QUICK REVISION · NUMBER

Number sets and signed numbers

• Check the sign before calculating.

• Use brackets around negative numbers in powers.

• Example: $(-3)^2 = 9$, but $-3^2 = -9$.

Watch out

Using the multiplication sign rule when adding: “a negative and a positive make a negative.” Addition depends on their values. For example, $-2 + 7 = 5$, while $-7 + 2 = -5$.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Decimals, rounding and accuracy

• Decimal places start after the decimal point.

• Significant figures start at the first non-zero digit.

• Keep extra digits and round the final result.

Watch out

Counting the zeros before the first non-zero digit as significant figures. In 0.00470, the significant digits are $4, 7$ and the final 0: three significant figures. That final zero records precision.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Fractions: all four operations

• Add / subtract: use the same denominator first.

• Multiply: top $\times$ top, bottom $\times$ bottom.

• Divide: multiply by the reciprocal.

Watch out

Adding the denominators as well as the numerators. $\frac{1}{2} + \frac{1}{3}$ is not $\frac{2}{5}$. Use a common denominator: $\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Ratio, proportion and rates

• Keep the quantities in the stated order.

• Sharing: add the parts, find one part, then scale.

• Rates: put all measurements into compatible units.

Watch out

Treating the first number in a ratio of $2 : 3$ as two-thirds of the total. There are $2 + 3 = 5$ parts, so the first share is $\frac{2}{5}$ of the total.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Surds and exact answers

• Find a square factor to simplify a root.

• Collect only terms with the same simplified root part.

• Keep exact surds until a decimal answer is requested.

Watch out

Splitting a square root across addition. $\sqrt{9+16}=\sqrt{25}=5$, but $\sqrt{9}+\sqrt{16}=3+4=7$. These are different calculations.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Percentages and percentage change

• Decide what represents 100%.

• Forward change: multiply by the percentage multiplier.

• Reverse change: divide the final amount by the multiplier.

Watch out

Assuming equal percentage increases and decreases cancel. Starting at $€100$, a 20% decrease gives $€80$; a 20% increase on $€80$ gives $€96$. The second percentage uses a different starting amount.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Money, bills, interest and tax

• Mark-up uses cost price; margin uses selling price.

• Compound interest applies the multiplier once per period.

• Use only the fictional tax rules and bands given in the question.

Watch out

Applying the higher tax rate to the whole income. When a question gives two tax bands, calculate tax on each band separately. Only the amount above the stated threshold uses the higher rate.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Indices and scientific notation

• $a^m a^n = a^{m+n}$: multiply same bases → add indices.

• $\frac{a^m}{a^n} = a^{m-n}$: divide same non-zero bases → subtract.

• $(a^m)^n = a^{mn}$: power of a power → multiply indices.

Watch out

Adding powers when adding terms. $x^2 + x^3$ is not x^5: these are unlike terms. For multiplication with the same base, $x^2 \times x^3 = x^5$.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Sets and Venn diagrams

• Union: in either set or both. Intersection: in both.

• In Venn diagrams, fill the deepest overlap first.

• Neither = universal total minus the union.

Watch out

Counting the overlap twice when finding how many are in A or B. If $n(A) = 12$, $n(B) = 10$ and $n(A \cap B) = 4$, the total is $12 + 10 - 4 = 18$, not 22.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · NUMBER

Complex numbers and Argand diagrams

• $i^2 = -1$. This is the rule used when multiplying imaginary parts.

• Add real parts to real parts and imaginary parts to imaginary parts.

Watch out

Including i when stating the imaginary part. For $z = 3 + 2i$, the imaginary part is 2, not $2i$. The coefficient of i is the imaginary part.

Need the method? Open the full chapter and worked examples.

Algebra and substitution

• An expression has no equals sign; an equation has one.

• Replace every occurrence of the variable.

• Use brackets for negative substitutions.

Watch out

Dropping the brackets when substituting a negative value. If $x = -2$, then $x^2 = (-2)^2 = 4$, not -4. In contrast, $-x^2 = -4$ because the minus is outside the square.

Need the method? Open the full chapter and worked examples.

Simplifying, expanding and dividing

• Collect only like terms.

• Multiply every term when expanding brackets.

• Check division by multiplying the quotient and divisor.

Watch out

Combining terms with different letter parts. $3x + 2x^2$ cannot become $5x^3$. Only like terms combine: $3x + 2x = 5x$.

