COURSE REVISION GUIDE

Analysis and approaches

For students taking IB Mathematics - Standard level

51 numbered sections | 5 topics | AA SL

EXAMINATIONS 2026-2028

Current course: first assessment 2021; final assessment November 2028. Checked against the official guide updated November 2024.

Build accurate algebra, clear reasoning and confidence with and without technology.

Use each checkbox after you can carry out the skill and explain your method. Return to unchecked skills, practice an example, then try a fresh question without the solution beside you.

YOUR COURSE MAP

1	**Number and algebra**	9 sections	**p. 2**
2	**Functions**	11 sections	**p. 4**
3	**Geometry and trigonometry**	8 sections	**p. 6**
4	**Statistics and probability**	12 sections	**p. 7**
5	**Calculus**	11 sections	**p. 9**

Skills beyond the checklist

Clear mathematical habits

Show your method; check restrictions, units and accuracy; justify what your answer means.

Your mathematical exploration

Investigate a focused question, develop your own mathematics, evaluate results and acknowledge sources.

Official syllabus and course versions

Open the official IB-hosted subject guide

2029 examinations onward: check the revised course information

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1 Number and algebra

Build reliable algebraic tools, recognise numerical patterns and justify why a result works.

1.1 Working across scales

- ☐ Calculate with very large or very small quantities and express the result in standard form.
- ☐ Keep the leading number from 1 up to, but not including, 10; translate a calculator's E display into a power of 10.

1.2 Patterns with a constant step

- ☐ Recover the first term and common difference from information about an arithmetic sequence.
- ☐ Find a particular term or a total of consecutive terms, including sums written with Σ.
- ☐ Build an arithmetic model for a context, make predictions and judge whether a constant step is a reasonable approximation.

1.3 Patterns with a constant multiplier

- ☐ Identify the first term and common ratio of a geometric sequence, including from incomplete information.
- ☐ Calculate terms and finite totals, and move between an expanded sum and Σ notation.

1.3 Patterns with a constant multiplier - continued

- ☐ Use a geometric model to describe repeated percentage change and interpret predictions in context.

1.4 Money over time

- ☐ Model compound growth and annual depreciation; distinguish a percentage change from the multiplier used in the model.
- ☐ Match the interest rate and number of periods to annual, half-yearly, quarterly or monthly compounding; use financial technology when appropriate.
- ☐ Adjust an investment's future value for inflation to describe its purchasing power.

1.5 Powers and logarithmic notation

- ☐ Simplify products, quotients and powers involving integer exponents, including zero and negative exponents.
- ☐ Translate an exponential statement into a logarithmic statement and explain which exponent a logarithm represents.

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1 Number and algebra / continued

1.5 Powers and logarithmic notation - continued

- ☐ Evaluate common and natural logarithms with technology, remembering that a real logarithm needs a positive argument.

1.6 Writing a convincing algebraic argument

- ☐ Establish a numerical or algebraic claim through a logical chain of justified steps.
- ☐ Prove an identity by transforming one side into the other; distinguish an identity from an equation true only for particular values.
- ☐ Check a proposed result and explain what the check does, and does not, establish.

1.7 Rewriting powers and solving exponential equations

- ☐ Connect rational powers with roots and simplify expressions, taking the principal non-negative root when an even root is intended.
- ☐ Expand or combine logarithms using their product, quotient and power rules; check positive arguments and valid bases.

1.7 Rewriting powers and solving exponential equations - continued

- ☐ Change the logarithm base when useful, and solve exponential equations with common bases or logarithms.

1.8 A finite total from infinitely many terms

- ☐ Decide whether a geometric series converges by checking that the absolute value of its ratio is less than 1.
- ☐ Use the sum to infinity to find a total or an unknown parameter, and reject values that fail the convergence condition.

1.9 Expanding a positive integer power

- ☐ Use binomial coefficients to expand a power of a two-term expression or extract a required term or coefficient.
- ☐ Calculate combination coefficients from factorials, Pascal's triangle or technology, keeping powers and signs consistent.

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2 Functions

Move between equations, graphs and descriptions to understand how inputs determine outputs.

2.1 Describing straight lines

- ☐ Find a line's gradient and intercepts from points, an equation or a diagram.
- ☐ Build and rearrange line equations in gradient-intercept, point-gradient and general form.
- ☐ Use gradient relationships to construct parallel or perpendicular lines and interpret a gradient in its context.

2.2 Inputs, outputs and reversing a function

- ☐ Interpret function notation and determine sensible domains and ranges from a formula, graph or model.
- ☐ Explain how an inverse reverses a one-to-one function; interchange its domain and range.
- ☐ Relate a function and its inverse through reflection in $y = x$, without confusing an inverse with a reciprocal.

