

# Chapter 2 – Quadratics

## ? Example 1 – Solving quadratic equations

Solve the following equations:

- a.  $x^2 - 2x - 15 = 0$       b.  $x^2 = 9x$       c.  $6x^2 + 13x - 5 = 0$   
d.  $x^2 - 5x + 18 = 2 + 3x$

## ? Example 2 – Solving quadratic equations without factorising

Solve the following equations:

- a.  $(2x - 3)^2 = 25$       b.  $(x - 3)^2 = 7$

## ? Example 3 – Quadratic formula to solve quadratic equations

Solve  $3x^2 - 7x - 1 = 0$  by using the formula.

## ? Example 4 – Completing the square

Complete the square for the expressions:

- a.  $x^2 + 8x$       b.  $x^2 - 3x$       c.  $2x^2 - 12x$

## ? Example 5 – Completing the square in the form $p(x + q)^2 + r$

Write  $3x^2 + 6x + 1$  in the form  $p(x + q)^2 + r$ , where  $p$ ,  $q$  and  $r$  are integers to be found.

## ? Example 6 – Solving quadratics by completing the square

Solve the equation  $x^2 + 8x + 10 = 0$  by completing the square.  
Give your answers in surd form.

## ? Example 7 – Solving quadratic equations

Solve the equation  $2x^2 - 8x + 7 = 0$ . Give your answers in surd form.

## ? Example 8 – Substituting into functions

The functions  $f$  and  $g$  are given by  $f(x) = 2x - 10$  and  $g(x) = x^2 - 9$ ,  $x \in \mathbb{R}$ .

- a. Find the values of  $f(5)$  and  $g(10)$ .  
b. Find the value of  $x$  for which  $f(x) = g(x)$ .

## ? Example 9 – Finding roots using functions

The function  $f$  is defined as  $f(x) = x^2 + 6x - 5$ ,  $x \in \mathbb{R}$ .

- a. Write  $f(x)$  in the form  $(x + p)^2 + q$ .  
b. Hence, or otherwise, find the roots of  $f(x)$ , leaving your answers in surd form.  
c. Write down the minimum value of  $f(x)$ , and state the value of  $x$  for which it occurs.

## ? Example 10 – Finding roots using functions

Find the roots of the function  $f(x) = x^6 + 7x^3 - 8$ ,  $x \in \mathbb{R}$ .

## ? Example 11 – Sketching quadratics

Sketch the graph of  $y = x^2 - 5x + 4$ , and find the coordinates of its turning point.

## ? Example 12 – Sketching quadratics without roots

Sketch the graph of  $y = 4x - 2x^2 - 3$ . Find the coordinates of its turning point and write down the equation of its line of symmetry.

## ? Example 13 – The discriminant: equal roots

Find the values of  $k$  for which  $f(x) = x^2 + kx + 9$  has equal roots.

## ? Example 14 – The discriminant: two distinct roots

Find the range of values of  $k$  for which  $x^2 + 4x + k = 0$  has two distinct real solutions.

## ? Example 15 – Modelling with quadratics

A spear is thrown over level ground from the top of a tower.

The height, in metres, of the spear above the ground after  $t$  seconds is modelled by the function:

$$h(t) = 12.25 + 14.7t - 4.9t^2, t \geq 0$$

- a. Interpret the meaning of the constant term 12.25 in the model.  
b. After how many seconds does the spear hit the ground?  
c. Write  $h(t)$  in the form  $A - B(t - C)^2$ , where  $A$ ,  $B$  and  $C$  are constants to be found.  
d. Using your answer to part c or otherwise, find the maximum height of the spear above the ground, and the time at which this maximum height is reached.