FEARNHILL SCHOOL

Maths

GRADE		DESCRIPTION
9	Mastering Secure Developing	**Numbers and Calculations** • Calculating bounds in area and volume questions • Manipulating surds including rationalising the denominator • Manipulating complex indices such as -¾, -⅔, -3/2 **Algebra** • Exponential/complex functions • Algebraic fractions • Transform functions, y = f(x+a); y = f(ax) • Expand more than 2 binomials using binomial expansion **Handling Data** • Calculate and interpret conditional probabilities using venn diagrams **Geometry and Measures** • transform graphical functions, e.g. y = f(x+a); y = f(ax) • solve 3D trigonometry problems • recall and use proofs of circle theorems • know and use proofs of construction theorems • use vectors in geometric problems and proofs • interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' (using formal function notation) • deduce turning points by completing the square • calculate or estimate gradients of graphs and areas under graphs, and interpret results in real-life cases (not including calculus) **Using and Explaining** • give reasons for the choices made when investigating within mathematics itself or when using mathematics to analyse tasks; these reasons explain why particular lines of enquiry or procedures are followed and others rejected • apply the mathematics known in familiar and unfamiliar contexts • reports include mathematical justifications, explaining solutions to problems involving a number of features or variables

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8	Mastering Secure Developing	**Numbers and Calculations** • Converting recurring decimals to fractions (more than one digit recurring) • Manipulating fractional indices such as ¾, ⅔, 3/2 • Work with general iterative processes **Algebra** • Solve equations, one linear and one quadratic algebraically • Solve quadratics by completing the square • Algebraic problems, explain why (n+1)(n+20) is an even number • Equation of circle and intersection points with line • Trig functions • Rearrange complex equations • Expand the products of 3 binomials • Reduce expressions to calculate the nth term of quadratic sequences **Handling Data** • Histograms **Geometry and Measures** • prove that triangles are congruent • use the fact that the area of triangle = ½absinC • use the sine and cosine rule • Volume, SA (mensuration) in 3D solids and 2D shapes • develop and follow alternative approaches • reflect on own lines of enquiry when exploring mathematical tasks; in doing so introduce and use a range of mathematical techniques • convey mathematical or statistical meaning through precise and consistent use of symbols that is sustained throughout the work • examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic or the process employed, or the results obtained, and make further progress in the activity as a result **Using and Explaining** • develop and follow alternative approaches • reflect on own lines of enquiry when exploring mathematical tasks; in doing so introduce and use a range of math techniques • convey mathematical or statistical meaning through precise and consistent use of symbols that is sustained through the work • examine generalisations or solutions reached in an activity, commenting constructively on the reasoning and logic or the process employed, or the results obtained, and make further progress in the activity as a result

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7	Mastering Secure Developing	**Numbers and Calculations** • Estimate powers and roots of any given positive number • Calculating upper and lower bounds • Manipulating fractional indices such as ½, ⅓, ¼ • Converting recurring decimals to fractions (single digit recurring) • Rationalising surds **Algebra** • Rearrange equations/formulae, variable twice • Simple algebraic fractions E.g. 1/x + 1/2x - 1/6x • Solve equations graphically • Difference of two squares • Simplify algebra involving powers • Equation of line through point and perpendicular to a given line **Handling Data** • Select and use a suitable sampling method, including stratified sampling • Probabilities of combined events using multiplication **Geometry and Measures** • calculate surface area or volume of pyramids and spheres • use Pythagoras' Theorem in 3D situations • use similarity in length, area and volume • calculate the distance between points using 3D co-ordinates • use circle theorems • carry out an enlargement with a negative fractional scale factor **Using and Explaining** • progressively refine or extend the mathematics used to generate fuller solutions, starting from problems or contexts that have been presented • give a reason for the choice of mathematical presentation, explaining features that have been selected • justify generalisations, arguments or solutions, showing some insight into the mathematical structure of the problem • appreciate the difference between mathematical explanation and experimental evidence

