ALDERBROOK SCHOOL

Mathematics

Curriculum Design

Years 7 to 11

2027

KEY STAGE 3 · KEY STAGE 4

IN THIS BOOKLET

Contents

01 Introduction 3

02 The Learning Journey in Pictures 5

03 Homework at Key Stage 3: Sparx Maths 7

04 Year 7 9

05 Year 7 Curriculum Sequence 11

06 Year 8 15

07 Year 8 Curriculum Sequence 17

08 Year 9 21

09 Year 9 Curriculum Sequence 23

10 Year 10 and the GCSE Programme 28

- 11 The Foundation Tier Programme 31
- 12 The Set 3 Programme 35
- 13 The Higher Tier Programme 40

14 The Year 11 Programme 44

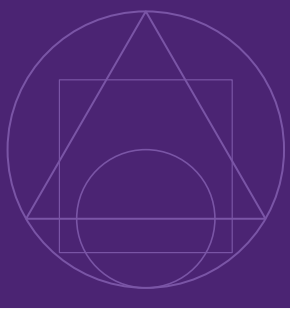
- 15 Year 11 Exam Sheets 46
- 16 Year 11 Further Support Strategies 47
- 17 Further Qualifications 49

18 The Maths Challenges 50

19 Our use of AI in Mathematics 52

WELCOME

Introduction



Having worked at Alderbrook School for nearly two decades, I have witnessed an inordinate number of changes to the National Curriculum and to the nature of examinations. There have been comprehensive changes to the way in which students are assessed. Notably, Key Stage 3 levels were abolished in 2014, which meant the onus was placed on schools to find innovative ways to track the relative progress of students. In 2017, GCSE Mathematics was completely overhauled; there was a 50% increase in subject content, which brought subsequent changes to exam structures and constraints. Inevitably, changes to A-level examinations and courses followed suit.

These continual changes have necessitated a continual focus on curriculum evolution. In Maths, we have worked ceaselessly to ensure our curriculum is both broad and challenging. No curriculum will ever be perfect, but curriculum designs should aim to cater for the needs of students. At Alderbrook, integral to our identity as a school community is the fact that our student body is incredibly diverse in every respect. Catering for the myriad needs and requirements of our student body will always remain a key focus for us in Maths. Whilst perhaps somewhat of an impossible task, we do believe our curriculum design is, at the very least, a 'best-fit' model at this moment in time. Student results over the past decade have been consistently and significantly above the national average; we attribute this success to numerous factors, but a sensible and coherent curriculum design certainly helps.

The aim of this booklet is to display our curriculum design as simply as possible, for each year group from Years 7 to 11. We will offer contextual insight into each year group, the key points of focus and how we aim to consolidate learning over time, rather than trying to convey the illusion that learning goals are conveniently achieved by all students at perfectly-timed intervals. This is not how learning takes place, as we have come to understand through years of our own research. It fills us with pride to witness our students progress over the course of five years, sporadically and chaotically, but inevitably. Through continual support, we aim to inspire the best outcomes for all of our students, whether that be a Grade 9 and further mathematical qualifications, or an Entry Level Certificate for students who find accessing the curriculum extremely difficult. Our curriculum design serves as guidance only. Teachers operate at their discretion and may deem certain curriculum areas too difficult or too simplistic for their intended audience. In either instance, the aim will be to address each particular curriculum aspect as comprehensively as possible, which may include extensive insight and further tasks for the most able. This booklet also contains information on the Maths Challenges that we offer to a variety of students, as well as the surge in Artificial Intelligence, how we make best use of it and advice for students in this regard also.

The last three years in particular have seen almost every single student achieve their best possible outcome at Key Stage 4. This is achieved through a serious, collective effort on the part of staff and students. Our endeavours are community-based and we are proud of our students. We aim to convey

Introduction *(continued)*

this sense of pride and give students a reason to want to succeed in a core subject that remains crucial to their future prospects.

With education in such a difficult place nationally at this moment in time, it fills me with pride to work as part of a team of fully-qualified Maths practitioners, who give their all for the betterment of the education of our young people.

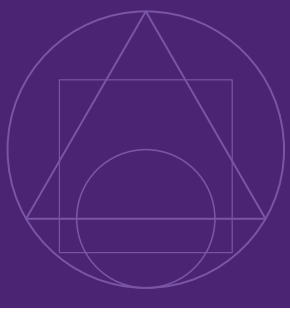
We appreciate the time taken to read any aspect of this document, and hope that our curriculum design is explained in a manner that is understandable and heartening.

My very best wishes,

Mr Cox

YEARS 7 TO 11

The Learning Journey in Pictures



For many years, we have been refining our curriculum model repeatedly, to cater for changes to the National Curriculum as well as to examinations. The learning journey was designed with all five years in mind, spanning both Key Stages 3 and 4.

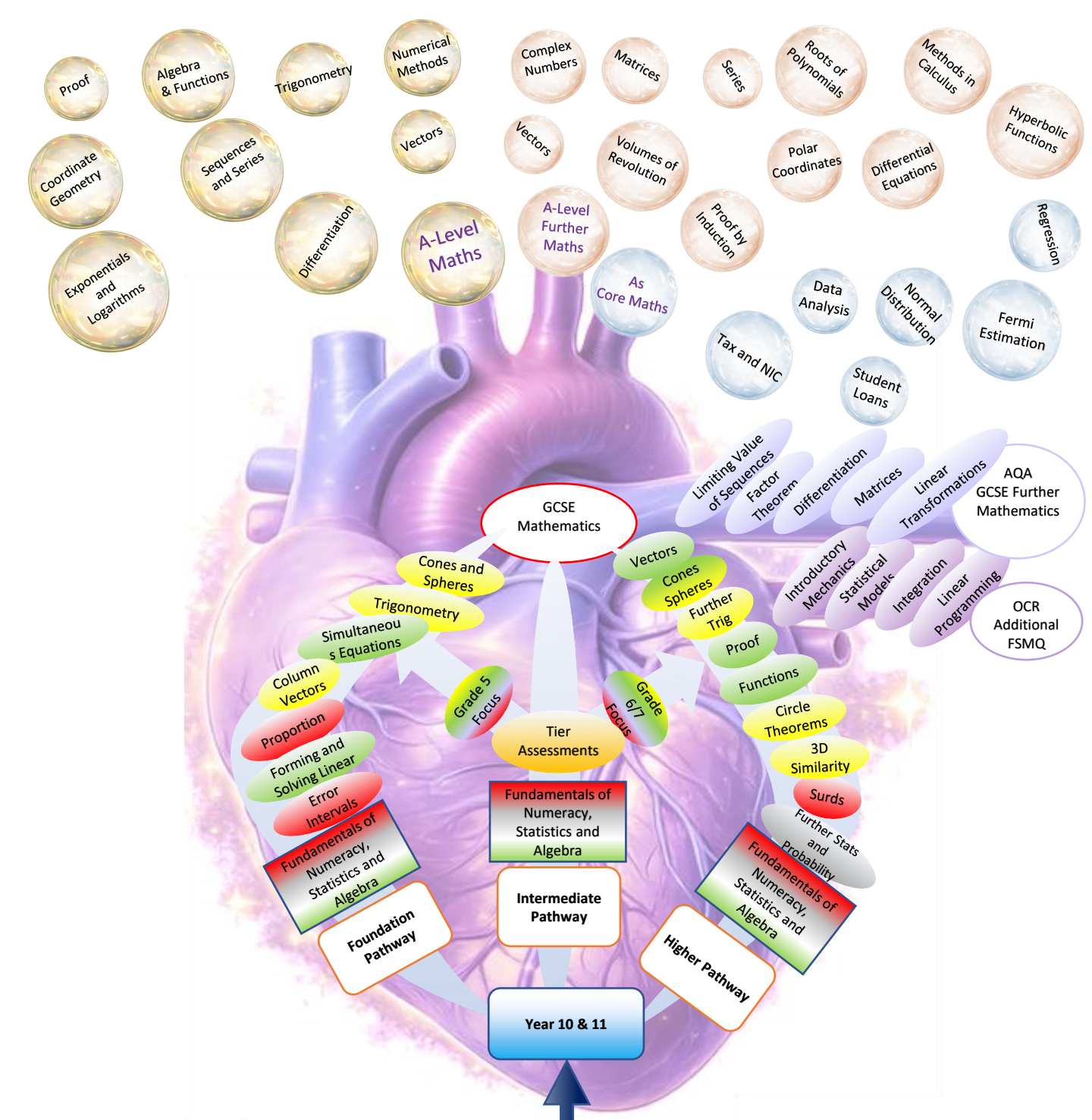
Overleaf is Mr Cox's somewhat overzealous depiction of the five-year journey, which can be seen in Maths classrooms along the corridors. Topics may seem to appear arbitrarily, but the purpose of the diagram is to show when key topics are introduced. For detailed information on exactly what is taught in each year, please see the curriculum sequence for each year group.

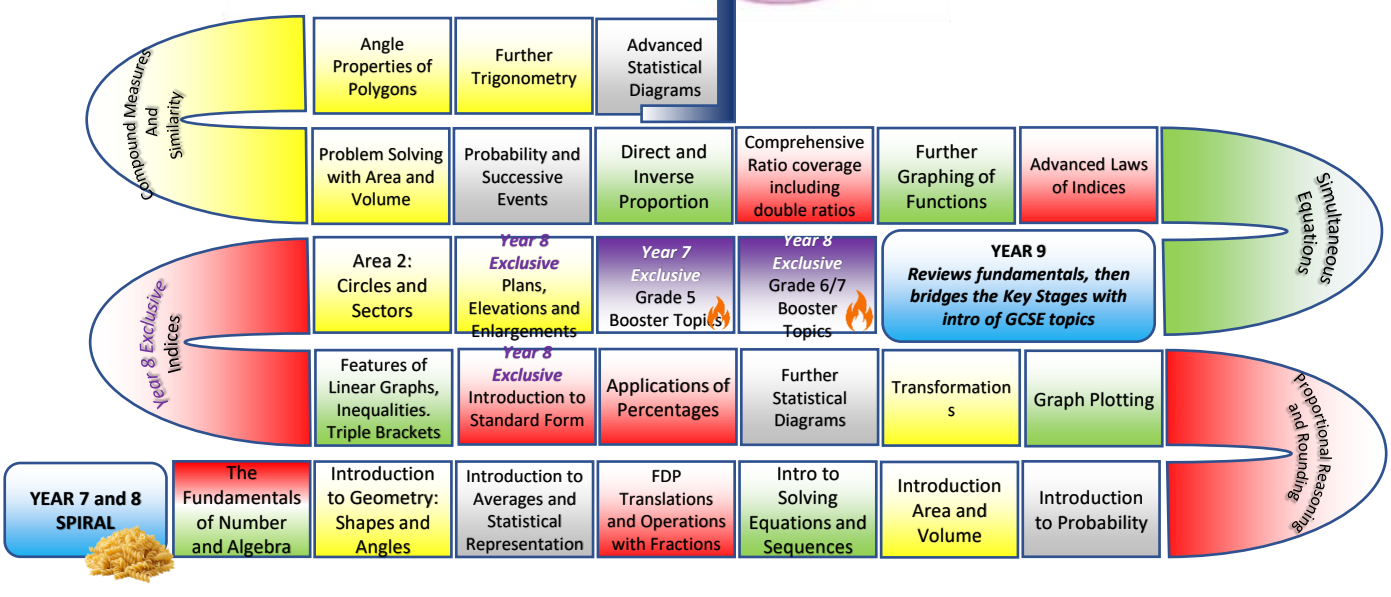
You may notice an array of 'bubbles' at the top of the diagram; the associated topics are those of the A-level Maths, Further Maths and Core Maths curricula, which are post-16 offers. Learning sequences for these qualifications are not detailed in this booklet.

The diagram begins by demonstrating the key areas addressed in Years 7 and 8; the relevant curricula are 'spiralised' (see the relevant sections for further details).

The topics then advance into what has been deemed the 'heart-centre': our GCSE curricula. You will notice three pathways; please read the GCSE sections for further information. The 'stents' stemming out to the right detail some of the key topics addressed in the further qualifications offered to some students in Year 11.

Whilst perhaps unconventional, the diagram reflects our light-hearted and spirited departmental philosophy on mathematical education. To this end, whilst it is not always possible, we do try to make lessons as engaging, enjoyable and motivational as possible.


Proof
Algebra & Functions
Trigonometry
Numerical Methods
Complex Numbers
Matrices
Series
Roots of Polynomials
Methods in Calculus
Hyperbolic Functions
Coordinate Geometry
Sequences and Series
Vectors
Vectors
Volumes of Revolution
Polar Coordinates
Differential Equations
Regression
Exponentials and Logarithms
Differentiation
A-Level Maths
A-Level Further Maths
Proof by Induction
As Core Maths
Data Analysis
Normal Distribution
Fermi Estimation
Tax and NIC
Student Loans
GCSE Mathematics
Limiting Value of Sequences
Factor Theorem
Differentiation
Matrices
Linear Transformations
AQA GCSE Further Mathematics
Cones and Spheres
Trigonometry
Simultaneous Equations
Vectors
Cones Spheres
Further Trig
Proof
Functions
Introductory Mechanics
Statistical Models
Integration
Linear Programming
OCR Additional FSMQ
Column Vectors
Proportion
Forming and Solving Linear
Error Intervals
Grade 5 Focus
Grade 6/7 Focus
Tier Assessments
Circle Theorems
3D Similarity
Surds
Further Stats and Probability
Fundamentals of Numeracy, Statistics and Algebra
Fundamentals of Numeracy, Statistics and Algebra
Fundamentals of Numeracy, Statistics and Algebra
Foundation Pathway
Intermediate Pathway
Higher Pathway
Year 10 & 11


Compound Measures And Similarity
Angle Properties of Polygons
Further Trigonometry
Advanced Statistical Diagrams
Problem Solving with Area and Volume
Probability and Successive Events
Direct and Inverse Proportion
Comprehensive Ratio coverage including double ratios
Further Graphing of Functions
Advanced Laws of Indices
Simultaneous Equations
Year 8 Exclusive Indices
Area 2: Circles and Sectors
Year 8 Exclusive Plans, Elevations and Enlargements
Year 7 Exclusive Grade 5 Booster Topics
Year 8 Exclusive Grade 6/7 Booster Topics
YEAR 9
Reviews fundamentals, then bridges the Key Stages with intro of GCSE topics
Features of Linear Graphs, Inequalities. Triple Brackets
Year 8 Exclusive Introduction to Standard Form
Applications of Percentages
Further Statistical Diagrams
Transformations
Graph Plotting
Proportional Reasoning and Rounding
YEAR 7 and 8 SPIRAL
The Fundamentals of Number and Algebra
Introduction to Geometry: Shapes and Angles
Introduction to Averages and Statistical Representation
FDP Translations and Operations with Fractions
Intro to Solving Equations and Sequences
Introduction Area and Volume
Introduction to Probability

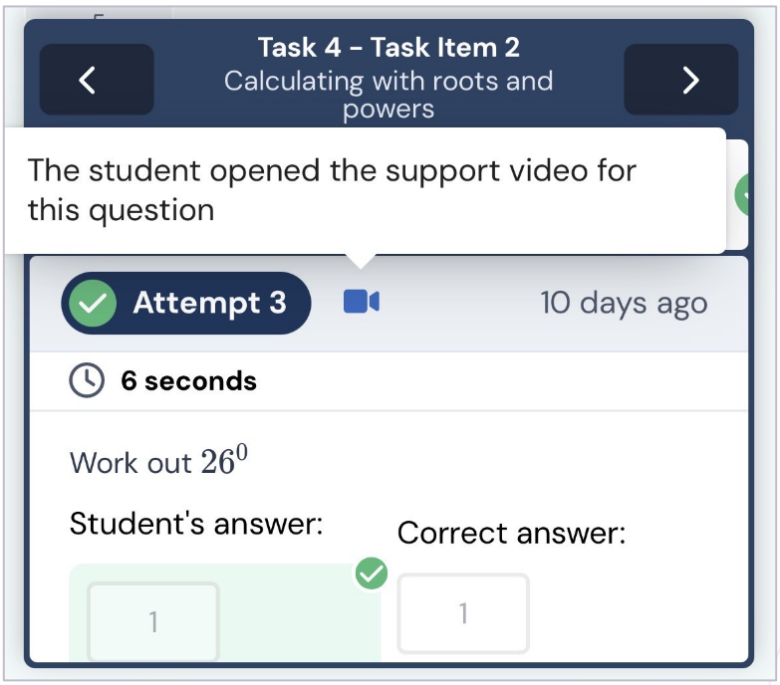
HOME LEARNING

Homework at Key Stage 3: Sparx Maths

The SPARX MATHS online learning platform to which we subscribe is employed exclusively at Key Stage 3. Overseen by Miss Murray, SPARX home learning tasks have been designed to sync with our curriculum learning sequences. Hence, homework tasks reflect what students have been taught in lessons. In some instances, assignments may simply mirror previous studies on certain selected fundamentals; teachers can delete set tasks if they do not cater for the pace and/or specific learning needs of the group.

