Curriculum and Assessment in Mathematics at KS3

Curriculum Statement: Mathematics

> Mathematics is not about numbers, equations, computations or algorithms: it is about understanding.
> - William Paul Thurston

Powerful Knowledge in Mathematics

Our curriculum aims to empower students to develop and apply problem solving skills focusing predominantly on the powerful and overarching mathematical components: proportional reasoning, geometrical reasoning and graphical representations.

Our aim is to encourage students to develop mathematical behaviour and as such our curriculum encourages students to develop deeper understanding to make links across curriculum areas and foster a mastery approach.

Curriculum features

At all levels, students are provided with opportunities to behave mathematically. The emphasis is on empowering students to notice, make connections, explain, justify, conjecture, prove.

We adopt a Mastery approach with one set of mathematical concepts and big ideas for all. We encourage students to deploy particular models to support their development (ratio tables, area model, graphing) as well as draw a pictorial representation to make sense of a given situation.

Challenge is provided through depth rather than acceleration. These beliefs are in line with the current National College of Excellence in Teaching Mathematics drive on Mastery.

Co Curriculum enrichment

Students will be offered a wide variety of opportunities and experiences that widen their appreciation of mathematics and the world around it. These will include:

- Developing an appreciation of some aspects of finance and more creative mathematics
- "Maths society community" leading to taking part in national competitions such as the UK Mathematics Individual Challenge and Team challenges
- Code breaking with opportunities to visit Bletchley Park
- Origami
- Maths in different cultures
- Opportunities to further explore mathematical ideas with key exponents in the mathematics community
- Students will be encouraged to read extracts around mathematics

Curriculum Overview Mathematics

Maths Curriculum at KS3 – An Overview

Year 7	Year 8	Year 9
Module 1 Directed Numbers Multiplication and Division – Area Model Factors, Multiples, Prime Numbers, Divisibility	Module 1 Powers and number system structure	Module 1 Surds
Module 2 Ratio table and area Model for multiplication Fractions, all balance of imagery and tool. Intro ratio table for fractions of amounts	Module 2 Percentages and ratio Pie Charts	Module 2 Conversions of currency. Stratified sampling Compound interest and depreciation
Module 3 Problem solving involving area and perimeter	Module 3 Pythagoras' theorem, area and circumference of circle	Module 3 Circles and Pythagoras in context
Module 4 Sequences and describing relationships	Module 4 Sequences – building up a structure expand and factorise double brackets	Module 4 Solving linear equations and inequalities. Quadratic sequences
Module 5 Co-ordinates and interpretation of graphs Linear & Real Life Graphs	Module 5 Solving equations graphically, including linear, quadratic and simultaneous	Module 5 Regions of inequalities and simultaneous equations – combination table and graph
Module 9 Construction – accurate drawing, observation and use of language	Module 6 and 7 Collecting, analysing and comparing data collecting, analysing and comparing grouped data	Module 9 Introduction to trigonometry and construction of loci.

Module 10 Symmetry, Reflective and rotational. Tessellation. Reflection.	Module 9 Generalising – Beginnings of formal Proof	Module 8 Probability Listing outcomes Relative Frequency Tree diagrams
		Module 10 Translation, including an introduction to vector notation, and rotation Enlargement, including positive, negative and fractional. year 8 and 9 content

KASH Reporting Criteria
Mathematics

KASH Reporting Criteria in Maths: Knowledge and Skills at KS3

Year 7:

Students will develop their **KNOWLEDGE** of:

- interpreting ratio tables and use these as tools to solve numerical problems
- using additive and multiplicative strategies (the multiplier is an integer value)
- using and applying ratio tables in the context of division and multiplication
- making appropriate use of number lines to represent and solve numerical problems including comparing measurements
- using the area model for long multiplication of integers and decimal numbers
- using 'reallotting' strategies to solve area problems of compound shapes

Students will develop their **SKILLS** in:

