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Square root algorithm

The square root algorithm, which helps to get the square root without using a calculator is not taught a lot in school today.

Teacher usually teach the process once and usually have students use a calculator afterward. If you want to understand how to get the square root without using a calculator, study the following example carefully!

Sorry, there are no shortcuts for this square root algorithm, so you will need patience before you master this algorithm!

Example: Square-root of 2685

$$\sqrt{2685}$$

First, always group the numbers in pairs starting from right to left and it is ok if there is only one number left in the leftmost position

I will use a space to show that they are being grouped in pairs. In this case, we have two pairs of 2 numbers

$$\sqrt{26\ 85}$$

Then, using the first pair, (26) find a number whose square is less than 26.

$5 \times 5 = 25$ and $6 \times 6 = 36$, so your number is 5. Put 5 on top of the square root sign

$$\begin{array}{c} 5 \\ \sqrt{26\ 85} \end{array}$$

Subtract the square of the number on top that is 5 from the first pair

Very important! When you first start, you always take the square root of the number on top

After that, you always double the number on top

Since $5^2 = 5 \times 5 = 25$, subtract 25 from 26

$$\begin{array}{c} 5 \\ \sqrt{26\ 85} \\ -25 \\ \hline 1 \end{array}$$

Bring down the next pair of numbers (85).

$$\begin{array}{c} 5 \\ \sqrt{26\ 85} \\ -25 \\ \hline 185 \end{array}$$

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Then, double 5 to get 10 and put 10 next to 185 on the left side

$$
\begin{array}{r}
5 \\
\sqrt{26\ 85} \\
-25 \\
\hline
10\qquad 185
\end{array}
$$

For the number 10, you will try to find a number you can put next to 0.

Let's call this number z. Then, find z such that 10z × z is less or equal to 185, but never bigger than 185

If I put 2 next to 10, I get 102 × 2 = 204 and 204 is bigger than 185, so z = 2 is not the number I need

However, if I put 1 next to 10, I get 101 × 1 = 101 and 101 is smaller than 185.

Thus, z = 1 is the number I will put next to 5

101 is the number I will subtract from 185

Put the 1 on top of the square root sign next to 5

$$
\begin{array}{r}
51 \\
\sqrt{26\ 85} \\
-25 \\
\hline
185
\end{array}
$$

Subtract 101 from 185

$$
101 \text{ times } 1 = \boxed{101} \longrightarrow
\begin{array}{r}
51 \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
\hline
84
\end{array}
$$

Bring down a pair of zeros next to 84 to continue the process and put a decimal point next to 51

$$
\begin{array}{r}
51. \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
\hline
8400
\end{array}
$$

Double 51 to get 102 and put 102 next to 8400 on the left side

$$
\begin{array}{r}
51. \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
102\qquad 8400
\end{array}
$$

For the number 102, you will try to find a number you can put next to 2.

Let's call this number z again. Then, find z such that 102z × z is less or equal to 8400, but never bigger than 8400

If I put 9 next to 102, I get 1029 × 9 = 9261 and 9261 is bigger than 8400

However, if I put 8 next to 1028, I get 1028 × 8 = 8224 and 8224 is smaller than 8400. Thus, z = 8 is the number I will put next to the decimal point

8224 is the number I will subtract from 8400

Put 8 on top of the square root sign next to the decimal point.

$$
\begin{array}{r}
51.8 \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
\hline
8400
\end{array}
$$

Subtract 8224 from 8400

$$
1028 \text{ times } 8 = \boxed{8224} \qquad
\begin{array}{r}
51.8 \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
\hline
8400 \\
-8224 \\
\hline
176
\end{array}
$$

Bring down a pair of zeros next to 176. Double 518 ignoring the decimal point to get 1036 and put 1036 next to 176000

$$
1036 \qquad
\begin{array}{r}
51.8 \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
\hline
8400 \\
-8224 \\
\hline
17600
\end{array}
$$

For the number 1036, you will try to find a number you can put next to 6.

Let's call this number z again. Then, find z such that 1036z × z is less or equal to 17600, but never bigger than 17600

If I put 2 next to 1036, I get 10362 × 2 = 20724

Since when z = 2, I get 20724 and 20724 is bigger than 17600, z = 2 is not the number I need

However, if I put 1 next to 1036, I get 10361 × 1 = 10361 amd 10361 is less than 17600. Thus, 10361 is is the number you will subtract from 17600

1 is the number you will put next to 8.

Put 1 on top of the square root sign next to the decimal point.

Subtract 10361 from 17600

$$
10361 \text{ times } 1 = \boxed{10361} \qquad
\begin{array}{r}
51.81 \\
\sqrt{26\ 85} \\
-25 \\
\hline
185 \\
-101 \\
\hline
8400 \\
-8224 \\
\hline
17600 \\
-10361 \\
\hline
7239
\end{array}
$$

I will stop here because it is a lot of work to put this square root algorithm here for you. Appreciate my effort? Look for the donation button above and please make a donation to keep this website running.

Feel free to continue the square root algorithm to get more decimal numbers, but I think I am done.

If you were looking for the square root of 785 for instance, the square root algorithm does not change at all

Notice that when you group the number in pairs starting from right to left, there will be only 1 number in the leftmost position. That number is 7 and that is fine

Just start with 7 and say to yourself, " The square of what number is less than 7 and proceed an already outlined above

I thought I said I was done. Why am I still talking about this square root algorithm?

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