Mathletics 3P Learning Progressions Understanding Practice and Fluency (UPF)



Levels 9 – 10 | United Kingdom



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Contents

I	Level 9	2
1	Number and Algebra	2
2	Measurement	17
3	Geometry	20
4	Chance and probability	29
5	Data	31
II	Level 10	33
6	Number and Algebra	33
7	Measurement	43
8	Geometry	47
9	Chance and probability	54
10) Data	57

Part I Level 9

1 Number and Algebra

Fractions, decimals and percentages				
Scientific notation (UK standard form)				
Learning Journey	Steps	Content	Details	
Scientific notation and standard form	1	Converting from standard form to standard notation for very large numbers	• convert from scientific notation to standard notation for very large numbers	
	2	Converting from standard form to standard notation for very small numbers	 convert from scientific notation to standard notation for very small numbers 	
	3	Converting from standard form to standard notation for very large numbers	• convert from standard form to sci- entific notation for very large num- bers	
	4	Converting from basic numerals to standard form for very small numbers	• convert from basic numerals to standard form for very small numbers	
	5	Combination of previous content	Combination of previous details	
Calculating in scientific notation	1	1 Calculating in standard form	• perform calculations involving standard form (without a calculator) applying laws of indices where there is 1 bracket	
			• perform calculations involving standard form (without a calculator) using laws of indices and 2 brackets to be multiplied	
			• perform calculations involving standard form (without a calculator) using laws of indices with 2 brackets involving division	

Financial maths						
	Interest					
Learning Journey	Steps	Content	Details			
Calculating simple inter- est	1	Solving problems involving simple interest	 solve problems involving simple in- terest 			
Calculating compound interest without a for- mula	1	Calculating compound interest without using a formula; calcu- lations based on simple interest (using appropriate digital tech- nology)	• calculate compound interest based on using repeated calculations of simple interest, for up to 3 years			
Calculating compound interest	1	Establishing and calculating com- pound interest using a formula in the form A= P(1 + R)n	• establish the formula to find com- pound interest, A= P(1 + R)n, where A is the total amount, P is the prin- cipal, R is the rate per compounding period as a decimal and n is the num- ber of compounding periods			

Learning Journey	Steps	Content	Details
	2	Solving problems involving the compound interest formula find- ing the variables other than A	• solve problems involving the com- pound interest formula finding the variables other than A
			• calculate the interest earned on a sum of money, given the amount, the interest rate and the number of years invested using $I = A - P$
	3	Solving problems involving com- pound interest, determining the time period required to achieve a particular total amount invested	• solve problems involving compound interest, by calculating the principal or interest rate needed to obtain a particular total amount for a com- pound interest investment
			• use a "given and check" strategy to determine the number of time periods required to obtain a particular total amount for a compound interest in- vestment
	4	Solving problems involving com- pound interest, determining the amount of money to be invested in order to achieve a particular to- tal amount invested after a given number of time periods with a given interest rate	• solve problems involving compound interest, determining the amount of money to be invested in order to achieve a particular total amount in- vested after a given number of time periods with a given interest rate
	5	Calculating and comparing investments for different com- pounding periods	• calculate and compare investments where the interest is applied at differ- ent times, eg applied monthly or an- nually

Rates and ratios				
	Proportion			
Learning Journey		Steps	Content	Details
Understanding proportion	direct	1	Recognising proportional rela- tionships between quantities	 interpret information between 2 quantities and decide if they are in a proportional relationship
		2	Investigating and understanding direct variation/proportion	 investigate situations which are ex- amples of direct variation/proportion
				• understand that x and y are directly proportional - if a value of x increases the value of y increases in the same proportion and as the value of x de- creases then the value of y decreases in the same proportion
		3	Understanding what direct varia- tion/proportion graphs look like	• understand that straight-line graphs represent direct varia- tion/proportion for the values given on each axis
		4	Interpreting and comparing direct variation/proportion graphs	• interpret and compare graphs in real-life situations to make in- formed choices, eg mobile phone charges, temperature conversions, time/distance/speed etc
Investigating rect/inverse propo	indi- rtion	1	Investigating and understand- ing indirect or inverse varia- tion/proportion	• investigate situations which are ex- amples of indirect or inverse varia- tion/proportion

Learning Journey	Steps	Content	Details
	2	Solving problems based on indi- rect (inverse) variation/proportion with and without digital technol- ogy	• solve problems using an under- standing of indirect (inverse) varia- tion/proportion with and without dig- ital technology
Creating direct and inversely proportionate graphs	1	Applying information to cre- ate indirect (inverse) varia- tion/proportion graphs	• create tables of values for indirect (inverse) variation/proportion prob- lems and then plot on the number plane
			• understand and/or comment on the significance of the shape of a graph representing indirect varia- tion/proportionality
	2	Interpreting graphs which rep- resent direct and indirect varia- tion/proportion	• recognise and interpret graphs rep- resenting direct and indirect varia- tion/proportion
			• identify whether a linear graph represents direct or indirect varia- tion/proportion with reference to the values on each axis
Determining the con- stant of proportionality	1	Identifying the constant of pro- portionality (unit rate) in tables, graphs, equations, diagrams and verbal descriptions of propor- tional relationships	• identify the constant of propor- tionality (unit rate) in tables, graphs, equations, diagrams and verbal de- scriptions of proportional relation- ships
	2	Representing proportional rela- tionships by equations	• represent proportional relation- ships by equations
	3	Determining the constant of pro- portionality (k = y/x) within math- ematical problems	• determine the constant of propor- tionality (k = y/x) within mathemati- cal problems
	4	Determining the constant of pro- portionality (k = y/x) within real- world problems	• determine the constant of propor- tionality ($k = y/x$) within real-world problems
Determining the con- stant of variation	1	Finding the value of the constant of variation (or proportionality) and using it to solve problems	• use information to write a direct variation/proportion equation and find the value of the constant of variation/proportion/proportionality
			• write, apply and solve equations within the context of direct varia- tion/proportion problems
	2	Solving direct varia- tion/proportion problems in various contexts	• solve problems involving rates and directly proportional relationships in various contexts, using dynamic ge- ometry software to construct and measure scale drawings
Graphing equations of direct proportion	1	Applying unitary information to create graphs	• apply the unitary information to create a table of values which can be plotted on the number plane

Learning Journey	Steps	Content	Details
			• understand the significance of the slope and direction of the graph (as 1 value increases so does the other or as 1 value decreases so does the other)
	2	Graphing proportional relation- ships	 graph proportional relationships

Algebra				
	Ctopo	Index/exponent laws	Detaile	
Applying the distributive law/property	1	Expanding algebraic expressions in the form a(b+c) by remov- ing grouping symbols (distributive law) where a and c are positive or negative integers and b is a vari- able with coefficient of 1	• expand algebraic expressions in the form a(b+c) by removing grouping symbols (distributive law) where a and c are positive or negative inte- gers and b is a variable with coeffi- cient of 1	
	2	Expanding algebraic expressions in the form a(b+c) by remov- ing grouping symbols (distributive law) where a, b and c can be pos- itive or negative numbers or vari- ables (coefficients 1 or -1)	• expand algebraic expressions in the form a(b+c) by removing grouping symbols (distributive law) where a, b and c can be positive or negative numbers or variables (coefficients 1 or -1)	
	3	Expanding algebraic expressions in the form a(b+c) by remov- ing grouping symbols (distribu- tive law) where a, b and c can be positive or negative numbers or variables (coefficients integers not limited to 1)	• expand algebraic expressions in the form a(b+c) by removing grouping symbols (distributive law) where a, b and c can be positive or negative numbers or variables (coefficients in- tegers not limited to 1)	
	4	Expanding algebraic expressions in the form a(b + c) by remov- ing grouping symbols (distributive law). Coefficients of pronumerals to be positive integers. Involve in- dices where power is a positive integer.	• expand algebraic expressions in the form a(b + c) by removing group- ing symbols (distributive law). Co- efficients of pronumerals to be pos- itive integers. Involve indices where power is a positive integer.	
	5	Expanding algebraic expressions in the form a(b + c) by remov- ing grouping symbols (distributive law). Coefficients of pronumer- als to be positive or negative inte- gers. Involve indices where power is a positive integer.	• expand algebraic expressions in the form a(b + c) by removing grouping symbols (distributive law). Coeffi- cients of pronumerals to be positive or negative integers. Involve indices where power is a positive integer.	
Distribute law (prop- erty): Adding like terms	1	Expanding algebraic expressions by removing grouping symbols and collecting like terms where applicable	• expand algebraic expressions by removing grouping symbols and collecting like terms where applicable	
Indices (exponents): Multiplication	1	Applying index laws further: mul- tiplication with integer indices (positive and negative indices)	• apply the index law for multiplying expressions with the same numerical base and integer indices (introducing negative indices)	

Learning Journey	Steps	Content	Details
			• apply the index law to simplify the multiplication of 2 or more terms with numerical bases and integer indices, leaving solutions in index form
			• apply the index law to simplify the multiplication of 2 or more terms with numerical bases and integer in- dices, evaluating the solution with and without a calculator
	2	Applying index laws further: mul- tiplication with integer indices (al- gebraic bases)	• apply the index law for multiplying expressions with the same algebraic base and integer indices
			• apply the index law to simplify the multiplication of 2 or more terms with algebraic bases and integer indices, leaving solutions in index form
Indices (exponents): Di- vision	1	Applying index laws further: divi- sion with integer indices (positive and negative indices)	• apply the index law to simplify the division of 2 or more terms with nu- merical bases and integer indices (in- troducing negative indices)
			• apply the index law to simplify the division of 2 or more terms with nu- merical bases and integer indices, leaving solutions in index form
			• apply the index law to simplify the division of two or more terms with numerical bases and integer in- dices, evaluating the solution with and without a calculator
	2	Applying index laws further: di- vision with integer indices (alge- braic bases)	• apply the index law for dividing expressions with the same algebraic base and integer indices
			• apply the index law to simplify the division of 2 or more terms with alge- braic bases and integer indices, leav- ing solutions in index form
Indices (exponents): Power of a power	1	Applying index laws further: power of a power with integer indices (positive whole number bases)	• apply the index law for raising an expression in index form to another index (positive numerical bases, pos- itive and negative integer indices)
			• apply the index law to simplify expressions involving raising a term written in index form to another in- dex, leaving solutions in index form (positive numerical bases, integer in- dices)
			• apply the index law to simplify expressions involving raising a term written in index form to another in- dex, evaluating the solution with and without a calculator (positive numer- ical bases, integer indices)

Learning Journey	Steps	Content	Details
	2	Applying index laws further: power of a power with integer indices (algebraic bases)	• apply the index law for raising an expression in index form to another index (algebraic bases and integer indices)
			 apply the index law to simplify expressions involving raising a term written in index form to another in- dex, leaving solutions in index form (algebraic bases and integer indices)
Indices (exponents): Zero index	1	Applying index laws further: zero index (positive and negative whole number bases)	• apply the meaning of the zero in- dex for expressions with positive and negative numerical bases
			• apply the zero index to simplify expressions involving the zero index and integer numerical bases
	2	Applying index laws further: zero index (algebraic bases)	 apply index laws: zero index (alge- braic bases)
			• apply the zero index to simplify expressions involving the zero index and algebraic bases
Indices (exponents): Mixed ops, coeffi- cient = 1	1	Applying index laws further: mixed index laws (integer bases) expressions to involve either 2 or more terms	• select the necessary index law(s) and apply them to simplify expres- sions of 2 or more terms involving in- dices with numerical bases and the operations of multiplication, division, power of a power, and the zero index
	2	Applying index laws further: mixed index laws (algebraic bases)	• select the necessary index law(s) and apply them to simplify expres- sions of 2 or more terms involving in- dices with algebraic bases and the operations of multiplication, division, power of a power, and the zero in- dex. Expressions to include positive and negative integers
Indices (exponents): Mixed ops, coefficient >1	1	Simplifying expressions that in- volve the product of simple alge- braic terms containing positive- integer indices with integer coef- ficients ≥1	• simplify expressions that involve the product of simple algebraic terms containing positive-integer indices with integer coefficients ≥1
	2	Simplifying expressions that in- volve the quotient of simple alge- braic terms containing positive- integer indices with integer coef- ficients ≥1	• simplify expressions that involve the quotient of simple algebraic terms containing positive-integer indices with integer coefficients ≥1
	3	Simplifying expressions that involve raising a power to a power involving simple algebraic terms containing positive-integer indices with integer coefficients	 simplify expressions that involve raising a power to a power involv- ing simple algebraic terms containing positive-integer indices with integer coefficients ≥1
	4	Ebmparing expressions such as 3a ² × 5a and 3a ² + 5a by substi- tuting values for a	• compare expressions such as $3a^2 \times 5a$ and $3a^2 + 5a$ by substituting values for a

Learning Journey	Steps	Content	Details
Indices (exponents): Neg index, numerical base	1	Evaluating numerical expressions involving a negative index by first rewriting with a positive index, eg $3^{-1} = \frac{1}{3}$ with an index of -1	• evaluate numerical expressions in- volving a negative index by first rewriting with a positive index, eg $3^{-1} = \frac{1}{3}$ with an index of -1
	2	Evaluating numerical expressions involving a negative index by first rewriting with a positive index, eg $3^{-4} = \frac{1}{3}^4 = \frac{1}{8}1$	• evaluate numerical expressions in- volving a negative index by first rewriting with a positive index, eg $3^{-4} = \frac{1}{3}^4 = \frac{1}{8}1$
Indices (exponents): Negative index	1	Evaluating algebraic expressions involving a negative index by first rewriting with a positive index, eg $a^{-1} = 1/a$ with an index of -1 and a coefficient of 1	• evaluate algebraic expressions in- volving a negative index by first rewriting with a positive index, eg $a^{-1} = 1/a$ with an index of -1 and a coefficient of 1
	2	Evaluating algebraic expressions involving a negative index by first rewriting with a positive index, eg $a^{-1} = 1/a$ with an index of -1 and a coefficient greater or equal to 1	• evaluate algebraic expressions in- volving a negative index by first rewriting with a positive index, eg $a^{-1} = 1/a$ with an index of -1 and a coefficient greater or equal to 1
Indices (exponents): Mixed with negative indices	1	Simplifying expressions that in- volve the product of simple al- gebraic terms with integer coef- ficients ≥1 with some negative powers	• simplify expressions that involve the product of simple algebraic terms containing positive-integer indices with integer coefficients ≥1
	2	Simplifying expressions that in- volve the quotient of simple al- gebraic terms with integer coef- ficients ≥1 with some negative powers	• simplify expressions that involve the quotient of simple algebraic terms containing positive-integer indices with integer coefficients ≥1
	3	Simplifying expressions that in- volve the raising a power to a power involving simple algebraic terms with integer coefficients ≥1 with some negative powers	• simplify expressions that involve the raising a power to a power in- volving simple algebraic terms con- taining positive-integer indices with integer coefficients ≥1
	4	Verifying whether a given expres- sion represents a correct simpli- fication of another algebraic ex- pression by substituting numbers for pronumerals	• verify whether a given expression represents a correct simplification of another algebraic expression by sub- stituting numbers for pronumerals
	5	Writing the numerical value of a given numerical fraction raised to the power of -1, leading to $(a/b)^{-1} = b/a$	• write the numerical value of a given numerical fraction raised to the power of -1 , leading to $(a/b)^{-1} = b/a$
		Factorising/factoring	
Factorising (factoring)	1	by identifying only algebraic fac- tors	• factorise algebraic expressions by finding a common algebraic factor and bringing it out the front of the brackets with its product inside the brackets

