Our goal as a department is to challenge and inspire all students to reach their mathematical potential. We offer a wide range of courses and utilize a variety of pedagogical modes to meet the specific needs of our students. Most Lakeside students choose to take our accelerated level courses, where offered, and are comfortable with the faster pace and level of challenge. Lakeside also offers honors and standard courses in mathematics. The honors courses offer additional challenge to students who show special interest and aptitude for learning mathematics. In an honors math section very little class time is spent going over foundational material. Students must be able to master concepts quickly, learn from their mistakes, and proactively seek help if they are having difficulty. This allows most class time to be spent on more advanced topics explored in greater depth. In our standard Geometry and Precalculus courses, significant class time is spent reviewing core concepts and topics are frequently explored from multiple perspectives with structured repetition to meet the needs of the learners. In all courses, emphasis is placed on collaboration, problem-solving, and mathematical communication. Additionally, all levels of courses at Lakeside provide a firm foundation in mathematics and will give students the background to succeed in advanced AP-level courses as upperclassmen and college-level mathematics in the future.

COURSE SELECTION
Students with questions about course selections may see any member of the department for advice. Any student interested in taking either an honors or accelerated level course should seek departmental approval (required departmental signature) by consulting with his or her current Lakeside math teacher to decide if the pace and focus of the course is appropriate. For incoming students the department considers each student’s test scores and academic background to decide an appropriate starting course (Algebra I, Algebra II, Geometry, etc.) and which version of that course is the best fit for that student. Incoming students may take a placement exam if he or she feels the department’s initial placement is not an appropriate fit for the student. Students or families with questions about the placement process should contact the mathematics department head for additional information.

TECHNOLOGY IN MATHEMATICS COURSES
All mathematics courses utilize technology to support student understanding. Students will use their laptops in all courses to access specific mathematics software, word processing, spreadsheets, and Web-based materials. Graphing calculators are required in all courses. Teachers in the department will teach using the TI-83 Plus or TI-84 models. A student wishing to use another type of calculator should discuss the advantages and disadvantages with his or her current math teacher.

M110 Algebra I
This course develops algebraic skills through multiple perspectives: analytically, graphically, and numerically. There is a focus on analyzing functions, particularly linear and quadratic functions, in a variety of contexts. Core skills are built on for later math classes, including work with exponents, fractional expressions, basic right trigonometry, and complex numbers. An emphasis is placed on algebraic problem-solving skills, conceptual understanding of mathematical situations, and graphical analysis of functions (including the use of the Geometer’s Sketchpad program). Additional priorities are developing problem-solving skills and gaining facility with technology such as the graphing calculator and Excel spreadsheets.

Course length: Yearlong course
Number of meetings per week: Three 45-minute periods and one 75-minute period
Prerequisites: None
M210 Algebra II
The course focuses on the analysis of functions and their applications while introducing students to a variety of topics in discrete mathematics. After exploring the algebraic, graphical, and numerical properties of general functions, specific types of functions will be examined from these perspectives. The course will examine each of the following families of functions: linear, quadratic, exponential, piecewise, logarithmic, rational, and trigonometric. Additional topics in discrete mathematics such as statistics, matrices, sequence and series, combinatorics, and probability will give students the tools to analyze interesting, highly relevant problems. Both computers and graphing calculators will be used extensively and are required for the course.

Course length: Yearlong course
Number of meetings per week: Three 45-minute periods and one 75-minute period
Prerequisites: Algebra I or placement by the department

M300 Geometry
The course covers topics in plane geometry: parallel and perpendicular lines and planes, congruence and similarity in two and three dimensions; coordinate geometry; and some review of algebra and trigonometry. Geometry approaches this material in a more visual and intuitive way than Accelerated Geometry, with less emphasis on formal proof. The course emphasizes problem-solving, pattern recognition, algebraic geometry, and constructions. Both dynamic geometry software and traditional compass and straightedge are utilized for construction and conjecturing.

Course length: Yearlong course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Algebra II

M310 Accelerated Geometry
The course covers modern as well as traditional topics in geometry: logic, parallel and perpendicular lines and planes, congruence and similarity in two and three dimensions, coordinate geometry, transformations including linear transformation matrices, and networks. Trigonometry and vectors are studied within in a geometric context. A major theme of this course is patterns in reasoning, including formal proof, visual analysis, and problem-solving. Both dynamic geometry software and traditional compass and straightedge are utilized for construction and conjecturing.

