**The Nottingham Emmanuel School – *Subject* Curriculum Map (2022-2023)**

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| Intent statement | The aim of our curriculum is to remove potential barriers by providing **all children with full access (wisdom)** to the curriculum through Teaching for Mastery, enabling them to achieve confidence and competence in Mathematics.  We aim to **raise aspirations** **(hope)** and maintain high expectations of ALL students to ensure they develop the Maths skills they need for the future, helping them to become the best versions of themselves. We will continue to treat students as individuals within our Mathematical **community** and ensure we use a range of collaborative techniques in our classrooms to deepen the collective acquisition of knowledge and **remove the stigma** **(dignity)** around mistakes being anything other than proof of learning. |
| Diversity across the curriculum | Mathematics is the universal language that is applicable to all backgrounds and careers. While we encourage students to explore a range of different cultural methods and number systems, our diversity in Maths is seen predominately through the career links we offer. We ensure that the careers we expose students to during KS3 to KS5 cover roles from a range of salaries and sectors and that the employees themselves represent different backgrounds, nationalities and genders.  |
| Careers across the curriculum | Mathematics is a subject that permeates through a vast number of careers and everyday tasks. We aim to ensure students fully grasp the wide reaching applications of the different topics they encounter in the classroom and use their success in lessons on those topics to further inspire their future goals and career aspirations.  |
|  |  | AUT 1 | AUT 2 | SPR 1 | SPR 2 | SUM 1 | SUM 2 |
| Year 7 | Title and objectives | Algebraic thinking | Place value and proportion | Applications of number | Directed number and fractional thinking | Constructing, measuring and using geometric sequences | Reasoning with number |
| Core knowledge | Exploring Sequences* Introduction to sequences in real world
* Different representations of sequences – predict and check
* Linear sequences - Ascending
* Linear sequences - Descending
* Frogs – Investigations
* Frogs – Write up
* Non-linear - Geometric Sequences.
* Non-linear - Fibonacci Sequences
* Generating sequences
* Sequences Consolidation lesson

Algebraic Notation* Function Machines – Introduction
* Function Machines – Inverse operation
* Algebraic conventions and function machines
* 2 step function machines
* Represent Functions Graphically
* Function Machines – solving word problems
* Function Machines – Consolidation lesson
* Substitution with one variable
* Substitution with more one variable
* Substitution – Consolidation lesson

Equality and Equivalence* Number walls and fact families- Numbers
* Number walls and fact families- Algebra
* Solving one step equations using function machines
* Solving one step equations using bar model
* Solving one step equations algebraically
* Understand like and unlike terms
* Collecting like terms – positives only
* Collecting like terms – with negatives
* Magic Squares – Numbers
* Magic Squares - Algebra
* Equal or equivalent
 | Place Value and ordering integers and decimals* Place Value
* Millions and Billions
* Work out integers on a number line
* Position integers on a number line
* Rounding (nearest power of 10)
* Comparing numbers
* Median – with whole numbers - decimals
* Median and Range – with whole numbers
* Median and Range – with negative and decimals.
* Decimals and place value
* Decimals on a number line
* Ordering integers and decimals
* Rounding (DP)
* Rounding (SF)
* Rounding – DP – SF Consolidation lesson
* Standard From - big numbers in standard form and standard form to ordinary
* Investigating negative powers of 10
* Standard From – decimals in standard form and standard form to ordinary
* Standard Form – Consolidation
* Represent fraction as diagram/number line
* Identify and use simple equivalent fractions
* Decimals to fractions
* Fractions to decimals
* Decimals to percentages
* Fractions to percentages
* Hundred Squares
* FDP consolidation
* Pie Charts
* Fractions as division
* Ordering FDP
* Exploring Fractions greater than 1
 | Addition and subtraction* Mental strategies addition and subtraction
* Addition and subtraction with standard form
* Perimeter – Basic shapes
* Perimeter – Problem solving
* Bank statements/ financial maths problems
* Frequency trees
* Bar charts and line graphs

Multiplication and division* HCF
* LCM
* Multiply and divide decimals by powers of 10
* Multiply integers by 0.1, 0.01 etc
* Multiplication method – partitioning
* Multiplication method – Lattice
* Area of rectangles
* Area of parallelograms
* Area of triangles
* Area of trapeziums
* Area problem solving/compound shape
* Understanding the division algorithm (bustop)
* Division with remainders
* Order of operations (BIDMAS)
* Finding the mean
* Mean problems

Fractions and percentages of amounts* Fractions of an amount
* Use a given fraction to find the whole and or other fractions
* Percentages of amount with calculator
* Percentages of amount without calculator
* Solve problems with fractions greater than 1 and percentages greater than 100
 | Operations with directed number* Adding negative numbers
* Subtracting negative numbers
* Comparing temperatures
* Counters to understand directed numbers A+S
* Evaluating negative number statements
* Counters to understand directed numbers M+D