Learning Journey	Steps	Content	Details
	2	Factorising algebraic expressions by taking out a common algebraic factor where the highest common factor is a term with 1 pronumeral and the power of the pronumeral is 1	• factorise algebraic expressions by taking out a common algebraic fac- tor where the highest common factor is a term with 1 pronumeral and the power of the pronumeral is 1
	3	Factorising algebraic expressions by taking out a common algebraic factor where the highest common factor is a term with one pronu- meral and the power of the pron- umeral is an integer greater or equal to 1.	• factorise algebraic expressions by taking out a common algebraic factor where the highest common factor is a term with one pronumeral and the power of the pronumeral is an integer greater or equal to 1.
	4	Factorising algebraic expressions by taking out a common algebraic factor where the highest com- mon factor is a term with multiple pronumerals and the power of the pronumerals is an integer greater or equal to 1.	• factorise algebraic expressions by taking out a common algebraic fac- tor where the highest common factor is a term with multiple pronumerals and the power of the pronumerals is an integer greater or equal to 1.
	5	Recognising that ex- pressions such as $24x^2y + 16xy^2 = 4xy(6x + 4y)$ may represent 'partial factorisa- tion' and that further factorisation is necessary to 'factorise fully'	 fully factorise expressions that have only been partially factorised
		Algebraic fractions	
Algebraic fractions: 4 ops numerical denomi- nators	1	Simplifying expressions that in- volve algebraic fractions requiring addition with numerical denomi- nators	• simplify expressions that involve al- gebraic fractions with numerical de- nominators involving addition
	2	Simplifying expressions that in- volve algebraic fractions requiring subtraction with numerical de- nominators	• simplify expressions that involve al- gebraic fractions with numerical de- nominators involving subtraction
	3	Simplifying expressions that in- volve algebraic fractions requiring multiplication with numerical de- nominators	• simplify expressions that involve al- gebraic fractions with numerical de- nominators involving multiplication
	4	Simplifying expressions that in- volve algebraic fractions requiring division with numerical denomi- nators	• simplify expressions that involve al- gebraic fractions with numerical de- nominators involving division
Algebraic fractions: Simplifying	1	Simplifying algebraic fractions with pronumerals in numerator only	• simplify algebraic fractions with pronumerals in numerator only
	2	Simplifying algebraic fractions with pronumerals in numerator and/or denominator	 simplify algebraic fractions with pronumerals in numerator and/or de- nominator
	3	Simplifying algebraic fractions with pronumerals in numerator and/or denominator including those involving indices	• simplify algebraic fractions with pronumerals in numerator and/or de- nominator including those involving indices

Learning Journey	Steps	Content	Details
		Algebraic formulas	
Using formulas	1	Using authentic formulas to solve problems involving substituting in known variables to solve a prob- lem	• use authentic formulas to solve problems involving substituting in known variables to solve a problem
	2	Solving equations arising from substitution into formulas, eg given P = 2I + 2b and P = 20, I = 6, solve for b	• solve equations arising from sub- stitution into formulas, eg given P = 2I + 2b and P = 20, I = 6, solve for b
	3	Substituting into formulas from other strands of the syllabus or from other subjects to solve prob- lems and interpret solutions, eg $A = \frac{1}{2}xy$, $v = u + at$, $C = 5/9(F - 32)$, $V = \pi r^2h$	• substitute into formulas from other strands of the syllabus or from other subjects to solve problems and interpret solutions, eg A = $\frac{1}{2}xy$, v = u + at, C = 5/9(F - 32), V = πr^2h
Solving word problems	1	Translating word problems into linear equations	• translate word problems into linear equations
			• solve word problems involving fa- miliar formulas, eg 'If the area of a triangle is 30 square centimetres and the base length is 12 centimetres, find the perpendicular height of the triangle'
	2	Solving word equations and inter- pret the solutions within a given context	• solve word equations and interpret the solutions within a given context
		Binomial products	
Expanding binomial products	1	Expanding binomial products by finding the areas of rectangles	• expand binomial products by find- ing the areas of rectangles
	2	Using algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pronumerals with coefficient of 1 and operators are +'s	• use algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pron- umerals with coefficient of 1 and op- erators are +'s
	3	Using algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pronumerals with coefficient of 1 and operators can be + or -	• use algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pron- umerals with coefficient of 1 and op- erators can be + or -
	4	Using algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pronumerals with coefficient greater or equal to 1 and opera- tors can be + or -	• use algebraic methods to expand binomial products in the form (a+b)(c+d) where a and c are pronumerals with coefficient greater or equal to 1 and operators can be + or -

Learning Journey	Steps	Content	Details
	5	Using algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pronumerals with coefficient greater or equal to 1 and opera- tors can be + or - and expansion involves indices	• use algebraic methods to ex- pand binomial products in the form (a+b)(c+d) where a and c are pron- umerals with coefficient greater or equal to 1 and operators can be + or - and expansion involves indices
		Solving equations	
Solving linear equations involving brackets	1	Solving equations involving multiple sets of brackets	 solve equations involving multiple sets of brackets
	2	Solving equations involving brackets with pronumerals on both sides	 solve equations involving brackets with pronumerals on both sides
Solving equations involving algebraic frac- tions	1	Solving linear equations involving algebraic fractions	 solve a range of linear equations, including equations that involve 2 or more fractions
	2	Solving monic linear equations in- volving algebraic fractions where at least 1 entire expression is in the numerator or denominator of a fraction	• solve monic linear equations involv- ing algebraic fractions where at least 1 entire expression is in the numera- tor or denominator of a fraction
	3	Solving non-monic linear equa- tions involving algebraic fractions where at least 1 entire expression is in the numerator or denomina- tor of a fraction	• solve non-monic linear equations involving algebraic fractions where at least 1 entire expression is in the numerator or denominator of a frac- tion
	4	Combination of previous content	Combination of previous details
Solving simple quadratic equations	1	Checking solutions of a quadratic equation by substituting	• check solutions of a quadratic equation by substituting
	2	Solving simple quadratic equa- tions of the form ax ² = c, leaving answers as decimal approxima- tions	• solve simple quadratic equations of the form ax ² = c, leaving answers as decimal approximations
	3	Solving simple quadratic equa- tions of the form ax ² = c, leaving answers in exact form	• solve simple quadratic equations of the form ax ² = c, leaving answers in exact form
		Inequalities	
Solving linear inequali- ties with two steps	1	Solving inequalities using inverse operations involving 2 steps with integer solutions	• solve inequalities using inverse op- erations involving 2 steps with inte- ger solutions
	2	Solving inequalities using inverse operations involving 2 steps with integer solutions, plotting solution on a number line	• solve inequalities using inverse op- erations involving 2 steps with inte- ger solutions plotting the solution on a number line
	3	Solving inequalities using inverse operations involving 2 steps with integer and non-integer solutions	• solve inequalities using inverse op- erations involving 2 steps with inte- ger and non-integer solutions

Learning Journey	Steps	Content	Details
	4	Solving inequalities using inverse operations involving 2 steps with integer and non-integer solutions plotting solution on a number line	• solve inequalities using inverse op- erations involving 2 steps with inte- ger and non-integer solutions plot- ting the solution on a number line
Solving linear inequali- ties with multiple steps	1	Solving inequalities using inverse operations involving 3 steps with integer and non-integer solutions	• solve inequalities using inverse op- erations involving 3 steps with inte- ger and non-integer solutions
	2	Solving inequalities using inverse operations involving 3 steps with integer and non-integer solutions, plotting solution on a number line	• solve inequalities using inverse op- erations involving 3 steps with inte- ger and non-integer solutions plot- ting the solution on a number line
	3	Solving inequalities with vari- ables either side of the equals sign	• solve inequalities with variables ei- ther side of the equals sign
	4	Representing and solving real-life scenario's using inequalities	• represent and solving real-life sce- nario's using inequalities
		Simultaneous equations	
Solving simultaneous equations graphically	1	Understanding simultaneous equations	• understand that solutions to a sys- tem of 2 linear equations in 2 vari- ables correspond to points of in- tersection of their graphs, because points of intersection satisfy both equations simultaneously
	2	Solving simultaneous equations with 2 variables graphically	• solve simultaneous equations graphically
Solving simultaneous equations algebraically	1	Solving simultaneous equations algebraically using the substitu- tion method	• solve simultaneous equations al- gebraically using the substitution method
	2	Solving simultaneous equations algebraically using the elimina- tion method	 solve simultaneous equations algebraically using the elimination method
	3	Checking the solution of simul- taneous equations either graphi- cally or algebraically	 check solution of simultaneous equation either graphically or alge- braically
	4	Solving real-world and mathe- matical problems leading to 2 lin- ear equations in 2 variables	• solve real-world and mathematical problems leading to 2 linear equa- tions in 2 variables, eg given coordi- nates for 2 pairs of points, determine whether the line through the first pair of points intersects the line through the second pair

Coordinate geometry			
	Ctores	Distance between two points	Deteile
Distance between two points without the for- mula	1	Using graphing software to find the distance between 2 points on the Cartesian plane	 use graphing software to find the distance between 2 points on the Cartesian plane
	2	Using the interval between 2 points on the Cartesian plane as the hypotenuse of a right-angled triangle and apply Pythagoras' theorem to determine the length of the interval joining the 2 points (ie 'the distance between the 2 points')	 use the interval between 2 points on the Cartesian plane as the hy- potenuse of a right-angled triangle and apply Pythagoras' theorem to determine the length of the interval joining the 2 points (ie 'the distance between the 2 points') describe how the distance between (or the length of the interval join- ing) 2 points can be calculated using Pythagoras' theorem
Distance between two points using the formula	1	Using the formula to find the dis- tance between 2 points on the Cartesian plane	• use the formula to find the distance between 2 points on the Cartesian plane
	2	Using the formula to find the dis- tance of the interval joining 2 points in order to solve a problem in a given context	 use the formula to find the distance of the interval joining two points on the Cartesian plane in order to solve a problem in a given context use the formula to find the distance of the interval joining 2 points on a diagram in order to solve a real-life problem in a given context
		Midpoint	
Finding the midpoint without the formula	1	Determining the midpoint of an interval using a diagram	• determine the midpoint of an inter- val using a diagram
	2	Using the process for calculating the 'mean' to find the midpoint, M, of the interval joining 2 points on the Cartesian plane	• use the process for calculating the 'mean' to find the midpoint, M, of the interval joining 2 points on the Carte- sian plane
Finding the midpoint us- ing the formula	1	Using the formula to find the midpoint of the interval joining 2 points on the Cartesian plane	• use the formula to find the midpoint of the interval joining 2 points on the Cartesian plane
	2	Using the formula to find the midpoint of the interval joining 2 points in order to solve a problem in a given context	 use the formula to find the midpoint of the interval joining 2 points on the Cartesian plane in order to solve a problem in a given context use the formula to find the midpoint of the interval joining 2 points on a map in order to solve a real-life prob- lem in a given context
	3	Using the midpoint formula to find the missing point on the line inter- val given 1 point and the midpoint	• use the midpoint formula to find the missing point on the line interval given 1 point and the midpoint

Learning Journey	Steps	Content	Details
		Gradient	
Finding the gradient without the formula	1	Plotting and joining 2 points to form an interval on the Cartesian plane and form a right-angled tri- angle by drawing a vertical side from the higher point and a hor- izontal side from the lower point	• plot and join 2 points to form an interval on the Cartesian plane and form a right-angled triangle by draw- ing a vertical side from the higher point and a horizontal side from the lower point
	2	Using the interval between 2 points on the Cartesian plane as the hypotenuse of a right-angled triangle and use the relationship gradient = rise/run to find the gra- dient of the interval joining the 2 points	 use the interval between 2 points on the Cartesian plane as the hy- potenuse of a right-angled trian- gle and use the relationship gradi- ent = rise/run to find the gradient of the interval joining the 2 points distinguish between positive and pogative gradients from a diagram
Finding the gradient us- ing the formula	1	Using the formula to find the gradient of the interval joining 2 points on the Cartesian plane	• use the formula to find the gradient of the interval joining 2 points on the Cartesian plane
	2	Using the formula to find the gradient of the interval joining 2 points in order to solve a problem in a given context	• use the formula to find the gradi- ent of the interval joining 2 points on the Cartesian plane in order to solve a problem in a given context
			• use the formula to find the gradi- ent of the interval joining 2 points on a diagram in order to solve a real-life problem in a given context
		Linear relationships	
Graphing vertical and horizontal lines	1	Graphing horizontal linear re- lationships from the equation where there is no x involved	• graph horizontal linear relation- ships from the equation where there is no x involved
			• know that a horizontal line has a zero gradient
	2	Graphing vertical linear relation- ships from the equation where there is no y involved	• graph vertical linear relationships from the equation where there is no y involved
			 know that a vertical line has an in- finite gradient
Writing equations of vertical and horizontal lines	1	Finding the equation of a given horizontal line	• find the equation of a given horizon- tal line
	2	Finding the equation of a given vertical line	• find the equation of a given vertical line
	3	Identifying the x-axis as the line y = 0 and the y-axis as the line x = 0	• identify the x-axis as the line y = 0 and the y-axis as the line x = 0
Finding and using x- and y-intercepts	1	Establishing and using the fact that substituting y = 0 into a lin- ear equation will give you the x-	• substitute y = 0 into a linear equa- tion in order to find the x-intercept
		intercept	• reproduce the x-intercept in coordi- nate form