Course length: Yearlong course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Successful completion of Algebra II. All accelerated/honors courses requires departmental approval.

M320 Honors Geometry
This course uses a variety of mathematical approaches to study plane and solid geometry. The course emphasizes different forms of mathematical proof and techniques of problem-solving. This class covers the content of our M310 course at a faster pace, which enables students to spend significant time covering additional topics such as vector analysis, linear algebra (through geometric transformations), and conic sections. Dynamic geometry software is utilized for construction and conjecturing.

Course length: Yearlong course
Number of meetings per week: Three 45-minute periods and one 75-minute period
Prerequisites: Excellent work in Algebra II or placement by the department. All accelerated/honors courses require departmental approval.
**M400 Precalculus**
The focus of Precalculus is on the concept of function and the use of functions as mathematical models. The content is similar to that of M410, though more time is spent developing and mastering core concepts. Topics necessary for success in either a calculus or a statistics course (including conic sections, regression techniques, trigonometry, and limits) will be studied. Students should anticipate some review of material from previous courses as a bridge toward more advanced understanding. A wide variety of pedagogical techniques will be employed to meet the needs of a diverse group of mathematics learners.

Course length: Yearlong course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Geometry or Accelerated Geometry or Honors Geometry

**M410 Accelerated Precalculus**
This problem-based inquiry course focuses on the advanced study of a wide range of mathematical topics, including polynomial, exponential, logarithmic, power, and trigonometric functions; conic sections; complex arithmetic; probability; sequences and series -- finite and infinite; limits; and rates of change. Additional topics such as parametric representation of functions, matrices, vectors, and statistics are introduced as time allows. The course materials and assessments are designed to promote and emphasize the following values: communication of mathematical ideas, persistence in solving challenging problems, self-reliance and resilience, resourcefulness, and collaboration.

Course length: Yearlong course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Excellent work in Geometry or successful completion of Accelerated Geometry or Honors Geometry. All accelerated/honors courses requires departmental approval.

**M420 Honors Precalculus**
The main focus of this course is a detailed exploration of the elementary functions covered in our M410 course and simultaneous development and application of differential calculus. In-depth understanding of both the algebraic and differential properties of linear, quadratic, polynomial, rational, radical, exponential, logarithmic, and trigonometric functions is developed through a combination of conceptual, graphical, algebraic, and computational reasoning. Emphasis is placed on review and extension of arithmetic skills, graphical analysis of functions, modeling, including optimization and related rates, mathematical communication, and the use of mathematical computing software such as Excel. Additional topics include sequences and series, counting and probability, complex numbers, and polar and parametric curves.

Course length: Yearlong course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: All accelerated/honors courses requires departmental approval.

**M510 Accelerated Calculus AB**
This course is an introduction to differential and integral calculus, equivalent to a robust semester of college-level calculus, for students with no previous exposure to calculus. This course emphasizes an intuitive, geometric understanding of calculus concepts and utilizes varied applications and problem-solving techniques from numerical, graphical, and algebraic perspectives. Topics include limits and continuity, the derivative and applications, the integral and applications, the Fundamental Theorem of Calculus, and differential equations with slope fields. This course prepares students for success on the AP Calculus AB exam in May.
**M515 Accelerated Calculus BC**
This course is an introduction to differential and integral calculus, equivalent to two semesters of college-level calculus, for students with no previous exposure to calculus. This course emphasizes an intuitive, geometric understanding of calculus concepts and utilizes varied applications and problem-solving techniques from numerical, graphical, and algebraic perspectives. Topics include limits and continuity, the derivative and applications, the integral and applications, the Fundamental Theorem of Calculus, differential equations with slope fields, series and applications, and the calculus of parametric, polar, and vector-valued equations. The TI-83/84 calculator is used extensively. This course prepares students for success on the AP Calculus BC exam in May.

**M520 Honors Calculus BC**
This course covers differential and integral calculus from an advanced perspective for students with previous exposure to differential calculus. Material covered is equivalent to two semesters of college-level calculus plus additional topics of a significantly more advanced or theoretical nature. This course builds on an intuitive, geometric understanding of calculus by exploring theory and proof. Topics include the formal limit definition of the derivative and integral, the derivative and applications, the integral and applications, advanced integration techniques, the Fundamental Theorem of Calculus, differential equations including coupled systems and phase plane analysis, series and applications, and the calculus of parametric, polar, and vector-valued equations. This course prepares students for success on the AP Calculus BC exam in May.