- describing given diagrams, identifying key features. Where appropriate students make sense of a given situation by drawing diagrams
- identifying similarities and differences in situations presented and using these to provide examples of their own of a similar nature. Students are able to provide examples of, as well as, counter examples
- offering suggestions and beginning to ask 'what if' questions considering the affects that changing one aspect has on the rest of the situation. Students provide explanations for their reasoning
- beginning to consider if mathematical statements are sometimes/always/never true
- describing and interpreting graphs and given a context provide meaning
- accepting that being stuck is a vital aspect of mathematical development and beginning to simplify a given problem to attempt to make progress
- using mathematical language appropriately

KASH Reporting Criteria in Maths: Knowledge and Skills at KS3

Year 8:

Students will develop their **KNOWLEDGE** of:

- being able to interpret ratio tables and using these as tools to solve numerical problems
- using appropriate calculations including unitary method and begin to consider decimal and fractional multipliers
- using the number line effectively to order numbers written in different formats as well as to solve equations with unknown on both sides
- using the area model to expand single and double brackets and begin to reverse this process (leading to factorising)
- using a combination of strategies to calculate the area of more complex shapes

Students will develop their **SKILLS** in:

- building on the noticing skills developed, they make and test conjectures. Students successfully justify their conjectures and refine these with contributions from others
- regularly questioning peers' contributions to the development of mathematical ideas
- being able to compare graphs and representations. Students use information given in graphical form to drive new information. Students appreciate links in graphical representation and are able to reverse problems (start with any aspect to complete others)
- considering what makes a given problem more demanding as well as how it can be simplified

KASH Reporting Criteria in Maths: Knowledge and Skills at KS3

Year 9:

Students will develop their **KNOWLEDGE** of:

- using ratio tables to solve problems with fluency. They select appropriate strategies considering efficiency when using a calculator and when this is not allowed. They can use multiplication and division by decimals and fractions with relative ease
- using the number line efficiently to order numbers written in different formats including index form, standard form and surd form. They use combination tables when solving linear simultaneous equations
- developing effective strategies to solve equations with unknown on both sides including those involving subtraction and fractional values of x
- using the area model effectively to factorise and expand single and double brackets
- using a combination of strategies to calculate area and surface area of complex shapes

Students will develop their **SKILLS** in:

- appreciating that being stuck is a necessary step to learning mathematics and are developing strategies to make progress in these situations. They are able to simplify multi-step problems and appreciate the importance of identifying what they can work out in order to make some progress with a given task
- developing noticing and justification skills to actively make links in areas of mathematics and where appropriate outside the subject. They have an inquisitive approach to mathematics and are not satisfied with reaching a solution. They regularly ask themselves questions like 'how can the problem made easier/harder', 'what changes if we change …', what happens if …', 'is this always/sometimes/never true'
- appreciating links in graphical representation and are able to reverse problems (start with any aspect to complete others) – in particular looking at the graph of quadratics
- using mathematical language appropriately
- beginning to distinguish between examples and mathematical proof
- using construction equipment with relative ease

Foundation Stages – Assessment Criteria Mathematics

Foundation Stages in Maths – Assessment Criteria at KS3

Using and applying

Pre Foundation Stage Students use mathematics as an integral part of classroom activities. They represent their work with objects or pictures and discuss it. They recognise and use a simple pattern or relationship. Students select the mathematics they use in some classroom activities. They discuss their work using mathematical language and are beginning to represent it using symbols and simple diagrams. They explain why an answer is correct.

Foundation Stage 1 Students try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results. Students discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams. Students show that they understand a general statement by finding particular examples that match it.

Foundation Stage 2 Students develop their own strategies for solving problems and use these strategies both in working within mathematics and in applying mathematics to practical contexts. When solving problems, with or without ICT, they check their results are reasonable by considering the context. They look for patterns and relationships, presenting information and results in a clear and organised way, using ICT appropriately. They search for a solution by trying out ideas of their own.

Foundation Stage 3 In order to explore mathematical situations, carry out tasks or tackle problems, students identify the mathematical aspects and obtain necessary information. They calculate accurately, using ICT where appropriate. They check their working and results, considering whether these are sensible. They show understanding of situations by describing them mathematically using symbols, words and diagrams. They draw simple conclusions of their own and explain their reasoning.