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6	Mastering Secure Developing	**Numbers and Calculations** • Solving problems involving powers and roots • Solving problems involving standard form • Substituting fractions and decimals into equations and expressions and finding the answers • Understand the relationship between recurring decimals to fractions • Solving problems involving repeated proportional change **Algebra** • Factorise quadratic expressions including the difference of two squares, where the coefficient of x2 greater than 1 and solve by factorising • Manipulate algebraic formulae, equations and expressions, finding common factors • Derive and use more complex formulae and change the subject • Evaluate algebraic formulae, substituting fractions, decimals and negative numbers • Solve inequalities in two variables and find the solution set • Sketch, identify and interpret graphs of linear, quadratic, cubic and reciprocal functions, and graphs that model real situations • Understand the effect on a graph of addition of (or multiplication by) a constant • Solve simultaneous equations; non-linear, by graph • Use y = mx + c to find the gradient and equation without drawing • Solve quadratic graphically • Cancelling down where denominator is an algebraic expression • Factorising various expressions, $6(a-b)^2 - 3(a-b)$ • Continue and describe simple geometric progressions • Solve quadratics by, factorizing or formula **Handling Data** • Estimate and find the median, quartiles and interquartile range for large data sets, including using a cumulative frequency diagram • Draw box plots from cumulative frequency diagrams • Compare two or more distributions and make inferences, using the shape of the distributions and measures of average and spread, including median and quartiles **Geometry and Measures** • use similarity • enlarge shapes with a negative integer **Using and Explaining** • carry through substantial tasks and solve quite complex problems by independently breaking them down into smaller, more manageable tasks

		• interpret, discuss and synthesise information presented in a variety of mathematical forms • writing explains and informs the use of diagrams • begin to give mathematical justifications
5	Mastering Secure Developing	**Numbers and Calculations** • Finding HCFs using prime factor decomposition • Calculating compound interest • Understanding and using negative indices (-1, -2, -3 etc.) • Identifying when are upper and lowers bounds useful • Calculating with fractions and mixed numbers • Calculate accurately with multiples of π • Calculating repeated percentage changes • Calculating reverse percentage problems • Dividing by a number between 0 and 1 and understanding the effects • Calculations involving proportional change (inverse proportion) **Algebra** • Use algebraic methods to solve simple simultaneous linear equations in two variables • Plot the graphs of simple quadratic and cubic functions • Quadratic tables and graphs • Real life graphs, water filling, travel graphs • Find length of a line given 2 points • Factorise quadratic expressions including the difference of two squares, where the coefficient of x2 is 1 • Multiply double brackets and simplify • Solve quadratics by factorising • Solve harder simultaneous equations using algebra • Draw and use tables and graphs of cubic and reciprocal functions **Handling Data** • Compare two simple distributions using the range and one of the mode, median or mean • Interpret diagrams and graphs (including pie charts), and draw simple conclusions for a single distribution • Data collection sheets • Use f x in a frequency table • Interpret a stem and leaf diagram to find the median • Construct a pie chart • Understand and use the probability scale from 0 to 1;find and justify probabilities based on equally likely outcomes in simple contexts • Probability of not = 1-n

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		• Find probabilities from a two way table • 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, leads to better estimates of probability **Geometry and Measures** • draw the locus of a point • use congruency • use sine, cosine and tangent in right-angled triangles • solve problems involving arcs, sectors and segments • write a vector in terms of two other vectors **Using and Explaining** • identify and obtain necessary information to carry through tasks and solve mathematical problems • check results, considering whether these are sensible • show understanding of situations by describing them mathematically using symbols, words and diagrams • draw simple conclusions and give an explanation of the reasoning
4	Mastering Secure Developing	**Numbers and Calculations** • Calculating percentage decrease and increase using a multiplier • Using a calculator in complex situations, knowing not to round during intermediate steps • Multiplying by a number between 0 and 1 and understanding the effects • Finding the prime factor decomposition of a number • Using the rules of indices in numeric situations (2, 3, 4 etc.) • Calculations involving proportional change (direct proportion) • Calculating with fractions (+, -, x and ÷) • Calculating with ratios • Multiplying and dividing by powers of 10 and decimals • Round to one significant figure and use to estimate answers to calculations (division by a number less than 1) • Multiplying and dividing numbers of any size **Algebra** • Square a linear expression, and expand and simplify the product of two linear expressions • Use graphical methods to solve simultaneous linear equations in two variables • Solve inequalities in one variable and represent the solution on a number line • Use mathematical and scientific formulae • Substitute into expressions and formulae • Derive formulae • Change the subject of simple formulae