Addition and Subtraction of fractions* Mixed number to Improper fraction
* Improper to Mixed Number fraction
* Add and subtract fractions with same denominator
* Add fractions with different denominator
* Subtract fractions with different denominator
* Add and subtract magic squares with fractions
* Add and subtract pyramids with fractions
* Worded questions
* Multiplying fraction and integer
* Multiplying integer and fraction
* Multiplying fraction and fraction
* Multiplying fractions with Mixed
* Add and subtract algebraic fractions
* Add and subtract more difficult algebraic fractions
* Dividing fractions
* Dividing algebraic fractions
 | Construction and Measuring* Understand and use letter and labelling conventions including those for geometric figures
* Draw and measure line segments including geometric figures
* Understand angles as a measure of turn
* Classify angles
* Measure angles up to 180
* Draw angles up to 180
* Draw and measure angles between 180 and 360
* Identify perpendicular and parallel lines
* Recognise types of triangle
* Recognise types of quadrilateral
* Identify polygons up to a decagon
* Construct triangles using SSS
* Construct triangles using SSS and ASA
* Construct more complex polygons
* Interpret simple pie charts using proportion
* Interpret pie charts using a protractor
* Draw pie charts

Geometric Reasoning* Understand and use the sum of angles at a point
* Understand and use the sum of angles on a straight line
* Understand and use the equality of vertically opposite angles
* Know and apply the sum of angles in a triangle
* Know and apply the sum of angles in a quadrilateral
* Solve angle problems using properties of triangles and quadrilaterals
* Solve complex angle problems
* Geometric Reasoning
* Find and use angle sum of any polygon
* Investigate angles in parallel lines
* Understand and use parallel line angle rules
* Use known facts to obtain simple proofs.
 | Developing Number sense* Mental addition and subtraction strategies for integers
* Mental Multiplication and division strategies for integers
* Mental arithmetic strategies for decimals
* Mental arithmetic strategies for fractions
* Factors to simplify calculations
* Estimation as a method for checking mental calculations
* Known number facts to derive other facts
* Known algebraic facts to derive other facts
* Mental strategy, formal written or calculator

Sets and Probability * Identify and represent sets
* Interpret and create intersection of sets
* Understand and use Union of sets
* Understand and complement a set
* Know and use vocabulary of probability
* Generate sample spaces for single events
* Calculate probability of a single event
* Understand and use the probability scale
* Know the sum of probabilities of all possible outcomes is 1

Prime numbers and Proof* Find and use multiples
* Identify factors of numbers and expressions
* Recognise and identify prime numbers
* Recognise square and triangular numbers
* Find common factors of a set of numbers including the HCF
* Find common multiples of a set of numbers including the LCM
* Write a number as a product of its prime factors
* Use a venn diagram to calculate the HCF and LCM
* Make and test conjecture
* Use counterexamples to disprove a conjecture
 |
| Skills | * Addition
* Subtraction
* Multiplication,
* Division
* Fractions
* Decimals
 | * Addition
* Subtraction
* Multiplication
* Division
* Fractions
* Decimals
* Percentages
* Scale
 | * Addition
* Subtraction
* Multiplication
* Division
* Fractions
* Decimals
* Percentages
 | * Addition
* Subtraction
* Multiplication
* Division
* Fractions
 | * Addition
* Subtraction
* Scale
 | * Addition
* Subtraction
* Multiplication
* Division
 |
| Covid recovery | Year 7 is the start of KS3, and there is a considerable overlap of content from KS2. The structure of our year 7 curriculum allows for revision from KS2 content. We recognise that students may need to spend longer reviewing KS2 material which might mean some of the higher steps/stretch areas of the scheme may not be covered by all students. As a result of this, all these steps are covered again/will be covered again in the core content of year 8 and year 9. |
| Careers | Embedded careers videos linked to:Sequences Algebra | Embedded careers videos linked to:Place valueMedian and rangeDecimal place valueStandard form | Embedded careers videos linked to:AreaPerimeterPercentages | Embedded careers videos linked to:Positive and negative numbersFractions | Embedded careers videos linked to:AnglesMeasurement | Embedded careers videos linked to:DataProbability |
| Year 8 | Title and objectives | Proportional Reasoning | Mathematical Representations | Algebraic techniques | Developing number | 2D Geometry | Reasoning with data |
| Core knowledge | Solving Ratio Problems* Understand ratio and ratio notation
* Dividing into a given ratio
* Simplifying ratio
* Comparing ratio as fractions
* Understand pi as a ratio between diameter and circumference
* Understand gradient of a line as a ratio

Multiplicative reasoning* Direct proportion
* Conversion graphs
* Converting currencies
* Similar shapes
* Scale factors
* Scale diagrams
* Interpreting maps
* Multiplying fraction with an integer
* Product of a pair of fractions
* Dividing integer by a fraction
* Dividing two fractions
* Reciprocal
* Mixed and improper fractions
* Algebraic fractions
 | Working in the Cartesian plane* Coordinates in four quadrants
* Horizontal and vertical line names and drawing
* Understanding the line y = x
* Y = kx and proportion links
* Y = x + a and y = -x + a
* Link straight line graphs with linear sequences
* Plotting y = mx + c

Scatter graphs* Draw and interpret a scatter graph
* Understand linear correlation
* Draw and use line of best fit
* Identify non-linear relationships
* Use ungrouped frequency tables
* Use grouped frequency tables
* Represent grouped discrete data
* Represent grouped continuous data
* Two way tables

Sample spaces* Sample space for 1 or more events
* Find probability from sample space
* Find probability from two-way tables
* Find probability from Venn diagrams
* Product rule for finding total number of outcomes
 | Brackets, equations and inequalities* Use basic index rules
* Use algebraic conventions
* Multiply single brackets
* Factorise single brackets
* Form equations and inequalities
* Use different representations for equations
* Solve linear equations
* Solve word problems that lead to linear equations
* Ratio and Algebra problems
* Solve linear inequalities

Further Sequences* Find patterns in spatial sequences
* Find different ways of describing spatial sequences
* Find the nth term of linear sequences
* All about Fibonacci
 | Multiplying and dividing with fractions* Find the product of any pair of fractions
* Divide any pair of fractions
* Multiply and divide with algebraic fractions

Working with fractions and percentages* Find percentages of amounts
* Find percentage increase and decrease
 | Angles in polygons* Understand and use the properties of diagonals of quadrilaterals
* Understand and use the sum of exterior and interior angles in any polygon.

