Pure Mathematics Year 12	Working towards expected outcomes Your child is not yet making the expected progress within this course.	Working at expected outcomes Your child is achieving the expected progress for this point within the course.	Working beyond expected outcomes Your child is exceeding the expected progress.
Autumn Term	Students working **towards** expected outcomes in Y12 can: • Use index laws with positive integer powers and evaluate simple expressions with negative or fractional indices when supported • Convert between root and index form (e.g. $\sqrt{x} = x^{1/2}$); simplify basic surds such as $\sqrt{a} \times \sqrt{b}$ or $1/\sqrt{2}$ • Solve quadratic equations by factorising when roots are integers, sketch quadratics with given roots • Use Pascal's triangle to expand simple binomial expressions for small values of n • Solve linear simultaneous equations and identify the point of intersection on a graph	Students working **at** expected in Y12 can: • Apply all laws of indices for rational exponents; solve equations involving unknown indices, including those requiring base manipulation • Fully simplify and rationalise surd expressions, including more complicated denominators • Solve quadratics using completing the square and the quadratic formula; sketch graphs and interpret roots • Use the discriminant to determine the number and nature of roots (two distinct, repeated, or no real roots) • Expand binomial expressions using factorial notation; find specific coefficients and apply to problem-solving • Solve linear–quadratic simultaneous equations algebraically and interpret their graphical solutions	Students working **beyond** expected in Y12 can: **In addition to the skills listed under 'Working At' for this topic, students working beyond expected outcomes can:** • Construct and solve unfamiliar problems involving indices and surds, including interpreting solutions in context • Use binomial expansions in multi-step contexts, such as matching coefficients, simplifying complex expressions, or solving estimation problems • Solve simultaneous equations or inequalities embedded in contextual or geometric settings • Use vectors to prove results such as collinearity or to find position vectors from given points or ratios • Form and justify coordinate geometry proofs using perpendicular gradients, midpoints, or line intersections

	• Solve linear inequalities in one variable and represent them on a number line • Understand that logarithms are the inverse of exponentials; evaluate $\log_a x$ and a^x for small integer values • Add and subtract 2D vectors in column form; understand the difference between a point and a vector • Identify gradient and y-intercept from $y = mx + c$ or from graphs; substitute into the line equation • Differentiate basic polynomial terms with positive integer powers using known rules • Understand that the derivative represents the gradient of a curve at a point	• Solve linear and quadratic inequalities; represent solutions graphically and using set notation • Use all logarithmic laws (product, quotient, power) to simplify and solve equations • Use i and j notation for vectors; calculate magnitude and direction; identify and work with parallel vectors • Use the point–gradient form $y - y_1 = m(x - x_1)$ to find the equation of a straight line; model geometric problems using line equations • Differentiate polynomials including terms with negative and fractional powers • Find the equation of a tangent or normal to a curve at a given point • Identify and classify stationary points using the second derivative • Sketch gradient functions and describe intervals where a function is increasing or decreasing	• Derive the gradient function for x^n using the first principles definition of the derivative for integer powers • Use differentiation in a modelling context to determine maxima or minima and interpret meaning in context (e.g. particle motion or profit)

Spring Term	Students working **towards** expected outcomes in Y12 can:	Students working **at** expected in Y12 can:	Students working **beyond** expected in Y12 can:
	• Recognise and sketch the general shapes of quadratic, cubic, and reciprocal graphs using key values • Understand that integration is the reverse of differentiation and apply the basic rule $\int x^n \, dx$ • Use $\int$ notation and integrate simple polynomials with positive integer powers • Estimate or identify area under a curve using basic techniques; understand the meaning of a definite integral • Recall and apply the sine rule and cosine rule to calculate missing lengths and angles in basic triangles • Sketch the sine, cosine and tangent graphs over a given domain with support	• Sketch cubic, quartic, and reciprocal graphs, identifying key features such as intercepts and asymptotes • Perform indefinite and definite integration of polynomials and apply this to finding area under a curve • Use definite integrals to find areas between curves and lines; interpret negative area in context • Solve multi-step triangle problems using sine and cosine rule, including bearings or algebraic expressions • Sketch and interpret graphs of sine, cosine and tangent functions including transformations • Use trigonometric identities (e.g. $\sin^2 x + \cos^2 x = 1$) to simplify expressions	• Analyse the number of real roots or turning points from a graph sketch and relate to function degree • Use integration to calculate more complex areas, including between curves and lines • Tackle more complex problems involving trigonometry and the ambiguous case • Use algebraic manipulation to derive a circle's equation from geometric conditions such as perpendicular bisectors or triangle vertices • Find equations of circumcircles or locate centres by intersecting perpendicular bisectors • Solve complex co-ordinate geometry problems, particularly involving proof

	• Evaluate trig functions for standard angles and use symmetry or graphs to find related values • Recall that the general equation of a circle with centre at the origin is $x^2 + y^2 = r^2$ • Identify the centre and radius from a circle equation in standard form	• Solve trigonometric equations in each interval, including those requiring use of identities or factoring • Complete the square to rewrite circle equations and identify centre and radius • Find points of intersection between lines and circles by solving simultaneous equations • Use the discriminant to determine whether a line intersects, touches, or misses a circle • Find the equation of a tangent to a circle at a given point using perpendicular gradients	

Summer Term	Students working **towards** expected outcomes in Y12 can:	Students working **at** expected in Y12 can:	Students working **beyond** expected in Y12 can:
	• Expand brackets and factorise expressions involving common factors or quadratics • Simplify simple algebraic fractions and understand notation for cancelling factors • Perform polynomial division when dividing by linear factors (e.g. x ± a) with support • Understand what a mathematical proof is and recognise basic examples (e.g. numerical cases) • Recall exponential graphs and evaluate exponential expressions using a calculator • Understand the natural logarithm (ln) as log base e and use ln and e for basic calculations	• Simplify and manipulate algebraic fractions, including factorising numerators and denominators • Use algebraic division and the factor theorem to factorise cubics and solve related equations • Construct and interpret mathematical proofs including deduction, exhaustion, and disproof by counterexample • Solve exponential equations involving e, and use natural logarithms to solve for unknowns • Model exponential growth or decay in applied contexts, including interpreting constants in equations • Use the radian measure and convert between degrees and radians fluently	• Use algebraic division alongside the factor theorem to fully factorise higher-order polynomials • Construct clear and rigorous mathematical proofs • Rearrange and solve exponential models in multi-step contexts; interpret limitations of models and suggest refinements • Solve multi-step problems involving arc lengths, sector areas, or small angle approximations in applied scenarios • Use trigonometric identities in radians to solve unfamiliar equations over non-standard intervals • Interpret convergence of a geometric series algebraically; justify or derive the condition for sum to infinity • Use sigma notation with algebraic expressions and derive general forms

	• Use the formulas for arc length and sector area in radians with provided values • Recall or substitute into nth term formulae for arithmetic or geometric sequences • Use the sum formulae for arithmetic and geometric sequences with given parameters	• Apply arc length and sector area formulae in radians, including within compound shape problems • Solve trigonometric equations in radians over a specified domain • Use the small angle approximations for $\sin\theta$, $\cos\theta$ and $\tan\theta$ for angles close to 0 (in radians) • Use nth term and sum formulae for arithmetic and geometric series; find unknown values given other terms • Use the condition $\|r\| < 1$ to determine whether a geometric series converges; find the sum to infinity • Use sigma notation to evaluate or construct simple summations • Work with recurrence relations to generate sequences	• Interpret and model using recurrence relations; classify sequences as increasing, decreasing, or periodic • Critically evaluate the suitability of a sequence or series model for a given real-world context