



CURRICULUM INTENT

MATHS



At Trinity our aim is to help students understand the universal language of Mathematics so they can feel empowered to make informed choices in their futures. Our teachers believe numerical fluency will not only help students to succeed in gaining fantastic Mathematics qualification but will help them to achieve in all their academic studies as well as in their workplace. Students are challenged to think in both real life and theoretical scenarios, to analyse and to create numerical arguments with both rigor and efficiency. When students leave Trinity, we want them to be able to use their knowledge to solve problems as well as navigate the world of statistics and beyond.



CURRICULUM INTENT OVERVIEW



HEAD KNOWLEDGE-RICH

Students will:

- learn Maths through big themes in the curriculum. At GCSE, these themes are Number, Algebra, Ratio & Proportion, Geometry and Statistics & Probability. At A level the big themes are; Algebra, Calculus, Geometry & Trigonometry, Statistics & Probability and Mechanics.
- learn about number properties, arithmetic operations and the relationship between fractions, decimals, percentages and ratio
- learn how to use and manipulate algebraic notation and how to use algebra to problem solve through writing and solving equations and inequalities moving to making generalisations and working with proofs at A level.
- learn about proportional relationships, in particular their application to real life problems.
- learn the properties of shapes, angles, lines, transformations, measurements, area, perimeter, volume and coordinate geometry, including trigonometric functions at A level.
- learn about the world of statistics, how to draw and interpret charts, analyse and draw conclusions from data. At A level, students deepen their understanding of statistical enquiry, hypothesis testing, statistical distributions and correlation & regression analysis.
- understand the language and concept of probability, applying knowledge to both theoretical and experimental scenarios, including probability theory at A level.
- be taught many facts and concepts in KS3 with deliberate practice to build automaticity over time. This leads to students being able to reason and problem solve. Factual knowledge is also taught in KS4 and KS5 but with an emphasis on reasoning and problem solving and the construction of mathematical arguments and proofs.
- be taught to communicate mathematical arguments with efficiency and rigor through clear explanations and logical presentation of the solutions.



HEART FAITH, LOVE AND RESPECT

Students will:

- be encouraged to be brave and share their mistakes to create a respectful class discussion. Teachers encourage students to question any models or answers and demonstrate a positive attitude when they make a mistake. This helps students to see both experts and notices make mistakes.
- be encouraged to take pride in their written work and independent work. Students know their work could be shown under the visualiser and are responsible for achieving 100% on homework each week and to actively seek help if they are struggling.
- be encouraged to do the right things as teachers uphold the school behaviour policy.
- understand their teacher has high expectations and wants them to be the best they can be.
- be exposed to their teachers love of working with a difficult problem and being able to prove their answer is correct. This is particularly prevalent when teaching A level where the beauty of the subject can be marvelled at.
- have the opportunity to take part in National Maths Challenges which give students the opportunity to problem solve using both the specific knowledge they have been taught as well as pure logical thinking.



HANDS APPLICATION OF KNOWLEDGE

Students will:

- feel empowered to make informed decisions about their future.
- be able to speak the universal language of number and understand the world around them.
- be able to construct a logical argument with rigor.
- be able to solve real-life problems by recalling number arithmetic, formulae, etc.
- know what knowledge to apply to solve a mathematical problem.
- know how to break down a problem and what strategy to employ to solve a mathematical problem.
- be able to interpret data and understand its limitations.
- understand that data can be manipulated to create a particular narrative.
- be able to make generalisations.
- have the skills needed for a lifetime of varying career paths, such as engineering, science, business, architecture, finance, technology and beyond.



CURRICULUM TO CLASSROOM

 HEAD KNOWLEDGE-RICH	KNOWLEDGE FOCUSED	Maths lessons are well sequenced episodes of learning linking to bigger themes which build over time to interleave prior knowledge. Increasingly, students have access to key knowledge through knowledge booklets. Where there is a natural link, real life situations are used to add context to key knowledge and help deepen understanding. Teachers use rigorous mathematical language and have ambition for students to speak like a mathematician when asking and answering questions. Students are challenged to improve their verbal reasoning, and teachers avoid 'rounding up answers'. Live modelling via a visualiser or whiteboard is seen in most lessons continually emphasises the correct presentation of solutions. The use of knowledge books across key stage 3 and 4 are used increasingly to ensure all students have access to the knowledge explained by the teacher, mitigating some of the barriers to learning our pupils may have.
	EXPERT TEACHERS (EXPLANATIONS)	Examples are carefully chosen. Initially, these may include simple numbers or allow use of a calculator to minimise cognitive load, before building complexity back in. Increasingly, the presentation of teaching materials is decluttered to minimise cognitive load.
	TAUGHT TO BE REMEMBERED	Lessons generally start with a spaced retrieval 'Do Now' task which focuses on recently acquired knowledge as well as retrieval from students' long-term memories. These tasks can also activate prior learning needed to access the new learning in the lesson. Interleaving new learning into prior topics starts to build as students become more fluent with their newly acquired skills. Mini-whiteboards are used to encourage the participation of all students, helping to guide the pace of the lesson and give students the opportunity to make low-stakes mistakes. and to help guide the pace of the lesson. Show call is increasingly visible in lessons with student responses being shown under a visualiser. A combination of 'hands up' and 'cold calling' are regularly used to check both engagement and understanding. Students' fluency skills are regularly assessed via low-stakes testing within lessons through the use of mini-whiteboards, quick quizzes and exit tickets. Teachers model rigorous mathematical language and challenge students to speak like a mathematician by employing 'right is right' when students are answering questions. Homework is set to test knowledge after it has been taught in lesson. KS3 and KS4 students use the homework platform Sparx. It is intelligent and slowly increases the level of challenge, starting with fluency and then interleaving. Students must achieve 100% on their homework. The platform offers support in the form of videos.

HEART FAITH, LOVE AND RESPECT	ENCOURAGING CLASSROOMS BASED ON FAITH, LOVE & RESPECT	When students arrive to their Maths lessons, they are greeted at the door and in most lessons, a Do Now task is ready for them to begin. Teachers have high expectations of students. They are expected to be on time, correctly dressed, fully equipped and to complete weekly homework. Those who fail to meet these high expectations are challenged and the school behaviour and sanctions policy is followed. During modelling, students are increasingly encouraged to focus on the teacher in various ways with prompts such as 'pens down, eyes on me' whilst teachers live model examples via a visualiser or whiteboard. Students are expected to participate in lessons with mini-whiteboards, and through questioning. Students are expected to respond to verbal and written feedback. In Maths lessons students know there is no-opt out when questioned. Teachers may re-phase the question or ask another student to help and use bounce back. Silence may be expected for independent deliberate practice to help reduce cognitive load and give a defined start to independent work. Our Maths teachers believe a culture of error is an opportunity for deeper learning. Students are encouraged to be brave and share their mistakes to create a respectful class discussion. Teachers encourage students to question any models or answers and demonstrate a positive attitude when they make a mistake. This helps students to see both experts and notices make mistakes.
HANDS APPLICATION OF KNOWLEDGE	EXPERT TEACHERS (MODELLING)	Modelling is teacher led, not student led. Expert teachers use visualisers and whiteboards to live model with the emphasis on the correct notation and presentation of a solution. Teachers also share what they are thinking at each step of a process. When solving complex problems, teachers may model how they have arrived at the strategy they will use to start a solution. Teachers subject specific knowledge ensures that the chosen examples give a natural opportunity to address common misconceptions before they arise. Increasingly knowledge books are used to minimise cognitive load which employ an 'I do, we do, you do' modelling approach.

	Do now tasks give students the opportunity to practice the retrieval of recent knowledge as well as knowledge from their long-term memory. This may activate prior learning needed for the lesson. Formal assessments provide students with a focal point to encourage revision. These are teacher marked, followed up with teacher feedback and the opportunity to evaluate and correct their work in purple pen. In KS3, students are assessed using White Rose end of unit assessments with fluency and reasoning as the focus. When students enter their GCSE and A level courses, past exam paper questions as used in their formal assessments which build over the course to include questions from past topics, essentially building towards an actual past exam paper and so include fluency, reasoning and problem solving throughout our KS4 assessment plan. In addition, KS5 assessments test the communication of mathematical arguments and proof. Teachers circulate classrooms during independent work and identify if there are any individual or class wide misconceptions. Teachers may address the whole class with a widely found misconception asking students to respond with mini-whiteboard question(s). Some teachers also mark work whilst they circulate. Mini-whiteboards are regularly used throughout large parts of a lesson to help assess students understanding and guide the pace at which increasingly more difficult questions are posed.
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LEARNING SEQUENCE – YEAR 7

OUTCOMES	Our Year 7 curriculum builds on the knowledge and skills acquired in KS2 and seeks to begin to use these skills in context to solve problems. Students are introduced to Algebra early on as this forms the foundation for many topics to come, and it is interleaved into the topics that follow. A key theme in Year 7 is Equality and Equivalence this being revisited several times throughout the year.
Sequences	This topic is designed to be accessed by all students while drawing in their interest into maths. Objectives • Describe and continue a sequence given diagrammatically • Represent sequences in tabular and graphical forms • Recognise the difference between linear and non-linear sequences • Continue numerical linear and non-linear sequences • Explain the term-to-term rule of numerical sequences in words <i>Tier 2 Word Focus: Indication</i>
Algebraic notation	Algebra and generalisation as well as formal algebraic notation are introduced for the first time. Objectives • Find the output of a single and double function machine • Use inverse operations to find the input given the output • Use diagrams and letters to generalise number operations • Use diagrams and letters with single and double function machines • Find the function machine given a one step and expression and two step expression • Substitute values into one step and two step expressions • Generate sequences given an algebraic rule <i>Tier 2 Word Focus: Subsequently</i>
Expressions and Equations	Building on the previous topic of Algebraic notation students begin to solve equations and collect like terms. Objectives • Equality and Equivalence • Like and unlike terms • Collect like terms • Solve 1-step equations • Solve 2-step equations <i>Tier 2 Word Focus: Variation</i>
Place Value & Ordering	Students consolidate Key Stage 2 learning here and extend it further. Objectives • Recognise the place value of any digit in an integer up to one billion • Understand and write integers up to one billion in words and figures • Work out intervals on a number line • Position integers and decimals on a number line • Compare two numbers using =, ≠, <, >, ≤ and ≥ • Compare and order any number up to one billion • Round integers to the nearest power of 10

