Progression pathways in Mathematics

From Numeracy and Mathematics experiences and outcomes level 3 and level 4 to National Qualifications in Mathematics at National 4, National 5 and Higher

This progression pathways table outlines the relationship between the experiences and outcomes for Numeracy and Mathematics and the Outcomes and Assessment Standards in the National Qualifications for Mathematics at National 4, National 5 and Higher levels.

The detail provided in this table draws mainly from the information provided in Unit Specifications, but also makes use of some of the information provided in the Course and Unit Support Notes where this provides further clarity. The relationships identified within this table identify pathways that are likely to be followed by many learners. These are not the only pathways that might be followed and centres will customise their approach to meet the needs of their learners.

The progression pathways tables could be used as a planning tool by:

- showing how skills can be progressively developed
- showing how skills cut across the Units that make up the Courses
- identifying potential for headroom activities
- identifying skills that might be used where there is a need to reinforce higher level ones
- providing a template for the development of more detailed learning plans for individual learners

Organisers	Experiences and outcomes	National 4	National 5	Higher
Estimation and rounding	*I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.* ***MNU 3-01a***	**N 1.2** Selecting and carrying out calculations involving whole numbers, fractions, decimals, percentages, ratio and proportion (round answers to the nearest significant figure or two decimal places).	**EF 1.4** Applying geometric skills linked to the use of formulae (calculating the volume of a standard solid with rounding to a given number of significant figures).	
	Having investigated the practical impact of inaccuracy and error, I can use my knowledge of tolerance when choosing the required degree of accuracy to make real-life calculations. ***MNU 4-01a***	**N 1.4** Interpreting the measurements and the results of calculations to make decisions (use appropriate checking methods, eg check sums and estimation, interpret results of measurements involving time, length, weight, volume and temperature).		
Number and number processes (including addition, subtraction, multiplication, division and negative numbers)	*I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.* ***MNU 3-03a***	**N 1.2** Selecting and carrying out calculations (provide opportunities for calculations involving: whole numbers, fractions, decimals, percentages, ratio and proportion. Collectively these calculations require evidence of all of the following: addition,		

		subtraction, multiplication and division).		
	Having recognised similarities between new problems and problems I have solved before, I can carry out the necessary calculations to solve problems set in unfamiliar contexts. ***MNU 4-03a***	**N 1.2** Selecting and carrying out calculations (use contexts likely to be familiar to the learner; be given to the learner with relevant supporting materials to help the learner interpret the problem; provide opportunities for calculations involving: whole numbers, fractions, decimals, percentages, ratio and proportion. Collectively these calculations require evidence of all of the following: addition, subtraction, multiplication and division). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (adding two decimal numbers and then subtracting from the result; multiplying a decimal number by a whole number).		

	I can continue to recall number facts quickly and use them accurately when making calculations. ***MNU 3-03b*** *I have investigated how introducing brackets to an expression can change the emphasis and can demonstrate my understanding by using the correct order of operations when carrying out calculations.* ***MTH 4-03b***	**N 1.2** Selecting and carrying out calculations (calculating whole number percentages of quantities [single-digit percentages, multiples of 10%, multiples of 20%, multiples of 25%, 50%]; calculating simple fractions of quantities; adding two decimal numbers [some with a differing number of decimal places] and then subtracting from the result; multiplying a decimal number by a single-digit whole number). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (adding two decimal numbers and then subtracting from the result; multiplying a decimal number by a whole number).		

	I can use my understanding of numbers less than zero to solve simple problems in context. ***MNU 3-04a***	**N 1.2** Selecting and carrying out calculations (add and subtract whole numbers including negative numbers).	**EF 1.1** Applying numerical skills to simplify surds/expressions using the laws of indices (working with algebraic expressions involving expansion of brackets).	
Multiples, factors and primes	*I have investigated strategies for identifying common multiples and common factors, explaining my ideas to others, and can apply my understanding to solve related problems.* ***MTH 3-05a*** *I can apply my understanding of factors to investigate and identify when a number is prime.* ***MTH 3-05b***	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (factorising a sum of terms with a numerical common factor).	**EF 1.2** Applying algebraic skills to manipulate expressions (factorising an algebraic expression; common factor, difference of squares, trinomials and combinations of these; completing the square in a quadratic expression with unitary x^2 coefficient).	**EF 1.1** Applying algebraic skills to manipulating expressions (factorising a cubic polynomial expression with unitary x^3 coefficient; determining composite and inverse functions). **EF 1.4** Applying geometric skills to vectors (working with collinearity).
Powers and roots	*Having explored the notation and vocabulary associated with whole number powers and the advantages of writing numbers in this form, I can evaluate powers of whole numbers mentally or using technology.* ***MTH 3-06a***	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (simplifying an expression which has more than one variable; evaluating an expression or a formula which has more than one variable). **R 1.2** Applying geometric skills to sides and angles	**R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras' theorem). **APP 1.3** Applying numerical skills to fractions and percentages (working with appreciation/depreciation).	

