Prerequisite Pure Topics (4 pages; 6/12/21)

The following is a list of topics that feature in the ordinary A Level syllabus, but which are needed for Further Maths A Level (and STEP), and may need to be studied in advance of their being covered in ordinary A Level lessons. (It may not be exhaustive.)

(1) Circle theorems

(2) Straight lines

(i) $\frac{y-y_1}{x-x_1} = m = \frac{y_2-y_1}{x_2-x_1}$

(ii) gradients of perpendicular lines

(3) Trigonometry

(i) Graphs of $y = sin\theta, cos\theta$ & $tan\theta$

(ii) Sine and Cosine rules

(iii) Area of triangle $= \frac{1}{2}bcsinA$

(iv) Radians (including arc length and area of sector)

(v) $y = sin\theta \rightarrow y = \theta$ as $\theta \rightarrow 0$

(vi) $sin\theta, cos\theta, tan\theta$ for $\theta = 30°, 45°, 60°$

(vii) $sec\theta, cosec\theta$ & $cot\theta$

(viii) $tan\theta = \frac{sin\theta}{cos\theta}$

(ix) compound angle formulae: $\sin(A \pm B), \cos(A \pm B)$

(including $\sin(2\theta) = 2sin\theta cos\theta$)

(x) $cos^2\theta + sin^2\theta = 1$ and $cos^2\theta - sin^2\theta = \cos(2\theta)$

(xi) $tan^2\theta + 1 = sec^2\theta$

(xii) Writing $acos\theta + bsin\theta$ as $Rcos(\theta - \alpha)$ etc

(4) Functions

(i) $y = a^x$, and $y = e^x$ in particular

(ii) inverse functions

(iii) quadratics

(iv) cubics

(v) $y = \frac{1}{x}$

(vi) transformations of $y = f(x)$ to $y = f(ax)$ and $y = f(x - a)$

(vii) $y = |ax + b|$

(viii) convex and concave curves

(5) Differentiation

(i) $sinx, cosx$ & $tanx$

(ii) e^{ax}

(iii) lnx

(iv) a^x

(v) stationary points

(vi) points of inflexion

(vii) product and quotient rules

(viii) chain rule

(ix) $\frac{dx}{dy}$ is reciprocal of $\frac{dy}{dx}$

(x) implicit differentiation

(6) Integration

(i) $sinx, cosx$

(ii) $\frac{1}{x}$

(iii) Definite integrals

(iv) Integration by Parts

(v) Integration by substitution; eg $\int cosx \, sin^n x \, dx$: let $u = sinx$

(7) Polynomials

(i) Factor and Remainder theorems

(ii) division of a polynomial by a linear factor, by equating coefficients

(iii) relation between roots and coefficients

(8) Logarithms

(i) $c = log_a b \Leftrightarrow a^c = b$

(ii) Logarithm rules

(9) Inequalities

(i) division by negative quantity

(10) Series

(i) Arithmetic series; including $\sum_{r=1}^{n} r = \frac{1}{2}n(n+1)$

(ii) Geometric series (including sum to infinity)

(iii) General Binomial expansion

(11) Proof by induction

(12) Partial Fractions

(13) Parametric equations

(14) Vectors

(i) Addition and subtraction

(ii) Position vectors

(iii) Equation of line (vector and cartesian forms)

(iv) Scalar product

(v) Equation of plane (vector and cartesian forms)