Core 4 Key Skills Checklist

How confident are you with each topic? $\surd$ *confident* $-$ *not very sure* $\times$ *very unsure*

Chapter 1: Binomial series expansion	
Apply the appropriate formula for a binomial expansion with negative or fractional powers, and recall that any expansion whose power is not a positive integer will have an infinite number of terms.	
Expand brackets of the form $(a + bx)^n$, where n is any rational number, by taking out a common factor of a^n.	
Determine the range of values of x for which an expansion is valid.	

Chapter 2: Rational functions and division of polynomials	
Simplify rational expressions by factorising and cancelling down.	
Multiply or divide rational expressions following rules of fractions.	
Add or subtract rational expressions by forming an algebraic common denominator.	
Appreciate how the order of a polynomial changes when it is divided by a linear term.	
Use the remainder theorem to determine remainders when a polynomial is divided by a linear term.	
Apply algebraic long division, or the method of inspection along with the remainder theorem, to divide a polynomial by a linear term.	

Chapter 3: Partial fractions and applications	
Identify and deal with improper algebraic fractions by using algebraic long division or remainder theorem.	
Apply rules of rational expressions to partial fractions to simplify an identity.	
Use either substitution of specific values for x or comparison of coefficients to determine unknown constants in partial fractions where appropriate.	
Integrate rational functions by splitting into partial fractions and applying rules of integration (for instance, $\int \frac{f'(x)}{f(x)} = \ln f(x)$ and reverse chain rule).	
Find the binomial expansion of a rational expression by splitting into partial fractions and applying the techniques of binomial expansion.	

Chapter 4: Implicit differentiation and applications	
Differentiate powers of one variable with respect to another.	
Differentiate any differentiable function of one variable with respect to another.	
Apply the chain rule and product rule for differentiation in conjunction with implicit differentiation.	

Chapter 5: Parametric equations for curves and differentiation	
Use chain rule to convert between $\frac{dy}{dx}$, $\frac{dy}{dt}$ and $\frac{dx}{dt}$.	
Rearrange parametric equations and apply rules of algebra and trigonometry to generate a Cartesian equation.	

Chapter 6: Further trigonometry with integration	
Apply the $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$ formulae to deal with compound angles.	
Accurately derive and apply double angle formulae from the above identities.	
Integrate functions of $\sin^2 x$ or $\cos^2 x$ using a suitable double angle formula.	
Write a function such as $a \sin\theta + b \cos\theta$ in the form $R\cos(\theta \pm \alpha)$ or $R\sin(\theta \pm \alpha)$, using the appropriate rules for finding R and α.	
Solve equations of the form $a \sin\theta + b \cos\theta = c$ by applying the method above.	

Chapter 7: Exponential growth and decay	
Solve equations involving indices by applying the laws of logarithms.	
Interpret functions of e^t in terms of growth or decay.	
Differentiate $P = Ae^{kt}$ to generate a differential equation of the form $\frac{dP}{dt} = kP$.	
Use the separation of variables method to solve the differential equation $\frac{dP}{dt} = kP$, giving a solution of the form $P = Ae^{kt}$.	
Determine the value of the unknown constants in an exponential growth or decay formula, and apply to problems.	

Chapter 8: Differential equations	
Recognise first order differential equations and apply the method of separation of variables to solve them.	
Use initial conditions to determine constants of integration and rearrange to make either variable the subject of the equation.	
Interpret 'rate' in terms of a differential with respect to time in order to formulate differential equations.	

Chapter 9: Vector equations of lines	
Interpret vectors, including 3D vectors, geometrically, and be able to describe and calculate the magnitude of a vector using Pythagoras.	
Use appropriate notation to describe vectors, including column form.	
Use vector addition and subtraction to calculate position vectors.	
Find the distance between two points using the magnitude of the vector between them.	
Find a unit vector in the direction of any given vector in column form.	
Calculate the dot product of two vectors, and hence the angle between them.	
Use the fact that $\boldsymbol{a} \cdot \boldsymbol{b} = 0$ when vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ are perpendicular.	
Generate the vector equation of a line by finding a position vector and a direction vector. Recall that any point on the line would be a valid position vector, and any vector pointing in the direction of the line would be a valid direction vector.	
Determine the point of intersection of two lines (if any) by solving the system of simultaneous equations formed from the two vector lines.	
Determine if two lines which don't intersect are parallel or skew.	
Find the shortest distance from a point to a line.	
Solve geometric problems involving vectors, including use of angle rules, properties of quadrilaterals and area of triangles.	