		of shapes (using Pythagoras' theorem).		
	I have developed my understanding of the relationship between powers and roots and can carry out calculations mentally or using technology to evaluate whole number powers and roots, of any appropriate number. ***MTH 4-06a*** *Within real-life contexts, I can use scientific notation to express large or small numbers in a more efficient way and can understand and work with numbers written in this form.* ***MTH 4-06b***	**R 1.2** Applying geometric skills to sides and angles of shapes (using Pythagoras' theorem).	**EF 1.1** Applying numerical skills to simplify surds/expressions using the laws of indices (simplifying surds; simplifying expressions using the laws of indices). **EF 1.2** Applying algebraic skills to manipulate expressions (working with algebraic expressions involving expansion of brackets). **EF 1.3** Applying algebraic skills to algebraic fractions (reducing an algebraic fraction to its simplest form). **R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras' theorem).	**EF 1.1** Applying algebraic skills to manipulating expressions (simplifying a numerical expression, using one of the laws of logarithms and exponents). **RC 1.1** Applying algebraic skills to solve equations (solving logarithmic and exponential equations, using one of the laws of logarithms and exponents). **RC 1.3** Applying calculus skills of differentiation (differentiating an algebraic function which is, or can be simplified to, an expression in powers of x). **RC 1.4** Applying calculus skills of integration (integrating an algebraic function which is, or can be, simplified to an expression of powers of

				x; integrating functions of the form $f(x) = (x+q)^n$). **APP 1.2** Applying calculus skills to optimisation and area (finding the area between a curve and the x -axis; finding the area between two curves or a straight line and a curve).
Fractions, decimal fractions and percentages (including ratio and proportion)	*I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.* ***MNU** 3-**07a***	**N 1.2** Selecting and carrying out calculations (find simple percentages and fractions of shapes and quantities, eg 50%, 10%, 20% and 25%, 33⅓%; ½, ⅓, ¼, 1/10, 1/5; calculate percentage increase and decrease; convert equivalences between common fractions, decimals and percentages). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (use of whole number percentages; calculating a non-unitary fraction of a quantity; adding two decimal	**APP 1.3** Applying numerical skills to fractions and percentages (working with reverse percentages; working with appreciation/depreciation; combination of operations on fractions including mixed numbers).	**EF 1.4** Applying geometric skills to vectors (working with collinearity; determining the coordinates of an internal division point of a line).

		numbers and then subtracting from the result; multiplying a decimal number by a whole number). **N 1.5** Explaining decisions based on the results of measurements and calculations (give reasons for decisions based on the results of calculations).		
	By applying my knowledge of equivalent fractions and common multiples, I can add and subtract commonly used fractions. ***MTH 3-07b***		**EF 1.3** Applying algebraic skills to algebraic fractions (reducing an algebraic fraction to its simplest form; applying one of the four operations to algebraic fractions).	**RC 1.3** Applying calculus skills of differentiation (differentiating an algebraic function which is, or can be simplified to, an expression in powers of x). **RC 1.4** Applying calculus skills of integration (integrating an algebraic function which is, or can be, simplified to an expression of powers of x).
	Having used practical, pictorial and written methods to develop my understanding, I can convert between whole or mixed numbers and	**N 1.2** Selecting and carrying out calculations (provide opportunities for calculations involving: whole numbers, fractions, decimals, percentages,	**EF 1.1** Applying numerical skills to simplify surds/expressions using the laws of indices (simplifying surds; simplifying expressions	**RC 1.3** Applying calculus skills of differentiation (differentiating an algebraic function which is, or can be simplified to, an expression in

