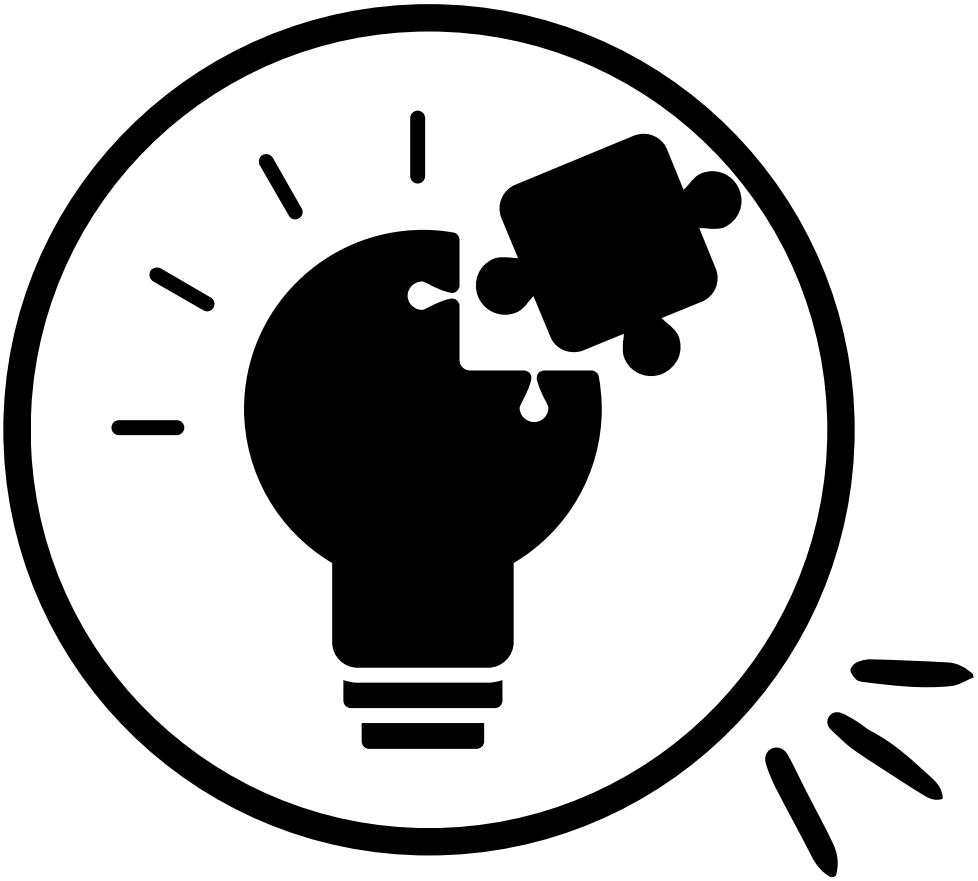
NAME



Middle School

COMMON MATH FORMULAS

PROBLEM SOLVING

Think Academy

Middle School Common Math Formulas

Whether you're preparing for math competitions, reviewing key concepts for school exams, or simply want a quick reference, this **Math Formula Cheat Sheet** brings together the most essential formulas across algebra, geometry, number theory, and coordinate math — all in one place.

This collection includes:

Arithmetic & Geometric Series

Pythagorean Theorem & Special Triangles

Combinations, Permutations & Binomial Theorem

Circle, Polygon & Solid Geometry Formulas

Key Algebra Identities (Difference of Squares, Sum/Diff of Cubes)

Coordinate Plane Tools (Distance, Midpoint, Slope)

Divisibility Rules & Prime Numbers

Powers Table

Common Arithmetic Series

$1 + 2 + 3 + \ldots + n = n(n+1)/2$

$1 + 3 + 5 + \ldots + (2n-1) = n^2$

$2 + 4 + 6 + \ldots + 2n = n(n+1)$

Combinations & Permutations

Combinations: $C(n, r) = n! / (r!\,(n-r)!)$

Permutations: $P(n, r) = n! / (n-r)!$

Powers Table (n, n^2, n^3)

n	n^2	n^3
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000
11	121	1331
12	144	1728
13	169	2197
14	196	2744
15	225	3375

