The **discriminant** is the expression under the radical sign in the quadratic formula.

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

↓

The **discriminant** is

$$b^2 - 4ac$$

What does the value of the **discriminant** tell us?

When the discriminant is **positive**…

If $b^2 - 4ac > 0$ ⟶ the equation has **2 real solutions**

When the discriminant is **zero**…

If $b^2 - 4ac = 0$ ⟶ the equation has **1 real solution**

When the discriminant is **negative**…

If $b^2 - 4ac < 0$ ⟶ the equation has **2 imaginary solutions**

Let's see some examples of calculating discriminants and why we can expect to get these different types (and numbers) of solutions… (go to Page 2!)

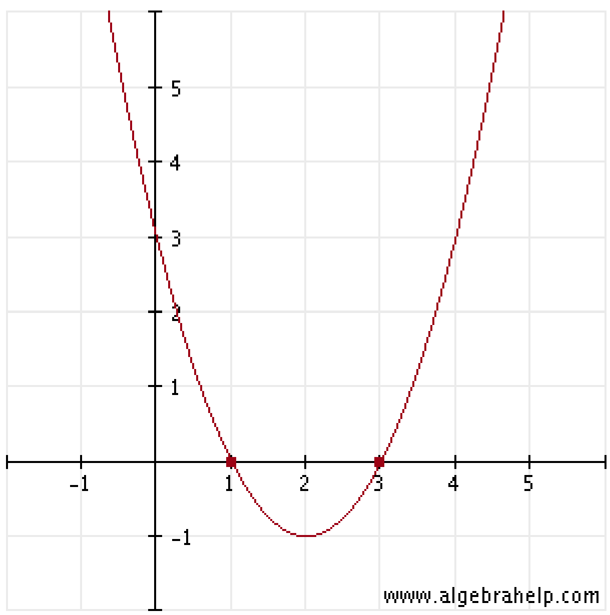
When the discriminant is **positive**…
If $b^2 - 4ac > 0$ ⟶ the equation has **2 real solutions**

Example 1

$$x^2 - 4x + 3 = 0$$

The discriminant is $(-4)^2 - 4(1)(3) = 16 - 12 = \mathbf{4}$**,** so expect **2 real solutions.**

Why?
The graph of $y = x^2 - 4x + 3$ crosses the x-axis **2 times** (when $x = 1$ & $x = 3$).



The 2 real solutions are $\boldsymbol{x = 1, 3}$.

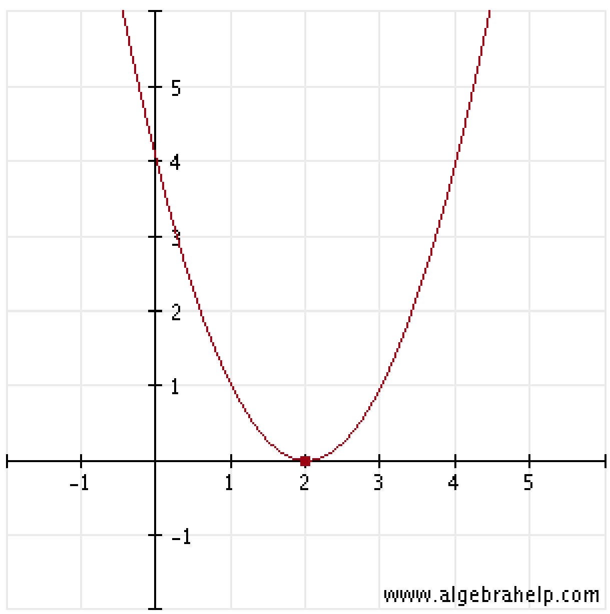
When the discriminant is **zero**…
If $b^2 - 4ac = 0$ ⟶ the equation has **1 real solution**

Example 2

$$x^2 - 4x + 4 = 0$$

The discriminant is $(-4)^2 - 4(1)(4) = 16 - 16 = \mathbf{0}$**,** so expect **1 real solution.**

Why?
The graph of $y = x^2 - 4x + 4$ touches the x-axis **1 time** (when $x = 2$).



The 1 real solution is $\boldsymbol{x = 2}$.

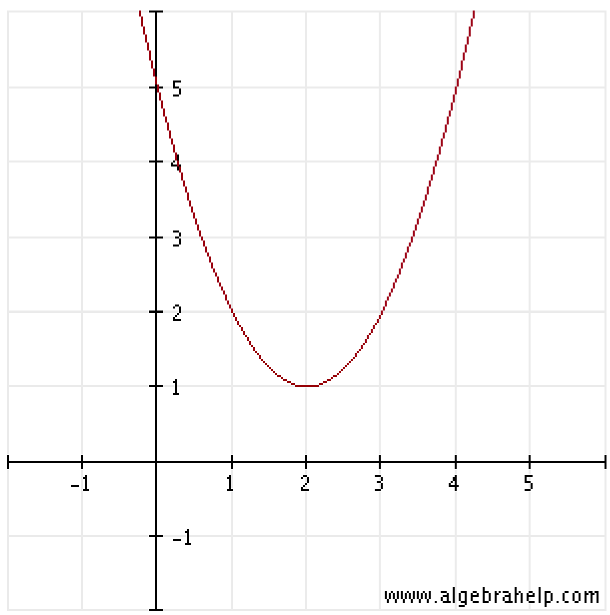
When the discriminant is **negative**…
If $b^2 - 4ac < 0$ ⟶ the equation has **2 imaginary solutions**

Example 3

$$x^2 - 4x + 5 = 0$$

The discriminant is $(-4)^2 - 4(1)(5) = 16 - 20 = -4$**,** so expect **2 imaginary solutions.**

Why?
The graph of $y = x^2 - 4x + 4$ **never touches the x-axis**.



The 2 imaginary solutions are $\boldsymbol{x = 2 \pm i}$.