

# Open House Information

## Math Circle Competition Team

### 1 A New Schedule

We have been optimizing our efforts to provide our students with the resources that will ensure their future success. With that in mind, we have decided to alter our current program.

Below are this year's schedule changes as well as notable recommended competitions, extra resources for self-study, and a list of suggested topics to review for this year's curriculum.

#### 1.1 Schedule Changes

Time	Program
1:30PM - 3:30PM	Math Circle

There will no longer be an Extended Mathematics Problem Session.

#### 1.2 Schedule Breakdown

The Math Circle curriculum will be divided into two parts: Fall and Spring semester.

1. During Fall semester, we will cover a broad curriculum that will keep both veterans and newcomers to Math Circle engaged. These students will be primarily focused on preparation for the AMC/AIME and on related topics. This semester's focus is perfect for students that wish to increase their AMC scores and expand their mathematical horizons.
2. During Spring semester, we will be focused on more specialized topics such as Game Theory, Logic, and Probability. These topics are not set in stone, and will be decided based on student interest. The second semester aims to engage students in deeper mathematics and incorporates hands-on activities such as probabilistic modeling, poker/card games, logic puzzles, and market making/trading.

#### 1.3 Competitions We Arrange

Below are the competitions we plan to attend this year. These competitions are subject to change.

- Carnegie Mellon Informatics and Mathematics Competition (January), Pittsburgh, PA
- American Mathematics Competition (AMC) (January 30), hosted at LSU
- University of Houston Math Contest *if time permits* (February), Houston, TX
- LSU Math Competition (March), hosted at LSU
- Berkeley Math Tournament (April), Berkeley, CA
- USMCA National Competition (May), if qualified, hosted at LSU

We suggest that everyone signs up for at least one AMC test, either through your school or through us (or both!). We will host at least one level of AMC A and B each given enough student sign ups.

## 2 Math and Coding Competitions

Boxed contests indicate student participation is expected. Starred contests are highly recommended. Some contests listed below are online and free, such as OMO and Purple Comet.

### 2.1 Math Competition Information

Competition	Registration Deadline	Competition Date
AMC 8	Oct. 01, 2019	Nov. 12, 2019
AMC 10/12 A	Dec. 02, 2020	Jan. 30, 2020
AMC 10/12 B	Jan. 03, 2020	Feb. 05, 2020
American Regions Math League (ARML)	May 2020	May 29-30, 2020
Berkeley Math Tournament (BMT)	Mar.	Apr.
Caltech-Harvey Mudd Math Competition	Rolling	Nov. 7, 2019
CMU Informatics/Math Competition (CMIMC)	Oct.	Jan.
Harvard-MIT Nov. Tournament (HMMT)	Sept.	Nov. 9, 2019
Harvard-MIT Feb. Tournament (HMMT)	Sept.	Feb. 15, 2019
Johns Hopkins Math Tournament	N/a	Feb.
LSU Math Contest	Mar.	Mar.
MATHCOUNTS	Dec. 1, 2019	Feb. - May 2020
★ Mandelbrot Competition	Sept.	Fall-Winter
Mu Alpha Theta (MA $\Theta$ )	N/a	N/a
★ Online Math Open (OMO)	Rolling	Oct. - Nov./ Apr.
Princeton Math Competition (PUMaC)	Sept.	Nov. 16
★ Purple Comet Math Meet	Feb.	Spring
Stanford Mathematics Tournament	N/a	Mar.
★ USA Math Talent Search (USAMTS)	Rolling	Oct. - Jan.

### 2.2 Computer Science Competition Information

Competition	Registration Deadline	Competition Date
★ American CompSci League (ACSL)	N/a	Dec. - Apr.
Code Chef	Monthly	Monthly
Code Forces	Monthly	Monthly
★ Facebook Hacker Cup	N/a	Jul.
★ Google Code Jam	Apr.	Apr.
HackerRank	Daily	Daily
★ USA Bebras Computing Challenge	N/a	Nov.
Philadelphia Classic	N/a	April
ProjectEuler	Daily	Daily
Top Coder	Daily	Daily
★ USA Computing Olympiad	N/a	Dec., Jan., Feb.
UCF High School Programming Tournament	Feb.	Mar.
★ Virginia Tech Programming Contest	N/a	Dec.

## 3 Useful Resources

Below are useful websites, handouts, and other learning materials to supplement the usual MCCT curriculum. Many of these should already be familiar to some of you. It is important to understand that learning mathematics and coding is primarily done through personal effort at home, *not* in the classroom. All of these listed resources are fantastic for self-studying and self-evaluation as you progress and gain knowledge.

### 3.1 Mathematics Resources

- Art of Problem Solving (<https://artofproblemsolving.com/>)
  - AoPS creates educational materials for motivated students. They offer books, classes, and online resources help students become creative, successful problem solvers.
  - Textbooks and classes contain a full math curriculum. Wiki also includes free educational resources to take middle and high school students far beyond the basics.
  - Their community forum is one of the best places for students to meet and discuss mathematics with like-minded peers around the world.
- Brilliant (<https://brilliant.org/>)
  - Brilliant has an interactive website and a mobile application that contains quizzes, courses, and reading material. Topics go beyond math and include physics, chemistry, and even finance.
  - Great for boosting quantitative and analytical skills on a day-to-day basis; using their app doesn't feel like studying.
  - Contains intermediate and advanced content for professionals. Still useful throughout college and into adulthood.
- Cut the Knot (<https://www.cut-the-knot.org/>)
  - An encyclopedic collection of math resources for all grades. Contains arithmetic games, problems, puzzles, and articles.
  - Particularly useful for geometry visualizations.
- expii (<https://www.exprii.com/>)
  - Similar to Brilliant with a website and app, but the learning interface is personalized. Topics have a multitude of different learning mediums (video, interactive, reading) that students can pick and choose from.
  - Also goes beyond mathematics with courses in every STEM topic. Content is community driven.
- IMOMath (<http://www.imomath.com/>)
  - A great collection of olympiad problems and training handouts.
  - Topics are proof based and are more advanced than AMC and AIME material. Most suitable for USA(J)MO qualifiers.

