**National Curriculum Key Stage 3 Maths**

| | TITLE | WHERE IS IT COVERED IN THE CURRICULUM? | ANY EXAMPLE OF GOING BEYOND NC? (If relevant) |
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| **Developing fluency** | consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals, fractions, powers and roots | All students who are working at or who are close to working at age related expectations complete 6 numeracy blocks in their first term at JMHS. These focus on improving fluency and understanding number (Stage E/F Blocks 1-6). These units are taught in mixed ability groups. For those students working significantly below age related expectations they complete a support curriculum Stage G. This stage almost exclusively focuses on numerical skills. | |
| | select and use appropriate calculation strategies to solve increasingly complex problems | When numeracy skills are taught, they are initially placed in context to build understanding. As students understanding of these new skills are developed they then move on to increasingly difficult problems. Once skills have been taught they are continually reused in future blocks of work. | |
| | use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships | The curriculum takes its roots from the Shanghai concept of 'concrete, abstract, generalise' This means from the very start of Year 7 students are expected to generalise their understanding. From Stage E and above this also includes students generalising their findings using algebra. | |

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| | substitute values in expressions, rearrange and simplify expressions, and solve equations | Students are introduced to formal algebraic techniques in stage E.<br>Stage E Block 8 – algebraic thinking<br>Stage E Block 10 – solving equations<br><br>Every student (including those working significantly below age related expectations) will study these blocks of work some time during Year 7 to 9. | |
| | move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs] | When algebraic manipulation techniques are studied they are explained by considering numbers first (Stage E Block 8 work on simplifying and expanding brackets). Graphical models such as the double number line and bar models are used extensively to explain different concepts (Stage F Block 10 – Proportional reasoning, Stage E Block 10 – Solving equations, Stage D Block 3 – Ratio and proportion). Pictorial and physical representation are used extensively when working with fractions (Stage G Block 4 – The fraction wall, Stage G Block 13 – Equivalent fractions, Stage E/F Block 4 Fractions). | All maths classrooms have magnetic equivalent fraction cards which are always available to support teachers in building understanding. |
| | develop algebraic and graphical fluency, including understanding linear and simple quadratic functions | Students study specific blocks looking at linear and quadratic functions.<br>Stage D Block 6 – Straight line graphs<br>Stage C Block 1 – quadratic expressions<br>Within these blocks students focus on how functions and graphs are linked and how changing one part of a function affects its graph and vice-versa. | |

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| | use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics. | Taking its influences from Shanghai, there is a very clear focus upon students using correct mathematical vocabulary within every unit of work right from the beginning of Year 7. | Within every block we have created lists of key vocabulary that we expect to master. In addition, to this there is the expectation that students use mathematical symbols and notation with precision. |
| **Reasoning Mathematically** | extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations | Stage E/F Blocks 1-6 help move students understanding of number on from KS2. Skills and techniques mastered in these initial blocks are then built upon throughout the rest of the year. | |
| | extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically | Within specific units of work focused on proportion, there is a clear development of skills.<br>Stage F Block 10 – Proportional reasoning<br>Stage D Block 3 – Ratio and proportion<br>Stage C Block 6 – Direct and inverse proportion<br>Students are introduced to the double number line as a graphical representation of proportion and bar models use to build understanding of ration. This develops into both ratio and proportional relationships being represented algebraically. | |
| | identify variables and express relations between variables algebraically and graphically | Algebraic variables are initially introduced to students using pictorial representations. Understanding is built from here (Stage E Block 8 – algebraic thinking). When equations are introduced to students this is firstly done using the bar model before moving onto a balance representation (Stage E Block 10 – solving equations) | |

