

Quadratic Equations Cheat Sheet

Comprehensive reference for quadratic equations, factoring, and graphing parabolas.

Three Forms of a Quadratic

Standard Form

Form: $ax^2 + bx + c = 0$

a, b, c are constants, $a \neq 0$

Best for: quadratic formula, factoring

Factored Form

Form: $y = a(x - r)(x - s)$

Roots (x-intercepts) at $x = r$ and $x = s$

Best for: finding zeros/roots

Vertex Form

Form: $y = a(x - h)^2 + k$

Vertex at (h, k)

Best for: finding vertex, graphing

Converting Between Forms

Standard to Vertex: Complete the square

Standard to Factored: Factor or use quadratic formula

Vertex to Standard: Expand $(x - h)^2$ and simplify

Factored to Standard: FOIL and simplify

Solving Methods

The Quadratic Formula

For $ax^2 + bx + c = 0$:

$$x = \frac{-b \pm (b^2 - 4ac)}{2a}$$

Always works for any quadratic. Remember: "negative b , plus or minus the square root, of b squared minus $4ac$, all over $2a$."

Factoring Methods

GCF first: Always factor out the greatest common factor

Simple trinomial: $x^2 + bx + c$: find two numbers that multiply to c and add to b

AC method: $ax^2 + bx + c$: find two numbers that multiply to ac and add to b , then group

Diff. of squares: $a^2 - b^2 = (a + b)(a - b)$

Perfect square: $a^2 + 2ab + b^2 = (a + b)^2$

Completing the Square

1. Start with $ax^2 + bx + c = 0$
2. Move c to the right: $ax^2 + bx = -c$
3. If $a \neq 1$, divide everything by a
4. Take half of b , square it: $(b/2)^2$
5. Add $(b/2)^2$ to both sides
6. Left side becomes $(x + b/2)^2$
7. Solve by taking square root of both sides

The Discriminant: $b^2 - 4ac$

Value	Meaning	Roots
$b^2 - 4ac > 0$	Positive	Two real solutions
$b^2 - 4ac = 0$	Zero	One repeated real solution
$b^2 - 4ac < 0$	Negative	No real solutions

Graphing Parabolas

Opens up: $a > 0$ (minimum at vertex)

Opens down: $a < 0$ (maximum at vertex)

Vertex: $x = -b / 2a$, then find y

Axis of symmetry: $x = -b / 2a$ (vertical line)

y-intercept: Set $x = 0$, $y = c$

x-intercepts: Set $y = 0$, solve for x

Always check: factoring is fastest, but the quadratic formula works every time. Use the discriminant first to know how many solutions to expect.