



A Community of Learners Making *Our* World Sustainable



GREEN SCHOOL - MATHEMATICS CURRICULUM OVERVIEW

Rationale



These Mathematics guidelines describe the Green School curriculum across Primary, Middle School and High School and reflect the vision and values of the school's purpose. There are several strands for each level of Mathematics that intentionally outline broad learning objectives. This document is intended to serve as a guide for Green School teachers to use best practice to implement specific student-centered lessons that adjust to student levels, needs and the learning environment.

Math is everywhere. Students are offered diverse ways in which to explore holistically, expressing their own understanding intellectually, physically, socially/emotionally and spiritually. These aspects act as lenses through which to understand the mathematical dimensions of the human experience.

At Green School, we believe students can remain academically competitive while having fun and connecting mathematics to themselves, others, and nature. Our Mathematics instruction for Grades 1-12 (Primary, Middle School and High School) reflects this philosophical stance. While we hold ourselves collectively accountable for student progress, we grant teachers the flexibility to use the instructional methods that their experience indicates will best help students reach their full potential.



Mathematics is a tool we use to understand ourselves and to grow from what we learn. We explore mathematics in various forms such as; insect-dissection geometry, bridge building across the Ayung River, Islamic art, climate change calculations, waste-management data analysis, and calculating biofuel formulas for Green School's

BioBus. We teach mathematics in an applied, collaborative, student-centred way that does not rely on traditional methods that require many more hours of repetitive homework. We set high expectations for our students to creatively apply mathematics concepts in all areas of study.

The goal of our Mathematics program is for students to have a comprehensive skill set that allows them to reason, think critically, and solve problems. Students study mathematics to enable them to be multi-dimensional beings who are able to identify problems, interpret and express ideas and apply logic and reason to the scenarios they are presented with in life. Our Mathematics program is attitudinal. We teach - and students learn - to establish a love of numbers, an understanding of the relevance of Mathematics to the real-world, and to ignite a thirst for learning that will last a lifetime.

STRANDS



Numbers

The Numbers strand provides students with opportunities to develop a functional understanding of a variety of concepts related to whole numbers - including, but not limited to, addition, subtraction, multiplication, division, factors, multiples, fractions, decimals, percentages, ratios and rates. Students develop their abilities to use and apply number skills so as to understand relative values, make informed quantitative judgments, and be flexible with different strategies when counting, computing, measuring and estimating. As students enter the High School system, Statistics learning outcomes are a part of the Number strand. Students are asked to apply these concepts to solve mathematical and real-world problems.

Shapes

The Shape strand provides students with functional and conceptual understandings of the measurements associated with length, perimeter, area, volume, mass, money, and time. Students learn formulae and strategies to solve tangible problems and apply their problem-solving skills to real-world circumstances and projects. In addition, students gain an understanding of geometric concepts including, but not limited to, shapes, patterns, 2D and 3D figures, lines, angles, and symmetry. Students are challenged to apply these concepts in concrete ways to solve both mathematical and real-world problems.

Relations

The Relations strand introduces students to the concept that numerical data is often represented in a variety of different ways. Students develop abilities to collect and collate data into tables and graphs. Accordingly, students learn how to view and interpret many types of data representations. In this strand, students develop an understanding of different types of probability calculations. Students also develop algebraic skills that become increasingly complex as they progress through the High School years. Therefore "Relations" comes to represent all learning with regard to functions - how the world functions, how humans function, how mathematics functions, both concretely and philosophically.

JUNIOR PRIMARY



Numbers

Why do numbers exist? We count, we compare and we calculate. As stepping stones lead us to the pond, how many are behind me, and how many are in front? Students add skills and subtract confusion as sums and differences become vital pieces of the junior primary students' math repertoire. Patterns of play incorporate manipulatives to creatively represent numbers within our world.

Shapes

From the patterns on a butterfly's wing, to the cylinders of the bamboo all around, forms begin to take shape, allowing students to create, build, and interact with 2D and 3D designs. Our world is a jigsaw puzzle of shapes. Students understand non-standard units of measurement and apply them to the age-old Green School question: How tall is a coconut tree and how many of ME would we need to reach the top?

Relations

What time will the gong ring? Students discover how the hands on the clock are different but related to their own two hands. Students begin to see the connections between time measurements of everyday routines and how these relationships help them organise their own day. How do we communicate through numbers and symbols? Students move graphically between the literal and the abstract and they learn the logic of symbolic meaning.

UPPER PRIMARY



Numbers

Nature narrates numbers as students begin to look at the various connections, relations and representations that exist with numbers both in and out of the classroom. They develop mental and written strategies to help them solve more challenging Mathematical problems. Step-by-step, students string concepts together in sequence as they also understand the relations one concept has to another- understanding operations, symbols, and using manipulatives to model and explain the process. Is the coconut half empty or half full? And can you crack it open in an equal way? Students explore fractions and their connection to whole numbers, decimals and percentages and recognize the equivalence in them.

Shapes

Shapes surround students at Green School. From the curves in the bamboo classroom to the hexagonal shaped Heart of School. In upper primary we are looking at more than just the external boundary or outline of an object. At this level we are looking at geometric patterns and their various properties. Exploring patterns, students create and tessellate. Students apply concepts of lines, symmetry, and shapes to create a deeper awareness of how things are pieced together. This strand also gives students a more in depth understanding of measurement and its various forms. We compare and convert our ideas to apply knowledge of metric units and extend that to comparisons and conversions. Students will learn to appreciate the adage, that Maths truly is everywhere!

