

### Steps to Solve a Quadratic Equation by Completing the Square

1. Write out the original problem.
2. Isolate the  $x^2$  and  $x$  terms on the left side of the equation and the right side should have the constant.
3. Divide both sides of the equation by the coefficient of the  $x^2$  term, that is  $a$ , by dividing each term in the entire equation.
4. Go off to the far side of the problem and find one half of the coefficient of the  $x$  term and square this value.
5. Add this squared value to both sides of the equation.
6. On the left side of the equation, factor the trinomial. Fractions may have to be used.
7. The trinomial on the left side will be a perfect square trinomial and when factored will have the form of,  $(x + h)^2$  or  $(x - h)^2$ .
8. Simplify the right side by adding the two constants together.
9. Follow the previous set of steps [**Steps to Solve a Quadratic Equation, in the form of  $a(x + h)^2 = k$ , Using the Square Root Method**]

Example: Solve  $3x^2 + 2x - 6 = 0$  using the method of completing the square.

$$3x^2 + 2x - 6 = 0$$

$$3x^2 + 2x = 6$$

$$\frac{3x^2}{3} + \frac{2x}{3} = \frac{6}{3}$$

$$x^2 + \frac{2}{3}x = 2$$

$$x^2 + \frac{2}{3}x + \frac{1}{9} = 2 + \frac{1}{9}$$

$$\left(x + \frac{1}{3}\right)\left(x + \frac{1}{3}\right) = \frac{18}{9} + \frac{1}{9}$$

$$\left(x + \frac{1}{3}\right)^2 = \frac{19}{9}$$

$$\left(\left(\frac{1}{2}\right)\left(\frac{2}{3}\right)\right)^2 = \left(\frac{1}{3}\right)^2$$
$$= \frac{1}{9}$$

Now we will use the square root method to finish the problem.

$$\left(x + \frac{1}{3}\right)^2 = \frac{19}{9}$$

$$\sqrt{\left(x + \frac{1}{3}\right)^2} = \pm \sqrt{\frac{19}{9}}$$

$$x + \frac{1}{3} = \pm \sqrt{\frac{19}{9}}$$

$$x + \frac{1}{3} = \pm \frac{\sqrt{19}}{\sqrt{9}}$$

$$x + \frac{1}{3} = \pm \frac{\sqrt{19}}{3}$$

$$x = -\frac{1}{3} \pm \frac{\sqrt{19}}{3}$$

$$x = \frac{-1 \pm \sqrt{19}}{3}$$