Year 9 - Indices and Standard Form: Journey of Knowledge

Context and Introduction to Unit:

Students will learn how to perform various operations involving fractions. These will involve improper fractions and mixed numbers. Students will also learn the various index laws and how to simplify numbers with a similar base. Students will have to convert ordinary numbers into standard form and number in standard form back to ordinary numbers. This will enable them to use various operations involving standard form.

Prior knowledge (KS2/KS3)

Students should know how to use various operations with fractions.
Students should be able to write powers of 10 in index form and recognise and recall powers of 10, i.e. $10^2 = 100$.
Students should recall the index laws.

The bigger picture:
Personal development opportunities.
Career links.
RSE

Nurse and Scientist

Mathematician – John Nash

CORE KNOWLEDGE AND SKILLS

Descriptor	Topic	SPARX	✓
- Devloping +	To evaluate terms using multiplication and division index laws	M135, M608, M150	
- Securing +	To use higher powers and roots.	M135	
	To confidently use all index laws, including negative indices and power zero	U235, U694	
	To convert between standard form and ordinary numbers and vice-versa	M719, M678	
	To multiply and divide in standard form.	U264	
- Mastering +	To confidently use all index laws, including negative indices, power zero and unit fractions.	U235, U694, U985	
	To work confidently with indices and fractions.	N/A	
	To write a given number as a power of another number	N/A	
	To adjust answers into correct standard form	U330, U534	
	To change the power of 10 to add and subtract in standard form	U290	
	To confidently use standard form in various contexts	U290, U161	
Excelling	To calculate using a combination of index laws	U772	
	To be able to confidently change the base of a power and solve equations by comparing indices	N/A	
	To solve equations in standard form	N/A	
	To apply standard form to science problems	U161	

ABOVE AND BEYOND

Add and subtract mixed number fractions.

Multiply mixed number fractions;

Divide mixed numbers by whole numbers and vice versa;

Find the reciprocal of an integer, decimal or fraction;

Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined).

VOCABULARY

Add, subtract, multiply, divide, mixed, improper, fraction, decimal, indices, standard form, power, reciprocal, index

Assessment

Unit 1 MAP followed by Acceleration

WHERE NEXT?

Use of algebra involving fractions.

- Astronomers use quadratic functions and equations for several studies like measuring trajectories (path/direction), gravitational collapse, debris plumes, the absorption and reflection of light from interstellar dust, and measuring the shock waves of supernovas.

- They also use maths skills when looking at objects in the sky with a telescope. Objects are a long distance away so distances will be written in standard form.

John Nash

Diversity & Inclusion

Brief History

John Nash, in full John Forbes Nash, Jr., (born June 13, 1928, Bluefield, West Virginia, U.S.—died May 23, 2015, near Monroe Township, New Jersey) was an American mathematician who was awarded the 1994 Nobel Prize for Economics for his landmark work, first begun in the 1950s, on the mathematics of game theory. He shared the prize with John C. Harsanyi and Reinhard Selten. In 2015 Nash won (with Louis Nirenberg) the Abel Prize for his contributions to the study of partial differential equations.

Nash enrolled in chemical engineering at the Carnegie Institute of Technology (later Carnegie Mellon University) in Pittsburgh before he switched to chemistry and then to mathematics

Year 9 - Indices and Standard Form: Journey of Knowledge

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones				
Emerging	Developing	Securing	Mastering	Excelling
Pupils can use index laws to simplify and calculate the value of numerical expressions.	***Pupils must be have an understanding of and be able to recall the basics of :*** *Calculate combinations of indices, fractions and brackets* *Use index laws to simplify expressions* *Calculate with powers and roots* *Estimate answers to calculations*	***Pupils must be able to recall the following content:*** Calculate combinations of indices and brackets, including nested brackets Use index laws to simplify expressions Understand numbers written in index form that are raised to a power Understand negative and zero indices Use powers of 10 Understand numbers written in index form that are raised to a power Understand negative and zero indices Use powers of 10 and their prefixes	***Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:*** Add and subtract mixed number fractions. Multiply mixed number fractions; Divide mixed numbers by whole numbers and vice versa; Find the reciprocal of an integer, decimal or fraction; Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined).	***Pupils should be able to recall all the content in the knowledge journey and extend to the following:*** Understand how the sign of a power of a negative number changes the sign of the answer Understand when to insert square brackets and when to insert round brackets in a calculation Understand numbers written in index form that are raised to a power Understand negative and zero indices Use powers of 10 and their prefixes Understand how to calculate numbers in standard form, e.g. add or subtract two numbers in standard form, or multiply or divide two numbers in standard form.

Year 9 - Expressions, Functions and Formulae: Journey of Knowledge

Context and Introduction to Unit
In this unit pupils will learn about the differences between expressions and formulae. They will look closely at expressions and how to simplify then and then this will then lead in to the pupils being able to write an example of an expression and formula or use them to substitute in to.
Prior knowledge (KS2 NC)
Pupils should be introduced to the use of symbols and letters to represent variables and unknowns in mathematical situations that they already understand, such as: missing numbers, lengths, coordinates and angles, formulae in mathematics and science, equivalent expressions (for example, a + b = b + a).