As the homework tasks are completed online, students can obtain instant feedback on whether they were successful in answering each question, affording students instantaneous feedback as to their own progress. If students are repeatedly getting certain questions wrong, SPARX will recommend a relevant video to aid understanding. In this respect, students are constantly re-exposed to weak areas with a view to consolidating understanding.

For teachers, SPARX offers continual updates on how students are doing. We can see how students have fared with various tasks and percentage rates of completion and accuracy. We can also see how long students spent completing assigned tasks, and when students have watched video clips to aid understanding. An example is shown below:



Homework at Key Stage 3: Sparx Maths *(continued)*

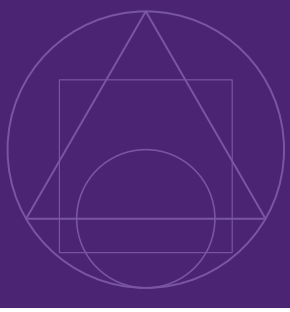
The fantastic individualised feedback from SPARX has proven very useful in terms of future planning.

In addition to homework tasks, SPARX also affords students additional practice for revision purposes, as well as presenting further questions based on weak areas. Again, teachers can see when students have accessed additional materials.

We believe SPARX really is an excellent online learning tool, which is why so many schools nationally are choosing to subscribe. Whilst continual refinements are necessary owing to the individual requirements of groups, the cycle of tasks, feedback and further materials has certainly made home learning more objective.

KEY STAGE 3

Year 7



When students come to us in Year 7, we aim to set them in Maths as soon as possible. Our internal assessments have been honed over many years to ensure that the data we use in setting students is as accurate as possible. Students also sit CAT tests (Cognitive Abilities Tests) over the course of one week during Maths lessons. CAT tests do not examine curriculum knowledge; they are more concerned with the logical reasoning abilities of students. When deciding upon sets, we use a combination of our internal assessment scores and the data we receive from primary schools. CAT scores can also provide additional information, particularly on the rare occasions when there are discrepancies.

We set students early because we find it enables a more successful learning experience: when students work in groups of similar ability, learning sequences are easier to design and can be better tailored to a narrower ability range. One thing we are keen to stress is that sets are not fixed. In fact, student progress over the course of five years can be extremely variable, and it is not uncommon for students to switch groups, although set moves are by no means a permanent fixture; groupings are regularly reviewed with a view to ensuring all students are learning at a pace suitable to them. It is predominantly Assessment Points that are used, over time, to ascertain whether or not it is advisable to move students across groups. Assessments have been refined year on year to ensure accurate data. However, we appreciate that assessments in and of themselves are merely a measure of momentary performance, and that these scores do not always reflect the extent of progress that students might have made. Hence, teacher input is also important. Most important of all is to observe each student's learning journey over time.

We would advise that students do not become disheartened by poor performances and, equally, do not get carried away with relatively strong individual performances. Our curriculum design is predicated on the aim of maximising outcomes over a five-year period, not by the end of Key Stage 3 nor by any specific year in particular.

It is important to note that, when designing and refining our Year 7 curriculum structure, we have had to account for a very wide range of abilities and needs. Furthermore, there is consistently a disparity in what students know prior to arriving, which seems to be informed by the primary schools they have attended. This is not actually problematic, because we have ensured that our Year 7 curriculum addresses many of the crucial, fundamental aspects of the National Curriculum. Aside from fundamentals in Numeracy and Algebra, we expose students early to Statistics, giving them insight into statistical diagrams and relevant inferences. We also expose students to various aspects of Shape and Space, affording them the opportunity to strengthen their geometrical reasoning and spatial awareness, which are not always commensurate with their abilities in Numeracy and Algebra.

Year 7 *(continued)*

Students are assessed three times in Year 7. The assessments make use of old, SATs-style questions (SATs were the assessments that used to establish Key Stage 3 levels – see the Introduction). We make partial use of these questions because they examine students' abilities to problem-solve and deconstruct questions prior to applying methodologies. This ability has become increasingly important at GCSE level following the overhaul in 2017 (see the Introduction).

The Year 7 curriculum begins with fundamentals of Numeracy and Algebra that some students may have seen in primary school. The early subsections serve as a good starting point from which students can progress. For our most able students, the eventual aim of Year 7 could perhaps best be summarised as being able to contend with many aspects of the Foundation Tier GCSE curriculum, which extends to Grade 5 (see the Year 10 section for further insight). There may be students who require even further extension, which is always possible owing to the hierarchical nature of Maths.

YEAR 7

Year 7 Curriculum Sequence



Prior to setting in Year 7, students complete a series of lessons in mixed-ability groups. These lessons serve as a light introduction to the subject and address some of the fundamentals that are crucial to advancement, such as the Chinese Method of Multiplication, which remains our preferred method owing to its ease of implementation. Many tasks are reliant on times tables, which students would be strongly advised to consolidate if they are not secure on arrival from primary school.

The curriculum is split into subsections drawn from each of the overarching strands of the curriculum, shown below. We aim to expose students to these strands intermittently, at spaced intervals, which helps with retention and recall.

N Number, Ratio and Proportion (N)

D Statistics and Data (D)

A Algebra and Functions (A)

G Shape, Space, Measures and Geometry (G)

Numeracy 1

- Place Value
- Number: Writing words in figures
- Number: Writing figures in words
- Addition: column method with integers
- Decimals: addition
- Subtraction: column method with integers
- Decimals: subtraction
- Multiplication: times tables
- Decimals: ordering
- Rounding: to whole numbers
- Rounding: to nearest 10
- Rounding: to nearest 100
- Multiplication: grid method (Chinese/lattice)
- Decimals: multiplying (Chinese/lattice)
- Divisibility Laws (lesson available)
- Division: short division (Bus stop divisor less than 10, integer and decimal answers)
- Negatives: addition/subtraction
- Negatives: multiplication
- Negatives: division
- Negatives: ordering
- Negatives: real life
- Division by 10, 100, 1000
- Division by powers of 10
- Multiplication: by 10, 100 etc
- Multiplication: powers of 10
- Number: square numbers

Numeracy 1 (continued)

- Number: square root
- Number: BIDMAS (order of operations)
- Fractions: equivalent
- Fractions: ordering
- Fractions: simplifying
- Fractions: improper to mixed number
- Fractions: mixed number to improper

Algebra 1

- Algebraic Substitution and the language of mathematics
- Linear graphs: substitution (xy table)
- Sequences: describing rules
- Sequences: missing terms
- Function Machines
- Algebra: Like terms and collecting
- Algebra: multiplying terms
- Algebra: dividing terms
- Indices: laws of multiply and divide powers
- Algebra: expanding single brackets
- Equations: solving unknown on one side
- Inequalities: meaning of
- Inequalities on a number line
- Coordinate systems

Year 7 Curriculum Sequence *(continued)*

Geometry 1

- 2D shapes: names
- 2D shapes: quadrilaterals
- 3D shapes: names
- 3D shapes: vertices, edges, faces
- Perimeter
- Perimeter: on a grid
- Angles: types of
- Angles: drawing
- Angles: estimation
- Angles: measuring
- Measuring Lines
- Angles: quadrilaterals
- Angles: right angle
- Angles: straight line
- Angles: triangle
- Symmetry: line

Statistics and Data 1

- Tally charts
- Reading Tables
- Tables: timetables
- Tables: distance charts
- Graphs: bar charts (reading)
- Graphs: pictograms (draw)
- Graphs: pictograms (interpret)
- Averages: mean
- Averages: median
- Averages: mode
- Averages: range
- Graphs: stem and leaf (draw)
- Graphs: stem and leaf (interpret)

Number 2

- Number: factors
- Number: multiples
- Number: common multiples/LCM
- Number: common factors/HCF
- Fractions: of shapes
- Fractions: fraction of an amount
- Fractions: addition and subtraction same denominator
- Fractions: addition and subtraction diff denominators
- Fractions: division

Number 2 (continued)

- Fractions: multiplication
- Percentages: of an amount (non-calc)
- Percentages: increasing/decreasing
- Number: prime numbers
- Number: product of primes
- Rounding: to decimal places
- FDP: percentages to decimals
- FDP: percentages to fractions
- FDP: decimals to fractions
- FDP: decimals to fractions (calc)
- FDP: decimals to percentages
- FDP: fractions to percentages
- FDP: fractions to decimals
- FDP: fractions to decimals (calc)
- FDP: key equivalents
- FDP: mixture
- FDP: ordering

Algebra 2

- Factorisation single bracket
- Algebra: expanding two brackets
- Equations: letters both sides
- Equations: involving fractions
- Inequalities: solving (one sign)
- Sequences: nth term

Geometry 2

- Area: on a grid
- Area: rectangle
- Area: triangle
- Area: parallelogram
- Area: L-shape
- Area: compound shapes
- Volume: cube/cuboid
- Volume: prism

Statistics and Data 2

- Probability: scale
- Probability: basic
- Probability: not happening
- Experimental Probability
- Probability: listing outcomes

Year 7 Curriculum Sequence *(continued)*

Statistics and Data 2 (continued)

- Probability: sample space
- Probability: relative frequency

Number 3

- Ratio: simplifying
- Ratio: express as fractions or %
- Ratio: sharing the total
- Proportion: unitary method
- Number: best buys
- Rounding: significant figures
- Number: estimation

Algebra 3

- Plotting Straight Line Graphs
- Simultaneous equations (elimination, both with + signs)

Geometry 3

- Translations: vector
- Translations: describing
- Reflections
- Reflections: describing
- Reflections: finding mirror line
- Rotations

Statistics and Data 3

- Tables: two-way tables
- Graphs: scatter graphs (draw and correlation)
- Frequency Trees
- Venn Diagrams (sorting)

Number 4

- Percentages: expressing as
- Percentages: multipliers
- Percentages: of an amount (calc)
- Percentages: compound interest
- Percentages: reverse Percentages

Algebra 4

- Linear graphs: gradient of a line
- Linear graphs: y=mx+c
- Linear graphs: find equation of a line
- Factorisation: quadratics
- Quadratics: solving (by factorising)
- Inequalities: solving (two signs)
- Expanding three brackets
- Algebra: changing the subject

Geometry 4

- Circles: parts
- Circumference of a Circle
- Area of a Circle
- Area of a sector
- Arc length of a sector (and maybe perimeter)
- Surface area of cuboids
- Enlargements – positive and positive fractional

Statistics and Data 4

- Draw and interpret pie charts

Year 7 Curriculum Sequence *(continued)*

Number 5 EXTENSION

- Ratio: Double Ratios (forming a triple ratio)
- Standard form: Conversions from ordinary numbers to standard form and vice versa
- Standard form: Multiply and Divide numbers in standard form
- Standard form: Addition and Subtraction of numbers in standard form
- Laws of indices: Raising terms to a power
- Laws of indices: Negative powers (not fractional)
- Surds (i) - Breaking down surds
- Surds (ii) - Multiplying and dividing surds
- Surds (iii) - Adding and subtracting surds

Algebra 5 EXTENSION

- Gradient between two points
- Plotting Quadratic Graphs
- Adding and Subtracting Algebraic Fractions

Geometry 5 EXTENSION

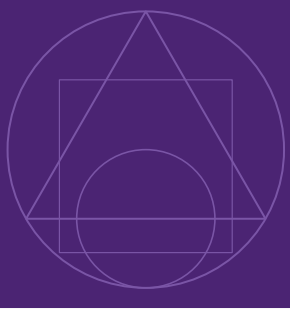
- Plans and Elevations
- Similar shapes (length)
- Similar shapes (area)
- Pythagoras' Theorem

Statistics and Data 5 EXTENSION

- Mean From Frequency Tables

KEY STAGE 3

Year 8



In Year 8, students can expect to revisit most of the aspects studied in Year 7, at similarly spaced intervals. As is commonly known, a 'spiralised curriculum' gives students further exposure, which is essentially what strengthens memory of the concepts taught. The equal spacing means that no concept is left unaddressed for too long.

Over recent years, the spiral format of re-exposure has proven highly effective, as students are presenting with more secure fundamentals on entry into Years 9 and 10. This is massively advantageous, since students can begin utilising this fundamental knowledge to access more advanced concepts. If it is very evident that a group has a firm grasp of concepts previously taught, teachers may, at their discretion, choose to omit entire lessons devoted to rehearsing these ideas.

As previously mentioned, it is not expected that, even after repeated exposure, students will have a secure working knowledge of every concept taught. The aim of re-exposure, above all else, is to provide greater confidence with concepts in subsequent years, owing to familiarity. It is worth noting that re-exposure is not only apparent through the cyclic nature of the curriculum design; we also make great use of review exercises at the beginning of lessons (also known as 'Starters' or 'Do it Now' activities). Review exercises give students the opportunity to review concepts multiple times in a concentrated period (there is more information on our review exercises in the Year 11 section).

Year 8 begins by addressing the fundamentals of Numeracy and Algebra once again, before students are introduced to applications of Geometry and Statistics. Whilst the modules are structured in an almost identical fashion, the content within each module is not necessarily identical. Concepts that are revisited identically are of particular importance. Of course, certain sections might feature additional content that is connected to that taught in Year 7 and, as always, teachers may explore concepts further at their discretion.

The additional concepts at the end of the curriculum are slightly more advanced than in Year 7. Teachers generally address these concepts once all of the predominant content has been delivered.

Assessment structures are very similar, although students can expect questions to be slightly more advanced than in Year 7. The purpose of our assessment structures, from Year 7 through to Year 11, is to grant students an increasing degree of exposure to problem-solving questions. By the time students reach Year 10, the necessity to be confident attempting such questions quickly becomes apparent. As in Year 7, there will be three assessments: two of which generally fall within our official Assessment Point windows, and one at a time confirmed during the year. Students are always given notice, and the topics taught are generally shared by staff via Class Charts to help students with their preparations.

Year 8 *(continued)*

By the end of Year 8, at the very least, students will have gained exposure to enough material to begin working with GCSE concepts in Year 9, which is, by design, an intermediary year that bridges the gap between the Key Stages.

Overleaf, our Year 8 curriculum is detailed in the same fashion as Year 7.

