Olympiad News

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In the last column, it was mentioned that Australia's International Mathematics Olympiad (IMO) team would be announced on 2 June, and that Angel Yu (Year 12, Perth Modern School) and Alexander Chua (Year 10, Christ Church Grammar School), were two Western Australians who were contenders for the team. In fact, both Angel and Alexander made the team, though Alexander was the reserve, which alas meant that he didn't compete. However, since Alexander is only in Year 10 now, he will surely be in the next two IMO teams. As it turns out, the results for this year's IMO, which was held in Amsterdam on 18 and 19 July, are just in! For full results, see:

http://www.imo2011.nl

and for the Australian summary, see:

http://www.amt.edu.au/imo2011.html

There you will see that the Australian team picked up three Silver and three Bronze medals; Angel Yu was awarded a Bronze. This year's result saw Australia drop ten places to 25, but significantly, all team members medalled this year. Last year the medal tally was 1 Gold, 3 Silver, 1 Bronze and 1 Honourable Mention – an Honourable Mention is awarded when a student is awarded full points for at least one problem, without receiving a medal. The result of 15th, last year, was significantly helped by the experience of the team; three students had been among the 2009 team that placed 23rd. This year, only one member: Timothy Large of NSW, had been in the previous year's team, and he improved from Bronze to Silver.

While at the Netherlands site, you might like to take a glance at the Hall of Fame. By a significant margin most participants are male, but Number 1, is female: Lisa Sauermann of Germany, who including this year has been to 5 IMOs, with a haul of 4 Gold and 1 Silver. This year's result was a perfect score: a score of 7 for each of the six problems. Wow! There's a strike for girl-power! The most number of times an Australian has participated in the IMO is three times, and one of these, Peter McNamara, who was a student of Hale School of WA, has the distinction of being the only Australian to have been awarded two Golds at IMOs (on his first outing in 1999, he achieved Bronze).

Tournament of the Towns (TT), Northern Spring round, for 2010-11, was held on Saturday, 7 May (O Level paper) and Saturday, 14 May (A level paper). Recall that the Tournament of the Towns is an “invitation-only” mathematics competition, with a 4-hour O paper of five questions, and a 5-hour A paper with seven questions. A student’s score on a paper is the highest total for their attempts at three of the questions. A student's overall score for the TT round is the better result of the two papers. The four highest ranked juniors and the two highest ranked seniors have had their papers forwarded to Moscow for a more rigorous marking; and hopefully they will receive a Diploma from the Russian Academy of Sciences, to go with their certificate from the Australian Mathematics Trust. A summary of these results in order of rank is below. The reason for the Distinction and Participation in amongst the Credits in the table for the Seniors, are due to minimum requirements of numbers of questions one needs to get out completely, before a Credit or higher can be awarded.

Junior Student	*Year*	*School*	*Result*	*WA Rank*
Alexander Chua	10	Christ Church GS	Distinction	1
Edward Yoo	10	All Saints' College	Distinction	2
Jack Cooper	10	Hale School	Distinction	3
Diffy Zhou	10	Perth Modern School	Distinction	4
Daryl Chung	10	Perth Modern School	Credit	=5
Conway Li	10	Perth Modern School	Credit	=5
Julia Schulz	9	All Saints' College	Credit	7
Isabelle Claxton	10	St Hilda's ASG	Credit	=8
Andrew Ho	10	Perth Modern School	Credit	=8
Zhixian Wu	9	Perth Modern School	Participation	9
Ciaran Murray	10	Trinity College	Participation	10
Brian Hao	10	Christ Church GS	Participation	11
Benjamin Chia	9	All Saints' College	Participation	12
Albert Qiu	8	Christ Church GS	Participation	12

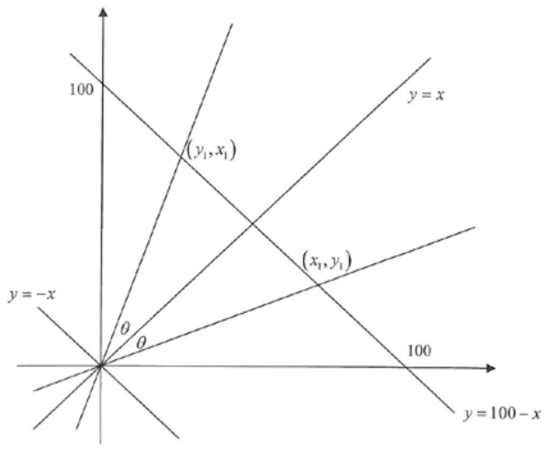
Senior Student	*Year*	*School*	*Result*	*WA Rank*
Andrew Yang	11	Rossmoyne SHS	Credit	1
Aaron Hurst	11	Home School	Distinction	2
Aaron Wong	12	Aquinas College	Participation	3
Michael Warton	11	Hale School	Credit	4
Li Kho	12	Willetton SHS	Credit	5
Kathleen Dyer	11	St Hilda's ASG	Credit	6

The next Olympiad level events are the Senior Mathematics Contest (SMC) and Australian Intermediate Mathematical Olympiad (AIMO) to be held on 9 and 11 August, respectively.

Finally, let us close with the following lovely problem from the recent Junior A Level TT.

Question 2 (TT, Northern Spring 2011, Junior A Level):
Passing through the origin of the x-y plane are 180 lines, including the coordinate axes, forming $1°$ angles with one another at the origin.
Determine the total sum of the x-coordinates of intersections of these lines with the line $y = 100 - x$.

Solution. Let S be the sum of the x-coordinates of the points of intersection of the 180 lines with the line $\ell : y = 100 - x$. Firstly, consider the line $y = x$ which makes an angle of $45°$ with the x-axis, and so is one of the 180 lines. It intersects ℓ at $(50,50)$ and so it contributes 50 to S. Now consider the two lines that make an angle of θ, where θ is an integer, with $y = x$. These lines are the reflection of one another in the line $y = x$. Thus if one of these lines intersects ℓ at (x_1, y_1), then the other intersects ℓ at (y_1, x_1). So together the contribution of these two lines to S is $x_1 + y_1$. Now (x_1, y_1) lies on S. So,



$$y_1 = 100 - x_1$$
$$\therefore x_1 + y_1 = 100.$$

So, we have 89 pairs of lines that contribute 100 to S, $y = x$ that contributes 50 (note that $y = x$ is its own reflection in itself), and one line $y = -x$ that does not intersect ℓ and hence contributes 0 to S. So,

$$S = 89 \times 100 + 50 = 8950$$

is the sum of the, x-coordinates of the intersections of the 180 lines with $y = 100 - x$.

Note. There are certainly other ways to solve this problem, e.g. finding an expression for the x-coordinate of the intersection of $y = x \tan\theta$ with $y = 100 - x$ leads to a solution eventually, but the above solution shows how a clever observation can lead to a particularly quick and elegant solution.