Arithmetic Sequence:

$a_n = a_1 + (n-1)d$ $S_n = n/2\ (a_1 + a_n)$

Geometric Sequence:

$a_n = a_1 * r^{n-1}$ $S_n = a_1\ (1-r^n)/(1-r),\ r \neq 1$

Divisibility Rules

÷2: last digit is 0, 2, 4, 6, or 8

÷3: sum of digits divisible by 3

÷4: last 2 digits divisible by 4

÷5: last digit is 0 or 5

÷6: divisible by both 2 and 3

÷8: last 3 digits divisible by 8

÷9: sum of digits divisible by 9

÷10: last digit is 0

Prime Numbers (Under 100)

2, 3, 5, 7, 11, 13, 17, 19, 23, 29 31, 37, 41, 43, 47, 53, 59, 61, 67 71, 73, 79, 83, 89, 97

Difference of Squares:

$a^2 - b^2 = (a + b)(a - b)$

Sum and Difference of Cubes:

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Binomial Theorem:

$(a + b)^n = \Sigma$ (n choose k) $a^{n-k} b^k$

Quadratic Formula:

$x = (-b \pm \sqrt{(b^2-4ac)}) / (2a)$

Parity Rules

even + even = even

odd + odd = even

even + odd = odd

even × even = even

odd × odd = odd

even × odd = even

Triangular Numbers

$T_n = \sum_{k=1}^{n} k = n(n+1)/2$

Pythagorean Theorem

$a^2 + b^2 = c^2$

Pythagorean Triples

(3, 4, 5) (5, 12, 13) (7, 24, 25) (8, 15, 17) (9, 40, 41) (12, 35, 37)

Circles

Circumference = $2\pi r$

Area = πr^2

Arc Length = $(x/360) \times 2\pi r$

Sector Area = $(x/360) \times \pi r^2$

Special Right Triangles

30-60-90 Triangle:

sides: $a, a\sqrt{3}, 2a$

45-45-90 Triangle:

sides: $b, b, b\sqrt{2}$

Triangle Inequality

$a + b > c$

$a + c > b$

$b + c > a$

Coordinate

Given $A(x_1, y_1)$ and $B(x_2, y_2)$:

Distance: $\sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$

Midpoint: $((x_1 + x_2)/2 , (y_1 + y_2)/2)$

Slope: $(y_2 - y_1)/(x_2 - x_1)$

Area of Polygons

Square: s^2 Rectangle: lw

Parallelogram: bh

Trapezoid: $\frac{1}{2}(b_1 + b_2)h$

Rhombus: $\frac{1}{2}d_1d_2$

Triangle: $\frac{1}{2}bh$

Equilateral Triangle: $(s^2\sqrt{3})/4$

Heron's Formula: $\sqrt{[s(s-a)(s-b)(s-c)]}$

Polygon Angles

Sum of Interior Angles: $180(n-2)$

Each Interior Angle (regular): $180(n-2)/n$

Central Angle (regular): $360/n$

Geometry

Solid	Surface Area	Volume
Cube	$6s^2$	s^3
Rectangular Prism	$2(lw + lh + wh)$	lwh
Cylinder	$2\pi rh + 2\pi r^2$	$\pi r^2 h$
Cone	$\pi r^2 + \pi r\sqrt{(r^2 + h^2)}$	$(1/3)\pi r^2 h$
Sphere	$4\pi r^2$	$(4/3)\pi r^3$
Pyramid	–	$(1/3)Bh$