YEAR 8

Year 8 Curriculum Sequence



N Number, Ratio and Proportion (N)

D Statistics and Data (D)

A Algebra and Functions (A)

G Shape, Space, Measures and Geometry (G)

Numeracy 1

- Addition: column method
- Subtraction
- Number: Writing words in figures
- Number: Writing figures in words
- Decimals: addition
- Decimals: subtraction
- Multiplication: times tables
- Decimals: ordering
- Rounding: to whole numbers
- Rounding: to nearest 10
- Rounding: to nearest 100
- Multiplication: grid method (Chinese/lattice)
- Decimals: multiplying (Chinese)
- Divisibility Laws (Lesson Available)
- Division: short division (Bus stop divisor less than 10)
- Decimals: dividing decimals by integers
- Negatives: addition/subtraction
- Negatives: multiplication
- Negatives: division
- Negatives: ordering
- Negatives: using negative numbers in real life scenarios
- Division by 10, 100, 1000
- Division by powers of 10
- Multiplication: by 10, 100 etc
- Multiplication: powers of 10
- Number: square numbers
- Number: square root
- Number: cube numbers
- Number: cube root
- Number: BIDMAS (order of operations)
- Fractions: equivalent
- Fractions: ordering
- Fractions: simplifying
- Ratio: simplifying
- Ratio: express as fractions or %
- Ratio: sharing the total

Numeracy 1 (continued)

- Proportion: unitary method

Algebra 1

- Algebra: expressions – forming
- Algebra: collecting like terms
- Algebra: multiplying terms
- Algebra: expanding single brackets
- Algebra: dividing terms
- Algebra: substitution
- Function Machines
- Equations: solving
- Algebra: changing the subject (inverting one and two-steps)
- Inequalities
- Inequalities on a number line
- Substituting into coordinate tables
- Sequences: describing term-to-term rules
- Sequences: missing terms
- Sequences: Fibonacci
- Indices: laws of

Geometry 1

- 2D shapes: names
- 2D shapes: quadrilaterals
- 3D shapes: names
- 3D shapes: vertices, edges, faces
- 3D shapes: nets
- Perimeter
- Perimeter: on a grid
- Angles: types of
- Angles: drawing
- Angles: estimation
- Angles: measuring
- Measuring Lines

Year 8 Curriculum Sequence *(continued)*

Geometry 1 (continued)

- Angles: right angle
- Angles: straight line
- Angles: triangle
- Angles: quadrilaterals
- Coordinates
- Coordinates: shapes on a grid
- Symmetry: line
- Symmetry: rotational

Statistics and Data 1

- Types of data: Qualitative/Quantitative
- Types of data: discrete & continuous
- Types of data: primary & secondary
- Tally charts
- Graphs: bar charts (reading)
- Reading Tables
- Tables: timetables
- Tables: distance charts
- Graphs: pictograms (draw)
- Graphs: pictograms (interpret)
- Averages: mean
- Averages: median
- Averages: mode
- Averages: range
- Graphs: line graphs
- Graphs: stem and leaf (interpret)
- Graphs: stem and leaf (draw)

Numeracy 2

- Number: factors
- Number: multiples
- Number: common multiples/LCM
- Number: common factors/HCF
- Fractions: of shapes
- Fractions: fraction of an amount
- Division: short division (Bus stop divisor > 10)
- Fractions: improper to mixed number
- Fractions: mixed number to improper
- Fractions: addition same denominator
- Fractions: addition diff denominators
- Fractions: division
- Fractions: multiplication
- Percentages: of an amount (non-calc)

Numeracy 2 (continued)

- Percentages: increasing/decreasing
- Number: prime numbers
- Number: product of primes
- Decimals: division by decimals
- Division: remainders (decimal answers)
- Rounding: to decimal places
- FDP: percentages to decimals
- FDP: percentages to fractions
- FDP: decimals to fractions
- FDP: decimals to fractions (calc)
- FDP: decimals to percentages
- FDP: fractions to percentages
- FDP: fractions to decimals
- FDP: fractions to decimals (calc)
- FDP: key equivalents
- FDP: mixture

Algebra 2

- Algebra: expanding two brackets
- Factorisation
- Equations: involving fractions
- Equations: solving (involving brackets)
- Equations: letters both sides
- Inequalities: solving (one sign)
- Plotting Straight Graphs
- Sequences: nth term
- Sequences: patterns

Geometry 2

- Area: on a grid
- Area: rectangle
- Area: triangle
- Area: parallelogram
- Area: trapezium
- Area: L-shape
- Area: compound shapes
- Circles: parts
- Circles: circumference
- Circles: area
- Surface area: cuboid
- Volume: cube/cuboid
- Volume: prism

Year 8 Curriculum Sequence *(continued)*

Statistics and Data 2

- Probability: scale
- Probability: basic
- Probability: not happening
- Experimental Probability
- Probability: listing outcomes
- Probability: sample space
- Probability: relative frequency

Numeracy 3

- Proportion: recipes
- Ratio: given one value
- Ratio: expressing as 1:n
- Number: best buys
- Number: currency
- FDP: ordering
- Rounding: significant figures
- Number: estimation
- Number: product of primes (LCM/HCF)

Algebra 3

- Equations: cross multiplication
- Algebra: changing the subject 2
- Equations: angles and perimeter
- Linear graphs: (across one method)
- Linear graphs: gradient of a line
- Linear graphs: midpoint of a line
- Linear graphs: drawing using y=mx+c
- Quadratic graphs: drawing

Geometry 3

- Parallel lines
- Perpendicular lines
- Angles: parallel lines
- Translations: column vectors
- Translations: describing
- Reflections
- Reflections: describing
- Reflections: finding mirror line
- Rotations

Statistics and Data 3

- Tables: two-way tables
- Graphs: scatter graphs (draw and correlation)
- Frequency Trees
- Venn Diagrams (sorting)

Numeracy 4

- Percentages: expressing as
- Percentages: multipliers
- Percentages: of an amount (calc)
- Percentages: compound interest
- Percentages: reverse
- Ratio: double ratios
- Standard form
- Standard form: multiplication
- Standard form: division
- Standard form: addition and subtraction

Algebra 4

- Indices: fractional
- Equations: Fractional advanced
- Simultaneous equations (elimination)
- Linear graphs: gradient between points
- Linear graphs: y=mx+c
- Linear graphs: find equation of a line
- Linear graphs: parallel lines
- Factorisation: quadratics
- Factorisation: difference of 2 squares
- Quadratics: solving (factorising)
- Inequalities: solving (two signs)

Geometry 4

- Plans and elevations
- Enlargements – positive and positive fractional
- Similar shapes (just length)

Statistics and Data 4

- Draw and interpret pie charts

Year 8 Curriculum Sequence *(continued)*

Number 5 — EXTENSION

- Recurring Decimals To Fractions
- Unknown Rate of Interest
- Surds (i) - Breaking down surds
- Surds (ii) - Multiplying and dividing surds
- Surds (iii) - Adding and subtracting surds

Algebra 5 — EXTENSION

- Linear graphs: y=mx+c (perpendicular)
- Expanding Three binomials
- Negative and Fractional Indices
- Changing Bases of Indices
- Factorising Harder Quadratics
- Completing the Square
- Quadratic Formula
- Adding and Subtracting Algebraic Fractions
- Simplifying Algebraic Fractions by factorising
- Quadratic nth Term
- Changing the Subject Factorising

Geometry 5 — EXTENSION

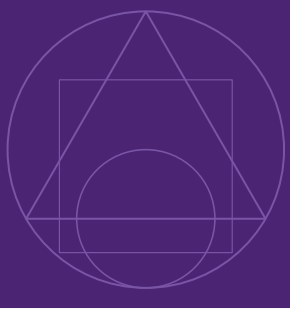
- Pythagoras' Theorem
- Interior + Exterior Angles
- Similar shapes (area and volume)
- Sectors (arc length and area)
- SDT

Statistics and Data 5 — EXTENSION

- Mean From Tables (frequency and grouped)
- Probability tree diagrams

BRIDGING KEY STAGES 3 AND 4

Year 9



Our Year 9 curriculum was expertly designed by our Key Stage 4 Coordinator, Mr Palmer, who undertook many years of research into memory and the mechanisms which aid retention. Mr Palmer worked in conjunction with our Key Stage 3 Coordinator, Mr Munford, to establish a framework that would lead students coherently from Key Stage 3 to Key Stage 4. In this sense, we perceive Year 9 as an intermediary year.

You may notice that the subsections are larger; this design is with good intent. Having been exposed to small subsets of the curriculum in Years 7 and 8, students in Year 9 meet more topics grouped together. This allows students to observe the interconnectivity between topics, as well as making them more memorable. The Year 7 and 8 curricula build schemas (mental frameworks in the long-term memory) that are prerequisites for Year 9.

The grouping of these pre-existing schemas not only helps to reinforce and connect related subsections of the curriculum, but the design also replicates that of Year 10. Unsurprisingly, over recent years, our students have, generally speaking, arrived in Year 10 with a more concrete base of fundamentals than in years gone by. We attribute this, in part, to our curriculum design.

Of course, we introduce new topics in Year 9, but we also make sure that content is delivered in a hierarchical fashion. Whilst tiers of entry (discussed further in the Year 10 section) are nowhere near established, we have designed the curriculum with an appreciation that students will eventually begin Year 10 on different pathways. However, because transitions across pathways remain a possibility, our curriculum design in Year 9 has been carefully planned.

The curriculum begins with another review of the fundamentals of Numeracy and Algebra. The content is predominantly aimed at Grades 4 and 5. Such content would be deemed ‘cross-over’ content at GCSE level, since these grades are accessible at both tiers. Some new Grade 5 topics are introduced, such as Direct Proportion at the end of the Ratio and Proportion section. To this end, a subsection dealing specifically with these areas is sensible, given that proportional reasoning constitutes 20–25% of the GCSE curriculum.

Following on from this subsection, there is a chance for students to revisit some basic Statistics and Probability, followed by a substantial subsection on Geometry. It must be noted that students do tend to find geometrical reasoning somewhat difficult, and GCSE exam questions (at both tiers) related to this aspect of the curriculum have proven particularly difficult since 2017.

At this point, there is a series of ‘Advanced’ sections. These sections contain content ranging from Grades 5 through to 7. As with previous years, delivery of the more advanced concepts is at the

Year 9 *(continued)*

discretion of teachers. Similarly, teachers may choose to omit some of the earlier, more simplistic content when teaching more able groups.

Year 9 has proven to be an excellent gateway to Year 10. Students are assessed three times over the course of the year. As always, assessment scores do inform groupings, but it must be stated that tiers of entry and groupings are not finalised by the end of Year 9 (see the Year 10 section for comprehensive insight to this end).

Please see overleaf for a comprehensive outline of the Year 9 learning sequence.

YEAR 9

Year 9 Curriculum Sequence

Fundamental Number

Basic number skills

- Place value and Expressing numbers in words
- Column addition and subtraction (including decimals)
- Ordering negative numbers
- Ordering decimal numbers
- Multiplying by 10,100 and 1000
- Dividing by 10,100 and 1000
- Long multiplication (up to 3 digits)
- Long multiplication including decimals
- Divisibility tests (including how you know if a number is divisible by 2,3,4,5)
- Long division of whole numbers (integer answers)
- Long division of whole numbers (decimal answers)
- Long division of decimal numbers (Fraction method)
- Basic powers and roots (Understanding how to square, cube, sq root, cube root basic numbers)
- Directed Numbers (+ - x ÷ Negative numbers)
- BIDMAS (including negative numbers)
- Use of calculator

Rounding

- Rounding to whole numbers
- Rounding to decimal places
- Rounding to significant figures
- Estimation

Factors and multiples

- Finding multiples and factors of numbers (up to 2 digits)
- Simple HCF (listing or CAKE)
- Simple LCM (listing or CAKE)
- Finding prime numbers up to 100
- Prime factorisation (30 = 5 x 3 x 2)
- Highest common factor and lowest common multiple of large numbers using prime factorisation and Venn diagrams

Fractions

- Finding equivalent fractions (including ordering)
- Simplifying fractions (including finding HCF to simplify complex fractions)
- Converting between mixed number fractions and improper fractions
- Multiplying fractions (including cross cancelling)

Fundamental Number (continued)

- Dividing fractions (using KCF)
- Adding and Subtracting Fractions
- Finding fractions of numbers
- Converting Percentages into decimals (and vice versa)
- Converting Fractions into decimals (and vice versa)
- Converting a fraction into a percentage (and vice versa)
- Order fractions, decimals and percentages

Percentages

- Finding percentage of numbers
- Percentage increase (without calculator)
- Percentage decrease (without calculator)
- Percentage change (with calculator)
- Finding magic multipliers (including finding percentages of numbers, increasing and decreasing)
- Finding simple interest using multipliers
- Finding compound interest using multipliers
- Finding compound depreciation using multipliers
- Finding reverse percentages using multipliers
- Finding reverse percentages without a calculator
- Finding the unknown rate of interest

Fundamental Algebra

Fundamental algebraic skills

- Language of maths (writing expressions, knowing the difference between expressions, terms, equations)
- Substitution
- Collecting like terms
- Multiplying and dividing terms (including powers)
- Expanding single brackets
- Expanding single brackets and simplifying
- Factorising into single brackets
- Expanding double brackets
- Expanding Triple Brackets
- Changing The Subject No Powers
- Changing The Subject With Powers
- Changing The Subject With Factorising

Solving linear equations + quadratics

- Solving simple linear equations (one or two inversions)

Year 9 Curriculum Sequence *(continued)*

Fundamental Algebra (continued)

- Solving simple linear equations with brackets
- Solving linear equations with multiple inversions (can involve fractions for example)
- Solving linear equations with variables on both sides
- Solving linear equations with variables, brackets and fractions on both sides
- Factorising simpler quadratics with positive coefficients only (could review FOIL first)
- Factorising simpler quadratics involving negative coefficients
- Solving quadratics by factorisation
- Solving quadratics using formula
- Converting recurring decimals to fractions

Basic Sequences

- Completing basic sequences (including fibonacci)
- Finding terms within a sequence (if 5n + 3, find 50th term)
- Generating sequence from the nth term
- Finding the nth term from a linear sequence
- Finding whether a term does/or doesn't exist in a sequence
- Quadratic sequences

Simultaneous Linear Equations

- Solving simultaneous equations where a pair of coefficients match completely
- Simultaneous equations where one equation requires scaling
- Simultaneous equations where both equations require scaling
- Worded Simultaneous Equations

Inequalities

- Inequalities on number lines
- Solve basic inequalities (1 step, 2 step, compound + represent on number line)

Laws of indices

- Multiplying and dividing powers
- Raising a power to a power
- Fractional powers
- Negative powers
- Mixture of all the laws of indices
- Converting numbers into standard form
- Converting standard form into numbers
- Correcting into standard form (i.e. 350×10^4 in standard form)

Fundamental Algebra (continued)

- Multiplying and dividing standard form
- Adding and subtracting numbers in standard form
- Calculator questions using standard form

Graphical work

- Plot co-ordinates on a graph
- Plot linear graphs
- Plot quadratic graphs
- Plot cubic graphs
- Plotting exponentials and reciprocals
- Finding the mid-point of a line (2 co-ordinates)
- Identify the equation of a line in the form y = mx + c (including finding gradient from a given line)
- Calculate the gradient from 2 points (change in y/change in x)
- Identify the equation of a straight line from 2 points
- Identify the equation of parallel lines
- Identify the equation of perpendicular lines

