Square and Cube Roots

Roots and Radicals

Radicals (also called roots) are directly related to exponents.

Square and Cube Roots

Roots and Radicals

The simplest types of radicals are square roots and cube roots.

Radicals beyond square roots and cube roots exist, but we will not explore them here.

Square and Cube Roots

Roots and Radicals

The rules for radicals that you will learn work for all radicals – not just square roots and cube roots.

Square and Cube Roots

Roots and Radicals

The symbol used to indicate a root is the radical symbol - $\sqrt{}$

Square and Cube Roots

Roots and Radicals

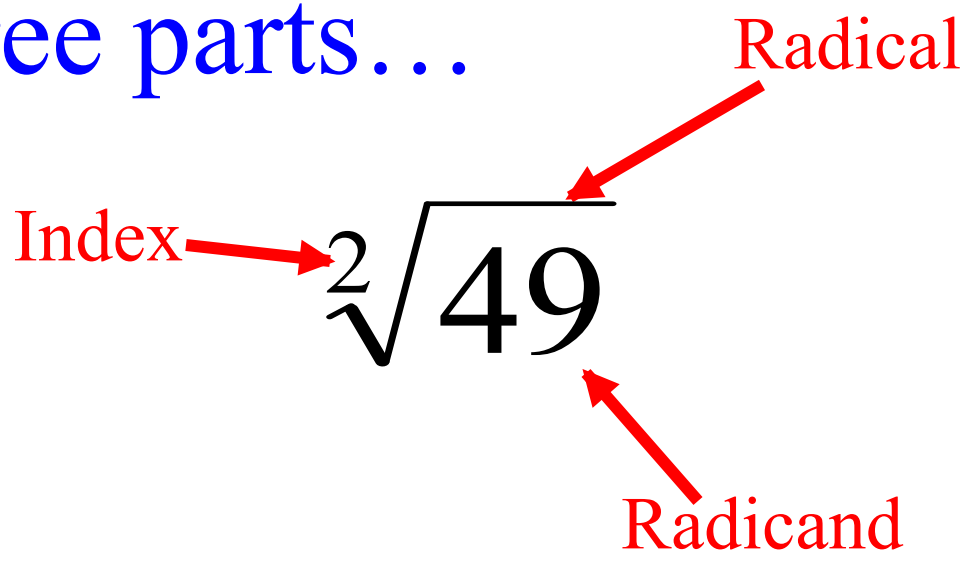
Every radical expression has three parts…

- Radical symbol
- Index
- Radicand

Square and Cube Roots

Roots and Radicals

Every radical expression has three parts…



Square and Cube Roots

Roots and Radicals

The cube root of 64 is written as $\sqrt[3]{64}$.

Square and Cube Roots

Roots and Radicals

What does square root mean?

What does cube root mean?

