Math Circles Program Path of Student Growth

MATH POTENTIALS

CALCULUS
Includes topics up to First Year University

By the end of the Math Circles Program, students acquire the necessary knowledge for success in University mathematics courses and are empowered to think like scientists, engineers, and architects.

Calculus is the mathematical study of continuous change. It is the gateway to more advanced courses in mathematics. The application of calculus to physics and engineering is the most significant factor in the development of modern science beyond where it was in the days of Archimedes. Calculus gives engineers the ability to model and control systems, enabling extraordinary power over the material world.

EPSILON & OMEGA
Includes topics up to Grade 12 BC curriculum

In Epsilon and Omega, students use their sophisticated mathematical habits of mind to search for meaning in mathematical problems with increased accuracy. Students explore "exact values," such as radials, rational exponents, and logarithms. Students develop an ability to visualize mathematical relationships through the study of functions and their graphs, presented in the Cartesian coordinate plane. After completion of these levels, students are fully prepared for the study of calculus.

GAMMA & DELTA
Includes topics up to Grade 10 BC curriculum

Now, armed with a strong understanding of the core concepts, students in Gamma and Delta levels develop the ability to generalize, abstract and investigate mathematical relationships. The result of this mindset allows students to adopt a mathematical way of thinking, where topics of fundamental mathematics can be studied from an advanced standpoint enabling them to see mathematics as interesting and meaningful. More complex problems are solved, mathematical connections are made, and students acquire strategic thinking and adaptive reasoning skills.

ALPHA & BETA
Includes topics up to Grade 8 BC curriculum

Students in Alpha and Beta develop a deeper understanding of the core concepts that are the foundation of mathematics. With this understanding students build the necessary tools to start taking on math problems like a mathematician would, by relying on reasoning and eliminating memorization. The goal is for students to see mathematics as a meaningful activity that helps us make sense of the world around us.
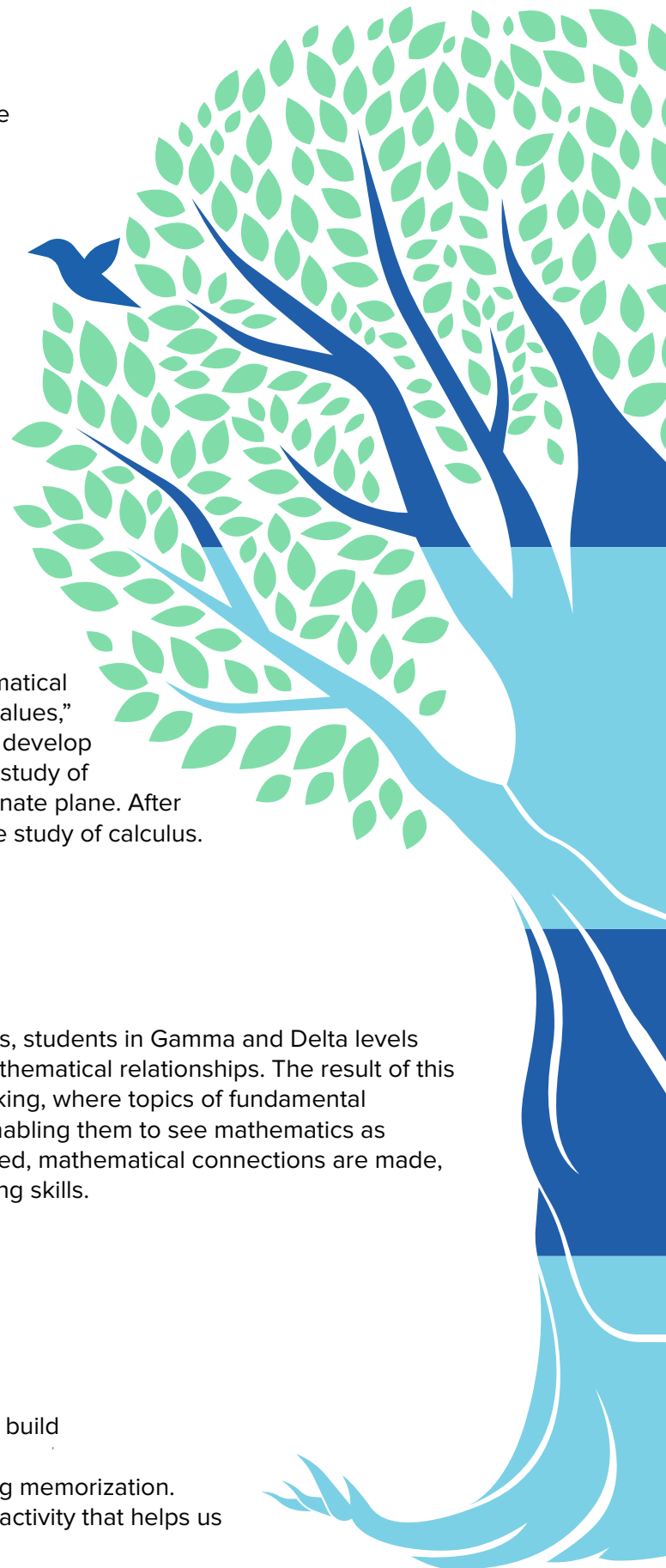
Math Circles Program
Lessons Learned

MATH POTENTIALS

CALCULUS
Includes topics up to First Year University

Derivative Calculus: Understanding differentiability and continuity. Interpretation and application of limits. Tangent line to a curve at a point and local linear approximation. Instantaneous and average rate of change. The Squeeze Theorem. Product and Quotient Rules. Chain Rule. Derivatives of trigonometric and composite functions. Use of graphing calculator. Analysis of graphs without the use of technology. Understanding how derivatives are used in science and engineering.

Integral Calculus: Interpretation and properties of definite integrals. Riemann Sum. Search for the meaning of Second Fundamental Law of Calculus. Integration of functions to find the area under a graph. Applied problems.

EPSILON & OMEGA
Includes topics up to Grade 12 BC curriculum

Enhanced experience with functions. Investigation of the properties of polynomial, rational, exponential, logarithmic, trigonometric, and radical functions. Development of techniques for combining functions. Broadened understanding of rates of change.

These courses are prerequisites for calculus and are closely aligned with the pre-calculus stream of the BC curriculum which is a university preparatory sequence of mathematics courses leading to study in sciences, engineering and commerce.

GAMMA & DELTA
Includes topics up to Grade 10 BC curriculum

Use of more sophisticated, standard mathematical notation. Deepening of students' understanding of mathematical patterns and relationships. Introduction to proof. Connections between numerical, graphical and symbolic representations. Connections within mathematics between various expressions of a similar idea (slope of a line, ratios between corresponding sides of similar figures, proportionality and rate). Mathematics is applied to solve real world problems through indirect measurement and application of similarity, trigonometry, and Pythagorean Theorem (ex. "how far is the ship?", "how tall is the tree?").

ALPHA & BETA
Includes topics up to Grade 8 BC curriculum

Procedural fluency with whole numbers, decimals and fractions. Proportional reasoning through the study of core concepts such as ratio, rate, percentage, and connection of these ideas to fractions (fraction as a point on a number line, fraction as a number, fraction as an operator, fraction as a ratio between two quantities). Conceptual understanding supported using mathematical modeling of problem situations, and connections to geometry. Problem solving. Gateway to algebra.