

INSIGHT BAY · THE FIELD NOTE

The twelve mistakes that cost the most marks in Year 10 mathematics.

Walk the gallery tonight. Recognise each exhibit in the examination, and step around it. With both exam cheat sheets from the Year 10 Field Guide: the rules on one page, the methods on another.

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ONE AUTHOR · FIFTEEN STUDENTS A YEAR · EVERY FORMULA DERIVED

The Mistake Museum

Twelve exhibits, each responsible for thousands of lost marks a year. Walk the gallery the night before; recognise them in the exam and step around.

EXHIBIT 01 · SPLIT ROOT

$$\sqrt{(9+16)} = 3+4$$

Roots never visit terms: $\sqrt{25} = 5$, not 7. The bar covers everything.

EXHIBIT 02 · SURD MERGER

$$\sqrt{3} + \sqrt{7} = \sqrt{10}$$

Unlike surds refuse to merge. $\sqrt{3} + \sqrt{7}$ is already the answer.

EXHIBIT 03 · HALVED NUMBER

$$9^{1/2} = 4.5$$

A half index is a root, not a half: $9^{1/2} = 3$.

EXHIBIT 04 · DELETED ROOT

$$x^2 = 11x \rightarrow x = 11$$

Dividing by x erased $x = 0$. Factorise: $x(x - 11) = 0$, two roots.

EXHIBIT 05 · SMUGGLED SQUARE

$$x^2 + 8x = (x + 4)^2$$

The bracket smuggles +16 in. Balance it: $(x + 4)^2 - 16$.

EXHIBIT 06 · UNSIGNED B

$$x^2 - 5x: "b = 5"$$

$b = -5$, so $-b = +5$. Substitute in brackets and the sign survives.

EXHIBIT 07 · ROOTED NEGATIVE

$$\sqrt{(4-20)} = 4$$

Nothing real squares to -16 . Read $b^2 - 4ac$ first: no roots, done.

EXHIBIT 08 · TERM CANCEL

$$(x+5)/(x^2+5) = 1/x$$

Only multiplied brackets cross the bar. Terms glued by $+$ stay.

EXHIBIT 09 · ADDED BOTTOMS

$$1/x + 1/y = 1/(x+y)$$

Bottoms harmonise, never add: the true sum is $(y+x)/xy$.

EXHIBIT 10 · BACKWARDS CHAIN

$$fg(x): f \text{ runs first}$$

The function nearest x catches it first: fg means g , then f .

EXHIBIT 11 · SIGN-ONLY PARTNER

$$m = 3 \rightarrow \text{partner} = -3$$

Flip *and* negate: $-1/3$. The product test $3 \times (-1/3) = -1$ certifies.

EXHIBIT 12 · PERCENT MONSTER

$$\text{up } 3\% \rightarrow \times 1.3$$

1.3 is thirty percent. Three percent is $\times 1.03$ — decimals place the rate.



HOW TO USE THE MUSEUM

Cover the small print and prosecute each exhibit aloud in one sentence. Any card you cannot convict names tonight's final piece of revision.



EXAMINERS REUSE THESE EVERY YEAR

Everything, on one page

SIMPLIFY SURDS

$$\sqrt{50} = \sqrt{25 \times 2} = 5\sqrt{2}$$

Hunt the biggest square factor;
root it out front.

SPLIT LAW

$$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$$

Products and quotients split;
sums never do.

COLLECT LIKE SURDS

$$p\sqrt{n} + q\sqrt{n} = (p+q)\sqrt{n}$$

Same root collects like a letter;
unlike surds refuse.

CONJUGATE PAIR

$$(a+\sqrt{b})(a-\sqrt{b}) = a^2 - b$$

Opposite middle signs erase
every root. DOTS in disguise.

UNIT-FRACTION INDEX

$$a^{1/n} = \sqrt[n]{a}$$

The denominator names the
root: $16^{1/2} = 4$.

M OVER N

$$a^{m/n} = (\sqrt[n]{a})^m$$

Root first, power second: $8^{2/3} = 2^2 = 4$.

NEGATIVE FRACTIONAL

$$9^{-1/2} = 1/3$$

Minus flips, fraction roots. Two
badges, two moves.

RATIONALISE

$$x \sqrt{n}/\sqrt{n} \cdot x \text{ conjugate}$$

Multiply by 1 in disguise until the
bottom is whole.

ZERO FIRST

**... = 0 before any
weapon**

Only zero names its factors.
Move everything left.

FACTOR ROUTE

**brackets → sign-flip
roots**

Each bracket is its own little
equation. Two answers.

COMPLETE THE SQUARE

$$x^2 + bx = (x+b/2)^2 - (b/2)^2$$

Halve b into the bracket; subtract
the smuggled square.

THE FORMULA

$$(-b \pm \sqrt{b^2 - 4ac})/2a$$

Brackets around every
substitution; $\pm$ means two runs.

DISCRIMINANT

$$b^2 - 4ac: +, 0, -$$

Two roots, one kiss, none. Read
before solving.

WEAPON CHOICE

scan → CTS → formula

Clean factors first, exactness
second, safety net last.

CANCELLING LAW

**factorise, strike
brackets**

Only multiplied brackets cross
the bar; terms stay.

