APEX ACADEMIC · FREE STUDY GUIDE

IGCSE Maths: where marks are lost

Six focused topic guides with questions and fully marked solutions.

EXAM-STYLE questions written by Apex tutors

Clear methods, marked working and the mistakes that commonly cost marks.

IGCSE MATHS

Completing the square

Method

1. Take out the coefficient of x^2 as a factor of the first two terms.
2. Halve the coefficient of x to get p inside the bracket.
3. Square that value and subtract it to keep the expression the same.
4. Tidy up the constants outside the bracket to get q.
5. Read the turning point straight off the completed form and check by expanding.

Question 1 · Extended · 2 marks

Write $x^2 + 6x + 5$ in the form $(x + p)^2 + q$.

Marked solution

M1 $(x + 3)^2 = x^2 + 6x + 9$, which is 4 more than $x^2 + 6x + 5$

A1 So $x^2 + 6x + 5 = (x + 3)^2 - 4$

> **Answer:** $(x + 3)^2 - 4$

Question 2 · Extended · 3 marks

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

Marked solution

M1 Half of -8 is -4, so start with $(x - 4)^2 = x^2 - 8x + 16$

M1 Subtract 16 and then add the original 3: $x^2 - 8x + 3 = (x - 4)^2 - 16 + 3$

A1 $= (x - 4)^2 - 13$

> **Answer:** $(x - 4)^2 - 13$

Question 3 · Extended · 4 marks

Write $x^2 + 4x - 1$ in the form $(x + p)^2 + q$, and hence solve $x^2 + 4x - 1 = 0$, giving exact answers.

Marked solution

M1 $(x + 2)^2 = x^2 + 4x + 4$, so $x^2 + 4x - 1 = (x + 2)^2 - 5$

A1 Completed square form: $(x + 2)^2 - 5$

M1 Set $(x + 2)^2 - 5 = 0$, so $(x + 2)^2 = 5$ and $x + 2 = \pm\sqrt{5}$

A1 $x = -2 \pm \sqrt{5}$

> **Answer:** $(x + 2)^2 - 5$, so $x = -2 \pm \sqrt{5}$

Question 4 · Extended · 4 marks

The curve $y = x^2 - 10x + 27$ has a minimum point. Find the coordinates of the minimum point and state the minimum value of y.

Marked solution

M1 Complete the square: $y = (x - 5)^2 - 25 + 27$

A1 $y = (x - 5)^2 + 2$

A1 The bracket is zero when $x = 5$, so the minimum point is $(5, 2)$

A1 The minimum value of y is 2

> **Answer:** Minimum point $(5, 2)$, minimum value $y = 2$

Question 5 · Extended · 3 marks

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

Marked solution

M1 Take out the 2 from the first two terms: $2(x^2 + 4x) + 5$

M1 Complete the square inside the bracket: $2((x + 2)^2 - 4) + 5$

A1 Multiply out: $2(x + 2)^2 - 8 + 5 = 2(x + 2)^2 - 3$

> **Answer:** $2(x + 2)^2 - 3$

Question 6 · Extended · 4 marks

Solve $2x^2 + 8x + 5 = 0$ by completing the square, giving your answers in surd form.

Marked solution

M1 From the completed form: $2(x + 2)^2 - 3 = 0$

M1 So $(x + 2)^2 = 3/2$ and $x + 2 = \pm\sqrt{(3/2)}$

A1 $\sqrt{(3/2)} = \sqrt{6} \div 2$, so $x = -2 + (\sqrt{6} \div 2)$

A1 The second root is $x = -2 - (\sqrt{6} \div 2)$

> **Answer:** $x = -2 \pm (\sqrt{6} \div 2)$

Question 7 · Higher · 4 marks

Solve $2x^2 - 10x + 7 = 0$ by completing the square, giving your answers in the form $(a \pm \sqrt{b}) \div c$.