The bigger picture:

Career link – Computer programmer

Mathematician: Sofia Kovalevskaya

CORE KNOWLEDGE

Descriptor	Topic	SPARX	✓
- Developing +	To solve 2 step equations including division	M509, M387	
	To substitute positive and negative integers into expressions involving indices an using the correct order of operations.	M208	
	To write and form equations from simple word problems and use your formula to solve a problem.	M957	
- Securing +	To confidently solve equations with unknowns on both sides including equations with brackets	M554	
	To write algebraic expressions from complex word questions and use them to solve problems.	M957	
	Form expressions to solve geometry problems.	M957	
	To change the subject of a formula for 2-step formula and word formula to solve problems.	M184	
	To be able to apply the skill to find missing lengths in geometry questions.	N/A	
	To confidently expand and simplify single brackets.	M237, M792	
	To expand two binomials.	M960	
- Mastering +	To write an expression for area when the side lengths are binomials.	M960	
	To solve equations with an unknown on both sides including the unknown in the denominator of the fraction	M387	
	To solve equations where the unknown is raised to a power.	N/A	
	To substitute positive and negative integers, decimals and fractions into expressions involving indices an using the correct order of operations.	M208, M979	
	To substitute into complex expressions including higher powers and roots.	M208, M979	
	Apply the equation of a line to real life situations and write formula from the graph and vice-versa.	M544, M888	
	To write algebraic expressions for area problems.	N/A	
	To change the subject of a formula in complex formula involving fractions, indices and roots.	U556	
Excelling	To use the equations of motion.	M979	
	To write expressions for more complex area questions including triangles	N/A	
	Find unknowns by equating coefficients and solving equations.	N/A	

ABOVE AND BEYOND

Expanding triple brackets.

Factorising quadratic expressions.

VOCABULARY

Expression
Formula
Substitute
Term
Simplify
Collect
Function machine
Input
Output

Assessment

Unit 2 MAP followed by acceleration.

WHERE NEXT?

KS4 – Knowing the difference between equations, formulae and expressions then forming/solving.

Year 9 – Dealing with Data: Journey of Knowledge

Context and Introduction to Unit

In this unit pupils will learn about the different ways to present statistical data. They will start by looking at how to calculate averages and range from a list and then move on to calculating these averages from a table. They will look closely at how to present the data in a variety of ways including as a scatter graph and stem and leaf diagram.

Prior knowledge (KS2 NC)

Pupils both encounter and draw graphs relating two variables, arising from their own enquiry and in other subjects.
Pupils know when it is appropriate to find the mean of a data set.
In lower KS3 pupils have also looked at calculating all averages from a set of data.

The bigger picture:

Career link:
Sports coach/analyst

Mathematician: William Spearman

CORE KNOWLEDGE

Descriptor	Topic	SPARX	✓
Developing +	To identify primary and secondary sources of data	U322	
	Design a suitable questionnaire	U911	
	To understand bias	U162	
	To find the mode, mean, median and range from a list.	M841, M940, M934, M328	
- Securing +	To identify different types of data including discrete and continuous data	U322	
	To find the mode, mean, median and range from a table.	M127	
	To write an ordered back to back stem and leaf diagram with a key	M648, M210	
	To describe correlation from a scatter graph and the relationship between two variables	M769, M596	
	To draw a line of best fit and use it to predict an outcome	M769, M596	
- Mastering +	To understand the importance of sampling	U162	
	To know how to take a random sample to eliminate bias.	U162	
	To find the averages from a grouped frequency table	M278	
	To find the averages from a back to back stem and leaf diagram and compare data	M648, M210	
	To understand anomalies and outliers and what may cause them	M769, M596	
Excelling	To know how to take a stratified sample to eliminate bias.	U162	
	To find missing values in tables given the averages	N/A	
	Understand why you cannot extrapolate when using a scatter graph	M769, M596	

ABOVE AND BEYOND

Explain statistical bias and the impact of a sample size

Read and interpret back to back stem and leaf diagrams

VOCABULARY

Range
Median
Mean
Mode
Frequency
Correlation
Data
Stem and leaf
Table
Primary
Secondary
Bias

Assessment

Unit 3 MAP followed by acceleration.

WHERE NEXT?

KS4 – Calculating the mean from a grouped frequency table and linking averages more to the context of the question that they have been given the data for.

- There are lots of different ways of collecting and interpreting data.

- An analyst or sports coach needs to be able to identify which data points are the most useful to feedback to the team and manager.

- They also need to be able to assess the accuracy and reliability of the data by having an advanced level of knowledge of how the data used has been collected, stored or retrieved.

William Spearman

Brief History

Diversity & Inclusion
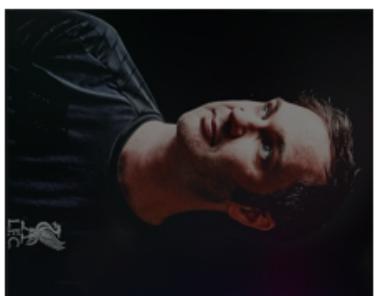
"It's a bit of a weird transition!" admits William Spearman, and it's hard to disagree.

