**Linear inequalities**

**A LEVEL LINKS**

**Scheme of work:** 1d. Inequalities – linear and quadratic (including graphical solutions)

Key points

* Solving linear inequalities uses similar methods to those for solving linear equations.
* When you multiply or divide an inequality by a negative number you need to reverse the inequality sign, e.g. < becomes >.

Examples

**Example 1** Solve −8 ≤ 4*x* < 16

|  |  |
| --- | --- |
| −8 ≤ 4*x* < 16  −2 ≤ *x*  < 4 | Divide all three terms by 4. |

**Example 2** Solve 4 ≤ 5*x* < 10

|  |  |
| --- | --- |
| 4 ≤ 5*x* < 10  ≤ *x* < 2 | Divide all three terms by 5. |

**Example 3** Solve 2*x* − 5 < 7

|  |  |
| --- | --- |
| 2*x* − 5 < 7  2*x* < 12  *x* < 6 | **1** Add 5 to both sides.  **2** Divide both sides by 2. |

**Example 4** Solve 2 − 5*x* ≥ −8

|  |  |
| --- | --- |
| 2 − 5*x* ≥ −8  −5*x* ≥ −10  *x* ≤ 2 | **1** Subtract 2 from both sides.  **2** Divide both sides by −5.  Remember to reverse the inequality when dividing by a negative number. |

**Example 5** Solve 4(*x* − 2) > 3(9 − *x*)

|  |  |
| --- | --- |
| 4(*x* − 2) > 3(9 − *x*)  4*x* − 8 > 27 − 3*x*  7*x* − 8 > 27  7*x* > 35  *x* > 5 | **1** Expand the brackets.  **2** Add 3*x* to both sides.  **3** Add 8 to both sides.  **4** Divide both sides by 7. |

Practice

**1** Solve these inequalities.

**a** 4*x* > 16 **b** 5*x* – 7 ≤ 3 **c** 1 ≥ 3*x* + 4

**d** 5 – 2*x* < 12 **e**  **f** 8 < 3 – 

**2** Solve these inequalities.

**a**  **b** 10 ≥ 2*x* + 3 **c** 7 – 3*x* > –5

**3** Solve

**a** 2 – 4*x* ≥ 18 **b** 3 ≤ 7*x* + 10 < 45 **c** 6 – 2*x* ≥ 4

**d** 4*x* + 17 < 2 – *x* **e** 4 – 5*x* < –3*x* **f** –4*x* ≥ 24

**4** Solve these inequalities.

**a** 3*t* + 1 < *t* + 6 **b** 2(3*n* – 1) ≥ *n* + 5

**5** Solve.

**a** 3(2 – *x*) > 2(4 – *x*) + 4 **b** 5(4 – *x*) > 3(5 – *x*) + 2

Extend

**6** Find the set of values of *x* for which 2*x* + 1 > 11 and 4*x* – 2 > 16 – 2*x*.

Answers

**1** **a** *x* > 4 **b** *x* ≤ 2 **c** *x* ≤ –1

**d** *x* > – **e** *x* ≥ 10 **f** *x* < –15

**2 a** *x* < –20 **b** *x* ≤ 3.5 **c** *x* < 4

**3 a** *x* ≤ –4 **b** –1 ≤ *x* < 5 **c** *x* ≤ 1

**d** *x* < –3 **e** *x* > 2 **f** *x* ≤ –6

**4 a** *t* <  **b** *n* ≥ 

**5 a** *x* < –6 **b** *x* < 

**6** *x* > 5 (which also satisfies *x* > 3)