

GCSE MATHEMATICS

FOUNDATION TIER

COMPREHENSIVE LESSON NOTEBOOK

UNIT 2 | ALGEBRA

TEACH-FROM-SCRATCH • PUBLICATION EDITION

20 detailed chapters • original diagrams • worked examples • guided practice • answers

INDEPENDENT PUBLICATION NOTICE

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COMPREHENSIVE LESSON NOTEBOOK

How to learn from this notebook

Meaning first. Method second. Practice third.

FIVE-PASS ROUTINE

1 Read the key idea without a calculator. 2 Cover each worked solution and reproduce it. 3 Complete practice independently. 4 Mark in a different colour and repair errors. 5 Retest after 2-7 days.

What a complete mathematics answer contains

- A clear model or calculation, not only a calculator display.
- Enough working for another person to follow the reasoning.
- Exact values until approximation is requested.
- Units and sensible rounding in context.
- A final statement when interpretation is required.

Error loop

REPAIR, DO NOT MERELY CORRECT

Label each error: concept, operation, arithmetic, calculator entry, accuracy, unit or interpretation. Write the corrected step and one sentence explaining the change.

Foundation does not mean superficial

Eduqas Foundation questions can combine familiar skills in unfamiliar contexts. Grade 4-5 success depends on selecting a method, connecting several steps and deciding whether the answer is reasonable.

COMPREHENSIVE LESSON NOTEBOOK

Unit 2 coverage map

Eduqas C300 Foundation Algebra content organised into a teachable sequence.

CH 01	Eduqas C300 FA1, FA3	Algebraic language and forming expressions
CH 02	Eduqas C300 FA4	Index laws and simple surds
CH 03	Eduqas C300 FA4	Expanding and factorising expressions
CH 04	Eduqas C300 FA2, FA5	Substitution and using formulae
CH 05	Eduqas C300 FA5	Changing the subject of a formula
CH 06	Eduqas C300 FA14	Solving linear equations
CH 07	Eduqas C300 FA15-FA16	Quadratic and simultaneous equations
CH 08	Eduqas C300 FA18	Linear inequalities
CH 09	Eduqas C300 FA19-FA21	Sequences and nth terms
CH 10	Eduqas C300 FA6-FA7, FA17	Functions, formula use and mixed algebra
CH 11	Eduqas C300 FA8	Coordinates, scales and plotting points
CH 12	Eduqas C300 FA9	Tables of values and linear graphs
CH 13	Eduqas C300 FA11-FA12	Quadratic, cubic and reciprocal graphs
CH 14	Eduqas C300 FA9-FA10	Gradient, intercept and $y = mx + c$
CH 15	Eduqas C300 FA13-FA15	Solving equations using graphs

COMPREHENSIVE LESSON NOTEBOOK

Fast-reference method bank

Understand each relationship before memorising it.

Like terms

same variable part; combine coefficients

Expand / factorise

$a(b+c)=ab+ac$; reverse with a common factor

Substitute

replace symbols; bracket negative values

Rearrange

same inverse operation on both sides

Equations

simplify, isolate, substitute to check

Inequality

reverse sign after $\times$ or $\div$ by a negative

Arithmetic nth term

difference $\times n$, then adjust

Function

input x is mapped to one output $f(x)$

Kinematics

$v=u+at$; $s=ut+\frac{1}{2}at^2$

Formula policy

use the formula supplied for the current exam series

CURRENT ASSESSMENT NOTE

Eduqas states that an additional formula sheet is integrated into examination papers from Summer 2026. Check the official Eduqas qualification page for the arrangement applying to your examination series.

COMPREHENSIVE LESSON NOTEBOOK

Algebraic language and forming expressions

Translate relationships into precise algebra.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA1, FA3. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Algebra represents general relationships. A letter can stand for an unknown or a changing quantity. An expression has no equals sign; an equation claims two expressions are equal; a formula links quantities; an identity is true for every permitted value.

KEY VOCABULARY

variable • coefficient • term • expression • equation • identity • formula

words

expression

equation

seven more than $n \rightarrow n + 7$

Why the method works

- Letters allow one rule to describe many numerical cases.
- Operation order and brackets preserve the intended relationship.
- Precise terminology tells you what kind of task is possible.

CHECK BEFORE MOVING ON

Answer mentally: Write an expression for 7 more than n . Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Algebraic language and forming expressions - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Identify the unknown and choose a letter.
- Translate operations in their spoken order.
- Keep expressions, equations, identities and formulae distinct.

WORKED EXAMPLE 1

Write an expression for 7 more than n .

SOLUTION

1. "More than" means add 7 to n .

ANSWER: $n + 7$ **WORKED EXAMPLE 2**

Write an expression for the cost of x tickets at £6 each plus a £2 booking fee.

SOLUTION

1. x tickets cost $6x$ pounds.
2. Add the fixed £2 fee.

ANSWER: $6x + 2$ **SELF-CHECK QUESTION**

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Algebraic language and forming expressions - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Pricing rules, perimeters, age relationships and computer formulas all translate words into algebra.

Common misconceptions

- Reversing “less than” phrases.
- Omitting brackets around a total.
- Treating an expression as if it can be solved.

GUIDED TRY

State whether $3x+5$ is an expression or equation. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain why $5(a+2)$ is not the same as $5a+2$. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Algebraic language and forming expressions

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Write an expression for 7 more than n .

[1]

2. Write an expression for the cost of x tickets at £6 each plus a £2 booking fee.

[2]

3. State whether $3x+5$ is an expression or equation.

[1]

4. Write an equation: three times a number, increased by 4, equals 25.

[2]

5. A rectangle has width w and length $w+3$. Write its perimeter.

[3]

6. Write an expression for half of the total of y and 8.

[2]

7. The n th odd number is $2n-1$. Find the 20th odd number.

[2]

8. Explain why $5(a+2)$ is not the same as $5a+2$.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Index laws and simple surds

Use index notation and simplify products, quotients and simple like surds.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA4. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Simplification changes the appearance of an expression without changing its value. Like terms have exactly the same variable part. Products combine numerical and variable factors; quotients remove common factors.

KEY VOCABULARY

like terms • coefficient • constant • product • quotient • power

$$7x + 4x - 3x = 8x$$

combine coefficients only when the variable part matches

Why the method works

- The distributive law justifies adding coefficients of like terms.
- Repeated variable factors are written with powers.
- Cancellation is division by a common non-zero factor.

CHECK BEFORE MOVING ON

Answer mentally: Simplify $x^3 \times x^5$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Index laws and simple surds - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- For the same base, add powers when multiplying and subtract powers when dividing.
- A power tells you how many equal factors are multiplied.
- Only like surds can be collected; keep the surd factor unchanged.

WORKED EXAMPLE 1

Simplify $x^3 \times x^5$.

SOLUTION

1. The base is the same.
2. Add the powers: $3+5=8$.

ANSWER: x^8

WORKED EXAMPLE 2

Simplify $a^9 \div a^4$.

SOLUTION

1. The base is the same.
2. Subtract the powers: $9-4=5$.

ANSWER: a^5

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Index laws and simple surds - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Compact expressions make later substitution, equation solving and modelling more reliable.

Common misconceptions

- Collecting unlike terms.
- Adding powers when terms are added rather than multiplied.
- Losing a negative coefficient.

GUIDED TRY

Write $p \times p \times p \times p \times p$ using index notation. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain why $2\sqrt{3} + 5\sqrt{2}$ cannot be collected. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Index laws and simple surds

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Simplify $x^3 \times x^5$.

[2]

2. Simplify $a^9 \div a^4$.

[2]

3. Write $p \times p \times p \times p \times p$ using index notation.

[1]

4. Simplify $3m^2 \times 4m^3$.

[2]

5. Simplify $18y^7 \div 6y^2$.

[2]

6. Simplify $3\sqrt{5} + 7\sqrt{5}$.

[2]

7. Simplify $9\sqrt{2} - 4\sqrt{2}$.

[2]

8. Explain why $2\sqrt{3} + 5\sqrt{2}$ cannot be collected.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Expanding and factorising expressions

Expand single and double brackets and factorise linear and quadratic expressions.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA4. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Expansion distributes a factor across every term in a bracket. Factorisation reverses this process by extracting a common factor. The two forms are equivalent and useful for different purposes.

KEY VOCABULARY

expand • factorise • bracket • common factor • distributive law

$$5(x + 3)$$

$$5x + 15$$

expand → ← factorise

Why the method works

- $a(b+c)=ab+ac$ follows from area or repeated addition.
- A common factor divides every term exactly.
- Expanding the result provides a direct check.

CHECK BEFORE MOVING ON

Answer mentally: Expand $5(x+3)$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Expanding and factorising expressions - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Multiply every term when expanding brackets.
- For x^2+bx+c , find two numbers with product c and sum b .
- Check factorisation by expanding the answer.

WORKED EXAMPLE 1

Expand $5(x+3)$.

SOLUTION

1. Multiply both terms by 5.

ANSWER: $5x + 15$

WORKED EXAMPLE 2

Factorise $12p^2+8p$.

SOLUTION

1. The highest common factor is $4p$.
2. Divide each term by $4p$.

ANSWER: $4p(3p + 2)$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Expanding and factorising expressions - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Area expressions, equation solving and later quadratic work all rely on moving between expanded and factorised forms.

Common misconceptions

- Multiplying only the first bracket term.
- Dropping a negative sign.
- Taking a factor that is not common to every term.

GUIDED TRY

Expand $(x+4)(x+7)$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Expand and simplify $2(x+3)+(x-1)(x+2)$. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Expanding and factorising expressions

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Expand $5(x+3)$.

