Mathematics
We believe that all of our pupils can be mathematicians, who enjoy and excel in mathematics at all levels. All The Mathematics Department will provide pupils with exciting, relevant, and challenging Mathematics, delivered by dedicated staff. Pupils will understand the underlying principles of the mathematics they learn, making links and developing reasoning skills and logical thinking. They will progress towards being independent mathematicians who can identify and correct misconceptions for themselves. Pupils will develop their confidence to tackle a range of problems. To achieve this, staff will design and develop simple and effective systems and interesting and effective teaching ideas and resources to enable classroom delivery and promote mathematics across the school. At New Line Learning Academy, we teach the National Curriculum for mathematics, which aims to ensure that all pupils: become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems. reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions

Year 8	
Term One	
Big Picture	Proportional Reasoning

Knowledge	Declarative - Key Facts To use ratio and scale Work with multiplicative change Multiply and divide fractions Procedural - What pupils should be able to do Ratio and Scale: Understand the meaning & representation of ratio Understand and use ratio notation Solve problems involving ratios of the form 1:n (or n:1) Solve proportional problems involving the ratio m:n Divide a value into a given ratio Express ratios in their simplest integer form Express ratios in the form 1:n (H) Compare ratios and related fractions Understand π as the ratio between diameter and circumference Understand gradient of a line as a ratio (H) Multiplicative Change: Solve problems involving direct proportion Explore conversion graphs Convert between currencies Explore direct proportion graphs (H) Explore relationships between similar shapes Understand scale factors as multiplicative representations Draw and interpret scale diagrams Interpret maps using scale factors and ratios Multiply and divide fractions: Represent multiplication of fractions Multiply a fraction by an integer Find the product of a pair of unit fractions Find the product of a pair of any fractions Divide an integer by a fraction Divide a fraction by a unit fraction Understand and use the reciprocal Divide any pair of fractions Multiply and divide improper and mixed fractions (H) Multiply and divide algebraic fractions (H)
Pitch it up	Exploring proportional graphs Start working with algebraic fractions Explore the connection between ratio and gradient

Pre-requisite knowledge	From KS2 and year 7: Consolidate their numerical and mathematical capability from KS2 Build on fractions of an amount knowledge from year 7 Develop understanding of gradient as more than just a slope Build ratio into equivalence knowledge of F.D.P
How will this term's content help with future learning?	Straight line graphs Scale drawings Y=mx+c Parallel lines Perpendicular lines Combining ratio Direct and indirect proportion
Authentic Connections	These three topics — **ratio & scale**, **multiplicative change**, and **multiplying/dividing fractions** — are all part of the broader concept of **proportional reasoning**, which is used in many careers that involve comparisons, models, recipes, resizing, or precise calculations. Here's a breakdown of **careers that use these mathematical skills regularly**: ⚖️ **1. Careers that Use Ratio & Scale** 👷 **Architect or Civil Engineer** • **Why:** They design buildings and structures using scaled drawings and blueprints. • **Skills used:** Converting between real-life dimensions and plans using scale factors, understanding ratios in design constraints. 🧵 **Fashion Designer or Tailor** • **Why:** Clothing designs often involve resizing patterns to fit different body sizes. • **Skills used:** Using ratio and scale to adjust patterns and fabric amounts proportionally. 👨‍🍳 **Chef or Nutritionist** • **Why:** Recipes need to be scaled up/down for different servings. • **Skills used:** Applying ratio and proportion when altering ingredient quantities or comparing nutritional values.

