

Syllabus



MATHEMATICAL KANGAROO COMPETITION

■ PRE-ECOLIER - 1 & 2 (GRADE- 1 & 2)

- Simple arithmetic operations with 1 digit and 2-digit numbers
- Distinguishing simple figures
- Time, clock. number of days in a week
- Number of months in a year

■ ECOLIER – 1 & 2 (GRADE- 3 & 4)

- Simple arithmetic operations with 1,2,3 and 4-digit numbers
- Recognizing geometric figures.
- A magic square with a sum of 15
- Time, clock. number of days in a week, number of months in a year
- Addition, subtraction, multiplication, division. intersection of sets
- Perimeter and area of a square, a rectangle

■ BENJAMIN- 1 & 2 (GRADE- 5 & 6)

- Addition, subtraction, multiplication, division.
- Magic squares
- Fractions and decimals.
- Clock, a calendar
- Perimeter of a polygon. area of a rectangle and a triangle
- Mathematical logic.
- Lines and rays on a surface
- A cube, a rectangular solid. Acute, right, and obtuse angles.

■ CADET – 1 & 2 (GRADE – 7 & 8)

- Operations on rational numbers
- Powers of natural numbers
- Angles: acute, right, and obtuse
- Equations, inequalities and systems of linear equations
- Area of a rectangle, a triangle and a circle
- Lines and rays on a surface
- Volume and surface area of geometric figures
- Supplementary angles, sum of angles in a triangle and in a quadrilateral
- Mathematical logic

■ JUNIOR – 1 & 2 (GRADE - 9 & 10)

- Operations on real numbers
- Functions, polynomials, equations, inequalities.
- Sequences of numbers
- Elements of combinatorics
- Synthetic & analytic plane geometry

■ STUDENT – 1 & 2 (GRADE – 11 & 12)

- Simple arithmetic operations with 1,2,3 and 4-digit numbers
- Operations on real numbers
- Functions, polynomials, equations, inequalities.
- Sequences of numbers
- Elements of combinatorics
- Synthetic & analytic plane geometry



Syllabus

SINGAPORE & ASIAN SCHOOLS MATH OLYMPIAD

■ GRADE 1 – 4 (PRIMARY 1 – 4)

- Arithmetic and Statistics
- Geometry and Mensuration
- Solving word problems using model method (or any other non-algebraic methods)
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and simple cryptarithms)

■ GRADE 5 – 6 (PRIMARY 5 – 6)

- Arithmetic and Statistics
- Geometry and Mensuration
- Solving word problems using model method (or any other methods including algebra)
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

■ GRADE – 7 (SECONDARY – 1)

- Arithmetic and Statistics
- Geometry, Graphs and Mensuration
- Statistics
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

■ GRADE – 8 (SECONDARY – 2)

- Arithmetic and Statistics
- Geometry, Graphs and Mensuration
- Pythagoras' Theorem, Statistics
- Solving word problems using model method (or any other methods including algebra)
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

■ GRADE 9 – 12 (SECONDARY 3 – 4, Junior College 1 – 2)

- Arithmetic and Statistics
- Geometry, Graphs and Mensuration
- Pythagoras' Theorem and Trigonometry
- Statistics and Probability
- Non-routine problem solving (including number patterns, divisibility tests, spatial visualisation, logic problems and cryptarithms)

Syllabus



SINGAPORE MATH GLOBAL ASSESSMENTS

Lower Primary Level/Grades 1-4

■ PRIMARY 1/GRADE 1

- Numbers up to 20
- Time
- Length
- Shapes
- Pictorial graph

■ PRIMARY 2/GRADE 2

- Numbers up to 100
- Addition & subtraction within 100
- Money
- Time
- Length
- 2D Shape
- Picture graph

■ PRIMARY 3/GRADE 3

- Numbers up to 1000
- Addition & Subtraction within 1000
- Multiplication and Division of 2,3,4,5 & 10
- Length
- Mass
- Volume
- Money
- Fractions
- Time
- Picture Graphs 11. 2-D & 3-D Shapes
- Heuristics