Learning Journey	Steps	Content	Details
	2	Establishing and using the fact that substituting x = 0 into a lin- ear equation will give you the y- intercept	 substitute x = 0 into a linear equation in order to find the y-intercept reproduce the y-intercept in coordinate form
	3	Finding the x and y-intercepts of any linear graphs	• find the x and y-intercepts of any linear graphs by substituting in x=0 for the y-intercept and y=0 for the x- intercept
	4	Graphing a linear relationship on the Cartesian plane using the x and y intercepts	• graph a linear relationship on the Cartesian plane by finding the x and y intercepts and ruling a line through them
Graphing using a table of values	1	Graphing a linear relationship on the Cartesian plane using a table of values	• graph a linear relationship on the Cartesian plane using a table of val- ues
			• graph the number pairs on the Cartesian plane
Graphing using the gradient-intercept method	1	Establishing that when given in the form y = mx + c, m is the gra- dient in the form rise/run	• establish that when given in the form $y = mx + c$, m is the gradient in the form rise/run
	2	Understanding that the gradient is the slope of a line in the form rise/run	• understand that the gradient is the slope of a line in the form rise/run
			• understand how a negative and positive gradient differ
	3	Establishing that when given in the form y = mx + c, c is the y-	• establish that when given in the form y = mx + c, c is the y-intercept
		intercept	• explain why c is always the y- intercept
	4	Graphing a linear relationship on the Cartesian plane using the gradient and y-intercept when the equation is in the form y = mx + c	• graph a linear relationship on the Cartesian plane using the gradient and y-intercept when the equation is in the form y = mx + c by first plotting the y-intercept
	5	Graphing a linear relationship on the Cartesian plane using the gradient and y-intercept when the equation is not in the form y = mx + c by rearranging to be in	• graph a linear relationship on the Cartesian plane using the gradient and y-intercept when the equation is not in the form $y = mx + c$ by rearranging to be in this form first
Craphing simple non		Non-linear relationships	
linear relations	1	completing a table of values	• graph simple quadratics by com- pleting a table of values
			• compare graphs of quadratics drawn from a table of values with quadratics drawn using digital tech- nology
Solving simple non- linear relationships	1	Solving simple quadratic equa- tions by inspection eg x ² = 49	• solve simple quadratic equations by inspection eg x²=49
	2	Solving simple cubic equations of the form ax ³ = k, leaving answers in exact form and as decimal ap- proximations	• solve simple cubic equations of the form ax ³ =k, leaving answers in exact form

Learning Journey	Steps	Content	Details
			 solve simple cubic equations of the form ax³=k, leaving answers as deci- mal approximations
	3	Solving exponential equations containing equal bases	 solve exponential equations con- taining equal bases (linear exponents only)eg: 53x=57x-2
Understanding parabo- las and their graphs	1	Understanding the language and important features of parabolas	• understand the language of parabolas, turning point (vertex), concavity, roots, x-intercept, y-intercept, axis of symmetry
	2	Understanding that $y = ax^2 + bx + c$ is the gen- eral equation of a parabola and manipulate equations to be in this form	• manipulate equations to be in the form y=ax²+bx+c
Investigating changes in a parabola equation	1	Investigating how the parabola with the equation y = ax ² changes as the value of a is changed using digital technology	• describe the features of the graph and how they change as the value of 'a' changes for both positive and neg- ative values of 'a'
			• understand that the sign of the co- efficient of x^2 (a) is what makes a parabola concave up or down. If a > 0 the parabola is concave up, If a < 0 the parabola is concave down
	2	Investigating how the parabola with the equation $y = ax^2 + k$ changes as the value of k is changed using digital technology	• describe the features of the graph and how they change as the value of k changes for both positive and neg- ative values of k
Finding the x- and y- intercepts of a parabola	1	Finding y-intercept for the graph of y=ax ² +bx+c, given a, b and c by substituting in x=0	• find y-intercept for the graph of y=ax ² +bx+c, given a, b and c by sub-stituting in x=0
Graphing parabolas	1	Graphing parabolas in the form y = $ax^2 + k$ with different values of a and k	• graph parabolas in the form $y = ax^2 + k$ with different values of a and k
	2	Determining the equation of a parabola, given a graph of the parabola with the main features clearly indicated	• determine the equation of a parabola, given a graph of the parabola with the main features clearly indicated

2 Measurement

Measurement – Area					
	Area of composite shapes				
Learning Journey	Steps	Content	Details		
Areas of composite shapes	1	Using appropriate units of time to measure very small or very large time intervals	• identify possible dissections of composite shapes to facilitate cal- culating the area of the composite shape		
	2	Calculating the areas of compos- ite figures by dissection into trian- gles, special quadrilaterals, quad- rants, semicircles and sectors	• calculate the areas of compos- ite figures by dissection into trian- gles, special quadrilaterals, quad- rants, semicircles and sectors		
	3	Solving a variety of practical problems involving the areas of quadrilaterals and composite shapes	• solve a variety of practical problems involving the areas of quadrilaterals and composite shapes		
	4	Defining an annulus and its asso- ciated terminology	• know the specific terms associ- ated with an annulus: concentric circles, larger/external radius ('R'), smaller/interior radius ('r')		
	5	Establishing and applying the area of an annulus	• find the area of an annulus by ap- plying the area of an annulus formula		
			• find the unknown variable using the area of an annulus formula in the context of a problem		

Measurement – Surface area					
	Surface area				
Learning Journey	Steps	Content	Details		
Finding surface area of cylinders	1	Finding the surface area: cylin- ders	• find the surface area of cylinders		
	2	Finding the surface area of parts of cylinders	• find the surface area of parts of cylinders		
	3	Finding the surface area of cylin- ders within the context of a prob- lem	• find the surface area of cylinders within the context of a problem		
	4	Finding the surface area of parts of cylinders within the context of a problem	• find the surface area of parts of cylinders within the context of a problem		
Finding surface area problems	1	Finding the surface area: rectan- gular prisms	• find the surface area of rectangular prisms		
	2	Finding the surface area of rect- angular prisms within the context of a problem	• find the surface area of rectangular prisms within the context of a prob- lem		
	3	Finding the surface area: trian- gular prisms (with and without Pythagoras' theorem)	• find the surface area of triangular prisms (with and without Pythago-ras' theorem)		

Learning Journey	Steps	Content	Details
	4	Finding the surface area of tri- angular prisms (with and without Pythagoras' theorem) within the context of a problem	• find the surface area of triangular prisms (with and without Pythago- ras' theorem) within the context of a problem

Measurement – Volume				
Learning Journey	Stens	Volume	Details	
Finding volumes of cylin- ders	1	Using the formula to find the vol- umes of cylinders	 find the volume of a right cylin- der given the area of the circle cross- section and perpendicular height in the same units find the volume of a right cylin- der given the area of the circle cross- 	
	2	Finding the height or greg of the	section and perpendicular height in different units • find the height or grea of the cir-	
	Z	circle cross-section for a right cylinder given the volume in the	cle cross-section for a right cylinder given the volume in the same units	
			• find the height or area of the cir- cle cross-section for a right cylinder given the volume in different units	
	3	Finding the volume of right cylin- ders, given their perpendicular heights and radius/diameter of their circular cross-sections all in	• find the volume of right cylinders, given their perpendicular heights and radius/diameter of their circular cross sections all in the same units	
		the same units	• find the volume of right cylinders, given their perpendicular heights and radius/diameter of their circular cross sections all in different units	
	4	Finding the radius, diameter or height of right cylinders, given their volume all in the same units	• find the radius, diameter or height of right cylinders, given their volume all in the same units	
			 find the radius, diameter or height of right cylinders, given their volume all in different units 	
	5	Solving a variety of practical problems involving the volume and capacity of right prisms and cylinders	• solve a variety of practical problems involving the volumes and capacities of right prisms and cylinders	
Finding volumes of composite right prisms	1	Calculating the volumes of com- posite right prisms with cross- sections that may be dissected into triangles and special quadri- laterals	• calculate the volumes of composite right prisms with cross-sections that may be dissected into triangles and special quadrilaterals	
	2	Calculating the volumes of composite right prisms with cross-sections that may be dis- sected into triangles and special quadrilaterals requiring the use of Pythagoras' theorem	• calculate the volumes of compos- ite right prisms with cross-sections that may be dissected into triangles and special quadrilaterals requiring the use of Pythagoras' theorem	
	3	Comparing the surface areas of prisms with the same volume	• compare the surface areas of prisms with the same volume	

Learning Journey	Steps	Content	Details
	4	Solving a variety of practical problems related to the volumes and capacities of composite right prisms with and without the use of Pythagoras' theorem	• solve a variety of practical problems related to the volumes and capacities of composite right prisms with and without the use of Pythagoras' the- orem

3 Geometry

Geometry			
		Similarity and scale factors	
Learning Journey	Steps	Content	Details
Introducing similarity	1	Introducing similarity	 introduce the definition of similarity
			 introduce the symbol for similarity
	2	Identifying that the ratio of corre-	• identify the ratio in which a shape
	2	sponding sides of similar shapes	has been dilated
		are proportional, including its	
		shape and dilation	
Identifying and con-	1	Identifying similar triangles, with	• identify which of a set of given
structing similar trian-		coordinate grids	triangles are similar with coordinate
gies			
	2	out coordinate grids	Identify which of a set of given tri-
			arids
	2	Constructing similar triangles by	• construct and label a similar trian-
	3	enlargement	ale to a given triangle and scaling
			constant by enlarging the triangle
			• construct and label a similar trian-
			gle to a given triangle and scaling
			constant by reducing the triangle
Understanding enlarge-	1	Understanding the importance of	• use enlargement transformations
ment in similarity		enlargement transformations in	to establish and explain similarity
similar triangles	1	for 2 triangles to be similar: if the	• establish and use the 4 tests for 2
similar thangles		3 sides of a triangle are propor-	of a triangle are proportional to the 3
		tional to the 3 sides of another	sides of another triangle, then the 2
		triangle, then the 2 triangles are	triangles are similar
		similar	
	2	Establishing and using the 4 tests	• establish and use the 4 tests for 2
		for 2 triangles to be similar: if	triangles to be similar: if 2 sides of
		2 sides of a triangle are propor-	a triangle are proportional to 2 sides
		ale, and the included angles are	angles are equal, then the 2 triangles
		equal, then the 2 triangles are	are similar
		similar	
	3	Establishing and using the 4 tests	• establish and use the 4 tests for 2
	Ū	for 4 triangles to be similar: if 4	triangles to be similar: if 2 angles of
		angles of a triangle are equal to	a triangle are equal to 2 angles of an-
		4 angles of another triangle, then	other triangle, then the 2 triangles are
			SITTICI
	А	Establishing and using the 4 tests	 establish and use the 4 tests
	4	for 2 triangles to be similar: if the	for 2 triangles to be similar: if the
		hypotenuse and a second side of	hypotenuse and a second side of
		a right-angled triangle are pro-	a right-angled triangle are propor-
		portional to the hypotenuse and	tional to the hypotenuse and a sec-
		angled trignale. then the 2 trian-	angle then the 2 triangles are similar
		gles are similar	

Learning Journey	Steps	Content	Details
Using scale factors to understand similar trian- gles	1	Using scale to analyse similar tri- angles	• find the missing side on a triangle given its similar figure and scale factor
			• find the missing angle on a triangle given its similar figure and scale factor
Using scale factors to find missing sides & an- gles	1	Finding the missing side on a shape given its similar figure and scale factor	• find the missing side on a shape given its similar figure and scale fac- tor
	2	Finding the missing angle on a shape given its similar figure and scale factor	• find the missing angle on a shape given its similar figure and scale fac- tor
Applying scale factors	1	Applying the scale factor to find unknown lengths in similar fig- ures in a variety of practical situ- ations	• apply the scale factor to find un- known lengths in similar figures in a variety of practical situations
	2	Calculating the scale factor be- tween an object and its image and vice versa involving similar 2D shapes	• calculate the scale factor between an object and its image and vice versa involving similar 2D shapes
	3	Calculating the scale factor be- tween an object and its image and vice versa involving similar figures in a variety of practical sit- uations	• calculate the scale factor between an object and its image and vice versa involving similar figures in a va- riety of practical situations
	4	Using scales on maps and dia- grams to solve practical problems	• use scales on maps and diagrams to solve practical problems
	5	Constructing scale drawings given an object and the scale factor	• construct scale drawings given an object and the scale factor
Area and volume scale factors	1	Establishing the relationship be- tween linear and area scale fac- tors (ratio)	• compare the areas of similar shapes, where the original shape has been enlarged by a given scale factor
			• understand and use the connection between the linear scale factor and the area scale factor to calculate the area of the enlarged shape, given the area of the original shape and the scale factor
			• understand and use the connection between the linear scale factor and the area scale factor to calculate the length of a missing side when the area and the related side length are known
	2	Solving problems in similar fig- ures using area ratios	• solve problems in similar figures us- ing the knowledge of the ratio of cor- responding sides and their areas
	3	Establishing the relationship be- tween linear and volume scale factors (ratio)	• compare the volumes of similar shapes, where the original shape has been enlarged by a given scale factor

Learning Journey	Steps	Content	Details
			• understand and use the connec- tion between the linear scale factor and the volume scale factor to cal- culate the volume of the enlarged shape, given the volume of the origi- nal shape and the scale factor
			• understand and use the connection between the linear scale factor and the volume scale factor to calculate the length of a missing side when the volume and the related side length are known
	4	Solving problems in similar fig- ures using volume ratios	• solve problems in similar figures us- ing the knowledge of the ratio of cor- responding sides and their volumes

Pythagoras' theorem			
		Triangles with right angles	
Learning Journey	Steps	Content	Details
Identifying sides of trian- gles with right angles	1	Identifying the hypotenuse as the longest side in any right-angled triangle and also as the side op- posite the right angle	• identify the hypotenuse as the longest side in any right-angled tri- angle and also as the side opposite the right angle
	2	Identifying and labelling sides of a right-angled triangle without any angle measures given	• identify and label the hypotenuse and the 2 shorter sides of a right- angled triangle
			• label the hypotenuse c and the shorter sides a and b in a right- angled triangle
			• label the hypotenuse c and the shorter sides a and b in a right- angled triangle within a given con- text
		Pythagoras' Theorem	
Finding a shorter side using Pythagoras' theo- rem	1	Finding the length of an unknown side (shorter sides only) using Pythagoras' theorem	• find the length of an unknown side (shorter sides only) using Pythago- ras' theorem
	2	Finding the length of an unknown side (shorter sides only) using Pythagoras' theorem rounding answers	• find the length of an unknown side (shorter sides only) using Pythago- ras' theorem rounding answers
	3	Finding the length of an unknown side (shorter sides only) using Pythagoras' theorem in a vari- ety of practical problems within a given context with and without diagrams given	• find the length of an unknown side (shorter sides only) using Pythago- ras' theorem in a variety of practical problems within a given context with and without diagrams given
Finding the hypotenuse using Pythagoras' theo- rem	1	Finding the length of an un- known side (hypotenuse only) us- ing Pythagoras' theorem	• find the length of an unknown side (hypotenuse only) using Pythagoras' theorem