Foundation Stage 4 Students carry out substantial tasks and solve quite complex problems by independently and systematically breaking them down into smaller, more manageable tasks. They interpret, discuss and synthesise information presented in a variety of mathematical forms, relating findings to the original context. Their written and spoken language explains and informs their use of diagrams. They begin to give mathematical justifications, making connections between the current situation and situations they have encountered before.

Foundation Stage 5 Starting from problems or contexts that have been presented to them, students explore the effects of varying values and look for invariance in models and representations, working with and without ICT. They progressively refine or extend the mathematics used, giving reasons for their choice of mathematical presentation and explaining features they have selected. They justify their generalisations, arguments or solutions, looking for equivalence to different problems with similar structures. They appreciate the difference between mathematical explanation and experimental evidence. Students develop and follow alternative approaches. They compare and evaluate representations of a situation, introducing and using a range of mathematical techniques. They reflect on their own lines of enquiry when exploring mathematical tasks. They communicate mathematical or statistical meaning to different audiences through precise and consistent use of symbols that is sustained throughout the work.

Beyond Foundation Stage Students critically examine the strategies adopted when investigating within mathematics itself or when using mathematics to analyse tasks. They examine generalisations or solutions reached in an activity and make further progress in the activity as a result. They comment constructively on the reasoning and logic, the

process employed and the results obtained. They explain why different strategies were used, considering the elegance and efficiency of alternative lines of enquiry or procedures. They apply the mathematics they know in a wide range of familiar and unfamiliar contexts. They use mathematical language and symbols effectively in presenting a convincing, reasoned argument. Their reports include mathematical justifications, distinguishing between evidence and proof and explaining their solutions to problems involving a number of features or variables.

Number and algebra

Pre Foundation Stage Students count, order, combine, increase and decrease quantities when solving problems in practical contexts. They read and write the numbers involved. Students count sets of objects reliably, and use mental recall of addition and subtraction facts to 10. They begin to understand the place value of each digit in a number and use this to order numbers up to 100. They choose the appropriate operation when solving addition and subtraction problems. They use the knowledge that subtraction is the inverse of addition. They use mental calculation strategies to solve number problems involving money and measures. They recognise sequences of numbers, including odd and even numbers.

Foundation Stage 1 Students show understanding of place value in numbers up to 1000 and use this to make approximations. They begin to use decimal notation, in the context of measures and money, and to recognise negative numbers in practical contexts such as temperature. Students use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers. They add and subtract numbers with two digits mentally and numbers with three digits using written methods. They use mental recall of the 2, 3, 4, 5 and 10 multiplication tables and derive the associated division facts. They solve whole-number problems involving multiplication or division including those that give rise to remainders. They use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent. Students use their understanding of place value to mentally multiply and divide whole numbers by 10 or 100. When solving number problems, they use a range of mental methods of computation with the four operations, including mental recall of multiplication facts up to 10 x 10.

Foundation Stage 2 When solving number problems, they use a range of mental methods of computation with the four operations, including mental recall of multiplication facts up to 10 x 10 and quick derivation of corresponding division facts. They select efficient strategies for addition, subtraction, multiplication and division. They recognise approximate proportions of a whole and use simple formulae expressed in words. Students use their understanding of place value to multiply and divide whole numbers and decimals. They order, add and subtract negative numbers in context. They use and interpret coordinates in all four quadrants.

Foundation Stage 3 Students use all four operations with decimals to two places. They solve simple problems involving ratio and direct proportion. They calculate fractional or percentage parts of quantities and measurements, using a calculator where appropriate. They construct, express in symbolic form and use simple formulae involving one or two operations. They use brackets appropriately. Students order and approximate decimals when solving numerical problems. They evaluate one number as a fraction or percentage of another. They find and describe in words the rule for the next term or nth term of a sequence where the rule is linear.

Foundation Stage 4 Students order and approximate decimals when solving numerical problems and equations, using trial and improvement methods. They understand and use the equivalences between fractions, decimals and percentages, and calculate using ratios in appropriate situations. They add and subtract fractions by writing them with a common denominator. They formulate and solve linear equations with whole-number coefficients. They represent mappings expressed algebraically, and use Cartesian coordinates for graphical representation interpreting general features. When making estimates, students round to one significant figure and multiply and divide mentally. They solve numerical problems involving multiplication and division with numbers of any size, using a calculator efficiently and appropriately.