	fractions. **MTH 3-07c** *I can choose the most appropriate form of fractions, decimal fractions and percentages to use when making calculations mentally, in written form or using technology, then use my solutions to make comparisons, decisions and choices.* **MNU 4-07a**	ratio and proportion. Collectively these calculations require evidence of all of the following: addition, subtraction, multiplication and division).	using the laws of indices). **APP 1.3** Applying numerical skills to fractions and percentages (combination of operations on fractions including mixed numbers).	powers of x). **RC 1.4** Applying calculus skills of integration (integrating an algebraic function which is, or can be, simplified to an expression of powers of x).
	I can solve problems involving fractions and mixed numbers in context, using addition, subtraction or multiplication. **MTH 4-07b**	**R 1.2** Applying geometric skills to sides and angles of shapes (using a fractional scale factor to enlarge or reduce a shape). **N 1.2** Selecting and carrying out calculations (find simple percentages and fractions of shapes and quantities, eg 50%, 10%, 20% and 25%, 33⅓%; ½, ⅓, ¼, 1/10, 1/5; calculate percentage increase and decrease; convert equivalences between common fractions, decimals and percentages).	**EF 1.3** Applying algebraic skills to algebraic fractions (applying one of the four operations to algebraic fractions). **EF 1.4** Applying geometric skills linked to the use of formulae (calculating the length of arc or the area of a sector of a circle).	**APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (finding the equation of a line parallel to and a line perpendicular to a given line; determining a recurrence relation from given information; using a recurrence relation to calculate a required term; finding and interpreting the limit of a sequence, where it exists).

		N 1.5 Explaining decisions based on the results of measurements and calculations (give reasons for decisions based on the results of calculations).		
	I can show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday contexts. ***MNU 3-08a***	**R 1.2** Applying geometric skills to sides and angles of shapes (using a fractional scale factor to enlarge or reduce a shape). **N 1.2** Selecting and carrying out calculations (calculate ratio and direct proportion).	**APP 1.3** Applying numerical skills to fractions and percentages (working with reverse percentages).	**EF 1.4** Applying geometric skills to vectors (working with collinearity; determining the coordinates of an internal division point of a line).
	Using proportion, I can calculate the change in one quantity caused by a change in a related quantity and solve real-life problems. ***MNU 4-08a***	**N 1.2** Selecting and carrying out calculations (calculate ratio and direct proportion).	**APP 1.3** Applying numerical skills to fractions and percentages (working with reverse percentages).	
Money In this Organiser all of the experiences and outcomes progress to the learning objectives indicated.	*When considering how to spend my money, I can source, compare and contrast different contracts and services, discuss their advantages and disadvantages, and*	**N 1.1** Selecting and using appropriate numerical notation and units (numerical notation should include: =, +, –, ×, ÷, /, <, >, (,), %, decimal point; units should	**APP 1.3** Applying numerical skills to fractions and percentages (working with appreciation/depreciation).	

	explain which offer best value to me. ***MNU 3-09a*** *I can budget effectively, making use of technology and other methods, to manage money and plan for future expenses*. ***MNU 3-09b*** *I can discuss and illustrate the facts I need to consider when determining what I can afford, in order to manage credit and debt and lead a responsible lifestyle.* ***MNU 4-09a*** *I can source information on earnings and deductions and use it when making calculations to determine net income.* ***MNU 4-09b*** *I can research, compare and contrast a range of personal finance products and, after making calculations, explain my preferred choices.* ***MNU 4-09c***	include: money [pounds and pence]). **N 1.2** Selecting and carrying out calculations (multiply whole numbers of any size, with up to four-digit whole numbers; divide whole numbers of any size, by a single-digit whole number or by 10 or 100; round answers to the nearest significant figure or two decimal places). **N 1.5** Explaining decisions based on the results of measurements or calculations (give reasons for decisions based on the results of calculations).		

Time	*Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.* ***MNU 3-10a***	**N 1.2** Selecting and carrying out calculations (calculate rate: eg km per hour or number of texts per month; calculate distance given speed and time; calculate time intervals using the 12-hour and 24-hour clock).		**RC 1.3** Applying calculus skills of differentiation (differentiating an algebraic function which is, or can be simplified to, an expression in powers of x). (In relation to displacement, velocity and acceleration.) **RC 1.4** Applying calculus skills of integration (integrating an algebraic function which is, or can be, simplified to an expression of powers of x). (In relation to displacement, velocity and acceleration.)
	I can research, compare and contrast aspects of time and time management as they impact on me. ***MNU 4-10a***	**N 1.4** Interpreting measurements and the results of calculations to make decisions (interpret results of measurements involving time, length, weight, volume and temperature).		
	I can use the link between time, speed and distance to carry out related calculations. ***MNU 4-10b***	**N 1.2** Selecting and carrying out calculations (calculate rate: eg km per hour or number of texts per month; calculate distance given speed and		**RC 1.3** Applying calculus skills of differentiation (differentiating an algebraic function which is, or can be simplified to, an expression in