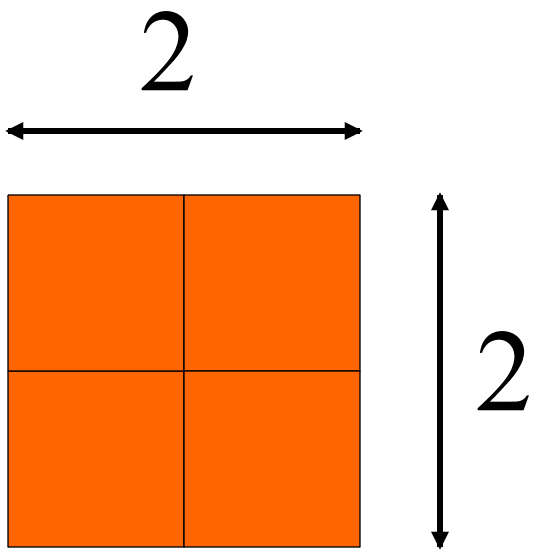
Square and Cube Roots

Roots and Radicals

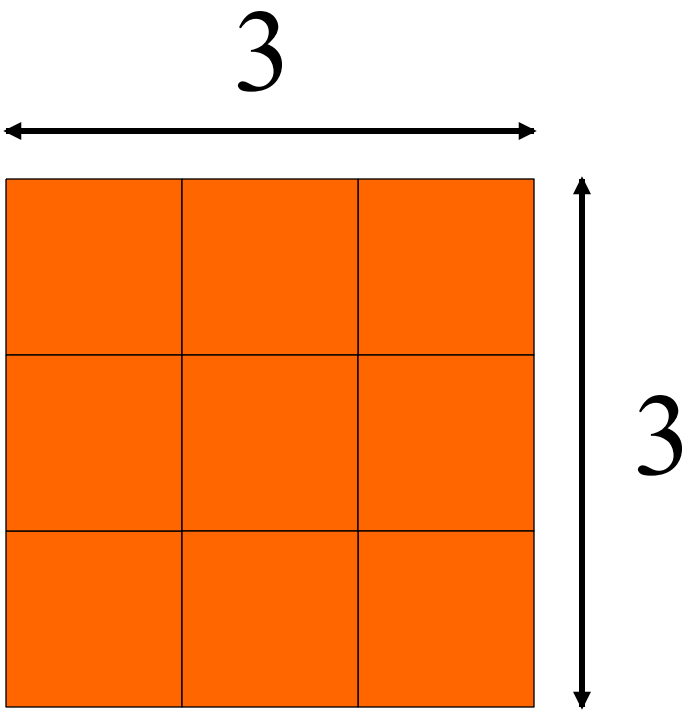
The square root of a number (or expression) is another number (or expression)…

…which when multiplied by itself (squared) gives back the original number (or expression).