	• Round a number to 1 significant figure <i>Tier 2 Word Focus: Derive</i>
Four Operations	In this topic students revise the four operations with both integers and decimals to embed key skills students will need across multiple disciplines Objectives • Add and subtract integers • Add and subtract decimals • Multiply and divide by 10, 100 and 1000 • Multiply and divide by 0.1 and 0.01 (E) • Multiply integers • Multiply decimals • Divide integers • Divide decimals by integers • Divide by a decimal (E) • Order of operation <i>Tier 2 Word Focus: Substantial</i>
Averages and Range	In this topic students will begin to understand how manipulate data. Calculating averages forms a fundamental cross-curricular skill. Objectives • Mode • Mean • Median • Range • Solve problems with average and range <i>Tier 2 Word Focus: Subsequently</i>
Rounding and Estimation	Students recap rounding and discover the difference between significant figures and decimal places when rounding. The most able will look at error interval notation. Objectives • Round to 1 significant figure • Round to 2 or more significant figures • Estimate answers to calculations • Solve problems with estimation • Understand and use error interval notation (E) <i>Tier 2 Word Focus: Variation</i>
Graphing Data	After analysing data in a previous unit, we are not looking at visual representations of data. This skill is transferrable across many disciplines. Objectives • Pictograms • Bar charts • Dual bar charts • Composite bar charts • Coordinates in the first quadrant • Scatter graphs • Correlation • Line of best fit • Time series • Non-linear relationships <i>Tier 2 Word Focus: Sufficient</i>

Fractions, Decimals and Percentages	Students will consolidate and extend their knowledge of fractions, decimals and percentages and explore a range of different representations Objectives • Students look at representations of Fractions decimals and percentages before thinking about conversions • Represent tenths and hundredths • Number lines with fractions and decimals • Tenths, hundredths, fifths and quarters • Eighths and thousandths • Understand percentages • Convert simple fractions, decimals and percentages • Fractions as diagrams • Fractions on a number line • Equivalent fractions • Fractions as division • Convert fractions, decimals and percentages • FDP greater than 1 (E) <i>Tier 2 Word Focus: Distinguish</i>
Directed Number	Students will now look at positive and negative numbers. Looking at positive and negative numbers and completing the four operations with them. Objectives • Directed number and number lines • Compare and order directed number • Calculations that cross zero • Directed number and zero pairs • Add directed number • Subtract directed number • Multiply and divide directed number • Order of operations with directed number • Use a calculator with directed number <i>Tier 2 Word Focus: Comprehensive</i>
Fractions and Percentages of amounts	This topic focuses on the key concepts of finding fractions of amounts and percentages of amounts. Visual representations such as bar models are used linking back to Equality and Equivalence. Objectives • Find a fraction of a given amount • Use a given fraction to find the whole and/or other fractions • Find a percentage of a given amount using mental methods as well as a calculator <i>Tier 2 Word Focus: Distinct</i>
Perimeter and Area	Students are well-verse in Perimeter and Area, so we explore this and link to problem solving with area and perimeter Objectives • Convert metric units of length • Perimeter of a polygon • Perimeter of a compound shape • Area of rectangles and parallelograms • Area of triangles • Area of trapezium • Solve problems with perimeter and area

	Form expressions with perimeter and area <i>Tier 2 Word Focus: Representation</i>
Speed, Distance and Time	Students will look at the compound measure of speed, distance and time. Making the links between different using and understanding that per is an operation for division. Objectives - Convert between milliseconds, seconds, minutes and hours - Convert between hours, days and years - Fractions of time - Solve problems with tables and timetables - Solve problems with time and the calendar - Calculate speed - Calculate distance and time - Solve problems with speed, distance and time - Interpret distance-time graphs - Draw distance-time graphs - Calculate speed from a distance-time graph (E) <i>Tier 2 Word Focus: Allocate</i>
Properties of Number	Students will discuss the very fabric of what a number is. We will explore different classifications of numbers and properties that certain numbers hold. Objectives - Multiples - Factors - Prime numbers - Write a number as a product of prime factors - Square, cube and triangular numbers - Square roots and cube roots - Explore higher powers and roots (E) - Highest common factor (HCF) - Lowest common multiple (LCM) - HCF and LCM from a Venn diagram (E) <i>Tier 2 Word Focus: Exhaust</i>
Adding and Subtracting Fractions	Adding and Subtraction fractions builds on the previous topic. Students now start to work with fractions of any denominator as well as mixed numbers. Bar models continue to be used as a visual representation of the problem, helping students to add and subtract any fraction or mixed number. Objectives - Convert between improper fractions and mixed numbers - Add and subtract any improper fractions and mixed numbers - Use equivalence to solve problems involving decimals and fractions and choosing the appropriate conversion <i>Tier 2 Word Focus: Tendency</i>
Angles and Polygons	Students will recall basic angle facts before broadening their knowledge with angles in parallel and perpendicular lines Objectives - Draw and measure angles - Understand and use geometric notation - Angles around a point - Angles on a straight line

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| | <ul style="list-style-type: none">• Vertically opposite angles• Recognise and name polygons• Parallel and perpendicular lines• Angles in a triangle• Angles in a quadrilateral• Solve angle problems• Angles in a polygon (E) |
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Tier 2 Word Focus: Overview



LEARNING SEQUENCE – YEAR 8

OUTCOMES	The Year 8 curriculum builds on the content taught in Year 7 and begins to deepen and develop students' understanding. Students study proportional relationships. Many more algebraic concepts are introduced to enable links to be established between geometry and algebraic manipulation. Calculator use is encouraged in Year 8 alongside regular opportunities for students to practise their mental Maths when appropriate.
Ratio	Students will build on knowledge of fractions to apply an understanding of proportion to ratios. Objectives • Understand the meaning of ratio and notation • Solve problems involving ratios of the form 1:n and n:1 • Solve problems involving ratios of the form n:m • Divide into ratio • Simplify ratio • Compare ratios and fractions • Find the gradient as a ratio <i>Tier two word: Subjective</i>
Proportion and Scale	Students will build on their knowledge of fractions and ratio studied in the previous unit to now link this to proportion. They will study how proportion links to conversion, similar shapes and scale diagrams and drawings. Students will study: Objectives • Direct proportion • Direct proportion graphs • Conversion graphs • Convert between currencies • Similar shapes • Convert metric units • Scale diagrams • Interpret maps using scale and ratio <i>Tier two word: Derive</i>
Algebraic Manipulation	Students will continue to develop their Algebraic Manipulation skills building upon their knowledge from Year 7. They will focus on forming expressions and looking at operations that involve brackets. Objectives • Form algebraic expressions • Simplify expressions • Use directed number with algebra • Substitution with directed number • Expand a single bracket • Factorise into a single bracket • Expand single brackets and simplify • Expand double brackets of the form $(x+a)(x+b)$ (E) • Factorise quadratic expressions (E) <i>Tier two word: Representation</i>

Co-ordinates and Graphs	In this topic students will learn how to draw graphs and use coordinates to support cross-curricular topics. Objectives • Work with coordinates in all four quadrants • Identify and draw lines parallel to the axis and $y=x$ • Draw lines in the form $y=x+c$ • Recognise lines of the form $y=kx$ and link to direct proportion. • Lines with a negative gradient • Lines in the form $y=x+c$ • Lines in the form $y=mx+c$ <i>Tier two word: Variation</i>
Multiplying and Dividing Fractions	Students will have some basic understanding of multiplying and dividing fractions from primary school and so this topic deepens understanding of multiplying and dividing fractions Objectives • Represent multiplication of fractions as diagrams • Multiply integers, fractions and mixed numbers to find the product • Use the reciprocal when dividing by a fraction • Divide integers, fractions and mixed numbers <i>Tier two word: Obtain</i>
Symmetry and Reflection	Students will study spatial reasoning with 2-d objects. Being able to perform some basic transformations and then describe them Objectives • Line symmetry • Rotational symmetry • Reflect a shape in a horizontal or vertical line • Reflect a shape in a diagonal line • Reflect a shape in a given equation of a line (E) • Describe a reflection (E) <i>Tier two word: Distinct</i>
Area, volume and Density	Students will recall names for 2D and 3D shapes, before exploring the space inside them. They will also look to problem solve with shapes including perimeter. Once students are able to find the area and volume they will transcend into using density with a given volume. Objectives • Area of 2D shapes • Area of compound shapes • Recognise prisms (including language of edges and vertices) • Volume of cubes and cuboids • Convert metric units of mass and capacity • Understand the units of mass/density/volume • Solve problems with density, mass and volume <i>Tier two word: Constraint</i>
Equations and inequalities	Here, students will build on their understanding of equivalence from Year 7. This topic will build on solving one and two step equations. Objectives • Identify and use formulae, expressions, identities and equations

	• Form algebraic expressions • Use negative numbers with algebra • Expand a single bracket • Expand multiple single brackets and simplify • Factorise into a single bracket • Solve equations, including equations with brackets • Form and solve equations with brackets • Understand and solve simple inequalities • Form and solve positive inequalities <i>Tier Two word: Critical</i>
Percentages	Students will recall knowledge of converting between fractions, decimals and percentages before studying specifically how to calculate with percentages. From increases and decreases to looking at percentage change. This is a critical skill used in many subjects across the curriculum. Objectives • Convert between decimals and percentages greater than 1 • Percentage increase using a multiplier • Percentage decrease using a multiplier • Percentage increase and decrease using a multiplier • Express one number as a percentage of another (calculator) • Express one number as a percentage of another (non-calculator) • Percentage change • Find the original value given a percentage • Choose appropriate methods to solve percentage problems <i>Tier two word: Fundamental</i>
Indices	In this topic students are building on prior knowledge of collecting like terms and creating the building blocks needed for the next topic; Standard Form. Objectives • Add and subtract expressions with indices • Simplify algebraic expressions by multiplying indices and use the addition law • Simplify algebraic expressions by dividing indices and use the subtraction law • Use the power law to simplify expressions <i>Tier two word: Exposure</i>
Standard form	Here, students build on their knowledge of simple powers such as squares and cubes studied in Year 7 where they learn to represent very small and large numbers using powers of 10. Objectives • Work with numbers greater than 1 in standard form • Work with numbers between 0 and 1 in standard form • Compare and order numbers in standard form • Mentally calculate with numbers in standard form • Multiply and divide numbers in standard form • Use a calculator to work with numbers in standard form <i>Tier two word: Extensive</i>
Interpret and represent data	Students will understand different types of data categorisation and how that affects what interpretations can be made about that data. They will compare distributions using sound mathematical knowledge. Objectives • Types of data

