

Grade 8 - Square Roots and Cube Roots - Lesson

Common Core 8.EE.A.2 · maths-pdf.fr/en/

A square root of p is a number that, when multiplied by itself, equals p ; a cube root of p is a number whose cube equals p . The equation x squared equals p has two solutions, plus and minus the square root, while x cubed equals p has one real solution.

Grade 8 · Common Core State Standards: **8.EE.A.2**

Key facts

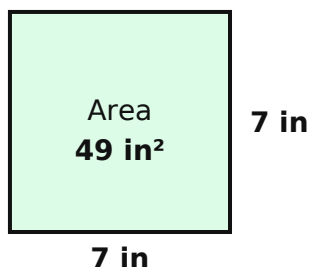
- $\sqrt{81} = 9$ because $9^2 = 81$; $\sqrt[3]{125} = 5$ because $5^3 = 125$.
- $x^2 = p$ with $p > 0$ has two solutions: $x = \pm\sqrt{p}$.
- $x^3 = p$ has one real solution: $x = \sqrt[3]{p}$.
- Know the perfect squares up to 15^2 and the perfect cubes up to 5^3 .
- Roots of non-perfect squares, like $\sqrt{20}$, are irrational and can be estimated.

What are square roots and cube roots?

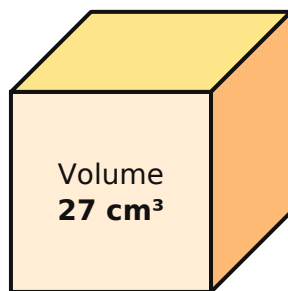
A square root undoes squaring and a cube root undoes cubing. If a square has area 49 square inches, its side is the number that multiplies by itself to give 49.

Definitions

$\sqrt{p}$ is the positive number whose square is p . $\sqrt[3]{p}$ is the number whose cube is p . A number such as 49 or 64 is a **perfect square**; 27 or 125 is a **perfect cube**.



A square of area 49 has side $\sqrt{49} = 7$.



A cube of volume 27 has edge $\sqrt[3]{27} = 3$.

Which squares and cubes should you know?

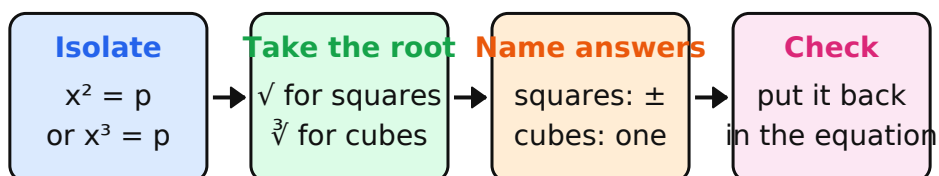
Know the squares up to $15^2 = 225$ and the cubes up to $5^3 = 125$. The table shows the squares and cubes from 1 to 10.

n	1	2	3	4	5	6	7	8	9	10
n^2	1	4	9	16	25	36	49	64	81	100
n^3	1	8	27	64	125	216	343	512	729	1000

Learn these squares and cubes by heart.

How do you solve x squared equals p?

Because both $7 \cdot 7$ and $(-7) \cdot (-7)$ equal 49, the equation $x^2 = 49$ has two solutions, $x = 7$ and $x = -7$. We write $x = \pm 7$. The equation $x^3 = 64$ has only one real solution, $x = 4$, since a negative number cubed is negative.



Squares have two solutions, cubes have one.

1. Isolate the power: for $3x^2 = 75$, divide by 3 to get $x^2 = 25$.
2. Take the root: $x = \pm\sqrt{25}$.
3. State the answers: $x = 5$ or $x = -5$.
4. Check: $3 \cdot 25 = 75$.

What if the number is not a perfect square?

Then the root is irrational, so we leave it as $\sqrt{p}$ or estimate it. For $x^2 = 20$, the solutions are $x = \pm\sqrt{20}$. Since $4^2 = 16$ and $5^2 = 25$, the value is between 4 and 5, about 4.47. The number $\sqrt{2}$ is irrational, so the side of a square with area 2 can never be written exactly as a fraction.

Fractions work too: $\sqrt{\frac{9}{16}} = \frac{3}{4}$ and $\sqrt[3]{\frac{8}{27}} = \frac{2}{3}$. Take the root of the numerator and of the denominator.

Questions about square roots and cube roots

Why does x squared equal 49 have two answers?

Both 7 and -7 square to 49, because a negative times a negative is positive. So $x = 7$ and $x = -7$ both work.

Is the square root of a negative number real?

No. No real number squared is negative, so $\sqrt{-9}$ is not a real number. A cube root of a negative number is fine: $\sqrt[3]{-8} = -2$.

What does the radical symbol mean by itself?

The radical symbol means the positive square root only. So $\sqrt{25} = 5$, while the equation $x^2 = 25$ has solutions 5 and -5.

How can I estimate a cube root?

Find the perfect cubes on each side. For $\sqrt[3]{30}$, $3^3 = 27$ and $4^3 = 64$, so the root is a little more than 3.

Is the square root of 2 a fraction?

No. It is irrational: its decimal 1.41421356... never ends or repeats, so no fraction equals it exactly.