2.3 Turning function information into a graph

- ☐ Produce a labelled sketch from a formula, description or calculator display, showing the important shape and features.
- ☐ Use graphing technology with a suitable viewing window, including for sums or differences of functions.

2.3 Turning function information into a graph - continued

- ☐ Distinguish a carefully scaled drawing from a sketch that communicates the essential behaviour.

2.4 Reading a graph with technology

- ☐ Locate roots, intercepts, turning points, extreme values and intersections accurately with graphing tools.
- ☐ Recognise symmetry and describe horizontal or vertical asymptotes from the graph.
- ☐ Check that the viewing window includes the features relevant to the question.

2.5 Combining and undoing functions

- ☐ Evaluate and form composite functions in the stated order, checking that intermediate outputs are allowed inputs.
- ☐ Find an inverse algebraically when the function is one-to-one and verify it by composition.
- ☐ Recognise the identity function and use the domain-range relationship when describing inverse functions.

2.6 Three useful views of a quadratic

- ☐ Move between expanded, factorised and completed-square forms of a quadratic.
- ☐ Read the intercepts, vertex and axis of symmetry from a suitable form and sketch the parabola.

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2 Functions / continued

2.6 Three useful views of a quadratic - continued

- ☐ Explain how the leading coefficient affects the direction and vertical stretch of the graph.

2.7 Quadratic roots and solution intervals

- ☐ Solve a quadratic using factorisation, completing the square or the quadratic formula, choosing an efficient method.
- ☐ Solve quadratic inequalities and show the correct intervals, including or excluding endpoints as required.
- ☐ Use the discriminant to decide how many real roots occur and to find parameter conditions.

2.8 Reciprocals and linear-over-linear functions

- ☐ Explain the shape and self-inverse property of $y = 1/x$.
- ☐ Sketch a rational function with a linear numerator and denominator, identifying intercepts and excluded input values.
- ☐ Find and label its vertical and horizontal asymptotes, checking any factor cancellation before claiming an asymptote.

2.9 Exponential and logarithmic graphs

- ☐ Sketch exponential and logarithmic functions, including base e, with their domains, ranges, intercepts and asymptotes.
- ☐ Explain the inverse relationship between these families and compare growth or decay for different valid bases.
- ☐ Rewrite a^x as $e^{(x \ln a)}$ and use inverse identities to simplify expressions.

2.10 Finding solutions in mathematical models

- ☐ Choose an algebraic, graphical or numerical method to solve an equation, including equations requiring technology.
- ☐ Use a substitution where it turns an exponential equation into a familiar algebraic form.
- ☐ Interpret solutions in a real situation, respecting the model's domain and the required accuracy.

2.11 Moving and stretching graphs

- ☐ Describe translations, reflections in either axis, and vertical or horizontal stretches using function notation.
- ☐ Apply a sequence of transformations in the correct order and track key coordinates, domains, ranges and asymptotes.
- ☐ Recognise that $f(qx)$ gives a horizontal stretch with factor $1/q$ for $q > 0$; the general combined input $ax + b$ belongs to the HL extension.

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My next practice task

3 Geometry and trigonometry

Use shapes, angles and vectors to connect algebra with position, distance and motion.

3.1 Measuring three-dimensional objects

- ☐ Calculate the distance and midpoint between points given by three coordinates.
- ☐ Find volumes and surface areas of solids, including right pyramids, right cones, spheres, hemispheres and combined shapes.
- ☐ Identify useful right-angled triangles to find lengths and angles between intersecting lines or between a line and a plane.

3.2 Choosing a triangle method

- ☐ Choose sine, cosine or tangent for a right-angled triangle and use an inverse ratio when finding an angle.
- ☐ Choose the sine rule or cosine rule for an appropriate non-right-angled triangle.
- ☐ Calculate a triangle's area from two sides and their included angle; label a supporting diagram.

3.3 Turning a situation into a triangle

- ☐ Translate a written description into a clear diagram with the relevant lengths and angles marked.
- ☐ Solve problems involving bearings, elevation, depression and distance using Pythagoras or trigonometry.
- ☐ Interpret the result with suitable units and check that it matches the geometry.

3.4 Angles measured by arc length

- ☐ Convert between degrees and radians, using exact multiples of π when appropriate.
- ☐ Use radian measure to calculate arc lengths, sector areas and unknown circle dimensions.

3.5 Extending trigonometry around the circle

- ☐ Use the unit circle to determine signs, related angles and exact values based on 0, π/6, π/4, π/3 and π/2.

