St George's School
Mathematics
KS5 Curriculum

PREREQUISITE KNOWLEDGE & SKILLS *The foundations needed to thrive in this subject.*	**Who should study this subject?** To succeed at A Level Mathematics you must love the subject, have an analytical mind, an eye for detail and thrive on the challenge of algebra, looking for patterns, applying theory to abstract problems and the determination to find the solution. Characteristics of the most successful mathematicians include: Persistence, Communication, Resilience, Critical thinking, Logic, Curiosity, Creativity, Organisation. **Key Skills developed during KS4:** A love of manipulating numbers and algebra along with an enquiring mind and ability to think logically with an eye for detail. **St George's course entry requirements:** In addition to the entry requirement for sixth form, a **grade 7** or above in Mathematics
QUALIFICATION *Exam Board, aims and objectives.*	**A Level Mathematics, OCR H240** https://www.ocr.org.uk/qualifications/as-and-a-level/mathematics-a-h230-h240-from-2017/ The new OCR A Level Mathematics qualification has been developed to provide students with a coherent course of study to develop mathematical understanding. Students are encouraged to think, act and communicate mathematically, providing them with the skills to analyse situations in mathematics and elsewhere
ASSESSMENT *Internal monitoring and final assessment.*	**Internal Assessment:** Students will have prep allocated at the end of each lesson and there will be a more formally assessed homework and topic test at the end of each major section of work (approx. two per half term). In addition there will be: - Start of Year 12: Review of Algebra Test (RAT) (Two 45 minute examinations) - Easter Year 12: End of year Examination (One 2 Hour examination) - September Year 13: AS Test - Christmas Year 13: Mock A2 Examination (Two 2 Hour examinations) **Final assessment:** Assessment for A Level is by three 2 hour written papers. - Paper 1 assesses content from Pure Mathematics - Paper 2 assesses content from Pure Mathematics and Statistics - Paper 3 assesses content from Pure Mathematics and Mechanics. All papers will be sat during the June sessions at the end of Year 13.
ENRICHMENT *Trips & Visits, wider reading, etc.*	**Visits and Events:** - Senior Maths Challenge - Maths Team Challenge - University of Hertfordshire Problem Solving Workshops **Wider reading:** - Books by Marcus du Sautoy, Rob Eastaway, Hannah Fry, Simon Singh and Ian Stewart - Podcasts including More or Less, Infinite Monkey Cage, Curious Cases of Rutherford and Fry There are websites which are useful for wider reading: - http://www.cut-the-rope.org/ - https://plus.maths.org/content/

NEXT STEPS *Where this subject can take you.*	We want students to understand mathematics and mathematical processes in a way that promotes confidence, fosters enjoyment and provides a strong foundation for progress to further study.
	Related University Courses:
	A Level Mathematics is one of the most widely accepted and respected subject choices by universities and is likely to enhance your options. Mathematics is offered as a single subject, part of a joint degree or is a vital part of 422 degree level courses in Great Britain.
	A Level Mathematics is a mandatory requirement for degree courses, such as Engineering, Physics, Statistics, and often Economics. Although not a requirement, A Level Mathematics is a typical subject taken by students on courses as wide ranging as Architecture, Law, Medicine, Psychology, Geography, Finance, Oceanography, Astronomy and Ecology.
	Career Paths:
	Mathematics is contained and used within a wide variety of careers, it opens doorways to careers within Accounting, Engineering, Technology and Zoology, to name a few. As a consequence, it can be considered as one of the most useful, diverse and powerful subjects that can be taken at this level.

	Year 12
Autumn Term	**Topics:** **AS Pure** Indices and Surds, Quadratic Functions, Polynomials, Using Graphs, Binomial Expansion, Differentiation, Applications of Differentiation and Integration **AS Statistics** Working with Data, Probability, Statistical Hypothesis Testing and Large Data Set **Skills** **AS Pure** Recalling and using the laws of indices Performing arithmetic with surds Graphing and solving quadratics Solving quadratic inequalities Using and interpreting the discriminant Manipulating polynomials including division and multiplication Recalling and using the factor theorem and sketching polynomial functions Further develop graphing skills including transforming graphs, reciprocal graphs and problems involving direct and indirect proportion. An introduction to the Binomial theorem, calculation of binomial coefficient and applying the binomial theorem. Sketching derivatives, differentiation from first principles, interpreting derivatives and second derivatives. Application of calculus involving tangents, normals, stationary points and solving optimisation problems. Integration to find the equations of curves, definite integrals, and an understanding of the significance of definite integration. **AS Statistics** Statistical diagrams including calculations from frequency tables and identifying outliers and cleaning data. Calculating and interpreting Standard Deviation, Calculating probability including using probability distributions with specific reference to the binomial distribution. Statistical hypotheses testing including finding critical regions Using ICT resources (excel) to investigate a large data set. **Assessment:** Work will be continually monitored with regular formal homework assessments and in class topic check points
Spring Term	**Topics:** **AS Pure** Coordinate geometry, logarithms, exponential models, trigonometric functions and equations, vectors.

AS Mechanics
Introduction to kinematics, motion with constant acceleration, forces and motion.

