Subject Curriculum Overview for Academic Year 2022/2023

Subject: Mathematics	Subject Leader: Mr S Card	Year Group: 12	AUTUMN TERM
Topic	**Key Learning Points**	**Key Vocabulary**	**Assessments**
C1 – Algebraic methods and coordinate geometry	• Sketch graphs of quadratics, identifying roots, intercepts and symmetry • Express quadratics in completed square form to find vertices and roots • Solve quadratics including those involving trig or exponential functions • Solve simultaneous equations using elimination and substitution methods • Find points of intersection of graphs by forming simultaneous equations • Use the discriminant to determine roots and number of intersections • Use the laws of indices to simplify algebraic expressions • Know and use the equation of a line to solve coordinate geometry problems • Know that the product of gradients of perpendicular lines is -1 • Solve coordinate geometry problems involving midpoints and gradients • Know the equation of a circle and solve problems involving circle properties • Complete the square to find the centre and radius of a circle • Find the equation of a tangent or normal on the circumference of a circle • Solve quadratic and linear inequalities • Use set notation to describe solutions to inequalities • Know and use the laws of indices to simply expressions and solve equations • Use and manipulate surds, including rationalising the denominator • Use proof by deduction and exhaustion and disproof by counter example	X and y -intercept Roots Vertex Minimum/maximum points Factorise Discriminant Variables Gradient Midpoint Parallel Perpendicular Tangent Normal Rational numbers Integers Exponent Base Rationalise	Weekly assignments used to assess understanding of current and previous knowledge Test in the week before Autumn half term holiday covering blocks C1 and C2
C2 – Polynomials and the binomial theorem	• Manipulate polynomials algebraically, including expanding and simplifying • Understand factorisation of polynomials up to cubics • Divide polynomials by algebraic expressions • Understand and use the factor theorem. • Understand and use the Binomial theorem with whole number indices	Polynomial Exponent Degree Identity Factorial Quotient Binomial	
C3 – Trigonometry	• Know how to draw the graphs of sine, cosine and tangent functions • Use symmetry and periodicity of trigonometric functions to solve problems • Solve problems requiring use of sine, cosine and area of triangle formulae • Know the identities $\tan\theta \equiv \sin\theta / \cos\theta$ and $\sin^2\theta + \cos^2\theta \equiv 1$ • Solve trigonometric equations including multiples of angles and quadratics • Prove trigonometric identities	Trigonometric ratio Function Periodic Identity	Weekly assignments used to assess understanding of current and previous knowledge

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C4 – Calculus	• Understand the different notation used for differentiation • Differentiate from first principles • Differentiate x^n, for rational values of n, multiples of, sums and differences • Apply differentiation to find gradients, tangents and normal • Identify stationary points and determine their nature using 2nd differential • Identify where functions are increasing or decreasing • Understand that differentiation is the 'reverse' of integration and vice versa • Integrate x^n, for rational values of n, multiples of, sums and differences • Evaluate definite integrals • Find areas under curves using integration (including areas under x-axis)	Gradient Chord Limit Derivative Constant Velocity Acceleration Turning/ stationary point Tangent Normal Asymptote Definite Upper and lower limit	Weekly assignments used to assess understanding of current and previous knowledge Test in the week before Christmas holiday covering blocks C3 and C4
S1 – Collecting, representing and interpreting data	• Understand the differences between samples and populations • Use correct notation relating to samples and populations • Understand how to use random, systematic, opportunity, stratified, quota and opportunity sampling • Explain the advantages and disadvantages of these sampling methods • Understand the importance of sample size • Calculate and use measures of central tendency (averages) • Calculate and use measures of variation (range, IQR and standard deviation) • Interpret diagrams for single-variable data • Interpret boxplots cumulative frequency curves and histograms • Comment on the skewness of a distribution shown in a boxplot. • Use diagrams to find probabilities of given events • Interpret scatter diagrams and regression lines for bivariate data • Understand informal interpretation of correlation. • Understand that correlation does not imply causation • Recognise and interpret possible outliers in data sets • Select or critique data presentation techniques in context • Clean data sets, including dealing with missing data, errors and outlier	Population Sample Parameter Statistic Biased Discrete Continuous Central Tendency Variation/dispersion Quartile Variance Standard Deviation Estimate Outlier Continuity correction Skewness Cumulative Bivariate Correlation Causation Independent/ dependent Correlation coefficient	Weekly assignments used to assess understanding of current and previous knowledge

Subject Curriculum Overview for Academic Year 2022/2023

Subject: Mathematics	Subject Leader: Mr S Card	Year Group: 12	SPRING TERM
Topic	**Key Learning Points**	**Key Vocabulary**	**Assessments**
S2 – Probability	• Use the vocabulary of probability theory • Solve problems involving mutually exclusive and independent events • Use the addition and multiplication rules of probability • Use a probability function to find a probability distribution • Recognise problems which can be modelled by the Binomial distribution • Solve problems involving the use of the Binomial distribution	Random Sample space Mutually exclusive Exhaustive Probability distribution Independent	Weekly assignments used to assess understanding of current and previous knowledge Statistics test on completion of blocks S1, S2 and S3
S3 – Hypothesis testing 1	• Apply the language of statistical hypothesis testing using a Binomial model • Conduct a statistical hypothesis test for the proportion in the Binomial distribution and interpret the results in context. • Understand the implications of using samples in hypothesis tests • Know that the significance level is the probability if incorrectly rejecting H_0	Null hypothesis Alternative hypothesis Significance level Test statistic 1-tail test 2-tail test Critical value Critical region Acceptance region, p-value	
M1 – Vectors	• Describe vectors using both column and unit vectors • Calculate the magnitude and direction of a vector • Convert between component form and magnitude/direction form • Add vectors diagrammatically and perform vector addition • Multiply vectors by scalars and understand their geometrical interpretations • Prove that two vectors are parallel • Know the conditions for collinearity • Understand that a vector diagram can be used to find resultants • Understand and use position vectors • Calculate the distance between two points represented by position vectors. • Solve problems in pure mathematics and in context	Vector Magnitude Scalar Resultant Collinear Component	Weekly assignments used to assess understanding of current and previous knowledge

