General Quadratic Equation $\underbrace{ax^2+bx+c=0}_{\text{standard form}}$

$$a\left(x^2+\frac{b}{a}x\right)+c=0$$

$$a\left(x^2+\frac{b}{a}x+\frac{b^2}{4a^2}-\frac{b^2}{4a^2}\right)+c=0$$

① $\frac{b}{a}\cdot\frac{1}{2}=\frac{b}{2a}$

② $\left(\frac{b}{2a}\right)^2=\frac{b^2}{4a^2}$

$$a\left(x^2+\frac{b}{a}x+\frac{b^2}{4a^2}\right)-\frac{b^2}{4a}+c=0$$

$$a\left(x+\frac{b}{2a}\right)^2-\frac{b^2}{4a}+c=0$$

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

$\times 4a$: $\frac{c}{1}=\frac{4ac}{4a}$ ($\times 4a$)

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

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

$\sqrt{4a^2}=2a$

divide by $a\neq 0$

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

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

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

$$x=-\frac{b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a} \rightarrow \boxed{x_{1,2}=\frac{-b\pm\sqrt{b^2-4ac}}{2a}}\ \checkmark$$

radical = root

The Quadratic Formula.

Example: $2x^2-5x+1=0$

$a=2$ $\quad b=-5$ $\quad c=1$

Substitution is a step! $x_{1,2}=\frac{-(-5)\pm\sqrt{(-5)^2-4(2)(1)}}{2(2)}$

$$x_{1,2}=\frac{5\pm\sqrt{25-8}}{4}=\frac{5\pm\sqrt{17}}{4}$$

conjugate pairs!

$$x_1=\frac{5+\sqrt{17}}{4},\quad x_2=\frac{5-\sqrt{17}}{4}$$

$$x_1=\frac{5}{4}+\frac{\sqrt{17}}{4},\quad x_2=\frac{5}{4}-\frac{\sqrt{17}}{4}$$