COURSE REVISION GUIDE

Applications and interpretation

For students taking IB Mathematics - Standard level

39 numbered sections | 5 topics | AI SL

EXAMINATIONS 2026-2028

Current course: first assessment 2021; final assessment November 2028. Checked against the official guide updated August 2025.

Use technology confidently, then interpret and communicate what the result means.

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**	8 sections	**p. 2**
2	**Functions**	6 sections	**p. 4**
3	**Geometry and trigonometry**	6 sections	**p. 5**
4	**Statistics and probability**	11 sections	**p. 6**
5	**Calculus**	8 sections	**p. 8**

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

Use numerical patterns and calculator models to make reliable decisions about quantities, growth and money.

1.1 Working across scales

- ☐ Convert between ordinary numbers and a × 10^n notation, keeping $1 \leq a < 10$ for a positive number.
- ☐ Calculate with very large or very small quantities and report the result using powers of ten, rather than the calculator's E notation.

1.2 Patterns with a fixed change

- ☐ Identify the starting term and common difference of an arithmetic sequence, including a sequence described in words.
- ☐ Find a chosen term, an unknown term number or the total of a finite arithmetic sequence; interpret a sum written with Σ.
- ☐ Build and interpret a constant-change model, estimate the change from imperfect data, and judge how useful its predictions are.

1.3 Patterns with a fixed multiplier

- ☐ Recognize repeated multiplication, identify the starting term and common ratio, and connect the ratio to a percentage change.
- ☐ Find terms and finite totals of a geometric sequence, including sums expressed with Σ.
- ☐ Use a geometric model to make and explain a growth or decay prediction, and check that it makes sense in the situation.

1.4 Growth, interest and loss of value

- ☐ Calculate compound growth and depreciation, distinguishing a percentage rate from its growth or decay multiplier.
- ☐ Handle yearly, half-yearly, quarterly and monthly compounding, using the formula or a financial calculator to find an unknown value.
- ☐ Allow for inflation when comparing an investment's future balance with its purchasing power.

My next practice task

My next practice task

1 Number and algebra / continued

1.5 Powers and undoing powers

- ☐ Simplify products, quotients and powers with integer exponents, including zero and negative exponents.
- ☐ Explain a logarithm as the exponent needed to produce a number and move between exponential and logarithmic statements.
- ☐ Evaluate log and ln with technology, recognize ln as base e, and check that the logarithm's input is positive.

1.6 Accuracy and sensible answers

- ☐ Round to an appropriate number of decimal places or significant figures while retaining unrounded values during calculations.
- ☐ Turn a rounded measurement into an interval of possible values and use its bounds to investigate a calculated quantity.
- ☐ Calculate percentage error, including the largest possible error caused by stated measurement accuracy.
- ☐ Estimate before calculating and reject answers that are unreasonable for the context or units.

1.7 Regular payments and balances

- ☐ Use a financial calculator to model loan repayments, regular saving and annuity withdrawals.
- ☐ Set the number of payments, rate, payment frequency and compounding frequency consistently; use opposite signs for money paid and money received.
- ☐ Find an unknown payment, balance, rate or duration and interpret the result; use end-of-period payments for examination questions.

1.8 Solving equations with technology

- ☐ Enter and solve a system of linear equations with two or three unknowns, then interpret the unique solution in context.
- ☐ Find polynomial roots with an appropriate calculator tool or graph and check which solutions are relevant to the problem.
- ☐ Connect a root of an equation with a zero of the corresponding function.

My next practice task

My next practice task

2 Functions

Turn relationships into graphs and models, then use their features to answer practical questions.

2.1 Describing a straight line

- ☐ Find and interpret a line's gradient and intercepts from its equation, coordinates or a practical situation.
- ☐ Write and convert between $y = mx + c$, $ax + by + d = 0$ and $y - y_1 = m(x - x_1)$.
- ☐ Construct parallel or perpendicular lines, using equal gradients or a gradient product of -1 where the gradients exist; recognize horizontal and vertical cases.

