

Grade 6 checklist

58 skills. Tick each one when you can do it. For grade 6 you need the skills for the grades below it too.

Number

- ☐ **Use prime factor form to reason** E.g. find the smallest number to multiply by to make a square number, using even powers. (Primes, factors, HCF and LCM)

- ☐ **Tell whether a fraction terminates or recurs** In its simplest form, a fraction terminates only if the denominator has no prime factors other than 2 and 5. (Recurring decimals)

- ☐ **Convert a pure recurring decimal to a fraction** E.g. $x = 0.\dot{7}2$: $100x - x = 72$, so $x = \frac{72}{99} = \frac{8}{11}$. (Recurring decimals)

- ☐ **Estimate powers and roots** Use nearby squares or cubes: $\sqrt{40}$ is between 6 and 7 (36 and 49), about 6.3. (Indices and roots)

- ☐ **Evaluate unit fractional indices** $a^{\frac{1}{n}}$ is the n th root of a , so $64^{\frac{1}{3}} = 4$. (Indices and roots)

- ☐ **Simplify a surd** Take out the largest square factor: $\sqrt{48} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$. (Surds)

- ☐ **Multiply and divide surds** $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$, e.g. $\sqrt{6} \times \sqrt{10} = \sqrt{60} = 2\sqrt{15}$, and $\sqrt{20} \div \sqrt{5} = \sqrt{4} = 2$. (Surds)

- ☐ **Add and subtract surds** Simplify first, then collect like surds: $\sqrt{50} + \sqrt{8} = 5\sqrt{2} + 2\sqrt{2} = 7\sqrt{2}$. (Surds)

- ☐ **Solve problems in standard form** E.g. find how many times bigger one quantity is, or a total from a very small unit amount. (Standard form)

- ☐ **Find the bounds of a sum or product** Upper bound: use both upper bounds; lower bound: use both lower bounds. (Upper and lower bounds)

- ☐ **Count when repeats are not allowed** Each choice has one fewer option: 4-digit codes with different digits: $10 \times 9 \times 8 \times 7 = 5040$. (Listing and the product rule)

Algebra

- ☐ **Find unknown constants in an identity** Expand and simplify one side, then match the coefficients of each power of x and the number terms. (Algebraic notation, substitution and identities)

- ☐ **Factorise quadratics with x^2 coefficient above 1** Split the middle term using two numbers with product ac , e.g. $3x^2 + 10x - 8 = (3x - 2)(x + 4)$. (Factorising)

- ☐ **Factorise fully in two stages** Take out a common factor, then factorise the bracket, e.g. $3x^2 - 12 = 3(x + 2)(x - 2)$. (Factorising)

- ☐ **Simplify algebraic fractions by factorising** Factorise top and bottom, then cancel common brackets, e.g. $\frac{3x+6}{x^2-4} = \frac{3}{x-2}$. (Algebraic fractions)

- ☐ **Add fractions with number denominators** Use a common denominator, e.g. $\frac{x}{3} + \frac{x}{4} = \frac{7x}{12}$. (Algebraic fractions)

- ☐ **Rearrange multi-step formulae with powers** e.g. $v^2 = u^2 + 2as$ gives $u = \sqrt{v^2 - 2as}$. (Changing the subject)

- ☐ **Solve equations with several fractions** Multiply every term by the LCM of the denominators, e.g. $\frac{x}{2} + \frac{x}{3} = 10$ gives $x = 12$. (Linear equations)
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- ☐ **Factorise harder quadratics to solve them** e.g. $2x^2 + x - 6 = 0$ gives $(2x - 3)(x + 2) = 0$, so $x = 1.5$ or $x = -2$. (Solving quadratic equations)
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- ☐ **Use the quadratic formula** Substitute a, b and c into $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ and round as instructed. (Solving quadratic equations)
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- ☐ **Rearrange an equation into a quadratic** Expand brackets or clear fractions to get $ax^2 + bx + c = 0$ before solving. (Solving quadratic equations)
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- ☐ **Complete the square for simple quadratics** Halve the coefficient of x: $x^2 + 6x + 1 = (x + 3)^2 - 9 + 1 = (x + 3)^2 - 8$. (Completing the square)
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- ☐ **Show inequalities as a region on a graph** Draw each boundary line (dashed for $<$ or $>$, solid for $\leq$ or $\geq$) and shade the region that fits all of them. (Inequalities)
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- ☐ **Sketch and interpret exponential graphs** $y = k^x$ with $k > 1$ passes through (0, 1), rises more and more steeply and never touches the x-axis. (Graphs of functions)
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- ☐ **Translate a graph vertically** $y = f(x) + a$ moves the graph up a units (down if a is negative). (Transforming graphs)
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- ☐ **Evaluate a function for a given input** Substitute the value for x, e.g. $f(x) = 3x^2 - 1$ gives $f(-2) = 11$. (Composite and inverse functions)
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- ☐ **Solve an equation such as $f(x) = k$** Set the function equal to the value and solve, e.g. $2x + 7 = 15$ gives $x = 4$. (Composite and inverse functions)
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- ☐ **Show a solution lies between two values** Substitute both values into the equation written as $\dots = 0$; a change of sign shows there is a solution between them. (Iteration)
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- ☐ **Write expressions for odd, even and consecutive numbers** Even $2n$, odd $2n + 1$, consecutive integers $n, n + 1, n + 2$. (Algebraic proof)
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- ☐ **Disprove a statement with a counterexample** Find one example where the statement is false and show why it is false. (Algebraic proof)
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- ☐ **Show that two expressions are identical** Expand and simplify one side until it matches the other exactly. (Algebraic proof)
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- ☐ **Find acceleration from a velocity–time graph** Acceleration is the gradient; a negative gradient is a deceleration. (Gradients and areas under graphs)
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- ☐ **Find distance from a velocity–time graph** Split the area under the graph into triangles, rectangles and trapezia and add them. (Gradients and areas under graphs)
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Ratio, proportion and rates of change

