Subject: Maths

Curriculum Vision

> ➢ Our core aim is to help students climb the tree of knowledge, so they can access university, higher education, employment or an apprenticeship.
> ➢ Our curriculum is embedded in a knowledge rich approach, and we firmly believe that knowledge begets knowledge. As a result, we use a spiral, progressive curriculum where knowledge is re-visited and developed further throughout their time at The Duston School
> ➢ Through the enacted curriculum, there is an expectation that students retain what they have been taught in their long-term memory. To give students the best chance to retain knowledge, topics are gone into depth rather than extending to new material. The Key Stage 3 curriculum is progressed throughout the first 3 years of the secondary-phase and we have prevented the early appearance of most Key Stage 4 content as we believe this thins the students understanding and be a detriment to students' long-term memory and being able to reproduce content in assessments at a later date.
> ➢ In Key Stage 4, students access the Edexcel GCSE for both Mathematics and Statistics. We believe that by doing the GCSE Statistics students get to see the real-life application of mathematics and how information is used to make informed decisions to balance with the content abstract topics within the GCSE Mathematics. Both exams are taught within the students' mathematics curriculum lessons.
>
> There is a strong emphasis on retrieval practice, sequencing and interleaving, with the curriculum seen as a progression model

Curriculum Intent

> ➢ The Key Stage 3 curriculum is focused on strengthening the fundamentals of the core topics of mathematics and building students confidence with these.
> ➢ Students see content through different questioning strands to builds students understanding of the knowledge and the applications and variations that it can support.
> ➢ The task of Key Stage 3 is to develop in students to 'know what to do, when you don't know what to do' through developing their problem-solving.
> ➢ In Key Stage 4, we set our students based on their prior-knowledge to support students to make the most progress from their starting points and support students to succeed within their lessons with the use of modelling and exam examples filtered through the lessons.

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Developing mathematical oracy is important for developing confident mathematicians and therefore knowledge retrieval questions and content is repeated throughout Knowledge Organisers and homework

Curriculum Offer : KS3

	Year 7	Year 8	Year 9
Term 1 & 2	**Topic 1: Calculations and Accuracy** • Using place value • Negatives numbers • decimals • multiplying decimals • introduction to sequences **Topic 2: Integers, Powers and Roots:**	**Topic 1: Calculations and Accuracy** • Ordering Numbers (inc decimal and negatives) • Recurring decimals • Median • Range • Dividing decimals • Rounding to decimal places	**Topic 1: Calculations and Accuracy** • Rounding to significant figures • Inequalities on a number line • Upper and lower bounds • Error intervals **Topic 2: Integers, Powers and Roots**

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- multiplication (inc. negatives)
- Squares and cube
- Division (inc. negatives)
- Fact families
- Factors and multiples
- HCF and LCM

Topic 3: Measures

- Converting metric length
- Converting metric mass
- Converting metric volume
- Converting and using time

Topic 4 (Part 1): Fractions, Decimals, Percentages

- Representing Fractions
- Simplifying and Equivalent Fractions

Topic 2: Integers, Powers and Roots

- Estimating square roots
- Basic laws of indices
- Converting standard form
- Adding and subtracting in standard form

Topic 3: Simplifying and Substitution

- Using function machines
- Expanding single brackets
- Expanding double brackets
- Factorising single brackets

- Laws of indices (fractional and negative)
- Operations with standard form numbers
- Introduction to surds
- Simplifying surds

Topic 3: Ratio and Proportion

- Re-cap ratio content from year 7
- Converting between fraction and ratio quantities
- Sharing problems
- Exchange Rates
- Direct Proportion
- Introduction to Inverse Proportion

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	• Fractions of amounts • Operations with Fractions		
Term 3 & 4	**Topic 4 (Part 2): Fractions, Decimal, Percentages** • Representing percentages • Percentage of amounts • Increase and Decrease by a percentage • Converting between Fractions, Decimals and Percentages **Topic 5: Ratio and Proportion** • Introduction to ratio • Simplifying and Equivalent ratio • Sharing ratio problems • Recipe problems • Best buy problems • Direct Proportion	**Topic 4: Fractions, Decimals, Percentages** • Converting between Fractions, Decimals and Percentages • Using decimal multipliers • Calculating Percentage problems **Topic 5: Forming and Solving Equations** • Introducing solving through algebra • Using function machines to solve problems • Solving linear equations • Solving linear equations with unknown on both sides	**Topic 4: Fractions, Decimals, Percentages** • Fractions re-cap • Percentage Increase and Decrease • Simple Interest • Compound Interest • Reverse percentages • Percentage change **Topic 5: Simplifying and Substitution** • Simplifying algebraic terms • Expanding Brackets • Factorising single and double brackets • Linking algebra to shape topics **Topic 6: Constructions**