		time; calculate time intervals using the 12-hour and 24-hour clock). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (using the relationship involving speed, distance and time, where the time is given or calculated as hours and minutes).		powers of x). (In relation to displacement, velocity and acceleration.) **RC 1.4** Applying calculus skills of integration (integrating an algebraic function which is, or can be, simplified to an expression of powers of x). (In relation to displacement, velocity and acceleration.)
Measurement	*I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required.* ***MNU 3-11a*** *Having investigated different routes to a solution, I can find the area of compound 2D shapes and the volume of compound 3D objects, applying my knowledge to solve practical problems.* ***MTH 3-11b***	**EF 1.2** Applying geometric skills to circumference, area and volume (calculating the circumference and area of a circle; calculating the area of a parallelogram, kite, trapezium; investigating the surface of a prism; calculating the volume of a prism). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (solving a problem using area and volume).	**EF 1.4** Applying geometric skills linked to the use of formulae (calculating the volume of a standard solid with rounding to a given number of significant figures).	**APP 1.2** Applying calculus skills to optimisation and area (determining the optimal solution for a given problem).

	I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations. ***MNU 4-11a***	**N 1.2** Selecting and carrying out calculations involving whole numbers, fractions, decimals, percentages, ratio and proportion (round answers to the nearest significant figure or two decimal places). **N 1.3** Recording measurements using a straightforward scale on an instrument (use measuring instruments with straightforward scales to measure length, weight, volume and temperature; read scales to the nearest marked, unnumbered division with a functional degree of accuracy).	**EF 1.4** Applying geometric skills linked to the use of formulae (calculating the volume of a standard solid with rounding to a given number of significant figures).	
	Through investigating real-life problems involving the surface area of simple 3D shapes, I can explore ways to make the most efficient use of materials and carry out the necessary calculations to solve related problems. ***MTH 4-11b***	**N 1.2** Selecting and carrying out calculations (calculate volume [cube and cuboid], area [rectangle and square] and perimeter [shapes with straight lines]). **EF 1.2** Applying geometric skills to circumference, area and	**EF 1.4** Applying geometric skills linked to the use of formulae (calculating the volume of a standard solid with rounding to a given number of significant figures).	**APP 1.2** Applying calculus skills to optimisation and area (determining the optimal solution for a given problem; finding the area between a curve and the x -axis; finding the area between two curves or a straight line and a curve).

	I have explored with others the practicalities of the use of 3D objects in everyday life and can solve problems involving the volume of a prism, using a formula to make related calculations when required. ***MTH 4-11c***	volume (calculating the circumference and area of a circle; calculating the area of a parallelogram, kite, trapezium; investigating the surface of a prism; calculating the volume of a prism). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (solving a problem using area and volume).		
Mathematics (its impact on the world, past, present and future) There are many examples of 'famous mathematicians' within the learning objectives. Pythagoras and Descartes are noted, but are by no means the only examples. There are many examples of mathematical skills in the workplace. The example highlighted could illustrate a professional statistician or actuary.	*I have worked with others to research a famous mathematician and the work they are known for, or investigated a mathematical topic, and have prepared and delivered a short presentation.* ***MTH 3-12a***	**R 1.2** Applying geometric skills to sides and angles of shapes (using Pythagoras' theorem; using a fractional scale factor to enlarge or reduce a shape). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (use of Pythagoras' theorem in a problem; solving a problem involving shape and coordinates).	**EF 1.4** Applying geometric skills linked to the use of formulae (determining the gradient of a straight line, given two points). **R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras' theorem).	

	I have discussed the importance of mathematics in the real world, investigated the mathematical skills required for different career paths and delivered, with others, a presentation on how mathematics can be applied in the workplace. ***MTH 4-12a***	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (extending a straightforward number or diagrammatic pattern and determining its formula).	**APP 1.4** Applying statistical skills to analysing data (forming a linear model from a given set of data).	**APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (determining a recurrence relation from given information; using a recurrence relation to calculate a required term; finding and interpreting the limit of a sequence, where it exists).
Patterns and relationships	*Having explored number sequences, I can establish the set of numbers generated by a given rule and determine a rule for a given sequence, expressing it using appropriate notation.* ***MTH 3-13a*** *Having explored how real-life situations can be modelled by number patterns, I can establish a number sequence to represent a physical or pictorial pattern, determine a general formula to describe the sequence, then use it to make evaluations and solve*	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (extending a straightforward number or diagrammatic pattern and determining its formula). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (creating and then using a formula).	**APP 1.4** Applying statistical skills to analysing data (forming a linear model from a given set of data).	**APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (determining a recurrence relation from given information; using a recurrence relation to calculate a required term; finding and interpreting the limit of a sequence, where it exists).

