



Square and cube roots

Two questions that sound identical

- Today: why $x^2 = 25$ has two answers and $\sqrt{25}$ has one.

Solve $x^2 = 25$

- $5 \times 5 = 25$. So $x = 5$.
- But $(-5) \times (-5) = 25$ too.

$x = 5$ or $x = -5$. Two numbers satisfy the equation.

Now evaluate $\sqrt{25}$

- The symbol means the PRINCIPAL root.
- $\sqrt{25} = 5$. Just the one.

Different question, different answer. Same words out loud.

So write it carefully

- $x^2 = 25 \rightarrow x = \pm\sqrt{25} = \pm 5$
- $\sqrt{25} \rightarrow 5$

The $\pm$ belongs to the EQUATION, not to the symbol.

Cube roots: sign survives

- $2^3 = 8$, so $\sqrt[3]{8} = 2$.
- $(-2)^3 = -8$, so $\sqrt[3]{-8} = -2$.

Only ONE answer for a cube root — and a negative one is fine.

Not division

- $\sqrt[3]{27}$ is not $27 \div 3$.
- $9^3 = 729$. Far too big.

$\sqrt[3]{27} = 3$, because $3 \times 3 \times 3 = 27$.

Know these by sight

- Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144
- Cubes: 1, 8, 27, 64, 125

$x^2 = 2$

- $1^2 = 1$ and $2^2 = 4$, so x is between 1 and 2.
- $\sqrt{2} = 1.41421\dots$ and never repeats.

$\sqrt{2}$ is irrational — no fraction gives it exactly.