Key Stage 5: Year 12 Maths

Overall Curriculum Goals

In year 12 Students are taught AQA AS Mathematics
A Level Maths aims to encourage learners to:

- Answer questions that test the content synoptically
- apply the knowledge they have learnt throughout the course in unfamiliar areas

Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
KEY IDEAS/CONCEPTS **Algebra and Functions (T1)** *Understand and use laws of indices *Manipulate surds and rationalise the denominator *Work with quadratic functions and their graphs; the discriminant of a quadratic function, including the conditions for real and repeated roots; completing the square; solution of quadratic equations including solving quadratic equations in a function of the unknown. *understand the relationship between the algebraic solution of simultaneous equations and the points of intersection of the corresponding graphs. In the case of one linear and one quadratic equation, recognise the geometrical significance of the discriminant of the resulting quadratic. Solve a pair of linear simultaneous equations using a calculator *give the range of values which satisfy more than one inequality. Illustrate regions on sketched graphs, defined by inequalities. Define algebraically inequalities that are given graphically **Proof (T1)** •set out a clear proof with the correct use of symbols, such as =, ⇒⇐⇔ , , ,,, ≡ ∴ • understand that considering examples can be useful in looking for structure, but this does not constitute a proof	**KEY IDEAS/CONCEPTS** **Differentiation (T1)** * Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f(x) at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of x. Understand and use the second derivative as the rate of change of gradient * Differentiate x^n , for rational values of n, and related constant multiples, sums and differences. * Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points, points of inflection. Identify where functions are increasing or decreasing **Integration (T1)** * Know and use the Fundamental Theorem of Calculus * Integrate x^n (excluding n = –1), and related sums, differences and constant multiples. *Evaluate definite integrals; use a definite integral to find the area under a curve. Understand that for areas lying below the x-axis the definite integral will give the negative of the required value Find areas between curves and straight lines	**KEY IDEAS/CONCEPTS** **Kinematics (T1)** * Understand and use fundamental quantities and units in the SI system: length, time, mass. Understand and use derived quantities and units: velocity, acceleration, force, weight * understand positions described relative to a given origin. Understand and describe the position of a particle through a combination of its initial position and a displacement. Demonstrate an understanding of the relationship between the vector quantities displacement and velocity and their associated scalar quantities distance and speed. Understand average speed and average velocity. * Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph * Understand, use and derive the formulae for constant acceleration for motion in a straight line * Use calculus in kinematics for motion in a straight line **Trigonometry (T1)** * Understand and use the definitions of sine, cosine and tangent for all arguments; the sine and cosine rules; the area of a triangle in the form 0.5absinC	**KEY IDEAS/CONCEPTS** **Forces and Newtons First Law (T1)** *Understand the concept of a force; understand and use Newton's first law * use F = ma for constant mass and constant force. Understand that objects can be modelled as particles Comment on the relevance of any modelling assumptions made * Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g, and its value in SI units to varying degrees of accuracy. * Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles; **Binomial Distribution (T2)** *Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution. **Hypothesis Testing (T2)** * Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance	**KEY IDEAS/CONCEPTS** Review + consolidate knowledge learnt so far, practice applying knowledge to unfamiliar areas and prepare for Finals	**KEY IDEAS/CONCEPTS**

