Double UK gold at the Maths 'world championship'!

Samuel Liew and Yuka Machino, Year 13 students at The West Bridgford School and Millfield School, have earned gold medals at the International Mathematical Olympiad (IMO). Yuka Machino, 17, came first amongst all female participants for the second year in a row at this prestigious competition involving over 100 countries, and the only female gold medallist.

The UK team, which is entered into the competition by the United Kingdom Mathematics Trust (UKMT) and supported by XTX Markets, was also awarded three silver medals and one Honourable Mention. This fantastic all-round performance meant the UK finished in 9th place out of 107 participating countries. This is the fourth time in six years that the UK has placed in the top 10 at the 'world championship of mathematics'.

Samuel Liew said: "It feels like a fairytale ending to a long journey as an Olympiad student. In spite of the IMO being virtual this year, it has still been an enriching experience both mathematically and in other ways. I am glad to have met many amazing people along the way and hope to stay in touch."

Yuka Machino said: "I'm pleased with how the IMO went this year. The first paper was stressful and difficult, but I was glad to be able to finish my IMO career on a high on Day 2. It was a shame I didn't get to meet contestants from other countries in person, but I hope I get a chance to do so at some point in the future."

The Team Leader was Dr Dominic Yeo (University of Oxford), and the Deputy Team Leader was Sam Bealing (Trinity College, Cambridge). Dominic Yeo, said "These problems would be found challenging by any mathematician of any age, and we're very proud of the UK team, and especially of Samuel and Yuka, for the creativity and breadth of their solutions. They have all worked hard for IMO 2021 throughout an unusual and challenging year, and another top ten finish is richly deserved. We hope that the skills they've learned, and the confidence gained from this super performance at IMO 2021 will set them up well for future progress in mathematics and beyond!"

For the first time in thirty years, two girls were selected for the UK IMO team in 2021. Both Yuka Machino and Jenni Voon had already participated at the European Girls Mathematical Olympiad (EGMO), earning gold medals. The first EGMO was held in Cambridge, UK, in 2012, with the goal of promoting the participation of young women in mathematics competitions. Dr Ceri Fiddes, the Director of EGMO 2012, and Head of Mathematics at Millfield School said:

"To be the top scoring female at the IMO for the second year in a row is a magnificent achievement. Yuka has been a fantastic role model at Millfield, displaying so much passion and dedication (in all areas of school life). I hope that this performance inspires others and, in particular, it would be great to see a continued increase in female participation at this level of mathematics."

The UK team was identified through a rigorous selection process, which included two British Mathematical Olympiad competitions held over two rounds in UK schools and online formats, and organised by the UKMT. UKMT Director Hannah Telfer said, 'Congratulations to all the UK team on their performance at this challenging IMO, and to Samuel and Yuka for their gold medals! For the UK once again to finish in the top ten is a fantastic achievement. We thank all those involved, from the teachers supporting our work in schools, to the mathematicians who volunteer to run the academic

preparation for IMO and our sponsors XTX Markets for inspiring the country's most enthusiastic young problem-solvers."

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About UKMT

The UK Mathematics Trust is a registered charity whose aim is to advance the education of children and young people in mathematics. It organises national mathematics competitions and other mathematical enrichment activities for UK secondary school students. Further information about the Trust and its activities is available at ukmt.org.uk.

More about IMO 2021

The UK team entry was organised by the UK Mathematics Trust and supported by XTX Markets. Information about selection and training for the IMO can be found at bmos.ukmt.org.uk

The six students representing the UK team were:

Mohit Hulse (Sri Kumaran Public School) - Silver Medal
Isaac King (Tonbridge School) - Silver Medal
Samuel Liew (The West Bridgford School) - Gold Medal
Yuka Machino (Millfield School) - Gold Medal
Daniel Naylor (Matthew Arnold School) - Honourable Mention
Jenni Voon (Landau Forte College) - Silver Medal

IMO 2021, the 62nd IMO, took place from 14 - 24 July 2021, and was organised by Russia. Due to the worldwide pandemic, the competition was held in an online format.

The competition consisted of two papers on 19 and 20 July, each with three problems of increasing difficulty, targeting the strongest school-aged mathematicians. The UK team sat the papers in Leeds. 52 students out of 619 were awarded gold medals.

The IMO is the world championship of mathematics for students in secondary education. It is a problem-solving contest for high school students, held in a different country in July every year. The first IMO was held in Romania in 1959, with seven countries taking part. Today, more than 100 countries participate, representing over 90% of the world's population. The IMO is the oldest, biggest, and most prestigious

of all the international science Olympiads and the problems of the IMO are notoriously difficult. More details can be found at imo-official.org.

The problems from this year's IMO can be found at www.imo-official.org/problems.aspx.

Full results can be found at www.imo-official.org/year_country_r.aspx?year=2021.

Samuel and Yuka earned their gold medals for solving the following problem:

IMO 2021 Problem 6 (proposed by Austria)
Let m>1 be an integer, A a finite set of integers (not necessarily positive) and $B_1, B_2, ..., B_m$ subsets of A. Suppose that, for every k=1,2,...,m, the sum of the elements of B_k is m^k. Prove that A contains at least m/2 elements.