AwesomeMath®

Summer Program 2022
Course Catalog

COURSE LEVELS

Level 1 - These courses are computationally oriented with a touch on proofs. They are suited for most USA math competitions (MathCounts National level, AMC10, AMC12, ARML, and the entry level of AIME).

Level 2 - These courses are about half computational problems and half proofs. They are well suited for the hard end of AIME and the entry level of Math Olympiad contests

Level 3 - These courses are proof oriented. They are well suited for students who can easily pass AIME and are seriously preparing for Math Olympiad contests.

Level 4 - These courses are proof oriented. They are well suited for USA(J)MO/IMO qualifiers.

ALGEBRA

Algebra 1.5

Develops essential skills such as factoring, grouping, recognizing roots, telescoping sums/products, and rationalizing. Solving (systems of) equations/inequalities (linear, absolute value, quadratic, rational, radical) is the main theme of the course. Discriminants, Viete's relations, and symmetric polynomials also play a central role. This is the entry level algebra course. It covers all AMC levels and easy end of AIME and ARML. This course is a good fit for students with MathCounts state level experience, AMC10/12 scores approaching AIME qualifying cuts, or an AIME score between 1 and 3.

Course Level: 1

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	A1.5-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	A1.5-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	A1.5-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	A1.5-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	A1.5-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	A1.5-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Algebra 2.5

Studies special systems of equations, discriminants, Viete's relations, symmetric polynomials, functional properties. Introduces (weighted) AM–GM–HM and Cauchy–Schwarz inequalities. This is the intermediate level algebra course. It covers the hard end of AMC12, and the medium to hard end of ARML and AIME. A student with an AIME score between 4 and 7 should be a good fit for this course.

Course Level: 2

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	A2.5-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	A2.5-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	A2.5-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	A2.5-02-PM	Mon-Fri	3:00 PM – 5:30 PM EST
June 27 - July 15	A2.5-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	A2.5-03-AM	Mon-Fri	8:00 AM – 10:30 AM EST
July 18 - August 5	A2.5-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	A2.5-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Algebra 3.5

Discusses functional equations, classical inequalities such as AM-GM-HM, Cauchy-Schwarz, Power-mean, and Jensen's inequalities, as well as Muirhead's and Schur' s inequalities, and inequalities related to symmetric polynomials. This is the advanced level algebra course. It covers the hard end of AIME and all levels of USAMO. A student with a strong algebra background and an AIME score of 8 or above should consider this course.

Course Level: 3

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	A3.5-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	A3.5-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	A3.5-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST

Abstract Algebra

Covers introduction to groups, cosets, Lagrange theorem, orbits and stabilizers, rings, integral domains, PIDs and Euclidean domains, fields, irreducibility and Gauss's Lemma, Morphism Theorems, polynomial rings, arithmetic of vectors and matrices, extension field, introduction to Galois Theory, solvability of quantic.

Course Level: 4

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	A4-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	A4-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	A4-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST

COMBINATORICS

Math Counts with Proofs

Studies the addition and multiplication principles, permutations and combinations, and probability. Teaches how to deal with over-counting and many useful properties of integer divisors. It also introduces mathematical proofs using pigeonhole principle, well-ordering, etc. This is the entry level combinatorics course. It covers MathCounts, all the AMC levels, and the easy end of AIME and ARML. This course is a good fit for students with MathCounts state level experience, AMC10/12 scores approaching AIME qualifying cuts, or AIME scores between 1 and 3.

Course Level: 1

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	C1-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	C1-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	C1-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	C1-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	C1-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	C1-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Counting Strategies

Discusses counting strategies such as the addition and multiplication principles, permutations and combinations, properties of the binomial coefficients, bijections, recursions, and the inclusion- exclusion principle. This is the intermediate level combinatorics course. It covers the hard end of AMC12, the medium to hard end of AIME and ARML, as well as the beginning USAMO level. A student with an AIME score between 4 and 7 should be a good fit for this course.

Course Level: 2

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	C2-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	C2-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	C2-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	C2-02-PM	Mon-Fri	3:00 PM – 5:30 PM EST
June 27 - July 15	C2-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	C2-03-AM	Mon-Fri	8:00 AM – 10:30 AM EST
July 18 - August 5	C2-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	C2-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Combinatorial Arguments

Introduces methods of mathematical proofs, including induction, proofs by contradiction, the Pigeonhole Principle, the well-ordering principle, colorings, assigning weights, bijections/mappings, recursion, calculating in two ways, and combinatorial constructions. Topics may include graph theory and combinatorial geometry. A focal point of the course is combinatorial number theory. This is the advanced level combinatorics course. It covers the hard end of AIME and the medium to hard end of USAMO. A student who is familiar with mathematics proofs and has an AIME score of 8 or above should consider this course.

Course Level: 3

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	C3-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
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July 18 - August 5	C3-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST

Combinatronics 4

Double counting between graph theory and combinatorial geometry: Extremal graph theory (Mantel and Turan, Kovari-Sos-Turan theorems, extremal number of sparse graphs, algebraic constructions); Planar graphs (Euler's formula and Kuratowski's theorem, crossing numbers and Szemeredi-Trotter theorem); Additive combinatorics (sums and products, convex sets); Algebraic methods.

