TAUNTON SCHOOL

Year 12 Syllabus in a nutshell

IB Maths HL

Year 12 Syllabus in a nutshell – IB Analysis and Approaches HL

NB The * denotes sections of the course that are covered by the SL route also. The sections **NOT** in bold have also been completed by the students taking the SL Analysis and Approaches course and therefore allowing for ease of movement across to the SL courses, and also giving you an idea of topics that are yet to be taught on the SL course in year 13. Topics taught by the SL teacher in the year 12 include basic Probability and Probability models – Binomial and normal distributions and therefore if you do swap you will need to cover these topics individually.

Topic	Guide Reference	Summary
Sequences and Series	SL1.2* SL1.3* SL1.4* SL1.6 * SL1.8* SL1.9* **AHL1.10** **AHL1.11** **AHL1.16**	Arithmetic sequences and series , use of the formulae for the nth term and the sum of the first n terms of the sequence, use of sigma notation for sums of arithmetic sequences, Applications of arithmetic sequences, analysis, interpretation and prediction where a model is not perfectly arithmetic in real life. Geometric sequences and series, Use of the formulae for the nth term and the sum of the first n terms of the sequence , Use of sigma notation for sums of geometric sequences, Applications of geometric sequences, Sum of infinite convergent geometric sequences Financial applications of geometric sequences and series: compound interest and annual depreciation Simple deductive proof, numerical and algebraic; how to lay out a left-hand side to right-hand side (LHS to RHS) proof , The symbols and notation for equality and identity The binomial theorem: expansion of $(a+b)$, $n \in \mathbb{N}$, Use of Pascal's triangle and *nCr*. **Counting principles, including permutations and combinations** **Extension of the binomial theorem to fractional and negative indices, ie (*a* + *b*) ^{n}, *n* ∈ ℚ, Partial fractions** **Solutions of systems of linear equations (a maximum of three equations in three unknowns) including cases where there is a unique solution, an infinite number of solutions or no solution.**
Indices and Logarithms	**SL1.5*** **SL1.7*** **SL2.9***	**Laws of exponents with integer exponents, Introduction to logarithms with base 10 and e, Numerical evaluation of logarithms using technology** **Laws of exponents with rational exponents, Laws of logarithms, Change of base of a logarithm, Solving exponential equations, including using logarithms.** **Exponential functions and their graphs: *f*(*x*) = *ax*, *a* > 0, *f*(*x*) = e^x** **Logarithmic functions and their graphs: *f*(*x*) = log*ax*, *x* > 0, *f*(*x*) = ln*x*, *x* > 0**
Complex Numbers	**AHL1.12**	**Complex numbers: the number i, where i2 = – 1. Cartesian form *z* = *a* + *b*i; the terms real part, imaginary part, conjugate, modulus and argument. The complex plane.**
Proof	**AHL1.15**	**Proof by mathematical induction, Proof by contradiction, Use of a counterexample to show that a statement is not always true**
Linear Geometry	SL2.1* SL2.4*	Different forms of the equation of a straight line , Gradient; intercepts, Lines with gradients, $m1$ and $m2$ Parallel lines $m_1 = m_2$, Perpendicular lines $m_1 \times m_2 = -1$ Determine key features of graphs, Finding the point of intersection of two curves or lines using technology