	related problems. **MTH 4-13a**			
	I have discussed ways to describe the slope of a line, can interpret the definition of gradient and can use it to make relevant calculations, interpreting my answer for the context of the problem. **MTH 4-13b**	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (calculating the gradient of a straight line from horizontal and vertical distances).	**EF 1.4** Applying geometric skills linked to the use of formulae (determining the gradient of a straight line, given two points). **APP 1.4** Applying statistical skills to analysing data (forming a linear model from a given set of data).	**RC 1.3** Applying calculus skills of differentiation (determining the equation of a tangent to a curve at a given point by differentiation). (In relation to the gradient of curve.) **APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (finding the equation of a line parallel to and a line perpendicular to a given line; using $m = \tan\theta$ to calculate a gradient or angle).
	Having investigated the pattern of the coordinate points lying on a horizontal or vertical line, I can describe the pattern using a simple equation. **MTH 4-13c**		**EF 1.4** Applying geometric skills linked to the use of formulae (determining the gradient of a straight line, given two points).	**APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (finding the equation of a line parallel to and a line perpendicular to a given line; using $m = \tan\theta$ to calculate a gradient or angle).

				RC 1.3 Applying calculus skills of differentiation (determining the equation of a tangent to a curve at a given point by differentiation). (In relation to the gradient of curve.)
	I can use a given formula to generate points lying on a straight line, plot them to create a graphical representation then use this to answer related questions. ***MTH 4-13d***	**R 1.1** Applying algebraic skills to linear equations (drawing and recognising a graph of a linear equation). **R 1.4** Applying statistical skills to representing data (drawing and applying a best-fitting straight line).	**R 1.1** Applying algebraic skills to linear equations (determining the equation of a straight line given the gradient; working with linear equations or inequalities; working with simultaneous equation).	**RC 1.3** Applying calculus skills of differentiation (determining the equation of a tangent to a curve at a given point by differentiation). **APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (finding the equation of a line parallel to and a line perpendicular to a given line; using $m = \tan\theta$ to calculate a gradient or angle).
Expressions and equations	*I can collect like algebraic terms, simplify expressions and evaluate using substitution.* ***MTH 3-14a***	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (simplifying an expression which has more than one variable; evaluating an expression or a formula which has	**R 1.1** Applying algebraic skills to linear equations (working with linear equations or inequations; working with simultaneous equations; changing the subject of a formula).	**EF 1.1** Applying algebraic skills to manipulating expressions (determining composite and inverse functions; identifying and sketching related algebraic functions).

		more than one variable). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (solving a linear equation requiring simplification; creating and then using a formula).		**EF 1.2/1.3** Applying trigonometric skills to manipulating expressions/applying algebraic and trigonometric skills to functions (application of the addition or double-angle formulae; application of trigonometric identities; converting $a\cos x + b\sin x$ to $k\cos(x \pm \alpha)$ or $k\sin(x \pm \alpha)$, α in 1st quadrant $k > 0$; identifying and sketching related trigonometric functions). **APP 1.2** Applying calculus skills to optimisation and area (finding the area between a curve and the x-axis; finding the area between two curves or a straight line and a curve).
	Having explored the distributive law in practical contexts, I can simplify, multiply and evaluate simple algebraic terms	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (using the distributive law in an	**EF 1.2** Applying algebraic skills to manipulate expressions (working with algebraic expressions involving expansion of	