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| | make and test conjectures about patterns and relationships; look for proofs or counterexamples | The curriculum takes its roots from the Shanghai concept of 'concrete, abstract, generalise' This means from the very start of Year 7 students are expected to generalise their understanding. From Stage E and above this also includes students generalising their findings using algebra. In Stage C block students are taught formally how to write a mathematical proof. | |
| | begin to reason deductively in geometry, number and algebra, including using geometrical constructions | Students are frequently required to explain their reasoning. | On every end of block homework task, we have included a question where students need to explain their reasoning. This gives students opportunity to both develop and get feedback on this skill. |
| | interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning | Numeracy blocks in stages E and F which are covered by all students by the end of Year 9 look at numerical problem solving. | |
| | explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally. | Throughout the teaching of both statistics and probability work there is a clear focus on what the calculations or graphs actually mean. Students are supported in analysing these results and explaining their reasoning in writing | |
| **Problem Solving** | develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems | Students are generally introduced to new concepts through problems set in context. Students frequently have the opportunity to continue to develop their problem-solving skills within the independent work phases of their lessons. | |

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| | develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics | Finance questions appear frequently throughout the different blocks and stages. Stage D Block 4 has a large financial focus looking at how to solve monetary problems involving percentage change such as compound interest and depreciation. | |
| | begin to model situations mathematically and express the results using a range of formal mathematical representations | Mathematical models such as the bar model and double number line are used extensively throughout the programme of study. New concepts and ideas are generalised algebraically where possible. | |
| | select appropriate concepts, methods and techniques to apply to unfamiliar and nonroutine problems. | Students are generally introduced to new concepts through problems set in context. Students frequently have the opportunity to continue to develop their problem-solving skills within the independent work phases of their lessons. | |
| **Number** | understand and use place value for decimals, measures and integers of any size | Stage G Block 1 – Place value<br>Stage E/ Block 6 – Decimals and rounding | |
| | order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥ | Stage G Block 1 – Place value<br>Stage G Block 6 – Negative numbers<br>Stage E/F Block 5 – Negative numbers | |
| | use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property | Stage E/F Block 2 – Multiples, factors and primes | Students taught form early on in KS3 how to use prime factorisation of numbers to find both HCFs and LCMs |

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| | use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative | Stage G Block 2 – Addition, subtraction and the bar model<br>Stage G Block 3 – Times tables and multiplication<br>Stage G Block 5 – Multiplying dividing and rounding integers<br>Stage G Block 8 – Division<br>Stage E/F Block 1 – Commutative and associative laws<br>Stage E/F Block 3 – Multiplication and division<br>Stage E Block 9 - Fractions | |
| | use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals | Stage F Block 13 – Squares, cubes, roots and order of operations<br>Stage D Block 1 – Rounding and approximation | |
| | recognise and use relationships between operations including inverse operations | Stage E/F Block 1 – Commutative and associative laws<br>Stage E/F Block 3 – Multiplication and division<br>Stage E Block 9 - Fractions | |
| | use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations | Stage F Block 13 – Squares, cubes, roots and order of operations<br>Stage C Block 3 – Positive and negative integers and standard form | |
| | interpret and compare numbers in standard form A x 10n 1≤A | Stage C Block 3 – Positive and negative integers and standard form | Time is also spent manipulating numbers written in standard form such as addition and subtraction without first taking the numbers out of standard form |
| | work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 2 7 or 0.375 and 8 3 ) | Stage E/F Block 4 – Fractions<br>Stage E/F Block 6 – Decimals and rounding<br>Stage E Block 9 - Fractions | |

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| | define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100% | Stage F Block 11 – Fractions and percentages<br>Stage D Block 4 – Percentage change | |
| | interpret fractions and percentages as operators | Stage F Block 11 – Fractions and percentages<br>Stage E Block 9 - Fractions<br>Stage D Block 4 – Percentage change | |
| | use standard units of mass, length, time, money and other measures, including with decimal quantities | Stage F Block 12 – Measurements<br>Stage D Block 9 – Compound measures | |
| | use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$ | Stage D Block 1 – Rounding and approximation | |
| | use a calculator and other technologies to calculate results accurately and then interpret them appropriately | Calculator skills are taught extensively in relevant sections of work from stage D onwards | |
| | appreciate the infinite nature of the sets of integers, real and rational numbers. | Stage E Block 11 – Sequences | |
| **Algebra** | use and interpret algebraic notation, including:<br>ab in place of $a \times b$<br>3y in place of $y + y + y$ and $3 \times y$<br>$a^2$ in place of $a \times a$, $a^3$ in place of $a \times a \times a$; $a^2 b$ in place of $a \times a \times b$<br>a/b in place of $a \div b$<br>coefficients written as fractions rather than as decimals<br>brackets | Stage E Block 8 – algebraic thinking<br>Stage C Block 1 – quadratic expressions | |

