



Mathematics is a highly interwoven subject; this curriculum maps attempts to highlight only some of the key links.

Unit Context Information: P1 – Pure 1 content, P2 – Pure 2, SM – Statistics or Mechanics, CP1 – Core Pure 1, FS – Further Statistics and D – Decision Mathematics

Unit Context	Topic name	Term	Skills developed	Next link in curriculum
P1.1	Algebraic Expressions	Autumn	• Multiply and divide integer powers • Expand a single term over brackets and collect like terms • Expand the product of two or three expressions • Factorise linear, quadratic and simple cubic expressions • Know and use the laws of indices • Simplify and use the rules of surds • Rationalise denominators	• Quadratics Y12
CP1.6	Matrices	Autumn	• Understand the concept of a matrix • Define the zero and identity matrices • Add and subtract matrices • Multiply a matrix by a scalar • Multiply matrices • Calculate the determinant of a matrix • Find the inverse of a matrix • Use matrices to solve systems of equations • Interpret simultaneous equations geometrically	• Linear Transformations • Computer graphics, Mechanics or Engineering in Further Education
CP1.7	Linear Transformations	Autumn	• Understand the properties of linear transformations and represent them using matrices • Perform reflections and rotations using matrices • Carry out enlargements and stretches using matrices • Find the coordinates of invariant points and the equations of invariant lines • Carry out successive transformations using matrix products • Understand linear transformations in three dimensions • Use inverse matrices to reverse linear transformations	• Computer graphics, Mechanics or Engineering in Further Education



P1.7a P1.7b	Algebraic Methods	Autumn	- Cancel factors in algebraic fractions - Divide a polynomial by a linear expression - Use the factor theorem to factorise a cubic expression Construct mathematical proofs using algebra - Use proof by exhaustion and disproof by counter-example	Algebraic Methods Y13
P1.5	Straight Line Graphs	Autumn	- Calculate the gradient of a line joining a pair of points - Understand the link between the equation of a line, and its gradient and intercept - Find the equation of a line given (i) the gradient and one point on the line or (ii) two points on the line - Find the point of intersection for any pair of straight lines - Know and use the rules for parallel and perpendicular gradients - Solve length and area problems on coordinate grids - Use straight line graphs to construct mathematical models	Circles Y12
P1.2	Quadratics	Autumn	- Solve quadratic equations using factorisation, the quadratic formula and completing the square - Read and use $f(x)$ notation when working with functions - Sketch the graph and find the turning point of a quadratic function - Find and interpret the discriminant of a quadratic expression - Use and apply models that involve quadratic functions	Graphs and Transformations Y12
P1.8	The Binomial Expansion	Autumn	- Use Pascal's triangle to identify binomial coefficients and use them to expand simple binomial expressions - Use combinations and factorial notation - Use the binomial expansion to expand brackets - Find individual coefficients in a binomial expansion - Make approximations using the binomial expansions	Binomial Expansion (Year 13) – This is a different type of expansion that is explored



P1.3	Equations and Inequalities	Autumn	- Solve linear simultaneous equations using elimination or substitution - Solve simultaneous equations: one linear and one quadratic - Interpret algebraic solutions of equations graphically - Solve linear inequalities - Solve quadratic inequalities - Interpret inequalities graphically - Represent linear and quadratic inequalities graphically	Graphs and transformations
P1.6	Circles	Autumn	- Find the midpoint of a line segment - Find the equation of the perpendicular bisector to a line segment - Know how to find the equation of a circle - Solve geometrical problems involving straight lines and circles - Use circle properties to solve problems on coordinate grids - Find the angle in a semicircle and solve other problems involving circles and triangles	Functions and Graphs Y13
P1.4	Graphs and Transformations	Autumn	- Sketch cubic graphs - Sketch quartic graphs - Sketch reciprocal graphs of the form $y = \frac{a}{x}$ and $y = \frac{a}{x^2}$ - Use intersection points of graphs to solve equations - Translate graphs - Stretch graphs - Transform graphs of unfamiliar functions	- Integration - Functions Y13
P1.9	Trigonometric Ratios	Autumn	- Use the cosine rule to find a missing side or angle - Use the sine rule to find a missing side or angle - Find the area of a triangle using an appropriate formula - Solve problems involving triangles - Sketch the graphs of the sine, cosine and tangent functions - Sketch simple transformations of these graphs	- Trigonometric Identities and Equations Y12 - Radians Y13



