

Math Education in USA

Actually in Minnesota

Regular School Math

- School math target 80% of student body.
- Large student/teacher ratio, top students are left alone.
- Lack of peer support.
- Mile wide, inch deep

GT Math to the rescue?

- MAP Test 95% ~ 99%
- Cannot find a good curriculum. (From Continental Math to Singapore Math in last 5 years)
- No qualified teacher.
- No accountability
- No Immersion experience
- Too many politics going on in GT landscape (Math is racist?)

What's good math program?

- Well defined curriculum
- Highly trained staff
- Daily practice
- Weekly review
- Measurable Progress report
- Accountability

UMTYMP

- University Of Minnesota Talent Youth Math Program
- Any one who is from 5th to 7th grade can be tested to join.
- Fast pace: 4 years high school content is packed into years.
- Best high school teachers from Twin Cities area.
- Post-doc or professors teaches calculus components.
- Good peer experience

UMTYMP – Who can be successful?

- Kids who do things fast.
- Kids who are organized and disciplined.
- Kids who do homework.

UMTYMP – Is it really good?

- Considered toughest math program in University of Minnesota, including its honor program.
- No need to do any more college math if you go to U of M.
- Other public U, maybe, you have to ask each individual school.
- IVY like school- No, but you might be able to skip intro level calculus class. Jump into high level class.
- IVY cares about UMTYMP? Definitely but not a spike factor.
- To put UMTYMP in its correct place: magnet school. Good but not guaranteed success.

UMTYMP – What's bad

- Too fast.
- Lack of problem solving skills.
- No proof based problem in high school component.
- Still too shallow. Several examples:
 - skip all challenging problems in Geometry
 - no Rank concept in Linear Algebra
 - still struggle to make Honor Roll in AMC 8 competition.

UMTYMP – how school view it

- High school math credits.
- B+ is shown as A on high school transcripts.
- But it's counted as unweighted GPA in Edina. (Wayzata and Mounts View)
- Next year, middle school is moved to a late start time, will miss 1 and half periods.

AP Class vs AP Exam

- AP Classes are offered through your school.
- AP Exams are administered by College Board.
- AP Classes counts as weighted GPA on your transcript.
- AP Exam DOES NOT count on your GPA
- You can choose not sending AP Exam to college.
- Self study AP Exam is possible but not encouraged.

AP Calculus

- AP Calculus AB and BC
- AB is for non-STEM major students.
- BC is for STEM students.
- BC covers more topics (not more difficult) such as series, parametric curves, polar function, integral by parts etc.
- BC exam will give you a score of AB but counts as only one AP course.

UMTYMP and AP Exam

- Math Analysis (Year 2) – AP Statistics
- Calculus I (Year 3) – AP Calculus AB,
- self study a few chapters on differential equation - BC

Math competition in US

- Why do math competition?
- Why do swim, hockey competition?
- It's a way to promote math interests and select math talent
- In fact, recent Fields award winners data shows a very positive correlation between math competition and math research.
- No such correlation in other competitions such as Physics or Chemistry.
- It's not for everyone. In Edina, less than 1% students are suitable to do math competition. So don't even think school will help you on math competitions.

Math Competition in Elementary School

- MOEM – All Edina elementary schools host it. Talk to your school GT teacher.
 - Parents' volunteer is a key factor
 - Books:
 - PreAlgebra by AOPS, Art o Problem Solving
 - Creative Problem Solving in School Mathematics by George Lenchner
 - Other: Math Kangaroo, game of 24, Sudoku
- Focus on Number sense and fun.

Math Competition in Middle School

- Minnesota Junior Math League – From Nov to Jan. 5 meets
- School's Math Club can send multiple teams
- Many school use this as a key factor to choose Mathcounts Team.
- Questions are basics, very close to middle school curriculum . help students to master key concepts.
- A great material to prepare SAT, ACT math.

Mathcounts

- Sponsored by CNA, National Society of Professional Engineers and National Council of Teachers of Mathematics.
- It competes at four level: School, Chapter, State and National.
- Each school can send 10 students to Chapter round. 4 compete as team, 6 as individual.
- Each chapter can send at least one winning team and top 4 individuals to State. Edina is at City Of Lakes South. We usually have 2 or 3 teams go to state.
- There is a wild card team go to state each year.
- Top 4 individuals and winning team coach will represent Minnesota in Nationals (Usually in May, at Orlando, DC or Boston)

Mathcounts - continued

- Each level of competition has 4 components
- Sprint round – 30 problems in 40 minutes. Each question worth 1 point. No calculator.
- Target round – 8 problems in 4 pairs. Each pair is given 6 minutes. Each problem worth 2 points. Calculator is allowed.
- Team round – 10 problems in 20 minutes. A team of 4 students. Calculator is allowed. Discussion among the team is allowed.
- Countdown round – head to head, fast pace oral elimination round. In many states, this is not used to rank individual; but in national, CD is used to determine final ranking for top 16 students.
- Topics are in 4 major subjects: Algebra, Geometry, Counting & Prob, Number Theory

Minnesota Mathcounts

- Free lodging and food at state meet.
- Individual ranking is determined by combined score of Sprint and Target round. (Countdown round is for entertainment only)
- Team score is determined by the sum of average of individual score of the team and team round score.
- www.mathcountsmn.org

AMC- American Math Competitions

- Sponsored by MAA, Mathematical Association of America
- www.maa.org
- Three level competitions for Secondary School students.
- AMC series, AMC 8, 10, 12. No college math needed.
- AIME . No college math needed.
- USAJMO/MO, TST select Team USA for IMO, EGMO, CGMO. No college math needed.
- PUTNAM – College, calculus needed

AMC – American Math Competitions

- AMC 8 – 8th grade and below. 25 multiple choice questions in 40 minutes. Each question worth 1 point. No penalty for wrong answers. Nov.
- AMC 10 – 10th grade and below. 25 multiple choice questions in 75 minutes. Each correct answer worth 6 points, wrong choice worth 0 points, no choice worth 1.5 points. Perfect score 150 points. Feb.
- AMC 12 – 12th grade and below. 25 multiple choice questions in 75 minutes. Each correct answer worth 6 points, wrong choice worth 0 points, no choice worth 1.5 points. Perfect score 150 points. Feb.
- Every one can take AMC. If your school does not host it, call UMTYMP or Minnesota High School Math League.

