

Grade A* looks like ...

- Derive harder algebraic proofs using reasoning and logic
- Simplify harder rational expressions, and solve more complex fractional linear equations with the unknown in the denominator
- Use completing the square to simplify or solve quadratic equations, and to find maximum and minimum values
- Solve harder quadratic equations ($a \neq 1$) by factorisation or using the quadratic formula
- In more complex cases, solve a pair of simultaneous equations in two unknowns where one is linear and one is quadratic (including of the form $x^2 + y^2 = r^2$)
- Transform the graphs of $y = f(x)$, such as linear, quadratic, cubic, sine and cosine functions, using the transformations $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$ and $y = af(x)$
- Manipulate surds in the form $a + b\sqrt{3}$
- Understand and use rational and irrational numbers
- Find the upper and lower bounds of more difficult calculations with quantities given to a various degrees of accuracy
- Draw, sketch and describe the graphs of trigonometric functions for angles of any size, including transformations involving scalings in either or both of the x and y directions
- Solve problems involving the volume of the frustum of a truncated cone
- Solve simple geometrical problems in 2-D using vectors, including use of the commutative and associative properties of vector addition
- Use tree diagrams to find probabilities of successive dependent events

Grade A looks like ...

- Use a wide range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately
- Use different representations effectively and recognise equivalent representations
- Demonstrate sound numerical skills and algebraic fluency; use a calculator effectively
- Use trigonometry and geometrical properties to solve problems
- Identify and use mathematics accurately in a range of contexts; choose methods of mathematical communication appropriate to the context
- Evaluate the appropriateness, effectiveness and efficiency of different approaches; state the limitations of an approach or the accuracy of results and use this information to inform conclusions within a mathematical or statistical problem.
- Make and test hypotheses and conjectures
- Adopt appropriate strategies to tackle problems (including those that are novel or unfamiliar), adjusting the approach when necessary
- Tackle problems that bring together different aspects of mathematics and may involve multiple variables. Identify some variables and investigate them systematically; the outcomes of which are used in solving the problem.
- Solve quadratic equations ($a=1$) by factorisation or using the quadratic formula
- In simple cases, solve a pair of simultaneous equations in two unknowns where one is linear and one is quadratic (including of the form $x^2 + y^2 = r^2$)
- Derive and use more complex formulae and change the subject of a formula, including cases where the subject occurs twice
- Know and understand that the intersection points of the graphs of a linear and quadratic function are the approximate solutions to the corresponding simultaneous equations
- Manipulate simple surds
- Determine the bounds of intervals
- Understand and use direct and inverse proportion
- Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and compass constructions
- Understand and use Pythagoras' theorem to solve 3-D problems
- Draw, sketch and describe the graphs of trigonometric functions for angles of any size
- Solve problems involving surface areas and volumes of cylinders, pyramids, cones and spheres
- Understand and use the formulae for the length of a circular arc and area and perimeter of a sector
- Understand the difference between formulae for perimeter, area and volume by considering dimensions
- Select and justify a sampling scheme and a method to investigate a population
- Use, interpret and compare histograms, including those with unequal class intervals
- Recognise when and how to work with probabilities associated with independent and mutually exclusive events

Grade B looks like ...