[2]

2. Factorise $12p^2+8p$.

[3]

3. Expand $(x+4)(x+7)$.

[3]

4. Expand $(x-3)(x+5)$.

[3]

5. Factorise $x^2+9x+20$.

[3]

6. Factorise $x^2-2x-15$.

[3]

7. Factorise x^2-49 .

[2]

8. Expand and simplify $2(x+3)+(x-1)(x+2)$.

[4]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Substitution and using formulae

Replace symbols accurately and preserve operation order.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA2, FA5. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Substitution replaces each symbol with its stated value. The original structure must remain intact, especially with negative numbers and powers. A formula then becomes a numerical calculation with units.

KEY VOCABULARY

substitute • evaluate • formula • input • output • unit

x

-3

x^2

9

2y

10

total

19

Why the method works

- Brackets show the substituted value is one complete number.
- Order of operations preserves the meaning of the formula.
- Units help test whether the output represents the intended quantity.

CHECK BEFORE MOVING ON

Answer mentally: Find $4a-3$ when $a=6$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Substitution and using formulae - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Write the formula first and identify each value.
- Substitute using brackets for negative values.
- Follow the order of operations and include units.

WORKED EXAMPLE 1

Find $4a-3$ when $a=6$.

SOLUTION

1. Substitute: $4(6)-3$.
2. $24-3=21$.

ANSWER: 21

WORKED EXAMPLE 2

Find x^2+2y when $x=-3$ and $y=5$.

SOLUTION

1. Use brackets: $(-3)^2+2(5)$.
2. $9+10=19$.

ANSWER: 19

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Substitution and using formulae - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Science formulas, measurement, finance and spreadsheet models all depend on accurate substitution.

Common misconceptions

- Squaring only the digit and losing the sign.
- Ignoring multiplication between a coefficient and a value.
- Rounding too early.

GUIDED TRY

Use $A=lw$ to find A when $l=8$ cm and $w=3.5$ cm. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain why brackets matter when substituting $x=-2$ into x^2 . Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Substitution and using formulae

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Find $4a-3$ when $a=6$.

[2]

2. Find x^2+2y when $x=-3$ and $y=5$.

[3]

3. Use $A=lw$ to find A when $l=8$ cm and $w=3.5$ cm.

[2]

4. Use $v=u+at$ when $u=4$, $a=3$ and $t=5$.

[2]

5. Find $2p^2-q$ when $p=-4$ and $q=7$.

[3]

6. Use $C=2\pi r$ to find C for $r=6$ cm, to 1 decimal place.

[3]

7. Use $s=(u+v)t/2$ when $u=3$, $v=11$, $t=4$.

[3]

8. Explain why brackets matter when substituting $x=-2$ into x^2 .

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Changing the subject of a formula

Use inverse operations to isolate a chosen variable.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA5. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

The subject is the variable written alone on one side. Rearranging uses inverse operations while maintaining equality. The order of reversal matters because the most recent outer operation is normally undone first.

KEY VOCABULARY

subject • inverse operation • isolate • rearrange • equivalent formula

$$y = 3x - 5$$

$$+5 \text{ both sides} \rightarrow y+5 = 3x \rightarrow \div 3 \rightarrow x=(y+5)/3$$

Why the method works

- Doing the same valid operation to both sides preserves equality.
- Inverse operations reverse the construction of the formula.
- Equivalent forms describe the same relationship from different viewpoints.

CHECK BEFORE MOVING ON

Answer mentally: Make x the subject of $y=x+7$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Changing the subject of a formula - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Treat the formula like an equation and do the same operation to both sides.
- Undo additions or subtractions before multiplications or divisions.
- Check by substituting simple values into both forms.

WORKED EXAMPLE 1

Make x the subject of $y = x + 7$.

SOLUTION

1. Subtract 7 from both sides.

ANSWER: $x = y - 7$

WORKED EXAMPLE 2

Make a the subject of $v = u + at$.

SOLUTION

1. Subtract u : $v - u = at$.
2. Divide by t .

ANSWER: $a = (v - u)/t$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Changing the subject of a formula - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Rearranged formulas let scientists and engineers calculate whichever quantity is unknown.

Common misconceptions

- Moving a term without changing its operation.
- Dividing only one term of a sum.
- Forgetting brackets in a numerator.

GUIDED TRY

Make w the subject of $A=lw$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain how to check a rearranged formula. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Changing the subject of a formula

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Make x the subject of $y=x+7$.

[2]

2. Make a the subject of $v=u+at$.

[3]

3. Make w the subject of $A=lw$.

[2]

4. Make r the subject of $C=2\pi r$.

[2]

5. Make x the subject of $y=3x-5$.

[3]

6. Make h the subject of $A=(b+h)/2$.

[3]

7. Make p the subject of $q=(p-4)/5$.

[3]

8. Explain how to check a rearranged formula.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Solving linear equations

Preserve equality while isolating the unknown.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA14. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A solution is a value that makes the original equation true. Think of an equation as a balance: every operation must affect both sides equally until the unknown is isolated.

KEY VOCABULARY

equation • solution • balance • inverse operation • check

$$4x + 3 = 27$$

subtract 3 from both sides • divide both sides by 4

Why the method works

- Equality is preserved by the same operation on both sides.
- Inverse operations undo the steps applied to the unknown.
- Substitution confirms the final value.

CHECK BEFORE MOVING ON

Answer mentally: Solve $4x+3=27$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Solving linear equations - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Simplify each side first when helpful.
- Use inverse operations on both sides.
- Check by substituting the solution into the original equation.

WORKED EXAMPLE 1

Solve $4x+3=27$.

SOLUTION

1. Subtract 3: $4x=24$.
2. Divide by 4: $x=6$.

ANSWER: $x = 6$

WORKED EXAMPLE 2

Solve $7x-9=3x+19$.

SOLUTION

1. Subtract $3x$: $4x-9=19$.
2. Add 9: $4x=28$.
3. Divide by 4.

ANSWER: $x = 7$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Solving linear equations - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Unknown costs, lengths, ages and rates are often found by setting up and solving linear equations.

Common misconceptions

- Changing a sign without applying an operation.
- Operating on only one side.
- Stopping before the variable is isolated.

GUIDED TRY

Solve $5(x-2)=35$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain why doing the same operation to both sides preserves equality. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Solving linear equations

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Solve $4x+3=27$.

[3]

2. Solve $7x-9=3x+19$.

[4]

3. Solve $5(x-2)=35$.

[3]

4. Solve $3(2x+1)=27$.

[3]

5. Solve $(x+5)/4=6$.

[3]

6. A taxi costs £3 plus £2 per mile. The fare is £19. Find miles.

[3]

7. Solve $8-2x=20$.

[3]

8. Explain why doing the same operation to both sides preserves equality.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Quadratic and simultaneous equations

Solve accessible Foundation equations and interpret both values.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA15-FA16. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A quadratic may have two roots because two factor values can make a product zero. Simultaneous equations describe two conditions that must both hold, so their shared solution satisfies each equation.

KEY VOCABULARY

quadratic • root • factor • simultaneous • eliminate • substitute

$$(x - 3)(x - 4) = 0$$

$$x - 3 = 0 \quad \text{or} \quad x - 4 = 0 \quad \rightarrow \quad x = 3 \text{ or } 4$$

Why the method works

- If $AB=0$, then $A=0$ or $B=0$.
- Factor pairs encode the required sum and product.
- Elimination or substitution reduces two unknowns to one.

CHECK BEFORE MOVING ON

Answer mentally: Solve $x^2-7x+12=0$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Quadratic and simultaneous equations - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- For monic quadratics, find two numbers with the required product and sum.
- Use the zero-product rule after factorising.
- For simultaneous equations, substitute or eliminate one variable.

WORKED EXAMPLE 1

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

SOLUTION

1. Factorise: $(x-3)(x-4)=0$.
2. Each bracket may equal zero.

ANSWER: $x = 3$ or $x = 4$

WORKED EXAMPLE 2

Solve $x^2 + 5x + 6 = 0$.

SOLUTION

1. Factorise: $(x+2)(x+3)=0$.
2. Set each factor to zero.

ANSWER: $x = -2$ or $x = -3$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Quadratic and simultaneous equations - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Areas, intersecting constraints, ticket totals and mixture conditions can produce quadratic or simultaneous models.

Common misconceptions

- Giving only one quadratic root.
- Forgetting to reject an impossible length.
- Solving one simultaneous equation but not checking the other.

GUIDED TRY

Solve simultaneously $x+y=11$ and $x-y=3$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Why can a quadratic equation have two solutions? Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Quadratic and simultaneous equations

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

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

[3]

2. Solve $x^2 + 5x + 6 = 0$.

[3]

3. Solve simultaneously $x + y = 11$ and $x - y = 3$.

[3]

4. Solve $y = 2x + 1$ and $x + y = 10$.

[4]

5. A rectangle has sides x and $x + 3$, area 40. Find x .

[4]

6. Solve $x^2 = 49$.

[2]

7. The sum of two numbers is 18 and their difference is 4. Find them.

[3]

8. Why can a quadratic equation have two solutions?

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Linear inequalities

Describe a range of values using symbols and number lines.

SPECIFICATION FOCUS

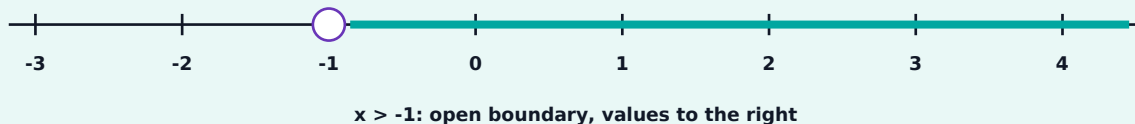
Eduqas reference Eduqas C300 FA18. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

An inequality describes a range rather than one value. Its symbol records which side of a boundary is allowed. Multiplication or division by a negative reverses order, so the inequality sign must reverse.