Learning Journey	Steps	Content	Details
	2	Finding the length of an un- known side (hypotenuse only) us- ing Pythagoras' theorem round- ing answers	• find the length of an unknown side (hypotenuse only) using Pythagoras' theorem rounding answers
	3	Finding the length of an un- known side (hypotenuse only) us- ing Pythagoras' theorem in a va- riety of practical problems within a given context with and without diagrams given	• find the length of an unknown side (hypotenuse only) using Pythagoras' theorem in a variety of practical prob- lems within a given context with and without diagrams given
Solving problems involv- ing Pythagoras' theorem	1	Finding the length of an un- known side (shorter side and hy- potenuse) using Pythagoras' the- orem	• find the length of an unknown side (shorter side and hypotenuse) using Pythagoras' theorem
	2	Finding the length of an un- known side (shorter side and hy- potenuse) using Pythagoras' the- orem rounding answers	• find the length of an unknown side (shorter side and hypotenuse) using Pythagoras' theorem rounding an- swers
	3	Finding the length of an un- known side (shorter side and hy- potenuse) using Pythagoras' the- orem in a variety of practical problems within a given context with and without diagrams given	• find the length of an unknown side (shorter side and hypotenuse) us- ing Pythagoras' theorem in a variety of practical problems within a given context with and without diagrams given
	4	4 Solving a variety of practical problems involving Pythagoras' theorem within given contexts involving finding missing sides and calculating perimeters with and without diagrams given	• solve a variety of practical problems within given contexts involving find- ing missing sides
			• solve a variety of practical problems within given contexts involving cal- culating perimeters
			• solve a variety of practical problems within given contexts including when sides have different units
	5	Solving a variety of problems involving unknown lengths in two-dimensional shapes that contain right-angled triangles within them	• solve a variety of problems in- volving unknown lengths in two- dimensional shapes that contain right-angled triangles within them
Exploring Pythagorean triads	1	Identifying a Pythagorean triad as a set of 3 numbers that satisfy Pythagoras' theorem	 identify a Pythagorean triad as a set of 3 numbers that satisfy Pythagoras' theorem
			 establish new Pythagorean triads by starting with another
Using the converse of Pythagoras' theorem	1	Using the converse of Pythago- ras' theorem to solve problems	• use the converse of Pythagoras' theorem to establish whether a trian- gle is a right-angled triangle
			• use the converse of Pythagoras' theorem to establish whether a tri- angle is a right-angled triangle for a practical problem within a given con- text

Learning Journey	Steps	Content	Details
Solving Pythagoras' the- orem problems: Exact values	1	Finding the length of an unknown side (shorter sides only) using Pythagoras' theorem leaving an- swers in surd form (exact form)	• find the length of an unknown side (shorter sides only) using Pythago- ras' theorem leaving answers in surd form (exact form)
	2	Finding the length of an un- known side (hypotenuse only) us- ing Pythagoras' theorem leaving answers in surd form (exact form)	• find the length of an unknown side (hypotenuse only) using Pythago- ras' theorem leaving answers in surd form (exact form)
	3	Finding the length of an un- known side (shorter side and hy- potenuse) using Pythagoras' the- orem leaving answers in surd form (exact form)	• find the length of an unknown side (shorter side and hypotenuse) us- ing Pythagoras' theorem leaving an- swers in surd form (exact form)
	4	Finding the length of an un- known side (shorter side and hy- potenuse) using Pythagoras' the- orem in a variety of practical problems within a given context with and without diagrams given, with answers given in surd form	• find the length of an unknown side (shorter side and hypotenuse) us- ing Pythagoras' theorem in a variety of practical problems within a given context with and without diagrams given, with answers given in surd form

Trigonometry			
		Trigonometry	
Learning Journey	Steps	Content	Details
Adding labels to trian- gles with right angles	1	Identifying and labelling parts of a right-angled triangle with refer- ence to a given angle	• identify the location of the opposite, adjacent and hypotenuse in right- angled triangles of different orienta- tion
	2	Labelling and assigning sides and their corresponding angles in tri- angles	• label sides in relation to angles in any triangle, eg side c is opposite an- gle C
Establishing trigono- metric relationships	1	Establishing the sine trigonomet- ric relationship on right-angled triangles	• establish the relationship of the op- posite side to the hypotenuse with re- spect to a given angle as the sine of that angle
	2	Establishing the cosine trigono- metric relationship on right- angled triangles	• establish the relationship of the ad- jacent side to the hypotenuse with re- spect to a given angle as the cosine of that angle.
	3	Establishing the tangent trigono- metric relationship on right- angled triangles	• establish the relationship of the op- posite side to the adjacent with re- spect to a given angle as the tangent of that angle
Determining trigono- metric ratios	1	Determining which 2 sides each trigonometric ratio applies with reference to a given angle	• determine which 2 sides of a right- angled triangle each trigonometric ratio applies to
			• select correct trigonometric ratio on triangles of different orientation

Learning Journey	Steps	Content	Details
	2	Attaining the 3 primary trigono- metric ratios on simple right- angled triangles with respect to a given angle	• attain the sine ratio in a right- angled triangle of different orienta- tions with respect to each acute an- gle in the triangle. Sides are either values or pronumerals
			• attain the cosine ratio in a right- angled triangle of different orienta- tions with respect to each acute an- gle in the triangle. Sides are either values or pronumerals
			• attain the tangent ratio in a right- angled triangle of different orienta- tions with respect to each acute an- gle in the triangle. Sides are either values or pronumerals
	3	Identifying which trigonometric ratio to use given 2 sides and an angle in a right-angled triangle	• identify that the sine ratio is rel- evant when given the opposite and hypotenuse sides with respect to a given angle
			• identify that the cosine ratio is rel- evant when given the adjacent and hypotenuse sides with respect to a given angle
			• identify that the tangent ratio is rel- evant when given the opposite and adjacent sides with respect to a given angle
Calculating trigonomet- ric ratios and angles	1	Calculating the approximation of trigonometric ratios for a given angle measured in degrees using the calculator	• calculate the approximate value of the sine ratio for a given angle measured in whole degrees on right- angled triangles with different ori- entation using the calculator, eg sin 30°=0.5
			• calculate the approximate value of the cosine ratio for a given angle measured in whole degrees on right- angled triangles with different orien- tation using the calculator, eg cos 60°=0.5
			• calculate the approximate value of the tangent ratio for a given angle measured in whole degrees on right- angled triangles with different orien- tation using the calculator, eg tan 45°=1
	2	Using a calculator to find an an- gle correct to the nearest degree, given one of the trigonometric ra- tios for the angle	• use a calculator to find an angle correct to the nearest degree, given one of the trigonometric ratios for the angle
Finding the missing side using trig ratios	1	Using trigonometric ratios to find the length of the missing numer- ator side on a right-angled trian- gles	• use the tangent ratio to calculate the length of the 'opposite' side given the respective angle and adjacent side in a right-angled triangle

Learning Journey	Steps	Content	Details
			• use the sine ratio to calculate the length of the 'opposite' side given the respective angle and hypotenuse in a right-angled triangle
			• use the cosine ratio to calculate the length of the 'adjacent' side given the respective angle and hypotenuse in a right-angled triangle
	2	Selecting the correct ratio in order to calculate the missing numera- tor side given an angle in a right- angled triangle with different ori- entations	• select the correct ratio in order to calculate the missing numerator side given an angle in a right-angled tri- angle with different orientations
	3	Using trigonometric ratios to find the length of the missing denomi- nator side on a right-angled trian- gles	• use the tangent ratio to calculate the length of the 'adjacent' side given the respective angle and opposite side in a right-angled triangle
			• use the sine ratio to calculate the length of the 'hypotenuse' side given the respective angle and opposite side in a right-angled triangle
			• use the cosine ratio to calculate the length of the 'hypotenuse' side given the respective angle and adja- cent side in a right-angled triangle
	4	Selecting the correct ratio in order to calculate any miss- ing denominator given an angle in a right-angled triangle with different orientations	 select the correct ratio in order to calculate any miss- ing denominator given an angle in a right-angled triangle with differ- ent orientations
	5	Solving more complex problems involving finding the missing side on a right-angled triangle	• solve a range of more complex right-angled triangle problems that involve finding the missing side given 1 angle with diagrams included
			• solve a range of more complex worded right-angled triangle prob- lems that involve finding the missing side given 1 angle without diagrams included
			• solve a range of more complex problems involving 1 or more than 1 right-angled triangle where side lengths needs to be found. Include examples in context using metric
			units, eg shadows, reflections, scale models, surveying, navigation, inac- cessible objects around the school (using a clinometer)
Finding the missing an- gle using trig ratios	1	Introducing inverse trigonomet- ric ratios as undoing the original function of the trigonometric ratio	• use inverse trigonometric functions to find an angle, given the ratio eg if sin C = $\frac{1}{2}$, find the size of angle C C = sin ⁻¹ ($\frac{1}{2}$) C = 30°

Learning Journey	Steps	Content	Details
	2	Using trigonometric ratios to find the size of a missing angle on a right-angled triangle	• use the inverse tangent ratio to find the size of a missing angle given the respective opposite and adjacent sides in right-angled triangles of dif- ferent orientations
			• use the inverse sine ratio to find the size of a missing angle given the re- spective opposite and adjacent sides in right-angled triangles of different orientations
			• use the inverse cosine ratio to find the size of a missing angle given the respective opposite and adjacent sides in right-angled triangles of dif- ferent orientations
	3	Selecting the correct inverse ratio in order to calculate any missing angle given 2 or more sides in a right-angled triangle with differ- ent orientations	• select the correct inverse ratio in order to calculate any missing an- gle given 2 or more sides in a right- angled triangle with different orien- tations
	4	Solving more complex problems involving finding the missing an- gle on a right-angled triangle	• solve a range of more complex right-angled triangle problems that involve finding the missing angle with diagrams included
			• solve a range of more complex worded right-angled triangle prob- lems that involve finding the missing angle without diagrams included
			• solve a range of more complex problems involving 1 or more than 1 right-angled triangle where angle needs to be found. Include exam- ples in context using metric units, eg shadows, reflections, scale mod- els, surveying, navigation, inaccessi- ble objects around the school (using a clinometer)
Angles of elevation and depression	1	Introducing angles of elevation and depression	• introduce and define angles of ele- vation and depression
			 identify angles of elevation and de- pression on diagrams
			• interpret, condtruct and label dia- grams involving angles of depression and elevation
	2	Solving problems involving an- gles of elevation and depression	 connect the alternate angles formed when parallel lines are cut by a transversal with angles of elevation and depression
			 solve problems involving angles of elevation and depression with and without diagrams provided
Solving 2D and 3D prob- lems using trig ratios	1	Solving various right-angled tri- angle problems involving two- dimensional problems	• represent word problems with a sketch with all important details

Learning Journey	Steps	Content	Details
			• solve various two-dimensional problems involving right-angled tri- angles of different orientation, with or without a diagram. Sides and/or angles
	2	Solving various right-angled tri- angle problems involving three- dimensional problems	• use the trigonometric ratios to calculate the lengths of edges and diagonals in rectangular prisms. Pythagoras can also be used in this context. Solve problems when the diagram is provided
			• solve various authentic three- dimensional problems involving right-angled triangles of differ- ent orientation, with or without a diagram

4 Chance and probability

Chance			
	Charac	Chance experiments	Datalla
Learning Journey	Steps	Content	Details
The fundamental count- ing principle	1	Understanding the fundamental counting principle	• understand the fundamental count- ing principle
	2	Solving problems involving the fundamental counting principle	• solve problems involving the funda- mental counting principle
Two-step chance exper- iments with replacement	1	Listing all outcomes for 2- step chance experiments, with replacement and assign proba- bilities to outcomes	• list all outcomes for 2-step chance experiments, with replacement and assign probabilities to outcomes
	2	Determining probabilities for events for 2-step chance experi- ments with replacement	• determine probabilities for events for 2-step chance experiments with replacement
	3	Calculating probabilities of sim- ple and compound events in 2- step chance experiments, with re- placement	• calculate probabilities of simple and compound events in 2-step chance experiments, with replacement
Two-step chance exper- iments without replace- ment	1	Listing all outcomes for 2-step chance experiments, without re- placement and assign probabili- ties to outcomes	• list all outcomes for 2-step chance experiments, without replacement and assign probabilities to outcomes
	2	Determining probabilities for events for 2-step chance experi- ments without replacement	• determine probabilities for events for 2-step chance experiments with- out replacement
	3	Calculating probabilities of simple and compound events in 2-step chance experiments without re- placement	• calculate probabilities of simple and compound events in 2-step chance experiments without replacement
		Relative frequency	
Calculating and using relative frequency	1	Predicting future relative out- comes using relative frequency	• predict future relative outcomes us- ing relative frequency
	2	Calculating probabilities of events, including events involving 'and', 'or' and 'not', from data contained in Venn diagrams rep- resenting 2 or 3 attributes	 calculate probabilities of events, including events involving 'and', 'or' and 'not', from data contained in Venn diagrams representing two or three attributes
	3	Calculating probabilities of events, including events involving 'and', 'or' and 'not', from data contained in two-way tables	 calculate probabilities of events, including events involving 'and', 'or' and 'not', from data contained in two-way tables
Using data to make pre- dictions about popula- tions	1	Making predictions from a sample that may apply to the whole pop- ulation	• make predictions from a sample that may apply to the whole popula- tion
			• consider the size of the sample when making predictions about the population

Learning Journey	Steps	Content	Details
	2	Investigating the appropri- ateness of sampling methods and sample size used in re- ports where statements about a population are based on a sample	• investigate the appropriateness of sampling methods and sample size used in reports where statements about a population are based on a sample

