Radicand and record the square of the number underneath the first pair of digits, do the subtraction, and then carry down the next pair of digits.

$$\begin{array}{r|l} & 6 \\ \hline 6 & 4096 \\ & - 36 \\ \hline & 496 \end{array}$$

Step V: To find the next divisor, double the digit of the root and write it on the left.

$$\begin{array}{r|l} & 64 \\ \hline 6 & 4096 \\ & - 36 \\ \hline 124 & 496 \\ & 496 \\ \hline & 0 \end{array}$$

Step VI: Since we get zero as remainder, so the square root of 4096 is 64.

## Estimation

We can [estimate](#) the square root of a number by using a Number Line.

We will learn about the concept using the following example.

Example: Estimate the square root of 40.

Solution: We follow the following steps to estimate the square root of 40.

Step I: Check the perfect squares that are close to 40, one perfect square that is less and one that is greater than 40.

In this case, the nearest perfect squares less than and greater than 40 are 36 and 49 respectively.

Step II: Check which perfect square is more close the number whose square root we are estimating.

$$6^2 = 36 \text{ and } 7^2 = 49$$

$$6^2 < 40 < 7^2$$

$$36 < 40 < 49$$

Now, we can see that 36 is closer to 40 as compared to 49.

So, the square root of 40 is approximately 6.

### **Try This:**

Estimate the square root of 58. (Answer: Approximately 8)

Now try it yourself! Should you still need any help, [click here](#) to schedule live online session with e Tutor!

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### **Reference Links:**

- [http://en.wikipedia.org/wiki/Square\\_root](http://en.wikipedia.org/wiki/Square_root)
- [http://en.wikipedia.org/wiki/Methods\\_of\\_computing\\_square\\_roots](http://en.wikipedia.org/wiki/Methods_of_computing_square_roots)
- <http://www.khanacademy.org/video/prime-factorization?playlist=Developmental%20Math>
- [http://en.wikipedia.org/wiki/Prime\\_factor](http://en.wikipedia.org/wiki/Prime_factor)
- <http://www.youtube.com/watch?v=UnshaiwljGY>
- [http://en.wikipedia.org/wiki/Methods\\_of\\_computing\\_square\\_roots#Rough\\_estimation](http://en.wikipedia.org/wiki/Methods_of_computing_square_roots#Rough_estimation)

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