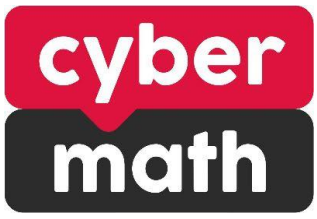

CYBERMATH ACADEMY

COURSE DESCRIPTIONS

www.cybermath.org

info@cybermath.academy

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GENERAL INFORMATION ON CYBERMATH ACADEMY'S COURSES

CyberMath Academy offers courses in math, advanced math, coding, physics, chemistry and biology. We have highly qualified instructors ranging from Ph.D.s to Ivy League graduate students, experienced teachers, engineers and expert professionals.

Application and Admission:

Students apply through our website. After we receive their applications, we ask them to submit documents and/or teacher recommendation letters to check qualifications/prerequisites for admission.

General Structure of The Courses:

Each of the courses below is intended and designed to be equivalent of a year-long (two semesters) course in public and private high schools. The courses are taught by high quality instructors either face-to-face (summer camps) or through live online sessions. The same courses are taught in our summer camps and online courses. Including the commencement and award ceremony (total of 3 hours in summer camps) and exam weeks (total of 4 hours), each course is comprised of 60 hours. The instruction is delivered through 30 sessions of 2 hour sessions in online courses and 40 sessions of 1.5 hour sessions in summer camps. Students take one midterm exam and one final exam in each course.

Online Platform:

Our online courses are delivered through live online sessions. Our instructors use our propriety online system for scheduling and lesson delivery, which allows them to share their screens, chat with students, solicit and receive their feedback and questions and share files.

Grading:
All student's grade will be broken down as follows:

- 20% Participation
- 20% Homework
- 20% Midterm (only 1)
- 40% Final Exam.

Grading Scale:
All courses follow the following grading scale below:

Letter Grade	Grade Scale %	GPA Value Standard Courses	GPA Value Honors Courses	GPA Value AP and Advanced Courses
A	92.5 – 100%	4.0	4.5	5.0
A-	90.0 – 92.4%	3.7	4.2	4.7
B+	87.5 – 89.9%	3.3	3.8	4.3
B	82.5 – 87.4%	3.0	3.5	4.0
B-	80.0 – 82.4%	2.7	3.2	3.7
C+	77.5 – 79.9%	2.3	2.8	3.3
C	70.0 – 77.4%	2.0	2.5	3.0
D	60.0 – 69.9%	1.0	1.0	1.0
F	0.0 – 59.9%	0	0	0

The details of the coursework offered online are listed below.

MATH

Mathematics is a language that all our children need to learn. Learning a language takes diligent work and practice. CyberMath Academy offers courses in:

- Common Core Math
- Honors Common Core Math
- Advanced Math (preparation towards math competitions organized by the Mathematical Association of America)

COMMON CORE MATH

CyberMath Academy's math courses use an innovative math program, "The Mathematics Enhancement Programme, Primary Project (MEP Primary)", developed in Europe with two decades of research in 15 countries. We take this brilliant program and modify it to meet the needs of the American students from all backgrounds while exceeding the targets specified by the Common Core standards.

The MEP has been developed by the Centre for Innovation in Mathematics Teaching (CIMT) at Plymouth University in England to enhance the mathematical progress of students. It is based on the evidence of good practice from an international longitudinal primary project (IPMA), where researchers tracked the mathematical progress of cohorts of students in a number of countries including Japan, Singapore, Russia, Hungary, England, Germany and Finland.

MEP is a workbook-based, spiral curriculum that emphasizes concepts and logical thinking. It is considered somewhat untraditional in its approaches, and contains many puzzle-type problems that require "out-of-box" thinking. It features:

- A spiral curriculum with continual revision; learning by heart encouraged, with progression in small, logical steps.
- Visualisation and Manipulatives are used in the early years and with less able students.
- Relating contexts to students' experiences where possible, demonstrating on a number line and modeling to help understanding.
- The "spiral" curriculum is a comprehensive program ensuring continual revision and progression through small and logical steps.
- We use one the best, proven-to-be-successful European Math curricula. At CyberMath Academy, we are not after a "quick fix".
- We would like to make sure that students will have a solid foundation in Math, which will carry him/her to success in life. Therefore, we track students Math competency with based on common core standards and report to parents frequently.

We provide the following math courses:

- Algebra-1
- Geometry
- Algebra-2
- PreCalculus

Mathematics Enhancement Programme will be supplemented with EngageNY to exceed standards.

ALGEBRA-1

Course Description:
The main objective of Algebra 1 is to provide the students with a strong background for all mathematical courses ahead. The basics of algebraic problem-solving are systematically taught. The students will gain a good grasp of the following topics: Basics of Algebra, equations, inequalities, functions at introductory level, linear functions, quadratic functions, equation and inequality systems, exponential functions, polynomials with factoring, radical expressions and equations, and data analysis and probability. Common Core State Standards will be taught and reinforced as the students learn how to practice these concepts in real-life situations. This course prepares students to take Honors Algebra 1, 2 and other upper level related courses.

Prerequisites:
Pre Algebra or 8th Grade Math, or placement test.

The Next Generation Science Standards (NGSS) Codes:

- NRN.1
- NRN.2
- NRN.3
- NQ.1
- NQ.2
- NQ.3
- NCN.1
- NCN.2
- NCN.3
- NCN.4
- NCN.5
- NCN.6
- NCN.7
- NCN.8
- NCN.9
- ASSE.1
- ASSE.1a
- ASSE.1b
- ASSE.2
- ASSE.3
- ASSE.3a
- ASSE.3b
- ASSE.3c
- ASSE.4
- AAPR.1
- AAPR.2
- AAPR.3
- AAPR.4
- AAPR.5
- AAPR.6
- AAPR.7
- ACED.1
- ACED.2
- ACED.3
- ACED.4
- AREI.1
- AREI.2
- AREI.3
- AREI.4
- AREI.4a
- AREI.4b
- AREI.5

- AREI.6
- AREI.7
- AREI.8
- AREI.9
- AREI.10
- AREI.11
- AREI.12
- F.IF.1
- F.IF.2
- F.IF.3
- F.IF.4
- F.IF.5
- F.IF.6
- F.IF.7
- F.IF.7a
- F.IF.7b
- F.IF.7c
- F.IF.7d
- F.IF.7e
- F.IF.8
- F.IF.8a
- F.IF.8b
- F.IF.9
- F.BF.1
- F.BF.1a
- F.BF.1b
- F.BF.1c
- F.BF.2
- F.BF.3
- F.BF.4
- F.BF.4a
- F.BF.4b
- F.BF.4c
- F.BF.4d
- F.BF.5
- F.LE.1
- F.LE.1a
- F.LE.1b
- F.LE.1c
- F.LE.2
- F.LE.3
- F.LE.4
- F.LE.5
- S.ID.1
- S.ID.2
- S.ID.3
- S.ID.4
- S.ID.5
- S.ID.6
- S.ID.6a
- S.ID.6b
- S.ID.6c
- S.ID.7
- S.ID.8
- S.ID.9

Textbook:
Mathematics Enhancement Programme

Additional Problem Sets by Problem-Attic.

Course Outcomes:

After completing, students will be able to:

- Write expressions and evaluate them with unknown values,
- Use properties to simplify expressions,
- Identify and differentiate the types of relationships that can be represented by proportions.
- Use inverse operations to simplify and find equivalent equations,
- Solve equations using mathematical operations and equality properties,
- Write and plot inequalities,
- Model real-world situations using functions.
- Model and analyze real-world situations using a system of equations or inequalities,
- Simplify expressions by applying properties of exponents,
- Explore the characteristics of exponential functions,
- Explore polynomials through adding, subtracting, multiplying and factoring, and apply real number properties to manipulate polynomial expressions,
- Plot and identify characteristics of quadratic functions,
- Plot and simplify rational expressions,
- Figure out different strategies to find solutions for quadratic equations,
- Add, subtract, multiply and divide using radicals and learn how to rationalize the denominator of a radical expression,
- Multiply and divide rational expressions and divide polynomials,
- Interpret data in a real-world terms,
- Analyze data with multiple approaches.

Topics Covered In This Course:

- Review of Pre-Algebra
- Solving Equations
- Solving Inequalities
- Introduction to Functions
- Linear Functions
- Systems of Equations and Inequalities
- Polynomial and Factoring
- Quadratic Functions and Equations
- Radical Expressions and Equations
- Rational Expressions and Functions
- Data Analysis and Probability

GEOMETRY

Course Description:
This course covers the required concepts of Euclidean geometry including definitions, postulates, and theorems. Throughout the course, Common Core standards are taught and reinforced as the student learns how to apply the concepts in real life situations. Areas of study include tools and language of geometry, reasoning and proof, parallel and perpendicular lines, congruent triangles, relationships within triangles, polygons and quadrilaterals, similarity, right triangles and trigonometry, transformations, area, surface area and volume, circles, and probability. This course prepares students to take Honors Geometry and other upper level related courses.

Prerequisites:
Algebra I or placement test.

The Next Generation Science Standards (NGSS) Codes:
- G.CO.1
- G.CO.2
- G.CO.3
- G.CO.4
- G.CO.5
- G.CO.6
- G.CO.7
- G.CO.8
- G.CO.9
- G.CO.10
- G.CO.11
- G.CO.12
- G.CO.13
- G.SRT.1
- G.SRT.1a
- G.SRT.1b
- G.SRT.2
- G.SRT.3
- G.SRT.4
- G.SRT.5
- G.SRT.6
- G.SRT.7
- G.SRT.8
- G.SRT.9
- G.SRT.10
- G.SRT.11
- G.C.1
- G.C.2
- G.C.3
- G.C.4
- G.C.5
- G.GPE.1
- G.GPE.2
- G.GPE.3
- G.GPE.4
- G.GPE.5
- G.GPE.6
- G.GPE.7
- G.GMD.1
- G.GMD.2
- G.GMD.3
- G.GMD.4
- G.MG.1

- G.MG.2
- G.MG.3

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:
Upon completion of this course, you should be able to:
- Understand and use the tools and language of Geometry through the exploration of points, lines, planes and angles.
- Understand, apply and use logical reasoning.
- Understand and apply the properties of parallel and perpendicular lines.
- Understand how special lines in triangles relate, and prove that two triangles are congruent.
- Understand and apply the properties of different types of polygons.
- Prove triangles are similar, and how to use the fact that two triangles are similar to find lengths of sides, and find out how the sides of a right triangle are related.
- Perform transformations and apply them to the real world.
- Use and apply area formulas, and finding the surface areas and volumes of three-dimensional figures.
- Apply theorems you learned in earlier chapters to segments touching circles.
- Use conditional probability, rules or probability, to use probability to make decisions

Topics Covered In This Course:
- The Tools and Language of Geometry
- Reasoning and Proof
- Parallel and Perpendicular Lines
- Congruent Triangles
- Relationships within Triangles
- Polygons and Quadrilaterals
- Similarity
- Right Triangles and Trigonometry
- Transformations
- Area
- Surface Area and Volume
- Circles
- Probability

ALGEBRA-2

Course Description:
Algebra 2 is designed to build on algebraic and geometric concepts. Throughout the course, Common Core standards are taught and reinforced as the student learns how to apply the concepts in real-life situations. It develops advanced Algebra skills such as Algebra 2 review, function families, quadratic functions and complex numbers, polynomials expressions and equations, exponential and logarithmic functions, rational functions, statistics, periodic functions and trigonometry, and applying trigonometric functions. This course prepares students to take Honors Algebra 1, 2 and other upper level related courses.