Marked solution

M1 Take out the 2: $2(x^2 - 5x) + 7 = 2((x - 5/2)^2 - 25/4) + 7$

M1 Multiply out: $2(x - 5/2)^2 - 25/2 + 7 = 2(x - 5/2)^2 - 11/2$

A1 Set equal to zero: $(x - 5/2)^2 = 11/4$, so $x = 5/2 \pm \sqrt{11} \div 2$

A1 Write over one denominator: $x = (5 \pm \sqrt{11}) \div 2$

> **Answer:** $x = (5 \pm \sqrt{11}) \div 2$

Where marks are lost

- Changing the expression instead of subtracting the square of p to balance it.
- Forgetting to multiply the subtracted constant by a when the coefficient of x^2 is not 1.
- Reading the turning point as (p, q) instead of $(-p, q)$.
- Losing the negative root when taking a square root.
- Leaving a fraction or surd unsimplified at the end.

IGCSE MATHS

Indices and surds

Method

1. Add the powers when multiplying and subtract them when dividing.
2. Multiply the powers when a power is raised to another power.
3. Turn a negative power into a reciprocal: $a^{-n} = 1/a^n$, and remember $a^0 = 1$.
4. Read a fractional power as a root and a power, so $a^{1/n}$ is the nth root of a.
5. Take the largest square factor out of a surd, and multiply top and bottom by the conjugate to rationalise a denominator.

Question 1 · Core · 3 marks

Evaluate (a) $6^8 \div 6^5$ (b) $(3^2)^4$

Marked solution

M1 (a) Subtract the powers: $6^8 \div 6^5 = 6^{8-5} = 6^3$

M1 (b) Multiply the powers: $(3^2)^4 = 3^{2 \times 4} = 3^8$

A1 $6^3 = 216$ and $3^8 = 6561$

> **Answer:** (a) 216 (b) 6561

Question 2 · Extended · 4 marks

Evaluate (a) 7^0 (b) 5^{-2} (c) $(2/5)^{-1}$

Marked solution

A1 (a) Any non-zero number to the power 0 is 1, so $7^0 = 1$

M1 (b) A negative power gives a reciprocal: $5^{-2} = 1/5^2$

A1 (b) $1/5^2 = 1/25$

A1 (c) Invert the fraction: $(2/5)^{-1} = 5/2$

> **Answer:** (a) 1 (b) 1/25 (c) 5/2

Question 3 · Extended · 3 marks

Evaluate (a) $49^{1/2}$ (b) $27^{1/3}$ (c) $16^{3/4}$

Marked solution

B1 (a) A power of 1/2 is a square root: $49^{1/2} = \sqrt{49} = 7$

B1 (b) A power of 1/3 is a cube root: $27^{1/3} = 3$

A1 (c) $16^{3/4} = (16^{1/4})^3 = 2^3 = 8$

> **Answer:** (a) 7 (b) 3 (c) 8

Question 4 · Extended · 3 marks

Simplify $\sqrt{50} + \sqrt{18} - \sqrt{8}$, giving your answer in the form $k\sqrt{2}$.

Marked solution

M1 $\sqrt{50} = \sqrt{(25 \times 2)} = 5\sqrt{2}$ and $\sqrt{18} = \sqrt{(9 \times 2)} = 3\sqrt{2}$

M1 $\sqrt{8} = \sqrt{(4 \times 2)} = 2\sqrt{2}$, so the expression is $5\sqrt{2} + 3\sqrt{2} - 2\sqrt{2}$

A1 $5\sqrt{2} + 3\sqrt{2} - 2\sqrt{2} = 6\sqrt{2}$

> **Answer:** $6\sqrt{2}$

Question 5 · Extended · 4 marks

Rationalise the denominator of (a) $1/\sqrt{3}$ (b) $10/\sqrt{5}$

Marked solution

M1 (a) Multiply top and bottom by $\sqrt{3}$: $1/\sqrt{3} \times \sqrt{3}/\sqrt{3} = \sqrt{3}/3$

A1 (a) $= \sqrt{3}/3$

M1 (b) Multiply top and bottom by $\sqrt{5}$: $10/\sqrt{5} \times \sqrt{5}/\sqrt{5} = 10\sqrt{5}/5$

A1 (b) $10\sqrt{5}/5 = 2\sqrt{5}$

> **Answer:** (a) $\sqrt{3}/3$ (b) $2\sqrt{5}$

Question 6 · Extended · 5 marks

(a) Expand and simplify $(2 + \sqrt{3})^2$. (b) Rationalise the denominator of $3/(2 + \sqrt{5})$.