Ratio and Proportion

Ratio

- Representing ratios (including converting ratio into Fractions or %'s)
- Simplifying ratios (including finding equivalent ratios)
- Simplifying ratios in the form 1:n (n can be a decimal)
- Sharing an amount into a given ratio (i.e. share £20 in ratio 3:2)
- Sharing ratio problems where you are not given the total (one amount given)
- Sharing ratio problems where you are given the difference
- Double ratio problems
- Changing ratio problems (where one of the parts of ratio does not change)
- Expressing a ratio as an equation

Proportionality

- Finding the value of 1 (if 4 pens cost 80p, how much does 1 pen cost) and any number of items
- Exchange rate problems
- Recipe problems
- Best buy problems
- Work rates where you have 1 "worker"
- Direct Proportion
- Inverse proportion

Year 9 Curriculum Sequence *(continued)*

Basic Statistics & Averages

- Frequency trees
- Tally charts and frequency tables
- Bar charts (critiquing and reading)
- Types of data (Discrete, Continuous, Qualitative, Quantitative)
- MMMR from lists of data (not tables)
- Scatter diagrams
- Correlation
- Stem and leaf diagram (constructing)
- Stem and leaf diagram (Interpreting)
- Frequency Polygon
- Pie charts (constructing)
- Pie charts (frequency vs angle problems)

Probability

- Introduction to probability - great horse race
- The probability scale
- Probability Basics (basic events, outcomes, P=1, Rules OR and NOT = 1-P)
- Listing outcomes
- Sample Space Diagrams
- Combinatorics (product rule for counting)
- Probability of independent events
- Theoretical probability and expected number
- Relative frequency
- Probability from Tables
- Two-way tables (including conditional probability)
- Completing Independent Tree Diagrams
- GCSE Questions on Independent Tree Diagrams
- Completing Tree Diagrams involving dependent/conditional probability (branches only)
- Completing Tree Diagrams involving dependent/conditional probability (answering questions)
- Complex conditional probability (exc. Algebraic questions)

Geometry

Basic shape

- Naming shapes (including 2d and 3d shapes)
- Properties of shape (triangles, rectangles, irregular vs regular, edges, vertices etc., tessellation)
- Perimeter of any polygon
- Area of quadrilaterals (exc. Trapeziums)
- Area of triangles

Geometry (continued)

- Area of compound shapes
- Area of trapeziums
- Circumference of a circle (including perimeter of semi circles, answers in terms of pi)
- Area of a circle (including semi circles, answers in terms of pi)
- Area of sectors
- Perimeter of sectors
- Reverse area questions (including circles!)
- Questions involving shaded areas
- Volume of cubes and cuboids
- Volume of prisms (including cylinders)
- Surface of cuboids
- Surface of prisms (including cylinders)
- Reverse volume questions
- Volume/SA of spheres and hemispheres
- Volume of cones and pyramids

Shape & proportion

- Compound measures - SDT
- Compound measures - DMV (include PFA)
- Metric conversions (including squared/cubic units)
- Similarity of shapes - lengths (i.e. using scale factors)
- Similarity of shapes - area and volume (using scale factors)

Transformations

- Reflection (1 lesson, do & describe)
- Rotation (1 lesson, do & describe)
- Basic column vectors
- Translation (1 lesson, do & describe)
- Enlargement without CoE
- Enlargement with CoE
- Enlargement with negative CoE
- Describing Enlargements

Angles

- Measuring angles (including drawing & classifying angles)
- Angle facts (right angle, straight line, around a point))
- Angles in triangles (and isosceles triangles)
- Angles in quadrilaterals (and special quads - parallelograms, kites)
- Angles with parallel lines
- Interior and exterior angles of regular polygons
- Sum of interior angles in irregular polygons ([n-2]x180)

Year 9 Curriculum Sequence *(continued)*

Geometry (continued)

- Basic bearings (3 principles, exclude Trig/pyth)

Pythagoras & Trigonometry

- Pythagoras theorem finding longest length
- Pythagoras theorem finding shorter lengths
- Pythagoras in context (GCSE Style questions)
- Identifying the correct trig function (no calculations)
- Trigonometry finding missing length (multiplying only)
- Trigonometry finding missing length (dividing only)
- Trigonometry finding missing angles
- Identifying and applying trigonometry or pythagoras

Year 9 Curriculum Sequence *(continued)*

Note: *The 'Advanced' sections that follow contain content ranging from Grades 5 to 7. Their delivery is at the discretion of teachers.*

Advanced Statistics — ADVANCED

Averages and their data representation

- Complex MMMR problems (reverse questions, means with 2 groups and 5 numbers have a mean of...)
- Mean From Tables (frequency and grouped)
- Median From Tables (frequency and grouped)
- Cumulative frequency graph (drawing)
- Cumulative frequency graph (Median, more than, less than ...)
- Cumulative frequency (UQ, LQ, IQR)
- Drawing Box Plots
- Histograms (draw from tables)
- Histograms (part graph, part table)
- Venn diagrams (Drawing and sorting)
- Venn diagrams (Frequencies and probability)
- Venn diagrams (Set notation)
- Venn diagrams (3 set)

Advanced Number — ADVANCED

- Surds (i) - Breaking down surds
- Surds (ii) - Multiplying and dividing surds
- Surds (iii) - Adding and subtracting surds
- Surds (iv) - Expanding brackets (including FOIL)
- Surds (v) - Rationalising denominator (excluding conjugate)
- GCSE Bounds - calculating upper bound/lower bound of a given expression
- GCSE Bounds - calculating suitable degree of accuracy within mixed topic (i.e. SDT)
- GCSE work rates questions

Advanced Algebra — ADVANCED

- Solving quadratic inequalities
- Representing inequalities graphically (regions)
- Factorising harder quadratics
- Functions (i) - Substitution
- Functions (ii) - Solving
- Functions (iii) - Inverse
- Functions (iv) - Composite
- Simplifying algebraic fractions
- Algebraic fractions and the four operations
- Solving algebraic fractions (no quadratics)
- Completing the square
- Determining the roots
- Quadratic simultaneous equations
- Basic algebraic proof (i.e. proof the sum of even numbers is even)
- Basic equations of circle

Advanced Geometry — ADVANCED

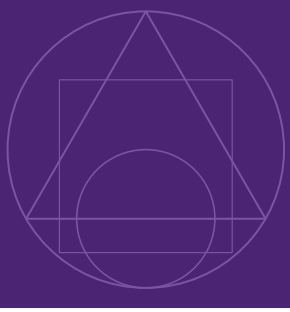
- Area of a triangle - sine rule
- Further trigonometry - sine rules
- Further trigonometry - cosine rules
- 3D Trig (including further trig, SOHCAHTOA and pythagoras)
- Circle theorems (non tangent rules)
- Circle theorems (tangent rules)
- Basic vector problems ("part a")
- Vector problems ("part b"... excluding proof)
- Similarity/Congruency (SAS, AAA, SSS, ASS, SASS, ASASA)
- Estimating speed from velocity/time graph
- Estimating distance from velocity/time graph

GCSE Statistics — ADVANCED

- Histograms (drawing only)
- Histograms (Part table, part graph)
- Histograms (interpreting... including averages)

KEY STAGE 4 · GCSE

Year 10 and the GCSE Programme



Students commence the two-year GCSE programme in Maths at the beginning of Year 10. This programme of study has been very carefully designed and refined over time. Firstly, it is necessary to dispel a common misconception: that the Foundation Tier GCSE lacks challenge or is merely a lesser-regarded tier. In 2017, the difficulty of the GCSE Maths qualification was increased significantly in a bid to raise standards nationally, and in many respects this initiative has been fruitful. The Foundation Tier GCSE is now surprisingly challenging, and students have to be very well prepared to contend with the examination constraints.

One of the problems of the 9–1 Maths GCSE is that, even though the Foundation Tier exams are notably challenging, the gulf in difficulty between the Foundation and Higher Tiers is huge. Hence, the decision to switch students across tiers, especially in the rare instance that a student switches from Foundation Tier to Higher Tier, has to be very carefully considered. Past evidence has taught us that this switch in particular seldom results in success (NB: we deem a 'successful' tier switch to be one in which a student who transitions from Foundation Tier to Higher Tier scores a Grade 6 or above).

Which students sit which tier varies from year to year, and our decisions for individual cohorts (and individual students) are commensurate with the present evidence. Generally speaking, we would always hope to enter Sets 1 and 2 for Higher Tier. With Set 3, entry depends on the ability and motivation of the individual group. Since 2017, we have overseen Set 3s entered for both Foundation Tier and Higher Tier. Our intention with Set 3s is to identify students capable of sitting Higher Tier, and so we have created a bespoke Intermediate Year 10 programme, which focuses predominantly on overlap material (at Grades 4 and 5), as well as introducing some classic Grade 6 and 7 Higher Tier material. Having an intermediate programme for our middle-ability groups makes tier changes in both directions far more accessible.

With respect to tier changes, we entirely respect that students may possess a sense of ambition – I refer here to students wanting to transition from Foundation Tier to Higher Tier. Their groupings at the beginning of Year 10 are based on three years' worth of evidence, and so students will in the main be well placed. We have assessment structures in place that, over two years, enable us to identify the correct tier of entry for each student and, ultimately, enable them to achieve their best grades. In Year 10, students are assessed in Maths five times. The assessments are not random; they are very intentionally designed to assess the content taught up to the point of assessment, in a cumulative fashion. Therefore, students can revise for these assessments and prove their desire to be successful. It is reasonable to suggest that by the end of Year 10, after being formally assessed fourteen times, student placement will be largely accurate. Even then,

Year 10 and the GCSE Programme *(continued)*

there are two rounds of mock exams in Year 11, which students can prepare for thoroughly should they wish to demonstrate ambition and progress.

Whilst on the topic of tiers of entry, I would like to discuss a point of potential contention. Over the last decade, we have received many suggestions about students displaying certain levels of ability when working alongside private tutors. Whilst many tutors do excellent work, and we fully endorse this form of extra practice, we occasionally hear appraisals of students that are discordant with the evidence we have garnered and, more importantly, with the teacher's level of insight into the student. Working one-to-one with a student and coaching them through individual topics can create an impression that the student is performing higher than the present evidence suggests. I would advise being very careful about such messaging; it does not do our students any favours.

All three of our programmes (Foundation, Intermediate and Higher) follow a similar order, with good reason. The learning sequences commence with Fundamental Numeracy (as in every previous year); we then move on to Statistics, followed by the Fundamentals of Algebra. These fundamentals are similar across all three programmes because they predominantly constitute Grade 4 content. Foundation Tier students will potentially need to cover more content in these subsections, owing to the additional grades preceding Grades 4 and 5.

All three programmes have been designed to be progressive. Whilst it is not possible to have a curriculum that advances perfectly through the numerical grading system (owing to the interconnectivity of ideas and the fact that all aspects of Maths are predicated on other ideas), it is generally true that content becomes increasingly challenging over the course of the year.

The Higher Tier curriculum has been very carefully designed to afford students the most gradual progression from Grades 4 and 5 through to potentially Grade 9 material. Furthermore, topics should always be accessible at the very least, because the mathematical skills that underpin even the loftiest of concepts will have been taught previously. There will be some instances where teachers have to be discerning about the delivery of certain topics. As an example, you will notice a topic called 'Vectors' at the end of the curriculum. This is one of the most challenging topics in the GCSE curriculum, and teaching such topics to students who do not naturally excel would have to be carefully considered.

It must be made clear that the purpose of Year 10 is to familiarise students with as much content (i.e. the mathematical principles and methodologies) as possible. However, students will not be exam-ready (excepting rare instances). At both tiers, having a secure working knowledge of all aspects of the curriculum does not imply that a student is ready to contend with the challenges of the examinations. At Foundation Tier, 50% of the exam is problem-solving in nature, rising to 60% of questions at Higher Tier. This is one of the main reasons that the Maths GCSE is far more difficult now than in the years preceding 2017; students generally require an inordinate amount of practice to become confident accessing the problem-solving questions presented in the exams. Furthermore, the most difficult problem-solving questions (known as Assessment Objective 3, or AO3) tend to be previously unseen, so students require a great deal of confidence and versatility to deconstruct these questions within the time constraints.

Year 10 and the GCSE Programme *(continued)*

This, in essence, defines the key difference between Years 10 and 11: Year 10 is designed to hone content knowledge, whereas Year 11 is designed to revisit content knowledge whilst affording students a remarkable amount of exam practice (see the Year 11 Programme).

On the topic of homework in Year 10, it will not be as regular nor as voluminous as in Year 11; our two-year programme is designed to assist students with retention, but in a timely fashion. Assigning appropriate volumes of work at regular intervals over the course of Year 11 enables students to be ready by the time of the actual exams.

Please see overleaf for our three programmes.

PATHWAY

Foundation

Grades 1–5

PATHWAY

Set 3

Overlap Grades 4–5 plus classic Grades 6–7

PATHWAY

Higher

Grades 4–9

YEAR 10 · GCSE

The Foundation Tier Programme

Fundamental Number

1. The Basic Operations, Place Value and Directed Numbers

- Adding and Subtracting positive integers using the column method
- Multiplication of positive integers
- Division by single digit numbers using the Bus Stop method or otherwise
- Place Value and ordering decimals
- Adding and subtracting with decimals
- Multiplication with decimals (using Chinese Method)
- Negative Numbers and adding and subtracting (directed numbers)
- Multiplying and dividing with negative numbers

2. Rounding Numbers, Powers of 10, Estimations and BIDMAS

- Rounding to nearest whole number
- Rounding to nearest 10,100 or 1000
- Rounding to decimal places
- Rounding to significant figures
- Multiplying and dividing by powers of 10, 100 and 1000 without a calculator
- Estimations by rounding to significant figures
- BIDMAS

3. Types of Number, Primes, HCF and LCM

- Factors, Multiples and Primes
- Square Numbers, Cube Numbers and Roots
- Prime Factorisation (Sieve of Eratosthenes to find all primes between 1 and 100)
- Finding HCF's and LCM's
- Worded LCM problems

4. Basic Inequalities

- To be able to input the correct inequality symbol between two quantities
- To be able to infer the inequality represented on a number line
- To be able to write down the integers represented by a double inequality

5. Fractions

- Definition of a fraction, fractional diagrams (shaded fractions etc)
- Equivalent Fractions (and simplify, order)

Fundamental Number (continued)

- Fractions of quantities
- Multiplying fractions (not top heavy)
- Dividing fractions (not involved with mixed numbers yet)
- Mixed Numbers (converting between top heavy fractions and mixed numbers and vice versa)
- Multiplying and dividing with mixed numbers
- Adding and subtracting fractions
- Adding and subtracting with mixed numbers

6. Percentages

- Converting between fractions, percentages and decimals
- Percentages of quantities without a calculator (i.e. the 10% method)
- Increasing and decreasing by a percentage without a calculator
- Percentages of quantities using a calculator (using percentage multipliers)
- Increasing and decreasing by a percentage using magic multipliers

7. Ratio

- Definition of a ratio and simplifying ratios (inc the form 1:n)
- Dividing in a given ratio
- Dividing in a given ratio (when only one part of the information or difference is known)
- Simplifying two ratios into a single 3-number ratio
- Merging two ratios and then sharing in a given triple-ratio

Probability and Statistics

1. Statistical Diagrams, Averages and Sampling

- Systematic listing - listing outcomes but NOT using the product rule
- Pictograms (can be taught within starters/mini-tests if set 4)
- Frequency trees (including basic probability questions)
- Bar charts and Dual Bar Charts
- Pie charts
- Line graphs including time series graphs

The Foundation Tier Programme *(continued)*

Probability and Statistics (continued)

- Scatter graphs
- Stem and leaf
- Sampling
- Averages - calculating mean, mode, range and median
- Averages - calculating from ungrouped data
- Averages - calculating from grouped data
- Venn diagrams - constructing
- Venn diagrams - understanding set notation
- Venn diagrams - Calculating probabilities