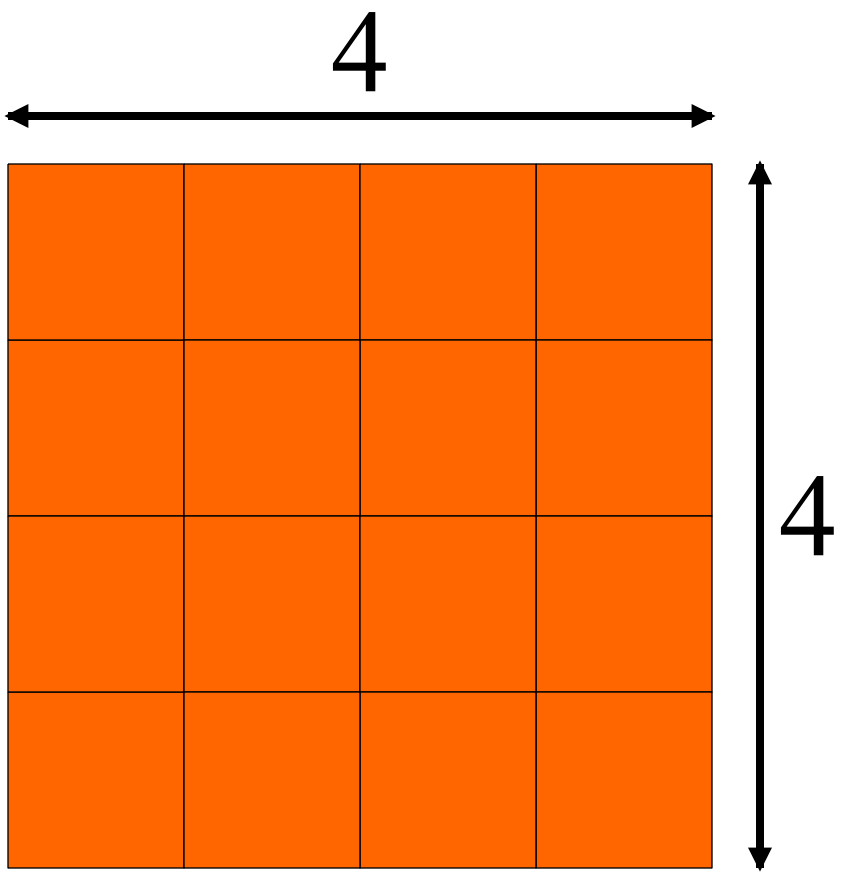
$2 \times 2 = 4$



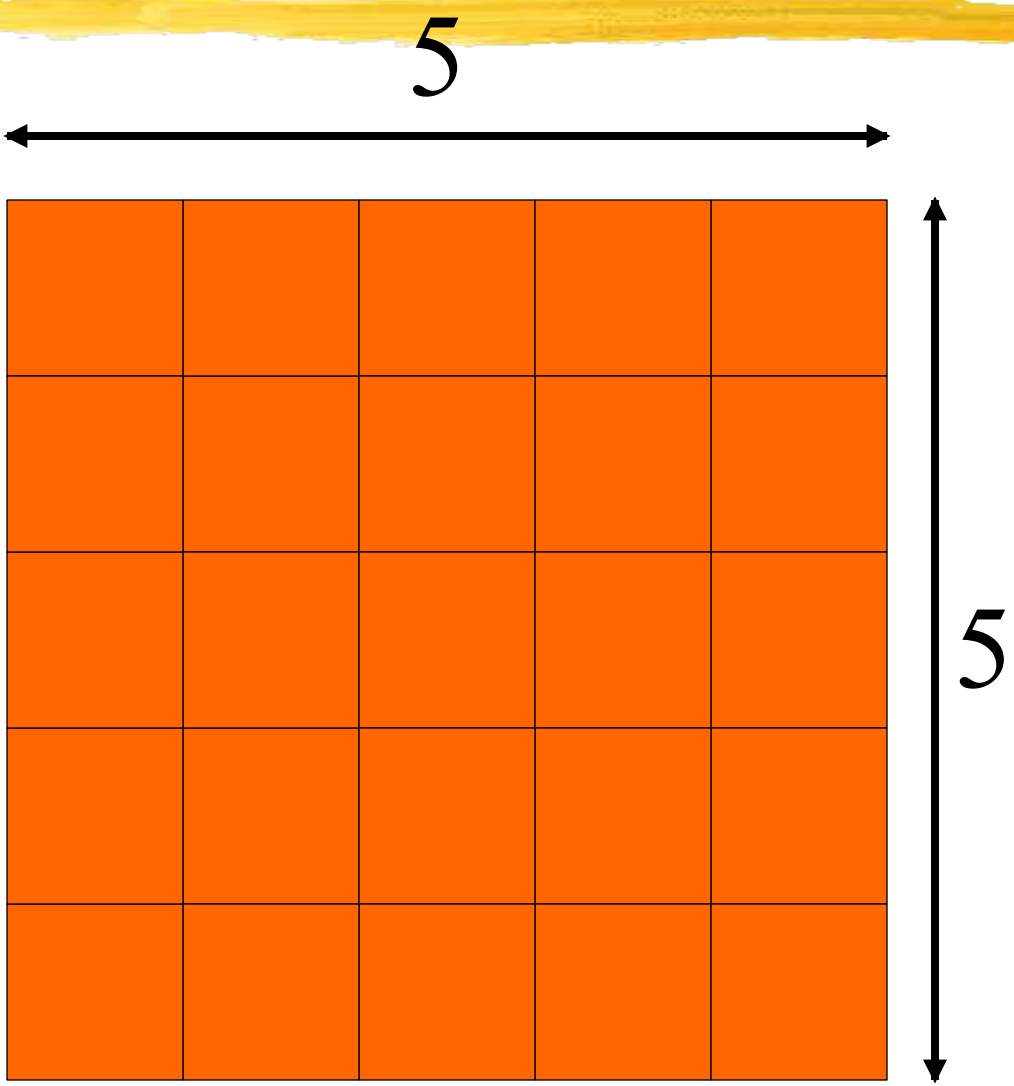
$3 \times 3 = 9$



$4 \times 4 = 16$



$5 \times 5 = 25$



Square and Cube Roots

Roots and Radicals

Example:

$\sqrt{49}$ has two answers:

7 is called the positive or principal square root.

-7 is called the negative square root.

Square and Cube Roots

Roots and Radicals

Example:

$\sqrt{49} = 7$ because $7 \cdot 7 = 7^2 = 49$

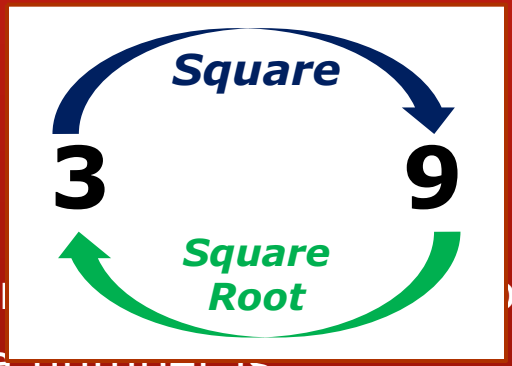
Also

$\sqrt{49} = -7$ because $(-7)(-7) = (-7)^2 = 49$

Square Roots

Ok, Square roots!

