



A Guide to Math Contests

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1 Introduction

This guide will introduce some of the competitions that we participate or have participated in. Sections 2-4 are most relevant for middle schoolers, while sections 5-9 are most relevant for experienced middle schoolers and high schoolers.







We hope you have fun participating in math contests!

2 MATHCOUNTS Rounds

MATHCOUNTS is the premier middle school contest. There are 4 rounds: Sprint, Target, Team, and Countdown.

WHAT DOES THE TEST LOOK LIKE? Every MATHCOUNTS competition consists of 4 rounds—Sprint, Target, Team and Countdown Round. Altogether the rounds are designed to take about 3 hours to complete. Here's what each round looks like.

 <p>Sprint Round 40 minutes 30 problems total no calculators used focus on speed and accuracy</p>	 <p>Target Round Approx. 30 minutes 8 problems total calculators used focus on problem-solving and mathematical reasoning</p> <p><i>The problems are given to students in 4 pairs. Students have 6 minutes to complete each pair.</i></p>	 <p>Team Round 20 minutes 10 problems total calculators used focus on problem-solving and collaboration</p> <p><i>Only the 4 students on a school's team can take this round officially.</i></p>	 <p>Countdown Round Maximum of 45 seconds per problem no calculators used focus on speed and accuracy</p> <p><i>Students with highest scores on Sprint and Target Rounds compete head-to-head. This round is optional at the school, chapter and state level.</i></p>
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The individual score is calculated as Sprint Score + $2 \cdot$ Target Score. This makes the maximum individual score 46.

The team score is calculated as the average of the individual scores of the team members plus twice the Team Round Score. Countdown Round is unofficial in South Dakota.

3 MATHCOUNTS Competitions

There are 4 levels of the MATHCOUNTS Competition Series. The **School** round is held at MMS the week before winter break. In this round, everyone competes individually in the Sprint and Target rounds, although we often do a Countdown Round¹ for fun. The top 8 students will compete at

¹It is also used for tiebreaks. However, the only ties that are broken are for the top 8.



Chapter. The top four individuals from the School Round form the official MMS team, while the next four students do not form a team.

The **Chapter** round is held in mid-February. In the past it was held on even years at SDSU and on odd years at NSU, but it might only be held at NSU in the future. This competition is held in mid-February. The top 2 teams and the top 4 individuals not on those teams advance to the state competition.

The **State** round is held in Pierre, South Dakota every year in March. The top 4 students (not necessarily from the same school) and the winning team's coach represent the South Dakota at the National Competition!

The **National Competition** will likely be held in Orlando (previously it has also been held in Boston and DC). In addition to competing, students get to meet other strong competitors (and trade pins!) and explore Disney Springs and the Kennedy Space Center. There are 224 competitors from 56 teams².

4 AMC 8

The AMC 8 is a 25-question, 40-minute, multiple choice test. The goal of the AMC 8 is for middle school students to develop positive attitudes towards analytical thinking and mathematics that can assist in future careers. Students can apply their math skills to unique problem-solving challenges in a low-stress and friendly environment. MMS hosts the AMC 8 each November. Each question on the AMC 8 is worth 1 point, and there is no penalty for guessing.

5 High School – MAA Circuit

5.1 AMC 10/12

The high school AMCs come in 4 different varieties: AMC 10A, AMC 10B, AMC 12A, and AMC 12B. 10 means that 10th graders and below can take it, and 12 means that 12th graders and below can take it. The A tests are held about a week before the B tests.

Depending on which test SDSU offers, Brookings High School will offer the other one. In the past, SDSU has always held the B test. You may take either the 10A or the 12A (but not both), and you may take either the 10B or the 12 B (but not both). We recommend that 10th graders and below take the 10A and 10B.

