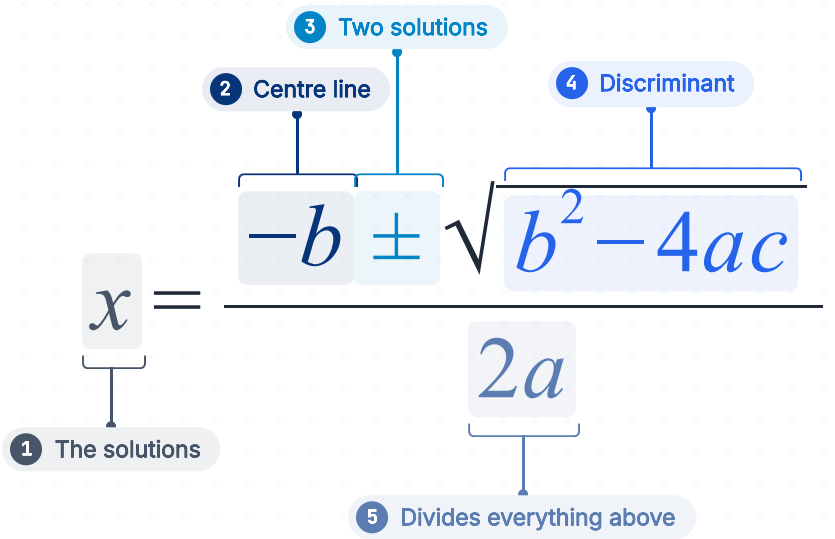
THE FORMULA, PART BY PART

The quadratic formula

completing the square once, in general form: put in a, b, c and read off both solutions



1 The solutions x

What the formula returns: the roots of $ax^2 + bx + c = 0$, the points where the parabola meets the x-axis. Example: for $2x^2 - 3x - 5 = 0$ the formula gives $x = 5/2$ and $x = -1$.

2 Centre line $-b$

Divided by 2a, −b gives the vertex line $x = -b/2a$, halfway between the two solutions. When the discriminant is 0, the single solution sits exactly there. Example: $b = -3$, so $-b = 3$ and the centre is 3/4, halfway between 5/2 and −1.

3 Two solutions $\pm$

One solution adds the square root, the other subtracts it, so the two solutions sit symmetrically around $-b/2a$. Example: $(3 + 7)/4 = 5/2$ and $(3 - 7)/4 = -1$.

4 Discriminant $b^2 - 4ac$

The **discriminant**: positive gives two real solutions, zero gives one, negative gives none. Its square root sets the gap between them, $\sqrt{\Delta} / |a|$. Example: $(-3)^2 - 4(2)(-5) = 49$, $\sqrt{49} = 7$, gap 7/2.

5 Divides everything above $2a$

The whole numerator goes over 2a, and the formula needs $a \neq 0$. Example: $2a = 4$, so all of 3 ± 7 is divided by 4. Dividing only the 7 gives $3 \pm 7/4$, which is wrong.