



Square and Square Root

Square

A square of a number is that number raised to the power of 2.

Or

When we multiply a number itself, the result we get is the square of the number multiplied.

e.g. $2 \times 2 = 2^2 = 4$; 4 is the square of 2.
 $3 \times 3 = 3^2 = 9$; 9 is the square of 3.

Perfect Square

A number is said to be perfect square, if it is a square of any natural number.

e.g. $4 \times 4 = 16$, $5 \times 5 = 25$

Here, 16 and 25 are perfect squares of 4 and 5, respectively.

Square Root

The square root of a number is that factor of the number which, when multiplied by itself will give that number.

e.g. $5 \times 5 = 25$, $8 \times 8 = 64$

The numbers 25 and 64 are the squares of 5 and 8, respectively. We can also say that the numbers 5 and 8 are the square roots of 25 and 64, respectively.

If $4^2 = 16$, we say that square root of 16 is 4 and we write $\sqrt{16} = 4$

Methods for Finding Square Root

1. Prime Factorisation method 2. Division method

Prime Factorisation Method

This method is suitable for finding square root of small numbers.

e.g. $\sqrt{144}$

2	144
2	72
2	36
2	18
3	9
3	3
	1

$$\begin{aligned} \therefore \sqrt{144} &= \sqrt{2 \times 2 \times 2 \times 2 \times 3 \times 3} \\ &= \sqrt{2^2 \times 2^2 \times 3^2} = 2 \times 2 \times 3 = 12 \end{aligned}$$

Example 1 Find the square root of 1089.

(a) 33 (b) 23 (c) 43 (d) 53

Sol. (a) Prime factor of 1089 = $11 \times 11 \times 3 \times 3$

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

Now, taking one number from each pair and multiplying them, we get $\sqrt{1089} = 11 \times 3 = 33$

Division Method

This method is suitable for finding square root of large numbers.

e.g. $\sqrt{151321}$

Steps of Division Method

- Make the pair of digits, starting from unit digit.
- Think of a number whose square is just equal to or less than first pair.
- Make this number as the divisor and the part of quotient and subtract its square from first pair.
- Now bring the second pair down, adjacent to the remainder as new dividend.
- For new trial divisor, double the quotient and enter a digit to be put at the unit place in the new divisor, such that the product of entire divisor with that digit is less than equal to the dividend.
- Repeat these steps till the last pair is taken up.

$$\begin{array}{r|l}
 & 389 \\
 3 & 15 \ 13 \ 21 \\
 & 9 \\
 \hline
 68 & 613 \\
 & 544 \\
 \hline
 769 & 6921 \\
 & 6921 \\
 \hline
 & \times
 \end{array}$$

$$\therefore \sqrt{151321} = 389$$

Example 2 Find the square root of 18769.

- (a) 117 (b) 137
(c) 147 (d) 133

Sol. (b)

$$\begin{array}{r|l}
 & 137 \\
 1 & 187 \ 69 \\
 & 1 \\
 \hline
 23 & 87 \\
 & 69 \\
 \hline
 267 & 1869 \\
 & 1869 \\
 \hline
 & \times
 \end{array}$$

$$\therefore \sqrt{18769} = 137$$

Example 3 $\sqrt{?} + 136 = \frac{5}{8}$ of 320

- (a) 1936 (b) 4624
(c) 4196 (d) 4096

Sol. (d) $\sqrt{?} + 136 = \frac{5}{8}$ of 320

$$\Rightarrow \sqrt{?} + 136 = \frac{5}{8} \times 320$$

$$\Rightarrow \sqrt{?} = 5 \times 40 - 136$$

$$\Rightarrow \sqrt{?} = 200 - 136 \Rightarrow ? = (64)^2$$

$$\therefore ? = 4096$$

Example 4 A gardener plants 4225 trees in such a way that there are as many rows as there are trees in a row. Find the number of trees in a row.

- (a) 65 (b) 68 (c) 78 (d) 75

Sol. (a) Number of rows = $\sqrt{4225}$

$$\begin{array}{r|l}
 & 65 \\
 6 & 42 \ 25 \\
 & 36 \\
 \hline
 125 & 625 \\
 & 625 \\
 \hline
 & \times
 \end{array}$$

So, number of rows = 65.

Helping Tips

- If number is given in form of fraction, then find the square root of numerator and denominator individually. e.g. $\sqrt{\frac{9}{16}} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}$
- If number is given in decimal form, then convert it in fraction form and then find the square root.
e.g. $\sqrt{0.09} = \sqrt{\frac{9}{100}} = \frac{\sqrt{9}}{\sqrt{100}} = \frac{3}{10} = 0.3$



Practice Exercise

- If $\sqrt{529} = x$, then find the value of x .
(a) 23 (b) 25
(c) 27 (d) 13
- Square root of $11\frac{9}{81}$ is
(a) $3\frac{2}{3}$ (b) $\frac{10}{3}$
(c) $\frac{8}{3}$ (d) $3\frac{1}{4}$
- If $\sqrt{81} + \sqrt{64} = x$, then find the value of x .
(a) 17 (b) 18
(c) 9 (d) 8
- If $\sqrt{900} + \sqrt{0.09} - \sqrt{0.000009} = x$, then find the value of x .
(a) 30.297 (b) 3.03
(c) 30.003 (d) 30.300
- If $48\sqrt{x} + 32\sqrt{x} = 320$, then find the value of x .
(a) 9 (b) 16 (c) 25 (d) 36
- Simplify the expression $\sqrt{16\frac{97}{144}} \times \sqrt{36}$.
(a) 16 (b) $\frac{47}{2}$ (c) 24.5 (d) 25.5
- What is the greatest number of 4 digits, which is perfect square?
(a) 9018 (b) 9999
(c) 9801 (d) 9899
- $\sqrt{176} + \sqrt{2401} = x$. Find the value of x .
(a) 15 (b) 18
(c) 16 (d) 14
- Find the value of expression $\sqrt{15612} + \sqrt{154} + \sqrt{225}$.
(a) 625 (b) 125 (c) 25 (d) 225
- Find the least number from which, multiplication of 2352 gives a perfect square number.
(a) 2 (b) 3 (c) 6 (d) 8