Prerequisites:
Algebra 1 and Geometry, or placement test.

The Next Generation Science Standards (NGSS) Codes:

- NRN.1
- NRN.2
- NQ.2
- NCN.1
- NCN.2
- NCN.7
- NCN.8
- NCN.9
- ASSE.1a
- ASSE.2
- ASSE.3a
- ASSE.4
- AAPR.1
- AAPR.2
- AAPR.3
- AAPR.4
- AAPR.5
- AAPR.6
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- ACED.2
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- AREI.2
- AREI.4
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- AREI.4b
- AREI.6
- AREI.7
- AREI.11
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- F.TF.2
- F.TF.5
- F.TF.8
- F.IF.1
- F.IF.2
- F.IF.3
- F.IF.4
- F.IF.5
- F.IF.6
- F.IF.7
- F.IF.7b
- F.IF.7c

- F.IF.7e
- F.IF.8
- F.IF.9
- F.BF.1
- F.BF.1b
- F.BF.3
- F.BF.4
- F.BF.4a
- F.LE.4
- S.ID.4
- S.ID.6
- S.IC.1
- S.IC.2
- S.IC.3
- S.IC.4
- S.IC.5
- S.IC.6
- S.MD.6
- S.MD.7

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:
Upon completion of this course, you should be able to:
- Use algebraic expressions to represent patterns,
- Solve equations and inequalities,
- Solve absolute value equations,
- Use functions to model real world situations,
- Work with functions,
- Analyze transformations and characteristics of function families,
- Find the vertex and standard form of a quadratic equation,
- Factor quadratic expressions,
- Solve quadratic equations,
- Gain an understanding of complex numbers,
- Classify, graph, and define end behavior of polynomial functions,
- Analyze the factored form of the polynomials and write polynomial functions from their zeros,
- Solve polynomial functions by graphing and factoring,
- Divide polynomials by long division and synthetic division,
- Model polynomial functions and identify the effect of transformations of polynomial functions,
- Work with radicals as a part of a function, equation, or by themselves,
- Add, subtract, multiply and divide functions,
- Find the composite of two functions,
- Find the inverse of a relation or a function,
- Understand the relationship between exponential and logarithmic functions and model exponential and logarithmic functions,
- Graph rational functions,
- Solve rational equations,
- Apply theoretical and experimental probabilities and compare data sets,
- Relate geometric measurements to trigonometry, to define radians, how to use radian measures and write and graph functions to describe periodic data,
- Verify trigonometric identity,
- Solve trigonometric equations and to solve real-world problems involving right triangles by using trigonometric ratios

Topics Covered In This Course:
- Review of Algebra 1 topics

- Quadratic Functions and Complex Numbers
- Polynomial Expressions and Equations
- Radical Functions
- Composite and Inverse Functions
- Exponential and Logarithmic Functions
- Rational Functions
- Statistics
- Periodic Functions and Trigonometry
- Applying Trigonometric Functions

PRECALCULUS

Course Description:
The course is intended for students with a strong background in Trigonometry and Algebra. It prepares students to take AP Calculus AB or a college calculus course. A range of topics including polynomial functions, rational functions, arithmetic and geometric progressions, trigonometric functions and their inverses, trigonometric identities, plots of trigonometric functions, combinations and permutation, theory of equations, polar coordinates, mathematical induction, and parametric equations is covered.

Prerequisites:
Algebra 1, 2 and Geometry, or better or equivalent by testing.

The Next Generation Science Standards (NGSS) Codes:

- MP.1
- MP.2
- MP.3
- MP.4
- MP.5
- MP.6
- MP.7
- MP.8
- N-CN.1
- N-CN.2
- N-CN.3
- N-CN.4
- N-CN.5
- N-CN.6
- N-CN.7
- N-CN.8
- N-CN.9
- N-VM.1
- N-VM.2
- N-VM.3
- N-VM.4
- N-VM.4a
- N-VM.4b
- N-VM.4c
- N-VM.5
- N-VM.5a
- N-VM.5b
- N-VM.6
- N-VM.7
- N-VM.8
- N-VM.9
- N-VM.10
- N-VM.11
- N-VM.12
- A-REI.3
- A-REI.4
- A-REI.4a
- A-REI.4b
- A-REI.5
- A-REI.6
- A-REI.7
- A-REI.8
- A-REI.9
- A-REI.10
- A-REI.11

- A-REI.12
- A-APR.2
- A-APR.3
- A-APR.4
- A-APR.5
- A-APR.6
- A-APR.7
- F-IF.2
- F-IF.3
- F-IF.4
- F-IF.5
- F-IF.7
- F-IF.7a
- F-IF.7b
- F-IF.7c
- F-IF.7d
- F-IF.7e
- F-IF.8
- F-IF.8a
- F-BF.1
- F-BF.1a
- F-BF.1b
- F-BF.1c
- F-BF.2
- F-BF.3
- F-BF.4
- F-BF.4a
- F-BF.4b
- F-BF.4c
- F-BF.4d
- F-TF.1
- F-TF.2
- F-TF.3
- F-TF.4
- F-TF.5
- F-TF.6
- F-TF.7
- F-TF.8
- F-TF.9
- G-SRT.6
- G-SRT.7
- G-SRT.8
- G-SRT.9
- G-SRT.10
- G-SRT.11
- G-GPE.1
- G-GPE.2
- G-GPE.3

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:
After successful completion of this course, students should be able to:
- Determine derivatives of functions and explain the results with respect to their application.
- Calculate marginal cost, marginal revenue and marginal profit using derivatives.
- Calculate higher derivatives and interpret the results.

- Draw plots of polynomial functions.
- Determine domains and limits of rational functions and polynomials.
- Determine inflection points, critical points and relative extreme points, and present the results in various settings.
- Calculate average and total sales using results obtained through integration via substitution.
- Understand and apply the Generalized Power Rule and the Chain Rule.
- Conduct optimization of the continuous functions on closed intervals.
- Solve problems involving depreciation, interest, demand, revenue, advertising, decay and elasticity of demand using logarithmic and exponential functions.
- Integrate definite and indefinite exponential, logarithmic and polynomial functions and express the results in various application formats.
- Calculate derivative using implicit differentiation.
- Calculate the area between curves and the average value over an interval using integration.

Topics Covered In This Course:

- Functions and Graphs: Basic, Composite and Inverse functions and their graphs.
- Polynomial and Rational Functions
- Trigonometric Functions
- Analytic Trigonometry
- Additional Topics in Trigonometry: Polar Coordinates, Matrices, Complex Numbers in Polar Form (DeMoivre's Theorem)
- Conic Sections and Analytic Geometry: The Ellipse, Hyperbola, Parabola, Parametric Equations
- Sequences, Induction, and Probability
- Introduction to Calculus

HONORS COMMON CORE MATH

We provide the following Honors Common Core Math courses:

- Honors Algebra-1
- Honors Geometry
- Honors Algebra-2
- Honors PreCalculus

HONORS ALGEBRA-1

Course Description:
Honors Algebra 1 is designed for students with an adequate background for the honors mathematics program. Almost all of the topics of Algebra-1 are covered in this course with greater depth and a faster pace with some additional topics. This course provides the students with a strong background to handle Honors Algebra 2 and similar other upper level courses.

Prerequisites:
Pre Algebra, Geometry, Algebra 1, or placement test.

The Next Generation Science Standards (NGSS) Codes:

- NRN.1
- NRN.2
- NRN.3
- NQ.1
- NQ.2
- NQ.3
- NCN.1
- NCN.2
- NCN.3
- NCN.4
- NCN.5
- NCN.6
- NCN.7
- NCN.8
- NCN.9
- ASSE.1
- ASSE.1a
- ASSE.1b
- ASSE.2
- ASSE.3
- ASSE.3a
- ASSE.3b
- ASSE.3c
- ASSE.4
- AAPR.1
- AAPR.2
- AAPR.3
- AAPR.4
- AAPR.5
- AAPR.6
- AAPR.7
- ACED.1
- ACED.2
- ACED.3
- ACED.4

- AREI.1
- AREI.2
- AREI.3
- AREI.4
- AREI.4a
- AREI.4b
- AREI.5
- AREI.6
- AREI.7
- AREI.8
- AREI.9
- AREI.10
- AREI.11
- AREI.12
- F.IF.1
- F.IF.2
- F.IF.3
- F.IF.4
- F.IF.5
- F.IF.6
- F.IF.7
- F.IF.7a
- F.IF.7b
- F.IF.7c
- F.IF.7d
- F.IF.7e
- F.IF.8
- F.IF.8a
- F.IF.8b
- F.IF.9
- F.BF.1
- F.BF.1a
- F.BF.1b
- F.BF.1c
- F.BF.2
- F.BF.3
- F.BF.4
- F.BF.4a
- F.BF.4b
- F.BF.4c
- F.BF.4d
- F.BF.5
- F.LE.1
- F.LE.1a
- F.LE.1b
- F.LE.1c
- F.LE.2
- F.LE.3
- F.LE.4
- F.LE.5
- S.ID.1
- S.ID.2
- S.ID.3
- S.ID.4
- S.ID.5
- S.ID.6
- S.ID.6a
- S.ID.6b

- S.ID.6c
- S.ID.7
- S.ID.8
- S.ID.9

Textbook:
Elementary Algebra, Harold Jacobs
Additional Problem Sets by Problem-Attic.

Course Outcomes:
After successful completion of this course, the students should be able to:
- Write, graph and solve linear equations.
- Have a sound knowledge of polynomial functions.
- Know how to factor expressions.
- Solve real-world problems using knowledge of arithmetic, exponents and equation solving.
- Write a linear equation from a graph.
- Conduct various operations with radical expressions.
- Make use of multiple methods to solve quadratics.
- Understand functions and their relationships with the real world.
- Use a range of different methods to solve linear systems.
- Write, solve and graph linear inequalities.
- Explore rational expressions and know how to use them when needed.

Topics Covered In This Course:
- Linear Equations
- Expressions and Equations Containing Two Variables
- Inequalities
- Properties of Exponents and Exponential Equations
- Polynomials and Radicals
- Quadratic Equations
- Transformations and Functions
- Rational Expressions
- Recursive Routines
- Scattered Data and Probability

HONORS GEOMETRY

Course Description:

This course is intended to help students understand the geometric concepts and build on middle school topics. Students will be taken from an inductive approach to deductive methods of proof when they study two dimensional and three dimensional geometric objects. Reasoning skills will be emphasized and students will explore different ways to use of the coordinate plane. For instruction and assessment, adequate technology from manipulatives to calculators and graphic drawing programs will be utilized.

Prerequisites:
Pre-Algebra, Geometry, Algebra 1, or placement test.

The Next Generation Science Standards (NGSS) Codes:

- G.CO.1
- G.CO.2
- G.CO.3
- G.CO.4
- G.CO.5
- G.CO.6
- G.CO.7
- G.CO.8
- G.CO.9
- G.CO.10
- G.CO.11
- G.CO.12
- G.CO.13
- G.SRT.1
- G.SRT.1a
- G.SRT.1b
- G.SRT.2
- G.SRT.3
- G.SRT.4
- G.SRT.5
- G.SRT.6
- G.SRT.7
- G.SRT.8
- G.SRT.9
- G.SRT.10
- G.SRT.11
- G.C.1
- G.C.2
- G.C.3
- G.C.4
- G.C.5
- G.GPE.1
- G.GPE.2
- G.GPE.3
- G.GPE.4
- G.GPE.5
- G.GPE.6
- G.GPE.7
- G.GMD.1
- G.GMD.2
- G.GMD.3
- G.GMD.4
- G.MG.1

- G.MG.2
- G.MG.3

Textbook:
Geometry, Seeing, Doing, Understanding, Harold Jacobs
Additional Problem Sets by Problem-Attic.

