# Prior learning topics

As noted in the previous section on prior learning, it is expected that all students have extensive previous mathematical experiences, but these will vary. It is expected that mathematics HL students will be familiar with the following topics before they take the examinations, because questions assume knowledge of them. Teachers must therefore ensure that any topics listed here that are unknown to their students at the start of the course are included at an early stage. They should also take into account the existing mathematical knowledge of their students to design an appropriate course of study for mathematics HL. This table lists the knowledge, together with the syllabus content, that is essential to successful completion of the mathematics HL course.

Students must be familiar with SI (*Système International*) units of length, mass and time, and their derived units.

| Topic | Content |
|---|---|
| **Number** | Routine use of addition, subtraction, multiplication and division, using integers, decimals and fractions, including order of operations. |
| | Rational exponents. |
| | Simplification of expressions involving roots (surds or radicals), including rationalizing the denominator. |
| | Prime numbers and factors (divisors), including greatest common divisors and least common multiples. |
| | Simple applications of ratio, percentage and proportion, linked to similarity. |
| | Definition and elementary treatment of absolute value (modulus), $\lvert a \rvert$. |
| | Rounding, decimal approximations and significant figures, including appreciation of errors. |
| | Expression of numbers in standard form (scientific notation), that is, $a \times 10^{k}$, $1 \le a < 10$, $k \in \mathbb{Z}$. |
| **Sets and numbers** | Concept and notation of sets, elements, universal (reference) set, empty (null) set, complement, subset, equality of sets, disjoint sets. Operations on sets: union and intersection. Commutative, associative and distributive properties. Venn diagrams. |
| | Number systems: natural numbers; integers, $\mathbb{Z}$; rationals, $\mathbb{Q}$, and irrationals; real numbers, $\mathbb{R}$. |
| | Intervals on the real number line using set notation and using inequalities. Expressing the solution set of a linear inequality on the number line and in set notation. |
| | Mappings of the elements of one set to another; sets of ordered pairs. |

| Topic | Content |
|---|---|
| **Algebra** | Manipulation of linear and quadratic expressions, including factorization, expansion, completing the square and use of the formula. |
| | Rearrangement, evaluation and combination of simple formulae. Examples from other subject areas, particularly the sciences, should be included. |
| | Linear functions, their graphs, gradients and $y$-intercepts. |
| | Addition and subtraction of simple algebraic fractions. |
| | The properties of order relations: $<, \leq, >, \geq$. |
| | Solution of linear equations and inequalities in one variable, including cases with rational coefficients. |
| | Solution of quadratic equations and inequalities, using factorization and completing the square. |
| | Solution of simultaneous linear equations in two variables. |
| **Trigonometry** | Angle measurement in degrees. Compass directions. Right-angle trigonometry. Simple applications for solving triangles. |
| | Pythagoras' theorem and its converse. |
| **Geometry** | Simple geometric transformations: translation, reflection, rotation, enlargement. Congruence and similarity, including the concept of scale factor of an enlargement. |
| | The circle, its centre and radius, area and circumference. The terms arc, sector, chord, tangent and segment. |
| | Perimeter and area of plane figures. Properties of triangles and quadrilaterals, including parallelograms, rhombuses, rectangles, squares, kites and trapeziums (trapezoids); compound shapes. Volumes of cuboids, pyramids, spheres, cylinders and cones. Classification of prisms and pyramids, including tetrahedra. |
| **Coordinate geometry** | Elementary geometry of the plane, including the concepts of dimension for point, line, plane and space. The equation of a line in the form $y = mx + c$. Parallel and perpendicular lines, including $m_1 = m_2$ and $m_1 m_2 = -1$. |
| | The Cartesian plane: ordered pairs $(x, y)$, origin, axes. Mid-point of a line segment and distance between two points in the Cartesian plane. |
| **Statistics and probability** | Descriptive statistics: collection of raw data, display of data in pictorial and diagrammatic forms, including frequency histograms, cumulative frequency graphs. |
| | Obtaining simple statistics from discrete and continuous data, including mean, median, mode, quartiles, range, interquartile range and percentiles. |
| | Calculating probabilities of simple events. |