		• Find the next term and nth term of quadratic sequences and functions and explore their properties • Trial and improvement, cubic • Solve equations 2x + 4 = 12 – 3x • Expand single brackets and simplify • nth term linear • Substitution into complex formulae **Handling Data** • Suggest a problem to explore using statistical methods, frame questions and raise conjectures • Identify possible sources of bias and plan how to minimise it • Design questionnaires • Select the appropriate average to analyse data • Understand relative frequency as an estimate of probability and use this to compare outcomes of an experiment • Examine critically the results of a statistical enquiry, and justify choices • Explain the use of mean, median, mode etc. **Geometry and Measures** • calculate missing lengths using Pythagoras' Theorem • solve problems using speed, distance, time and mass, volume, density • calculate lengths, surface areas and volume in shapes and prisms • consider rounding accuracy when solving problems **Using and Explaining** • try different approaches and find ways of overcoming difficulties that arise when solving problems • begin to organise work and check results • discuss mathematical work and begin to explain thinking • use and interpret mathematical symbols and diagrams • show understanding of a general statement by finding particular examples that match it • develop strategies for solving problems and use these strategies both in working 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 own ideas

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3	Mastering Secure Developing	**Numbers and Calculations** • Round to one significant figure and use to estimate answers to calculations • Solving problems involving proportion in simple cases • Calculating with fractions in simple cases • Calculating profit and loss • Calculating an increase or decrease by a percentage • Calculating with ratios in recipes • Divide a quantity into two or more parts in a given ratio • When is it helpful to be able to work out one number as a fraction or percentage of another? • When is it appropriate to calculate using ratio? • Why is useful to be able to add and subtract fractions with common denominators • Solve problems involving ratio and direct proportion • Use the equivalence of fractions, decimals and percentages to compare proportions **Algebra** • Use systematic trial and improvement methods and ICT tools to find approximate solutions to harder equations • Construct and solve linear equations with integer coefficients • Generate terms of a sequence using term-to-term and position-to-term definitions of the sequence, on paper and using ICT • Write an expressions to describe the nth term of an arithmetic sequence • 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-life situations **Handling Data** • Design a survey or experiment • Explain deficiencies in questionnaires/sampling techniques • 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 • Stem and leaf • Simple time series graphs • Scatter graphs

		• Draw and use lines of best fit • Correlation • Mode from grouped frequencies • Mean from a discrete frequency distribution • Find and record all possible mutually exclusive outcomes for single events and two successive events in a systematic way • Relative probability • Communicate interpretations and results of a statistical survey using selected tables, graphs, and diagrams in support **Geometry and Measures** • calculate the area and circumference of a circle • understand and recall the properties of polygons • find missing angles using intersecting and parallel lines • recall the special properties of quadrilaterals • enlarge shapes given a scale factor • calculate the volume and surface area of a cuboid • use simple plans and elevations • draw nets of shapes **Using and Explaining** • calculate the area and circumference of a circle • understand and recall the properties of polygons • find missing angles using intersecting and parallel lines • recall the special properties of quadrilaterals • enlarge shapes given a scale factor • calculate the volume and surface area of a cuboid • use simple plans and elevations • draw nets of shapes

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2	Mastering Secure Developing	**Numbers and Calculations** • Simplifying ratios • How can I put numbers in order including negative numbers? • Using a calculator, e.g. '$1{\cdot}5^3$' and 'square root of $23{\cdot}78$' • Calculating with fractions in simple cases • Finding percentages by mental methods • Using the four rules with negative numbers • Calculating VAT • What happens when I multiply and divide whole numbers by 10, 100 and 1000? • How can I add and subtract negative numbers? • Why is it important to be able to simplify a fraction? • What process can I use to work out a fraction or percentage of a number? • Why is it important to be able to use inverse operations of approximation to check my answers • Rounding to 1 significant figure • Long multiplication and division, including decimals • Ordering fractions, decimals and percentages • Calculating indices and roots, e.g. 4^3, $2^3 \times 3^2$,'the cube of 4' • What happens when I add, subtract, multiply and divide numbers like 19.75 and 34.21? • How do I multiply or divide a three digit number by a two digit number? **Algebra** • Use letter symbols to represent unknown numbers or variables • Know and use the order of operations and understand that the algebraic operations follow the same conventions and order as arithmetic operations • Simplify or transform linear expressions by collecting like terms; multiplying a single term over a bracket • Substitute integers into simple formulae • Use and interpret co-ordinates in all four quadrants • Plot the graphs of simple linear functions **Handling Data** • Compare two simple distributions using the range and one of the mode, median or mean • Interpret diagrams and graphs (including pie charts), and draw simple conclusions for a single distribution • Data collection sheets • Use f x in a frequency table • Interpret a stem and leaf diagram to find the median • Construct a pie chart