Answers

1	(a)	2	(b)	3	(a)	4	(a)	5	(b)	6	(c)	7	(c)	8	(a)	9	(b)	10	(b)
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Hints & Solutions

- $$\begin{array}{r} 23 \\ 2 \overline{) 529} \\ \underline{4} \\ 43 \\ \underline{43} \\ 129 \\ \underline{129} \\ 0 \end{array}$$
 $\therefore \sqrt{529} = 23$
- $$\sqrt{11\frac{9}{81}} = \sqrt{\frac{11 \times 81 + 9}{81}}$$

$$= \sqrt{\frac{900}{81}} = \frac{30}{9} = \frac{10}{3}$$
- $$x = \sqrt{81} + \sqrt{64}$$

$$= \sqrt{3 \times 3 \times 3 \times 3} + \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2}$$

$$= 3^2 + 2^2 = 9 + 4 = 13$$
- $$x = \sqrt{900} + \sqrt{0.09} - \sqrt{0.000009}$$

$$= \sqrt{900} + \sqrt{\frac{9}{100}} + \sqrt{\frac{9}{1000000}}$$

$$= 30 + \frac{3}{10} - \frac{3}{1000}$$

$$= 30 + 0.3 - 0.003 = 30.297$$
- $$48\sqrt{x} + 32\sqrt{x} = 320$$

$$\Rightarrow \sqrt{x}(48 + 32) = 320$$

$$\Rightarrow 80\sqrt{x} = 320$$

$$\Rightarrow \sqrt{x} = 4, \text{ square of both sides}$$

$$\Rightarrow x = 4^2 = 16$$

$$\begin{aligned}
 6. \quad \sqrt{16\frac{97}{144}} \times \sqrt{36} &= \sqrt{\frac{16 \times 144 + 97}{144}} \times \sqrt{36} \\
 &= \sqrt{\frac{2401}{144}} \times \sqrt{36} \\
 &= \frac{49}{12} \times 6 = \frac{49}{2} = 24.5
 \end{aligned}$$

7. Greatest number of 4 digits = 9999
 We find that, $9999 = (99)^2 + 198$
 So, $(99)^2 = 9999 - 198 = 9801$

$$\begin{aligned}
 8. \quad \sqrt{2401} &= \sqrt{7 \times 7 \times 7 \times 7} = 7 \times 7 = 49 \\
 \therefore x &= \sqrt{176 + 49} = \sqrt{225} = 15
 \end{aligned}$$

$$\begin{aligned}
 9. \quad \sqrt{15612 + \sqrt{154 + \sqrt{225}}} \\
 = \sqrt{15612 + \sqrt{154 + 15}}
 \end{aligned}$$

$$\begin{aligned}
 &= \sqrt{15612 + \sqrt{169}} \\
 &= \sqrt{15612 + 13} = \sqrt{15625} \\
 &= 125
 \end{aligned}$$

10.

2	2352
2	1176
2	588
2	294
3	147
7	49
7	7
	1

$$2352 = \overline{2 \times 2 \times 2 \times 2 \times 3 \times 7 \times 7}$$

$\therefore$ Required number = 3



Try Yourself

- If $\frac{x}{\sqrt{4}} = \sqrt{16}$, then find the value of x.
 (a) 4 (b) 16 (c) 8 (d) 12
- Find the square root of 7921.
 (a) 79 (b) 69 (c) 89 (d) 98
- Simplify the expression $\sqrt{\frac{324}{81}}$.
 (a) 3 (b) 9 (c) 18 (d) 2
- If $\sqrt{x} + \sqrt{484} = 40$, then find the value of x is
 (a) 325 (b) 415 (c) 324 (d) 525
- If $\sqrt{\frac{196}{7}} \times \sqrt{\frac{900}{x}} = 4$, then find the value of x.
 (a) 1575 (b) 1521 (c) 1296 (d) 2116
- What is the least number of 4 digits, which is perfect square?
 (a) 1089 (b) 1024
 (c) 1000 (d) 9999

- Simplify $\sqrt{\frac{625}{144}} + \frac{11}{12}$.
 (a) 2 (b) 6 (c) 3 (d) 9
- Simplify $\frac{\sqrt{225}}{16} \times \frac{\sqrt{256}}{15} \times \frac{324}{18}$.
 (a) 15 (b) 16 (c) 18 (d) 12
- Find the value of $\frac{12^2 + 14^2}{\sqrt{10000}}$.
 (a) $\frac{17}{5}$ (b) $\frac{5}{17}$ (c) $\frac{5}{3}$ (d) $\frac{17}{3}$
- What is the value of $\sqrt{\frac{0.289}{0.00121}}$?
 (a) $\frac{160}{11}$ (b) $\frac{150}{11}$ (c) $\frac{175}{11}$ (d) $\frac{170}{11}$

Answers

- | | | | | |
|-------|-------|-------|-------|--------|
| 1 (c) | 2 (c) | 3 (d) | 4 (c) | 5 (a) |
| 6 (b) | 7 (c) | 8 (c) | 9 (a) | 10 (d) |