P1.10	Trigonometric Identities and Equations	Autumn	- Calculate the sine, cosine and tangent of any angle - Know the exact trigonometric ratios for 30°, 45° and 60° - Know and use the relationships $\tan \theta \equiv \frac{\sin \theta}{\cos \theta}$ and $\sin^2 \theta + \cos^2 \theta \equiv 1$ - Solve simple trigonometric equations of the forms $\sin \theta = k$, $\cos \theta = k$ and $\tan \theta = k$ - Solve more complicated trigonometric equations of the forms $\sin n\theta = k$ and $\sin(\theta \pm \alpha) = k$ and equivalent equation involving cos and tan - Solve trigonometric equations that produce quadratics	Trigonometric Functions Y13
P1.12	Differentiation	Autumn	- Find the derivative, $f'(x)$ or $\frac{dy}{dx}$, of a simple function - Use the derivative to solve problems involving gradients, tangents and normal - Identify increasing and decreasing functions - Find the second order derivative, $f''(x)$ or $\frac{d^2y}{dx^2}$ of a simple function - Find stationary points of functions and determine their nature - Sketch the gradient function of a given function - Model real-life situations with differentiation	- Differentiation (Year 13) - Integration Y12 and 13 - Variable Acceleration Y12
P1.13	Integration	Autumn	- Find y given $\frac{dy}{dx}$ for x^n - Integrate polynomials - Find $f(x)$, given $f'(x)$ and a point on the curve - Evaluate a definite integral - Find the area bounded by a curve and the x-axis - Find areas bounded by curves and straight lines	Integration Y13
P1.14	Exponentials and Logarithms	Autumn	- Sketch graphs of the form $y = a^x$, $y = e^x$, and transformations of these - Differentiate e^{kx} and understand why this result is important - Use and interpret models that use exponential functions - Recognise the relationship between exponents and logarithms - Recall and apply the laws of logarithms - Solve equations of the form $a^x = b$ - Describe and use the natural logarithm function - Use logarithms to estimate the values of constants in non-linear models	- Regression, Correlation and Hypothesis Testing Y13 - Various other topics Y13



CP1.1	Complex Numbers	Autumn	• Introduction to imaginary and complex numbers • Multiply complex numbers • Divide of complex numbers using the complex conjugate • Find the roots of quadratic equations • Solve cubic and quartic equations	• Argand Diagrams • Complex Numbers Yr13
CP1.2	Argand Diagrams	Autumn	• Be able to represent complex numbers on an argand diagram • Find the modulus and argument of a complex number • Write any complex number in terms of its modulus and argument • Use complex numbers to represent a locus of points or regions on an Argand diagram	• Complex Numbers Yr13
SM1.1	Data Collection	Autumn	• Understand 'population', 'sample' and 'census', and comment on the advantages and disadvantages of each • Understand the advantages and disadvantages of simple random sampling, systematic sampling, stratified sampling, quota sampling and opportunity sampling • Define qualitative, quantitative discrete and continuous data, and understand grouped data • Understand the large data set	• Measures of Location and Spread Y12
SM1.2	Measures of Location and Spread	Autumn	• Calculate measures of central tendency such as the mean, median and mode • Calculate measures of location such as percentiles and deciles • Calculate measures of spread such as range, interquartile range and inter-percentile range • Calculate variance and standard deviation • Understand and use coding	• Probability Y12 • Representations of Data Y12
SM1.3	Representations of Data	Autumn	• Identify outliers in data sets • Draw and interpret boxplots • Draw and interpret cumulative frequency diagrams • Draw and interpret histograms • Compare two data sets	• Correlation Y12