■ PRIMARY 3-4/GRADES 3-4

- Numbers up to 100 000
- Factors and Multiples
- 4 Operations of Whole Numbers within 100 000
- Fractions
- Decimals
- Time
- Area and Perimeter
- Angles
- Properties of Rectangles and Squares
- Line Symmetry
- Tables, Bar Graphs & Line Graphs
- Money
- Length, Mass and Volume
- Parallel and Perpendicular Lines
- Heuristics

Upper Primary Level to Secondary Level/ Grades 5-11

■ PRIMARY 5-6/GRADES 5-6

- Numbers up to 10 million
- 4 Operations of Whole Numbers within 10 million
- 4 Operations of Fractions, 4 Operations of Decimals
- Ratio
- Percentage
- Area and Perimeter of Composite Figures, Angles
- Properties of Triangles & Quadrilaterals
- Volume of Cube and Cuboid
- Rate and Speed
- Average
- Algebra
- Pie Graphs, Nets Solid Figures
- Heuristics

■ SECONDARY 1-2 / GRADES 7-8

- 4 Operations of Numbers
- Ratio & Proportion, Percentage
- Rate & Speed
- Algebraic Expressions & Formulae
- Functions & Graphs
- Equations and Inequalities
- Angles, Triangles and Polygons
- Congruence and Similarity
- Pythagoras' Theorem
- Mensuration
- Data Analysis

■ SECONDARY 3-4 / GRADES 9-10/11-12

- Numbers and Number Patterns
- Angles and Polygons
- Mensuration, Arc Length and Area of Sector
- Equations, Functions and Polynomials
- Inequalities, Indices and Surds
- Coordinate Geometry and Circles
- Pythagoras' Theorem, Further Trigonometry and Applications of Trigonometry
- Trigonometric Functions, Identities and Equations
- Congruence and Similarity, Area and Volume of Similar Figures and Solids
- Geometry and Properties of Circles
- Set Language and Notation
- Probability
- Statistical Data Analysis
- Vectors in Two Dimensions
- Binomial Theorem
- Matrices

Syllabus



DOKA (DEPTH OF KNOWLEDGE ASSESSMENT)

■ PAPER P (GRADE 1 & 2)

- Addition and Subtraction, Comparing
- Consecutive Numbers
- Distance Line and Intervals
- Length, Mass, Mixed Operations
- Model Drawing, Money
- Multiples and Grouping
- Number Line
- Time
- Transferring

■ PAPER Q (GRADE 3 & 4)

- Before and After
- Comparing
- Numbers and Pattern
- Distance Line and Intervals
- Fractions, Length, Making A List/ Table
- Mass, Mixed Operations
- Model Drawing
- Money
- Multiples and Grouping
- Time and Calendar
- Transferring
- Volume

■ PAPER R (GRADE 5 & 6)

- Average
- Area and Perimeter
- Before and After
- Comparing
- Numbers and Pattern
- Fractions
- Making A List/ Table
- Measures and Units
- Model Drawing
- Mixed Operations
- Percentages
- Ratios
- Speed
- Transferring

■ PAPER S (GRADE 7 & 8)

- Algebraic Expressions
- Circles
- Counting
- Linear Inequalities, Measures and Units
- Percentages, Plane and Solid Geometry
- Probability, Pythagoras' Theorem

- Ratios
- Rates and Proportions
- Quadratic Expressions and Factorisation
- Simultaneous Equations
- Transformations
- Volume

■ PAPER T (GRADE 9 & 10)

- Algebraic Expressions, Bearing
- Circle Theorems, Coordinate Geometry
- Indices and Rules
- Measures and Units
- Plane and Solid Geometry
- Probability
- Pythagoras' Theorem
- Rationalise the Denominator
- Quadratic Expressions and Factorisation
- Set and Venn Diagrams
- Ratios
- Rates and Proportions
- Simultaneous Equations
- Transformations
- Trigonometry and Rules
- Vector

