

Grade 7 checklist

72 skills. Tick each one when you can do it. For grade 7 you need the skills for the grades below it too.

Number

- ☐ **Find numbers from a given HCF and LCM** Work backwards from the HCF and LCM to find possible pairs of numbers. (Primes, factors, HCF and LCM)
- ☐ **Convert decimals with a non-recurring part** E.g. $x = 0.4\dot{1}$: $100x - 10x = 41.11\ldots - 4.11\ldots = 37$, so $x = \frac{37}{90}$. (Recurring decimals)
- ☐ **Prove a recurring decimal equals a fraction** Show the full algebraic method, from 'let $x = \dots$ ' to the simplified fraction. (Recurring decimals)
- ☐ **Evaluate any fractional or negative fractional index** Root, then power, then flip if negative: $8^{-\frac{2}{3}} = \frac{1}{2^2} = \frac{1}{4}$. (Indices and roots)
- ☐ **Expand brackets containing surds** Multiply every term by every term: $(3 + \sqrt{2})(1 - \sqrt{2}) = 1 - 2\sqrt{2}$. (Surds)
- ☐ **Rationalise a denominator with a single surd** For $\frac{6}{\sqrt{3}}$, multiply top and bottom by $\sqrt{3}$: $\frac{6\sqrt{3}}{3} = 2\sqrt{3}$. (Surds)
- ☐ **Find the bounds of a difference or quotient** For the upper bound of $a - b$ or $a \div b$, use the upper bound of a and the lower bound of b . (Upper and lower bounds)
- ☐ **Use bounds with compound measures** Upper bound of speed = upper bound of distance $\div$ lower bound of time. (Upper and lower bounds)
- ☐ **Count pairs when order doesn't matter** From n people, the number of pairs is $\frac{n(n-1)}{2}$, e.g. 8 people make 28 pairs. (Listing and the product rule)

Algebra

- ☐ **Expand the product of three binomials** Expand two brackets first, then multiply by the third, e.g. $(x + 1)(x + 2)(x - 3) = x^3 - 7x - 6$. (Expanding brackets)
- ☐ **Multiply and divide algebraic fractions** Factorise, flip the second fraction if dividing, then cancel and multiply. (Algebraic fractions)
- ☐ **Add fractions with algebraic denominators** Multiply the denominators to get a common denominator, e.g. for $\frac{2}{x+1} + \frac{3}{x-2}$ use $(x + 1)(x - 2)$. (Algebraic fractions)
- ☐ **Simplify fractions involving harder quadratics** Factorise quadratics such as $2x^2 - 5x - 3$ before cancelling. (Algebraic fractions)
- ☐ **Use fractional indices in algebra** The denominator is a root and the numerator a power, e.g. $(16x^8)^{\frac{1}{2}} = 4x^4$. (Laws of indices in algebra)
- ☐ **Rearrange when the subject appears twice** Collect the subject terms on one side and factorise, e.g. $ax + b = cx + d$ gives $x = \frac{d-b}{a-c}$. (Changing the subject)