	🔁 **2. Careers that Use Multiplicative Change** 📈 **Business Analyst / Marketer** • **Why:** They track growth rates (e.g., sales doubling, user increases) and analyse data trends. • **Skills used:** Calculating percentage increases/decreases, compound growth, and working with multipliers. 🧬 **Biologist or Environmental Scientist** • **Why:** Populations, bacteria, and environmental effects often grow or decay at **multiplicative rates**. • **Skills used:** Understanding exponential change, scaling data, and interpreting proportional growth. 💰 **Financial Advisor / Economist** • **Why:** Interest rates, inflation, and investments involve repeated proportional changes. • **Skills used:** Using percentage multipliers and interpreting real-world implications of multiplicative changes.
	➗ **3. Careers that Use Multiplying & Dividing Fractions** 👨‍⚕️ **Pharmacist or Lab Technician** • **Why:** They calculate precise doses based on fractions of millilitres or grams. • **Skills used:** Multiplying/dividing quantities and concentrations using fractions. 🏗️ **Builder or Carpenter** • **Why:** Many materials come in fractional lengths or quantities. • **Skills used:** Dividing materials, combining measurements, or calculating areas using fractional dimensions. 👩‍🏫 **Maths Teacher or Tutor** • **Why:** Deep understanding of how and why fraction operations work is essential for teaching them accurately. • **Skills used:** Explaining real-life contexts like dividing pizzas, recipes, or lengths.

Term Two	
Big Picture	Geometric and Statistical representations

Knowledge	Declarative – Key Facts Working in the Cartesian Plane Representing Data Tables & Probability Procedural – What pupils should be able to do Working in the Cartesian Plane: Work with coordinates in all four quadrants Identify and draw lines that are parallel to the axes Recognise and use the line y=x Recognise and use lines of the form y=kx Link y=kx to direct proportion problems Explore the gradient of the line y=kx (H) Recognise and use lines of the form y=x+a Explore graphs with negative gradient (y=-kx, y=a-x, x+y=a) Representing Data: Draw and interpret scatter graphs Understand and describe linear correlation Draw and use line of best fit (1) and (2) Identify non-linear relationships identify different types of data Read and interpret ungrouped frequency tables Represent grouped discrete data Represent continuous data grouped into equal classes Represent data in two-way tables Tables & Probability: Construct sample spaces for 1 or more events Find probabilities from a sample space Find probabilities from two-way tables Find probabilities from Venn diagrams Use the product rule for finding the total number of possible outcomes

Pitch it up	Explore and quantify gradients Answer more complex probability problems
Pre-requisite knowledge	From year 7: Coordinates in positive quadrants Substitution of values into an equation Four operations with integers, decimals and fractions Tally charts

How will this term's content help with future learning?	Understanding the data handling cycle Completing reflections Straight line graphs Probability
Authentic Connections	Each of these — **Working in the Cartesian Plane**, **Representing Data**, and **Tables & Probability** — is foundational for analysing and interpreting information, solving problems visually, and making decisions based on patterns and predictions. Here's a breakdown of **careers where these skills are directly applied**: 🧭 **1. Careers that Use Working in the Cartesian Plane** 🎮 **Game Developer / Animator** • **Why:** Games and animations are built using 2D and 3D coordinate systems. • **Skills used:** Plotting objects on the Cartesian plane, moving characters using coordinates and vectors. 🛰️ **Aerospace Engineer / Pilot** • **Why:** Flight paths and control systems are mapped using coordinate geometry. • **Skills used:** Tracking position in airspace using Cartesian or polar coordinates. 👩‍🏫 **Maths / Physics Teacher** • **Why:** Teaching graphing, functions, and motion in the plane requires strong visual reasoning. • **Skills used:** Demonstrating how coordinates model real-world problems. 📊 **2. Careers that Use Representing Data** 📈 **Statistician / Data Analyst** • **Why:** They collect, organise, and present data to support conclusions and decisions. • **Skills used:** Using bar charts, histograms, scatter plots, and pie charts to communicate findings clearly. 🧬 **Medical Researcher / Public Health Analyst** • **Why:** They analyse trends in data (like infection rates, treatment outcomes). • **Skills used:** Representing data to show patterns, making data accessible to others. 🎓 **Educational Researcher / Policy Advisor** • **Why:** Analysing school performance and exam trends helps shape policy. • **Skills used:** Representing and interpreting data to spot gaps and improvements. 🎲 **3. Careers that Use Tables & Probability** 🧠 **AI / Machine Learning Engineer**

	• **Why:** Probabilities drive decision-making in artificial intelligence. • **Skills used:** Using **two-way tables**, conditional probability, and interpreting chance events. 🧪 **Geneticist / Biologist** • **Why:** Genetic inheritance and mutations involve probabilistic thinking. • **Skills used:** Using Punnett squares (tables) and probability models to predict traits or outcomes.