- Select and combine known facts and problem solving strategies to solve geometrical problems of increasing complexity
- Consider possible approaches to exploring a question or testing a hypothesis; refine methods as enquiry progresses
- Factorise quadratic expressions including the difference of two squares
- Solve inequalities in two variables and find the solution set
- Derive and use more complex formulae and change the subject of a formula including cases where a power of the subject appears in the question or solution
- Identify and sketch graphs of linear and simple quadratic and cubic functions
- Understand the effect on the graph of addition of (or multiplication by) a constant
- Understand the equivalence between recurring decimals and fractions
- Understand and use efficient methods to add, subtract, multiply and divide fractions, interpreting division as a multiplicative inverse
- Use a multiplier raised to a power to represent and solve problems involving repeated proportional change, e.g. compound interest
- Calculate with standard index form, using a calculator as appropriate
- Know, and use, that if two 2-D shapes are similar, corresponding angles are equal and corresponding sides are in the same ratio
- Understand and use trigonometrical relationships in right-angled triangles, and use these to solve problems, including those involving bearings
- Estimate and find the median, quartiles and interquartile range for large data sets, including using a cumulative frequency diagram
- Compare two or more distributions and make inferences, using the shape of the distributions and measures of average and spread including median and quartiles
- Know when to add or multiply two probabilities: if A and B are mutually exclusive, then the probability of A or B occurring is $P(A) + P(B)$, whereas if A and B are independent events, the probability of A and B occurring is $P(A) \times P(B)$
- Use tree diagrams to calculate probabilities of combinations of independent events

Grade C looks like ...

- Use a range of mathematical techniques, terminology, diagrams & symbols consistently, appropriately and accurately
- Use different representations effectively and recognise some equivalent representations
- Demonstrate sound numerical skills and use a calculator effectively
- Apply ideas of proportionality to numerical problems & use geometric properties of angles, lines & shapes
- Identify relevant information, select appropriate representations and apply appropriate methods and knowledge. Use different methods of mathematical communication.
- Understand the limitations of evidence and sampling, and the difference between a mathematical argument and conclusions based on experimental evidence
- Identify evidence that supports or refutes conjectures and hypotheses
- Construct a mathematical argument & identify inconsistencies in a given argument or exceptions to a generalisation
- Tackle problems that bring aspects of mathematics together; identify strategies to solve problems involving a limited number of variables; communicate the chosen strategy, making changes as necessary
- Construct and solve linear equations with integer coefficients (with and without brackets, negative signs anywhere in the equation, positive or negative solution), using an appropriate method
- Square a linear expression, expand the product of two linear expressions of the form $x \pm n$ and simplify the corresponding quadratic expression
- Solve a pair of simultaneous linear equations by eliminating one variable; link a graphical representation of an equation or pair of equations to the algebraic solution
- Solve linear inequalities in one variable, and represent the solution set on a number line
- Use formulae from mathematics and other subjects; substitute numbers into expressions and formulae; derive a formula and, in simple cases, change its subject
- Find the next term and the n th term of quadratic sequences and functions and explore their properties
- Plot graphs of simple quadratic and cubic functions
- Understand and use proportional changes expressed as fractions, decimals, percentages and ratios
- Use the equivalence of fractions, decimals and percentages to compare proportions
- Calculate percentages and find the outcome of a given percentage increase or decrease
- Use proportional reasoning to solve a problem, choosing the correct numbers to take as 100%, or as a whole
- Estimate calculations by rounding to one significant figure and multiplying and dividing mentally
- Understand the effects of multiplying and dividing by numbers between 0 and 1
- Use calculators efficiently and appropriately to perform complex calculations with numbers of any size, knowing not to round during intermediate steps of a calculation
- Solve problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons, justifying inferences and explaining reasoning with diagrams and text
- Deduce and use formulae for the area of a triangle, parallelogram and trapezium; calculate areas of compound shapes made from rectangles and triangles
- Solve problems involving the area and circumference of a circle
- Understand and apply Pythagoras' theorem when solving problems in 2-D
- Solve problems involving surface areas and volumes of right prisms
- Enlarge 2-D shapes, given a centre of enlargement and a whole-number scale factor, on paper and using ICT; extend to enlarging 2-D shapes, given a fractional scale factor; recognise the similarity of the resulting shapes
- Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half of the unit in either direction
- Understand & use measures of speed (and other compound measures such as density or pressures) to solve problems

- Suggest a problem to explore using statistical methods, frame questions and raise conjectures
- Design a survey or experiment to capture the necessary data from one or more sources; determine the sample size and degree of accuracy needed
- Select, construct and modify, on paper and using ICT, suitable graphical representation to progress an enquiry, including frequency diagrams and scatter graphs to develop further understanding of correlation
- Estimate the mean, median and range of a set of grouped data and determine the modal class
- Compare two or more distributions and make inferences, using the shape of the distributions and measures of average and range
- Understand relative frequency as an estimate of probability and use this to compare outcomes of an experiment

Grade D looks like ...