Marked solution

M1 (a) $(2 + \sqrt{3})^2 = 4 + 4\sqrt{3} + 3$

A1 (a) $= 7 + 4\sqrt{3}$

M1 (b) Multiply top and bottom by the conjugate $2 - \sqrt{5}$: $3(2 - \sqrt{5})/((2)^2 - (\sqrt{5})^2)$

M1 (b) The denominator is $4 - 5 = -1$, so the fraction is $-3(2 - \sqrt{5})$

A1 (b) $= 3\sqrt{5} - 6$

> **Answer:** (a) $7 + 4\sqrt{3}$ (b) $3\sqrt{5} - 6$

Question 7 · Higher · 5 marks

(a) Given that $8^{2/3} = 2^k$, find the value of k. (b) Rationalise the denominator of $(\sqrt{5} + 1)/(\sqrt{5} - 1)$, giving your answer in the form $(a + b\sqrt{5})/c$.

Marked solution

M1 (a) $8^{2/3} = (8^{1/3})^2 = 2^2$

A1 (a) So $k = 2$

M1 (b) Multiply top and bottom by $\sqrt{5} + 1$: $(\sqrt{5} + 1)^2/((\sqrt{5})^2 - 1^2)$

M1 (b) $= (5 + 2\sqrt{5} + 1)/4 = (6 + 2\sqrt{5})/4$

A1 (b) Divide top and bottom by 2: $(3 + \sqrt{5})/2$

> **Answer:** (a) $k = 2$ (b) $(3 + \sqrt{5})/2$

Where marks are lost

- Writing $2^3 \times 2^4$ as 2^{12}: the powers are multiplied only when one power is raised to another power.
- Leaving $\sqrt{50}$ as the answer when the question asks for the simplest form, instead of $5\sqrt{2}$.
- Writing 3^{-2} as -9. A negative power gives a reciprocal, so the answer is $1/9$.
- Rationalising a denominator such as $3/(2 + \sqrt{5})$ by multiplying by $\sqrt{5}$ instead of by the conjugate $2 - \sqrt{5}$.
- Forgetting that $a^0 = 1$, and treating the zero power as though the answer were 0.

IGCSE MATHS

Quadratic equations

Method

1. Rearrange the equation so that one side is zero.
2. Take out any common factor before you factorise.
3. Factorise the quadratic and set each bracket equal to zero.
4. If it will not factorise, use the quadratic formula with a, b and c.
5. Check each root in the original equation and keep the negative ones.

Question 1 · Core · 2 marks

Solve $x^2 - 7x + 12 = 0$.

Marked solution

M1 Find two numbers with product 12 and sum −7: they are −3 and −4, so $(x - 3)(x - 4) = 0$

A1 $x - 3 = 0$ or $x - 4 = 0$, giving $x = 3$ or $x = 4$

> **Answer:** $x = 3$ or $x = 4$

Question 2 · Core · 3 marks

Solve $3x^2 - 12x = 0$.

Marked solution

M1 Take out the common factor: $3x(x - 4) = 0$

M1 $3x = 0$ gives $x = 0$

A1 $x - 4 = 0$ gives $x = 4$, so the two roots are 0 and 4

> **Answer:** $x = 0$ or $x = 4$

Question 3 · Core · 3 marks

Solve $x^2 = 5x + 24$.