2. Basic Probability, Expectation, Sample Space Diagrams and Tree Diagrams

- The probability scale - describing probability in words + knowing values of 0 and 1
- Relative frequency involving completing tables of exhaustive events
- Relative frequency involving calculating probability of repeated events
- Sample space diagrams used to calculate probability of 2 independent events
- Calculating probabilities from partly complete tree diagram
- Calculating probabilities from empty tree diagram
- Calculating probabilities of unconditional events with no tree diagram given

Fundamental Algebra

1. Algebraic Essentials

- The Coordinate Plane, identifying coordinates and coordinate problems
- The language of maths (i.e. if I have "p" pencils and I remove 4 then p - 4 is the expression)
- Substitution
- Collecting like terms
- Multiplying and dividing terms
- Expanding single brackets
- Expanding single brackets and simplifying
- Expanding double brackets (FOIL)
- Factorising single brackets

2. Rearranging linear equations and Solving Linear Equations and Inequalities

- Function Machines (and write y in terms of x when the input is x)
- Rearranging linear equations

Fundamental Algebra (continued)

- Solving simple linear equations (one or two inversions) with variable on one side
- Solving simple linear equations with brackets
- Solving linear equations with multiple inversions (can involve fractions for example)
- Solving linear equations with variables on both sides
- Solving linear equations with variables and brackets on both sides
- Solving linear equations with variables, brackets and fractions on one or both sides
- Solving linear inequalities and number lines

3. Types of Sequences

- Basic concept of a sequence (identifying term to term rule and missing numbers)
- nth term of a linear sequence
- Using the nth term to generate terms in a sequence
- nth term from patterns and pictures
- Special sequences e.g. Fibonacci
- Geometric Sequences

Advanced Number

1. Proportional Reasoning

- Value for Money
- Recipe Questions
- Exchange Rates
- Work Rates

2. Using a calculator and Powers and Roots

- Using a calculator
- Powers and Roots

3. Standard Form

- Writing Numbers greater than 10 in standard form and vice versa
- Writing numbers smaller than 1 in standard form and vice versa
- Adjusting numbers so that they are expressed in standard form
- Multiplying numbers in standard form without a calculator
- Dividing numbers in standard form without a calculator
- Adding and subtracting numbers in standard form without a calculator (using column addition or subtraction)

The Foundation Tier Programme *(continued)*

Advanced Number (continued)

- Putting quantities in standard form (or otherwise) in numerical order by considering the order of magnitude

4. Error Intervals and Bounds

- Error intervals
- Bounds calculations

5. Laws of Indices

- First two laws of indices recap (adding and subtracting powers of the same base number)
- Terms raised to powers
- Negative powers and power of 0

6. Difficult Percentages

- Percentage Change
- Simple interest
- Compound Interest and Depreciation
- Reverse Percentages

Fundamental Geometry

- Basic 3 types of angle and identifying parallel lines
- Measuring and drawing angles
- Naming 2D shapes (regular and irregular)
- 2D shapes properties, including line symmetry and order of rotational symmetry
- Naming 3D solids
- Identifying vertices, faces and edges of 3D solids

1. Basic Angle Properties (around a point, on a line, in a triangle, in a quadrilateral)

- Angles around a point
- Angles on a line
- Angles in a triangle
- Angles in a quadrilateral

2. Perimeter, Area (inc. problem-solving) Volume (prisms only) and Surface Area

- Perimeter
- Area of rectangles
- Area of triangles
- Area of compound shapes
- Area of parallelograms
- Area of trapeziums
- Circle parts and circumference of circles
- Area of circles
- Area problem solving

Fundamental Geometry (continued)

- Volume of cuboids and prisms inc. compound prisms (e.g. L-shapes)
- Surface area of cuboids
- Surface area of prisms
- Volumes of prism in context (filling containers etc)

3. Unit Conversions

- Unit conversions – metric to metric and metric to imperial

4. Transformations, constructions, loci, map scales and plans and elevations

- Performing and describing reflections
- Performing and describing rotations
- Performing and describing translations using column vector notation
- Combinations of transformations and 'Describing fully the single transformation'
- Performing and describing positive enlargements
- Performing and describing fractional enlargements
- Constructions (i) – Angle Bisectors
- Constructions (ii) – Perpendicular Bisectors
- Constructing an equilateral triangle using a compass
- Loci problems and regions (including map scales)
- Plans and elevations

5. Interior and Exterior angles and angles in parallel lines

- Exterior angles of a regular polygon
- Interior angles of a regular polygon
- Sum of interior angles of a regular polygon [(n-2)x 180]
- Interior angles of irregular polygons
- Alternate and corresponding angles

Further Graphical and Advanced Algebra

1. Graphical Algebra (functions)

- Plotting Straight line graphs
- Understanding gradient and intercept and being able to identify the equation of a line
- Straight line graphs in context
- Plotting Quadratic Graphs
- Plotting Cubic graphs

2. Distance-Time graphs and SDT

- Constructing and Interpreting Distance-Time Graphs

The Foundation Tier Programme *(continued)*

Further Graphical and Advanced Algebra (continued)

- Problems with Speed Distance and Time

3. Forming and Solving Linear Equations

- Forming equations from shape dimensions
- Forming equations from angle properties
- Forming equations from ages expressed algebraically

4. Quadratic Factorisation and solving

- Factorising basic quadratics
- Factorising quadratics with no middle term (difference of two squares)
- Solving quadratics = 0

5. Simultaneous Equations

- Solving simultaneous equations where a pair of coefficients match completely
- As above with opposite signs
- Simultaneous equations where one equation requires scaling
- Simultaneous equations where both equations require scaling
- Forming and Solving simultaneous equations representing worded problems

6. Direct Proportion and Inverse Proportion

- Setting up an equation to solve a directly proportional relationship
- Substituting into the direct proportion equation
- Setting up and substituting into an equation of inverse proportionality
- Constructing and interpreting graphs representing quantities in direct proportion

7. Column vectors

- Representing column vectors using vectors and vice versa
- Operations with column vectors

Further Geometry

1. Sectors

- Area of a sector
- Arc length of a sector
- Problem-solving (sector prisms, area-covering, working backwards)

Further Geometry (continued)

2. Pythagoras and Trigonometry

- Pythagoras' Theorem – finding the hypotenuse given the two shorter sides
- Pythagoras' Theorem – finding a shorter side
- Trigonometry – finding angles using the sine ratio
- Trigonometry – finding angles using the cosine ratio
- Trigonometry – finding angles using the tangent ratio
- Trigonometry – finding angles by selecting and using the correct ratio (SOH CAH TOA)
- Trigonometry – finding a side using the sine ratio
- Trigonometry – finding a side using the cosine ratio
- Trigonometry – finding a side using the tangent ratio
- Trigonometry – finding a side by selecting and using the correct ratio (SOH CAH TOA)
- Consolidation – finding lengths and angles

3. Volume of Cones and Spheres

- Volume of a cone
- Volume of a Pyramid
- Surface Area of a cone
- Volume of a sphere and hemisphere
- Surface area of a sphere
- Composite Shapes

4. Density and Population Density

- Using the DMV formula to work out Density, Mass or Volume
- Using the DMV formula where volume of a 3D shape has to be computed first
- Calculate population density

5. Similarity and Congruence

- Similarity – Finding the scale factor to work out missing lengths of similar shapes
- More challenging similarity questions (shape within shape etc)
- Conditions for congruence and proving two shapes are congruent

YEAR 10 · GCSE

The Set 3 Programme

Fundamental Number

Basic Number Skills

- Long multiplication (up to 3 digits)
- Long multiplication including decimals
- Long division of integers
- Long division of decimal numbers
- Reciprocals
- Use of calculator

Rounding

- Rounding to significant figures
- Estimation
- Error intervals
- Truncation

Prime numbers

- HCF and LCM in context (i.e. bus times)
- Finding prime numbers up to 100
- Prime factorisation
- Finding HCF of larger numbers (prime factorisation/venn)
- Finding LCM of larger numbers (prime factorisation/venn)

Fractions

- Converting mixed number fractions to improper fractions
- Converting improper fractions to mixed numbers
- Multiplying fractions (including cross cancelling)
- Dividing fractions
- Adding Fractions
- Subtracting Fractions
- Fractions and multiple operations
- Converting Percentages/Fractions/Decimals

Percentages

- Basic percentage questions for non-calculator paper
- Percentage change (with calculator)
- Calculating percentage profit
- Finding simple interest
- Finding compound interest using multipliers
- Finding compound depreciation using multipliers
- Finding reverse percentages using multipliers
- Finding reverse percentages without a calculator
- Finding the unknown rate of interest

Fundamental Number (continued)

Ratio

- Representing ratios (including converting ratio into Fractions or %'s)
- Simplifying ratios in the form 1:n (n can be a decimal)
- Sharing an amount into a given ratio
- Sharing ratio problems where you are not given the total
- Sharing ratio problems where you are given the difference
- Double ratio problems (including GCSE questions)
- GCSE style ratio problems

Proportion

- Exchange rate problems
- Recipe problems
- Best buy problems
- Direct proportion

Statistics

Statistical diagrams

- Scatter diagrams
- Correlation
- Frequency Polygon
- Pie charts
- Time series Graphs

Averages

- GCSE style mean related problems (MMMR recap)
- Mean From Tables (frequency and grouped)
- Median From Tables (frequency and grouped)
- Cumulative frequency graph (drawing)
- Cumulative frequency graph (More than, less than ...)
- Cumulative frequency (UQ, LQ, IQR)
- Drawing Box Plots
- Interpreting Box Plots (including comparing CF and comparing data)
- Stem and leaf (Using stem and leaf to draw box plot)
- Venn diagrams (Drawing and sorting)
- Venn diagrams (Frequencies and probability)
- Venn diagrams (Set notation)
- Venn diagrams (3 set)

The Set 3 Programme *(continued)*

Statistics (continued)

Probability

- Probability Basics (basic events, outcomes, P=1, 3 Rules AND/OR and NOT = 1-P)
- Listing outcomes
- Sample Space Diagrams
- Combinatorics
- Probability of independent events
- Theoretical probability
- Relative frequency
- Probability from Tables
- Two-way tables (including conditional probability)
- Completing Independent Tree Diagrams
- GCSE Questions on Independent Tree Diagrams
- Completing Tree Diagrams involving dependent/conditional probability (branches only)
- Completing Tree Diagrams involving dependent/conditional probability (answering questions)

Algebra and Number

Basic Algebraic Skills

- Language of maths (writing expressions, knowing the difference between expression, terms, equations)
- Substitution
- Collecting like terms
- Multiplying and dividing terms (including powers)
- Expanding brackets
- Expanding brackets and simplifying
- Factorising into single brackets
- Expanding double brackets
- Expanding 3 binomials
- Changing subject of a formula with no powers, x appears once
- Changing subject of a formula with powers involved, x appears once

Solving Equations

- Solving linear equations with multiple inversions (can involve fractions for example)
- Solving linear equations with variables on both sides
- Solving linear equations with variables and brackets on both sides
- Solving linear equations with variables, brackets and fractions on both sides
- Forming and solving linear equations

Algebra and Number (continued)

- Factorising simpler quadratics with positive coefficients only (could review FOIL first)
- Factorising simpler quadratics involving negative coefficients
- Solving quadratics by factorisation
- Solving quadratics using formula

Sequences

- Completing basic sequences (including fibonacci)
- Finding terms within a sequence (if 5n + 3, find 50th term)
- Generating sequence from the nth term
- Finding the nth term from a linear sequence
- Finding whether a term does/or doesn't exist in a sequence

Simultaneous Equations

- Simultaneous equations (i) - No multiplication required
- Simultaneous equations (ii) - Multiplying one equation with only positives
- Simultaneous equations (iii) - Multiplying both equations with only positives
- Simultaneous equations (iv) - Multiplying both equations with varying signs
- Solving worded simultaneous equations

Inequalities

- Inequalities on number lines
- Solve basic inequalities (1 step and 2 step + represent on number line)
- Solving compound inequalities

Laws of indices

- Multiplying and dividing powers
- Raising a power to a power
- Fractional powers
- Negative powers
- Mixture of all the laws of indices

Standard form

- Converting numbers into standard form
- Converting standard form into numbers
- Correcting into standard form (i.e. 350×10^4 in standard form)
- Multiplying and dividing standard form
- Adding and subtracting numbers in standard form
- Calculator questions using standard form

The Set 3 Programme *(continued)*

Algebra and Number (continued)

Graphical topics

- Plot linear graphs
- Plot quadratic graphs
- Plot cubic graphs
- Plotting exponentials and reciprocals
- Finding the mid-point of a line (2 co-ordinates)
- Identify the equation of a line in the form y = mx + c
- Calculate the gradient from 2 points (change in y/change in x)
- Identify the equation of a straight line from 2 points
- Identify the equation of parallel lines

Additional Number

Grade 6 topics

- Mean Problem solving
- Work Rates
- The Multiplication Rule (product rule for counting)
- Capture/Recapture
- Direct Proportion (and corresponding graphs)
- Inverse Proportion
- Converting recurring decimals to fractions (non-calc)

Shape

Area/Volume

- Area of trapeziums
- Area of a circle
- Circumference of a circle
- Area of sectors
- Perimeter of sectors
- Reverse area questions (including circles!)
- Questions involving shaded areas
- Volume of cubes and cuboids
- Volume of prisms (including cylinders)
- Surface area of prisms
- Reverse volume questions
- Volume/SA of spheres and hemispheres

Compound Measures

- SDT
- DMV
- DMV mixing liquids

Shape (continued)

Transformations

- Reflection (1 lesson, do & describe)
- Basic column vectors
- Translation (1 lesson, do & describe)
- Rotation (1 lesson, do & describe)
- Enlargement without CoE
- Enlargement with CoE
- Enlargement with negative CoE
- Describing Enlargements

Construction

- Constructions (i) - Angle Bisectors
- Constructions (ii) - Perpendicular Bisectors
- Constructing an equilateral triangle using a compass
- Loci problems and regions
- Plans and elevations

Angle laws

- Angle facts (right angle, straight line, around a point)
- Angles in triangles and quadrilaterals
- Angles with parallel lines
- Interior and exterior angles of regular polygons
- Sum of interior angles in irregular polygons ([n-2]x180)
- GCSE Angle problems

Pythagoras & Trigonometry

- Pythagoras theorem finding longest length
- Pythagoras theorem finding shorter lengths
- Pythagoras in context (GCSE Style questions)
- Identifying the correct trig function (no calculations)
- Trigonometry finding missing length (multiplying only)
- Trigonometry finding missing length (dividing only)
- Trigonometry finding missing angles
- Identifying and applying trigonometry or pythagoras
- Knowing exact values of Sin/Cos/Tan (30,45,60,90 degrees)

Shape extras

- Similar shapes and congruency (Foundation)

The Set 3 Programme *(continued)*

Note: *At this point, most of the overlap content has been covered, in addition to some of the predominant Grade 6 content commonly examined at Higher Tier. If it is clear at this point that students are legitimately on a Higher Tier trajectory, teachers may, at their discretion, begin teaching some of the loftier Higher Tier content. The topics that follow are deemed 'Priority Topics', because they are not only classic Higher Tier GCSE topics, but are also somewhat more accessible than the most challenging areas.*