After all, how – and indeed why – do you go from earning a PhD in physics from Harvard and working at the European Organisation for Nuclear Research (CERN) to being part of Liverpool FC's research department?

"Unlike many people working in football, I grew up being really bad at most team sports... I still am, and that's probably not a surprise given that I am one of the nerds of the place!" Spearman, the club's lead data scientist, explains.

Year 9 – Dealing with Data: Assessment Plan

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. The scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones				
Emerging	Developing	Securing	Mastering	Excelling
Pupils have basic knowledge of ordering a set of integers and decimals.	*Pupils must be have an understanding of and be able to recall the basics of :* Calculating the mode, median, mean and range from a list of data Naming the different types of correlation Use a data collection sheet	*Pupils must be able to recall the following content:* Drawing a stem and leaf diagram Reading information from a scatter graph Explain the difference between primary and secondary data Design a questionnaire	*Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:* Calculating the mean from a frequency table Criticise a questionnaire Calculate the mean from a grouped frequency table	*Pupils should be able to recall all the content in the knowledge journey and extend to the following:* Calculate the mean from a grouped frequency table Explain statistical bias and the impact of a sample size Read and interpret back to back stem and leaf diagrams *Pupils should also be able to use all vocabulary on the knowledge journey independently and in context.*

Multiplicative Reason: Journey of Knowledge

Context and Introduction to Unit
Pupils will have previously studied transformations and scale factors which also links to decimals, fractions and percentages. They will have a basic understanding of proportion through looking at best buy problems.

Prior knowledge
Pupils should be able to find a percentage of an amount and relate percentages to decimals.
Pupils should be able to rearrange equations and use these to solve problems.
Pupils should know speed = distance/time, density = mass/volume.

The bigger picture:

Pharmacist
Model Designer

Mathematician: Dorothy Vaughn

CORE KNOWLEDGE

Descriptor	Topic	SPARX	✓
- Developing +	To understand that scale factor is the ratio between sides	M377	
	To write one value as a percentage of another	M264	
	To use compound formula for speed	U151	
	Solve best buy problems using multiplicative relationships	M681	
- Securing +	To enlarge a shape with a positive scale factor from a centre of enlargement	M178	
	To calculate percentage change	U278	
	To answer profit and loss questions	U278	
	Find amount following a percentage increase or decrease	M476, M533	
	To use compound formula for speed, pressure and density	U151, U910, U527	
	Solve best buy problems using multiplicative relationships and the unitary method	M681	
- Mastering +	To enlarge a shape from a from a centre of enlargement with a fractional scale factor	M178	
	To describe an enlargement.	M178	
	To find original amounts following a percentage increase or decrease	M528	
	To find the original amount using inverse operations	M528	
	To correctly apply compound formula involving changes of units	U151, U910, U527	
	To understand the relationship between compound measures, rates of change and the gradient of a graph	U256	
	To solve problems involving both direct and inverse proportion	U721, U357	
Excelling	To enlarge a shape with a negative scale factor	M178	
	To be able to describe combined enlargements as a single transformation	M178	
	Given two values find the percentage increase or decrease	U278	
	Understand average compound measures given separate journey's or materials	U151, U910, U527	
	To recognise when values are in direct, inverse and no proportion	U721, U357	

ABOVE AND BEYOND

Understand that solving problems involving the comparison of compound measures or constant rates may require changing units
Understand why a speed given (or calculated) may (or may not) be an average speed
Understand how to distinguish between situations where quantities are in direct, inverse or not proportional at all
Apply understanding of inverse proportion to compound measure

VOCABULARY

ratio, proportion, best value, proportional change, compound measure, density, mass, volume, speed, distance, time, density, mass, volume, pressure, acceleration, velocity, inverse, direct

Assessment

Unit 4 MAP followed by acceleration.

WHERE NEXT?

Unit 15: Constructions: Triangles, Nets, Plan and Elevation, Loci, Scale Drawings and Bearings

CAREERS ALERT!

- Pharmaceutical maths involves completing mathematical calculations that are important to the distribution of medications. There's little room for error in this field, so pharmacists' calculations must be accurate and reliable.

- Pharmacists need to be able to calculate with percentages when they are combining medications and also convert between units of measure.

Dorothy Vaughn

Brief History

Dorothy Jean Johnson Vaughan (September 20, 1910 - November 10, 2008) was an American mathematician and human computer who worked for the National Advisory Committee for Aeronautics (NACA), and NASA, at Langley Research Centre in Hampton, Virginia. In 1949, she became acting supervisor of the West Area Computers, the first African-American woman to receive a promotion and supervise a group of staff at the centre.

She later was promoted officially to the position of supervisor. During her 28-year career, Vaughan prepared for the introduction of computers in the early 1960s by teaching herself and her staff the programming language of Fortran. She later headed the programming section of the Analysis and Computation Division (ACD) at Langley. Vaughan is one of the women featured in Margot Lee Shetterly's history Hidden Figures: The Story of the African-American Women Who Helped Win the Space Race (2016). It was adapted as a biographical film of the same name, also released in 2016.