Geometry and Trigonometry in 2D and 3D	SL3.1* SL3.2* SL3.3*	The distance between two points in three- dimensional space, and their midpoint , Volume and surface area of three-dimensional solids including right-pyramid, right cone, sphere, hemisphere and combinations of these solids , The size of an angle between two intersecting lines or between a line and a plane Use of sine, cosine and tangent ratios to find the sides and angles of right-angled triangles , The sine rule: $a/\sin A = b/\sin B = c/\sin C$, The cosine rule: $c^2 = a^2 + b^2 - 2ab \sin C$; $\cos C = a^2 + b^2 - c^2 / 2ab$, Area of a triangle as $1/2\ ab \sin C$ Applications of right and non-right-angled trigonometry, including Pythagoras' theorem , Angles of elevation and depression , Construction of labelled diagrams from written statements
Statistics	SL4.1* SL4.2* SL4.3* SL4.4* SL 4.10	Concepts of population, sample, random sample, discrete and continuous data , Reliability of data sources and bias in sampling , Interpretation of outliers , Sampling techniques and their effectiveness Presentation of data (discrete and continuous): frequency distributions (tables) , Histograms , Cumulative frequency; cumulative frequency graphs; use to find median, quartiles, percentiles, range and interquartile range (IQR) , Production and understanding of box and whisker diagrams. Measures of central tendency (mean, median and mode) , Estimation of mean from grouped data , Modal class , Measures of dispersion (interquartile range, standard deviation and variance) , Effect of constant changes on the original data , Quartiles of discrete data Linear correlation of bivariate data , Pearson's product−moment correlation coefficient, r , Scatter diagrams; lines of best fit, by eye, passing through the mean point , Equation of the regression line of y on x , Use of the equation of the regression line for prediction purposes , Interpret the meaning of the parameters, a and b, in a linear regression $y = ax + b$ Equation of the regression line of x on y , Use of the equation for prediction purposes
Functions	SL2.2* SL2.3* SL2.4* SL2.5* SL2.6* SL2.7* SL2.8* SL2.10* SL2.11* **AHL2.12** **AHL2.13** **AHL2.14** **AHL2.15** **AHL2.16**	Concept of a function, domain, range and graph , Function notation, for example $f(x)$, $v(t)$, $C(n)$, The concept of a function as a mathematical model , Informal concept that an inverse function reverses or undoes the effect of a function , Inverse function as a reflection in the line $y = x$, and the notation $f^{-1}(x)$ The graph of a function; its equation $y = f(x)$, Creating a sketch from information given or a context, including transferring a graph from screen to paper , Using technology to graph functions including their sums and differences Determine key features of graphs , Finding the point of intersection of two curves or lines using technology Composite functions , Identity function , Finding the inverse function $f^{-1}(x)$ The quadratic function $f(x) = ax^2 + bx + c$: its graph, y-intercept 0, c , Axis of symmetry , The form $f(x) = a(x - p)(x - q)$, x intercepts $(p, 0)$ and $(q, 0)$, The form $f(x) = a(x - h)^2 + k$, vertex (h, k) Solution of quadratic equations and inequalities , The quadratic formula , The discriminant $\Delta = b^2 - 4ac$ and the nature of the roots, that is, two distinct real roots, two equal real roots, no real roots The reciprocal function $f(x) = 1/x$, $x \neq 0$: its graph and self-inverse nature , Rational functions of the form $f(x) = ax+b / cx+d$ and their graphs , Equations of vertical and horizontal asymptotes