2.2 Inputs, outputs and reverse processes

- ☐ Read function notation and explain how a function assigns an output to an input in a mathematical or real-world model.
- ☐ Identify a function's domain and range, allowing for both mathematical restrictions and restrictions imposed by the situation.
- ☐ Interpret f^{-1} as reversing a one-to-one function, exchange domain and range, and relate the two graphs by reflection in $y = x$.

2.3 From a model to a useful graph

- ☐ Use graphing technology to display a function, or a sum or difference of functions, in a suitable viewing window.
- ☐ Produce a labelled sketch from a formula, a description or a calculator screen, including the important shape and features.
- ☐ Distinguish an accurate drawing from a sketch and label axes, units and significant coordinates where relevant.

2.4 Reading a graph's landmarks

- ☐ Locate intercepts, roots, turning points and maximum or minimum values with technology.
- ☐ Identify symmetry, a vertex, and horizontal or vertical asymptotes when present.

2.4 Reading a graph's landmarks - continued

- ☐ Find intersections of graphs and explain what the coordinates mean for an equation or model.

2.5 Choosing a family of models

- ☐ Use linear and piecewise-linear relationships, and recognize when a cubic model is appropriate.
- ☐ Interpret a quadratic model through its vertex, symmetry, intercepts and roots, using technology as needed.
- ☐ Use exponential growth or decay models, including base-e models, and interpret a vertical offset and horizontal asymptote.
- ☐ Use direct and inverse power variation with integer powers; recognize the restriction and vertical asymptote at $x = 0$ for negative powers.
- ☐ Interpret a sine or cosine model in degrees through its amplitude, period and midline; converting between sine and cosine forms is not required.

2.6 Building and testing a model

- ☐ Choose a model from the shape of the data and the context, define its variables and set a meaningful domain.
- ☐ Find unknown parameters from known points or initial conditions, including solving up to three simultaneous linear equations with technology.
- ☐ Use the completed model to estimate values, answer questions and make predictions with appropriate units.
- ☐ Check the model against the situation, explain its limitations and discuss whether extrapolation is justified; non-linear regression is not required at SL.

My next practice task

3 Geometry and trigonometry

Use labelled diagrams to connect lengths, angles, areas and the geometry of locations.

3.1 Measuring three-dimensional shapes

- ☐ Find the distance and midpoint between points given by three coordinates.
- ☐ Calculate volume and surface area for solids such as right pyramids, cones, spheres and hemispheres, including shapes assembled from several solids.
- ☐ Identify the right-angled triangle needed inside a three-dimensional diagram and use it to find a length or an angle between intersecting lines or a line and a plane.

3.2 Solving triangles

- ☐ Choose sine, cosine or tangent to find missing sides and angles of a right-angled triangle.
- ☐ Select the sine rule or cosine rule for a non-right-angled triangle; the ambiguous sine-rule case is outside this section.
- ☐ Find a triangle's area from two sides and their included angle, using a clearly labelled diagram.

3.3 From a description to a diagram

- ☐ Translate a practical problem into a labelled diagram and choose between Pythagoras and trigonometry.
- ☐ Interpret bearings and angles of elevation or depression correctly, then calculate an unknown distance or angle.
- ☐ Keep the geometry and units consistent when a solution needs more than one triangle.

3.4 Parts of a circle

- ☐ Use the fraction of a full turn to calculate the length of an arc or the area of a sector.
- ☐ Find an unknown radius or angle from an arc or sector measurement, working in degrees; radians are not required at AI SL.

3.5 The boundary between two points

- ☐ Find a segment's midpoint and the gradient perpendicular to it, then form the equation of its perpendicular bisector.
- ☐ Construct the same equation when the segment's line and midpoint are supplied, handling horizontal and vertical segments correctly.

3.6 Nearest-site regions

- ☐ Read a Voronoi diagram by identifying sites, cells, edges and vertices, and determine the nearest site to a position.
- ☐ Find a boundary equation from site coordinates, calculate a region's area where required, and update the relevant boundaries when a site is added.
- ☐ Estimate a value at an unsampled position by using the value at its nearest site.
- ☐ Compare relevant Voronoi vertices to choose a location as far as possible from the nearest site; the examination setting uses a vertex where three edges meet.

