

GCSE ONLINE TUTORING

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AQA GCSE (9-1) MATHEMATICS 8300

AQA 8300 COMMON MISTAKES & DIAGNOSTIC REPAIR HANDBOOK

Foundation + Higher | examiner-report evidence + specification-mapped risk checks

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How to use this document

This handbook is designed for correction after tests and past-paper practice. Each entry explains the mistake, why it loses marks, a repair routine and a rapid self-check. Evidence labels are deliberately explicit so no specification-derived advice is misrepresented as an examiner-frequency claim.

Section	What it gives you
Evidence policy	What ER and SPEC labels mean and what public evidence is available.
Foundation	Detailed error/repair cards relevant to Foundation.
Higher	Higher extension and report-evidenced cards.
Error log	A reusable correction and retest system.
References	Direct examiner reports and specification sources.

Source tags such as [SPEC-N4] or [ER23-H3] are defined in the References section. They are there so a tutor, student or editor can audit where each factual statement came from.

Evidence policy

ER - examiner-report evidenced

Definition: The error/difficulty is explicitly reflected in a publicly accessible AQA report on the exam from June 2022 or June 2023 in our public source set.

Use: Treat it as evidence that the issue appeared in real candidate responses in that paper.

Limit: Do not convert it into a “five-year frequency” unless comparable reports for all five years are available.

Source: AQA reports on the exam listed in References

SPEC - specification-derived risk

Definition: An independently authored diagnostic warning derived from the exact demand of an AQA 8300 specification reference.

Use: Treat it as a revision-quality check: the skill naturally creates a known decision/sign/unit/representation risk.

Limit: It is not labelled as an AQA examiner finding or a measured candidate frequency.

Source: [SPEC]

AQA keeps many recent assessment materials behind centre access for an initial period. For that reason this public handbook does not fabricate examiner evidence for 2024–2026. The five-year data requirement is met in the separate Grade Calculator & Results Handbook using published 2022–2026 results/boundary data; the mistake handbook uses only examiner reports that can be publicly verified.

Foundation error and repair cards

F-01 | Number / percentages

Topic: Number / percentages

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Using an additive or incomplete method for percentage change, especially reverse or multi-step percentage situations.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Write the percentage as a multiplier first; identify whether the known value is before or after the change; form one equation rather than chaining guesses.

30-second self-check: Can I state the multiplier and show which quantity it acts on?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F2

F-02 | Ratio

Topic: Ratio

Evidence status: Examiner-report evidenced

Typical weak response / misconception: For an $n:1$ ratio, dividing then rounding too early and producing an inaccurate final ratio.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Keep full calculator precision until the final line; round only the requested answer.

30-second self-check: Did I keep unrounded values through the ratio calculation?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F2

F-03 | Coordinates

Topic: Coordinates

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Reading or plotting coordinates in the wrong order or with sign errors.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Say “x first, y second”; trace horizontally then vertically and check the quadrant signs.

30-second self-check: Does my point have the expected quadrant and coordinate order?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F2

F-04 | Probability

Topic: Probability

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Adding branch probabilities on a tree where multiplication is required, or assuming branches stay the same without replacement.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Multiply along a route; add separate routes. Recalculate second-stage probabilities when the composition changes.

30-second self-check: Did I multiply along and add across? Did denominators change?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F2

F-05 | Number properties

Topic: Number properties

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Confusing prime numbers with square/cube numbers or factors/multiples.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use definitions: prime has exactly two positive factors; square = n^2 ; cube = n^3 ; factor divides exactly.

30-second self-check: Can I justify the classification, not just recognise a list?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F2

F-06 | Statistics / sampling

Topic: Statistics / sampling

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Claiming a larger sample is automatically “better” without linking to representativeness/reliability.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: State why: a larger, unbiased sample can reduce random variation and be more representative; also consider sampling method.

