Completing the Square

1. Make sure the coefficient of x^2 is 1.
2. Take the constant to the other side.
3. Divide the coefficient of x by 2 and square the result, then add to both sides.
4. You just completed the square because now the left side of the equation is a perfect square trinomial.
5. Factor using the factoring formula for perfect square trinomials: $\boldsymbol{x^2 + 2xy + y^2 = (x + y)^2}$ or $\boldsymbol{x^2 - 2xy + y^2 = (x - y)^2}$
6. Take the square root of both sides.
7. Simplify.
8. Solve.

Example: $3x^2 - 18x - 48 = 0$

$3^2 \quad \frac{18}{3} \qquad \frac{48}{3} \quad -()x - = 0$ Step 1

$()\,x$
3

$x^2 - 6x - 16 = 0$

$x^2 - 6x - 16 + 16 = 0 + 16$ Step 2

$x^2 - 6x = 16$

$x^2 - 6x + (^{-6})^2 = 16 + (^{-6})^2$ Step 3
$\quad\quad 2 \qquad\qquad\quad 2$

$x^2 - 6x + 9 = 16 + 9$

$x^2 - 6x + 9 = 25$ Step 4

Step 5 $(x - 3)^2 = 25$

Step $\sqrt{(x - 3)^2} = \pm\sqrt{25}$ 6

$x - 3 = \pm 5$

$x - 3 + 3 = \pm 5 + 3$

$x = \pm 5 + 3$ Step 7

$\boldsymbol{x = 8, x = -2}$ Step 8 Answer

Example: $x^2 - 2x - 2 = 0$

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

$x^{2} - 2x + (\frac{-2}{2})^2 = 2 + (\frac{-2}{2})^2$ Step 3

$x^2 - 2x + 1 = 2 + 1$

Step 4 $x^2 - 2x + 1 = 3$

Step 5 $(x - 1)^2 = 3$

Step 6 $x \quad \sqrt{(x - 1)^2} = \pm\sqrt{3} \quad - 1 = \pm\sqrt{3}$

$x - 1 + 1 = 1 \pm \sqrt{3}$ Step 7

$x = 1 + \sqrt{3},\ x = 1 - \sqrt{3}$ Step 8 Answer

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