	• Outliers and Errors • Averages and range • Choose the most appropriate average • Compare distributions using average and the range • Averages from ungrouped frequency tables • Represent and interpret grouped discrete data • Represent and interpret continuous data grouped into equal classes <i>Tier two word: Essentially</i>
Angles in parallel lines and polygons	Students should be able to recall some basic angle facts from KS2 which should allow them to access the following Objectives • Identify and calculate with alternate, corresponding and co-interior angles • Solve complex problems with parallel line angles • Identify and calculate with sides and angles in special quadrilaterals • Understand and use the sum of exterior angles of any polygon • Understand and use the sum of interior angles of any polygon • Calculate missing interior angles in regular polygons <i>Tier two word: Exception</i>
Tables and Probability	Students will use knowledge of fractions, decimals and percentages in the new context of probability in this new topic. Objectives • Use the language of probability • Place events on a number line • Write simple probabilities • Know probabilities add to 1 • Construct sample spaces for 1 or more events • Find probabilities from sample space • Represent and find probabilities from two-way tables • Find probabilities from Venn diagrams <i>Tier two word: Clarity</i>
Circles	Students will develop their knowledge of circles using the correct mathematical terminology to label parts of the circle Objectives • Circle vocabulary • Pi as a ratio • Circumference of a circle • Perimeter of parts of a circle • Area of a circle • Area of parts of a circle • Area and circumference of a circle • Perimeter of compound shapes with circles • Perimeter and area of compound shapes with circles <i>Tier two word: Deviation</i>
Graphs and Charts	Students will use their previous knowledge of data, to explore how we represent data. They will explore different representations to understand how graphs can be misleading. Objectives • Pictograms and bar charts • Vertical line charts

	• Line graphs • Draw pie charts • Interpret pie charts • Choose the most appropriate graph or chart • Compare distributions using graphs • Misleading graphs and charts <i>Tier two word: Irrelevant</i>
Sequences	Students will learn how to describe different sequences and generate sequences using a given rule Objectives • Generate and describe a sequence given a rule in words • Generate a sequence given a simple algebraic rule • Generate a sequence given a complex algebraic rule (E) • nth term of a linear sequence <i>Tier two word: Indication</i>



LEARNING SEQUENCE – YEAR 9

OUTCOMES	The Year 9 curriculum builds on the content taught in Year 7 and Year 8 and further deepens and develops students' understanding. Year 9 helps to lay the foundations for more complex topics which will be studied at GCSE. Students will work with more algebraic concepts, be introduced to Pythagoras, Trigonometry and Quadratics. Also, students will have the opportunity to understand key concepts related to money such as wages, tax and interest.
Properties of number	Students begin year 9 recapping the basic properties of numbers, focussing on factors primes and multiples. Once this core knowledge is recalled, they will move on to applying this through highest common factors and lowest common multiples Objectives • Factors, multiples and primes • Highest common factor (HCF) and lowest common multiple (LCM) • Write a number as a product of prime factors • Venn diagrams • Use a Venn diagram to calculate the HCF and LCM • Integers, real numbers and rational numbers <i>Tier two word: Critical</i>
Percentages	Students will recall knowledge from year 8 regarding percentages and continued to study percentage increase and decrease they will also solve problems both with and without a calculator before exploring compound interest. Objectives • Percentage increase and decrease • Simple interest • Express a change as a percentage • Find the original value after a percentage change • Solve problems with percentages (non-calc) • Solve problems with percentages (calculator) • Repeat percentage change • Compound interest <i>Tier two word: Distinct</i>
Area and Volume	Students will recall core knowledge from year 8 on on area perimeter and use this to explore nets of 2D shapes. They will then use this, combined with the area of a circle to find the volume of prisms and cylinders. Objectives • Nets • Area of 2D shapes • Area and circumference of circles • Surface area of cubes and cuboids • Volume of a prism • Volume of a cylinder <i>Tier two word:</i>

Equations, Inequalities and Formuale	Students will continue to build upon ideas explored in year 8 and this is no different in this unit. Students will recall core knowledge around algebraic manipulation and solving equations before moving on to solve inequalities they will then look at the real-world applications of changing the subject of a formula. Objectives • Solve equations and inequalities • Solve equations and inequalities with brackets • Solve equations and inequalities with unknowns on both sides • Solve problems with equations and inequalities • Substitute into formulae and expressions • Change the subject of a formula (one-step) • Change the subject of a formula (two-step) <i>Tier two word: Execute</i>
Fractions	Students will spend time recalling core knowledge on the four operations with fractions and use this knowledge to apply the fractions of amounts. Making the link between the command word 'of' and multiplication Objectives • Add and subtract fractions • Multiply and divide fractions • Fractions of an amount <i>Tier two word: Tendency</i>
Rates	Students will recall speed distance and time from year 7 before looking at their graphs and exploring different rates of change and their units. They will also look at flow problems and their graphs Objectives • Speed, distance and time • Distance-time graphs • Solve flow problems and their graphs • Rates and change and their units <i>Tier two word: Variation</i>
Standard Form	Students will recall key facts about standard form. They will then learn how to write, order, multiply, divide, add and subtract numbers in standard form. Standard form is used in science though there is a cross-curricular link here Objectives • Numbers in standard form • Compare and order numbers in standard form • Multiply and divide numbers in standard form • Add and subtract numbers in standard form <i>Tier two word: Extensive</i>
Maths and Money	Arguably one of the most important subjects we teach in mathematics to year 9 is Maths and money. Students will explore tax, jobs, investing, Saving and borrowing, budgeting, spending overseas money and insurance. Whilst not a topic on the GCSE specification necessarily, it is it is a vitally important life skill of one we feel we must teach thoroughly. Objectives • Understand a bank account • Value added tax • Ways to pay

	• Jobs and pay • Ways to save • Investing • Borrowing (buying a house) • Borrowing (loans) • Running a house or business • Budgeting • Spending overseas • Insurance <i>Tier two word: Sufficient</i>
Straight line graphs	Students will recall core knowledge from year 8 regarding straight line graphs. They will then begin to explore the equation of a straight-line $y = mx + c$. Before understanding in greater detail how gradients affect a graph. They will also study and be able to interpret the gradient from real life graphs chances are you can think about this Objectives • Lines parallel to the axes, $y=x$ and $y=-x$ • Explore gradients • Explore intercepts • $y=mx+c$ • Find the equation of a line from a graph • Interpret gradient and intercepts of real-life graphs <i>Tier two word: Distinguish</i>
Ratio & Proportion	Ratio is a core component of the GCSE mathematics specification and therefore it's important that it is interleaved across key stage 3 and 4. Students will need to rely on knowledge of ratios in order to understand direct proportion. Using previous topics, we will then explore direct and inverse proportion graphs and begin to solve ratio problems where part or whole of the information is given Objectives • Direct proportion • Direct proportion and conversion graphs • Inverse proportion • Ratio problems (whole or part given) <i>Tier two word: Clarity</i>
Construction, congruence and similarity	In this unit students will explore construction, similarity and congruence. They will become competent in using mathematical instruments of compasses and protractors to construct triangles, construct angles and perform a perpendicular bisector. They will then be able to identify congruence shapes before understanding the difference between congruence and similarity Objectives • Construct and interpret scale drawings • Construct triangles using ASA, SAS and SSS • Construct an angle bisector • Construct a perpendicular bisector • Construct a perpendicular to or from a point • Identify congruent figures • Congruent triangles • Recognise enlargement and similarity • Work out unknown lengths and angles in similar shapes <i>Tier two word: Fundamental</i>

Algebraic Manipulation	Algebraic manipulation is another core part of the GCSE specification and therefore requires constant Recall. This unit explores expanding of factorising expressions into single and double brackets It begins to introduce the idea of quadratic equation to students. Objectives • Expand single brackets and simplify • Factorise into a single bracket • Expand double brackets • Factorise quadratic expressions (E) <i>Tier two word: Extensive</i>
Pythagoras' Theorem	Pythagoras's theorem affords the opportunity to explore right-handed triangles like never before. Students will learn new vocabulary including the hypotenuse and adjacent and apply pythagoras' theorem to right angle triangles. Objectives • Solve equations with squares and square roots • Identify the hypotenuse • Determine whether a triangle is right-angled • Pythagoras' theorem (find the hypotenuse) • Pythagoras' theorem (find any side) • Use Pythagoras' theorem on coordinate axes <i>Tier two word: Derive</i>
Non-linear graphs	Mathematics is all about interleaving ideas and we return to algebraic manipulation and use the skills acquired to now plot quadratic graphs we begin to interpret our quadratic graphs before exploring reciprocal and exponential graphs. Objectives • Substitute into quadratic expressions • Draw simple quadratic graphs • Draw more complex quadratic graphs • Interpret quadratic graphs • Interpret reciprocal and exponential graphs <i>Tier two word: Overview</i>
Probability	Probability affords the students the opportunity to explore the likelihood of outcomes. they will study different set notation before moving on to understand how probabilities are constructed. They will understand the difference between theoretical probability and experimental probability and look at expected outcomes before extracting probabilities from Venn diagrams. Objectives • Identify and represent sets • Intersection of a set • Union of a set • Probability of a single event • Use diagrams to work out probability • Relative frequency • Expected outcomes • Independent events • Probabilities from Venn diagrams <i>Tier two word: Exhaust</i>

Transformations	Students will explore the four types of transformation in this topic. They will understand the differences between reflections rotations and enlargements and translations, as well as being able to perform these transformations with any specialist equipment that is required. They will then understand how to describe a transformation. Objectives • Enlargement (positive scale factor) • Enlargement from a point (positive scale factor) • Enlargement (fractional scale factor) • Describe an enlargement • Rotation about a point • Describe a rotation • Translation • Describe a translation • Reflection <i>Tier two word: Obtain</i>
Trigonometry	Building on a previous knowledge of Pythagoras's theorem, students will now explore trigonometry. Students will learn to label sides with hypotenuse, opposite and adjacent before using and understanding of three trigonometric ratios of sine, cosine and tangent. They will use this knowledge to find angles and Missing side and our most able will be able to problem solve. Objectives • Identify hypotenuse, opposite and adjacent sides • Use the tangent ratio to find unknown side lengths • Use sine and cosine ratios to find unknown side lengths • Use sine, cosine and tangent ratios to find unknown angles • Choose the right method <i>Tier two word: Allocate</i>
Simultaneous Equations	For our most able students they will begin to explore solving simultaneous equations at the end of year 9. This is an optional module for those students who have finished the rest of the content in year 9 as this is a topic that is explored again in year 10 in great detail. Objectives • Use one value to find another • Introduction to simultaneous equations • Solve simultaneous equations using graphs • Solve simultaneous equations (no adjustments) • Manipulating equations • Solve simultaneous equations (adjust one) <i>Tier two word: Review</i>



LEARNING SEQUENCE – YEAR 10

Foundation

Indices and Decimals

Students begin KS4 exploring number facts in great deal. We continue to embed standard form, studied in year 9, to ensure its understanding.