KEY VOCABULARY

inequality • boundary • solution set • strict • inclusive • number line



Why the method works

- Number-line direction makes greater and smaller values visible.
- Open and filled circles distinguish excluded and included boundaries.
- Negative scaling reflects positions across zero and reverses order.

CHECK BEFORE MOVING ON

Answer mentally: Solve $x+5<12$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Linear inequalities - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Solve like an equation while preserving the inequality.
- Reverse the sign when multiplying or dividing by a negative number.
- Use an open circle for $<$ or $>$ and a filled circle for $\leq$ or $\geq$.

WORKED EXAMPLE 1

Solve $x+5<12$.

SOLUTION

1. Subtract 5 from both sides.

ANSWER: $x < 7$

WORKED EXAMPLE 2

Solve $3x \geq 18$.

SOLUTION

1. Divide both sides by positive 3; sign stays the same.

ANSWER: $x \geq 6$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Linear inequalities - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Capacity limits, budgets, minimum ages and tolerance ranges are naturally expressed as inequalities.

Common misconceptions

- Using a filled circle for a strict inequality.
- Forgetting to reverse the sign after negative division.
- Listing values outside an inclusive boundary.

GUIDED TRY

Solve $-2x < 10$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain why the sign reverses when dividing by a negative. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Linear inequalities

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Solve $x+5<12$.

[2]

2. Solve $3x\geq 18$.

[2]

3. Solve $-2x<10$.

[3]

4. Solve $4x-3\leq 13$.

[3]

5. List the integer solutions of $-2<x\leq 3$.

[2]

6. A lift holds at most 600 kg. Four people total 312 kg. Write and solve an inequality for boxes of 24 kg.

[4]

7. Represent $x>-1$ on a number line.

[2]

8. Explain why the sign reverses when dividing by a negative.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Sequences and nth terms

Generate, describe and continue structured number patterns.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA19-FA21. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A sequence is an ordered list generated by a rule. Arithmetic sequences change by a constant amount and have linear nth terms. Recurrence rules use earlier terms to generate later ones.

KEY VOCABULARY

sequence • term • position • common difference • nth term • recurrence

4

7

10

13

...

common difference +3 → nth term $3n + 1$

Why the method works

- A constant first difference creates a linear position-to-term relationship.
- The coefficient of n equals the common difference.
- An adjustment aligns the rule with the first term.

CHECK BEFORE MOVING ON

Answer mentally: Write the next two terms: 5, 9, 13, 17, ... Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Sequences and nth terms - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Find first differences for an arithmetic sequence.
- Use difference $\times n$, then adjust to match a known term.
- Check the rule for at least two positions.

WORKED EXAMPLE 1

Write the next two terms: 5, 9, 13, 17, ...

SOLUTION

1. The common difference is +4.
2. Add 4 twice.

ANSWER: 21, 25

WORKED EXAMPLE 2

Find the nth term of 4, 7, 10, 13, ...

SOLUTION

1. Difference is 3, so start with $3n$.
2. At $n=1$, $3n$ gives 3; add 1.

ANSWER: $3n + 1$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Sequences and nth terms - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Savings plans, tile patterns, seating rows and repeated processes can be modelled by sequences.

Common misconceptions

- Using the term value instead of its position.
- Assuming every sequence is arithmetic.
- Checking the rule for only one term.

GUIDED TRY

Find the 20th term of $3n-2$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain how to check an nth-term rule. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Sequences and nth terms

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Write the next two terms: 5, 9, 13, 17, ...

[2]

2. Find the nth term of 4, 7, 10, 13, ...

[3]

3. Find the 20th term of $3n-2$.

[2]

4. Is 47 in the sequence $5n+2$?

[3]

5. Find the nth term of 12, 9, 6, 3, ...

[3]

6. Continue the Fibonacci-type sequence 2, 3, 5, 8, 13, ...

[2]

7. The nth term is $4n-7$. Find the first positive term.

[3]

8. Explain how to check an nth-term rule.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Functions, formula use and mixed algebra

Use functions and supplied formulae, then connect algebraic skills.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA6-FA7, FA17. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Mixed algebra requires choosing the representation before calculating. Algebra can solve a particular unknown or prove a statement for every integer. A valid proof uses a general variable and a logically equivalent conclusion.

KEY VOCABULARY

model • proof • conjecture • counterexample • restriction • validation

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- A variable captures all cases rather than selected examples.
- Simplification exposes structure such as a common factor.
- Substitution and contextual checks validate solutions.

CHECK BEFORE MOVING ON

Answer mentally: A function is defined by $f(x)=3x-2$. Find $f(5)$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Functions, formula use and mixed algebra - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- A function maps each permitted input to one output.
- Substitute into a supplied formula with brackets and units.
- Verify results by substitution or inverse operations.

WORKED EXAMPLE 1

A function is defined by $f(x)=3x-2$. Find $f(5)$.

SOLUTION

1. Substitute $x=5$.
2. $f(5)=3 \times 5 - 2 = 13$.

ANSWER: 13**WORKED EXAMPLE 2**

The function g maps x to x^2+1 . Find $g(-4)$.

SOLUTION

1. Use brackets: $(-4)^2+1$.
2. $16+1=17$.

ANSWER: 17**SELF-CHECK QUESTION**

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Functions, formula use and mixed algebra - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Planning, optimisation, pattern justification and financial modelling combine several algebraic skills.

Common misconceptions

- Testing a few examples and calling it proof.
- Ignoring restrictions such as positive lengths.
- Selecting a method from a keyword alone.

GUIDED TRY

A function machine multiplies by 4 then subtracts 7. Its output is 25. Find the input. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State two checks for an algebraic or function answer. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Functions, formula use and mixed algebra

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A function is defined by $f(x)=3x-2$. Find $f(5)$.

[2]

2. The function g maps x to x^2+1 . Find $g(-4)$.

[2]

3. A function machine multiplies by 4 then subtracts 7. Its output is 25. Find the input.

[3]

4. Using $v=u+at$, find v when $u=6$ m/s, $a=2.5$ m/s² and $t=8$ s.

[3]

5. Using $s=ut+\frac{1}{2}at^2$, find s when $u=3$, $a=2$ and $t=4$.

[3]

6. Solve $4(2x+1)=3x+29$.

[4]

7. Prove the sum of three consecutive integers is a multiple of 3.

[4]

8. State two checks for an algebraic or function answer.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Coordinates, scales and plotting points

Read and plot ordered pairs accurately in four quadrants.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA8. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Coordinates are ordered pairs (x,y) . The x-coordinate gives horizontal position and the y-coordinate gives vertical position. Scales must be read before plotting, particularly when axes do not increase by one.

KEY VOCABULARY

coordinate • origin • axis • quadrant • scale • midpoint

model**simplify****solve****check****interpret**

a complete algebraic argument has a logical chain

Why the method works

- Ordered pairs encode two independent directions.
- Axis signs identify the quadrant.
- A midpoint averages corresponding coordinates.

CHECK BEFORE MOVING ON

Answer mentally: State the coordinates of a point 3 right and 2 up from the origin. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Coordinates, scales and plotting points - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Read the horizontal x-coordinate first.
- Move vertically to the y-coordinate second.
- Check the scale and quadrant before marking the point.

WORKED EXAMPLE 1

State the coordinates of a point 3 right and 2 up from the origin.

SOLUTION

1. Horizontal movement gives $x=3$.
2. Vertical movement gives $y=2$.

ANSWER: (3, 2)

WORKED EXAMPLE 2

Plot A(-4,3). Which quadrant contains A?

SOLUTION

1. x is negative and y is positive.
2. Move 4 left and 3 up.

ANSWER: Quadrant II

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Coordinates, scales and plotting points - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Maps, screens, designs and tracking systems locate objects with coordinate grids.

Common misconceptions

- Reading y before x.
- Ignoring a non-unit scale.
- Changing both coordinates during a reflection in one axis.

GUIDED TRY

Find the midpoint of (2,4) and (8,10). First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain why (2,-3) and (-3,2) are different points. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Coordinates, scales and plotting points

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. State the coordinates of a point 3 right and 2 up from the origin.

[1]

2. Plot A(-4,3). Which quadrant contains A?

[2]

3. Find the midpoint of (2,4) and (8,10).

[3]

4. Reflect (5,-2) in the x-axis.

[2]

5. A point lies on the y-axis and has $y=-6$. State it.

[1]

6. Point B is (-2,-5). Translate it 4 right and 7 up.

[2]

7. Three vertices are (1,1),(5,1),(5,4). Give the fourth vertex of the rectangle.

[2]

8. Explain why (2,-3) and (-3,2) are different points.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Tables of values and linear graphs

Generate coordinates and draw a continuous straight-line graph.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA9. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A table turns an equation into coordinate pairs. For a linear rule, equal changes in x create equal changes in y , so correctly plotted points lie on one straight continuous line.

KEY VOCABULARY

table • substitute • coordinate • continuous • linear

model**simplify****solve****check****interpret**

a complete algebraic argument has a logical chain

Why the method works

- Substitution generates points satisfying the equation.
- A constant rate produces constant gradient.
- Joining points represents all intermediate inputs.

CHECK BEFORE MOVING ON

Answer mentally: Complete $y=2x+1$ when $x=3$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Tables of values and linear graphs - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Choose or use the stated x-values.
- Substitute each x into the equation to calculate y.
- Plot accurately and join with one straight line.

WORKED EXAMPLE 1

Complete $y=2x+1$ when $x=3$.