Further area and perimeter* Calculate the area of a trapezium
* Find the circumference of a circle given a radius or diameter and vice versa
* Find the length of arcs
* Find the area of a circle given a radius or diameter and vice versa
* Find the area and perimeter of compound shapes involving circles

Symmetry and reflection* Recognise line symmetry
* Recognise rotational symmetry
* Reflect shapes in vertical, horizontal and diagonal lines
 | Questionnaires and Charts* Design and critise questionnaires
* Draw and interpret bar charts, line charts and line graphs

Measures of location* Understand and use the mean, median and mode
* Choose the most appropriate average
* Work with frequency tables
* Identify outliers
* Compare distributions
 |
| Skills | * Problem solving
* Inference
* Ratio
* Multiplication
* Division
 | * Multiplication
* Fractions
* Plotting coordinates
 | * Adding
* Subtracting
* Multiplying
* Dividing
* Indices
 | * Multiplying
* Dividing
* Fractions
* Percentages
 | * Multiplying
* Dividing
* Adding
* Subtracting
 | * Adding
* Dividing
* Analysing an answer
* Logical reasoning
 |
| Covid recovery | In Year 8 students build on their knowledge and skills gained from Year 7 and KS2 through learning about how to use bar models to understand proportional relationships so additional time has been built in to pre teach prior content that need to be included. |
| Careers | Embedded careers videos linked to:RatioProportionFractions | Embedded careers videos linked to:GraphsData | Embedded careers videos linked to:AlgebraSequences | Embedded careers videos linked to:FractionsPercentages | Embedded careers videos linked to:TransformationsSymmetry | Embedded careers videos linked to:Data |
| Year 9 | Title and objectives | **Algebraic Manipulation** | **Further Coordinate Geometry** | **Angles, Construction and Congruence** | **Quadratic Expressions, Equations and Graphs** | **Pythagoras, Surds and Surface Area** | **Probability and Venn Diagrams** |
| Core knowledge | Distributive Law* Multiplying out positive single brackets.
* Multiplying out single brackets with negatives.

Expanding* Multiply out two brackets with positives
* Multiply out two brackets with negatives.
* Using identities to expand brackets.
* Multiplying out three brackets

Factorising* Factorise single brackets with positive factors
* Factorise single brackets with negative factors
* Factorise single brackets with variable factors
* Factorise brackets a=1 with positives
* Factorise brackets a=1 with negatives
* Factorise brackets a=1 with mixture
* Factorise brackets a>1
* Factorise brackets b=0 (difference of two squares)
* Factorising problems

Algebraic fractions* Simplifying single term fractions
* Simplifying single term fractions using factorising.
* Add algebraic fractions
* Subtract algebraic fractions
* Multiply algebraic fractions
* Divide algebraic fractions
* Rationalising single term denominator
* Rationalising multiple term denominator
 | Coordinate Relationships* Plotting coordinates in one quadrant
* Plotting coordinates in four quadrants
* Lines parallel to the axis
* Coordinate relationships with a straight line
* Coordinate relationships with a midpoints
* Coordinate relationships with real life graphs
* Use multiple representations of straight lines
* Drawing line using table of values
* Understanding how to find the gradient of a line
* Understanding how to find points on a line including the y-intercept.

Understanding y = mx + c* Naming a graph
* Draw the graph
* Finding the equation of a line given the coordinate and gradient
* Finding the equation of a line given two coordinates
* Finding the equation of a line given a parallel
* Understanding reciprocals
* Finding the equation of a line given perpendicular lines
 | Angles* Vertically opposite angles
* Understanding parallel lines
* Corresponding angles
* Alternate angles
* Co-interior angles
* Using protractor to measure angles
* Using protractor to draw angles
* Drawing bearings
* Measuring bearings
* Calculating bearing

Shape* Using a compass
* Constructing polygons
* Interior angles of polygons
* Exterior angles of polygons
* Tessellations

Constructions* ASA triangles
* SAS triangles
* SSS triangles
* Congruent triangles
* Angle bisector
* Perpendicular from a point
* Perpendicular bisector
* Angles
 | Quadratic Expressions* Understanding shape and property of a parabola
* Drawing Quadratic Graphs
* Finding roots from the graph
* Finding roots from quadratic graphs
* Finding roots through factorising
* Form and Solve Quadratic Equation by factorising
* Complete the Square a=1 when positives
* Complete the Square a=1 when negatives
* Complete the Square a>1 when mixture
* Using the Quadratic Formula
* Forming and solving a quadratic equation.

  | Pythagoras* Proof of Pythagoras
* Finding the hypotenuse
* Finding a shorter side
* Pythagoras in context
* Pythagoras Problems linked to quadratics