In 2019, Vaughan was honoured with the Congressional Gold Medal posthumously.

Diversity & Inclusion

Year 8 – Multiplicative Reason: Assessment Plan

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones				
Emerging	Developing	Securing	Mastering	Excelling
Pupils have basic knowledge Enlarge 2D shapes using a positive whole number scale factor and centre of enlargement	*Pupils must be have an understanding of and be able to recall the basics of :* Find the centre of enlargement by drawing lines on a grid Enlarge 2D shapes using a positive whole number scale factor and centre of enlargement Find the centre of enlargement by drawing lines on a grid	*Pupils must be able to recall the following content:* Calculate percentage change Solve best-buy problems Understand that the scale factor is the ratio of corresponding lengths *Enlarge 2D shapes using a negative whole number scale factor* *Enlarge 2D shapes using a fractional scale factor*	*Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:* Find an original value using inverse operations Calculate percentage change Solve problems using compound measures Solve problems using constant rates and related formulae Solve problems involving inverse proportion	*Pupils should be able to recall all the content in the knowledge journey and extend to the following:* *Understand that solving problems involving the comparison of compound measures or constant rates may require changing units* *Understand why a speed given (or calculated) may (or may not) be an average speed* *Understand how to distinguish between situations where quantities are in direct, inverse or not proportional at all* *Apply understanding of inverse proportion to compound measures*

Year 9 - Constructions: Journey of Knowledge

Context and Introduction to Unit:

In constructions and scale drawings students learn how to construct triangles and elevation drawings to scale. As learning progresses they explore how to bisect lines and angles as in introduction to Constructing Loci at GCSE.

Prior knowledge (KS2/KS3)

know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles

draw given angles, and measure them in degrees (°)

Know names and angle properties of specific triangles

Know metric conversions

The bigger picture:

Personal development opportunities.
Career links.
RSE

Architect and Design
Mathematician: Hypatia

CORE KNOWLEDGE AND SKILLS

Descriptor	Topic	SPARX	✓
- Developing +	Construct accurate nets of solids	M518	
	To use a protractor accurately	M780, M331	
- Securing +	To accurately draw 2D shapes using a ruler and protractor	M331	
	Use map scales to solve problems and draw scale drawings	M112	
- Mastering +	To construct angular and perpendicular bisectors	M239, M232	
	To construct SSS triangles using a compass	M565	
	To solve problems involving scale and change of units	M112	
Excelling	To construct angles of 60, 30, 15 and 45 degrees using a compass	U979	
	Construct other regular polygons with a compass	U678	
	Apply constructions to solve loci problems.	M253	

ABOVE AND BEYOND

Constructing accurate scale diagrams (including triangles) in a strategy for solving problems involving finding sizes of angles and unknown lengths

VOCABULARY

Construction
Loci
Vertex
Perpendicular
Bisect
Equidistant
Protractor
Compass

Assessment

Unit 5 MAP followed by acceleration.

WHERE NEXT?

KS4 – Loci
KS4 - proving similarity and congruence

Hypatia

Brief History

Hypatia[a] (born c. 350–370; died 415 AD)was a neoplatonist philosopher, astronomer, and mathematician who lived in Alexandria, Egypt, then part of the Eastern Roman Empire. She was a prominent thinker in Alexandria where she taught philosophy and astronomy.
Although preceded by Pandrosion, another Alexandrine female mathematician, she is the first female mathematician whose life is reasonably well recorded. Hypatia was renowned in her own lifetime as a great teacher and a wise counsellor. She wrote a commentary on Diophantus's thirteen-volume Arithmetica, which may survive in part, having been interpolated into Diophantus's original text, and another commentary on Apollonius of Perga's treatise on conic sections, which has not survived. Many modern scholars also believe that Hypatia may have edited the surviving text of Ptolemy's Almagest, based on the title of her father Theon's commentary on Book III of the Almagest.

CAREERS ALERT!

Unit 5 Career – Architect

- Architects must have a good understanding of angles and be able to calculate with them as well as construct them.

- Architects must also know how to calculate the perimeter and area of shapes to create a building that will match the criteria given.

- They must be confident using both Pythagoras' Theorem and Trigonometry as both of these are geometry topics so important for building and designing structures.

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Hypatia

Brief History

Diversity & Inclusion

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Year 9 - Constructions: Journey of Knowledge

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones			
Emerging	Developing	Securing	Mastering
Pupils can use index laws to simplify and calculate the value of numerical expressions. Construct with a protractor	*Pupils must have an understanding of and be able to recall the basics of :* Use scales on maps and diagrams Construct and draw accurate scale diagrams	*Pupils must be able to recall the following content:* Make accurate constructions of angle bisectors, perpendicular bisectors using drawing equipment Construct accurate triangles Construct accurate nets of solids involving triangles	*Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:* Construct accurate angles of 45°, 30°, 60° based on known constructions of perpendicular bisector, angle bisector and equilateral triangle Use scale diagrams to solve problems Constructing accurate scale diagrams (including triangles) in a strategy for solving problems involving finding sizes of angles and unknown lengths