Coordinate Geometry (T2) *be able to solve problems using gradients, midpoints and the distance between two points, including the form y = mx + c and the forms y = a and x = b for horizontal and vertical lines. Know that the product of the gradients of two perpendicular lines is −1. Understand necessary and sufficient conditions for a quadrilateral to be a square, rectangle, rhombus, parallelogram, kite or trapezium and be able to apply understanding of straight lines to these * Understand and use the coordinate geometry of the circle including using the equation of a circle in the form $(x - a)^2 + (y - b)^2 = r^2$; completing the square to find the centre and radius of a circle; use the following properties: the angle in a semicircle is a right angle, the perpendicular from the centre to a chord bisects the chord, the radius of a circle at a given point on its circumference is perpendicular to the tangent to the circle at that point. Find the equation of a tangent or normal at a point **Polynomials and Functions (T2)** *****Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem.	**Vectors (T1)** *become familiar with both column vectors and i, j notation, where i and j are unit vectors in perpendicular directions. know that vectors may be used to describe translations of graph * Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form. *Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations. * Understand and use position vectors; calculate the distance between two points represented by position vectors *Use vectors to solve problems in pure mathematics and in context, including forces and kinematics **Polynomials and Functions (T2)** * Understand and use graphs of functions; sketch curves defined by simple equations including polynomial, y= a/x and $y = a/x^2$ (including their vertical and horizontal asymptotes); interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations. Understand and use proportional relationships and their graphs * Understand the effect of simple transformations on the graph of y = f(x) including sketching associated graphs: y = af(x), y = f(x) + a, y = f(x + a) and y = f(ax) **Binomial Expansion (T2)** ***** answer questions requiring the full binomial expansion of expressions of the form $(a+bx)^n$, where n is a small positive integer. Find the coefficients of particular powers of x (complete expansion not required) Understand factorial	* Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity. *Use tan(x)=sin(x) / cos(x) $Sin^2x + cos^2x = 1$ * Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle. **Descriptive Stats (T2)** *Understand the terms 'population' and 'sample'. Use samples to make informal inferences about the population. Understand and use sampling techniques, including simple random sampling and opportunity sampling. Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples can lead to different conclusions about the population *Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency. Connect to probability distributions * Interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagrams which include distinct sections of the population (calculations involving regression lines are excluded). Understand informal interpretation of correlation. Understand that correlation does not imply causation. * Interpret measures of central tendency and variation, extending to standard deviation. Be able to calculate standard deviation, including from summary statistics. * Recognise and interpret possible outliers in data sets and statistical diagrams. Select or critique data presentation techniques in the context of a statistical problem. Be able to clean data, including dealing	level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, p-value; *Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context. Understand that a sample is being used to make an inference about the population and appreciate that the significance level is the probability of incorrectly rejecting the null hypothesis		

	notation and nCr and link to binomial probabilities **<u>Exponentials and Logs (T2)</u>** * sketch and use simple transformations of the graph of the function a^x (where a is a positive integer). Sketch and use simple transformations of the graph of the function e^x * Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications. * understand and be able to use the equivalences: $y=a^x \Leftrightarrow \log_a x= y$ and $y=e^x \Leftrightarrow \ln x=y$. Know that the graph of y = ln x is a reflection in the line y=x of the graph of $y= e^x$. Be able to perform simple single transformations of the functions $y= e^x$ and y = ln x Be able to manipulate logs and exponentials within the solution to a problem. *know and use laws of logs *solve equations of the form $a^x=b$ * reduce a non-linear relationship to linear form. Plot a graph from given data, drawing a line of best fit by eye and using it to calculate the gradient and intercept to estimate for unknown constant	with missing data, errors and outliers. **<u>Probability (T2)</u>** * Understand and use mutually exclusive and independent events when calculating probabilities. Link to discrete and continuous distributions * Understand and use conditional probability, including the use of tree diagrams, Venn diagrams, two-way tables. Understand and use the conditional probability formula $P(A\|B) = \frac{P(A\cap B)}{P(B)}$			
Sequence of Teaching (T1 & T2 run parallel)					
Key Topics/Subtopics: **Algebra + Functions (T1)** • **Indices** • **Surds** • **Simultaneous Equations** • **Quadratic Functions** • **Inequalities** **Proof (T1)** **Coordinate Geometry (T2)** • Straight lines • Circles **Polynomials and Functions (T2)** • Polynomial manipulation	**Key Topics/Subtopics:** **Differentiation (T1)** • Understand the idea of differentiation • Differentiate polynomials • Application of differentaition **Integration (T1)** • Know and use the Fundamental Theorem of Calculus • Integrate x^n	**Key Topics/Subtopics:** **Kinematics (T1)** • Quantities and units in mechanics • position; displacement; distance travelled; velocity; speed; acceleration. • Use and interpret graphs in kinematics • * formulae for constant acceleration for motion in a straight line • Calculus in kinematics	**Key Topics/Subtopics:** **Forces and Newtons Law (T1)** • Newtons First Law • Newtons Second Law • Weight and motion in a straight line under gravity • Newtons Third Law **Binomial Distribution (T2)** • Calculate probabilities using the Binomial Distribution	**Key Topics/Subtopics:**	**Key Topics/Subtopics:**