Surds* Reviewing squared numbers
* Introducing Surds
* Simplifying Surds
* Additions and subtraction with surds
* Multiplying and dividing with surds
* Expanding brackets with surds
* Rationalising Surds with a single term denominator
* Rationalising Surds with a multiple terms

3D * Visualising in 3D
* Pythagoras in 3D
* Solving in 3D Pythagoras problems
* Solving in 3D Pythagoras pyramids

Surface Area* Surface Area of Pyramids
* Surface area of cuboids
* Area of circles
* Circumference of circles
* Surface area of cylinders
* Surface area of cones
 | Probability* Compare the size of fractions by either comparing numerators, comparing denominators or converting to decimals.
* List all possible outcomes of an event in a systematic way
* Sample space diagrams

Tree Diagrams* Drawing frequency diagrams
* Drawing probability tree diagrams with replacement
* Drawing probability tree diagrams without replacement
* Probability trees problems

Venn Diagrams* Introduction to drawing Venn Diagrams
* Introduction to union
* Introduction to intersection
* Set notation
* Finding probabilities from a Venn Diagrams using set diagram
 |
| Skills | * Multiplication
* Division
* Addition
* Subtraction
* Fractions
* Synoptic links to area
* Synoptic link to probability trees
* Calculator use to remove barriers
 | * Multiplication
* Scale
* Synoptic link to area
* Synoptic link to ratio
* Calculator table function
 | * Scale
* Addition
* Subtraction
* Calculator use to remove barriers
* Using a compass and protractor
* Synoptic links to forming and solving equations
 | * Calculator table function for quadratics
* Addition
* Subtraction
* Multiplication
* Fractions
* Problem solving- exam type questions
 | * Calculator to remove barriers (π button)
* Multiplication
* Scale
 | * Fractions
* Calculator use to remove barriers (fraction button)
 |
| Covid recovery | Additional time to review addition and subtraction fractionsAlgebraic thinking from year 7 | Additional time already built in to review coordinate geometry  | Additional time to review angle facts (year 7) |  | Review formula of areas (year 7) | Additional time to review tree and frequency diagrams from year 8 that was missed due to reduced lesson time |
| Careers | Embedded careers videos linked to:QuadraticsFractions | Embedded careers videos linked to:Coordinate geometry | Embedded careers videos linked to:Angles | Embedded careers videos linked to:Problem solvingQuadraticsGraphs | Embedded careers videos linked to:Pythagoras3D shapes | Embedded careers videos linked to:ProbabilityData |
| Year 10 | Title and objectives | Similarity and Trigonometry | Multi-variable Algebra and Circle Geometry | Science Skills | Relationships | Data | Probability |
| Core knowledge(Higher Only) | Trigonometric Ratios * Work fluently with hypotenuse, opposite and adjacent sides.
* Use the tangent ratio to find missing sides
* Use the sine and cosine ratio to find missing sides
* Use all three ratios to find missing angles
* Work with exact trigonometric values
* Recap calculating sides using Pythagoras theorem
* Choose between Pythagoras and Trigonometry
* Using a combination of Pythagoras and Trigonometry
* Use the sine rule to find the area
* Use the sine rule to find the length
* Use the sine rule to find the angles
* Use the cosine rule to find the area
* Use the cosine rule to find the length
* Use the cosine rule to find the angles
* Draw Trigonometric Graphs
* Solve Trigonometric Equations
 | Simultaneous Equations * Solve Simultaneous Equations by elimination as addition
* Solve Simultaneous Equations by elimination as subtraction
* Select method of solution
* Solve Simultaneous Equations by balancing coefficients
* Solve Simultaneous Equations by substitution
* Recap drawing linear graphs
* Solve Simultaneous Equations graphically

Quadratics* Plot quadratic graphs
* Find the roots of a quadratic equations by factorising
* Form and solve quadratic equations
* Form and solve quadratic equations with a>1
* Quadratic Formula

Circles* Sector Area
* Arc Length
* Equation of a circle
* Quadratic-Linear Simultaneous Equations
* Working with the equation of the tangent
* Circle Theorems
 | Forms of number* Use numbers number facts to find related calculations
* Recap of index form
* Working with negative indices
* Working with fractional indices
* Expressing large numbers in standard form
* Expressing small numbers in standard form
* Calculating numbers with standard form

Compound Measures* Solve problems involving measure;
* Density (fluently change between units)
* Pressure (fluently change between units)
* Interpret distance time graphs
* Calculating average speed
* Approximate the gradient of a curve at a given point and the area under the graph.
* Estimating speed
* Velocity and acceleration
* Finding surface area of prism
* Finding surface area of cylinders
* Finding surface area of cones
* Finding surface area of spheres
* Volume of prisms
* Volume of cylinders
* Volumes of cones and pyramids
* Volume of speheres
 | Sequences* Generating sequences
* Linear nth term
* Generating using the nth term
* Quadratic Sequences
* Solving equations using iterations
* Quadratic Inequalities
* Completing the square
* Combining ratios, writing ratios 1:n
* Unit pricing
* Understand how to convert currency
* Direct and inverse proportion
* Recognise and drawing different types of graphs (reciprocal, exponential, quadratic, cubic)
* Function notation
* Compound and inverse functions
* Recognise and sketch translations of graphs
* Recognise and sketch reflections of graphs
 | Average and Range* Solve problems involving the mean
* Frequency Tables Recap
* Estimating the mean from frequency tables
* Be able to work with all three averages and the range in different contexts

