IB – NSW HSC Mathematics Subject Mapping

Methods

Based on the NSW Maths mapping team's report, the IB has conducted further analysis on the mapping of the new DP Maths courses to each of the local courses. Each content statement from the NSW syllabi was categorised against the DP mathematics courses as either a complete match, a partial match or as prior learning and percentage matches were calculated.

Mathematics: analysis and approaches (MAA) SL/HL

Currently, the ACTAC REG outcome has mapped MAA SL to the NSW HSC Advanced Mathematics course. With the analysis on percentage matching, there is a 79% match when comparing MAA SL to the NSW HSC Advanced Mathematics course. Table below shows the percentage match of the MAA courses in both levels to the NSW HSC Maths courses.

NSW - Advanced Mathematics vs Analysis and approaches		
Level	**SL**	**HL**
Blank	35	10
Prior Learning	7	8
Complete	115	145
Partial	7	1
Total	164	164
%C + PL	74	93
%C, P, PL	**79**	**94**

NSW - Extension 1 mathematics vs Analysis and approaches		
Level	SL	HL
Prior Learning	0	0
Complete	20	73
Partial	0	0
Total		
%C + PL	21	78
%C, P, PL	**21**	**78**

NSW - Extension 2 mathematics vs Analysis and approaches		
Level		**HL**
Prior Learning		1
Complete		49
Partial		0
Total		
%C + PL		68
%C, P, PL		68

Mathematics: applications and interpretation (MAI) SL/HL

With the analysis on percentage matching, there is a 71% match when comparing MAI SL to NSW HSC Advanced Mathematics course. In addition, there is a substantial amount of additional material of the same level which is included in MAI SL but not in the NSW HSC Advanced Mathematics course. Please refer to Appendix 1 for further details.

On the other hand, MAI HL lies between NSW HSC Maths Extension 1 and 2 having 56% and 49% matches respectively. When taking a conservative approach, MAI HL is likely aligned to the NSW HSC Maths Extension 1 course. There is also additional material of an equivalent level in MAI HL which is not offered in the NSW HSC Maths Extension 1 course. Please refer to Appendix 2 for further details.

NSW - Advanced Mathematics vs Applications and Interpretation		
Level	**SL**	**HL**
Blank	48	15
Prior Learning	7	8
Complete	93	139
Partial	16	2
Total	164	164
%C + PL	61	90
%C, P, PL	**71**	**91**

NSW - Extension 1 mathematics vs Applications and Interpretation		
Level	SL	HL
Prior Learning	0	0
Complete	12	51
Partial	3	2
Total	94	94
%C + PL	13	54
%C, P, PL	**16**	**56**

NSW - Extension 2 mathematics vs Applications and Interpretation		
Level		**HL**
Prior Learning		1
Complete		31
Partial		4
Total		
%C + PL		44
%C, P, PL		**49**

Proposal on subject mapping

Although MAI HL does not contain formal proof which arises many times within the NSW HSC Maths Extension 1 course, however, many of the modelling concepts in the NSW Maths Extension 2 course could appear on paper 3 of the MAI HL course. These topics were not included in our count and therefore, lowers the percentage match on the mapping. There is, however, additional material of an equivalent level in the MAI HL course which is not in the NSW HSC Maths Extension 1 course.

If it is suggested that MAI SL maps to the NSW HSC Advanced Mathematics course, then MAI HL should be at least a level above that if the extra content and time is considered.

IB Subjects	ACTAC REG Recommendation	Proposal
Mathematics: applications and interpretation SL	General Mathematics / Maths Standard 2	Maths Advanced
Mathematics: analysis and approaches SL	Mathematics / Maths Advanced	Maths Advanced
Mathematics: applications and interpretation HL	Mathematics / Maths Advanced	Maths Extension 1
Mathematics: analysis and approaches HL	Maths Extension 2	Maths Extension 2

Appendix 1 Additional MAI SL Content

Topic	Strand	Content
Number and Algebra	SL1.1	Operations with numbers in the form a×10k where 1≤a<10 and k is an integer.
	SL1.6	Approximation: decimal places, significant figures.
	SL1.6	Upper and lower bounds of rounded numbers.
	SL1.6	Percentage errors.
	SL1.6	Estimation.
	SL1.8	Use technology to solve: Systems of linear equations in up to 3 variables Polynomial equations
Functions	SL 2.6	Modelling skills: Use the modelling process described in the "mathematical modelling" section to create, fit and use the theoretical models in section SL2.5 and their graphs
	SL 2.6	Develop and fit the model: Given a context recognize and choose an appropriate model and possible parameters. Determine a reasonable domain for a model.
	SL 2.6	Find the parameters of a model.
	SL 2.6	Test and reflect upon the model: Comment on the appropriateness and reasonableness of a model. Justify the choice of a particular model, based on the shape of the data, properties of the curve and/or on the context of the situation.
	SL 2.6	Use the model: Reading, interpreting and making predictions based on the model.
Geometry and Trigonometry	SL 3.6	Voronoi diagrams: sites, vertices, edges, cells. Addition of a site to an existing Voronoi diagram. Nearest neighbour interpolation. Applications of the "toxic waste dump" problem.
Statistics and Probability	SL 4.1	Reliability of data sources and bias in sampling.
	SL 4.1	Sampling techniques and their effectiveness.
	SL 4.10	Spearman's rank correlation coefficient, rs.
	SL 4.10	Awareness of the appropriateness and limitations of Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient, and the effect of outliers on each.
	SL 4.11	Formulation of null and alternative hypotheses, H0and H1. Significance levels. p -values.
	SL 4.11	Expected and observed frequencies. The $\chi 2$ test for independence: contingency tables, degrees of freedom,

		critical value. The $\chi 2$ goodness of fit test.
	SL 4.11	The t -test. Use of the p -value to compare the means of two populations. Using one-tailed and two-tailed tests.

