IGCSE MATHEMATICS 0580 · CHAPTER 4 NOTES · ~21 MIN READ

Equations & inequalities

Solve linear, simultaneous and quadratic equations and inequalities with confidence. Balance diagrams, graphs and step-by-step methods show you what each answer really means.

Linear equations | Simultaneous equations | Quadratic equations | Quadratic formula | Completing the square | Inequalities

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No tag = **Core** (everyone) EXTENDED Extended only highlight = comes up again and again

Test yourself at the end

IN 30 SECONDS

- An equation is a **balance**: whatever you do to one side you must do to the **other**. To solve, **undo the operations in reverse order** and **check** the answer.
- **Simultaneous equations** are solved where two lines **cross**. Use **elimination** (make a letter match, then add or subtract) or **substitution**.
- **Quadratics** are solved by **factorising**, the **formula** or **completing the square**. **Inequalities** are solved like equations, but **flip the sign** when multiplying or dividing by a **negative**.

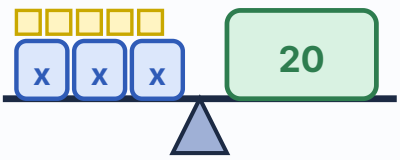
BY THE END YOU CAN

- Solve linear equations, including brackets, fractions and unknowns on both sides.
- Form and solve equations from words.
- Solve two simultaneous linear equations by graph, elimination and substitution.
- Solve linear inequalities and show them on a number line.
- Solve quadratic equations by factorising, using the formula and by completing the square. EXT
- Solve simultaneous equations where one is linear and one is quadratic. EXT
- Show inequalities as regions on a graph, and solve quadratic inequalities. EXT

1 Linear equations

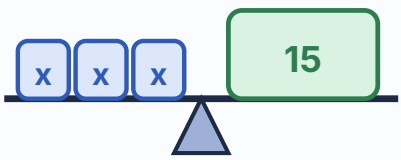
Solving step by step

An equation is a balance: do the same to both sides



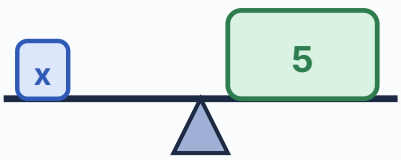
3x + 5 = 20

start



3x = 15

– 5 from both sides



x = 5

÷ 3 on both sides

Keep the balance level: do exactly the same to both sides until x is on its own.

Equation — a statement that two expressions are equal. To **solve** it means to find the value(s) of the letter that make it **true**.

- **Order:** (1) expand any **brackets**; (2) collect the **x-terms on one side** and the **numbers on the other**; (3) **divide** to get x.
- **Undo + and – first, then × and ÷.** Reverse BIDMAS.
- **Check:** put your answer back into the **original** equation. Both sides must match.

WORKED EXAMPLE

Solve 3x + 5 = 20.

1. subtract 5 from both sides: 3x = 15
2. divide both sides by 3: **x = 5**
3. **check: 3(5) + 5 = 20 ✓**

WORKED EXAMPLE

Solve 4(2x – 3) = 20.

1. expand: 8x – 12 = 20
2. add 12: 8x = 32
3. divide by 8: **x = 4**
4. **check: 4(8 – 3) = 20 ✓**

WORKED EXAMPLE

Solve 7x – 4 = 3x + 20.

1. subtract 3x from both sides: 4x – 4 = 20
2. add 4: 4x = 24
3. **divide by 4: x = 6**

WORKED EXAMPLE

Solve $\frac{x}{3} + 2 = 7$.

1. subtract 2: $\frac{x}{3} = 5$
2. **multiply both sides by 3: x = 15**

Riyaz Sir

Unknowns on both sides and fractions

Unknown on both sides

$5x - 3 = 2x + 9$

↓ $- 2x$

$3x - 3 = 9$

↓ $+ 3$

$3x = 12$

↓ $\div 3$

$x = 4$

check: $5(4) - 3 = 17$ and $2(4) + 9 = 17$ ✓

With fractions

$(x + 1) \div 2 = (x - 2) \div 3$

↓ $\times 6$ (the LCM)

$3(x + 1) = 2(x - 2)$

↓ expand

$3x + 3 = 2x - 4$

↓ $- 2x$ and $- 3$

$x = -7$

check: $-6 \div 2 = -3$ and $-9 \div 3 = -3$ ✓

With fractions, multiply every term by the lowest common multiple of the denominators to clear them.