■ PAPER U (GRADE 11 & 12)

- Algebraic Expressions, Bearing
- Circle Theorems
- Coordinate Geometry
- Indices and Rules
- Measures and Units
- Plane and Solid Geometry
- Probability, Pythagoras' Theorem
- Rationalise the Denominator
- Quadratic Expressions and Factorisation
- Set and Venn Diagrams
- Ratios, Rates and Proportions
- Simultaneous Equations
- Transformations
- Trigonometry and Rules
- Vector
- Differentiation and Integration
- Matrices and Multiplication
- Combination and Permutation



Syllabus

AMERICAN MATHEMATICS OLYMPIAD

■ GRADE 2

- Place values in the base-ten number system.
- Simple fractions such as halves, thirds, and quarters or fourths.
- Addition and subtraction and related multiplication and division problems involving numbers less than 100.
- Simple number patterns involving addition or subtraction.
- Measuring length, time, and money, and collecting data in real-world contexts.
- Relating numbers less than 100 to points on the number lines.
- Basic counting strategies and reasoning in the context of life-like stories.
- Recognize, count, and see connections among simple 2D shapes such as triangles and rectangles.
- Problem solving strategies in the above areas.

■ GRADE 3

- Place values and number sense in the base ten number system.
- Understanding and solving multiplication and division problems around 100.
- Understanding fractions as numbers and in context, including unit fractions.
- Solving word problems using a modeling approach.
- Measuring length, weight, liquid volume, time, and money.
- Interpreting data from a scaled picture or bar graph.
- Developing concepts of perimeter and area of plane figures.
- Pattern identification and extensions of numbers and shapes.

■ GRADE 4

- Understanding of numbers and operations in the base ten number system.
- Four arithmetical operations on multi-digit whole numbers.
- Building upon the understanding of whole-number addition and multiplication to include fractions.
- Understanding factors, multiples, and divisibility.
- Recognizing patterns in number sequences or shapes to solve problems.

- Properties of two-dimensional shapes, including lines and angles.
- Solving real-world problems involving time, money, distance, weight, and liquid volumes.
- Creating mathematical models to solve challenging word problems.

■ GRADE 5

- The base-ten place value system and operations with integers and decimals to hundredths.
- Use fractions and special percentages as numbers and make sense of their operations in real-world contexts.
- Make sense of number patterns and numerical expressions.
- Use measurements in real-world situations, represent and analyze data using visuals and descriptors such as average, minimum, maximum, median, mode.
- Areas of 2D shapes and volumes of 3D solids and the underlying concepts such as unit squares and unit cubes.
- Graph points, lines, and make sense of simple relations in the Cartesian Coordinate System.
- Counting strategies and chances in real-world contexts.
- Extensions and problem solving scenarios involving one or more of the above ideas.

■ GRADE 6

- Understanding the base-ten number system and its properties.
- Solving arithmetic problems involving whole numbers, fractions, mixed numbers, and decimals.
- Finding factors and multiples of a whole number; understanding prime factorization.
- Understanding data variability and distribution, including related quantitative measures.
- Linear algebraic expressions and inequalities.
- Counting strategies.
- Spatial visualization of 2D and 3D shapes; solving problems involving area, surface area, and volume.
- Extensions and integration of mathematical ideas in the above areas.

■ GRADE 7

- Number systems and their properties; arithmetic operations with rational numbers.
- Proportional relationships and their applications.
- Using and solving linear equations in real-world contexts.
- Operations involving numeric and algebraic expressions and linear equations.
- Construction and properties of geometric figures such as circles, triangles, rectangle, parallelograms, and trapezoids; solving problems involving angles, area, surface area, and volume.
- Counting strategies, number sequences.
- Understanding random sampling, inferences, and probability models.
- Extensions and integrations of the mathematical ideas mentioned above.