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| | substitute numerical values into formulae and expressions, including scientific formulae | Stage E Block 8 – algebraic thinking<br>Stage D Block 2 – Formulae | |
| | understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors | Stage E Block 8 – algebraic thinking<br>Stage E Block 10 – solving equations<br>Stage E Block 11 – Sequences<br>Stage C Block 1 – quadratic expressions<br>Stage C Block 4 – Linear inequalities<br>Stage C Block 11 – Proof | |
| | simplify and manipulate algebraic expressions to maintain equivalence by:<br>collecting like terms<br>multiplying a single term over a bracket<br>taking out common factors<br>expanding products of two or more binomials | Stage E Block 8 – algebraic thinking<br>Stage C Block 1 – quadratic expressions | |
| | understand and use standard mathematical formulae; rearrange formulae to change the subject | Stage D Block 2 – Formulae | This skill is significantly built upon in context through work on perimeter, area, volume, surface area, Pythagoras and trigonometry |
| | model situations or procedures by translating them into algebraic expressions or formulae and by using graphs | Stage E Block 8 – algebraic thinking<br>Stage E Block 10 – Solving equations<br>Stage D Block 2 – Formulae | |
| | use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement) | Stage E Block 10 – Solving equations | This skill is significantly built upon in context through work on sequences, perimeter, area, volume, surface area, Pythagoras and trigonometry<br><br>Students also begin to look at how to solve simple quadratic equations by factorising and graphically |
| | work with coordinates in all four quadrants | Stage G Block 11 – Coordinates<br>Stage E Block 12 - Transformations | |

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| | recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane | Stage D Block 6 – Straight line graphs<br>Stage C Block 1 – quadratic expressions | |
| | interpret mathematical relationships both algebraically and graphically | Stage D Block 6 – Straight line graphs | |
| | reduce a given linear equation in two variables to the standard form y = mx + c; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically | Stage D Block 6 – Straight line graphs | |
| | use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations | Stage D Block 6 – Straight line graphs<br>Stage C Block 1 – quadratic expressions<br>Stage C Block 2 – simultaneous equations | |
| | find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs | Stage D Block 6 – Straight line graphs<br>Stage D Block 4 – Percentage change<br>Stage C Block 1 – quadratic expressions | |
| | generate terms of a sequence from either a term-to-term or a position-to-term rule | Stage E Block 11 – Sequences | |
| | recognise arithmetic sequences and find the nth term | Stage E Block 11 – Sequences | |
| | recognise geometric sequences and appreciate other sequences that arise. | Stage C Block 9 – Geometric and quadratic sequences | Students also begin to look at simple quadratic sequences and using nth term rules to describe these |

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| **Ratio, proportion and rates of change** | change freely between related standard units [for example time, length, area, volume/capacity, mass] | Stage F Block 12 – Measurements<br>Stage D Block 5 – Maps, Bearings, constructions and loci<br>Stage D Block 9 – Compound measures | |
| | use scale factors, scale diagrams and maps | Stage D Block 5 – Maps, Bearings, constructions and loci | |
| | express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1 | Stage G Block 13 – Equivalent fractions<br>Stage E/F Block 4 – Fractions<br>Stage E – Block 9 Fractions | |
| | use ratio notation, including reduction to simplest form | Stage F Block 10 – Proportional reasoning<br>Stage D Block 3 – Ratio and proportion | Lots of work is put in from very early in KS3 to develop pictorial representations of ratio using the bar model. |
| | divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio | Stage F Block 10 – Proportional reasoning<br>Stage D Block 3 – Ratio and proportion | |
| | understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction | Stage F Block 10 – Proportional reasoning<br>Stage D Block 3 – Ratio and proportion | |
| | relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions | Stage D Block 3 – Ratio and proportion | |
| | solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics | Stage F Block 11 – Fractions and percentages<br>Stage D Block 4 – Percentage change | |

