

Mathematics overview: Stage 8*

Unit	Hours	KNOWLEDGE
Numbers and the number system	12	<ul style="list-style-type: none"> use the concepts and vocabulary of prime numbers, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem (7*, 8*) interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer (8*, 9*)
Calculating	12	<ul style="list-style-type: none"> 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 (8*) use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (7*, 8*)
Visualising and constructing	12	<ul style="list-style-type: none"> calculate with roots, and with integer indices (8*, 9*) use inequality notation to specify simple error intervals due to truncation or rounding (8*, 9*) measure line segments and angles in geometric figures, including interpreting maps and scale Drawings (8*) interpret plans and elevations of 3D shapes (8*)
Algebraic proficiency: tinkering	12	<ul style="list-style-type: none"> identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (7*, 8*) use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle) (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*) rearrange formulae to change the subject (8*, 9*)
Exploring fractions, decimals and percentages	4	<ul style="list-style-type: none"> argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments (8*) translate simple situations or procedures into algebraic expressions or formulae (8*) work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $7/2$ or 0.375 or $3/8$) (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*, 9*) understand and use proportion as equality of ratios (8*)
Proportional reasoning	12	<ul style="list-style-type: none"> express a multiplicative relationship between two quantities as a ratio or a fraction (8*) relate ratios to fractions and to linear functions (8*) use compound units (such as speed, rates of pay, unit pricing and density) (8*, 9*) solve problems involving direct and inverse proportion, including graphical and algebraic representations (8*, 9*) generate terms of a sequence from either a term-to-term or a position-to-term rule (7*, 8*)
Pattern sniffing	4	<ul style="list-style-type: none"> deduce expressions to calculate the nth term of linear sequences (7*, 8*) recognise and use Fibonacci type sequences (8*)
Investigating angles	8	<ul style="list-style-type: none"> 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) (8*)
Calculating fractions, decimals and percentages	8	<ul style="list-style-type: none"> interpret fractions and percentages as operators (8*) solve problems involving percentage change, percentage increase and decrease, including original value problems, and simple interest including in financial mathematics (7*, 8*) express one quantity as a fraction of another where the fraction is less than 1 and greater than 1 (8*) solve linear equations with the unknown on both sides of the equation (7*, 8*) find approximate solutions to linear equations using a graph (8*) find approximate solutions to simultaneous equations using a graph (8*)
Solving equations and inequalities	4	<ul style="list-style-type: none"> compare lengths, areas and volumes using ratio notation (8*) calculate perimeters of 2D shapes, including circles (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*)
Calculating space	12	<ul style="list-style-type: none"> 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*)

Algebraic proficiency: visualising	12	<ul style="list-style-type: none"> • know and apply formulae to calculate volume of right prisms (including cylinders) (8*) • identify and interpret gradients and intercepts of linear functions graphically and algebraically (8*, 9*) • recognise, sketch and interpret graphs of linear functions and simple quadratic functions (8*, 9*) • interpret graphs and graphs of non-standard (<i>piece-wise linear</i>) functions in real contexts, to find approximate solutions to problems such as • interpret the gradient of a straight line graph as a rate of change (8*) • apply systematic listing strategies (8*) • record describe and analyse the frequency of outcomes of probability experiments using frequency trees (7*,8*) • enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams (8*,9*) • interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data (8*) • use and interpret scatter graphs of bivariate data (8*) • recognise correlation (8*) • draw estimated lines of best fit; make predictions (8*) • know correlation does not indicate causation; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing (8*) • 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*) <p><u>Key Stage 4</u></p> <ul style="list-style-type: none"> • calculate with standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer (KS4 (9*)) • simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$ (KS4 (9*)) • recognise and use quadratic sequences (KS4, 9*) • calculate exactly with multiples of pi (KS4) • simple kinematic problems involving distance and speed (KS4 (9*)) • use the form $y = mx + c$ to identify parallel lines (KS4) • enumerate sets and combinations of sets systematically, using tree diagrams (KS4 (9*))
Understanding risk II	8	
Presentation of data	8	
Measuring data	8	