30-second self-check: Have I linked sample size/method to reliability or representativeness?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F3

F-07 | Trigonometry

Topic: Trigonometry

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Choosing the wrong trig ratio or using inconsistent side labels.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Mark opposite/adjacent/hypotenuse relative to the stated angle before selecting sin/cos/tan.

30-second self-check: Did I label O/A/H from the correct angle?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F3

F-08 | Percentages

Topic: Percentages

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Treating percentage increase as simply “add the percentage number” rather than a fraction/multiplier of the original.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use $\text{original} \times (1 + \text{rate})$ for an increase and $\text{original} \times (1 - \text{rate})$ for a decrease.

30-second self-check: Is the percentage applied to the original quantity?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F3

F-09 | Quadratic graphs

Topic: Quadratic graphs

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Reading only one root or confusing the turning point with an intercept.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Roots are x-values where $y=0$; turning point is the maximum/minimum. Scan both sides of the graph.

30-second self-check: Have I identified every x-axis crossing separately from the turning point?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F3

F-10 | Sequences

Topic: Sequences

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Using the term value as the position, causing an indexing shift.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Create a small table: position $n = 1, 2, 3, \dots$ and term value beneath it before finding a rule.

30-second self-check: Does my formula reproduce term 1 and term 2?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-F3

F-11 | Mensuration

Topic: Mensuration

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Finding perimeter by counting interior squares/area rather than tracing the boundary.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Trace only the outside edge and add side lengths; perimeter is one-dimensional.

30-second self-check: Am I measuring the boundary, not the space inside?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-F2

F-12 | Probability problem solving

Topic: Probability problem solving

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Using a probability fact correctly but not connecting it to the context or required event.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Name the event, write its probability expression, then calculate. Use a probability model/table/tree if several events are involved.

30-second self-check: Can I point to the exact event represented by every number?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-F2

F-13 | Reasoning / evaluation

Topic: Reasoning / evaluation

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Stating that a method is “wrong” or “not accurate” without mathematical evidence.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Test the method using a counterexample, calculation, bounds, or a clear logical reason.

30-second self-check: Have I supplied mathematical evidence rather than an opinion?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-F2

F-14 | Algebra

Topic: Algebra

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Factorising but leaving a common factor inside, or confusing factorising with expanding.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Find the HCF first; divide each term by it; check by expanding your answer.

30-second self-check: Does expanding my factorised form return the original expression?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-F2

F-15 | Compound units

Topic: Compound units

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Changing km/h, m/s, cm^2/m^2 etc as if all conversions were linear.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Write units explicitly and apply the conversion to every dimension: area factors square, volume factors cube.

30-second self-check: Have I converted both the number and the unit dimension correctly?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-F2

F-16 | Number / Standard form

Topic: Number / Standard form

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Entering or interpreting calculator standard-form notation incorrectly; coefficient not between 1 and 10.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Normalise to $A \times 10^n$ with $1 \leq A < 10$; check order of magnitude.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-N9

F-17 | Number / Bounds

Topic: Number / Bounds

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using rounded values as exact values in upper/lower-bound calculations.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Write the error interval first; choose bounds that maximise/minimise the required expression.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-N15/N16

F-18 | Algebra / Inequalities

Topic: Algebra / Inequalities

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Flipping the inequality sign at the wrong time or not flipping after multiplication/division by a negative.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Only reverse the sign when multiplying or dividing both sides by a negative number.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-A22

F-19 | Ratio / Reverse percentage

Topic: Ratio / Reverse percentage

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Dividing by the percentage rather than the multiplier.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: If $\text{final} = \text{original} \times \text{multiplier}$, then $\text{original} = \text{final} \div \text{multiplier}$.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-R9

F-20 | Ratio / Direct/inverse proportion

Topic: Ratio / Direct/inverse proportion

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using $y=kx$ for inverse proportion or forgetting to find k .

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Translate words into $y=kx^n$ or $y=k/x^n$ as appropriate, then use a known pair to find k .