A **square root** is the opposite of **squaring** a number.



Three squared is nine, the square root of nine is three!

- A square root of a number is ...

... a value that can be **multiplied by itself** to give the original number!

- A square root of **9** is ...

... **3**, because **when 3 is multiplied by itself** you get **9**!

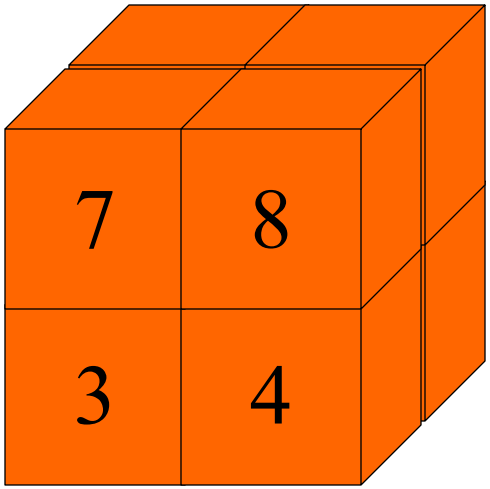
Square and Cube Roots

Roots and Radicals

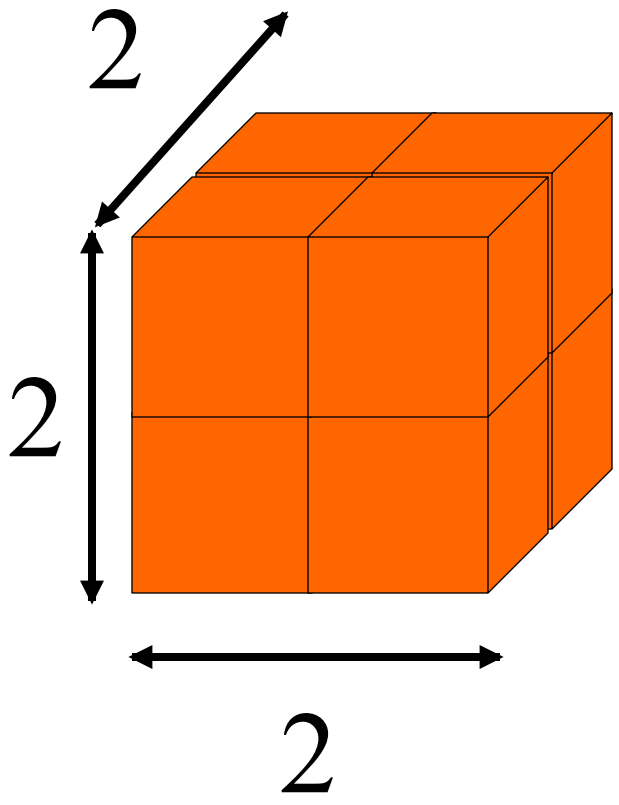
The cube root of a number (or expression) is another number (or expression) …

…which when multiplied by itself three times (cubed) gives back the original number (or expression).