Objectives

- Use the four operations with negative numbers.
- Know the square and cube numbers and evaluate higher powers.
- Calculate square and cube roots.
- Use the laws of indices.
- Solve problems that require the combined use of more than 1 index law.
- Evaluate a negative index.
- Multiply and divide by 10, 100, 1000
- Evaluate positive and negative powers of 10.
- Write numbers in standard form and ordinary form.
- Compare and order numbers in standard and ordinary form.
- Multiply and divide numbers written in standard form.

Algebraic Expression

Students revisit the basics of algebra and build on skills developed in Key Stage 3. This prior knowledge is used throughout the Year 10 & 11. Students extend their knowledge of other key areas of maths by being able to generalise using algebra and so this is a fundamental building block for GCSE.

Objectives

- Know the meaning of term, expression, equation, identity, formula and inequality.
- Write expressions using algebraic notation.
- Simplify expressions by collecting like terms.
- Multiply terms, including use of indices.
- Divide expressions and simplify simple algebraic fractions.
- Expand single brackets.
- Simplify expressions involving brackets.
- Factorise linear expressions.

Percentages

Percentages features heavily in GCSE examinations and this topic builds on existing Key Stage 3 knowledge. Calculator and non-calculator methods are used throughout. Students deepen their understanding of real-life percentages e.g. using different types of interest. Student vocabulary builds quickly in this unit with lots of real-life problems being used.

Objectives

- Convert between percentages and decimals.
- Write one number as a percentage of another.
- Calculate a percentage of an amount using a decimal multiplier.
- Use decimal multipliers to complete percentage increases and decreases.
- Calculate the percentage change between two numbers.
- Calculate percentage profit and loss.
- Calculate the original amount, before a percentage change.
- Calculate simple interest.

Averages, Range and Presenting Data

In this topic students build on Key Stage 3 work on collection, representation and use of summary statistics to describe data. Much of the content will be familiar from other students e.g. Science and Geography with the use of everyday life examples. Students will both construct tables and charts as well as interpret the data shown by the tables and charts. Students will develop their skills in being able to decide on the most appropriate way to display data and have an understanding of the limitations each table or chart may have. Students will develop skills in being able to criticise tables and charts which are misleading.

Objectives

- ☐ Calculate the mode, median and mean of a list of numbers.
- ☐ Calculate the range of a set of numbers.
- ☐ Work backwards from the mode, median and range to find data values.
- ☐ Use averages and the range to compare distributions.
- ☐ Construct and interpret stem and leaf diagrams.
- ☐ Find averages and the range from a stem and leaf diagram.
- ☐ Construct and interpret pictograms.
- ☐ Construct and interpret bar charts and composite bar charts.
- ☐ Find the mode and range from a frequency table.
- ☐ Construct and interpret grouped frequency tables & frequency polygons.
- ☐ Construct and interpret Frequency Polygons

Formulae and Equations

Students build, extend and deepen their knowledge of equations, inequalities and sequences from Key Stage 3. Key vocabulary is developed here which helps students to access questions which look mathematically similar but require different approaches. Students look at solving equations and inequalities as well as forming. Sequences are revisited and extended from Key Stage 3 to start to formalise sequences with algebraic rules.

Objectives

- ☐ Find the inputs and outputs of functions.
- ☐ Substitute positive and negative numbers into expressions and formulae.
- ☐ Solve 1 step equations.
- ☐ Solve multi step equations, including those involving division.
- ☐ Solve equations with unknowns on both sides.
- ☐ Set up equations from contexts such as area or angle diagrams.

Students revisit fractions and develop their ability to apply fluency skills to more reasoning and problem-solving style questions.

Factors and Multiples

This short unit recognises the need for understanding of factors and multiples of numbers. Due to the cyclic nature of our curriculum, this is a topic students should already understand. Therefore, we are consolidating learnt knowledge to ensure understanding. Products of prime factors a skill that students will revisit in this unit to cement understanding.

Objectives

- ☐ Recognise odd and even numbers.
- ☐ Recognise factors, multiples and primes.
- ☐ Find common factors and multiples and the highest common factor and lowest common multiple of two numbers.
- ☐ Write a number as a product of prime factors.

Rearranging formulae and Sequences

Students begin this unit by recapping rearranging formulae. This is a key skill needed for this unit. Students will then progress onto sequences looking at both arithmetic, and geometric sequences. They will become proficient in finding missing terms and continuing sequences of various kinds. Students should be able to find the n th term of an arithmetic sequence.

Objectives

- ☐ Rearrange formulae involving one or two steps.
- ☐ Find missing terms and continue an arithmetic sequence.
- ☐ Find missing terms and continue a geometric sequence.
- ☐ Find missing terms and continue a Fibonacci sequence.
- ☐ Use term to term rules.
- ☐ Find and use the n th term of an arithmetic sequence.

Co-ordinates and Linear Graphs

This topic builds on earlier study of straight-line graphs in Year 9. Students plot straight lines from given equations and find and interpret the equation of a straight line from a variety of situations. Students learn to interpret real life graphs and appreciate what the gradient and y -intercept represent in real life situations that they may come across e.g. mobile phone tariffs and taxi journeys.

Objectives

- ☐ Plot co-ordinates.
- ☐ Construct and recognise graphs parallel to the axes (e.g. $y = 4$), $y = x$ and $y = -x$.
- ☐ Find the midpoint of a pair of co-ordinates.
- ☐ Plot linear graphs.
- ☐ Work out the gradient of a line.
- ☐ Work out the equation of a linear graph.
- ☐ Identify the gradient and y intercept from the equation or graph.

Speed Distance and Time

Speed, Distance, Time, encompasses the average speed of movement. Students will make the link between science, and maths in this topic and will work with different compound units for speed. They will develop an understanding of how a graph can be used to represent this information and use a graph to describe different types of motion

Objectives

- ☐ Convert between units of time.
- ☐ Calculate time intervals.
- ☐ Calculate speeds, distances and times.
- ☐ Interpret and use distance time graphs.
- ☐ Know that the gradient of a distance time graph represents the speed of the object and calculate the speed from the graph.

Pythagoras and Trigonometry

Pythagoras and Trigonometry is a topic delivered at the back end of year 9. Students will be expected to recall all key formulae for right-angled triangles before understanding angles of elevation and depression. Students must be able to understand which mathematical concept is the most appropriate for the problem posed.

Objectives

- ☐ Use Pythagoras' Theorem to find missing sides in triangles.
- ☐ Recognise Pythagorean triples and identify whether triangles are right angled.
- ☐ Label the sides of a triangle as opposite, adjacent or hypotenuse.
- ☐ Use sine, cosine and tangent ratios to find missing lengths and angles in triangles.
- ☐ Calculate angles of elevation and depression.

Higher

Indices, Surds and Decimals

Students recall core knowledge from a range of KS3 number topics. They will look at surds in detail before exploring the link between surds and indices

Objectives

- Use the four operations with negative numbers.
- Calculate square and cube roots of integers, fractions and mixed numbers.
- Recognise surds and know that they are irrational numbers.
- Multiply integers and surds.
- Simplify surds.
- Add and subtract surds.
- Use the four operations with surds.
- Evaluate bases raised to fractional and negative powers.
- Use the laws of indices.
- Multiply and divide decimals.
- Write numbers in standard form.
- Multiply and divide with numbers in standard form.

Expressions and Identities

Students revisit the basics of algebra and build on skills developed in Key Stage 3. This consolidation unit is used throughout Year 10 & 11. Students extend their knowledge of other key area of maths by being able to generalise using algebra and so this is a fundamental building block for GCSE. They will recall key algebraic concepts of expanding and factorising brackets before introducing surds into the mix. Expanding on this knowledge students will then understand how this works with triple brackets. Year 10 will now be taught algebraic proof. This skill requires critical thinking and the need to form coherent arguments. This transferable skill is vital for students to develop their critical thinking.

Objectives

- Use the four operations with variables.
- Apply the laws of indices to variables, including the power law to variables with coefficients.
- Expand single brackets and simplify expressions containing multiple brackets.
- Expand single brackets with surds.
- Expand double brackets, including the difference of two squares.
- Expand double brackets with surds.
- Expand triple brackets.
- Recognise and use identities.
- Factorise linear and quadratic expressions, including of the form $x^2 - a^2$
- Prove conjectures involving odds, evens and multiples.

Circle Theorems

Students will use and prove circle theorems. They will recognise the equation of a circle with centre, origin and find the equation of a tangent to the circle. Students will apply the knowledge to solve problems involving circle theorems. Students are introduced to the mechanics of a theorem and use them to reason with a wide variety of problems.

Objectives

- Recognise a tangent meets a radius at 90 degrees. Identify subtended angles.
- Know and use the angle in a semi-circle is a right angle, angle at the centre is twice the angle at the circumference, angles in the same segment are equal, the opposite angles in a cyclic quadrilateral add up to 180 degrees and tangents to a point are equal in length, the perpendicular from the centre bisects a chord and the alternate segment theorem.

Primes and Bounds

Students should be well versed in the number facts regarding prime numbers. We will recall how to find a product of prime factors before using this skill to find the HCF and LCM of a group of numbers. Students will explore a variety of methods to find the HCF and LCM and will look to solve a wide variety of problems. Rounding and estimating exposes students to the rules of rounding and where it is useful across the curriculum.