Foundation Stage 5 Students understand the effects of multiplying and dividing by numbers between 0 and 1. They understand and use proportional changes, calculating the result of any proportional change using only multiplicative methods. They find and describe in symbols the next term or nth term of a sequence where the rule is quadratic. They use algebraic and graphical methods to solve simultaneous linear equations in two variables. Students solve problems that involve calculating with powers, roots and numbers expressed in standard form. They manipulate algebraic formulae, equations and expressions, finding common factors and multiplying two linear expressions. They sketch and interpret graphs of linear and quadratic.

Students choose to use fractions or percentages to solve problems involving repeated proportional changes or the calculation of the original quantity given the result of a proportional change. They evaluate algebraic formulae or calculate one variable, given the others, substituting fractions, decimals and negative numbers. They solve inequalities in two variables. They sketch and interpret graphs of cubic and reciprocal functions, and graphs that model real situations. They solve simultaneous equations in two variables where both equations are linear. They solve problems using intersections and gradients of graphs.

Beyond Foundation Stage Students understand and use rational and irrational numbers. They determine the bounds of intervals. They understand and use direct and inverse proportion. In simplifying algebraic expressions, they use rules of indices for negative and fractional values. In finding formulae that approximately connect data, they express general laws in symbolic form. They solve simultaneous equations in two variables where one equation is linear and the other is quadratic.

Shape and Space

Pre Foundation Stage When working with 2-D and 3-D shapes, students use mathematical language to describe properties and positions. They measure and order objects using direct comparison, and order events. Students use mathematical names for common 3-D and 2-D shapes and describe their properties, including numbers of faces, edges and vertices. They distinguish between straight and turning movements, recognise angle as a measurement of turn, and right angles in turns. They begin to use everyday non-standard and standard units to measure length and mass.

Foundation Stage 1 Students classify 3-D and 2-D shapes in various ways using mathematical properties such as reflective symmetry for 2-D shapes. They use non-standard units, standard metric units of length including finding perimeters, capacity and mass, and standard units of time, in a range of contexts. They reflect simple shapes in a mirror line. They choose and use appropriate units and tools, interpreting, with appropriate accuracy, numbers on a range of measuring instruments.

Foundation Stage 2 Students use and make geometric 2-D and 3-D patterns, scale drawings and models in practical contexts. They find areas of simple shapes. They identify all the symmetries of 2-D shapes. They make sensible estimates of a range of measures in relation to everyday situations.

Foundation Stage 3 When constructing models and drawing or using shapes, students measure and draw angles to the nearest degree and use language associated with angles. They know the angle sum of a triangle and that of angles at a point. They convert one metric unit to another. They understand and use the formula for the area of a rectangle. Students recognise and use common 2-D representations of 3-D objects. They know and use the properties of quadrilaterals. They devise instructions for a computer to generate and transform shapes and paths. . They understand and use appropriate formulae for areas of plane rectilinear figures and volumes of cuboids when solving problems.

Foundation Stage 4 They solve problems using angle and symmetry, properties of polygons and angle properties of intersecting and parallel lines, and explain these properties. They devise instructions for a computer to generate and transform shapes and paths. They understand and use appropriate formulae for finding circumferences and areas of circles when solving problems. They appreciate the imprecision of measurement and recognise that a measurement given to the nearest whole number may be inaccurate by up to one half in either direction. They understand and use compound measures, such as speed.

Foundation Stage 5 Students understand and apply Pythagoras' theorem when solving problems in two dimensions. They calculate lengths, areas and volumes in plane shapes and right prisms. They enlarge shapes by a fractional scale factor, and appreciate the similarity of the resulting shapes. They determine the locus of an object moving according to a rule. Students understand and use congruence and mathematical similarity. They use sine, cosine and tangent in right-angled triangles when solving problems

in two dimensions. Students sketch the graphs of sine, cosine and tangent functions for any angle. They calculate lengths of circular arcs and areas of sectors. They appreciate the continuous nature of scales that are used to make measurements.