	involving a bracket. **MTH 4-14a**	expression with a numerical common factor to produce a sum of terms).	brackets).	
	I can find the factors of algebraic terms, use my understanding to identify common factors and apply this to factorise expressions. **MTH 4-14b**	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (factorising a sum of terms with a numerical common factor).	**EF 1.2** Applying algebraic skills to manipulate expressions (factorising an algebraic expression; completing the square in a quadratic expression with unitary x^2 coefficient; reducing an algebraic fraction to its simplest form). **R 1.3** Applying algebraic skills to quadratic equations (solving a quadratic equation which has been factorised; using the discriminant to determine the number of roots).	**EF 1.1** Applying algebraic skills to manipulating expressions (factorising a cubic polynomial expression with unitary x^3 coefficient).
	Having discussed ways to express problems or statements using mathematical language, I can construct, and use appropriate methods to solve, a range of simple equations. **MTH 3-15a**	**EF 1.1** Applying algebraic skills to manipulating expressions and working with formulae (extending a straightforward number or diagrammatic pattern and determining its formula).	**R 1.1** Applying algebraic skills to linear equations (working with linear equations or inequations; working with simultaneous equations; changing the subject of a formula).	**RC 1.1** Applying algebraic skills to solve equations (solving cubic polynomial equations with unitary x^3 coefficient; given the nature of the roots of an equation, use the discriminant to find an unknown).

		R 1.1 Applying algebraic skills to linear equations (solving linear equations; changing the subject of a formula). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (solving a linear equation requiring simplification; creating and then using a formula).	**R 1.3** Applying algebraic skills to quadratic equations (solving a quadratic equation which has been factorised; solving a quadratic equation using the quadratic formula).	**RC 1.2** Applying trigonometric skills to solve equations (solve trigonometric equations in degrees, including those involving trigonometric formulae or identities, in a given interval).
	I can create and evaluate a simple formula representing information contained in a diagram, problem or statement. ***MTH 3-15b***	**AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (creating and then using a formula).	**R 1.1** Applying algebraic skills to linear equations (working with linear equations or inequations).	
	Having discussed the benefits of using mathematics to model real-life situations, I can construct and solve inequalities and an extended range of equations. ***MTH 4-15a***	**R 1.1** Applying algebraic skills to linear equations (drawing and recognising a graph of a linear equation; solving linear equations; changing the subject of a formula).	**R 1.1** Applying algebraic skills to linear equations (working with linear equations or inequations). **R 1.2** Applying algebraic skills to graphs of quadratic relationships (recognise and determine the equation of a quadratic function from its graph; sketching a quadratic	

			function; identifying features of a quadratic function).	
Properties of 2D shapes and 3D objects	*Having investigated a range of methods, I can accurately draw 2D shapes using appropriate mathematical instruments and methods.* ***MTH 3-16a***	**R 1.2** Applying geometric skills to sides and angles of shapes (using a fractional scale factor to enlarge or reduce a shape). (The skill required to draw an accurate enlargement.)		
	I have explored the relationships that exist between the sides, or sides and angles, in right-angled triangles and can select and use an appropriate strategy to solve related problems, interpreting my answer for the context. ***MTH 4-16a***	**R 1.2** Applying geometric skills to sides and angles of shapes (using Pythagoras' theorem; using a fractional scale factor to enlarge or reduce a shape). **R 1.3** Applying trigonometric skills to right-angled triangles. (calculating a side in a right-angled triangle; calculating an angle in a right-angled triangle) **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (use of	**R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras' theorem). **R 1.5** Applying trigonometric skills to graphs and identities (working with the graphs of trigonometric functions; working with trigonometric relationships in degrees). **APP 1.1** Applying trigonometric skills to triangles which do not have a right angle (calculating the area of a triangle using trigonometry; using the	**EF 1.2** Applying trigonometric skills to manipulating expressions (application of the addition or double-angle formulae; application of trigonometric identities; converting $a\cos x + b\sin x$ to $k\cos(x \pm \alpha)$ or $k\sin(x \pm \alpha)$, α in 1st quadrant $k > 0$). **EF 1.4** Applying geometric skills to vectors (using the scalar product). **RC 1.2** Applying

		Pythagoras' theorem in a problem; use of trigonometry to calculate a side or angle of a right-angled triangle).	sine and cosine rules to find a side or angle).	trigonometric skills to solve equations (solve trigonometric equations in degrees, including those involving trigonometric formulae or identities, in a given interval). **RC 1.3** Applying calculus skills of differentiation (differentiating $k\sin x,\ k\cos x$). **RC 1.4** Applying calculus skills of integration (integrating functions of the form $f(x) = p\cos x$ and $f(x) = p\sin x$).
	Having investigated the relationships between the radius, diameter, circumference and area of a circle, I can apply my knowledge to solve related problems. ***MTH 4-16b***	**EF 1.2** Applying geometric skills to circumference, area and volume (calculating the circumference and area of a circle).	**EF 1.4** Applying geometric skills linked to the use of formulae (calculating the length of arc or the area of a sector of a circle).	