Representing Data* Construct and interpret pie charts
* Use line graphs to represent time series
* Construct and interpret Box Plots
* Construct and interpret cumulative frequency diagrams and graphs
* Construct and interpret histograms
 | * Combinations
* Relative Frequency
* Using two way tables
* Understand independent events
* Using tree diagrams
* Conditional probability from Venn Diagrams and Tree Diagrams
* Algebraic Probability
 |
| Skills | Ratio, Calculator Use, (Sin, Cos, Tan, arcsin, arccos, artan)Graph Drawing skills | Addition, Subtraction, Multiplication, Problem SolvingCalculator skills (pi button) | Changing unitsCalculator use (Standard form button, index buttons)AdditionMultiplicationDivision | Multiplication, Ratio, Calculator Use, (Ans button, for iterative processes) | Calculator use to remove barriersAddition, Division | Multiplication, Ratio, FDP,Problems solvingGeneral Calculator use to remove barriers |
| Covid recovery | Solving Equations* Recap solving equations from Year 8 Aut 2
* Recap Substitution from 8 Aut 2

Surds* Working fluently with surds
* Simplify surds
* Expand brackets with surds
 | Solving Equations* Recap solving equations from Year 8 Aut 2
* Recap Substitution from 8 Aut 2

Circles, Area and PerimeterRecap from Year 8 Spr 1 | Indices from 8Aut23D Geometry from 8Sum1 | Generating nth term 8Spr2Ratios 8Aut1 | Averages 7Sum1 (old scheme)Pie Charts 7Sum1 (old scheme) | Probability tree diagrams 8Sum1 |
| Careers | Embedded careers videos linked to:Pythagoras and Trigonometry  | Embedded careers videos linked to:CirclesAlgebra | Embedded careers videos linked to:Standard formGraphs Area | Embedded careers videos linked to:Sequences RatioProportionTransformation | Embedded careers videos linked to:DataStatistics | Embedded careers videos linked to:Probability As well as:Interview with an Urban regeneration manager that then links into a lesson on regenerating a ‘local’ factory |
| Year 11 | Title and objectives | COVID CATCH UP | COVID CATCH UP | A bespoke curriculum will be created for each class based on mock data. Each year 11 teacher will go through their class’s question level analysis (QLA) from the mock students completed in November and identify the key topics students in their class struggled with.These topics shall be combined with exam techniques and planned into a personalised curriculum for each class that can be shared with the students so that they have full clarity on what will be covered within lessons. Teachers will create a second bespoke scheme of learning after the second mock examination in March to make sure students are consistently focusing on the right key areas to enable them to be successful.All groups will aim to include * Basic algebra skills
* Fractions
* Percentages
* Problem solving techniques
* Area, perimeter and right angled triangles
 |
| Core knowledge | Foundation* Types of Number
* Rounding and estimation
* Using number
* Simplify and solve

Higher* Surface area and volume
* Transformations
* Similar shapes
* Vector geometry
 | Foundation* Percentages
* Representing data
* Averages and Spread
* Right angled Triangles

Higher* Function notation
* Compound functions
* Inverse functions
* Quadratic sequences
* Iteration and solving equations
 |
| Skills | Exam technique, exam language, four operations, synoptic questions |
| Covid recovery | Additional time given to these topics that have been missed in year 9 and 10 due to covid/ covid recovery that has already taken place in the last two years | This year, additional time is given to each class to work on the specific areas of weakness that has been identified as gaps during covid and through mock examinations |
| Careers | Career videos to be embedded when appropriate with the Bespoke curriculum of this year |
| Year 12 - Mechanics | Title and objectives | Straight Lines and Circles, Proof, Polynomials | Binomial Expansion, Vectors | Kinematics, Forces and Newton’s Laws 1 | Forces and Newton’s Laws 2, Integration | Variable Acceleration, Revision / Exams | Sequences and Series (Year 13 content) |
| Core knowledge | STRAIGHT LINES AND CIRCLES* Distance between two points and midpoints
* The equation of a straight line
* Parallel and perpendicular lines
* The equation of a circle
* Solving problems with lines and circles

PROOF* Mathematical arguments and notation
* Proof by deduction, exhaustion and counter-example

POLYNOMIALS* Polynomial division
* The factor theorem
* Sketching polynomial functions
 | BINOMIAL EXPANSION* Understanding the Binomial Theorem
* Solving problems involving binomial coefficients
* Applications of the Binomial Theorem

VECTORS* Describe vectors using magnitude and direction
* Addition and subtraction of vectors
* Problems involving equal and parallel vectors
* Understand position and displacement vectors
* Use vectors to solve geometrical problems
 | KINEMATICS IN ONE DIMENSION* Displacement, velocity and acceleration
* Calculus and kinematics
* Displacement-time graphs
* Velocity-time graphs
* Problems involving kinematics

FORCES AND NEWTONS LAWS* Deriving the constant acceleration formula
* Solving problems involving the constant acceleration formula and vertical motion
* Newton’s Laws of motion
* Problems involving gravity and resultant forces
* Types of forces, gravity and weight
* Forces in equilibrium
 | FORCES AND NEWTONS LAWS* Newton’s third law
* Normal reaction force
* Solving complex problems in involving equilibrium
* Connected particles
* Problems involving pulleys

