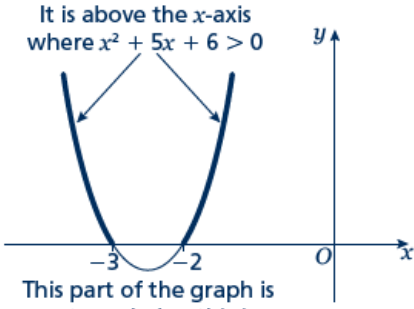# Quadratic inequalities

> **A LEVEL LINKS**
> **Scheme of work:** 1d. Inequalities – linear and quadratic (including graphical solutions)
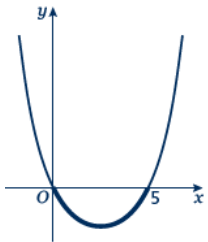
Key points

- First replace the inequality sign by = and solve the quadratic equation.
- Sketch the graph of the quadratic function.
- Use the graph to find the values which satisfy the quadratic inequality.
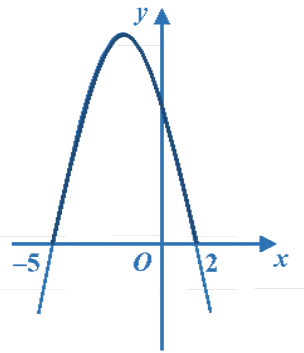
Examples

Example 1   Find the set of values of x which satisfy $x^2 + 5x + 6 > 0$

$x^2 + 5x + 6 = 0$ $(x + 3)(x + 2) = 0$ $x = -3$ or $x = -2$	**1** Solve the quadratic equation by factorising.
It is above the x-axis where $x^2 + 5x + 6 > 0$ This part of the graph is not needed as this is where $x^2 + 5x + 6 < 0$ $x < -3$ or $x > -2$	**2** Sketch the graph of $y = (x + 3)(x + 2)$ **3** Identify on the graph where $x^2 + 5x + 6 > 0$, i.e. where $y > 0$
	4 Write down the values which satisfy the inequality $x^2 + 5x + 6 > 0$

Example 2   Find the set of values of x which satisfy $x^2 - 5x \leq 0$

$x^2 - 5x = 0$ $x(x - 5) = 0$ $x = 0$ or $x = 5$ $0 \le x \le 5$	**1** Solve the quadratic equation by factorising. **2** Sketch the graph of $y = x(x - 5)$ **3** Identify on the graph where $x^2 - 5x \le 0$, i.e. where $y \le 0$ **4** Write down the values which satisfy the inequality $x^2 - 5x \le 0$

Example 3 Find the set of values of x which satisfy $-x^2 - 3x + 10 \ge 0$

$-x^2 - 3x + 10 = 0$ $(-x + 2)(x + 5) = 0$ $x = 2$ or $x = -5$ $-5 \le x \le 2$	**1** Solve the quadratic equation by factorising. **2** Sketch the graph of $y = (-x + 2)(x + 5) = 0$ **3** Identify on the graph where $-x^2 - 3x + 10 \ge 0$, i.e. where $y \ge 0$ **3** Write down the values which satisfy the inequality $-x^2 - 3x + 10 \ge 0$

Practice

1   Find the set of values of x for which $(x + 7)(x - 4) \le 0$

2   Find the set of values of x for which $x^2 - 4x - 12 \ge 0$

3   Find the set of values of x for which $2x^2 - 7x + 3 < 0$

4   Find the set of values of x for which $4x^2 + 4x - 3 > 0$

5   Find the set of values of x for which $12 + x - x^2 \geq 0$

Extend

Find the set of values which satisfy the following inequalities.

6 $x^2 + x \leq 6$

7 $x(2x - 9) < -10$

8 $6x^2 \geq 15 + x$

Answers

1                         $-7 \leq x \leq 4$

2                         $x \leq -2 \text{ or } x \geq 6$

3                         $\dfrac{1}{2} < x < 3$

4                         $x < -\dfrac{3}{2} \text{ or } x > \dfrac{1}{2}$

5                         $-3 \leq x \leq 4$

6                         $-3 \leq x \leq 2$

7     $2 < x < 2\dfrac{1}{2}$

8     $x \leq -\dfrac{3}{2} \text{ or } x \geq \dfrac{5}{3}$