Course Outcomes:

After successful completion of the course, the students should be able to:
- Model and solve problems using trigonometric rules and principles.
- Solve right triangle problems using trigonometric ratios.
- Use the unit circle to define trigonometric relationship values.
- Precisely calculate the values for angles in radians and degrees.
- Solve problems involving area, length and volume of geometric objects.
- Model and solve probability problems using volume, area and length.
- Draw conclusions and solve problems using deductive reasoning and logic.
- Solve problems making use of definitions, properties and angle and line theorems.
- Generate direct (two-column, flow, and paragraph) and indirect proofs.
- Solve problems by making use of properties, definitions and theorems of two-dimensional objects (triangles, quadrilaterals, polygons and circles).
- Generate direct (two-column, flow, and paragraph) and indirect proofs.
- Generate direct (two-column, flow, and paragraph) and indirect proofs by making use of definitions, properties, and theorems of angles, lines and two dimensional objects.
- Solve problems through generating and applying properties of the solid objects.
- Explain the polygon transformation (translation, rotation, dilation, reflection etc.) in the coordinate plane using simple algebraic terms.
- Describe the polygon transformations in the coordinate plane making use of matrix operations (addition, subtraction, multiplication, scalar multiplication).

Topics include:
- Deductive and inductive reasoning
- Direct and indirect proof
- Parallel lines and planes
- Congruence and similarity
- Polygons
- Perimeter, area, and volume
- Right triangles
- Circles
- Coordinate geometry
- Transformations and symmetry
- Constructions and Loci

HONORS ALGEBRA-2

Course Description:

Honors Algebra II is an accelerated but full length online course. Within the scope of this course, the students will add up to the topics introduced in Algebra I and learn how to manipulate and apply advanced functions and algorithms. Online course materials in the form of interactive web pages, videos, notes and sample problems with solutions will be made available for the student.

Prerequisites:
Pre-Algebra, Geometry, Algebra 1, 2, or placement test.

The Next Generation Science Standards (NGSS) Codes:

- NRN.1
- NRN.2
- NQ.2
- NCN.1
- NCN.2
- NCN.7
- NCN.8
- NCN.9
- ASSE.1a
- ASSE.2
- ASSE.3a
- ASSE.4
- AAPR.1
- AAPR.2
- AAPR.3
- AAPR.4
- AAPR.5
- AAPR.6
- ACED.1
- ACED.2
- ACED.3
- ACED.4
- AREI.1
- AREI.2
- AREI.4
- AREI.4a
- AREI.4b
- AREI.6
- AREI.7
- AREI.11
- F.TF.1
- F.TF.2
- F.TF.5
- F.TF.8
- F.IF.1
- F.IF.2
- F.IF.3
- F.IF.4
- F.IF.5
- F.IF.6
- F.IF.7
- F.IF.7b
- F.IF.7c
- F.IF.7e
- F.IF.8

- F.IF.9
- F.BF.1
- F.BF.1b
- F.BF.3
- F.BF.4
- F.BF.4a
- F.LE.4
- S.ID.4
- S.ID.6
- S.IC.1
- S.IC.2
- S.IC.3
- S.IC.4
- S.IC.5
- S.IC.6
- S.MD.6
- S.MD.7

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:.
After successful completion of the course, the students should be able to:
- Solve inequalities and first degree equations containing one variable.
- Draw a graph for linear functions and determine the slope and intercepts.
- Write equations to represent linear functions.
- Solve problems on equation systems in two and three variables.
- Solve problems related to linear programming applications.
- Make evaluations and operations with matrices.
- Multiply, divide, add and subtract monomial, polynomial and rational functions.
- Perform basic operations containing radical expressions and exponents.
- Multiply, divide, add and subtract complex numbers.
- Factor, complete the square and use the quadratic formula to solve quadratic equations containing one variable.
- Solve and draw graphs for quadratic functions and inequalities.
- Identify important information and sketch exponential, logarithmic and polynomial functions.
- Determine the terms and calculate sums of arithmetic and geometric sequences and series
- Use scientific and graph drawing calculator tools for mathematical problems and applications.
- Utilize algebraic concepts as tools to solve problems
- Explore applications and establish connections of algebraic concepts with specific fields.

Topics include:
- Linear Functions,
- Quadratic Functions,
- Quadratic Equations,
- Complex Numbers,
- Polynomial Functions,
- Rational Exponents,
- Radical Functions,
- Exponential and Logarithmic Functions,
- Rational Functions,
- Sequences and Series,
- Trigonometric Ratios and Functions,
- Probability,
- Data Analysis and Statistics.

HONORS PRECALCULUS

Course Description:

Honors Precalculus is intended for students who have passed Honors Algebra II successfully. The course will provide the students with an in-depth study of all topics essential for studying AP Calculus. Focusing on the relationship between advanced Algebra topics and trigonometry, this honors level introductory calculus course will promote the students to explore and comprehend the nature of nonlinear systems, graphs, and rational and polynomial functions.

As the students explore families of functions, they will actively engage in reasoning, problem solving, connecting and communicating in mathematical terms. Exponential, logistic, logarithmic, trigonometric and inverse trigonometric functions of numerical, graphical and algebraic approaches will be specifically emphasized. Polar Coordinate System, DeMoivre's Theorem, Series, Sequences, Binomial Theorem and Mathematical Induction will be studied within the course. Mathematical modeling of real world examples and data analysis will be an integral part of this course to further improve the understanding of these topics.

Prerequisites:
Honors Algebra II or placement test.

The Next Generation Science Standards (NGSS) Codes:

- MP.1
- MP.2
- MP.3
- MP.4
- MP.5
- MP.6
- MP.7
- MP.8
- N-CN.1
- N-CN.2
- N-CN.3
- N-CN.4
- N-CN.5
- N-CN.6
- N-CN.7
- N-CN.8
- N-CN.9
- N-VM.1
- N-VM.2
- N-VM.3
- N-VM.4
- N-VM.4a
- N-VM.4b
- N-VM.4c
- N-VM.5
- N-VM.5a
- N-VM.5b
- N-VM.6
- N-VM.7
- N-VM.8
- N-VM.9
- N-VM.10
- N-VM.11
- N-VM.12
- A-REI.3
- A-REI.4

- A-REI.4a
- A-REI.4b
- A-REI.5
- A-REI.6
- A-REI.7
- A-REI.8
- A-REI.9
- A-REI.10
- A-REI.11
- A-REI.12
- A-APR.2
- A-APR.3
- A-APR.4
- A-APR.5
- A-APR.6
- A-APR.7
- F-IF.2
- F-IF.3
- F-IF.4
- F-IF.5
- F-IF.7
- F-IF.7a
- F-IF.7b
- F-IF.7c
- F-IF.7d
- F-IF.7e
- F-IF.8
- F-IF.8a
- F-BF.1
- F-BF.1a
- F-BF.1b
- F-BF.1c
- F-BF.2
- F-BF.3
- F-BF.4
- F-BF.4a
- F-BF.4b
- F-BF.4c
- F-BF.4d
- F-TF.1
- F-TF.2
- F-TF.3
- F-TF.4
- F-TF.5
- F-TF.6
- F-TF.7
- F-TF.8
- F-TF.9
- G-SRT.6
- G-SRT.7
- G-SRT.8
- G-SRT.9
- G-SRT.10
- G-SRT.11
- G-GPE.1
- G-GPE.2
- G-GPE.3

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:
After successful completion of the course, the students should be able to:

- Determine the range, domain and other attributes of polynomial, rational, quadratic, exponential, piecewise defined, logarithmic and trigonometric functions, and their inverses.
- Use algebraic methods to combine and compose functions.
- Determine the domain and range of a function obtained through combination or composition of functions.
- Calculate the x and y intercepts, roots, maxima and minima of functions.
- Calculate and locate the intervals over which a function increases or decreases.
- Determine and analyze functions' graphical properties such as holes, extrema, asymptotes and end behavior.
- Detect symmetric properties of even and odd functions.
- Determine the relationship between the graphical representation of discontinuities and end behavior.
- Recognize a family of functions that model relationships in real-world.
- Perform transformations on power, polynomial, quadratic, rational, logarithmic, and trigonometric functions.
- Use computing technology to calculate the regression equation for two variable data sets including logarithmic, polynomial, power, exponential and sinusoidal curves using technology.
- Use regression equations to interpolate and extrapolate using the available data

Topics Covered In This Course:

- The Nature of Functions and Complex Numbers
- Matrices
- Systems of Equations
- Functions and Their Graphs
- Rational Functions
- Right Triangle and Circular Trigonometry
- Graphing Trigonometric Functions
- Trigonometry
- Vectors
- Conics and Analytic Geometry
- Statistics and Probability
- Mathematical Modeling
- Sequences and Series

ADVANCED MATH COURSES

We provide the following advanced math courses:

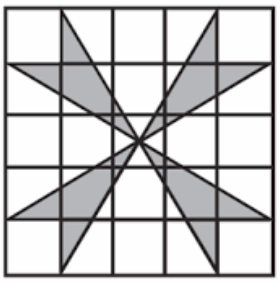
- Advanced Middle School Math with competition problems
- Advanced High School Math with competition problems
- Proof Mathematics with AIME and USAMO problems
- AP Calculus AB,
- AP Calculus BC
- Multivariable Calculus
- AP Statistics

ADVANCED MIDDLE SCHOOL MATH WITH MATHCOUNTS/AMC 8-10 PROBLEMS

This course covers the main topics in middle school math. Students will be mastering these topics while solving challenging problems at the level of or from MathCounts, AMC-8, AMC 10 and similar competitions. They go above and beyond Common Core standards in this brain-stimulating course. They will also solve mathematical puzzles and cyphers in our summer math camp and learn topics that are typically not covered at traditional school settings.

Recommended Grade Levels: Although we do not limit students by grade level in our summer math camps, this course is typically recommended for students in grades 4th-8th.

Course Description: This course will familiarize students with the essential concepts and techniques in Pre-Algebra, Algebra I, Geometry, Number Theory and Combinatorics. We will have a specific emphasis on problem solving where the students will constantly be challenged to think creatively.



Teaching Philosophy: We believe that building good problem-solving skills is as (if not more) important than knowing lots of theorems. As such, although the course will cover a considerable amount of material, the main emphasis will be on building problem-solving intuition and training students to think creatively when faced with classes of problems they've never seen before.

Class Participation: Students are expected to actively participate in class. We will employ the Socratic method, which is a cooperative dialogue between the students and teacher to stimulate critical thinking. Students will also collaborate with classmates while solving challenging problems.

Contest Preparation: MathCounts, AMC 8, AMC 10.

Textbook: The course curriculum is owned and copyright by CyberMath Academy. The class material is composed of unique blends of problems hand picked from prestigious competitions from around the globe, along with many historical problems and fascinating puzzles.

Course Outcomes: As of the completion of the summer math camp, students will:

1. Have complete mastery of concepts covered in standard Pre-Algebra, Algebra I and Geometry courses, as well as topics not covered in the traditional school curriculum.
2. Be able to explain and employ important theorems and techniques used in Combinatorics, Number Theory, and Geometry.
3. Be able to reduce unfamiliar problems to basic principles, and cleverly employ techniques they've learned to find shortcuts in solution methods.

