

# Square Roots

Your need to know from memory all the following perfect squares:

$$\sqrt{4}, \sqrt{9}, \sqrt{16}, \sqrt{25}, \sqrt{36}, \sqrt{49}, \sqrt{64}, \sqrt{81}, \sqrt{100}, \sqrt{121}, \sqrt{144}, \dots$$

and  $\sqrt{a^2}, \sqrt{b^2}, \sqrt{c^2}, \sqrt{d^2}, \dots, \sqrt{x^2}, \sqrt{y^2}, \sqrt{z^2}$

Simplifying a square root means to find all perfect square factors that are located inside the square root symbol (radical) and remove them.

Simplify:	$\sqrt{18}$	Example
	$\sqrt{9 \cdot 2}$	Factor out the perfect square 9
	$\sqrt{9} \cdot \sqrt{2}$	Separate the square root of 9 from the square root of 2
	$3\sqrt{2}$	Replace the square root of 9 with the value 3

Simplify:	$\sqrt{75x^3}$	Example
	$\sqrt{25 \cdot 3 \cdot x^2 \cdot x}$	Factor out the perfect squares 25 and $x^2$
	$\sqrt{25} \cdot \sqrt{x^2} \cdot \sqrt{3x}$	Separate the perfect squares of 25 and $x^2$
	$5x\sqrt{3x}$	Replace the square roots of 25 and $x^2$ with 5 and $x$

Simplify:	$\sqrt{48x^3y^6}$	Example
	$\sqrt{16 \cdot 3 \cdot x^2x \cdot y^2y^2y^2}$	Factor out the perfect squares: 16, $x^2$ , $y^2$ , $y^2$ , $y^2$
	$\sqrt{16}\sqrt{x^2}\sqrt{y^2}\sqrt{y^2}\sqrt{y^2}\sqrt{3x}$	Separate the perfect squares of 16, $x^2$ , $y^2$ , $y^2$ , $y^2$
	$4xyyy\sqrt{3x}$	Replace the square roots of 16, $x^2$ , $y^2$ with 4, $x$ , $y$
	$4xy^3\sqrt{3x}$	Simplify the $y$ 's using exponents

Like terms have the same value inside the square root (radical):

<u>Like radicals</u>	<u>Unlike radicals</u>
$\sqrt{2}$ and $3\sqrt{2}$	$\sqrt{2}$ and $\sqrt{11}$
$2\sqrt{5}$ and $7\sqrt{5}$	$3\sqrt{7}$ and $7\sqrt{3}$
$4\sqrt{3m}$ and $7\sqrt{3m}$	$6\sqrt{5r}$ and $7\sqrt{5h}$

Example:  $5\sqrt{7} + 2\sqrt{7} - 4\sqrt{7}$  simplifies to:  $3\sqrt{7}$

Example:  $5\sqrt{3} + 2\sqrt{5x} + 6\sqrt{3} + 4\sqrt{5x}$  simplifies to:  $11\sqrt{3} + 6\sqrt{5x}$