M2 – Kinematics	• Know and use the SI units for velocity, acceleration, force and weight • Understand and use the language of kinematics • Understand, use and interpret displacement time graphs • Understand, use and interpret velocity time graphs • Derive the formulae for constant acceleration for motion in a straight line • Use and apply formulae for constant acceleration • Use calculus in kinematics for motion in a straight line with variable acceleration	Position Displacement Distance travelled Velocity Speed Acceleration	Weekly assignments used to assess understanding of current and previous knowledge Mechanics test on completion of blocks M1, M2 and M3
M3 – Forces and Newton's laws	• Understand the concept of a force; understand and use Newton's first law • Understand and use Newton's second law for motion in a straight line • Understand and use weight and motion in a straight line under gravity • Know that gravity is a measure of acceleration and its value in SI units • Understand and use Newton's third law; equilibrium of forces • Solve problems involving smooth pulleys and connected particles	Normal reaction Equilibrium Resolve Frictional Resultant Motion	

Subject Curriculum Overview for Academic Year 2022/2023

Subject: Mathematics	Subject Leader: Mr S Card	Year Group: 12	SUMMER TERM
Topic	**Key Learning Points**	**Key Vocabulary**	**Assessments**
C5 – Exponentials and logs	• Know and use the function a^x and its graph, where a is positive. • Know and use the function e^x and its graph. • Understand and be able to use the equivalence $y = a^x \Leftrightarrow \log_a y = x$ • Know that $\log_e x$ can be written as $\ln x$ and the equivalence $y = e^x \Leftrightarrow \ln y = x$ • Know that the graph of $y = \ln x$ is a reflection of $y = e^x$ in the line $y = x$ • Perform simple single transformations of the functions $y = e^x$ and $y = \ln x$ • Manipulate logs and exponentials within the solution to a problem. • Know, understand and be able to use the laws of logarithms • Know that $\log_a a = 1$ and $\log_a 1 = 0$ for $a > 0$ • Solve equations of the form $a^x = b$ • Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y • Understand and use exponential growth and decay • Understand limitations and refinements of exponential models	Exponent Index Base Exponential Logarithmic Constant of proportionality Parameter	Weekly assignments used to assess understanding of current and previous knowledge
Preparation, analysis and review of Year 12 exams	• Preparation for Year 12 exams including learning of key knowledge and formulae • Completion of practice and past papers • Students sit a full set of AS level exam papers • Feedback and evaluation		
C6 – Further differentiation	• Differentiate from first principles sin x and cos x • Use the second derivative to make connections with concave, convex sections of curves and points of inflection • Differentiate e^{kx} and a^{kx}, sin kx, cos kx and tan kx, and multiples of • Understand and use the derivative of ln x. • Apply differentiation to find points of inflection	Trigonometric ratio Concave Convex Point of inflection Tangent Gradient Stationary point	Weekly assignments used to assess understanding of current and previous knowledge

C7 – Algebraic fractions and functions	• Draw graphs of modulus functions • Apply transformations to graphs of modulus functions. • Solve equations involving modulus functions • Understand and use composite functions, inverse functions, and their graphs • Define a function as a one-to-one or a many-to-one mapping • Find ranges and domains of functions • Know the conditions for the existence of the inverse of a function • Understand the relationship between the domain and range of a function and those of its inverse • Draw graphs of inverse functions by reflecting in the line y = x • Understand the effects of combinations of transformations • Simplify rational expressions including by factorising and cancelling • Decompose rational functions into partial fractions	Domain Range Modulus Composite Inverse Transformation Partial Factorise Degree Decomposing Coefficients	Weekly assignments used to assess understanding of current and previous knowledge

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How parents can support learning in the subject this academic year

Practice of mathematical skills is an essential part of students developing confidence, building fluency and improving problem-solving skills.
Students are expected to complete at least 6 hours of independent work per week:

- 4 hours of tutorial work (one hour after each lesson). Students are expected to self-mark this work and seek help when experiencing difficulties.
- 1 hour of revision work. Students will be set a revision task each week which will help them to remember key knowledge and practice previously taught skills.
- 1 hour of assessed work. Students will be given a weekly assignment focusing on the skills that they have recently been taught in lessons. This will be used to assess their understanding of a topic and may result in follow up work requiring to be completed.

Due to the hierarchical structure of Mathematics, it is vital that students catch up on any work missed through absences. Students should copy up notes and examples from lessons into their notebooks and attempt any tutorial work set. If they need support with the work then please encourage them to speak to their teacher or attend Maths Club where staff will be there to help and support.

Recommended Reading

Why do Buses Come in Threes? - Rob Eastaway/Jeremy Wyndham
How to Cut a Cake? - Ian Stewart
The Number Mysteries - (Marcus Du Sautoy
Thinking in Numbers - Daniel Tammet
Closing the Gap: The Quest to Understand Prime Numbers - Vicky Neale
50 Mathematical Ideas You Really Need to Know - Tony Crilly
The Hidden Mathematics of Sport - Rob Eastaway/John Haigh
Fermat's Last Theorem - Simon Singh
The Music of the Primes - Marcus du Sautoy

Points to note

Students are expected to bring a graphical calculator to every maths lesson. The model we currently recommend is the Casio FX CG50S. This calculator can be purchased through the school via parentpay at a significant discount to what is available commercially.