My next practice task

My next practice task

4 Statistics and probability

Question the quality of data, describe patterns, and use probability models and tests to support conclusions.

4.1 Collecting trustworthy data

- ▢ Distinguish a population from a sample and classify numerical data as discrete or continuous.
- ▢ Choose and evaluate simple random, systematic, stratified, quota and convenience sampling; explain when selection can introduce bias.
- ▢ Assess a data source's reliability and decide how to investigate missing values or recording mistakes.
- ▢ Identify values below $Q_1 - 1.5$ IQR or above $Q_3 + 1.5$ IQR as outliers, then use context to judge whether they are valid observations or possible errors.

4.2 Making data visible

- ▢ Organize data into a frequency table with clearly defined, gap-free intervals and draw a histogram for equal class widths.
- ▢ Build and read cumulative-frequency graphs to estimate medians, quartiles, percentiles, ranges and interquartile ranges.
- ▢ Draw and interpret box plots, mark outliers separately and compare distributions using centre, spread and symmetry.
- ▢ Use a box plot's symmetry as one clue when judging a possible normal model; frequency-density histograms are not required.

4.3 Summarizing centre and spread

- ▢ Choose and calculate a mean, median or mode, and identify the modal class when grouped intervals have equal width.
- ▢ Estimate a grouped-data mean with class midpoints and explain why it is an estimate.
- ▢ Use technology for quartiles, standard deviation and variance; recognize that variance is the square of standard deviation and that quartile conventions may differ.

4.3 Summarizing centre and spread - continued

- ▢ Predict how adding a constant or multiplying every observation changes the centre and spread; treat a data set as the population unless the question specifies otherwise.

4.4 Investigating a linear relationship

- ▢ Read a scatter plot, describe a linear relationship's direction and strength, and sketch a reasonable fit through the mean point.
- ▢ Calculate Pearson's r with technology and explain why it measures linear association rather than establishing cause and effect.
- ▢ Find the y-on-x regression line with technology and interpret its gradient and intercept in context.
- ▢ Predict y from x while discussing extrapolation and why reversing a y-on-x prediction may be unreliable.

4.5 Describing chance

- ▢ Identify a trial, possible outcomes, the sample space and an event, using a list or table where useful.
- ▢ Calculate theoretical probabilities from equally likely outcomes and distinguish them from experimental relative frequencies.
- ▢ Use a complementary event to simplify a probability and calculate the expected count from a number of trials and an event probability.

4.6 Combining events and information

- ▢ Choose a tree, Venn diagram, outcome table or sample-space diagram to organize a probability problem.
- ▢ Calculate probabilities involving 'and', inclusive 'or' and 'not', subtracting an overlap where necessary.

4 Statistics and probability / continued

4.6 Combining events and information - continued

- ☐ Update a probability when information is given and handle draws both with and without replacement.
- ☐ Distinguish mutually exclusive events from independent events and check independence using the relevant probabilities.

4.7 Expected outcomes of a discrete model

- ☐ Read or construct a discrete probability distribution from a table or a rule, checking that probabilities are non-negative and total 1.
- ☐ Use the distribution to find event probabilities and calculate its expected value as a weighted average.
- ☐ Interpret expected value in context, including a player's net gain; a fair game has expected net gain zero.

4.8 Counting successes

- ☐ Check that a binomial model is appropriate: a fixed number of independent trials, two outcomes per trial and a constant success probability.
- ☐ Use calculator distribution tools for exact, cumulative and interval probabilities, translating words such as 'at least' accurately.
- ☐ Find and interpret the binomial mean np and variance $np(1 - p)$.

4.9 Working with a bell-shaped model

- ☐ Interpret the mean and standard deviation of a normal model, sketch and shade relevant regions, and use the approximate 68%, 95% and 99.7% proportions.
- ☐ Calculate probabilities below, above or between values with technology and relate probability to area under the curve.