- Khan Academy (<https://www.khanacademy.org/>)
  - Expansive collection of video content on all STEM topics.
  - Contains some competition math, but most suitable for supplementing high school and undergraduate class topics.
- Notable Content Creators:
  - 3Blue1Brown (<http://www.3blue1brown.com/>) is a popular mathematics YouTuber who makes beautiful visualizations of math and technology related topics. His series on linear algebra is a must-watch.
  - Alex Zhu (<http://alexzhu.me/math-tutoring/>) offers remote olympiad tutoring. He provides weekly problem sets and Skype tutoring.
  - Alexander Remorov (<http://alexanderrem.weebly.com/math-competitions.html>) is a Quant Researcher at BlackRock and Ph.D. from MIT. He was formerly a Deputy Leader for Canada’s IMO team, and has written numerous handouts on olympiad topics.
  - David Altizio/djmathman (<http://www.contrib.andrew.cmu.edu/~daltizio/mathstuff.html>) is one of the most prolific olympiad writers in the nation. He frequently writes for contests such as the AMC, AIME, and USA(J)MO. Look up his username on the AoPS community forum as well.
  - Evan Chen/v\_Enhance (<http://web.evanchen.cc/olympiad.html>) is another widely prolific contest writer. He assists at the USA Mathematical Olympiad Summer Program and also writes for many of the aforementioned contests. His handouts are considered the best of the best, and are vital for any aspiring olympiad student.
  - Po-Shen Loh (<http://www.math.cmu.edu/~lohp/olympiad.shtml>) is a math professor at Carnegie Mellon University and the coach of the USA IMO Team. He runs the Mathematical Olympiad Summer Program and his lessons and handouts are very helpful. His content for the undergraduate Putnam exam is also very thorough.
  - Yufei Zhao (<http://yufeizhao.com/olympiad/>) is a math professor at MIT and a former IMO coach for both the USA and Canada. His handouts are useful for olympiad content, but he also has material on undergraduate topics for the Putnam.

## 3.2 Coding Resources

- Code Academy (<https://www.codecademy.com/>)
- Competitive Programming (<https://cpbook.net/>)
- Cracking the Coding Interview (<http://www.crackingthecodinginterview.com/>)
- Introduction to Algorithms/CLRS ([https://en.wikipedia.org/wiki/Introduction\\_to\\_Algorithms](https://en.wikipedia.org/wiki/Introduction_to_Algorithms))
- Notable Content Creators:
  - DarthPrince (<http://codeforces.com/blog/entry/15729>)
  - Inishan (<https://codeforces.com/blog/entry/23054>)
  - Matei Zaharia ([https://cs.stanford.edu/~matei/programming\\_contests/](https://cs.stanford.edu/~matei/programming_contests/))

## 4 Topics to Review

Here is a sample list of terms and topics we will use frequently throughout the course. If students do not know the meaning of a word here, they are encouraged to ask and look into the term to refresh themselves. The more important terms will be covered in class, but it is important that every student is on relatively the same page when it comes to vocabulary.

### 4.1 Algebra

Exponent	Logarithm	Root	Rationalized denominator
Equation	Variable	Coefficient	Constant
Ordered pair	Conjugate	Real	Imaginary
Quadratic	Discriminant	Polynomial	FOIL method
Degree	Identity	Conjecture	Definition
Theorem	Corollary	Axiom	Lemma
Arithmetic Mean	Geometric Mean	Inequality	

### 4.2 Counting/Probability

Counting	Probability	$\Sigma$	$\Pi$
Sequence	Series	Permutation	Combination
“Choose”	“Permute”		

### 4.3 Geometry

Point	Line	Ray	Line segment
Collinear	Concurrent	Congruent segments	Midpoint
Angle	Congruent angles	Right angle	Straight angle
Acute angle	Obtuse angle	Parallel lines	Perpendicular lines
Perpendicular bisector	Transversal	Vertical angles	Corresponding angles
Alternate interior angles	Alternate exterior angles	Complementary angles	Supplementary angles
Reflex angle			
Triangle	Quadrilateral	Rhombus	Trapezoid
$n$ -gon	Polygon	Regular polygon	Parallelogram
Internal angles	External angles		
Angle bisector	Median	Altitude	Equilateral triangle
Right triangle	30-60-90 triangle	45-45-90 triangle	Isosceles triangle
Scalene triangle	Obtuse triangle	Isosceles right triangle	
SSS	ASA	SAS	HL
Circle	Radius	Diameter	Center
Chord	Sector	Tangent line	Secant line
Arc	Minor Arc	Major arc	Semicircle

### 4.4 Number Theory

Multiple	Divisor	Quotient	Divisible	Factor
Remainder	Perfect square	Perfect cube	Factorial	

## 5 Contact Information

For submitting problem solutions, please e-mail [mcct@mathcircle.us](mailto:mcct@mathcircle.us). For questions and concerns regarding weekly practices, competitions, or related matters, please email [mcct@mathcircle.us](mailto:mcct@mathcircle.us). Students with questions about math problems or concepts may e-mail instructors and TAs at their discretion.

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