Need the method? Open the full chapter and worked examples.

Factorising expressions and quadratics

• Check for a common factor first.

• Guide number: $a \times c$. Pair: product ac, sum b.

• Split the middle term, group, then factor the shared bracket.

Watch out

Choosing a pair that has the correct product but the wrong sum. For $x^2 + 5x + 6$, 1 and 6 multiply to 6 but add to 7. Use 2 and 3: $(x + 2)(x + 3)$.

Need the method? Open the full chapter and worked examples.

Algebraic fractions

• State excluded values from the original denominators.

• Use equivalent fractions with a common denominator.

• Cancel factors, never separate terms in a sum.

Watch out

Cancelling a term that is joined by addition. $\frac{x+3}{x}$ cannot become 3. Only common factors cancel: $\frac{x(x+3)}{x} = x + 3$ when $x \neq 0$.

Need the method? Open the full chapter and worked examples.

Solving linear equations

• Goal: leave the variable on its own.

• Do the same operation to both sides.

• Check in the original equation.

Watch out

Dividing only one term when dividing an equation. From $2x + 6 = 10$, dividing both sides by 2 gives $x + 3 = 5$, not $x + 6 = 5$. Every term must be divided.

Need the method? Open the full chapter and worked examples.

Simultaneous linear equations

• Choose which variable to remove.

• For addition, make equal-sized opposite terms and add.

• Substitute back to find the second value; check both equations.

Watch out

Stopping after finding x when the question asks for x and y. Substitute x into an original equation to find y, then check the pair in both original equations.

Need the method? Open the full chapter and worked examples.

Quadratic equations and roots

• Put the equation equal to zero first.

• Factorise when possible; set each factor equal to zero.

• Otherwise use the quadratic formula and consider both signs.

Watch out

Dividing only the square-root part by $2a$ in the quadratic formula. The whole numerator is divided: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Keep both terms above the same fraction bar.

Need the method? Open the full chapter and worked examples.

Inequalities and solution sets

• Reverse the inequality when multiplying or dividing by a negative.

• Open endpoint: equality excluded. Filled endpoint: equality included.

• Check whether the domain is integers or real numbers.

Watch out

Forgetting to reverse the sign when multiplying or dividing both sides by a negative number. For example, $-2x < 6$ gives $x > -3$, not $x < -3$. Adding or subtracting does not reverse the sign.

Need the method? Open the full chapter and worked examples.

Changing the subject of a formula

• Identify the variable that must be the subject.

• Undo addition / subtraction, then multiplication / division as needed.

• Keep a whole numerator together with a fraction bar or brackets.

Watch out

Dividing only one part of a sum when changing the subject. From $y = 3x + 4$, subtract 4 first, then divide the whole difference: $x = \frac{y-4}{3}$, not $y - \frac{4}{3}$.

Need the method? Open the full chapter and worked examples.

Patterns and nth terms

• Write the term positions, starting at the stated n-value.

• Constant first difference → linear; constant non-zero second difference → quadratic.

• Check your rule against the original terms.

Watch out

Starting at $n = 0$ when the question numbers the first term as 1. For $T_n = 3n + 2$, the first term is $3(1) + 2 = 5$, not 2.

Need the method? Open the full chapter and worked examples.

Functions and graphs

• Input x first, output y second.

• Roots: where $y = 0$. Y-intercept: where $x = 0$.

• An intersection has the same coordinates on both graphs.

Watch out

Swapping input and output coordinates. The point $(2, 5)$ means input 2 gives output 5. It does not mean that input 5 gives output 2.

Need the method? Open the full chapter and worked examples.

Differentiation: the first steps

• For a power, multiply by the old power and reduce the power by 1: $\frac{d}{dx}(x^n) = nx^{n-1}$.

• Differentiate each term separately. Keep its coefficient.

Watch out

Reducing the power without multiplying by the original power. The derivative of x^3 is $3x^2$, not x^2.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · ALGEBRA AND FUNCTIONS

Slopes, tangents and turning points

• A stationary point has $f'(x) = 0$. Solve this equation for x, then use the original function to find y.

• At a stationary point, $f''(x) > 0$ gives a minimum and $f''(x) < 0$ gives a maximum. A zero second derivative needs another check.

