



## Report on the 52nd International Mathematical Olympiad

Amsterdam, the Netherlands

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2011 Samuel Beatty Contestant

The International Mathematical Olympiad is the most prestigious high school mathematics competition in the world. Held annually, each participating country can send up to 6 secondary students to compete. This year, 564 students from 101 countries arrived in Amsterdam for the contest. The contest is 2 days long, with 3 problems in 4.5 hours each day. The questions are given a score out of 7, for a total score out of 42. These long and difficult problems require great ingenuity and cleverness to solve.

The Canadian team this year was: Alex Song from Detroit MI, James Rickards from Ottawa ON, Hunter Spink from Calgary AB, Matthew Brennan from Toronto ON, Heinrich Jiang from Windsor ON, and Mariya Sardarli from Edmonton AB. We were chosen based on the results of three contests: the Asian Pacific Mathematical Olympiad (APMO), the United States of America Mathematical Olympiad (USAMO), and the Canadian Mathematical Olympiad (CMO). Our team was relatively new, with only Alex and Hunter having competed before.

Before the competition, we trained in Banff for two weeks. We were nestled between mountains at the beautiful Banff International Research Station for Mathematical Innovation and Discovery (BIRS). Our team leader was Dorette Pronk from Dalhousie University, our deputy leader was David Arthur from Google, and our Leader Observer was Jacob Tsimerman from Harvard University. In addition, we had

several other trainers join us including: Alex Fink, Farzin Barekat, Lino Demasi, and Robert Morewood. We had perhaps the best and most experienced group of trainers; in the early 2000s Jacob Tsimerman received a perfect IMO score and David Arthur was just 4 points from a perfect score.

A typical day consisted of getting up for breakfast at around 7:30, though a few of us often opted for just a little bit more sleep. We were in the classroom by 8:30, ready for a lecture and problems to try. For some mornings, we instead had a mock olympiad. This helped to give us a good idea of what the actual IMO would be like. After lunch we resumed with another lecture and problem solving session. Even after supper we had problem solving sessions many times. In all we were probably doing math for over 8 hours every day.

The accommodations at BIRS were fabulous. The rooms were spacious, and the classroom chairs were quite comfortable. Mealtime in the dining room was great, there was a wide selection of food where even picky eaters could find plenty of food. The amazing view out the window as we ate was an added bonus.

Much free time at BIRS was spent doing math. However, some of us also engaged in other activities such as hiking. The nearby Tunnel Mountain was scaled a couple times, and several of us took the long hike to experience some

hot springs. The excursion brought us to Lake Louise and beyond for some spectacular views on a short hike. During the final week we used the local sports facilities for basketball, soccer, and rock climbing. There definitely was great opportunity for exercise on campus!

Jacob Tsimerman and Dorette Pronk left a few days early, and the rest of the team on July 15th. The initial departure turned out to be a bit too exciting, as the transporter to the airport was told to arrive at 4AM instead of the intended 3AM. It was a bit of a scary hour, but we made it to the airport to catch our flight in time. A few of us were able to sleep on the long transatlantic flight, but some were not so lucky. We finally arrived in Amsterdam at around 10AM to be greeted by our guide, Anne de Haan (who happens to be a former IMO contestant as well).

Amsterdam was a lot like any large city in Canada, but with many small differences. In most places bikes had their own path, and many of us continually forgot this. Bicycles are very important in the Netherlands; their laws dictate that bicycles are rarely at fault in collisions. This makes motorists very careful around them, a nice change from many places in Canada.

The first two days were spent adjusting to the time difference. Many of us went to bed quite early and slept for a long time. For our entertainment in the meantime, the hotel we were staying in had a games room. There were

several foosball and air hockey tables, as well as a seemingly endless supply of chess boards and countless other games. No matter how full the room got, there were always more games to play.

On the second day, Sunday, the opening ceremonies were held. All of the countries paraded on stage, and some countries (like South Korea) did a dance or other short scene. A dance group was there to help introduce each country; they added an interesting flavour to the ceremony.

Monday was contest day! After a 6:30 breakfast we were bussed about 10 minutes to the contest location, then nervously waited for the contest to begin. When we finally opened our contest folder many of us could not believe it: where was the geometry? Traditionally there were always 2 geometry problems, one on each day. However, today, number 1 was number theory/algebra, 2 was combinatorial geometry, and 3 was algebra. While combinatorial geometry can often include a good bit of geometry, this question did not. It was a beautiful question about a process fittingly called a windmill. After the contest was over and all the contestants convened it became obvious that #2 was misplaced. It seemed that nobody had solved it! On our team we had all solved #1, but only Alex had done more, solving #3. As it turns out #2 ended up being much harder than #3, which is a rarity.

Day two was much better for us, our whole team solved #4, and 4 of us solved #5. However, everyone else found it much easier as well, so we had to wait to see what medals we would win.

The contest this year was a very beautiful contest, though the lack of geometry made some of us sad. The only true geometry question was #6, which turned out to be one of the hardest geometry problems ever on the IMO. An interesting tidbit of information was in the Jury meeting a vote was held on what



problem to put as #2, the vote was between the windmill problem that appeared and a Euclidean Geometry problem. The windmill problem won by 1 vote. We were that close to a totally different looking contest.

It was now time to relax! We went on several excursions in the following days. A trip to the Hague included a visit to the Escher Museum and the beach. We spent the day after that sailing and touring a couple smaller Dutch towns. The final excursion was a walk around Amsterdam where we got to see many of the great places around town. It was a great time, the Netherlands is a very beautiful country!

While we were having fun, our leaders were in coordination arguing for our marks. This year was very easy, the coordinators were easy to work with and no argument was necessary to get our marks. In the end Alex ended up with a 29, Hunter and James had 22, Mariya and Matthew had 21, and Heinrich had a 17. At the hotel we could see the scoreboard of everyone's scores, however to keep the mystery they put an asterisk over one score per person. It seemed a sure thing that Alex was getting a gold and Heinrich had a bronze. Hunter and James also seemed to have a secure silver, which left Matt and Mariya worrying about the cutoff. Would it be 21? Or was it going to be one too high at 22?

The following morning we got our answer: 22. Mariya and Matthew were initially disappointed, but were happy to have the highest possible bronze score. Overall we had one of the best results for Canada: 1 gold, 2 silver, and 3 bronze.

Our team score was 132, which was just higher than last year's team score! We were ranked 17th as a country out of 101 countries, tied with the United Kingdom.

Overall, we were quite happy with our performance. Everyone had received a perfect



score on both #1 and #4; we were one of only 4 countries to accomplish this! There were several individual performances of note this year. Lisa Sauermann of Germany became the most decorated IMOer ever, winning her 4th gold medal with a perfect score! This pushes her to 4 golds and one silver, bettering her countryman Christian Reiher. Also of note was the age of many top contestants. Raul Sarmiento from Peru was 6th with a 35 and he is only 13! In fact, this is his 3rd medal! 14 year olds near the top include Lin Chen from China who was 3rd, David Yang from USA who was 4th, and our own Alex Song who was 25th!

With the closing ceremonies completed, the IMO was now over. We flew back without trouble early the next day. Reality had now set in: it was over. The last three weeks of our life had been some of the best of our lives. Thanks goes out to our trainers who helped and supported us the whole way, our guide who did a great job in showing us around, and the many sponsors including the Canadian Mathematical Society and the Samuel Beatty Fund; without them this would not have been possible. The IMO was a great experience for all and hopefully it can continue on for many years to come!