The AMC 10 and 12 are 25-question, 75-minute, multiple choice test. The AMC 10/12 provides an opportunity for high school students to develop positive attitudes towards analytical thinking

²Including the 50 states, Washington DC, the State Department, The US Department of Defense, Guam, Puerto Rico, and the Virgin Islands.



and mathematics that can assist in future careers. The AMC 10/12 is the first in a series of competitions that eventually lead all the way to the International Mathematical Olympiad. This contest heavily favors problem solving skills over formula knowledge. Many prestigious universities such as MIT and Caltech ask for AMC 10/12 scores. The score is calculated as $6 * \text{\#correct} + 1.5 * \text{\#blank} + 0 * \text{\#wrong}$. Since incorrect answers are worth less than a blank answer, a good idea is to not guess. The maximum score is 150.

5.2 AIME

High scorers (top 2.5% on the AMC 10 and top 5% on the AMC 12) are invited to take the American Invitational Mathematics Exam (AIME). The AIME is a short-answer 15 question, 3 hour examination, with each answer an integer between 000 to 999. The questions on the AIME are much more difficult than those on the AMC 10/12.

5.3 USA(J)MO

The United States of America Mathematical Olympiad (USAMO) and the United States of America Junior Mathematical Olympiad (USAJMO) are proof-based exams. The exam runs over two days with 4.5 hours and 3 questions per day. Each problem is scored out of 7 with partial credit available.

USAJMO index is calculated by $\text{AMC 10} + 10 \cdot \text{AIME Score}$, and USAMO index is calculated by $\text{AMC 12} + 10 \cdot \text{AIME Score}$. The ~ 250 students with the highest USAJMO indices are invited to the USAJMO, and the ~ 250 students with the highest USAMO indices are invited to the USAMO.

5.4 MOP

The Mathematical Olympiad (Summer) Program (abbreviated MOP) is a 3-week intensive problem solving camp held at Carnegie Mellon University to help high school students prepare for math olympiads. While the program is free to participants, invitations are limited to the top finishers on USA(J)MO. MOP selects and train the US team for the International Mathematical Olympiad and the European Girls' Math Olympiad.

5.5 International Math Olympiad

The International Mathematical Olympiad is the pinnacle of all high school mathematics competitions and the oldest of all international scientific competitions. Each year, countries from around the world send a team of 6 students to compete in a grueling competition. Like the USA(J)MO, the competition takes place over 2 consecutive days with 3 problems and 4.5 hours per day.



6 USA Mathematical Talent Search

The USA Mathematical Talent Search (USAMTS) is a free proof-based competition open to all US middle and high school students. There are 3 rounds of 5 questions each worth 5 points.

The USAMTS allows students a full month to work out their solutions. Carefully written justifications are required for each problem. The problems range in difficulty from being within the reach of most high school students to challenging the best students in the nation. Students may use any materials (including books, calculators, and computers), but all work must be their own.

Student solutions to the USAMTS problems are graded and returned with comments. The goal is to help all students develop problem solving skills, improve their technical writing abilities, and mature mathematically.

The USAMTS is one of the ways to qualify for the American Invitational Mathematics Examination (AIME). However, it is much more difficult to qualify for the AIME through USAMTS than the AMCs. A very high score is needed (usually around 68/75), and few people qualify. Most likely, the people who qualified for the AIME through USAMTS also qualified for the AIME through the AMC 10/12.

With permission, USAMTS participant's names and addresses are provided to colleges, universities, and employers for recruitment purposes.

7 Purple Comet

Purple Comet is a team short-answer competition held each year in April. Teams of up to 6 may use any non-internet resources, including calculators and programming software. The middle school division has 20 questions in 60 minutes while the high school division has 30 questions in 90 minutes.

8 NEMO

NEMO is a short-answer competition held each year in November and run by students from MOP (including Serena). The individual round consists of 20 questions in 60 minutes and is roughly AMC 12 difficulty. The team round allows teams of up to 4 to complete 12 questions and a minigame in 30 minutes. The acronym NEMO stands for something different each year.