Marked solution

M1 Rearrange so one side is zero: $x^2 - 5x - 24 = 0$

M1 Factorise: $(x - 8)(x + 3) = 0$

A1 $x = 8$ or $x = -3$

> **Answer:** $x = 8$ or $x = -3$

Question 4 · Extended · 3 marks

Solve $2x^2 + 4x - 1 = 0$, giving your answers in surd form.

Marked solution

M1 Use $x = (-b \pm \sqrt{(b^2 - 4ac)}) \div 2a$ with $a = 2$, $b = 4$ and $c = -1$: $x = (-4 \pm \sqrt{24}) \div 4$

M1 Simplify the surd: $\sqrt{24} = 2\sqrt{6}$, so $x = (-4 \pm 2\sqrt{6}) \div 4$

A1 Divide every term by 2: $x = -1 \pm (\sqrt{6} \div 2)$

> **Answer:** $x = -1 \pm (\sqrt{6} \div 2)$

Question 5 · Extended · 3 marks

A ball is kicked and its height above the ground after t seconds is $h = 12t - 5t^2$ metres. Find the two times when the ball is 4 m above the ground.

Marked solution

M1 Set $12t - 5t^2 = 4$ and rearrange: $5t^2 - 12t + 4 = 0$

M1 Factorise: $(5t - 2)(t - 2) = 0$

A1 $t = 2/5$ or $t = 2$

> **Answer:** $t = 2/5$ s and $t = 2$ s

Question 6 · Extended · 4 marks

A rectangle is 5 cm longer than it is wide. Its area is 84 cm^2. Find the dimensions of the rectangle.

Marked solution

M1 Let the width be x cm, so the length is $x + 5$ cm and $x(x + 5) = 84$

M1 Expand and factorise: $x^2 + 5x - 84 = 0$, so $(x + 12)(x - 7) = 0$

A1 $x = 7$, because $x = -12$ is impossible for a length

A1 The rectangle is 7 cm by 12 cm

> **Answer:** 7 cm by 12 cm

Question 7 · Higher · 4 marks

Solve $4x^2 - 12x + 7 = 0$, giving your answers in the form $(a \pm \sqrt{b}) \div c$.

Marked solution

M1 Use the formula with $a = 4$, $b = -12$ and $c = 7$: $x = (12 \pm \sqrt{((-12)^2 - 4 \times 4 \times 7)}) \div 8$

M1 The discriminant is $144 - 112 = 32$, and $\sqrt{32} = 4\sqrt{2}$, so $x = (12 \pm 4\sqrt{2}) \div 8$

A1 Divide every term by 4: $x = (3 + \sqrt{2}) \div 2$

A1 The second root is $x = (3 - \sqrt{2}) \div 2$

> **Answer:** $x = (3 \pm \sqrt{2}) \div 2$

Where marks are lost

- Losing the $x = 0$ root when you divide both sides by x instead of factorising.
- Factorising before moving every term to one side, so the product is not equal to zero.
- Using the formula with the wrong sign for a negative b or c.
- Giving only the positive root when the equation has two.
- Rounding a surd answer when an exact answer is required.

IGCSE MATHS

Reverse percentages

Method

1. Decide what percentage your amount represents: 100% plus the increase, or 100% minus the decrease.
2. Write that percentage as a decimal multiplier, for example 1.25 for a 25% increase or 0.85 for a 15% decrease.
3. Divide the amount by the multiplier to find the original amount.
4. Check by applying the percentage change to your answer and seeing whether you get the amount in the question.

Question 1 · Core · 3 marks

In a sale a jacket is reduced by 20% and now costs £72. Find the price of the jacket before the sale.

Marked solution

M1 A 20% reduction leaves 80%, so £72 is 80% of the original price

M1 Original price = 72 ÷ 0.8

A1 = £90.00

> **Answer:** £90.00

Question 2 · Core · 3 marks

After a pay rise of 6%, a worker earns £477 per week. Find the weekly pay before the rise.