5 Data

Data				
		Collecting data	Detelle	
Learning Journey	Steps	Content	Details	
Collecting everyday data	1	Identifying everyday questions and issues involving at least 1 numerical and at least 1 categorical-variable	• identify everyday questions and issues involving at least 1 numer- ical and at least 1 categorical- variable	
	2	Investigating relevant issues in- volving at least 1 numerical and at least 1 categorical variable us- ing information gained from sec- ondary sources	• investigate relevant issues involv- ing at least 1 numerical and at least 1 categorical variable using informa- tion gained from secondary sources	
		Displaying data		
Constructing and inter- preting data displays	1	Constructing frequency his- tograms and polygons from a frequency distribution table	• construct frequency histograms and polygons from a frequency dis- tribution table	
	2	Constructing back-to-back stem- and-leaf plots to display and compare 2 like sets of numerical-	• construct back-to-back stem-and- leaf plots to display and compare 2 like sets of numerical-data	
		data	• construct back-to-back stem-and- leaf plots with decimal values to display and compare 2 like sets of numerical-data	
	3	Describing the shape of distri- butions of data using the terms 'positively skewed', 'negatively skewed', 'symmetric' or 'bi-modal'	• describe the shape of distributions of data using the terms 'positively skewed', 'negatively skewed', 'sym- metric' or 'bi-modal'	
	4	Describing the shape of data displayed in stem-and-leaf plots, dot plots and histograms	• describe the shape of data dis- played in stem-and-leaf plots, dot plots and histograms	
Comparing data dis- plays	1	Calculating and comparing means, medians and ranges of 2 sets of numerical data displayed in back-to-back stem-and-leaf	• calculate and compare means, me- dians and ranges of 2 sets of numer- ical data displayed in back-to-back stem-and-leaf plots	
		plots	• make comparisons between 2 like sets of data by referring to the mean, median and/or range for data dis- played in back-to-back stem-and- leaf plots	
	2	Calculating and comparing means, medians and ranges of 2 sets of numerical data displayed in parallel dot plots	• calculate and compare means, me- dians and ranges of 2 sets of nu- merical data displayed in parallel dot plots	
			• make comparisons between 2 like sets of data by referring to the mean, median and/or range for data dis- played in parallel dot plots	

Learning Journey	Steps	Content	Details
	3	Calculating and comparing means, medians and ranges of 2 sets of numerical data displayed in histograms	• calculate and compare means, me- dians and ranges of 2 sets of numer- ical data displayed in histograms
			• make comparisons between 2 like sets of data by referring to the mean, median and/or range for data dis- played in histograms

Part II Level 10

6 Number and Algebra

Algebra			
		Factorising (Factoring)	
Learning Journey	Steps	Content	Details
Factorising (Factoring)	1	Factorising algebraic expressions by identifying only algebraic fac- tors	• factorise algebraic expressions by finding a common algebraic factor and bringing it out the front of the brackets with its product inside the brackets
Factorising (factoring) using difference of 2 sq	1	Factorising monic quadratic ex- pressions involving the difference of 2 squares	• factorise monic quadratic expres- sions involving the difference of 2 squares
	2	Factorising non-monic quadratic expressions involving the differ- ence of 2 squares	• factorise non-monic quadratic ex- pressions involving the difference of 2 squares
	3	Factorising non-monic quadratic expressions involving the differ- ence of 2 squares where a HCF needs to be taken out first	• factorise non-monic quadratic ex- pressions involving the difference of 2 squares where a HCF needs to be taken out first
Factorising (factoring) using grouping	1	Factorising monic quadratic ex- pressions involving grouping in pairs with four-term expressions	• factorise monic quadratic expres- sions involving grouping in pairs with four-term expressions
	2	Factorising non-monic quadratic expressions involving grouping in pairs with four-term expressions	• factorise non-monic quadratic ex- pressions involving grouping in pairs with four-term expressions
	3	Factorising non-monic quadratic expressions involving grouping in pairs with four-term expressions where a HCF needs to be taken out first	• factorise non-monic quadratic ex- pressions involving grouping in pairs with four-term expressions where a HCF needs to be taken out first
Factorising (factoring) using perfect squares	1	Factorising monic quadratic expressions involving perfect squares	• factorise monic quadratic expres- sions involving perfect squares
	2	Factorising non-monic quadratic expressions involving perfect squares	• factorise non-monic quadratic ex- pressions involving perfect squares
	3	Factorising non-monic quadratic expressions involving perfect squares where a HCF needs to be taken out first	• factorise non-monic quadratic ex- pressions involving perfect squares where a HCF needs to be taken out first
Factorising (factoring) quadratic trinomials	1	Factorising monic quadratic ex- pressions involving quadratic tri- nomials	• factorise monic quadratic expres- sions involving quadratic trinomials

Learning Journey	Steps	Content	Details
	2	Factorising non-monic quadratic expressions involving quadratic trinomials	• factorise non-monic quadratic ex- pressions involving quadratic trino- mials
	3	Factorising non-monic quadratic expressions involving quadratic trinomials where a HCF needs to be taken out first	• factorise non-monic quadratic ex- pressions involving quadratic trino- mials where a HCF needs to be taken out first
Factorising (factoring) complex fractions	1	Factorising and simplifying ex- pressions where at least one en- tire quadratic expression sits in the numerator or denominator position of a fraction	• factorise and simplify expressions where at least one entire quadratic expression sits in the numerator or denominator and must be factorised first
	2	Factorising and simplifying ex- pressions where at least 1 entire quadratic expression sits in the numerator or denominator posi- tion of a fraction where a HCF needs to be taken out first	• factorise and simplify expressions where at least 1 entire quadratic ex- pression sits in the numerator or de- nominator and must be factorised first where a HCF needs to be taken out first
		Quadratic equations	
Solving quadratic equa- tions by factorisation	1	Solving non-monic quadratic equations of the form $ax^2 + bx + c = 0$ by factorisa- tion	• solve non-monic quadratic equa- tions of the form ax ² +bx+c=0 by fac- torisation
Solving quadratic equa- tions: Completing the square	1	Solving monic quadratic equa- tions of the form $ax^2 + bx + c = 0$ by completing the square	• solve monic quadratic equations of the form ax ² +bx+c=0 by completing the square
	2	Solving non-monic quadratic equations of the form $ax^2 + bx + c = 0$ by complet- ing the square	• solve non-monic quadratic equa- tions of the form ax ² +bx+c=0 by com- pleting the square
Solving quadratic equa- tions with quadratic for- mula	1	Solving monic quadratic equa- tions of the form $ax^2 + bx + c = 0$ by using the quadratic formula	• solve monic quadratic equations of the form ax ² +bx+c=0 by using the quadratic formula
	2	Solving non-monic quadratic equations of the form $ax^2 + bx + c = 0$ by using the quadratic formula	• solve non-monic quadratic equa- tions of the form ax ² +bx+c=0 by us- ing the quadratic formula
Solving a variety of quadratic equations	1	Solving a variety of monic quadratic equations	 solve a variety of monic quadratic equations
	2	Solving a variety of non-monic quadratic equations	 solve a variety of non-monic quadratic equations
	3	Checking solutions of a quadratic equation by substituting	 check solutions of a quadratic equation by substituting
The discriminant	2	Using the discriminant to iden- tify whether a given quadratic equation has real solutions and whether those solutions are unique or equal	• identify whether a given quadratic equation has real solutions, and if there are real solutions, whether they are or are not equal

Learning Journey	Steps	Content	Details
			• predict the number of distinct real solutions for a particular quadratic equation
Quadratic equations in context	1	Solving quadratic equations re- sulting from substitution into for- mulas	• solve quadratic equations resulting from substitution into formulas
	2	Solving real-life problems involv- ing quadratic equations within a given context	• solve real-life problems involving quadratic equations within a given context
	3	Creating quadratic equations to solve a variety of problems and check solutions	• create quadratic equations to solve a variety of problems and check so- lutions
	4	Explaining why one of the solu- tions to a quadratic equation gen- erated from a word problem may not be a possible solution to the problem	• explain why one of the solutions to a quadratic equation generated from a word problem may not be a possi- ble solution to the problem
		Polynomials	
Introducing polynomials	1	Understanding the definition of a polynomial to be an expression in the form $a_nx_n + a_{n-1}x_{n-1} + \dots a_1x_1 + a_0x_0$	 recognise a polynomial
	2	Understanding the definitions in- volved with polynomials	• understand the terms 'degree', 'leading term', 'leading coefficient', 'constant term' and 'monic polyno- mial'
	3	Stating the number of zeros that a polynomial of degree n can have	• state the number of zeros that a polynomial of degree n can have
	4	Performing operations with poly-	 add and subtract polynomials
		nomials	• multiply polynomials by linear expressions
Using the remainder and factor theorems	1	Using the remainder theorem to find the remainder when a poly- nomial is divided by the expres- sion (x-a)	• use the remainder theorem to find the remainder when a polynomial is divided by the expression (x-a)
	2	Using the remainder and factor theorems to determine whether (x-a) is a factor of a given polyno- mial	• use the remainder and factor theo- rems to determine whether (x-a) is a factor of a given polynomial
	3	Solving problems involving the factor and/or remainder theorems where an unknown variable must be found	• solve problems involving the factor and/or remainder theorems where an unknown variable must be found
Dividing polynomials	1	Dividing polynomials by linear expressions to find the quotient and remainder, expressing the polynomial as the product of the linear expression and another polynomial plus a remainder, ie $P(x)=(x-a)Q(x)+c$	• divide polynomials by linear expres- sions to find the quotient and remain- der, expressing the polynomial as the product of the linear expression and another polynomial plus a remainder, ie $P(x)=(x-a)Q(x)+c$

Learning Journey	Steps	Content	Details
Using theorems to factor and solve polynomials	1	Using the factor theorem to factorise particular polynomials completely	• use the factor theorem to factorise particular polynomials completely
	2	Using the factor theorem and long division to find all zeros of a sim- ple polynomial P(x) and then solve P(x)=0	• use the factor theorem and long division to find all zeros of a simple polynomial $P(x)$ and then solve $P(x)=0$ (degree ≤ 4)
Understanding key points of polynomial graphs	1	Connecting the roots of the equa- tion $P(x)=0$ to the x-intercepts, and the constant term to the y- intercept, of the graph of $y=P(x)$	• connect the roots of the equation $P(x)=0$ to the x-intercepts, and the constant term to the y-intercept, of the graph of $y=P(x)$
	2	Determining the importance of the sign of the leading term of a polynomial on the behaviour of the curve as $x\!\to\pm\infty$	\bullet explain the importance of the sign of the leading term of a polynomial on the behaviour of the curve as $x \to \pm \infty$
	3	Determining the effect of single, double and triple roots of a poly- nomial equation P(x)=0 on the shape of the graph of y=P(x)	• determine the effect of single, dou- ble and triple roots of a polynomial equation P(x)=0 on the shape of the graph of y=P(x)
Sketching polynomials	1	Using the leading term, the roots of the equation $P(x)=0$, and the x- and y-intercepts to sketch the graph of $y=P(x)$	• use the leading term, the roots of the equation $P(x)=0$, and the x- and y-intercepts to sketch the graph of $y=P(x)$
			 describe the key features of a poly- nomial
	2	Sketching the graph of a polyno- mial, given its key features includ- ing zeros	• sketch the graph of a polynomial, given its key features including zeros
	3	Sketching a polynomial curve given the polynomial of any de- gree in factored form	 sketch a polynomial curve given the polynomial of any degree in factored form
	4	Finding the polynomial in factored form given a sketch of its graph	• find the polynomial in factored form given a sketch of its graph
	5	Using the graph of y=P(x) to sketch y=-P(x), y=P(-x), y=P(x)+c, y=kP(x)	• use the graph of y=P(x) to sketch y=-P(x), y=P(-x), y=P(x)+c, y=kP(x)

Number theory			
		Surds (radicals)	
Learning Journey	Steps	Content	Details
Introducing surds (radi- cals)	1	Converting from surd form (with nth root) to index form	• write surds in index form for positive fractions with a numerator of 1
			• write surds in index form for posi- tive/negative fractions with a numer- ator of 1
			• write surds in index form for posi- tive proper fractions with numerator greater or equal to 1

Learning Journey	Steps	Content	Details
			• write surds in index form for pos- itive/negative proper fractions with numerator greater or equal to 1
			• write surds in index form for pos- itive/negative improper/vulgar frac- tions with numerator greater or equal to
Understanding surd (radicals) general rules	1	Understanding multiplication general formulae for surd rules	• understand multiplication general formulae for surd rules
	2	Understanding division general formulae for surd rules	• understand division general formu- lae for surd rules
Simplification and +/- of surds (radicals)	1	Simplifying a surd: the radicand being a whole number	• apply the method to simplify a sin- gle surd realising you need to look for a factor that is a perfect square
	2	Rewriting simplified surds	 return a simplified surd into a single surd (unsimplified form)
	3	Simplifying expressions in- volving surds in calculations: addition/subtraction where surd simplification is not necessary	• simplify surds in calculations: addi- tion/subtraction where surd simplifi- cation is not necessary
	4	Simplifying expressions in- volving surds in calculations: addition/subtraction where surd simplification is necessary	• simplify surds in calculations: addi- tion/subtraction where surd simplifi- cation is necessary
Multiplying and dividing surds (radicals)	1	Simplifying expressions involving surds in calculations: multiplica- tion where surd simplification is not necessary	 apply simplifying surds to simple surd multiplication examples
	2	Simplifying expressions involving surds in calculations: multiplica- tion where surd simplification is necessary	• apply simplifying expressions in- volving surds in calculations to sim- plify surd multiplication examples
	3	Simplifying surds in calculations: division	• apply simplifying surds n calcula- tions to simple division examples
	4	Simplifying expressions involving surds in calculations: division where the surds have coefficients	• apply the method used to simplify the division of surds with coefficients
	5	Combination of previous content	 Combination of previous details
Expanding brackets with surds (radicals)	1	Simplifying expressions involving surds in calculations: use of the distributive law required	• extend simplifying expressions in- volving surds in calculations to find solutions when examples have sin- gle brackets requiring expansion by a single value
			• extend simplifying expressions in- volving surds in calculations to find solutions when examples have sin- gle brackets requiring expansion by a surd
			• extend simplifying expressions in- volving surds in calculations to find solutions when examples have sin- gle brackets requiring expansion by a surd with a coefficient

Learning Journey	Steps	Content	Details
	2	Expanding and simplifying ex- pressions involving surds in cal- culations: binomial expansion re- quired	• extend expanding and simplifying expressions involving surds in calcu- lations to find solutions when exam- ples have 2 brackets requiring ex- pansion
			• extend expanding and simplifying expressions involving surds in calcu- lations to find solutions when exam- ples have 2 brackets requiring ex- pansion involving surds with coeffi- cients
	3	Expanding and simplifying ex- pressions involving surds in cal- culations: expanding a square re- quired	• expand and simplify surds in calcu- lations: expanding a square required
Making the denominator rational	1	Rationalising the denominator with a single surd	• rationalise the denominator with a single surd
	2	Rationalising the denominator of a surd which has a coefficient	• rationalise the denominator of a surd which has a coefficient
	3	Rationalising more complex de- nominators using conjugate surds	• apply rationalising a denominator using conjugate surds to examples
Solving problems involv- ing surds (radicals)	1	Applying surds to problems within context: trigonometry	• calculate the exact value of a trigonometric ratio in a right-angled triangle, given the lengths of 2 sides
	2	Solving problems using surds	 solve problems involving surds, with and without a calculator

