Derivation of Quadratic formulae

To derive: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$ax^2 + bx + c = 0$ (general form of quadratic equation)

$4a(ax^2 + bx + c) = 4a(0)$ [multiply both sides by $4a$]

$4a^2x^2 + 4abx + 4ca = 0$

Transfer $4ac$ from LHS to RHS

$4a^2x^2 + 4abx = -4ac$

$(2ax)^2 + 2 \times 2ax \times b = -4ac$

Now add $b^2 - b^2$ in LHS

$(2ax)^2 + 2 \times 2ax \times b + b^2 - b^2 = -4ac$

Transfer $-b^2$ from LHS to RHS

$(2ax)^2 + 2 \times 2ax \times b + b^2 = b^2 - 4ac$

on comparing LHS with $a^2 + 2ab + b^2$

$(2ax)^2 + 2 \times 2ax \times b + b^2 = (2ax + b)^2$

$$(2ax + b)^2 = b^2 - 4ac$$

Now square root both sides

$$\sqrt{(2ax + b)^2} = \pm\sqrt{b^2 - 4ac}$$

$$2ax + b = \pm\sqrt{b^2 - 4ac}$$

$$2ax = -b \pm \sqrt{b^2 - 4ac}$$

Derived

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