Topics Covered In This Course:

Algebra

- Ratios and Proportions
- Algebraic Expressions
- Linear Equations
- Functions
- Inequalities
- Polynomial Expressions
- Pascal's Triangle
- Binomial Theorem
- Quadratic Equations

Combinatorics

- Counting
- Statistics
- Probability
- Permutations
- Combinations

Number Theory

- Divisibility
- GCD and LCM
- Prime Factorization
- Radicals and Exponents
- Modular Arithmetic
- Sequences and Series
- Gauss's Formula

Geometry

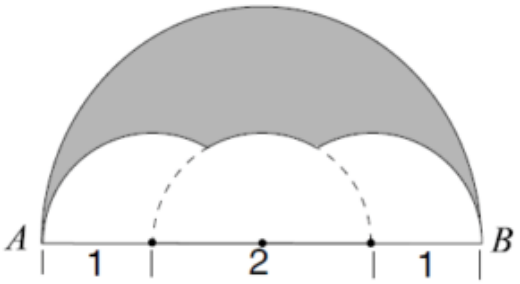
- Angles
- Triangles
- Pythagorean Theorem
- Polygons
- Circles
- Perimeter, Area and Volume
- Coordinate Geometry
- 3D Geometry

ADVANCED HIGH SCHOOL MATH WITH AMC 10/12 PROBLEMS

This course prepares students for the American Mathematics Competitions 10 and 12 and the non-proof parts of AIME. The topics taught include the entire high school curriculum, including trigonometry, advanced algebra, Precalculus and advanced geometry, but exclude calculus. Our curriculum also includes some additional challenging and brain-stimulating topics outside of the traditional school curriculum.

Recommended Grade Levels: Although we do not limit students by grade level in our summer math camps, this course is typically recommended for advanced 7th and 8th graders and high school students.

Course Description: This course will familiarize students with the essential concepts and techniques in Algebra II, PreCalculus, Combinatorics, Number Theory, and Geometry. We will have a specific emphasis on problem solving where the students will constantly be challenged to think creatively.



Teaching Philosophy: We believe that building good problem-solving skills is as (if not more) important than knowing lots of theorems. As such, although the course will cover a considerable amount of material, the main emphasis will be on building problem-solving intuition and training students to think creatively when faced with classes of problems they've never seen before.

Class Participation: Students are expected to actively participate in class. We will employ the Socratic method, which is a cooperative dialogue between the students and teacher to stimulate critical thinking. Students will also collaborate with classmates while solving challenging problems.

Contest Preparation: AMC 10/12, AIME, ARML, Mandelbrot, Purple Comet.

Textbook: The course curriculum is owned and copyright by CyberMath Academy. The class material is composed of unique blends of problems hand picked from prestigious competitions from around the globe, along with many historical problems and fascinating puzzles.

Course Outcomes: As of the completion of the summer math camp, students will:

1. Have complete mastery of concepts covered in standard Algebra II and PreCalculus courses, as well as more advanced topics (such as Vieta's formulas, Complex Numbers, and manipulation of Series).
2. Be able to explain and employ important theorems and techniques used in Combinatorics, Number Theory, and Geometry.
3. Be able to reduce unfamiliar problems to basic principles, and cleverly employ techniques they've learned to find shortcuts in solution methods.

Topics Covered In This Course:

Algebra

- Quadratics/Discriminants & Conic Sections
- System of Equations
- Polynomial Division
- Rational Root Theorem
- Fundamental Theorem of Algebra
- Vieta's Formulas
- Sequences and Series
- Induction
- Radicals and Rationalizing Denominators
- Algebraic Factorizations
- Complex Numbers
- Inequalities
- Functions
- Exponents and Logarithms

Combinatorics

- Basic Counting: Constructive and Complimentary
- Sets, Bijections, and Logic
- Principle of Inclusion Exclusion
- Combinations and Permutations
- Pascal's Triangle
- Binomial Theorem
- Combinatorial Identities
- Pigeonhole Principle
- Expected Value
- Stars & Bars
- Recursion
- Fibonacci Numbers

Number Theory

- Prime Factorization
- Divisibility Rules
- Euclidean Algorithm
- Diophantine Equations
- Bezout's Identity
- Modular Arithmetic & Exponentiation
- Fermat's Little Theorem
- Wilson's Theorem
- Chinese Remainder Theorem
- Multiplicative Functions
- Euler's Theorem

Geometry

- Congruent & Similar Triangles
- Special Parts of a Triangle
- Triangle Area Formulas
- Quadrilaterals
- Angles in Polygons
- Inscribed Angles in Circles
- Power of a Point
- Three-Dimensional Geometry
- Trigonometry for Right Triangles
- Unit Circle & Radians
- Trigonometric Identities
- Extended Law of Sines & Law of Cosines
- Polar Coordinates & Geometry of Complex Numbers

Click here to see sample lecture notes

To get more information on AMC 8, 10, 12 and AIME competitions, please visit Mathematical Association of America's American Mathematics Competitions (AMC) Page.

PROOF MATHEMATICS WITH AIME AND USAMO PROBLEMS

This course is a part of our Math Olympiad Program. You can find more information about our Math Olympiad Program below:

Math Olympiad Program Levels
There are two tracks in this course:

Proof Mathematics with AIME Problems

For students who can comfortably qualify for the AIME and solve the first half of problems on the exam. These students might be aiming to qualify for USA(J)MO and have a pleasant start on the olympiad.

USA(J)MO: For students who can already comfortably qualify for USA(J)MO, and are aiming to score highly on it.

First: Students' level is determined according to the scale below:

1. Starting out on AMC, trying to qualify for AIME
2. Can solve 2 problems on AIME, hoping to solve 8
3. Can solve 6+ problems on AIME, hoping to solve 13
4. Can qualify for USA(J)MO, hoping to solve a problem or two
5. Can solve one or two USA(J)MO problems and solve hard USAJMO or medium USAMO problems
6. Aiming to solve the final P3 / P6 problems on USAMO

Second: Our Math Olympiad Program has two tracks:
Entry Level Math Olympiad Course with Computations (Advanced AIME with Proofs)

* Prerequisites: 6+ on AIME
* Aiming for high AIME scores, and a couple problems on USA(J)MO

Advanced Math Olympiad Course (USAJMO)

* Prerequisites: consistently qualify for USA(J)MO
* Aiming to score 14+ on USAMO

Third: Placement

- If a student matches in levels 1 or 2, you should sign up for our Advanced High School Math with AMC 10/12 Problems course. It covers AMC 10/12 and the non-proof problems on the AIME.
- If a student matches in levels 3 or 4, you should sign up for our Advanced AIME with Proofs course.
- If a student matches in levels 5 or 6, you should sign up for our USA(J)MO course.

Math Olympiad Program Curriculum
There are two tracks in this program:

Advanced AIME with Proofs: For students who can comfortably qualify for the AIME and solve the first half of the problems on the exam. These students might be aiming to qualify for USA(J)MO and have a pleasant start on the olympiad.

USA(J)MO: For students who can already comfortably qualify for USA(J)MO, and are aiming to score highly on it.

These two tracks overlap in any given year. The curriculum runs in a three-year cycle.

Contest preparation: AIME, HMMT, USA(J)MO, IMO.

Curriculum: The course operates on a three-year cycle, so students can repeat the course up to three times total, across both tracks. The summer math camp and year-round materials are disjoint.

Textbook: The course curriculum is owned and copyright by CyberMath Academy. The class material is composed of unique blends of problems hand picked from prestigious competitions from around the globe, along with many historical problems and fascinating puzzles.

A detailed listing of topics covered appears below. Not all topics occur in all years. Most topics occur in multiple years, but they will have different examples and problems each time they appear over the three-year cycle.

Each iteration of the course contains several practice exams.

1. **Topics appearing only in Advanced AIME with Proofs**

Algebra

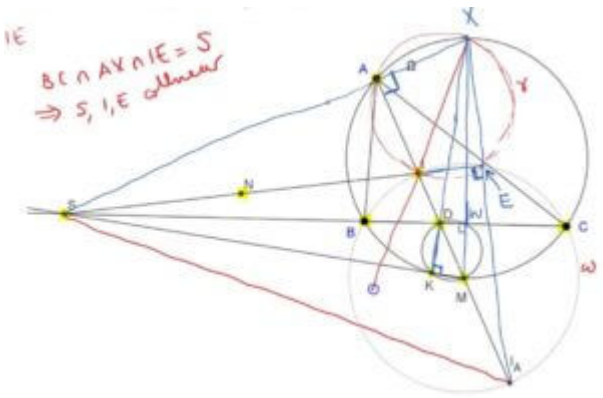
- Symmetric Polynomials. Vieta's formulas, Newton sums, fundamental theorem of elementary symmetric polynomials.
- Logarithms.Computational problems and equations involving logarithms.
- Trig Equation. Algebraic problems involving trig functions.
- Intro Functional Equation. Introduction to olympiad-style functional equations. Substitutions, injectivity and surjectivity, Cauchy's functional equation.
- Inequalities. Introduction to olympiad-style inequalities. AM-GM and Cauchy-Schwarz.

Combinatorics

- Computations with Probability. Random variables, expected value, linearity of expectation.
- Enumeration. Computational counting problems.
- Monovariants and Invariants. Finite processes.

Geometry

- Computational Geometry. AIME-style problems in Euclidean geometry.
- Angle Chasing.
- Trig in Geometry.
- Elementary Geometry. Angle chasing, power of a point, homothety.
- Basics of Complex Numbers. Introduction to complex numbers in geometry.



Number theory

- Computations with Modular Arithmetic. Fermat, Wilson, Chinese Remainder theorem.
- Diophantine Equations. Introduction to olympiad-style Diophantine equations.
- Chinese Remainder Theorem.

2. **Topics appearing in both tracks**

Algebra

- Generating Functions. Their uses in combinatorial sums.
- Linear Recursions and Finite Differences.
- Sums. Swapping order of summation.
- Polynomials. Fundamental theorem of algebra, factorizations, roots.

Combinatorics

- Weights and Colorings.
- Induction and Recursion.
- Linearity of Expectation and Double-Counting.
- Algorithms. Combinatorial problems involving discrete-time processes.

- Graph Theory. Definitions and problems.
- Ad-Hoc Constructions.
- Problems on Rectangular Grids.

Geometry
- Power of a Point.
- Homothety
- Common Configurations.

Number theory
- Divisibility and Euclidean Algorithm. Bounding the remainders.
- Look at the Exponent. p-adic evaluation, lifting the exponent.
- Orders. Primes of the form a2 + b2. Primitive roots.

3. Topics appearing only in USA(J)MO

Algebra
- Functional Equations. More difficult functional equations at the USAMO/IMO level.
- Advanced Inequalities. Jensen and Schur. Fudging, smoothing.
- Analysis and Calculus. Understanding the complete theorem statements in calculus and how they can be applied to olympiad problems. Differentiation and the relation to multiplicity of roots. Lagrange multipliers. Compactness.

Combinatorics
- Advanced Graph Theory. More difficult olympiad problems involving graphs.
- Advanced Algorithms.
- Games and Processes.

Geometry
- Projective Geometry. Harmonic bundles, poles and polars.
- Inversion.
- Spiral Similarity.
- Complex Numbers. Applications to problems.
- Barycentric Coordinates. Applications to problems.

Number theory
- Constructions in Number Theory.
- Integer Polynomials. Irreducibility, minimal polynomials, a taste of Galois theory.
- Quadratic Reciprocity. Legendre symbols.