Numbers and the number system

KNOWLEDGE

- use the concepts and vocabulary of prime numbers, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem (7*, 8*)
- interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer (8*, 9*)
- calculate with standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer (KS4 (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 (8*)
- use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (7*, 8*)
- calculate with roots, and with integer indices (8*, 9*)
- use inequality notation to specify simple error intervals due to truncation or rounding (8*, 9*)

Visualising and constructing

KNOWLEDGE

- measure line segments and angles in geometric figures, including interpreting maps and scale Drawings (8*)
- interpret plans and elevations of 3D shapes (8*)
- identify, describe and construct similar shapes, including on coordinate axes, by considering enlargement (7*, 8*)
- use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle) (8*, 9*)

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*)
- rearrange formulae to change the subject (8*, 9*)
- simplify and manipulate algebraic expressions by expanding products of two binomials and factorising quadratic expressions of the form $x^2 + bx + c$ (KS4 (9*))
- argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments (8*)
- translate simple situations or procedures into algebraic expressions or formulae (8*)

Exploring fractions, decimals and percentages

KNOWLEDGE

- work interchangeably with terminating decimals, their corresponding fractions (such as 3.5 and $7/2$ or 0.375 or $3/8$) and percentages (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*, 9*)
- understand and use proportion as equality of ratios (8*)
- express a multiplicative relationship between two quantities as a ratio or a fraction (8*)
- relate ratios to fractions and to linear functions (8*)
- use compound units (such as speed, rates of pay, unit pricing and density) (8*, 9*)
- solve problems involving direct and inverse proportion, including graphical and algebraic representations (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 n th term of linear sequences (7*, 8*)
- recognise and use Fibonacci type sequences (8*)
- recognise and use quadratic sequences (KS4, 9*)

Investigating angles

KNOWLEDGE

- 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) (8*)

Calculating fractions, decimals and percentages**KNOWLEDGE**

- interpret fractions and percentages as operators (8*)
- solve problems involving percentage change, percentage increase and decrease, including original value problems, and simple interest including in financial mathematics (7*, 8*)
- express one quantity as a fraction of another where the fraction is less than 1 and greater than 1 (8*)

Solving equations**KNOWLEDGE**

- solve linear equations with the unknown on both sides of the equation (7*, 8*)
- find approximate solutions to linear equations using a graph (8*)
- find approximate solutions to simultaneous equations using a graph (8*)

Calculating space**KNOWLEDGE**

- compare lengths, areas and volumes using ratio notation (8*)
- calculate perimeters of 2D shapes, including circles (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 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*)
- apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs (8*, 9*)
- know and apply formulae to calculate volume of right prisms (including cylinders) (8*)
- calculate exactly with multiples of pi (KS4)

Algebraic proficiency: visualising**KNOWLEDGE**

- identify and interpret gradients and intercepts of linear functions graphically and algebraically (8*, 9*)
- recognise, sketch and interpret graphs of linear functions and simple quadratic functions (8*, 9*)
- 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 (KS4 (9*))
- use the form $y = mx + c$ to identify parallel lines (KS4)
- interpret the gradient of a straight line graph as a rate of change (8*)

Understanding risk II**KNOWLEDGE**

- enumerate sets and combinations of sets systematically, using tree diagrams (KS4 (9*))
- apply systematic listing strategies (8*)
- record describe and analyse the frequency of outcomes of probability experiments using frequency trees (7*, 8*)
- enumerate sets and combinations of sets systematically, using tables, grids and Venn diagrams (8*, 9*)

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 (8*)
- use and interpret scatter graphs of bivariate data (8*)
- recognise correlation (8*)
- draw estimated lines of best fit; make predictions (8*)
- know correlation does not indicate causation; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing (8*)

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*)