- **Fractions:** multiply **both sides** by the LCM of the denominators. **Every term** must be multiplied, not just one.
- **Keep the x-terms positive** when you can: move the **smaller** x-term across. This avoids sign mistakes.

WORKED EXAMPLE

Solve $\frac{x + 3}{2} - \frac{x - 1}{4} = 3$.

1. multiply every term by 4: $2(x + 3) - (x - 1) = 12$
2. expand (watch the minus): $2x + 6 - x + 1 = 12$
3. collect: $x + 7 = 12$
4. **$x = 5$**
5. **check: $8 \div 2 - 4 \div 4 = 4 - 1 = 3$ ✓**

COMMON MISTAKE

Expanding $-(x - 1)$ as $-x - 1$. The minus changes **both** signs: $-(x - 1) = -x$ **$+ 1$**.

Forming equations from words

- **Let** a letter stand for the unknown, write what you know as an **expression**, set up an **equation**, solve it and **answer the question**.

WORKED EXAMPLE

The sides of a triangle are x, x + 3 and 2x − 1 cm. The perimeter is 30 cm. Find the sides.

1. perimeter: $x + (x + 3) + (2x - 1) = 30$
2. $4x + 2 = 30$
3. $4x = 28$, so **$x = 7$**
4. sides: **7 cm, 10 cm, 13 cm**
5. **(7 + 10 + 13 = 30 ✓)**

WORKED EXAMPLE

Sam is 3 times as old as his daughter. In 4 years the sum of their ages will be 52. How old is Sam now?

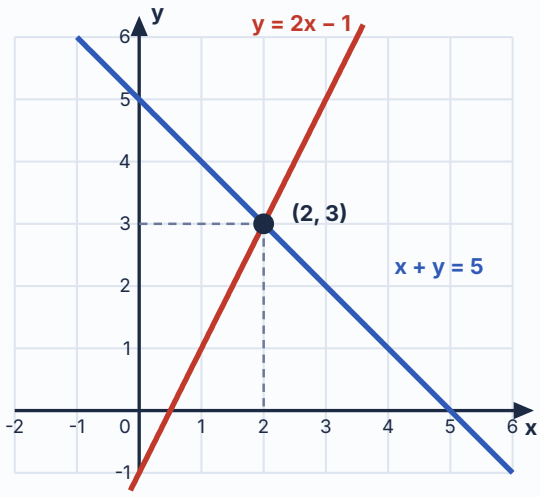
1. daughter = d, Sam = 3d
2. in 4 years: $(d + 4) + (3d + 4) = 52$
3. $4d + 8 = 52$, so $d = 11$
4. **Sam = 3 × 11 = 33 years old**

EXAM TIP

Always **answer the question asked**: x is often not the final answer. Check by putting the values back into the **words** of the question.

2 Simultaneous equations

Solving by graph



Each line is all the points that fit one equation.
Where the lines cross, both equations are true:
x = 2 and y = 3
check: 2 + 3 = 5 ✓
2(2) – 1 = 3 ✓

Every point on a line fits that line's equation. The crossing point fits both.

- **Simultaneous** means "at the same time": find the values of **x and y** that make **both** equations true.
- **Graph method:** draw both lines. The **coordinates of the crossing point** are the solution.
- **Parallel lines** never cross, so there is **no solution**.

Elimination and substitution

Elimination

(1) 3x + 2y = 12

(2) x + y = 5

(2) × 2: 2x + 2y = 10 (3)

(1) – (3): x = 2

put x = 2 in (2): 2 + y = 5

y = 3

same signs: subtract, different: add

Substitution

(1) y = 2x – 1

(2) x + y = 5

replace y in (2):

x + (2x – 1) = 5

3x = 6, so x = 2

y = 2(2) – 1 = 3

one equation must give x or y

Both methods give x = 2 and y = 3.
Check in the equation you did not use.

Elimination removes one letter by adding or subtracting. Substitution replaces one letter using the other equation.