AP CALCULUS AB

Course Description:
In this course, students will study the topics as outlined in the Calculus AB guideline by the College Board as it appears in the AP Calculus Course Description. The ultimate goal is to introduce students to the major concepts of a first-year college calculus course, with the overall objective of preparing the students for the Advanced Placement exam in May. The AP Calculus AB course is concerned primarily with developing student's understanding of the concepts of calculus, and providing them with experience in its methods and applications. The course emphasizes a multi-representational approach to calculus. Concepts, results, and problems are expressed graphically, numerically, analytically, and verbally. Broad concepts and widely applicable methods are emphasized. The major themes of the course are: limits, approximation, derivatives, integrals, and applications and modeling.–

Prerequisites:
PreCalculus or Honors PreCalculus or placement test.

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:
After completing, students will be able to:

- Evaluate limits, perform operations with limits, and determine the continuity of a function.
- Develop the concept of the derivative and the skills needed to calculate and evaluate the derivative using explicit and implicit techniques.
- Use the derivative to analyze polynomial, rational and trigonometric functions and their graphs while modeling real world applications such as optimization, related rates, and motion problems.
- Develop the concept of the antiderivative and the skills needed to determine indefinite integrals.
- Work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. You should understand the connections among these representations.
- Understand the meaning of the derivative in terms of a rate of change and local linear approximation and use derivatives to solve a variety of problems.
- Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and use integrals to solve a variety of problems.
- Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
- Communicate mathematics both orally and in well-written sentences and explain solutions to problems.
- Model a written description of a physical situation with a function, a differential equation, or an integral.

Topics Covered In This Course:

- Precalculus Review
- Limits and Continuity
- The Derivative
- Applications of the Derivative
- The Definite Integral
- Differential Equations and Mathematical Modeling
- Applications of Definite Integrals

AP CALCULUS BC

Course Description:
Calculus BC includes all topics covered in Calculus AB plus additional topics, and is designed to qualify the students for placement and credit in a course that is one course beyond what's granted for Calculus AB.

This course is designed to be a high school course consisting of work comparable to calculus courses in colleges and universities; it is intended to be demanding and challenging. Students in this course are expected to seek college credit, college placement, or both as determined by the results of the Advanced Placement (AP) Calculus BC examination. Appropriate credit and placement are granted by each college or university in accordance with their own policies.

Prerequisites:
Students enrolled in this course should have completed Calculus AB and at least four years of high school mathematics in which they have studied algebra 1,2, geometry and precalculus. Alternatively students can take a placement test.

Textbook:
Mathematics Enhancement Programme
Additional Problem Sets by Problem-Attic.

Course Outcomes:
After completing, students will be able to:

- Work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. You should understand the connections among these representations.
- Understand the meaning of the derivative in terms of a rate of change and local linear approximation and be able to use derivatives to solve a variety of problems.
- Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and use integrals to solve a variety of problems.
- Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
- Communicate mathematics both orally and in well-written sentences and explain solutions to problems.
- Model a written description of a physical situation with a function, a differential equation, or an integral.
- Determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.

Topics Covered In This Course:

- Limits
- Definition of Derivative
- Chain Rule
- Implicit Differentiation
- Mean Value Theorem
- L'Hospital's Rule
- Riemann Sums
- Functions Defined by Definite Integrals
- Modeling & Solving Differential Equations
- Rectilinear Motion
- Parametric Equations
- Introduction to Series
- Series Convergence
- Series Manipulation

MULTIVARIABLE CALCULUS

Course Description:
The mathematics required to describe most "real life" systems involves functions of more than one variable, so the differential and integral calculus developed in a first course in Calculus must be extended to functions of more variables. In this course, the key results of one-variable calculus are extended to higher dimensions: differentiation, integration, and the link between them provided by the Fundamental Theorem of Calculus are all generalised. The machinery developed can be applied to another generalisation of one-variable Calculus, namely to complex calculus, and the course also provides an introduction to this subject. The material covered in this course forms the basis for mathematical analysis and application across an extremely broad range of areas, essential for anyone studying the hard sciences, engineering, or mathematical economics/finance.

Prerequisites:
Calculus AB, BC or placement test.

Textbook: Larson, Hostetler, & Edwards (2002). Calculus (7th ed.). Boston, MA: Houghton Mifflin Company.

Course Outcomes:
To present the fundamental concepts of multivariable calculus and to develop student understanding and skills in the topic necessary for its applications to science and engineering.
Upon completion of this course, students should be able to:

- Manipulate vectors to perform geometrical calculations in three dimensions.
- Calculate and interpret derivatives in up to three dimensions.
- Integrate functions of several variables over curves and surfaces.
- Use Green’s theorem and the Divergence theorem to compute integrals.
- Communicate Calculus and other mathematical ideas effectively in speech and in writing.
- Solve mathematical problems using analytical methods.
- Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
- Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences

Topics Covered In This Course:

- Introduction to multivariable calculus,
- Differentiation of scalar- and vector-valued functions,
- Higher-order derivatives, extrema,
- Lagrange multipliers and the implicit function theorem,
- Integration over regions, volumes, paths and surfaces,
- Green's, Stokes' and Gauss's theorems,
- Differential forms,
- Curvilinear coordinates,
- Complex numbers and functions,
- Complex differentiation,
- Complex integration and Cauchy's theorems, and
- Conformal mappings.

AP STATISTICS

Course Description:
The Advanced Placement Program offers a course description and exam in statistics to secondary/high school students who wish to complete studies equivalent to a one semester, introductory, non-calculus-based, college course in statistics. This AP Statistics course covers topics in Probability, Regression Analysis, and Sampling Distributions. This course prepares students to succeed on the AP Statistics exam and subsequent courses that draw on material from this course. Exams contain both multiple choice and free response questions modeled after the AP Statistics exam. Instructors use virtual classroom software allowing video, voice, text, screen sharing and whiteboard interaction. In this course, students will study the topics as outlined in the Statistics AP guideline by the College Board as it appears in the AP Statistics Course Description.

Prerequisites:
Algebra-2 or placement test.

Textbook: Starnes, Daren S., Dan Yates, and David S. Moore. The Practice of Statistics. New York: W.H. Freeman & Co./BFW.

Course Outcomes:
After completing, students will be able to:

- Choose the best method of graphical display and make the appropriate graphs.
- Analyze and extract needed information from graphs and describe central tendency, spread and outliers, using appropriate terminology.
- Graph side-by-side boxplots, find standard deviation, mean and the 5-number summary on their calculators.
- Understand the concept of standardizing a value within a normal distribution and be able to calculate a z-score.
- Calculate the value's percentile.
- Recognize bivariate data, be able to identify the explanatory and response variable and calculate the least squares regression line.
- Analyze scatter plots and residual plots to describe the relationship and pattern between the variables and be able to communicate pertinent information.
- Predict how influential and outlier values will affect that line.
- Understand various aspects of correlation.
- Extract the necessary information from a computer print-out to write the equation of a line, identify the r^2 value and describe what it represents with appropriate terminology.
- Understand how to transform curved data to create a least squares regression line and to convert that equation to an equation of an exponential or power function.
- Identify observational and experimental data.
- Learn to recognize potential sources of bias in data and will learn techniques of data collection to reduce the possibility bias and to collect data that is approximately representative of the population.
- Understand the differences between sampling and experimentation.
- Learn techniques of blocking and simulation.
- Communicate all aspects of sampling and experimentation with appropriate terminology.

Topics Covered In This Course:

- Exploring Data: Describing patterns and departures from patterns (20%–30%)
    - Constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)
    - Summarizing distributions of univariate data
    - Comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)
    - Exploring bivariate data
    - Exploring categorical data
- Sampling and Experimentation: Planning and conducting a study (10%–15%)

    - Overview of methods of data collection
    - Planning and conducting experiments
    - Planning and conducting surveys
    - Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys
- Anticipating Patterns: Exploring random phenomena using probability and simulation (20%–30%)
    - Probability
    - Combining independent random variables
    - The normal distribution
    - Sampling distributions
- Statistical Inference: Estimating population parameters and testing hypotheses (30%–40%)
    - Estimation (point estimators and confidence intervals)
    - Tests of significance

COMPUTER SCIENCE COURSES

CyberMath Academy's coding and technology program provides a challenging environment for students in which they master coding with the participation of brilliant students from all over the globe.
Courses offered in coding:

- Python Programming
- Java Processing
- AP Computer Science Principles
- AP Computer Science A
- C++ Programming and USACO Bronze
- AP Computer Science A & USACO Silver

PYTHON PROGRAMMING

Course Description:

This course is designed to cover the basics of computer programming for students without prior programming experience. It introduces students to coding while teaching basic level algorithms. Students get a chance to practice their newly learned skills through producing algorithms that solve real-life problems.

The recommended grade levels: 4th-12th.

Prerequisites:
None

Textbook:
CyberMath Academy's lecture notes and assignments.

Course Outcomes:
After completing, students will be able to:

- Learn basic programming concepts such as types, functions, and best practices
- Solve programming challenges using these fundamental python concepts to gain a better understanding of programming
- Learn to deal with common algorithmic problems
- Learn the basics of programming and are able to write codes that solve computer science problems
- Solve by using the algorithms and techniques taught through challenging projects.

Topics included:

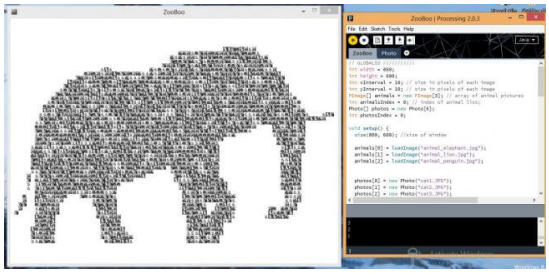
- Variables and Operators
- Conditionals
- Loops
- Arrays
- Strings
- Functions
- Files
- Matrices

JAVA PROCESSING

Course Description: This course is a collaborative and project-based introduction to object-oriented computer programming through MIT's Java-based computer language Processing, with an emphasis on problem solving, visual arts, graphic design, and animation.

This course teaches students programming in Java Processing. In this course, students will learn object-oriented programming in a fun and exciting way, that will effectively prepare them for learning any C-based programming language. It is designed for students who are comfortable with the math level (Pre-Algebra), and is not proficient in any programming languages. Block-based and introductory programming experience are fine, if the student is proficient in any programming languages, they should enroll in our USACO and AP Computer courses. The recommended grade levels: 4th-8th.

What is Java Processing?: Processing is a visual arts based open source language developed at MIT.



The Processing software is used by thousands of visual designers, artists, and architects to create their works. Projects created with Processing have been featured at the Museum of Modern Art in New York, the Victoria and Albert Museum in London, the Centre Georges Pompidou in Paris, and many other prominent venues. Processing is used to create projected stage designs for dance and music performances; to generate images for music videos and film; to export images for posters, magazines, and books; and to create interactive installations in galleries, in museums, and on the street. Some prominent projects include the House of Cards video for Radiohead, the MIT Media Lab's generative logo, and the Chronograph projected software mural for the Frank Gehry-designed New World Center in Miami. But the most important thing about Processing and culture is not high-profile results – it's how the software has engaged a new generation of visual artists to consider programming as an essential part of their creative practice.

Processing is essentially an extremely visual front-end to Java. When you click "Run", the program converts your code into Java code and then runs it. It was built for two purposes:

1. To be an easy to learn but powerful language for beginning developers and artists.
2. To be easy to code visual ideas. That is, it's much faster to code the same concept in Processing than in Java or C++.