Objectives

- Write numbers as the product of their prime factors.
- Find the highest common factor and lowest common multiple of large numbers and those written in prime factor form.
- Round and truncate decimals.
- Estimate calculations by rounding.
- Recognise whether estimations are under- or over- estimates.
- Find upper and lower bounds and write error intervals.
- Use a calculator effectively.
- {change recurring decimals into their corresponding fractions and vice versa}

Formulae, Simultaneous Equations, Sequences

Students return to algebraic manipulation focussing on Rearranging equations. This is a key skill needed in science when dealing with experiments and looking at the relationship between variables. Students will progress at their own pace through a variety of different equations to rearrange. Students will then study simultaneous equations. Some students will have started this at the end of year 9 but all students will be given pictorial and algebraic representations to solve equations.

Objectives

- Rearrange formulae using the order of operations.
- Rearrange formulae involving fractional and negative coefficients, variables in the denominator of a fraction, powers and roots.
- Rearrange formulae involving brackets and where there are two instances of the variable that is required as the subject.
- Solve linear simultaneous equations.
- Set up simultaneous equations to solve from contexts.
- Recognise arithmetic, geometric and Fibonacci sequences.
- Use iterative notation to generate terms of a sequence.
- Find the next term in a quadratic sequence. Find the n th term of a quadratic.

Stats & Probability

Students will revisit the 4 averages mean, median, mode and range. They will look at combined means before looking at representations of averages and data including box plots, stem and leaf diagrams, cumulative frequency diagrams, and scatter graphs, they will then, move on to looking at probability with tree diagrams.

- Find the mean. Recognise the effect of outliers on the mean.
- Use the mean to compare sets of data. Work backwards from the mean to find missing data.
- Solve problems involving combined means or where the mean of a set of data changes.
- Calculate the mode and median. Recognise advantages and disadvantage of different averages.
- Calculate the range and compare data sets.
- Construct and interpret stem and leaf diagrams. Calculate the interquartile range and knows its benefit. Construct box plots and cumulative frequency diagrams and scatter graphs.
- Construct tree diagrams for dependent and independent events.

Quadratics

Students throughout KEY Stage 3, have looked at various skills, with regards to quadratics. However, in year 10 we try to bring this all together. Students recap factorising quadratics, before understanding the zero property which allows us to solve quadratic equations. students will explore various methods of solving quadratics, including completing the square quadratic formula, and factorisation. Students will be then, look at plotting quadratics and understanding the shape of the graph as well as various key components of a quadratic graph.

Objectives

- Solve quadratic equations using inverse operations and factorising.
- Write a quadratic in completed square form.
- Solve quadratics using the quadratic formula.
- Plot quadratic graphs and recognise co-ordinates of points on quadratic graphs.
- Identify the x and y intercepts of a quadratic graph.
- Work out the turning point of a quadratic graph and its line of symmetry.
- Estimate solutions to quadratic equations using graphs.

Co-ordinate Geometry

This topic builds on earlier study of straight line graphs in Year 9. Students plot straight lines from given equations and find and interpret the equation of a straight line from a variety of situations. Students learn to interpret real life graphs and appreciate what the gradient and y-intercept represent in real life situations that they may come across e.g. mobile phone tariffs and taxi journeys.

Objectives

- Calculate horizontal and vertical distances between co-ordinates and use this to solve problems involving diagonal distances.
- Use Pythagoras' theorem to find a distance between two co-ordinates.
- Find the midpoint of two co-ordinates.
- Rearrange a formula to the form $y = mx + c$ in order to find the gradient of the line.
- Find the equation of a line given its gradient and a point.
- Identify parallel and perpendicular lines, including those passing through a particular point.
- Know the equation of a circle.

Advanced Fractions

Objectives

- Rationalise the denominator of a surd.
- Simplify algebraic fractions.
- Multiply and divide algebraic fractions.
- Add and subtract algebraic fractions.
- Solve equations involving algebraic fractions.

Transformations and Constructions

Students revisit and extend their learning from Key Stage 3, exploring all the transformations and constructions, relating these to symmetry and properties of shapes. There is an emphasis on describing as well as performing the transformations.

Objectives

- Enlarge shapes with positive, fractional and negative scale factors
- Perform combined transformations on shapes
- Use a pair of compasses and a protractor accurately.
- Know the compass directions and use map scales.
- Measure and calculate bearings.
- Use maps and scale drawings.
- Calculate bearings using angle rules.
- Use a pair of compasses to create loci.
- Bisect lines and angles, recognising the points created are equidistant from other points or lines.
- Construct the perpendicular to a point.
- Construct a locus of points on a map, using scales



LEARNING SEQUENCE – YEAR 11

Foundation

Right-angled Triangles

Students revisit Pythagoras and Trigonometry here and develop the application of their understanding to solve problems in both right-angled triangles and other shapes. Emphasis is placed on linking the trigonometric functions to ratios.

Calculations, Rounding & Estimation

Students will be recalling skills involving rounding, to various different methods, decimal places and significant figures. Students will then explore how error bounds are used in real life to

- Use a calculator to evaluate powers & roots and work with numbers in standard form.
- Round numbers to the nearest ten, hundred, thousand.
- Round to a given number of decimal places.
- Round to a given number of significant figures.
- Find upper and lower bounds.
- Write error intervals for measurements.
- Estimate calculations, recognising whether estimations are over or underestimates.
- Solve word problems involving money, bank accounts, profits and rates.

Money, Measures and Rates

Students in this unit, rely heavily on a multitude of skills acquired lower down the school. This is possibly one of the most useful topics we study as there is a emphasis on money in the real world. This topic links percentages to profit and loss. Looking at how to save money and calculate correctly using percentages in variety of ways. Students then focus on converting a variety of metric and imperial units. Finally in this chapter students will look at conversion graphs as a way of converting units and linking this to rates of pay. Students will need to understand gradient and then create the link between gradient and rates

Objectives

- Recognise types of units for length, area, volume, mass and capacity.
- Convert metric units.
- Convert non-metric units where the conversion is provided.
- Convert currencies.
- Use conversion graphs and other graphs involving rates or real-life contexts.
- Work with scale diagrams to make estimates.

Area and Volume

As students transcend through year 11, they begin to form various links between previous units. In this unit, following on from the previous one we now link conversations to be able to find area, and volume of 2D and 3D shapes. This is a topic students have been before and should be well verse in recalling formulae for the area of various 2D shapes. They will now expand this into volume. They will build upon the previous topic of unit conversions and use this to ensure their calculations are correct for the context of the question.

Objectives

- Calculate perimeter, including compound rectilinear shapes.
 - Work out the area of triangles, parallelograms, trapezia and compound shapes.
 - Know the names for parts of circles.
 - Find the area and circumference of circles.
 - Calculate the area and perimeter of semi circles and quarter circles.
 - Solve problems involving area, perimeter and scale drawings.
 - Calculate the surface area of cubes and cuboids.
 - Calculate the volume of cuboids, prisms, cylinders and spheres.
 - Solve contextual problems involving area, volume and units.
 - Calculate density and pressure.
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- Calculate the surface area of cubes and cuboids.
 - Calculate the volume of cuboids, prisms, cylinders and spheres.
 - Solve contextual problems involving area, volume and units.
 - Calculate density and pressure.

Quadratic Equations & Graphs

Students develop their knowledge of non-linear graphs in this unit, looking at quadratic graphs. Students develop an understanding of how a quadratic equation can be represented as a graph, how they can manipulate a quadratic equation to identify key parts of a quadratic graph and how they can read a graph to help them identify the associated graphical representation.

Objectives

- Expand double brackets.
- Factorise quadratic expressions.
- Plot quadratic graphs.
- Recognise the roots and turning points of a quadratic graph.

Fractions, Decimals, Percentages and Ratio

Students revisit another topic they should be very well verse in by now. Students recall how to order and compares numbers in both fraction, decimal and percentage form. They explore efficient methods of converting between the three forms, before linking this to ratio. Ratio is often a topic student struggle with therefore having a good recap is perfect at this stage of the course and key skills they will need in the next topic

Objectives

- Convert between fractions, decimals and percentages.
- Order and compare fractions, decimals and percentages.
- Calculate with decimals.
- Convert between ratios and fractions.
- Write ratios in the form 1 : n
- Share in a given ratio.
- Simplify a ratio between three variables, connected as a : b and b : c

Data and Probability

In this topic students explore methods for collecting and representing data. They look at a variety of methods and analyse their suitability depending on the data source. Students will then study how this affects their representation depending on the data type. Once this has been completed students will then move onto looking at probability. They will rely heavily on the skills they have perfected in the previous topic as they explore a range of different probability structures. Visual representations will be crucial to understanding this topic and therefore students must make every effort to engage in all representations.

Objectives

- Use proportional methods of sampling.
- Construct and use frequency trees.
- Populate Venn diagrams.
- Recognise unions and intersections of sets.
- Recognise probabilities add up to 1 whole.
- List outcomes systematically.
- Construct and use tree diagrams for independent events.
- Understand experimental probabilities and how their accuracy increases with no. of trials.
- Construct and interpret pie charts.
- Construct and interpret time series graphs.
- Construct and interpret scatter graphs and correlation.

- Construct and interpret pie charts.
- Construct and interpret time series graphs.
- Construct and interpret scatter graphs and correlation.

Transformations

Students finish the foundation GCSE by studying the four transformations. Students often struggle with this topic, especially committing it to long term memory so having it at the end serves to ensure it is fresh in the mind before upcoming examinations. Students explore the four transformations and practise the mechanics of doing the transformations before understanding how to effectively describe the transformations.

Objectives

- Translate shapes using a vector. Describe translations.
- Reflect shapes in a given mirror line. Describe reflections.
- Identify line and rotational symmetry.
- Rotate shapes and describe rotations.
- Enlarge shapes with positive and fractional scale factors.

