Intro to Solving Quadratic Equations

Level 1 - Solve using the Square Root Principle and the Zero Product Property
Level 2 - Solve by factoring and then using the Zero Product Property
Level 3 - Solve by factoring polynomials of higher orders

When solving an equation we are finding the values for the unknown variables that make the equation true.

A **quadratic equation** is an equation that can be written in the form $\mathbf{ax^2 + bx + c = 0}$.

Some equations may look different at first, but can still be solved using similar strategies.

Key Skills:

- **Square Root Principle**: If $x^2 = k$, then $x = \pm \sqrt{k}$.
- **Zero Product Property:** If $a \cdot b = 0$, then $a = 0$ or $b = 0$.
- **Factoring:** Rewriting an expression as a product to apply the Zero Product Property.
- **Higher-Order Factoring:** Some equations involve powers like x^4, but can be simplified by substituting another variable in for x^2.

Example #1	**Example #2**	**Example #3**	**Example #4**
$(x-1)^2 = 16$	$x^2 - 5x = 0$	$x^2 - 6x - 27 = 0$	$x^4 - 5x^2 + 4 = 0$
$x - 1 = \pm 4$ *so,* $x = 5$ *or* $x = -3$	$x(x-5) = 0$ *the zero – product property says :* *if* $a \cdot b = 0$, $a = 0$ *or* $b = 0$ *here,* $a = x$ *and* $b = x - 5$ *so,* $x = 0$ *or* $x - 5 = 0$ $x = 0$ *or* $x = 5$	$(x-9)(x+3) = 0$ $x - 9 = 0$ *or* $x + 3 = 0$ *so,* $x = 9$ *or* $x = -3$	*let* $x^2 = y$ *this gives :* $y^2 - 5y + 4 = 0$ $(y-4)(y-1)$ *so,* $y = 4$ *or* $y = 1$ *since* $y = x^2$ $x^2 = 4$ *or* $x^2 = 1$ *so,* $x = \pm 2$ *or* $x = \pm 1$

Remember:

- Always set the equation equal to zero before factoring.
- Look for common factors first to make factoring easier.
- When you see powers like x^4, check if the equation can be rewritten using x^2.