Term Three	
Big picture	Algebraic Techniques
Knowledge	Declarative – Key Facts Brackets, Equations and inequalities Sequences Indices Procedural – What pupils should be able to do Brackets, Equations and Inequalities: Form algebraic expressions Use directed number with algebra Multiply out a single bracket Factorise into a single bracket Expand multiple single brackets and simplify Expand a pair of binomials (H) Solve equations, including with brackets Form and solve equations with brackets Understand and solve simple inequalities Form and solve inequalities Solve equations and inequalities with unknowns on both sides (H) Form and solve equations 7 inequalities with unknowns on both sides (H) Identify and use formulae, expressions, identities and equations Sequences: Generate sequences given a rule in words Generate sequences given a simple algebraic rule Generate sequences given a complex algebraic rule Find the nth term of a linear sequence (H) Indices: Adding & subtracting expressions with indices Simplifying algebraic expressions by multiplying indices

	Simplifying algebraic expressions by dividing indices Use the addition law for indices Use the addition and subtraction law for indices Exploring powers of powers (H)
Pitch it up	Find nth term Explore powers of powers Explore negative powers Solve equations and inequalities with unknowns on both sides
Pre-requisite knowledge	From Year 7: Extend a sequence Find the position to term rule in words Understand powers Place value Use algebraic notation
How will this term's content help with future learning?	In Year 9: Forming and solving equations Rearranging simple formulae In Year 10: Solving more complex and algebraic fractions Finding the nth term of a sequence In Year 11: Rearranging complex formulae Solving quadratic equations Solving simultaneous equations
Authentic Connections	The topics **Brackets, Equations & Inequalities**, **Sequences**, and **Indices** are core components of algebra and mathematical reasoning — and they are especially valuable in careers that involve formulas, patterns, optimisation, and modelling change. Here's a breakdown of **careers that use these skills** in real-world contexts: **1. Careers that use Brackets, Equations & Inequalities** **Engineer (Mechanical, Electrical, Civil, etc.)** • **Why:** Engineers use algebraic equations to solve for unknowns, optimise systems, and apply constraints. • **Skills used:** Expanding and factorising expressions, solving simultaneous equations, interpreting inequalities for safe design limits. **Electrician / Technician**

	• **Why:** They work with formulas involving resistance, voltage, and power. • **Skills used:** Substituting into equations, rearranging formulas with brackets. 🎮 **Computer Programmer / Software Developer** • **Why:** Writing code often involves logical conditions, expressed using algebraic-style syntax and inequalities. • **Skills used:** Using brackets for function arguments, testing constraints using inequalities.
	🔢 **2. Careers that use Sequences** 📈 **Economist / Market Analyst** • **Why:** Sequences model trends in data such as stock prices, population growth, or inflation. • **Skills used:** Recognising and extending arithmetic and geometric sequences, analysing patterns over time. 🔬 **Biologist / Environmental Scientist** • **Why:** Patterns in growth rates (e.g., bacteria, animal populations) follow sequences. • **Skills used:** Using recurrence relations, understanding exponential growth (linked with sequences and indices). 🧠 **Mathematician / Cryptographer** • **Why:** Sequences are at the heart of number theory, coding, and encryption algorithms. • **Skills used:** Analysing and generating sequences, finding formulae for nth terms.
	✖ **3. Careers that use Indices (Powers, Exponents)** 🌌 **Physicist / Astronomer** • **Why:** Large and small quantities (e.g., mass of planets, size of atoms) are expressed in standard form using indices. • **Skills used:** Laws of indices, simplifying expressions, scientific notation. 💰 **Financial Analyst / Banker** • **Why:** Compound interest and investment growth follow exponential models. • **Skills used:** Calculating using powers, understanding exponential functions. 🧪 **Chemist** • **Why:** Chemical reactions often follow exponential laws and powers in rate equations. • **Skills used:** Using indices in formulas, balancing equations with powers of substances.