Because of its convenience, Processing is mainly used for data visualization, visual art/design, app development, and education. Its educational accessibility means the skills from coding in Processing very easily translate to any other C-based language (C, C++, C#, Java, Javascript, Python, Ruby).

Art/design: Art and design are half the point of the language. The class will mostly deal with 2D but we'll also spend a couple lessons doing 3D.

Why Processing?: Processing is a fantastic first programming language for 2 reasons:

1. The syntax is easy and it's easy to understand.
2. The incredible visual component and speed of compilation. When you click run, you almost immediately see what you just coded.

This makes programming interesting and accessible in a way no other language does. It's very satisfying to make things appear and interact with you with only basic understanding of the language.

Prerequisites: Students should be reasonably skilled in mathematical reasoning at a 5th/6th grade level; the class has a high problem solving component. Two important topics students should know:

- **Coordinate grid:** Student must be able to understand plotting on a Cartesian plane (x and y coordinates). Knowing how to graph things is unnecessary.
- **Basic pre-algebra:** Student must be able to solve basic algebraic equations like 250 = x + w/2 where w = 50 (answer: x = 225).

- Decent typing skills: or the student will fall behind. Student doesn't have to be a professional typewriter, just the ability to touch type. Students shouldn't have to think too hard about the keyboard when they should be thinking about what's on the screen.

Textbook: The course curriculum is being developed by CyberMath Academy.
Processing software

Course Outcomes: After completing, students will be able to:
- Gain the skills to design, code, and debug basic animations and games in the language Processing,
- Gain programming skills to be well-prepared for further computer science study and independent programming projects and problem solving

Topics:
- Fundamentals of Computer Programming
- The Basics of Data Types
- Control Flow
- Iteration and Functional Programming
- Recursion
- Classes
- Objects and Methods

Connections to Other Subject Areas
- Cartesian Geometry,
- Number Bases (binary and hexadecimal),
- Pseudorandomness,
- Kinematics,
- Fractals, and
- Mathematical Problem Solving With Computers

Prior understanding of computer programming not required.

Class projects: This course features projects that are independent and collaborative design and development of games and interactive animations. There will be 10 projects, on, in order:

- Drawing things with basic shapes,
- Interactive 2D/3D animations (moving an object, basic text editor, solar system model)
- Designing modifiable single player games, and
- Mathematical art.

AP COMPUTER SCIENCE PRINCIPLES

Course Description:
AP Computer Science Principles offers a multidisciplinary approach to teaching the underlying principles of computation. The course will introduce students to the creative aspects of programming, abstractions, algorithms, large data sets, the Internet, cybersecurity concerns, and computing impacts. AP Computer Science Principles also gives students the opportunity to use current technologies to create computational artifacts for both self-expression and problem solving. Together, these aspects of the course make up a rigorous and rich curriculum that aims to broaden participation in computer science. In this course, students will study the topics as outlined in the Computer AP guideline by the College Board as it appears in the AP Computer Science Principles Course Description.

This course prepares students to take AP Computer Science Principles and other upper level related courses.

Prerequisites:
None.

Textbook:
Computer Science Principles: The Foundational Concepts of Computer Science – For AP Computer Science Principles by Kevin Hare, Pindar Van Arman

Course Outcomes:
After completing, students will be able to:

- Learn to draw connections between different computing concepts.
- Engage in the creative aspects of computing by designing and developing interesting computational artifacts as well as by applying computing techniques to creatively solve problems.
- Develop models and simulations of natural and artificial phenomena, use them to make predictions about the world, and analyze their efficacy and validity.
- Design and produce solutions, models, and artifacts, and they evaluate and analyze their own computational work as well as the computational work others have produced.
- Describe computation and the impact of technology and computation, explain and justify the design and appropriateness of their computational choices, and analyze and describe both computational artifacts and the results or behaviors of those artifacts.
- Collaborate on a number of activities, including investigation of questions using data sets and in the production of computational artifacts.

Topics Covered In This Course:

- Computational Thinking
- Programming
- Data Representation
- Digital Media Processing
- Big Data
- Innovative Technologies
- The AP Exam

AP COMPUTER SCIENCE A

Course Description:
AP Computer Science A is equivalent to a first-semester, college-level course in computer science. The course introduces students to computer science with fundamental topics that include problem solving, design strategies and methodologies, organization of data (data structures), approaches to processing data (algorithms), analysis of potential solutions, and the ethical and social implications of computing. The course emphasizes both object-oriented and imperative problem solving and design using Java language. These techniques represent proven approaches for developing solutions that can scale up from small, simple problems to large, complex problems. The AP Computer Science A course curriculum is compatible with many CS1 courses in colleges and universities. In this course, students will study the topics as outlined in the Computer AP guideline by the College Board as it appears in the AP Computer Science A Course Description.

Prerequisites:
Completion of Algebra I and high school introductory computer science course, or placement test.

Textbook:
Big Java by Cay S. Horstmann

Course Outcomes:
Students should be able to:

- Design, implement, and analyze solutions to problems.
- Use and implement commonly used algorithms.
- Develop and select appropriate algorithms and data structures to solve new problems
- Write solutions fluently in an object-oriented paradigm.
- Write, run, test, and debug solutions in the Java programming language, utilizing standard Java library classes and interfaces from the AP Java subset.
- Read and understand programs consisting of several classes and interacting objects.
- Read and understand a description of the design and development process leading to such a program, and
- Understand the ethical and social implications of computer use.

Topics Covered In This Course:

- Object-Oriented Program Design
    - Program and class design
- Program Implementation
    - Implementation techniques
    - Programming constructs
    - Java library classes and interfaces included in the AP Java Subset
- Program Analysis
    - Testing
    - Debugging
    - Runtime exceptions
    - Program correctness
    - Algorithm analysis
    - Numerical representations of integers
- Standard Data Structures
    - Primitive data types (int, boolean, double)
    - Strings
    - Classes
    - Lists
    - Arrays (1-dimensional and 2-dimensional)
- Standard Operations and Algorithms
    - Operations on data structures
    - Searching
    - Sorting

- VI. Computing in Context
    - System reliability
    - Privacy
    - Legal issues and intellectual property
    - Social and ethical ramifications of computer use

C++ PROGRAMMING AND USACO BRONZE

In this course, while learning coding in C++, students will be trained to master the fundamental skills to correctly understand the questions on USACO Bronze competitions and design and implement algorithms to solve them. These skills will be practiced extensively to help students meet the time limits set for each problem.

USACO is the most prestigious pre-college Computer Science competition in the states (See our **AP Computers and USACO** page).

While your program must solve the problem presented on a USACO competition, it must also do it fast. Your program must be submitted within the specified time period and should not produce any compilation or runtime errors. There will be a number of test cases that your program will be judged on.

Prerequisites/Requirements: B or above in Pre-Algebra.

Textbook: The course curriculum is owned and copyright by CyberMath Academy.

Topics Covered

- Introduction to C++
- Variables and Operators
- Conditionals
- Loops
- Arrays
- Strings
- Functions
- Files
- Matrices

AP COMPUTER SCIENCE A & USACO SILVER

This course prepares students for the USACO Silver Contest and AP Computer Science A Exam through comprehensive lectures and practice problems from national and international competitions, taught and guided by an expert instructor. In this course, students hone their problem solving skills while they advance their algorithm designs and implementation. It's a fun and friendly challenging environment which mathematically advanced students experience the thrill of solving real-life like problems through computer programming. In this course, students will study the topics as outlined in the Computer AP guideline by the College Board as it appears in the AP Computer Science A Course Description.

Prerequisites:
At least one of the following requirements needs to be satisfied. The student:

- Has taken a computer programming course before (in either Java, Python or C++)
- Has taken the USACO Bronze class, or
- Has scored 400+ in a USACO Bronze contest.

Textbook: The course curriculum is owned and copyright by CyberMath Academy.

Topics Covered:

- Sorting
- Searching (Sequential Search, Binary Search)
- Brute Force
- Silver Level Techniques (FloodFill, RMQ, Prefix Sums)
- String Algorithms (Silver Level)
- Data Structure (Stack, Queue, Vector, Set, Map, PriorityQueue- Silver Level)
- Recursion
- Depth first Search
- Breadth first Search
- Bitset & Binary Operations
- Object-Oriented Program Design

SCIENCE COURSES

We also offer the following science courses:

- Biology
- Chemistry
- Physics
- AP Biology
- AP Chemistry
- AP Physics 1
- AP Physics 2
- AP Physics C: Mechanics
- AP Physics Class and Physics Olympiad (F=m*a)
- USA Physics Olympiad (USAPhO)
- USA Biology Olympiad (USABO)
- The International Biology Olympiad (IBO)

BIOLOGY

Course Description:
Biology is designed to provide the students with an understanding of how living organisms work and survive through various processes. The course will cover the basics of life, cells, microorganisms, plants, animals and the human body along with fundamentals of Ecology, Genetics. The students will reach to an understanding of the interrelation of these topics and the interactions among the organs and the organisms; for instance, how cells form tissues that make the organs which in turn build the systems that operate numerous life functions. Students will learn to identify the key concepts of the life systems through the provided reading material and then apply their knowledge in various activities. Multiple choice midterms and a cumulative multiple choice final exam will be conducted for the assessment. This course will provide the students with a strong background to take AP Biology and other advanced Biology courses.

Prerequisites:
None

Textbook:
Biozone Biology for NGSS (2nd Edition)

The Next Generation Science Standards (NGSS) Codes:

- HS-LS1-1
- HS-LS1-2
- HS-LS1-3
- HS-LS1-4
- HS-LS1-5
- HS-LS1-6
- HS-LS1-7
- HS-LS2-1
- HS-LS2-2
- HS-LS2-3
- HS-LS2-4
- HS-LS2-5
- HS-LS2-6
- HS-LS2-7
- HS-LS2-8
- HS-LS3-1
- HS-LS3-2
- HS-LS3-3

- HS-LS4-1
- HS-LS4-2
- HS-LS4-3
- HS-LS4-4
- HS-LS4-5
- HS-LS4-6

Course Outcomes:
Upon successful completion of this course, students will be able to:

- Understand the important structural and functional roles of biological compounds in all types of cells.
- Understand how molecules and their chemical properties are important for cellular processes and reactions.
- Understand that DNA is the genetic information storing molecule of living organism.
- Understand how various cellular processes are regulated by numerous proteins.
- Evaluate the genetic research and biotechnology with respect to ethical, social and legal implications.
- Understand the geologic time scale and find out how organisms are classified.
- Understand the sensitive limits on the internal conditions of the cells, organs and organisms.
- Differentiate general structure and cellular organization of plants and their reproductive systems.
- Understand the feedback mechanisms for organs and systems that maintain homeostasis.
- Identify the environmental factors that are important for homeostasis.
- Interpret scientific data and use graphics to identify the elements commonly explained in high school Biology courses.
- Understand the population growth and its predictable patterns.
- Realize how increased resource consumption and waste production control population growth and result in consequences affecting Earth's sustainability.
- Understand the consumption of natural resources and ecological footprint of populations and assess the associated technological developments.
- Test their knowledge, locating appropriate quizzes on all of the concepts found in the provided videos.

