HL Math Topics Self-Check   Name_____

1. In each section, a) circle any items that you need to review; b) check one or more boxes next to the section.
2. KEEP THIS PAPER for reference between now and the IB Math exam.

Topic 1: Algebra	All good!	Review myself	Get help	Refresh before test
1.1 Arithmetic sequences and series; sum of finite arithmetic series; geometric sequences and series; sum of finite and infinite geometric series; Sigma notation; Applications.				
1.2 Exponents and logarithms; Laws of exponents; laws of logarithms; Change of base.				
1.3 Counting principles, including permutations and combinations. The binomial theorem: expansion of $(a + b)^n$				
1.4 Proof by mathematical induction.				
1.5 Complex numbers: the number i; the terms real part, imaginary part, conjugate, modulus and argument. Cartesian form $z = a+bi$; Sums, products and quotients of complex numbers.				
1.6 Modulus–argument (polar) form $z = r(\cos\theta + i\sin\theta) = r\,\text{cis}\theta = r\,e^{i\theta}$; The complex plane.				
1.7 Powers of complex numbers: de Moivre's theorem; nth roots of a complex number.				
1.8 Conjugate roots of polynomial equations with real coefficients.				
1.9 Solutions of systems of linear equations (a maximum of three equations in three unknowns), including cases where there is a unique solution, an infinity of solutions or no solution.				
Topic 2: Functions				
2.1 Concept of function $f : x \rightarrow f(x)$. Domain, range; image (value). Odd and even functions. Composite functions $f \circ g$; Identity function. One-to-one and many-to-one functions. Inverse function, including domain restriction. Self-inverse functions.				
2.2 The graph of a function; its equation $y = f(x)$. Investigation of key features of graphs, such as maximum and minimum values, intercepts, horizontal and vertical asymptotes and symmetry, and consideration of domain and range. The graphs of the functions $y = |f(x)|$ and $y = f(|x|)$ The graph of $y = 1/f(x)$ given the graph of $y = f(x)$				
2.3 Transformations of graphs: translations; stretches; reflections in the axes. The graph of the inverse function as a reflection in $y=x$				
2.4 The rational function $x \mapsto (ax + b)/(cx+d)$, and its graph. Exponential functions and graphs; Logarithmic functions and graphs				
2.5 Polynomial functions and their graphs. The factor and remainder theorems; The fundamental theorem of algebra.				
2.6 Solving quadratic equations using the quadratic formula; Use of the discriminant $\Delta = b^2-4ac$ to determine the nature of the roots; Solving polynomial equations both graphically and algebraically; Sum and product of the roots of polynomial equations; Solution of $a^x = b$ using logarithms; Use of technology to solve a variety of equations, including those where there is no appropriate analytic approach.				
2.7 Solutions of $g(x) \geq f(x)$. Graphical or algebraic methods, for simple polynomials up to degree 3. Use of technology for these and other functions.				
Topic 3: Trigonometry	All good!	Review myself	Get help	Refresh before

				test
3.1	The circle: radian measure of angles; length of an arc; area of a sector.				
3.2	Definition of cosθ , sinθ and tanθ in terms of the unit circle. Exact values of sin, cos and tan of 0, π/6, π/4, π/3, π/2 and their multiples. Definition of the reciprocal trigonometric ratios secθ , cscθ and cotθ; Pythagorean identities				
3.3	Compound angle identities; Double angle identities.				
3.4	Composite functions of the form $f(x) = a\sin(b(x+c)) +d$. Applications				
3.5	The inverse functions arcsin x , arccos$x$, arctan$x$; their domains and ranges; graphs.				
3.6	Algebraic and graphical methods of solving trigonometric equations in a finite interval, including the use of trigonometric identities and factorization. Not required:The general solution of trigonometric equations				
3.7	The cosine rule; The sine rule including the ambiguous case; Area of a triangle as $1/2ab$ sin C; applications				
Topic 4: Vectors					
4.1	Concept of a vector; Representation of vectors using directed line segments; Unit vectors; base vectors *i, j, k;* Components of a vector; Algebraic and geometric approaches to the following: the sum and difference of two vectors; the zero vector 0 , the vector −v ; multiplication by a scalar, *kv* ; magnitude of a vector; position vectors OA = a; AB=*b - a*				
4.2	The definition of the scalar product of two vectors. Properties of the scalar product:$v \cdot w = w \cdot v$; $u \cdot (v + w) = u \cdot v + u \cdot w$; (kv)·w=k(v *w ·); v ·v= v2* . The angle between two vectors. Perpendicular vectors; parallel vectors.				
4.3	Vector equation of a line in two and three dimensions: $r = a + \lambda b$. Simple applications to kinematics. The angle between two lines.				
4.4	Coincident, parallel, intersecting and skew lines; distinguishing between these cases. Points of intersection.				
4.5	The definition of the vector product of two vectors. Properties of the vector product: *v × w =−w×v* ; *u×(v+w)=u×v +u×w*; *(kv)×w=k(v* *×w); v×v=0.* Geometric interpretation of $|v \times w|$.				
4.6	Vector equation of a plane *r = a+λb+μc* Use of normal vector to obtain the form *r·n=a·n*. Cartesian equation of a plane $ax + by + cz = d$.				
4.7	Intersections of: a line with a plane; two planes; three planes. Angle between: a line and a plane; two planes.				