Topic 6: Simplifying and Substitution:

- Introducing Algebra
- Simplifying terms
- Collecting like terms
- Forming expressions
- Substitution

Topic 7: Area and Perimeter:

- Working out Perimeter Problems
- Formulas for calculating Area of Basic 2D Shapes
- Reverse area problems
- Working out the area of compound 2D Shapes

- Re-arranging simple equations

Topic 6: Area, Perimeter and Volume

- Area and Perimeter recap
- Circumference of a Circle
- Area of a circle
- Nets of shapes
- Surface Area of prisms
- Volume of a Prism

Topic 7: Sequences, Functions and Graphs

- Finding the rule of a sequence
- Understanding arithmetic sequences
- Understanding geometric sequences
- Understanding Fibonacci sequence
- Finding nth term of a linear sequence

- Perpendicular bisectors
- Angle bisectors
- Perpendicular bisectors from a point
- Constructing 30°, 45° 60°, 90° angles
- Drawing Elevations

Topic 7: Forming and Solving

- Solving linear equations problems
- Solving equations with unknown on both sides
- Re-arranging equations
- Solving linear simultaneous equations

		• Finding the midpoint of two co-ordinates • Drawing vertical and horizontal lines • Plotting linear graphs • Identifying the equations of a linear line	
Term 5 & 6	**Topic 8: Lines, Angles and Shape** • Drawing and accurately measuring angles • Using a compass • • Using angle rules for types of triangles • Using angle rules for types of quadrilaterals • Learning formula for the sum of interior angles of a polygon **Topic 9: Representing Data** • Pictograms • Bar Charts	**Topic 8: Representing Data** • Using average calculations • Working out averages from frequency tables • Scatter graphs • Box plots • Cumulative Frequency **Topic 9: Pythagoras Theorem** • Introducing Pythagoras' Theorem and Hypotenuse • Using Pythagoras' Theorem to calculate	**Topic 8: Sequences, Functions and Graphs** • Drawing linear graphs • Identifying linear graphs • Solving simultaneous equations graphically • Using rules for parallel and perpendicular lines • Plotting quadratics • Solving equations using a graph **Topic 9: Shape**

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- Vertical line bars
- Pie charts
- Two-Way Tables
- Calculating Mean
- Calculating Mode
- Stem and Leaf

Topic 10: Probability

- Probability Scale
- Calculating Probability as fractions
- Sample Space Diagrams
- Using Sets
- Venn Diagrams

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missing sides of a triangle
- Using Pythagoras' Theorem to solve problems involving right-angled triangles

Topic 10: Transformations

- Understanding vectors
- Translations
- Rotations
- Reflections
- Enlargements
- Describing transformations

- Converting metric area and volume units
- Calculating volume problems
- Calculating Surface Area problems
- Applying Pythagoras' Theorem
- Introducing Trigonometry
- Using trigonometry to work out an angle
- Using trigonometry to work out a length

Topic 10: Probability

- Relative frequency
- Expected frequency
- Introducing probability trees
- Introducing conditional probability

		• Set Notation with Venn Diagrams

Curriculum Offer : KS4 for students for those accessing the Edexcel Higher Curriculum

	Year 10	Year 11
Term 1	**Topic 1: Integers, Powers and Roots** • HCF and LCM • Index Laws • Surds **Topic 2: Lines, Angles and Shape** • Angles Facts • Angles in parallel Lines • Angles in polygons • Circle Theorems **Topic 3: Simplifying and Substitution** • Simplifying algebra • Expanding Brackets • Factorising Brackets	**Topic 1: Probability** • Probability Basics • Relative and Expected frequencies • Tree Diagrams • 'And' and 'Or' rule • Conditional Probability • Probability with algebra **GCSE Statistics Unit 5: Time Series** • Drawing Time Series Graphs • Interpreting Time Series graphs • Trend Lines • Moving Averages • Seasonal Variation • Predicting outcomes