3.5 Extending trigonometry around the circle - continued

- ☐ Connect tangent with sine divided by cosine and with the gradient of a line through the origin.
- ☐ Check for two possible triangles when applying the sine rule in an ambiguous case.

3.6 Using identities instead of finding an angle

- ☐ Use $\sin^2\theta + \cos^2\theta = 1$ to connect ratios and select signs from the angle's quadrant.
- ☐ Apply the sine and cosine double-angle identities to simplify expressions or determine exact values.
- ☐ Find a related trigonometric ratio without first calculating the angle.

3.7 Modelling a repeating pattern

- ☐ Sketch sine, cosine and tangent graphs and identify their periods, zeros and relevant asymptotes.
- ☐ Interpret amplitude, horizontal shift, vertical shift and period in a transformed trigonometric model.
- ☐ Build or use a sinusoidal model for a repeating situation, matching units and interpreting parameters in context.

3.8 Finding every trigonometric solution in an interval

- ☐ Solve trigonometric equations by algebra or graphing and list all solutions in the specified finite interval.
- ☐ Use identities or substitution to reduce an equation to a quadratic in a trigonometric ratio.
- ☐ Check endpoints, angle units and rejected values; an unrestricted general solution is outside this section's requirements.

4 Statistics and probability

Critique data, quantify uncertainty and choose models that answer a clearly stated question.

4.1 Asking whether data can be trusted

- ☐ Distinguish populations from samples and discrete from continuous data; assess the credibility of the collection process.
- ☐ Compare simple random, systematic, stratified, quota and convenience sampling, identifying likely sources of bias.
- ☐ Investigate missing values and recording mistakes; identify outliers using the 1.5 IQR fences without automatically discarding valid observations.

4.2 Displaying and comparing distributions

- ☐ Organise discrete or continuous data in frequency tables and equal-width frequency histograms.
- ☐ Construct and read cumulative-frequency graphs to estimate medians, quartiles, percentiles and spread.
- ☐ Draw box plots with marked outliers and compare centre, spread and symmetry; consider whether a roughly normal shape is plausible.
- ☐ Use equal class widths for histogram work here; frequency-density histograms are outside the assessed section.

4.3 Choosing numerical summaries

- ☐ Calculate and interpret mean, median and mode; estimate a grouped mean using class midpoints and identify the modal class.
- ☐ Use technology for quartiles, variance and standard deviation, and interpret these alongside the interquartile range.

4.3 Choosing numerical summaries - continued

- ☐ Predict how adding a constant or multiplying every observation changes measures of centre and spread.
- ☐ Recognise that different quartile conventions can produce slightly different answers for discrete data.

4.4 Predicting y from x

- ☐ Describe a scatter plot's linear association and use technology to obtain and interpret Pearson's correlation coefficient.
- ☐ Draw a sensible best-fit line through the mean point and obtain the y-on-x regression equation with technology.
- ☐ Interpret the slope and intercept and make appropriate predictions of y, treating extrapolation and reverse prediction cautiously.
- ☐ Explain why strong correlation does not establish causation and why Pearson's r can mislead for a non-linear pattern.

4.5 Building a probability model

- ☐ Describe the sample space and events for a trial, checking whether the outcomes really are equally likely.
- ☐ Calculate theoretical probabilities and complements, and compare them with experimental relative frequencies.
- ☐ Use probability to predict an expected count over repeated trials, without interpreting that count as a guarantee.

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4 Statistics and probability / continued

4.6 Combining and conditioning events

- ☐ Choose a tree, Venn diagram, outcome table or sample-space diagram to organise a multi-stage probability problem.
- ☐ Calculate probabilities involving inclusive 'or', 'and', complements and conditional information.
- ☐ Distinguish independence from mutual exclusivity and update probabilities correctly when sampling without replacement.

4.7 A random quantity and its long-run average

- ☐ Build or interpret a discrete probability distribution from a table or rule and ensure its probabilities total 1.
- ☐ Calculate an expected value by weighting each possible value with its probability.
- ☐ Interpret expected net gain, including entry costs, to judge whether a game is fair.

4.8 Counting successes with a binomial model

- ☐ Check that a fixed number of independent trials each has two outcomes and the same success probability.
- ☐ Use binomial technology for individual, cumulative and interval probabilities, handling 'at least' and 'more than' carefully.
- ☐ Find and interpret the model's mean and variance, np and np(1 − p).

4.9 Areas under a normal curve

- ☐ Sketch a normal model with its mean and standard deviation and use symmetry and the approximate 68%, 95%, 99.7% pattern.

