



Learning Aims and Curriculum Intent:

The aims are to enable 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
- apply mathematics in other fields of study and be aware of the relevance of mathematics to the world of work and to situations in society in general
- use their mathematical knowledge to make logical and reasoned decisions in solving problems both within pure mathematics and in a variety of contexts, and communicate the mathematical rationale for these decisions clearly and recognise incorrect reasoning
- generalise mathematically, construct mathematical proofs, use skills and techniques to solve challenging problems that require them to decide on the solution strategy
- represent situations mathematically and understand the relationship between problems in context and mathematical models that may be applied to solve them
- draw diagrams and sketch graphs to help explore mathematical situations and interpret solutions, make deductions and inferences, and draw conclusions
- read and comprehend articles concerning applications of mathematics and communicate their understanding
- use technology such as calculators and computers effectively and recognise when their use may be inappropriate
- take increasing responsibility for their own learning and the evaluation of their own

Term	Content, Key Questions and Knowledge	Skills	Assessment
Michaelmas	<p>Pure Mathematics:</p> <p>What are the algebraic skills that we have previously learn? How are they applied to complex models?</p> <p>1. How do we manipulate algebra to solve general problems concerning solving equations and making approximations?</p> <ul style="list-style-type: none"> • Algebraic expressions and quadratics • Equation and inequalities • Graphs and transformation • Exponential and logarithms • Algebraic methods • The binomial expansion <p>2. What are some tools to model and solve geometric problems?</p> <ul style="list-style-type: none"> • Straight line graphs • Trigonometric ratio • Trigonometric • Circles • Vectors <p>3. What is calculus and how to use differentiation to solve problems? (e.g. gradient and normal of a curve, rate of change of a quantity, maximum and minimum amount of a quantity, etc.)</p> <ul style="list-style-type: none"> • Differentiation 	<ul style="list-style-type: none"> - Solving equations - Solving quadratic inequalities - Transforming graphs - Using logarithm to solve equations related to powers - Sketching logarithmic graphs - Applying the factor theorem to find a factor for a high-order polynomial - Carry out algebraic division - Completely factorise a high-order polynomial - Expanding a binomial raised to a power completely, or up to a certain order - Find the value of a binomial raised to a certain power using its expansion - Solving geometric problems with the sine, cosine and area rules - Solve trigonometric equations within a domain using the CAST diagram - Applying trigonometric identities to solve equations - Writing the equation of a circle - Using geometric interpretation and equation of a circle to solve for different quantities related to circle - Using vectors to solve geometric problems - Differentiating polynomials - Finding the gradient and normal to a curve - Find the rate of change of a quantity - Finding maxima and minima of polynomials 	<p>Retrieval quizzes to build knowledge acquisition and understanding.</p> <p>Exam Practice questions</p> <p>In-class retrieval questions</p> <p>Exam conditions questions</p>

**Pure Mathematics:
Calculus continued...**

How to use integration to solve problems? (simple differential equations, area under a curve, cumulative amounts, etc.)

- Integration

Statistics:

How to interpret data and check if a set of data is displaying an outcome that is as expected?

- 1. How to collect grouped data and evaluate it in terms of spread and location, and trend?**
 - Data collection
 - Measures and location and spread
 - Representation of data
 - Correlation
- 2. What are some common distributions and how to find the probability of a certain outcome? (the number of wins for a team in ten games, the frequency of rolling each number from a biased dice, etc.)**
 - Probability
 - Statistical distribution
- 3. How to check if the outcome of an event is as expected or not? (has a team improved after a new training regimen? Is a newly developed drug more effective?)**
 - Hypothesis testing

Mechanics:

How to solve problems related to motions?