SOLUTION

1. $y=2(3)+1$.
2. $y=7$.

ANSWER: $y = 7$

WORKED EXAMPLE 2

For $y=3x-2$, find y when $x=-2$.

SOLUTION

1. $y=3(-2)-2$.
2. $y=-6-2=-8$.

ANSWER: $y = -8$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Tables of values and linear graphs - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Linear graphs model constant prices, speeds, conversions and regular changes.

Common misconceptions

- Arithmetic errors for negative x .
- Joining with a jagged freehand line.
- Using an unsuitable scale.

GUIDED TRY

Give three points on $y=x+4$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Why should points for a linear equation be joined by a line? Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Tables of values and linear graphs

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Complete $y=2x+1$ when $x=3$.

[2]

2. For $y=3x-2$, find y when $x=-2$.

[2]

3. Give three points on $y=x+4$.

[3]

4. Does $(3,8)$ lie on $y=2x+2$?

[2]

5. Find where $y=4x-8$ crosses the x -axis.

[3]

6. Find where $y=-2x+6$ crosses the y -axis.

[2]

7. A table for $y=5-x$ has $x=-1,0,2$. Find the y -values.

[3]

8. Why should points for a linear equation be joined by a line?

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Quadratic, cubic and reciprocal graphs

Connect equations with their characteristic shapes.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA11-FA12. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Graph families have recognisable structures. Quadratics curve with one turning point, cubics can change curvature, and reciprocal graphs split around excluded axis values. Equations and shapes should be connected through substitution and symmetry.

KEY VOCABULARY

quadratic • cubic • reciprocal • symmetry • intercept • asymptote

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- Powers determine how signs and magnitudes behave.
- Intercepts come from setting x or y to zero.
- Excluded inputs create gaps or asymptotic behaviour.

CHECK BEFORE MOVING ON

Answer mentally: Name the graph type of $y=x^2$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Quadratic, cubic and reciprocal graphs - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Use symmetry, intercepts and turning behaviour.
- A quadratic has a U-shape; a cubic changes direction through an S-like shape.
- A reciprocal graph has separate branches and does not meet its axes.

WORKED EXAMPLE 1

Name the graph type of $y=x^2$.

SOLUTION

1. The highest power of x is 2.

ANSWER: Quadratic

WORKED EXAMPLE 2

Find $y=x^2-1$ when $x=3$.

SOLUTION

1. $3^2-1=9-1=8$.

ANSWER: 8

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Quadratic, cubic and reciprocal graphs - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Curved graphs model area, volume, sharing rates and non-linear change.

Common misconceptions

- Calling every curve quadratic.
- Joining reciprocal branches across $x=0$.
- Forgetting that negative values square positively.

GUIDED TRY

State the y-intercept of $y=x^2+2$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Describe one feature that distinguishes a quadratic from a straight line. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Quadratic, cubic and reciprocal graphs

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. Name the graph type of $y=x^2$.

[1]

2. Find $y=x^2-1$ when $x=3$.

[2]

3. State the y-intercept of $y=x^2+2$.

[2]

4. Find $y=x^3$ when $x=-2$.

[2]

5. For $y=6/x$, find y when $x=3$.

[2]

6. Why is $x=0$ not allowed in $y=6/x$?

[2]

7. Which graph is symmetric about the y-axis: $y=x^2$ or $y=x^3$?

[2]

8. Describe one feature that distinguishes a quadratic from a straight line.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Gradient, intercept and $y = mx + c$

Interpret the equation of a straight line.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA9-FA10. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A straight-line equation summarises two visual features. The gradient m is vertical change per horizontal unit; c is the value of y when $x=0$. Together they fix the whole line.

KEY VOCABULARY

gradient • intercept • rise • run • $y=mx+c$

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- Gradient is a ratio of corresponding changes.
- The intercept anchors the line at $x=0$.
- A constant gradient produces a straight line.

CHECK BEFORE MOVING ON

Answer mentally: State the gradient and y -intercept of $y=3x-4$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Gradient, intercept and $y = mx + c$ - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- In $y=mx+c$, m is gradient and c is y -intercept.
- Calculate gradient as change in y divided by change in x .
- Use two clear points and keep the direction consistent.

WORKED EXAMPLE 1

State the gradient and y -intercept of $y=3x-4$.

SOLUTION

1. Compare with $y=mx+c$.

ANSWER: Gradient 3; y -intercept -4

WORKED EXAMPLE 2

Find the gradient through $(1,2)$ and $(5,10)$.

SOLUTION

1. Change in $y=10-2=8$.
2. Change in $x=5-1=4$.
3. Gradient= $8/4=2$.

ANSWER: 2

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Gradient, intercept and $y = mx + c$ - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Rates and fixed charges are naturally represented by gradient and intercept.

Common misconceptions

- Reversing rise and run.
- Using points not exactly on the line.
- Confusing x- and y-intercepts.

GUIDED TRY

Write the equation of gradient 4 and y-intercept 7. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain the meaning of a negative gradient. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Gradient, intercept and $y = mx + c$

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. State the gradient and y-intercept of $y=3x-4$.

[2]

2. Find the gradient through (1,2) and (5,10).

[3]

3. Write the equation of gradient 4 and y-intercept 7.

[2]

4. Find the gradient of $y=-5x+2$.

[1]

5. A line crosses the y-axis at 3 and passes through (2,9). Find its equation.

[4]

6. Find the x-intercept of $y=2x-6$.

[3]

7. A horizontal line passes through $y=-2$. Write its equation.

[2]

8. Explain the meaning of a negative gradient.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Solving equations using graphs

Use intersections and axis crossings as approximate solutions.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA13-FA15. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Graphs solve equations visually. A root is an x-axis crossing, while an intersection solves equality between two functions. Accuracy is limited by plotting and scale.

KEY VOCABULARY

root • intersection • approximate • axis crossing • accuracy

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- At an x-intercept, $y=0$.
- At an intersection, both graphs have the same coordinates.
- Substitution tests the read value.

CHECK BEFORE MOVING ON

Answer mentally: The graph $y=2x-6$ crosses the x-axis at $x=3$. Solve $2x-6=0$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Solving equations using graphs - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- A root is an x-value where the graph has $y=0$.
- Two graphs are equal where they intersect.
- Read approximate values using the graph scale and stated accuracy.

WORKED EXAMPLE 1

The graph $y=2x-6$ crosses the x-axis at $x=3$. Solve $2x-6=0$.

SOLUTION

1. A root occurs where $y=0$.

ANSWER: $x = 3$

WORKED EXAMPLE 2

Graphs $y=x+1$ and $y=7-x$ intersect at $(3,4)$. Solve $x+1=7-x$.

SOLUTION

1. At the intersection both expressions have equal y-values.

ANSWER: $x = 3$

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Solving equations using graphs - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Graphical solutions are useful when exact algebra is difficult or a visual estimate is sufficient.

Common misconceptions

- Reporting the y-coordinate instead of x.
- Giving excessive precision.
- Missing a second intersection.

GUIDED TRY

A quadratic crosses the x-axis at -2 and 5. State its roots. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State one check for a graphical solution. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Solving equations using graphs

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. The graph $y=2x-6$ crosses the x-axis at $x=3$. Solve $2x-6=0$.

[1]

2. Graphs $y=x+1$ and $y=7-x$ intersect at $(3,4)$. Solve $x+1=7-x$.

[2]

3. A quadratic crosses the x-axis at -2 and 5. State its roots.

[2]

4. A graph of $y=x^2$ has $y=16$ at two points. Solve $x^2=16$.

[2]

5. The lines $y=3x-1$ and $y=8$ intersect. Find x .

[3]

6. A graph gives a root between 2.4 and 2.5. State it to 1 decimal place if the crossing is 2.46.

[2]

7. Why might a graph give an approximate rather than exact solution?

[2]

8. State one check for a graphical solution.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Conversion and comparison graphs

Read and construct graphs connecting two measurement scales.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA13. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A conversion graph links two scales. If zero of one quantity corresponds to zero of the other and the rate is constant, the line passes through the origin. Offset conversions have non-zero intercepts.

KEY VOCABULARY

conversion • scale factor • proportional • unit • origin

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- Gradient is the conversion factor.
- Axes allow either direction of conversion.
- Units determine the meaning of the rate.

CHECK BEFORE MOVING ON

Answer mentally: A graph shows $\text{£}1 = \$1.25$. Convert $\text{£}48$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Conversion and comparison graphs - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Identify which quantity is on each axis.
- Use a straight proportional line only when zero maps to zero.
- Read across and down carefully, keeping units.

WORKED EXAMPLE 1

A graph shows £1=\$1.25. Convert £48.

SOLUTION

1. $48 \times 1.25 = 60$.

ANSWER: \$60

WORKED EXAMPLE 2

A conversion graph shows 5 miles=8 km. Convert 30 miles.

SOLUTION

1. Scale factor is 6.
2. $8 \times 6 = 48$ km.

ANSWER: 48 km

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Conversion and comparison graphs - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Currency, distance, mass and temperature conversions use linked scales.

Common misconceptions

- Reading from the wrong axis.
- Assuming every conversion is direct proportion.
- Dropping units.

GUIDED TRY

A line passes through (4,10) and the origin. Find y when $x=7$. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Explain how to reverse a conversion graph reading. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Conversion and comparison graphs

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A graph shows $\text{£}1 = \$1.25$. Convert $\text{£}48$.