Course Level: 4

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	C4-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	C4-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	C4-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

GEOMETRY

Elements of Geometry

Deals with computational geometry in two dimensions using Euclidean methods, including manipulation of angles and lengths, as well as the basic properties of polygons, circles, and the relations between figures. Analytic geometry is also a focal point. This is the entry level geometry course. It covers MathCounts, all AMC levels, and the easy end of AIME and ARML. This course is a good fit for students with MathCounts state level experience, AMC10/12 scores approaching AIME qualifying cuts, or AIME scores between 1 and 3.

Course Level: 1

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	GEO1-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	GEO1-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	GEO1-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	GEO1-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	GEO1-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	GEO1-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Computational Geometry

Studies non-synthetic techniques in solving geometry problems: coordinate geometry, vectors (2- and 3- dimensional), planes, spheres, trigonometry, and complex numbers. Features many important geometric themes: The Law of Sines and the Law of Cosines, Ptolemys theorem, Cevas theorem, Menelauss theorem, Stewarts theorem, Herons and Brahmaguptas formulas, Brocard points, dot product and the vector form of the Law of Cosines, the Cauchy-Schwarz inequality, 3-dimensional coordinate systems, as well as linear representation and traveling on the earth (sphere). This is the intermediate level geometry course. It covers the hard end of AMC12, the medium to hard end of AIME and ARML. A student with an AIME score between 4 and 7 should consider this course.

Course Level: 2

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	GEO2-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	GEO2-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	GEO2-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
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June 27 - July 15	GEO2-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	GEO2-03-AM	Mon-Fri	8:00 AM – 10:30 AM EST
July 18 - August 5	GEO2-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	GEO2-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Geometric Proofs

Focuses on classical topics such as concurrency, col-linearity, cyclic quadrilaterals, special centers/points of triangles, and geometric constructions. Introduces important transformations translation, reflections, and spiral similarities, with a touch on projective and inversive geometry. This is the advanced level geometry course. It covers the hard end of AIME and the medium to hard end of USAMO. A student with a strong background in geometry and an AIME score of 8 or above should consider this course.

Course Level: 3

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	GEO3-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	GEO3-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	GEO3-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Geometry 4

This course will cover: Isogonal Points, Apollonian Coaxial Circles, Inversion-basic properties and Inversion-angles and distances, Geometry of Conics (tangent lines, isogonal properties, directrix and 3D sections), Affine Transformations, Projective Plane and Cross Ratio, 2D and 3D Projections, Duality in Projective Geometry, Theorems of Pascal and Brianchon, Involutions I and II.

Course Level: 4

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	GEO4-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	GEO4-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	GEO4-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

NUMBER THEORY

Number Sense

Studies divisibility, factoring, numerical systems, divisors and arithmetic functions of divisors. Setting-up and solving linear Diophantine equations is also a focal point of the course. This is the entry level number theory course. It covers MathCounts, all AMC levels, and the easy end of AIME and ARML. This course is a good fit for students with MathCounts state level experience, AMC10/12 scores approaching AIME qualifying cuts, or AIME scores between 1 and 3.

Course Level: 1

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	NT1-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	NT1-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	NT1-02-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 27 - July 15	NT1-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	NT1-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	NT1-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Modular Arithmetic

Develops essential skills in number theory: divisibility, the division algorithm, prime numbers, the Fun- damental Theorem of Arithmetic, GCD, LCM, Bezouts identity, the Euclidean algorithm, modular arithmetic, and divisibility criteria in the decimal system. Studies numerical functions such as the number of divisors or the sum of divisors of integers. This is the intermediate level number theory course. It covers the hard end of AMC12 and the medium to hard end of AIME and ARML. A student qualified for AIME with a score between 4 and 7 should be a good fit for this course.

Course Level: 2

Prerequisites: None

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	NT2-01-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
June 6 - June 24	NT2-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
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June 27 - July 15	NT2-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	NT2-03-AM	Mon-Fri	8:00 AM – 10:30 AM EST
July 18 - August 5	NT2-03-AM2	Mon-Fri	11:00 AM – 1:30 PM EST
July 18 - August 5	NT2-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Number Theory

Focuses on in-depth discussions of Diophantine equations, residue classes, quadratic reciprocity, Fermats little theorem, Eulers theorem, primitive roots, and Eulers totient function, etc. This is the advanced level number theory course. It covers the hard end of AIME and the medium to hard end of USAMO. A student with a strong background in number theory and an AIME score of 8 or above should consider this course.

Course Level: 3

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	NT3-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
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July 18 - August 5	NT3-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Number Theory 4

Rings of Arithmetic Functions, analytic continuation, Euler Product, Asymptotic Analysis, Prime Number Theorem, Elliptic Curve, Sieve Methods, Anatomy of Integers.

Course Level: 4

Prerequisites: Student submitted solutions to Part II of Admission Test

When this course is offered (choose one):

Session Date	Section	Meeting Days	Time
June 6 - June 24	NT4-01-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
June 27 - July 15	NT4-02-PM2	Mon-Fri	7:00 PM – 9:30 PM EST
July 18 - August 5	NT4-03-PM2	Mon-Fri	7:00 PM – 9:30 PM EST

Need additional help choosing courses? Admitted students can refer to the enrollment section of their student dashboard for course selection tips and sample problems from each course.