■ GRADE 8

- Number systems, irrational numbers, and the nature of place-value number systems.
- Radical expressions and powers with integer exponents.
- Number patterns, arithmetic sequences, algebraic expressions, linear equations, and linear functions.
- The processes and properties of similarity and congruence.
- The Pythagorean Theorem and its applications.
- Properties of 2D and 3D shapes such as triangles, quadrilaterals, cubes, cones, cylinders, and spheres.
- Counting strategies and their applications in approaching probability problems.
- Extensions and problem solving scenarios in the above areas.

■ GRADE 9

- Number systems including place-value systems other than ten; irrational numbers, radical expressions, and definitions of π , e , i , and complex numbers; prime numbers, GCD, LCM, and relatively prime numbers.
- Arithmetic and geometric sequences; linear functions, quadratic functions, exponential function, and their inverses; function graphs; function composition.
- Polynomial arithmetic, factorization, zeros of polynomials; rational expressions and radical expressions.
- Reasoning with equations and inequalities algebraically and geometrically.
- Representing and solving simple systems of equations using matrices; vectors and their operations.
- Properties of common 2D shapes such as triangles, quadrilaterals, and circles.
- Angles related to circles.
- Similarity, congruence and related processes and processes such as dilation, reflection, and rotations.

- The Pythagorean Theorem and its applications in connecting geometry and algebra in the Cartesian System.
- Counting strategies, conditional probability, data analysis, and modeling in real-world contexts.
- Extensions and problem solving scenarios involving one or more of the above ideas.

■ GRADE 10

- Real and complex number systems, vectors, and their representations.
- Expansion and factorization of algebraic expressions; solving word problems using algebra, percentages, rates, money, distance-speed-time relations.
- Exponential and logarithmic functions and their properties.
- Rational, irrational, complex number operations as well as prime factorization, GCD, LCM.
- Similarity and congruence of triangles, properties of angles in a circle.
- Graphs of linear, quadratic, and polynomial functions.
- Arithmetic and geometric sequences and the related processes.
- The Pythagorean Theorem and its extensions and applications with trigonometric functions.
- Counting strategies, probability of single events, multiple events, and conditional probability.
- Trigonometric functions, trigonometric identities, and their applications in real-world contexts.
- Extension and integration of mathematical ideas in the above areas.

■ GRADE 11 & 12

- Number systems including integers, rational numbers, real numbers, and complex numbers; rational exponents; vectors, and matrix quantities.
- Arithmetic operations on polynomials and rational expressions; solving linear and quadratic equations, inequalities, and systems of equations.
- Constructing, transforming, modeling, and graphing linear functions, quadratic functions, exponential functions, logarithm functions, rational functions, and trigonometric functions.
- Arithmetic and geometric sequences.
- Properties of triangles, rectangles, parallelograms, trapezoids, regular polygons, and circles.
- Properties and processes of perpendicular bisectors of segments and angle bisectors.
- Concepts of congruence, similarity, symmetry, and related geometry transformations such as translations, rotations, and reflection.
- Algebra and geometry connections in the Cartesian coordinate system.
- Counting techniques, independence, conditional probability, and rules of probability.
- Extensions and problem solving scenarios in the above areas.

Syllabus



VANDA International Science Competition

■ GRADE 3 - 4 (PRIMARY 3-4)

- **Diversity** - Diversity of living and non-living things, Diversity of Materials
- **Cycles** - Cycles in plants and animals, Cycles in matter and water
- **Systems** - Plant system, Human system, Solar system
- **Interactions** - Interaction of forces
- **Energy** - Energy forms and uses

■ GRADE 5 - 6 (PRIMARY 5-6)

- **Diversity** - Diversity of living and non-living things, Diversity of Materials
- **Cycles** - Cycles in plants and animals, Cycles in matter and water
- **Systems** - Human system, Cell system, Electrical system, Solar System
- **Interactions** - Interaction of forces, Interaction within the environment
- **Energy** - Energy forms and uses, Energy conversion

