

French Bacculaureate Program

The mathematics admission test is based on the French Bacculaureate program (Level 2, math's speciality). The program comprises four main topics: algebra and geometry, analysis, probability theory and algorithms. In addition to the mathematics program, logical reasoning questions will test your decision-making and abstraction abilities. These questions are general and do not require prior knowledge of the mathematics program. You can find a detailed listing of the notions included in the four main topics in French [here](#) (a summary in English is accessible [here](#)).

Algebra and Geometry

Combinatorics and counting

Additive and multiplicative principles. Cartesian product.

Counting of k-tuples from a collection of distinct or non-distinct elements. Permutations.

Counting of combinations. Pascal's triangle and Pascal's rule.

Geometry in space

Bases and coordinate systems in space.

Vector calculus in space: linear combinations.

Systems of parametric equations of lines and planes.

Orthogonality in space and computation of distances.

Scalar product and properties (remarkable identities, polarization identity).

Vector normal to a plane. Cartesian equation of a plane.

Orthogonal projection.

Sets and logic

Membership, sets, elements, inclusion.

Union, intersection.

Reciprocity and converse of an implication.

Disjunction of cases.

Reductio ad absurdum (reasoning by the absurd).

Analysis

Sequences and induction

Mathematical induction (Principle of reasoning by induction).
Definition of convergence and divergence of a sequence.
Computation of limits, limit operations.
Limit comparisons (including geometric sequences).

Functions: limit, continuity, derivatives

Limit of a function.
Continuity of a function. Image of an interval. Intermediate Value Theorem.
Derivative of a compound function.
Second derivative. Convexity. Inflexion point. Increasing/decreasing functions.

Logarithm function

Definition.
Properties and characteristic relations
Limits and derivative (including $\ln(u)$).
Study of functions involving exponentials and logarithms.

Sine and cosine functions

Equations of the type of $\cos(x) = a$; inequations of the type of $\cos(x) < a$.
Study of trigonometric functions. Derivatives, variations, representative curves.

Primitives (inverse derivatives) of a continuous function

Properties of primitive functions.
Primitives of usual functions.

Differential equations

Differential equation $y' = f$ where f is a given function (search for primitives).
Differential equations of the first order ($y' = ay$ and $y' = ay + b$).

Integral Calculus

Definition of the integral. Formula $F(b) - F(a)$.
Computation of integrals.
Properties of integrals (linearity, integration of an inequality, Chasles relation, and diverse Theorems).
Integration by parts.
Mean value of a function.

Probability Theory

Discrete probabilities

Succession of independent trials.

Bernoulli process.

Binomial distribution.

Random variables, expectation

Sum of random variables.

Expectation, variance, standard deviation. Linearity of expectation. $V(aX) = a^2V(X)$.

Expectation and variance of the Binomial distribution.

Concentration, the law of large numbers

Bienayme-Chebyshev inequality.

Concentration inequality

Law of large numbers.

Algorithms and Logical Thinking

Algorithms

The notion of variables, types of variables, assignment, conditional instructions, loops, the notion of lists (e.g., add or delete elements, iterative methods), ...

Logical Thinking

Make decisions and reason in a coherent manner.

General logical reasoning skills: Deductive, abductive, and inductive reasoning.