Watch out

Using the derivative to find a point's y-coordinate. For $f(x) = x^2 + 1$ at $x = 2$, the slope is $f'(2) = 4$, but the height is $f(2) = 5$. Use the original function for y.

Need the method? Open the full chapter and worked examples.

QUICK REVISION · GEOMETRY AND TRIGONOMETRY

Units, time and scale

• Use compatible units before calculating.

• Area scale factors are squared; volume scale factors are cubed.

• Multiply a fractional hour by 60 to convert it to minutes.

Watch out

Using the length conversion factor for area. Since $1m = 100$ cm, $1\text{m}^2 = 100 \times 100 = 10000\text{cm}^2$, not 100cm^2.

Need the method? Open the full chapter and worked examples.

Perimeter and area

• Perimeter: distance around. Area: surface inside.

• Use perpendicular height, not automatically a sloping side.

• Circle formulas use radius, not diameter.

Watch out

Using a sloping side as the height. In $A = \frac{1}{2}bh$, h must meet the chosen base at a right angle. A sloping side can be used as height only if it is perpendicular to that base.

Need the method? Open the full chapter and worked examples.

Volume, surface area and nets

• Volume uses cubic units; surface area uses square units.

• Prism volume $=$ cross-section area $\times$ length.

• Count exposed surfaces only; do not count joined internal faces.

Watch out

Giving surface area in cubic units or volume in square units. Surface area measures covering and uses units such as cm^2; volume measures space and uses cm^3.

Need the method? Open the full chapter and worked examples.

Angles and geometrical reasoning

• Name the angle fact before calculating.

• Line : 180°. Point : 360°. Triangle : 180°.

• Parallel-line rules require parallel lines.

Watch out

Assuming angles are equal just because two lines look parallel. Corresponding and alternate-angle equalities require parallel lines. Use the given parallel marks or establish that the lines are parallel first.

Need the method? Open the full chapter and worked examples.

Congruence, similarity and triangle results

• Congruent: same size and shape. Similar: same shape.

• Match corresponding vertices before using ratios.

• Check the conditions of the theorem or congruence test.

Watch out

Using equal angles to claim two triangles are congruent. Equal corresponding angles show similarity, so the shape is the same; the triangles may still be different sizes.

Need the method? Open the full chapter and worked examples.

Pythagoras and its converse

• Right triangle only: $a^2 + b^2 = c^2$.

• c is the hypotenuse, opposite the right angle.

• Square first; take the positive square root for a length.

Watch out

Using $a^2 + b^2 = c^2$ for a triangle that is not right-angled. It applies to right-angled triangles, and c must be the hypotenuse: the side opposite the right angle.

Need the method? Open the full chapter and worked examples.

Right-angled trigonometry

• Label opposite, adjacent and hypotenuse relative to the angle.

• Choose the ratio containing the known and unknown sides.

• Use degree mode; use an inverse ratio to find an angle.

Watch out

Treating the same side as “opposite” whichever angle is used. Identify the chosen angle first. The opposite side faces that angle; the adjacent side touches it and is not the hypotenuse.

Need the method? Open the full chapter and worked examples.

Sine rule, cosine rule and triangle area

• Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B}$. Match each side with its opposite angle.

• Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$. Use two sides and the angle between them, or all three sides.

Watch out

Pairing a side with an angle beside it in the sine rule. In $\frac{a}{\sin A} = \frac{b}{\sin B}$, side a must be opposite angle A, and side b opposite angle B.

Need the method? Open the full chapter and worked examples.

Coordinate geometry

• Keep the same point order in each subtraction.

• Midpoint: average the x-values and the y-values.

• Slope: vertical change ÷ horizontal change.

Watch out

Reversing the point order in only half of the slope formula. For $(1, 2)$ and $(3, 6)$, use $\frac{6-2}{3-1} = 2$, not $\frac{6-2}{1-3} = -2$. Keep the same point order in both differences.

Need the method? Open the full chapter and worked examples.

Straight lines and their equations

• $y = mx + c$: m is slope; c is y-intercept.

• Parallel lines have equal slopes; check vertical-line exceptions.

• At an intersection, set the two expressions for y equal.

Watch out

Using a negative slope to mean “perpendicular.” A line of slope 2 is perpendicular to one of slope $-\frac{1}{2}$, not -2. For two finite slopes, the product must be -1. A horizontal line is perpendicular to a vertical line, whose slope is undefined.