- 1. How to use mathematical models to solve problems related to motions?**
 - Modelling in mechanics
- 2. How do objects move under constant acceleration?**
 - Constant acceleration
- 3. How do forces affect the acceleration of an object?**
 - Forces and motion
- 4. How to find quantities related to motion for an object moving with variable acceleration?**
 - Variable acceleration

- Integrate polynomials
- Solving simply differential equations
- Finding area under a curve
- Describing methods of data collection
- Describing the pros and cons of each method of data collection
- Finding the mean, mode, median, upper and lower quartiles, range and interquartile range for a set of data
- Finding the mean, mode, median, upper and lower quartiles, range and interquartile range for a set of grouped data
- Producing and interpreting scatter graphs
- Producing and interpreting histograms
- Producing and interpreting box plots
- Identifying correlation from scatter graphs
- Identifying correlation from the PMCC
- Finding simple probabilities
- Properties of independent and mutually exclusive events
- Producing and interpreting Venn diagrams
- Writing probability distribution as a table
- Writing probability distribution as a function
- Identifying a binomial distribution
- Find probabilities related to binomial distributions
- Set up a hypothesis test by stating the null and alternative hypotheses, and defining all unknowns involved
- Carry out a hypothesis test by calculating relevant probabilities and comparing to significant level
- Carry out a hypothesis test by calculating relevant values to compare with critical values
- Calculating the actual significant level
- Finding p -values
- Write and solve equations related to position and time
- Finding velocity using a displacement-time graph
- Finding total displacement using a velocity-time graph
- Finding the acceleration using a velocity-time graph
- Finding the velocity using an acceleration-time graph
- Identifying the appropriate suvat equation to apply
- Substituting and solving suvat equations
- Interpreting the physical meaning of the polarity of a vector quantity
- Drawing force diagrams
- Able to find resultant force in one dimension
- Writing force equations using $F = ma$
- Solving force equations to find the value of force, mass or acceleration
- State how a value would change when another quantity in the scenario changes
- Able to state limitations of models
- Able to state assumptions to be made in a model
- Using calculus to functions of displacement, velocity or acceleration from another function in time.
- Using calculus to find instantaneous displacement, velocity or acceleration from a function in time.

Retrieval quizzes to build knowledge acquisition and understanding.

Exam Practice questions

In-class retrieval questions

Exam conditions questions

Trinity	Revision for End of Year Exams, and... Pure Mathematics: What are some higher level algebraic skills that can be applied to more complex models? <ul style="list-style-type: none"> • Algebraic methods • Functions and graphs • Sequences and series • Binomial expansion • Numerical methods 	<ul style="list-style-type: none"> - Able to identify when to use proof by contradiction - Able to carry out proof by contradiction - Simplifying algebraic fractions - Operations with algebraic fractions - Expressing an algebraic fraction as partial fractions - Expressing an improper algebraic fraction as a mixed-algebraic fraction by doing algebraic division - Sketching graphs of modulus functions - Solving modulus functions - Determining if an expression is a function or not - Explaining why an expression is or is not a function - Expressing a mapping as a function - Finding the domain and range of a function - Sketching a function in a required domain and range - Evaluating a function - Finding and evaluating composite functions - Finding and evaluating inverse functions - Sketching and solving equation in the form $y = f(x)$ - Sketching and solving equation in the form $y = f(x)$ - Transforming functions including modulus functions - Solving problems related to arithmetic sequences and series - Solving problems related to geometric sequences and series - Finding sum to infinity - Applying sigma notation - Solving problems related to recurrence relations - Expanding binomials with fractional or negative indices - Expanding binomials in the form $(a+bx)^n$ where n is fractional or negative - Using partial fractions before binomial expansion - Locating root by identifying a change in sign - Rearrange an equation to obtain an appropriate iteration formula - Applying iterative formulae to find approximation of roots to an equation - Apply the Newton-Raphson method to find approximation of roots to an equation 	Retrieval quizzes to build knowledge acquisition and understanding. Exam Practice questions In-class retrieval questions Exam conditions questions
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What consolidation looks like in this subject	Retrieval practice	
Examples of Homework	Interleave homework on a two week cycle, Exam practice questions, Text book	
Key terminology	Verify, Show, Solve, Explain, Evaluate, Prove, Analyses, Hence, Limits, Constraints	
Super-curricular enrichment and scholarly extension	Read: https://simonsingh.net/category/blog/ Watch: https://www.numberphile.com/ Listen: https://podcasts.ox.ac.uk/series/secrets-mathematics Visit: https://www.sciencemuseum.org.uk/see-and-do/mathematics-winton-gallery	
Useful websites	www.integralmaths.org www.nrich.maths.org www.physicsandmathstutor.com www.ukmt.org.uk/smc	
Who can I contact?	Head of Department	Mr Ashiq
	Teachers	