Objectives of Mathematics for third year secondary (SE)

Literal and numerical calculations

Combinations

- Identify the combinations of elements of a finite set.
- Calculate the number of combinations of p elements of a set formed by n elements (P ≤ n) by using the formula $C_n^p = \dfrac{n!}{p!(n-p)!}$
- To construct the Pascal's triangle using the formula $C_n^p = C_{n-1}^{p-1} + C_{n-1}^p$
- Know and use the binomial formula to expand the expression $(a + b)^n$.

Definitions and representations

Rational functions

- Know that a rational function is in the form of $f(x) = \dfrac{P(x)}{Q(x)}$ where P(x) and Q(x) are two polynomial functions.
- Determine the domain of definition of a rational function.
- Determine the parity of a rational function and explore.
- Study the sense of variations of a rational function.
- Study the limits at the boundaries of the domain of definition of a rational function.
- Find the vertical and the horizontal asymptotes.
- Graphical interpretations of the limits.
- Verify that a given straight line is an asymptote.
- Graphical representation of a rational function.
- Solve graphically the equation in the form of $\dfrac{P(x)}{Q(x)} = m$ where m is a real parameter.

Inverse functions

- Know and calculate the composite function of two functions.
- Know the inverse function f^{-1} of a continuous and strictly monotone function f.
- Know that the inverse function f^{-1} doesn't exist unless if the function f is continuous and strictly monotone.
- Determine the domain of definition of an inverse function.
- Know that a function and its inverse function have the same sense of variations.
- Calculate, if it is possible, the explicit expression of the inverse function.

- Know that the representative curves of a function and its inverse function are symmetric to each other with respect to the first bisector of an ortho-normal system.

Logarithmic functions
- Know the domain of definition, the variations and the representative curve of the natural logarithm function.
- Know and use the properties of natural logarithm.
- Characterize the number e.
- Know some particular limits.
- Know that the derivative of lnu where u is a function of x is a primitive of $\dfrac{u'}{u}$ with u ≠ 0.

Exponential functions

- Know that the exponential function of base e is the inverse function of the natural logarithm function.
- Know the domain of definition, the variations and the representative curve of the exponential function of base e.
- Know and use the properties of exponential function of base e.
- Know some particular limits.
- Know that the derivative of e^u where u is a function of x is a primitive of $u'e^u$.

Numerical Sequences
- Know a numerical sequence.
- Calculate the first terms of a numerical sequence.
- Study the variations of a numerical sequence.
- Know that a geometric sequence (u_n) of common ratio q where $|q| < 1$ admits "0" as limit.
- Know that $S_n = u_1 + u_2 + ... + u_n = a\dfrac{1-q^n}{1-q}$ where "a" is the first term and q is the common ratio.
- Know that the limit of $S_n \to +\infty$ and $|q| < 1$ and using it.

Continuity and derivations
Derivatives
- Know and use the derivative of a composite function at a point.
- Calculate the derivative of an inverse function by using the formula $\left(f^{-1}\right)'(y_0) = \dfrac{1}{f'(x_0)}$ with $y_0 = f(x_0)$.
- Know the derivative of an inverse function over an interval.

Second derivative
- Calculate the second derivative of at a point and over an interval.
- Use the second derivative to determine the nature of an extremum.
- Apply the second derivative for optimized problems.

Hopital's Rule
- Use the Hopital's rule to calculate the limits.

Integrations
Integrals
- Know the integral of a continuous function over an interval [a; b] as the real F(b) – F(a) where F is a primitive of F over [a; b].
- Use the inverse readings of the formulas of integrations.
- Use the method of integrations by parts.
- Know and use some properties of integrals.
- Use integrals to calculate the area.

Mathematical models for economics and social sciences

Functions of economics and social sciences.

- Know and calculate the profit, the revenue, the cost, the loss, the utility, the depreciation and the level of production.
- Know and calculate the demand, the supply, the elasticity of the demand and the market equilibrium.
- Know and calculate the following characteristics of economical functions: the rate, the average, the marginal, maximum and minimum.

Financial mathematics
- Know the terminology of: The capital, simple interest, compound interest, interest rate, period, the actual value and the acquired value.
- Know and apply the relation that links: the capital, the rate, the period and the interest.
- Know and apply the relation that links: the acquired value, the capital, the rate and the period.
- Know and use the formulas of the annuity.

Statistics
Measures of central tendency and measures of variability
- Know the median class.
- Know the modal class.
- Know and calculate analytically and graphically the median and the mode.

- Identify and determine the range.
- Identify and calculate: the mean, the mean-deviation, the variance and the standard-deviation.
- Compare and interpret two statistical series having the same mean but different standard-deviation.

Distributions in two variables

- Know that a statistical series of two variables is formed of distributions in two variables defined over the same population.
- Know and construct the scatter plot (diagram of dispersion) of a distribution in two variables.
- Know the center of gravity and place it.
- Identify and calculate the covariance of the two variables.
- Identify and calculate the coefficient of linear correlation.
- Give the significance of the coefficient of linear correlation.
- Determine the two regression lines by the method of least squares.

Probability

Conditional probability and total probability

- Calculate $P_B(A)$ by the formula: $P_B(A) = P(A/B) = \dfrac{P(A \cap B)}{P(B)}$.
- Calculate $P(A \cap B)$ by the formula: $P(A \cap B) = P(A/B) \times P(B) = P(B/A) \times P(A)$ where A and B are two non impossible events.
- Know the A and B are two independent events $P(A/B) = P(A)$.
- Know that the event B_1, B_2, …, B_n form a partition of a sample space Ω, if $B_1 \cup B_2 \cup \ldots \cup B_n = \Omega$ and $B_i \cap B_j = \emptyset$ for $i \neq j$.
- Know and use the formula of the total probability is given by: $P(E) = P(E/B_1) \cdot P(B_1) + P(E/B_2) \cdot P(B_2) + \ldots + P(E/B_n) \cdot P(B_n)$.

Random real variables
- Identify a random variable.
- Know the set Ω_X of the possible values of a random variable X.
- Define the law of probability by finding the values of the random variable X and the corresponding probability of each value.
- Determine the function of distribution F of a random variable.
- Representation of the function F.
- Graphical interpretation for the value F(a) for a real constant "a".
- Know and calculate the mathematical expectation of a random variable.
- Know and calculate the variance of X.
- Identify and calculate the standard – deviation of X.