INTEGRATION* Rules for integration
* Finding the equation of a curve
* Definite integrals
* Calculate the area between a curve and a line
 | Variable AccelerationBESPOKE REVISION / MOCK EXAMS | SEQUENCES AND SERIES* Term-to-term and position-to-term rules
* Sigma notation
* Arithmetic sequences and series
* Geometric sequences and series
* Infinite geometric series
* Mixed arithmetic and geometric problems
 |
| Skills | * CALCULATOR: Solving polynomial function
 | * Formula Book – Binomial Expansion
 | * Formula Book – SUVAT equations
 | * CALCULATOR: definite integrals using the integral button
 |  | * Formula Book – Arithmetic and Geometric Series
 |
| Covid recovery | Additional intervention offered to anyone who has had to isolate due to covid and has missed key content |
| Year 12 - Statistics | Title and objectives | Algebraic Manipulation, Quadratic Equations, Graphs and Inequalities | Data Presentation /Representation, Probability and Statistical Distributions | Statistical Sampling and Hypothesis Testing, Trigonometry | Differentiation, Logarithms | Exponentials, Revision / Exams | Functions, Further Transformations of Graphs (Year 13 content) |
| Core knowledge | ALGEBRAIC MANIPULATION* Laws of indices
* Surds

QUADRATIC EQUATIONS* Solving quadratic equations
* Graphs of quadratic equations
* Completing the square
* Quadratic inequalities
* The discriminant
* Disguised quadratics

GRAPHS, LINEAR AND QUADRATIC INEQUALITIES* Intersections of graphs
* Transforming graphs
* Reciprocal Graphs
* Sketching inequalities
 | DATA PRESENTATION AND REPRESENTATION* Draw and interpret statistical diagrams including histograms, cumulative frequency diagrams and box and whisker plots
* Standard deviation
* Calculate and interpret the mean, standard deviation and variance from frequency tables.
* Interpret correlation coefficients and regression lines
* Calculate and determine outliers

PROBABILITY AND STATISTICAL DISTRIBUTIONS* Mutually exclusive and independent probabilities
* Probability distributions
* The binomial distribution
 | STATISTICAL SAMPLING AND HYPOTHESIS TESTING* Methods of sampling
* Hypothesis testing for the binomial distribution
* Understand critical regions for hypothesis testing.

TRIGONOMETRY* Sine Rule, Cosine Rule, Area using Sine
* Graphs of sine, cosine and tangent functions
* Transformations of trigonometric graphs
* Trigonometric identities
* Solving trigonometric equations in degrees
 | DIFFERENTIATION* Sketching derivatives
* Differentiation from first principals
* Rules of differentiation
* Interpreting derivatives and second derivatives
* Solving problems involving tangents, normal and stationary points
* Optimisation

LOGARITHMS* Understand the relationship between logarithms and indices
* Understand the laws of logarithms
* Solve exponential equations including disguised quadratics
 | EXPONENTIALS* Graphs of exponential and logarithmic functions
* Solve problems involving exponential functions
* Approximate an exponential model as a straight line

BESPOKE REVISION / MOCK EXAMS | FUNCTIONS* Mappings and functions
* Domain and range
* Composite functions
* Inverse functions

FURTHER TRANSFORMATIONS OF GRAPHS* Combined graph transformations
* The modulus function
* Solving modulus equations and inequalities
 |
| Skills | * CALCULATOR: Solving polynomial function
* CALCULATOR: Solving inequality function
 | * CALCULATOR: Using the 1-var statistics calculations
* CALCULATOR: y=a+bx statistics function
* CALCULATOR: Binomial PD / Binomial CD functions
* Formula Book – Standard Deviation
 | * Reading Cumulative Binomial Tables from Formula Book
 | * CALCULATOR: using the gradient function button to evaluate the gradient of a curve at a particular point
* CALCULATOR: using the log button with different bases
* Formula Book – log rules for changing base
 |  |  |
| Covid recovery | Additional intervention offered to anyone who has had to isolate due to covid and has missed key content |
| Careers | Lesson planned in to look at how statistics skills can be used to become a data analyst  |
| Year 12 FM | Title and objectives | Complex Numbers, Argand Diagrams, Roots of Polynomials and Matrices | Series, Proof by Induction, Linear Transformations and Vectors | Mechanics | Further Vectors, Conic Section 1 and Inequalities | Volumes of Revolution, The t-formulae and Numerical Methods | Bespoke Revision |
| Core knowledge | COMPLEX NUMBERS* Imaginary and Complex Numbers
* Multiplying and Dividing Complex Numbers
* Roots of Quadratic Equations
* Solving Cubic and Quartic Equations

ARGAND DIAGRAMS**Required A-level Knowledge: Radians*** Argand Diagrams
* Modulus-Argument Form
* Loci
* Regions obtained by inequalities

ROOTS OF POLYNOMIALS* Roots of Quadratic, Cubic and Quartic Equations.
* Expressions Relating to Roots of a Polynomial
* Linear Transformations of Roots

MATRICES* Introduction to Matrices
* Matrix Multiplication
* Determinants
* Inverting 2x2 and 3x3 Matrices
* Solving systems of Equations using Matrices
 | SERIES* Sum of Natural Numbers
* Sums of Squares and Cubes

PROOF BY INDUCTION* Proof by Induction
* Proving Disability Results
* Proving Matrices Results

LINEAR TRANSFORMATIONS* Linear Transformations in 2D
* Reflections and Rotations
* Enlargements and Stretches
* Successive Transformations
* Linear Transformations in 3D
* The inverse of a Linear Transformation

