

Mathematics: applications and interpretations.

Section 1: Numbers and Algebra

Previous knowledge:

- Number systems: natural numbers N ; integers, Z ; rationals, Q , and irrationals; real numbers, R
- SI (Système International) units for mass, time, length, area and volume and their derived units, eg. speed
- Rounding, decimal approximations and significant figures, including appreciation of errors
- Definition and elementary treatment of absolute value (modulus), a
- Use of addition, subtraction, multiplication and division using integers, decimals and fractions, including order of operations
- Prime numbers, factors (divisors) and multiples
- Greatest common factor (divisor) and least common multiples (HL only)
- Simple applications of ratio, percentage and proportion
- Manipulation of algebraic expressions, including factorization and expansion
- Rearranging formulae
- Calculating the numerical value of expressions by substitution
- Evaluating exponential expressions with simple positive exponents
- Evaluating exponential expressions with rational exponents (HL only)
- Use of inequalities, $<$, \leq , $>$, \geq , intervals on the real number line
- Simplification of simple expressions involving roots (surds or radicals)
- Rationalising the denominator (HL only)
- Expression of numbers in the form $a \times 10^k$, $1 \leq a < 10$, $k \in Z$
- Familiarity with commonly accepted world currencies
- Solution of linear equations and inequalities
- Solution of quadratic equations and inequalities with rational coefficients (HL only)
- Solving systems of linear equations in two variables
- Concept and basic notation of sets. Operations on sets: union and intersection
- Addition and subtraction of algebraic fractions (HL only).

Note: HL skills are included for clarification

Knowledge. By the end of this section you must know

- What a number is.
- What a natural number, an integer, a rational number and a real number is.
- What a sequence and a series is. What an arithmetic sequence is.
- The common difference method and how to use it in a non-arithmetic sequence.
- What a geometric sequence is, and how to distinguish between arithmetic and geometric sequences.
- At least two phenomena that follow arithmetic sequences and another two that follow geometric sequences.
- The relationship between the geometric progression and the exponential function.
- What compound interest is.
- What an annuity is, as well as a life annuity.
- What are the seven basic units of measurement in the S.I. and their multipliers and prefixes from “nano” to “tera” as well as their notations.
- What a logarithm is. What the base of a logarithm is.
- What an approximation is and its advantages and disadvantages.
- That errors spread in different ways into different variables.

Skills. By the end of this section you must be able to

- Operate with numbers in scientific notation, such as $4.5 \cdot 10^{-6}$ or $2.0 \cdot 10^8$. You must be able to add, subtract, divide and multiply them. You must be able to, given a number in a non-scientific notation, express it in scientific notation.
- Distinguish between an arithmetic sequence and one that is not arithmetic.
- Calculate, using the formula and the sigma notation, the n th term of an arithmetic sequence. Calculate also the sum of the n first terms of an arithmetic sequence.

- Calculate, using the formula and the sigma notation, the n th term of an geometric sequence. Calculate also the sum of the n first terms of a geometric sequence as well as its ratio.
- Calculate the final capital of an investment subject to compound interest when given the initial capital, the interest rate and the time. Calculate any possible variable in this exercise given all the others.
- Evaluate the advantages and disadvantages of the different modalities of amortization. *
- Simplify, expand and operate with integer exponents.
- Calculate simple logarithms with integer base. Use the calculator to calculate any logarithm.
- When expressing data, choose an appropriate degree of accuracy depending on the data they are based on.
- Calculate the error in a given measurement and express it in terms of the percentage error.
- Using your calculator, solve systems of up to 3 equations with 3 variables.