

# The discriminant: equal roots

**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  $a \neq 0$ .
- For the quadratic function  $f(x) = a(x + p)^2 + q$ , the graph of  $y = f(x)$  has a turning point at  $(-p, q)$ .
- For the quadratic equation  $ax^2 + bx + c = 0$ , the expression  $b^2 - 4ac$  is called the discriminant. The value of the discriminant shows how many roots  $f(x)$  has:
  - If  $b^2 - 4ac > 0$  then the quadratic function has two distinct real roots.
  - If  $b^2 - 4ac = 0$  then the quadratic function has one repeated real root.
  - If  $b^2 - 4ac < 0$  then the quadratic function has no real roots.

## Practice questions

1 The equation  $x^2 + 3pq + p = 0$ , where  $p$  is a non-zero constant, has equal roots.

Find the value of  $p$ .

2 The equation  $x^2 + 2px + (3p + 4) = 0$ , where  $p$  is a positive constant, has equal roots.

(a) Find the value of  $p$ .

(b) For this value of  $p$ , solve the equation  $x^2 + 2px + (3p + 4) = 0$ .

3 Given that the equation  $kx^2 + 12x + k = 0$ , where  $k$  is a positive constant, has equal roots, find the value of  $k$ .

## Answers

1  $p = \frac{4}{9}$

2 (a)  $p = 4$

(b)  $x = -4$

3  $k = 6$