Equation of a Line

Standard Form: $Ax + By = C$

Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Think Academy US ONLINE

Middle School Math Program

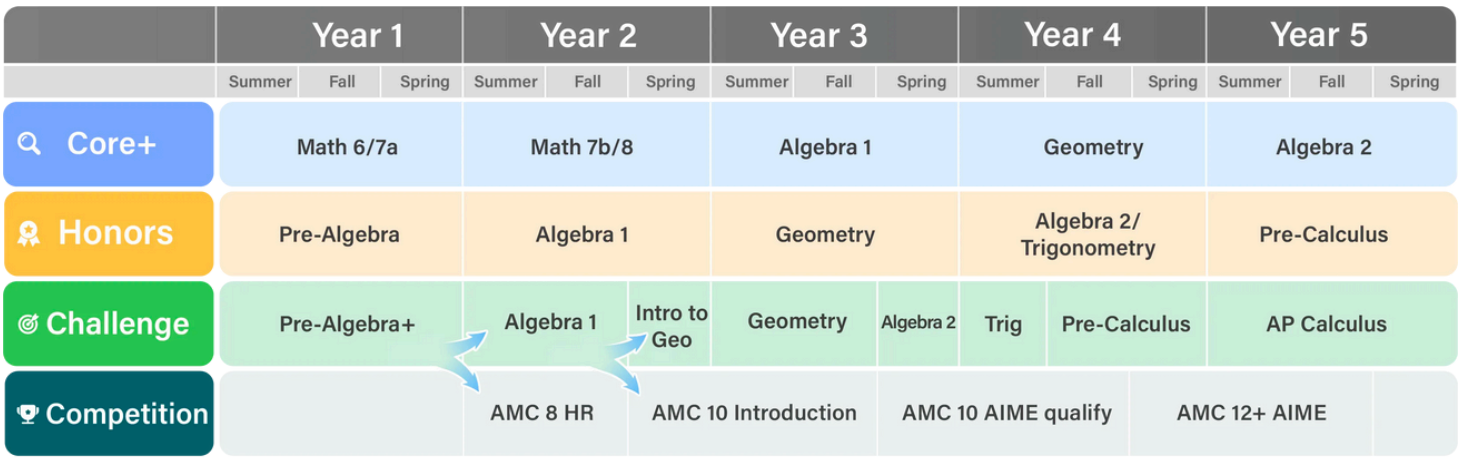
Think Academy’ s Middle School Long-Term Math Program is designed for Grades 6–9, offering a professional, systematic, and comprehensive year-round curriculum tailored to North American students. The program includes four tracks: Core+, Honors, Challenge, and Competition.

Core+（School Curriculum Track）： Focuses on previewing and reinforcing key concepts through targeted practice, helping students easily achieve A grades in school math at their current grade level.

Honors（Accelerated Advancement Track）： One year ahead of standard pace, matching the fastest public-school classes. It deepens understanding and aims for placement in advanced tracks, completion of 5 AP STEM courses before graduation, and perfect SAT/ACT Math scores.

Challenge： Two years ahead of standard pace, covering Algebra 1, Geometry, and Algebra 2 in two years. Align with top private schools, preparing students to complete 8 AP STEM courses and get perfect SAT/ACT Math results by graduation.

Competition： Design around the AMC syllabus, build competitive math skills through advanced, contest-level topics. Taught by an experienced coaching team with a proven record of training AMC and AIME winners, it helps students qualify for AIME by Grades 8–9.



Think Academy US ONLINE
Middle School Competition Track Student Results

2022-2024 AMC8 Number of Students Awarded:

456	397	134
Achievement Roll (Lower Grade Achievement Award)	**Honor Roll** (National Top 5%)	**DHR** (National Top 1%)

2022-2024 AMC10 Number of Students Awarded:

304	187	45
AIME Qualification (National Top 7%)	**Honor Roll** (National Top 5%)	**DHR** (National Top 1%)

2024 Think Global IMO Award Winner

7 Golds 1 Silver

Ranked first globally in total gold medals.

International Mathematical Olympiad
Foundation Bronze Sponsor

Think Academy is an official partner of the International Mathematical Olympiad (IMO)

Why Think Academy Competition Courses Trained Thousands of Award-Winning Students?