Marked solution

M1 £477 is 106% of the old pay, so the multiplier is 1.06

M1 Old pay = 477 ÷ 1.06

A1 = £450.00

> **Answer:** £450.00

Question 3 · Extended · 3 marks

A shop reduces a bicycle by 15% in a sale and sells it for £357. Find the price of the bicycle before the sale.

Marked solution

M1 A 15% reduction leaves 85%, so £357 is 85% of the original price

M1 Original price = 357 ÷ 0.85

A1 = £420.00

> **Answer:** £420.00

Question 4 · Extended · 4 marks

The price of a laptop includes 20% VAT and is £486. Find the price before VAT and the amount of VAT charged.

Marked solution

M1 £486 is 120% of the price before VAT, so the multiplier is 1.2

M1 Price before VAT = 486 ÷ 1.2

A1 = £405.00

A1 VAT = 486 − 405 = £81.00

> **Answer:** Price before VAT £405.00, VAT £81.00

Question 5 · Extended · 4 marks

A shop sells a chair for £138 and makes a profit of 15% on the cost price. Find the cost price of the chair and the profit.

Marked solution

M1 The selling price is 115% of the cost price, so the multiplier is 1.15

M1 Cost price = 138 ÷ 1.15

A1 = £120.00

A1 Profit = 138 − 120 = £18.00

> **Answer:** Cost price £120.00, profit £18.00

Question 6 · Extended · 5 marks

In a sale a television is reduced by 20%. The sale price is then reduced by a further 10%, and the final price is £432. (a) Find the original price. (b) Find the overall percentage reduction.

Marked solution

M1 The two reductions give a single multiplier: 0.8 × 0.9 = 0.72

M1 Original price = 432 ÷ 0.72

A1 (a) = £600.00

M1 (b) The final price is 0.72 of the original, so the reduction is 1 − 0.72 = 0.28

A1 (b) = 28%

> **Answer:** (a) £600.00 (b) 28%

Question 7 · Higher · 5 marks

The value of a painting fell by 10% in the first year and then rose by 5% in the second year. After the two changes it was worth £15,120. (a) Find the value before the two changes. (b) Find the overall percentage change in the value.

Marked solution

M1 The two changes give a single multiplier: 0.9 × 1.05 = 0.945

M1 Value before the changes = 15,120 ÷ 0.945

A1 (a) = £16,000.00

M1 (b) 0.945 = 1 − 0.055, so the value is 5.5% lower than at the start

A1 (b) 5.5% decrease

> **Answer:** (a) £16,000.00 (b) 5.5% decrease

Where marks are lost

- Taking 20% of the final price instead of dividing by 0.8, which does not undo the reduction.
- Using 0.25 for a 25% increase. The multiplier is 1.25, and 0.25 only finds the increase itself.
- Adding 20% VAT to a price that already includes VAT.
- Rounding the original amount before using it to find a second quantity such as the VAT or the profit.
- Treating a profit of 15% on the cost price as 15% of the selling price, which gives the wrong cost price.

IGCSE MATHS

Sequences and the nth term

Method

1. Find how much the sequence changes by each time, then look at the differences of those differences.
2. For a linear sequence the nth term has the form $an + b$, where a is the common difference.
3. Compare the sequence with an to find the constant b.
4. For a quadratic sequence compare with an^2, where a is half the second difference, then find the remaining linear part.
5. Substitute n = 1, 2 and 3 back into your formula to check it gives the first three terms.

Question 1 · Core · 3 marks

Find the nth term of the sequence 5, 8, 11, 14, ...

Marked solution

M1 The terms go up by 3 each time, so the nth term starts with $3n$

M1 Compare with $3n$: 3, 6, 9, 12, ... and each term is 2 more than this

A1 So the nth term is $3n + 2$

> **Answer:** $3n + 2$

Question 2 · Core · 4 marks

A sequence has nth term $4n - 7$. (a) Find the 15th term. (b) Which term of the sequence is 41?