4.9 Working with a bell-shaped model - continued

- ☐ Use inverse normal calculations to find cut-off values or percentiles when the mean and standard deviation are given; standardizing to z is not required.

4.10 Comparing ranks

- ☐ Assign ranks to paired data, use average ranks for ties and find Spearman's coefficient with technology.
- ☐ Choose between Pearson's and Spearman's measures by considering whether the relationship is linear or more generally monotonic.
- ☐ Explain how outliers and the use of ranks affect the interpretation and limitations of each coefficient.

4.11 Using evidence to test a claim

- ☐ State H_0 and H_1, choose or interpret a significance level, and use a p-value to decide whether the evidence is strong enough to reject H_0; explain the conclusion in context.
- ☐ Test whether two categorical variables are independent using a contingency table, expected counts, χ^2 and $(\text{rows} - 1)(\text{columns} - 1)$ degrees of freedom.
- ☐ Test whether observed counts fit a proposed distribution with a χ^2 goodness-of-fit test; at SL use categories $- 1$ degrees of freedom.
- ☐ Use technology for χ^2 statistics and p-values, or compare the statistic with a supplied upper-tail critical value; check expected counts, which exceed 5 in examination questions.
- ☐ Compare two population means with an unpaired pooled two-sample t-test on technology, choosing one or two tails appropriately; use the stated normal-population and equal-variance assumptions.

5 Calculus

Connect the gradient of a curve with change, and accumulated area with integration and practical decisions.

5.1 Zooming in on a rate of change

- ☐ Estimate a limit from a table or graph and describe how slopes between nearby points approach the gradient at a point.
- ☐ Interpret a derivative as a gradient function or a rate of change, including the units in a practical setting.
- ☐ Read notation such as $f'(x)$ and dy/dx; formal algebraic limit techniques are not required here.

5.2 When a function rises or falls

- ☐ Use positive and negative derivative values to identify intervals where a function increases or decreases.
- ☐ Relate $f'(x) = 0$ to a horizontal tangent and interpret derivative signs from a graph.

5.3 Differentiating powers

- ☐ Apply the power rule to a constant multiple of x^n when n is an integer, including negative powers.
- ☐ Differentiate sums of integer-power terms and constants, then evaluate a derivative at a required input.

5.4 Lines that touch or cross at right angles

- ☐ Find a curve's gradient at a specified point using differentiation or a numerical derivative on the calculator.
- ☐ Use the point and gradient to form a tangent equation, then find the perpendicular normal, treating a horizontal tangent's vertical normal separately.

5.5 Reversing differentiation and finding area

- ☐ Find antiderivatives of sums of integer-power terms, excluding an x^{-1} term, and include the constant of integration.

5.5 Reversing differentiation and finding area - continued

- ☐ Use a point or other supplied condition to determine the constant and check the result by differentiation.
- ☐ Write a definite integral with suitable limits before evaluating it with technology.
- ☐ Connect antiderivatives, definite integrals and the area between a positive curve and the x-axis.

5.6 Locating stationary points

- ☐ Solve $f'(x) = 0$ analytically or with technology, using a numerical derivative graph where appropriate, and find the corresponding points on the original curve.
- ☐ Identify local maximum and minimum points from the curve or its gradient behaviour.
- ☐ Distinguish a local turning point from the greatest or least value over the whole stated domain.

5.7 Choosing the best feasible value

- ☐ Translate an optimization problem into a function and a feasible domain, using the situation's constraints.
- ☐ Find suitable stationary candidates, compare them with relevant endpoints and decide which value answers the practical question.
- ☐ State and interpret the optimum with appropriate units; kinematics questions are not part of the AI SL calculus examination scope.

5.8 Estimating area from sampled heights

- ☐ Apply the trapezoidal rule to equally spaced values from a table or function, giving interior heights twice the endpoint weighting.
- ☐ Find the interval width correctly, calculate the estimated area and interpret its value and units in context.