Right-angled Triangles Students revisit Pythagoras and Trigonometry here and develop the application of their understanding to solve problems in both right-angled triangles and other shapes. Emphasis is placed on linking the trigonometric functions to ratios.
Right-angled Triangles Students revisit Pythagoras and Trigonometry here and develop the application of their understanding to solve problems in both right-angled triangles and other shapes. Emphasis is placed on linking the trigonometric functions to ratios.
Constructions, Loci & Bearings Students revisit and extend their learning from Key Stage 3, exploring all transformations, relating these to symmetry and properties of shapes where appropriate. There is an emphasis on describing as well as performing transformations. Using the correct mathematical language here promote deep thinking and understanding.
Multiplicative Reasoning Students develop their multiplicative reasoning in a variety of contexts, from simple scale factors through to complex equations. Students are exposed to many real-life applications of compound measures and the different equations that can be created to solve problems. This unit further develops the Fractions and Percentages unit studied in Year 10 by moving students on to solving problems like reverse percentages.
Quadratic Equations & Graphs Students develop their knowledge of non-linear graphs in this unit, looking at quadratic graphs. Students develop an understanding of how a quadratic equation can be represented as a graph, how they can manipulate a quadratic equation to identify key parts of a quadratic graph and how they can read a graph to help them identify the associated graphical representation.
Fractions, Indices & Standard Form Much of the content for this unit builds in Key Stage 3 required skills. Here students move from being able to process a skill to being able to apply the appropriate operation to a posed worded-problem.
Congruency, Similarity & Vectors Building on their experience of enlargement and similarity in previous years, this unit extends students' experiences and looks for more formality in dealing with congruent and similar triangles. Congruency is introduced through considering what information is needed to produce congruent and similar triangles. Students will build on existing knowledge of vectors from Key Stage 3. Again, this unit will look to formalise prior knowledge with an emphasis on correct notation, understanding the difference between positive and negative vectors and develop a sense of vector arithmetic.
More Algebra Students develop their algebra skills further by forming and solving simultaneous equations in context as well as developing algebraic proof skills.
Revision Students have now been exposed all the fluency skills, reasoning discussion and applications of their skills throughout Year 10 & 11. Students now enter the revision stage in class which predominantly takes the form of students practicing exam questions with teacher feedback. Students must be given time to get used to how the exam papers will be set, how to approach the exam papers and what is expected, to gain all the marks available for each question.

Inequalities

Students build, extend and deepen their knowledge of equations, inequalities and sequences from Key Stage 3. Key vocabulary is developed here which helps students to access questions which look mathematically similar but require different approaches. Students look at solving equations and inequalities as well as forming. Sequences if revisited and extended from Key Stage 3 to start to formalise sequences with algebraic rules.

- Know and use the inequality symbols ($>$, $<$, $\neq$, $\leq$, $\geq$)
- Solve simple one and two step inequalities.
- Represent solutions to inequalities on the number line.
- Solve three-part inequalities.

Higher**Probability**

This topic builds on Key Stage 3 and provides good context in which to revisit fraction arithmetic and conversion between fractions, decimals & percentages. Tables and Venn diagrams are revisited and student understanding of tree diagrams is developed here. Students work with both independent events as well as conditional probability. The topic extends students algebraic fluency when solving complex probability problems.

More Trigonometry

Students' trigonometry knowledge is developed further in this unit by linking it to similar triangles. Here the emphasis is on non-right-angled triangles and the application of fluency skills to complex problems requiring students to draw their own sketches and apply bearing rules.

Objectives

- Find missing sides and angles in right-angled triangles using Pythagoras & sin, cos & tan ratios.
- Use trigonometry in 3D to find missing lengths and angles.
- Use the sine and cosine rules to find missing lengths and angles in triangles.
- Use $\frac{1}{2} ab \sin C$ to find the area of any triangle.

Area and Volume

As students transcend through year 11, they begin to form various links between previous units. In this unit, following on from the previous one we now link conversations to be able to find area, and volume of 2D and 3D shapes. This is a topic students have been before and should be well verse in recalling formulae for the area of various 2D shapes. They will now expand this into volume. They will build upon the previous topic of unit conversions and use this to ensure their calculations are correct for the context of the question. Students studying the higher content will have to apply these skills to more complex shapes. Students will also revisit content relating to circles in an attempt to round off this topic.

Objectives

- Find the area of triangles, quadrilaterals and compound shapes.
- Name the parts of circles, including radius, diameter, tangent, segment, sector, chord and arc.
- Find the area and circumference of circles.
- Find the area of semi and quarter circles and of any sector of a circle.
- Find the arc length of a sector of a circle, or the perimeter of a sector.
- Find the surface area of prisms, cylinders, spheres, cones and pyramids.
- Find the volume of prisms, cylinders, spheres, cones and pyramids.
- Know how the area and volume of shapes change as their dimensions are increased.
- Use length, area and volume ratios to find missing quantities in enlarged 2D and 3D shapes.

Measures and Real-Life Graphs

Students in this topic will convert between many different units of measure. They will link this to science and other topics.

Objectives

- Convert between metric measures of length, area, volume, mass and capacity.
- Solve contextual problems involving area, volume and units.
- Know the relationship between density, mass and volume. Find missing quantities.
- Know the relationship between pressure, force and area. Find missing quantities.
- Convert between units of time and calculate time intervals.
- Know the relationship between speed, distance and time. Find missing quantities.
- Draw and interpret distance time graphs, knowing the meaning of the gradient.
- Use real life graphs. Recognise the meaning of their gradients and y-intercepts.

Equations and Inequalities

Students continue to expand and explore their knowledge base of algebraic representations. They will continue to solve equations and understand how an inequality affects their solution. Students will also understand how to solve multiple equations simultaneously.

Objectives

- Solve simultaneous equations where both are linear, or one is linear and the other is non-linear.
- Solve equations involving algebraic fractions.
- Solve equations using iteration.
- Solve quadratic simultaneous equations.
- Represent inequalities on the number line.
- Solve simple inequalities and three-part inequalities.
- Represent inequalities graphically by shading regions.

Non-Linear Graphs and Functions

Students are coming towards the end their compulsory mathematical education in schools. They are now introduced to function notation as a way of expressing functions. This is a key representation students who continue to read A-level mathematics will need. Students will revisit the graphs of multiple forms to ensure full understanding

Objectives

- Use function notation and evaluate functions.
- Create and evaluate composite functions. Solve equations involving composite functions.
- Find inverse functions. Compose functions and inverse functions.
- Know the difference between evaluating a function and solving a function for a particular value, both algebraically and graphically.
- Recognise the graphs of linear, quadratic, cubic, circular, trigonometric, reciprocal and exponential graphs.
- Translate and reflect graphs, knowing the effect on the function and the graph.

Further Stats and Probability

This topic builds on Key Stage 3 and provides good context in which to revisit fraction arithmetic and conversion between fractions, decimals & percentages. Tables and Venn diagrams are revisited, and student understanding of tree diagrams is developed here. Students work with both independent events as well as conditional probability. The topic extends students algebraic fluency when solving complex probability problems.

Objectives

- Know techniques for sampling and recognise limitations of samples.
- Calculate averages from frequency and grouped frequency tables.
- Construct frequency polygons.
- Understand and use time series graphs.
- Construct and interpret histograms for data with unequal width groups.
- Construct tree diagrams.
- Work backwards using a tree diagram to find missing original probabilities.

Vectors and Exact Trig Values

Students will build on existing knowledge of vectors from Key Stage 3. Again, this unit will look to formalise prior knowledge with an emphasis on correct notation, understanding the difference between positive and negative vectors and develop a sense of vector arithmetic. Students combine knowledge of 2D shapes and vectors to form mathematically sound vector proofs.

Objectives

- Describe a vector using vector notation.
- Find a resultant vector.
- Describe journeys using vectors where paths are split in a given ratio or at their midpoint.
- Prove that two vectors are parallel.
- Calculate the exact values of sin, cos and tan for 0, 30, 45, 60 and 90 degrees without a calc.



LEARNING SEQUENCE – YEAR 12

Maths A level is taught in 2 strands by 2 different teachers;

Strand A – Pure Mathematics and Mechanics

Strand B – Pure Mathematics and Statistics

A level lessons follow a textbook and each unit of work is linked to a given chapter which is highlighted below.

Strand A – Pure mathematics and Mechanics	Strand B – Pure Mathematics and Statistics
Algebraic Expressions – Pure 1 Chapter 1 Students will build on GCSE algebra skills to: • Be able to perform essential algebraic manipulations, such as expanding brackets, collecting like terms, factorising etc. • Understand and be able to use the laws of indices for all rational exponents. • Be able to use and manipulate surds, including rationalising the denominator.	Algebraic Methods – Pure 1 Chapter 7 Students will build on GCSE algebra skills to: • Be able to fully factorise a cubic expression • Be able to use algebraic division • Know and be able to apply the factor theorem • Understand and be able to use the structure of mathematical proof, proceeding from given assumption through a series of logical steps to a conclusion • Be able to use methods of proof, including proof by deduction, proof by exhaustion and disproof by counterexample
Quadratics – Pure 1 Chapter 2 Students will build on GCSE algebra skills to: • Be able to work with quadratic functions and their graphs. (The notation $f(x)$ may be used.). • Know and be able to use the discriminant of a quadratic function, including the conditions for real and repeated roots. • Be able to complete the square. (Including cases where $a > 1$ and $a < 0$ (This also includes a proof of the quadratic formula). • Solution of quadratic equations by factorisation, use of the formula, use of a calculator and completing the square. • Including solving quadratic equations in a function of the unknown. (These functions could include	Graphs and Transformations – Pure 1 Chapter 4 Students will build on their knowledge of graphs from GCSE to: • Understand and use graphs of functions. • Be able to sketch curves defined by simple equations including polynomials. This includes simple cubic and quartic functions. • Be able to sketch $y = a/x$ and $y = a/x^2$ (including their horizontal and vertical asymptotes) • Interpret algebraic solution of equations graphically and be able to use intersection points of graphs to solve equations.

powers of x, trigonometrical functions of x, exponential and logarithmic functions of x).	• Understand and use proportional relationships and their graphs (Direct proportion between two variables.) • Understand the effect of simple transformations on the graph of $y = f(x)$, including sketching associated graphs: $y = af(x)$, $y = f(x) + a$, $y = f(ax)$ and $y = f(x + a)$ and combinations of these transformations. • Students should be able to apply a combination of these transformations to any of the functions in the a-level specification (quadratics, cubics, quartics, reciprocals, a/x^2, $\mod x$, $\sin x$, $\cos x$, $\tan x$, e^x and a^x) and sketch the resulting graph.
Equations and Inequalities – Pure 1 Chapter 3 Students will build on GCSE algebra skills to: • Be able to solve linear simultaneous equations using elimination and substitution. • Be able to use substitution to solve simultaneous equations where one equation is linear and the other quadratic. The quadratic may involve powers of 2 in one unknown or in both unknowns. • Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions. (These would be reducible to linear or quadratic inequalities). • Express solutions through correct use of 'and' and 'or' or through set notation. • Represent linear and quadratic inequalities graphically. (Shading and use of dotted and solid lines convention is required).	The Binomial Expansion – Pure 1 Chapter 8 Students will develop new skills in binomial expansion so they can: • Understand and use the binomial expansion of $(a + bx)^n$ for positive integer n; the notations $n!$ and nCr, link to binomial probabilities. • Use of Pascal's triangle • Relation between binomial coefficients • Be aware of alternative notations for nCr.
Straight Line Graph – Pure 1 Chapter 5 Students will build on GCSE algebra skills to: • Understand and use the equation of a straight line. (This includes the equation of a line through two given points, and the equation of a line parallel (or perpendicular) to a given line through a given point.). • Gradient conditions for two straight lines to be parallel or perpendicular. • Be able to use straight-line models in a variety of contexts, e.g. the line for converting degrees	