Beyond Foundation Stage Students sketch the graphs of sine, cosine and tangent functions for any angle, and generate and interpret graphs based on these functions. They use sine, cosine and tangent of angles of any size, and Pythagoras' theorem when solving problems in two and three dimensions. They construct formal geometric proofs. They calculate the surface area of cylinders and volumes of cones and spheres.

Statistics

Pre Foundation Stage Students sort objects and classify them, demonstrating the criterion they have used. They collect data to answer questions. Students sort objects and classify them using more than one criterion. When they have gathered information to answer a question or explore a situation, students record results in simple lists, tables, diagrams and block graphs, in order to communicate their findings.

Foundation Stage 1 Students extract and interpret information presented in simple tables and lists. They construct charts and diagrams to communicate information they have gathered for a purpose, and they interpret information presented to them in this form. Students generate and answer questions that require the collection of discrete data which they record using a frequency table. They understand and use an average and range to describe sets of data. They construct and interpret simple line graphs.

Foundation Stage 2 Using technology where appropriate: students group data in equal class intervals if necessary, represent collected data in frequency diagrams and interpret such diagrams. Students understand and use the mean of discrete data. They compare two simple distributions using the range and one of the mode, median or mean. . They understand and use the probability scale from 0 to 1.

Foundation Stage 3 Students interpret graphs and diagrams, including pie charts, and draw conclusions. They collect and record continuous data, choosing appropriate equal class intervals over a sensible range to create frequency tables. They construct and interpret frequency diagrams. They construct pie charts. They find and justify probabilities and approximations to these by selecting and using methods based on equally likely outcomes and experimental evidence, as appropriate. They understand that different outcomes may result from repeating an experiment.

Foundation Stage 4 They draw conclusions from scatter diagrams, and have a basic understanding of correlation. They use measures of average and range, with associated frequency polygons, as appropriate, to compare distributions and make inferences. When dealing with a combination of two experiments, they identify all the outcomes. When solving problems, they use their knowledge that the total probability of all the mutually exclusive outcomes of an experiment is 1.

Foundation Stage 5 Students specify hypotheses and test them by designing and using appropriate methods that take account of variability or bias. They determine the modal class and estimate the mean, median and range of sets of grouped data, selecting the statistic most appropriate to their line of enquiry. They understand relative frequency as an estimate of probability and use this to compare outcomes of experiments. Students interpret and construct cumulative frequency tables and diagrams. Students estimate the median and interquartile range and use these to compare distributions and make inferences. They understand how to calculate the probability of a compound event and use this in solving problems. Students interpret and construct histograms

Beyond Foundation Stage Students understand how different methods of sampling and different sample sizes may affect the reliability of conclusions drawn. They select and justify a sample and method to investigate a population. They recognise when and how to work with probabilities associated with independent, mutually exclusive events.

Attitudes and Habits

At Laurus Cheadle Hulme we expect all of our students to display the following **Attitudes and Habits in all of their subjects**.

Development in each area will be judged by the subject teacher as either, **emerging, establishing, secure, enhancing or excelling** dependant on the progress being made.

ATTITUDES

- Ready to learn and quick to settle
- Takes responsibility for learning
- Has a thirst for learning
- Willing to work independently with focus/without teacher input
- Willing to actively participate in a variety of situations
- Seeks to develop learning by questioning
- Takes risks to further learning
- Maintains a positive relationship with others
- Shows respect at all times
- Always puts effort into learning/classwork/P & P
- Understands the importance of working to deadlines
- Takes responsibility for their own and others safety in school/classroom/learning environment
- Meets school expectations of behaviour/learning/attendance

HABITS

- Prepared to learn
- Fully equipped for lessons
- Prepared for assessment
- Actively engages with learning
- Always responds to targets/feedback
- Seeks to demonstrate knowledge through answering questions
- Seeks opportunities to be challenged
- Able to work independently with focus
- Willing to ask for help if needed and knows where to find help
- Follows all instructions
- Work is well organised
- P & P is always completed
- Regularly meets deadlines
- Seeks opportunities to participate in extra-curricular activities and/or roles of responsibility
- Attendance follows school's expectations