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	• Algebraic Fractions • Functions	**Topic 2: Number and Algebra** Revisiting and revising the Number and Algebra content from the exam specification with a focus on exam technique and supporting students at their appropriate levels.
Term 2	**Topic 4: Area and Perimeter** • Area and Perimeter Problems • Arc Length • Area of a sector • Solving Problems **Topic 5: Calculations and Accuracy** • Estimating calculations • Rounding and Truncating • Bounds **Topic 6: Fractions, Decimals and Percentage** • Operations with fractions • Decimal Multiplier problems • Appreciation and Depreciation • Writing recurring decimals as fractions	**Topic 3: Shape and Geometry** Revisiting and revising the Shape and Geometry content from the exam specification with a focus on exam technique and supporting students at their appropriate levels. **GCSE Statistics Unit 6: Probability** • Absolute and Relative Risk • Venn Diagrams • Set Notation (inc. Given that) • Conditional Probability

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Term 3	**Topic 7: Ratio and Proportion** - Ratio problems - Similar Shapes and Congruency - Area and Volume Scale Factors - Direct Proportion - Inverse Proportion **GCSE Statistics Unit 2: Analysing Data** - Calculating Averages and range - Finding Geometric Mean - Finding weighted mean - Using Interpolation to find the median - Finding Quartiles and Percentiles of data - Creating a Box Plot - Finding standard deviation - Understand Skew - Identify outliers in data - Compare data - Transforming Data values	**Mock Exams** Lessons will focus on revision in preparation for and during the Mock Exam season. Weeks post the mock season will focus on the key areas of each class ensuring that misconceptions and key content is addressed and given appropriate time to fix. **GCSE Statistics Unit 7: Index Numbers** - Simple Index Numbers - Calculations involving index numbers - Using Index Numbers (RPI, CPI, GDP) - Weighted Index Numbers - Chain base Index Numbers - Rates of change

Term 4	**Topic 8: Sequences, Functions and Graphs** • Using nth term of linear sequences to solve problems • Quadratic Sequences • Equations of parallel and perpendicular lines • Key points on a graph • Reciprocal and Exponential graphs • Transforming Graphs **GCSE Statistics Unit 3: Representing Data** • Terminology of Data • Comparative and Composite Bar Charts • Back-to-back stem and leaf diagrams • Cumulative frequency graphs • Population pyramids • Choropleth Maps • Frequency Polygons • Histograms • Interpreting data from a graph • Understanding misleading graphs	**Topic 4: Data, Ratio and Proportion** Revisiting and revising the Shape and Geometry content from the exam specification with a focus on exam technique and supporting students at their appropriate levels. **GCSE Statistics Unit 8: Distributions** • Binomial Distribution • Normal Distribution • Standardised Scores • Quality Assurance

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| Term 5 | **Topic 9: Forming and Solving Equations**

• Solving linear equations
• Solving inequalities
• Solving quadratic equations through factorising
• Solving quadratic equations graphically
• Using the quadratic formula
• Solving simultaneously a quadratic and linear equation
• Using Iterations to estimate a solution

Topic 10: Pythagoras and Trigonometry

• Re-cap
• Using Pythagoras' Theorem in 3D
• Re-cap Trigonometry
• Sine Rule
• Cosine Rule
• Exact Trig values
• Area of a triangle
• Drawing trigonometric functions

GCSE Statistics Unit 4: Scatter Graphs and Spearman Rank | **Final Stages**
During this term, classes will focus on key areas identified through past assessments and exam revision. The lessons will be focused on exposing students to exam material such that they become familiar with exam content. |

	- Drawing and reading data off of a Scatter Graph - Describing correlations - Describing relationships - Line of Best fit - Equation of a line of best fit - Interpreting a line of best fit - Interpolating data and extrapolating data - Understanding spearman's rank - Calculating spearman's rank correlation co-efficient - Understanding product moment correlation co-efficient	
Term 6	**Topic 11: Volume and Surface Area** Surface Area of shapes (inc. cylinders and sphere)	