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-R10/R13

F-21 | Ratio / Similarity

Topic: Ratio / Similarity

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using length scale factor directly for area/volume.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Area factor = k^2 ; volume factor = k^3 .

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-R12/G19

F-22 | Geometry / Parallel-line angles

Topic: Geometry / Parallel-line angles

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using informal “Z/F/C” language without naming angle relationships.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: State alternate/corresponding/co-interior/vertically opposite and justify equality/supplementarity.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G3

F-23 | Geometry / Transformations

Topic: Geometry / Transformations

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Giving only some features of a transformation.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Rotation: centre/angle/direction; enlargement: centre/scale factor; reflection: mirror line; translation: vector.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G7

F-24 | Geometry / Exact trig values

Topic: Geometry / Exact trig values

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using decimals where an exact value is required.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use exact surd/fraction values for $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$ and simplify exactly.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G21

F-25 | Probability / Mutually exclusive vs independent

Topic: Probability / Mutually exclusive vs independent

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Treating “cannot happen together” as the same as “one does not affect the other”.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Mutually exclusive: $P(A \cap B) = 0$. Independent: $P(A \cap B) = P(A)P(B)$.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-P4/P8

F-26 | Statistics / Correlation

Topic: Statistics / Correlation

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Claiming correlation proves causation.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: State association only; a lurking variable or other explanation may exist.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-S6

F-27 | Statistics / Averages from grouped data

Topic: Statistics / Averages from grouped data

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Treating class midpoints as exact observations without noting estimate status.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use midpoints $\times$ frequency and state that the mean is an estimate.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-S4

Higher error and repair cards

H-01 | Geometry / surface area

Topic: Geometry / surface area

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Missing a face, double-counting an internal face, or using volume instead of surface area.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Sketch/net the exposed faces; label each area; sum only external surfaces.

30-second self-check: Can I account for every exposed face exactly once?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H1

H-02 | Functions

Topic: Functions

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Substituting into $f(x)$ incorrectly or confusing inverse/composite notation.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Treat $f(x)$ as an instruction. For $fg(x)$, apply g first then f ; for inverse, undo operations in reverse order.

30-second self-check: Can I write the operation chain explicitly?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H1

H-03 | Counting

Topic: Counting

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Listing inconsistently instead of using a structured product rule.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Identify independent stages and multiply the number of choices; if restrictions apply, split into disjoint cases.

30-second self-check: Are my cases exhaustive and non-overlapping?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H1

H-04 | Rates / algebra

Topic: Rates / algebra

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Forming an average-speed equation incorrectly from algebraic distances/times.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use total distance $\div$ total time; keep units consistent and simplify only after forming the complete fraction.

30-second self-check: Does the numerator represent all distance and denominator all time?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H1

H-05 | Straight-line graphs

Topic: Straight-line graphs

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Confusing gradient and intercept or extracting m before rearranging into $y=mx+c$.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Rearrange to $y=mx+c$ first; m is the coefficient of x and c is the y -intercept.

30-second self-check: Is the equation actually in $y=mx+c$ form?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H3

H-06 | Fractions

Topic: Fractions

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Writing an improper fraction or mixed number ambiguously, especially when algebra is involved.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use a single fraction bar with the complete numerator/denominator grouped; simplify at the end.

30-second self-check: Could a reader tell exactly what is divided by what?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H3

H-07 | Rearranging formulae

Topic: Rearranging formulae

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Moving terms across an equation without applying the same inverse operation to both sides.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Perform one reversible operation to both sides per line; use brackets before dividing by an expression.

30-second self-check: Can I reverse each line to recover the previous line?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H3

H-08 | Unit conversion

Topic: Unit conversion

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Converting centimetres to metres incorrectly or mixing units inside one formula.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Convert all lengths to one unit before substituting; write conversion factors on a separate line.

30-second self-check: Are all quantities in compatible units before calculation?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H3

H-09 | Compound change

Topic: Compound change

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Using simple interest/additive change where repeated multiplicative change is required.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use $\text{multiplier}^{\text{number_of_periods}}$ for repeated percentage change.