Marked solution

M1 (a) Substitute $n = 15$: $4 \times 15 - 7$

A1 (a) $= 60 - 7 = 53$

M1 (b) Solve $4n - 7 = 41$, so $4n = 48$

A1 (b) $n = 12$, so 41 is the 12th term

> **Answer:** (a) 53 (b) the 12th term

Question 3 · Core · 3 marks

Is 100 a term of the sequence with nth term $3n + 4$? Show your working.

Marked solution

M1 Suppose $3n + 4 = 100$

M1 $3n = 96$, so $n = 32$

A1 32 is a whole number, so yes: 100 is the 32nd term

> **Answer:** Yes, 100 is the 32nd term

Question 4 · Extended · 4 marks

Find the nth term of the sequence 2, 7, 14, 23, 34, ...

Marked solution

M1 First differences are 5, 7, 9, 11 and the second difference is 2, so the nth term contains n^2

M1 Subtract $n^2 = 1, 4, 9, 16, 25$ from the terms: 1, 3, 5, 7, 9

A1 The remainder is the linear sequence $2n - 1$

A1 So the nth term is $n^2 + 2n - 1$

> **Answer:** $n^2 + 2n - 1$

Question 5 · Extended · 4 marks

Find the nth term of the sequence 3, 10, 21, 36, 55, ...

Marked solution

M1 First differences are 7, 11, 15, 19 and the second difference is 4, so the nth term contains $2n^2$

M1 Subtract $2n^2 = 2, 8, 18, 32, 50$ from the terms: 1, 2, 3, 4, 5

A1 The remainder is the linear sequence n

A1 So the nth term is $2n^2 + n$

> **Answer:** $2n^2 + n$

Question 6 · Extended · 4 marks

The nth term of a sequence is $n^2 + 3n$. (a) Find the value of n for which the term is 40. (b) Decide whether 88 is a term of the sequence.

Marked solution

M1 (a) $n^2 + 3n = 40$, so $n^2 + 3n - 40 = 0$

A1 (a) $(n + 8)(n - 5) = 0$, so $n = 5$

M1 (b) $n^2 + 3n = 88$, so $n^2 + 3n - 88 = 0$ and $(n + 11)(n - 8) = 0$

A1 (b) $n = 8$, so 88 is the 8th term

> **Answer:** (a) $n = 5$ (b) yes, 88 is the 8th term

Question 7 · Higher · 5 marks

A gardener plants trees in rows. The first row has 3 trees, the second row has 8, the third row has 15 and the fourth row has 24. (a) Find the nth term for the number of trees in row n. (b) How many trees are in row 12? (c) Which row has 143 trees?

Marked solution

M1 First differences are 5, 7, 9 and the second difference is 2, so the nth term contains n^2

M1 Subtract n^2 = 1, 4, 9, 16 from the terms: 2, 4, 6, 8, so the remainder is $2n$

A1 (a) The nth term is $n^2 + 2n$

A1 (b) Row 12: $12^2 + 2 \times 12 = 144 + 24 = 168$

A1 (c) $n^2 + 2n = 143$, so $(n + 1)^2 = 144$ and $n = 11$ (reject $n = -13$ because a row number must be positive)

> **Answer:** (a) $n^2 + 2n$ (b) 168 trees (c) row 11

Where marks are lost

- Writing $3n$ as the whole answer when the sequence starts at 5, instead of comparing with $3n$ and adding the constant.
- Halving the second difference and then forgetting to compare with an^2 to find the rest of the formula.
- Assuming a sequence is linear without working out the second difference.
- Saying a number is not in the sequence when the equation gives a whole-number value of n.
- Giving the terms of the sequence instead of the nth term when the question asks for the formula.

IGCSE MATHS

Simultaneous equations

Method

1. Label the two equations and decide whether to eliminate or substitute.
2. To eliminate, multiply one or both equations so a pair of coefficients matches.
3. Add or subtract the equations to remove one unknown, then solve for the other.
4. Substitute that value back into the simpler equation to find the second unknown.
5. For a linear and a quadratic pair, expect two answers and check both in both equations.

