Solving Quadratic Equation

Intro	$ax^2 + bx + c = 0$ $a\ is\ the\ coefficient\ of\ x^2\ (Quadratic\ term)$ $b\ is\ the\ coefficient\ of\ x^1\ (Linear\ term)$ $c\ is\ the\ coefficient\ of\ x^0\ (Constant\ value)$
1	Type 1: No linear term e.g. 1 $Mth\ 1:\ \ x^2 - 9 = 0$ $x^2 = 9$ $x = \pm 3$ $Mth\ 2:\ \ x^2 - 9 = 0$ $(x + 3)(x - 3) = 0$ $x = \pm 3$ e.g. 2 $\frac{v}{8} = \frac{18}{v}$ $v^2 = 144$ $v = \pm 12$
2	Type 2: No constant term (Note: Do not divide by x, as it will becomes a linear equation instead) e.g. 1 $2x^2 = 7x$ $x(2x - 7) = 0$ $x = 0, x = \frac{7}{2}$
3	Type 3: Solve by Factorization e.g. 1 $3x^2 - 5x - 8 = 0$ $(3x - 8)(x + 1) = 0$ $x = \frac{8}{3}, x = -1$
4	Type 4: Completed Square form $(x + a)^2 = b$ e.g. 1 $(x + 2)^2 = 16$ $x + 2 = \pm 4$ $x = 2, x = -6$

	e.g. 2 $$(3x+2)^2 = 43$$ $$3x+2 = \pm\sqrt{43}$$ $$x = \frac{\sqrt{43}-2}{3}, x = \frac{-\sqrt{43}-2}{3}$$
5	<u>Type 5: Solve by completing Square</u> e.g. 1 $$x^2+8x+9=0$$ $$x^2+8x+4^2 = -9+4^2$$ $$(x+4)^2 = 7$$ $$x+4 = \pm\sqrt{7}$$ $$x = \sqrt{7}-4, \quad x = -\sqrt{7}-4$$ Condition: 1. $Coefficient\ of\ x^2\ must\ be\ 1$ 2. $Add\ coefficient\ of\ x \rightarrow \left(\frac{coefficient\ of\ x^1}{2}\right)^2$ 3. $Works\ for\ negative\ coefficient\ too.$
6	<u>Type 6: Solve by Formulae</u> $$ax^2+bx+c=0$$ $$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$ Prove (Solve by Type 5 Completing square): $$ax^2+bx+c=0$$ $$x^2+\frac{b}{a}x = -\frac{c}{a}$$ $$x^2+\frac{b}{a}x+\left(\frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2-\frac{c}{a}$$ $$x^2+\frac{b}{a}x+\frac{b^2}{4a^2} = \frac{b^2}{4a^2}-\frac{4ac}{4a^2}$$ $$\left(x+\frac{b}{2a}\right)^2 = \frac{b^2}{4a^2}-\frac{4ac}{4a^2}$$

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