Angle, symmetry and transformation	*I can name angles and find their sizes using my knowledge of the properties of a range of 2D shapes and the angle properties associated with intersecting and parallel lines.* ***MTH 3-17a***	**R 1.2** Applying geometric skills to sides and angles of shapes (using parallel lines, symmetry and circle properties to calculate angles). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (use of Pythagoras' theorem in a problem; solving a problem involving shape and coordinates).	**R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras' theorem; applying the properties of shapes to determine an angle involving at least two steps; using similarity to calculate a volume).	**APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (finding the equation of a line parallel to and a line perpendicular to a given line; using properties of tangency in the solution of a problem).
	Having investigated navigation in the world, I can apply my understanding of bearings and scale to interpret maps and plans and create accurate plans, and scale drawings of routes and journeys. ***MTH 3-17b***	**R 1.2** Applying geometric skills to sides and angles of shapes (using a fractional scale factor to enlarge or reduce a shape).	**APP 1.1** Applying trigonometric skills to triangles which do not have a right angle (using the sine and cosine rules to find a side or angle; using bearings with trigonometry).	**EF 1.4** Applying geometric skills to vectors (working with collinearity; using the scalar product).
	I can apply my understanding of scale when enlarging or reducing pictures and shapes, using different	**R 1.2** Applying geometric skills to sides and angles of shapes (using a fractional scale factor to enlarge or reduce a	**R 1.4** Applying geometric skills to lengths, angles and similarity (using similarity to calculate a volume).	

	methods, including technology. **MTH 3-17c**	shape).		
	Having investigated the relationship between a radius and a tangent and explored the size of the angle in a semi-circle, I can use the facts I have established to solve related problems. **MTH 4-17a**	**R 1.2** Applying geometric skills to sides and angles of shapes (using Pythagoras' theorem; using parallel lines, symmetry and circle properties to calculate angles). **R 1.3** Applying trigonometric skills to right-angled triangles. (calculating a side in a right-angled triangle; calculating an angle in a right-angled triangle) **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (use of Pythagoras' theorem in a problem; solving a problem involving shape and coordinates).	**R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras' theorem; applying the properties of shapes to determine an angle involving at least two steps).	**APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences (determining and using the equation of a circle; using properties of tangency in the solution of a problem).
	I can apply my understanding of the properties of similar figures to solve problems	**R 1.2** Applying geometric skills to sides and angles of shapes (using a fractional scale factor to	**R 1.4** Applying geometric skills to lengths, angles and similarity (applying the converse of Pythagoras'	

	involving length and area. ***MTH 4-17b***	enlarge or reduce a shape).	theorem; applying the properties of shapes to determine an angle involving at least two steps; using similarity to calculate a volume).	
	I can use my knowledge of the coordinate system to plot and describe the location of a point on a grid. ***MTH 2-18a / MTH 3-18a*** *I can plot and describe the position of a point on a 4-quadrant coordinate grid.* ***MTH 4-18a***	**AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (use of Pythagoras' theorem in a problem; solving a problem involving shape and coordinates).	**EF 1.4** Applying geometric skills linked to the use of formulae (determining the gradient of a straight line, given two points).	
	I can apply my understanding of the 4-quadrant coordinate system to move, and describe the transformation of, a point or shape on a grid. ***MTH 4-18b***	**AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (solving a problem involving shape and coordinates).	**APP 1.2** Applying geometric skills to vectors (adding or subtracting two-dimensional vectors using directed line segments; determining coordinates of a point from a diagram representing a 3D object; adding or subtracting two- or three-dimensional vectors using components; calculating the magnitude of a vector).	**EF 1.4** Applying geometric skills to vectors (determining the resultant of vector pathways in three dimensions; working with collinearity; determining the coordinates of an internal division point of a line; using the scalar product). **APP 1.1** Applying algebraic skills to rectilinear shapes, to circles and to sequences

				(finding the equation of a line parallel to and a line perpendicular to a given line; using $m = \tan\theta$ to calculate a gradient or angle; determining and using the equation of a circle; using properties of tangency in the solution of a problem).
	*I can illustrate the lines of symmetry for a range of 2D sh*apes *and apply my understanding to create and complete symmetrical pictures and patterns.* ***MTH 2-19a / MTH 3-19a***	**EF 1.2** Applying geometric skills to circumference, area and volume (using rotational symmetry). **R 1.2** Applying geometric skills to sides and angles of shapes (using parallel lines, symmetry and circle properties to calculate angles).	**R 1.1** Applying algebraic skills to linear equations (recognise and determine the equation of a quadratic function from its graph; sketching a quadratic function; identifying features of a quadratic function).	
	Having investigated patterns in the environment, I can use appropriate mathematical vocabulary to discuss the rotational properties of shapes, pictures and patterns and can apply my understanding when completing or creating designs. ***MTH 4-19a***	**EF 1.2** Applying geometric skills to circumference, area and volume (using rotational symmetry).		