VECTORS* Equation of a line in 3D
* Equation of a Plane in 3D
* Scalar Product
* Calculating Angles between lines and Planes
* Points of Intersection
* Finding Perpendicular Lines
 | MOMENTUM & IMPULSE (**Further Mechanics)*** Momentum in One Direction
* Conservation of Momentum
* Momentum as a Vector

WORK, ENERGY & POWER **(Further Mechanics)*** Work Done
* Kinetic & Potential Energy
* Conservation of Mechanical Energy and the Work Energy Principal
* Power

ELASTIC COLLISIONS IN ONE DIMENSION **(Further Mechanics)*** Direct Impact and Newton’s law of Restitution
* Direct Collision with a Smooth Plane
* Loss of Kinetic Energy
* Successive Direct Impacts
 | VECTORS (**Further Pure)*** Vector Product
* Finding Areas
* Scalar Triple Product
* Straight Lines
* Solving Geometrical Problems

CONIC SECTIONS 1 **(Further Pure)*** Parametric Equations
* Parabolas
* Rectangular Hyperbolas
* Tangents and Normals
* Loci

INEQUALITIES (**Further Pure)*** Algebraic Methods
* Using Graphs to Solve Inequalities
* Modulus Inequalities
 | VOLUMES OF REVOLUTION**Required A-level Knowledge: Integration of Polynomials, Integration to find areas under graphs.*** Volumes of Revolution around the -axis
* Volumes of Revolution around the -axis
* Adding and Subtracting Volumes
* Modelling with Volumes of Revolution

THE t-FORMULAE (**Further Pure)****Required A-level Knowledge: Double Angle Formulae, definitions of sec, cosec and cot*** The t-formulae
* Applying the t-formulae to Trigonometric Identities
* Solving Trigonometric Equations
* Modelling with Trigonometry

NUMERICAL METHODS (**Further Pure)*** Solving First-Order Differential Equations
* Solving Second-Order Differential Equations
* Simpson’s Rule
 | BESPOKE REVISION |
| Skills | * CALCULATOR: Complex number mode to manipulate complex numbers
* CALCULATOR: Switching between radians and degrees
* CALCULATOR: Solving quadratics and cubics.
* CALCULATOR: Manipulating matrices including finding the inverse
 | * CALCULATOR: Series button
 |  |  | CALCULATOR: Integration button |  |
| Covid recovery | Consideration given for any student isolating to catch up. |
| Careers | Lesson(s) planned to look at the real world application of matrices and the jobs that links to |
| Year 13 - Mechanics | Title and objectives | Radian Measure, Proof, Vectors in 3D | Further Differentiation, further applications of calculus | Differential Equations, Moments, Forces in Context | Application of Forces, Projectiles | Application of Vectors |  |
| Core knowledge | RADIAN MEASURE* Understanding radians as an angle measure
* Inverse trigonometric functions
* Solving trigonometric equations in radians
* Arc length and sector area
* Small angle approximations
* Reciprocal trigonometric functions

PROOF* Proof by contradiction
* Criticising proof

VECTORS IN 3D* 3D Vectors
* Solving Geometrical Problems
* Applications to Mechanics
 | FURTHER DIFFERENTIATION* The chain rule
* The product rule
* The quotient rule
* Implicit differentiation
* Differentiation of reciprocal functions

FURTHER APPLICATIONS OF CALCULUS* Concave and convex curves and points of inflection
* Parametric equations
* Differentiating parametric equations
* Integrating parametric equations
* Connected rates of change
 | DIFFERENTIAL EQUATIONS* Solving differential equations with 1 or 2 variables
* Modelling with differential equations

MOMENTS* The turning effect of a force
* Equilibrium
* Centres of Mass and Tilting

FORCES IN CONTEXT* Resolving forces
* Motion on a slope
* Coefficient of friction
 | APPLICATION OF FORCES* Modelling with static particles
* Modelling with friction
* Forces with rigid static bodies
* Dynamics with inclined planes

PROJECTILES* Modelling projectile motion
* Horizontal, vertical and angled projection
* The trajectory of a projectile
 | APPLICATIONS OF VECTORS* Describing motion in two dimensions
* Constant acceleration equations
* Calculus with vectors

BESPOKE REVISION / MOCK EXAMS |  |
| Skills | * Formula Book – small angle approximations
 | * Formula Book - standard differentials
 |  |  |  |  |
| Covid recovery | Additional intervention offered to anyone who has had to isolate due to covid and has missed key content |
| Year 13 - Statistics | Title and objectives | Partial Fractions, Trigonometry, calculus of exponential and trig functions | Binomial Theorem, Further Integration | Numerical Methods, Regression and Correlation, Large Data Set | Further Probability, The Normal Distribution | Further Hypothesis Testing |  |
| Core knowledge | PARTIAL FRACTIONS* Polynomials recap (including problem solving with factor theorem)
* Simplifying rational functions
* Partial fractions with distinct and repeated factors
* Improper fractions

TRIGNOMETRY* Compound angle identities
* Double angle identities
* Solving trigonometric equations
* Functions in the form
* Proving trigonometric identities
* Modelling with trigonometric functions

CALCULUS OF EXPONENTIAL AND TRIGONOMETRIC FUNCTIONS* Differentiation
* Integration
 | BINOMIAL THEROEM* Binomial theorem for fractional and negative powers
* Expansion of compound expressions