Priority Topics — GRADES 6–7

- Compound interest - finding the value of x%
- Big Wordy Ones - with a focus on ratio based problems
- HCF & LCM - when given in power form
- HCF & LCM - working backwards (problem solving types)
- Histograms - filling graph from complete table
- Histograms - filling graph from part complete table
- Volume of a prism inc. compound prisms (e.g. L-shapes)
- Volumes of prism in context (filling containers etc)
- DMV - find density by first calculating the volume of a shape
- DMV - mixed liquids questions - (eg. Find the density of Liquid C when Liquid A and Liquid B are mixed)
- Further trig - Sine rule
- Further trig - cosine rule
- Further trig - Area of a triangle
- Shaded areas of sectors - involving ½ab sin C and/or cosine/sine rule
- Solving equations in various fractional forms (exclude x's on the denominator)
- Rearranging equations with x on one side - must involve multiple operations and powers
- Rearranging equations with x on both sides
- Factorising harder quadratics (a > 1)
- Solving harder quadratics (a > 1)
- Forming and solving equations - must involve using the formula!
- Simultaneous Equations - one lesson practicing all types
- Quadratic Simultaneous Equations
- Identifying the equation of a line from gradient and intercept

Priority Topics (continued) — GRADES 6–7

- Identifying equation of a line 'difference in y's / difference in x's'
- Finding equations of parallel lines (passing through given y-intercept)
- Finding equations of perpendicular lines (passing through given y-intercept)
- Finding equations of parallel lines and perpendicular lines passing through arbitrary points
- Solving linear simultaneous equations graphically
- Graphical inequalities
- Plotting graphs - linear, quadratic, cubic and exponential
- Identifying types of graphs
- Identifying turning points and roots of quadratics
- Laws of indices - PRACTICE recap basic laws and exam practice
- Laws of indices - practice fractional and negative with specific exam question practice involving all laws
- Standard form - PRACTICE non calc exam questions
- Standard form - PRACTICE calc exam questions
- Surds I - Basic three laws; multiplying, dividing and adding
- Surds II - Simplifying surds
- Surds III - Summing dissimilar surds
- Surds IV - expanding brackets and FOIL with binomials containing surds
- Rationalising the denominator (including two-term denominators)
- Sectors - Area and Arc Length
- Surface area of prisms
- Transformations - 1 lesson - PRACTICE Translation, Rotation, Reflection Exam Questions
- Transformation recap - 1 lesson - enlargement (Normal + fractional + negative)
- Transformation - PRACTICE exam questions involving multiple transformations + invariant points
- Angle laws - PRACTICE Parallel Line exam Questions
- Pythagoras and Basic trig - PRACTICE exam questions involving multiple right angle triangles
- Similar shapes - Area and Volume
- Non-linear simultaneous equations
- Quadratic Inequalities
- Functions - substituting and solving - (eg. If f = 3x - 4; find f(5) and f(x) = 10)
- Iteration
- Constructions (i) - Angle Bisectors
- Constructions (ii) - Perpendicular Bisectors
- Constructing an equilateral triangle using a compass

The Set 3 Programme *(continued)*

Priority Topics (continued) GRADES 6–7

- Loci problems and regions
- Plans and elevations

YEAR 10 · GCSE

The Higher Tier Programme

Fundamental Number (including basic proportion)

1. Fractions (4-5)

- Multiplying and dividing fractions and mixed numbers
- Adding and subtracting fractions and mixed numbers

2. Percentages (4-5)

- Compound interest and depreciation
- Reverse percentages
- Percentage Change

3. Ratio (4-5)

- Dividing in a given ratio
- Double Ratios

4. Approximations (4-5)

- Rounding to significant figures
- Approximations using rounding

5. Prime Factorisation and LCM & HCF (4)

- Prime Factorisation
- Using a Venn Diagram for LCM HCF
- LCM HCF contextual questions

6. Basic Proportional reasoning (4)

- Recipe Questions
- Exchange Rates
- Best Buys

Probability and Statistics

1. Averages and Basic Statistical Diagrams (4)

- Two-way tables
- Mode and Mean from a frequency table (and grouped frequency table)
- Median from a frequency table
- Frequency Polygons
- Probability from Tables and Expectation
- Relative Frequency
- Scatter Diagrams
- Pie charts

2. Further Probability and Statistical Diagrams (5-8)

- Independent Events
- Tree Diagrams

Probability and Statistics (continued)

- Complex Probability (no tree diagram pre-drawn)
- Venn Diagrams
- Cumulative Frequency
- Box Plots
- Histograms (i) - Constructing a histogram
- Histograms (ii) - Using the histogram to complete the frequency table and vice versa
- Histograms (iii) - Inferring frequencies from histograms
- Histograms (iv) - working out quartiles from histograms

Fundamental Algebra

1. Basic Algebra at Higher Tier (4-6)

- Algebraic Substitution
- First two laws of indices
- Collecting like terms
- Expanding single brackets
- Expanding brackets and simplifying
- Expanding product of two binomials (FOIL) and simplifying
- Expanding 3 binomials
- Factorising into single brackets

2. Basic Algebra at Higher Tier II: Solving Linear Equations and Inequalities (4-5)

- Rearranging equations (subject variable appearing once only)
- Solving linear equations (unknown on one side)
- Solving linear equations (ii) Variables on both sides
- Solving linear equations (iii) Variables on both sides involving fractions
- Forming and solving linear equations from algebraic expressions
- Linear Inequalities
- Solving linear inequalities of this type: $2 < 3x - 1 < 5$

3. Quadratics and Equations (5-7)

- Factorising basic quadratics ($a = 1$)
- Solving basic quadratics ($a = 1$)
- Factorising harder quadratics ($a > 1$)
- Solving harder quadratics ($a > 1$)
- The quadratic formula

The Higher Tier Programme *(continued)*

Fundamental Algebra (continued)

4. Linear Simultaneous Equations (5)

- Simultaneous equations (i) - No multiplication required
- Simultaneous equations (ii) - Multiplying one equation
- Simultaneous equations (iii) - Multiplying both equations with varying signs
- Simultaneous equations (iv) - worded problems (with and without a calculator)

5. Basic Sequences (4-5) and Quadratic Sequences

- General term of a linear sequence
- nth term from patterned sequences
- Fibonacci sequences
- Geometric sequences
- Quadratic sequences (general term)
- Algebra based sequence problems

6. Straight Line Graph Theory (including graphical inequalities) & solving simultaneous equations graphically (4-8)

- Coordinates and midpoints of line segments (and problem-solving questions)
- Plotting Straight line graphs
- Identifying the equation of a line from gradient and intercept
- Identifying equation of a line 'difference in y's / difference in x's'
- Finding equations of parallel lines (passing through given y-intercept)
- Finding equations of perpendicular lines (passing through given y-intercept)
- Finding equations of parallel lines and perpendicular lines passing through arbitrary points
- Straight Line Graphs in context
- Solving linear simultaneous equations graphically
- Graphical Inequalities

7. Additional Graphs

- Plotting Quadratic Graphs
- Identifying Roots and turning points of a quadratic graph
- Plotting Cubic graphs
- Reciprocal graphs
- Exponential Graphs

Advanced Number

1. Advanced Ratio and Proportion and recurring decimals to fractions

- Mean Problem solving
- Work Rates
- The Multiplication Rule (product rule for counting)
- Capture/Recapture
- Direct Proportion (and corresponding graphs)
- Inverse Proportion
- Converting recurring decimals to fractions (non-calc)

2. Laws of Indices and Standard Form

- Laws of indices II - power to a power – e.g. $(a^2)^3$, leading to $(4a^2b^3)^5$
- Laws of indices III - Simple fractional powers (1/n)
- Laws of indices IV - Fractions raised to integer powers and fractional powers (1/n only)
- Laws of indices V - dealing with tougher fractional powers with numerator > 1
- Laws of Indices VI - Negative powers, including fractions raised to negative powers
- Laws of Indices VII - Changing base number to solve equations (top set only in Year 10)
- Standard Form I - Putting numbers > 10 into standard form
- Standard Form II - Putting small numbers < 1 into standard form
- Standard Form III - Multiplying and dividing numbers in standard form
- Adding and subtracting numbers in standard form with and without a calculator
- Order of magnitude and ordering numbers given in standard form

3. Surds

- Surds I - Basic three laws; multiplying, dividing and adding
- Surds II - Simplifying surds
- Surds III - Summing dissimilar surds
- Surds IV - expanding brackets and FOIL with binomials containing surds
- Rationalising the denominator (including simplification and rationalising with two-term denominators)

4. Error Intervals and Bounds

- Error Intervals
- Bounds I - Introduction to bounds (a.k.a limits of accuracy) with integer quantities

The Higher Tier Programme *(continued)*

Advanced Number (continued)

- Bounds II - Maximising or Minimising when quantities have been specified to a given number of significant figures
- Bounds III - Contextual problems and questions requiring student to find degree of accuracy

Fundamental Geometry

1. Area, Sectors and Volume (prisms only)

- Areas of triangles & rectangles and compound area
- Area of parallelograms, trapeziums
- Area and circumference of circles
- Sectors - area and arc length
- Volume of a prism inc. compound prisms (e.g. L-shapes)
- Volumes of prism in context (filling containers etc)
- Surface area of prisms

2. Transformations, constructions, loci and plans and elevations. (4, 7-8)

- Performing and describing reflections and rotations
- Performing and describing translations using column vector notation
- Combinations of transformations and 'Describing fully the single transformation'
- Performing and describing positive and fractional enlargements
- Performing and describing negative enlargements
- Constructions (i) - Angle Bisectors
- Constructions (ii) - Perpendicular Bisectors
- Constructing an equilateral triangle using a compass
- Loci problems and regions
- Plans and elevations

3. Basic Angle Properties (4,5)

- Basic angle properties (on a line, around a point, in a quadrilateral, in a triangle)
- Scale drawings and bearings
- Alternate and corresponding angles (co-interior)
- Interior/Exterior angles of regular polygons
- Interior/Exterior angles of irregular polygons

4. Right-angled triangles: Pythagoras and Trigonometry (4,5 +)

- Pythagoras' Theorem (addition and subtraction problems)

Fundamental Geometry (continued)

- Trigonometry (i) Finding angles using the inverse sine function
- Trigonometry (ii) Finding angles using the inverse cosine function
- Trigonometry (ii) Finding angles using the inverse tangent function
- Trigonometry (iv) Using the correct inverse function to find angles
- Trigonometry (v) Using the sine, cosine and tangent functions to find different lengths
- Trigonometry (vi) Finding angles and lengths and mixed problems

5. Similarity (5-8)

- Similarity in two dimensions using scale factors
- Similarity using 3 scale factors for length, area, volume (including ratio problems)

6. Circle Theorems (6-8)

- Angles in semi circles, Angles standing on the same arc, Opposite angles of a cyclic quadrilateral
- Tangents from an external point, Angle at the centre and edge,Tangent meets radius at 90
- Alternate Segment Theorem
- Proofs of circle theorems

Further Graphical and Advanced Algebra

1. Further Rearranging and Algebraic Proof (8)

- Rearranging equations when the subject appears twice on one side
- Algebraic Proof

2. Algebraic Fractions (7-8)

- Adding or subtracting algebraic fractions
- Solving non-linear equations with algebraic fractions
- Simplifying algebraic fractions by factorisation and cancellation
- Multiplying and dividing algebraic fractions (using factorisation and cancellation)
- Multiple operations with algebraic fractions

3. Quadratic Applications (8)

- Forming and solving linear equations with shape (4-5)
- Forming and solving quadratic equations from shapes
- Completing the square
- Completing the square and using to identify turning points of a quadratic curve

The Higher Tier Programme *(continued)*

Further Graphical and Advanced Algebra (continued)

- Non-linear simultaneous equations
- Using straight line graphs to solve quadratics (the method of intersection)
- Quadratic Inequalities

4. Speed, Distance, Time and Rates of Change (4-7)

- Speed Distance Time calculations
- Distance-Time Graphs
- Velocity-Time graphs
- Area under a curve (strips of equal width)
- Estimating gradient from a curve

5. Functions, Further Graphs and Transformations of Functions

- Functional Notation
- Composite Functions
- Inverse Functions
- Iteration
- General iterative processes (eg growth)
- The Graphs of the Sine and Cosine Functions
- The graph of a circle - specific problems
- Transforming functions (graphs)

Advanced Shape

1. Geometric Proof

- Being able to prove congruency, similarity and equal angles using geometric properties and the SSS, SAS, ASA, RHS acronyms

2. Density, Mass, Volume & Mixtures (5-8)

- Density, Mass, Volume (as a simple compound measure)
- DMV mixtures

3. Further Right-angled Trigonometry (5-8)

- Trigonometry and Pythagoras
- 3D problems with trigonometry
- Trigonometric Ratios without a calculator

4. Further Trigonometry (7-8)

- Cosine Rule (Finding an angle)
- Cosine Rule (Finding a length)
- NRA triangle area formula
- Sine Rule (angles)
- Sine Rule (length)
- Combinations of the three formulae

Advanced Shape (continued)

5. Complex Volume (5-9)

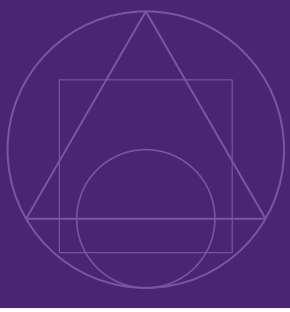
- Volume of cones and pyramids
- Volumes of frustums
- Volume of sphere and hemisphere
- Surface Area of Cones, Spheres and hemispheres
- Questions relating the dimensions of 2 or more shapes

6. Vector Geometry

- Column vector notation and vector sums (intro to resultant vectors)
- Resultant vectors in diagrammatic problems
- Parallel Vectors, Midpoints with vectors
- Vectors split into a ratio
- Collinearity and proving straight line

KEY STAGE 4 · GCSE

The Year 11 Programme



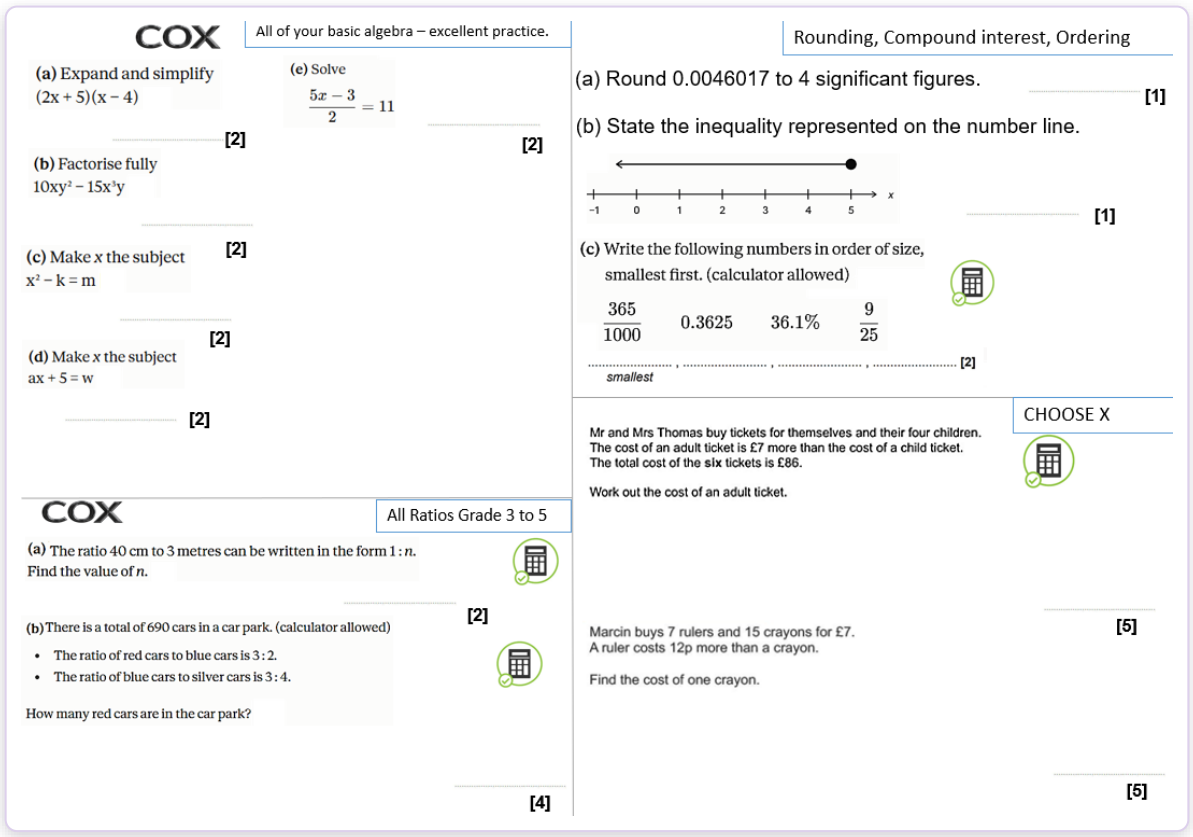
We are particularly proud of our Year 11 programme of study and revision. Firstly, the curriculum sequence mirrors that of Year 10. This is because most teachers will have covered the vast majority of the content in Year 10 and will begin from the start again in Year 11, giving students a second chance to review all aspects. The purpose of Year 11 lessons is not only to review the curriculum content, but also to give students insight into the relevant exam skills they will require for each topic. We use a multitude of mechanisms to ensure that students gain the practice they need.