- **Elimination:** (1) make the coefficients of one letter the **same size** (multiply an equation); (2) **same signs: subtract; different signs: add**; (3) solve; (4) substitute back to find the other letter.
- **Substitution:** use when one equation already gives **y = ...** or **x = ...** Put it into the other equation.
- **Always check** in the equation you did **not** use to find the second letter.

WORKED EXAMPLE

Solve 2x + y = 7 and x − y = 2.

1. the y terms have **different signs**: add the equations
2. 3x = 9, so **x = 3**
3. put in (1): 6 + y = 7, so **y = 1**
4. **check in (2): 3 − 1 = 2 ✓**

WORKED EXAMPLE

Solve 2x + 3y = 13 and 5x − 2y = 4.

1. (1) × 2: 4x + 6y = 26
2. (2) × 3: 15x − 6y = 12
3. different signs: add: 19x = 38, so **x = 2**
4. put in (1): 4 + 3y = 13, so **y = 3**
5. **check in (2): 10 − 6 = 4 ✓**

WORKED EXAMPLE

Solve x = y + 2 and 3x + y = 14.

1. substitute x: 3(y + 2) + y = 14
2. 4y + 6 = 14, so **y = 2**
3. x = 2 + 2 = **4**
4. **check: 12 + 2 = 14 ✓**

WORKED EXAMPLE

2 pens and 3 notebooks cost £9. 3 pens and 1 notebook cost £6.50. Find the cost of each.

1. let a pen cost p and a notebook cost n: 2p + 3n = 9 and 3p + n = 6.5
2. from (2): n = 6.5 − 3p
3. substitute: 2p + 3(6.5 − 3p) = 9
4. 2p + 19.5 − 9p = 9, so −7p = −10.5
5. **p = £1.50, n = £2.00**

One linear and one quadratic

EXTENDED

- EXT **Substitute** the linear equation into the quadratic, solve the **quadratic**, then find **y** for **each** x. You normally get **two pairs** of answers.

WORKED EXAMPLE

EXT **Solve y = x + 1 and $y = x^2 - 5$.**

1. set equal: $x^2 - 5 = x + 1$
2. $x^2 - x - 6 = 0$
3. $(x - 3)(x + 2) = 0$
4. x = 3 or x = −2
5. **y = x + 1: (3, 4) and (−2, −1)**

WORKED EXAMPLE

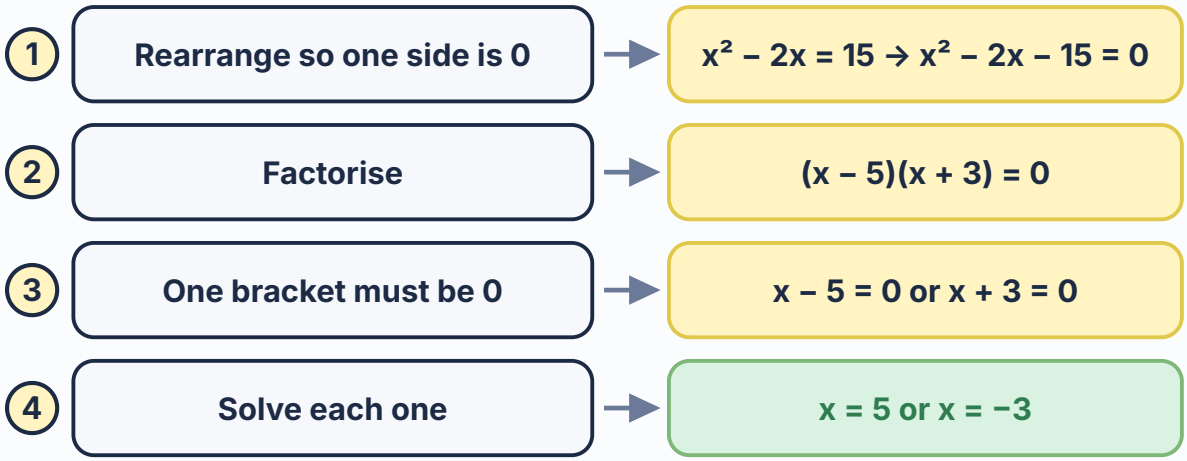
EXT **Solve $x^2 + y^2 = 25$ and $y = x + 1$.**

1. $x^2 + (x + 1)^2 = 25$
2. $2x^2 + 2x + 1 = 25$
3. $x^2 + x - 12 = 0$, so $(x + 4)(x - 3) = 0$
4. $x = -4$ gives $y = -3$; $x = 3$ gives $y = 4$
5. **$(-4, -3)$ and $(3, 4)$**

3 Quadratic equations EXT

Solving by factorising

Solving by factorising: it must equal 0 first



A product is zero only if one of its factors is zero. That is why the right side must be 0.