Year 9 - Sequences, Inequalities, Equations and Proportion: Journey of Knowledge

Context and Introduction to Unit:

Learners consolidate their understanding of arithemetic sequences and derive formulas for geometric sequences.
Students learn how to represent inequalities on a number line and solve an inequation using the balance method.
Students construct and solve equations using fractions and powers
Students derive formulae based on direct and inversely proportional arguments

Prior knowledge (KS2/KS3)

Balancing equations, forming equations

Term to term rules, position to term rules

Number lines

Operations with fractions

The bigger picture:

Personal development opportunities.
Career links.
RSE
Bakers and Chemists
Mathematician: Joan Clark

CORE KNOWLEDGE AND SKILLS

Descriptor	Topic	SPARX	✓
- Developing +	To recognise and continue arithmetic and pattern sequences	M241, M381	
	To list integers that satisfy an inequality	U509	
- Securing +	To recognise and continue arithmetic, geometric and pattern sequences	M241, M381, M991	
	To find the missing values in a sequence.	M991	
	To find the nth term of an arithmetic sequence	M241, M381, M991	
	To represent inequalities on a number line.	U509	
	To solve direct and inverse proportion questions	M478, U357	
- Mastering +	Use the nth term to solve problems and determine whether a value appears in a given sequence	M991	
	Find the nth term of a sequence containing fractions, where the numerator and denominator have a different nth term.	M991	
	To recognise quadratic sequences	N/A	
	To solve inequalities including an unknown on both sides	M118, M732	
	To write and use an algebraic expression for direct proportion	M742, M665	
	To solve algebraic proportion problems which involve changing the subject	M742, M665	
Excelling	To recognise quadratic sequences and find the nth term	M418	
	To solve two-part inequalities	U145	
	To understand that multiplying or dividing by a negative number reverses the inequalities.	U759	
	To solve problems involving direct and inverse proportion using known scientific relationships	M118, M732	
	Solve algeraic propotion problems which include squares and roots.	M118, M732	

ABOVE AND BEYOND

plot inequalities graphically
Represent geometric sequences graphically

VOCABULARY

Quadractic sequence
Inequality
Direct proportional
Inversely proportional

Assessment

Unit 6 MAP followed by acceleration.

WHERE NEXT?

KS4 simultaneous equations
Rate of change and acceleration

- The most obvious maths skill involved in being a baker is the ability to measure and weigh accurately using scales. Bakers will also scale recipes up or down depending on how many the recipe feeds compared to how many they are catering for. This relies heavily of the baker having the ability to use proportion correctly.

- Head bakers will also be in charge of calculating food costs in order to determine appropriate meal prices and how much of each item needs to be produced depending on how popular it is.

Joan Clark

Brief History

Joan Elisabeth Lowther Clarke was born on 24 June 1917 in West Norwood, London, England. She was the youngest child of Dorothy (née Fulford) and the Revd William Kemp Lowther Clarke. She had three brothers and one sister.

Clarke attended Dulwich High School for Girls in south London and won a scholarship in 1936, to attend Newnham College, Cambridge, where she gained a double first degree in mathematics and was a Wrangler. **She was denied a full degree**, as until 1948 Cambridge awarded these only to males.

Clarke's mathematical abilities were first discovered by Gordon Welchman, in an undergraduate Geometry class at Cambridge. Welchman was one of the top four mathematicians to be recruited in 1939 to supervise decoding operations at Bletchley Park. After noticing Clarke's mathematical abilities he recruited her to join him at Bletchley Park and be a part of the 'Government Code and Cypher School' (GCCS).

Diversity & Inclusion

Year 9 - Sequences, Inequalities, Equations and Proportion: Journey of Knowledge

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones			
Emerging	Developing	Securing	Mastering
Pupils can use index laws to simplify and calculate the value of numerical expressions. Use the nth term to generate an arithmetic sequence Recognise geometric sequences Recognise quadratic sequences	*Pupils must have an understanding of and be able to recall the basics of :* Find and use the nth term of an arithmetic sequence Represent inequalities on a number line Find integer values that satisfy an inequality	*Pupils must be able to recall the following content:* Derive formula for position to term rule of quadratic sequences Satisfy single inequalities by balancing	*Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:* Satisfy two or more inequalities by balancing Construct and solve equations including fractions or powers Write formulae connecting variables in direct or inverse proportion display regions graphically that satisfy inequalities Use algebra to solve problems involving direct or inverse proportion

Year 9 - Circles, Pythagoras & Prisms: Journey of Knowledge

Context and Introduction to Unit:
Students are guided through the discovery of Pythagoras' Theorem. They use Pythagoras' Theorem to find the hypotenuse and shorter side of any right-angled triangle. Students learn how to calculate the circumference and area of circles both as decimals and in terms of π. Learning progresses from 2D circles to finding the total surface area and volume of cylinders. Students learn how to estimate solutions by rounding and finding the limits of accuracy of rounded numbers. As learning progresses they are challenged to calculate the upper and lower bounds in calculations

Prior knowledge (KS2/KS3)
Area formulas, metric conversions
rounding to significant figures

