



## Report on the 51st International Math Olympiad

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The International Mathematical Olympiad (IMO) is the most prestigious high school mathematics competition in the world. Held annually in a different location each year, each country sends a team of at most six secondary students to write a contest over two days. Each day of the contest, the contestants are presented with three essay-style problems to be solved in 4.5 hrs, for a total of 9 hrs. These problems are frequently in the style of “mini” mathematics research problems, requiring clever and novel arguments and ideas. This year the 51<sup>th</sup> IMO, held in Astana, Kazakhstan, was one of the largest IMO to date, with 97 countries sending national teams.

Each country decides who they are going to send to the IMO. The Canadian team is traditionally chosen in mid-May based on the results of other contests, including those which are similar to the IMO. These include the Asian-Pacific Mathematical Olympiad (APMO), the United States of America Mathematical Olympiad (USAMO), and our own Canadian Mathematical Olympiad (CMO). This year our team consisted of Yu (Robin) Cheng from Coquitlam, BC, Alex Song from Detroit MI, Hunter Spink from Calgary AB, Yuqi Zhu from Vancouver BC, Jonathan Zung from Toronto ON, and myself from London ON. Our team was exceptionally talented, with three out of the six of us—Robin, Hunter and I—having previously attended IMO 2009 in Bremen, Germany. The three newcomers had also proved themselves very capable in the selection contests. One contestant in particular, Alex Song, the winner of the 2010 Canadian Mathematical Olympiad, also happened to be a 7<sup>th</sup> grader, an incredible achiever.

Before we headed to the IMO site in Astana, we spent one week at Wilfrid Laurier University in Waterloo training for the competition. The training was organized by our team leaders, Adrian Tang, Alex Remorov, and Victoria Krakovna, who are former IMO participants. Additionally, Laurier University math professor Dr. Wang made sure we had plenty of snacks all the time and were very comfortable in Waterloo. Our team leaders gave us plenty of lectures, problems and mock contests for practice. Because this year training was shorter than in previous years (by contrast, last year’s training was two weeks long), we had a mock Olympiad each day, to ensure we were comfortable with the exam.

Officially, eight hours per day at the training camp are spent doing math, with a mock Olympiad in the morning, a lecture in the afternoon, and a problem session in the evening. However, most of our team spent a large portion of our free time working on problems too, with several members working through recreational time, excursions, and even meals!

Our accommodations at Laurier were excellent, with each of us having a single room to ourselves. Plus, the freedom in the cafeteria coupled with the generous meal cards were given meant that we were always very well fed, and always eating what we loved best. We also went to local restaurants to eat. After the second week, we finally headed to the IMO site in Astana, Kazakhstan. We arrived two days before the actual competition date to adjust to jetlag.

Astana was a very modern and futuristic-looking city, with golden towers, artistically shaped skyscrapers, and a huge castle that turned out to be a fancy apartment complex, all this built only in the past 12 years since the capital was moved there from Almaty. The day before the contest, the IMO officially started with the Opening

Ceremony at the Palace of Independence. There, the Minister of Education and Science of Kazakhstan delivered a speech, and then each country paraded on stage as a team and waved to all the other teams. A Kazak rock band, Ulytau, played at the ceremony too. After the Opening Ceremony, we had a nice lunch outside, where we went around and met the other teams. We were then packed into buses for the ride to Bauldaren, a lake resort surrounded on three sides by majestic mountains. It was at Bauldaren that we would write the IMO.

During the night at Bauldaren, dinner was a bit hectic as everyone tried to get in line to eat as early as possible. But team member Yuqi Zhu revealed that he had brought Instant Noodles just in case for us, so we had a hearty dinner in our rooms. The next morning, the morning of the IMO, we woke up early and ate (or tried to eat) a good breakfast, nervous about the upcoming contest. We forgot about our anxiety, though, when we received the problems and started devoting all our energy towards solving them. Problem 1 was a problem about functional equations. Typically, the first problem on the IMO is fairly easy, to get contestants comfortable with the exam. However, this year, it actually turned out to be tricky, and although everyone on our team had the solution, many of us lamented about making small mistakes. Problem 2 was a nice problem from Euclidean Geometry, and proved to be fairly instructive. Only two Canadians were able to solve it. Problem 3, the hardest problem of the contest that day, was to prove a certain number theoretic result. Only one member of our team, Robin Cheng, was able to find the elusive solution.

The same process repeated the next day. Problem 4 was a problem in Euclidean Geometry again, but this year, it was again, actually rather tricky for a first problem! Problem 5 was an interesting problem in combinatorics. The solution eluded many contestants from many countries, and even when some countries' deputy leaders tried it, they had difficulties with it! Problem 6 was the last problem of the day, a result in algebra and sequences. Hunter Spink, the Canadian that day who was the proud solver of that problem, interestingly believed that problem 6 was easier than problem 5 (For those interested, the contest in English, information about the city of Astana and Bauldaren, and greetings are available at <http://www.imo2010org.kz/>, the official IMO 2010 website.)

After the contest was over, we could finally relax. Over the next few days, while our Team Leader and Deputy Leader would be discussing and arguing for our solutions with the problem coordinators, the organizers showed us the sights of Bauldaren. The Kazaks were very enthusiastic about showing us their unique culture, so we were very much immersed in traditional Kazak music. There were also lots of fun events organized, including a rock concert, disco, and a paddle boat trip that allowed us to experience the unique geography of Bauldaren. We also spent much time with the other teams, especially the Americans and the Australians. Team members Jonathan Zung and Alex Song enjoyed playing the game of Hearts with the Australians.

Eventually all the scores were decided on and we got to see our medal standings. In the IMO, half the contestants get medals, and the numbers of gold, silver, and bronze medals are roughly in the proportion 1:2:3. Our team received 2 golds, 1 silver and 2 bronzes and an honorable mention. Moreover, we placed 13th in the unofficial country rankings, the best performance in Canadian history, percentage wise! We were all very happy with our performance. We received our medals and certificates at the Closing Ceremony that evening and were treated to a farewell barbeque afterwards. We flew back to Canada the next day.

Despite being a lot of work, being a member of the Canadian IMO team has been one of the most enjoyable experiences of my high-school career. This would not be possible without the support of the Canadian Mathematical Society and sponsors like the Samuel Beatty Fund. Also, thanks go to the leaders, coaches, and teachers who helped us succeed to the extent which we did.