	• Volume of shapes (inc. cylinders and spheres) • Finding Surface Area and Volume of cones and frustums **End of Year Exam feedback and addressing misconceptions.**	

Curriculum Offer : A-level Mathematics

	Year 12	Year 13

AS – Paper 1
 A-level – Paper 1 and 2
	☐ **Algebra and Functions**
	     o Manipulating algebraic expressions
	     o Solving quadratic equations
	     o Understanding functions and their graphs
	     o Transformations of functions
	 • **Coordinate Geometry**
		• **Algebraic Methods**
		     o Proof by contradiction
		     o Algebraic fractions and division
		     o Partial fractions with repeated factors
		 • **Functions and Graphs**
		     o Modulus functions

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- o Equations of straight lines
- o Midpoints and distances
- o Geometric proofs using algebra
- **Trigonometry**
  - o Trigonometric ratios and identities
  - o Solving trigonometric equations
  - o Graphs of sine, cosine, and tangent functions
- **Sequences and Series**
  - o Arithmetic and geometric sequences
  - o Summation notation
  - o Formulae for nth term and sum of series
- **Exponentials and Logarithms**
  - o Laws of indices
  - o Natural logarithms and exponential functions
  - o Solving exponential and logarithmic equations
- **Differentiation**
  - o Derivatives from first principles

- o Composite and inverse functions
- o Transformations of graphs
- **Trigonometry and Radians**
  - o Radian measure
  - o Arc length and area of sectors
  - o Trigonometric identities and equations
  - o Small angle approximations
- **Trigonometric Functions**
  - o Secant, cosecant, and cotangent functions
  - o Graphs and properties
  - o Solving equations involving these functions
- **Parametric Equations**
  - o Sketching parametric curves
  - o Converting between parametric and Cartesian forms
  - o Differentiation of parametric equations
- **Differentiation**

- Rules of differentiation
- Tangents, normals, and stationary points
- Applications to curve sketching and optimization
- **Integration**
  - Indefinite and definite integrals
  - Integration as the reverse of differentiation
  - Area under curves
- **Graphs and Transformations**
  - Sketching graphs of functions
  - Applying transformations (translations, reflections, stretches)
- **Proof**
- Mathematical proof techniques including deduction and contradiction
- Proof by exhaustion and counterexample

- Chain rule, product rule, quotient rule
- Implicit differentiation
- Differentiation of exponential, logarithmic, and trigonometric functions
- Second derivatives and rates of change
- **Integration**
  - Integration by substitution and by parts
  - Use of partial fractions in integration
  - Definite integrals and area under curves
  - Solving differential equations
- **Numerical Methods**
  - Iterative methods for solving equations
  - Newton-Raphson method
  - Numerical integration (trapezium rule)
- **Vectors**

		• 3D vector geometry • Vector equations of lines • Scalar product and applications

AS – Paper 2
 	
A-level – Paper 3
	Statistics Topics
	
	• **Data Collection**
	
	   o Populations and samples
	
	   o Sampling methods (random and non-random)
	
	   o Types of data (qualitative, quantitative, discrete, continuous)
	
	   o Use of the large data set
	
	• **Measures of Location and Spread**
	
	   o Mean, median, mode
	
	   o Range, interquartile range, variance, standard deviation
	
	   o Coding techniques
	
	• **Representing Data**
	
	   o Box plots
	
	   o Cumulative frequency diagrams
	
	   o Histograms
		Statistics Topics
		
		• **Regression and Correlation**
		
		   o Linear regression models
		
		   o Interpretation of correlation coefficients
		
		   o Use of regression lines for prediction
		
		• **Conditional Probability**
		
		   o Tree diagrams and Venn diagrams
		
		   o Independent and dependent events
		
		   o Calculating probabilities using conditional relationships
		
		• **The Normal Distribution**
		
		   o Properties of the normal curve
		
		   o Standard deviation and mean
		
		   o Using the standard normal distribution (Z-scores)

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- o Identifying outliers
- **Correlation and Regression**
  - o Scatter diagrams
  - o Linear regression
  - o Product moment correlation coefficient
- **Probability**
  - o Mutually exclusive and independent events
  - o Venn diagrams and tree diagrams
- **Statistical Distributions**
- Discrete probability distributions
- Binomial distribution
- Cumulative probabilities

