West Kirby Grammar School

Curriculum Map – Year 13 – Mathematics 2023-24

Mathematics is a highly interwoven subject. This curriculum map outlines just some of the next links stemming from each topic.

Topic name	Term	Skills developed	Next link in curriculum
Regression and Correlation	Autumn	• Understand exponential models in bivariate data • Use a change of variable to estimate coefficients in an exponential model • Understand and calculate the product moment correlation coefficient • Carry out a hypothesis test for zero correlation	• Normal Distribution (continuation of exploring various Hypothesis Tests) Y13
Functions and Graphs	Autumn	• 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
Algebraic Methods	Autumn	• 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 Y13
Moments	Autumn	• Calculate the turning effect of a force applied to a rigid body • Calculate the resultant moment of a set of forces acting on a rigid body • Solve problems involving uniform rods in equilibrium • Solve problems involving non-uniform rods • Solve problems involving rods on the point of tilting	• Forces and Friction Y13

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Binomial Expansion	Autumn	• 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
Sequences and Series	Autumn	• 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
Forces and Friction	Autumn	• Resolve forces into components • Use the triangle law to find a resultant force • Solve problems involving smooth or rough inclined planes • Understand friction and the coefficient of friction • Use $F \leq \mu R$	• Applications of Forces Y13
Radians	Autumn	• Convert between degrees and radians and apply this to trigonometric graphs and their transformations • Know exact values of angles measured in radians • Find an arc length using radians • Find areas of sectors and segments using radians • Solve trigonometric equations in radians • Use approximate trigonometric values when θ is small	• Trigonometry and Modelling Y13
Trigonometric Functions	Autumn	• Understand the definitions or secant, cosecant and cotangent and their relationship to cosine, sine and tangent • Understand the graphs of secant, cosecant and cotangent and their domain and range • Simplify expressions, prove simple identities and solve equations involving secant, cosecant and cotangent	• Trigonometry and Modelling Y13

		• Prove and use $\sec^2 x \equiv 1 + \tan^2 x$ and $\operatorname{cosec}^2 x \equiv 1 + \cot^2 x$ • Understand and use inverse trigonometric functions and their domain and ranges	
Trigonometry and Modelling	Autumn	• Prove and use the addition formulae • Understand and use the double-angle formulae • Solve trigonometric equations using the double-angle and addition formulae • Write expressions of the form $a\cos\theta \pm b\sin\theta$ in the forms $R\cos(\theta \pm \alpha)$ or $R\sin(\theta \pm \alpha)$ • Prove trigonometric identities using a variety of identities • Use trigonometric functions to model real-life situations	• Differentiation Y13 • Integration Y13
Parametric Equations	Autumn	• Convert parametric equations into Cartesian form by substitution • Convert parametric equations into Cartesian form using trigonometric identities • Understand and use parametric equations of curves and sketch parametric curves • Solve coordinate geometry problems involving parametric equations • Use parametric equations in modelling in a variety of contexts	• Differentiation (Part 2) Y13
Differentiation (Part 1)	Autumn	• Differentiate trigonometric functions • Differentiate exponentials and logarithms • Differentiate functions using the chain, product and quotient rules	• Integration Y13 • Differentiation (Part 2) Y13
Conditional Probability	Autumn	• Understand set notation in probability • Understand conditional probability • Solve conditional probability problems using two-way tables and Venn diagrams • Use probability formulae to solve problems • Solve conditional probability using tree diagrams	• Normal Distribution Y13

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Normal Distribution	Spring	• Understand the normal distribution and the characteristics of a normal distribution curve • Find percentage points on a standard normal curve • Calculate values on a standard normal curve • Find unknown means and/or standard deviations for a normal distribution • Approximate a binomial distribution using a normal distribution • Select appropriate distributions and solve real-life problems in context • Carry out a hypothesis test for the mean of a normal distribution	• Statistics in Further Education or Further Maths A-level Statistics (Discrete random variables and other distributions)
Integration	Spring	• Integrate standard mathematical functions including trigonometric and exponential functions and use the reverse of the chain rule to integrate functions of the form $f(ax + b)$ • Use trigonometric identities in integration • Use the reverse of the chain rule to integrate more complex functions • Integrate functions by making a substitution, using integration by parts and using partial fractions • Use integration to find the area under a curve • Use the trapezium rule to approximate the area under a curve • Solve simple differential equations and model real-life situations with differential equations	• Calculus in Further Education (Physics and Mathematics) and in Further Mathematics A-level
Differentiation (Part 2)	Spring	• Differentiate parametric equations • Differentiate functions which are defined implicitly • Use the second derivative to describe the behaviour of a function • Solve problems involving connected rates of change and construct simple differential equations	• Calculus in Further Education (Physics and Mathematics) and in Further Mathematics A-level

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Projectiles	Spring	• Model motion under gravity for an object projected horizontally • Resolve velocity into components • Solve problems involving particles projected at an angle • Derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile	• Further Kinematics Y13
Vectors	Spring	• Understand 3D Cartesian coordinates • Use vectors in three dimensions • Use vectors to solve geometric problems • Model 3D motion in mechanics with vectors	• Vectors in Further Mathematics or Mechanics in Further Education (Engineering, Physics and Mathematics)
Numerical Methods	Spring	• Locate roots of $f(x) = 0$ by considering changes of sign • Use iteration to find an approximation to the root of the equation $f(x) = 0$ • Use the Newton-Raphson procedure to find approximations to the solutions of equations of the form $f(x) = 0$ • Use numerical methods to solve problems in context	• Further Education (Computing, Engineering, Physics and Mathematics)
Applications of Forces	Spring/Summer	• Find an unknown force when a system is in equilibrium • Solve statics problems involving weight, tension and pulleys • Understand and solve problems involving limiting equilibrium • Solve problems involving connected particles that require the resolution of forces	• Mechanics in Further Education (Engineering, Physics and Mathematics)
Further Kinematics	Summer	• Work with vectors for displacement, velocity and acceleration when using the vector equations of motion • Use calculus with harder functions of time involving variable acceleration • Differentiate and integrate vectors with respect to time	• Mechanics in Further Education (Engineering, Physics and Mathematics)