Quadratic equation — an equation where the highest power of x is **x^2**, written $ax^2 + bx + c = 0$. It usually has **two solutions** (roots).

- EXT **Always make one side zero first.** Then factorise (see Algebraic manipulation), set **each bracket = 0** and solve.

WORKED EXAMPLE

EXT **Solve $x^2 - 2x - 15 = 0$.**

1. factorise: $(x - 5)(x + 3) = 0$
2. $x - 5 = 0$ or $x + 3 = 0$
3. **$x = 5$ or $x = -3$**

WORKED EXAMPLE

EXT **Solve $2x^2 + 5x - 3 = 0$.**

1. $a \times c = -6$, numbers that add to 5: **+6 and −1**
2. split: $2x^2 + 6x - x - 3 = 0$
3. $2x(x + 3) - 1(x + 3) = 0$
4. $(2x - 1)(x + 3) = 0$
5. **$x = \frac{1}{2}$ or $x = -3$**

WORKED EXAMPLE

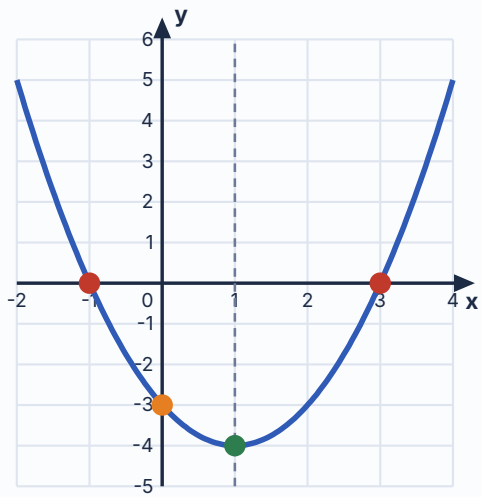
EXT **Solve $x^2 = 7x$.**

1. make one side zero: $x^2 - 7x = 0$
2. factorise: $x(x - 7) = 0$
3. **$x = 0$ or $x = 7$**

COMMON MISTAKE

EXT Dividing both sides of $x^2 = 7x$ by x. That **loses the solution $x = 0$**. Always move everything to one side and factorise instead.

Roots on a graph



$y = x^2 - 2x - 3$
$y = (x + 1)(x - 3)$

roots $x = -1$ and $x = 3$
(where the graph crosses $y = 0$)

turning point (1, −4)
on the line of symmetry $x = 1$

y-intercept (0, −3)
(put $x = 0$)

The solutions of a quadratic are where its graph crosses the x-axis. The turning point lies halfway between them.

- EXT The **roots** are the **x-intercepts** (where $y = 0$). The graph is **symmetrical** about the vertical line through the turning point.
- EXT The **turning point** is at the **midpoint of the roots**: $(-1 + 3) \div 2 = 1$.

The quadratic formula

For $ax^2 + bx + c = 0$

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

Solve $2x^2 + 3x - 4 = 0$

$a = 2, b = 3, c = -4$

$x = (-3 \pm \sqrt{(9 + 32)}) \div 4$

$x = (-3 \pm \sqrt{41}) \div 4$

$x = 0.851$ or $x = -2.351$

1. write a, b and c with their signs (here c = −4)
2. put $b^2 - 4ac$ in brackets: $3^2 - 4 \times 2 \times (-4) = 41$
3. the ± gives two answers: use + then − (3 s.f.)

Write down a, b and c with their signs, substitute carefully, and use ± to get both roots.

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

for $ax^2 + bx + c = 0$. Use brackets for any negative number

- EXT Use the formula when the quadratic **does not factorise** or the question asks for answers to **decimal places or significant figures**.
- EXT Put **$b^2 - 4ac$ in brackets** on the calculator and keep the **whole fraction line** covered: (−b ± √(...)) ÷ (2a).