[2]

2. A conversion graph shows 5 miles = 8 km. Convert 30 miles.

[2]

3. A line passes through (4,10) and the origin. Find y when $x=7$.

[3]

4. A temperature graph maps 0°C to 32°F . Is it direct proportion?

[2]

5. On a graph, 12 cm represents 30 km. Find km per cm.

[2]

6. Convert 72 km to miles using 5 miles = 8 km.

[3]

7. Why should a conversion graph have labelled units?

[2]

8. Explain how to reverse a conversion graph reading.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Distance-time graphs

Interpret motion from gradient and horizontal sections.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA13. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

A distance-time graph records position relative to a reference point. Its gradient is speed. A horizontal section means time passes without a distance change; a steeper section means faster motion.

KEY VOCABULARY

distance • time • speed • gradient • stationary

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- Distance divided by time is speed.
- Gradient measures this same ratio visually.
- Returning toward the reference makes distance fall.

CHECK BEFORE MOVING ON

Answer mentally: A cyclist travels 12 km in 40 minutes. Find average speed in km/h. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Distance-time graphs - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Gradient represents speed: distance divided by time.
- A horizontal section means distance is unchanged, so the object is stopped.
- A steeper section represents greater speed.

WORKED EXAMPLE 1

A cyclist travels 12 km in 40 minutes. Find average speed in km/h.

SOLUTION

1. 40 minutes = $\frac{2}{3}$ hour.
2. $12 \div (\frac{2}{3}) = 18$ km/h.

ANSWER: 18 km/h

WORKED EXAMPLE 2

What does a horizontal distance-time segment mean?

SOLUTION

1. Time changes but distance does not.

ANSWER: The object is stationary

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Distance-time graphs - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Travel tracking and race analysis use distance-time graphs to compare journeys.

Common misconceptions

- Treating height as speed.
- Comparing visual steepness when scales differ.
- Mixing minutes and hours.

GUIDED TRY

A car travels 150 km in 2.5 hours. Find average speed. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State two features needed to compare journeys fairly. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Distance-time graphs

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A cyclist travels 12 km in 40 minutes. Find average speed in km/h.

[3]

2. What does a horizontal distance-time segment mean?

[1]

3. A car travels 150 km in 2.5 hours. Find average speed.

[2]

4. Two lines start together; line A is steeper. Which object is faster?

[1]

5. A walker reaches 6 km at 10:30 after starting 09:00. Find speed.

[3]

6. A journey goes 20 km out then returns to zero distance. What does zero represent?

[2]

7. Why is a vertical segment impossible on a distance-time graph?

[2]

8. State two features needed to compare journeys fairly.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Cost, filling and temperature graphs

Interpret intercepts, slopes, plateaus and changes of direction.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA13. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Real-world graphs tell stories through intercepts, slopes and turning behaviour. The same numerical feature has different meaning depending on axis labels and units.

KEY VOCABULARY

fixed charge • rate • plateau • curve • context

model**simplify****solve****check****interpret**

a complete algebraic argument has a logical chain

Why the method works

- An intercept represents an initial amount.
- Gradient represents change per unit input.
- A changing gradient shows a changing rate.

CHECK BEFORE MOVING ON

Answer mentally: A taxi graph starts at £4 when distance is 0. Interpret £4. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Cost, filling and temperature graphs - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Translate each graph feature into the context.
- An intercept can represent a starting amount or fixed charge.
- Changing gradient means the rate changes.

WORKED EXAMPLE 1

A taxi graph starts at £4 when distance is 0. Interpret £4.

SOLUTION

1. It is paid before any distance is travelled.

ANSWER: The fixed starting charge

WORKED EXAMPLE 2

A tank-volume graph is horizontal for 5 minutes. Interpret.

SOLUTION

1. No net liquid enters or leaves.

ANSWER: The volume does not change

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Cost, filling and temperature graphs - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Bills, tanks, temperature and production are interpreted from graphical features.

Common misconceptions

- Ignoring the context.
- Calling every flat part zero.
- Assuming a curved graph has constant rate.

GUIDED TRY

A cost line has gradient £2.40 per hour and intercept £5. Write the rule. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Give one reason a real-world graph may be curved. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Cost, filling and temperature graphs

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A taxi graph starts at £4 when distance is 0. Interpret £4.

[1]

2. A tank-volume graph is horizontal for 5 minutes. Interpret.

[1]

3. A cost line has gradient £2.40 per hour and intercept £5. Write the rule.

[2]

4. A cooling graph falls quickly then more slowly. Describe the rate.

[2]

5. A phone plan costs £12 plus 5p per text. Find cost for 80 texts.

[3]

6. A tank rises from 100 L to 340 L in 8 min. Find filling rate.

[2]

7. Why can two graphs with the same shape tell different stories?

[2]

8. Give one reason a real-world graph may be curved.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Gradients and rates of change

Interpret gradient as change per unit in Foundation contexts.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA10, FA13. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Gradient measures output change per input unit. In context, it may represent speed, cost per item, filling rate or temperature change.

KEY VOCABULARY

rate of change • gradient • rise • run • units

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- Units confirm a gradient meaning.
- Rise divided by run gives the rate over an interval.
- A zero gradient means no change in the vertical quantity.

CHECK BEFORE MOVING ON

Answer mentally: A distance-time graph rises 18 km in 0.5 h. Find its gradient. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Gradients and rates of change - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Gradient means vertical change divided by horizontal change.
- Attach units by dividing the vertical-axis unit by the horizontal-axis unit.
- Check scales before comparing steepness.

WORKED EXAMPLE 1

A distance-time graph rises 18 km in 0.5 h. Find its gradient.

SOLUTION

1. Gradient = change in distance $\div$ change in time.
2. $18 \div 0.5 = 36$ km/h.

ANSWER: 36 km/h

WORKED EXAMPLE 2

A tank-volume graph rises from 120 L to 300 L in 6 minutes. Find the rate.

SOLUTION

1. Change in volume = 180 L.
2. $180 \div 6 = 30$ L/min.

ANSWER: 30 L/min

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Gradients and rates of change - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Travel, pricing and filling graphs use gradient to communicate rate.

Common misconceptions

- Comparing visual steepness when scales differ.
- Dividing horizontal change by vertical change.
- Giving a number without rate units.

GUIDED TRY

A graph rises from 4 m/s to 10 m/s over 3 s. Find its gradient. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State one limitation of estimating a gradient from a curve. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Gradients and rates of change

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. A distance-time graph rises 18 km in 0.5 h. Find its gradient.

[2]

2. A tank-volume graph rises from 120 L to 300 L in 6 minutes. Find the rate.

[3]

3. A graph rises from 4 m/s to 10 m/s over 3 s. Find its gradient.

[3]

4. State units of gradient on a distance-km against time-hour graph.

[2]

5. Line A rises 24 units over a run of 6. Line B rises 15 over a run of 5. Which is steeper?

[3]

6. What does zero gradient mean on a temperature-time graph?

[1]

7. A cost graph has gradient 2.8 with cost in pounds and mass in kg. Interpret it.

[2]

8. State one limitation of estimating a gradient from a curve.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Mixed graphical reasoning

Select coordinates, equations, gradients, intersections and context.

SPECIFICATION FOCUS

Eduqas reference Eduqas C300 FA8-FA21 synthesis. This lesson develops representation, accurate calculation, reasoning and interpretation within Foundation Tier.

Understand the idea

Mixed graph questions require disciplined reading. Titles and units identify the model; geometry of the graph then determines whether to use a coordinate, rate, crossing or area.

KEY VOCABULARY

axis • scale • coordinate • gradient • intersection • area

model

simplify

solve

check

interpret

a complete algebraic argument has a logical chain

Why the method works

- Each feature answers a different mathematical question.
- Units provide an independent check.
- Substitution or trend checks test plausibility.

CHECK BEFORE MOVING ON

Answer mentally: For $y=2x+5$, find the point when $x=-3$. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Mixed graphical reasoning - method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Read titles, axes, scales and units first.
- Decide whether the task concerns a point, gradient, intercept, intersection or area.
- Check the answer against the visible trend and context.

WORKED EXAMPLE 1

For $y=2x+5$, find the point when $x=-3$.

SOLUTION

1. $y=2(-3)+5=-1$.

ANSWER: (-3, -1)

WORKED EXAMPLE 2

Find the gradient through $(-2,1)$ and $(4,13)$.

SOLUTION

1. Change in $y=12$; change in $x=6$.
2. Gradient= 2 .

ANSWER: 2

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Mixed graphical reasoning - apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Graph literacy supports decisions in travel, finance, science and data monitoring.

Common misconceptions

- Starting calculations before reading scales.
- Giving an answer without units.
- Using a method suited to the wrong graph type.

GUIDED TRY

Write the line with gradient -3 and intercept 4 . First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State two checks when reading a graph. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Mixed graphical reasoning

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. For $y=2x+5$, find the point when $x=-3$.

[2]

2. Find the gradient through $(-2,1)$ and $(4,13)$.

[3]

3. Write the line with gradient -3 and intercept 4.

[2]

4. A quadratic has roots 1 and 6. Solve $y=0$.

[2]

5. A distance-time line covers 27 km in 45 min. Find km/h.

[3]

6. A conversion line through the origin contains $(8,20)$. Find y when $x=14$.

[3]

7. A graph crosses the y -axis at -2 and passes $(3,7)$. Find its equation.

[4]

8. State two checks when reading a graph.

[2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Algebraic language and forming expressions

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Write an expression for 7 more than n .

ANSWER: $n + 7$

Method cue: "More than" means add 7 to n . Check sign, size, accuracy and units.

2. Write an expression for the cost of x tickets at £6 each plus a £2 booking fee.

ANSWER: $6x + 2$

Method cue: x tickets cost $6x$ pounds. Check sign, size, accuracy and units.

