Simplifying Radicals with Variables

Level 1 - Simplify radicals involving integers and variables
Level 2 - Simplify radicals of higher degree

Simplifying radicals means rewriting them in their simplest form. This can be done with numbers and variables.

Reminder:
A **radical** is another name for a **root**, such as a square root ($\sqrt{}$) or cube root ($\sqrt[3]{}$).
A **surd** is a radical simplified to a form where the **radicand** (number or expression under the radical sign) is in its simplest form.

To simplify a radical expression:

1. Factor the number or variable under the radical sign.
2. Look for perfect powers (like squares, cubes, etc., depending on the root).
3. Take out perfect powers from under the radical.

Radicals with **variables** follow the same rules.
We use our knowledge of prime factorization and the exponent laws to simplify.

Helpful Hint:
If the exponent on a variable is equal to or larger than the root's degree, part of it can be taken out of the radical.

Example #1 $\sqrt{81}$	**Example #2** $\sqrt{8x^2}$	**Example #3** $\sqrt{12x^2y}$	**Example #4** $-2\sqrt[3]{16x^4y^5}$
$\sqrt{9^2}$	$\sqrt{2 \ \ 2\cdot 2\cdot x^2}$	$\sqrt{2\cdot 2\cdot 3\cdot x^2\cdot y}$	$-2\sqrt[3]{2\cdot 2\cdot 2\cdot x^3\cdot x \ \ y^3\cdot y^2}$
9	$\sqrt{2\cdot 2^2\cdot x^2}$	$\sqrt{3\cdot 2^2\cdot x^2\cdot y}$	$-2\sqrt[3]{2\cdot 2\cdot 2\cdot x^3\cdot x \ \ y^3\cdot y^2}$
	$2x\sqrt{2}$	$2x\sqrt{3y}$	$-2\cdot 2\cdot x\cdot y\sqrt[3]{2xy^2}$
			$-4xy\sqrt[3]{2xy^2}$

Remember:

- Separate the number and variable parts of the radical before simplifying.
- Use exponent rules: for even roots (like square roots), divide exponents by 2; for cube roots, divide by 3.