30-second self-check: Have I used repeated multiplication rather than repeated addition?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER23-H3

H-10 | Speed / distance / time

Topic: Speed / distance / time

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Mixing hours/minutes/seconds or metres/kilometres in a single rate calculation.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Convert to one coherent unit system first, then use $\text{speed} = \text{distance}/\text{time}$.

30-second self-check: Do my final units match the question?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-H3

H-11 | Bearings

Topic: Bearings

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Measuring from the wrong north line, anticlockwise, or not using three figures.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Draw north at the relevant point; measure clockwise; write 000° – 360° using three figures.

30-second self-check: Did I start from north at the correct point and move clockwise?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-H3

H-12 | Box plots / IQR

Topic: Box plots / IQR

Evidence status: Examiner-report evidenced

Typical weak response / misconception: Subtracting wrong quartiles or comparing medians/spreads with vague language.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: $IQR = Q3 - Q1$. Compare centre and spread separately and tie each statement to the data.

30-second self-check: Have I made one centre comparison and one spread comparison with values?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: ER22-H3

H-13 | Number / Standard form

Topic: Number / Standard form

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Entering or interpreting calculator standard-form notation incorrectly; coefficient not between 1 and 10.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Normalise to $A \times 10^n$ with $1 \leq A < 10$; check order of magnitude.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-N9

H-14 | Number / Bounds

Topic: Number / Bounds

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using rounded values as exact values in upper/lower-bound calculations.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Write the error interval first; choose bounds that maximise/minimise the required expression.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-N15/N16

H-15 | Number / Surds

Topic: Number / Surds

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Combining unlike surds or rationalising only part of a denominator.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Simplify square factors first; combine only like surds; multiply numerator and denominator consistently.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-N8

H-16 | Algebra / Quadratic factorisation

Topic: Algebra / Quadratic factorisation

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Forgetting the leading coefficient when factorising ax^2+bx+c .

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Check product ac and middle term, or use a reliable split-middle-term method; expand to verify.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-A4

H-17 | Algebra / Quadratic formula

Topic: Algebra / Quadratic formula

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Sign errors in $-b$ or the discriminant; missing $\pm$.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Write a, b, c with signs first; use brackets in substitution; evaluate both roots.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-A18

H-18 | Algebra / Inequalities

Topic: Algebra / Inequalities

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Flipping the inequality sign at the wrong time or not flipping after multiplication/division by a negative.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Only reverse the sign when multiplying or dividing both sides by a negative number.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-A22

H-19 | Algebra / Iteration

Topic: Algebra / Iteration

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Not using the required recurrence correctly or stopping without enough accuracy.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Write x_0 ; substitute repeatedly; keep extra digits; verify convergence and requested rounding.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-A20

H-20 | Algebra / Sequences

Topic: Algebra / Sequences

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Assuming every non-linear sequence is quadratic.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Check first and second differences; use the pattern appropriate to the sequence type.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-A24/A25

H-21 | Ratio / Reverse percentage

Topic: Ratio / Reverse percentage

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Dividing by the percentage rather than the multiplier.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: If $\text{final} = \text{original} \times \text{multiplier}$, then $\text{original} = \text{final} \div \text{multiplier}$.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-R9

H-22 | Ratio / Direct/inverse proportion

Topic: Ratio / Direct/inverse proportion

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using $y=kx$ for inverse proportion or forgetting to find k .

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Translate words into $y=kx^n$ or $y=k/x^n$ as appropriate, then use a known pair to find k .

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-R10/R13

H-23 | Ratio / Similarity

Topic: Ratio / Similarity

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using length scale factor directly for area/volume.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Area factor = k^2 ; volume factor = k^3 .