Question 1 · Core · 3 marks

Solve the simultaneous equations $2x + 3y = 12$ and $x - y = 1$.

Marked solution

M1 Rearrange the second equation: $x = y + 1$

M1 Substitute into the first: $2(y + 1) + 3y = 12$, so $5y = 10$ and $y = 2$

A1 Then $x = 2 + 1 = 3$

> **Answer:** $x = 3$, $y = 2$

Question 2 · Core · 3 marks

Solve the simultaneous equations $3x + 2y = 16$ and $x + 2y = 12$.

Marked solution

M1 The y terms match, so subtract the second equation from the first: $2x = 4$

M1 $x = 2$

A1 Substitute back: $2 + 2y = 12$, so $y = 5$

> **Answer:** $x = 2$, $y = 5$

Question 3 · Core · 4 marks

Three coffees and two teas cost £13. Two coffees and three teas cost £12. Find the cost of one coffee and the cost of one tea.

Marked solution

M1 Let a coffee cost c and a tea cost t: $3c + 2t = 13$ and $2c + 3t = 12$

M1 Multiply the first equation by 3 and the second by 2: $9c + 6t = 39$ and $4c + 6t = 24$

M1 Subtract: $5c = 15$, so $c = 3$

A1 Then $6 + 3t = 12$, so $t = 2$

> **Answer:** A coffee costs £3 and a tea costs £2

Question 4 · Extended · 4 marks

Solve the simultaneous equations $4x + 3y = 25$ and $3x + 2y = 18$.

Marked solution

M1 Multiply the first equation by 2 and the second by 3: $8x + 6y = 50$ and $9x + 6y = 54$

M1 Subtract the first from the second: $x = 4$

M1 Substitute back: $16 + 3y = 25$, so $3y = 9$

A1 $y = 3$

> **Answer:** $x = 4$, $y = 3$

Question 5 · Extended · 4 marks

Solve the simultaneous equations $2x + 3y = 13$ and $3x - 2y = 0$.

Marked solution

M1 From the second equation $y = 3x \div 2$

M1 Substitute into the first: $2x + 3(3x \div 2) = 13$, so $13x \div 2 = 13$

M1 $x = 2$

A1 Then $y = 6 \div 2 = 3$

> **Answer:** $x = 2$, $y = 3$

Question 6 · Extended · 5 marks

Solve the simultaneous equations $y = x + 1$ and $x^2 + y^2 = 25$.

Marked solution

M1 Substitute $y = x + 1$ into the second equation: $x^2 + (x + 1)^2 = 25$

M1 Expand: $2x^2 + 2x + 1 = 25$, so $x^2 + x - 12 = 0$

M1 Factorise: $(x + 4)(x - 3) = 0$

A1 $x = 3$ gives $y = 4$

A1 $x = -4$ gives $y = -3$

> **Answer:** $x = 3$, $y = 4$ and $x = -4$, $y = -3$

Question 7 · Higher · 5 marks

A rectangle has a perimeter of 26 cm and an area of 40 cm^2. Find its length and width.

Marked solution

M1 Let the sides be x cm and y cm: $x + y = 13$ and $xy = 40$

M1 Substitute $y = 13 - x$ into the area equation: $x(13 - x) = 40$

M1 Rearrange and factorise: $x^2 - 13x + 40 = 0$, so $(x - 5)(x - 8) = 0$

A1 $x = 5$ or $x = 8$

A1 The sides are 5 cm and 8 cm, whichever way round they are taken

> **Answer:** 5 cm by 8 cm

Where marks are lost

- Adding the equations when the matching coefficients have opposite signs, or subtracting when they match.
- Finding one unknown and forgetting to substitute back for the second.
- Giving only one pair of values when a linear and a quadratic equation meet twice.
- Multiplying only part of an equation when scaling it.
- Leaving the answer inside a square root or fraction instead of simplifying it.

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