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Topic 5: Statistics					
5.1	Concepts of population, sample, random sample and frequency distribution of discrete and continuous data. Grouped data: mid-interval values, interval width, upper and lower interval boundaries. Mean, variance, standard deviation.				
5.2	Concepts of trial, outcome, equally likely outcomes, sample space (*U*) and event. The probability of an event *A* as P(*A*) = *n*(*A*) . *n*(*U*) The complementary events *A* and *A'* (not *A*). Use of Venn diagrams, tree diagrams, counting principles and tables of outcomes to solve problems.				
5.3	Combined events; the formula for P(*A* ∪ *B*) . Mutually exclusive events.				
5.4	Conditional probability; Independent events; Use of Bayes' theorem for a maximum of three events.				
5.5	Concept of discrete and continuous random variables and their probability distributions. Definition and use of probability density functions; Expected value (mean), mode, median, variance and standard deviation; Applications.				
5.6	Binomial distribution, its mean and variance; Poisson distribution, its mean and variance.				
5.7	Normal distribution. Properties of the normal distribution. Standardization of normal variables.				
Topic 6: Calculus					
6.1	Informal ideas of limit, continuity and convergence. Definition of derivative from first principles $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ The derivative interpreted as a gradient function and as a rate of change. Finding equations of tangents and normal; Identifying increasing and decreasing functions. The second derivative. Higher derivatives				
6.2	Derivatives of x^n , sin x , cos x , tan x , e^x and ln x . Differentiation of sums and multiples of functions; The product and quotient rules; The chain rule for composite functions. Related rates of change; Implicit differentiation. Derivatives of sec$x$, csc$x$, cot$x$, ax, log$a$ x, arcsin x , arccos x and arctan x .				
6.3	Local maximum and minimum values; Optimization problems; Points of inflexion with zero and non-zero gradients; Graphical behaviour of functions, including the relationship between the graphs of f , f' and f''.				
6.4	Indefinite integration as anti-differentiation; Indefinite integral of x^n , sin x , cos x and e^x . Other indefinite integrals using the results from 6.2; The composites of any of these with a linear function.				
6.5	Anti-differentiation with a boundary condition to determine the constant of integration. Definite integrals; Area of the region enclosed by a curve and the *x*-axis or *y*-axis in a given interval; areas of regions enclosed by curves; Volumes of revolution about the *x*-axis or *y*-axis.				
6.6	Kinematic problems involving displacement *s*, velocity *v* and acceleration *a*. Total distance travelled.				
6.7	Integration by substitution; Integration by parts.				

	Topic 9 – Option: Calculus	All good!	Review myself	Get help	Refresh before test
9.1	Infinite sequences of real numbers and their convergence or divergence.				
9.2	Convergence of infinite series. Tests for convergence: comparison test; limit comparison test; ratio test; integral test. The *p-series,* $\sum 1/np$ Series that converge absolutely. Series that converge conditionally. Alternating series. Power series: radius of convergence and interval of convergence. Determination of the radius of convergence by the ratio test.				
9.3	Continuity and differentiability of a function at a point Continuous functions and differentiable functions.				
9.4	The integral as a limit of a sum; lower and upper Riemann sums. Fundamental theorem of calculus. Improper integrals of the type $\int_a^\infty f(x)\,dx$				
9.5	First-order differential equations. Geometric interpretation using slope fields, including identification of isoclines. Numerical solution of dy/dx = f (x, *y)* using Euler's method. Variables separable. Homogeneous differential equation dy/dx = f(y/x) using the substitution *y = vx.* Solution of *y' + P(x)y = Q(x),* using the integrating factor.				
9.6	Rolle's theorem. Mean value theorem. Taylor polynomials; the Lagrange form of the error term. Maclaurin series for e^x , sinx, cosx, ln(1+x), $(1+x)^p$, $p \in Q$. Use of substitution, products, integration and differentiation to obtain other series. Taylor series developed from differential equations.				
9.7	The evaluation of limits of the form lim x →a f(x)/g(x) and lim x→ infinity f(x)/g(x) using l'Hopital's rule or the Taylor series.				
Miscellaneous We may cover these as they come up. If you have specific questions, ASK!					
M1	Graphing Calculator Skills – graph in appropriate window (and then sketch if asked), solve equations, numerical integral, stats commands, what needs to be memorized				
M2	Command Terms – show, explain, find, etc.				
M3	Problem-Solving – How do I approach…?				
M4	No Calculator Skills – arithmetic, simplifying fractions, simplifying radicals, evaluating definite integrals, etc.				
M5	How to write a numerical answer – exact, rounding, simplifying				
M6	How to show work for…				
M7	How to show reasoning for…				