

Grade 8 checklist

34 skills. Tick each one when you can do it. For grade 8 you need the skills for the grades below it too.

Number

- ☐ **Rationalise a denominator containing a bracket** For $\frac{1}{3+\sqrt{2}}$, multiply top and bottom by $3 - \sqrt{2}$, since $(3 + \sqrt{2})(3 - \sqrt{2}) = 7$, giving $\frac{3-\sqrt{2}}{7}$. (Surds)
- ☐ **Give exact answers in geometry problems** Keep surds in Pythagoras and trigonometry, e.g. a hypotenuse of $\sqrt{72} = 6\sqrt{2}$ cm. (Surds)
- ☐ **Choose a suitable degree of accuracy** Round both bounds; give the most accurate value that they both round to. (Upper and lower bounds)
- ☐ **Use bounds in formulas and trigonometry** Decide which bound of each value makes the answer as large (or small) as possible. (Upper and lower bounds)
- ☐ **Count with restrictions on positions** Fill the restricted places first and split into cases if needed, e.g. even numbers greater than 3000. (Listing and the product rule)

Algebra

- ☐ **Solve equations with algebraic fractions** Multiply every term by the common denominator, usually giving a quadratic to solve. (Algebraic fractions)
- ☐ **Simplify with negative fractional indices** Root, then power, then take the reciprocal, e.g. $(27x^6)^{-\frac{2}{3}} = \frac{1}{9x^4}$. (Laws of indices in algebra)
- ☐ **Rearrange fractions with the subject twice** e.g. $y = \frac{x+2}{x-3}$ gives $x = \frac{3y+2}{y-1}$. (Changing the subject)
- ☐ **Complete the square when a is not 1** Take out a factor of a first, e.g. $2x^2 - 8x + 3 = 2(x - 2)^2 - 5$. (Completing the square)
- ☐ **Prove a quadratic is always positive** Complete the square and use the fact that a square is never negative. (Completing the square)
- ☐ **Find where a line meets a circle** Substitute into $x^2 + y^2 = r^2$, e.g. $y = x + 1$ and $x^2 + y^2 = 13$ meet at $(2, 3)$ and $(-3, -2)$. (Simultaneous equations)
- ☐ **Continue geometric sequences involving surds** e.g. 2, $2\sqrt{3}$, 6, $6\sqrt{3}$, ...: multiply by $\sqrt{3}$ each time. (Sequences and the nth term)
- ☐ **Solve equations by drawing a suitable line** e.g. use the graph of $y = x^2 - 3x$ and the line $y = x + 2$ to solve $x^2 - 4x - 2 = 0$. (Graphs of functions)
- ☐ **Describe a combined translation as a vector** $y = f(x + 2) - 1$ is a translation by $\begin{pmatrix} -2 \\ -1 \end{pmatrix}$. (Transforming graphs)
- ☐ **Transform trigonometric graphs** e.g. $y = \cos(x - 90^\circ)$ is the cos graph moved 90° to the right, which gives the same graph as $y = \sin x$. (Transforming graphs)

- ☐ **Solve equations involving composite functions** e.g. form and solve an equation from $gf(x) = 25$.
(Composite and inverse functions)

- ☐ **Explain what the iterated values represent** The values get closer to a solution of the original equation.
(Iteration)

- ☐ **Prove results about consecutive and square numbers** e.g. the difference between the squares of two consecutive odd numbers is a multiple of 8. (Algebraic proof)

- ☐ **Find the equation of a tangent** Find the gradient of the radius, take the negative reciprocal, then substitute the point to find c. (Equation of a circle and tangents)

- ☐ **Find where a line meets a circle** Substitute the line into $x^2 + y^2 = r^2$ and solve the quadratic. (Equation of a circle and tangents)

- ☐ **Tell whether trapezia overestimate or underestimate** Trapezia overestimate if the curve bends upwards, and underestimate if it bends downwards. (Gradients and areas under graphs)

- ☐ **Interpret gradients and areas in context** Say what the value means, with units, e.g. an area under a velocity–time graph is a distance in metres. (Gradients and areas under graphs)

Ratio, proportion and rates of change

- ☐ **Find the rate from start and end values** Work out final $\div$ start, take the nth root to get the multiplier, then turn it into a percentage. (Compound interest, growth and decay)

- ☐ **Work out the effect of changing a variable** If $y = kx^2$ and x is tripled, y is multiplied by 9. (Direct and inverse proportion)

Geometry and measures

- ☐ **Choose and combine rules in multi-step problems** Pick the right rule at each stage, e.g. cosine rule for a side, then $\frac{1}{2}ab \sin C$ for an area, including bearings problems. (Sine rule, cosine rule and $\frac{1}{2}ab \sin C$)

- ☐ **Use the alternate segment theorem** The angle between a tangent and a chord equals the angle in the alternate segment. (Circle theorems)

- ☐ **Solve multi-step problems with full reasons** Combine several theorems and angle facts, stating the reason for each step. (Circle theorems)

- ☐ **Find length scale factors from areas or volumes** Square root the area factor or cube root the volume factor to get k, then use it. (Similar shapes (length, area, volume))

- ☐ **Prove lines parallel or points collinear** Show one vector is a multiple of another; for collinear points they must also share a point. (Vectors)

Probability

- ☐ **Form and solve an equation from probabilities** Write the branch probabilities in terms of an unknown, set up an equation (often a quadratic) and solve it. (Tree diagrams and combined events)

- ☐ **Test whether two events are independent** Compare $P(A \text{ and } B)$ with $P(A) \times P(B)$, or $P(A \text{ given } B)$ with $P(A)$: if they are equal, the events are independent. (Conditional probability)

Statistics

- ☐ **Check a box plot against a graph** Test whether the median, quartiles and extreme values of a box plot agree with a cumulative frequency graph or table. (Cumulative frequency and box plots)

 - ☐ **Work out a missing frequency density scale** Use a bar whose frequency you know to find what each unit of height, or each square, represents. (Histograms)

 - ☐ **Estimate a frequency within part of a class** Assume the values are spread evenly through the class, and use frequency density $\times$ the width of the part you need. (Histograms)
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