The bigger picture:
Personal development opportunities.
Career links.
RSE
Surveyor

Mathematician: Pythagoras

CORE KNOWLEDGE AND SKILLS

Descriptor	Topic	SPARX	✓
- Securing +	To find the circumference and area of a circle	M169, M231	
	To find the perimeter and area of semi-circles and quadrants	M280, M340	
	To use Pythagoras to find any side in a right-angled triangle	M677	
	To calculate the surface area and volume of right prisms	M722, M661	
	Find the upper and lower bounds of a measurement and write error intervals	M730	
- Mastering +	Solve compound shape problems involving circles	N/A	
	To find the radius or diameter given the circumference or area	M169, M231	
	To solve problems involving arcs and sectors of circles	M280, M340	
	To solve problems using Pythagoras, including finding perimeters and area of triangles and trapezia.	M677	
	Use Pythagoras as a proof to demonstrate that a triangle is a right-angled triangle	M677	
	To find the volume and surface area of a cylinder	M697, M396	
	To convert between cube measurements	M465	
	To write percentage error intervals	M730	
	To solve straight forward geometry problems involving bounds	N/A	
Excelling	To extend to Pythagoras in 3D	M147	
	To use Pythagoras in volume and surface area questions	N/A	
	To find expressions for volume and surface area given algebraic lengths	N/A	

ABOVE AND BEYOND
Set up and solve equations using volumes of prisms
Work to appropriate degrees of accuracy

VOCABULARY

Volume
Cuboid
Prism
Cross section
Circumference
Semi-circle
Perimeter
Hypotenuse
Opposite
Adjacent
Square number
Square root

Assessment

Unit 7 MAP followed by acceleration.

WHERE NEXT?

KS4 volumes of cones and spheres
KS4 Trigonometry

CAREERS ALERT!

- Pythagoras' Theorem is used to calculate the steepness of slopes of hills or mountains. A surveyor looks through a theodolite toward a measuring stick a fixed distance away, so that the theodolite's line of sight and the measuring stick form a right angle.

- Trigonometry is used when measuring the height and angles of land. It can be used to measure the elevation from a certain point to a mountain.

Pythagoras

Pythagoras, (born c. 570 BCE, Samos, Ionia [Greece]—died c. 500-490 BCE, Metapontum, Lucanium [Italy]).
He was a Greek philosopher, mathematician, and founder of the Pythagorean brotherhood that, although religious in nature, formulated principles that influenced the thought of Plato and Aristotle and contributed to the development of mathematics and Western rational philosophy

Pythagoras himself came up with the theory that numbers are of great importance for understanding the natural world, and he studied the role of numbers in music. Although the Pythagorean theorem bears his name, the discoveries of the Pythagorean theorem and that the square root of 2 is an irrational number were most likely made after his death by his followers.

Diversity & Inclusion

Year 9 - Circles, Pythagoras & Prisms: Journey of Knowledge

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones			
Emerging	Developing	Securing	Mastering
Pupils can use index laws to simplify and calculate the value of numerical expressions. Calculate the circumference of a circle Estimate calculations involving pi (p)	*Pupils must have an understanding of and be able to recall the basics of :* Solve problems involving the circumference of a circle Calculate the area of a circle Find the length of an unknown side of a right-angled triangle	*Pupils must be able to recall the following content:* Solve problems involving the area of a circle Solve problems involving right-angled triangles Calculate the volume and surface area of a right prism	*Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:* Calculate the volume and surface area of a cylinder Convert between m3, cm3 and mm3 Find the lower and upper bounds for a measurement Calculate percentage error intervals

Year 9 - Graphs: Journey of Knowledge

Context and Introduction to Unit:
Students learn how to plot and derive the equation of straight line graphs in the form y = mx + c. Learning progresses on from this to find the equation of parallel and perpendicular lines in the form ax + by +c = 0. Students then go on plot quadratic, cubic, reciprocal and exponential graphs.

Prior knowledge (KS2/KS3)
Recognise and describe linear number sequences, including those involving fractions and decimals, and find the term-to-term rule.
Generate and describe linear number sequences.
Rearranging formula

The bigger picture:
Personal development opportunities.
Career links.
RSE
Construction Worker
Mathematician: Sophie Germain

CORE KNOWLEDGE AND SKILLS

Descriptor	Topic	SPARX	✓
- Securing +	Recognise that coordinates on a line are solutions to the equation.	N/A	
	To recognise the gradient and y-intercept from an equation written in the form y=mx+c	M544, M888	
	To understand that the intersection of two graphs is a solution to both equations	M658	
	To draw two lines to solve simultaneous equations	M658	
	To interpret non-linear real-life graphs		
Mastering +	Rearrange equations to the form y=mx+c	M544	
	Write the equation of a parallel line	U898	
	Draw a straight line given the equation	M544	
	To draw graphs from equations in the form ax+bc=c	N/A	
	To form simultaneous equations from word questions and solve graphically	U137, M658	
	To plot a quadratic graph from a table of values	U989	
	To plot and recognise cubic graphs.	U980	
	To recognise inverse proportion graphs	M448	
Excelling	To use y=0 and x=0 to plot graphs	N/A	
	To find lines perpendicular to a given line	U898	
	To understand that simultaneous equations can have one, none or infinitely many solutions	N/A	
	To solve simultaneous equations graphically including quadratic and cubic graphs	U875	

ABOVE AND BEYOND

Draw cubic graphs, recognise their features and distinguish between them and linear or quadratic graphs

VOCABULARY

Intercept
Gradient
y-intercept
Linear
Parallel
Perpendicular
Substitute
Reciprocal

Assessment

Unit 8 MAP followed by acceleration.