Functions and graphs				
	Functions			
Learning Journey	Steps	Content	Details	
Identifying functions	1	Defining a function as a rule or relationship where for each input value there is only 1 output value, or that associates every member of 1 set with exactly 1 member of a second set	• define a function as a rule or rela- tionship where for each input value there is only one output value, or that associates every member of one set with exactly one member of a second set	
			 decide whether a given relationship is a function or a relation 	
	2	Using the vertical line test on a graph to decide whether it represents a function or a relation	• use the vertical line test on a graph to decide whether it represents a function or a relation	
		Parabolas		
Understanding key fea- tures of parabolas	1	Understanding the language and important features of parabolas	• understand the important features to be marked on a parabola; y- intercept, x-intercept(s)/roots, turning point(vertex)	
	2	Understanding that $y = ax^2 + bx + c$ is the gen- eral equation of a parabola and manipulate equations to be in this form	• manipulate equations to be in the form y=ax²+bx+c	

Learning Journey	Steps	Content	Details
Investigating parabola graphs	1	Investigating how the parabola with the equation y = ax ² changes as the value of a is changed using digital technology	• describe the features of the graph and how they change as the value of 'a' changes for both positive and neg- ative values of 'a'
			• understand that the sign of the co- efficient of x^2 (a) is what makes a parabola concave up or down. If a > 0 the parabola is concave up, If a < 0 the parabola is concave down
	2	Investigating how the parabola with the equation $y = ax^2 + k$ changes as the value of k is changed using digital technology	• describe the features of the graph and how they change as the value of k changes for both positive and neg- ative values of k
	3	Graphing parabolas in the form y = ax ² + k with different values of a and k	 graph parabolas in the form y = ax² + k with different values of a and k
	4	Investigating how the parabola with the equation $y = (x + a)^2$ changes as the value of a is changed using digital technology	• describe the features of the graph and how they change as the value of a changes for both positive and neg- ative values of a
	5	Investigating how the parabola with the equation $y=(x + a)2 + k$ changes as the value of k is changed using digital technology	• describe the features of the graph and how they change as the value of k changes for both positive and neg- ative values of k
Parabolas: Vertex and axis of symmetry	1	Determining the equation of the axis of symmetry of a parabola using the midpoint of the inter- val joining the points at which the parabola cuts the x-axis	• determine the equation of the axis of symmetry of a parabola using the midpoint of the interval joining the points at which the parabola cuts the x-axis
	2	Determining the equation of the axis of symmetry of a parabola using the formula x=-b/2a	• determine the equation of the axis of symmetry of a parabola using the formula x=-b/2a
	3	Finding the coordinates of the vertex of a parabola by using the midpoint of the interval joining the points at which the parabola cuts the x-axis and substituting to ob- tain the y-coordinate of the vertex	• find the coordinates of the ver- tex of a parabola by using the mid- point of the interval joining the points at which the parabola cuts the x- axis and substituting to obtain the y- coordinate of the vertex
	4	Finding the coordinates of the vertex of a parabola by using the formula for the axis of sym- metry to obtain the x-coordinate and substituting into the equation to obtain the y-coordinate of the vertex	• find the coordinates of the vertex of a parabola by using the formula for the axis of symmetry to obtain the x-coordinate and substituting to obtain the y-coordinate of the vertex
Finding x- and y- intercepts of parabolas	1	Finding y-intercept for the graph of y=ax ² +bx+c, given a, b and c by substituting in x=0	• find y-intercept for the graph of y=ax ² +bx+c, given a, b and c by substituting in x=0

Learning Journey	Steps	Content	Details
	2	Finding x-intercepts (roots or zeros) of a parabola, where relevant, for the graph of $y = ax^2 + bx + c$, given a, b and c by substituting in $y = 0$ and fractariation	• find x-intercepts (roots or zeros), where relevant, for the graph of y=ax ² +bx+c, given a, b and c by sub- stituting in y=0 and factorising for monic equations
		factorising	• find x-intercepts (roots or zeros), where relevant, for the graph of y=ax ² +bx+c, given a, b and c by sub- stituting in y=0 and factorising for non-monic equations
	3	Finding x-intercepts (roots or zeros) of a parabola, where relevant, for the graph of $y = ax^2 + bx + c$, given a, b and c by substituting in $y = 0$ and	• find x-intercepts (roots or zeros), where relevant, for the graph of y=ax ² +bx+c, given a, b and c by sub- stituting in y=0 and completing the square for monic equations
		completing the square	• find x-intercepts (roots or zeros), where relevant, for the graph of y=ax ² +bx+c, given a, b and c by sub- stituting in y=0 and completing the square for non-monic equations
	4	Finding x-intercepts (roots or zeros) of a parabola, where relevant, for the graph of $y = ax^2 + bx + c$, given a, b and c by substituting in $y = 0$ and using the quadratic formula	• find x-intercepts (roots or zeros), where relevant, for the graph of $y=ax^2+bx+c$, given a, b and c by substituting in y=0 and using the quadratic formula for monic equa- tions
			• find x-intercepts (roots or ze- ros), where relevant, for the graph of y=ax ² +bx+c, given a, b and c by substituting in y=0 and using the quadratic formula for non-monic equations
Graphing parabolas	1	Graphing a variety of parabolas where the equation is given in the form $y = ax^2 + bx + c$, for various values of a, b and c using a table of values	• graph a variety of parabolas where the equation is given in the form y=ax ² +bx+c, for various values of a, b and c using a table of values
	2	Graphing parabolas where the equation is given in the form $y = ax^2 + bx + c$, for various values of a, b and c by finding x-intercept(s) (using factorising), the y-intercept and the turning point (vertex)	• graph parabolas where the equa- tion is given in the form y=ax ² +bx+c, for various values of a, b and c by finding x-intercept(s) (using factoris- ing), the y-intercept and the turning point (vertex)
	3	Graphing parabolas where the equation is given in the form $y = ax^2 + bx + c$, for various val- ues of a, b and c by finding x- intercept(s) (using completing the square), the y-intercept and the turning point (vertex)	• graph parabolas where the equa- tion is given in the form y=ax ² +bx+c, for various values of a, b and c by finding x-intercept(s) (using complet- ing the square), the y-intercept and the turning point (vertex)

Learning Journey	Steps	Content	Details
	4	Graphing parabolas where the equation is given in the form $y = ax^2 + bx + c$, for various val- ues of a, b and c by finding x- intercept(s) (using the quadratic formula), the y-intercept and the turning point (vertex)	• graph parabolas where the equa- tion is given in the form y=ax ² +bx+c, for various values of a, b and c by finding x-intercept(s) (using the quadratic formula), the y-intercept and the turning point (vertex)
Parabolas and their transformations	1	Describing, interpreting and sketching parabolas and their translations	• describe, interpret and sketch parabolas and their translations
	2	Describing, interpreting and sketching parabolas and their reflections	• describe, interpret and sketch parabolas and their reflections
	3	Describing, interpreting and sketching parabolas and their rotations	 describe, interpret and sketch parabolas and their rotations
	4	Describing, interpreting and sketching parabolas and their dilations	 describe, interpret and sketch parabolas and their dilations
		Exponentials	
Exponential functions and their transforma- tions	1	Describing, interpreting and sketching exponential functions and their translations	• describe, interpret and sketch exponential functions and their translations
	2	Describing, interpreting and sketching exponential functions and their reflections	• describe, interpret and sketch expo- nential functions and their reflections
	3	Describing, interpreting and sketching exponential functions and their rotations	• describe, interpret and sketch expo- nential functions and their rotations
	4	Describing, interpreting and sketching exponential functions and their dilations	• describe, interpret and sketch expo- nential functions and their dilations
		Non-linear relationships	
Sketching non-linear graphs	1	Identifying and naming different types of graphs from their equa- tions	 identify and name different types of graphs from their equations
	2	Sketching any particular curve by using a table of values	• sketch any particular curve by using a table of values
	3	Sketching any particular curve by determining its features from its equation	• sketch any particular curve by de- termining its features from its equa- tion including x and y-intercepts, turning points (if applicable), asymp- totes (if applicable)
Determining equations of non-linear graphs	1	Identifying equations whose graph is symmetrical about the y-axis	• identify equations whose graph is symmetrical about the y-axis
	2	Determining a possible equation from a given graph and check us- ing digital technologies	• determine a possible equation from a given graph and check using digital technologies

Learning Journey	Steps	Content	Details
	3	Comparing and contrasting dif- ferent types of graphs and deter- mining possible equations from the key features	• compare and contrast different types of graphs and determine pos- sible equations from the key features

		Coordinate geometry	
	Charac	Parallel and perpendicular lines	
Learning Journey	Steps	Content	Details
Identifying parallel lines	1	Solving problems involving paral- lel lines	 understand the characteristics of 2 lines that make them parallel and that they have the same gradients determine whether 2 given lines are
			parallel
	2	Finding the equation of a line that is parallel to another given line us- ing y=mx+c	• find the equation of a line that is parallel to another given line using y=mx+c
Identifying perpendicu- lar lines	1	Solving problems involving per- pendicular lines	\bullet understand the characteristics of 2 lines that make them perpendicular: $m_1m_2\text{=-1}$ or m_1 = -1/m_2
			• determine whether 2 given lines are perpendicular
	2	Finding the equation of a line that is perpendicular to another given line using y=mx+c	• find the equation of a line that is perpendicular to another given line using y=mx+c
Equations of lines: par- allel & perpendicular lines	1	Finding the equation of a line that is parallel to another given line and going through a given point	• find the equation of a line that is parallel to another given line and goes through a given point
	2	Finding the equation of a line that is perpendicular to another given line and going through a given point	• find the equation of a line that is perpendicular to another given line and goes through a given point
	3	Finding the equation of a perpen- dicular bisector of a line interval	• find the equation of a perpendicular bisector of a line interval
Problems involving par- allel & perpendicular lines	1	Solving problems involving collinearity	• show that 3 given points are collinear
	2	Using coordinate geometry to in- vestigate and describe the prop- erties of triangles and quadrilat- erals	• use coordinate geometry to inves- tigate and describe the properties of triangles and quadrilaterals
	3	Showing that 4 specified points form the vertices of particular quadrilaterals	• show that 4 specified points form the vertices of particular quadrilaterals
	4	Proving that a particular triangle drawn on the Cartesian plane is right-angled	• prove that a particular triangle drawn on the Cartesian plane is right-angled

7 Measurement

Measurement – Surface area				
	Change	Surface area	Detaile	
Learning Journey	Steps	Content	Detalls	
pyramids & cones	1	mids (without Pythagoras' theo-	• find the surface area of pyramids (without Pythagoras' theorem)	
		rem)	 find the surface area of pyra- mids (without Pythagoras' theorem) within the context of a problem 	
	2	Finding the surface area: pyra- mids (with and without Pythago- ras' theorem)	• find the surface area of pyramids (with and without Pythagoras' theo- rem)	
			• find the surface area of pyramids (with and without Pythagoras' theo- rem) within the context of a problem	
	3	Finding the surface area: cones (without Pythagoras' theorem)	 find the surface area of cones (with- out Pythagoras' theorem) 	
			• find the surface area of cones (with- out Pythagoras' theorem) within the context of a problem	
	4	Finding the surface area: cones (with and without Pythagoras'	 find the surface area of cones (with and without Pythagoras' theorem) 	
		theorem)	• find the surface area of cones (with and without Pythagoras' theorem) within the context of a problem	
Finding surface area of	1	Finding the surface area: spheres	 find the surface area of spheres 	
spheres			• find the surface area of spheres within the context of a problem	
	2	Finding the surface area: parts of spheres	 find the surface area of parts of spheres 	
			• find the surface area of parts of spheres within the context of a prob- lem	
	3	Combination of previous content	 Combination of previous details 	
Finding dimensions of objects given surface area	1	Finding possible dimensions of three-dimensional shapes given the surface area	• find possible dimensions of three- dimensional shapes given the sur- face area	
			• find possible dimensions of three- dimensional shapes given the sur- face area within the context of a problem	
	2	Finding the missing dimension, given the other necessary dimen- sions and the surface area	• find the missing dimension, given the other necessary dimensions and the surface area	
			• find the missing dimension, given the other necessary dimensions and the surface area within the context of a problem	
		Surface area of composite solid	S	
Surface area of com- posite solids involving prisms	1	Finding the surface area: com- posite solids involving prisms	• find the surface area of compos- ite three-dimensional shapes involv- ing prisms	

Learning Journey	Steps	Content	Details
			• find the surface area of compos- ite three-dimensional shapes involv- ing prisms within the context of a problem
	2	Finding the surface area: com- posite solids involving cylinders	• find the surface area of compos- ite three-dimensional shapes involv- ing cylinders
			• find the surface area of compos- ite three-dimensional shapes involv- ing cylinders within the context of a problem
	3	Solving a variety of practical problems related to surface areas of prisms, cylinders and related composite solids	• solve a variety of practical prob- lems related to surface areas of prisms, cylinders and related com- posite solids
Surface area of compos- ite solids with pyramids	1	Finding the surface area: com- posite solids involving pyramids	• find the surface area of compos- ite three-dimensional shapes involv- ing pyramids
			• find the surface area of compos- ite three-dimensional shapes involv- ing pyramids within the context of a problem
	2	Finding the surface area: com- posite solids involving cones	• find the surface area of compos- ite three-dimensional shapes involv- ing cones
			• find the surface area of composite three-dimensional shapes involving cones within the context of a problem
	3	Finding the surface area: com- posite solids involving spheres and parts of spheres	• find the surface area of compos- ite three-dimensional shapes involv- ing spheres and parts of spheres
			• find the surface area of compos- ite three-dimensional shapes involv- ing spheres within the context of a problem
	4	Finding the surface area: com- posite solids involving the ad- dition of any three-dimensional shapes	• find the surface area of composite three-dimensional shapes involving the addition any three-dimensional shapes
			• find the surface area of compos- ite three-dimensional shapes involv- ing the addition of shapes within the context of a problem
	5	Finding the surface area: com- posite solids involving the sub- traction of any three-dimensional	 find the surface area of composite 3D shapes involving the subtraction of any 3D shapes
		snapes	• find the surface area of compos- ite 3D shapes involving the subtrac- tion of shapes within the context of a problem