**M530 Accelerated Statistics**
This course is designed to provide students with the equivalent of a standard college-level statistics course. Students will be introduced to the major statistical concepts and tools for collecting, analyzing, and drawing reasonable conclusions from data. Students will be evaluated on homework, tests, projects, and a major end-of-year project. This course uses modern methods of data analysis and students will make extensive use of the data-handling capabilities of graphing calculators. This course prepares students for success on the AP Statistics exam in May.

**M620 Honors Multivariable Calculus**
This is a standard, college-level multivariable calculus course which incorporates relevant topics in linear algebra for students having completed a full year of differential and integral calculus. Topics studied include the
geometry of Euclidean space, differentiation, optimization, vector-valued functions, double and triple integrals, change of variables formula and integral applications, integrals over paths and surfaces, as well as the major integral theorems (Green’s, Stokes’, and Gauss’).

Course length: Yearlong course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Successful completion of any BC calculus course or departmental permission. All accelerated/honors courses require departmental approval.

M450a  Studies in Literature: Chaos Theory
(Team-taught course — receives English E450 or math credit)
What do fractals have to do with literature? What’s the connection between emergence in complex systems and great fiction? Here’s a surprise: Some of the great works of literature from the last 100 years can be interpreted in new and meaningful ways when viewed through the filter of the mathematics and physics of chaos and complexity theory. This class is an adventurous attempt to bridge two cultures: science/math and the humanities. To do so, we explore explicit and implicit connections between literary and scientific endeavors of selected writers, mathematicians, and scientists as they have struggled with the dynamically changing intellectual landscape of the 20th century. The course looks at how mathematical concepts such as iteration, self-similarity, and fractals help unlock the metaphysically speculative fictions of Borges and Calvino, as well as works by Woolf, Kafka, Connie Willis, and Colson Whitehead. Students write in a variety of modes and work on various creative projects that combine literary interpretation with mathematical thinking, all in an effort to fuse the two domains of the course. (Counts as either an English or a mathematics credit.)

Course length: Fall-term course
Number of meetings per week: Three 45-minute periods and one 75-minute period
Prerequisites: None

M460  Fall Topics in Mathematics (not offered in 2015-2016)
This topical survey course is designed for students interested in exploring different branches of mathematics that fall outside the scope of material found within the math department’s required course sequence. Students will explore one or two branches of mathematics during the semester. Possible topics for the fall may include: linear optimization, formal logic, cryptography, number theory, knot and graph theory, information design, or 3-D modeling and printing. Specific course topics will be advertised during the course selection period in January. Students may enroll in either Fall Topics in Mathematics or Spring Topics in Mathematics, or both.

Course length: Fall-semester course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Algebra II

M461  Spring Topics in Mathematics
This topical survey course is designed for students interested in exploring different branches of mathematics that fall outside the scope of material found within the math department’s required course sequence. Students will explore one or two branches of mathematics during the semester. Possible topics for the spring may include: linear optimization, formal logic, cryptography, number theory, knot and graph theory, information design, or 3-D modeling and printing. Topics will differ from those offered in the fall semester. Specific course topics will be advertised during the course selection period in January. Students may enroll in either Fall Topics in Mathematics or Spring Topics in Mathematics, or both.

Course length: Spring-semester course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Algebra II

**COMPUTER SCIENCE AND ENGINEERING WITHIN THE MATHEMATICS DEPARTMENT**

Computers have become ubiquitous and necessary; we all use them whether we realize it or not. Many fields have been transformed by applications of computing technology, including medicine, sports, robotics, architecture, music, games, literature, apparel design, communication, and international development. Computer science is all about transforming our reality by solving problems in these and other domains. Far from just “using computers,” computer science is a dynamic, academic field that has roots in engineering, mathematics, business, philosophy, psychology, linguistics, and the arts.

The computer science curriculum enriches the Lakeside math sequence. While courses in computer science do not satisfy the three-year mathematics graduation requirement, the math department strongly suggests that students consider elective courses in computer science to develop mature habits of mind and experience a highly relevant, modern interdisciplinary field.

**M741 Computer Science I**

This course is open to all students with little or no programming experience who want to go beyond just using computer applications. Computer Science I is an introduction to how computers work and how to write software. High technical expertise is not required, only an open mind and a willingness to experiment, explore, and have some serious fun. The course will focus on the fundamentals of programming through projects involving interactive graphics and games (Scratch, Phrogram, or Python), animation and art (Processing). This course is designed as an introductory experience for students who are curious about computers and programming, but who have limited or no formal training. This course was formerly called Interactive Computer Systems.