WHERE NEXT?

KS4 graphs circles and non linear functions

- Epidemiology is the study of how often diseases occur in different groups of people and why. Epidemiological information is used to plan and evaluate strategies to prevent illness and manage patients treatment.

- Epidemiologists use graphs which compare the number of cases and the date of diagnosis.

- They use rates to measure the frequency at which a health event occurs over a period of time.

Sophie Germain

Diversity & Inclusion

Brief History

Marie-Sophie Germain (French; 1 April 1776 – 27 June 1831) was a French mathematician, physicist, and philosopher. Despite initial opposition from her parents and difficulties presented by society, she gained education from books in her father's library, including ones by Euler, and from correspondence with famous mathematicians such as Lagrange, Legendre, and Gauss (under the pseudonym of Monsieur LeBlanc).

One of the pioneers of elasticity theory, she won the grand prize from the Paris Academy of Sciences for her essay on the subject. Her work on Fermat's Last Theorem provided a foundation for mathematicians exploring the subject for hundreds of years after.

Due to prejudice against her sex, she was unable to make a career out of mathematics, but she worked independently throughout her life. Before her death, Gauss had recommended that she **be awarded an honorary degree**, but that never occurred. On 27 June 1831, she died from breast cancer. At the centenary of her life, **a street and a girls' school were named after her**. The Academy of Sciences established the Sophie Germain Prize in her honour.

Year 9 - Graphs: Journey of Knowledge

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones			
Emerging	Developing	Securing	Mastering
Pupils can use index laws to simplify and calculate the value of numerical expressions. Draw a graph from its equation, without working out points	***Pupils must have an understanding of and be able to recall the basics of :*** Write the equation of a line in the form y = mx + c Compare graph lines using their equations Solve simultaneous equations by drawing graphs	***Pupils must be able to recall the following content:*** Write the equation of a line parallel to another line Draw graphs with equations in the form ax+ by = c Understand the relationship between the gradients of perpendicular lines Rearrange equations of graphs into the form y = mx + c Draw graphs with quadratic equations in the form y = x2	***Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:*** Write the equation of a line perpendicular to another line Solve problems using simultaneous equations Interpret graphs of quadratic functions Draw and interpret graphs showing inverse proportion Draw and interpret non-linear graphs

Year 9 - Probability: Journey of Knowledge

Context and Introduction to Unit:
Students learn how to measure the likelihood of an event happening using keywords, fractions, decimals and percentages. Later, learning progresses on to calculating a sample space to find the probability of two or more events.
Students learn how to calculate the probability of an event happening using sample space and Venn Diagrams.

Prior knowledge (KS2/KS3)
compare and order fractions whose denominators are all multiples of the same number
identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths

The bigger picture:
Personal development opportunities.
Career links.
RSE
Meteorology

Mathematician: Owain Wyn Evans

CORE KNOWLEDGE AND SKILLS

Descriptor	Topic	SPARX	✓
- Developing +	To calculate simple probability	M941, M938	
- Securing +	To calculate probability relative frequency	M332	
	To improve the accuracy of experiment more trials must be completed	N/A	
	To complete a two-way table and find probability	M899	
	To complete a sample space diagram and find probability	M718	
- Mastering +	To understand mutual exclusivity. That P(A) and P(NOTA) are mutually exclusive.	M755	
	To construct a two-way table from a word question	M899	
	To discuss whether a game is fair	N/A	
	To draw venn diagrams and calculate probability	M419	
	To understand and use set terminology	M829	
Excelling	To use sample space diagrams to consider 'AND and 'OR' rules	M755	
	To understand that venn diagrams represent sets that are not mutually exclusive (eg P(A) AND P(B) are not mutually exclusive	M419	
	Extend venn diagrams to three events.	M829	

ABOVE AND BEYOND

Understand that Venn diagrams represent sets of data that are not mutually exclusive, and allow us to calculate probability of P(A and B) when A and B are not mutually exclusive
Begin to understand that when A and B are not mutually exclusive, P(A) + P(B) counts the intersection of A and B twice

VOCABULARY

Probability
Two way table
Venn diagram
Probability tree
Experimental probability
Theoretical probability

Assessment

Unit 9 MAP followed by acceleration.

WHERE NEXT?

KS4 probability trees

CAREERS ALERT!

- Meteorologists predict the probability of precipitation, along with other weather conditions, with computer models that contain many mathematical formulae. First they input data from weather observations and calculate the weather conditions in each section for a point in the near future.

