Quadratic Equations Cheat Sheet

Complete quadratic equations cheat sheet with quadratic formula, factoring methods, completing the square, graphing parabolas, and vertex form. Free PDF download.

Standard Forms

Standard Form

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

General quadratic equation

Vertex Form

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

Vertex at (h, k)

Factored Form

$$y = a(x - r_1)(x - r_2)$$

Roots at r_1 and r_2

Intercept Form

$$y = a(x - p)(x - q)$$

x-intercepts at p and q

The Quadratic Formula

Quadratic Formula

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

Solves $ax^2 + bx + c = 0$

Discriminant

$$D = b^2 - 4ac$$

Determines nature of roots

Two Real Roots

$$D > 0$$

Two distinct real solutions

One Real Root

$$D = 0$$

One repeated real solution

Complex Roots

$$D < 0$$

Two complex conjugate solutions

Vieta's Formulas

Sum of Roots

$$r_1 + r_2 = -\frac{b}{a}$$

Product of Roots

$$r_1 \cdot r_2 = \frac{c}{a}$$

Reconstruct Equation

$$x^2 - (r_1 + r_2)x + r_1 r_2 = 0$$

From known roots

Completing the Square

Step 1

$$ax^2 + bx + c = a\left(x^2 + \frac{b}{a}x\right) + c$$

Factor out a from first two terms

Step 2

$$a\left(x^2 + \frac{b}{a}x + \frac{b^2}{4a^2}\right) + c - \frac{b^2}{4a}$$

Add and subtract $(b/2a)^2$

Step 3

$$a\left(x + \frac{b}{2a}\right)^2 + c - \frac{b^2}{4a}$$

Factor perfect square

Parabola Properties

Vertex x-coordinate

$$h = -\frac{b}{2a}$$

x-value of vertex

Vertex y-coordinate

$$k = f(h) = c - \frac{b^2}{4a}$$

y-value of vertex

Axis of Symmetry

$$x = -\frac{b}{2a}$$

Vertical line through vertex

Direction

$$a > 0 \text{ opens up}, a < 0 \text{ opens down}$$

y-intercept

$$(0, c)$$

Where parabola crosses y-axis

Special Factoring

Difference of Squares

$$x^2 - a^2 = (x + a)(x - a)$$

Perfect Square

$$x^2 + 2ax + a^2 = (x + a)^2$$

AC Method

$$ax^2 + bx + c : \text{find } m, n \text{ where } mn = ac, m + n = b$$

Split middle term