Skills:

AS Pure
Calculating and using equations of circles and complex geometric problem solving
Understanding logarithms and applying logarithmic laws as well as solving exponential equations
Applying exponential and logarithmic functions knowledge to develop mathematical modelling and data analysis skills
Understanding and using trigonometric functions and their graphs and exact trigonometric values
Understanding and using trigonometric identities, solving trigonometric equations and transforming trigonometric graphs
Developing geometry skills with a detailed study of vectors, understanding position and displacement vectors and using vectors to solve geometrical problems

AS Mechanics
Using mechanics to model real-life scenarios
Understanding kinematics and how to use calculus to solve kinematic problems
Using travel graphs and solving problems in kinematics.
Deriving equations for motion with constant acceleration, using and applying constant acceleration formula including to vertical motion under gravity culminating in solving multi-stage problems.
Understanding the concept of force (Newton's first law), how it is related to acceleration (Newtons second Law), what happens when several forces act on an object and different types of forces

Assessment:
Work will be continually monitored with regular formal homework assessments and in class topic check points.
A formal year 12 examination is taken at Easter (One 2 Hour examination)

Summer Term	**Topics:** **AS Pure -** Triangles and Proof **AS Mechanics -** Connected Bodies **A2 Pure -** Binomial Expansion, Sequences and Series, Functions, Further Graph Transformations **Skills:** During the summer term students complete all AS topics and then start to develop the skills required for A2 examinations. **AS Pure** Applying the sine rule, cosine rules to find sides and angles of any triangle Applying the formula for the area of a triangle when you don't know the perpendicular height Using appropriate language and terminology of proof; including proofs by counter example, deduction and exhaustion **AS Mechanics** Recalling and using Newton's third law Calculating contact force Finding tensions in rods and strings connecting two bodies Analysing the motion of particles connected by a string passing over a pulley **A2 Pure** Applying the binomial expansion to include negative and fractional indices Using sigma notation Calculating the summation of arithmetic and geometric sequences and series Problem solving skills relating to sequences and series Understanding mappings, functions, domains, ranges and inverses Expanding graphing skills to include the modulus function and combined transformations **Assessment:** Work will be continually monitored with regular formal homework assessments and in class topic check points

	Year 13
Autumn Term	**Topics:** **A2 Pure -** Radians, Further Trig, Calculus of exponential and trigonometric Functions, Further Differentiation **A2 Statistics -** Conditional Probability, Normal Distribution, Further Hypothesis Testing **A2 Mechanics -** Forces and Moments **Skills:** **A2 Pure** Using radian measures and inverse trigonometric functions. Using geometric modelling skills revisiting arcs, sectors, triangles and small angle approximations. Extending trigonometric and algebraic skills with compound angles, double angles, and reciprocal trigonometric functions Modelling skills enhanced to include real –life scenarios for $a\sin x + b\cos x$ Extending calculus skills include differentiation and integration of exponential and logarithmic functions. Extending calculus differentiation skills further applying the chain, product and quotient rules, completing implicit differentiation and differentiating inverse functions. **A2 Statistics** Reviewing statistical analysis skills including set notation, Venn diagrams, two-way tables, tree diagrams and practice modelling real-life scenarios using probability Using the normal distribution and its inverse, finding means and standard deviations and further development of modelling skills involving normal distributions Developing hypothesis testing further to include distributions of the sample mean, and testing for correlation coefficients **A2 Mechanics** Developing forces knowledge to include resolving forces, coefficient of forces, motion on a slope and further equilibrium problems. Understanding the turning effects of a force including non-uniform rods and equilibrium problems. **Assessment:** **AS Examination during September** Subsequent work will be continually monitored with regular formal homework assessments and in class topic check points.
Spring Term	**Topics:** **A2 Pure -** Further Integration, Further applications of calculus, Differential Equations, Numerical Methods, Numerical Integration, Proof **A2 Mechanics -** Application of Vectors, Projectiles **Skills:** **A2 Pure** Using calculus integration to reverse standard derivatives and integration by substitution, integration by parts, trigonometric identities in integration and integrating rational functions. Applying integration skills to properties of curves, parametric equations, related rates of change and calculating more complicated areas under curves. Creating and solving differential equations, using them to create a model and solve real-life scenarios Using numerical methods for locating roots of a function Using the Newton Raphson and iterative methods for solving problems and developing an appreciation of the limitations of numerical methods. Developing proof by contradiction skill set and criticising proofs **A2 Mechanics** Extending vectors knowledge into 3-D, representing vectors in **i, j, k** notation Using vectors to solve both kinematic and geometrical problems in 3-D. **Assessment:** **A2 Mock examination in January** Subsequent work will be continually monitored with regular formal homework assessments and in class checkpoints

Summer Term	**Topics:** The general aim is that all formal teaching of new topics is complete by the Spring term. This term is used for revision. **Skills:** Analysing multi- step problems Deciding on logical solution paths Communicating logically and with mathematical rationale. Developing independent revision skills and self-help groups Refining examination techniques of resilience, timekeeping and answering questions accurately by use of Mark Schemes. **Assessment:** 'In class' revision topics check points and low grade quizzes may be given to support students' independent revision at the discretion of the teacher. Final Assessment as detailed above