Term Four	
Big picture	Developing Number Sense
Knowledge	Declarative – Key Facts Calculate with Fractions and percentages Write in and convert with standard index form Develop number sense Procedural – What pupils should be able to do Fractions and Percentages: Convert fluently between key fractions, decimals and percentages Calculate key fractions, decimals and percentages of an amount without a calculator Calculate fractions, decimals and percentages of an amount using calculator methods Convert between decimals and percentages greater than 100% Percentage decrease with a multiplier Calculate percentage increase and decrease using a multiplier Express one number as a fraction or a percentage of another without a calculator Express one number as a fraction or a percentage of another using calculator methods Work with percentage change Choose appropriate methods to solve percentage problems Find the original amount given the percentage less than 100% (H) Find the original amount given the percentage greater than 100% (H) Choose appropriate methods to solve complex percentage problems (H) Standard Index Form: Investigate positive powers of 10 Work with numbers greater than 1 in standard form Investigate negative powers of 10 Work with numbers between 0 and 1 in standard form Compare and order numbers in standard form Mentally calculate with numbers in standard form Add and subtract numbers in standard form Multiply and divide numbers in standard form Use a calculator to work with numbers in standard form Understand and use negative indices (H) Understand and use fractional indices (H)

	Number Sense: Round numbers to powers of 10 and 1 significant figure Round numbers to a given number of decimal places Estimate the answer to a calculation Understand and use error interval notation (H) Calculate using the order of operations Calculate with money Convert metric measures of lengths Convert metric units of weight and capacity Convert metric units of area (H) Convert metric units of volume (H) Solve problems involving time and the calendar
Pitch it up	Work with reverse percentage problems Calculate repeated percentage change Work with negative and fractional indices Consider error intervals Convert units of area and volume
Pre-requisite knowledge	From Year 7: Equivalence between fractions, decimals and percentages How to find simple percentages of an amount Understand powers of ten Place value Know simple metric conversions
How will this term's content help with future learning?	Error intervals Solve percentage problems Conversion of area and volume units Reverse percentage change Compound interest Bounds Similar shapes
Authentic Connections	These three topics — **calculating with fractions and percentages**, **working with standard index form**, and **developing number sense** — are essential in a wide range of careers, particularly those involving money, measurement, data analysis, and science. Here's a breakdown of **careers that use these skills regularly**: 🧱 **1. Careers that use Calculating with Fractions and Percentages** 💰 **Accountant / Financial Analyst** • **Why:** They calculate tax, profit margins, discounts, and interest rates. • **Skills used:** Converting between percentages and fractions, comparing costs, budgeting. 👨‍🍳 **Chef or Baker** • **Why:** Recipes use fractional and percentage quantities for ingredients.

	• **Skills used:** Scaling recipes up/down, adjusting ingredient amounts precisely. 🏥 **Nurse / Pharmacist** • **Why:** Medication dosages often involve fractions or percentages of standard doses. • **Skills used:** Calculating safe doses, interpreting medicine labels (e.g., 0.25ml or 5%).
	✨ **2. Careers that use Standard Index Form (Scientific Notation)** 🌌 **Astronomer / Physicist** • **Why:** They work with **very large** or **very small** numbers (e.g., distances in space, atomic sizes). • **Skills used:** Writing and converting values in standard form, multiplying/dividing numbers in index form. 🧬 **Biologist / Chemist** • **Why:** Measurements like the size of cells or number of atoms use powers of ten. • **Skills used:** Using standard form to simplify complex data and equations. 💻 **Computer Scientist** • **Why:** Data storage and computing power often involve exponential quantities (e.g., gigabytes, megabytes). • **Skills used:** Understanding large numbers in standard form and converting units.
	🔢 **3. Careers that use Number Sense** 🛒 **Retail Manager / Buyer** • **Why:** They make quick estimates about stock, pricing, discounts, and profits. • **Skills used:** Approximating totals, rounding, estimating percentage reductions mentally. 👷 **Construction Worker / Site Manager** • **Why:** They measure materials, estimate quantities, and work with costs. • **Skills used:** Estimating lengths, volumes, and understanding numerical patterns on the fly.

