Pearson Edexcel

Solving quadratic equations

> **A LEVEL LINKS**
> **Scheme of work:** 1b. Quadratic functions – factorising, solving, graphs and the discriminants

Key points

- A quadratic equation is an equation in the form $ax^2 + bx + c = 0$ where $a \neq 0$.
- To factorise a quadratic equation find two numbers whose sum is b and whose products is ac.
- When the product of two numbers is 0, then at least one of the numbers must be 0.
- If a quadratic can be solved it will have two solutions (these may be equal).

Example 2   Solve $2x^2 - 7x - 12 = 0$. Give your solutions in surd form.

	(You can use the Quadratic formula or complete the square)
$2x^2 - 7x - 12 = 0$	**1** Before completing the square write $ax^2 + bx + c$ in the form $$a\left(x^2 + \frac{b}{a}x\right) + c$$
$2\left(x^2 - \frac{7}{2}x\right) - 12 = 0$	
$2\left[\left(x - \frac{7}{4}\right)^2 - \left(\frac{7}{4}\right)^2\right] - 12 = 0$	**2** Now complete the square by writing $x^2 - \frac{7}{2}x$ in the form $$\left(x + \frac{b}{2a}\right)^2 - \left(\frac{b}{2a}\right)^2$$
$2\left(x - \frac{7}{4}\right)^2 - \frac{49}{8} - 12 = 0$	**3** Expand the square brackets.
$2\left(x - \frac{7}{4}\right)^2 - \frac{145}{8} = 0$	**4** Simplify.
$2\left(x - \frac{7}{4}\right)^2 = \frac{145}{8}$	**5** Rearrange the equation to work out x. First, add $\frac{145}{8}$ to both sides.
$\left(x - \frac{7}{4}\right)^2 = \frac{145}{4}$	**6** Divide both sides by 2.
$x - \frac{7}{4} = \pm\frac{\sqrt{145}}{2}$	**7** Square root both sides. Remember that the square root of a value gives two answers.
$x = \frac{7}{4} \pm \frac{\sqrt{145}}{2}$	**8** Add $\frac{7}{4}$ to both sides.

So $x = \dfrac{7}{4} - \dfrac{\sqrt{145}}{2}$ **or** $x = \dfrac{7}{4} + \dfrac{\sqrt{145}}{2}$	**9** Write down both the solutions.

Practice questions

1 Solve

    a $6x^2 + 4x = 0$ **b** $2x^2 - 7x - 4 = 0$

    c $3x^2 - 13x - 10 = 0$ **d** $3x(x - 1) = 2(x + 1)$

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

Answers

1   **a** $x = 0$ or $x = -\dfrac{2}{3}$ b $x = -\dfrac{1}{2}$ or $x = 4$

     c $x = -\dfrac{2}{3}$ or $x = 5$ d $x = -\dfrac{1}{3}$ or $x = 2$

2 $\dfrac{-6 \pm \sqrt{6^2 - 4 \times 3 \times -2}}{2 \times 3}$

      $(x + 1)^2 - 1 - \dfrac{2}{3} = 0$

      $x = 0.29$ and $x = -2.29$