

# Quadratic Equations

# Key points

## Key points and concepts

- There are three methods of solving quadratic equations:

- (i) **quadratic factorisation**, where we can write

$$ax^2 + bx + c = a(x - p)(x - q) \text{ when } p \text{ and } q \text{ are rational numbers}$$

which has solution  $x = p$  or  $x = q$

- (ii) **formula**  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

- (iii) **completing the square**, where we write

$$ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c$$

- Note that if  $(x - a)(x - b) = 0$ , then either  $x - a = 0$  or  $x - b = 0$ , giving  $x = a$  or  $x = b$ .
- Quadratic equations have 2, 1 or 0 real roots according to the value of " $b^2 - 4ac$ ":
  - (i) If  $b^2 > 4ac$ , there are 2 real distinct roots
  - (ii) If  $b^2 = 4ac$ , there is 1 (repeated) real root
  - (iii) If  $b^2 < 4ac$ , there are no real roots.