CSCA Mathematics

48 questions | 60 minutes | Marked out of 100 | Single-answer multiple choice | Paper in Chinese or English | No calculator

The official syllabus (2025 edition) has four modules. Every topic below belongs to one of them; a line marked "beyond the syllabus" is taught in our course for depth and is not needed for the paper.

How to use it: tick a topic when you can answer questions on it against the clock, not when you have read about it. Lessons and timed mock papers for every topic are free at csca.help.

Module 1 — Sets and Inequalities

- [ ] Set notation: roster form, set-builder form, interval notation, cardinality
- [ ] Union, intersection and complement, including De Morgan's laws
- [ ] Venn diagrams with two and three circles, and the counting formula
- [ ] Subsets and power sets
- [ ] Linear inequalities and systems of inequalities
- [ ] Quadratic inequalities, including the perfect-square edge cases
- [ ] Rational (fractional) inequalities such as $(x - 1)/(x + 2) > 0$, solved by sign analysis without multiplying by an unknown-sign denominator
- [ ] Absolute value inequalities of the form $|f(x)| < a$ and $|f(x)| > a$

Module 2 — Functions

- [ ] Domain and range, including domains restricted by square roots and logarithms
- [ ] Piecewise functions
- [ ] Even, odd and injective (one-to-one) functions
- [ ] Inverse functions and their domains
- [ ] Composite functions, evaluated and decomposed
- [ ] Exponential functions, growth and decay models
- [ ] Logarithmic functions, log rules and logarithmic equations
- [ ] Transformations: shifts, stretches and reflections
- [ ] Power functions, and trigonometric functions: radians, the unit circle, graphs and periods of sin, cos and tan, and the standard identities
- [ ] Derivatives: definition, geometric meaning (slope of the tangent), the basic rules, and simple applications (monotonicity, extrema)
- [ ] Arithmetic sequences and series: nth term, sum of the first n terms
- [ ] Geometric sequences and series: nth term, sum, and sum to infinity when $|r| < 1$

Module 3 — Geometry and Algebra

- [ ] Coordinate geometry: slopes, distances, midpoints, parallel and perpendicular lines
- [ ] Circle equations, tangent lines and tangent length
- [ ] Ellipses, hyperbolas and parabolas: standard equations, foci, eccentricity, asymptotes, focus and directrix
- [ ] Vectors: components, magnitude, dot product, applications (including the Law of Sines and Law of Cosines for solving triangles)
- [ ] Complex numbers: the form a + bi, modulus, conjugate, and the four operations
- [ ] Solid geometry: the rectangular coordinate system in space, distance between two points in space, and surface area and volume of prisms, pyramids, cylinders, cones and spheres

Module 4 — Probability and Statistics

- [ ] Classical probability: equally likely outcomes, complementary and mutually exclusive events
- [ ] Counting with permutations and combinations (not named in the syllabus, but useful for counting outcomes in classical probability)
- [ ] Statistics: mean, median, mode, variance, standard deviation and quartiles
- [ ] The normal distribution: the bell curve, symmetry about μ, and the meaning of σ

Beyond the syllabus, taught in our course for depth: limits and continuity, product/quotient/chain rules in depth, concavity and related rates, integrals and areas, conditional probability, the binomial distribution, correlation and regression