Mathematics overview: Stage 9

Unit	Hours	KNOWLEDGE
Calculating	16	- apply and interpret limits of accuracy, including upper and lower bounds **(7,8,9)** - calculate with roots **(7, 9)** - use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a prependicualr line to a given line from/at a given point, bisecting a given angle) **(9)** - use these to construct given figures and solve loci problems: know that the perpendicular distance from a point to a line is the shortest distance to the line **(9)** - identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (including fractional scale factors) **(8,9)** - simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$ **(7,8,9)** - find approximate solutions to quadratic equations using a graph **(9)** - translate simple situations or procedures into algebraic expressions or formulae and by using graphs **(9)** - simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$ **(7,8,9)** - find approximate solutions to quadratic equations using a graph **(9)** - translate simple situations or procedures into algebraic expressions or formulae and by using graphs **(9)** - solve problems involving direct and inverse proportion including graphical and algebraic representations **(9)** - apply the concept of similarity, including the relationships between lengths in similar figures (scale diagrams and maps) **(8,9)** - change freely between compound units (e.g. density, pressure) in numerical and algebraic contexts **(8,9)** - use compound units such as density **(8,9)** - recognise and use Fibonacci and geometric type sequences **(9)** - identify and apply circle definitions and properties, including: tangent, arc, sector and segment **(7,8,9)** - know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$, and apply it to find lengths in right-angled triangles in two dimensional figures **(8,9)** - know the trigonometric ratios, $\sin\theta$ = opposite/hypotenuse, $\cos\theta$ = adjacent/hypotenuse, $\tan\theta$ = opposite/adjacent **(9)** - apply trigonometric ratios to find angles and lengths in right-angled triangles in two dimensional figures **(9)** - use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) **(9)** - apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' Theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs **(8,9)** - identify and interpret gradients and intercepts of linear functions algebraically **(8,9)** - recognise, sketch and interpret graphs of quadratic functions **(7,8,9)** - find approximate solutions to simultaneous equations using a graph **(7,9)** - enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams **(7,8,9)** - understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size **(7,8,9)** - interpret and construct tables, charts and diagrams, including tables and line graphs for time series data and know their appropriate use **(7,9)** - know correlation does not indicate causation; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing **(8,9)**
Visualising and constructing	12	
Algebraic proficiency: tinkering	12	
Proportional reasoning	12	
Pattern sniffing	8	
Solving equations and inequalities I	8	
Calculating space	16	
Conjecturing	8	
Algebraic proficiency: visualising	16	
Solving equations and inequalities II	12	
Understanding risk	8	

Presentation of data	8	### <u>Key Stage 4</u> • calculate with standard form A × 10ⁿ, where 1 ≤ A < 10 and n is an integer **(KS4)** • Calculate with fractional indices **(KS4)** • calculate exactly with surds **(KS4)** • change recurring decimals into their corresponding fractions and vice versa **(KS4)** • solve quadratic equations algebraically by factorizing **(KS4)** • use compound units such as pressure **(KS4)** • Recognise and use quadratic sequences **(KS4)** • understand and use the concepts and vocabulary of inequalities **(KS4)** • solve linear inequalities in one variable **(KS4)** • represent the solution set to an inequality on a number line **(KS4)** • calculate arc lengths, angles and areas of sectors of circles **(KS4)** • use the form $y = mx + c$ to identify parallel lines **(KS4)** • find the equation of the line through two given points, or through one point with a given gradient **(KS4)** • solve, in simple cases, two linear simultaneous equations in two variables algebraically **(KS4)** • derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution • calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions **(KS4)** • construct and interpret diagrams for grouped discrete data and continuous data, i.e. cumulative frequency graphs, and know their appropriate use **(KS4)**

Calculating

KNOWLEDGE

- apply and interpret limits of accuracy, including upper and lower bounds **(7,8,9)**
- calculate with roots **(7, 9)**
- calculate with standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer **(KS4)**
- Calculate with fractional indices **(KS4)**
- calculate exactly with surds **(KS4)**
- change recurring decimals into their corresponding fractions and vice versa **(KS4)**

Visualising and constructing

KNOWLEDGE

- use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a prependicualr line to a given line from/at a given point, bisecting a given angle) **(9)**
- use these to construct given figures and solve loci problems: know that the perpendicular distance from a point to a line is the shortest distance to the line **(9)**
- identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (including fractional scale factors) **(8,9)**

Algebraic proficiency: tinkering

KNOWLEDGE

- simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$ **(7,8,9)**
- find approximate solutions to quadratic equations using a graph **(9)**
- translate (i.e. model) simple situations or procedures into algebraic expressions or formulae and by using graphs **(9)**
- solve quadratic equations algebraically by factorizing **(KS4)**

Proportional reasoning

KNOWLEDGE

- solve problems involving direct and inverse proportion including graphical and algebraic representations **(9)**
- apply the concept of similarity, including the relationships between lengths in similar figures (scale diagrams and maps) **(8,9)**
- change freely between compound units (e.g. density, pressure) in numerical and algebraic contexts **(8,9)**
- use compound units such as density **(8,9)**
- use compound units such as pressure **(KS4)**

Pattern sniffing

KNOWLEDGE

- recognise and use Fibonacci and geometric type sequences **(9)**
- Recognise and use quadratic sequences **(KS4)**

Solving equations and inequalities

KNOWLEDGE

- understand and use the concepts and vocabulary of inequalities **(KS4)**
- solve linear inequalities in one variable **(KS4)**
- represent the solution set to an inequality on a number line **(KS4)**

Calculating space

KNOWLEDGE

- identify and apply circle definitions and properties, including: tangent, arc, sector and segment **(7,8,9)**
- know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$, and apply it to find lengths in right-angled triangles in two dimensional figures **(8,9)**
- know the trigonometric ratios, $sin\theta$ = opposite/hypotenuse, $cos\theta$ = adjacent/hypotenuse, $tan\theta$ = opposite/adjacent **(9)**
- apply trigonometric ratios to find angles and lengths in right-angled triangles in two dimensional figures **(9)**
- calculate arc lengths, angles and areas of sectors of circles **(KS4)**

Conjecturing

KNOWLEDGE

- use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) **(9)**
- apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' Theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs **(8,9)**

Algebraic proficiency: visualising

KNOWLEDGE

- identify and interpret gradients and intercepts of linear functions algebraically **(9)**
- recognise, sketch and interpret graphs of quadratic functions **(7,8,9)**
- use the form $y = mx + c$ to identify parallel lines **(KS4)**
- find the equation of the line through two given points, or through one point with a given gradient **(KS4)**

Solving equations and inequalities

KNOWLEDGE

- solve, in simple cases, two linear simultaneous equations in two variables algebraically **(KS4)**
- derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution **(KS4)**
- find approximate solutions to simultaneous equations using a graph **(7,9)**

Understanding risk

KNOWLEDGE

- calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions **(KS4)**
- enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams **(7,8,9)**
- understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size **(7,8,9)**

Presentation of data

KNOWLEDGE

- interpret and construct tables, charts and diagrams, including tables and line graphs for time series data and know their appropriate use **(7,9)**
- know correlation does not indicate causation; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing **(8,9)**
- construct and interpret diagrams for grouped discrete data and continuous data, i.e. cumulative frequency graphs, and know their appropriate use **(KS4)**