Mathematics overview: Stage 8

Unit	Hours	KNOWLEDGE
[Numbers and the number system](#)	12	• interpret standard form $A \times 10^n$, where $1 \le A < 10$ and n is an integer (8,9) • use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation a<x≤b (7,8,9)
[Calculating](#)	12	• apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative (7,8)
[Visualising and constructing](#)	12	• use conventional notation (and calculate with roots and indices) for priority of operations, including brackets, powers, roots and reciprocals (7,8,9) • measure line segments and angles in geometric figures, including interpreting maps and scale drawings (8) • Use of bearings (KS4) • identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (8,9)
[Algebraic proficiency: tinkering](#)	12	• use scale factors, scale diagrams and maps (8,9) • use and interpret algebraic notation, including: a^2b in place of $a \times a \times b$, coefficients written as fractions rather than as decimals (7,8) • understand and use the concepts and vocabulary of factors (7,8) • simplify and manipulate algebraic expressions by taking out common factors and simplifying expressions involving sums, products and powers, including the laws of indices (7,8,9)
[Exploring fractions, decimals and percentages](#)	4	• substitute numerical values into scientific formulae (7,8) • work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 or 3/8) (7,8) • express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) (7,8) • identify and work with fractions and proportion (as equality of ratios) in ratio problems (8) • express a multiplicative relationship between two quantities as a ratio or a fraction (8)
[Proportional reasoning](#)	12	• use compound units (such as speed, rates of pay, unit pricing) (8,9) • change freely between compound units (e.g. speed, rates of pay, prices) in numerical contexts (8,9) • relate ratios to fractions and to linear functions (8) • generate terms of a sequence from either a term-to-term or a position-to-term rule (7,8) • deduce expressions to calculate the nth term of linear sequences (7,8)
[Pattern sniffing](#)	4	• understand and use alternate and corresponding angles on parallel lines (8) • derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons) (7,8)
[Investigating angles](#)	8	• interpret fractions and percentages as operators (7,8) • work with percentages greater than 100% (7,8)
[Calculating fractions, decimals and percentages](#)	8	• solve problems involving percentage change, including original value problems, and simple interest including in financial mathematics (7,8) • Understand and use the concepts and vocabulary of identities (7,8) • find approximate solutions to linear equations using a graph (8,9) • calculate perimeters of 2D shapes, including circles (8) • identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference (7,8) • know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2 (8) • calculate areas of circles and composite shapes (8)
[Solving equations and inequalities](#)	4	• know and apply formulae to calculate volume of right prisms (including cylinders) (7,8) • 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) • identify and interpret gradients and intercepts of linear functions graphically (8,9)
[Calculating space](#)	12	• recognise, sketch and interpret graphs of linear functions and simple quadratic functions (7,8)

[Algebraic proficiency: visualising](#)	12	- plot and interpret graphs and graphs of non-standard (*piece-wise linear)* functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance and speed (7,8) - apply systematic listing strategies (7,8,9) - enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams (7,8) - construct theoretical possibility spaces for combined experiments with equally likely outcomes and use these to calculate theoretical probabilities (7,8,9) - apply the property that's the possibilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one (7,8) - interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data (7,8,9) - use and interpret scatter graphs of bivariate data (8,9) - draw estimated lines of best fit; make predictions (8,9) - recognise correlation (8,9) - interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers) (7,8,9) **Key Stage 4** - interpret plans and elevations of 3D shapes (KS4) - solve linear equations with the unknown on both sides of the equation (KS4) - calculate exactly with multiples of pi (KS4) - calculate the surface area of right prisms (including cylinders) (KS4)
[Understanding risk II](#)	8	
[Presentation of data](#)	8	
[Measuring data](#)	8	

Numbers and the number system

KNOWLEDGE

- interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer **(8,9)**
- use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a < x \leq b$ **(7,8,9)**

Calculating

KNOWLEDGE

- apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative **(7,8)**
- use conventional notation (and calculate with roots and indices) for priority of operations, including brackets, powers, roots and reciprocals **(7,8,9)**

Visualising and constructing

KNOWLEDGE

- measure line segments and angles in geometric figures, including interpreting maps and scale drawings **(8)**
- Use of bearings **(KS4)**
- identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement **(8,9)**
- use scale factors, scale diagrams and maps **(8,9)**
- interpret plans and elevations of 3D shapes **(KS4)**

Algebraic proficiency: tinkering

KNOWLEDGE

- use and interpret algebraic notation, including: a^2b in place of $a \times a \times b$, coefficients written as fractions rather than as decimals **(7,8)**
- understand and use the concepts and vocabulary of factors **(7,8)**
- simplify and manipulate algebraic expressions by taking out common factors and simplifying expressions involving sums, products and powers, including the laws of indices **(7,8,9)**
- substitute numerical values into scientific formulae **(7,8)**

Exploring fractions, decimals and percentages

KNOWLEDGE

- work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 or 3/8) **(7,8)**

Proportional reasoning

KNOWLEDGE

- express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) **(7,8)**
- identify and work with fractions and proportion (as equality of ratios) in ratio problems **(8)**
- express a multiplicative relationship between two quantities as a ratio or a fraction **(8)**
- use compound units (such as speed, rates of pay, unit pricing) **(8,9)**
- change freely between compound units (e.g. speed, rates of pay, prices) in numerical contexts **(8,9)**
- relate ratios to fractions and to linear functions **(8)**

Pattern sniffing

KNOWLEDGE

- generate terms of a sequence from either a term-to-term or a position-to-term rule **(7,8)**
- deduce expressions to calculate the nth term of linear sequences **(7,8)**

Investigating angles

KNOWLEDGE

- understand and use alternate and corresponding angles on parallel lines **(8)**
- derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons) **(7,8)**

Calculating fractions, decimals and percentages

KNOWLEDGE

- interpret fractions and percentages as operators **(7,8)**
- work with percentages greater than 100% **(7,8)**
- solve problems involving percentage change, including original value problems, and simple interest including in financial mathematics **(7,8)**

Solving equations and inequalities

KNOWLEDGE

- Understand and use the concepts and vocabulary of identities **(7,8)**
- find approximate solutions to linear equations using a graph **(8,9)**
- solve linear equations with the unknown on both sides of the equation **(KS4)**

Calculating space

KNOWLEDGE

- calculate perimeters of 2D shapes, including circles **(8)**
- identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference **(7,8)**
- know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2 **(8)**
- calculate areas of circles and composite shapes **(8)**
- know and apply formulae to calculate volume of right prisms (including cylinders) **(7,8)**
- 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)**
- calculate exactly with multiples of pi **(KS4)**
- calculate the surface area of right prisms (including cylinders) **(KS4)**

Algebraic proficiency: visualising

KNOWLEDGE

- identify and interpret gradients and intercepts of linear functions graphically **(8,9)**
- recognise, sketch and interpret graphs of linear functions and simple quadratic functions **(7,8)**
- plot and interpret graphs and graphs of non-standard (*piece-wise linear*) functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance and speed **(7,8)**

Understanding risk II

KNOWLEDGE

- apply systematic listing strategies **(7,8,9)**
- enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams **(7,8)**
- construct theoretical possibility spaces for combined experiments with equally likely outcomes and use these to calculate theoretical probabilities **(7,8,9)**
- apply the property that's the possibilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one **(7,8)**

Presentation of data	
KNOWLEDGE	

- interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data **(7,8,9)**
- use and interpret scatter graphs of bivariate data **(8,9)**
- draw estimated lines of best fit; make predictions **(8,9)**
- recognise correlation **(8,9)**

Measuring data	
KNOWLEDGE	

- interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers) **(7,8,9)**