4.9 Areas under a normal curve - continued

- ☐ Translate a probability statement into a shaded region and calculate its area with technology.
- ☐ Use inverse-normal technology to find a boundary or percentile when the mean and standard deviation are known.

4.10 Predicting x from y

- ☐ Find the x-on-y regression equation with technology and use it to predict x from a specified y.
- ☐ Choose the regression direction to match the variable being predicted; do not treat the two regression lines as interchangeable.

4.11 Checking independence with probability formulae

- ☐ Apply the conditional-probability formula to connect a restricted sample space with an intersection probability.
- ☐ Test independence using $P(A \cap B) = P(A)P(B)$ or an equivalent conditional-probability comparison, where defined.
- ☐ Explain the conclusion in the context of the two events.

4.12 Standard scores and unknown normal parameters

- ☐ Convert between a value and its z-score and interpret the sign and size of that score.
- ☐ Use inverse-normal results to form equations for an unknown mean, standard deviation or both.
- ☐ Solve the parameter equations and check that the standard deviation is positive and the probabilities are consistent.

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My next practice task

5 Calculus

Connect local rates of change with accumulated change, then use both to analyse functions and models.

5.1 From a changing secant to an instantaneous rate

- ☐ Estimate a limit from a table or graph and describe what value the function approaches.
- ☐ Explain a derivative as a tangent gradient or an instantaneous rate, using notation suited to the variables.
- ☐ Connect the tangent gradient with a limiting sequence of secant gradients; formal limit techniques are reserved for HL.

5.2 Where a function rises or falls

- ☐ Use the sign of the first derivative to identify intervals of increasing or decreasing behaviour.
- ☐ Relate positive, negative and zero gradients to the graphs of a function and its derivative.

5.3 Differentiating integer powers

- ☐ Apply the power rule to constant multiples of integer powers, including negative powers after suitable rewriting.
- ☐ Differentiate sums of these terms and simplify the resulting derivative.

5.4 Equations touching and crossing a curve

- ☐ Find the gradient at a specified point using a derivative or technology, then write the tangent equation.
- ☐ Find the normal equation using perpendicularity, recognising horizontal and vertical special cases.

5.5 Recovering a function and measuring area

- ☐ Reverse the power rule for sums of integer powers other than x^−1, including the arbitrary constant.
- ☐ Use a given function value to determine that constant.
- ☐ Write a definite integral for the area beneath a positive curve and evaluate it with technology, connecting it with antiderivatives.

5.6 Choosing a differentiation rule

- ☐ Differentiate rational powers, sine, cosine, e^x and ln x, including their sums and constant multiples.
- ☐ Identify inner and outer functions and apply the chain rule to a composite expression.
- ☐ Use product and quotient rules when required, combining rules and simplifying carefully.

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5 Calculus / continued

5.7 Reading a function through its derivatives

- ☐ Calculate second derivatives and use either $f''(x)$ or d^2y/dx^2 notation correctly.
- ☐ Connect the shapes of f, f′ and f″, including how changes in gradient show on the derivative graphs.

5.8 Classifying key points and finding an optimum

- ☐ Find stationary points and classify local maxima or minima using a sign change in f′ or a valid second-derivative test.
- ☐ Distinguish concave-up and concave-down intervals and confirm a change in concavity at an inflection point.
- ☐ Set up and solve an optimisation problem within a meaningful domain, comparing relevant boundary values.
- ☐ Recognise that $f'' = 0$ alone does not prove an inflection point, and that an inflection point need not be stationary.

5.9 Connecting position, velocity and acceleration

- ☐ Move between displacement, velocity and acceleration using differentiation or integration and any initial conditions.
- ☐ Distinguish speed from velocity and identify changes of direction.

5.9 Connecting position, velocity and acceleration - continued

- ☐ Calculate displacement from the integral of velocity and total distance from the integral of speed, splitting at sign changes when useful.

5.10 Recognising antiderivative patterns

- ☐ Integrate rational powers, sine, cosine, exponentials and 1/x, using $\ln|x|$ for the last case.
- ☐ Integrate these functions with a linear inner expression, including the required constant factor.
- ☐ Recognise a multiple of an inner derivative and use the reverse chain rule or an equivalent substitution.

5.11 Definite integrals and enclosed regions

- ☐ Evaluate a definite integral from an antiderivative, or use technology when an analytic antiderivative is unsuitable.
- ☐ Separate signed accumulation from geometrical area and split an interval where the curve changes sign.
- ☐ Find areas between curves by locating intersections and integrating the appropriate difference, writing the setup before calculating.

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