

## Completing the Square (a = 1)

### Starter

1. **(Review of Y10 material)** Solve  $x^2 + 7x + 12 = 0$  by factorising.
2. Solve the equations, giving your answers to 3 s.f.:  
(a)  $(x + 3)^2 - 5 = 0$  (b)  $(x - 7)^2 - 6 = 0$  (c)  $(x - 2)^2 + 11 = 0$   
**Hint:** Rearrange to make  $x$  the subject.

### Notes

As we can see from the starter some quadratic expressions do not factorise so we need another way to be able to solve them.

If we can get the expression into the form  $(x + p)^2 - q$ , we can solve the equation by simply rearranging.

The method of getting the quadratic into the form  $(x + p)^2 - q$  is called **completing the square**.

- E.g. 1**
- (a) Expand the bracket and collect like terms:
    - (i)  $(x + 3)^2 - 5$
    - (ii)  $(x + 4)^2 - 6$
  - (b) What do you notice about the number in the bracket?

### Success criteria – completing the square

1. Halve the coefficient of  $x$  to get the number in the bracket
2. Subtract the square of the number in the bracket
3. Do the arithmetic

**E.g. 2** Express  $x^2 - 6x + 11$  in completed square form.

#### Working:

$$x^2 - 6x + 11 \equiv (x - 3)^2 \dots$$

$$x^2 - 6x + 11 \equiv (x - 3)^2 - (-3)^2 + 11$$

$$\equiv (x - 3)^2 - 9 + 11$$

$$\equiv (x - 3)^2 + 2$$

*Halve coefficient of  $x$*

*Subtract square of number in bracket*

*We always subtract a number*

*Do the arithmetic*

**E.g. 3** Complete the square: (a)  $x^2 + 2x + 2$  (b)  $x^2 + 4x + 7$  (c)  $x^2 - 10x + 64$

**E.g. 4** Complete the square: (a)  $x^2 + 5x + 12$  (b)  $x^2 - 7x - 1$

**Working:** (a)  $x^2 + 5x + 12 \equiv (x + 2.5)^2 - 2.5^2 + 12$

$$\equiv (x + 2.5)^2 - 6.25 + 12$$

$$\equiv (x + 2.5)^2 + 5.75$$

**Video:** [Completing the square](#)

[Solutions to Starter and E.g.s](#)

### Exercise

9-1 class textbook: p398 E12.4 Qu 1-9

A\*-G class textbook: p358 E12.2 Qu 1-9

9-1 homework book: p135 E12.4 Qu 1-3

A\*-G homework book: p100 E12.2 Qu 1-3

### Summary

Completing the square:

1. Halve the coefficient of  $x$  to get the number in the bracket
2. Subtract the square of the number in the bracket
3. Do the arithmetic

[Homework book answers \(only available during a lockdown\)](#)