Need the method? Open the full chapter and worked examples.

Equations of circles

• Centre (h, k) and radius r give $(x - h)^2 + (y - k)^2 = r^2$.

• The signs inside the brackets are opposite to the centre coordinates.

Watch out

Reading the number on the right as the radius. In $x^2 + y^2 = 25$, 25 is r^2, so the radius is $\sqrt{25} = 5$, not 25.

Need the method? Open the full chapter and worked examples.

Circle angles and cyclic quadrilaterals

• Use the same arc when comparing centre and circumference angles.

• An angle in a semicircle is 90°.

• Opposite angles in a cyclic quadrilateral total 180°.

Watch out

Adding adjacent angles of a cyclic quadrilateral to get 180°. It is the opposite angles that add to 180°: if one angle is 110°, its opposite angle is 70°.

Need the method? Open the full chapter and worked examples.

Enlargements and scale factors

• A scale factor of 2 doubles every length. A factor of one half halves every length.

• Lengths scale by k; areas by k^2 and volumes by k^3 for similar solids.

Watch out

Multiplying area by the length scale factor only once. If all lengths double, the area multiplies by $2^2 = 4$ and the volume by $2^3 = 8$.

Need the method? Open the full chapter and worked examples.

Constructions and clear geometry reasoning

• 16 : Circumcircle. Construct perpendicular bisectors of two triangle sides. Their intersection is the circumcentre. Draw a circle from it through a vertex.

• 17 : Incircle. Construct two internal angle bisectors. Their intersection is the incentre. Construct its perpendicular distance to a side as the radius.

Watch out

Erasing the compass arcs after finishing a construction. The arcs show how the required point or line was found. Leave the useful construction marks visible; do not replace the method with a measured guess.

Need the method? Open the full chapter and worked examples.

Planning a statistical investigation

• Define the population and question.

• Choose a sample that avoids systematic bias.

• State what the data can and cannot show.

Watch out

Assuming a larger sample automatically removes bias. Asking many members of one sports club about favourite sports can still misrepresent the whole school. Use a sampling method suited to the population.

Need the method? Open the full chapter and worked examples.

Tables, charts and stem-and-leaf plots

• Read the key and scale first.

• Order stem-and-leaf entries and give a key.

• Compare both a typical value and spread when comparing groups.

Watch out

Reading left-hand leaves in a back-to-back stem-and-leaf plot as though it were a right-hand plot. With key $2|3 = 23$, the row $8\ 5\ 1 \mid 2$ on the left represents $28, 25$ and 21; read outwards from the stem to list them in increasing order.

Need the method? Open the full chapter and worked examples.

Averages, spread and grouped data

• Mean: add and divide by the number of values.

• Median: order first, then find the middle.

• Grouped mean uses midpoints and is an estimate.

Watch out

Finding the middle value before sorting the data. In $8, 2, 5$, the median is 5 after ordering as $2, 5, 8$; it is not the middle entry 2 in the original list.

Need the method? Open the full chapter and worked examples.

Probability and relative frequency

• Use equally likely outcomes when counting probabilities.

• Probability $=$ favourable outcomes $\div$ all outcomes.

• Check that the result lies between 0 and 1.

Watch out

Assuming all possible totals of two fair dice are equally likely. Total 2 has one outcome, $(1, 1)$; total 7 has six outcomes. Count the equally likely ordered dice outcomes, not just the names of the totals.

Need the method? Open the full chapter and worked examples.

Combined events, trees and tables

• Multiply along an independent sequence of events.

• Add mutually exclusive successful paths.

• Use the total of the group actually selected.

Watch out

Confusing independent with mutually exclusive. Two coin tosses are independent. Getting heads and tails on the same single toss is mutually exclusive: both cannot happen on that toss.

Need the method? Open the full chapter and worked examples.

Standard deviation, normal data and margin of error

• Standard deviation describes spread around the mean. Use the population standard-deviation setting when that is the quantity requested.

• For an approximately normal distribution, about 68% is within one standard deviation of the mean, 95% within two, and 99.7% within three.

Watch out

Writing a margin of error of 0.05 as 0.05%. A proportion of 0.05 is 5 percentage points. A sample estimate of 60% with this margin gives approximately 55% to 65%.

Need the method? Open the full chapter and worked examples.