



MATH DEPARTMENT

Year of 2025-2026

Lessons required for the Math Entrance Exam: (Grade 11S to 12LS-GS)

*Calculator is needed.

1. Quadratic Equations

The students should be able to:

- Solve complete and incomplete quadratic equations.
- Find two real numbers whose sum S and product P are given ($x^2 - Sx + P = 0$).

2. Quadratic Inequalities

The students should be able to:

- Study the sign of a quadratic function.
- Solve quadratic inequalities with one unknown.
- Solve a system of quadratic inequalities with one unknown.

3. Polynomials

The students should be able to:

- Divide two polynomials using the Euclidean division.
- Factorize a second degree polynomial.
- Factorize a third degree polynomial knowing a root (using identification method and long division).

4. Limits

The students should be able to:

- Study the Limit of some basic functions as x tends to $\pm\infty$.
- Study the Limit of some basic functions as x approaches a real number.
- Deduce horizontal and vertical asymptotes to a curve of a function from its limits.
- Study the continuity at a certain point of a function.

5. Derivatives

The students should be able to:

- Study the differentiability of a function using the limit definition of derivative.
- Find the derivative of a function using differentiation rules.
- Study the sense of variation of a function by studying the sign of its derivative.

6. Antiderivatives:

The students should be able to:

- Find the antiderivatives of a given function.
- Prove that a given function is an antiderivative of a function.
- Find the antiderivative of a function verifying a certain condition.
- Apply properties of linearity for antiderivatives.

7. Study of Polynomial and Rational Functions

The students should be able to:

- Study the Sense of Variations of given functions (draw table of variations and locate the local extrema).
- Find an equation of a tangent to the curve of a function at a point on the curve.
- Show that a given line is an oblique asymptote to the curve of a rational function.
- Study the relative positions of a curve and its oblique asymptote.
- Prove a given line as an axis of symmetry to the curve of a function.
- Prove a given point as a center of symmetry to the curve of a function.
- Graph the curve of a function.
- Solve equations and inequalities graphically.

8. Counting

The students should be able to:

- Calculate Factorials.
- Count possibilities using the product principle.
- Solve counting problems of sampling with replacement (r-list).
- Solve counting problems of sampling without replacement (permutation).

9. Probability

The students should be able to:

- Define sample spaces, complementary events, impossible events, certain events, mutually exclusive events.
- Calculate the probability of complementary events, event A or B ($A \cup B$) and event A and B ($A \cap B$).
- Calculate the Probability of an event in the case of equally likely events.

10. Orthogonality in Space

The students should be able to:

- Prove lines orthogonal.
- Prove a line perpendicular to a plane.
- Prove 2 planes perpendicular.
- Prove a mediator plane of a segment.

11. Vectors and Systems of the Space:

The students should be able to:

- Find the coordinates of a point and a vector (in addition to product of a vector by a real number and sum of two vectors) of the space.
- Plot a point in a system of the space.
- Prove vectors collinear/coplanar/equal.

12. Oriented Angles

The students should be able to:

- Find a unit vector.
- Find oriented angles between 2 vectors and 2 lines.
- Use the relations between oriented angles.
- Draw direct and indirect geometric figures (triangles, squares...).

13. Trigonometric Equations

The students should be able to:

- Solve equations of the form: $\cos x = a$.
- Solve equations of the form: $\sin x = a$.
- Solve equations of the form: $\tan x = a$.
- Define the polar coordinates of a point.
- Change from Cartesian to Polar coordinates and vice versa.

14. Trigonometry 2: Formulas of Addition and Transformation

The students should be able to:

- Simplify expressions including the forms: $\cos(a - b)$, $\cos(a + b)$, $\sin(a - b)$, $\sin(a + b)$, $\tan(a - b)$, $\tan(a + b)$, $\cos(2a)$, $\sin(2a)$ and $\tan(2a)$.
- Use transformation formulas of a product to a sum (linearization): $\sin a \sin b$, $\cos a \cos b$, $\sin a \cos b$

15. Circles

The students should be able to:

- Write an equation of a circle.
- Find the center and radius of a circle given its equation.