		• Understand and use the probability scale from 0 to 1;find and justify probabilities based on equally likely outcomes in simple contexts • Probability of not = 1-n • Find probabilities from a two way table • 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, leads to better estimates of probability **Geometry and Measures** • interpret co-ordinates in all 4 quadrants • measure and draw angles to the nearest degree • accurately construct and draw models and shapes • know that angles of a triangle or on a straight line total 180 degrees • know that angles around a point total 360 • know and use the formula to find out the perimeter and area of a rectangle and the volume of cuboids • estimate and convert metric units in everyday life • recall metric equivalents for imperial units **Using and Handling** • use mathematics as an integral part of classroom activities • represent work with objects or pictures and discuss it • recognise and use a simple pattern or relationship • select the mathematics to be used in some classroom activities • discuss work using some mathematical language and begin to represent it using symbols and simple diagrams • explain why an answer is correct

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1	Mastering Secure Developing	**Numbers and Calculations** • Rounding to the nearest integer • Identifying fractions from a shaded diagram • Ordering, reading and writing whole numbers • How can I find multiples? • How can I find factors? • What are square numbers • What happens when I add and subtract numbers like 13.64 and 48.95? • Rounding to the nearest 10,100, 1000 • Identifying percentages from a shaded diagram • Calculating simple fractions of quantities (numerator of 1) • Understanding the order of operations • Understanding place value • Finding simple squares, cubes and roots • Finding factors of numbers • What happens when I multiply and divide whole numbers by 10 and 100? • How can I remember my tables up to 10x10? • Why is it important to check my own answers? • Interpreting bills and timetables • Ordering decimals • Converting fractions to a ratio, e.g. 1/3 of a whole is 1:2 • Carrying out long multiplication and division: 3-digit by 2-digit • Calculating simple percentages of quantities • Calculating simple fractions of quantities • Rounding to various decimal places • Converting between fractions, decimals and percentages • Using negative numbers in context • How can I write decimal numbers in the correct order? **Algebra** • Know and use complements to 100 to find unknowns • Continue whole number sequences forwards and backwards • Use formulae expressed in words • Understand the role of the equals symbol in number sequences

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		• Use inverse operations to calculate unknowns in two- or three- step problems • Use and interpret co-ordinates in the first quadrant • Continue sequences forwards and backwards which involve decimals, negative numbers or two operations. **Handling Data** • Gather information and decide what data to collect to answer a question • Extract and interpret information presented in simple tables, lists, bar charts and pictograms • Construct bar charts and pictograms where the symbol represents a group of units • Describe properties of a data set • Given a problem that can be addressed by collecting and analysing data, suggest possible answers • Make tables/lists/tally charts, for discrete data • Group data in equal class intervals and decide how best to represent it to show the information most clearly • Construct and interpret frequency diagrams , simple line graphs and bar charts • Understand and use the mode and range to describe sets of data • Find the median and mode using single digits • Understand the idea of 'certain' and 'impossible' within probability • Use the language of probability to describe the likelihood of events • List all outcomes • Estimate probability from diagrams/tables **Geometry and Measures** • understand reflective symmetry including shapes with more than 1 line of symmetry • use units of time & know the relationship between them (sec, hour, min, day, week, month, year) • identify right angles in given shapes • make, describe and draw right angled turns • read a number from a scale with all divisions marked and some numbers • classify 2D/3D shapes using mathematical properties e.g. irregular right angles symmetry • describe the position of a point on a grid using co-ordinates • recognise all lines of symmetry in a shape and sketch a reflective pattern • read the time in minutes and calculate time differences • use and interpret co-ordinates in the first quadrant • work out the area and perimeter of a triangle • change m to cm, cm to mm, £ to p & vice versa • classify triangles & quadrilaterals by property, & or by name • recognise simple cases of rotational symmetry

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		• estimate then use a protractor to measure & draw angles to the nearest degree • calculate the perimeter and area of simple compound shapes that will split into rectangles • read and plot points using co-ordinates in all four quadrants **Using and Handling** • use mathematics as an integral part of classroom activities • represent work with objects or pictures and discuss it • recognise and use a simple pattern or relationship • select the mathematics to be used in some classroom activities • discuss work using some mathematical language and begin to represent it using symbols and simple diagrams • explain why an answer is correct