Course length: Spring-semester course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: None

**M750 Computer Science II**

This fast-paced semester long course introduces students to computer programming through the Java language. The course begins by studying elementary algorithms, data types, flow of control, user input, file input/output, recursion and some graphical applications using procedural programming techniques. Problem analysis, planning, coding, and debugging will be emphasized for each project. This course will also teach principals and techniques of software engineering (software life cycle, programming practices, etc.). Students with a programming background in Java or another language can refine their skills by choosing to complete more complex projects. This course when combined with Computer Science III prepares students for success on the AP Computer Science exam in May.

Course length: Fall-semester course
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: Departmental permission or successful completion Computer Science I

**M755 Computer Science III**

This semester long course is a continuation of Computer Science II covering object oriented programming and inheritance, more advanced data structures (lists, stacks, queues, trees), and the efficiency and complexity
algorithms (particularly searching, sorting). Problem analysis, planning, coding, and debugging will be emphasized for each project. This course prepares students for success on the AP Computer Science Exam in May. Students also design and complete a 3-5 week long independent project after the AP exam, culminating in a presentation to the class at the end of the term.

Course length: Spring-semester course  
Number of meetings per week: Two 45-minute periods and one 75-minute period  
Prerequisites: Successful completion of Computer Science II

**M760 Computer Science IV**  
This semesterlong course continues the sequence of Computer Science II/III for students interested in further exposure to advanced topics in computer science. Whereas the introductory sequence focuses on programming “desktop” (or laptop) machines, in CS IV we focus on programming “beyond” the desktop. Beyond the desktop one must take into account interesting factors like limited constraints (such as memory and screen size in the case of a cellphone), concurrency (two people modifying a database used by a website at exactly the same time), or variability in power (when working on embedded hardware systems). Other areas such as data mining, cloud computing, robotics, or other advanced topics may be covered based on student interest as time allows. In each unit students design and complete a larger independent project that requires independent exploration and learning depending on the individual needs of their project, culminating in a presentation to the class at the end of the unit.

Course length: Fall-semester course  
Number of meetings per week: Two 45-minute periods and one 75-minute period  
Prerequisites: Successful completion of Computer Science II/III or in rare cases departmental permission.

**M765 Making it Real: 3-D Computer-Based Prototyping and Printing**  
As the printing press and desktop laser printers transformed the face of printing, the 3-D printer has the potential to redefine the process of design and manufacturing. Currently this technology has already been implemented in creative ways within many fields including, but not limited to, medicine, jewelry design, architecture, and engineering. This semesterlong project-based course explores the future of innovative design practices using 3-D modeling and printing. Students in this course will spend the first part of the semester learning how to use the 3-D printers and associated Computer Aided Design software such as Trimble Sketchup, Rhino 3D, and OpenSCAD. In the second half of the semester, the students get first-hand experience at designing and developing a larger project that will solve a “real world problem” using a process called “rapid prototyping” to refine their designs. Students will document and reflect on their experiences and what they learn in a forum that can be shared with others in the class as well as the instructor.

Course length: Spring-semester course  
Number of meetings per week: Two 45-minute periods and one 75-minute period  
Prerequisites: None

**M770 S.T.E.A.M.E.D. Design, Make, Repeat**  
*Science, Technology, Engineering, Arts, Math, Aesthetics, Design*  
(Team-taught course — receives math or art credit)

“Makerspaces” and “Making” are two big buzzwords today. But what is making? According to Merriam-Webster it’s the “the action or process of producing something,” but it is much more than that. Students in this yearlong class will learn the art of prototyping and iterative design, synthesizing concepts from science, technology, math, art, and other disciplines. They will choose self-directed projects after thoughtful analysis of
the needs they see in the world around them. Students will also learn the basics of user-centered design, where all phases of the project are tested and refined with potential user ("customer") input. The expectation is that students will push themselves expand their knowledge and learn new skills, such as sketching, testing, revising, prototyping, and various fabrication tools as needed, depending on the concepts and production requirements of the project. Students will need to be resourceful and resilient in acquiring the knowledge necessary to complete a project. Each project will include reflection on what went right and wrong in their process, and evaluation from and presentation to a larger community.

Course length: Fall-semester course for elective credit. No credit will be given towards completion of the arts requirement.
Number of meetings per week: Two 45-minute periods and one 75-minute period
Prerequisites: None