- Solve problems and carry through substantial tasks by breaking them into smaller, more manageable tasks, using a range of efficient techniques, methods and resources, including ICT; give solutions to an appropriate degree of accuracy
- Interpret, discuss and synthesise information presented in a variety of mathematical forms
- Use logical argument to establish the truth of a statement
- Use systematic trial and improvement methods and ICT tools to find approximate solutions to equations such as $x^3 + x = 20$
- Generate terms of a sequence using term-to-term and position-to-term definitions of the sequence, on paper and using ICT
- Plot the graphs of linear functions, where y is given explicitly in terms of x ; recognise that equations of the form $y = mx + c$ correspond to straight-line graphs
- Construct functions arising from real-life problems and plot their corresponding graphs; interpret graphs arising from real situations
- Use the terms square, positive and negative square root, cube and cube root
- Recall integer squares from 2×2 to 15×15 and the corresponding square roots
- Divide a quantity into two or more parts in a given ratio and solve problems involving ratio and direct proportion
- Add and subtract fractions by writing them with a common denominator, calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction
- Classify quadrilaterals by their geometric properties
- Identify alternate and corresponding angles: understand a proof that the sum of the angles of a triangle is 180° and of a quadrilateral is 360°
- Devise instructions for a computer to generate and transform shapes and paths
- Visualise and use 2-D representations of 3-D objects
- Know that translations, rotations and reflections preserve length and angle and map objects onto congruent images
- Use straight edge and compasses to do standard constructions
- Deduce and use formulae for the volume of a cuboid; calculate volumes and surface areas of cuboids
- Design, trial and if necessary refine data collection sheets; construct tables for large discrete and continuous sets of raw data, choosing suitable class intervals; design and use two-way tables
- Select, construct and modify, on paper and using ICT:
 - pie charts for categorical data;
 - bar charts and frequency diagrams for discrete and continuous data;
 - simple time graphs for time series;
 - scatter graphs.

Identify which are most useful in the context of the problem.

- Find and record all possible mutually exclusive outcomes for single events and two successive events in a systematic way
- Know that the sum of probabilities of all mutually exclusive outcomes is 1 and use this when solving problems
- Communicate interpretations and results of a statistical survey using selected tables, graphs and diagrams in support

Grade E looks like ...

- Solve word problems and investigations from a range of contexts
- Break a complex calculation into simpler steps, choosing and using appropriate and efficient operations and methods
- Simplify or transform linear expressions by collecting like terms
- Multiply a single term over a bracket
- Plot the graphs of simple linear functions
- Round decimals to the nearest decimal place; round a number to one significant figure
- Order negative numbers in context
- Recognise and use number patterns and relationships
- Use equivalence between fractions and order fractions and decimals
- Understand simple ratio
- Extend mental methods of calculation to include decimals, fractions and percentages
- Add, subtract, multiply and divide integers
- Use function keys on a calculator for powers and roots
- Find one number as a fraction of another
- Use a wider range of properties of 2-D and 3-D shapes
- Reason about position and movement and transform shapes
- Read and interpret scales on a range of measuring instruments, explaining what each labelled division represents
- Ask questions, plan how to answer them and collect the data required
- Create and interpret line graphs where the intermediate values have meaning
- Construct and interpret stem-and-leaf diagrams
- Estimate probabilities from experimental data; understand that:
 - if an experiment is repeated there may be, and usually will be, different outcomes;
 - increasing the number of times an experiment is repeated generally leads to better estimates of probability.