		Solving equations, both graphically and analytically , Use of technology to solve a variety of equations, including those where there is no appropriate analytic approach , Applications of graphing skills and solving equations that relate to real-life situations Transformations of graphs , Translations: $y = f(x) + b$; $y = f(x) - a$, Reflections (in both axes): $y = -f(x)$; $y = f(-x)$, Vertical stretch with scale factor p: $y = pf(x)$, Horizontal stretch with scale factor 1 q : $y = f(qx)$, Composite transformations **Polynomial functions, their graphs and equations; zeros, roots and factors. The factor and remainder theorems** **Sum and product of the roots of polynomial equations** **Rational functions, Odd and even functions.** **Finding the inverse function, *f*−1(*x*), including domain restriction, Self-inverse functions** **Solutions of *g*(*x*) ≥ *f*(*x*), both graphically and analytically** **The graphs of the functions, *y* = | *f*(*x*)| and *y* = *f*(|*x*|), *y* = 1/ *f*(*x*), *y* = *f*(*ax* + *b*), *y* = [*f*(*x*)]2** **Solution of modulus equations and inequalities.**
Calculus	SL5.1* SL5.2* SL5.3* SL5.4* **SL5.5*** SL5.6* SL5.7* SL5.8* SL5.9* **SL5.10*** **SL5.11*** **AHL5.12** **AHL5.14** **AHL5.15** **AHL5.16**	Introduction to the concept of a limit , Derivative interpreted as gradient function and as rate of change Increasing and decreasing functions , Graphical interpretation of $f'(x)>0$, $f'(x) = 0$, $f'(x)< 0$ Derivative of $f(x) = ax^n$ $f'(x) = anx^{n-1}$, $n \in \mathbb{Z}$, The derivative of functions of the form $f(x) = ax^{\,n}$ _$bx^{\,n-1}$ . . . where all exponents are integers Tangents and normals at a given point, and their equations **Introduction to integration as anti-differentiation of functions of the form *f*(*x*) = *axn* + *bxn* − 1 + ..., where *n* ∈ ℤ, *n* ≠ − 1** **Anti-differentiation with a boundary condition to determine the constant term**. **Definite integrals using technology. Area of a region enclosed by a curve *y* = *f*(*x*) and the *x* -axis, where *f*(*x*) > 0.** Derivative of x n ($n \in \mathbb{Q}$), sin x, cos x, e x and ln x , Differentiation of a sum and a multiple of these functions , The chain rule for composite functions , The product and quotient rules The second derivative ,Graphical behaviour of functions, including the relationship between the graphs of f, f' and f'' Local maximum and minimum points , Testing for maximum and minimum , Optimization , Points of inflexion with zero and non-zero gradients Kinematic problems involving displacement s, velocity v, acceleration a and total distance travelled **Indefinite integral of x^n ($n \in \mathbb{Q}$), sin*x*, cos*x*, 1/*x* and e^x** **The composites of any of these with the linear function *ax* + *b*** **Integration by inspection (reverse chain rule) or by substitution for expressions of the form: ∫*kg*′(*x*) *f*(*g*(*x*))d*x*** **Definite integrals, including analytical approach** **Areas of a region enclosed by a curve *y* = *f*(*x*) and the *x*-axis, where *f*(*x*) can be positive or negative, without the use of technology.** **Areas between curves.** **Informal understanding of continuity and differentiability of a function at a point.** **Understanding of limits (convergence and divergence). Definition of derivative from first principles** **Higher derivatives**

		Implicit differentiation. Related rates of change. Optimisation problems **Derivatives of tan*x*, sec*x*, cosec*x*, cot*x*, *ax*, log*ax*, arcsin*x*, arccos*x*, arctan*x*.** **Indefinite integrals of the derivatives of any of the above functions. The composites of any of these with a linear function** **Use of partial fractions to rearrange the integrand** **Integration by substitution. Integration by parts. Repeated integration by parts**.
Trigonometry	SL3.4 SL3.5 SL3.6 SL3.7 SL3.8 **AHL3.9** **AHL3.10** **AHL3.11**	The circle: radian measure of angles; length of an arc; area of a sector. Definition of tan θ as $sin\theta$ / cos θ Exact values of trigonometric ratios of 0, π/ 6 , π/ 4 , π /3 , π/ 2 and their multiples , Extension of the sine rule to the ambiguous case The circular functions sin x, cos x, and tan x; amplitude, their periodic nature, and their graphs , Composite functions of the form $f(x)$ = a sin($b(x + c) + d$) , Transformations , Real-life contexts Solving trigonometric equations in a finite interval, both graphically and analytically , Equations leading to quadratic equations in sin x, cos x, or tan x **Definition of the reciprocal trigonometric ratios secϑ, cosecϑ and cotϑ.** **Pythagorean identities: 1 + tan$^2\vartheta$ = sec$^2\vartheta$, 1 + cot$^2\vartheta$ = cosec$^2\vartheta$** **The inverse functions *f*(*x*) = arcsin*x*, *f*(*x*) = arccos*x*, *f*(*x*) = arctan*x*; their domains and ranges; their graphs.** **Compound angle identities. Double angle identity for tan.** **Relationships between trigonometric functions and the symmetry properties of their graphs.**