■ GRADE 7-8 (SECONDARY 1-2)

- **Diversity** - Exploring Diversity of Matter by their Physical Properties, Exploring Diversity of Matter by its Chemical Composition, Exploring Diversity of Matter Using Separation Techniques, Understanding Diversity of Living Things
- **Cycles** - Model of Cells – the Basic Units of Life, Model of Matter – The Particulate Nature of Matter
- Model of Matter - Atoms and Molecules, Ray Model of Light
- **Systems** - Transport System in Living Things, Human Digestive System, Human Sexual Reproductive System, Electrical Systems
- **Interactions** - Interactions through the application of forces Energy and Work Done, Transfer of Sound Energy through Vibrations, Effects of Heat & its Transmission, Chemical Changes, Interactions within Ecosystems

■ GRADE - 9 (SECONDARY 3)

Chemistry

- Experimental Chemistry
- The Particulate Nature of Matter

- Formulae, Stoichiometry and the Mole
- Electrolysis, Energy from Chemicals
- Chemical Reactions

Physics

- Physical Quantities, Units and Measurement
- Kinematics, Dynamics
- Mass, weight & density
- Turning Effect of Forces
- Kinetic Model of Matter
- Pressure, Temperature
- Thermal properties of matter
- Energy, Work and Power

Biology

- Cells Structure and Organisation
- Movement of Substances
- Biological Molecules
- Nutrition in Humans
- Nutrition in Plants
- Transport in Flowering Plants
- Transport in Humans
- Respiration in Humans

■ GRADE - 10 & 11 (SECONDARY 4)

Chemistry

- Acids, Bases and Salts
- The Periodic Table
- Metals, Air
- Organic Chemistry

Physics

- General Wave properties
- Light, Electromagnetic Spectrum
- Sound, Static Electricity, Current of Electricity
- D.C. circuit
- Practical Electricity, Magnetism
- Electromagnetism
- Electromagnetic Induction

Biology

- Excretion in Humans
- Homeostasis
- Co-ordination and Response in Humans
- Reproduction, Cell Division
- Molecular Genetics, Inheritance
- Organisms and their Environment

Syllabus



Design Thinking with robotics and Computational Thinking International Competition

■ GRADES 1-2:

Preparatory Computational Thinking

This course is designed to prepare very young children for learning the core ideas of computer science. It is thought that children at this age have very limited mental faculties for performing one of the central aspects of computational thinking: abstraction. Lessons and activities in this course will therefore mostly concern concrete pattern finding and following and completing instructions. This course may be done without a computer, but the experience of the students can be enriched if computers are available. This lesson outline is (heavily) based on

<https://classic.csunplugged.org/> and <https://code.org/educate/curriculum/elementary-school>

- **Lesson 1:** Pattern Recognition
- **Lesson 2:** Sequencing, Debugging Using the Computer, Learning to Click, Drag, and Drop
- **Lesson 3:** Loops
- **Lesson 4:** Binary Representation of Numbers
- **Lesson 5:** Representation of Text and Images

■ GRADES 3-4:

Introduction to Computer Science and Computational Thinking 1

This course introduces young children to the core ideas of computer science. Many key ideas of computer science are made accessible and engaging for this age group by presenting them as games. This course may be done without a computer, but the experience of the students can be enriched if computers are available. This lesson outline is (heavily) based on

<https://classic.csunplugged.org/> and <https://code.org/educate/curriculum/elementary-school>.

