Pearson
Edexcel

Complete the square

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

Key points

- Completing the square lets you write a quadratic equation in the form $p(x + q)^2 + r$

Examples

Example 1   Complete the square for the expression $x^2 + 6x$

$x^2 + 6x$ $= \left(x + \dfrac{6}{2}\right)^2 - \left(\dfrac{6}{2}\right)^2$ $= (x + 3)^2 - 9$	**1** Write $x^2 + bx + c$ in the form $\left(x + \dfrac{b}{2}\right)^2 - \left(\dfrac{b}{2}\right)^2 + c$ **2** Simplify.

Example 2   Complete the square for the expression $2x^2 - 7x$

$2x^2 - 7x$ $= 2\left(x^2 - \dfrac{7}{2}x\right)$ $= 2\left[\left(x - \dfrac{7}{4}\right)^2 - \left(\dfrac{7}{4}\right)^2\right]$ $= 2\left(x - \dfrac{7}{4}\right)^2 - \dfrac{49}{8}$	**1** Before completing the square write $ax^2 + bx + c$ in the form $a\left(x^2 + \dfrac{b}{a}x\right) + c$ **2** Now complete the square by writing $x^2 - \dfrac{7}{2}x$ in the form $\left(x + \dfrac{b}{2a}\right)^2 - \left(\dfrac{b}{2a}\right)^2$ **3** Expand and Simplify

Practice questions

1 Complete the square for the following expressions:

   a $x^2 + 8x$ **b** $x^2 - 10x$ **c** $x^2 - x$

   d $3x^2 - 15x$ **e** $12x - 2x^2$

Answers

1 Solve by completing the square.

   a $(x + 4)^2 - 16$ **b** $(x - 5)^2 - 25$ **c** $\left(x - \dfrac{1}{2}\right)^2 - \dfrac{1}{4}$

   d $3\left(x - \dfrac{5}{2}\right)^2 - \dfrac{75}{4}$ **e** $-2(x - 3)^2 + 18$