WORKED EXAMPLE

EXT **Solve $2x^2 + 3x - 4 = 0$. Give answers to 3 decimal places.**

1. $a = 2, b = 3, c = -4$
2. $b^2 - 4ac = 9 - 4 \times 2 \times (-4) = 9 + 32 =$ **41**
3. $x = \frac{-3 \pm \sqrt{41}}{4}$
4. **$x = 0.851$ or $x = -2.351$**

WORKED EXAMPLE

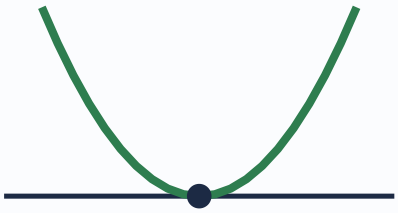
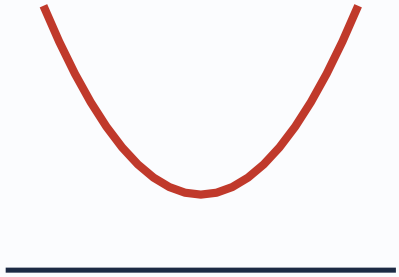
EXT **Solve $x^2 - 4x - 3 = 0$ to 3 significant figures.**

1. $a = 1, b = -4, c = -3$
2. $b^2 - 4ac = 16 + 12 =$ **28**
3. $x = \frac{4 \pm \sqrt{28}}{2}$
4. **$x = 4.65$ or $x = -0.646$**

COMMON MISTAKE

EXT Writing −b as −4 when b = −4. If b is **negative**, −b is **positive**: −(−4) = **+4**.

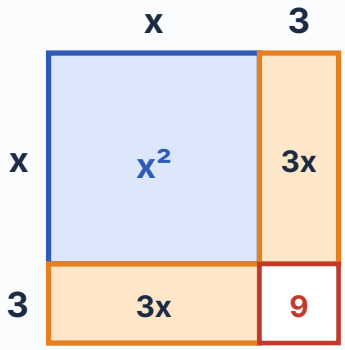
How many solutions?

$b^2 - 4ac > 0$	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$
		
two different roots crosses the x-axis twice	**one repeated root** touches the x-axis	**no real roots** misses the x-axis

The sign of $b^2 - 4ac$, the part under the square root, tells you how many times the graph meets the x-axis.

- EXT **$b^2 - 4ac > 0$:** two different roots. **$b^2 - 4ac = 0$:** one repeated root. **$b^2 - 4ac < 0$:** the square root of a negative number does not exist, so **no real roots**.

Completing the square



missing corner:
$3 \times 3 = 9$

$$(x + 3)^2 = x^2 + 6x + 9$$

$$\text{so } x^2 + 6x = (x + 3)^2 - 9$$

rule: halve the number in front of x,
then subtract its square

$$x^2 + 6x + 2 = (x + 3)^2 - 9 + 2$$
$$= (x + 3)^2 - 7$$

minimum point $(-3, -7)$

Half the coefficient of x goes inside the bracket, and its square is subtracted so the value does not change.

- EXT **Form:** $x^2 + bx + c = (x + \frac{b}{2})^2 - (\frac{b}{2})^2 + c$. The **turning point** is $(-\frac{b}{2}, q)$ when the answer is $(x + p)^2 + q$.

WORKED EXAMPLE

EXT **Write $x^2 + 6x + 2$ in the form $(x + p)^2 + q$.**

1. halve 6: p = **3**
2. $(x + 3)^2 = x^2 + 6x + 9$, so subtract 9
3. $x^2 + 6x + 2 = (x + 3)^2 - 9 + 2$
4. **$= (x + 3)^2 - 7$**

WORKED EXAMPLE

EXT **Write $x^2 - 8x + 3$ in the form $(x + p)^2 + q$.**

1. halve −8: p = **−4**
2. $(x - 4)^2 = x^2 - 8x + 16$, so subtract 16
3. $= (x - 4)^2 - 16 + 3$
4. **$= (x - 4)^2 - 13$**

WORKED EXAMPLE

EXT **Solve $x^2 + 6x - 2 = 0$ by completing the square. Give answers to 3 s.f.**