This programme was first designed in 2021, when the onus was placed on schools to provide evidence of student progress and final outcomes. In order to substantiate final grades, we granted students every possible opportunity to demonstrate progress and, ultimately, to perform as well as they could in the final internal assessments. The programme was so effective that we have refined it every year since, and our results distributions have been somewhat breathtaking. What matters most, and what has been apparent, is that our programme ensures that students are entered for the correct tier and that all students fulfil their mathematical potential. This does not discount students contending with unfavourable circumstances that negatively impact upon their education. Even in such instances, it fills us with pride to think that our programme affords every student their very best opportunity to succeed.

The Year 11 Programme *(continued)*

Year 11 Lesson Structures

Lesson structures will vary depending on the individual group. However, something we have implemented department-wide is a specific format of review exercise (example below), in which students are exposed repeatedly to exam-style questions in order to hone their skills. The topics covered are at the discretion of the teacher, and the four quadrants enable a variety of topics to be covered. Below is an example of a Foundation Tier review exercise created by Mr Cox:



COX

All of your basic algebra – excellent practice.

(a) Expand and simplify
$(2x + 5)(x - 4)$

[2]

(b) Factorise fully
$10xy^2 - 15x^3y$

[2]

(c) Make x the subject
$x^2 - k = m$

[2]

(d) Make x the subject
$ax + 5 = w$

[2]

(e) Solve
$\frac{5x - 3}{2} = 11$

[2]

COX

All Ratios Grade 3 to 5

(a) The ratio 40 cm to 3 metres can be written in the form $1 : n$.
Find the value of n.

[2]

(b) There is a total of 690 cars in a car park. (calculator allowed)

- The ratio of red cars to blue cars is 3 : 2.
- The ratio of blue cars to silver cars is 3 : 4.

How many red cars are in the car park?

[4]

Rounding, Compound interest, Ordering

(a) Round 0.0046017 to 4 significant figures.

[1]

(b) State the inequality represented on the number line.

[1]

(c) Write the following numbers in order of size, smallest first. (calculator allowed)

$\frac{365}{1000}$ 0.3625 36.1% $\frac{9}{25}$

..... , ... , ... , ... [2]
smallest

CHOOSE X

Mr and Mrs Thomas buy tickets for themselves and their four children.
The cost of an adult ticket is £7 more than the cost of a child ticket.
The total cost of the six tickets is £86.

Work out the cost of an adult ticket.

[5]

Marcin buys 7 rulers and 15 crayons for £7.
A ruler costs 12p more than a crayon.

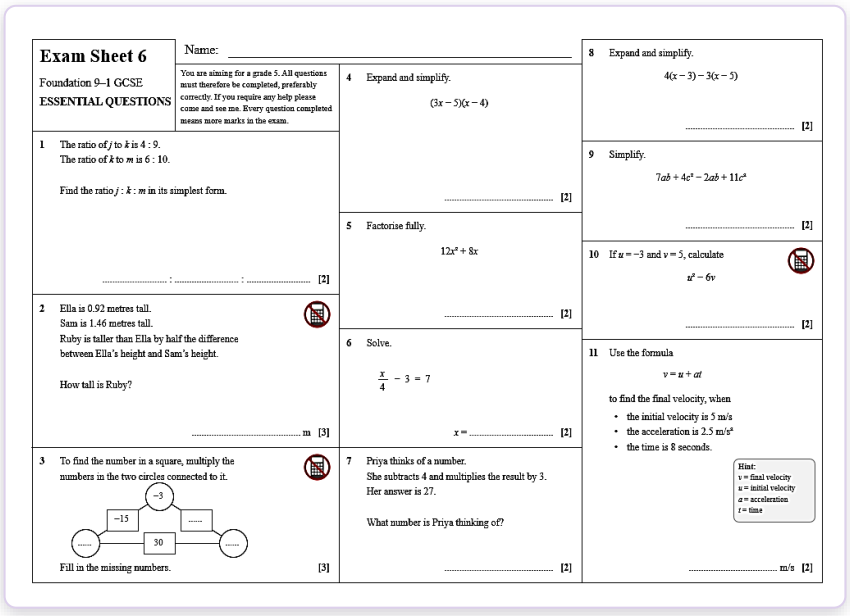
Find the cost of one crayon.

[5]

THE YEAR 11 PROGRAMME

Year 11 Exam Sheets

All students receive weekly exam sheets designed by staff. They are assigned weekly for homework and marked by staff, with feedback usually given the following week. Different teachers have their own bespoke ways of grading these sheets. For students, it is imperative that their effort with these double-sided A3 sheets is consistent; they contain an entire collation of key examination questions that have been very carefully selected. Over the course of approximately fifteen sheets, students will have covered a huge proportion of the curriculum (at both tiers). Below is an example of a Foundation Tier exam sheet (front and back) created by Mr Cox:



Exam Sheet 6

Foundation 9–1 GCSE

ESSENTIAL QUESTIONS

Name: _____

You are aiming for a grade 5. All questions must therefore be completed, preferably correctly. If you require any help please come and see me. Every question completed means more marks in the exam.

1 The ratio of j to k is 4 : 9.
The ratio of k to m is 6 : 10.

Find the ratio $j : k : m$ in its simplest form.

..... : ..... : ..... [2]

2 Ella is 0.92 metres tall.
Sam is 1.46 metres tall.
Ruby is taller than Ella by half the difference between Ella's height and Sam's height.

How tall is Ruby?

..... m [3]

3 To find the number in a square, multiply the numbers in the two circles connected to it.

Fill in the missing numbers. [3]

4 Expand and simplify.

$(3x - 5)(x - 4)$

..... [2]

5 Factorise fully.

$12x^2 + 8x$

..... [2]

6 Solve.

$\frac{x}{4} - 3 = 7$

$x =$ ..... [2]

7 Priya thinks of a number.
She subtracts 4 and multiplies the result by 3.
Her answer is 27.

What number is Priya thinking of?

..... [2]

8 Expand and simplify.

$4(x - 3) - 3(x - 5)$

..... [2]

9 Simplify.

$7ab + 4a^2 - 2ab + 11a^2$

..... [2]

10 If $u = -3$ and $v = 5$, calculate

$u^2 - 6v$

..... [2]

11 Use the formula

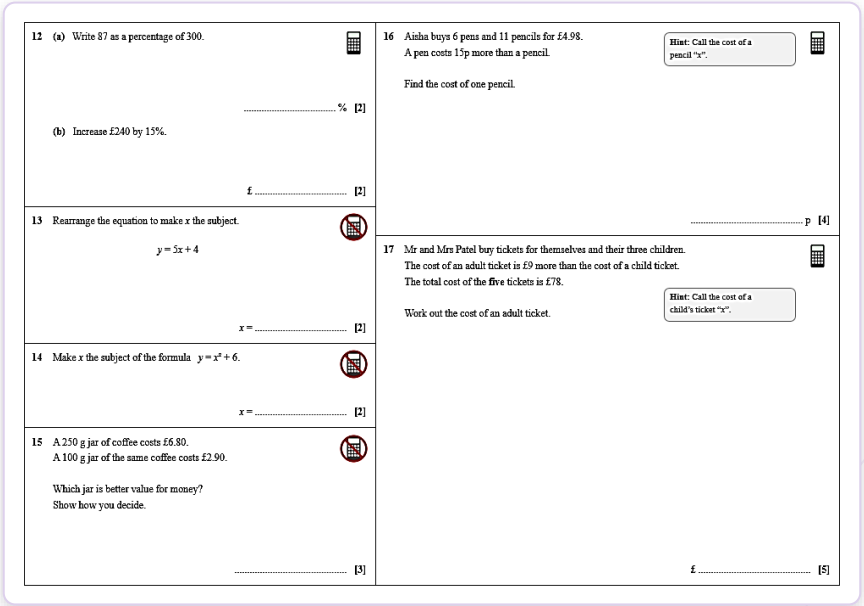
$v = u + at$

to find the final velocity, when

- the initial velocity is 5 m/s
- the acceleration is 2.5 m/s²
- the time is 8 seconds.

Hint:
v = final velocity
u = initial velocity
a = acceleration
t = time

..... m/s [2]



12 **(a)** Write 87 as a percentage of 300.

..... % [2]

(b) Increase £240 by 15%.

£ ..... [2]

13 Rearrange the equation to make x the subject.

$y = 5x + 4$

$x =$ ..... [2]

14 Make x the subject of the formula $y = x^2 + 6$.

$x =$ ..... [2]

15 A 250 g jar of coffee costs £6.80.
A 100 g jar of the same coffee costs £2.90.

Which jar is better value for money?
Show how you decide.

..... [3]

16 Aisha buys 6 pens and 11 pencils for £4.98.
A pen costs 15p more than a pencil.

Find the cost of one pencil.

Hint: Call the cost of a pencil "x".

..... p [4]

17 Mr and Mrs Patel buy tickets for themselves and their three children.
The cost of an adult ticket is £9 more than the cost of a child ticket.
The total cost of the five tickets is £78.

Work out the cost of an adult ticket.

Hint: Call the cost of a child's ticket "x".

£ ..... [5]

THE YEAR 11 PROGRAMME

Year 11 Further Support Strategies

Drop-in Sessions and the Mini Test Cycle

Once the exam sheets come to a close, usually by early February, we begin our second phase of preparation. Weekly assessments sat by all students (at both tiers) maintain a cycle of continual preparation. The mini tests are designed by Alderbrook staff to give students low-stakes exam practice under timed conditions and, over the course of these assessments, we aim to cover the majority of the curriculum. Our Tuesday drop-in sessions go hand-in-hand with these weekly assessments, as the resources we provide are tailored to the content of the end-of-week assessments. We have found this preparatory phase in particular to be outstanding practice for students. But our offer doesn't end here.

The Ultimate Guides

Aptly named, these comprehensive revision guides were created by Mr Cox (with answers contributed by staff) with the purpose of addressing all aspects of the curricula at both tiers. These guides are exclusive to Alderbrook students and serve as a single revision source. We print a copy for each student, usually before the Christmas break. We advise students to use the guide as a content-knowledge tracker; students can make good use of the questions within it to hone their content knowledge. Better yet, every single question is a past exam question.

These guides have been updated many times since 2017, as the nature of exam questions has changed and the number of additional nuances in exams has increased. The third edition of each guide has been produced and edited for 2027. With specifications due to be overhauled again in the coming years, we will continually update our resources to ensure that we are always ahead of the curve, so that our students receive the best offer we can afford them.

In conjunction with the Ultimate Guides, we strongly advise students to complete past papers under timed conditions. Completing past papers affords students practice under the appropriate conditions, and also enables them to identify weak areas. If students are unsure of the topic in question, they should always ask their teachers; at this point, the guides can be used for further questions. We appreciate that not all students will be able to access exam papers from home, so we print packs of papers for students from January of Year 11.

Mock Exams

As mentioned earlier, students will sit two rounds of mock exams in Maths. Whilst we encourage students to prepare as thoroughly as possible, we certainly do not want students to become stressed and bogged down. Whilst mocks may serve as useful indicators of progress, they do not contribute to a student's final grade. In Maths specifically, we have also found that a student's mock performance does not necessarily denote their final grade, so students need not worry if they have tried in earnest to prepare but their efforts didn't seem to go to plan. As we say to all of our students: just stick at it and keep working hard! In the end, as we have seen year after year, the students who work the hardest, with a sense of optimism, are the most likely to achieve their full potential.

Year 11 Further Support Strategies *(continued)*

We cannot overstate how proud we are of all of our students; with such a vast and diverse student body, the remarkable progress we see our students make over the course of five years is our daily motivation.

THE YEAR 11 PROGRAMME

Further Qualifications

Entry Level Certificate

Whilst the vast majority of students will sit the Maths GCSE, not all students find the standard GCSE curriculum accessible. In some cases, it might be more appropriate to enter students for the AQA Entry Level Certificate (ELC).

Information on the ELC can be found here:
https://www.aqa.org.uk/subjects/mathematics/elc/mathematics-5930/specification

Further Qualifications for the Most Able

For outstanding mathematicians, or students who have progressed through a combination of innate ability and a lot of hard work, we offer further qualifications in our subject. Generally speaking, however, to be entered we insist upon students demonstrating the full capability of a Grade 9 by around January of Year 11. We do not wish for students' additional efforts on further qualifications to detract from their primary aim, which will always be to achieve a Grade 9 in GCSE Mathematics.

AQA Level 2 Further Mathematics

Each year, we enter a subset of our top-set students for the AQA Further Mathematics qualification. Whilst not a necessary prerequisite for A-level Maths, the curriculum content does provide useful insight into such post-16 courses. The exams are very challenging and the grading system mirrors that of the GCSE. With this being said, we would advise students against entering for this qualification only to dedicate a partial degree of effort, resulting in a low grade (e.g. a Grade 6 or below). Lower grades in this qualification are potentially attainable by gifted students, but such results will not prove fruitful once students transition to A-level Maths (or even Further Maths).

More information on this qualification can be found here:
https://www.aqa.org.uk/all-about-maths/spec-8365

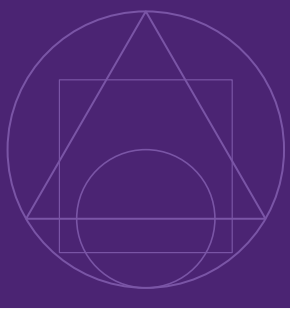
OCR FSMQ Additional Mathematics

For a very small minority of students (usually a couple), there might even be the opportunity to enter for a third qualification in Maths, namely the OCR FSMQ in Additional Mathematics. We reserve this qualification for students who are categorically going to attain a Grade 9 in the GCSE and whose preparation will not detract from their efforts in other subjects. This qualification is not a requirement in any sense, but it does provide an enjoyable challenge for truly elite mathematicians, covering aspects of the Maths and Further Maths A-levels such as Integration, Mechanics and Linear Programming.