- ☐ **Form and solve a quadratic in context** e.g. from an area; reject any solution that is impossible, such as a negative length. (Solving quadratic equations)
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- ☐ **Solve a quadratic by completing the square** Rearrange to $(x + p)^2 = k$ and square root both sides, e.g. $(x + 3)^2 = 8$ gives $x = -3 \pm 2\sqrt{2}$. (Completing the square)
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- ☐ **Find the turning point from completed square form** $y = (x + p)^2 + q$ has its minimum point at $(-p, q)$. (Completing the square)
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- ☐ **Find unknowns by comparing forms** Expand the completed square and match coefficients, e.g. $x^2 + bx + 11 \equiv (x + 4)^2 + c$ gives $b = 8, c = -5$. (Completing the square)
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- ☐ **Solve linear and quadratic simultaneous equations** Substitute the linear equation into the quadratic, solve, then find the matching values. (Simultaneous equations)
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- ☐ **Solve a quadratic inequality** Find the roots, sketch the graph and choose the part above or below the x-axis, e.g. $x^2 - x - 6 < 0$ gives $-2 < x < 3$. (Inequalities)
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- ☐ **Find the nth term of a quadratic sequence** Halve the second difference to get the coefficient of n^2 , subtract that n^2 term, then find the linear part. (Sequences and the nth term)
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- ☐ **Find perpendicular gradients and lines** Perpendicular gradients multiply to -1 , so a line perpendicular to $y = 2x + 1$ has gradient $-\frac{1}{2}$. (Straight-line graphs)
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- ☐ **Sketch and use trigonometric graphs** Know $y = \sin x$ and $y = \cos x$ (repeat every 360°) and $y = \tan x$ (repeats every 180°), and use symmetry to find angles. (Graphs of functions)
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- ☐ **Translate a graph horizontally** $y = f(x + a)$ moves the graph a units to the left; $y = f(x - a)$ moves it a units to the right. (Transforming graphs)
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- ☐ **Reflect a graph in either axis** $y = -f(x)$ reflects it in the x-axis; $y = f(-x)$ reflects it in the y-axis. (Transforming graphs)
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- ☐ **Find where a point moves to** Apply the transformation to the coordinates, e.g. under $y = f(x - 3)$, $(2, 5)$ moves to $(5, 5)$. (Transforming graphs)
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- ☐ **Find a composite function** $fg(x)$ means apply g first, then f : substitute $g(x)$ into f . (Composite and inverse functions)
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- ☐ **Find an inverse function** Write $y = f(x)$, make x the subject, then write $f^{-1}(x)$ in terms of x . (Composite and inverse functions)
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- ☐ **Use an iterative formula** Substitute x_0 to get x_1 , then x_1 to get x_2 , and so on, using ANS on your calculator. (Iteration)
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- ☐ **Find a solution to a given accuracy** Keep iterating until successive values round to the same answer, e.g. to 3 decimal places. (Iteration)
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- ☐ **Show an equation rearranges to a given form** e.g. show that $x^3 + 4x - 1 = 0$ can be written as $x = \frac{1-x^3}{4}$. (Iteration)
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- ☐ **Prove results about odd and even numbers** e.g. the sum of two odd numbers: $(2m + 1) + (2n + 1) = 2(m + n + 1)$, which is even. (Algebraic proof)
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- ☐ **Prove an expression is a multiple** Factorise to show it is $k \times$ an integer, e.g. $6n + 6 = 6(n + 1)$. (Algebraic proof)
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- ☐ **Find the radius from a circle's equation** $x^2 + y^2 = 36$ is a circle with centre (0, 0) and radius 6.
(Equation of a circle and tangents)

- ☐ **Write the equation of a circle** Radius 5 gives $x^2 + y^2 = 25$; through (3, -4) gives $r^2 = 9 + 16 = 25$, the same circle. (Equation of a circle and tangents)

- ☐ **Check whether a point lies on a circle** Substitute the coordinates: the point is on the circle only if $x^2 + y^2$ equals r^2 . (Equation of a circle and tangents)

- ☐ **Estimate a gradient by drawing a tangent** Draw a tangent at the point, make a large right-angled triangle and work out rise $\div$ run. (Gradients and areas under graphs)

- ☐ **Find an average rate of change** Work out the gradient of the chord joining two points on the curve.
(Gradients and areas under graphs)

- ☐ **Estimate the area under a curve** Split it into strips of equal width and add the areas of the trapezia.
(Gradients and areas under graphs)

Ratio, proportion and rates of change

- ☐ **Form an equation when a ratio changes** Write the amounts as multiples of x, apply the change and solve the equation given by the new ratio. (Ratio)

- ☐ **Combine percentage changes using multipliers** Multiply the multipliers, e.g. if the length and width of a rectangle both go up by 10%, its area is multiplied by $1.1 \times 1.1 = 1.21$. (Percentages and reverse percentages)

- ☐ **Work backwards to find the original value** Divide the final value by multiplierⁿ. (Compound interest, growth and decay)

- ☐ **Use an iterative formula for growth or decay** Apply a formula such as $u_{n+1} = 1.04u_n$ one step at a time. (Compound interest, growth and decay)

- ☐ **Form equations involving squares, cubes and roots** Write, for example, $y = kx^2$ or $y = \frac{k}{\sqrt{x}}$ and find k from given values. (Direct and inverse proportion)

Geometry and measures

- ☐ **Use Pythagoras in 3D shapes** Find the space diagonal of a cuboid or the height of a pyramid using two right-angled triangles. (Pythagoras' theorem (incl. 3D))