Measurement – Volume			
Learning lourney	Steps	Volume of solids	Details
Volume of cones	1	Developing the formula for the volume of cones	 develop and use the formula to find the volumes of cones
	2	Solving a variety of practical problems involving the volume of cones	• solve a variety of practical problems involving the volume of cones
	3	Developing a formula to find the volume of pyramids	• develop and use the formula to find the volumes of pyramids
	4	Solving a variety of practical problems involving the volume of pyramids	• solve a variety of practical problems involving the volume of pyramids
	5	Combination of previous content	Combination of previous details
Volume of spheres	1	Developing the formula for the volume of a sphere	• develop and use the formula to find the volumes of spheres
	2	Solving a variety of practical problems involving the volume of spheres	• solve a variety of practical problems involving the volume of spheres in- cluding related problems such as half of spheres
	3	Finding dimensions of a sphere given its volume (metric units)	• find the dimensions of a sphere, given its volume, by substitution into a formula
			• find the dimensions of a sphere, given its volume, by substitution into a formula within the context of a problem
	4	Finding dimensions of part of a sphere given its volume (metric units)	• find the dimensions of a part of a sphere, given its volume, by substitu- tion into a formula
			• find the dimensions of a part of a sphere, given its volume, by substitu- tion into a formula within the context of a problem
	5	Combination of previous content	 Combination of previous details
		Volume of composite solids	
Finding the volume of composite solids	1	Finding the volumes of solids that have uniform cross-sections that are sectors, including semicircles and quadrants	• find the volumes of solids that have uniform cross-sections that are sec- tors, including semicircles and quad- rants
	2	Finding the volumes of composite solids involving prisms and cylin- ders, eg a cylinder on top of a rect- angular prism	 find the volumes of composite solids involving prisms and cylinders, eg a cylinder on top of a rectangular prism
			• dissect composite solids into 2 or more simpler solids to find their vol- umes
	3	Solving a variety of practical problems related to the volumes and capacities of prisms, cylin- ders and related composite solids	• solve a variety of practical problems related to the volumes and capacities of prisms, cylinders and related com- posite solids

Learning Journey	Steps	Content	Details
Calculating the volume of composite solids	1	Calculating the volume of com- posite solids without spheres and cones (metric units)	• dissect composite solids into 2 or more simpler solids, without spheres or cones
			• find the volumes of composite solids without spheres or cones
			• solve a variety of practical problems in context without spheres or cones
	2	Calculating the volume of com- posite solids with spheres and cones included (metric units)	• dissect composite solids into 2 or more simpler solids with spheres or cones
			• find the volumes of composite solids with spheres or cones
			• solve a variety of practical problems in context with spheres or cones
	3	Calculating the volume of com- posite solids (metric units) (Pythagoras' theorem neces- sary)	• dissect composite solids into 2 or more simpler solids (Pythagoras' the- orem necessary)
			• find the volumes of composite solids (Pythagoras' theorem necessary)
			• solve a variety of practical problems in context (Pythagoras' theorem necessary)
	4	Solving real-life problems involv- ing the calculations of composite solids	• solve real-life problems involving the calculations of composite solids

8 Geometry

Geometry – Circles			
	Charac	Circle terminology	Details
Circle terminology	Steps	Identifying and naming the pri-	• identify and name parts of a cir-
Circle terminology	1	mary parts of the circle	• identify and name parts of a cir- cle (centre, radius, diameter, circum- ference, sector, arc, tangents, semi- circle)
	2	Understanding the use of the terms 'major' and 'minor' within	 understand the terms 'major sector' and 'minor sector'
		the context of circles	 understand the terms 'major arc' and 'minor arc'
			 understand the terms 'major seg- ment' and 'minor segment'
	3	Identifying and naming further parts of the circle	 identify and name parts of a circle (chord, secant, segment)
	4	Using terminology associated with angles in circles	• use terminology associated with angles in circles
	5	Identifying the arc on which an angle at the centre or circumfer- ence stands	• identify the arc on which an angle at the centre or circumference stands
		Circle properties	
Circle properties: Tan- gents	1	Understanding and demonstrat- ing that at any point on a circle there is a unique tangent to the circle	• understand and demonstrate that at any point on a circle there is a unique tangent to the circle
	2	Understanding and demonstrat- ing that a tangent is perpendic- ular to the radius at the point of contact	• understand and demonstrate that a tangent is perpendicular to the radius at the point of contact
Circle properties: Equal radii	1	Applying the property that all radii on a circle are equal in length	• apply the property that all radii on a circle are equal in length including the implication that any triangle formed with 2 radii will be isosceles to solve problems
	2	Using the property that all radii on a circle are equal in length to find the length of a chord given the angle at the centre (angle in degrees)	• use the property that all radii on a circle are equal in length to find the length of a chord given the angle at the centre (angle in degrees)
	3	Using the property that all radii on a circle are equal in length to find the area of the isosceles triangle given the angle at the centre (an- gle in degrees)	• use the property that all radii on a circle are equal in length to find the area of the isosceles triangle given the angle at the centre (angle in de- grees)
	4	Using the property that all radii on a circle are equal in length to find the area of the minor seg- ment given the angle at the cen- tre (angle in degrees)	• use the property that all radii on a circle are equal in length to derive the formula for the area of the minor segment given the angle at the centre

Learning Journey	Steps	Content	Details
			• use the property that all radii on a circle are equal in length to find the area of the minor segment given the angle at the centre
	5	Using the area of the minor seg- ment, find the area of the major segment	• use the area of the minor segment find the area of the major segment
Circle properties: Chord properties	1	Proving and applying the prop- erty that chords of equal length in a circle subtend equal angles at the centre and are equidistant from the centre	• apply the property that chords of equal length in a circle are equidis- tant from the centre to solve prob- lems
	2	Proving and applying the prop- erty that a perpendicular from the centre of a circle to a chord bisects the chord and that conversely, the line from the centre of a circle to the midpoint of a chord is perpen- dicular to the chord	• apply the property that a perpen- dicular from the centre of a circle to a chord bisects the chord and that conversely, the line from the centre of a circle to the midpoint of a chord is perpendicular to the chord to solve problems
	3	Proving and applying the prop- erty that the perpendicular bisec- tor of a chord of a circle passes through the centre	• apply the property that the perpen- dicular bisector of a chord of a cir- cle passes through the centre to solve problems
	4	Proving and applying the prop- erty that given any 3 non- collinear points, the point of intersection of the perpendicular bisectors of any 2 sides of the triangle, formed by the 3 points, is the centre of the circle through all 3 points	• apply the property that given any 3 non-collinear points, the point of intersection of the perpendicular bi- sectors of any 2 sides of the triangle, formed by the 3 points, is the cen- tre of the circle through all 3 points to solve problems
	5	Proving and applying the prop- erty that when 2 circles intersect, the line joining their centres bi- sects their common chord at right angles	• apply the property that when 2 cir- cles intersect, the line joining their centres bisects their common chord at right angles to solve problems
Circle properties: Angle in a semicircle property	1	Proving and applying the prop- erty that the angle in a semicircle is a right angle	• apply the property that the angle in a semicircle is a right angle to solve problems involving the value of un- known angles
	2	Applying the property that the angle in a semicircle is a right angle involving Pythagoras' theo- rem	• apply the property that the angle in a semicircle is a right angle involving Pythagoras' theorem to find an un- known diameter length (Pythagoras' theorem finding the hypotenuse)
			• apply the property that the angle in a semicircle is a right angle involv- ing Pythagoras' theorem to find an unknown chord length (Pythagoras' theorem finding a shorter side)
	3	Applying the property that the angle in a semicircle is a right an- gle involving trigonometric ratios	• apply the property that the angle in a semicircle is a right angle involv- ing trigonometric ratios to find an un- known diameter length

Learning Journey	Steps	Content	Details
			• apply the property that the angle in a semicircle is a right angle involv- ing trigonometric ratios to find an un- known chord length
			• apply the property that the angle in a semicircle is a right angle involv- ing trigonometric ratios to find an un- known angle
	4	Applying the property that the angle in a semicircle is a right an- gle to find the area of a triangle	• apply the property that the angle in a semicircle is a right angle to find the area of a triangle
	5	Applying the property that the angle in a semicircle is a right an- gle to find the area of a triangle in order to find the area of the seg-	• apply the property that the angle in a semicircle is a right angle to find the area of a triangle in order to find the area of the minor segment
		ment	• apply the property that the angle in a semicircle is a right angle to find the area of a triangle in order to find the area of the minor segment in order to find the major segment
Circle properties: Angle properties	1	Proving and applying the prop- erty that the angle at the centre of a circle is twice the angle at the circumference standing on the same arc	• apply the property that the angle at the centre of a circle is twice the angle at the circumference standing on the same arc to solve problems
	2	Proving and applying the prop- erty that angles at the circumfer- ence, standing on the same arc,	• apply the property that angles at the circumference, standing on the same arc, are equal to solve problems
	3	PF&AAU and applying the prop- erty that the opposite angles of cyclic quadrilaterals are supple- mentary	• apply the property that the oppo- site angles of cyclic quadrilaterals are supplementary to solve problems
	4	Proving and applying the prop- erty that an exterior angle at a vertex of a cyclic quadrilateral is equal to the interior opposite an- gle	• apply the property that an exterior angle at a vertex of a cyclic quadrilat- eral is equal to the interior opposite angle to solve problems
	5	Combination of previous content	Combination of previous details
Circle properties: Solve problems using proper- ties	1	Applying chord properties of circles to find unknown angles, lengths and areas in diagrams	• apply chord properties of circles to find unknown angles, lengths and areas in diagrams
	2	Applying angle properties of circles to find unknown angles, lengths and areas in diagrams	• apply angle properties of circles to find unknown angles, lengths and areas in diagrams
	3	Combination of previous content	Combination of previous details

Geometry - Reasoning					
	Geometric reasoning to solve problems				
Learning Journey	Steps	Content	Details		
Solving problems using geometric reasoning	1	Proving and applying theorems to triangles	• prove and apply that the exterior angle of a triangle is equal to the sum of the 2 interior opposite angles		
	2	Solving problems involving simi- larity ratios and areas and vol- umes	 solve problems involving similarity ratios and areas and volumes 		
	3	Applying theorems and prop- erties related to triangles and quadrilaterals in order to solve problems, giving reasons for each step	• apply theorems and properties re- lated to triangles and quadrilaterals in order to solve problems, giving rea- sons for each step. Find both missing angles and/or missing sides.		
	4	Applying tests for quadrilaterals	• apply tests for quadrilaterals		

Trigonometry				
Bearings				
Learning Journey	Steps	Content	Details	
True bearings	1	Introducing true bearings	 introduce true bearings including using degrees, eg 045° 	
			 convert between true bearings and compass bearings 	
	2	Constructing diagrams of given information (true bearings)	 construct accurate scale diagrams of given information (true bearings) 	
			• represent problems involving true bearings in diagrammatic form in or- der to assist solving problems	
	3	Solving problems involving true bearings using Pythagoras' theo- rem	 solve problems involving true bear- ings using Pythagoras' theorem with and without diagrams 	
			• solve a variety of practical prob- lems involving true bearings using Pythagoras' theorem within a given context	
	4	Solving problems involving true bearings using trigonometric ra- tios	• solve problems involving true bear- ings using trigonometric ratios with and without diagrams	
			• solve a variety of practical problems involving true bearings using trigono- metric ratios within a given context	
	5	Solving problems involving true bearings	• solve problems involving true bear- ings with and without diagrams	
			• solve a variety of practical problems involving true bearings within a given context	
		Triangles with no right angles		
Using the sine rule	1	Applying the sine rule	 identify relevant information on a triangle for input into the sine rule 	
	2	Finding an unknown side using the sine rule	• apply the sine rule as a formula isolating the lower case pronumeral (side length)	

Learning Journey	Steps	Content	Details
			• find the missing side on a trian- gle using the sine rule given its corre- sponding angle and another side and angle that are corresponding
	3	Finding an unknown angle using the sine rule	• apply the sine rule as a formula isolating the upper case pronumeral (angle)
			• find the missing angle on a trian- gle using the sine rule given its corre- sponding side and another side and angle that are corresponding. In- clude the ambiguous case
	4	Solving problems using the sine rule	• solve problems in context using the sine rule
Using the cosine rule	1	Applying the cosine rule	 apply the cosine rule as a formula isolating the lower case pronumeral (side length)
			 apply the cosine rule as a formula isolating the upper case pronumeral (angle)
			• rearrange cosine rule to make dif- ferent pronumerals the subject
	2	Using the cosine rule to find a missing side	• find the missing side on a triangle using the cosine rule given its corre- sponding angle and the other 2 sides
	3	Using the cosine rule to find a missing angle	• find the missing angle on a triangle using the cosine rule given the 3 sides of the triangle
	4	Solving problems using the cosine rule	• solve problems in context using the cosine rule in order to extend the knowledge of the cosine rule
Using the area rule	1	Applying the area of a triangle rule	• apply the area of a triangle rule as a formula isolating the lower case pronumeral (side length)
			• apply the area of a triangle rule as a formula isolating the upper case pronumeral (angle)
			• rearrange the area of a triangle rule to make different pronumerals the subject
	2	Using the area of a triangle rule to find the area of a triangle	• find the area of a triangle using the area of a triangle rule given 2 sides and the included angle
	3	Using the area of a triangle rule to find a missing side	• find the missing side on a triangle using the area of a triangle rule given the other 3 variables
	4	Using the area of a triangle rule to find a missing angle	• find the missing angle in a triangle using the area of a triangle rule given the other 3 variables
	5	Using the area of a triangle rule to solve problems	• solve problems in context using the area of a triangle rule in order to ex- tend the knowledge of the area of a triangle rule