Topics Covered In This Course:

- Introduction to Biology
- Understanding Living Things
- Cells
- Genetics
- Evolution
- Viruses
- Prokaryotes
- Protists
- Fungi
- Plants
- Animals
- The Human Body
- The Interdependence of Life
- Ecosystems and Human Impact

CHEMISTRY

Course Description:

The objective of this course is to help students study matter and its modifications for a better understanding of the world around them. The course is intended to provide the students with a sound background to comfortably handle AP Chemistry. Therefore the contents are designed very similar to the topics covered in a typical high school Chemistry. Students will be encouraged to apply scientific questioning to establish an understanding of chemical concepts, making use of a variety of resources including interactive web-based video, suggested text books, problem-solving and related applications. The following chapters will be taught: Introduction to Chemistry; Atoms, Molecules and Ions; Stoichiometry; Atomic Structure and Bonding; Gases, Liquids, and Solids; Properties of Solutions; Energy: Thermochemistry; Acids and Bases; and Organic Chemistry. Lab kits with included procedures will be used to run experimental activities. Homework assignments and discussion sessions, in addition to a comprehensive final exam will be used for assessment. This course is intended to prepare the students to comfortable follow AP Chemistry and other upper level Chemistry courses.

Prerequisites:
Algebra 1 or placement test.

Textbook:
Chemistry: The Central Science (14th Edition) by Theodore E. Brown

The Next Generation Science Standards (NGSS) Codes:

- HS-PS1-1
- HS-PS1-2
- HS-PS1-3
- HS-PS1-4
- HS-PS1-5
- HS-PS1-6
- HS-PS1-7
- HS-PS1-8
- HS-PS2-6
- HS-PS3-4
- HS-PS4-3
- HS-PS4-4
- HS-ESS1-1
- HS-ESS1-2
- HS-ESS1-3
- HS-ESS1-4
- HS-ESS1-5
- HS-ESS1-6
- HS-ESS2-5
- HS-ESS3-5
- HS-ESS3-6

Course Outcomes:

After successfully completing this course, the students will be able to:

- Demonstrate an understanding of matter and energy at the atomic level and molecular level along with their behavior and interaction between them.
- Recognize atoms, molecules, ions and chemical reactions in symbols and in standard names.
- Estimate molecular geometry, atomic structure and chemical bonding using accepted models.
- Demonstrate an understanding of matter and energy, and physical or chemical modifications applying quantitative reasoning approach.
- Analyze the reactions between acids and basis and basic equilibrium concepts using commonly accepted chemical models.

- Become competent in searching for theoretical information and collecting experimental data with an ability to interpret them.

Topics Covered In This Course:

- Atoms, Molecules, and Ions
- Chemical Bonding
- Conservation of Matter
- Stoichiometry
- Gases, Liquids, and Solids
- Acids and Bases
- Solutions
- Reaction Rates
- Chemical Equilibrium
- Organic Nomenclature
- Nuclear Chemistry

PHYSICS

Course Description:

Physics teaches students to be able to use mathematical and conceptual thinking to understand the processes in the nature. The main themes of the course are based on motion, force and energy. Students will gain different points of view to examine the objects by developing a good understanding of straight-line motion, circular motion and gravitation. Causes of motion and interactions among objects are focused to understand the nature of force. Collisions and the mechanism of action of the simple machines will be explained to illustrate the transfer of the energy generated in a system along with its efficiency. Different energy types according to the atomic nature of matter will be introduced in addition to descriptions of three phases of matter with respect to their unique characteristics. The difference between temperature and heat, and heat transfer will be covered with respect to definition of heat transfer and the factors affecting it. Other energy types such as waves, electricity, magnetism and nuclear energy will also be introduced within the course. Conceptual relationships that are unique to each form of energy, and how they contribute to our world will be discussed. The course will end with the introduction of The Special Theory of Relativity and the General Theory of Relativity that constitute the cornerstones of modern Physics. This course will help students gain a background to take upper levels courses such as AP Physics 1, AP Physics 2 and other related courses. Short answer, problem solving, or true/false type mid-term and final exams will be conducted for assessment.

Prerequisites:
Algebra 1 and Geometry or placement test.

Textbook:
Conceptual Physics: The High School Physics program by Paul G. Hewitt

The Next Generation Science Standards (NGSS) Codes:

- HS-PS1-1
- HS-PS1-2
- HS-PS1-3
- HS-PS1-4
- HS-PS1-5
- HS-PS1-6
- HS-PS1-7
- HS-PS1-8
- HS-PS2-1
- HS-PS2-2
- HS-PS2-3
- HS-PS2-4
- HS-PS2-5
- HS-PS2-6
- HS-PS3-1
- HS-PS3-2
- HS-PS3-3
- HS-PS3-4
- HS-PS3-5
- HS-PS4-1
- HS-PS4-2
- HS-PS4-3
- HS-PS4-4
- HS-PS4-5

Course Outcomes:

After successful completion of this course the students will be able to:

- Demonstrate and understanding for the major laws of Physics.

- Explain physical phenomena and solve problems applying the laws of heat and work, electromagnetism, hydrostatics, kinetic theory of gases, mechanics, oscillatory motion and waves, electricity and magnetism, and optics.
- Identify and measure physical quantities.
- Understand the works of scientists and the associated theories that contributed to the development of laws explaining physical phenomena.
- Utilize fundamental physical principles to develop new explanations and insights for natural phenomena.
- Build clarity in definition and the search for appropriateness of evidence for examining physical phenomena using analytical skills developed.
- Demonstrate a clear understanding on how to apply scientific approach to the fundamental principles ruling the universe.

Topics Covered In This Course:

- Kinematics,
- One and Two-dimensional motion,
- Force,
- Newton's Laws of Motion,
- Work,
- Energy,
- Momentum,
- Circular motion,
- Thermodynamics,
- Waves,
- Optics,
- Electrostatics,
- Electric Current,
- Magnetism,
- Atomic physics.

AP BIOLOGY

Course Description:
This course is a comprehensive overview of general biology. The scope of the course is designed to be very similar to a college introductory Biology that is usually offered to pre-medical or freshman Biology students. The course will provide the students with a learning strategy focused on developing critical thinking skills and cognitive approaches. AP Biology aims to equip students with an understanding of the micro and macro scales of life. After comprehending the basics of Biology, students will move on to explore the role of phylogenetics on the diversity and similarity of life. How living systems store, transfer, receive and respond to information and the mechanisms through which the organisms make use of free energy will be explored by the students. As the equivalent of an introductory college biology course, AP Biology will help students to gain enough information to be prepared for the AP exam and for advanced study in basic sciences, health sciences, or engineering.
In this course, students will study the topics as outlined in the Biology AP guideline by the College Board as it appears in the AP Biology Course Description.

Prerequisites:
Biology or placement test.

Textbook:
Biology for AP® Courses

Course Outcomes:
After successful completion of this course, the students will be able to:
- Make use of projects and class discussions to enhance problem solving skills.
- Use a theme-oriented approach to get familiar with the biological terms and the basic concepts.
- Explain scientific phenomena and solve scientific problems using representations and model systems.
- Make use of written essays, assignments and research reports to improve scientific communication skills.
- Extend thinking and design experiments within the context of the AP course employing scientific questioning.
- Utilize appropriate mathematical tools.
- Analyze data and evaluate available evidence.
- Interconnect information across different scales, concepts and domains.

Topics Covered In This Course:
- Scientific method and experimental design
- Biochemistry
- Characteristics of life
- Molecular biology
- Genetics
- Mechanisms of evolution
- Evolutionary history of biological diversity
- Plant and animal form and function
- Ecology

AP CHEMISTRY

Course Description:
AP Chemistry is designed with a very similar content to the first year college General Chemistry.Students will acquire fundamental analytical skills to assess chemical problems. Within the scope of this course, the students will get the opportunity to develop the skills to draw conclusions based on informed judgment and available evidence. The course will provide the students with content relevant to common chemistry problems, and an exam that assesses students' understanding of the particulate nature of matter rather than just memorizing the rules. In this course, students will study the topics as outlined in the Chemistry AP guideline by the College Board as it appears in the AP Chemistry Course Description.

Prerequisites:
Chemistry or placement test.

Textbook:
Zumdahl, Steven S., Susan A. Zumdahl, and Donald J. DeCoste. Chemistry (AP Edition). 10th edition. National Geographic Learning/Cengage Learning.

Course Outcomes:
After successful completion of this course, the students will be able to:

- Demonstrate a strong background in Chemistry, very close to a first year college Chemistry.
- Master chemical calculations by making use of problem solving skills.
- Master common laboratory techniques by applying them in the laboratory.
- Understand important descriptive skills in chemical studies.
- Solve chemistry problems and analyze quantitative data obtained from laboratory experiments by exploring common concepts in Chemistry.
- Pass the AP Exam successfully to receive placement at the college of choice.
- Take courses for which General Chemistry is a prerequisite.
- Free time for other important courses by meeting laboratory course requirement.

Topics Covered In This Course:

- Introduction to Matter and Measurement
- Atoms, Molecules, and Ions
- Stoichiometry
- Reactions in Aqueous Solutions
- Gases
- Thermochemistry
- Modern Atomic Theory
- Electron familyigurations and Periodicity
- Chemical Bonding: Fundamental Concepts
- Molecular Geometry and Bonding Theory
- Oxidation-Reduction Reactions
- Condensed Phases: Liquids and Solids
- Physical Properties of Solutions
- Chemical Kinetics
- Chemical Equilibrium
- Acids and Bases
- Thermodynamics
- Electrochemistry
- Nuclear Chemistry
- Chemistry of Metals
- Nonmetals
- Instructional Laboratory Demonstrations

AP PHYSICS 1

Course Description:
The course provides students with an introductory experience in the concepts and methods of physical analysis, focused on classical mechanics and simple electrical circuits. Building the ability to reason qualitatively and quantitatively is a primary focus, with inquiry and investigation, modeling and diagramming, symbolic algebra, unit analysis, communication and argumentation, laboratory techniques, data analysis, and integration and application of concepts as emphasized skills. Students have the primary responsibility for building understanding, with the instructor as a resource and guide. In this course, students will study the topics as outlined in the Physics AP guideline by the College Board as it appears in the AP Physics 1 Course Description.

Prerequisites:
High School Physics or placement test.

Textbook:
College Physics for AP Courses
Additional Lectures and Problem Sets by CyberMath Academy

Course Outcomes:
After completing, students will be able to:

- Use representations and models to communicate scientific phenomena and solve scientific problems
- Use mathematics appropriate
- Engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course
- Perform data analysis and evaluation of evidence
- Work with scientific explanations and theories
- Connect and relate knowledge across various scales, concepts, and representations in and across domains
- Carry out open-inquiry investigations to solidify their knowledge of physics.
- Choose applicable models for the situation, what variables to investigate/measure, an appropriate data collection and analysis process, and how to draw/defend appropriate/ accurate conclusions that are well supported by the methodology and data.

Topics Covered In This Course:

- Kinematics
- Dynamics
- Newton's Laws of Motion
- Simple Harmonic Motion
- Conservation Laws
- Rotation
- Oscillations and Gravitation
- Mechanical Waves and Sound
- Electrostatics, and Simple Circuit Analysis.

AP PHYSICS 2

Course Description:
The AP Physics 2 course is an algebra-based, introductory college-level physics course. Students cultivate their understanding of Physics through inquiry-based investigations as they explore topics. Building the ability to reason qualitatively and quantitatively is a primary focus, with inquiry and investigation, modeling and diagramming, symbolic algebra, unit analysis, communication and argumentation, laboratory techniques, data analysis, and integration and application of concepts as emphasized skills. Students have the primary responsibility for building understanding, with the instructor as a resource and guide. In this course, students will study the topics as outlined in the Physics AP guideline by the College Board as it appears in the AP Physics 2 Course Description.

Prerequisites:
Physics, AP Physics 1 or placement test.