Term Five	
Big picture	Developing Geometry
Knowledge	Declarative – Key Facts Angles in parallel lines and polygons Area of trapezia and circles

	Line symmetry and reflection Procedural – What pupils should be able to do Angles in parallel lines and polygons Understand and use basic angle rules and notation Investigate angles between parallel lines and the transversal Identify and calculate with alternate and corresponding angles Identify and calculate with co-interior, alternate and corresponding angles Solve complex problems with parallel line angles Constructions triangles and special quadrilaterals Investigate the properties of special quadrilaterals Identify and calculate with sides and angles in special quadrilaterals Understand and use the properties of diagonals of quadrilaterals Understand and use the sum of exterior angles of any polygon Calculate and use the sum of the interior angles in any polygon Calculate missing interior angles in regular polygons Prove simple geometric facts (H) Construct an angle bisector (H) Construct a perpendicular bisector of a line segment (H) Area of trapezia and circles Calculate the area of triangles, rectangles and parallelograms Calculate the area of a trapezium Calculate the perimeter and area of compound shapes (1) Investigate the area of a circle Calculate the area of a circle and parts of a circle without a calculator Calculate the area of a circle and parts of a circle with a calculator Calculate the perimeter and area of compound shapes (2) Line symmetry and reflection: Recognize line symmetry Reflect a shape in a horizontal or vertical line 1 (shapes touching the line) Reflect a shape in a horizontal or vertical line 2 (shapes not touching the line) Reflect a shape in a diagonal line 1 (shapes touching the line) Reflect a shape in a diagonal line 2 (shapes not touching the line)
Pitch it up	Complex constructions Reflection in diagonal lines or y=mx+c
Pre-requisite knowledge	From Year 7: Measure with a protractor Draw lines and angles accurately Introduce angles Angles on a straight line Recap Angles around a point Calculate angles Vertically opposite angles Angles in a triangle

	Area of simple 2d shapes Plotting y=a and x=a
How will this term's content help with future learning?	Solve area problems Area of sectors Angle problems with equations Combining transformations
Authentic Connections	These three topics — **angles in parallel lines and polygons**, **area of trapezia and circles**, and **line symmetry and reflection** — are all geometry-based and are applied in many **design, construction, planning, and engineering careers**. Here's a breakdown of **careers that directly use these skills**: 🔺 **1. Careers that use Angles in Parallel Lines and Polygons** 🏗️ **Architect / Civil Engineer** • **Why:** Understanding internal angles, structural layouts, and how lines interact is essential in building design. • **Skills used:** Calculating angles in regular polygons, using alternate and corresponding angles to plan accurate designs. ✏️ **Graphic Designer / Technical Illustrator** • **Why:** Creating precise layouts often involves understanding parallel lines and geometric relationships. • **Skills used:** Using accurate angles and shapes for technical or artistic designs. 🚓 **Accident Investigator / Forensic Analyst** • **Why:** Analyzing the geometry of collision paths, impact angles, and vehicle movements. • **Skills used:** Applying knowledge of angles and line relationships to reconstruct events. 📐 **2. Careers that use Area of Trapezia and Circles** 📊 **Land Surveyor / Town Planner** • **Why:** Used for calculating land areas, plotting parks, roads, and irregular plots. • **Skills used:** Finding area of non-rectangular shapes, especially curved and trapezoidal land sections. 🎨 **Landscape Designer / Interior Designer** • **Why:** Planning outdoor or indoor spaces involves calculating floor or surface areas. • **Skills used:** Calculating circular patios, curved features, and trapezoidal furniture layouts. 🧪 **Chemical Engineer / Lab Technician** • **Why:** Area is important when dealing with surface reactions or equipment design (e.g., circular tanks). • **Skills used:** Calculating curved surface areas and applying formulas to real contexts.