SHARED FLOORS

**convert tops with
bottoms**

Bottoms harmonise, never add;
then tops combine.

FRACTION EQUATIONS

**x shared bottom, all
terms**

Fractions vanish; a revealed x^2
goes to Part 2.

SUBJECT TWICE

**gather · factorise ·
divide**

The answer may never contain
its own subject.

EVALUATE F

f(a): a everywhere

Negative inputs ride in brackets:
 $(-2)^2 = 4$.

COMPOSITE ORDER

fg(x): g first

Nearest to x runs first; fg $\neq$ gf in
general.

INVERSE RECIPE

$$y = f(x) \rightarrow x = \dots \rightarrow$$

swap

On functions, $^{-1}$ is reversal, never
reciprocal.

GRADIENT

$$(y_2 - y_1)/(x_2 - x_1)$$

Same subtraction order top and
bottom, always.

LINE FROM CLUES

m first, point catches c

c lives at x = 0 only; spare point
checks.

PERPENDICULAR

$$m_1 \times m_2 = -1$$

Flip and negate; parallel lines
just copy m.

MIDPOINT · LENGTH

$$\text{average} \cdot \sqrt{(\Delta x^2 + \Delta y^2)}$$

Middle by averaging, distance by
Pythagoras.

SKETCH FROM FACTORS

**roots + pq + fold
midway**

Brackets to roots, constants to
intercept, vertex on fold.

VERTEX FORM

$$(x+a)^2 + b \rightarrow (-a, b)$$

Smiles bottom at b; k - (...)²
peaks at k.

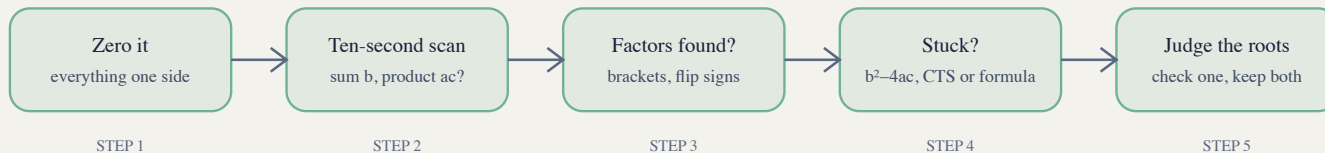
COMPOUND CURVE

$$y = a \cdot b^x \cdot b = 1 \pm \text{rate}$$

Start a, multiplier b; growth
above 1, decay below.

How to do anything, in order

THE QUADRATIC FLOWCHART · WORKS ON EVERY EQUATION IN THIS BOOK



SURDS, ONE BREATH

Products split, sums never,
biggest square walks out front,
like surds collect like letters,
conjugates erase every root.
Exact beats decimal until told.

RATIONALISE A BOTTOM

1 · Single surd? $\times \sqrt{n}/\sqrt{n}$.
2 · $a \pm \sqrt{b}$? $\times$ the conjugate.
3 · Simplify what surfaces.
4 · Decimal-check both forms.
You multiplied by 1 in disguise.

FRACTION EQUATIONS

1 · Find the shared bottom.
2 · Multiply every single term.
3 · Zero and solve what remains.
4 · Reject bottom-zeroing roots.
An x^2 appearing is Part 2's cue.

BUILD AN INVERSE

1 · Write $y = f(x)$.
2 · Make x the subject.
3 · Swap the letters, badge it f^{-1} .
4 · Round-trip one number.
 $f(9) = 2$, then $f^{-1}(2) = 9 \checkmark$

LINE THROUGH DATA

1 · m from the gradient formula.
2 · One point rides through for c .
3 · Write $y = mx + c$ whole.
4 · Spend the spare point.
Same subtraction order, twice.

LAUNCH · QUADRATIC CARGO

Look for the unknown.
Assign a letter, units on.
Uncover the relation.
Note the equation; zero it.
Crack it with Part 2.
Head back; reject impossible roots.

SPOT THE SHAPE FIRST

Every Year 10 word problem is one of four shapes:
a quadratic build (areas, products, Pythagoras),
a rearrange-then-drive (formula, then numbers),
a line from data (two readings, one rule),
or a compound forecast ($\times$ the same multiplier). Name it, then LAUNCH.

THE THREE-SWEEP FINISH

Before handing in, sweep three times:
root sweep: every quadratic answered with both roots, stories with the rejection written?
sign sweep: every $-b$ and $(-n)^2$ wearing brackets?
exact sweep: surds exact to the last line, rounded once?

TIMING RULES THAT WIN PAPERS

SURVEY THE PAPER · 30 S

RECALL QUESTIONS FIRST

90 S STALL → FLAG & SKIP

NAME THE WEAPON

LAST 5 MIN: THREE SWEEPS

FINAL THOUGHT



Method regenerates memory: these flows rebuild any formula you forget.

WHERE THIS CAME FROM

This is one section of one volume.

The Insight Bay Field Guides rebuild the whole of school algebra and geometry in eight volumes, Years 7 to 12. Every formula is derived rather than asserted, every worked solution is verified, and every year ends in an Exam Lab like the one this note was taken from.

Each volume is \$79. The Complete Library, all eight volumes in one download, is \$349. Both come with a 30-day money-back guarantee, and the price of anything you buy is credited in full against your first tutoring programme.

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