Mechanics Topics
- **Kinematics**
  - o Motion in a straight line
  - o Displacement, velocity, acceleration
  - o Using equations of motion (SUVAT)
- **Forces and Newton's Laws**

- o Approximating binomial distributions with normal models
- **Hypothesis Testing**
- Formulating null and alternative hypotheses
- One-tailed and two-tailed tests
- Critical regions and significance levels
- Hypothesis testing using the binomial and normal distributions

Mechanics Topics

Moments
  - o Calculating moments about a point
  - o Conditions for equilibrium
  - o Applications to beams and rigid bodies
- **Forces and Friction**
  - o Resolving forces on inclined planes
  - o Static and dynamic friction
  - o Limiting equilibrium
- **Projectiles**
  - o Horizontal and vertical motion

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	- Types of forces (weight, normal reaction, tension, friction) - Newton's laws of motion - Equilibrium and resolving forces **Connected Particles and Dynamics** - Pulley systems - Motion of connected particles - Variable acceleration	- Equations of motion in two dimensions - Maximum height, range, and time of flight **Applications of Forces** - Connected particles (e.g., pulley systems) - Variable acceleration - Newton's laws in complex systems **Further Kinematics** - Using calculus in motion problems - Velocity and acceleration as derivatives - Displacement from integration

Curriculum Offer : A-level Further Mathematics

	Year 12	Year 13
Core	**Complex Numbers** Basic operations (addition, subtraction, multiplication, division)	**Complex Numbers** - De Moivre's Theorem - Roots of complex numbers

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- Solving quadratic equations with complex roots
- Argand diagrams
- Modulus and argument
- Geometric interpretation of complex numbers

📐 Roots of Polynomials

- Fundamental Theorem of Algebra
- Factor theorem and polynomial division
- Complex roots and conjugate pairs
- Solving cubic and quartic equations

🧮 Matrices

- Matrix operations (addition, multiplication)
- Determinants of 2×2 and 3×3 matrices
- Inverse matrices
- Solving systems of linear equations using matrices

- Loci in the complex plane
- Applications to trigonometric identities

📐 Matrices and Linear Transformations

- Matrix multiplication and inverse matrices
- Determinants and their properties
- Solving systems of equations using matrices
- Linear transformations and eigenvalues/eigenvectors

📊 Series and Maclaurin Expansions

- Summation of series
- Use of sigma notation
- Maclaurin series for standard functions
- Approximations using series expansions

📈 Calculus and Applications

- Further integration techniques

📊 Series

- Arithmetic and geometric series
- Use of sigma notation
- Recurrence relations
- Proof and manipulation of series

🔄 Proof by Induction

- Structure and logic of inductive proofs
- Applications to divisibility, summation, and recurrence relations

📈 Vectors

- 3D vector geometry
- Vector equations of lines
- Scalar product and applications

📏 Volumes of Revolution

- Using integration to find volumes
- Rotating curves around the x- or y-axis

- Volumes of revolution
- Differential equations (first and second order)
- Modelling with differential equations

🌀 Polar Coordinates

- Converting between Cartesian and polar forms
- Sketching polar graphs
- Area enclosed by polar curves

🔺 Hyperbolic Functions

- Definitions of sinh, cosh, tanh
- Identities and graphs
- Inverse hyperbolic functions
- Differentiation and integration of hyperbolic functions

🧮 Vectors in 3D

- Vector equations of lines and planes
- Scalar and vector products
- Applications to geometry and mechanics

Further Stats	□ **Discrete Random Variables (DRVs)**	□ **Discrete Probability Distributions**

	o Definition and properties of DRVs
	
	   o Probability distributions
	
	   o Calculating expected value $E(X)$ and variance $\text{Var}(X)$
	
	   o Linear transformations of DRVs
	
	• **Poisson Distribution**
	
	   o Characteristics and assumptions
	
	   o Calculating probabilities using the Poisson formula
	
	   o Mean and variance of the distribution
	
	   o Approximating binomial distributions with Poisson
	
	• **Geometric and Negative Binomial Distributions**
		o *Geometric distribution*: models the number of trials until the first success
		
		   o *Negative binomial distribution*: generalization of geometric for multiple successes
		
		   o *Poisson distribution*: models rare events over time or space
		
		• **Central Limit Theorem**
		
		   o Understanding sampling distributions
		
		   o Approximating distributions of sample means
		
		   o Application to hypothesis testing
		
		• **Hypothesis Testing**
		
		   o Tests using Poisson and binomial distributions

- o Geometric distribution: modelling number of trials until first success
- o Negative binomial: generalization for multiple successes
- o Mean and variance calculations