	🔁 **3. Careers that use Line Symmetry and Reflection** 🧵 **Fashion Designer / Pattern Cutter** • **Why:** Garment patterns rely heavily on symmetry for fit and aesthetic. • **Skills used:** Reflecting designs accurately, identifying lines of symmetry in templates. 🧬 **Biologist / Medical Illustrator** • **Why:** Many organisms and body structures are symmetrical. • **Skills used:** Recognising and representing bilateral symmetry in diagrams or models. 🎮 **Video Game Designer / Animator** • **Why:** Character design and environment layouts often use reflection and symmetry to ensure consistency and balance. • **Skills used:** Applying transformations (e.g., reflection) in 2D and 3D environments.

	🧠 **Cross-discipline example:**
	🧱 **Construction / CAD Technician**
	• Uses:
	  ○ **Angles** for precise building joins and layout
	  ○ **Area calculations** for materials and floorplans
	  ○ **Symmetry and reflection** for balanced, mirrored architectural features

Term Six	
Big picture	Reasoning with data
Knowledge	Declarative – Key Facts Understanding and complete the data handling cycle Calculate and interpret different measures of location Procedural – What pupils should be able to do The data handling cycle: Set up a statistical enquiry Design and criticize questionnaires Draw and interpret pictograms, bar charts and vertical line charts Draw and interpret multiple bar charts

	Draw and interpret pie charts Draw and interpret line graphs Choose the most appropriate diagram for given set of data Represent and interpret grouped quantitative data Find and interpret the range Compare distributions using charts Identify misleading graphs Measures of location: Understand and use the mean, median and mode Choose the most appropriate average Find the mean from an ungrouped frequency table (H) Find the mean from a grouped frequency table (H) Identify outliers Compare distributions using averages and the range1
Pre-requisite knowledge	From Year 7: How to complete tally charts Addition Division Inequality notation
How will this term's content help with future learning?	Read and interpret more complex grpahs such as Histograms and cumulative frequency tables Find averages from stem and leaf diagrams Combine mean
Pitch it up	Find averages from graphs and tables Use average to make comparisons of data Calculate averages from grouped frequency tables
Authentic Connections	These two important data topics — **understanding and completing the data handling cycle**, and **calculating and interpreting different measures of location (mean, median, mode, range)** — are foundational in careers that involve **collecting, analysing, and making decisions based on data**. Here's a breakdown of **careers where these skills are essential**: 📊 **1. Careers that use the Data Handling Cycle** The **data handling cycle** involves: **posing questions**, **collecting data**, **analysing data**, and **interpreting results**. 🧪 **Scientist / Researcher** • **Why:** Scientific investigations rely on carefully designed data collection and interpretation. • **Skills used:** Planning experiments, analysing results, drawing evidence-based conclusions.

	Public Health Analyst / Epidemiologist • **Why:** They gather data about disease outbreaks and population health. • **Skills used:** Designing surveys, collecting data, analysing trends, informing healthcare responses. **Market Researcher / Business Analyst** • **Why:** Understanding customer behaviour or product performance involves full use of the data cycle. • **Skills used:** Creating questionnaires, collecting consumer data, spotting patterns to guide decisions.
	2. Careers that use Measures of Location (Mean, Median, Mode, Range) **Statistician / Data Analyst** • **Why:** They summarise large data sets to find patterns and make predictions. • **Skills used:** Choosing appropriate averages, interpreting variability, comparing data sets. **Teacher / Education Consultant** • **Why:** Pupil assessment and progress tracking rely on average scores and identifying outliers. • **Skills used:** Calculating class averages, spotting performance trends, informing interventions. **HR / Recruitment Analyst** • **Why:** Analysing salaries, staff retention, and survey feedback requires statistical insight. • **Skills used:** Comparing average salaries, identifying typical values and extremes

Resources

Assessments
At the end of each unit, pupils will sit an assessment that will determine and evidence the amount of progress made during the teaching period. To allow these to have a formative element the pupils will then complete some work, which closes identified gaps. All of the assessments are designed to contain at least 40% reasoning and problem-solving elements in order to prepare pupils for the style of questions they will encounter in the new specification GSCE. Throughout both years' pupils will be graded in line with the newly formed GCSE Grades 1-9 (with the addition of an Entry Level and Novice Level) to allow all our pupils to see their progress across all 5 years of their secondary Maths education. Reports however will indicate only whether the pupil is working towards, on track, or exceeding their target.