Learning Journey	Steps	Content	Details
		Solve problems using trigonomet	ry
Solving problems in tri- angles without right an- gles	1	Solving a variety of two- dimensional problems involving the sine, cosine and area of a triangle rules of different orienta- tion	• solve a variety of two-dimensional problems involving the sine, cosine and area of a triangle rules of differ- ent orientation
	2	Solving a variety of three- dimensional problems involving the sine, cosine and area of a triangle rules of different orienta- tion	• solve a variety of three-dimensional problems involving the sine, cosine and area of a triangle rules of differ- ent orientation
		Trigonometric Identities and ratio	os
Using trigonometric identities	1	Deriving and using the trigono- metric identitiy $tan\theta = sin\theta/cos\theta$ using the unit circle (using θ)	• use the trigonometric identity that the tangent ratio is expressed as $tan\theta = sin\theta/cos\theta$ using the unit circle
	2	DerivingandusingthePythagoreanidentity $sin2\theta+cos2\theta = 1$ (using θ)	• use the Pythagorean identity $\sin 2\theta + \cos 2\theta = 1$
Investigating trigono- metric ratios	1	Investigating the sine, cosine, tangent ratios for (at least) $0^{\circ} \le \theta \le 360^{\circ}$ using the unit circle and dynamic mathematical software (using θ)	 communicate how the value of each trigonometric ratio changes as θ travels from 0° to 360° find the value of each trigonometric ratio for angles of any magnitude using the calculator and confirming with the aid of the unit circle
	2	Comparing the features of trigonometric curves, including periodicity and symmetry	• compare the features of trigono- metric curves, including periodicity and symmetry
	3	Sketching the sine, cosine, tan- gent ratios for (at least) $0^{\circ} \le \theta$ $\le 360^{\circ}$	• sketch the sine, cosine, tangent ratios for (at least) $0^{\circ} \le \theta \le 360^{\circ}$
		Angles of any magnitude	
Angles of any magni- tude	1	Investigating graphs of the sine, cosine and tangent functions for angles of any magnitude, includ- ing negative angles	• investigate graphs of the sine, co- sine and tangent functions for angles of any magnitude, including negative angles
	2	Using the unit circle or graphs of trigonometric functions to es- tablish and use the following relationships for obtuse angles, where $0^{\circ} \le A \le 90^{\circ}$: sinA = sin (180° – A)	• use the unit circle or graphs of trigonometric functions to establish and use the following relationships for obtuse angles, where $0^{\circ} \le A \le 90^{\circ}$: sinA = sin (180° – A)
	3	Using the unit circle or graphs of trigonometric functions to establish and use the follow- ing relationships for obtuse angles, where $0^{\circ} \le A \le 90^{\circ}$: $\cos A = -\cos(180^{\circ} - A)$	• use the unit circle or graphs of trigonometric functions to establish and use the following relationships for obtuse angles, where $0^{\circ} \le A \le 90^{\circ}$: $\cos A = -\cos(180^{\circ} - A)$

Learning Journey	Steps	Content	Details
	4	Using the unit circle or graphs of trigonometric functions to establish and use the follow- ing relationships for obtuse angles, where $0^{\circ} \le A \le 90^{\circ}$: tanA = -tan(180° - A)	• use the unit circle or graphs of trigonometric functions to establish and use the following relationships for obtuse angles, where $0^{\circ} \le A \le 90^{\circ}$: tanA = -tan(180° - A)
	5	Solving problems using the an- gles of any magnitude identities	 solve problems using the angles of any magnitude identities
		Trigonometric equations	
Solving simple trigono- metric equations	1	Finding the exact values of trigonometric ratios	• construct triangles in order to ob- tain exact trigonometric ratios for 0°, 30°, 45°, 60°
			• find the exact value for sine ratio for angles 0°, 30°, 45°, 60°
			• find the exact value for cosine ratio for angles 0°, 30°, 45°, 60°
			• find the exact value for tangent ra- tio for angles 0°, 30°, 45°, 60°
	2	Solving problems using the exact trigonometric ratios	• solve problems using the of trigono- metric ratios leaving in exact form where necessary
	3	Deriving relationships between sine and cosine ratios of comple- mentary angles in right-angled triangles (using θ)	• use complementary angle relation- ships to solve problems
	4	Solving trigonometric equations involving exact ratios and com- plementary angles giving all pos- sible solutions	• solve trigonometric equations in- volving exact ratios and complemen- tary angles giving all possible solu- tions

9 Chance and probability

Chance				
	Charge	Chance experiments	Detaile	
Learning Journey	Steps		Detdiis	
Ihree-step chance ex- periments with replace- ment	1	Listing all outcomes for 3- step chance experiments, with replacement and assign proba- bilities to outcomes	• list all outcomes for 3-step chance experiments, with replacement and assign probabilities to outcomes	
	2	Determining probabilities for events for 3-step chance experi- ments with replacement	• determine probabilities for events for 3-step chance experiments with replacement	
	3	Calculating probabilities of sim- ple and compound events in 3- step chance experiments, with re- placement	• calculate probabilities of simple and compound events in 3-step chance experiments, with replacement	
Three-step chance experiments without replacement	1	Listing all outcomes for 3-step chance experiments, without re- placement and assigning proba- bilities to outcomes	• list all outcomes for 3-step chance experiments, without replacement and assign probabilities to outcomes	
	2	Determining probabilities for events for 3-step chance experi- ments without replacement	• determine probabilities for events for 3-step chance experiments with- out replacement	
	3	Calculating probabilities of simple and compound events in 3-step chance experiments without re- placement	• calculate probabilities of simple and compound events in 3-step chance experiments without replacement	
Understanding indepen- dent events	1	Understanding that independent events have a set probability that do not rely on previous events	• explore examples of independent events, eg consecutive rolls of dice	
	2	Understanding that dependent events have a probability that changes according to previous events	 explore examples of dependent events, eg drawing cards from a deck 	
	3	Determining if 2 events, A and B, are independent by using the characteristic that if the probabil- ity of A and B occurring together is the product of their probabilities	• determine if 2 events, A and B, are independent by using the character- istic that if the probability of A and B occurring together is the product of their probabilities	
	4	Recognising and using the fact that for independent events P(A and B) = P(A) × P(B)	• recognise and use the fact that for independent events $P(A \text{ and } B) = P(A) \times P(B)$	
		Conditional probability		
Introducing conditional probability	1	Identifying mistakes in interpret- ing conditional probability state- ments	• identify mistakes in interpreting conditional probability statements	
	2	Determining the conditional prob- ability of A given B as the fraction of B's outcomes that also belong to A	• determine the conditional probabil- ity of A given B as the fraction of B's outcomes that also belong to A	
			• interpret the answer to questions modelled on conditional probability calculations	

Learning Journey	Steps	Content	Details
	3	Applying the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpreting the answer in terms of the model	 apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B)
			 interpret the answer to questions modelled on the addition rule for probability
	4	Applying the general Multi- plication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B A) = P(B)P(A B)$, and interpreting the answer in terms of the model	• apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B A) = P(B)P(A B)
			• interpret the answer to questions modelled on the multiplication rule for probability
Conditional probability and two-way tables	1	Constructing and interpreting two-way frequency tables of data when 2 categories are as- sociated with each object being classified	• construct and interpret two-way frequency tables of data when two categories are associated with each object being classified
	2	Determining if events are inde- pendent using a two-way table as a sample space	• determine if events are independent using a two-way table as a sample space
	3	Approximating conditional prob- abilities using two-way tables as a samples space	• approximate conditional probabili- ties using two-way tables as a sam- ples space
	4	Calculating and interpreting con- ditional probabilities through rep- resentation using expected fre- quencies with two-way tables	• calculate probabilities through rep- resentation using expected frequen- cies with two-way tables
			• interpret conditional probabilities through representation using ex- pected frequencies with two-way tables
	5	Calculating and interpreting probabilities of compound events	• calculate probabilities of compound events using two-way tables
		using two-way tables	• interpret probabilities of compound events using two-way tables
Conditional probability and tree diagrams	1	Calculating and interpreting con- ditional probabilities through rep- resentation using expected fre- quencies with tree diagrams	 calculate conditional probabili- ties through representation using expected frequencies with tree diagrams
			 interpret conditional probabili- ties through representation using expected frequencies with tree diagrams
	2	Calculating and interpreting probabilities of compound events using tree diagrams	• calculate and interpret probabilities of compound events using tree dia- grams
			• interpret probabilities of compound events using tree diagrams
Conditional probability and arrays	/ 1 Calcul dition resent quenc	Calculating and interpreting con- ditional probabilities through rep- resentation using expected fre-	• calculate conditional probabili- ties through representation using expected frequencies with arrays
		quencies with arrays	 interpret conditional probabili- ties through representation using expected frequencies with arrays

Learning Journey	Steps	Content	Details
	2	Calculating and interpreting probabilities of compound events	 calculate probabilities of compound events using arrays
		using arrays	 interpret probabilities of compound events using arrays
Conditional probability and Venn diagrams	1	Calculating and interpreting con- ditional probabilities through rep- resentation using expected fre- quencies with Venn diagrams	 calculate conditional probabili- ties through representation using expected frequencies with Venn diagrams
			 interpret conditional probabili- ties through representation using expected frequencies with Venn diagrams
	2	Calculating and interpreting probabilities of compound events	 calculate probabilities of compound events using Venn diagrams
		using Venn diagrams	 interpret probabilities of compound events using Venn diagrams
Set theory and Venn di- agrams	1	Defining unions, intersections and complements of subsets using symbols	\bullet define unions as the combination of subsets, ie if an element is in A \cup B then the element can be in either A or B
			• define intersections as the crossover between subsets, ie if an element is in A \cap B then the element must be in A and B
			• define complements of an event as all outcomes that are not the event
	2	Identifying different regions on a Venn diagram using set theory	 identify different regions on a Venn diagram using set theory

10 Data

Data				
		Interquartile range		
Learning Journey	Steps	Content	Details	
Interquartile range	1	Defining quartiles and interquartile-range	• defining quartiles and interquartile- range	
	2	Describing the proportion of data values contained be- tween various quartiles	• describe the proportion of data values contained between various quartiles	
	3	Determining the upper and lower extremes, median, and upper and lower quartiles for sets of numerical-data	• determine the upper and lower ex- tremes, median, and upper and lower quartiles for sets of numerical-data	
	4	Determining the interquartile range for sets of data	• determine the interquartile range for sets of data	
		Box-and-whisker plots		
Constructing and in- terpreting box-and- whisker plot	1	Constructing a box-and-whisker plot using the median, the upper and lower quartiles, and the up- per and lower extremes of a set of data	• construct a box-and-whisker plot using the median, the upper and lower quartiles, and the upper and lower extremes of a set of data	
	2	Comparing 2 or more sets of data using parallel box-and-whisker- plots drawn on the same scale	• compare 2 or more sets of data using parallel-box-and-whisker- plots drawn on the same scale	
Comparing box-and- whisker plots	1	Determining quartiles from data displayed in histograms and dot	• determine quartiles from data dis- played in histograms and dot plots	
		plots, and using these to draw a box-and-whisker plot to repre- sent the same set of data	• draw a box-and-whisker plot to represent the same set of data displayed in a histogram	
	2	Identifying skewed and symmet- rical sets of data displayed in histograms and dot plots, and describing the shape/features of the corresponding box-and-	 identify skewed and symmet- rical sets of data displayed in histograms and dot plots describe the shape/features of the corresponding box-and-whister plot 	
		whisker plot for such sets of data	for such sets of data	
		Bivariate data		
Scatter plots	1	Describing, informally, the strength and direction of the relationship between 2 variables displayed in a scatter plot	• describe, informally, the strength and direction of the relationship be- tween 2 variables displayed in a scatter plot	
	2	Making predictions from a given scatter plot or other graph	• make predictions from a given scat- ter plot or other graph	
	3	Drawing conclusions from a given scatter plot	 draw conclusions from a given scatter plot 	

Learning Journey	Steps	Content	Details
Line of best fit	1	Knowing that straight lines are widely used to model relation- ships between 2 quantitative variables. For scatter plots that suggest a linear association, in- formally fitting a straight line, and informally assessing the model fit by judging the closeness of the data points to the line	• know that straight lines are widely used to model relationships between 2 quantitative variables. For scat- ter plots that suggest a linear asso- ciation, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line
	2	Using the equation of a linear model to solve problems in the context of bivariate measurement data	 use the equation of a linear model to solve problems in the context of bi- variate measurement data interpret the gradient and intercent
Bivariate data	1	Recognising the difference be- tween an independent variable and its dependent variable	 recognise the difference between an independent variable and its de- pendent variable
	2	Distinguishing bivariate data from single variable (univariate) data	• distinguish bivariate data from sin- gle variable (univariate) data
	3	Describing changes in the depen- dent variable over time	• describe changes in the dependent variable over time
	4	Interpreting data dis- plays representing 2 or more dependent numerical- variables against time	• interpret data dis- plays representing 2 or more dependent numerical- variables against time
		Reviewing data in the media	
Evaluating statistical reports	1	Analysing graphical displays to recognise features that may have been manipulated to cause a mis- leading interpretation and/or sup- port a particular point of view	• analyse graphical displays to recognise features that may have been manipulated to cause a mis- leading interpretation and/or support a particular point of view
Critical analysis of data in the media	1	Investigating the appropri- ateness of sampling methods and sample size used in re- ports where statements about a population are based on a sample	• investigate the appropriateness of sampling methods and sample size used in reports where statements about a population are based on a sample
	2	Determining whether a sample used enables inferences or con- clusions to be drawn about the relevant population	• determine whether a sample used enables inferences or conclusions to be drawn about the relevant popula- tion
	3	Evaluating whether graphs in a report could mislead, and whether graphs and numerical information support the claims	• evaluate whether graphs in a report could mislead, and whether graphs and numerical information support the claims
		Data analysis	
Using the mean and standard deviation of data sets	1	Defining standard deviation and the percentiles they represent	• define standard deviation and the percentiles they represent

Learning Journey	Steps	Content	Details
	2	Finding the standard deviation of a set of data using digital tech- nologies	• find the standard deviation of a set of data using digital technologies
	3	Investigating and describing the effect, if any, on the standard de- viation of adding a data value to the set of data	• investigate and describe the effect, if any, on the standard deviation of adding a data value to the set of data
	4	Investigating and describing the effect, if any, on the standard deviation of altering all of the data values in the set of data by operations such as doubling all data values or adding a con- stant to all data values	• investigate and describe the ef- fect, if any, on the standard devia- tion of altering all of the data values in the set of data by operations such as doubling all data values or adding a constant to all data values
	5	Fitting a data set to a normal dis- tribution using its mean and stan- dard deviation	• fit a data set to a normal distribu- tion using its mean and standard de- viation
Estimating population percentages	1	Estimating population percent- ages of a data set using its mean and standard deviation	• estimate population percentages of a data set using its mean and stan- dard deviation (assuming the popu- lation fits a normal distribution)
Comparing data using mean and standard de- viation	1	Comparing 2 sets of data by using the mean and standard deviation	• compare 2 sets of data by using the mean and standard deviation
	2	Comparing and describing the spread of sets of data with the same mean but different stan- dard deviations	• compare and describe the spread of sets of data with the same mean but different standard deviations
	3	Comparing and describing the spread of sets of data with dif- ferent means by referring to stan- dard deviation	• compare and describe the spread of sets of data with different means by referring to standard deviation
Bivariate data and lines of best fit	1	Predicting what might happen between known data values and predicting what might happen beyond known data values using lines of best fit	• predict what might happen be- tween known data values (interpo- lation) and predict what might hap- pen beyond known data values using lines of best fit



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