- The Met Office is already beginning to provide more probability based information on its website. This includes information on the chance of rain and the possible range of maximum and minimum temperatures for our 5000 or so location forecasts available online.

Owain Wyn Evans

Brief History

Owain Wyn Evans born 9 March 1984 is a Welsh broadcaster and drummer. He is a BBC Radio 2 DJ and TV presenter, and previously a weather presenter on BBC Look North, BBC North West and BBC Breakfast.

Evans is also a regular item presenter for the television magazine and chat show programme _The One Show._

In addition to his television work, he is known for his drumming, social media and LGBTQ activism. He is patron of the charity LGBT Foundation.

Diversity & Inclusion

Year 9 - Probability: Journey of Knowledge

MAPs – Pupils will complete WOW zone tasks in lessons as well as end of topic tests. This scores will be recorded and used to contribute towards grades which are reported home.

Summative assessment – The knowledge from this unit will be tested as part of a 1 hour P2S exam which will be based on a combination of units covered in the assessment window.

Assessment Milestones			
Emerging	Developing	Securing	Mastering
Pupils can use index laws to simplify and calculate the value of numerical expressions. Identify mutually exclusive outcomes and events	***Pupils must have an understanding of and be able to recall the basics of :*** Work out the probabilities of mutually exclusive outcomes and events Understand that 'A' and 'not A' are mutually exclusive and so P(A) + P(not A) = 1 Decide if a game is fair	***Pupils must be able to recall the following content:*** Calculate estimates of probability from experiments List all the possible outcomes of one or two events in a sample space diagram Decide whether a dice or spinner is unbiased Show all the possible outcomes of two events in a two-way table Calculate probabilities from two-way tables	***Pupils should be able to recall all the content in the knowledge journey and demonstrate application through the following:*** Understand the importance of knowing whether events are mutually exclusive before attempting to work out P(A or B) Draw Venn diagrams Calculate probabilities from Venn diagrams Understand that Venn diagrams represent sets of data that are not mutually exclusive, and allow us to calculate probability of P(A and B) when A and B are not mutually exclusive Begin to understand that when A and B are not mutually exclusive, P(A) + P(B) counts the intersection of A and B twice

Comparing Shapes: Journey of Knowledge

Context and Introduction to Unit
In this unit pupils will learn about the definitions of similar and congruent and how they are different. Pupils will look at calculating a scale factor and then using this to calculate a missing length of a given shape.
They will then look at triangles and trigonometry.

Prior knowledge (KS2 NC)
Pupils describe the properties of shapes and explain how unknown angles and lengths can be derived from known measurements.

The bigger picture:

Career link – Nurses (interpreting CAT & MRI scans)

Mathematician: Al-Battani

CORE KNOWLEDGE

Descriptor	Topic	SPARX	✓
- Securing +	To understand the terms congruence and similarity	M124, M377	
	To find the and use the scale factor for 2D shapes	M324	
- Mastering +	To solve similar triangle problems	U578	
	To solve similar triangle problems within other polygons	U578	
	Identify congruence and similarity	M124, M377	
	To recognise the trigonometric ratio's and use them to find missing angles and lengths	U605, U283, U545	
	To use trigonometry to solve real-life problems, including angles of elevation and depression	U967	
Excelling	To prove geometry statements using congruence and similarity	N/A	
	To solve problems involving bearings	M260, M416, U545	
	Identify right-angled triangles in cubes and cuboids and solve problems	U170	

ABOVE AND BEYOND

Using scale factors linked to volume and surface area.

VOCABULARY
Similar
Congruent
Side
Angle
Length
Sine
Cosine
Tangent
Triangle
Opposite
Adjacent
Hypotenuse

Assessment

Unit 10 MAP followed by acceleration.

WHERE NEXT?

KS4 – Similar shapes looking at the ratio between area and volume and the scale factors that link them.

Shapes with algebraic dimensions linking to solving equations.

CAREERS ALERT!

- Nurses routinely use addition, fractions, ratios and algebraic equations each day to deliver the right amount of medication to their patients or monitor changes in their health.

- Nurses will be expected to monitor information seen on an MRI or CAT scan and interpret the shapes that have developed and what they will mean in terms of treatment given.

Al-Battani

Abū ʿAbd Allāh Muḥammad ibn Jābir ibn Sinān al-Raqqī al-Ḥarrānī aṣ-Ṣābiʾ al-Battānī (Arabic: محمد بن جابر بن سنان الرقي الحراني الصابي البتاني), usually called **al-Battānī**, Latinized as **Albategnius**,[n 2] (before 858 – 929) was an astronomer, astrologer and mathematician, who lived and worked for most of his life at Raqqa, now in Syria. He is considered to be the greatest and most famous of the astronomers of the medieval Islamic world.

Al-Battānī's writings became instrumental in the development of science and astronomy in the west. His *Kitāb az-Zīj aṣ-Ṣābiʾ* (c. 900), is the earliest extant *zīj* (astronomical table) made in the Ptolemaic tradition that is hardly influenced by Hindu or Sasanian astronomy. Al-Battānī refined and corrected Ptolemy's *Almagest*, but also included new ideas and astronomical tables of his own.