3. State whether $3x+5$ is an expression or equation.

ANSWER: Expression

Method cue: It has no equals sign. Check sign, size, accuracy and units.

4. Write an equation: three times a number, increased by 4, equals 25.

ANSWER: $3x + 4 = 25$

Method cue: Three times the number is $3x$. Check sign, size, accuracy and units.

5. A rectangle has width w and length $w+3$. Write its perimeter.

ANSWER: $4w + 6$

Method cue: Perimeter = $2w + 2(w+3)$. Check sign, size, accuracy and units.

6. Write an expression for half of the total of y and 8.

ANSWER: $(y + 8)/2$

Method cue: "Total of y and 8" is $y+8$. Check sign, size, accuracy and units.

7. The n th odd number is $2n-1$. Find the 20th odd number.

ANSWER: 39

Method cue: Substitute $n=20$. Check sign, size, accuracy and units.

8. Explain why $5(a+2)$ is not the same as $5a+2$.

ANSWER: The 5 multiplies both terms inside the bracket.

Method cue: $5(a+2)=5a+10$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Index laws and simple surds

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Simplify $x^3 \times x^5$.

ANSWER: x^8

Method cue: The base is the same. Check sign, size, accuracy and units.

2. Simplify $a^9 \div a^4$.

ANSWER: a^5

Method cue: The base is the same. Check sign, size, accuracy and units.

3. Write $p \times p \times p \times p \times p$ using index notation.

ANSWER: p^5

Method cue: There are five equal factors of p. Check sign, size, accuracy and units.

4. Simplify $3m^2 \times 4m^3$.

ANSWER: $12m^5$

Method cue: Multiply the coefficients: $3 \times 4 = 12$. Check sign, size, accuracy and units.

5. Simplify $18y^7 \div 6y^2$.

ANSWER: $3y^5$

Method cue: $18/6 = 3$. Check sign, size, accuracy and units.

6. Simplify $3\sqrt{5} + 7\sqrt{5}$.

ANSWER: $10\sqrt{5}$

Method cue: The surd parts match. Check sign, size, accuracy and units.

7. Simplify $9\sqrt{2} - 4\sqrt{2}$.

ANSWER: $5\sqrt{2}$

Method cue: The surd parts match. Check sign, size, accuracy and units.

8. Explain why $2\sqrt{3} + 5\sqrt{2}$ cannot be collected.

ANSWER: They are unlike surds.

Method cue: The surd factors are different. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Expanding and factorising expressions

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Expand $5(x+3)$.

ANSWER: $5x + 15$

Method cue: Multiply both terms by 5. Check sign, size, accuracy and units.

2. Factorise $12p^2+8p$.

ANSWER: $4p(3p + 2)$

Method cue: The highest common factor is $4p$. Check sign, size, accuracy and units.

3. Expand $(x+4)(x+7)$.

ANSWER: $x^2 + 11x + 28$

Method cue: Multiply every term. Check sign, size, accuracy and units.

4. Expand $(x-3)(x+5)$.

ANSWER: $x^2 + 2x - 15$

Method cue: Multiply every term, keeping the signs. Check sign, size, accuracy and units.

5. Factorise $x^2+9x+20$.

ANSWER: $(x+4)(x+5)$

Method cue: $4 \times 5=20$. Check sign, size, accuracy and units.

6. Factorise $x^2-2x-15$.

ANSWER: $(x-5)(x+3)$

Method cue: $-5 \times 3=-15$. Check sign, size, accuracy and units.

7. Factorise x^2-49 .

ANSWER: $(x-7)(x+7)$

Method cue: Recognise a difference of two squares. Check sign, size, accuracy and units.

8. Expand and simplify $2(x+3)+(x-1)(x+2)$.

ANSWER: $x^2 + 5x + 4$

Method cue: Expand to $2x+6+x^2+x-2$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Substitution and using formulae

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Find $4a-3$ when $a=6$.

ANSWER: 21

Method cue: Substitute: $4(6)-3$. Check sign, size, accuracy and units.

2. Find x^2+2y when $x=-3$ and $y=5$.

ANSWER: 19

Method cue: Use brackets: $(-3)^2+2(5)$. Check sign, size, accuracy and units.

3. Use $A=lw$ to find A when $l=8$ cm and $w=3.5$ cm.

ANSWER: 28 cm²

Method cue: $A=8\times 3.5$. Check sign, size, accuracy and units.

4. Use $v=u+at$ when $u=4$, $a=3$ and $t=5$.

ANSWER: 19

Method cue: $v=4+3\times 5$. Check sign, size, accuracy and units.

5. Find $2p^2-q$ when $p=-4$ and $q=7$.

ANSWER: 25

Method cue: $2(-4)^2-7$. Check sign, size, accuracy and units.

6. Use $C=2\pi r$ to find C for $r=6$ cm, to 1 decimal place.

ANSWER: 37.7 cm

Method cue: $C=2\pi\times 6=12\pi$. Check sign, size, accuracy and units.

7. Use $s=(u+v)t/2$ when $u=3$, $v=11$, $t=4$.

ANSWER: 28

Method cue: $s=(3+11)\times 4\div 2$. Check sign, size, accuracy and units.

8. Explain why brackets matter when substituting $x=-2$ into x^2 .

ANSWER: They show the whole negative number is squared.

Method cue: $x^2=(-2)^2=4$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Changing the subject of a formula

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Make x the subject of $y=x+7$.

ANSWER: $x = y - 7$

Method cue: Subtract 7 from both sides. Check sign, size, accuracy and units.

2. Make a the subject of $v=u+at$.

ANSWER: $a = (v-u)/t$

Method cue: Subtract u : $v-u=at$. Check sign, size, accuracy and units.

3. Make w the subject of $A=lw$.

ANSWER: $w = A/l$

Method cue: Divide both sides by l . Check sign, size, accuracy and units.

4. Make r the subject of $C=2\pi r$.

ANSWER: $r = C/(2\pi)$

Method cue: Divide by 2π . Check sign, size, accuracy and units.

5. Make x the subject of $y=3x-5$.

ANSWER: $x = (y+5)/3$

Method cue: Add 5: $y+5=3x$. Check sign, size, accuracy and units.

6. Make h the subject of $A=(b+h)/2$.

ANSWER: $h = 2A - b$

Method cue: Multiply by 2: $2A=b+h$. Check sign, size, accuracy and units.

7. Make p the subject of $q=(p-4)/5$.

ANSWER: $p = 5q + 4$

Method cue: Multiply by 5: $5q=p-4$. Check sign, size, accuracy and units.

8. Explain how to check a rearranged formula.

ANSWER: Substitute the same numerical values into both forms.

Method cue: Both forms should produce a consistent relationship. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Solving linear equations

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Solve $4x+3=27$.**ANSWER: $x = 6$**

Method cue: Subtract 3: $4x=24$. Check sign, size, accuracy and units.

2. Solve $7x-9=3x+19$.**ANSWER: $x = 7$**

Method cue: Subtract $3x$: $4x-9=19$. Check sign, size, accuracy and units.

3. Solve $5(x-2)=35$.**ANSWER: $x = 9$**

Method cue: Divide by 5: $x-2=7$. Check sign, size, accuracy and units.

4. Solve $3(2x+1)=27$.**ANSWER: $x = 4$**

Method cue: Divide by 3: $2x+1=9$. Check sign, size, accuracy and units.

5. Solve $(x+5)/4=6$.**ANSWER: $x = 19$**

Method cue: Multiply by 4: $x+5=24$. Check sign, size, accuracy and units.

6. A taxi costs £3 plus £2 per mile. The fare is £19. Find miles.**ANSWER: 8 miles**

Method cue: Equation: $3+2m=19$. Check sign, size, accuracy and units.

7. Solve $8-2x=20$.**ANSWER: $x = -6$**

Method cue: Subtract 8: $-2x=12$. Check sign, size, accuracy and units.

8. Explain why doing the same operation to both sides preserves equality.**ANSWER: Equal quantities remain equal after the same change.**

Method cue: If $\text{left}=\text{right}$, then $\text{left}+k=\text{right}+k$ and similarly for valid multiplication/division. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Quadratic and simultaneous equations

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

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

ANSWER: $x = 3$ or $x = 4$

Method cue: Factorise: $(x-3)(x-4)=0$. Check sign, size, accuracy and units.

2. Solve $x^2+5x+6=0$.

ANSWER: $x = -2$ or $x = -3$

Method cue: Factorise: $(x+2)(x+3)=0$. Check sign, size, accuracy and units.

3. Solve simultaneously $x+y=11$ and $x-y=3$.

ANSWER: $x = 7$, $y = 4$

Method cue: Add equations: $2x=14$, so $x=7$. Check sign, size, accuracy and units.

4. Solve $y=2x+1$ and $x+y=10$.

ANSWER: $x = 3$, $y = 7$

Method cue: Substitute: $x+2x+1=10$. Check sign, size, accuracy and units.

5. A rectangle has sides x and $x+3$, area 40. Find x .

ANSWER: $x = 5$

Method cue: $x(x+3)=40$, so $x^2+3x-40=0$. Check sign, size, accuracy and units.

6. Solve $x^2=49$.

ANSWER: $x = 7$ or $x = -7$

Method cue: Both 7^2 and $(-7)^2$ equal 49. Check sign, size, accuracy and units.

7. The sum of two numbers is 18 and their difference is 4. Find them.

ANSWER: 11 and 7

Method cue: Let $x+y=18$ and $x-y=4$. Check sign, size, accuracy and units.

8. Why can a quadratic equation have two solutions?

ANSWER: Two different inputs can produce the same squared relationship.

Method cue: After factorising, either factor may be zero. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Linear inequalities

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Solve $x+5<12$.