1. $(x + 3)^2 - 9 - 2 = 0$
2. $(x + 3)^2 = 11$
3. $x + 3 = \pm\sqrt{11}$
4. $x = -3 \pm 3.3166...$
5. **$x = 0.317$ or $x = -6.32$**

WORKED EXAMPLE

EXT **Write $2x^2 + 8x + 5$ in the form $a(x + p)^2 + q$.**

1. take out 2 from the x terms: $2(x^2 + 4x) + 5$
2. complete the square: $2[(x + 2)^2 - 4] + 5$
3. $= 2(x + 2)^2 - 8 + 5$
4. **$= 2(x + 2)^2 - 3$ (turning point $(-2, -3)$)**

Problems that lead to quadratics

WORKED EXAMPLE

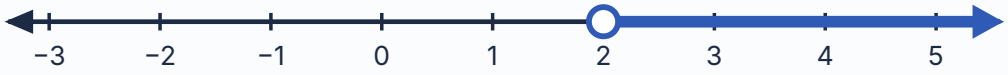
EXT **A rectangle has width x cm and length $(x + 3)$ cm. Its area is 40 cm². Find x.**

1. area: $x(x + 3) = 40$
2. $x^2 + 3x - 40 = 0$
3. $(x + 8)(x - 5) = 0$
4. $x = -8$ or **$x = 5$**
5. **a length cannot be negative, so $x = 5$: the rectangle is 5 cm by 8 cm**

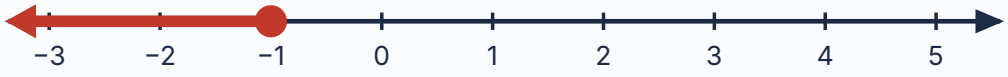
4 Inequalities

Number lines

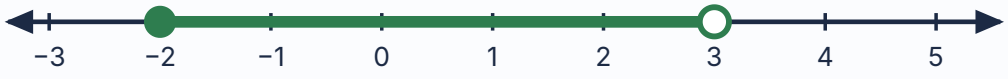
$x > 2$



$x \leq -1$



$-2 \leq x < 3$



open circle = not included (< or >) filled circle = included (≤ or ≥)

An open circle means the number itself is not included. A filled circle means it is included.

- **Symbols:** > greater than, < less than, ≥ greater than or equal to, ≤ less than or equal to.
- **Solve** like an equation, then **show** the answer on a number line: **open circle** for < and >, **filled circle** for ≤ and ≥.
- A **double inequality** such as $-2 \leq x < 3$ gives a segment on the number line.

WORKED EXAMPLE

Solve 3x − 4 ≤ 11 and show the answer on a number line.

1. add 4: 3x ≤ 15
2. divide by 3: **x ≤ 5**
3. **filled circle at 5 and an arrow pointing left**

WORKED EXAMPLE

Solve −2 < 2x + 1 ≤ 9. List the integer values of x.

1. subtract 1 from all three parts: −3 < 2x ≤ 8
2. divide all three by 2: **−1.5 < x ≤ 4**
3. **integers: −1, 0, 1, 2, 3, 4**

Multiplying or dividing by a negative

Why the sign flips



2 < 4 is true

multiply by −1: the order reverses

−2 > −4

Solve −2x < 6

divide both sides by −2

and FLIP the sign

x > −3

test x = 0: 0 < 6 ✓

test x = −4: 8 < 6 ×

(−4 is not > −3)

A negative number turns the number line around, so the inequality sign must turn around too.

Flip rule — when you **multiply or divide** an inequality by a **negative** number, **reverse the sign**: < becomes > and ≤ becomes ≥.

WORKED EXAMPLE

Solve −2x < 6.

1. divide both sides by −2 and **flip the sign**
2. **x > −3**
3. **test x = 0: −2(0) = 0, and 0 < 6 ✓**

WORKED EXAMPLE

Solve 5 − 3x ≥ 14.