Celsius to degrees Fahrenheit, distance against time for constant speed, etc.	
Circles – Pure 1 Chapter 6 Students will begin to develop further geometry skills from GCSE to: • Understand and use the co-ordinate geometry of the circle including using the equation of a circle in the form $(x - a)^2 + (y - b)^2 = r^2$ • Students should be able to find the radius and the coordinates of the centre of the circle given the equation of the circle, and vice versa. • Students should also be familiar with the equation $x^2 + y^2 + 2fx + 2gy + c = 0$. • Completing the square to find the centre and radius of a circle. • Use of the following properties: ○ the angle in a semicircle is a right angle ○ the perpendicular from the centre to a chord bisects the chord ○ the radius of a circle at a given point on its circumference is perpendicular to the tangent to the circle at that point. • Students should be able to find the equation of a circumcircle of a triangle with given vertices using these properties. • Students should be able to find the equation of a tangent at a specified point, using the perpendicular property of tangent and radius.	Trigonometric Ratios – Pure 1 Chapter 9 Students will build on their knowledge of trigonometry from GCSE to: • Understand and be able to use the definitions of sine, cosine and tangent for all arguments • Use of x and y coordinates of points on the unit circle to give cosine and sine respectively. • Understand and be able to use the sine and cosine rules, including the ambiguous case of the sine rule. • Understand and be able to use the area of a triangle in the form $\frac{1}{2}ab\sin C$. • Understand and be able to use the sine, cosine and tangent functions; their graphs, symmetries and periodicity. • Knowledge of graphs of curves with equations such as $y = \sin x$, $y = \cos(x + 30)$, $y = \tan 2x$ is expected.
Differentiation – Pure 1 Chapter 12 Students will begin to develop their understanding of differentiation in order to: • Understand and use the derivative of $f(x)$ as the gradient of the tangent to the graph of $y = f(x)$ at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change. • Know that dy/dx is the rate of change of y with respect to x. (The notation $f'(x)$ may be used for the first derivative and $f''(x)$ may be used for the second derivative.) • Be able to sketch the gradient function for a given curve. This could relate speed and acceleration for example. • Be able to find second derivatives	Trigonometric identities and equations - Pure 1 Chapter 10 Students will continue to develop their trigonometry to: • Understand and be able to use $\tan x = \sin x / \cos x$. • Understand and use $\sin^2 \theta + \cos^2 \theta = 1$ • Both of the above identities may be used to solve trigonometric equations and angles will be in degrees. • They may also be used to prove further identities. • Be able to solve trigonometric equations within a given interval, including quadratic equations in $\sin$, $\cos$ and $\tan$ and

• Understand differentiation from first principles for small positive integer powers of x (powers of 2 and 3) • Understand and use the second derivative as the rate of change of the gradient. • Be able to differentiate x^n, for rational values of n, and related constant multiples, sums and differences.	equations involving multiples of the unknown angle.
Integration - Pure 1 Chapter 13 Students will begin to develop their understanding of integration in order to: • Know and be able to use the Fundamental Theorem of Calculus. Integration as the reverse process of differentiation. Students should know that for indefinite integrals a constant of integration is required. • Be able to integrate x^n (excluding $n = -1$), and related sums, differences and constant multiples. • Given $f'(x)$ and a point on the curve students should be able to find an equation of the curve in the form $y = f(x)$. • Be able to evaluate definite integrals. • Be able to use a definite integral to find the area under a curve.	
Vectors – Pure 1 Chapter 11 Students will build on basic knowledge of vectors from GCSE in order to: • Be able to use vectors in two dimensions. Students should be familiar with column vectors and with the use of i and j unit vectors in two dimensions. • Be able to calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form. Students should be able to find a unit vector in the direction of a, and be familiar with the notation for mod a. • Be able to add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars and understand their geometrical interpretations. This is the triangle and parallelogram laws of addition. Students must have an understanding of parallel vectors. • Understand and be able to use position vectors, $(\vec{AB} = b - a)$	Data Collection – Statistics 1 Chapter 1 Students will begin to develop their statistic skills building on GCSE knowledge to: • Understand and be able to use the terms 'population' and 'sample' • Be able to describe advantages and disadvantages of sampling compared to census • Know how to use samples to make informal inferences about the population • Understand and be able to use sampling techniques, including simple random sampling, stratified sampling, systematic sampling, quota sampling and opportunity (or convenience) sampling. • Be able to select or critique sampling techniques in the context of solving a statistical problem • Understand that different samples can lead to different conclusions about the population.

• Be able to calculate the distance between two points represented by position vectors. • Be able to use vectors to solve problems in pure mathematics and in context, (including forces).	
Exponentials and Logarithms – Pure 1 Chapter 14 Students will build on their knowledge of index laws to begin their understanding of exponents and logarithms in order to: • Know and be able to use the function a^x and its graph, where a is positive. (Understand the difference in shape between $a < 1$ and $a > 1$). • Know and be able to use the function e^x and its graph. • Know and be able to use the definition of $\log(ax)$ as the inverse of a^x, where a is positive and $x \geq 0$ • Know and be able to use the function $\ln(x)$ and its graph. • Know and be able to use $\ln(x)$ as the inverse function of e^x. • "Understand and use the laws of logarithms: ○ $\log(x) + \log(y) = \log(xy)$ ○ $\log(x) - \log(y) = \log(x/y)$ ○ $\log_a x = \log_a x^k$ (including, for example $k = -1$ and $k = -\frac{1}{2}$) ○ $\log_a a = 1$ • Be able to solve equations of the form $a^x = b$. Students may use the change of base formula. • Be able to use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^n$, given data for x and y. • Plot $\log y$ against $\log x$ and obtain a straight line where the intercept is $\log a$ and the gradient is n. • Plot $\log y$ against x and obtain a straight line where the intercept is $\log k$ and the gradient is $\log b$.	Measures of Location and Spread - Statistics 1 Chapter 2 Students will build on GCSE knowledge of measures of location and spread to: • Be able to interpret measures of location: mean, median and mode. Data may be discrete, continuous, grouped or ungrouped. • Be able to interpret measures of variation: standard deviation, variance, range and interpercentile range. • Be able to use linear interpolation to calculate percentiles from grouped data. • Be able to calculate standard deviation, including from summary statistics.
	Representations of Data - Statistics 1 Chapter 3 Students will continue to build on GCSE knowledge of statistics to: • Recognise and interpret possible outliers in data sets and statistical diagrams. Any

	rule needed to identify outliers will be specified in the question. • Be able to select or critique data presentation techniques in the context of a statistical problem. Students will be expected to draw simple inferences and give interpretations to measures of central tendency and variation. Significance tests, other than those mentioned in chapter 7, will not be expected. • Be able to clean data, including dealing with missing data, errors and outliers. For example, students may be asked to identify possible outliers on a box plot or scatter diagram.
Modelling in Mechanics – Mechanics 1 Chapter 8 Students will build on GCSE knowledge to: • Understand and use fundamental quantities and units in the S.I. system: Length (displacement, distance travelled), time, mass. • Understand and use derived quantities and units: velocity, acceleration, force, weight.	Probability – Statistics 1 Chapter 5 Students will further their knowledge of probability from GCSE to: • Understand and be able to use mutually exclusive and independent events when calculating probabilities. Venn diagrams or tree diagrams may be used. • Be able to make links to discrete and continuous distributions. No formal knowledge of probability density functions is required but students should understand that area under the curve represents probability in the case of a continuous distribution.
Constant Acceleration – Mechanics 1 Chapter 9 Students will begin to use knowledge from physics and maths to deepen and further their mechanics skill in order to: • Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration. • Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph. Graphical solutions to problems may be required. • Understand, use and derive the formulae for constant acceleration for motion in a straight line. (Understand and use suvat formulae for constant acceleration in 2-D).	Correlation – Statistics 1 Chapter 4 Students will build on GCSE knowledge of graphs in order to: • Interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagram which include distinct sections of the population (calculations involving regression lines are excluded). This includes the use of interpolation and the dangers of extrapolation. Variables other than x and y may be used. • Students should be familiar with the terms explanatory (independent) and response (dependent) variables. • Understand informal interpretation of correlation. Use of terms such as positive,

	negative, zero, strong and weak are expected. Understand that correlation does not imply causation
Forces and Motion – Mechanics 1 Chapter 10 Students will deepen their mechanics skills so they can: - Understand the concept of a force; understand and use Newton's first law. (Normal reaction, tension, thrust or compression, resistance) - Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2D (i, j) vectors). - Problems will involve motion in a straight line with constant acceleration in scalar form, where the forces act either in parallel or perpendicular to the motion. - Problems may involve motion in a straight line with constant acceleration in vector form, where the forces are given in i-j form or as a column vector. - Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g, and its value in S.I. units to varying degrees of accuracy. - The default value of g will be 9.8ms^{-2} but some questions may specify another value e.g. $g = 10\text{ms}^{-2}$. - The inverse square law for gravitation is not required and g may be assumed to be constant, but students should be aware that g is not a universal constant but depends on location. - Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles. - Problems may be set where forces need to be resolved (restricted to forces in two perpendicular directions or simple cases of forces given as 2D vectors). - Connected particle problems could include problems with particles in contact e.g. lift problems.	Statistical Distributions – Statistics 1 Chapter 6 Students will develop their knowledge from this topic in order to: - Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution. - Students will be expected to use distributions to model a real-world situation and to comment critically on the appropriateness. - Students should know and be able to identify the discrete uniform distribution. - The notation $X \sim B(n, p)$ may be used. - Use of a calculator to find individual or cumulative binomial probabilities.
Forces and Friction – Mechanics 2 Chapter 5 This is a Y13 topic but leads on nicely from the previous chapter:	