ANSWER: $x < 7$

Method cue: Subtract 5 from both sides. Check sign, size, accuracy and units.

2. Solve $3x\geq 18$.

ANSWER: $x \geq 6$

Method cue: Divide both sides by positive 3; sign stays the same. Check sign, size, accuracy and units.

3. Solve $-2x<10$.

ANSWER: $x > -5$

Method cue: Divide by -2. Check sign, size, accuracy and units.

4. Solve $4x-3\leq 13$.

ANSWER: $x \leq 4$

Method cue: Add 3: $4x\leq 16$. Check sign, size, accuracy and units.

5. List the integer solutions of $-2<x\leq 3$.

ANSWER: -1, 0, 1, 2, 3

Method cue: Values must be greater than -2 and at most 3. Check sign, size, accuracy and units.

6. A lift holds at most 600 kg. Four people total 312 kg. Write and solve an inequality for...

ANSWER: $b \leq 12$

Method cue: $312+24b\leq 600$. Check sign, size, accuracy and units.

7. Represent $x>-1$ on a number line.

ANSWER: Open circle at -1, arrow to the right

Method cue: Strict $>$ excludes -1. Check sign, size, accuracy and units.

8. Explain why the sign reverses when dividing by a negative.

ANSWER: A negative multiplication reverses order on the number line.

Method cue: For example $2<5$ but $-2>-5$. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Sequences and nth terms

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Write the next two terms: 5, 9, 13, 17, ...

ANSWER: 21, 25

Method cue: The common difference is +4. Check sign, size, accuracy and units.

2. Find the nth term of 4, 7, 10, 13, ...

ANSWER: $3n + 1$

Method cue: Difference is 3, so start with $3n$. Check sign, size, accuracy and units.

3. Find the 20th term of $3n-2$.

ANSWER: 58

Method cue: Substitute $n=20$. Check sign, size, accuracy and units.

4. Is 47 in the sequence $5n+2$?

ANSWER: Yes, it is the 9th term

Method cue: Solve $5n+2=47$. Check sign, size, accuracy and units.

5. Find the nth term of 12, 9, 6, 3, ...

ANSWER: $15 - 3n$

Method cue: Difference is -3, so begin $-3n$. Check sign, size, accuracy and units.

6. Continue the Fibonacci-type sequence 2, 3, 5, 8, 13, ...

ANSWER: 21, 34

Method cue: Each term is the sum of the previous two. Check sign, size, accuracy and units.

7. The nth term is $4n-7$. Find the first positive term.

ANSWER: 1, when $n = 2$

Method cue: At $n=1$, term=-3. Check sign, size, accuracy and units.

8. Explain how to check an nth-term rule.

ANSWER: Substitute several position numbers and compare with the sequence.

Method cue: Check $n=1$ and at least one later term. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Functions, formula use and mixed algebra

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A function is defined by $f(x)=3x-2$. Find $f(5)$.

ANSWER: 13

Method cue: Substitute $x=5$. Check sign, size, accuracy and units.

2. The function g maps x to x^2+1 . Find $g(-4)$.

ANSWER: 17

Method cue: Use brackets: $(-4)^2+1$. Check sign, size, accuracy and units.

3. A function machine multiplies by 4 then subtracts 7. Its output is 25. Find the input.

ANSWER: 8

Method cue: Reverse the operations: add 7, then divide by 4. Check sign, size, accuracy and units.

4. Using $v=u+at$, find v when $u=6$ m/s, $a=2.5$ m/s² and $t=8$ s.

ANSWER: 26 m/s

Method cue: Substitute the supplied values. Check sign, size, accuracy and units.

5. Using $s=ut+1/2at^2$, find s when $u=3$, $a=2$ and $t=4$.

ANSWER: 28

Method cue: $s=3 \times 4 + 1/2 \times 2 \times 4^2$. Check sign, size, accuracy and units.

6. Solve $4(2x+1)=3x+29$.

ANSWER: $x = 5$

Method cue: Expand: $8x+4=3x+29$. Check sign, size, accuracy and units.

7. Prove the sum of three consecutive integers is a multiple of 3.

ANSWER: $3(n+1)$, so it is a multiple of 3

Method cue: Let integers be n , $n+1$, $n+2$. Check sign, size, accuracy and units.

8. State two checks for an algebraic or function answer.

ANSWER: Substitute into the original rule and check context or restrictions.

Method cue: Check signs and operations. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Coordinates, scales and plotting points

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. State the coordinates of a point 3 right and 2 up from the origin.

ANSWER: (3, 2)

Method cue: Horizontal movement gives $x=3$. Check sign, size, accuracy and units.

2. Plot A(-4,3). Which quadrant contains A?

ANSWER: Quadrant II

Method cue: x is negative and y is positive. Check sign, size, accuracy and units.

3. Find the midpoint of (2,4) and (8,10).

ANSWER: (5, 7)

Method cue: Average x -values: $(2+8)/2=5$. Check sign, size, accuracy and units.

4. Reflect (5,-2) in the x -axis.

ANSWER: (5, 2)

Method cue: The x -coordinate stays fixed. Check sign, size, accuracy and units.

5. A point lies on the y -axis and has $y=-6$. State it.

ANSWER: (0, -6)

Method cue: Every point on the y -axis has $x=0$. Check sign, size, accuracy and units.

6. Point B is (-2,-5). Translate it 4 right and 7 up.

ANSWER: (2, 2)

Method cue: New $x=-2+4=2$. Check sign, size, accuracy and units.

7. Three vertices are (1,1),(5,1),(5,4). Give the fourth vertex of the rectangle.

ANSWER: (1, 4)

Method cue: Match $x=1$ with $y=4$ to complete parallel sides. Check sign, size, accuracy and units.

8. Explain why (2,-3) and (-3,2) are different points.

ANSWER: Their x - and y -coordinates are reversed.

Method cue: Coordinates are ordered pairs. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Tables of values and linear graphs

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Complete $y=2x+1$ when $x=3$.

ANSWER: $y = 7$

Method cue: $y=2(3)+1$. Check sign, size, accuracy and units.

2. For $y=3x-2$, find y when $x=-2$.

ANSWER: $y = -8$

Method cue: $y=3(-2)-2$. Check sign, size, accuracy and units.

3. Give three points on $y=x+4$.

ANSWER: For example $(-4,0)$, $(0,4)$, $(2,6)$

Method cue: Substitute chosen x -values. Check sign, size, accuracy and units.

4. Does $(3,8)$ lie on $y=2x+2$?

ANSWER: Yes

Method cue: At $x=3$, $y=2(3)+2=8$. Check sign, size, accuracy and units.

5. Find where $y=4x-8$ crosses the x -axis.

ANSWER: $(2, 0)$

Method cue: On the x -axis $y=0$. Check sign, size, accuracy and units.

6. Find where $y=-2x+6$ crosses the y -axis.

ANSWER: $(0, 6)$

Method cue: On the y -axis $x=0$. Check sign, size, accuracy and units.

7. A table for $y=5-x$ has $x=-1,0,2$. Find the y -values.

ANSWER: 6, 5, 3

Method cue: Substitute each x . Check sign, size, accuracy and units.

8. Why should points for a linear equation be joined by a line?

ANSWER: Every intermediate real x -value has a corresponding y -value.

Method cue: The relationship is continuous. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Quadratic, cubic and reciprocal graphs

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Name the graph type of $y=x^2$.

ANSWER: Quadratic

Method cue: The highest power of x is 2. Check sign, size, accuracy and units.

2. Find $y=x^2-1$ when $x=3$.

ANSWER: 8

Method cue: $3^2-1=9-1=8$. Check sign, size, accuracy and units.

3. State the y-intercept of $y=x^2+2$.

ANSWER: (0, 2)

Method cue: Set $x=0$. Check sign, size, accuracy and units.

4. Find $y=x^3$ when $x=-2$.

ANSWER: -8

Method cue: $(-2)^3=-8$. Check sign, size, accuracy and units.

5. For $y=6/x$, find y when $x=3$.

ANSWER: 2

Method cue: Substitute: $y=6\div3=2$. Check sign, size, accuracy and units.

6. Why is $x=0$ not allowed in $y=6/x$?

ANSWER: Division by zero is undefined.

Method cue: The graph therefore has no point on the y -axis. Check sign, size, accuracy and units.

7. Which graph is symmetric about the y-axis: $y=x^2$ or $y=x^3$?

ANSWER: $y = x^2$

Method cue: Positive and negative x give the same square. Check sign, size, accuracy and units.

8. Describe one feature that distinguishes a quadratic from a straight line.

ANSWER: A quadratic curves and has a turning point.

Method cue: A straight line has constant gradient. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Gradient, intercept and $y = mx + c$

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. State the gradient and y-intercept of $y=3x-4$.

ANSWER: Gradient 3; y-intercept -4

Method cue: Compare with $y=mx+c$. Check sign, size, accuracy and units.

2. Find the gradient through (1,2) and (5,10).

ANSWER: 2

Method cue: Change in $y=10-2=8$. Check sign, size, accuracy and units.

3. Write the equation of gradient 4 and y-intercept 7.

ANSWER: $y = 4x + 7$

Method cue: Use $y=mx+c$ with $m=4$, $c=7$. Check sign, size, accuracy and units.

4. Find the gradient of $y=-5x+2$.

ANSWER: -5

Method cue: The coefficient of x is the gradient. Check sign, size, accuracy and units.

5. A line crosses the y-axis at 3 and passes through (2,9). Find its equation.

ANSWER: $y = 3x + 3$

Method cue: Gradient= $(9-3)/(2-0)=3$. Check sign, size, accuracy and units.