- ☐ **Find the overall percentage change over time** Work out multiplierⁿ, e.g. $0.9^3 = 0.729$ is a 27.1% decrease. (Compound interest, growth and decay)
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- ☐ **Form and use equations like $y = kx$** Substitute a known pair of values to find k, then use the formula. (Direct and inverse proportion)
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- ☐ **Find the density of a mixture** Divide the total mass by the total volume, working out each part separately first. (Speed, density and pressure)
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- ☐ **Convert rates and algebraic quantities between units** Change one unit at a time, e.g. 2.5 litres per second = 9000 litres per hour = 9 m^3 per hour. (Converting units)
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Geometry and measures

- ☐ **Prove angle results using known facts** Use letters and a chain of reasons to show a general result, e.g. that the exterior angle of a triangle equals the sum of the two interior opposite angles. (Angles, parallel lines and polygons)
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- ☐ **Give exact answers as simplified surds** On a non-calculator Higher paper, an exact length such as $\sqrt{45}$ is written as $3\sqrt{5}$. (Pythagoras' theorem (incl. 3D))
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- ☐ **Find a triangle's area using $\frac{1}{2}ab \sin C$** Use two sides and the angle between them: area = $\frac{1}{2} \times a \times b \times \sin C$. (Sine rule, cosine rule and $\frac{1}{2}ab \sin C$)
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- ☐ **Use the tangent and radius facts** A tangent meets a radius at 90° , and the two tangents from a point outside a circle are equal in length. (Circle theorems)
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- ☐ **Use the angle in a semicircle** An angle at the circumference subtended by a diameter is 90° . (Circle theorems)
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- ☐ **Find the angle or radius of a sector** Substitute the given arc length or area into the formula and solve for θ or r . (Arcs and sectors)
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- ☐ **Form and solve equations from areas** Write the area in terms of x , set it equal to the given value and solve, possibly as a quadratic. (Area and perimeter)
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- ☐ **Solve problems with composite solids** e.g. a cone on a hemisphere, or finding a length when the volume is given. (Volume and surface area)
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- ☐ **Prove that two triangles are congruent** Give three pairs of equal sides or angles with reasons, then state the condition. (Congruence and geometric proof)
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- ☐ **Prove angle results using known facts** Use a chain of angle facts with reasons to prove a general result, often using letters. (Congruence and geometric proof)
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Probability

- ☐ **Solve problems with three events** Multiply three probabilities along each path, count the paths you need, and use $1 - P(\text{none})$ for 'at least one'. (Tree diagrams and combined events)
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- ☐ **Complete a three-set Venn diagram** Fill the centre (in all three sets) first, then the regions in exactly two sets, then each 'only' region and the outside. (Venn diagrams and set notation)
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- ☐ **Find 'given that' probabilities from two-way tables** Use only the row or column you are given, e.g. $P(\text{walks given Year 10}) = \text{Year 10 walkers} \div \text{all Year 10 students}$. (Conditional probability)
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Statistics

- ☐ **Find quartiles and IQR from a list** In an ordered list of n values, the quartiles are the $\frac{n+1}{4}$ th and $\frac{3(n+1)}{4}$ th values. (Cumulative frequency and box plots)
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- ☐ **Draw a cumulative frequency graph** Plot each running total at the upper end of its class and join the points with a smooth curve or straight lines. (Cumulative frequency and box plots)

- ☐ **Estimate the median and quartiles from a graph** Read across from $\frac{n}{2}$, $\frac{n}{4}$ and $\frac{3n}{4}$ on the cumulative frequency axis to the curve, then down. (Cumulative frequency and box plots)

- ☐ **Draw and interpret a box plot** Mark the minimum, lower quartile, median, upper quartile and maximum against a scale. (Cumulative frequency and box plots)

- ☐ **Calculate frequency density for each class** Frequency density = frequency $\div$ class width, so a wider class needs a lower bar for the same frequency. (Histograms)

- ☐ **Draw a histogram with unequal class widths** Draw touching bars whose heights are the frequency densities, against a continuous scale. (Histograms)

- ☐ **Interpret the gradient of a line of best fit** The gradient is the change in y for each increase of 1 in x, described in context. (Scatter graphs and correlation)

- ☐ **State the assumptions of capture–recapture** The population does not change between samples, marked animals mix evenly, and marks are not lost. (Sampling and capture–recapture)

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