AIME – American Invitational Math Exam

- Top 2.5% AMC 10 and Top 5% AMC 12 test takers are invited to take AIME. March
- 15 questions in 3 hours.
- Each question worth one point.
- All answers are numbers from 1 to 999.

USAJMO USAMO

- $\text{AMC 10 score} + 10 * \text{AIME score} = \text{USAJMO index}$
- $\text{AMC 12 score} + 10 * \text{AIME score} = \text{USAMO index.}$
- Roughly 250 are invited to take USAJMO test.
- Roughly 250 are invited to take USAMO test.
- Tests are in 2 days, each day 4.5 hours for 3 problem.
- Answers are detail proof based.
- Each problem worth 7 points.
- These two tests are used to select about 60 students for Math Olympiad Summer Program. (MOSP or MOP).
- During the camp, several TSTST (Team Selection Test Selection Test) are used to select TEAM USA to go to International Math Olympiad.

Other Math Activities in High School

- Minnesota High School Math League.
- 5 meets a year.
- State Tournament and Math Bowl at the end of year.
- MN Math League selects 60 students to ARML at end of school year.
- ARML – American Regional Math League.
- Big year end party for math students. Great social events for math students.
- ARML problems can be easy like mathcounts or very complex real world problem.

HMMT, CMIMC, PUMAC

- MN Math League also sends top students to these famous college student-run math competitions.
- HMMT – Harvard-MIT
- CMIMC – Carnegie Mellon, only one has a CS component in the competition.
- PUMAC – Princeton.

All these competitions are held at University campus, you get a chance to see the school in its daily life, no need to schedule campus visit anymore.

Difficulty Level of competitions

- MOEM: 1
- AMC 8: Problem 1 – 12: 1; Problem 12 – 25: 1.5
- Mathcounts: School: 1 -1.5; Chapter 1.5; State 2; National: 2.5;
- AMC 10: 1 – 3
- AMC 12: 2 – 4
- AIME: 3 – 6
- ARML: 4 – 6
- USAJMO: 6 – 7; USAMO: 7 – 9
- US TST: 7 – 9.5
- China TST: 7 – 10
- IMO: 6.5 – 9.5

What books for math competitions?

- One place has all: AOPS, Art of Problem Solving.
www.artofproblemsolving.com
- For elementary, Beast Academy
- For middle to high school:
- AMC/Mathcounts: intro level books: PreAlgebra, Intro to Number Theory, Intro to Algebra, Intro to Geometry, Intro to Counting & Prob
- AIME: Art of Problem Solving: Vol1 & 2; Intermediary Series;
- USAJMO/MO: WOOT program.
- It has free online exercise bank: Alcumus

Summer Camps for Math

- Two categories: Competition Camp, Math Enrichment
- Two major competition based camp: Awesome Math, Ideamath.
- Ideamath: Run by former Team USA coach Feng Zhuming. Top coaching staff, all former competition winners.
- Awesome Math: Run by another former coach Titu. First such camp in USA, long experience but water down a little bit recently.

Enrichment Camp

- Local: Summer Math Institute, run by math league, one week overnight camp at Augsburg College. Non competitive.
- National:
- MathCamp, also called Canada/USA Camp, 5 week intensive math enrichment camp, covers variable topics in advanced math, also have sessions on math Olympiad style problem solving. Age from 14 to 19. Cost is at most \$4500 this year. This is very cheap compare to IdeaMath or AwesomeMath.
- Ross Summer Program. Thinking deeply of simple Things. Focus on Number Theory. Very famous and tough. Research style camp. Cost is also about \$4500 for 6-week.

Camp - continued

- PROMYS – Founded by former ROSS alumni. Hosted by Boston University. Same style as ROSS but not limited to Number Theory. Also very competitive to get in.
- HCSSiM – Hampshire College Summer Studies in Mathematics. Kind like Mathcamp, a little later in the summer, so maybe an alternative if it fits your schedule.
- Mathily – Bryn Mawr College in Penn. 5-week intensive math enrichment program focus on discrete math for high school students. It has Mathily-Er for younger students.
- All these above are very competitive and 很给力.

Girls in Math by the numbers.

- Roughly 30 out of 220 mathcounts nationals are girls.
- 20% of AIME qualifiers are girls.
- ~ 5% of USAJMO/MO qualifiers are girls.
- 40% of Canada/USA Camp are girls.
- About 50% of MIT students are girls.
- All Girls/All Math camp at U. of Nebraska.
<http://www.math.unl.edu/programs/agam/>
- Math Prize for Girls Competition – MIT every September. MIT AO recruits at the competition every year.

What's happening lately?

- Professor Pavlo Pylyavskyy of U is going to start a math club this summer following famous math circle style in Russia and both coastal area. He was a two-time IMO gold medal winner and a Putnam Fellow. 大咖
- Someone is working very diligently to bring IdeaMath camp to Minnesota in the summer of 2019.
- So watch out.