Appendix 2 Additional MAI HL Content

Topic	Strand	Content
Number and Algebra	AHL 1.13	Adding sinusoidal functions with the same frequencies but different phase shift angles.
	AHL 1.14	Definition of a matrix: the terms element, row, column and order for m×n matrices.
	AHL1.14	Algebra of matrices: equality; addition; subtraction; multiplication by a scalar for m×n matrices.
	AHL 1.14	Multiplication of matrices. Properties of matrix multiplication: associativity, distributivity and non-commutativity.
	AHL1.14	Identity and zero matrices. Determinants and inverses of n×n matrices with technology, and by hand for 2×2 matrices.
	AHL 1.14	Awareness that a system of linear equations can be written in the form Ax=b.
	AHL1.14	Solution of the systems of equations using inverse matrix.
	AHL 1.15	Eigenvalues and eigenvectors. Characteristic polynomial of 2×2 matrices. Diagonalization of 2×2 matrices (restricted to the case where there are distinct real eigenvalues).
	AHL 1.15	Applications to powers of 2×2 matrices.
Functions	AHL 2.9	Logistic models: f(x) = L/(1+Ce^-kx); L, C, k>0

Topic	Strand	Content
Geometry and Trigonometry	AHL 3.10	Concept of a vector and a scalar. Representation of vectors using directed line segments. Unit vectors; base vectors i, j, k. Components of a vector; column representation; The zero vector 0, the vector v.
	AHL 3.10	Position vectors
	AHL 3.10	Rescaling and normalizing vectors.
	AHL 3.12	Motion with variable velocity in two dimensions.
	AHL 3.13	Definition and calculation of the vector product of two vectors
	AHL 3.13	Geometric interpretation of |v×w|.
	AHL 3.13	Components of vectors.
	AHL 3.14	Graph theory: Graphs, vertices, edges, adjacent vertices, adjacent edges. Degree of a vertex.
	AHL 3.14	Simple graphs; complete graphs; weighted graphs.
	AHL 3.14	Directed graphs; in degree and out degree of a directed graph. Subgraphs; trees.

	AHL 3.15	Adjacency matrices. Walks. Number of k -length walks (or less than k -length walks) between two vertices
	AHL 3.15	Weighted adjacency tables. Construction of the transition matrix for a strongly-connected, undirected or directed graph.
	AHL 3.16	Tree and cycle algorithms with undirected graphs. Walks, trails, paths, circuits, cycles.
	AHL 3.16	Eulerian trails and circuits. Hamiltonian paths and cycles. Minimum spanning tree (MST) graph algorithms: Kruskal's and Prim's algorithms for finding minimum spanning trees.
	AHL 3.16	Chinese postman problem and algorithm for solution, to determine the shortest route around a weighted graph with up to four odd vertices, going along each edge at least once.
	AHL 3.16	Travelling salesman problem to determine the Hamiltonian cycle of least weight in a weighted complete graph. Nearest neighbour algorithm for determining an upper bound for the travelling salesman problem. Deleted vertex algorithm for determining a lower bound for the travelling salesman problem.
Statistics and Probability	AHL 4.12	Categorizing numerical data in a $\chi 2$ table and justifying the choice of categorisation. Choosing an appropriate number of degrees of freedom when estimating parameters from data when carrying out the $\chi 2$ goodness of fit test.
	AHL 4.12	Definition of reliability and validity. Reliability tests. Validity tests.
	AHL 4.13	Non-linear regression
	AHL 4.13	Sum of square residuals (SSres) as a measure of fit for a model.
	AHL 4.13	The coefficient of determination (R^2). Evaluation of R^2 using technology.
	AHL 4.14	Linear transformation of a single random variable.
	AHL 4.14	Expected value of linear combinations of n random variables. Variance of linear combinations of n independent random variables.
	AHL 4.15	A linear combination of n independent normal random variables is normally distributed. In particular, $X \sim N(\mu, \sigma 2) \Rightarrow \bar{X} \sim N(\mu, \sigma^2/n)$.
	AHL 4.15	Central limit theorem.
	AHL 4.16	Confidence intervals for the mean of a normal population.
	AHL 4.17	Poisson distribution, its mean and variance. Sum of two independent Poisson distributions has a Poisson distribution.

	AHL 4.18	Critical values and critical regions. Test for population mean for normal distribution
	AHL 4.18	Test for proportion using binomial distribution.
	AHL 4.18	Test for population mean using Poisson distribution.
	AHL 4.18	Use of technology to test the hypothesis that the population product moment correlation coefficient (ρ) is 0 for bivariate normal distributions
	AHL 4.18	Type I and II errors including calculations of their probabilities.
	AHL 4.19	Transition matrices. Powers of transition matrices.
	AHL 4.19	Regular Markov chains. Initial state probability matrices.
	AHL 4.19	Calculation of steady state and long-term probabilities by repeated multiplication of the transition matrix or by solving a system of linear equations.
Calculus	AHL 5.14	Solving by separation of variables.
	AHL 5.16	Euler's method for finding the approximate solution to first order differential equations. Numerical solution of dydx=f(x,y).
	AHL 5.16	Numerical solution of the coupled system dx/dt=f1(x,y,t) and dy/dt=f2(x,y,t).
	AHL 5.17	Phase portrait for the solutions of coupled differential equations of the form: dxdt=ax+by dydt=cx+dy. Qualitative analysis of future paths for distinct, real, complex and imaginary eigenvalues. Sketching trajectories and using phase portraits to identify key features such as equilibrium points, stable populations and saddle points.
	AHL 5.18	Solutions of d^2x/dt^2=f(x,dxdt,t) by Euler's method.