6. Find the x-intercept of $y=2x-6$.

ANSWER: (3, 0)

Method cue: Set $y=0$. Check sign, size, accuracy and units.

7. A horizontal line passes through $y=-2$. Write its equation.

ANSWER: $y = -2$

Method cue: Every point has the same y -value. Check sign, size, accuracy and units.

8. Explain the meaning of a negative gradient.

ANSWER: y decreases as x increases.

Method cue: The line falls from left to right. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Solving equations using graphs

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. The graph $y=2x-6$ crosses the x-axis at $x=3$. Solve $2x-6=0$.

ANSWER: $x = 3$

Method cue: A root occurs where $y=0$. Check sign, size, accuracy and units.

2. Graphs $y=x+1$ and $y=7-x$ intersect at $(3,4)$. Solve $x+1=7-x$.

ANSWER: $x = 3$

Method cue: At the intersection both expressions have equal y-values. Check sign, size, accuracy and units.

3. A quadratic crosses the x-axis at -2 and 5 . State its roots.

ANSWER: $x = -2$ and $x = 5$

Method cue: Each x-intercept has $y=0$. Check sign, size, accuracy and units.

4. A graph of $y=x^2$ has $y=16$ at two points. Solve $x^2=16$.

ANSWER: $x = -4$ or $x = 4$

Method cue: The horizontal line $y=16$ intersects twice. Check sign, size, accuracy and units.

5. The lines $y=3x-1$ and $y=8$ intersect. Find x .

ANSWER: $x = 3$

Method cue: At intersection $3x-1=8$. Check sign, size, accuracy and units.

6. A graph gives a root between 2.4 and 2.5 . State it to 1 decimal place if the crossing is...

ANSWER: 2.5

Method cue: 2.46 rounds to 2.5 . Check sign, size, accuracy and units.

7. Why might a graph give an approximate rather than exact solution?

ANSWER: The plotted scale and line thickness limit precision.

Method cue: Reading between grid lines introduces uncertainty. Check sign, size, accuracy and units.

8. State one check for a graphical solution.

ANSWER: Substitute the read x-value into the original equation.

Method cue: The two sides should be close within graph-reading accuracy. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Conversion and comparison graphs

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A graph shows £1=\$1.25. Convert £48.

ANSWER: \$60

Method cue: $48 \times 1.25 = 60$. Check sign, size, accuracy and units.

2. A conversion graph shows 5 miles=8 km. Convert 30 miles.

ANSWER: 48 km

Method cue: Scale factor is 6. Check sign, size, accuracy and units.

3. A line passes through (4,10) and the origin. Find y when x=7.

ANSWER: 17.5

Method cue: $\text{Rate} = 10/4 = 2.5$. Check sign, size, accuracy and units.

4. A temperature graph maps 0°C to 32°F. Is it direct proportion?

ANSWER: No

Method cue: The line does not pass through the origin. Check sign, size, accuracy and units.

5. On a graph, 12 cm represents 30 km. Find km per cm.

ANSWER: 2.5 km per cm

Method cue: $30 \div 12 = 2.5$. Check sign, size, accuracy and units.

6. Convert 72 km to miles using 5 miles=8 km.

ANSWER: 45 miles

Method cue: $72 \div 8 = 9$ groups. Check sign, size, accuracy and units.

7. Why should a conversion graph have labelled units?

ANSWER: The numerical scales may represent different quantities.

Method cue: Units determine the meaning and direction of conversion. Check sign, size, accuracy and units.

8. Explain how to reverse a conversion graph reading.

ANSWER: Start from the other axis and trace to the same line.

Method cue: The graph represents both directions of the same relationship. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Distance-time graphs

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A cyclist travels 12 km in 40 minutes. Find average speed in km/h.

ANSWER: 18 km/h

Method cue: 40 minutes = $\frac{2}{3}$ hour. Check sign, size, accuracy and units.

2. What does a horizontal distance-time segment mean?

ANSWER: The object is stationary

Method cue: Time changes but distance does not. Check sign, size, accuracy and units.

3. A car travels 150 km in 2.5 hours. Find average speed.

ANSWER: 60 km/h

Method cue: Speed = $150 \div 2.5 = 60$. Check sign, size, accuracy and units.

4. Two lines start together; line A is steeper. Which object is faster?

ANSWER: Object A

Method cue: Greater gradient means more distance per unit time. Check sign, size, accuracy and units.

5. A walker reaches 6 km at 10:30 after starting 09:00. Find speed.

ANSWER: 4 km/h

Method cue: Elapsed time = 1.5 hours. Check sign, size, accuracy and units.

6. A journey goes 20 km out then returns to zero distance. What does zero represent?

ANSWER: The starting point

Method cue: Distance from the start has returned to zero. Check sign, size, accuracy and units.

7. Why is a vertical segment impossible on a distance-time graph?

ANSWER: It would mean changing distance with no passage of time.

Method cue: That requires infinite speed. Check sign, size, accuracy and units.

8. State two features needed to compare journeys fairly.

ANSWER: Same axis scales/units and gradients over comparable intervals.

Method cue: Check both time and distance scales. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Cost, filling and temperature graphs

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A taxi graph starts at £4 when distance is 0. Interpret £4.

ANSWER: The fixed starting charge

Method cue: It is paid before any distance is travelled. Check sign, size, accuracy and units.

2. A tank-volume graph is horizontal for 5 minutes. Interpret.

ANSWER: The volume does not change

Method cue: No net liquid enters or leaves. Check sign, size, accuracy and units.

3. A cost line has gradient £2.40 per hour and intercept £5. Write the rule.

ANSWER: $C = 2.4h + 5$

Method cue: Gradient gives hourly charge. Check sign, size, accuracy and units.

4. A cooling graph falls quickly then more slowly. Describe the rate.

ANSWER: Cooling is fastest at first and then slows

Method cue: The graph is steep initially and becomes less steep. Check sign, size, accuracy and units.

5. A phone plan costs £12 plus 5p per text. Find cost for 80 texts.

ANSWER: £16

Method cue: $80 \times £0.05 = £4$. Check sign, size, accuracy and units.

6. A tank rises from 100 L to 340 L in 8 min. Find filling rate.

ANSWER: 30 L/min

Method cue: $\text{Change} = 240 \text{ L}$. Check sign, size, accuracy and units.

7. Why can two graphs with the same shape tell different stories?

ANSWER: Axes, units and scales may differ.

Method cue: Interpretation depends on labelled quantities and context. Check sign, size, accuracy and units.

8. Give one reason a real-world graph may be curved.

ANSWER: The rate changes continuously.

Method cue: A changing gradient produces a curve. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Gradients and rates of change

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A distance-time graph rises 18 km in 0.5 h. Find its gradient.

ANSWER: 36 km/h

Method cue: Gradient=change in distance ÷ change in time. Check sign, size, accuracy and units.

2. A tank-volume graph rises from 120 L to 300 L in 6 minutes. Find the rate.

ANSWER: 30 L/min

Method cue: Change in volume=180 L. Check sign, size, accuracy and units.

3. A graph rises from 4 m/s to 10 m/s over 3 s. Find its gradient.

ANSWER: 2 m/s²

Method cue: Vertical change=6 m/s. Check sign, size, accuracy and units.

4. State units of gradient on a distance-km against time-hour graph.

ANSWER: km/h

Method cue: Vertical units divided by horizontal units. Check sign, size, accuracy and units.

5. Line A rises 24 units over a run of 6. Line B rises 15 over a run of 5. Which is steeper...

ANSWER: Line A

Method cue: Gradient A=24÷6=4. Check sign, size, accuracy and units.

6. What does zero gradient mean on a temperature-time graph?

ANSWER: Temperature is constant

Method cue: There is no vertical change per unit time. Check sign, size, accuracy and units.

7. A cost graph has gradient 2.8 with cost in pounds and mass in kg. Interpret it.

ANSWER: The cost increases by £2.80 per kilogram.

Method cue: Read vertical units per horizontal unit. Check sign, size, accuracy and units.

8. State one limitation of estimating a gradient from a curve.

ANSWER: The value depends on the chosen interval or tangent.

Method cue: A curve has a changing rate. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Mixed graphical reasoning

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. For $y=2x+5$, find the point when $x=-3$.

ANSWER: (-3, -1)

Method cue: $y=2(-3)+5=-1$. Check sign, size, accuracy and units.

2. Find the gradient through (-2,1) and (4,13).

ANSWER: 2

Method cue: Change in $y=12$; change in $x=6$. Check sign, size, accuracy and units.

3. Write the line with gradient -3 and intercept 4.

ANSWER: $y = -3x + 4$

Method cue: Use $y=mx+c$. Check sign, size, accuracy and units.

4. A quadratic has roots 1 and 6. Solve $y=0$.

ANSWER: $x = 1$ or $x = 6$

Method cue: Roots are x -intercepts. Check sign, size, accuracy and units.

5. A distance-time line covers 27 km in 45 min. Find km/h.

ANSWER: 36 km/h

Method cue: $45 \text{ min}=0.75 \text{ h}$. Check sign, size, accuracy and units.

6. A conversion line through the origin contains (8,20). Find y when $x=14$.

ANSWER: 35

Method cue: Gradient= $20 \div 8=2.5$. Check sign, size, accuracy and units.

7. A graph crosses the y -axis at -2 and passes (3,7). Find its equation.

ANSWER: $y = 3x - 2$

Method cue: Gradient= $(7-(-2))/3=3$. Check sign, size, accuracy and units.

8. State two checks when reading a graph.

ANSWER: Check scales/units and substitute or compare with the trend.

Method cue: Use the correct axis direction. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Independent authorship and release check

Eduqas Foundation Mathematics • Unit 2 Algebra

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