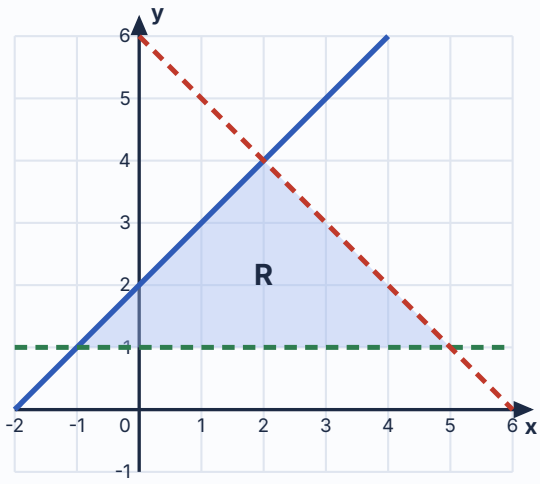
1. subtract 5: −3x ≥ 9
2. **divide by −3 and flip: x ≤ −3**

MEMORY TRICK

To **avoid flipping**, move the x term to the **positive** side instead: 5 − 3x ≥ 14 becomes 5 − 14 ≥ 3x, so −9 ≥ 3x, so **−3 ≥ x**, which is x ≤ −3.

Graphical inequalities

EXTENDED



y ≤ x + 2 (solid)
y > 1 (dashed)
x + y < 6 (dashed)

solid line: ≤ or ≥
dashed line: < or >
test a point, e.g. (2, 2):
2 ≤ 4 ✓ 2 > 1 ✓ 4 < 6 ✓
so R is the triangle

Draw each boundary line, solid for ≤ or ≥ and dashed for < or >, then shade or label the region that satisfies all the inequalities.

- EXT **Boundary lines:** use **solid** lines for ≤ and ≥ (points **on** the line count) and **dashed** lines for < and >.
- EXT **Which side?** Test a point that is **not on the line**, such as (0, 0) or a point inside the region.

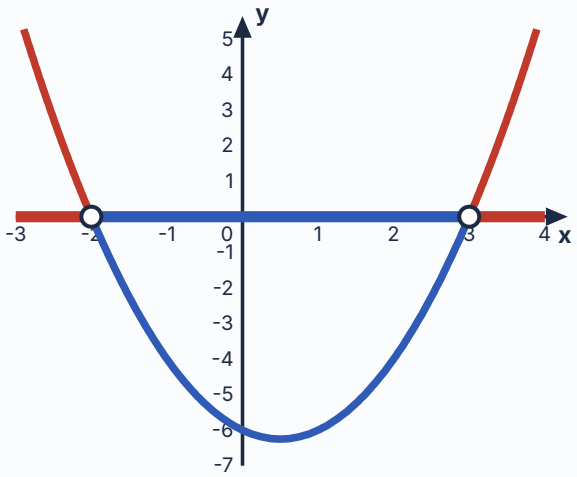
WORKED EXAMPLE

EXT **The region R is bounded by y = x + 2 (solid), y = 1 (dashed) and x + y = 6 (dashed). Write down the three inequalities.**

1. test the point (2, 2) inside R
2. y = x + 2 is solid and 2 ≤ 4, so **y ≤ x + 2**
3. y = 1 is dashed and 2 > 1, so **y > 1**
4. **x + y = 6 is dashed and 4 < 6, so x + y < 6**

Quadratic inequalities

EXTENDED



$x^2 - x - 6 < 0$
below the x-axis
$-2 < x < 3$

$x^2 - x - 6 > 0$
above the x-axis
$x < -2$ or $x > 3$

roots: $x = -2, 3$
(open circles: < and > do not include them)

Find the roots, sketch the curve, and read off where it is below the axis (less than 0) or above it (greater than 0).

- EXT **Method:** (1) solve the **equation** to find the roots; (2) **sketch** the parabola (**U shape** when the x^2 term is positive); (3) read the **x-values** where the graph is below or above the axis.

WORKED EXAMPLE

EXT **Solve $x^2 - x - 6 < 0$.**

1. factorise: $(x - 3)(x + 2) = 0$, so roots $x = 3$ and $x = -2$
2. U-shaped curve, and we want y **below** the axis
3. **$-2 < x < 3$**

WORKED EXAMPLE

EXT **Solve $x^2 - 9 \geq 0$.**

1. roots: $x = -3$ and $x = 3$
2. U-shaped curve, and we want y **on or above** the axis
3. **$x \leq -3$ or $x \geq 3$**

COMMON MISTAKE

EXT Writing "$x < -3$ or $x > 3$" as **$-3 > x > 3$**. That is impossible. Two separate regions need the word **"or"**.

