

## Unit C1

### Pure Mathematics 1

Topics	Notes
1. Laws of indices for all rational exponents.	
Use and manipulation of surds.	To include simplification of fractions such as $\frac{2 + \sqrt{5}}{3 - \sqrt{5}}$ .
Quadratic functions and their graphs. The discriminant of a quadratic function. Completing the square. Solution of quadratic equations.	The nature of the roots of a quadratic equation. Condition for real roots and equal roots. To include finding the maximum or minimum value of a quadratic function.
Simultaneous equations: analytical solution by substitution, e.g. one linear and one quadratic.	To include finding the points of intersection or the point of contact of a line and a curve
Solution of linear and quadratic inequalities.	To include the solution of inequalities such as $1 - 2x < 4$ and $x^2 - 6x + 8 \geq 0$ .
Graphs of functions; sketching curves defined by simple equations. Geometrical interpretation of algebraic solution of equations. Use of intersection points of graphs of curves to solve equations.	The equations will be restricted to the form $y = f(x)$ .
Knowledge of the effect of simple transformations on the graph of $y = f(x)$ as represented by $y = af(x)$ , $y = f(x) + a$ , $y = f(x + a)$ , $y = f(ax)$ .	
2. Equation of a straight line, including the forms $y = mx + c$ , $y - y_1 = m(x - x_1)$ and $ax + by + c = 0$ . Conditions for two straight lines to be parallel or perpendicular to each other.	To include finding the gradient, equation, length and mid-point of a line joining two given points. To include finding the equations of lines which are parallel or perpendicular to a given line.
3. Algebraic manipulation of polynomials, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the Factor Theorem and the Remainder Theorem.	The use of the Factor Theorem and Remainder Theorem will be restricted to cubic polynomials and the solution of cubic equations.
Binomial expansion of $(1+x)^n$ for positive integer $n$ . The notations $n!$ and $\binom{n}{r}$ .	Binomial expansion of $(a + b)^n$ for positive integer $n$ is also required.

<b>Topics</b>	<b>Notes</b>
<p>4. The derivative of <math>f(x)</math> as the gradient of the tangent to the graph of <math>y = f(x)</math> at a point; the gradient of the tangent as a limit; interpretation as a rate of change; second order derivatives.</p> <p>Differentiation of <math>x^n</math> and related sums and differences.</p> <p>Application of differentiation to gradients, tangents and normals, maxima and minima, and stationary points, increasing and decreasing functions.</p>	<p>To include finding from first principles the derivative of a polynomial of degree less than 3. The notations <math>\frac{dy}{dx}</math> or <math>f'(x)</math> may be used.</p> <p>To include polynomials.</p> <p>Equations of tangents and normals. The use of maxima and minima in simple optimisation problems. To include stationary points of inflection and simple curve sketching.</p>