	• Evaluate definite integrals; use a definite integral to find the area under a curve **Vectors (T1)** • Use vectors in 2 and 3 dimensions • Magnitude and direction of vectors • Vector addition and multiplication • Position vectors and distance • Vectors in context **Polynomials and Functions (T2)** • Graphs of polynomials • Transformations of graphs **Binomial Expansion (T2)** • Expansion of $(ax+b)^n$ **Exponentials and Logs (T2)** • Graphs of $y=a^x$ and $y=e^x$ • Know that the gradient of e^{kx} is equal to ke^{kx} • $y=a^x \Leftrightarrow \log_a x= y$ and $y=e^x \Leftrightarrow \ln x=y$. • laws of logs • solve equations of the form $a^x=b$ • reduce a non-linear relationship to linear form.	**Trigonometry (T1)** • Sine, cosine and area of triangle • Sin, cos, tan graphs • AS Level trig identities • Solve simple trig equations in degrees **Descriptive Stats (T2)** • Statistical sampling • Data presentation and interpretation **Probability (T2)** • Mutually exclusive and independent events • Conditional Probability	**Hypothesis Testing (T2)** • Binomial Distribution Hypothesis testing		
ILC: CONSOLIDATION & RETRIEVAL					
ILC Half Term 1	**ILC Half Term 2**	**ILC Half Term 3**	**ILC Half Term 4**	**ILC Half Term 5**	**ILC Half Term 6**
GCSE recap – Indices, Surds, Solving linear equations, rearranging formula, linear graphs, factorising quadratics and cubics, using the quadratic formula, completing the square, equation of a circle, algebraic division, graphs of cubics and reciprocals	Half term 1 recall - Gradient functions, trigonometry, straight lines, circles, proof, polynomial and factor theorem, differentiation, curve sketching	Half term 2 recall – integration, vectors, exponentials and logs,	Half term 3 recall – kinematics, probability, trigonometry, binomial expansion, forces	Half term 4 recall and preparation for Finals	
ILC: KEY SKILLS					
Formative Assessment Materials					

○ **Check Up and Interim MIB to go with each topic**					
Summative Assessment					
HT1	**HT2**	**HT3**	**HT4**	**HT5**	**HT6**
○ Chapter 1 (Algebra and Functions and Co-ordinate Geometry) Assessment	○ Chapter 2 (Polynomials and Functions) and chapter 4 (Calculus) Assessments	○ Chapter 5 Exponentials and Logs), Chapter 7 Kinematics) and Chapter 9 (Descriptive Stats) Assessments	Chapter 3 (Trigonometry), Chapter 8 (Forces and Newtons Law), Chapter 10 (Binomial Distribution) and Chapter 11 Hypothesis Testing) Assessment	○ Mock Finals (Full AS Exam. Paper 1 – 1.5 hours Pure and Mechanics, Paper 2 – 1.5 hours Pure and Stats.	• Finals (Full AS Exam. Paper 1 – 1.5 hours Pure and Mechanics, Paper 2 – 1.5 hours Pure and Stats.
Assessment Week Resit (as applicable)					
CEIAGS and Co-Curricular					
○ UKMT ○ Integral Maths Ritangle Team Competition ○ SUMS - Steps to University for Maths Monthly Newsletter ○ Introduction to STEP and Oxbridge style interviews in the Summer Term					

Year 13

Overall Curriculum Goals

A Level Maths aims to encourage learners to:

- Answer questions that test the content synoptically
- apply the knowledge they have learnt throughout the course in unfamiliar areas

Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
KEY IDEAS/CONCEPTS **Trigonometry (T1)** • **Understand and use the definitions of sine, cosine and tangent for all arguments; the sine and cosine rules; the area of a triangle in the form 0.5absinC (E1)** • **Understand and use the standard small angel approximations of sine, cosine and tangent (E2)** • **Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity (E3)** • **Understand and use the definitions of secant, cosecant and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent; understanding their graphs; their ranges and domains (E4)** • **Understand and use the trigonometric identities for tangent in terms of sine and cosine and for the Pythagorean identities using sine and cosine and their associated forms (E5)** • **Understand and use double angle formulae; sue of formulae for sin(A+B), sin(A-B), cos(A+B), cos(A-B),**	**KEY IDEAS/CONCEPTS** **Functions** • **Understand and use composite functions, inverse functions and their graphs (B8)** • **Understand the effect of simple transformations on the graph of y = f(x) including sketching associated graphs; y = af(x), y = f(x) + a, y = f(x+a) and y = f(ax) and combinations of these transformations (B9)** • **Use of functions in modelling, including consideration of limitations and refinements of the models (B11)** • **Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms (C3).** **General Binomial Expansion** • **Understand and use the binomial expansion of (a+bx)^n for positive integer n; the notations n! and nCr; link to binomial probabilities. Extend to any rational n, including its use for approximation. (D1)** • **Manipulate polynomials algebraically, including expanding brackets and collecting like terms,**	**KEY IDEAS/CONCEPTS** **Normal Distribution** • **Understand and use the normal distribution as a model; find probabilities using the Normal distribution. Link to histograms, mean, standard deviation, points of inflection and the binomial distribution (N2)** • **Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or Normal model may not be appropriate (N3)** **Hypothesis Testing** • **Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, p-value; extend to correlation coefficients as measures of how close data points lie to a straight line and be able to interpret a given correlation coefficient**	**KEY IDEAS/CONCEPTS** Mock Exams and Revision	**KEY IDEAS/CONCEPTS** Mock Exams (II) and revision	**KEY IDEAS/CONCEPTS**

tan(A+B) and tan(A-B); understand geometric proofs of these formulae. Understand and use expressions in harmonic form (E6) • Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle (E7) • Construct proofs involving trigonometric functions and identities (E8) • Use trigonometric functions to solve problems in context, including problems vectors, kinematics and forces (E9) Functions (T1) • Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, the modulus of a linear function, reciprocal functions including their vertical and horizontal asymptotes; interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations. Understand and use proportional relationships and their graphs. (B7) Differentiation (T2) • Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f(x) at a general point (x,y); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient	factorisation and simple algebraic division; use of the factor theorem. Simplify rational expressions including by factorising and cancelling, and algebraic division by linear expressions only) (B6) • Decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than three terms, numerators constant or linear) (B10) Sequences and Series • Work with sequences including those given by a formula for the nth term and those generate by a simple relation of the form xn+1 = f(xn); increasing sequences; decreasing sequences; periodic sequences (D2) • Understand and use sigma notation for sums of series (D3) • Understand and work with arithmetic sequences and series, including the formulae for nth term and the sum to n terms (D4) • Understand and work with geometric sequences and series including the formulae for the nth terms and the sum of a finite geometric series, including the use of modulus of r < 1; modulus notation (D5) • Use sequences and series in modelling (D6) Normal Distribution	using a given p-value or critical value (calculation of correlation coefficients is excluded) (O1) • Conduct a statistical hypothesis test for the mean of a Normal distribution with known, given or assumed variance and interpret the results in context. (O3) Numerical methods and integration • Locate roots of f(x)=0 by considering changes of sign of f(x) in an interval of x on which f(x) is sufficiently well-behaved. Understand how change of sign methods can fail (I1) • Solve equations approximately using simple iterative methods; be able to draw associated cobweb and staircase diagrams. Solve equations using the Newton-Raphson method and other recurrence relations of the form xn+1 = g(xn). Understand how such methods can fail (I2) • Understand and use numerical integration of functions, including the use of the trapezium rule and estimating the approximate area under the curve and limits that it must lie between (I3) • Use numerical methods to solve problems in context (I4) Forces and Newtons Law (T2) • Understand the concept of a force; understand		

