Curriculum Map – Year 12 – Mathematics (2023-24)

West Kirby Grammar School

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

Topic name	Term	Skills developed	Next link in curriculum
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
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
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	Straight Line Graphs Y12
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	- Straight Line Graphs Y12 - Circles Y12

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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
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
Modelling in Mechanics	Autumn	• 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
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

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 interpercentile range - Calculate variance and standard deviation - Understand and use coding	- Probability Y12 - Representations of Data Y12
Algebraic Methods	Autumn	- Cancel factors in algebraic fractions - Divide a polynomial by a linear expression - Use the factor theorem to factorise a cubic expression	Algebraic Methods Y13
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
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
Proof	Autumn	- Construct mathematical proofs using algebra - Use proof by exhaustion and disproof by counter-example - Use proof by contradiction to prove true statements	Various topics such as Trigonometry require well-presented and logical arguments in "Show that" questions Y12

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Constant Acceleration	Autumn	- 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)
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
Trigonometric Ratios	Spring	- 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
Trigonometric Identities and Equations	Spring	- 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
Integration	Spring	- 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

Exponentials and Logarithms	Spring	- 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
Correlation	Spring	- 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
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
Forces and Motion	Spring	- 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

Vectors	Summer	- 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
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
Statistical Distributions	Summer	- 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
Hypothesis Testing	Summer	- 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)