- ☐ **Find lengths and angles in 3D shapes** Find the angle between a line and a plane using a right-angled triangle inside the shape. (Right-angled trigonometry)

- ☐ **Find a missing side with the sine rule** Use $a \div \sin A = b \div \sin B$ when you know an angle and the side opposite it. (Sine rule, cosine rule and $\frac{1}{2}ab \sin C$)

- ☐ **Find a missing angle with the sine rule** Use $\sin A \div a = \sin B \div b$, then $\sin^{-1}$. (Sine rule, cosine rule and $\frac{1}{2}ab \sin C$)

- ☐ **Find a missing side with the cosine rule** Use $a^2 = b^2 + c^2 - 2bc \cos A$ when you know two sides and the angle between them. (Sine rule, cosine rule and $\frac{1}{2}ab \sin C$)

- ☐ **Find a missing angle with the cosine rule** Use $\cos A = (b^2 + c^2 - a^2) \div 2bc$ when you know all three sides. (Sine rule, cosine rule and $\frac{1}{2}ab \sin C$)

- ☐ **Use the angle at the centre theorem** The angle at the centre is twice the angle at the circumference subtended by the same arc. (Circle theorems)

- ☐ **Use same-segment and cyclic quadrilateral facts** Angles in the same segment are equal, and opposite angles of a cyclic quadrilateral add up to 180° . (Circle theorems)

- ☐ **Use the perpendicular bisector of a chord** The perpendicular from the centre to a chord bisects the chord. (Circle theorems)

- ☐ **Find the area of a segment** Sector area minus the area of the triangle, using $\frac{1}{2}ab \sin C$ for the triangle. (Arcs and sectors)

- ☐ **Find the volume of a frustum** Volume of the large cone minus the small cone, using similar triangles for any missing lengths. (Volume and surface area)

- ☐ **Use the area scale factor** If lengths are multiplied by k , areas are multiplied by k^2 . (Similar shapes (length, area, volume))

- ☐ **Use the volume scale factor** If lengths are multiplied by k , volumes (and masses of the same material) are multiplied by k^3 . (Similar shapes (length, area, volume))

- ☐ **Use congruence to prove further results** After proving triangles congruent, deduce that other sides or angles are equal. (Congruence and geometric proof)

- ☐ **Enlarge by a negative scale factor** The image is on the opposite side of the centre and upside down. (Transformations)

- ☐ **Use ratios to find vectors along lines** If P divides AB in the ratio 1 : 3, then $\overrightarrow{AP} = \frac{1}{4}\overrightarrow{AB}$. (Vectors)

- ☐ **Use sine and cosine rules with bearings** When the triangle is not right-angled, use the sine rule or the cosine rule. (Bearings and scale drawings)

Probability

- ☐ **Use algebra to find missing Venn numbers** Write each region in terms of x , add them all to make the total and solve the equation. (Venn diagrams and set notation)

- ☐ **Find conditional probabilities from a Venn diagram** For 'given that A', divide the number in the region you want by the number in A, not by the grand total. (Venn diagrams and set notation)

- ☐ **Find conditional probabilities from a Venn diagram** Divide the number in the part you need by the number in the whole of the given set. (Conditional probability)

- ☐ **Use conditional probabilities on tree diagrams** The second set of branches gives the probability of the second event given what happened first, so the branches can differ. (Conditional probability)

- ☐ **Use expected frequencies to find conditional probabilities** Turn the probabilities into numbers out of a convenient total, such as 100 or 1000, then read off the fraction you need. (Conditional probability)

Statistics

- ☐ **Find an unknown frequency from a mean** Write the mean as an algebraic fraction, set it equal to the given mean and solve the equation. (Averages and spread)

- ☐ **Estimate how many are above a value** Read up from the value to the curve and across; for 'more than', subtract this reading from the total. (Cumulative frequency and box plots)

- ☐ **Compare distributions using median and IQR** Compare the medians (on average) and the interquartile ranges (consistency), in context. (Cumulative frequency and box plots)

 - ☐ **Find frequencies from a histogram** Frequency = frequency density $\times$ class width, which is the area of the bar. (Histograms)

 - ☐ **Decide if an estimate is too high or too low** Work out how a broken assumption changes the number of marked animals recaptured, and so the estimate. (Sampling and capture–recapture)
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