FURTHER INTEGRATION* Integration of
* Integrating f(ax+b)
* Using trigonometric identities
* Reverse chain rule
* Integration by substitution
* Integration by parts
* Integration rational functions
* Finding complex areas e.g. between 2 curves, between a curve and the y-axis.
 | NUMERICAL METHODS* Locating roots of a function
* Fixed-point iteration and its limitations
* The Newton-Raphson method and its limitations
* Applications to modelling
* The trapezium rule

REGRESSION & CORRELATION* Exponential models
* Measuring Correlation
* Hypothesis testing for correlation coefficients

THE LARGE DATA SET* Understanding and interrogating
 | FURTHER PROBABILITY* Set notation
* Conditional Probability
* Venn diagrams
* Probability Formulae
* Tree diagrams

THE NORMAL DISTRIBUTION* The normal distribution
* The inverse normal distribution
* The Standard Normal Distribution
* Finding unknown
* Approximating the binomial distribution
 | FURTHER HYPOTHESIS TESTING* Calculating and interpreting probabilities using the normal distribution for a sample
* Hypothesis testing for the normal distribution

BESPOKE REVISION / MOCK EXAMS |  |
| Skills | * Formula Book – compound angle formulae
 | * Formula Book – binomial expansion
* Formula Book – standard integrals, Integration by Parts formula
 | * Formula Book – Numerical Methods formulae
* LDS
* Formula Book – critical values for PMCC
* CALCULATOR: y=a+bx statistics function
 | * Formula Book – probability formulae
* CALCULATOR: Normal Distribution function
 | * Formula Book – percentage points for the normal distribution
 |  |
| Covid recovery | Additional intervention offered to anyone who has had to isolate due to covid and has missed key content |
| Year 13 FM | Title and objectives | Further Mechanics and Complex Numbers | Series, Methods in Calculus and Volumes of Revolution | Polar Coordinates, Hyperbolic Functions and Methods in Differential Equations | Modelling with Differential Equations, Conic Sections 2 and Taylor Series | Methods in Calculus, Reducible Differential Equations and Revision | Exams |
| Core knowledge | ELASTIC STRINGS AND SPRINGS **(Further Mechanics)*** Hooke’s law
* Elastic Energy

ELASTIC COLLISIONS IN 2D **(Further Mechanics)*** Oblique Impact with a fixed Surface
* Successive Oblique Impacts
* Oblique Impact of Smooth Spheres

COMPLEX NUMBERS* Exponential Form of Complex Numbers
* Multiplying and Dividing Complex Numbers
* De Moivre’s Theorem
* Trigonometric Identities
* Sums of Series
* th Roots of Complex Numbers
* Geometric Problems involving Roots
 | SERIES**Required A-level Knowledge: Partial Fractions, Product Rule, Chain Rule, Quotient Rule, Differentials of** * Method of Differences
* Higher Derivatives
* Maclaurin Series
* Maclaurin Series of Compound Functions

METHODS IN CALCULUS**Required A-level Knowledge: Reverse Chain Rule, Integration by Parts, Integration by Substitution*** Improper Integrals
* The Mean Value of a Function
* Differentiating Inverse Trigonometric Functions
* Integrating with Inverse Trigonometric Functions
* Integrating using Partial Fractions

VOLUMES OF REVOLUTION* Volumes of Revolution around the -axis
* Volumes of Revolution around the -axis
* Volumes of Revolution of Parametrically Defined Curves
* Modelling with Volumes of Revolution
 | POLAR COORDINATES* Polar Coordinates and Equations
* Sketching Curves
* Area Enclosed by a Polar Curve
* Tangents to Polar Curves

HYPERBOLIC FUNCTIONS* Introduction to Hyperbolic Functions
* Inverse Hyperbolic Functions
* Identities and Equations
* Differentiating Hyperbolic Functions
* Integrating Hyperbolic Functions

METHODS IN DIFFERENTIAL EQUATIONS* First-Order Differential Equations
* Second-Order Homogeneous Differential Equations
* Second-Order Non-Homogeneous Differential Equations
* Using Boundary Conditions
 | MODELLING WITH DIFFERENTIAL EQUATIONS* Modelling with First-Order Differential Equations
* Simple Harmonic Motion
* Damped and Forced Harmonic Motion
* Coupled First-Order Simultaneous Differential Equations

CONIC SECTIONS 2 **(Further Pure)*** Ellipses
* Hyperbolas
* Eccentricity
* Tangents and Normals to an Ellipse
* Tangents and Normals to a Hyperbola
* Loci

TAYLOR SERIES **(Further Pure)*** Taylor Series
* Finding Limits
* Series Solutions of Differential Equations
 | METHODS IN CALCULUS **(Further Pure)*** Leibnitz’s Theorem and th Derivatives
* L’Hospital’s Rule
* The Weierstrass Substitution

REDUCIBLE DIFFERENTIAL EQUATIONS **(Further Pure)*** First-Order Differential Equations
* Second-Order Differential Equations
* Modelling with Differential Equations
 | EXAM REVISION |
| Skills | FORMULA BOOK: Maclaurin series | CALCULATOR: Integration buttonFORMULA BOOK: Integrating inverse trig functions | CALCULATOR: Option button to access hyperbolic functionsFORMULA BOOK: Integrating hyperbolic functions |  |  |  |
| Covid recovery | Consideration given for any student isolating to catch up. |