Relations

What does my relationship with the world look like? Students learn visually through graphs and pictures. We learn to create and interpret various graphs, including scales, and apply this to solving problems. How long does it take to cross the river and is there a faster way? We are making connections from time to everyday activities. Students learn not only how to interpret time in hours, minutes, and seconds, but start to explore and compare the likelihood of particular outcomes in simple chance experiments.

MIDDLE SCHOOL



Numbers

The Number Strand units provide a platform for building confidence in basic arithmetic. Students utilise the school gardens, student kitchen, surrounding jungle and the Ayung River to develop a lifelong affinity with Numbers. The units are student-centred, project-based and consistently linked with skills that allow us to play with numbers in the real world. The Number strand units aim to re-focus the students who have become disenchanted with Mathematics, stimulate the interest of students who enjoy Mathematics, and challenge the students who are looking to delve further into the subject.

Shapes

Middle School students desire space more freely at this developmental stage – the Measurement and Geometry units are opportunities to look at the world through a mathematical, spatial perspective. Students build on their prior knowledge from the Numbers strand as they develop their understanding of theoretical content and (reasoning) skills within the classroom in student-centered, project-based and challenge-rich learning activities. Then they emerge, into the green spaces that surround them, to apply these ideas in real-world exercises.

Relations

In the Relations strand, Middle School students explore the relationships between numbers and various abstract concepts. In the Data, Probability, and Algebra units, students delve deeply into the paradigm of relations. They seek to develop social connections within our local community as they are taught the skills of collecting, organising, analysing, and displaying data. Students see the real-world potential of solving problems through Sustainability Data Projects as they use the Sustainability Compass - Nature, Economy, Society, Well Being – to provide solutions to real-world issues. Fun-filled games relate students to the concepts of Probability. The Algebra unit is designed to direct our MS students to begin to contemplate the abstract en route towards HS Algebra. The Space strand allows students to communicate their knowledge in graphical and artistic forms.

INTRODUCTORY HIGH SCHOOL



Numbers

Numeracy is as important as literacy to real world survival. At this level students will be striving to grow their confidence and sense with numbers. Knowledge pours from the test-tube to the buttons on the calculator, as students compute the connections from one discipline to another. In addition (literally) students will learn stark realities about playing the lottery. Evaluating risks proportionately, students are guided to make strong choices about probable outcomes.

Shapes

Polygons prevail--everywhere. Students can name most of the common polygons and are familiar with simple polygon properties. At this level, students begin to derive formulae and start to learn the theorems that govern geometry. The age-old Green School question: How tall is a coconut tree and how can the pythagorean theorem help us calculate its height? Students are setting a foundation for inductive reasoning that will lead to geometric proofs. Point+property=polygon proof

Relations

The word problem: A delicate balancing act between words and numbers. Students first ponder the meaning of balance as preparation for learning equations. Later, students also consider the broader meaning of equity to realize how to arithmetically approach solving and equation. Students will apply their learning to the equation of a line. After tackling slope, students will slide on to introductory quadratic equations. Students traverse these pathways whilst also seeking the balance between understanding and application as they find relations to the real-world.

INTERMEDIATE HIGH SCHOOL



Numbers

Be radical and solve radical equations! The properties learned at this level are analogous to learning times tables in upper primary. Understanding the properties of exponents will be very important when studying the behavior of functions... and functions are fun! It is just easier to move on with your math learning if you know the property or can do the computation in your head. Trust us on this one!

Shapes

Believe it or not, until this point students have not actually had to use any abstract reasoning in their math growth. At this level, students will choose from a giant bank of geometric theorems, postulates and axioms to construct arguments that cannot be disputed. Developing the mind in this direction is invaluable and applicable. Students will be able to advocate, debate and simply get what they want.

Relations

Functions. Functions. Functions. After all of these years students are now ready to understand equations as functions. It is said that every behavior, event or instance can be explained as a function. Hurricanes show behavior of the golden ratio as well as so many other things such as the mating behavior of bees. One might wonder what the function of the stock market it is. The introduction to functions will spark curiosity and motivate math minds to continue on with their studies.

ADVANCED HIGH SCHOOL



Numbers

Narrative numbers! At this level, “numbers” mostly come to mean data and probability. Students will collect and work with sets of numbers and see the story they tell. Results from data are almost always necessary for informed decision making. Further number work includes probability. Predicting stories! Students’ jaws will drop when they learn about the number of permutations on a Rubic’s Cube.

Shapes

At this level, shape has everything to do with the behavior of a function. Looking at inputs and outputs are helpful, but it can be as limiting as a close viewing of a painting--you might see only one color. With the help of infinity and zero we are effectively taking a step back to see the spectrum colors or in this case the changes in a line, the turning points, and symmetry. Some may say circles are not polygons--yet isn’t it simply a polygon with an infinite number of sides? Students will learn to appreciate mathematics as art.

Relations

Many students have been waiting for years to be enlightened by mathematics. Never fear--calculus is here! Learning at this level is a gateway to understanding abstract concepts and an exciting time for students learn about the instant as a unit of time and how that disproves Usain Bolt as the fastest human in the world. Going through the motions, students discover how math extends to physical properties of phenomena.