Data and analysis	*I can work collaboratively, making appropriate use of technology, to source information presented in a range of ways, interpret what it conveys and discuss whether I believe the information to be robust, vague or misleading.* ***MNU 3-20a***	**N 2.1** Extracting and interpretation data from at least two different straightforward graphical forms (straightforward graphical forms should include: a table with at least four categories of information; a chart where the values are given or where the scale is obvious, eg pie; a graph where the scale is obvious, eg bar, pie, scatter or line graph; a diagram, eg stem and leaf, map or plan).	**APP 1.4** Applying statistical skills to analysing data (comparing data sets using statistics including a measure of spread).	
	When analysing information or collecting data of my own, I can use my understanding of how bias may arise and how sample size can affect precision, to ensure that the data allows for fair conclusions to be drawn. ***MTH 3-20b***	**N 2.2** Making and explaining decisions based on the interpretation of data (offer reasons for the decisions made based on the interpretation of data).	**APP 1.4** Applying statistical skills to analysing data (comparing data sets using statistics including a measure of spread).	
	I can evaluate and interpret raw and graphical data using a variety of methods, comment on relationships I observe within the data and communicate my findings	**EF 1.3** Applying statistical skills to representing and analysing data and to probability (determining statistics of a data set; interpreting calculated statistics).	**APP 1.4** Applying statistical skills to analysing data (comparing data sets using statistics including a measure of spread).	

	to others. ***MNU 4-20a***	**N 2.2** Making and explaining decisions based on the interpretation of data (make decisions based on observations of patterns and trends in data; make decisions based on reading scales in straightforward graphical forms; offer reasons for the decisions made based on the interpretation of data).		
	In order to compare numerical information in real-life contexts, I can find the mean, median, mode and range of sets of numbers, decide which type of average is most appropriate to use and discuss how using an alternative type of average could be misleading. ***MTH 4-20b***	**N 2.2** Making and explaining decisions based on the interpretation of data (make decisions based on calculations involving data; offer reasons for the decisions made based on the interpretation of data). **AV 1.1** Using operational and reasoning skills to determine solutions in mathematical or real-life situations (calculation of the mean of a data set; the mean should require division of a whole number by a single-digit	**APP 1.4** Applying statistical skills to analysing data (comparing data sets using statistics including a measure of spread).	

		whole number and rounding of the answer to two decimal places; comparing data sets using calculation or determination of statistics).		
	*I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs**,** making effective use of technology.* ***MTH 2-21a / MTH 3-21a*** *I can select appropriately from a wide range of tables, charts, diagrams and graphs when displaying discrete, continuous or grouped data, clearly communicating the significant features of the data.* ***MTH 4-21a***	**EF 1.3** Applying statistical skills to representing and analysing data and to probability (constructing a frequency table with class intervals from raw data; determining statistics of a data set; interpreting calculated statistics; representing raw data in a pie chart). **R 1.4** Applying statistical skills to representing data (constructing a scattergraph).	**APP 1.4** Applying statistical skills to analysing data (forming a linear model from a given set of data).	
Ideas of chance and uncertainty	*I can find the probability of a simple event happening and explain why the consequences of the event, as well as its probability, should be*	**N 2.3** Making and explaining decisions based on probability (recognise patterns and trends and use these to state the probability of an		

	considered when making choices. ***MNU 3-22a***	event happening; make predictions and use these predictions to make decisions; use relative frequencies, contingency tables and describe probability through the use of percentages, decimal fractions and fractions to make and explain decisions). **EF 1.3** Applying statistical skills to representing and analysing data and to probability (using probability).		
	By applying my understanding of probability, I can determine how many times I expect an event to occur, and use this information to make predictions, risk assessment, informed choices and decisions. ***MNU 4-22a***	**EF 1.3** Applying statistical skills to representing and analysing data and to probability (using probability). **N 2.3** Making and explaining decisions based on probability (make predictions and use these predictions to make decisions).		