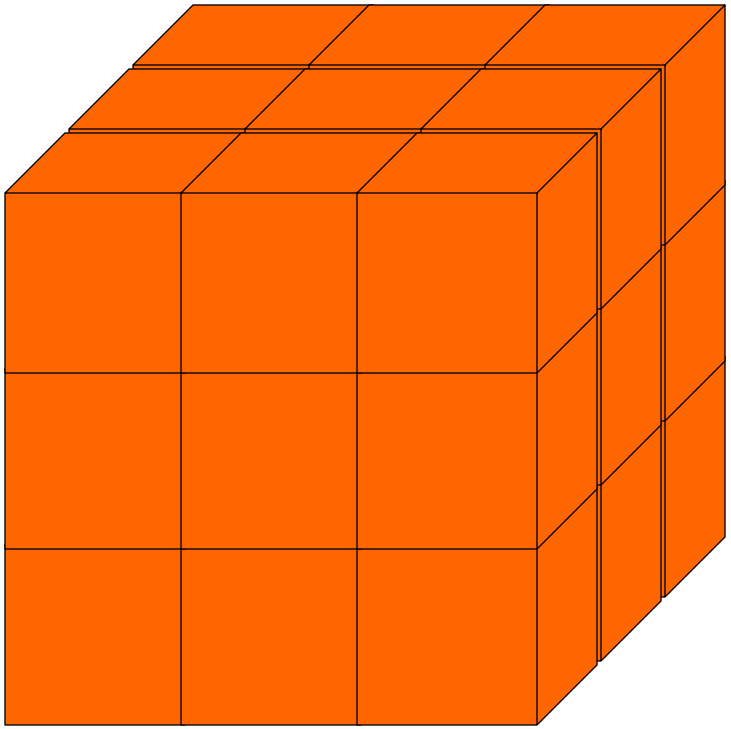
Cubes



2 x 2 x 2 = 8



3 x 3 x 3 = 27



Square and Cube Roots

Roots and Radicals

Example:

$$\sqrt[3]{64} = 4 \quad \text{because} \quad 4 \cdot 4 \cdot 4 = 4^3 = 64$$

$$\sqrt[3]{-64} = -4 \quad \text{because}$$

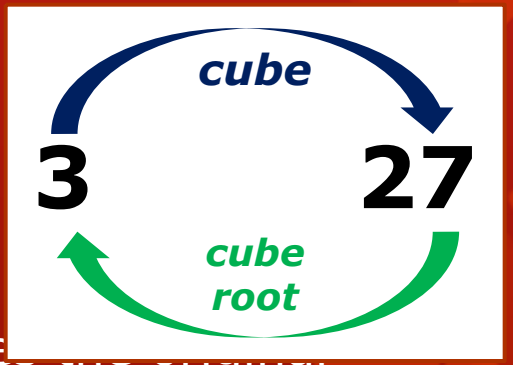
$$(-4)(-4)(-4) = (-4)^3 = -64$$

Cube Roots

Cube Roots!

A **cube root** goes the other direction of having something **cubed**

3 cubed is 27, so the **cube root of 27 is 3**!



- The cube root of a number is …

… a special value that when **cubed** gives the original number!

- The cube root of **27** is …

… **3**, because **when 3 is cubed** you get **27**!

Square and Cube Roots

Roots and Radicals

If a number is a perfect square, then you can find its exact square root.

A perfect square is simply a number (or expression) that can be written as the square [raised to 2^{nd} power] of another number (or expression).

Square and Cube Roots

Roots and Radicals

If a number is a perfect cube, then you can find its exact cube root.

A perfect cube is simply a number (or expression) that can be written as the cube [raised to 3^{rd} power] of another number (or expression).

Square and Cube Roots

Roots and Radicals

Not all numbers or expressions have an exact square root or cube root as in the previous examples.

Square and Cube Roots

Roots and Radicals

If a number is NOT a perfect square, then you CANNOT find its exact square root.

If a number is NOT a perfect cube, then you CANNOT find its exact cube root.

You can approximate these square roots and cube roots of real numbers with a calculator.

Square and Cube Roots

Roots and Radicals

Examples:

$$\sqrt{40} \approx 6.325$$

$$\sqrt{135} \approx 11.619$$

$$\sqrt[3]{40} \approx 3.42$$

$$\sqrt[3]{74} \approx 4.198$$

WATCH, LISTEN, LEARN!

Roots and Radicals

Example:

$$\sqrt[3]{729} = 9 \quad \text{because} \quad 9 \cdot 9 \cdot 9 = 9^3 = 729$$

Help Me

Roots and Radicals

Example:

$\sqrt{324} = 18$ because $18 \cdot 18 = 18^2 = 324$

Your Turn

Roots and Radicals

Example:

$$\sqrt[3]{216} = 6 \quad \text{because} \quad 6 \cdot 6 \cdot 6 = 6^3 = 216$$

SAGE AND SCRIBE – Shortest will be Scribe

Copy and Complete the Square and Cube Root sums!
Good luck!

Square	Cube
1. √9 = ?	1. √27 = ?
2. √225 = ?	2. √216 = ?
3. √64 = ?	3. √1 = ?
4. √16 = ?	4. √8 = ?
5. √49 = ?	5. √343 = ?

Done?
Click Here!

Answers (no peeking!)

Here are the answers to the previous questions, hope you get them right!

Square	Cube
1. 3	1. 3
2. 15	2. 6
3. 8	3. 1
4. 4	4. 2
5. 7	5. 7

Click here!