- Understand and use Newton's second law for motion in a straight line; extend to situations where forces need to be resolved (restricted to 2 dimensions). - Resolve forces in 2 dimensions; equilibrium of a particle under coplanar forces. - Understand and use addition of forces; resultant forces; dynamics for motion in a plane. Understand friction and the coefficient of friction and use $F \leq \mu R$	
Variable Acceleration - Mechanics 1 Chapter 11 - Use calculus in kinematics for motion in a straight line. (The level of calculus required will be consistent with that in Paper 1) $v = \frac{dr}{dt}, a = \frac{dv}{dt} = \frac{d^2r}{dt^2}$ $r = \int v \cdot dt, v = \int a \cdot dt$	Hypothesis Testing – Statistics 1 Chapter 7 Students will put their new skills into practise to be able to: - Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, p-value. - An informal appreciation that the expected value of a binomial distribution is given by np may be required for a 2-tail test. - Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context. - Understand that a sample is being used to make an inference about the population. - Hypotheses should be expressed in terms of the population parameter p. - Appreciate that the significance level is the probability of incorrectly rejecting the null hypothesis. - A formal understanding of Type 1 errors is not expected.
Differentiation - Pure 2 Chapter 9 Part 1 Students will build on their Y12 knowledge to begin the Y13 content to: - Be able to differentiate e^{kx} and a^{kx}, $\sin kx$, $\cos kx$, $\tan kx$ and related sums, differences and constant multiples. - Understand and use the derivative of $\ln x$ - Differentiate using the product rule, the quotient rule and the chain rule.	Radians – Pure 2 Chapter Students will begin to develop knowledge of radians to: Be able to work with radian measure, including use for arc length and area of a sector. This includes use of the formulae for arc length and areas of sectors.

	• Know and use the exact values of sin, cos and tan for $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi$ and multiples thereof. • Understand and use the standard small angle approximations of sine, cosine and tangent.
Trigonometric Functions – Pure 2 Chapter 6 Students will build on trigonometric skills from Y12 in order to: • Understand and use the definitions of secant, cosecant, and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains. (For both degrees and radians). • Understand and use trigonometric identities for sec squared and cosec squared.	Functions and Graphs – Pure 2 Chapter Students will build on Y12 knowledge of graphs for Y13 content in order to: • Understand the modules of a linear function and be able to sketch its graph. • Understand and use composite functions, inverse functions and their graphs.
Trigonometry and Modelling – Pure 2 Chapter 7 Students will continue to develop their trigonometry skills to: • Understand and use double angle formulae; use of formulae for $\sin(A+B)$, $\sin(A-B)$, $\cos(A+B)$, $\cos(A-B)$, $\tan(A+B)$, $\tan(A-B)$. • Understand geometrical proofs of these formulae. • Understand and use expressions for $a \cos x + b \sin x$ in the equivalent forms of $r \cos(x + a)$ or $r \sin(x + a)$.	



LEARNING SEQUENCE – YEAR 13

Strand A – Pure mathematics and Mechanics	Strand B – Pure Mathematics and Statistics
Trigonometric Functions – Pure 2 Chapter 6 Students will build on their knowledge on trigonometry from Y12 to: - Understand and use the definitions of secant, cosecant, and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains. (For both degrees and radians). - Understand and use trigonometric identities for sec squared and cosec squared.	Algebraic Methods – Pure 2 Chapter 1 Students build on their knowledge of proof and algebraic fractions to: - Understand and use proof by contradiction (including proof of the irrationality of root 2 and the infinity of primes, and application to unfamiliar proofs). - Be able to simplify rational expressions, including by factorising and cancelling, and algebraic division (by linear expressions only). - Be able to decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than 3 terms, numerators constant or linear).
Trigonometry and Modelling – Pure 2 Chapter 7 Students will continue to develop their trigonometry skills to: - Understand and use double angle formulae; use of formulae for $\sin(A+B)$, $\sin(A-B)$, $\cos(A+B)$, $\cos(A-B)$, $\tan(A+B)$, $\tan(A-B)$. - Understand geometrical proofs of these formulae. Understand and use expressions for $a \cos x + b \sin x$ in the equivalent forms of $r \cos(x + a)$ or $r \sin(x + a)$.	Parametric Equations – Pure 2 Chapter 8 Students will begin to develop their knowledge on parametric equations in order to: - Understand and use the parametric equations of curves and conversion between Cartesian form and parametric form. - Be able to use parametric equations in modelling in a variety of contexts.
Differentiation - Pure 2 Chapter 9 Part 2 Students will build on their knowledge of differentiation from Y12 to: - Be able to differentiate $\sin x$ and $\cos x$ from first principles. - Differentiate simple functions and relations defined implicitly or parametrically, for the first derivative only.	Numerical Methods – Pure 2 Chapter 10 Building on Y12 knowledge students will learn to: - Be able to locate roots of $f(x) = 0$ by considering changes of sign of $f(x)$ in an interval of x on which $f(x)$ is sufficiently well behaved. - Understand how change of sign methods can fail.

• Understand and use the second derivative in connection to concave and convex sections of curves and points of inflection. • Construct simple differential equations in pure mathematics and in context, (contexts may include kinematics, population growth and modelling the relationship between price and demand).	• Solve equations approximately using simple iterative methods, be able to draw cobweb and staircase diagrams. • Be able to solve equations using the Newton-Raphson method and other recurrence relations. • Understand how such methods can fail. • Be able to use numerical methods to solve problems in context.
Integration – Pure 2 Chapter 11 Students will build on their knowledge of integration from Y12 to: • Be able to integrate e^{kx}, $\frac{1}{x}$, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples. (This includes integration of standard functions such as $\sin 3x$, $\sec^2 2x$, $\tan x$, e^{5x}, $\frac{1}{2x}$. Students are expected to be able to use trigonometric identities to integrate, for example $\sin 2x$, $\tan 2x$, $\cos 2 3x$). • Be able to use definite integration to find the area between 2 curves. (This is an extension of the work already taught in year 12) This includes curves defined parametrically. • Understand and use integration as the limit of a sum. • Be able to carry out simple cases of integration by substitution and integration by parts; understand these methods as the inverse processes of the chain and product rule respectively. (Integration by substitution includes finding a suitable substitution and is limited to cases where one substitution will lead to a function which can be integrated) (Integration by parts includes more than one application of the method but excludes reduction formulae). • Be able to integrate using partial fractions that are linear in the denominator. • Be able to evaluate the analytical solution of simple first order differential equations with separate variables, including finding particular solutions. (Separation of variables may require factorisation involving a common factor). • Interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics.	Vectors – Pure 2 Chapter 12 Students will build on Y11 knowledge of vectors in order to: • Be able to use vectors in 2 and 3 dimensions.

Moments – Mechanics 2 Chapter 4 Students will begin to build on their schema in order to: • Calculate the turning effect of a force applied to a rigid body. • Calculate the resultant moment of a set of forces acting on a rigid body. • Solve problems involving uniform rods in equilibrium, non-uniform rods and rods on the point of tilting.	Sequences and Series – Pure 2 Chapter 3 Students will build on knowledge of sequences in order to: • Be able to work with sequences including those given by a formula for the nth term and those generated by a simple term to term relationship. This includes increasing sequences, decreasing sequences and periodic sequences. • Understand and use sigma notation for the sums of series. • Understand and work with arithmetic sequences and series, including the formulae for nth term and the sum to n terms. The proof of the sum formula for an arithmetic sequence should be known including the formula for the sum of the first n natural numbers. • Understand and work with geometric sequences and series, including the formulae for the nth term and the sum of a finite geometric series; the sum to infinity of a convergent series, including the use of $r < 1$; modulus notation. • Be able to use sequences and series in modelling.
Applications of Forces – Mechanics 2 Chapter 7 Students will begin to use their knowledge to apply it so they can: • Find an unknown force when a system is in equilibrium. • Solve statics problems involving weight, tension and pulleys. • Understand and solve problems involving limiting equilibrium. • Solve problems involving motion on a rough or smooth inclined plane. • Solve problems involving connected particles that require the resolution of forces.	Binomial Expansion – Pure 2 Chapter 4 Students will build on what they have learnt about binomial in Y12 to: • Understand and use the Binomial expansion of $(a + bx)^n$ for any rational n, including its use for approximation; be aware that the expansion is valid for $\frac{bx}{a} < 1$.
Projectiles – Mechanics 2 Chapter 6 Students will continue to apply mechanics principles to: • Model motion under gravity for an object projected horizontally • Resolve velocity into components	Regression, Correlation and Hypothesis – Statistics 2 Chapter 1 Students will build on Y12 Stas to: • Understand exponential models in bivariate data

• Solve problems involving particles projected at an angle • Derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile	• Use a change of variable to estimate coefficient in an exponential model • Understand and calculate the product moment correlation coefficient • Carry out a hypothesis test for zero correlation
Further Kinematics – Mechanics 2 Chapter 8 Students will use build on previous knowledge in order to: • Work with vectors for displacement, velocity and acceleration when using the vector equations of motion. • Use calculus with harder functions of time involving variable acceleration. • Differentiate and integrate vectors with respect to time.	Conditional Probability – Statistics 2 Chapter 2 Students will use their knowledge of probability to learn to: • Understand set notation in probability • Understand conditional probability • Solve conditional probability problems using two-way tables and Venn diagrams • Use probability formulae to solve problems • Solve conditional probability using tree diagrams
	Normal Distribution – Statistics 2 Chapter 3 Students will learn to: • Understand the normal distribution and the characteristics of a normal distribution curve. • Find percentage points on a standard normal curve. • Calculate values on a standard normal curve • Find unknown means and/or standard deviations for a normal distribution. • Approximate a binomial distribution using a normal distribution. • Select appropriate distributions and solve real-life problems in context. • Solve conditional probability using tree diagrams.
Revision Students have now been exposed all content from Pure, Statistics and Mechanics. Students now enter the revision stage in class which predominantly takes the form of students practicing exam questions with teacher feedback. Students must be given time to get used to how the exam papers will be set, how to approach the exam papers and what is expected to gain all the marks available for each question.	



ENRICHMENT, SUPPORT, EXTRA-CURRICULAR

- Maths help club
- National Maths Challenge
- After school Intervention classes
- Further Maths Level 2 Certificate