- **Hypothesis Testing**
  - o Formulating null and alternative hypotheses
  - o One-tailed and two-tailed tests
  - o Critical regions and significance levels
  - o Hypothesis tests using Poisson and geometric distributions

- **Central Limit Theorem (CLT)**
- Understanding sampling distributions
- Using CLT to approximate distributions of sample means

- o Critical regions and significance levels
- o One-tailed and two-tailed tests

- **Chi-Squared Tests**
  - o Goodness-of-fit tests
  - o Contingency tables
  - o Degrees of freedom and expected frequencies

- **Probability Generating Functions**
  - o Definition and use in deriving moments
  - o Applications to discrete distributions

- **Quality of Tests**
- Type I and Type II errors
- Power of a test
- Balancing significance and reliability

	• Applications in hypothesis testing	

Decision	☐ **Algorithms**
	   o Definition and structure of algorithms
	   o Flow charts and pseudo-code
	   o Efficiency and order of algorithms
	• **Graph Theory**
	   o Terminology: vertices, edges, paths, cycles
	   o Types of graphs: simple, weighted, directed
	   o Adjacency matrices and list representations
	• **Graph Algorithms**
	   o *Dijkstra's Algorithm*: shortest path
	   o *Prim's and Kruskal's Algorithms*: minimum spanning tree
		☐ **Algorithms and Graph Theory**
		   o Definitions and classifications of graphs (simple, weighted, directed, bipartite)
		   o Adjacency matrices and list representations
		   o Graph traversal algorithms (e.g., depth-first and breadth-first search)
		• **Minimum Spanning Trees**
		   o Prim's Algorithm
		   o Kruskal's Algorithm
		   o Applications in network design
		• **Shortest Path Algorithms**
		   o Dijkstra's Algorithm
		   o Floyd's Algorithm (for all-pairs shortest paths)

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- o *Chinese Postman Problem*: shortest route covering all edges
- o *Travelling Salesperson Problem*: shortest route visiting all vertices
- **Route Inspection and Network Flows**
  - o Eulerian and semi-Eulerian graphs
  - o Flow capacity and conservation
  - o Maximum flow-minimum cut theorem
- **Linear Programming**
  - o Formulating linear inequalities
  - o Graphical solution of linear programs
  - o Objective functions and feasible regions
- **Critical Path Analysis**
  - o Activity networks

- **Route Inspection**
  - o Eulerian and semi-Eulerian graphs
  - o Chinese Postman Problem
  - o Finding optimal routes that cover all edges
- **Travelling Salesperson Problem (TSP)**
  - o Heuristic methods for solving TSP
  - o Nearest neighbour and minimum spanning tree approaches
- **Matchings and Allocation**
  - o Bipartite graphs
  - o Hungarian Algorithm for optimal assignments
- **Linear Programming**
  - o Formulating linear programs
  - o Graphical solutions

	- Forward and backward passes - Float times and project scheduling **Matchings** • Bipartite graphs • Use of the *Hungarian Algorithm* for optimal assignments	- Simplex method (introduction and applications) **Critical Path Analysis** - Activity networks - Forward and backward passes - Float times and project scheduling **Flows in Networks** • Maximum flow-minimum cut theorem • Flow augmentation and bottlenecks

Careers

Mathematics is more than just numbers and equations—it's a powerful toolkit for solving real-world problems, developing logical thinking, and making informed decisions. Whether you're aiming for a career in engineering, finance, medicine, architecture, data science, or even game design, a strong foundation in maths opens doors to countless opportunities.

Employers across industries value the analytical and problem-solving skills that maths cultivates. From budgeting and coding to interpreting data and designing systems, the ability to think mathematically is a superpower in today's tech-driven world.

In short, studying Secondary Maths isn't just about passing exams—it's about building a future where you can think critically, adapt quickly, and thrive in any career path you choose.