- **Lesson 1:** Review of Sequencing and Loops, Conditions
- **Lesson 2:** Trees
- **Lesson 3:** Information Theory
- **Lesson 4:** Searching
- **Lesson 5:** Sorting
- **Lesson 6:** Programming Languages

■ GRADES 5-6:

Introduction to Computer Science and Computational Thinking 2

This is a natural continuation of the previous course. If the schedule allows, in theory, a 3rd grader who has completed the previous course can immediately start this course. There is no need to wait until the 5th grade, as long as the student is mature enough for slightly more abstract reasoning. A little bit of familiarity with algebra will be assumed for some parts of the course, in particular, the use of variables and functions, but students will likely be able to learn the concept even without having encountered it in math classes before as they will be presented using a visual programming language. Some parts of this course strictly require a computer while some parts don't. This lesson outline is (lightly) based on

<https://classic.csunplugged.org/> and <https://code.org/educate/curriculum/elementary-school>.

- Lesson 1: Functions
- Lesson 2: Variables
- Lesson 3: Introduction to Networks (Graph Theory)
- Lesson 4: Finite State Automata
- Lesson 5: Boolean Algebra, Constraint Satisfaction Problems

■ GRADES 7-8:

Programming in Python

Now that the student has “conceptually” learned most core computer science concepts and have done a little bit of programming in a visual programming language, they should be ready to do some “real” programming. Algebra is a pre-requisite for this course: students should already be familiar with the notions of variables, equations, inequalities, and functions.

- **Lesson 1:** Introduction to Python, Input and Output, Primitives, Variables, Model of Evaluation, Conditionals
- **Lesson 2:** Lists, Strings, Iteration, Loop Invariants
- **Lesson 3:** Functions, Principle of Abstraction and Modularity, Top-down Design
- **Lesson 4:** Testing and Debugging
- **Lesson 5:** Lambda Expressions and Higher-Order Functions
- **Lesson 6:** Recursion

■ GRADES 9-10:

Introduction to Algorithm Design 1

Having learned and mastered the basics of programming, students can now begin their journey into what is popularly called “competitive programming.” At this stage, they begin learning fundamental problem solving and algorithm design principles which are at the heart of computer science. Additionally, they also learn how to prove correctness and efficiency, and learn practical implementation with a programming language.

- **Lesson 1:** Complete Search
- **Lesson 2:** Asymptotic Analysis
- **Lesson 3:** Modular Arithmetic

■ GRADES 11-12:

Introduction to Algorithm Design 2

This is a natural continuation of the previous course. If the schedule allows, in theory, a 9th grader who has completed the previous course can immediately start this course. There is no need to wait until the 11th grade, as long as the student is mature enough for analysis and proofs. This lesson outline is (lightly) based on a programming camp that we have already successfully held in the Philippines.

- **Lesson 1:** Introduction to C++, Review of Binary Representation, Bitwise Operations, Bitmasking
- **Lesson 2:** Linear Data Structures
- **Lesson 3:** Tree Data Structures
- **Lesson 4:** Greedy Algorithms
- **Lesson 5:** Shortest Paths
- **Lesson 6:** Amortized Analysis, Two-pointers Method, Disjoint Set Union-Find



Syllabus



HIPPO ENGLISH OLYMPIAD

- Questions will be drawn from school plus syllabus from different standard curriculum of national and international level.
- Sample questions and the online exam can be taken from the official HIPPO website: <https://www.hippo-competition.org/eng/practice.html>

■ Examination Topics

| Topic | A1 | A2 | B1 | B2 | C1 | C2 |
|------------------------------|----|----|----|----|----|----|
| Personal Details | | | | | | |
| Family & Friends | | | | | | |
| Hobbies & Leisure Activities | | | | | | |
| Holidays | | | | | | |
| Transport | | | | | | |
| Weather | | | | | | |
| Shopping | | | | | | |
| Health & Exercise | | | | | | |
| Education | | | | | | |
| Work, Jobs & Careers | | | | | | |
| Films, Media & Entertainment | | | | | | |
| Books and Literature | | | | | | |
| News, Lifestyles & Culture | | | | | | |
| Environment | | | | | | |
| Technology & Science | | | | | | |
| Community and Society | | | | | | |
| Law and Order | | | | | | |
| Abstract topics | | | | | | |

LEGEND: ARE TOPICS COVERED IN THE RESPECTIVE GRADE / CATEGORY