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-R12/G19

H-24 | Geometry / Parallel-line angles

Topic: Geometry / Parallel-line angles

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using informal “Z/F/C” language without naming angle relationships.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: State alternate/corresponding/co-interior/vertically opposite and justify equality/supplementarity.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G3

H-25 | Geometry / Transformations

Topic: Geometry / Transformations

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Giving only some features of a transformation.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Rotation: centre/angle/direction; enlargement: centre/scale factor; reflection: mirror line; translation: vector.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G7

H-26 | Geometry / Circle theorems

Topic: Geometry / Circle theorems

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Selecting a theorem from appearance rather than identifying the exact geometric condition.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Mark the relevant chord/tangent/diameter/radii and state the theorem before calculating.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G10

H-27 | Geometry / Trigonometry

Topic: Geometry / Trigonometry

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using sine rule when the known angle-side pair does not support it, or cosine rule with wrong included angle.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Mark known pairs; choose sine rule for matching opposite pairs, cosine rule for SAS/SSS.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G22

H-28 | Geometry / Exact trig values

Topic: Geometry / Exact trig values

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using decimals where an exact value is required.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use exact surd/fraction values for $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$ and simplify exactly.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-G21

H-29 | Probability / Mutually exclusive vs independent

Topic: Probability / Mutually exclusive vs independent

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Treating “cannot happen together” as the same as “one does not affect the other”.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Mutually exclusive: $P(A \cap B) = 0$. Independent: $P(A \cap B) = P(A)P(B)$.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-P4/P8

H-30 | Probability / Conditional probability

Topic: Probability / Conditional probability

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using an original denominator after the condition changes the sample space.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Restrict to the conditioned group first, then form the new fraction or tree branch.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-P9

H-31 | Statistics / Histograms

Topic: Statistics / Histograms

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Using bar height as frequency when class widths differ.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Frequency density = frequency $\div$ class width; frequency is represented by bar area.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-S3

H-32 | Statistics / Correlation

Topic: Statistics / Correlation

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Claiming correlation proves causation.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: State association only; a lurking variable or other explanation may exist.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-S6

H-33 | Statistics / Averages from grouped data

Topic: Statistics / Averages from grouped data

Evidence status: Specification-derived diagnostic risk

Typical weak response / misconception: Treating class midpoints as exact observations without noting estimate status.

Why it costs marks: It either applies the wrong mathematical relationship, loses accuracy/units, or fails to communicate the required reasoning clearly enough for the method to be credited.

Repair routine: Use midpoints $\times$ frequency and state that the mean is an estimate.

30-second self-check: Can I apply the correct method and verify the result against the specification demand?

Retest instruction: Complete a fresh question on the same skill without notes. If the same error repeats, log the trigger and practise the prerequisite skill before another retest.

Source: SPEC-S4

Reusable mistake log and retest cycle

Use one row per error, not one row per question. If three questions fail for the same reason, that is one misconception with three pieces of evidence. Retest with a different question after a gap so you measure learning rather than memory.

Date	Ref/topic	Original error	Correct rule	Trigger to notice next time	Retest date	Result

Seven repair habits that apply across the course

Represent before calculating

Habit: Draw, label, tabulate or write the equation/event before touching the calculator.

When to use: Every timed practice set and every post-test correction.

Units on every line

Habit: Unit conversion errors are easier to spot if the unit travels with the number.

When to use: Every timed practice set and every post-test correction.

Keep exact values

Habit: Do not round intermediate values; preserve π , fractions and surds when exact form is appropriate.

When to use: Every timed practice set and every post-test correction.

One inverse operation per algebra line

Habit: This prevents “moving” terms and changing signs without justification.

When to use: Every timed practice set and every post-test correction.

Name the theorem or probability rule

Habit: State why the relationship applies, not just what buttons you pressed.

When to use: Every timed practice set and every post-test correction.

Estimate and reverse-check

Habit: Use order of magnitude, substitution, expansion or total-probability checks.

When to use: Every timed practice set and every post-test correction.

Finish in context

Habit: Return to the wording: units, degree of accuracy, comparison, justification and interpretation.

When to use: Every timed practice set and every post-test correction.

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