Riyaz Sir

5 Test yourself

Test yourself — cover the answers first

QUICK CHECK

1. Solve $5x - 7 = 18$.
2. Solve $3(x + 4) = 27$.
3. Solve $9 - 2x = 3x - 1$.
4. Solve $\frac{x}{4} + 3 = 8$.
5. Solve $x + y = 9$ and $x - y = 3$.
6. Solve $y = 2x$ and $x + y = 12$.
7. Solve $4x - 1 > 11$.
8. Solve $-3x \leq 12$.
9. List the integers that satisfy $-2 \leq x < 2$.
10. EXT Solve $x^2 - 5x + 6 = 0$.
11. EXT Solve $x^2 = 9x$.
12. EXT Solve $2x^2 - 7x + 3 = 0$.
13. EXT Solve $x^2 + 2x - 4 = 0$, giving answers to 2 decimal places.
14. EXT Write $x^2 + 10x + 7$ in the form $(x + p)^2 + q$.
15. EXT Solve $x^2 - 16 < 0$.
16. EXT Solve $x^2 - 4 \geq 0$.

EXAM-STYLE

17. Solve $4(x - 3) = 2x + 7$. [3]
18. Solve the simultaneous equations $3x + 2y = 7$ and $5x - 2y = 9$. [3]
19. 2 adult tickets and 3 child tickets cost £35. 1 adult ticket and 4 child tickets cost £30. Find the cost of one adult ticket and one child ticket. [4]
20. Solve $3 - 2x < 11$ and show the solution on a number line. [3]
21. EXT Solve $x^2 - 3x - 10 = 0$. [3]
22. EXT Solve $3x^2 + 4x - 5 = 0$, giving your answers correct to 2 decimal places. [4]
23. EXT Write $x^2 - 6x + 1$ in the form $(x - p)^2 - q$, and hence solve $x^2 - 6x + 1 = 0$ to 2 decimal places. [4]
24. EXT A rectangle has width x cm and length $(x + 4)$ cm. The area is 45 cm². Find the dimensions. [4]
25. EXT Solve $x^2 - 2x - 8 > 0$. [3]

Show answers

1. x = 5
2. x = 5
3. x = 2
4. x = 20
5. x = 6, y = 3
6. x = 4, y = 8
7. x > 3
8. x ≥ −4
9. −2, −1, 0, 1
10. x = 2 or x = 3
11. x = 0 or x = 9
12. x = 3 or x = 0.5
13. x = 1.24 or x = −3.24
14. $(x + 5)^2 - 18$
15. −4 < x < 4
16. x ≤ −2 or x ≥ 2
17. 4x − 12 = 2x + 7
    2x = 19
    x = 9.5
18. add the equations: 8x = 16, so x = 2
    6 + 2y = 7, so y = 0.5
19. let adult = a and child = c: 2a + 3c = 35 and a + 4c = 30
    a = 30 − 4c, so 2(30 − 4c) + 3c = 35
    60 − 5c = 35, so c = 5
    a = 30 − 20 = 10: adult £10, child £5
20. −2x < 8
    divide by −2 and flip the sign: x > −4
    open circle at −4 with an arrow pointing right
21. (x − 5)(x + 2) = 0
    x = 5 or x = −2
22. a = 3, b = 4, c = −5: $b^2 - 4ac = 16 + 60 = 76$
    x = (−4 ± √76) ÷ 6
    x = 0.79 or x = −2.12
23. $(x - 3)^2 - 9 + 1 = (x - 3)^2 - 8$
    $(x - 3)^2 = 8$
    x = 3 ± √8
    x = 5.83 or x = 0.17
24. $x(x + 4) = 45$, so $x^2 + 4x - 45 = 0$
    (x + 9)(x − 5) = 0
    x = 5 (reject −9)
    5 cm by 9 cm

25. roots from $(x - 4)(x + 2) = 0$: $x = 4$ and $x = -2$
U-shaped graph, above the axis outside the roots
$x < -2$ or $x > 4$

Stuck on a question?

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Ask Riyaz Sir