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SM1.4	Correlation	Autumn	• Draw and interpret scatter diagrams for bivariate data • Interpret correlation and understand that it does not imply causation • Interpret the coefficients of a regression line equation for bivariate data • Understand when you can use a regression line to make predictions	• Regression, Correlation and Hypothesis Testing Y13
P1.11	Vectors	Spring	• Use vectors in two dimensions • Use column vectors and carry out arithmetic operations on vectors • Calculate the magnitude and direction of a vector • Understand and use position vectors • Use vectors to solve geometric problems • Understand vector magnitude and use vectors in speed and distance calculations • Use vectors to solve problems in context	• Mechanics Y13 • Vectors Y13
CP1.9	Vectors	Spring	• Understand and use the vector and Cartesian forms of the equation of a straight line in three dimensions • Understand and use the vector and Cartesian forms of the equation of a plane • Calculate the scalar product for two 3D vectors • Calculate the angle between two vectors, two lines, a line and a plane, or two planes • Understand and use the scalar product form of the equation of a plane • Determine whether two lines meet and determine the point of intersection • Calculate the perpendicular distance between: two lines, a point and a line, or a point and a plane	• Geometry, Calculus or Linear Algebra in Further Education



CP1.3	Series	Spring	- Find sums of sets of natural numbers - Find the sums of squares and cubes of 'n' natural numbers	Series Yr13
CP1.4	Roots of polynomials	Spring	- Derive and use the relationships between the roots of a quadratic equation - Derive and use the relationships between the roots of a cubic equation - Derive and use the relationships between the roots of a quartic equation - Evaluate expressions relating to the roots of polynomials - Find the equation of a polynomial whose roots are a linear transformation of the roots of a given polynomial	Engineering and Physics in Further Education
CP1.5	Volumes of revolution	Spring	- Find the volume of revolution when a curve is rotated around the x-axis - Find the volume of revolution when a curve is rotated around the y-axis - Find more complicated volumes of revolution - Model real-life objects using volumes of revolution	Volumes of revolution Yr13
SM1.5	Probability	Spring	- Calculate probabilities for single events - Draw and interpret Venn Diagrams - Understand mutually exclusive and independent events, and determine whether two events are independent - Use and understand tree diagrams - Understand set notation in probability - Understand conditional probability - Solve conditional probability problems using two-way tables and Venn diagrams	Statistical Distributions Y12



SM1.6	Statistical Distributions	Spring	- Understand and use simple discrete probability distributions including the discrete uniform distribution - Understand the binomial distribution as a model and comment on appropriateness - Calculate individual probabilities for the binomial distribution - Calculate cumulative probabilities for the binomial distribution	- Hypothesis Testing Y12 - Discrete Random Variables
SM1.7	Hypothesis Testing	Spring	- Understand the language and concept of hypothesis testing - Understand that a sample is used to make an inference about a population - Find critical values of a binomial distribution using tables - Carry out a one-tailed test for the proportion of the binomial distribution and interpret the results - Carry out a two-tailed test for the proportion of the binomial distribution and interpret the results	Further Hypothesis Testing in Y13 Statistics (e.g. Normal Distribution)
FS.1	Discrete Random Variables	Spring	- Find the expected value of a discrete random variable X - Find the expected value of X^2 - Find the variance of a discrete random variable - Use the expected value and variance of a function of X - Solve problems involving random variables	Chi-Squared Tests
FS.2	Poisson Distributions	Spring	- Use the Poisson distribution to model real-world situations - Use the additive property of the Poisson distribution - Understand and use the mean and variance of the Poisson distribution - Understand and use the mean and variance of the binomial distribution - Use the Poisson distribution as an approximation to the binomial distribution	Hypothesis Testing of Poisson distributions
FS.4a	Hypothesis Testing of Poisson Distribution	Spring	- Use hypothesis tests to test for the mean λ of a Poisson distribution - Find critical regions of a Poisson distribution using tables	Chi-Squared Tests



D.1	Algorithms	Spring	• Use and understand an algorithm given in words • Understand how flow charts can be used to describe algorithms • Carry out a bubble sort • Carry out a quick sort • Carry out the three bin-packing algorithms and understand their strengths and weaknesses • Determine the order of an algorithm	• Maths, Computer Science or Software engineering at Further Education
D.2a	Graphs and Networks	Spring	• Know how graphs and networks can be used to create mathematical models • Be familiar with basic terminology used in graph theory • Know some special types of graph • Understand how graphs and networks can be represented using matrices	• Graphs and Networks Yr13
D.3	Algorithms on graphs	Spring	• Use Kruskal's algorithm to find a minimum spanning tree • Use Prim's algorithm on a network to find a minimum spanning tree • Apply Prim's algorithm to a distance matrix • Use Dijkstra's algorithm to find the shortest path between two vertices in a network • Use Floyd's algorithm	• Maths, Computer Science or Software engineering at Further Education
D.4a	Route Inspection	Spring	• Use the orders of nodes to determine whether a graph is Eulerian, semi-Eulerian or neither • Use the route inspection (Chinese postman) algorithm to find the shortest route in a network	• Route inspection Yr13
D.6	Linear Programming	Spring	• Formulate a problem as a linear programming problem • Illustrate a two-variable linear programming problem graphically • Locate the optimal point in a feasible region using the objective line (ruler) method • Use the vertex testing method to locate the optimal point • Determine solutions that need integer values	• Simplex Algorithm Yr13