More information on this qualification can be found here:
https://www.ocr.org.uk/qualifications/fsmq/additional-mathematics/

BEYOND THE CLASSROOM

The Maths Challenges



Having been at Alderbrook for some years now, it has been a pleasure to work alongside such a broad and diverse student body. It is more than apparent that many of our most able students are outstanding mathematicians, and it has been a pleasure to identify extra-curricular, mathematical challenges for our students to engage with. In particular, the Maths Challenges have gained obvious traction over the past few years.

The Maths Challenge is an incredible opportunity we offer to the strongest mathematicians at Alderbrook School. The Challenge is run by the UK Maths Trust, which is a charity that devotes its time to developing students' mathematical abilities. As a charity, they coordinate both national and international competitions for bright young mathematicians. As a school, we take part in three of the national competitions – The Junior, Intermediate and Senior Maths challenges. Each year in England, 700,000 students compete across all of the challenges and we are very proud of our entrants.

At various points along their school journey, our best mathematicians get the opportunity to compete in each of these challenges. The challenges are problem-solving in nature and they take place on set dates, much like official, external examinations. Students complete the challenges and their answers are then sent to the UKMT, who mark and score each entry. Students get one of four awards: Participation, Bronze, Silver or Gold. The most successful students can be invited to take part in the next round of their challenge and compete against the very best in the country.

The Maths Challenges *(continued)*

1

The Junior Maths Challenge

YEARS 7 AND 8 · 60 MINUTES

This challenge is available to Years 7 and Year 8. All top-set students across both year groups will be afforded the opportunity to sit this challenge. The challenge is sixty minutes long and is designed to test problem-solving and logical reasoning abilities.

2

The Intermediate Challenge

YEARS 9 AND 10 · 60 MINUTES

This challenge is specifically for Years 9 and 10. As with the Junior Challenge, all top set students will have the opportunity to attempt this sixty-minute array of complex questions, testing their abilities with much tougher problems.

3

The Senior Maths Challenge

SIXTH FORM AND YEAR 11 · 90 MINUTES

This challenge is mainly aimed at Sixth Form students taking A-Level Maths. However, our brightest Year 11 students also get the opportunity to participate. This challenge is particularly difficult and students get ninety minutes for completion.

We believe this is a great opportunity for our students who excel in mathematics and problem solving to compete against the rest of the country. It has been a pleasure to witness how well our students have been performing across these challenges in recent years.

If you would like further information on this please have a look on their website.

Competitions - UKMT

Thank you for taking the time to read,

Miss Murray.

LEARNING AT HOME

Our use of AI in Mathematics

I am proud to state that I have worked at Alderbrook for more than a decade. I have been at the forefront of pedagogical developments at Alderbrook, with my personal research in areas such as learning and memory recall being a focal point of staff training over recent years. In order to afford our students the best possible offer, I make it my aim to remain abreast of all advancements that may help (or hinder) our practice as teachers. With AI having entered the public domain, its general use remains a point of seeming controversy; and it is not something we are keen to merely ignore. However, there is much to celebrate in the way of AI's evolution, and this section will hopefully serve to allay many fears and to offer some insight into how we are currently using it, whilst offering some objective advice to students.

There are, and will continue to be, massive benefits to students using AI to learn at home. Yet I remain concerned about students who use it poorly. Learning Maths has a profound effect on one's cognitive reasoning abilities. The study of Mathematics goes far beyond learning facts and information to produce answers that are marked right or wrong, as the ancient stigma dictates. Through studying Maths, students develop key skills that they take with them for the rest of their lives. Furthermore, these are the very skills that allow them to improve at the subject itself as they transition into Key Stage 4 and sit their examinations.

It is this that leads to my concerns with AI. Simply put, if a student uses AI to bypass their own thinking, then there will be significant negative knock-on effects. **They are bypassing the very thing they need to do in order to improve.**

It is also worth stating from the outset that AI is not a replacement for the resources we already provide. Our Exam Sheets, Ultimate Guides, homework tasks and class resources have been created by teachers with many years of experience, both in the classroom and with the examinations themselves. These resources far outweigh anything AI can produce. Used well, AI should sit alongside them and help students get more out of them, never replace them.

Below, I have outlined from experience what I believe are some of the correct ways to use AI to aid development, followed by some of the things students should avoid when they use AI. Where possible, I have included an example of what this looks like in practice.

Our use of AI in Mathematics *(continued)*

How AI Can Aid Progress

1

Generating Emulator Questions

AFTER A TRICKY LESSON OR HOMEWORK · ALL YEARS

Students will often be presented with questions in class that they find challenging, or that they run out of time to answer. By taking a photo of the question, they can ask AI to create similar questions with new numbers and subtle changes. This allows them to practise at home the new skill that they perhaps found difficult in the lesson.

The same is true when completing homework. If a student has struggled through a problem and needed many prompts to complete it, they can then create a new question that allows them to practise it again, this time on their own. An example is shown below.

AI Assistant

STUDENT

PHOTO OF CLASSWORK

Q7. Solve $3(2x - 5) = 4x + 7$

I found this question hard in my lesson today. Can you make me 5 similar questions with different numbers? Please don't show me the answers until I ask.

AI

Of course! Here are five questions that use the same skill (expanding a bracket, then solving with x on both sides):

1. $4(3x - 2) = 5x + 13$
2. $2(5x + 3) = 3x + 20$
3. $5(x - 4) = 2x + 1$
4. $6(2x - 1) = 8x + 10$
5. $3(4x + 1) = 7x - 12$ (watch out – negative answer!)

Have a go, then ask me for the answers to check your work.

Ask anything...

A student photographs a classwork question and asks for similar practice, with the answers held back.

Our use of AI in Mathematics *(continued)*

2

Generating Worksheets

PAST PAPERS · CLASS SHEETS · ONLINE WORKSHEETS

Students can take past papers, class worksheets or online worksheets (Corbettmaths etc.) and, similar to point 1, ask AI to generate similar worksheets. By asking AI to change the questions, gradually increase the difficulty or create more challenge problems, students can then build upon the sheet they were practising. For example:

EXAMPLE PROMPT

"Here is a Corbettmaths worksheet on the area of sectors. Make me a new version with different numbers. Keep questions 1–5 at the same level, make 6–8 harder, and add two challenge questions at the end. Put the answers on a separate page."

3

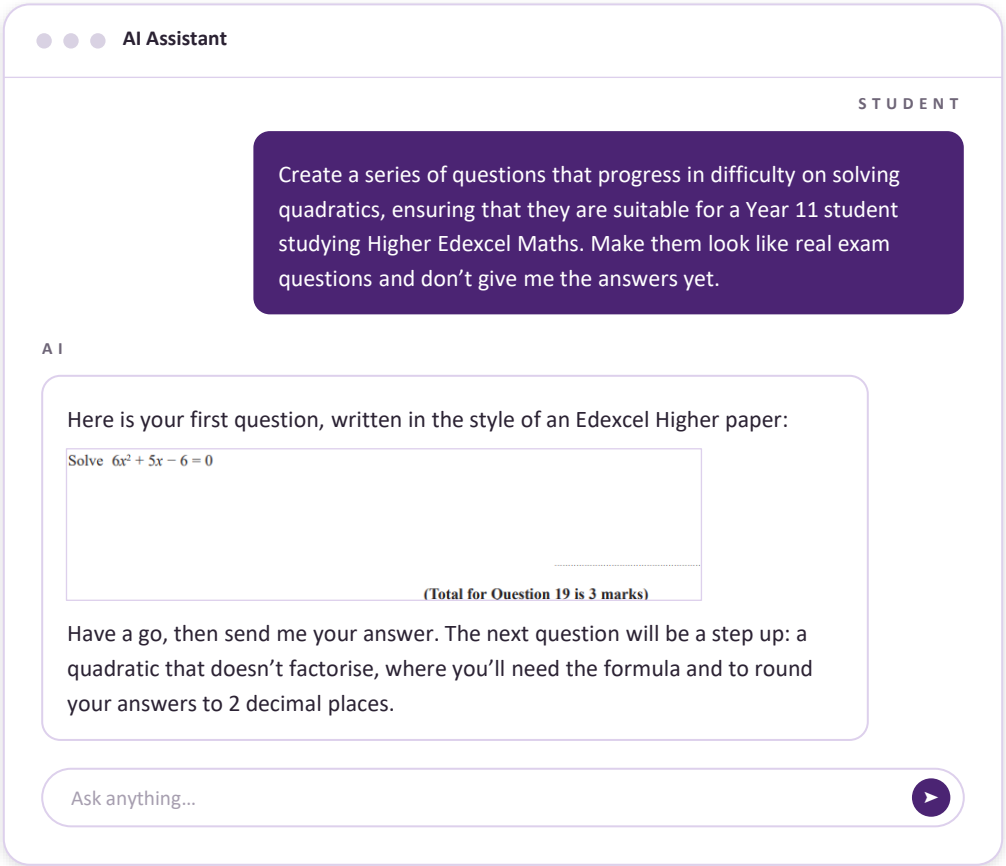
Creating Board-Specific Questions

KEY STAGE 4

This is key for students at Key Stage 4. Students practising at home can find questions and then ask AI to recreate them in a style that is similar to that of their own exam board.

This is also true when students are seeking to improve on a challenging topic. For example, a student could simply prompt AI to "create a series of questions that progress in difficulty on solving quadratics, ensuring that they are suitable for a Year 11 student studying Higher Edexcel Maths." An example is shown below:

Our use of AI in Mathematics *(continued)*



The student asks for board-specific practice, and the AI responds with a question in the Edexcel Higher style.

4

Using AI to Find Errors

ONLY ONCE THE QUESTION HAS BEEN ATTEMPTED

This is a difficult one, as students must get good at spotting their own errors; this is a key skill, as it is exactly what they will need to do in their final examinations. However, for many students attempting a new type of question for the first time, it can be very frustrating to arrive at an answer that is wrong and be totally unsure why. If AI can locate that area of the working, and this allows the student to understand where their misconception lies, then this can greatly improve their understanding. The key is to ask AI to *point to* the error, not to correct it.

Our use of AI in Mathematics *(continued)*

PHOTO OF STUDENT WORKING

Expand and simplify $(x + 4)(x - 3)$

$= x^2 - 3x + 4x + 12$

$= x^2 + x + 12$

AI Assistant

I got $x^2 + x + 12$ but the answer is $x^2 + x - 12$. Don't tell me the answer, just tell me which line my mistake is on.

Your mistake is in the **first line of your working**, in the last term. What is +4 × −3? Have another go at that line.

The AI points the student to the line containing the error, but leaves the correcting to them.

5

Finding a Way In

COMPLEX AND PROBLEM-SOLVING QUESTIONS

This is perhaps the most interesting one, as, if used poorly, it can significantly weaken students' progress. Complex problems are often very challenging to start; finding the first step that opens the question up is frequently the hardest part. A single prompt can often give students the scaffold they need to then access the rest of the question.

However, students should be cautious. This should be done subtly, and AI should not be used to provide multi-step help, as this will then bypass their own thinking.

AI Assistant

PHOTO OF HOMEWORK

The area of a rectangle is 60 cm^2. The length is 4 cm more than the width. Work out the width.

I don't know how to start this. Can you give me ONE hint for the first step only? Don't solve it.

Try calling the width x. What would the length be in terms of x? Then think about how you find the area of a rectangle. Come back if you get stuck at the next step!

One hint, one step. The student still has to form and solve the equation themselves.

Our use of AI in Mathematics *(continued)*

How AI Can Hinder Progress

1

Letting AI Do the Thinking

THE BIGGEST RISK

When students generate answers to questions in a way that significantly reduces their own thinking, this will lead to zero improvement, and can actually cause their progress to slow down or even go backwards. The student in this instance is forgoing thinking, and thinking is the only thing that leads to improvement.

2

Using AI to Finish Homework Quickly

HOMEWORK AND EXAM SHEETS

As mentioned earlier, our homework is bespoke and created by our own teachers. It is designed to be challenging and to help students develop the skills they need to improve their final grade at the end of Year 11. If students use AI to create answers and copy them down, this nullifies all of the effort that has gone into those tasks: theirs and ours.

3

Practising Questions Not Suited to Their Exam Board

KEY STAGE 4

This is less damaging, but worth discussing. Students need to ensure that they are practising board-specific questions, as this will allow them to understand the patterns, nuances and specific styles that each board likes to use. Generic Maths practice is never a bad thing, but tailoring questions to the board will improve students' development.

Our use of AI in Mathematics *(continued)*

4

Using AI in Place of Our Resources

CLASS NOTES · ULTIMATE GUIDES · EXAM SHEETS

I want to make a particular point of this one. The resources we provide are created by teachers with many years of experience, who know our students, our methods and the exams inside out. They are pitched at the right level, follow the methods taught in lessons and reflect exactly what students will face in their final examinations. These resources far outweigh anything AI can produce. When students turn to AI first, they are often shown a different method from the one taught in class, which leads to confusion, or given practice that does not match their exam. AI should add to our resources, never replace them. If in doubt, students should go to their exercise books and the Ultimate Guides, or ask their teacher.

5

Shortcuts That Feel Like Learning

THE SUBTLE MISUSES

Some misuses of AI are less obvious, and students often genuinely believe they are using it well. Three in particular concern me. The first is looking at the answer “just to check” before attempting a question; once the answer has been seen, the attempt is no longer the student’s own. The second is getting an answer and then asking AI for “the working” to copy down; the homework may look worthy of full method marks, but none of that thinking ever took place, and it gives teachers a false picture of what the student can actually do. The third is taking hint after hint; one hint to find a way in is fine, but repeatedly asking “and the next step?” means that, before long, AI has solved the whole question. Each of these feels productive, but the outcome is the same: the thinking has been bypassed.

Our use of AI in Mathematics *(continued)*

What Does a Good Prompt Look Like?

Often, the difference between AI helping and hindering comes down to what a student types. Below is the same homework question, asked in two very different ways:

✗ BYPASSES THINKING

"Answer all the questions on this sheet and show the working."

The student copies a finished answer. Nothing is learned, and the teacher no longer sees what the student can actually do.

✓ SUPPORTS THINKING

"I've tried Q4 and got 12.5. Am I on the right track? Don't show me the method, just tell me if I've gone wrong and roughly where."

The student has done the thinking first, and the AI acts like a teacher giving feedback.

A Word of Caution: Check the Maths

AI tools are not always right. They can, and do, make mistakes with calculations, and they will often do so while sounding completely confident. Students should treat anything AI produces as something to check rather than something to trust: compare it with the answers on the original sheet, check it with a calculator, or ask their teacher.

Our use of AI in Mathematics *(continued)*

Quick Prompt Guide for Students

The prompts below can be copied, adapted and used at home. Each one is designed to keep the student doing the thinking.

WHEN YOU WANT TO…	TRY ASKING…
Practise a question you found hard	*"Make me 5 questions similar to this one with different numbers. Don't show the answers until I ask."*
Make a whole worksheet	*"Turn this worksheet into a new one that gets harder as it goes, with the answers on a separate page."*
Practise for your exam board	*"Write these in the style of [state exam board] GCSE questions, with the marks shown."*
Find your mistake	*"Here is my working. Tell me which line my mistake is on, but don't correct it."*
Get started on a problem	*"Give me one hint for the first step only. Don't solve it."*
Check your understanding	*"Ask me 3 questions on [topic], one at a time, and tell me if I get each one right."*

The Golden Rules

1. Try it yourself first
2. Ask for one hint at a time
3. Keep the answers hidden until you're ready
4. Always check the maths

Used well, AI can be an excellent study partner, offering endless practice at exactly the right level, whenever students need it. Used poorly, it quietly takes away the very thinking that makes students better mathematicians. The rule of thumb we give our students is simple: **if AI is doing the thinking, you are not learning.**

Thank you for taking the time to read,

Mr Palmer.