function for a given curve; second derivatives; differentiation from frsit principles for small positive integer powers of x and for sinx and cosx. Understand and use the second derivative as the rate of change of the gradient;connection to convex and concave sections of curves and points of inflection. (G1) • Differentiate x^n, for rational values of n, and related constant multiples, sums and differences. Differentiate e^(kx) and a^(kx), sinkx, coskx and tankx, related sums, differences and constant multiples. Understand and use the derivative of lnx (G2) • Apply differentiation to find gradients, tangents and normal, maxima and minima and stationary points, points of inflection. Identify where functions are increasing or decreasing (G3) • Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions (G4) Implicit Differentiation and Parametric Functions (T2) • Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms (C3) • Use parametric equations in modelling	• Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution (N1) Integration (T2) • Carry our simple cases of integration by substitution and integration by parts; understand these methods as the inverse processes of the chain and product rules respectively. (H5) • Integrate using partial fractions that are linear in the denominator (H6) Differential Equations (T2) • Construct simple differential equations in pure mathematics and in context (contexts may include kinematics, population growth and modelling the relationship between price and demand) (G6) • Evaluate the analytical solution of simple first order differential equations with separation variables, including finding particular solutions. (H7) • Intepret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution; includes links to kinematics (H8) Kinematics (T2)	and use Newton's first law (R1) • Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); extend to situations where forces need to be resolved (restricted to 2 dimensions) (R2) • Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g, and its value in S1 units to varying degrees of accuracy (R3) • Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces (R4) • Understand and use addition of forces; resultant forces; dynamics for motion in a plane (R5) • Understand and use the F<=uR model for friction; coefficient of friction; motion of a body on a rough surface; limiting friction and static (R6) Moments			

in a variety of contexts (C4) • Differentiate simple functions and relations defined implicitly or parametrically, for first derivative only (G5) **Integration (T2)** • Know and use the Fundamental Theorem of Calculus (H1) • Integrate x^n (excluding n = -1) and related sums, differences and constant multiples. Integrate e^(kx), 1/x, sinkx, coskx and related sums, differences and constant multiples (H2) • Evaluate definite integrals; use a definite integral to find the area under a curve and the area between two curves (H3) • Understand and use integration as the limit of a sum (H4)	• Understand and use the language of kinematics; position; displacement;distance travelled; velocity; speed;acceleration (Q1) • Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and are under the graph (Q2) • Understand, use and derive the formulae for constant acceleration for motion in a straight line; extend to 2 dimensions using vectors (Q3) • Use calculus in kinematics for motion in a straight line and extend to 2 dimensions using vectors (Q4) • Model motion under gravity in a vertical plane using vectors; projectiles (Q5)	• Understand and use moments in simple static contexts. (S1)			
Sequence of Teaching (T1 & T2 run parallel)					
Key Topics/Subtopics:	**Key Topics/Subtopics:**	**Key Topics/Subtopics:**	**Key Topics/Subtopics:**	**Key Topics/Subtopics:**	**Key Topics/Subtopics:**
ILC: CONSOLIDATION & RETRIEVAL					
ILC Half Term 1	**ILC Half Term 2**	**ILC Half Term 3**	**ILC Half Term 4**	**ILC Half Term 5**	**ILC Half Term 6**
ILC: KEY SKILLS					

Formative Assessment Materials					
○ **Check Up and Interim MIB to go with each topic**					
Summative Assessment					
HT1	**HT2**	**HT3**	**HT4**	**HT5**	**HT6**
○ Trigonometry ○ Differentiation ○ Integration	○ Functions ○ General Binomial Expansion and Sequences and Series ○ Differential Equations ○ Kinematics	○ Normal Distribution ○ Hypothesis Testing ○ Numerical Methods and Integration ○ Forces and Newtons Law ○ Moments		○	•
Assessment Week Resit (as applicable)					
CEIAGS and Co-Curricular					
○ UKMT ○ Integral Maths Ritangle Team Competition ○ SUMS - Steps to University for Maths Monthly Newsletter ○ Introduction to STEP and Oxbridge style interviews in the Summer Term					