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| | solve problems involving direct and inverse proportion, including graphical and algebraic representations | Stage F Block 10 – Proportional reasoning<br>Stage D Block 3 – Ratio and proportion<br>Stage C Block 6 – Direct and inverse proportion | Lots of work is put in from very early in KS3 to develop pictorial representations of direct proportion using double number lines. |
| | use compound units such as speed, unit pricing and density to solve problems. | Stage D Block 9 – Compound measures | |
| **Geometry and measures** | derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders) | Stage F Block 9 – Area<br>Stage D Block 7 – Perimeter of shapes<br>Stage D Block 11 – Area of shapes<br>Stage D Block 11 – Volume and surface area of prisms<br>Stage C Block 13 – Volume and surface area | Cones, Pyramids and spheres also considered |
| | calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes | Stage G Block 7 – Measuring lengths and perimeter<br>Stage D Block 7 – Perimeter of shapes | Area and perimeters of sectors also considered |
| | draw and measure line segments and angles in geometric figures, including interpreting scale drawings | Stage G Block 7 – Measuring lengths and perimeter<br>Stage F Block 7 – Angles<br>Stage D Block 5 – Maps, bearings, constructions and loci | |
| | derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line | Stage E Block 7 – Lines and angles<br>Stage D Block 5 – Maps, bearings, constructions and loci | |
| | describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric | Stage F Block 8 – Properties of shapes and solids<br>Stage E Block 7 – Lines and angles | |

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| | Use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles | Stage E Block 7 – Lines and angles<br>Stage C Block 7 – Enlargement and similar shapes | |
| | derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies | Stage F Block 8 – Properties of shapes and solids<br>Stage E Block 7 – Lines and angles | |
| | identify properties of, and describe the results of, translations, rotations and reflections applied to given figures | Stage E block 12 | The concept and term ‘invariance’ is also introduced |
| | identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids | Stage C Block 7 – Enlargement and similar shapes | |
| | apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles | Stage F Block 7 – Angles<br>Stage E Block 7 – Lines and angles | |
| | understand and use the relationship between parallel lines and alternate and corresponding angles | Stage D Block 8 – Geometry and angles | |
| | derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons | Stage D Block 8 – Geometry and angles | |
| | apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras’ Theorem, and use known results to obtain simple proofs | Stage D Block 8 – Geometry and angles<br>Stage D Block 13 – Pythagoras Theorem | |
| | use Pythagoras’ Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles | Stage D Block 13 – Pythagoras Theorem | |

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| | use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D | Stage F Block 8 – Properties of shapes and solids<br>Block 13 – Representations of solids | Different ways of representing 3D solids using a 2D drawings are also studied. This includes work on isometric and plan and elevational drawing. |
| | interpret mathematical relationships both algebraically and geometrically. | Stage D Block 8 – Geometry and angles<br>Stage D Block 13 – Pythagoras Theorem | |
| **Probability** | record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale | Stage D Block 10 – Probability | |
| | understand that the probabilities of all possible outcomes sum to 1 | Stage D Block 10 – Probability | |
| | enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams | Stage D Block 10 – Probability<br>Stage C Block 10 – Set notation and probability | |
| | generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities. | Stage D Block 10 – Probability<br>Stage C Block 10 – Set notation and probability | Tree diagrams introduced in addition to sample space diagrams to combine events when the probabilities are not equal |
| **Statistics** | describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers) | Stage G Block 14 – Presentation of data<br>Stage F Block 14 – Averages and data<br>Stage E Block 14 – Understanding averages<br>Stage D Block 14 – Grouped and bivariant data<br>Stage C Block 12 – Cumulative frequency and box plots | Interquartile range introduced as another method for analysing spread of data. This is shown how to be calculated from both discrete and continuous data |
| | construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data | Stage G Block 14 – Presentation of data<br>Stage F Block 14 – Averages and data<br>Stage D Block 14 – Grouped and bivariant data | |

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| | describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs | Stage D Block 14 – Grouped and bivariant data | |