

# A level Maths

## Summer Assignment

EDEXCEL 9MAO

<https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html>

### 1b-2 Completing the square

#### A LEVEL LINKS

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

### Key points

- Completing the square for a quadratic rearranges  $ax^2 + bx + c$  into the form  $p(x + q)^2 + r$
- If  $a \neq 1$ , then factorise using  $a$  as a common factor.

### Examples

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

|   |  |
|---|--|
| $x^2 + 6x - 2$ $= (x + 3)^2 - 9 - 2$ $= (x + 3)^2 - 11$ | <ol style="list-style-type: none"> <li>1 Write <math>x^2 + bx + c</math> in the form <math>\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c</math></li> <li>2 Simplify</li> </ol> |
|---|--|

**Example 2** Write  $2x^2 - 5x + 1$  in the form  $p(x + q)^2 + r$

|  |  |
|--|--|
| $2x^2 - 5x + 1$ $= 2\left(x^2 - \frac{5}{2}x\right) + 1$ $= 2\left[\left(x - \frac{5}{4}\right)^2 - \left(\frac{5}{4}\right)^2\right] + 1$ $= 2\left(x - \frac{5}{4}\right)^2 - \frac{25}{8} + 1$ $= 2\left(x - \frac{5}{4}\right)^2 - \frac{17}{8}$ | <ol style="list-style-type: none"> <li>1 Before completing the square write <math>ax^2 + bx + c</math> in the form <math>a\left(x^2 + \frac{b}{a}x\right) + c</math></li> <li>2 Now complete the square by writing <math>x^2 - \frac{5}{2}x</math> in the form <math>\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2</math></li> <li>3 Expand the square brackets – don't forget to multiply <math>\left(\frac{5}{4}\right)^2</math> by the factor of 2</li> <li>4 Simplify</li> </ol> |
|--|--|

## Practice

1 Write the following quadratic expressions in the form  $(x + p)^2 + q$

a  $x^2 + 4x + 3$

b  $x^2 - 10x - 3$

c  $x^2 - 8x$

d  $x^2 + 6x$

e  $x^2 - 2x + 7$

f  $x^2 + 3x - 2$

2 Write the following quadratic expressions in the form  $p(x + q)^2 + r$

a  $2x^2 - 8x - 16$

b  $4x^2 - 8x - 16$

c  $3x^2 + 12x - 9$

d  $2x^2 + 6x - 8$

3 Complete the square.

a  $2x^2 + 3x + 6$

b  $3x^2 - 2x$

c  $5x^2 + 3x$

d  $3x^2 + 5x + 3$

## Extend

4 Write  $(25x^2 + 30x + 12)$  in the form  $(ax + b)^2 + c$ .

**Answers**

1 a  $(x+2)^2 - 1$

b  $(x-5)^2 - 28$

c  $(x-4)^2 - 16$

d  $(x+3)^2 - 9$

e  $(x-1)^2 + 6$

f  $\left(x + \frac{3}{2}\right)^2 - \frac{17}{4}$

2 a  $2(x-2)^2 - 24$

b  $4(x-1)^2 - 20$

c  $3(x+2)^2 - 21$

d  $2\left(x + \frac{3}{2}\right)^2 - \frac{25}{2}$

3 a  $2\left(x + \frac{3}{4}\right)^2 + \frac{39}{8}$

b  $3\left(x - \frac{1}{3}\right)^2 - \frac{1}{3}$

c  $5\left(x + \frac{3}{10}\right)^2 - \frac{9}{20}$

d  $3\left(x + \frac{5}{6}\right)^2 + \frac{11}{12}$

4  $(5x+3)^2 + 3$