D.8a	Critical Path Analysis	Spring	- Model a project by an activity network using a precedence table - Use dummy activities - Identify and calculate early and late event times in activity networks - Identify critical activities - Calculate the total float of an activity - Calculate and use Gantt (cascade) charts	Critical Path Analysis Yr13
SM1.8	Modelling in Mechanics	Spring	- Understand how the concept of a mathematical model applies to mechanics - Understand and be able to apply some of the common assumptions used in mechanical models - Know SI units for quantities and derived quantities used in mechanics - Know the difference between a scalar and vector quantities	- Constant Acceleration Y12 - Underpins all KS5 Mechanics
SM1.9	Constant Acceleration	Spring	- Understand and interpret displacement-time graphs - Understand and interpret velocity-time graphs - Derive the constant acceleration formulae and use them to solve problems - Use the constant acceleration formulae to solve problems involving vertical motion under gravity	- Variable Acceleration Y12 - Projectiles Y13 (working in 2 Dimensions)
SM1.10	Forces and Motion	Summer	- Draw force diagrams and calculate resultant forces - Understand and use Newton's first law - Calculate resultant forces by adding vectors - Understand and use Newton's second law, $F = ma$ - Apply Newton's second law to vector forces and acceleration - Understand and use Newton's third law - Solve problems involving connected particles	- Moments Y13 - Forces and Friction Y13
SM1.11	Variable Acceleration	Summer	- Understand that displacement, velocity and acceleration may be given as functions of time - Use differentiation to solve kinematics problems - Use calculus to solve problems involving maxima and minima - Use integration to solve kinematics problems - Use calculus to derive constant acceleration formulae	Further Kinematics Y13



FS.6a	Chi-Squared Tests	Summer	- Form hypotheses about how well a distribution fits as a model for an observed frequency distribution and measure goodness of fit of a model to observed data - Understand degrees of freedom and use the chi-squared (χ^2) family of distributions - Be able to test a hypothesis - Apply goodness-of-fit tests to discrete data - Use contingency tables	Chi-Squared Tests Yr13
CP1.8	Proof by induction	Summer	- Understand the principle of proof by mathematical induction and prove results about sums of series - Prove results about divisibility using induction - Prove results about matrices using induction	Proof and abstract algebra in Further Education
P2.1	Algebraic Methods	Summer	- Use proof by contradiction to prove true statements - Multiply and divide two or more algebraic fractions - Add or subtract two or more algebraic fractions - Convert an expression with linear factors in the denominator into partial fractions - Divide algebraic expressions - Convert an improper fraction into partial fraction form	Sequences and Series
P2.3	Sequences and Series	Summer	- Find the nth term of an arithmetic sequence - Prove and use the formula for the sum of the first n terms of an arithmetic series - Find the nth term of a geometric sequence - Prove and use the formula for the sum to infinity of a convergent geometric sequence - Use sigma notation to describe series - Generate sequences from recurrence relations - Model real-life situations with sequences and series	Numerical Methods in Further Education



P2.2	Functions and Graphs	Summer	• Understand and use the modulus function • Understand mappings and functions, and use domain and range • Combine two or more functions to make a composite function • Know how to find the inverse of a function graphically and algebraically • Sketch the graphs of the modulus functions $y = f(x)$ and $y = f(x)$ • Apply a combination of two (or more) transformations to the same curve • Transform the modulus function	• Parametric Equations Y13
P2.4	Binomial Expansion	Summer	• Expand $(1 + x)^n$ for any rational constant n and determine the range of values of x for which the expansion is valid • Expand $(a + bx)^n$ for any rational constant n and determine the range of values of x for which the expansion is valid • Use partial fractions to expand fractional expressions	• Integration Y13