1 One-Stop Professional System for Math Competitions

Think Competition follows the AMC syllabus and aligns with students' learning pace. **Grades 5–6 focus on AMC 8**, while **Grades 7–8 focus on AMC 10**. The curriculum covers the four core modules of math competitions — Algebra, Geometry, Number Theory, and Counting & Probability — enabling students to achieve one competition milestone each year and **complete AMC 10 preparation before high school, successfully qualifying for AIME**.

2 Expert Coaches. Top Results. Proven Success.

Think Competition courses are taught by **instructors with many years of competition teaching experience**, enabling students to master complex contest concepts efficiently and with ease.

James
Upenn - 5 YOE

Dennis
Duke - 4 YOE

Yichen
Columbia - 4 YOE

3 Collaborate and Excel with Outstanding Peers

Each year, the Competition Track begins with an entrance assessment to ensure students learn alongside peers of similar ability. This structure makes preparation more engaging and collaborative, as students motivate one another and grow together throughout the journey.

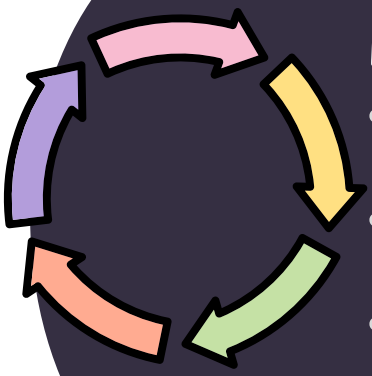
Think Academy US Online

Course Highlights

Clear Structure, Worry-Free for Parents

Personalized Learning Plans with Full Progress Tracking

- **Before Enrollment:** Teachers create **personalized study plans** based on each student's goals and ability
- **During Learning:** Teachers give **regular feedback and targeted advice**, helping parents track progress
- **Mid-Term & Final Evaluations**: **Parent meetings** and updated study plans ensure steady improvement



Weekly Learning Cycle to Ensure Steady Progress

- **Pre-Class Preparation: 15-minute preview** to review key concepts and prepare for new lessons
- **Homework: Assigned after each class**, with teacher feedback shared with parents
- **Office Hour: Free live sessions** to review and clarify difficult problems
- **Homework Review Videos:** Each homework question includes a **detailed video explanation** for easy review

Year-Round Learning Support

- **Year-round Parent App service** providing fast responses
- Through the Parent App, parents get **direct contact with teachers** for efficient communication and real-time progress updates
- Instant online homework help for **timely learning support**

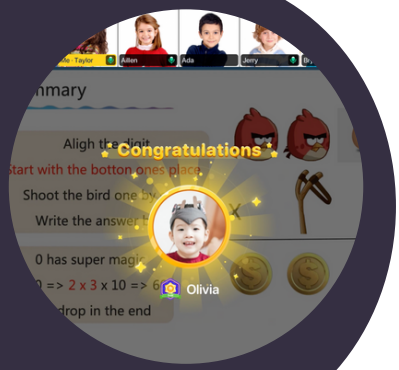
Think Academy US Online

Course Highlights

Happy Learning, Better Results

Thoughtfully Crafted Lessons Inspire a Love for Math

- **Interactive games and scenario-based teaching** make math fun and engaging
- **Gold coin reward system** lets students exchange coins for prizes, motivating them to complete learning tasks actively



Self-Developed Learning App Enhances Every Online Class

- **Think Academy learning app** enhances in-class interaction with hand-raising, polls, and group activities —**keeping students engaged every three minutes**
- Teachers **track progress in real time** for an effective learning experience

A Sense of Achievement Builds Intrinsic Motivation

- Students learn efficiently in class and get **full after-class support** with detailed homework videos and free weekly Office Hours.
- Students **gain higher grades, faster progress**. They are naturally motivated to put more effort in STEM learning and become **confident math learners**