Grade F looks like ...

- Use some mathematical techniques, terminology, diagrams and symbols from the foundation tier consistently, appropriately and accurately
- Use some different representations effectively and select information from them
- Complete straightforward calculations competently with and without a calculator
- Use simple fractions and percentages, simple formulae and some geometric properties, including symmetry
- Work mathematically in everyday and meaningful contexts; make use of diagrams and symbols to communicate mathematical ideas.
- Check the accuracy and reasonableness of results on occasions
- Test simple hypotheses and conjectures based on evidence; use data to look for patterns and relationships
- State a generalisation arising from a set of results and identify a counter-example
- Solve simple problems, some of which are non-routine
- Construct, express in symbolic form, and use simple formulae involving one or two operations
- Use coordinates in all four quadrants to locate and specify points
- Explore and describe number patterns and relationships including multiple, factor and square
- Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 and 1000
- Reduce a fraction to its simplest form by cancelling common factors
- Order, add and subtract negative numbers in context
- Use all four operations with decimals to two places
- Solve simple problems involving ratio and direct proportion
- Calculate fractional or percentage parts of quantities and measurements, using a calculator where necessary
- Understand and use an appropriate non-calculator method for solving problems involving multiplying and dividing any three-digit by any two-digit number
- Check the reasonableness of results by reference to knowledge of the context or to the size of the numbers, by applying inverse operations or by estimating using approximations
- Measure and draw angles to the nearest degree, when constructing models and drawing or using shapes
- Use language associated with angle and know and use the angle sum of a triangle and that of angles at a point
- Identify all the symmetries of 2-D shapes
- Solve problems involving the conversion of units and make sensible estimates of a range of measures in relation to everyday situations
- Understand and use the formula for the area of a rectangle and distinguish area from perimeter
- Understand and use the mean of discrete data and compare two simple distributions, using the range and one of mode, median or mean
- Interpret graphs and diagrams, including pie charts, and draw conclusions
- Understand and use the probability scale from 0 to 1
- In probability, select methods based on equally likely outcomes and experimental evidence, as appropriate
- Understand that different outcomes may result from repeating an experiment

Grade G looks like ...

- Use and interpret mathematical symbols and diagrams
- Understand a general statement by finding particular examples that match it
- Review their work and reasoning
- Develop and use their own strategies within mathematics and in applying mathematics to practical contexts
- Present information and results in a clear and organised way
- Search for a solution by trying out ideas of their own
- Recognise a wider range of sequences
- Begin to use simple formulae expressed in words
- Use and interpret coordinates in the first quadrant
- Understand place value in numbers to 1000; use place value to make approximations
- Recognise negative numbers in contexts such as temperature
- Begin to use decimal notation in contexts such as money
- Recognise approximate proportions of a whole and use simple fractions and percentages to describe these
- Order decimals to three decimal places
- Use a range of mental methods of computation with all operations; including use of recall of addition and subtraction facts to 20
- Use efficient written methods of addition and subtraction and of short multiplication and division; including multiplication and division of two digit numbers by 2, 3, 4 or 5 as well as 10 with whole number answers and remainders
- Recall multiplication facts up to 10×10 and quickly derive corresponding division facts
- Solve problems with or without a calculator
- Classify 3-D and 2-D shapes in various ways using mathematical properties such as reflective symmetry for 2-D shapes
- Begin to recognise nets of familiar 3-D shapes, e.g. cube, cuboid, triangular prism, square-based pyramid
- Use standard units of time
- Make 3-D models by linking given faces or edges and draw common 2-D shapes in different orientations on grids
- Find perimeters of simple shapes and find areas by counting squares
- Collect and record discrete data
- Group data, where appropriate, in equal class intervals
- Use Venn and Carroll diagrams to record their sorting and classifying of information
- Construct and interpret frequency diagrams, simple line graphs and pictograms, where the symbol represents a group of units
- Understand and use the mode and range to describe sets of data