Textbook:
College Physics for AP Courses
Additional Lectures and Problem Sets by CyberMath Academy

Course Outcomes:
After completing, students will be able to:

- Review formulas for calculating density, force, energy, mass, and buoyancy.
- Analyze the theorems and principles created by such scientists as Archimedes, Torricelli, Bernoulli, and Planck.
- Identify the relationship between electric fields, volt unit charges, charged particles, charge collections, electric potential difference, and equivalent capacitance.
- Learn the various laws of physics, including Snell's Law, Faraday's Law, the Zeroth Law of Thermodynamics, the first and second laws of thermodynamics, and the Ideal Gas Law.
- Explore techniques for calculating radioactive decay and identify the effects of the different types of decay.
- Determine the properties of light, color, sound, waves, absorption, reflection, and refraction.
- Investigate magnetic fields and figure out how magnetism affects charged particles.
- Check out the different types of direct current circuits, such as parallel, series, and resistor-capacitor.
- Study how heat transfer relates to thermal expansion, phase changes, and heat capacity.
- Practice solving different physics equations, such as formulas for converting units or mathematical methods for determining pressure.
- Define the concepts of carbon dating, fusion, fission, and radioactive nuclides.

Topics Covered In This Course:

- Fluids in Physics: Definition and Characteristics
- Pressure: Definition, Units, and Conversions
- Hydrostatic Pressure: Definition, Equation, and Calculations
- Buoyancy: Calculating Force and Density with Archimedes' Principle
- Fluid Mass, Flow Rate and the Continuity Equation
- Bernoulli's Principle: Definition and Examples
- Bernoulli's Equation: Formula, Examples & Problems
- Torricelli's Theorem: Tank Experiment, Formula and Examples

AP PHYSICS C: MECHANICS

Course Description:
The Physics C: Mechanics course is equivalent to a one-semester, calculus-based, college-level physics course. It is especially appropriate for students planning to specialize or major in physical science or engineering. Introductory differential and integral calculus is used throughout the course. This course follows the curriculum set forth by the College Board and is equivalent to a second semester algebra-based Physics course. Students must have taken AP Physics 1 as a prerequisite course. Minimum grades of "B" or higher in AP Physics 1 and Algebra 2 Honors are good predictors for success in this course. There will be a focus on inquiry-based laboratory activities which challenge students to design and carry out experiments targeting certain learning objectives. In this course, students will study the topics as outlined in the Physics AP guideline by the College Board as it appears in the AP Physics C Mechanics Course Description.

Prerequisites:
Physics, AP Physics 1, and AP Physics 2, or placement test.

Textbook:
College Physics for AP Courses
Additional Lectures and Problem Sets by CyberMath Academy

Course Outcomes:
After completing, students will be able to:

- Establish how magnetic fields are created and identify the effect of magnetic forces.
- Inspect the different types of capacitors and go over how they build up, store, and finally discharge energy.
- Learn about Coulomb's Law and Gauss's Law to better understand electrical fields and forces.
- Examine the spring constant and Hooke's Law in relationship to simple harmonic motion.
- Review how Kepler and Newton established various laws about gravitation.
- Scrutinize the differences between linear momentum and angular momentum.
- Practice finding the center of gravity and the center of mass.
- Analyze formulas for determining the potential energy within all energy types.
- Use kinematics to solve problems about acceleration, time, velocity, speed, and distance.
- Determine standard basic vectors and figure out how to graph all types of vectors.

Topics Covered In This Course:

- Studying the Motion of Objects
- Scalars and Vectors
- Distance and Displacement in Physics
- Speed and Velocity
- Acceleration
- Significant Figures and Scientific Notation
- Uniformly-Accelerated Motion and the Big Five Kinematics Equations
- Representing Kinematics with Graphs
- Ticker Tape Diagrams: Analyzing Motion and Acceleration
- What are Vector Diagrams?
- Using Position vs. Time Graphs to Describe Motion
- Determining Slope for Position vs. Time Graphs
- Using Velocity vs. Time Graphs to Describe Motion
- Determining Acceleration Using the Slope of a Velocity vs. Time Graph
- Velocity vs. Time
- Understanding Graphs of Motion
- Graphing Free Fall Motion: Showing Acceleration
- The Acceleration of Gravity
- Projectile Motion: Definition and Examples
- Kinematic Equations List: Calculating Motion

AP PHYSICS CLASS AND PHYSICS OLYMPIAD (F=M*A)

Course Description:
F=m*a is a high school physics competition run by the American Association of Physics Teachers (AAPT) and the American Institute of Physics (AIP). This course prepares students for this competition as well as AP Physics 1 as outlined by the College Board.

Prerequisites:
Algebra 2 and Introductory High School Physics Course or placement test.

Textbook:
The 5th edition of Halliday, Resnick, and Krane's Physics, Volume 1 and Volume 2

Course Outcomes:
After completing, students will be able to:

- Learn and succeed in physics beyond the level of High School Physics
- Prepare with little to only basic high school knowledge of Physics to take the AP Physics A Test and the USAPhO F=m*a exam
- Encourage excellence in physics education throughout the United States to reach the gold standard in physics.
- Encourage in continuing knowledge and understanding above and beyond that normally encountered in high school physics courses.
- Foster both a collaborative and a personal commitment to science that is observed in the physics research world.

Topics Covered:

- Motion Along a Straight Line
- Motion in Two or Three dimensions
- Equilibrium
- Newton's Laws of Motion
- Work and Energy
- Momentum and Collisions
- Rigid Body Dynamics
- Gravitation
- Periodic Motion
- Waves
- Electrostatics
- Electrical Circuits

USA PHYSICS OLYMPIAD (USAPHO)

Course Description:
The United States National Physics Olympiad (USAPhO) is a high school physics competition run by the American Association of Physics Teachers (AAPT) and the American Institute of Physics (AIP). This course prepares students for this competition.

Prerequisites:
AP Physics Class and Physics Olympiad (F=m*a) course or placement test.

Textbook:
CyberMath Academy's lecture notes and problem sets

Course Outcomes:
After completing, students will be able to:

- Learn and succeed in physics beyond the level of High School Physics
- Prepare for the USAPhO exam
- Encourage excellence in physics education throughout the United States to reach the gold standard in physics.
- Encourage in continuing knowledge and understanding above and beyond that normally encountered in high school physics courses.
- Foster both a collaborative and a personal commitment to science that is observed in the physics research world.

Topics Covered:

- MECHANICS
    - Motion in One Dimension
    - Motion in Two Dimensions
    - Newton's Laws of Motion
    - Work, Energy and Conservation of Energy
    - Momentum, Collisions and Rocket Motion
    - Dynamics of Rigid Objects and Angular Momentum
    - Static Equilibrium
    - Universal Gravitation and Kepler's Laws
    - Fluid Mechanics
    - Simple Harmonic Motion
    - Mechanical Waves
    - Mechanics in General
- ELECTROMAGNETISM
    - Electric Fields and Gauss's Law
    - Electric Potential
    - Capacitance and Dielectrics
    - DC Circuits
    - Magnetic Fields and Magnetism in Matter
    - Faraday's Law and Inductance
    - AC Circuits
    - EM Waves
    - Electromagnetism in General
- THERMODYNAMICS
    - The First Law of Thermodynamics
    - Kinetic Theory of Gases
    - Entropy and the Second Law of Thermodynamics
    - Thermodynamics in General
- LIGHT AND OPTICS
    - Geometrical Optics and Image Formation
    - Young's Experiment and Interference of LightWaves
    - Diffraction, Resolving Power and Polarization
    - Optics in General

- MODERN PHYSICS
  - Relativity
  - Introduction to Quantum Physics (Blackbody Radiation, The Photoelectric Effect and the Compton Effect)
  - Bohr's Model of the Hydrogen Atom and Atomic Spectra
  - Nuclear Physics and Radioactivity
  - Particle Physics and Cosmology
  - Modern Physics in General

USA BIOLOGY OLYMPIAD (USABO)

Course Description:
As the premiere biology competition for high school students in the United States, the USA Biology Olympiad (USABO) enriches the life science education of nearly 10,000 talented students annually. It provides the motivation, curricular resources, and skills training to take them beyond their classroom experience to the level of international competitiveness.

After two rounds of challenging exams, twenty Finalists are invited to a residential training program where they learn advanced biological concepts and exacting lab skills at the USABO National Finals. Ultimately, four students earn the right as Team USA to represent the USA at the International Biology Olympiad (IBO), a worldwide competition involving student teams from over seventy countries.

Prerequisites:
Introductory High School Biology Course or placement test.

Textbook:
Practical Skills in Biomolecular Science, 5th ed.
Color Atlas of Biochemistry
Campbell Biology (11th Edition)

Course Outcomes:
After completing, students will be able to:

- Encourage excellence in biology education throughout the United States to reach the gold standard in biology.
- Demonstrate to the educational community that biology is important to students worldwide.
- Strive to promote communication, understanding, and improvement of biology education between high schools in the U.S. and other countries participating in the International Biology Olympiad (IBO).
- Encourage in continuing knowledge and understanding above and beyond that normally encountered in high school biology courses.
- Foster both a collaborative and a personal commitment to science that is observed in the biological research world.

Topics Covered In This Course:

- Animal Anatomy
- Physiology
- Cell Biology
- Genetics and Evolution
- Plant Anatomy and Physiology
- Ecology
- Biosystematics
- Ethology

These topics are covered in the four exams: Open, Semifinal, Nationals, and IBO.

- 50min past exam practice
- 10min break
- 30min exam practice explanation
- 50min past exam practice
- 10min break
- 30min exam practice explanation

THE INTERNATIONAL BIOLOGY OLYMPIAD (IBO)

Course Description:
The International Biology Olympiad (IBO) is the annual World Championship Biology Competition for high school students. The first academic international Olympiads were launched under the auspices of the United Nations in the 1960's. The programs have expanded gradually to include over 70 countries across five continents. Currently, international academic Olympiads are held annually in mathematics, physics, chemistry, informatics, linguistics, astronomy, and biology. The USA Biology Olympiad (USABO) and the International Biology Olympiad (IBO) award individual achievement in theoretical and laboratory biology knowledge. IBO delegations consist of four students and two academic advisors. Although everyone who is ultimately chosen to travel abroad represents the U.S., each student will receive an individual score. Students will be awarded medals as individuals, not as a team. Further information about academic Olympiads can be found by visiting International Biology Olympiad (IBO).

Prerequisites:
USABO course or placement test.

Textbooks:
How To Prepare for the Biology Olympiad And Science Competitions
Campbell Biology (11th Edition)
Color Atlas of Biochemistry
Molecular Biology of the Cell
Genetics: Analysis and Principles (WCB Cell & Molecular Biology)
Vander's Human Physiology
Stern's Introductory Plant Biology
Ecology
Principles of Animal Behavior
Modern Biology: Skills Practice Labs: Includes Dissection Labs
Brock Biology of Microorganisms (14th Edition)
Biology of Animals

Course Outcomes:
After completing, students will be able to:
- Cope with failures and anxiety before the tests
- Manage the time
- Memorize information quicker and more effectively
- Develop practical skills
- Get into and survive in the lab
- Stimulate active interest in biological studies
- Challenges and stimulates students to expand their talents
- Promote a career in science
- Promote and exchange ideas about biology education
- Promote networking and understanding between biology students
- Bring together gifted students

Topics Covered In This Course:
- General biology
- Biochemistry
- Molecular biology
- Genetics
- Human anatomy and physiology
- Plant biology
- Ecology and Ethology
- Practical skills in bimolecular sciences
- Zoology